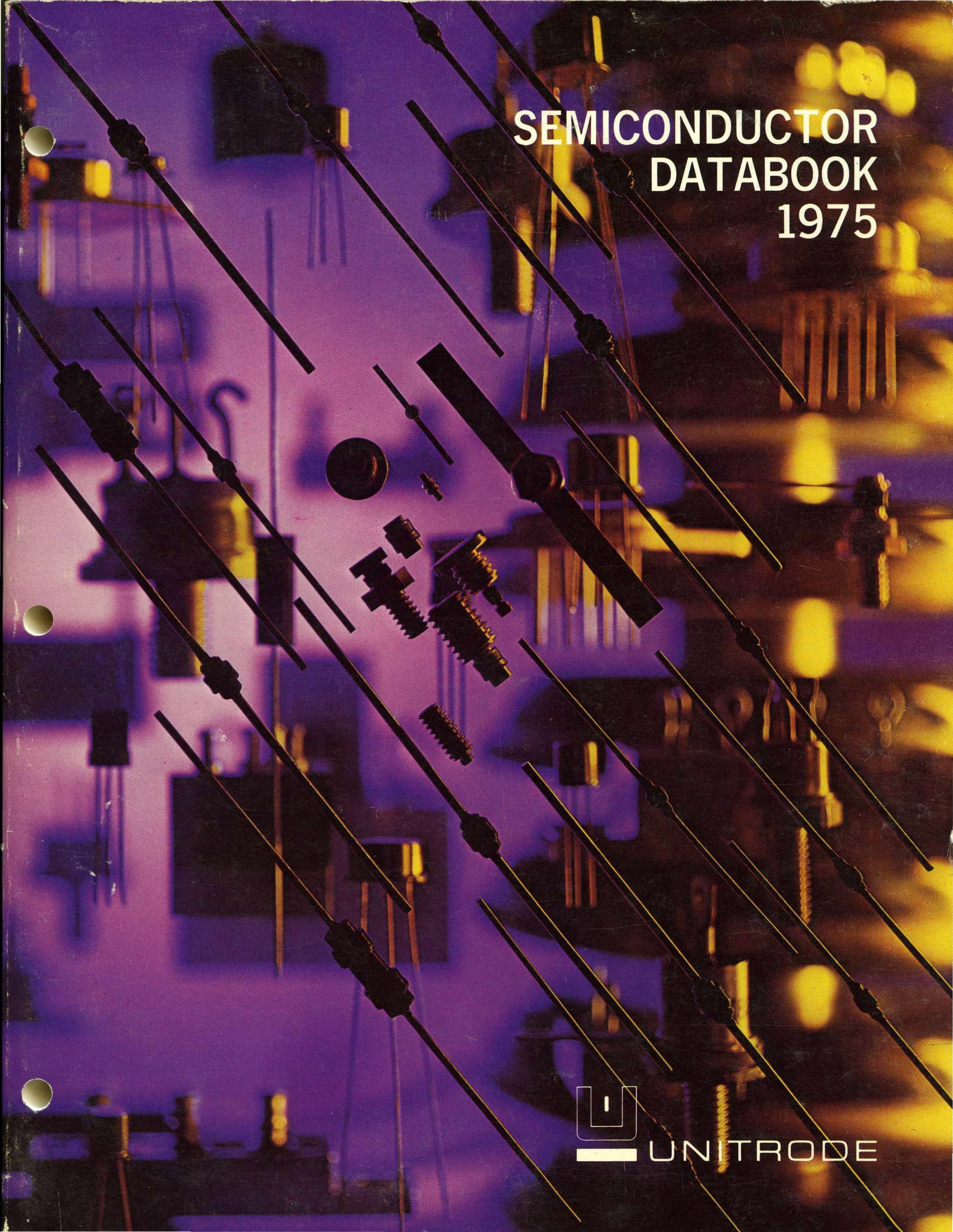
SEMICONDUCTOR DATABOOK 1975



UNITRODE

UNITRODE
SEMICONDUCTOR
DATABOOK
1975

15M-0375 JC/CG

Printed in U.S.A.

INTRODUCTION

From its inception 15 years ago, Unitrode has acquired a reputation for maintaining an unusually high level of quality, performance, and reliability in its entire line of silicon semiconductor devices. Excellence was first established with Unitrode's uniquely controlled avalanche, hard-glass passivated Rectifiers and Zener Diodes, and later expanded, through corporate acquisition, to include planar passivated low-power, high-speed SCRs, PUTs, and high-speed Power Transistors and Darlingtons.

Unitrode has been at the forefront in meeting the fast changing needs of industry. The Company has also developed (1) Doorbell® Rectifier Modules to provide reliable, economic solid-state rectifier tube replacements in high-voltage power supplies, (2) Diode Stacks that require no compensation, (3) SCRs fast enough for laser pulse modulators, (4) solid-state A.C. Switches, and (5) the first Hybrid Power Switching Circuits for Switching Regulator applications in the industry.

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I. ADMINISTRATIVE

SALES OFFICES

Presented below is a list of Unitrode District Offices, Domestic Representatives, and Foreign Representatives. For information on Unitrode's domestic distributors in your area, contact the local Unitrode Manufacturer's Representative or District Sales Office.

UNITRODE FIELD OFFICES:

Eastern Regional Office, 580 Pleasant Street, Watertown, Mass. 02172 (617) 926-0404
Western Regional Office, 15300 Ventura Boulevard, Suite 421, Sherman Oaks, California 91403 (213) 783-1301
Midwest District Office, 440 East Dixie Drive, West Carrollton, Ohio 45449 (513) 859-5872
New York District Office, 20 Route 110, Suite 1009, Melville, New York 11746 (516) 549-5400, (201) 487-3045
Mid-Atlantic and Southeast District Office, 500 Office Center Drive, Suite 118, Ft. Washington, Penna. 19034 (215) 542-9112

DOMESTIC REPRESENTATIVES

ALABAMA
20th Century Marketing, Inc.
Hertz Skycenter
P.O. Box 6127
Huntsville — 35806
205-772-9237

ARIZONA
Fred Board Associates, Inc.
P.O. Box 1906
Scottsdale — 85252
602-994-9388

ARKANSAS
See Texas

CALIFORNIA — NORTHERN
Brooks Technical Group
2465 East Bayshore Drive
Suite 345
Palo Alto — 94303
415-328-3232

CALIFORNIA — SOUTHERN
Unitrode Corp.
15300 Ventura Blvd.
Suite 421
Sherman Oaks — 91403
213-783-1301

S.R. Electronics
8333 Clairmont Mesa Blvd.
Suite 213
San Diego — 92111
714-565-8411

Astralonics
P.O. Box 946
Newbury Park — 91320
805-498-3988

COLORADO
Simpson Associates, Inc.
2552 Ridge Road
Littleton — 80120
303-794-8381

CONNECTICUT
Kanan Associates
P.O. Box 127
Washington Depot — 06794
203-868-0513

DELAWARE
See Pennsylvania — Eastern

DISTRICT OF COLUMBIA
See Maryland

FLORIDA
Conley & Associates, Inc.
P.O. Box 668
West Broadway
Oviedo — 32765
305-365-3283

Conley & Associates, Inc.
1612 N.W. 2nd Ave.
Boca Raton — 33432
305-395-6108

Conley & Associates, Inc.
2821 Kimberly Lane
Tampa — 33618
813-933-3183

GEORGIA
20th Century Marketing, Inc.
6175 Ridgeway
Douglasville — 30134
404-942-6483

IDAHO
See Washington

ILLINOIS — NORTHERN
Carlson Electronic Sales Co.
7448 North Harlem Ave.
Chicago — 60648
312-774-9022

ILLINOIS — SOUTHERN
See Missouri

INDIANA — NORTHERN
See Illinois — Northern

INDIANA — SOUTHERN
Baehr, Greenleaf
& Associates, Inc.
P.O. Box 6191
1917 Fairfax Avenue
Ft. Wayne — 46806
219-447-1608

IOWA
See Illinois — Northern

KANSAS
Carlson Electronic Sales Co.
2310 West 75th Street
Shawnee Mission — 66208
913-432-2144

KENTUCKY
See Ohio

LOUISIANA
See Texas

MAINE
See Massachusetts

MARYLAND
New Era Sales Inc.
300 Hospital Drive
Suite 218
Glen Burnie — 21061
301-768-6666

MASSACHUSETTS
Kanan Associates
100 Main Street
Reading — 01867
617-944-8484

DOMESTIC REPRESENTATIVES (Continued)

MICHIGAN
J. L. Montgomery Associates
25160 Lahser Road
Southfield — 48075
313-358-2616

J. L. Montgomery Associates
2215 Oak Industrial Drive, N. E.
Grand Rapids — 49505
616-774-9308

MINNESOTA
Charles E. Bohlig Co.
P.O. Box 16183
Minneapolis — 55416
612-922-7011

MISSISSIPPI
See Alabama

MISSOURI — EASTERN
Carlson Electronic Sales Co.
453 North Lindbergh
St. Louis — 63141
314-991-0262

MISSOURI — WESTERN
See Kansas

MONTANA
See Washington

NEBRASKA
See Kansas

NEVADA — NORTHERN
See California — Northern

NEVADA — SOUTHERN
See Arizona

NEW HAMPSHIRE
See Massachusetts

NEW JERSEY — NORTHERN
Unitrode Corp.
20 Route 110
Suite 1009
Melville, N.Y. — 11746
201-487-3045

NEW JERSEY — SOUTHERN
See Pennsylvania — Eastern

NEW MEXICO
See California — Northern

NEW YORK — METROPOLITAN AND LONG ISLAND
Unitrode Corp.
20 Route 110
Suite 1009
Melville — 11746
516-549-5400

NEW YORK — UPSTATE
Reagan/Compar Albany, Inc.
6 Highland Avenue
Albany — 12205
518-489-7408

Reagan/Compar Albany, Inc.
41 Woodberry Road
New Hartford — 13413
315-732-3775

Reagan/Compar Albany, Inc.
42 Winding Brook Drive
Fairport — 14450
716-271-2230

Reagan/Compar Albany, Inc.
P.O. Box 135
Endwell — 13760
607-723-8743

NORTH CAROLINA
P.J. Nahser, Inc.
1349 S. Church Street
P.O. Box 432
Burlington — 27215
919-226-8053

NORTH DAKOTA
See Minnesota

OHIO
Baehr, Greenleaf
& Associates, Inc.
9505 Montgomery Road
Cincinnati — 45242
513-891-3826

Dayton
513-426-5485

Baehr, Greenleaf
& Associates, Inc.
14700 Detroit Avenue
Cleveland — 44107
216-221-9030

Baehr, Greenleaf
& Associates, Inc.
P.O. Box 5722
Columbus — 43221
614-486-4046

OKLAHOMA
See Texas

OREGON
See Washington

PENNSYLVANIA — EASTERN
GCM Associates
275 Commerce Drive
Ft. Washington — 19034
215-646-7535

PENNSYLVANIA — WESTERN
Covert & Newman Co.
300 Mt. Lebanon Blvd.
Pittsburgh — 15234
412-563-0303

RHODE ISLAND
See Massachusetts

SOUTH CAROLINA
See North Carolina

SOUTH DAKOTA
See Minnesota

TENNESSEE
See Alabama

TEXAS
Semiconductor Sales Assoc.
312 N. Central Expressway
Suite 204
Richardson — 75080
214-321-6181

UTAH
Simpson Associates, Inc.
2480 South Main Street
Suite 105
Salt Lake City — 84115
801-486-3731

VERMONT
See Massachusetts

VIRGINIA
See Maryland

WASHINGTON
SD-R^2
14040 N.E. 8th Street
Bellevue — 98007
206-747-9424

WEST VIRGINIA
See Pennsylvania — Western

WISCONSIN
Carlson Electronic Sales Co.
Northbrook Executive Center
10701 West North Avenue
Suite 209
Milwaukee — 53226
414-476-2790

WYOMING
See Colorado

CANADA
Kaytronics Limited
7370 Cote St. Luc
Suite 210
Montreal 267, Quebec
514-487-3434

Kaytronics Limited
1001 Finch Ave., W.
Downsview, Ont.
416-638-5511

BRITISH COLUMBIA
See Washington

AUSTRALIA
C.E.M.A. (Distr.) Pty. Ltd.
P.O. Box 578
Crows Nest, N.S.W. 2065
Tel: 419-2397
TELEX: 790-22846

DENMARK
A. Fredslund Pedersen
Finsensvej 39
Copenhagen F.
Tel: Godthab (01-36) 9050
TELEX: 855-15052

ENGLAND
Walmore Electronics Limited
11-15 Betterton Street,
Drury Lane
London WC2H 9BS
Tel: 01-836 1228
TELEX: 851-28752

FINLAND
Nores & Company, Oy.
Fabianinkatu 32
Helsinki 10
Tel: 13-360
TELEX: 857-121676

FRANCE
Almex S. A.
Zone Industrielle d'Antony
48, rue de l'Aubepine
92160 Antony
Tel: 666-21-12
TELEX: 842-28823

Spetelec
Cidex A111
94532 — Rungis Principal
Tel: 686-56-65
TELEX: 842-25801

GERMANY
EBV Elektronik GmbH
Gabriel-Max-Str. 72
8 Munich 90
Tel: 089/64-40-55/8
TELEX: 841-0524535

EBV Elektronik GmbH
Oststrasse 129
4 Duesseldorf
Tel: 0211-8-48-46-46/7
TELEX: 841-8587267

EBV Elektronik GmbH
Myliusstrasse 54
6 Frankfurt/Main 1
Tel: 0611-72-04-16/8
TELEX: 841-413590

EBV Elektronik GmbH
Alexanderstr. 63
D-7 Stuttgart 1
Tel: 0711/24 74 81
TELEX: 841-0722271

ISRAEL
S.T.G. International
52 Nachlat Benjamin Street
P.O.B. 1276
Tel-Aviv
Tel: 53459
TELEX: 922-03-2229

ITALY
Comprel s.r.l.
Viale Ca Granda 2
20162 Milano
Tel: 64.38.519, 64.38.763
TELEX: 843-32250

Mediterranean Trading Co. SRL
Via Lombardia 30
Roma, 00187
Tel: 481. 976, 479. 070

JAPAN
Rikei Corporation
1-18-14 Nishi Shimbashi
Minato-Ku
Tokyo 105
Tel: 03-591-5241
TELEX: 781-J24208, J23772

NETHERLANDS
Koning en Hartman
Elektrotechniek B.V.
30 Koperwerf
The Hague 2033
Tel: 67-83-80
TELEX: 844-31528

NORWAY
Neco A/S
Stanseveien 4
P.O. Box 81, Ovre Grorud
Oslo 9
Tel: 25-93-10
TELEX: 856-19247

SOUTH AFRICA
Electrolink (Pty.) Ltd.
P.O. Box 1020
Cape Town, Cape 8000
Republic of South Africa
Tel: 45-7656/7
TELEX: 960-577320

SWEDEN
Swedish Electrolink AB
Stora Nygatan 39
11127 Stockholm
Tel: 08-11-45-95
TELEX: 854-11848

SWITZERLAND
Rotronic AG
Rautistrasse 12
8047 Zurich
Tel: 0152-32-11
TELEX: 845-56135

TERMS AND CONDITIONS

All factory orders are subject to a $250 minimum charge.*
Orders are F.O.B. factory.
Terms Net 30 days.

*Contact your Unitrode Representative for the name of the local Unitrode Distributor for the purchase of requirements under $250.

HIGH RELIABILITY SCREENING:

Unitrode offers a standard high reliability screening program called "HR 201 Screening" for most of its standard products. Parts with this screening can be ordered from the factory by calling out the Unitrode HR 201 specification applicable to the product being ordered. See section titled "Reliability Processing" for further information and the Unitrode O. E. M. Price List for costs.

INSULATED STUDS

Power Rectifiers and Zener Diodes with insulated studs can be ordered from the factory by adding a V or W suffix to the part number. See section titled "Packaging Data " under Applications for a detailed description of the V and W studs.

REVERSE POLARITY

To order Power Rectifiers or Zeners with reverse polarity (anode to stud) add an "R" suffix to the part number.

SPECIAL LEAD MATERIAL

For axial leaded Rectifiers or Zeners with special leads, add suffix M, N, T, U, V, W, S, R, or Q to the part number. See section titled "Packaging Data" under Applications for a description of the available special leads.

II. PART NUMBER INDEX

II. PART NUMBER INDEX

PAGE	PART NUMBER	DESCRIPTION
	ZENER	
*	1N3016-1N3043	1.0W; 20%
*	1N3016A-1N3043A	1.0W; 10%
*	1N3016B-1N3043B	1.0W; 5%
*	1N3016B-1N3043BJAN	1.0W; 5%
*	1N3016B-1N3043BJANTX	1.0W; 5%
*	1N3044-1N3051	1.0W; 20%
*	1N3044A-1N3051A	1.0W; 10%
*	1N3044B-1N3051B	1.0W; 5%
	RECTIFIER	
53	1N3611	1.0A; 200V
53	1N3611JAN	1.0A; 200V
53	1N3611JANTX	1.0A; 200V
53	1N3612	1.0A; 400V
53	1N3612JAN	1.0A; 400V
53	1N3612JANTX	1.0A; 400V
53	1N3613	1.0A; 600V
53	1N3613JAN	1.0A; 600V
53	1N3613JANTX	1.0A; 600V
53	1N3614	1.0A; 800V
53	1N3614JAN	1.0A; 800V
53	1N3614JANTX	1.0A; 800V
*	1N3656	0.75A; 200V
*	1N3657	0.75A; 400V
*	1N3658	0.75A; 600V
	RECTIFIER STACK	
*	1N3764	3KV
	RECTIFIER	
*	1N3957	1.0A; 1000V
*	1N3981	2.0A; 200V
*	1N3982	2.0A; 400V
*	1N3983	2.0A; 600V
	ZENER	
392	1N4096	3.0W; 5%
392	1N4097	3.0W; 5%
392	1N4098	3.0W; 5%
	RECTIFIER	
55	1N4245	1.0A; 200V
55	1N4245JAN	1.0A; 200V
55	1N4245JANTX	1.0A; 200V
55	1N4245JANTXV	1.0A; 200V
55	1N4246	1.0A; 400V
55	1N4246JAN	1.0A; 400V
55	1N4246JANTX	1.0A; 400V
55	1N4246JANTXV	1.0A; 400V
55	1N4247	1.0A; 600V
55	1N4247JAN	1.0A; 600V
55	1N4247JANTX	1.0A; 600V
55	1N4247JANTXV	1.0A; 600V
	ZENER	
*	1N4321	1.0W; 10%
57	1N4461-1N4488	1.5W; 5%
57	1N4461-1N4483JAN	1.5W; 5%
57	1N4461-1N4483JANTX	1.5W; 5%
57	1N4461-1N4483JANTXV	1.5W; 5%
57	1N4489	1.5W; 5%
*	1N4503	3.0W; 10%
*	1N4504	3.0W; 10%
59	1N4736-1N4764	1.0W; 10%
59	1N4736A-1N4764A	1.0W; 5%
*	1N4881	3.0W; 10%
*	1N4882	3.0W; 10%
*	1N4883	3.0W; 5%
*	1N4884	3.0W; 5%
*	1N4889	5.0W; 5%
	RECTIFIER	
61	1N4942	1.0A; 200V
61	1N4942JAN	1.0A; 200V
61	1N4942JANTX	1.0A; 200V
61	1N4942JANTXV	1.0A; 200V
61	1N4944	1.0A; 400V

PAGE	PART NUMBER	DESCRIPTION
	RECTIFIER	
61	1N4944JAN	1.0A; 400V
61	1N4944JANTX	1.0A; 400V
61	1N4944JANTXV	1.0A; 400V
61	1N4946	1.0A; 600V
61	1N4946JAN	1.0A; 600V
61	1N4946JANTX	1.0A; 600V
61	1N4946JANTXV	1.0A; 600V
	ZENER	
63	1N4954-1N4969	5.0W; 5%
63	1N4954-1N4969JAN	5.0W; 5%
63	1N4954-1N4969JANTX	5.0W; 5%
63	1N4954-1N4969JANTXV	5.0W; 5%
63	1N4970-1N4975	5.0W; 5%
63	1N4970-1N4975JAN	5.0W; 5%
63	1N4970-1N4975JANTX	5.0W; 5%
63	1N4970-1N4975JANTXV	5.0W; 5%
63	1N4976-1N4983	5.0W; 5%
63	1N4976-1N4983JAN	5.0W; 5%
63	1N4976-1N4983JANTX	5.0W; 5%
63	1N4976-1N4983JANTXV	5.0W; 5%
63	1N4984-1N4988	5.0W; 5%
63	1N4984-1N4988JAN	5.0W; 5%
63	1N4989-1N4996	5.0W; 5%
63	1N4989-1N4995JAN	5.0W; 5%
392	1N5063-1N5090	3.0W; 5%
392	1N5091-1N5103	3.0W; 5%
392	1N5104-1N5117	3.0W; 5%
*	1N5118-1N5122	5.0W; 5%
*	1N5123-1N5128	5.0W; 5%
*	1N5129-1N5134	5.0W; 5%
	RECTIFIER	
*	1N5180	4.0A; 100V
*	1N5185	3.0A; 60V
65	1N5186	3.0A; 100V
65	1N5186JAN	3.0A; 100V
65	1N5186JANTX	3.0A; 100V
65	1N5187	3.0A; 200V
65	1N5187JAN	3.0A; 200V
65	1N5187JANTX	3.0A; 200V
65	1N5188	3.0A; 400V
65	1N5188JAN	3.0A; 400V
65	1N5188JANTX	3.0A; 400V
65	1N5190	3.0A; 600V
65	1N5190JAN	3.0A; 600V
65	1N5190JANTX	3.0A; 600V
*	1N5206	2.0A; 440V
*	1N5207	4.0A; 400V
*	1N5320	1.0A; 120V
*	1N5330	0.5A; 1500V
67	1N5415	3A; 50V
67	1N5415JAN	3A; 50V
67	1N5415JANTX	3A; 50V
67	1N5416	3A; 100V
67	1N5416JAN	3A; 100V
67	1N5416JANTX	3A; 100V
67	1N5417	3A; 200V
67	1N5417JAN	3A; 200V
67	1N5417JANTX	3A; 200V
67	1N5418	3A; 400V
67	1N5418JAN	3A; 400V
67	1N5418JANTX	3A; 400V
67	1N5419	3A; 500V
67	1N5419JAN	3A; 500V
67	1N5419JANTX	3A; 500V
67	1N5420	3A; 600V
67	1N5420JAN	3A; 600V
67	1N5420JANTX	3A; 600V
*	1N5433	2.0A; 700V
*	1N5434	2.0A; 700V
*	1N5435	12.0A; 700V
69	1N5550	5.0A; 200V

*Contact factory for specifications and ratings

PAGE	PART NUMBER	DESCRIPTION
	RECTIFIER	
69	1N5550JAN	5.0A; 200V
69	1N5550JANTX	5.0A; 200V
69	1N5550JANTXV	5.0A; 200V
69	1N5551	5.0A; 400V
69	1N5551JAN	5.0A; 400V
69	1N5551JANTX	5.0A; 400V
69	1N5551JANTXV	5.0A; 400V
69	1N5552	5.0A; 600V
69	1N5552JAN	5.0A; 600V
69	1N5552JANTX	5.0A; 600V
69	1N5552JANTXV	5.0A; 600V
69	1N5553	5.0A; 800V
69	1N5553JAN	5.0A; 800V
69	1N5553JANTX	5.0A; 800V
69	1N5553JANTXV	5.0A; 800V
	RECTIFIER STACK	
71	1N5597	10KV
71	1N5597JAN	10KV
71	1N5600	5KV
71	1N5600JAN	5KV
71	1N5603	5KV
71	1N5603JAN	5KV
	TRANSIENT SUPPRESSOR	
74	1N5610	33V
74	1N5610JAN	33V
74	1N5610JANTX	33V
74	1N5611	43.7V
74	1N5611JAN	43.7V
74	1N5611JANTX	43.7V
74	1N5612	54V
74	1N5612JAN	54V
74	1N5612JANTX	54V
74	1N5613	190V
74	1N5613JAN	190V
	RECTIFIER	
76	1N5614	1.0A; 200V
76	1N5614JAN	1.0A; 200V
76	1N5614JANTX	1.0A; 200V
78	1N5615	1.0A; 200V
78	1N5615JAN	1.0A; 200V
78	1N5615JANTX	1.0A; 200V
76	1N5616	1.0A; 400V
76	1N5616JAN	1.0A; 400V
76	1N5616JANTX	1.0A; 400V
78	1N5617	1.0A; 400V
78	1N5617JAN	1.0A; 400V
78	1N5617JANTX	1.0A; 400V
76	1N5618	1.0A; 600V
76	1N5618JAN	1.0A; 600V
76	1N5618JANTX	1.0A; 600V
78	1N5619	1.0A; 600V
78	1N5619JAN	1.0A; 600V
78	1N5619JANTX	1.0A; 600V
76	1N5620	1.0A; 800V
76	1N5620JAN	1.0A; 800V
76	1N5620JANTX	1.0A; 800V
76	1N5622	1A; 1000V
76	1N5622JAN	1A; 1000V
76	1N5622JANTX	1A; 1000V
	TRANSIENT SUPPRESSOR	
80	1N5629-1N5650	1500W; 10%
80	1N5629-1N5650A	1500W; 5%
	PIN DIODE	
50	1N5767	100V
	RECTIFIER	
82	1N5802	2.5A; 50V
86	1N5802JAN	2.5A; 50V
86	1N5802JANTX	2.5A; 50V
82	1N5803	2.5A; 75V
82	1N5804	2.5A; 100V

PAGE	PART NUMBER	DESCRIPTION
82	1N5804JAN	2.5A; 100V
86	1N5804JANTX	2.5A; 100V
82	1N5805	2.5A; 125V
82	1N5806	2.5A; 150V
86	1N5806JAN	2.5A; 150V
86	1N5806JANTX	2.5A; 150V
82	1N5807	6.0A; 50V
86	1N5807JAN	6.0A; 50V
86	1N5807JANTX	6.0A; 50V
82	1N5808	6.0A; 75V
82	1N5809	6.0A; 100V
86	1N5809JAN	6.0A; 100V
86	1N5809JANTX	6.0A; 100V
82	1N5810	6.0A; 125V
82	1N5811	6.0A; 150V
86	1N5811JAN	6.0A; 150V
86	1N5811JANTX	6.0A; 150V
82	1N5812	20.0A; 50V
82	1N5813	20.0A; 75V
82	1N5814	20.0A; 100V
82	1N5815	20.0A; 125V
82	1N5816	20.0A; 150V
	TRANSIENT SUPPRESSOR	
80	1N5907	1500W;6V
	PIN DIODE	
50	1N5957	100V
	ZENER	
*	1N5959-1N5975	3.0W; 20%
*	1N5959A-1N5975A	3.0W; 10%
*	1N5959B-1N5975B	3.0W; 5%
*	1N5976-1N5980	3.0W; 20%
*	1N5976A-1N5980A	3.0W; 10%
*	1N5976B-1N5980B	3.0W; 5%
	SCR	
*	2N876	.35A@100°C 15V; TO-18
*	2N877	.35A@100°C 30V; TO-18
*	2N878	.35A@100°C 60V; TO-18
*	2N879	.35A@100°C 100V; TO-18
*	2N880	.35A@100°C 150V; TO-18
*	2N881	.35A@100°C 200V; TO-18
*	2N882	.35A@100°C 300V; TO-18
*	2N883	.35A@100°C 400V; TO-18
*	2N884	.35A@100°C; 15V; TO-18
*	2N885	.35A@100°C 30V; TO-18
*	2N886	.35A@100°C 60V; TO-18
*	2N887	.35A@100°C 100V; TO-18
*	2N888	.35A@100°C 150V; TO-18
*	2N889	.35A@100°C 200V; TO-18
*	2N890	.35A@100°C 300V; TO-18
*	2N891	.35A@100°C 400V; TO-18
	GTO SCR	
*	2N892	150mA@75°C 15V; TO-18
*	2N893	150mA@75°C 15V; TO-18
*	2N894	150mA@75°C 30V; TO-18
*	2N895	150mA@75°C 30V; TO-18
*	2N896	150mA@75°C 60V; TO-18
*	2N897	150mA@75°C 60V; TO-18
*	2N898	150mA@75°C 100V; TO-18
*	2N899	150mA@75°C 100V; TO-18
*	2N900	150mA@75°C 200V; TO-18
*	2N901	150mA@75°C 200V; TO-18
	SCR	
*	2N948	.26A@125°C 30V; TO-18
*	2N949	.26A@125°C 60V; TO-18
*	2N950	.26A@125°C 100V; TO-18
*	2N951	.26A@125°C 200V; TO-18
	TRANSISTOR	
*	2N1208	NPN; 5A; 60V; TO-61
*	2N1209	NPN; 5A; 45V; TO-61
*	2N1212	NPN; 5A; 60V; TO-61

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PAGE	PART NUMBER	DESCRIPTION
	SCR	
*	2N1595	1.0A@80°C 50V; TO-5
*	2N1596	1.0A@80°C 100V; TO-5
*	2N1597	1.0A@80°C 200V; TO-5
*	2N1598	1.0A@80°C 300V; TO-5
*	2N1599	1.0A@80°C 400V; TO-5
	TRANSISTOR	
*	2N1647	NPN; 3.0A; 60V; TO-59
*	2N1648	NPN; 3.0A; 80V; TO-59
*	2N1649	NPN; 3.0A; 60V; TO-59
*	2N1650	NPN; 3.0A; 80V; TO-59
*	2N1714	NPN; 0.75A; 60V; TO-5
*	2N1715	NPN; 0.75A; 100V; TO-5
*	2N1716	NPN; 0.75A; 60V; TO-5
*	2N1717	NPN; 0.75A; 100V; TO-5
*	2N1718	NPN; 0.75A; 60V; TO-5; Stud Mount
*	2N1719	NPN; 0.75A; 100V; TO-5; Stud Mount
*	2N1720	NPN; 0.75A; 60V; TO-5; Stud Mount
*	2N1721	NPN; 0.75A; 100V; TO-5; Stud Mount
89	2N1724	NPN; 5.0A; 80V; TO-61
89	2N1724A	NPN; 5.0A; 120V; TO-61
89	2N1725	NPN; 5.0A; 80V; TO-61
	SCR	
*	2N1869	1.25A@100°C 15V; TO-9
91	2N1870	1.25A@100°C 30V; TO-9
91	2N1870A	1.25A@100°C 30V; TO-9
91	2N1870A JAN	1.25A@100°C 30V; TO-9
91	2N1871	1.25A@100°C 60V; TO-9
91	2N1871A	1.25A@100°C 60V; TO-9
91	2N1871A JAN	1.25A@100°C 60V; TO-9
91	2N1872	1.25A@100°C 100V; TO-9
91	2N1872A	1.25A@100°C 100V; TO-9
91	2N1872A JAN	1.25A@100°C 100V; TO-9
91	2N1873	1.25A@100°C 150V; TO-9
91	2N1874	1.25A@100°C 200V; TO-9
91	2N1874A	1.25A@100°C 200V; TO-9
91	2N1874A JAN	1.25A@100°C 200V; TO-9
95	2N1875	1.25A@100°C 15V; TO-9
95	2N1876	1.25A@100°C 30V; TO-9
95	2N1877	1.25A@100°C 60V; TO-9
95	2N1878	1.25A@100°C 100V; TO-9
95	2N1879	1.25A@100°C 150V; TO-9
95	2N1880	1.25A@100°C 200V; TO-9
99	2N1881	1.0A@100°C 30V; TO-9
99	2N1882	1.0A@100°C 60V; TO-9
99	2N1883	1.0A@100°C 100V; TO-9
99	2N1884	1.0A@100°C 150V; TO-9
99	2N1885	1.0A@100°C 200V; TO-9
	TRANSISTOR	
*	2N1886	NPN; 3.0A; TO-59
	SCR	
*	2N2009	1.3A@80°C 25V; TO-5
*	2N2010	1.3A@80°C 50V; TO-5
*	2N2011	1.3A@80°C 100V; TO-5
*	2N2012	1.3A@80°C 200V; TO-5
*	2N2013	1.3A@80°C 300V; TO-5
*	2N2014	1.3A@80°C 400V; TO-5
	TRANSISTOR	
*	2N2150	NPN; 2.0A; 80V; TO-59
101	2N2151	NPN; 2.0A; 80V; TO-59
101	2N2151JAN	NPN; 2.0A; 100V; TO-59
101	2N2151JANTX	NPN; 2.0A; 100V; TO-59
	SCR	
103	2N2322	1.6A@85°C 25V; TO-5
103	2N2322A	1.6A@85°C 25V; TO-5
103	2N2323	1.6A@85°C 50V; TO-5
103	2N2323JAN	1.6A@85°C 50V; TO-5

PAGE	PART NUMBER	DESCRIPTION
	SCR	
103	2N2323JANTX	1.6A@85°C 50V; TO-5
103	2N2323A	1.6A@85°C 50V; TO-5
103	2N2323A JAN	1.6A@85°C 50V; TO-5
103	2N2323A JANTX	1.6A@85°C 50V; TO-5
103	2N2324	1.6A@85°C 100V; TO-5
103	2N2324JAN	1.6A@85°C 100V; TO-5
103	2N2324JANTX	1.6A@85°C 100V; TO-5
103	2N2324A	1.6A@85°C 100V; TO-5
103	2N2324A JAN	1.6A@85°C 100V; TO-5
103	2N2324A JANTX	1.6A@85°C 100V; TO-5
103	2N2325	1.6A@85°C 150V; TO-5
103	2N2325A	1.6A@85°C 150V; TO-5
103	2N2326	1.6A@85°C 200V; TO-5
103	2N2326JAN	1.6A@85°C 200V; TO-5
103	2N2326JANTX	1.6A@85°C 200V; TO-5
103	2N2326A	1.6A@85°C 200V; TO-5
103	2N2326A JAN	1.6A@85°C 200V; TO-5
103	2N2326A JANTX	1.6A@85°C 200V; TO-5
103	2N2327	1.6A@85°C 250V; TO-5
103	2N2327A	1.6A@85°C 250V; TO-5
103	2N2328	1.6A@85°C 300V; TO-5
103	2N2328JAN	1.6A@85°C 300V; TO-5
103	2N2328JANTX	1.6A@85°C 300V; TO-5
103	2N2328A	1.6A@85°C 300V; TO-5
103	2N2328A JAN	1.6A@85°C 300V; TO-5
103	2N2328A JANTX	1.6A@85°C 300V; TO-5
103	2N2329	1.6A@85°C 400V; TO-5
103	2N2329JAN	1.6A@85°C 400V; TO-5
103	2N2329JANTX	1.6A@85°C 400V; TO-5
*	2N2344	1.6A@55°C 25V; TO-5
*	2N2345	1.6A@55°C 50V; TO-5
*	2N2346	1.6A@55°C 100V; TO-5
*	2N2347	1.6A@55°C 150V; TO-5
*	2N2348	1.6A@55°C 200V; TO-5
	TRANSISTOR	
*	2N2657	NPN; 5.0A; 60V; TO-5
*	2N2658	NPN; 5.0A; 80V; TO-5
	SCR	
*	2N2679	.35A@55°C 30V; TO-18
*	2N2680	.35A@55°C 60V; TO-18
*	2N2681	.35A@55°C 100V; TO-18
*	2N2682	.35A@55°C 200V; TO-18
*	2N2683	.28A@55°C 30V; TO-18
*	2N2684	.28A@55°C 60V; TO-18
*	2N2685	.28A@55°C 100V; TO-18
*	2N2686	.28A@55°C 200V; TO-18
*	2N2687	.28A@55°C 30V; TO-18
*	2N2688	.28A@55°C 60V; TO-18
*	2N2689	.28A@55°C 100V; TO-18
*	2N2690	.28A@55°C 200V; TO-18
	TRANSISTOR	
106	2N2811	NPN; 10.0A; 50V; TO-61
106	2N2812	NPN; 10.0A; 50V; TO-61
106	2N2813	NPN; 10.0A; 70V; TO-61
106	2N2814	NPN; 10.0A; 70V; TO-61
*	2N2828	NPN; 3.0A; 60V; TO-59
*	2N2829	NPN; 3.0A; 60V; TO-59
*	2N2849	NPN; 5.0A; 80V; Low Profile TO-5
108	2N2850	NPN; 5.0A; 80V; Low Profile TO-5
108	2N2850-1	NPN; 5.0A; 80V; TO-5
108	2N2850-2	NPN; 5.0A; 80V; TO-59
108	2N2850-3	NPN; 5.0A; 80V; Low Profile TO-5 Stud
108	2N2851	NPN; 5.0A; 80V; Low Profile TO-5
108	2N2851-1	NPN; 5.0A; 80V; TO-5
108	2N2851-2	NPN; 5.0A; 80V; TO-59
108	2N2851-3	NPN; 5.0A; 80V; Low Profile TO-5 Stud

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PAGE	PART NUMBER	DESCRIPTION
	TRANSISTOR	
108	2N2852	NPN; 5.0A; 80V; Low Profile TO-5
108	2N2852-1	NPN; 5.0A; 80V; TO-5
108	2N2852-2	NPN; 5.0A; 80V; TO-59
108	2N2852-3	NPN; 5.0A; 80V; Low Profile TO-5 Stud
112	2N2853	NPN; 5.0A; 40V; Low Profile TO-5
112	2N2853-1	NPN; 5.0A; 40V; TO-5
112	2N2853-2	NPN; 5.0A; 40V; TO-59
112	2N2853-3	NPN; 5.0A; 40V; Low Profile TO-5 Stud
112	2N2854	NPN; 5.0A; 40V; Low Profile TO-5
112	2N2854-1	NPN; 5.0A; 40V; TO-5
112	2N2854-2	NPN; 5.0A; 40V; TO-59
112	2N2854-3	NPN; 5.0A; 40V; Low Profile TO-5 Stud
112	2N2855	NPN; 5.0A; 40V; Low Profile TO-5
112	2N2855-1	NPN; 5.0A; 40V; TO-5
112	2N2855-2	NPN; 5.0A; 40V; TO-59
112	2N2855-3	NPN; 5.0A; 40V; Low Profile TO-5 Stud
112	2N2856	NPN; 5.0A; 40V; Low Profile TO-5
112	2N2856-1	NPN; 5.0A; 40V; TO-5
112	2N2856-2	NPN; 5.0A; 40V; TO-59
112	2N2856-3	NPN; 5.0A; 40V; Low Profile TO-5 Stud
*	2N2858	NPN; 3A; 80V; TO-5
*	2N2859	NPN; 3A; 100V; TO-5
*	2N2877	NPN; 5A; 80V; TO-111
*	2N2878	NPN; 5A; 80V; TO-111
*	2N2879	NPN; 5A; 100V; TO-111
*	2N2880	NPN; 5A; 100V; TO-111
*	2N2890	NPN; 5A; 80V; TO-5
*	2N2891	NPN; 5A; 80V; TO-5
*	2N2892	NPN; 5A; 80V; TO-59
*	2N2893	NPN; 5A; 80V; TO-59
*	2N2983	NPN; 3A; 80V; TO-5
*	2N2984	NPN; 3A; 120V; TO-5
*	2N2985	NPN; 3A; 80V; TO-5
*	2N2986	NPN; 3A; 120V; TO-5
*	2N2987	NPN; 1A; 80V; TO-5
*	2N2988	NPN; 1A; 100V; TO-5
*	2N2989	NPN; 1A; 80V; TO-5
*	2N2990	NPN; 1A; 100V; TO-5
*	2N2991	NPN; 1A; 80V; TO-5 Stud
*	2N2992	NPN; 1A; 100V; TO-5 Stud
*	2N2993	NPN; 1A; 80V; TO-5 Stud
*	2N2994	NPN; 1A; 100V; TO-5 Stud
*	2N2995	NPN; 1A; 100V; TO-5 Stud
	SCR	
*	2N3001	.25A@55°C 30V; TO-18
*	2N3002	.25A@55°C 60V; TO-18
*	2N3003	.25A@55°C 100V; TO-18
*	2N3004	.25A@55°C 200V; TO-18
*	2N3005	.25A@55°C 30V; TO-18
*	2N3006	.25A@55°C 60V; TO-18
*	2N3007	.25A@55°C 100V; TO-18
*	2N3008	.25A@55°C 200V; TO-18
118	2N3027	500mA@100°C 30V; TO-18
118	2N3027JAN	500mA@100°C 30V; TO-18
118	2N3027JANTX	500mA@100°C 30V; TO-18
118	2N3028	500mA@100°C 60V; TO-18
118	2N3028JAN	500mA@100°C 60V; TO-18
118	2N3028JANTX	500mA@100°C 60V; TO-18
118	2N3029	500mA@100°C 100V; TO-18
118	2N3029JAN	500mA@100°C 100V; TO-18
118	2N3029JANTX	500mA@100°C 100V; TO-18

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118	2N3030	.5A@100°C 30V; TO-18
118	2N3030JAN	.5A@100°C 30V; TO-18
118	2N3030JANTX	.5A@100°C 30V; TO-18
118	2N3031	.5A@100°C 60V; TO-18
118	2N3031JAN	.5A@100°C 60V; TO-18
118	2N3031JANTX	.5A@100°C 60V; TO-18
118	2N3032	.5A@100°C 100V; TO-18
118	2N3032JAN	.5A@100°C 100V; TO-18
118	2N3032JANTX	.5A@100°C 100V; TO-18
*	2N3254	.25A@55°C 15V; TO-46
*	2N3255	.25A@55°C 30V; TO-46
*	2N3256	.25A@55°C 60V; TO-46
*	2N3257	.25A@55°C 15V; TO-46
*	2N3258	.25A@55°C 30V; TO-46
*	2N3259	.25A@55°C 60V; TO-46
*	2N3273	2.2A@85°C 100V; TO-5
*	2N3274	2.2A@85°C 200V; TO-5
*	2N3275	2.2A@85°C 300V; TO-5
*	2N3276	2.2A@85°C 400V; TO-5
	TRANSISTOR	
*	2N3418	NPN; 3.0A; 60V; TO-5
*	2N3419	NPN; 3.0A; 80V; TO-5
*	2N3420	NPN; 3.0A; 60V; TO-5
*	2N3421	NPN; 3.0A; 80V; TO-5
*	2N3445	NPN; 7.5A; 60V; TO-3
*	2N3446	NPN; 7.5A; 80V; TO-3
*	2N3447	NPN; 7.5A; 60V; TO-3
*	2N3448	NPN; 7.5A; 80V; TO-3
*	2N3469	NPN; 5.0A; 25V; TO-5
*	2N3487	NPN; 7.5A; 60V; TO-3
*	2N3488	NPN; 7.5A; 80V; TO-3
*	2N3489	NPN; 7.5A; 100V; TO-3
*	2N3490	NPN; 7.5A; 60V; TO-3
*	2N3491	NPN; 7.5A; 80V; TO-3
*	2N3492	NPN; 7.5A; 100V; TO-3
	SCR	
*	2N3555	1.6A; 30V; TO-5
*	2N3556	1.6A; 60V; TO-5
*	2N3557	1.6A; 100V; TO-5
*	2N3558	1.6A; 200V; TO-5
*	2N3559	1.6A; 30V; TO-5
*	2N3560	1.6A; 60V; TO-5
*	2N3561	1.6A; 100V; TO-5
*	2N3562	1.6A; 200V; TO-5
	TRANSISTOR	
*	2N3597	NPN; 20.0A; 40V; TO-63
*	2N3598	NPN; 20.0A; 60V; TO-63
*	2N3599	NPN; 20.0A; 80V; TO-63
*	2N3744	NPN; 5.0A; 40V; TO-111
*	2N3745	NPN; 5.0A; 60V; TO-111
*	2N3746	NPN; 5.0A; 80V; TO-111
*	2N3747	NPN; 5.0A; 40V; TO-111
*	2N3748	NPN; 5.0A; 60V; TO-111
*	2N3749	NPN; 5.0A; 80V; TO-111
*	2N3750	NPN; 5.0A; 40V; TO-111
*	2N3751	NPN; 5.0A; 60V; TO-111
*	2N3752	NPN; 5.0A; 80V; TO-111
125	2N3850	NPN; 5.0A; 80V; TO-59
125	2N3851	NPN; 5.0A; 80V; TO-59
125	2N3852	NPN; 5.0A; 40V; TO-59
125	2N3853	NPN; 5.0A; 40V; TO-59
128	2N3878	NPN; 7.0A; 50V; TO-66
128	2N3879	NPN; 7.0A; 50V; TO-66
130	2N3996	NPN; 5.0A; 80V; TO-111
130	2N3996JAN	NPN; 5.0A; 80V; TO-111
130	2N3996JANTX	NPN; 5.0A; 80V; TO-111
130	2N3996JANTXV	NPN; 5.0A; 80V; TO-111
130	2N3997	NPN; 5.0A; 80V; TO-111
130	2N3997JAN	NPN; 5.0A; 80V; TO-111
130	2N3997JANTX	NPN; 5.0A; 80V; TO-111
130	2N3997JANTXV	NPN; 5.0A; 80V; TO-111

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PAGE	PART NUMBER	DESCRIPTION
	TRANSISTOR	
130	2N3998	NPN; 5.0A; 80V; TO-59
130	2N3998JAN	NPN; 5.0A; 80V; TO-59
130	2N3998JANTX	NPN; 5.0A; 80V; TO-59
130	2N3998JANTXV	NPN; 5.0A; 80V; TO-59
130	2N3999	NPN; 5.0A; 80V; TO-59
130	2N3999JAN	NPN; 5.0A; 80V; TO-59
130	2N3999JANTX	NPN; 5.0A; 80V; TO-59
130	2N3999JANTXV	NPN; 5.0A; 80V; TO-59
*	2N4000	NPN; 1.0A; 80V; TO-5
*	2N4001	NPN; 1.0A; 100V; TO-5
*	2N4002	NPN; 30.0A; 80V; TO-63
*	2N4003	NPN; 30.0A; 100V; TO-63
*	2N4070	NPN; 10.0A; 100V; TO-3
*	2N4075	NPN; 3.0A; 80V; TO-111
*	2N4076	NPN; 3.0A; 80V; TO-111
	SCR	
*	2N4096	1A@25°C 50V; TO-46
*	2N4097	1A@25°C 100V; TO-46
*	2N4108	180mA@25°C 50V; TO-18
*	2N4109	180mA@25°C 100V; TO-18
*	2N4110	180mA@25°C 200V; TO-18
*	2N4144	250mA@75°C 15V; TO-18
*	2N4145	250mA@75°C 30V; TO-18
*	2N4146	250mA@75°C 60V; TO-18
*	2N4147	250mA@75°C 100V; TO-18
*	2N4148	250mA@75°C 150V; TO-18
*	2N4149	250mA@75°C 200V; TO-18
	TRANSISTOR	
132	2N4150	NPN; 10.0A; 70V; TO-5
134	2N4150JAN	NPN; 10.0A; 70V; TO-5
134	2N4150JANTX	NPN; 10.0A; 70V; TO-5
	SCR	
*	2N4212	1.0A@85°C 25V; TO-5
*	2N4213	1.0A@85°C 50V; TO-5
*	2N4214	1.0A@85°C 100V; TO-5
*	2N4215	1.0A@85°C 150V; TO-5
*	2N4216	1.0A@85°C 200V; TO-5
*	2N4217	1.0A@85°C 250V; TO-5
*	2N4218	1.0A@85°C 300V; TO-5
*	2N4219	1.0A@85°C 400V; TO-5
	TRANSISTOR	
*	2N4237	NPN; 1.0A
*	2N4238	NPN; 1.0A
*	2N4239	NPN; 1.0A
*	2N4300	NPN; 2.0A
*	2N4301	NPN; 10.0A
*	2N4862	NPN; 2.0A
*	2N4863	NPN; 2.0A
*	2N4864	NPN; 2.0A
*	2N5038	NPN; 20.0A
*	2N5039	NPN; 20.0A
	SCR	
137	2N5060	0.8A@70°C 30V; TO-92
137	2N5061	0.8A@70°C 60V; TO-92
137	2N5062	0.8A@70°C 100V; TO-92
137	2N5063	0.8A@70°C 150V; TO-92
137	2N5064	0.8A@70°C 200V; TO-92
	TRANSISTOR	
*	2N5074	NPN; 3A; 200V; TO-59
*	2N5075	NPN; 3A; 200V; TO-59
*	2N5076	NPN; 3A; 200V; TO-59
*	2N5077	NPN; 3A; 200V; TO-59
*	2N5313	NPN; 10A; 80V; TO-61
*	2N5315	NPN; 10A; 100V; TO-61
*	2N5317	NPN; 10A; 80V; TO-61
*	2N5319	NPN; 10A; 100V; TO-61
*	2N5334	NPN; 3A; 60V; TO-39
*	2N5335	NPN; 3A; 80V; TO-39
*	2N5336	NPN; 5A; 80V; TO-39
*	2N5337	NPN; 5A; 80V; TO-39
*	2N5338	NPN; 5A; 100V; TO-39

PAGE	PART NUMBER	DESCRIPTION
	TRANSISTOR	
*	2N5339	NPN; 5A; 100V; TO-39
*	2N5346	NPN; 7A; 80V; TO-59
*	2N5347	NPN; 7A; 80V; TO-59
*	2N5348	NPN; 7A; 100V; TO-59
*	2N5349	NPN; 7A; 100V; TO-59
*	2N5427	NPN; 7A; 80V; TO-66
*	2N5428	NPN; 7A; 80V; TO-66
*	2N5429	NPN; 7A; 100V; TO-66
*	2N5430	NPN; 7A; 100V; TO-66
*	2N5477	NPN; 7A; 80V; TO-59
*	2N5478	NPN; 7A; 80V; TO-59
*	2N5479	NPN; 7A; 100V; TO-59
*	2N5480	NPN; 7A; 100V; TO-59
141	2N5487	NPN; 5A; 80V; TO-5 Low Profile
141	2N5487-1	NPN; 5A; 80V; TO-5
141	2N5487-3	NPN; 5A; 80V; TO-5 Stud
141	2N5488	NPN; 5A; 100V; TO-5 Low Profile
141	2N5488-1	NPN; 5A; 100V; TO-5
141	2N5488-3	NPN; 5A; 100V; TO-5 Stud
144	2N5552	NPN; 10A; 80V; TO-5
144	2N5552-4	NPN; 10A; 80V; TO-5 Stud
146	2N5658	NPN; 20A; 80V; TO-59
146	2N5659	NPN; 20A; 80V; TO-111
148	2N5660	NPN; 3A; 200V; TO-66
150	2N5660JAN	NPN; 3A; 200V; TO-66
150	2N5660JANTX	NPN; 3A; 200V; TO-66
148	2N5661	NPN; 3A; 300V; TO-66
150	2N5661JAN	NPN; 3A; 300V; TO-66
150	2N5661JANTX	NPN; 3A; 300V; TO-66
148	2N5662	NPN; 3A; 200V; TO-5
150	2N5662JAN	NPN; 3A; 200V; TO-5
150	2N5662JANTX	NPN; 3A; 200V; TO-5
148	2N5663	NPN; 3A; 300V; TO-5
150	2N5663JAN	NPN; 3A; 300V; TO-5
150	2N5663JANTX	NPN; 3A; 300V; TO-5
154	2N5664	NPN; 5A; 200V; TO-66
154	2N5664JAN	NPN; 5A; 200V; TO-66
154	2N5664JANTX	NPN; 5A; 200V; TO-66
154	2N5665	NPN; 5A; 300V; TO-66
154	2N5665JAN	NPN; 5A; 300V; TO-66
154	2N5665JANTX	NPN; 5A; 300V; TO-66
154	2N5666	NPN; 200V; TO-5
154	2N5666JAN	NPN; 200V; TO-5
154	2N5666JANTX	NPN; 200V; TO-5
154	2N5667	NPN; 300V; TO-5
154	2N5667JAN	NPN; 300V; TO-5
154	2N5667JANTX	NPN; 300V; TO-5
	SCR	
158	2N5719	0.5A@100°C 60V; TO-18
158	2N5720	0.5A@100°C 100V; TO-18
158	2N5721	0.5A@100°C 200V; TO-18
158	2N5722	0.5A@100°C 300V; TO-18
158	2N5723	0.5A@100°C 400V; TO-18
162	2N5724	1.6A@85°C 60V; TO-5
162	2N5725	1.6A@85°C 100V; TO-5
162	2N5726	1.6A@85°C 200V; TO-5
162	2N5727	1.6A@85°C 300V; TO-5
162	2N5728	1.6A@85°C 400V; TO-5
	PUT	
166	2N6027	375mW@25°C 40V; TO-98
166	2N6028	375mW@25°C 40V; TO-98
	TRANSISTOR	
*	2N6077	NPN; 7A; 300V; TO-66
*	2N6078	NPN; 7A; 275V; TO-66
	PUT	
*	2N6116	400mW@25°C 40V; TO-18
*	2N6117	400mW@25°C 40V; TO-18
*	2N6118	400mW@25°C 40V; TO-18
170	2N6119	400mW@25°C 40V; TO-18
170	2N6120	400mW@25°C 40V; TO-18

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PAGE	PART NUMBER	DESCRIPTION
	PUT	
174	2N6137	400mW@25°C 40V; TO-18
174	2N6138	400mW@25°C 100V; TO-18
	TRANSISTOR	
178	2N6232	NPN; 10A; 100V; TO-5
178	2N6232-4	NPN; 10A; 100V; TO-5 Stud
*	2N6233	NPN; 5A; 225V; TO-66
*	2N6234	NPN; 5A; 275V; TO-66
*	2N6235	NPN; 5A; 325V; TO-66
	DARLINGTON	
180	2N6350	NPN; 10.0A; 80V; TO-33
180	2N6350JAN	NPN; 10.0A; 80V; TO-33
180	2N6350JANTX	NPN; 10.0A; 80V; TO-33
180	2N6351	NPN; 10.0A; 150V; TO-33
180	2N6351JAN	NPN; 10.0A; 150V; TO-33
180	2N6351JANTX	NPN; 10.0A; 150V; TO-33
180	2N6352	NPN; 10.0A; 80V; TO-66
180	2N6352JAN	NPN; 10.0A; 80V; TO-66
180	2N6352JANTX	NPN; 10.0A; 80V; TO-66
180	2N6353	NPN; 10.0A; 150V; TO-66
180	2N6353JAN	NPN; 10.0A; 150V; TO-66
180	2N6353JANTX	NPN; 10.0A; 150V; TO-66
	SCR	
*	3L1015	0.5A@75°C 15V; TO-18
*	3L1030	0.5A@75°C 30V; TO-18
*	3L1060	0.5A@75°C 60V; TO-18
*	3L1100	0.5A@75°C 100V; TO-18
*	3L2015	0.5A@100°C 15V; TO-18
*	3L2030	0.5A@100°C 30V; TO-18
*	3L2060	0.5A@100°C 60V; TO-18
*	3L2100	0.5A@100°C 100V; TO-18
	PHOTO SCR	
*	3P15	0.3A@50°C 15V; TO-18
*	3P30	0.3A@50°C 30V; TO-18
*	3P60	0.3A@50°C 60V; TO-18
*	3P100	0.3A@50°C 100V; TO-18
*	3P150	0.3A@50°C 150V; TO-18
*	3P200	0.3A@50°C 200V; TO-18
*	3P1020	0.3A@50°C 15V; TO-18
*	3P1021	0.3A@50°C 30V; TO-18
*	3P1022	0.3A@50°C 60V; TO-18
*	3P1023	0.3A@50°C 100V; TO-18
	FULL WAVE BRIDGE	
183	469-1	1 ph; 10A; 200V
183	469-2	1 ph; 10A; 400V
183	469-3	1 ph; 10A; 600V
186	673-1	1 ph; 1.5A; 100V
186	673-2	1 ph; 1.5A; 200V
186	673-3	1 ph; 1.5A; 300V
186	673-4	1 ph; 1.5A; 400V
186	673-5	1 ph; 1.5A; 500V
186	673-6	1 ph; 1.5A; 600V
188	673-7	1 ph; H.V.; 1200V
188	673-7.5	1 ph; H.V.; 1800V
188	673-8	1 ph; H.V.; 2400V
188	673-8.5	1 ph; H.V.; 3000V
188	673-9	1 ph; H.V.; 3600V
188	673-10	1 ph; H.V.; 4200V
188	673-11	1 ph; H.V.; 4800V
188	673-12	1 ph; H.V.; 5000V
186	676-1	1 ph; 1.0A; 100V
186	676-2	1 ph; 1.0A; 200V
186	676-3	1 ph; 1.0A; 300V
186	676-4	1 ph; 1.0A; 400V
186	676-5	1 ph; 1.0A; 500V
186	676-6	1 ph; 1.0A; 600V
188	676-12	1 ph; H.V.; 1200V
188	676-18	1 ph; H.V.; 1800V
188	676-24	1 ph; H.V.; 2400V
188	676-30	1 ph; H.V.; 3000V
188	676-36	1 ph; H.V.; 3600V
188	676-42	1 ph; H.V.; 4200V

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PAGE	PART NUMBER	DESCRIPTION
	FULL WAVE BRIDGE	
188	676-48	1 ph; H.V.; 4800V
188	676-50	1 ph; H.V.; 5000V
186	677-1	1 ph; 1.0A; 50V
186	677-2	1 ph; 1.0A; 100V
186	677-3	1 ph; 1.0A; 150V
186	677-4	1 ph; 1.0A; 200V
191	678-1	3 ph; 25.0A; 100V
191	678-2	3 ph; 25.0A; 200V
191	678-3	3 ph; 25.0A; 300V
191	678-4	3 ph; 25.0A; 400V
191	678-5	3 ph; 25.0A; 500V
191	678-6	3 ph; 25.0A; 600V
194	679-1	1 ph; 25.0A; 100V
194	679-2	1 ph; 25.0A; 200V
194	679-3	1 ph; 25.0A; 300V
194	679-4	1 ph; 25.0A; 400V
194	679-5	1 ph; 25.0A; 500V
194	679-6	1 ph; 25.0A; 600V
194	680-1	1 ph; 10.0A; 100V
194	680-2	1 ph; 10.0A; 200V
194	680-3	1 ph; 10.0A; 300V
194	680-4	1 ph; 10.0A; 400V
194	680-5	1 ph; 10.0A; 500V
194	680-6	1 ph; 10.0A; 600V
	DOUBLER OR CENTER TAP	
197	681-1	15.0A; 100V
197	681-2	15.0A; 200V
197	681-3	15.0A; 300V
197	681-4	15.0A; 400V
197	681-5	15.0A; 500V
197	681-6	15.0A; 600V
	FULL WAVE BRIDGE	
191	682-1	3 ph; 20.0A; 100V
191	682-2	3 ph; 20.0A; 200V
191	682-3	3 ph; 20.0A; 300V
191	682-4	3 ph; 20.0A; 400V
191	682-5	3 ph; 20.0A; 500V
191	682-6	3 ph; 20.0A; 600V
194	683-1	1 ph; 20.0A; 100V
194	683-2	1 ph; 20.0A; 200V
194	683-3	1 ph; 20.0A; 300V
194	683-4	1 ph; 20.0A; 400V
194	683-5	1 ph; 20.0A; 500V
194	683-6	1 ph; 20.0A; 600V
194	684-1	1 ph; 10.0A; 100V
194	684-2	1 ph; 10.0A; 200V
194	684-3	1 ph; 10.0A; 300V
194	684-4	1 ph; 10.0A; 400V
194	684-5	1 ph; 10.0A; 500V
194	684-6	1 ph; 10.0A; 600V
199	685-2.5	3 ph; 2.5KV
199	685-3	3 ph; 3.0KV
199	685-4	3 ph; 4.0KV
199	685-5	3 ph; 5.0KV
199	685-7	3 ph; 7.0KV
201	686-2.5	1 ph; 2.5KV
201	686-3	1 ph; 3.0KV
201	686-4	1 ph; 4.0KV
201	686-5	1 ph; 5.0KV
201	686-7	1 ph; 7.0KV
	CENTER TAP	
203	687-5	5.0KV
203	687-6	6.0KV
203	687-8	8.0KV
203	687-10	10.0KV
203	687-12	12.0KV
	RECTIFIER STACK	
205	688-10	10.0KV
205	688-12	12.0KV
205	688-15	15.0KV

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PAGE	PART NUMBER	DESCRIPTION
	RECTIFIER STACK	
205	688-18	18.0KV
205	688-20	20.0KV
205	688-25	25.0KV
	FULL WAVE BRIDGE	
207	690-8	3 ph; 8.0KV
207	690-10	3 ph; 10.0KV
207	690-12	3 ph; 12.0KV
207	690-15	3 ph; 15.0KV
209	691-1	3 ph; 4.5A; 100V
209	691-2	3 ph; 4.5A; 200V
209	691-3	3 ph; 4.5A; 300V
209	691-4	3 ph; 4.5A; 400V
209	691-5	3 ph; 4.5A; 500V
209	691-6	3 ph; 4.5A; 600V
209	692-1	3 ph; 3.5A; 100V
209	692-2	3 ph; 3.5A; 200V
209	692-3	3 ph; 3.5A; 300V
209	692-4	3 ph; 3.5A; 400V
209	692-5	3 ph; 3.5A; 500V
209	692-6	3 ph; 3.5A; 600V
211	693-1	1 ph; 3.5A; 100V
211	693-2	1 ph; 3.5A; 200V
211	693-3	1 ph; 3.5A; 300V
211	693-4	1 ph; 3.5A; 400V
211	693-5	1 ph; 3.5A; 500V
211	693-6	1 ph; 3.5A; 600V
211	694-1	1 ph; 3.0A; 100V
211	694-2	1 ph; 3.0A; 200V
211	694-3	1 ph; 3.0A; 300V
211	694-4	1 ph; 3.0A; 400V
211	694-5	1 ph; 3.0A; 500V
211	694-6	1 ph; 3.0A; 600V
191	695-1	3 ph; 15.0A; 100V
191	695-2	3 ph; 15.0A; 200V
191	695-3	3 ph; 15.0A; 300V
191	695-4	3 ph; 15.0A; 400V
191	695-5	3 ph; 15.0A; 500V
191	695-6	3 ph; 15.0A; 600V
191	696-1	3 ph; 15.0A; 100V
191	696-2	3 ph; 15.0A; 200V
191	696-3	3 ph; 15.0A; 300V
191	696-4	3 ph; 15.0A; 400V
191	696-5	3 ph; 15.0A; 500V
191	696-6	3 ph; 15.0A; 600V
213	697-1	1 ph; 2.5A; 100V
213	697-2	1 ph; 2.5A; 200V
213	697-3	1 ph; 2.5A; 300V
213	697-4	1 ph; 2.5A; 400V
213	697-5	1 ph; 2.5A; 500V
213	697-6	1 ph; 2.5A; 600V
213	698-1	1 ph; 2.25A; 100V
213	698-2	1 ph; 2.25A; 200V
213	698-3	1 ph; 2.25A; 300V
213	698-4	1 ph; 2.25A; 400V
213	698-5	1 ph; 2.25A; 500V
213	698-6	1 ph; 2.25A; 600V
215	700-1	3 ph; 2.5A; 100V
215	700-2	3 ph; 2.5A; 200V
215	700-3	3 ph; 2.5A; 300V
215	700-4	3 ph; 2.5A; 400V
215	700-5	3 ph; 2.5A; 500V
215	700-6	3 ph; 2.5A; 600V
215	701-1	3 ph; 2.25A; 100V
215	701-2	3 ph; 2.25A; 200V
215	701-3	3 ph; 2.25A; 300V
215	701-4	3 ph; 2.25A; 400V
215	701-5	3 ph; 2.25A; 500V
215	701-6	3 ph; 2.25A; 600V
217	800-1	3 ph; 40.0A; 50V
217	800-2	3 ph; 40.0A; 100V
217	800-3	3 ph; 40.0A; 125V
217	800-4	3 ph; 40.0A; 150V

PAGE	PART NUMBER	DESCRIPTION
	FULL WAVE RECTIFIER	
217	801-1	3 ph; 20.0A; 50V
217	801-2	3 ph; 20.0A; 100V
217	801-3	3 ph; 20.0A; 125V
217	801-4	3 ph; 20.0A; 150V
220	802-1	1 ph; 35.0A; 50V
220	802-2	1 ph; 35.0A; 100V
220	802-3	1 ph; 35.0A; 125V
220	802-4	1 ph; 35.0A; 150V
220	803-1	1 ph; 20.0A; 50V
220	803-2	1 ph; 20.0A; 100V
220	803-3	1 ph; 20.0A; 125V
220	803-4	1 ph; 20.0A; 150V
	DOUBLER OR CENTER TAP	
223	804-1	20.0A; 50V
223	804-2	20.0A; 100V
223	804-3	20.0A; 125V
223	804-4	20.0A; 150V
	SCR	
*	AA1	±25mA@80°C 400V; TO-18
*	AA2	±25mA@80°C 300V; TO-18
*	AA3	±25mA@80°C 200V; TO-18
226	AA100	0.5A@100°C 60V; TO-18
226	AA101	0.5A@100°C 100V; TO-18
226	AA102	0.5A@100°C 200V; TO-18
226	AA103	0.5A@100°C 300V; TO-18
226	AA104	0.5A@100°C 400V; TO-18
226	AA107	0.5A@100°C 60V; TO-18
226	AA108	0.5A@100°C 100V; TO-18
226	AA109	0.5A@100°C 200V; TO-18
226	AA110	0.5A@100°C 300V; TO-18
226	AA111	0.5A@100°C 400V; TO-18
226	AA114	0.5A@100°C 60V; TO-18
226	AA115	0.5A@100°C 100V; TO-18
226	AA116	0.5A@100°C 200V; TO-18
226	AA117	0.5A@100°C 300V; TO-18
226	AA118	0.5A@100°C 400V; TO-18
230	AD100	1.6A@85°C 60V; TO-5
230	AD101	1.6A@85°C 100V; TO-5
230	AD102	1.6A@85°C 200V; TO-5
230	AD103	1.6A@85°C 300V; TO-5
230	AD104	1.6A@85°C 400V; TO-5
230	AD107	1.6A@85°C 60V; TO-5
230	AD108	1.6A@85°C 100V; TO-5
230	AD109	1.6A@85°C 200V; TO-5
230	AD110	1.6A@85°C 300V; TO-5
230	AD111	1.6A@85°C 400V; TO-5
230	AD114	1.6A@85°C 60V; TO-5
230	AD115	1.6A@85°C 100V; TO-5
230	AD116	1.6A@85°C 200V; TO-5
230	AD117	1.6A@85°C 300V; TO-5
230	AD118	1.6A@85°C 400V; TO-5
*	BA150	0.5A@100°C 30V; TO-18
*	BA151	0.5A@100°C 60V; TO-18
*	BA152	0.5A@100°C 100V; TO-18
*	BD100	2.0A@100°C 30V; TO-59
*	BD101	2.0A@100°C 60V; TO-59
*	BD102	2.0A@100°C 100V; TO-59
234	CB200	0.5A@100°C 30V; TO-18
234	CB201	0.5A@100°C 60V; TO-18
234	CB202	0.5A@100°C 100V; TO-18
234	CB203	0.5A@100°C 200V; TO-18
	GTO - SCR	
*	CB5020	0.25A@75°C 30V; TO-18
*	CB5021	0.25A@75°C 60V; TO-18
*	CB5022	0.25A@75°C 100V; TO-18
*	CB5023	0.25A@75°C 200V; TO-18
	SCR	
238	CD200	1.6A@85°C 30V; TO-5
238	CD201	1.6A@85°C 60V; TO-5
238	CD202	1.6A@85°C 100V; TO-5

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PAGE	PART NUMBER	DESCRIPTION
	SCR	
238	CD203	1.6A@85°C 200V; TO-5
	GTO - SCR	
*	CD5000	1.0A@25°C 30V; TO-5
*	CD5001	1.0A@25°C 60V; TO-5
*	CD5002	1.0A@25°C 100V; TO-5
*	CD5003	1.0A@25°C 200V; TO-5
	FOUR-LEADED SCR	
*	CL1	1.6A@85°C 200V; TO-33
*	CL2	1.6A@85°C 100V; TO-33
*	CL3	1.6A@85°C 60V; TO-33
	SCR	
241	CM100	5.0A@100°C 60V; TO-59
241	CM101	5.0A@100°C 100V; TO-59
241	CM102	5.0A@100°C 200V; TO-59
241	CM103	5.0A@100°C 300V; TO-59
241	CM104	5.0A@100°C 400V; TO-59
*	EL20	±25mA@25°C 200V; TO-18
*	EL25	±25mA@25°C 250V; TO-18
*	EL30	±25mA@25°C 300V; TO-18
*	EL35	±25mA@25°C 350V; TO-18
*	EL40	±25mA@25°C 400V; TO-18
	QUAD SCR	
*	EL200	±25mA@25°C 200V; TO-100
*	EL200G	±25mA@25°C 200V; TO-100
*	EL250	±25mA@25°C 250V; TO-100
*	EL250G	±25mA@25°C 250V; TO-100
*	EL300	±25mA@25°C 300V; TO-100
*	EL300G	±25mA@25°C 300V; TO-100
*	EL350	±25mA@25°C 350V; TO-100
*	EL350G	±25mA@25°C 350V; TO-100
*	EL400	±25mA@25°C 400V; TO-100
*	EL400G	±25mA@25°C 400V; TO-100
	SCR	
243	GA100	400mA@100°C 30V; TO-18
243	GA101	400mA@100°C 60V; TO-18
243	GA102	400mA@100°C 80V; TO-18
247	GA200	60V; TO-18
247	GA200A	60V; TO-18
247	GA201	100V; TO-18
247	GA201A	100V; TO-18
250	GA300	60V; TO-18
250	GA300A	60V; TO-18
250	GA301	100V; TO-18
250	GA301A	100V; TO-18
*	GB100	5.0A@100°C 30V; TO-59
*	GB101	5.0A@100°C 60V; TO-59
*	GB102	5.0A@100°C 80V; TO-59
247	GB200	60V; TO-59
247	GB200A	60V; TO-59
247	GB201	100V; TO-59
247	GB201A	100V; TO-59
*	GB300	60V; TO-59
*	GB300A	60V; TO-59
*	GB301	100V; TO-59
*	GB301A	100V; TO-59
253	ID100	0.5A@100°C 30V; TO-18
253	ID101	0.5A@100°C 60V; TO-18
253	ID102	0.5A@100°C 100V; TO-18
253	ID103	0.5A@100°C 150V; TO-18
253	ID104	0.5A@100°C 200V; TO-18
253	ID105	0.5A@100°C 300V; TO-18
253	ID106	0.5A@100°C 400V; TO-18
257	ID200	1.6A@70°C 50V; TO-5
257	ID201	1.6A@70°C 100V; TO-5
257	ID202	1.6A@70°C 150V; TO-5
257	ID203	1.6A@70°C 200V; TO-5
257	ID300	1.6A@70°C 300V; TO-5
257	ID301	1.6A@70°C 400V; TO-5
259	IP100	0.8A@70°C 30V; TO-92
259	IP101	0.8A@70°C 60V; TO-92
259	IP102	0.8A@70°C 100V; TO-92

PAGE	PART NUMBER	DESCRIPTION
	SCR	
259	IP103	0.8A@70°C 150V; TO-92
259	IP104	0.8A@70°C 200V; TO-92
259	IP105	0.8A@70°C 300V; TO-92
259	IP106	0.8A@75°C 400V; TO-92
	PUT	
263	P13T1	375mW@25°C 40V; TO-92
263	P13T2	375mW@25°C 40V; TO-92
	PHOTO SCR	
267	PF30	300mA@50°C 30V; TO-18
267	PF30A	300mA@50°C 30V; TO-18
267	PF60	300mA@50°C 60V; TO-18
267	PF60A	300mA@50°C 60V; TO-18
267	PF100	300mA@50°C 100V; TO-18
267	PF100A	300mA@50°C 100V; TO-18
267	PF200	300mA@50°C 200V; TO-18
267	PF200A	300mA@50°C 200V; TO-18
	HYBRID CIRCUIT	
273	PIC100	AC Switch; 1.0A; 200V; TO-5
273	PIC101	AC Switch; 1.0A; 200V; TO-5
273	PIC102	AC Switch; 1.0A; 400V; TO-5
273	PIC103	AC Switch; 1.0A; 400V; TO-5
*	PIC110	AC Switch; 1.0A; 175V; TO-5
*	PIC111	AC Switch; 1.0A; 350V; TO-5
*	PIC120	AC Switch; 4.0A; 200V; TO-59
*	PIC121	AC Switch; 4.0A; 200V; TO-59
*	PIC122	AC Switch; 4.0A; 400V; TO-59
*	PIC123	AC Switch; 4.0A; 400V; TO-59
*	PIC130 AC Switch	4.0A; 175V; TO-59
*	PIC131 AC Switch	4.0A; 350V; TO-59
275	PIC400 Pwr. Pulser	8.0A; 60V; TO-3
275	PIC401 Pwr. Pulser	8.0A; 60V; TO-3
*	PIC410 Pwr. Pulser	8.0A; 60V; TO-3
	POWER DARLINGTON	
279	PIC500 Dual Darlington	NPN; 10.0A; 100V; TO-3
279	PIC501 Dual Darlington	NPN; 10.0A; 100V; TO-3
279	PIC502 Dual Darlington	NPN; 8.0A; 80V; TO-3
	HYBRID CIRCUIT	
283	PIC600 Sw. Reg.	5.0A; 60V (Pos.); TO-66
283	PIC601 Sw. Reg.	5.0A; 80V (Pos.); TO-66
283	PIC610 Sw. Reg.	5.0A; 60V (Neg.); TO-66
283	PIC611 Sw. Reg.	5.0A; 80V (Neg.); TO-66
287	PIC625 Sw. Reg.	15A; 60V (Pos.); TO-66
287	PIC626 Sw. Reg.	15A; 80V (Pos.); TO-66
287	PIC635 Sw. Reg.	15A; 60V (Neg.); TO-66
287	PIC636 Sw. Reg.	15A; 80V (Neg.); TO-66
	PHOTO SCR	
267	PR30	300mA@50°C 30V; TO-18
267	PR30A	300mA@50°C 30V; TO-18
267	PR60	300mA@50°C 60V; TO-18
267	PR60A	300mA@50°C 60V; TO-18
267	PR100	300mA@50°C 100V; TO-18
267	PR100A	300mA@50°C 100V; TO-18
267	PR200	300mA@50°C 200V; TO-18
267	PR200A	300mA@50°C 200V; TO-18
	FULL WAVE BRIDGE	
291	SPA25	1 ph; 25.0A; 100V
291	SPA25JAN	1 ph; 25.0A; 100V
291	SPB25	1 ph; 25.0A; 200V
291	SPB25JAN	1 ph; 25.0A; 200V
291	SPC25	1 ph; 25.0A; 400V
291	SPC25JAN	1 ph; 25.0A; 400V
291	SPD25	1 ph; 25.0A; 600V
291	SPD25JAN	1 ph; 25.0A; 600V
	TRANSISTOR	
*	SSP3020	NPN; 2.0A; 120V; TO-5
*	SSP3050	NPN; 5.0A; 60V; TO-66
*	SSP3051	NPN; 5.0A; 80V; TO-66
*	SSP3200	NPN; 20.0A; 80V; TO-61
*	SSP3201	NPN; 20.0A; 80V; TO-61
*	SSP3300	NPN; 30.0A; 80V; TO-63
*	SSP3301	NPN; 30.0A; 60V; TO-63

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PAGE	PART NUMBER	DESCRIPTION
	TRANSISTOR	
*	SSP3302	NPN; 30.0A; 80V; TO-3
*	SSP3303	NPN; 30.0A; 60V; TO-3
	PUT	
294	U13T1	400mW@25°C 40V; TO-18
294	U13T2	400mW@25°C 40V; TO-18
294	U13T3	400mW@25°C 100V; TO-18
294	U13T4	400mW@25°C 100V; TO-18
	DARLINGTON	
296	U2T101	NPN; 10.0A; 80V; TO-33
296	U2T105	NPN; 10.0A; 150V; TO-33
298	U2T151	PNP; 10.0A; 80V; TO-33
298	U2T155	PNP; 10.0A; 120V; TO-33
296	U2T201	NPN; 10.0A; 80V; TO-66
296	U2T205	NPN; 10.0A; 150V; TO-66
298	U2T251	PNP; 10.0A; 80V; TO-66
298	U2T255	PNP; 10.0A; 150V; TO-66
300	U2T301	NPN; 5.0A; 60V; TO-33
300	U2T305	NPN; 5.0A; 150V; TO-33
302	U2T351	PNP; 10.0A; 60V; TO-33
302	U2T355	PNP; 10.0A; 120V; TO-33
300	U2T401	NPN; 5.0A; 60V; TO-66
300	U2T405	NPN; 5.0A; 150V; TO-66
302	U2T451	PNP; 5.0A; 60V; TO-66
302	U2T455	PNP; 5.0A; 120V; TO-66
304	U2T501	NPN; 20.0A; 80V; TO-66
304	U2T505	NPN; 20.0A; 150V; TO-66
304	U2T601	NPN; 20.0A; 80V; TO-3
304	U2T605	NPN; 20.0A; 150V; TO-3
306	U2T712	NPN; 5.0A; 200V; TO-33
306	U2T713	NPN; 5.0A; 300V; TO-33
306	U2T722	NPN; 5.0A; 200V; TO-66
306	U2T723	NPN; 5.0A; 300V; TO-66
306	U2T822	NPN; 10.0A; 200V; TO-66
306	U2T823	NPN; 10.0A; 300V; TO-66
306	U2T832	NPN; 10.0A; 200V; TO-3
306	U2T833	NPN; 10.0A; 300V; TO-3
	RECTIFIER STACK	
310	UDA5	5.0KV
310	UDA7.5	7.5KV
310	UDA10	10.0KV
310	UDA15	15.0KV
310	UDB2.5	2.5KV
310	UDB5	5.0KV
310	UDB7.5	7.5KV
310	UDC5	5.0KV
310	UDC7.5	7.5KV
310	UDC10	10.0KV
310	UDC15	15.0KV
310	UDD2.5	2.5KV
310	UDD5	5.0KV
310	UDD7.5	7.5KV
310	UDE2.5	2.5KV
310	UDE5	5.0KV
310	UDF2.5	2.5KV
310	UDF5	5.0KV
	ZENER	
313	UDZ110-UDZ119	Bi-directional; 3W; 5%
313	UDZ120-UDZ140	Bi-directional; 3W; 5%
313	UDZ210-UDZ219	Bi-directional; 3W; 10%
313	UDZ220-UDZ240	Bi-directional; 3W; 10%
313	UDZ707-UDZ760	Bi-directional; 3W; 5%
313	UDZ770-UDZ790	Bi-directional; 3W; 5%
313	UDZ807-UDZ860	Bi-directional; 3W; 10%
313	UDZ870-UDZ890	Bi-directional; 3W; 10%
313	UDZ5110-UDZ5119	Bi-directional; 5W; 5%
313	UDZ5120--UDZ5140	Bi-directional; 5W; 5%
313	UDZ5210-UDZ5219	Bi-directional; 5W; 10%
313	UDZ5220-UDZ5240	Bi-directional; 5W; 10%
313	UDZ5707-UDZ5760	Bi-directional; 5W; 5%
313	UDZ5770-UDZ5790	Bi-directional; 5W; 5%
313	UDZ5807-UDZ5860	Bi-directional; 5W; 10%

PAGE	PART NUMBER	DESCRIPTION
	ZENER	
313	UDZ5870-UDZ5890	Bi-directional; 5W; 10%
313	UDZ7110	Bi-directional; 6W; 5%
313	UDZ7210	Bi-directional; 6W; 10%
313	UDZ7707-UDZ7760	Bi-directional; 6W; 5%
313	UDZ7807-UDZ7860	Bi-directional; 6W; 10%
313	UDZ8110-UDZ8120	Bi-directional; 1W; 5%
313	UDZ8210-UDZ8220	Bi-directional; 1W; 10%
313	UDZ8707-UDZ8791	Bi-directional; 1W; 5%
313	UDZ8807-UDZ8891	Bi-directional; 1W; 10%
	RECTIFIER	
82	UES101 (1N5802)	2.5A; 50V
82	UES102 (1N5803)	2.5A; 75V
82	UES103 (1N5804)	2.5A; 100V
82	UES104 (1N5805)	2.5A; 125V
82	UES201 (1N5807)	6.0A; 50V
82	UES202 (1N5808)	6.0A; 75V
82	UES203 (1N5809)	6.0A; 100V
82	UES204 (1N5810)	6.0A; 125V
*	UES301	20.0A; 50V
*	UES302	20.0A; 75V
*	UES303	20.0A; 100V
*	UES304	20.0A; 125V
316	UES501	50.0A; 50V
316	UES502	50.0A; 75V
316	UES503	50.0A; 100V
316	UES504	50.0A; 125V
316	UES505	50.0A; 150V
	RECTIFIER STACK	
319	UFB2.5	2.5KV
319	UFB5	5.0KV
319	UFB7.5	7.5KV
319	UFS5	5.0KV
319	UFS7.5	7.5KV
319	UFS10	10.0KV
322	UGB5	5.0KV
322	UGB7.5	7.5KV
322	UGB10	10.0KV
322	UGD5	5.0KV
322	UGD7.5	7.5KV
322	UGD10	10.0KV
322	UGE2.5	2.5KV
322	UGE5	5.0KV
322	UGE7.5	7.5KV
322	UGF2.5	2.5KV
322	UGF5	5.0KV
322	UGF7.5	7.5KV
	PIN DIODE	
50	UM4001	100V
50	UM4002	200V
50	UM4004	400V
50	UM4006	600V
50	UM4008	800V
50	UM4010	1000V
50	UM4012	1200V
50	UM4301	100V
50	UM4302	200V
50	UM4304	400V
50	UM4306	600V
50	UM4310	1000V
50	UM4901	100V
50	UM4902	200V
50	UM4904	400V
50	UM4906	600V
50	UM4910	1000V
50	UM6001	100V
50	UM6002	200V
50	UM6004	400V
50	UM6006	600V
50	UM6010	1000V
50	UM6101	100V
50	UM6102	200V

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PAGE	PART NUMBER	DESCRIPTION
	PIN DIODE	
50	UM6104	400V
50	UM6106	600V
50	UM6108	800V
50	UM6201	100V
50	UM6202	200V
50	UM6204	400V
50	UM6206	600V
50	UM6601	100V
50	UM6602	200V
50	UM6604	400V
50	UM6606	600V
50	UM7001	100V
50	UM7002	200V
50	UM7004	400V
50	UM7006	600V
50	UM7010	1000V
50	UM7016	1600V
50	UM7101	100V
50	UM7102	200V
50	UM7104	400V
50	UM7108	800V
50	UM7201	100V
50	UM7202	200V
50	UM7204	400V
50	UM7206	600V
50	UM7301	100V
50	UM7302	200V
50	UM7304	400V
50	UM7306	600V
50	UM7310	1000V
50	UM7901	100V
50	UM7902	200V
50	UM7904	400V
50	UM7906	600V
50	UM7910	1000V
50	UM9301	100V
50	UM9302	100V
50	UM9303	100V
	TRANSISTOR	
325	UPT011	NPN; 0.5A; 150V; TO-5
325	UPT012	NPN; 0.5A; 200V; TO-5
325	UPT013	NPN; 0.5A; 250V; TO-5
325	UPT014	NPN; 0.5A; 300V; TO-5
325	UPT015	NPN; 0.5A; 300V; TO-5
325	UPT021	NPN; 0.5A; 150V; TO-46
325	UPT022	NPN; 0.5A; 200V; TO-46
325	UPT023	NPN; 0.5A; 250V; TO-46
325	UPT024	NPN; 0.5A; 300V; TO-46
325	UPT025	NPN; 0.5A; 300V; TO-46
328	UPT111	NPN; 1.0A; 40V; TO-5
328	UPT112	NPN; 1.0A; 60V; TO-5
328	UPT113	NPN; 1.0A; 80V; TO-5
328	UPT114	NPN; 1.0A; 100V; TO-5
328	UPT115	NPN; 1.0A; 100V; TO-5
328	UPT121	NPN; 1.0A; 40V; TO-66
328	UPT122	NPN; 1.0A; 60V; TO-66
328	UPT123	NPN; 1.0A; 80V; TO-66
328	UPT124	NPN; 1.0A; 100V; TO-66
328	UPT125	NPN; 1.0A; 100V; TO-66
331	UPT211	NPN; 2.0A 40V; TO-5
331	UPT212	NPN; 2.0A; 60V; TO-5
331	UPT213	NPN; 2.0A; 80V; TO-5
331	UPT214	NPN; 2.0A; 100V; TO-5
331	UPT215	NPN; 2.0A; 100V; TO-5
331	UPT221	NPN; 2.0A; 40V; TO-66
331	UPT222	NPN; 2.0A; 60V; TO-66
331	UPT223	NPN; 2.0A; 80V; TO-66
331	UPT224	NPN; 2.0A; 100V; TO-66
331	UPT225	NPN; 2.0A; 100V; TO-66
334	UPT311	NPN; 2.0A; 150V; TO-5
334	UPT312	NPN; 2.0A; 200V; TO-5
334	UPT313	NPN; 2.0A; 250V; TO-5

PAGE	PART NUMBER	DESCRIPTION
	TRANSISTOR	
334	UPT314	NPN; 2.0A; 300V; TO-5
334	UPT315	NPN; 2.0A; 300V; TO-5
334	UPT321	NPN; 2.0A; 150V; TO-66
334	UPT322	NPN; 2.0A; 200V; TO-66
334	UPT323	NPN; 2.0A; 250V; TO-66
334	UPT324	NPN; 2.0A; 300V; TO-66
334	UPT325	NPN; 2.0A; 300V; TO-66
*	UPT410	NPN; 3.5A; 200V; TO-3
*	UPT410A	NPN; 3.5A; 200V; TO-66
*	UPT411	NPN; 3.5A; 300V; TO-3
*	UPT411A	NPN; 3.5A; 300V; TO-66
*	UPT413	NPN; 2.0A; 325V; TO-3
*	UPT413A	NPN; 2.0A; 325V; TO-66
*	UPT423	NPN; 3.5A; 325V; TO-3
*	UPT423A	NPN; 3.5A; 325V; TO-66
*	UPT430	NPN; 5.0A; 300V; TO-3
*	UPT430A	NPN; 5.0A; 300V; TO-66
*	UPT431	NPN; 5.0A; 325V; TO-3
*	UPT431A	NPN; 5.0A; 325V; TO-66
337	UPT521	NPN; 3.5A; 150V; TO-66
337	UPT522	NPN; 3.5A; 200V; TO-66
337	UPT523	NPN; 3.5A; 250V; TO-66
337	UPT524	NPN; 3.5A; 300V; TO-66
337	UPT525	NPN; 3.0A; 300V; TO-66
337	UPT531	NPN; 3.0A; 150V; TO-3
337	UPT532	NPN; 3.0A; 200V; TO-3
337	UPT533	NPN; 3.0A; 250V; TO-3
337	UPT534	NPN; 3.0A; 300V; TO-3
337	UPT535	NPN; 3.0A; 300V; TO-3
340	UPT611	NPN; 5.0A; 40V; TO-5
340	UPT612	NPN; 5.0A; 60V; TO-5
340	UPT613	NPN; 5.0A; 80V; TO-5
340	UPT614	NPN; 5.0A; 100V; TO-5
340	UPT615	NPN; 5.0A; 100V; TO-5
340	UPT621	NPN; 5.0A; 40V; TO-66
340	UPT622	NPN; 5.0A; 60V; TO-66
340	UPT623	NPN; 5.0A; 80V; TO-66
340	UPT624	NPN; 5.0A; 100V; TO-66
340	UPT625	NPN; 5.0A; 100V; TO-66
343	UPT721	NPN; 5.0A; 150V; TO-66
343	UPT722	NPN; 5.0A; 200V; TO-66
343	UPT723	NPN; 5.0A; 250V; TO-66
343	UPT724	NPN; 5.0A; 300V; TO-66
343	UPT725	NPN; 5.0A; 300V; TO-66
343	UPT731	NPN; 5.0A; 150V; TO-3
343	UPT732	NPN; 5.0A; 200V; TO-3
343	UPT733	NPN; 5.0A; 250V; TO-3
343	UPT734	NPN; 5.0A; 300V; TO-3
343	UPT735	NPN; 5.0A; 300V; TO-3
346	UPT821	NPN; 10.0A; 40V; TO-66
346	UPT822	NPN; 10.0A; 60V; TO-66
346	UPT823	NPN; 10.0A; 80V; TO-66
346	UPT824	NPN; 10.0A; 100V; TO-66
346	UPT825	NPN; 10.0A; 100V; TO-66
346	UPT831	NPN; 10.0A; 40V; TO-3
346	UPT832	NPN; 10.0A; 60V; TO-3
346	UPT833	NPN; 10.0A; 80V; TO-3
346	UPT834	NPN; 10.0A; 100V; TO-3
346	UPT835	NPN; 10.0A; 100V; TO-3
349	UPT931	NPN; 10.0A; 150V; TO-3
349	UPT932	NPN; 10.0A; 200V; TO-3
349	UPT933	NPN; 10.0A; 250V; TO-3
349	UPT934	NPN; 10.0A; 300V; TO-3
349	UPT935	NPN; 10.0A; 300V; TO-3
351	UPT1021	NPN; 15.0A; 40V; TO-66
351	UPT1022	NPN; 15.0A; 60V; TO-66
351	UPT1023	NPN; 15.0A; 80V; TO-66
351	UPT1024	NPN; 15.0A; 100V; TO-66
351	UPT1025	NPN; 15.0A; 100V; TO-66
351	UPT1031	NPN; 15.0A; 40V; TO-3
351	UPT1032	NPN; 15.0A; 60V; TO-3
351	UPT1033	NPN; 15.0A; 80V; TO-3

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	TRANSISTOR	
351	UPT1034	NPN; 15.0A; 100V; TO-3
351	UPT1035	NPN; 15.0A; 100V; TO-3
354	UPT1131	NPN; 20.0A; 40V; TO-3
354	UPT1132	NPN; 20.0A; 60V; TO-3
354	UPT1133	NPN; 20.0A; 80V; TO-3
354	UPT1134	NPN; 20.0A; 100V; TO-3
354	UPT1135	NPN; 20.0A; 100V; TO-3
	RECTIFIER	
356	UR105	1.0A; 50V
356	UR110	1.0A; 100V
356	UR115	1.0A; 150V
356	UR120	1.0A; 200V
356	UR125	1.0A; 250V
356	UR205	2.0A; 50V
356	UR210	2.0A; 100V
356	UR215	2.0A; 150V
356	UR220	2.0A; 200V
356	UR225	2.0A; 250V
*	UR710	1.0A; 100V
*	UR720	1.0A; 200V
	RECTIFIER STACK	
359	US12	1.2KV
359	US15	1.5KV
359	US18	1.8KV
359	US20	2.0KV
359	US25	2.5KV
359	US30	3.0KV
359	US35	3.5KV
359	US40	4.0KV
359	US45A	4.5KV
359	US50A	5.0KV
359	US60A	6.0KV
359	US70A	7.0KV
359	US80A	8.0KV
359	US100A	10.0KV
359	US120A	12.0KV
359	US150A	15.0KV
359	US180A	18.0KV
359	US200A	20.0KV
319	USB2.5	2.5KV
319	USB5	5.0KV
319	USB7.5	7.5KV
319	USB10	10.0KV
359	USR12	1.2KV
359	USR15	1.5KV
359	USR18	1.8KV
359	USR20	2.0KV
359	USR25	2.5KV
359	USR30	3.0KV
359	USR35	3.5KV
359	USR40A	4.0KV
359	USR45A	4.5KV
359	USR50A	5.0KV
359	USR60A	6.0KV
359	USR70A	7.0KV
359	USR80A	8.0KV
359	USR100A	10.0KV
359	USR120A	12.0KV
359	USR150A	15.0KV
359	USR180A	18.0KV
319	USS5	5.0KV
319	USS7.5	7.5KV
319	USS10	10.0KV
319	USS15	15.0KV
	RECTIFIER	
*	UT111 (1N536)	0.75A; 50V
*	UT112 (1N537)	0.75A; 100V
*	UT113 (1N3656)	0.75A; 200V
*	UT114 (1N539)	0.75A; 300V
*	UT115 (1N3657)	0.75A; 400V
*	UT117 (1N547)	0.75A; 500V
	RECTIFIER	
*	UT118 (1N3658)	0.75A; 600V
*	UT119	0.75A; 800V
*	UT120	0.75A; 1000V
*	UT211 (1N645)	0.75A; 225V
*	UT212 (1N646)	0.75A; 300V
*	UT213 (1N647)	0.75A; 400V
*	UT214 (1N648)	0.75A; 500V
*	UT215 (1N649)	0.75A; 600V
*	UT221 (1N676)	0.5A; 100V
*	UT222 (1N677)	0.75A; 100V
*	UT223 (1N678)	0.5A; 200V
*	UT224 (1N679)	0.75A; 200V
*	UT225 (1N681)	0.5A; 300V
*	UT226 (1N682)	0.75A; 300V
*	UT227 (1N683)	0.5A; 400V
*	UT228 (1N684)	0.75A; 400V
*	UT229 (1N685)	0.5A; 500V
*	UT231 (1N686)	0.75A; 500V
*	UT232 (1N687)	0.5A; 600V
*	UT233 (1N689)	0.75A; 600V
*	UT234	1.0A; 200V
*	UT235	1.0A; 400V
263	UT236	1.0A; 100V
263	UT237	1.0A; 500V
263	UT238	1.0A; 600V
263	UT242	1.25A; 200V
263	UT244	1.25A; 400V
263	UT245	1.25A; 500V
263	UT247	1.25A; 600V
263	UT249	1.25A; 100V
263	UT251	1.5A; 100V
263	UT252	1.5A; 200V
263	UT254	1.5A; 400V
263	UT255	1.5A; 500V
263	UT257	1.5A; 600V
263	UT258	1.5A; 800V
263	UT261	2.0A; 100V
263	UT262 (1N3981)	2.0A; 200V
263	UT264 (1N3982)	2.0A; 400V
263	UT265	2.0A; 500V
263	UT267 (1N3983)	2.0A; 600V
263	UT268	2.0A; 800V
263	UT347	1.0A; 1000V
263	UT361	1.0A; 800V
263	UT362	1.2A; 800V
263	UT363	1.2A; 1000V
263	UT364	1.5A; 1000V
*	UT905A	1.5A; 50V
*	UT910A	1.5A; 100V
*	UT920A	1.5A; 200V
*	UT940A	1.5A; 400V
*	UT950A	1.5A; 500V
*	UT1005A	3.0A; 50V
*	UT1010A	3.0A; 100V
*	UT1020A	3.0A; 200V
*	UT1040A	3.0A; 400V
*	UT1050A	3.0A; 500V
367	UT2005	2.0A; 50V
367	UT2010	2.0A; 100V
367	UT2020	2.0A; 200V
367	UT2040	2.0A; 400V
367	UT2060	2.0A; 600V
*	UT2080	2.0A; 800V
367	UT3005	3.0A; 50V
367	UT3010	3.0A; 100V
367	UT3020	3.0A; 200V
367	UT3040	3.0A; 400V
367	UT3060	3.0A; 600V
*	UT3080	3.0A; 800V
367	UT4005	4.0A; 50V
367	UT4010 (1N5180)	4.0A; 100V
367	UT4020	4.0A; 200V

*Contact factory for specifications and ratings

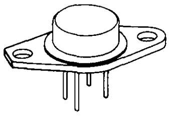
II. PART NUMBER INDEX

PAGE	PART NUMBER	DESCRIPTION
	RECTIFIER	
367	UT4040 (1N5207)	4.0A; 400V
367	UT4060	4.0A; 600V
*	UT4080	4.0A; 800V
*	UT4100	4.0A; 1000V
371	UT5105	7.5A; 50V
371	UT5110	7.5A; 100V
371	UT5120	7.5A; 200V
371	UT5130	7.5A; 300V
371	UT5140	7.5A; 400V
371	UT5160	7.5A; 600V
371	UT6105	9.0A; 50V
371	UT6110	9.0A; 100V
371	UT6120	9.0A; 200V
371	UT6130	9.0A; 300V
371	UT6140	9.0A; 400V
371	UT6160	9.0A; 600V
371	UT8105	12.0A; 50V
371	UT8110	12.0A; 100V
371	UT8120	12.0A; 200V
371	UT8130	12.0A; 300V
371	UT8140	12.0A; 400V
371	UT8160	12.0A; 600V
374	UTR01	1.0A; 50V
374	UTR02	2.0A; 50V
374	UTR10	0.5A; 100V
374	UTR11	1.0A; 100V
374	UTR12	2.0A; 100V
374	UTR20	0.5A; 200V
374	UTR21	1.0A; 200V
374	UTR22	2.0A; 200V
374	UTR30	0.5A; 300V
374	UTR31	1.0A; 300V
374	UTR32	2.0A; 300V
374	UTR40	0.5A; 400V
374	UTR41	1.0A; 400V
374	UTR42 (1N5206)	2.0A; 400V
374	UTR50	0.5A; 500V
374	UTR51	1.0A; 500V
374	UTR52	2.0A; 500V
374	UTR60	0.5A; 600V
374	UTR61	1.0A; 600V
374	UTR62	2.0A; 600V
*	UTR70	0.5A; 700V
*	UTR71	1.0A; 700V
378	UTR2305	2.0A; 50V
378	UTR2310	2.0A; 100V
378	UTR2320	2.0A; 200V
378	UTR2340	2.0A; 400V
378	UTR2350	2.0A; 500V
378	UTR2360	2.0A; 600V
378	UTR3305	3.0A; 50V
378	UTR3310	3.0A; 100V
378	UTR3320	3.0A; 200V
378	UTR3340	3.0A; 400V
378	UTR3350	3.0A; 500V
378	UTR3360	3.0A; 600V
378	UTR4305	4.0A; 50V
378	UTR4310	4.0A; 100V
378	UTR4320	4.0A; 200V
378	UTR4340	4.0A; 400V
378	UTR4350	4.0A; 500V
378	UTR4360	4.0A; 600V
382	UTR4405	6.0A; 50V
382	UTR4410	6.0A; 100V
382	UTR4420	6.0A; 200V
382	UTR4430	6.0A; 300V
382	UTR4440	6.0A; 400V
382	UTR5405	7.5A; 50V
382	UTR5410	7.5A; 100V
382	UTR5420	7.5A; 200V
382	UTR5430	7.5A; 300V
382	UTR5440	7.5A; 400V
382	UTR6405	9.0A; 50V
	RECTIFIER	
382	UTR6410	9.0A; 100V
382	UTR6420	9.0A; 200V
382	UTR6430	9.0A; 300V
382	UTR6440	9.0A; 400V
385	UTX105	1.0A; 50V
385	UTX110	1.0A; 100V
385	UTX115	1.0A; 150V
385	UTX120	1.0A; 200V
385	UTX125	1.0A; 250V
385	UTX205	2.0A; 50V
385	UTX210	2.0A; 100V
385	UTX215	2.0A; 150V
385	UTX220	2.0A; 200V
385	UTX225	2.0A; 250V
388	UTX3105	3.0A; 50V
388	UTX3110	3.0A; 100V
388	UTX3115	3.0A; 150V
388	UTX3120	3.0A; 200V
*	UTX3125	3.0A; 250V
388	UTX4105	4.0A; 50V
388	UTX4110	4.0A; 100V
388	UTX4115	4.0A; 150V
388	UTX4120	4.0A; 200V
*	UTX4125	4.0A; 250V
	ZENER	
391	UZ110-UZ119	3W; 5%
391	UZ120-UZ140	3W; 5%
391	UZ210-UZ219	3W; 10%
391	UZ220-UZ240	3W; 10%
391	UZ310-UZ319	3W; 20%
391	UZ320-UZ340	3W; 20%
391	UZ706-UZ760	3W; 5%
391	UZ770-UZ790	3W; 5%
391	UZ806-UZ860	3W; 10%
391	UZ870-UZ890	3W; 10%
391	UZ906-UZ960	3W; 20%
391	UZ970-UZ990	3W; 20%
393	UZ4110-UZ4120	5W; 5%
393	UZ4210-UZ4220	5W; 10%
393	UZ4706-UZ4791	5W; 5%
393	UZ4806-UZ4891	5W; 10%
395	UZ5110-UZ5119	5W; 5%
395	UZ5120-UZ5240	5W; 5%
395	UZ5210-UZ5240	5W; 10%
395	UZ5310-UZ5340	5W; 20%
395	UZ5706-UZ5760	5W; 5%
395	UZ5770-UZ5790	5W; 5%
395	UZ5806-UZ5860	5W; 10%
395	UZ5870-UZ5890	5W; 10%
*	UZ5906-UZ5960	5W; 20%
*	UZ5970-UZ5990	5W; 20%
397	UZ7110	10W; 5%
397	UZ7110L	6W; 5%
397	UZ7210	10W; 10%
397	UZ7210L	6W; 10%
397	UZ7310	10W; 20%
397	UZ7310L	6W; 20%
397	UZ7706-UZ7750	10W; 5%
397	UZ7706L-UZ7750L	6W; 5%
397	UZ7756-UZ7790	10W; 5%
397	UZ7756L-UZ7790L	6W; 5%
397	UZ7806-UZ7850	10W; 10%
397	UZ7806L-UZ7850L	6W; 10%
397	UZ7851-UZ7890	10W; 10%
397	UZ7851L-UZ7890L	6W; 10%
*	UZ8110-UZ8120	1W; 5%
*	UZ8210-UZ8220	1W; 10%
399	UZ8706-UZ8790	1W; 5%
399	UZ8806-UZ8890	1W; 10%

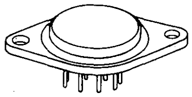
*Contact factory for specifications and ratings

III. PRODUCT SELECTION GUIDE

POWER HYBRID CIRCUITS



4-Pin TO-66



8-Pin TO-3

SWITCHING REGULATOR POWER OUTPUT CIRCUITS (Efficiency 85%)

Output Current		5A		15A	
		Pos	Neg	Pos	Neg
Package Style		**4-Pin TO-66**		**4-Pin TO-66**	
Input & Output Voltage	60V	PIC600	PIC610	PIC625	PIC635
	80V	PIC601	PIC611	PIC626	PIC636
Fall Time					
Voltage		75ns		300ns	
Current		150ns		300ns	
On-State Voltage		1.5V @ 2A		1.5V @ 7A	

ONE-SHOT POWER PULSE GENERATOR

Output Current		8A	8A
Package Style		**8-Pin TO-3**	**8-Pin TO-3**
Input & Output Voltage	60V	PIC400	PIC401
Output Pulse Widths		.5-2ms with 1% tolerance	2-50ms with 2.5% tolerance

RECTIFIERS


A

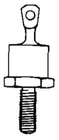

B


C

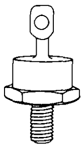
STANDARD RECOVERY

Average D.C. Output Current		1A	2A	3A	4A	7.5A	9A	12A
Package Style		**A**	**A**	**B**	**B**	**C**	**C**	**C**
PEAK INVERSE VOLTAGE	50V	UR105	UR205	UT3005	UT4005	UT5105	UT6105	UT8105
	75V							
	100V	UT236 UR110	UT261 UR210	UT3010	UT4010	UT5110	UT6110	UT8110
	125V							
	150V	UR115	UR215					
	200V	UT234 UR120 1N4245* 1N5614*	UT262 UR220 1N3611**	UT3020	UT4020 1N5550*	UT5120	UT6120	UT8120
	250V	UR125	UR225					
	300V							
	400V	UT235 1N4246* 1N5616*	UT264 1N3612**	UT3040	UT4040 1N5551*	UT5140	UT6140	UT8140
	600V	UT238 1N4247* 1N5618*	UT267 1N3613**	UT3060	UT4060 1N5552*			
	800V	UT361 1N4248* 1N5620*	UT268 1N3614**		1N5553*			
	1000V	UT347 1N5622*	UT364					

* Available as JAN, JANTX, JANTXV.
** Available as JAN, JANTX.



DO-4



DO-5

FAST RECOVERY

Average D.C. Output Current		1A	2A	2.5A	3A	4A	6A	6.5A	7.5A	9A	20A	50A
Package Style		**A**	**A**	**A**	**B**	**B**	**B**	**C**	**C**	**C**	**DO-4**	**DO-5**
PEAK INVERSE VOLTAGE	50V	UTR01 UTX105	UTR02 UTX205	1N5802*	UTR3305 UTX3105 1N5415	UTR4305 UTX4105	1N5807*	UTR4405	UTR5405	UTR6405	1N5812	UES501
	75V			1N5803			1N5808				1N5813	UES502
	100V	UTR11 UTX110	UTR12 UTX210	1N5804*	UTR3310 UTX3310 1N5186** 1N5416*	UTR4310 UTX4110	1N5809*	UTR4410	UTR5410	UTR6410	1N5814	UES503
	125V			1N5805			1N5810				1N5815	UES504
	150V			1N5806*	UTX3115	UTX4115	1N5811*				1N5816	UES505
	200V	UTR21 UTX120 1N4942* 1N5615*	UTR22 UTX220		UTR3320 UTX3120 1N5187** 1N5417*	UTR4320 UTX4120		UTR4420	UTR5420	UTR6420		
	250V	UTX125	UTX225									
	300V	UTR31	UTR32									
	400V	UTR41 1N4944* 1N5617*	UTR42		UTR3340 1N5188** 1N5418*	UTR4340		UTR4440	UTR5440	UTR6440		
	600V	UTR61 1N4946* 1N5619*	UTR62		UTR3360 1N5190** 1N5420*	UTR4360						
	800V											
	1000V											
Reverse Recovery Time (max.)		75-250 ns	75-250 ns	25ns	100-400 ns	100-400 ns	30ns	300-500 ns	300-500 ns	300-500 ns	35ns	50ns

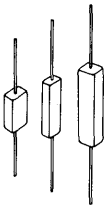
* Available as JAN, JANTX, JANTXV.
** Available as JAN, JANTX.

RECTIFIER ASSEMBLIES

High Voltage Stacks and Modules

STANDARD RECOVERY

I



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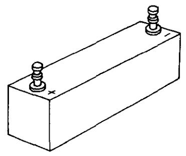
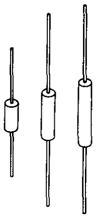
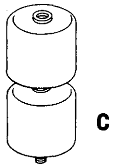


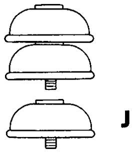
A

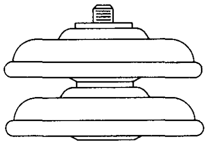


Peak Inverse Voltage	AVERAGE D.C. OUTPUT CURRENT										
	≤.25A	.25—.5A	.5—.75A	.75—1A	1—1.5A	1.5—2A	2—2.5A	2.5—3A	3—4A	4—5A	5—6A	6—7A
1.2kV					US12 **(A)**							
1.5kV				US15 **(A)**								
1.8kV			US18 **(A)**									
2.0kV			US20 **(A)**									
2.5kV			US25 **(A)**		USB2.5 **(C)**			UDB2.5 **(J)**			UDE2.5 **(J)**	UGE2.5 **(J)**
3.0kV			US30 **(A)**									
3.5kV		US35 **(A)**										
4.0kV		US40 **(A)**										
4.5kV		US45A **(I)**										
5.0kV		US50A **(I)**	USB5 USS5 **(C)**			UDA5 UDB5 1N5600* **(J)**				UGB5 UDE5 **(J)**	UGE5 1N5603* **(J)**	
6.0kV	US60A **(I)**											
7.0kV	US70A **(I)**											
7.5kV		USS7.5 **(C)**	USB7.5 **(C)**		UDA7.5 UDB7.5 **(J)**			UGB7.5 **(J)**	UGE7.5 **(J)**			
8.0kV	US80A **(I)**											
10kV	US100A **(I)**	USB10 USS10 **(C)**	688-10 **(F)**	UDA10 1N5597* **(J)**			UGB10 **(J)**					
12kV	US120A **(I)**	688-12 **(F)**										
15kV	US150A **(I)**	USS15 **(C)** 688-15 **(F)**										
18kV	US180A **(I)**	688-18 **(F)**										
20kV	688-20 **(F)** US200A **(I)**											
25kV	688-25 **(F)**											

* Available as JAN.







FAST RECOVERY

UD

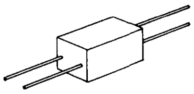
UG

III PRODUCT SELECTION GUIDE

Peak Inverse Voltage	AVERAGE D.C. OUTPUT CURRENT									
	≤.25A	.25—.5A	.5—.75A	.75—1A	1—1.5A	1.5—2A	2—2.5A	2.5—4A	4—5A	5—6A
1.2kV					USR12 **(A)**					
1.5kV				USR15 **(A)**						
1.8kV			USR18 **(A)**							
2.0kV			USR20 **(A)**							
2.5kV		USR25 **(A)**		UFB2.5 **(C)**			UDD2.5 **(J)**		UDF2.5 **(J)**	UGF2.5 **(J)**
3.0kV		USR30 **(A)**								
3.5kV		USR35 **(A)**								
4.0kV		USR40A **(I)**								
4.5kV		USR45A **(I)**								
5.0kV	USR50A **(I)**		UFB5 UFS5 **(C)**		UDC5 UDD5 **(J)**			UGD5 UGF5 UDF5 **(J)**		
6.0kV	USR60A **(I)**									
7.0kV	USR70A **(I)**									
7.5kV		UFB7.5 UFS7.5 **(C)**		UDC7.5 UDD7.5 **(J)**			UGF7.5 **(J)**			
8.0kV	USR80A **(I)**									
10kV	USR100A **(I)**	UFS10 **(C)**	688-10R **(F)** UDC10 **(J)**			UGD10 **(J)**				
12kV	USR120A **(I)**	688-12R **(F)**								
15kV	USR150A **(I)**	UDC15 **(J)** 688-15R **(F)**								
18kV	USR180A **(I)**	688-18R **(F)**								
20kV	688-20R **(F)**									
25kV	688-20R **(F)**									
Reverse Recovery Time (max.)	500ns	500ns	500ns	500ns	500ns	500ns	500ns	500ns	500ns	500ns

RECTIFIER ASSEMBLIES

Single Phase Full-Wave Bridges



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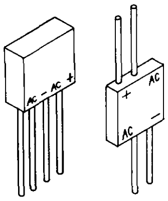
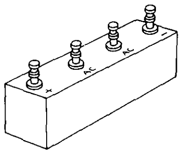


B

STANDARD RECOVERY

Peak Inverse Voltage Per Leg	AVERAGE D.C. OUTPUT CURRENT						
	≤.25A	.25—.75A	.75—1.5A	1.5—2.5A	2.5—5A	5—10A	10—25A
50V							
100V			673-1 **(B)**	697-1 **(B)**	693-1 **(H)**	680-1 **(E)**	679-1 SPA-25* **(E)**
125V							
150V							
200V			673-2 **(B)**	697-2 **(B)**	693-2 **(H)**	680-2 469-1** **(E)**	679-2 SPB-25* **(E)**
300V			673-3 **(B)**	697-3 **(B)**	693-3 **(H)**	680-3 **(E)**	679-3 **(E)**
400V			673-4 **(B)**	697-4 **(B)**	693-4 **(H)**	680-4 469-2** **(E)**	679-4 SPC-25* **(E)**
500V			673-5 **(B)**	697-5 **(B)**	693-5 **(H)**	680-5 **(E)**	679-5 **(E)**
600V			673-6 **(B)**	697-6 **(B)**	693-6 **(H)**	680-6 469-3** **(E)**	679-6 SPD-25* **(E)**
1.2kV		673-7 **(B)**					
1.8kV		673-75 **(M)**					
2.4kV		673-8 **(M)**					
2.5kV			686-2.5 **(O)**				
3.0kV		673-85 **(M)**	686-3 **(O)**				
3.6kV	673-9 **(M)**						
4.0kV			686-4 **(O)**				
4.2kV	673-10 **(M)**						
4.8kV	673-11 **(M)**						
5.0kV	673-12 **(M)**	686-5 **(O)**					
7.0kV		686-7 **(O)**					

* Available as JAN. ** Available as JAN, JANTX.



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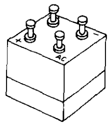

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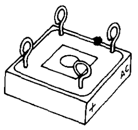


E

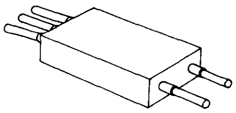
III PRODUCT SELECTION GUIDE

FAST RECOVERY

Peak Inverse Voltage Per Leg	AVERAGE D.C. OUTPUT CURRENT									
	≤.25A	.25—.75A	.75—1.5A		1.5—2.5A	2.5—5A	5—10A	10—25A		25—35A
50V				677-1 **(B)**					803-1 **(E)**	802-1 **(E)**
100V			676-1 **(B)**	677-2 **(B)**	698-1 **(B)**	694-1 **(H)**	684-1 **(E)**	683-1 **(E)**	803-2 **(E)**	802-2 **(E)**
125V									803-3 **(E)**	802-3 **(E)**
150V				677-3 **(B)**					803-4 **(E)**	802-4 **(E)**
200V			676-2 **(B)**	677-4 **(B)**	698-2 **(B)**	694-2 **(H)**	684-2 **(E)**	683-2 **(E)**		
300V			676-3 **(B)**		698-3 **(B)**	694-3 **(H)**	684-3 **(E)**	683-3 **(E)**		
400V			676-4 **(B)**		698-4 **(B)**	694-4 **(H)**	684-4 **(E)**	683-4 **(E)**		
500V			676-5 **(B)**		698-5 **(B)**	694-5 **(H)**	684-5 **(E)**	683-5 **(E)**		
600V			676-6 **(B)**		698-6 **(B)**	694-6 **(H)**	684-6 **(E)**	683-6 **(E)**		
1.2kV		676-12 **(M)**								
1.8kV		676-18 **(M)**								
2.4kV		676-24 **(M)**								
2.5kV			686-25R **(O)**							
3.0kV		676-30 **(M)**	686-3R **(O)**							
3.6kV	676-36 **(M)**									
4.0kV			686-4R **(O)**							
4.2kV	676-42 **(M)**									
4.8kV	676-48 **(M)**									
5.0kV	676-50 **(M)**	686-5R **(O)**								
7.0kV		686-7R **(O)**								
Reverse Recovery Time (max.)	500ns	500ns	500ns	75ns	500ns	500ns	500ns	500ns	50ns	50ns

RECTIFIER ASSEMBLIES

Three Phase Full-Wave Bridges



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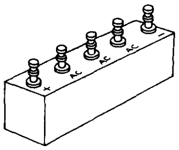
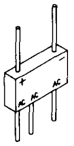


P

STANDARD RECOVERY

Peak Inverse Voltage Per Leg	AVERAGE D.C. OUTPUT CURRENT					
	≤.25A	.25—1A	1—2.5A	2.5—4.5A	4.5—15A	15—25A
50V						
100V			700-1 **(K)**	691-1 **(Q)**	695-1 **(D)**	678-1 **(D)**
125V						
150V						
200V			700-2 **(K)**	691-2 **(Q)**	695-2 **(D)**	678-2 **(D)**
300V			700-3 **(K)**	691-3 **(Q)**	695-3 **(D)**	678-3 **(D)**
400V			700-4 **(K)**	691-4 **(Q)**	695-4 **(D)**	678-4 **(D)**
500V			700-5 **(K)**	691-5 **(Q)**	695-5 **(D)**	678-5 **(D)**
600V			700-6 **(K)**	691-6 **(Q)**	695-6 **(D)**	678-6 **(D)**
2.5kV		685-2.5 **(P)**				
3.0kV		685-3 **(P)**				
4.0kV		685-4 **(P)**				
5.0kV		685-5 **(P)**				
6.0kV						
7.0kV		685-7 **(P)**				
8.0kV	690-8 **(G)**					
10kV	690-10 **(G)**					
12kV	690-12 **(G)**					
15kV	690-15 **(G)**					

III PRODUCT SELECTION GUIDE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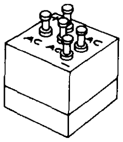
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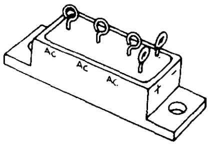
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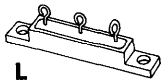
FAST RECOVERY

Peak Inverse Voltage Per Leg	AVERAGE D.C. OUTPUT CURRENT							
	≤.25A	.25—1A	1—2.5A	2.5—4.5A	4.5—15A	15—25A		25—40A
50V							801-1 **(D)**	800-1 **(D)**
100V			701-1 **(K)**	692-1 **(Q)**	696-1 **(D)**	682-1 **(D)**	801-2 **(D)**	800-2 **(D)**
125V							801-3 **(D)**	800-3 **(D)**
150V							801-4 **(D)**	800-4 **(D)**
200V			701-2 **(K)**	692-2 **(Q)**	696-2 **(D)**	682-2 **(D)**		
300V			701-3 **(K)**	692-3 **(Q)**	696-3 **(D)**	682-3 **(D)**		
400V			701-4 **(K)**	692-4 **(Q)**	696-4 **(D)**	682-4 **(D)**		
500V			701-5 **(K)**	692-5 **(Q)**	696-5 **(D)**	682-5 **(D)**		
600V			701-6 **(K)**	692-6 **(Q)**	696-6 **(D)**	682-6 **(D)**		
2.5kV		685-2.5R **(P)**						
3.0kV		685-3R **(P)**						
4.0kV		685-4R **(P)**						
5.0kV		685-5R **(P)**						
6.0kV		685-7R **(P)**						
7.0kV								
8.0kV	690-8R **(G)**							
10kV	690-10R **(G)**							
12kV	690-12R **(G)**							
15kV	690-15R **(G)**							
Reverse Recovery Time (max.)	500ns	500ns	500ns	500ns	500ns	500ns	50ns	50ns

RECTIFIER ASSEMBLIES

Doubler and Center Tap Rectifier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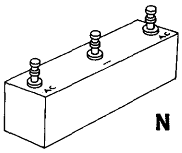
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Peak Inverse Voltage Per Leg	**STANDARD RECOVERY** AVERAGE D.C. OUTPUT CURRENT		**FAST RECOVERY** AVERAGE D.C. OUTPUT CURRENT	
	≤1A	1—15A	≤1A	1—20A
50V				804-1 **(L)**
100V		681-1 **(L)**		804-2 **(L)**
125V				804-3 **(L)**
150V				804-4 **(L)**
200V		681-2 **(L)**		
300V		681-3 **(L)**		
400V		681-4 **(L)**		
500V		681-5 **(L)**		
600V		681-6 **(L)**		
2.5kV				
3.0kV				
4.0kV				
5.0kV	687-5 **(N)**		687-5R **(N)**	
6.0kV	687-6 **(N)**		687-6R **(N)**	
7.0kV				
8.0kV	687-8 **(N)**		687-8R **(N)**	
10kV	687-10 **(N)**		687-10R **(N)**	
12kV	687-12 **(N)**		687-12R **(N)**	
15kV				
Reverse Recovery Time (max.)			500ns	50ns

POWER ZENERS

DO-13

AA

BB

CCL

TRANSIENT VOLTAGE SUPPRESSORS

Breakdown Voltage BV (Volts)	@ I_T (mA)	TYPE	Surge I_{PP} (A)	Maximum V_Z @ I_{PP} (V)
Package Style		**DO-13**		
6.12 - 7.48	10	1N5629	139	10.8
6.45 - 7.14	10	1N5629A	143	10.5
6.75 - 8.25	10	1N5630	128	11.7
7.13 - 7.88	10	1N5630A	132	11.3
7.38 - 9.02	10	1N5631	120	12.5
7.79 - 8.61	10	1N5631A	124	12.1
8.19 - 10.0	1	1N5632	109	13.8
8.65 - 9.55	1	1N5632A	112	13.4
9.00 - 11.0	1	1N5633	100	15.0
9.5 - 10.5	1	1N5633A	103	14.5
9.9 - 12.1	1	1N5634	93	16.2
10.5 - 11.6	1	1N5634A	96	15.6
10.8 - 13.2	1	1N5635	87	17.3
11.4 - 12.6	1	1N5635A	90	16.7
11.7 - 14.3	1	1N5636	79	19.0
12.4 - 13.7	1	1N5636A	82	18.2
13.5 - 16.5	1	1N5637	68	22.0
14.3 - 15.8	1	1N5637A	71	21.2
14.4 - 17.6	1	1N5638	64	23.5
15.2 - 16.8	1	1N5638A	67	22.5
16.2 - 19.8	1	1N5639	56.5	26.5
17.1 - 18.9	1	1N5639A	59.5	25.2
18.0 - 22.0	1	1N5640	51.5	29.1
19.0 - 21.0	1	1N5640A	54	27.7
19.8 - 24.2	1	1N5641	47	31.9
20.9 - 23.1	1	1N5641A	49	30.6
21.6 - 26.4	1	1N5642	43	34.7
22.8 - 25.2	1	1N5642A	45	33.2
24.3 -29.7	1	1N5643	38.5	39.1
25.7 - 28.4	1	1N5643A	40	37.5
27.0 - 33.0	1	1N5644	34.5	43.5
28.5 - 31.5	1	1N5644A	36	41.4
29.7 - 36.3	1	1N5645	31.5	47.7
31.4 - 34.7	1	1N5645A	33	45.7
32.4 - 39.6	1	1N5646	29	52.0
34.2 - 37.8	1	1N5646A	30	49.9
35.1 - 42.9	1	1N5647	26.5	56.4
37.1 - 41.0	1	1N5647A	28	53.9
38.7 - 47.3	1	1N5648	24	61.9
40.9 - 45.2	1	1N5648A	25.3	59.3
42.3 - 51.7	1	1N5649	22.2	67.8
44.7 - 49.4	1	1N5649A	23.2	64.8
45.9 - 56.1	1	1N5650	20.4	73.5
48.5 - 53.6	1	1N5650A	21.4	70.1

TRANSIENT VOLTAGE SUPPRESSORS

Minimum V_Z (V)	Type	Surge I_{PP} (A)	Maximum (V)
Package Style	**CCL**		
32.5	1N5610**	33	42
44	1N5611**	24	60
55.6	1N5612**	19	76
193	1N5613*	6	250

* Available as JAN.

** Available as JAN & JANTX.

BI-DIRECTIONAL ZENERS

	Power	1W	3W	5W	6W
Package Style		**AA**		**BB**	**CCL**
VOLTAGE, V_G (10% Tolerance)	7.5	UDZ8807	UDZ807	UDZ5807	UDZ7807
	8.2	UDZ8808	UDZ808	UDZ5808	UDZ7808
	9.1	UDZ8809	UDZ809	UDZ5809	UDZ7809
	10	UDZ8810	UDZ810	UDZ5810	UDZ7810
	12	UDZ8812	UDZ812	UDZ5812	UDZ7812
	15	UDZ8815	UDZ815	UDZ5815	UDZ7815
	18	UDZ8818	UDZ818	UDZ5818	UDZ7818
	20	UDZ8820	UDZ820	UDZ5820	UDZ7820
	24	UDZ8824	UDZ824	UDZ5824	UDZ7824
	27	UDZ8827	UDZ827	UDZ5827	UDZ7827
	30	UDZ8830	UDZ830	UDZ5830	UDZ7830
	33	UDZ8833	UDZ833	UDZ5833	UDZ7833
	36	UDZ8836	UDZ836	UDZ5836	UDZ7836
	40	UDZ8840	UDZ840	UDZ5840	UDZ7840
	45	UDZ8845	UDZ845	UDZ5845	UDZ7845
	60	UDZ8860	UDZ860	UDZ5860	UDZ7860
	300		UDZ230	UDZ5230	
	220		UDZ222	UDZ5222	
	100		UDZ210	UDZ5210	UDZ7210

POWER ZENERS

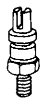

A


B

Power		1W		1.5W	3W	5W	5W	6W	10W
Package Style		**A**		**A‡**	**A‡**	**B**	**B‡**	**CL‡**	**C‡**
VOLTAGE V_Z (5% Tolerance)†	6.8V	1N4736A	UZ8706	1N4461*	1N5063	UZ4706	1N4954*	UZ7706L	UZ7706
	7.5V	1N4737A	UZ8707	1N4462*	1N5064	UZ4707	1N4955*	UZ7707L	UZ7707
	8.2V	1N4738A	UZ8708	1N4463*	1N5065	UZ4708	1N4956*	UZ7708L	UZ7708
	9.1V	1N4739A	UZ8709	1N4464*	1N5066	UZ4709	1N4957*	UZ7709L	UZ7709
	10V	1N4740A	UZ8710	1N4465*	1N5067	UZ4710	1N4958*	UZ7710L	UZ7710
	11V	1N4741A	UZ8711	1N4466*	1N5068		1N4959*	UZ7711L	UZ7711
	12V	1N4742A	UZ8712	1N4467*	1N4883	UZ4712	1N4960*	UZ7712L	UZ7712
	13V	1N4743A	UZ8713	1N4468*	1N5069	UZ4713	1N4961*	UZ7713L	UZ7713
	14V		UZ8714		1N5070		1N5118	UZ7714L	UZ7714
	15V	1N4744A	UZ8715	1N4469*	1N5071	UZ4715	1N4962*	UZ7715L	UZ7715
	16V	1N4745A	UZ8716	1N4470*	1N5072	UZ4716	1N4963*	UZ7716L	UZ7716
	18V	1N4746A	UZ8718	1N4471*	1N5073	UZ4718	1N4964*	UZ7718L	UZ7718
	20V	1N4747A	UZ8720	1N4472*	1N4884	UZ4720	1N4965*	UZ7720L	UZ7720
	22V	1N4748A	UZ8722	1N4473*	1N5074	UZ4722	1N4966*	UZ7722L	UZ7722
	24V	1N4749A	UZ8724	1N4474*	1N5075	UZ4724	1N4967*	UZ7724L	UZ7724
	27V	1N4750A	UZ8727	1N4475*	1N5076	UZ4727	1N4968*	UZ7727L	UZ7727
	30V	1N4751A	UZ8730	1N4476*	1N5077	UZ4730	1N4969*	UZ7730L	UZ7730
	33V	1N4752A	UZ8733	1N4477*	1N5078	UZ4733	1N4970*	UZ7733L	UZ7733
	36V	1N4753A	UZ8736	1N4478*	1N5079	UZ4736	1N4971*	UZ7736L	UZ7736
	39V	1N4754A		1N4479*	1N5080	UZ4739	1N4972*		
	40V		UZ8740		1N5081		1N5119	UZ7740L	UZ7740
	43V	1N4755A		1N4480*	1N5082	UZ4743	1N4973*		
	45V		UZ8745		1N5083		1N5120	UZ7754L	UZ7745
	47V	1N4756A		1N4481*	1N5084	UZ4747	1N4974*		
	50V		UZ8750		1N5085		1N5121	UZ7750L	UZ7750
	51V	1N4757A		1N4482*	1N5086	UZ4751	1N4975*		
	56V	1N4758A	UZ8756	1N4483*	1N5087	UZ4756	1N4976*	UZ7756L	UZ7756
	60V		UZ8760		1N5088		1N5122	UZ7760L	UZ7760
	62V	1N4759A		1N4484	1N5089	UZ4762	1N4977*		
	68V	1N4760A		1N4485	1N5090	UZ4768	1N4978*		

* Available as JAN, JANTX, & JANTXV
** Available as JAN
‡ Unitrode fused-in-glass construction
† 10% and 20% tolerance also available.

CL



C

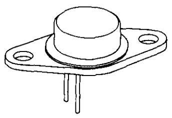
Power		1W		1.5W	3W	5W	5W	6W	10W
Package Style		**A**		**A‡**	**A‡**	**B**	**B‡**	**CL‡**	**C‡**
VOLTAGE V_Z (5% Tolerance)†	70V		UZ8770		1N5091		1N5123	UZ7770L	UZ7770
	75V	1N4761A	UZ8775	1N4486	1N5092	UZ4775	1N4979*	UZ7775L	UZ7775
	80V		UZ8780		1N5093		1N5124	UZ7780L	UZ7780
	82V	1N4762A		1N4487	1N5094	UZ4782	1N4980**		
	90V		UZ8790		1N4096		1N5125	UZ7790L	UZ7790
	91V	1N4763A		1N4488	1N4095	UZ4791	1N4981**		
	100V	1N4764A	UZ8110	1N4489	1N4097	UZ4110	1N4982**	UZ7110L	UZ7110
	110V		UZ8111		1N5096	UZ4111	1N4983**		
	120V		UZ8112		1N5097	UZ4112	1N4984**		
	130V		UZ8113		1N5098	UZ4113	1N4985**		
	140V		UZ8114		1N5099				
	150V		UZ8115		1N4098	UZ4115	1N4986**		
	160V		UZ8116		1N5100	UZ4116	1N4987**		
	170V		UZ8117		1N5101		1N5127		
	180V		UZ8118		1N5102	UZ4118	1N4988**		
	190V		UZ8119		1N5103		1N5128		
	200V		UZ8120		1N5104	UZ4120	1N4989**		
	220V				1N5105		1N4990**		
	240V				1N5106		1N4991**		
	260V				1N5107		1N5129		
	270V				1N5108		1N4992**		
	280V				1N5109		1N5130		
	300V				1N5110		1N4993**		
	320V				1N5111		1N5131		
	330V				1N5112		1N4994**		
	340V				1N5113		1N5132		
	360V				1N5114		1N4995**		
	380V				1N5115		1N5133		
	390V				1N5116		1N4996		
	400V				1N5117		1N5134		

* Available as JAN, JANTX, & JANTXV
** Available as JAN
‡ Unitrode fused-in-glass construction
† 10% and 20% tolerance also available.

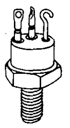
NPN POWER SWITCHING TRANSISTORS

.5-20A, 40-400V, f_T=20-80MHz

TO-5



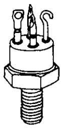
TO-66



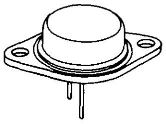
TO-59

Maximum Collector Current		.5 AMP	1 AMP		2 AMP		3 AMP		
Package Style		**TO-5**	**TO-5**	**TO-66**	**TO-5**	**TO-66**	**TO-5**	**TO-66**	**TO-59**
COLLECTOR VOLTAGE RATING V_{CEO}	40V								
	50V								
	60V		UPT111	UPT121	UPT211 UPT311	UPT221 UPT321	2N3418 2N3420		2N2828 2N2829
	75V								
	80V		UPT112	UPT122	UPT212 UPT312	UPT222 UPT322	2N2983 2N2985 2N3419 2N3421		
	100V		UPT113	UPT123	UPT213 UPT313	UPT223 UPT323			
	120V		UPT114	UPT124	UPT214 UPT314	UPT224 UPT324	2N2984 2N2986		
	150V	UPT011	UPT115	UPT125	UPT215 UPT315	UPT225 UPT325			
	200V	UPT012			2N5662*	2N5660*	UPT531	UPT521	2N5074 2N5075
	250V	UPT013					UPT532	UPT522	2N5076 2N5077
	300V	UPT014			2N5663*	2N5661*	UPT533	UPT523	
	350V						UPT534	UPT524	
	400V	UPT015					UPT535	UPT525	

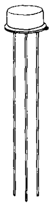
* JAN, JANTX versions available.



TO-111



TO-3



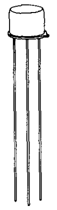
Pancake
TO-5

Maximum Collector Current		5 AMP						7 AMP	
Package Style		**Pancake TO-5**	**TO-5**	**TO-66**	**TO-3**	**TO-59**	**TO-111**	**TO-66**	**TO-59**
COLLECTOR VOLTAGE RATING V_{CEO}	40V					2N3852 2N3853			
	50V							2N3878	
	60V	2N2853 2N2854 2N2855 2N2856	UPT611	UPT621		2N2877 2N2878 2N3744 2N3747 2N3750			
	75V							2N3879	
	80V	2N2851 2N2852 2N5487	UPT612	UPT622		2N2150 2N2151* 2N3850 2N3851 2N3998* 2N3999*	2N3996* 2N3997*	2N5427 2N5428	2N5347 2N5477 2N5478
	100V	2N5488	UPT613	UPT623				2N5429 2N5430	2N5348 2N5349 2N5479 2N5480
	120V		UPT614	UPT624					
	150V		UPT615	UPT625					
	200V		2N5666*	2N5664* UPT721	UPT731				
	250V			UPT722	UPT732				
	300V		2N5667*	2N5665* UPT723	UPT733				
	350V			UPT724	UPT734				
	400V			UPT725	2N5241 UPT735				

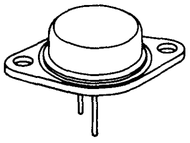
* JAN, JANTX versions available.

NPN POWER SWITCHING TRANSISTORS

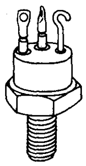
.5-20A, 40-400V, f_T=20-80MHz



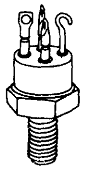
TO-5



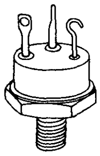
TO-3



TO-59



TO-111

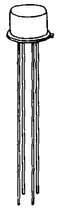


TO-61

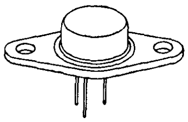
Maximum Collector Current		10 AMP					15 AMP	20 AMP
Package Style		**TO-5**	**TO-3**	**TO-59**	**TO-111**	**TO-61**	**TO-3**	**TO-3**
COLLECTOR VOLTAGE RATING V_{CEO}	40V					2N5304		2N6257
	60V		UPT831				UPT1031	UPT1131
	70V	2N4150*						
	80V	2N5552	UPT832	2N5658	2N5659	2N5317	UPT1032	UPT1132
	100V	2N6332	UPT833			2N5315 2N5319	UPT1033	UPT1133
	120V		UPT834				UPT1034	UPT1134
	150V		UPT835				UPT1035	UPT1135
	200V		UPT931				UPT1331	
	250V		UPT932				UPT1332	
	300V		UPT933				UPT1333	
	350V		UPT934				UPT1334	
	400V		UPT935				UPT1335	

*** JAN, JANTX versions available**

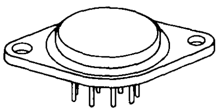
POWER DARLINGTONS



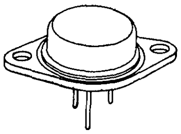
TO-33



TO-66 (3 PIN)



TO-3 (8 PIN)



TO-3 (3 PIN)

NPN POWER DARLINGTONS

Maximum Collector Current		2 AMP		5 AMP				10 AMP	
Package Style		**TO-33**	**TO-66 (3 PIN)**	**TO-33**	**TO-66 (3 PIN)**	**TO-3 (3 PIN)**	**TO-3 (8 PIN)**	**TO-66 (3 PIN)**	**TO-3 (3 PIN)**
COLLECTOR VOLTAGE RATING V_{CEO}	60V	U2T301	U2T401						
	80V			U2T101 2N6350*	U2T201 2N6352*		PIC502‡	U2T501	U2T601
	100V						PIC500‡ PIC501‡		
	150V	U2T305	U2T405	U2T103 2N6351*	U2T205 2N6353*			U2T505	U2T605
	200V	U2T712	U2T722		U2T732	U2T832			
	300V	U2T713	U2T723		U2T733	U2T833			

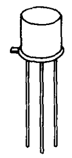
* Available as JAN & JANTX.

‡ Dual Darlingtons — Consult factory for NPN, PNP or complementary pairs in other ratings.

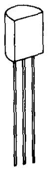
PNP POWER DARLINGTONS

Maximum Collector Current		2 AMP		5 AMP	
Package Style		**TO-33**	**TO-66 (3 PIN)**	**TO-33**	**TO-66 (3 PIN)**
COLLECTOR VOLTAGE RATING V_{CEO}	60V	U2T351	U2T451		
	80V			U2T151	U2T251
	120V	U2T355	U2T455	U2T155	U2T255

SCRs



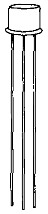
TO-18



TO-92

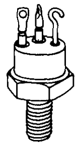
On-State Current $I_{T(RMS)}$		0.5A						0.8A
Package Style		**TO-18**						**TO-92**
REPETITIVE PEAK OFF-STATE, V_{DRM} and REVERSE VOLTAGE, V_{RRM}	30V			2N3030*		2N3027* ID100	CB200	2N5060 IP100
	60V	AA100	2N5719 AA107	2N3031*	AA114	2N3028* ID101	CB201	2N5061 IP101
	100V	AA101	2N5720 AA108	2N3032*	AA115	2N3029* ID102	CB202	2N5062 IP102
	150V					ID103		2N5063 IP103
	200V	AA102	2N5721 AA109		AA116	ID104	CB203	2N5064 IP104
	300V	AA103	2N5722 AA110		AA117	ID105		IP105
	400V	AA104	2N5723 AA111		AA118	ID106		IP106
Gate-Trigger Current I_{GT}		2μA	20μA		200μA		400μA	200μA
Holding Current I_H @ R_{GK}=1K		2mA	2mA	4mA	2mA	5mA	3mA	5mA

* Available as JAN and JANTX types.



TO-9

TO-5



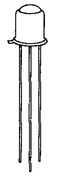
TO-59

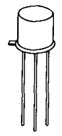
On-State Current $I_{T(RMS)}$		1A	1.25A		1.6A					5A
Package Style		**TO-9**			**TO-5**					**TO-59**
REPETITIVE PEAK OFF-STATE VOLTAGE, V_{DRM} and REVERSE VOLTAGE, V_{RRM}	30V	2N1881	2N1876	2N1870A**			2N2322 (25V)		CD200	
	60V	2N1882	2N1877	2N1871A**	AD100	2N2323A* 2N5724 AD107	2N2323* (50V) AD114	ID200 (50V)	CD201	CM100
	100V	2N1883	2N1878	2N1872A**	AD101	2N2324A* 2N5724 AD108	2N2324* AD115	ID201	CD202	CM101
	150V	2N1884	2N1879	2N1873A		2N2325A	2N2325	ID202		
	200V	2N1885	2N1880	2N1874A**	AD102	2N2326A* 2N5726 AD109	2N2326* AD116	ID203	CD203	CM102
	300V				AD103	2N2328A* 2N5727 AD110	2N2328* AD117	ID300		CM103
	400V				AD104	2N5728 AD111	2N2329* AD118	ID301		CM104
Gate-Trigger Current I_{GT}		2mA	20μA	200μA	2μA	20μA	200μA		400μA	200μA
Holding Current I_H @ R_{GK}=1K		2mA	3mA	5mA	2mA	2mA	2mA	3mA	3mA	3mA
		@ I_G=−150μA								

* Available as JAN and JANTX types.

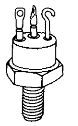
** Available as JAN type.

SCRs—SPECIAL PURPOSE


TO-18 Lens


TO-18


TO-5


TO-59

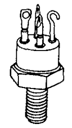

TO-111

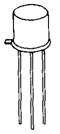
		PHOTO-SCRs		RADIATION HARDENED	ULTRA-FAST SWITCHING SCRs			
On-State Current $I_{T(RMS)}$		0.3A		0.4A	0.4A		6A	
Package Style		**TO-18 Lens**		**TO-18**	**TO-18**		**TO-59**	
REPETITIVE PEAK OFF-STATE VOLTAGE, V_{DRM} and REVERSE VOLTAGE, V_{RRM}	30V	PF30 PF30A	PR30 PR30A	GA100				
	60V	PF60 PF60A	PR60 PR60A	GA101	GA200 GA300	GA200A GA300A	GB200 GB300	GB200A GB300A
	100V	PF100 PF100A	PR100 PR100A	GA102 (80V)	GA201 GA301	GA201A GA301A	GB201 GB301	GB201A GB301A
	200V	PF200 PF200A	PR200 PR200A					
	300V	PF300 PF300A	PR300 PR300A					
	400V	PF400 PF400A	PR400 PR400A					
Key Parameters		λ_T @ R_{GK}=27K 50 F.C.	λ_T @ R_{GK}=27K 10 F.C.	I_{GT} (Post 3X10^{14} NVT) 20mA	tr 20ns	tr 20ns	tr 20ns	tr 20ns
		I_H @ R_{GK}=4.7K 1mA		I_H (Post 3X10^{14} NVT) 30mA	tq 2μs	tq .5μs	tq 2μs	tq .5μs

AC SWITCHES (Low-Level Triac Replacements)

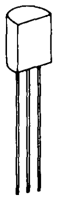
On-State Current $I_{T(RMS)}$		0.8A		4A	
Package Style		**TO-5**		**TO-111**	
REPETITIVE PEAK OFF-STATE VOLTAGE, V_{DRM}	200V	PIC100	PIC101	PIC120	PIC121
	400V	PIC102	PIC103	PIC122	PIC123
Gate Trigger Current, I_{GT}*		2mA	5mA	2mA	5mA
Gate Trigger Voltage, V_{GT}*		0.4V — 1V			
Holding Current I_H*		1.5mA	3mA	1.5mA	3mA
Voltage V_T*		2.5V @ 1A			

* Valid for operation in both 1st and 3rd quadrants.

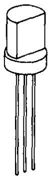
PUTs — PROGRAMMABLE UNIJUNCTION TRANSISTORS



TO-18



TO-92



TO-98

Peak Recurrent Forward Current		8A		5A	2A
Package Style		**TO-18**		**TO-92**	**TO-98**
MIN. VALLEY CURRENT, I_V MAX. PEAK POINT CURRENT, I_P	$I_V = 25\mu A$ @ $R_G = 10K$ $I_P = .15\mu A$ @ $R_G = 1Meg$	U13T2	U13T4	P13T2	
	$I_V = 70\mu A$ @ $R_G = 10K$ $I_P = 2\mu A$ @ $R_G = 1Meg$	U13T1	U13T3	P13T1	
	$I_V = 1mA$ @ $R_G = 200\Omega$ $I_P = .15\mu A$ @ $R_G = 1Meg$	2N6120			2N6028
	$I_V = 1.5mA$ @ $R_G = 200\Omega$ $I_P = 2\mu A$ @ $R_G = 1Meg$	2N6119 2N6137*	2N6138*		2N6027
Forward and Reverse Voltage; V_{AK}, V_{AKR}		40V	100V	40V	

* Available as JAN and JANTX types.

HARD BONDED CHIPS

CHIP	PART NO.	CURRENT RATING	VOLTAGE RATING
Rectifiers			
Standard Recovery	UCR03**	1A	200-600V
	UCR06**	4A	200-600V
	UCR08**	8A	200-600V
	UCR11**	15A	200-600V
Fast Recovery (Under 500ns)	UCR03**-R	1A	200-300V
	UCR06**-R	4A	200-300V
	UCR08**-R	8A	200-300V
	UCR11**-R	15A	200-300V
Ultra-Fast Recovery (Under 75ns)	UCR03**-X	1A	100-300V
	UCR06**-X	4A	100-300V
	UCR08**-X	8A	100-300V
	UCR11**-X	15A	100-300V
Zeners			
5% tolerance	UCZ87**	1W	6.8-45V
10% tolerance	UCZ88**	1W	6.8-45V
PUTs			
Standard	UCP0140	150mA	40V
Sensitive	UCP0140L	150mA	40V
SCR's			
General Purpose	UCS12**	.8A	30-200V
	UCS14**	.8A	300-400V
	UCS17**	1.6A	30-400V
High Speed $T_r = 50ns$	UCS01**	.5A	30-100V
High Speed $T_r = 15ns$	UCS05**-R	.5A	60-100V
Light Sensitive	UCS03**	.3A	30-200V
	UCS16**	.3A	300-400V
Power Switching Transistors	UCT00**	.5A	200-300V
	UCT01**	1A	60-100V
	UCT02**	2A	60-300V
	UCT03**	3A	200-300V
	UCT05**	5A	60-300V
	UCT10**	10A	60-300V
	UCT15**	15A	60-100V
	UCT20**	20A	60-100V
Power Darlingtons NPN	UCC02**	2A	60-150V
	UCC05**	5A	60-150V
	UCC10**	10A	60-150V
PNP	UCC02**-P	2A	60-120V
	UCC05**-P	5A	60-120V

** Part Number Designation:

For All Products Except Zeners. First asterisk represents hundreds of volts, second asterisk represents tens of volts (e.g. for voltage rating of 250V, order UCR0325).

For Zeners Only. First asterisk represents tens of volts, second asterisk represents units of volts to nearest lower whole number (e.g. for voltage rating of 6.8, order UCZ8706; for 45V, order UCZ8745)

Detailed specifications available through your local Unitrode Sales Representative.

SOLDERABLE POWER THYRISTOR CHIPS AND ChipStrate™

ChipStrate is the designation for a Unitrode glassivated power thyristor chip mounted on a miniature, high-thermal-conductivity, metal clad ceramic substrate.

PART NUMBERING SYSTEM

X—XX—XX—XX

Type

Geometry Code

Current Rating in Amps

First two digits of voltage rating

Chip	**Type**	Geometry Code	I_T (RMS)* (Amperes)	V_{FX}, V_{RX} (Volts)	I_{GT} (mA Max.)
TRIAC	**B**	8	10	200 through 600	100
	B	6	20		100
	B	4	30		150
	B	5	40		150
SCR	**R**	8	15	200 through 600	25
	R	6	25		25
	R	4	40		40
	R	5	55		40
EDGE GATE SCR	**R**	9	4	200 through 600	10
TRIAC-SENSITIVE GATE	**B**	9	3	200 through 600	25
PHOTO SCR	**P**	7	0.5	30 through 500	Light Intensity to Trigger 800 Foot-Candles Max.
FAST SWITCHING SCR t_{off} under 10 microseconds	**R**	2	8	200 through 600	30
SENSITIVE GATE SCR	**R**	7	0.5	200 through 600	200μA
HIGH VOLTAGE DIODES	**D**	1	0.5	400 through 800	—
TRIGGER DIODES	**X**	1	Minimum Hysteresis Type 20 Volt Nominal Standard 30 Volt Nominal		

All dimensions in inches

* Current ratings are at an operating temperature of 65°C as measured on the substrate immediately adjacent to the chip. (Equivalent to case temperature in a packaged unit.) Current rating at 65°C derates nearly to zero at an operating temperature of 100°C.

Detailed specifications available through your local Unitrode Sales Representative.

ChipStrate™ is a trademark of Unitrode Corporation

PIN DIODES

MICROWAVE PIN DIODES

Type	Breakdown Voltage Range	Total Capacitance (0V, 1 GHz) C_T max.	Series Resistance (100mA, 1 GHz) R_S max.	Parallel Resistance (100V, 1 GHz) R_P min.	Average Thermal Resistance Θ_A max.	Average Power Dissipation P_A max.	Peak Power Dissipation P_P max.	Carrier Lifetime I_F=10mA min.
	(V)	(pF)	(Ω)	(KΩ)	(°C/W)	(W)	(KW)	τ (μs)
UM4000	100-1200	3.0	0.5	2	6	25	100	5.0
UM4300	100-1000	2.2	1.5	2	8	18	500	5.0
UM4900	100-1000	3.0	0.5	2	4	37	100	5.0
UM6000	100-1000	0.5	1.7	15	25	6	25	1.0
UM6100	100-600	0.7	1.2	12	25	6	15	0.9
UM6200	100-600	1.1	0.4	10	25	6	10	0.6
UM6600	100-600	0.4	2.5	10	35	4	13	1.0
UM7000	100-2000	0.9	1.0	10	15	10	60	2.5
UM7100	100-600	1.2	0.6	8	15	10	35	2.0
UM7200	100-600	2.2	0.25	7	15	10	20	1.5
UM7300	100-1000	0.7	3.5	10	20	7.5	100	2.5
UM7900	100-1000	0.8	1.0	10	10	15	60	2.5

GENERAL PURPOSE PIN DIODE

Type	Total Capacitance (50V, 1MHz)	RF Resistance (10μA, 100MHz)	RF Resistance (20mA, 100MHz)	RF Resistance (100mA, 100MHz)	Reverse Current (BV_R=100V) I_R Max.	Carrier Lifetime (I_F=10mA) Min.
	C_T max. (pF)	(Ω)	(Ω)	(Ω)	(μA)	(μs)
1N5767	0.4	1000 min. 3000 typ.	8 max. 4 typ.	2.5 max. 1.5 typ.	10	1

LOW DISTORTION AGC PIN DIODE

1N5957	0.4	1500 min. 3000 typ.	8 max. 6 typ.	3.5 max. 2 typ.	10	1.5 2 typ.

CATV ATTENUATOR PIN DIODES

Type	Total Capacitance C_T max. (0V, 100MHz)	RF Resistance (100mA, 100MHz) Max.	RF Resistance (10μA, 100MHz) Min.	Forward Current (R_D=75Ω F=100MHz) Typical	Third Order Distortion (F_1=10MHz F_2=13MHz P=50dBmV)	Reverse Current (BV_R=75V) I_R Max.
	(pF)	(Ω)	(Ω)	(mA)	(dB) max.	(μA)
UM9301	0.8	3.5	3000	1.1	−65	1
UM9302	0.8	6.0	4000	2.0	−75	1
UM9303	0.8	10.0	10000	4.0	−85	1

TWO-WAY RADIO ANTENNA SWITCHES

Type	Total Capacitance (0V, 100MHz) C_T Max.	RF Resistance (50mA, 100MHz) Max.	Reverse Current (BV_R= 50) Max.	Transmit Harmonic Distortion (P_{IN}=20W F=50MHz I=20mA) Max.	Receive Third Order Distortion (P_{IN}=10mW, 0 Bias F_A=50MHz F_B=51MHz) Max.	Average Power Dissipation P_A Max.
	(pF)	(Ω)	(μA)	(dB)	(dB)	(W)
UM9401 THRU UM9404*	1.5	1	10	−40	−60	8.5

* Available in four package styles.

Detailed specifications available through your local Unitrode Sales Representative.

IV. PRODUCT DATA SHEETS

RECTIFIERS

Military Approved, 1 Amp, General Purpose

JAN & JANTX 1N3611-1N3614

FEATURES

- Qualified to MIL-S-19500/228
- Continuous Rating: 1A
- Surge Rating: 30A
- PIV: to 800V

DESCRIPTION

This series of MIL approved JAN and JANTX general purpose 1 amp rectifiers are useful in many high rel applications.

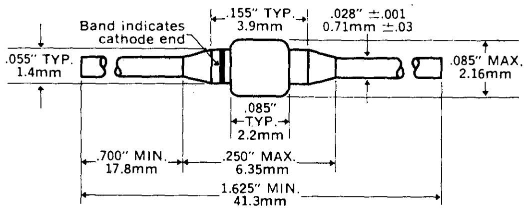
ABSOLUTE MAXIMUM RATINGS

Peak Reverse Voltage Min.	Reverse Working Voltage	Type
240V	200V	JAN & JANTX 1N3611
480V	400V	JAN & JANTX 1N3612
720V	600V	JAN & JANTX 1N3613
920V	800V	JAN & JANTX 1N3614

Maximum Average D.C. Output Current	
@ $T_A = 100°C$	1.0A
@ $T_A = 150°C$	0.3A
Non-Repetitive Sinusoidal	
Surge Current (8.3ms)	30A
Operating Temperature Range	—65°C to +175°C
Storage Temperature Range	—65°C to +200°C
Thermal Resistance	See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

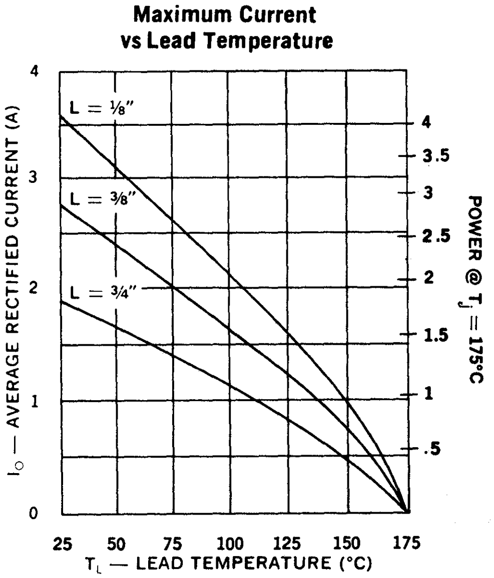
JAN & JANTX1N3611-1N3614

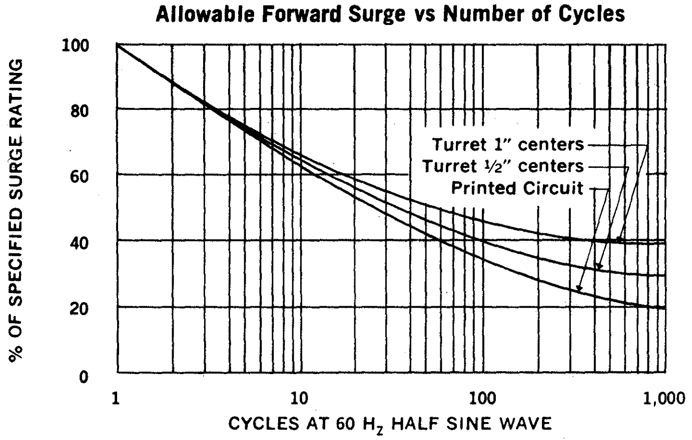


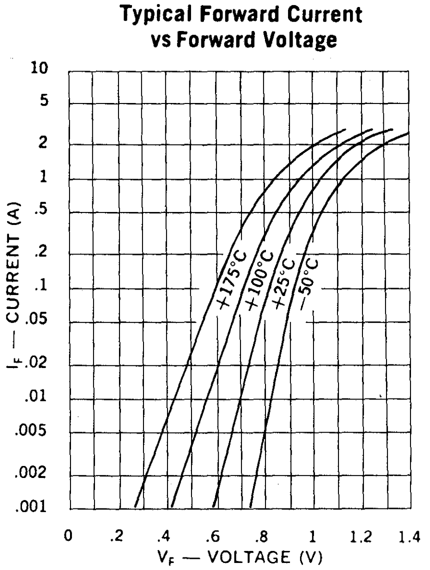
BODY A

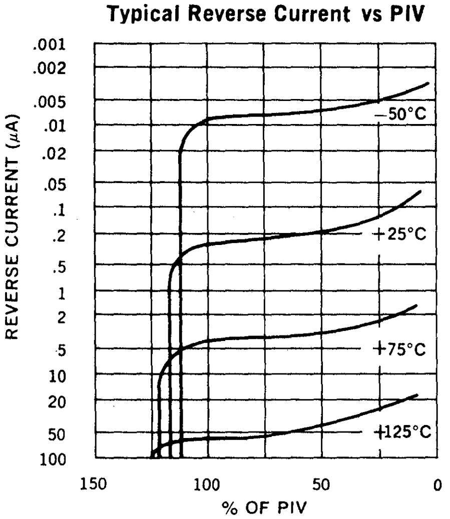
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Peak Reverse D.C. Voltage	Minimum Reverse Breakdown Voltage @ 100µA	Peak Forward Voltage Min.	Peak Forward Voltage Max.	Maximum D.C. Reverse Current at D.C. Voltage 25°C	Maximum D.C. Reverse Current at D.C. Voltage 150°C
JAN & JANTX 1N3611	200V	240V	0.6V	1.1V(pk) @ 1.0A	1µA	300µA
JAN & JANTX 1N3612	400V	480V				
JAN & JANTX 1N3613	600V	720V				
JAN & JANTX 1N3614	800V	920V				









RECTIFIERS

JAN & JANTX 1N4245-1N4249

Military Approved, 1 Amp, General Purpose

FEATURES

- Qualified to MIL-S-19500/286
- Surge Rating: 25A
- PIV: to 1000 V
- Controlled Avalanche
- No Plastic, Epoxy, Silicone, Oxides, Gases or Solder are used

DESCRIPTION

This series of general purpose power rectifiers are available as JAN or JANTX for many power supply applications.

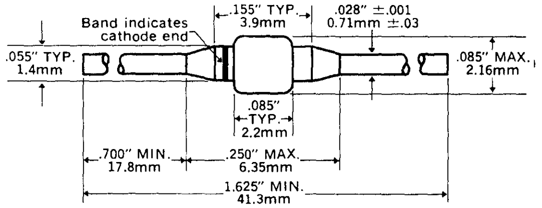
ABSOLUTE MAXIMUM RATINGS

Maximum Reverse Voltage	Type
200V	JAN & JANTX 1N4245
400V	JAN & JANTX 1N4246
600V	JAN & JANTX 1N4247
800V	JAN & JANTX 1N4248
1000V	JAN & JANTX 1N4249

Maximum Average D.C. Output Current	
@ T_A = 100°C	1.0A
@ T_A = 150°C	0.333A
Non-Repetitive Sinusoidal Surge Current	25A
Operating Temperature Range	—65°C to +175°C
Storage Temperature Range	—65°C to +175°C
Thermal Resistance	See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX 1N4245-1N4249



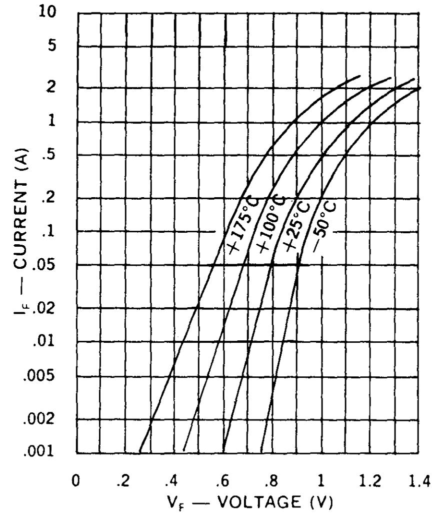
BODY A

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

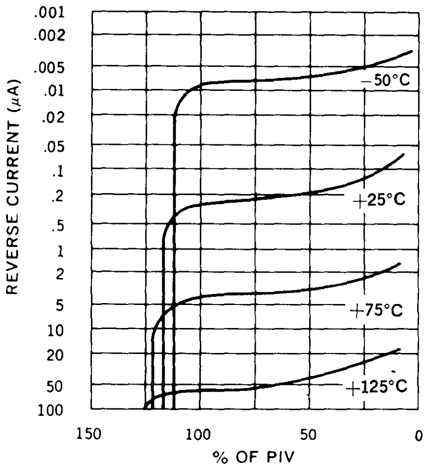
Type	PIV	Minimum Reverse Breakdown Voltage @ 100µA	Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*
			Min.	Max.	25°C	150°C	
JAN & JANTX 1N4245	200V	240V	0.6V	1.3V(pk) @ 3.0A(pk)	1.0µA	150µA	5.0µs
JAN & JANTX 1N4246	400V	480V					
JAN & JANTX 1N4247	600V	720V					
JAN & JANTX 1N4248	800V	960V					
JAN & JANTX 1N4249	1000V	1150V					

*Measured in circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

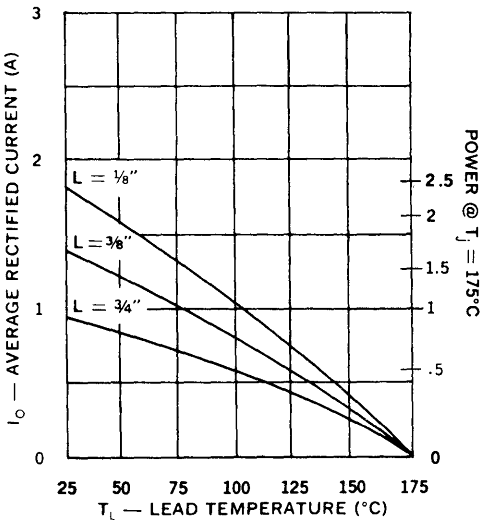
Typical Forward Current vs Forward Voltage



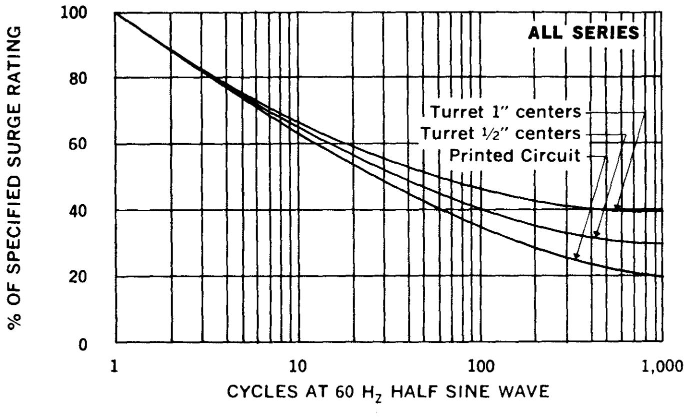
Typical Reverse Current vs PIV



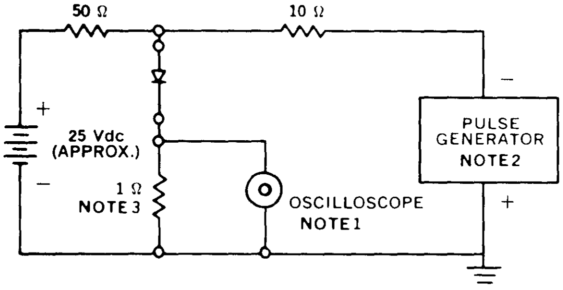
Maximum Current vs Lead Temperature



Allowable Forward Surge vs Number of Cycles



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

POWER ZENERS

1.5 Watt, Military

1N4461-1N4489

FEATURES

- 5 Times Greater Surge Rating than JAN1N3016 Series
- Low Reverse Current: to 50nA
- ¼ Size of Conventional 1 Watt Zeners
- JAN and JANTX Types Available

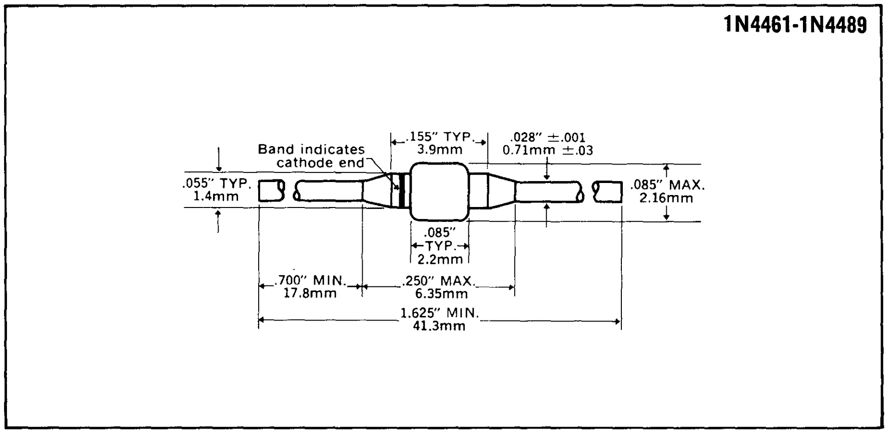
DESCRIPTION

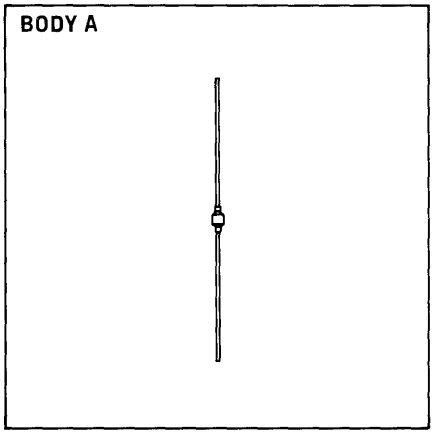
Fused-in-glass, metallurgically bonded 1.5 watt zeners, qualified to MIL-S-19500/406.

ABSOLUTE MAXIMUM RATINGS

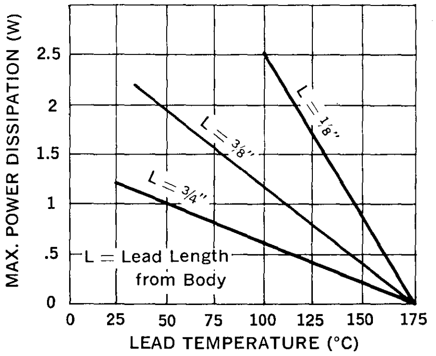
Zener Voltage, V_Z	6.8 to 100V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	−65°C to +175°C

MECHANICAL SPECIFICATIONS

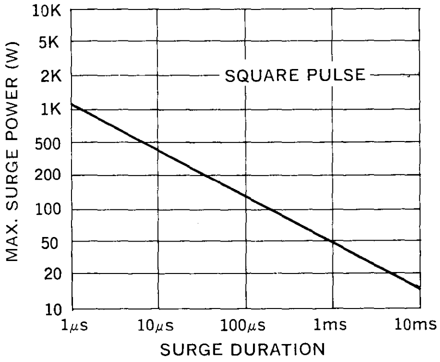




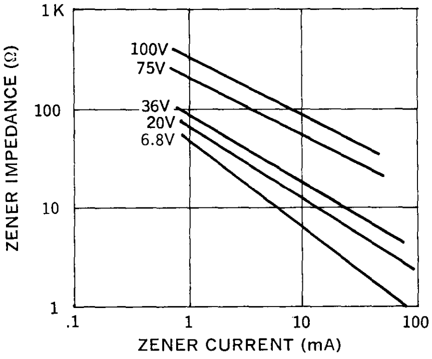
Power Dissipation vs. Lead Temperature Derating Curve



Max. Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



	Electrical Specifications at 25°C								Maximum Ratings	
Type	Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance §			Voltage ** Regulation ΔBV Max	Maximum Reverse Leakage Current		Maximum Cont. Current I_{ZM}	Maximum Surge Current‡ I_S
			Z_Z @ I_{ZT}	Z_{ZK} @ I_{ZK}	I_{ZK}		I_R @ V_R	V_R		
±5% Tolerance	Volts	mA	Ohms	Ohms	mA	Volts	µA	Volts	mA	Amps
1N4461*	6.8	37	2.5	200	1.0	.30	5.0	4.08	210	5.0
1N4462*	7.5	34	2.5	400	.5	.35	1.0	4.50	191	4.5
1N4463*	8.2	31	3.0	400	.5	.40	.50	4.92	174	3.9
1N4464*	9.1	28	4.0	500	.5	.45	.30	5.46	157	3.4
1N4465*	10	25	5.0	500	.25	.50	.30	8.0	143	3.0
1N4466*	11	23	6.0	550	.25	.55	.30	8.8	130	2.6
1N4467*	12	21	7.0	550	.25	.60	.20	9.6	119	2.4
1N4468*	13	19	8.0	550	.25	.65	.10	10.4	110	2.2
1N4469*	15	17	9.0	600	.25	.75	.05	12.0	95	1.8
1N4470*	16	15.5	10.0	600	.25	.80	.05	12.8	90	1.6
1N4471*	18	14	11.0	650	.25	.83	.05	14.4	79	1.4
1N4472*	20	12.5	12.0	650	.25	.95	.05	16.0	71	1.2
1N4473*	22	11.5	14	650	.25	1.0	.05	17.6	65	1.1
1N4474*	24	10.5	16	700	.25	1.1	.05	19.2	60	.90
1N4475*	27	9.5	18	700	.25	1.3	.05	21.6	53	.80
1N4476*	30	8.5	20	750	.25	1.4	.05	24.0	48	.75
1N4477*	33	7.5	25	800	.25	1.5	.05	26.4	43	.66
1N4478*	36	7.0	27	850	.25	1.7	.05	28.8	40	.60
1N4479*	39	6.5	30	900	.25	1.8	.05	31.2	37	.54
1N4480*	43	6.0	40	950	.25	1.9	.05	34.4	33	.48
1N4481*	47	5.5	50	1000	.25	2.1	.05	37.6	30	.45
1N4482*	51	5.0	60	1100	.25	2.3	.05	40.8	28	.42
1N4483*	56	4.5	70	1300	.25	2.5	.05	44.8	26	.39
1N4484	62	4.0	80	1500	.25	2.7	.05	49.6	23	.35
1N4485	68	3.7	100	1700	.25	3.0	.05	54.4	21	.32
1N4486	75	3.3	130	2000	.25	3.3	.05	60.0	19	.29
1N4487	82	3.0	160	2500	.25	3.6	.05	65.6	17	.26
1N4488	91	2.8	200	3000	.25	4.0	.05	72.8	16	.23
1N4489	100	2.5	250	3100	.25	4.4	.05	80.0	14	.20

* Available as JAN and JANTX.

† All Zener voltages are measured with an automated test set using a 35 millisecond test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60 cycle AC Voltage created when AC current with RMS value of 10% of DC Zener test current is superimposed on the test current.

** ΔBV is obtained by measuring the voltage change when the test current is changed from 10% to 50% of Iz max under DC conditions. During this measurement the leads are heat sunk .375 inch from the body and maintained at 25°C.

‡ Ratings shown are for peak sinusoidal surge current of 8.3 ms duration using 60 cycle AC. The 8.3 ms square pulse rating is 71% of the value shown. Rating exceeds JEDEC Registered Specification.

POWER ZENERS
1 Watt, Industrial

1N4736-1N4764
1N4736A-1N4764A

FEATURES
- High Surge Ratings
- Small Physical Size
- Impervious to Moisture

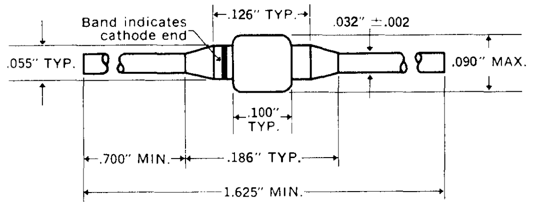
DESCRIPTION
One watt zener diodes, hermetically sealed in glass.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 100V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	−65°C to +200°C

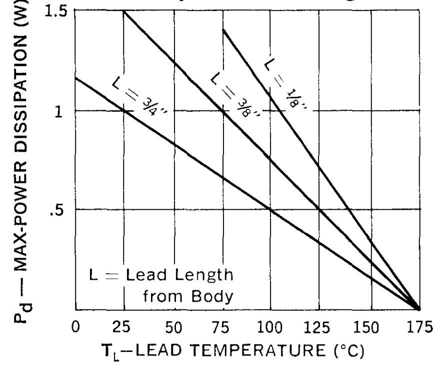
MECHANICAL SPECIFICATIONS

1N4736-1N4764 1N4736A-1N4764A

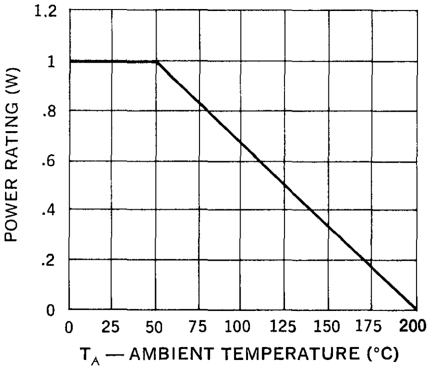


Dimensions in inches.

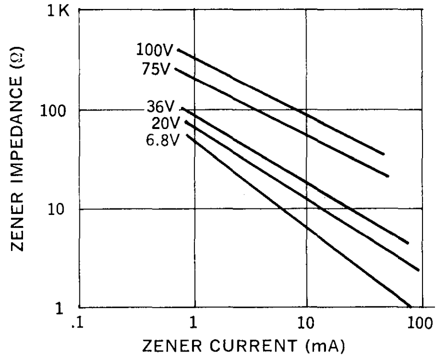
Body A10



Power Dissipation vs. Lead Temperature Derating Curve



Power Rating vs. Ambient Temperature



Typical Zener Impedance vs. Zener Current

UNITRODE

Type	Electrical Specifications at 25°C							Max. Ratings†	
Voltage Tolerance *	Nominal Zener Voltage ** V_Z @ I_{ZT}	Test Current I_{ZT}	Max Zener Impedance §			Maximum Leakage Current I_R @ V_R		Maximum Continuous Current I_{ZM}	Maximum Surge Current I_S ‡
			Z_Z @ I_{ZT}	Z_{ZK} @ I_{ZK}	I_{ZK}				
±10% Tolerance	Volts	mA	Ohms	Ohms	mA	µA	Volts	mA	Amps
1N4736	6.8	37	3.5	700	1.0	10	4	133	5.00
1N4737	7.5	34	4.0	700	0.5	10	5	121	4.50
1N4738	8.2	31	4.5	700	0.5	10	6	110	3.90
1N4739	9.1	28	5.0	700	0.5	10	7	100	3.37
1N4740	10	25	7	700	0.25	10	7.6	91	2.77
1N4741	11	23	8	700	0.25	5	8.4	83	2.25
1N4742	12	21	9	700	0.25	5	9.1	76	2.25
1N4743	13	19	10	700	0.25	5	9.9	69	2.25
1N4744	15	17	14	700	0.25	5	11.4	61	1.65
1N4745	16	15.5	16	700	0.25	5	12.2	57	1.65
1N4746	18	14	20	750	0.25	5	13.7	50	1.12
1N4747	20	12.5	22	750	0.25	5	15.2	45	1.12
1N4748	22	11.5	23	750	0.25	5	16.7	41	1.12
1N4749	24	10.5	25	750	0.25	5	18.2	38	.825
1N4750	27	9.5	35	750	0.25	5	20.6	34	.825
1N4751	30	8.5	40	1000	0.25	5	22.8	30	.825
1N4752	33	7.5	45	1000	0.25	5	25.1	27	.675
1N4753	36	7.0	50	1000	0.25	5	27.4	25	.562
1N4754	39	6.5	60	1000	0.25	5	29.7	23	.562
1N4755	43	6.0	70	1500	0.25	5	32.7	22	.450
1N4756	47	5.5	80	1500	0.25	5	35.8	19	.450
1N4757	51	5.0	95	1500	0.25	5	38.8	18	.450
1N4758	56	4.5	110	2000	0.25	5	42.6	16	.390
1N4759	62	4.0	125	2000	0.25	5	47.1	14	.337
1N4760	68	3.7	150	2000	0.25	5	51.7	13	.337
1N4761	75	3.3	175	2000	0.25	5	56.0	12	.277
1N4762	82	3.0	200	3000	0.25	5	62.2	11	.225
1N4763	91	2.8	250	3000	0.25	5	69.2	10	.225
1N4764	100	2.5	350	3000	0.25	5	76.0	9	.225

*Add suffix A to specify ±5% tolerance. $V_F = 1.5V$ max @ $I_F = 200$ ma on all types.

†Ratings are based on free air. T_A is 25°C.

** All zener voltages are measured with an automated test set using a 35 millisecond test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

‡Figures shown are for a maximum surge of one half sine wave for 8.3mS. Rating exceeds JEDEC registered specification.

§Zener impedance is derived from the 60-cycle AC voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

RECTIFIERS

JAN & JANTX 1N4942-1N4946

Military Approved, 1 Amp, Fast Recovery

FEATURES

- Qualified to MIL-S-19500/359
- Surge Rating: 15A
- PIV: to 600V
- Controlled Avalanche

DESCRIPTION

These fast recovery rectifiers are suitable for use as power devices for many applications. Devices are available as JAN or JANTX.

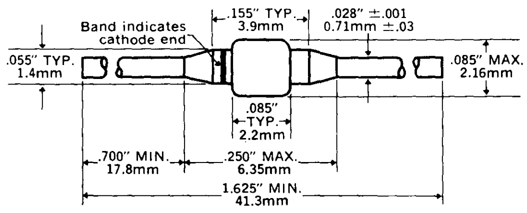
ABSOLUTE MAXIMUM RATINGS

Maximum Reverse Voltage	Type
200V	JAN & JANTX 1N4942
400V	JAN & JANTX 1N4944
600V	JAN & JANTX 1N4946

Maximum Average D.C. Output Current	
@ $T_A = 55°C$	1.0A
@ $T_A = 100°C$	0.75A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	15A
Operating Temperature Range	—65°C to +175°C
Storage Temperature Range	—65°C to +175°C
Thermal Resistance	See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX 1N4942-1N4946



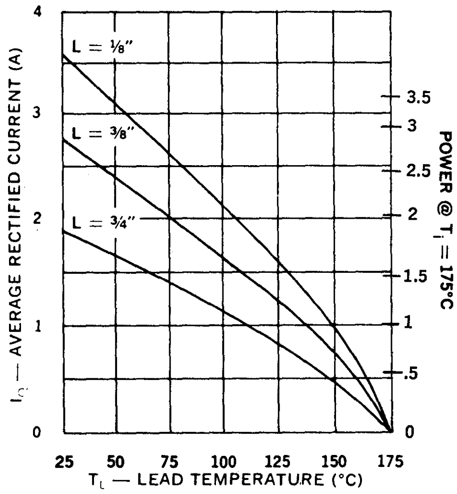
BODY A

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

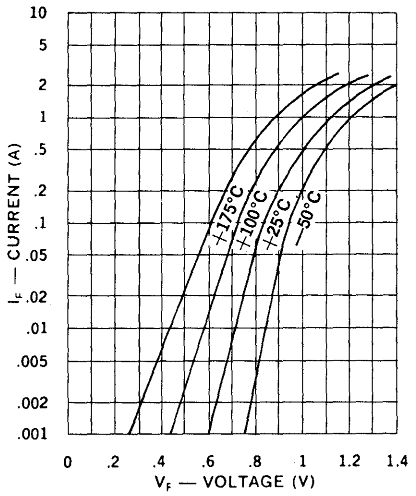
Type	Peak Inverse Voltage	Minimum Reverse Breakdown Voltage @ 50µA	Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*	Capacitance @ $V_R = 12V$ f = 1MHz
			Min.	Max.	25°C	150°C		
JAN & JANTX 1N4942	200V	220V	0.6V	1.3Vdc @ 1 Adc	1.0µA	200µA	150ns	45pf
JAN & JANTX 1N4944	400V	440V					150ns	35pf
JAN & JANTX 1N4946	600V	660V					250ns	25pf

*Measured in circuit $I_F = \frac{1}{2}A$, $I_R = 1.0A$, $I_{REC} = \frac{1}{4}A$

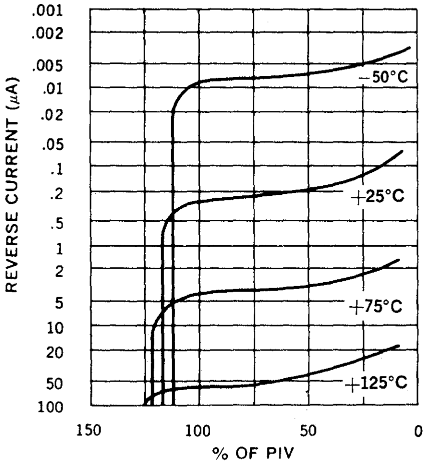
Maximum Current vs Lead Temperature



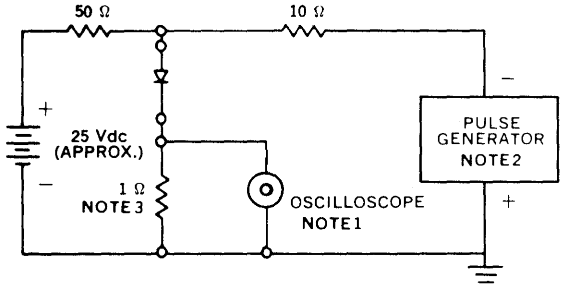
Typical Forward Current vs Forward Voltage



Typical Reverse Current vs PIV



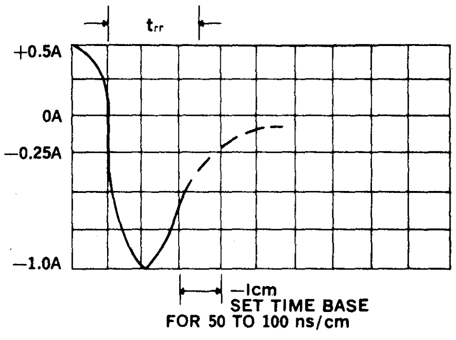
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform.



POWER ZENERS
5 Watt, Military

1N4954-1N4996

FEATURES
- 2 Times Greater Surge Rating than Conventional 10 Watt Zeners
- Small Physical Size
- JAN and JANTX Types Available

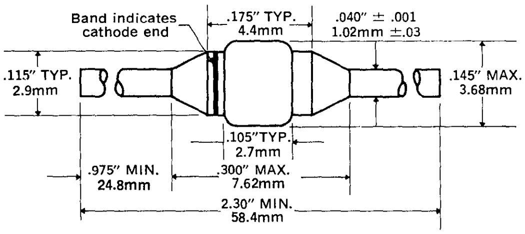
DESCRIPTION
Fused-in-glass, metallurgically-bonded 5 watt zeners, qualified to MIL-S-19500/356.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 390V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	−65°C to +175°C

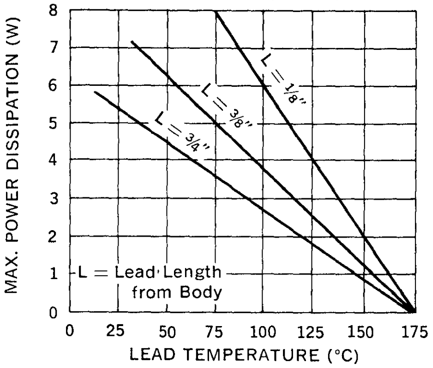
MECHANICAL SPECIFICATIONS

1N4954-1N4996

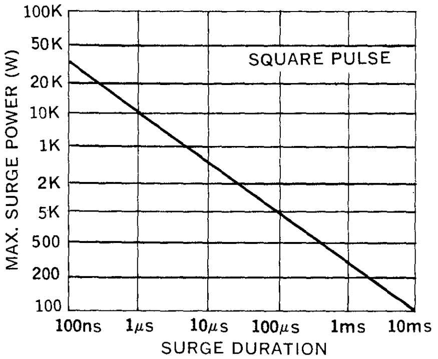


BODY B

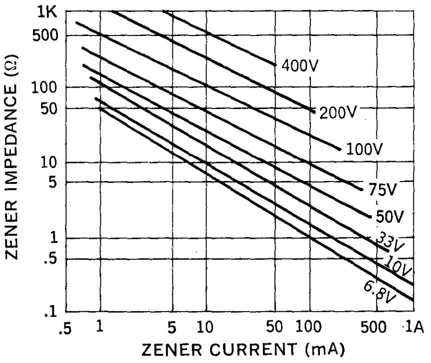
Power Dissipation vs. Lead Temperature Derating Curve



Max. Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



UNITRODE

Electrical Specifications at 25°C										Maximum Ratings	
Type	Nominal Zener Voltage† V_Z @ I_{ZT}	Test Current I_{ZT}	Maximum Zener Impedance §		Voltage Regulation ΔBV §§	Maximum Reverse Leakage Current			Maximum Temperature Coeff. T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current‡ I_S
			Z_Z @ I_{ZT}	Z_{ZK}†† @ I_{ZK} = 1mA		I_R††	I_R	V_R			
±5% Tolerance	Volts	mA	Ohms	Ohms	Volts	μA		Volts	%/°C	mA	Amps
1N4954*	6.8	175	1.0	1000	0.7	150	300	5.2	.05	700	40
1N4955*	7.5	175	1.5	800	0.7	100	200	5.7	.06	630	32
1N4956*	8.2	150	1.5	600	0.7	50	100	6.2	.06	580	24
1N4957*	9.1	150	2.0	400	0.7	25	50	6.9	.06	520	22
1N4958*	10.0	125	2.0	125	0.8	25	25	7.6	.07	475	20
1N4959*	11	125	2.5	130	0.8	10	15	8.4	.07	430	19
1N4960*	12	100	2.5	140	0.8	10	10	9.1	.07	395	18
1N4961*	13	100	3.0	145	0.8	10	10	9.9	.08	365	16
1N4962*	15	75	3.5	150	1.0	5	5	11.4	.08	315	12
1N4963*	16	75	3.5	155	1.1	5	5	12.2	.08	294	10
1N4964*	18	65	4.0	160	1.2	5	5	13.7	.085	264	9.0
1N4965*	20	65	4.5	165	1.5	2	2	15.2	.085	237	8.0
1N4966*	22	50	5.0	170	1.8	2	2	16.7	.085	216	7.0
1N4967*	24	50	5.0	175	2.0	2	2	18.2	.090	198	6.5
1N4968*	27	50	6.0	180	2.0	2	2	20.6	.090	176	6.0
1N4969*	30	40	8	190	2.5	2	2	22.8	.090	158	5.5
1N4970*	33	40	10	200	2.8	2	2	25.1	.095	144	5.0
1N4971*	36	30	11	220	3.0	2	2	27.4	.095	132	4.5
1N4972*	39	30	14	230	3.0	2	2	29.7	.095	122	4.0
1N4973*	43	30	20	240	3.3	2	2	32.7	.095	110	3.5
1N4974*	47	25	25	250	3.5	2	2	35.8	.095	100	3.2
1N4975*	51	25	27	270	4.0	2	2	38.8	.095	92	3.0
1N4976*	56	20	35	320	4.4	2	2	42.6	.095	84	2.8
1N4977*	62	20	42	400	5.0	2	2	47.1	.100	76	2.5
1N4978*	68	20	50	500	5.5	2	2	51.7	.100	70	2.2
1N4979*	75	20	55	620	6.0	2	2	56.0	.100	63.0	2.0
1N4980**	82	15	80	720	6.6	2	2	62.2	.100	58.0	1.8
1N4981**	91	15	90	760	7.5	2	2	69.2	.100	52.5	1.6
1N4982**	100	12	110	800	8.0	2	2	76.0	.100	47.5	1.4
1N4983**	110	12	125	1000	9.0	2	2	83.6	.100	43.0	1.2
1N4984**	120	10	170	1150	10	2	2	91.2	.100	39.5	1.00
1N4985**	130	10	190	1250	11	2	2	98.8	.105	36.6	0.80
1N4986**	150	8	330	1500	13	2	2	114.0	.105	31.6	0.75
1N4987**	160	8	350	1650	14	2	2	121.6	.105	29.4	0.70
1N4988**	180	5	450	1750	16	2	2	136.8	.110	26.4	0.60
1N4989**	200	5	500	1850	18	2	2	152	.110	23.6	0.50
1N4990**	220	5	550	2000	19	2	2	167	.115	21.6	0.50
1N4991**	240	5	650	2050	22	2	2	182	.115	19.8	0.40
1N4992**	270	5	800	2100	25	2	2	206	.120	17.5	0.35
1N4993**	300	4	950	2150	28	2	2	228	.120	15.6	0.30
1N4994**	330	4	1175	2200	32	2	2	251	.120	14.4	0.25
1N4995**	360	3	1400	2300	35	2	2	274	.120	13.0	0.22
1N4996	390	3	1800	2500	40	2	2	297	.120	12.0	0.20

** Available as JAN.

* Available as JAN and JANTXV.

† All zener voltages are measured with an automated test set using a 35 msec test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

§§ ΔBV is obtained by measuring the voltage change when the test current is changed from 10% to 50% of Iz max under DC conditions. During this measurement the leads are heat sunk .375 inch from the body and maintained at 25°C.

★ Maximum current based on 5 Watt Rating. See lead temperature derating curves for proper mounting methods.

‡ Figures shown are for a peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

†† These specifications apply only to JAN and JANTX types.

RECTIFIERS

Military Approved, 3 Amp, Fast Recovery

JAN & JANTX 1N5186-1N5190

FEATURES

- Continuous Rating: 3A
- Qualified to MIL-S-19500/424
- PIV : to 600V
- Recovery Time: 150ns
- Miniature Size
- Controlled Avalanche

DESCRIPTION

These miniature fast recovery rectifiers permit operation at full power at frequencies as high as 100kHz sine wave.
They are qualified to military specification and available as JAN or JANTX.

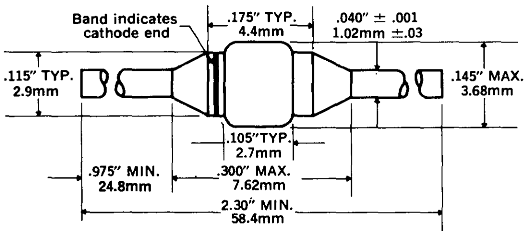
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
100V	JAN & JANTX 1N5186
200V	JAN & JANTX 1N5187
400V	JAN & JANTX 1N5188
600V	JAN & JANTX 1N5190

Maximum Average D.C. Output Current	
@ $T_A = 25°C$	3.0A
@ $T_A = 150°C$	0.7A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	80A
Operating Temperature Range	—65°C to +175°C
Storage Temperature Range	—65°C to +200°C
Thermal Resistance	See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX 1N5186-1N5190



BODY B

UNITRODE

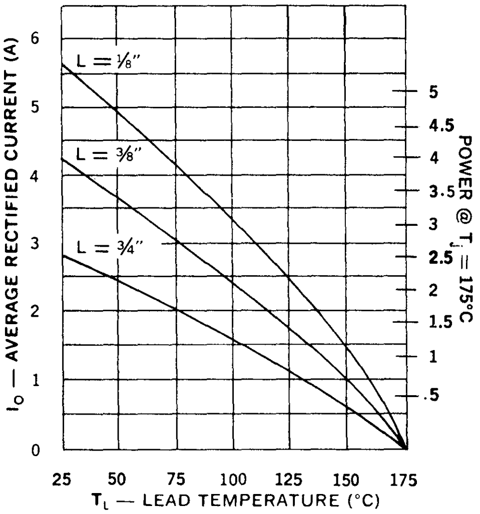
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Peak Inverse Voltage	Minimum Reverse Breakdown Voltage @ 100μA	Peak Forward Voltage		Maximum Reverse D.C. Current @ PIV	
			Min.	Max.	25°C	100°C
JAN & JANTX 1N5186	100V	120V	0.9V @ 9A(pk) (8.3ms)	1.5V	2μA	100μA
JAN & JANTX 1N5187	200V	240V				
JAN & JANTX 1N5188	400V	480V				
JAN & JANTX 1N5190	600V	660V				

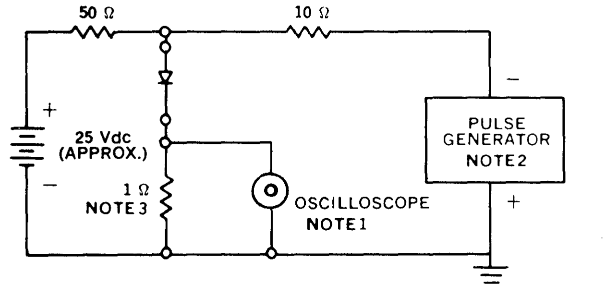
Type	Reverse Recovery Time*	Capacitance @ $V_R = 0V$ f = 1MHz	Capacitance @ $V_R = 4V$ f = 1MHz
JAN & JANTX 1N5186	150ns	300pf	200pf
JAN & JANTX 1N5187	200ns	300pf	170pf
JAN & JANTX 1N5188	250ns	230pf	120pf
JAN & JANTX 1N5190	400ns	180pf	90pf

*Recovery time measured from $I_F = 0.5A$ to $I_R = 1.0A$, $I_{REC} = 0.25A$

Maximum Current vs Lead Temperature



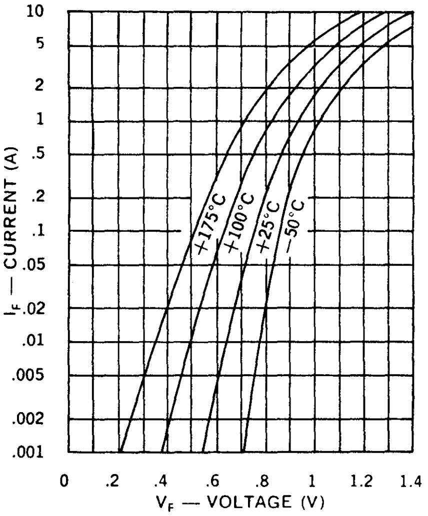
Reverse-Recovery Circuit



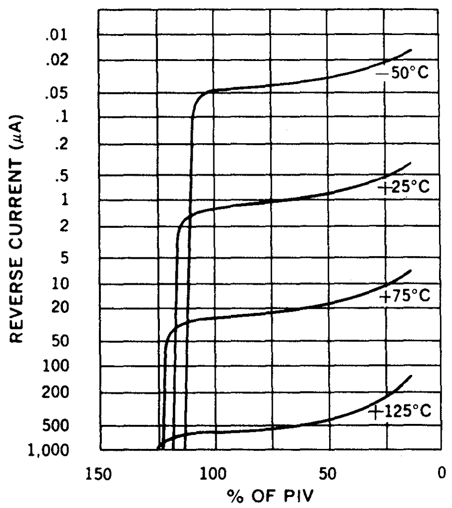
NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Typical Forward Current vs Forward Voltage



Typical Reverse Current vs PIV



RECTIFIERS

Military Approved, Fast Recovery, 3 Amp

JAN & JANTX 5415
JAN & JANTX 5416
JAN & JANTX 5417
JAN & JANTX 5418
JAN & JANTX 5419
JAN & JANTX 5420

FEATURES

- Qualified to MIL-S-19500/411
- JAN & JANTX Available
- PIV: to 600V
- Controlled Avalanche

DESCRIPTION

This series of devices as designed to meet the need for high speed, power rectifiers in military high-rel power supplies.

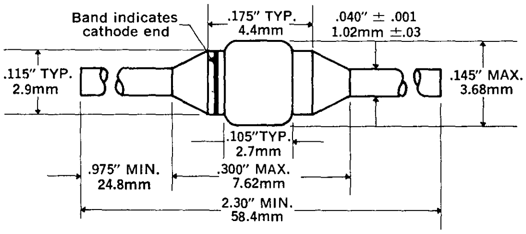
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
50V	JAN & JANTX 1N5415
100V	JAN & JANTX 1N5416
200V	JAN & JANTX 1N5417
400V	JAN & JANTX 1N5418
500V	JAN & JANTX 1N5419
600V	JAN & JANTX 1N5420

Maximum Average D.C. Output Current	
@ $T_A = 55°C$	3.0A
@ $T_A = 100°C$	2.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	80A
Operating Temperature Range	—65°C to +175°C
Storage Temperature Range	—65°C to +200°C
Thermal Resistance θ_{JL} @ L = 3/8″	20°C/W See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX 5415 JAN & JANTX 5417 JAN & JANTX 5419
JAN & JANTX 5416 JAN & JANTX 5418 JAN & JANTX 5420



Dimensions in inches.

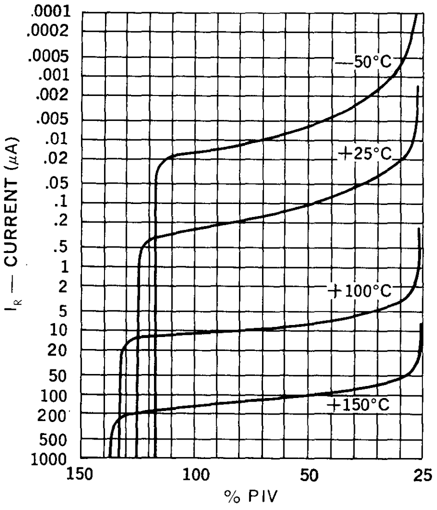
BODY B

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

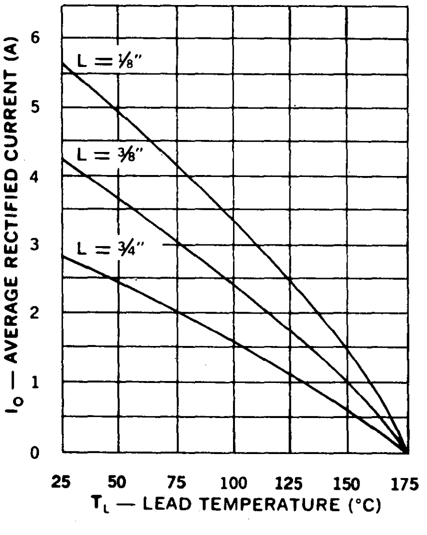
Type	PIV	Minimum Reverse Breakdown Voltage @ 50μA	Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*
			Min.	Max.	25°C	100°C	
JAN & JANTX 1N5415	50V	55V	0.6V @ 9Adc tp = 300μs	1.5V(pk)	1.0μA	20μA	150
JAN & JANTX 1N5416	100V	110V					150
JAN & JANTX 1N5417	200V	220V					150
JAN & JANTX 1N5418	400V	440V					150
JAN & JANTX 1N5419	500V	550V					250
JAN & JANTX 1N5420	600V	660V					400

*Measured in circuit I_F = .05 A, I_R = 1A, I_{REC} = 0.25 A.

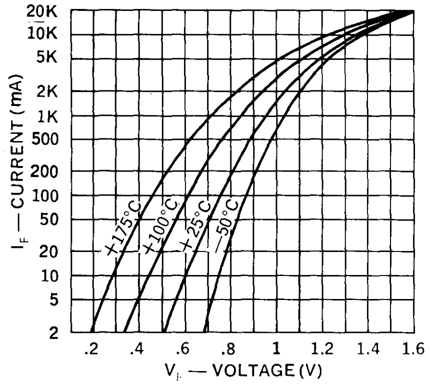
Typical Reverse Current vs. PIV



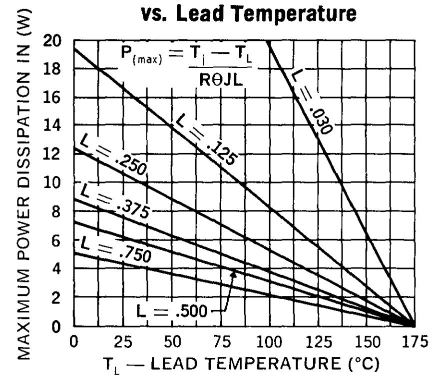
Maximum Current vs Lead Temperature



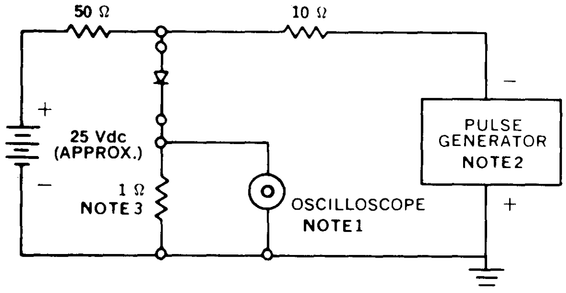
Typical Forward Current vs. Forward Voltage



Maximum Power vs. Lead Temperature



Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS

Military Approved, 5 Amp, General Purpose

JAN & JANTX 1N5550-1N5553

FEATURES
- Qualified to MIL-S-19500/420A
- Continuous Rating: 5A
- PIV: to 800V
- TX Parts 100% Screened
- Miniature Size
- Controlled Avalanche

DESCRIPTION

This series of military approved rectifiers is useful in many military applications. The 100% screening requirements in the "TX" version combined with the unique Unitrode construction assures the highest degree of reliability.

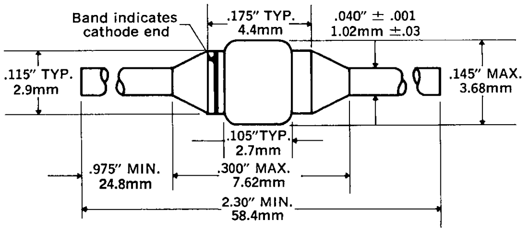
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
200V	JAN AND JANTX 1N5550
400V	JAN AND JANTX 1N5551
600V	JAN AND JANTX 1N5552
800V	JAN AND JANTX 1N5553

Maximum Average D.C. Output Current	
@ $T_A = 55°C$	3.0A
@ $T_L = 55°C$	5.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	100A
Operating Temperature Range	—65°C to +175°C
Storage Temperature Range	—65°C to +200°C
Thermal Resistance	See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX 1N5550-1N5553



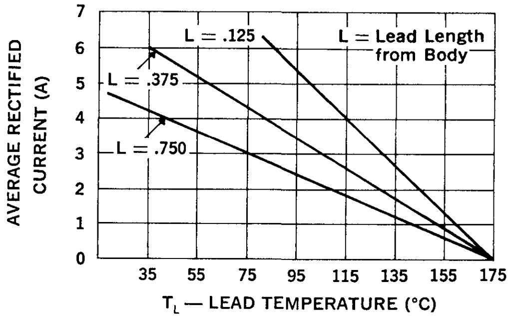
BODY B

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

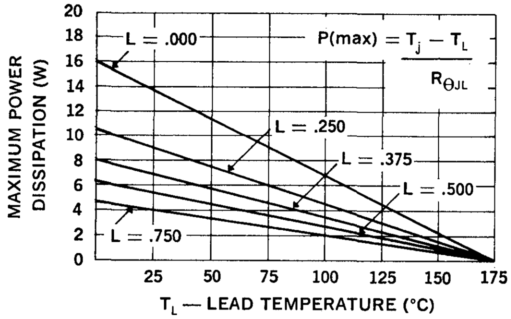
Type	Peak Inverse Voltage	Minimum Reverse Breakdown Voltage @ 50μA	Peak Forward Voltage		Maximum Leakage Current @ PIV		Maximum Reverse Recovery Time*
			Min.	Max.	25°C	100°C	
JAN & JANTX 1N5550	200V	240V	0.6V @ $I_F = 9A(pk)$ (8.3ms)	1.2V	1.0μA	75μA	2.0μs
JAN & JANTX 1N5551	400V	460V					
JAN & JANTX 1N5552	600V	660V					
JAN & JANTX 1N5553	800V	880V					

*Measured in a test circuit $I_F = 0.5A$, $I_R = 1.0A$, $I_{REC} = 0.25A$

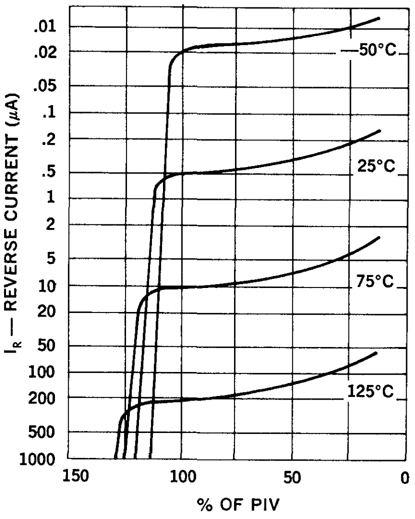
Maximum Current vs. Lead Temperature



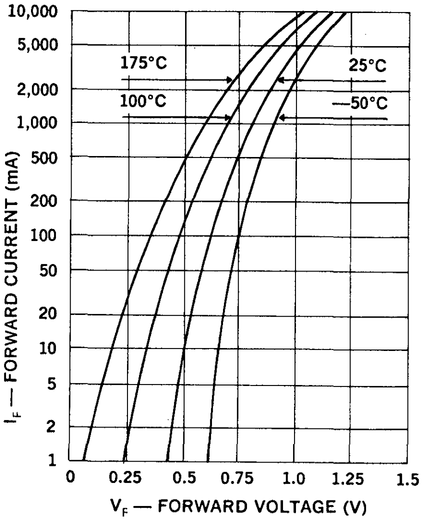
Maximum Power Dissipation vs. Lead Temperature



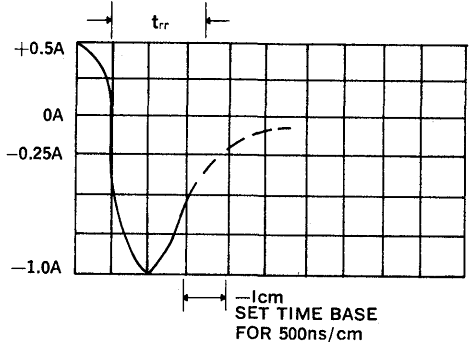
Reverse Current vs. PIV



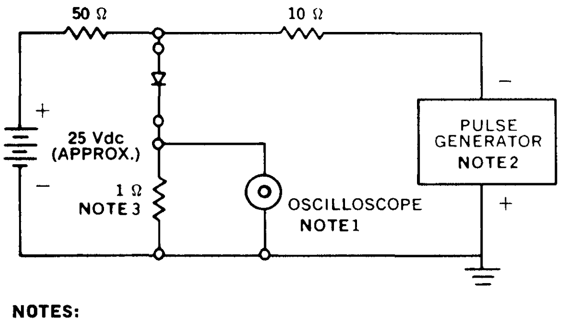
Forward Current vs. Forward Voltage



Characteristic Wave Form



Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIER ASSEMBLIES

High Voltage Stacks, 1 Amp to 5 Amp, Military Approved

JAN 1N5597
JAN 1N5600
JAN 1N5603

FEATURES

- Qualified to MIL-S-19500/404A
- PIV: to 10kV
- Surge Ratings: to 200A
- Current Ratings: to 5A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Modular Package For Easy Stacking

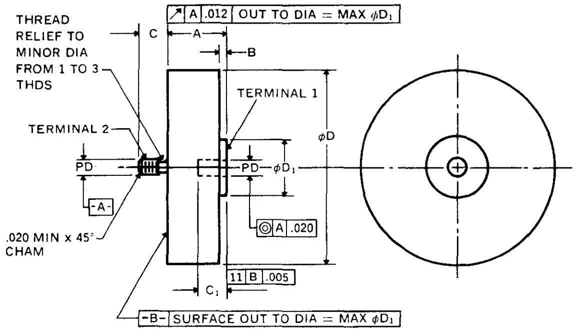
DESCRIPTION

This series of military high-voltage high-current stacks offers the utmost in reliability as required in military system designs. The rectifiers are assembled with diodes which have been subjected to TX type screening tests.

ABSOLUTE MAXIMUM RATINGS

	JAN 1N5597	JAN 1N5600	JAN 1N5603
Peak Inverse Voltage	10kV	5kV	5kV
Maximum Average D.C. Output Current @ $T_C = 75°C$	1A	2A	5A
Non-Repetitive Sinusoidal Surge (8.3ms) @ $T_C = 75°C$	30A	80A	200A
Operating and Storage Temperature Range	−65°C to +150°C		

MECHANICAL SPECIFICATIONS



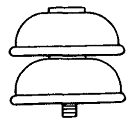
JAN 1N5597 JAN 1N5600

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses		NOTES
	Minimum	Maximum	
A	.73 (18.54)	.83 (21.08)	8
B		.080 (2.03)	
C	.240 (6.10)	.264 (6.71)	2,6
C_1	.265 (6.73)	.400 (10.16)	4
φD	1.85 (46.99)	1.95 (49.53)	
$φD_1$	.57 (14.48)	.67 (17.02)	

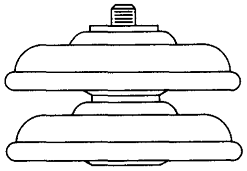
JAN 1N5603

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses		NOTES
	Minimum	Maximum	
A	.970 (24.64)	1.020 (25.91)	8
B	.050 (1.27)	.080 (2.03)	
C	.307 (7.80)	.317 (8.05)	3
C_1	.318 (8.08)	.400 (10.16)	5,7
φD	3.450 (87.63)	3.650 (92.71)	
$φD_1$	.95 (24.13)	1.250 (31.75)	

JAN 1N5597, JAN 1N5600



JAN 1N5603



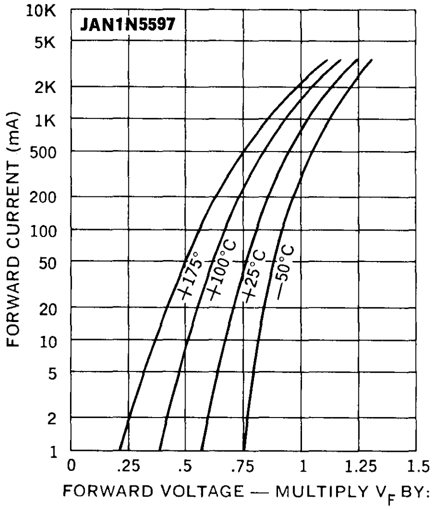
1. All marking shall be on cathode side of module.
2. Threaded stud ¼-28UNF-2A.
3. Threaded stud ⅜-24UNF-2A.
4. Threaded insert ¼-28UNF-2B.
5. Threaded insert ⅜-24UNF-2B.
6. Cathode connected to terminal 2.
7. Cathode connected to terminal 1.
8. Module contour within dimension A is not specified.

UNITRODE

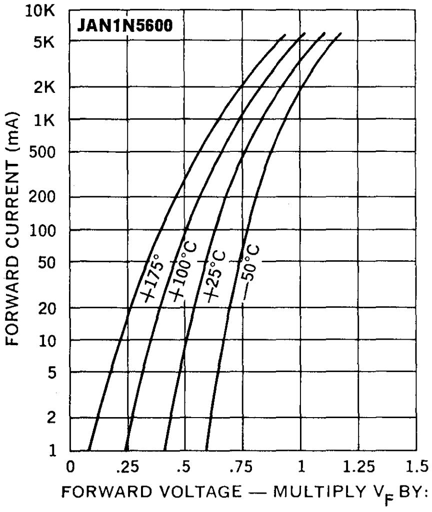
Electrical Specifications (at 25°C unless noted)

Type	PIV	Forward Voltage Drop		Maximum Leakage Current @ PIV		Capacitance @ V_R = 100V		Maximum Reverse Transient Energy Absorption
		Min.	Max.	T_A = 25°C	T_A = 100°C	Min.	Max.	
	kV			μA	μA	pf	pf	joules
JAN 1N5597	10	13V @ 1A	19V @ 1A	1	75	5	30	2
JAN 1N5600	5	6V @ 2A	10V @ 2A	5	100	7	30	6
JAN 1N5603	5	6V @ 5A	10V @ 5A	5	100	15	40	12

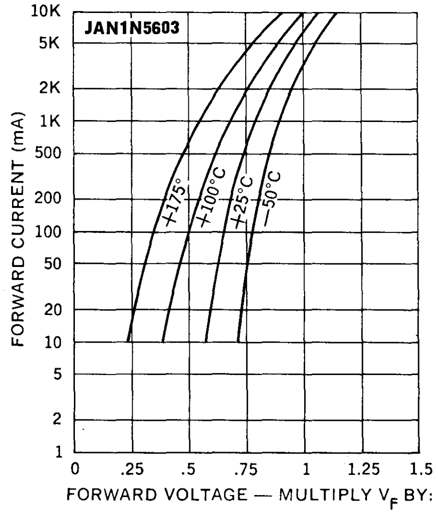
Typical Forward Voltage vs. Forward Current



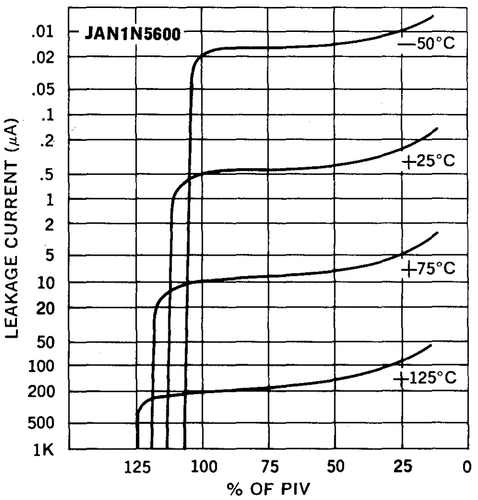
Typical Forward Voltage vs. Forward Current



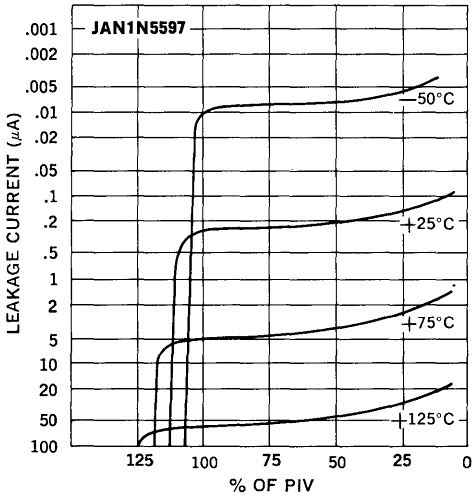
Typical Forward Voltage vs. Forward Current



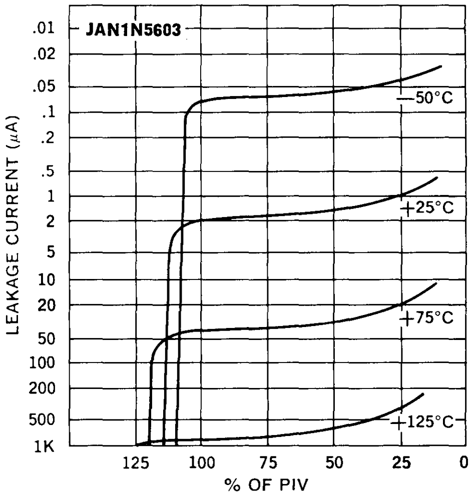
Typical Leakage Current vs. PIV



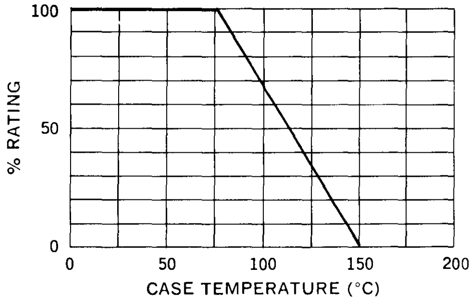
Typical Leakage Current vs. PIV

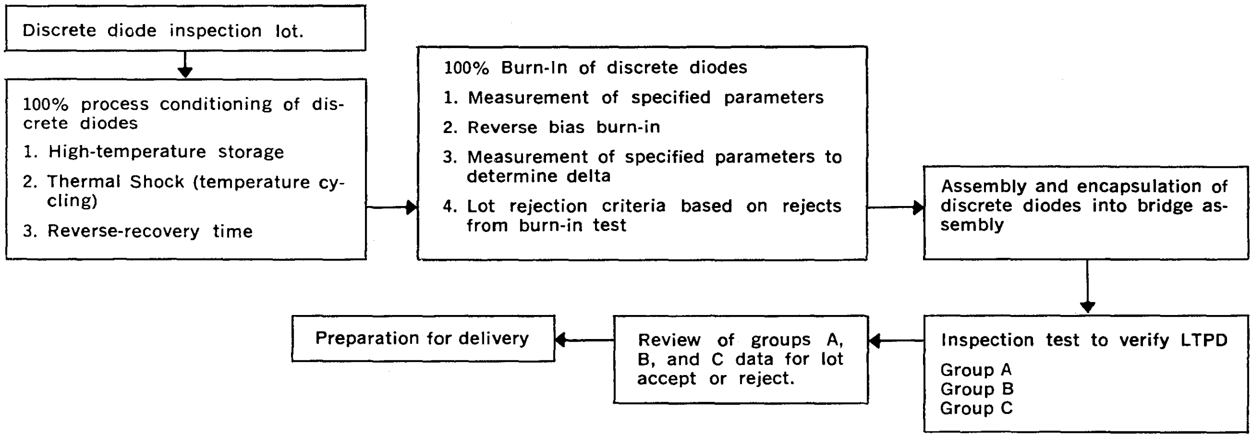


Typical Leakage Current vs. PIV



Current Derating Curve





Discrete diode inspection lot.

100% process conditioning of discrete diodes

1. High-temperature storage
2. Thermal Shock (temperature cycling)
3. Reverse-recovery time

100% Burn-In of discrete diodes

1. Measurement of specified parameters
2. Reverse bias burn-in
3. Measurement of specified parameters to determine delta
4. Lot rejection criteria based on rejects from burn-in test

Assembly and encapsulation of discrete diodes into bridge assembly

Inspection test to verify LTPD
Group A
Group B
Group C

Review of groups A, B, and C data for lot accept or reject.

Preparation for delivery

POWER ZENERS

1N5610-1N5613

Transient Suppressor Diodes

FEATURES

- 1500 Watts for 1ms Pulse Power Capability
- Small Physical Size
- Fused-in-Glass Construction Provides High Reliability
- Designed to be Used in Mil-Std-704A Applications
- JAN and JANTX Versions Available per MIL-S-19500/434

DESCRIPTION

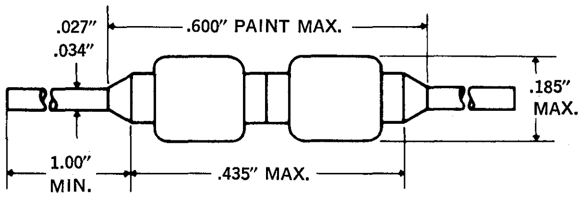
Each of these devices consists of two fused-in-glass zeners brazed together in a series configuration to provide maximum surge protection.

ABSOLUTE MAXIMUM RATINGS (at 25°C except where otherwise noted)

	1N5610	1N5611	1N5612	1N5613
Zener Voltage	See Electrical Specifications			
Forward Surge Current	200A	200A	200A	200A
Zener Surge Current, at 25°C	32.0A	24.0A	19.0A	5.7A
Surge Current, at 150°C	5.5A	4.8A	3.2A	1.0A
Surge Power	See Graph			
Storage and Operating Temperature	—65°C to +175°C			

MECHANICAL SPECIFICATIONS

1N5610-1N5613



Polarity: Cathode indicated by band.
Weight: 1.5 gram (approximate).
Mounting Position: Any. **Leads:** Tinned Copper.
Marking: Type number marked on unit.

Double C BODY

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Min. Zener Voltage § Vz @ ImA	Max. Zener Voltage† Vz @ Is		Max. Reverse Leakage Current I_R @ V_R		Max. Forward Voltage‡ @ 100 Amps	Typical Temperature Coefficient
	Volts	Volts	Amps	µA	Volts	Volts	%/°C
1N5610*	33.0	47.5	32.0	5.0	30.5	4.8	.093
1N5611*	43.7	63.5	24.0	5.0	40.3	4.8	.094
1N5612*	54.0	79.5	19.0	5.0	49.0	4.8	.096
1N5613**	191.0	265.0	5.7	5.0	175.0	4.8	.100

Notes: * Available as JAN and JANTX.
** Available as JAN.
§ Duration of applied current ⩽ 300ms, duty cycle ⩽ 2%.
† Utilizing a pulse which decays exponentially to 50% of the peak value in 1ms. See graph entitled "Pulse Waveform."
‡ Peak Sinusoidal surge current of 8.3ms duration using 60 cycle A.C.

APPLICATIONS

Voltage transients can be suppressed with series elements, shunt elements, or a combination of both. These elements may be passive or active. For low and medium power applications, a series resistor and zener clamp offer several attractive features:

1. Simplicity of design
2. High reliability
3. Fast response time

The 1N5610 series of surge suppressors will suppress the following transients defined by *MIL-S-704A* without the use of any series limiting resistance beyond that provided by the source:

1. All 600V transients (category #1 on chart below)
2. All 80V transients except those generated by the main voltage regulator (category #2 on chart below)
3. The overvoltage transients generated by the *main voltage regulator* (category #3 on chart below) will also be suppressed by the 1N5610 series if:
   a. A 20 ohm series limiting resistor is used, or
   b. No series resistance is used but the zener is protected within 500 µs by using, for example, an SCR crowbar

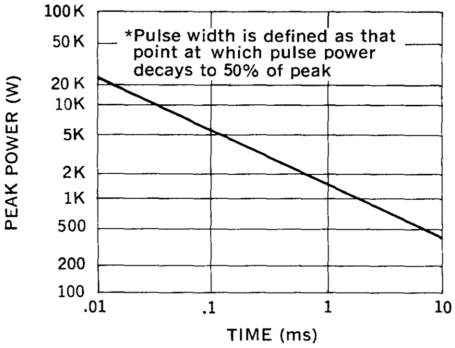
The above statements are based on the source impedances and dv/dt characteristics as given in ARINC* Specification #413. This report entitled "Guidance for Aircraft Electrical Power Utilization and Transient Protection" serves to further define *MIL-STD-704A* for large aircraft electrical systems.

Category	Source of Transient	Maximum Amplitude	Duration	Min. Source Impedance	dv/dt
1.	Inductive Switching	600 V	⩽ 10 µs	50 ohms	
2.	BUS Switching	80 V	⩽ 10 ms	15 ohms	
3.	Main Voltage Regulator	80 V	⩾ 10 ms	0.2 ohms	50V/ms

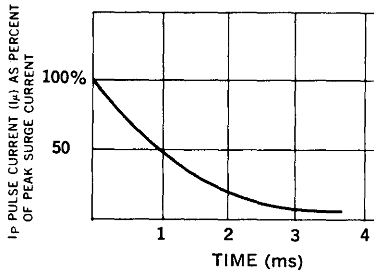
These Surge Suppressors are useful in a variety of other applications where semiconductor devices must function reliably in an environment subject to extremely high but short term surges.

* ARINC stands for Aeronautical Radio, Inc. (Annapolis, Maryland 21401)

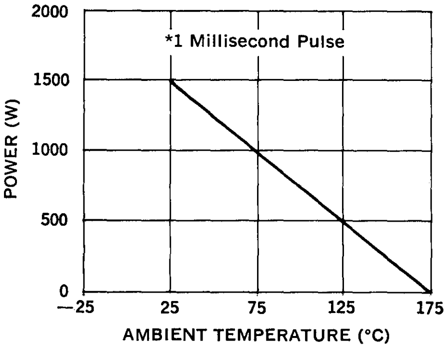
Peak Power Rating vs. Pulse Width*



Pulse Waveform



Peak Power Rating*
vs. Ambient Temperature



RECTIFIERS

Military Approved, Standard Recovery, 1 Amp

JAN & JANTX 5614
JAN & JANTX 5616
JAN & JANTX 5618
JAN & JANTX 5620
JAN & JANTX 5622

FEATURES

- Qualified to MIL-S-19500/427
- JAN and JANTX Available
- PIV: to 1000V
- Controlled Avalanche

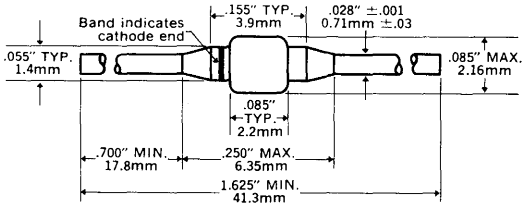
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
200V	JAN & JANTX 1N5614
400V	JAN & JANTX 1N5616
600V	JAN & JANTX 1N5618
800V	JAN & JANTX 1N5620
1000V	JAN & JANTX 1N5622

Maximum Average D.C. Output Current	
@ $T_A = 55°C$	1.0A
@ $T_A = 100°C$	0.75A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	30A
Operating Temperature Range	−65°C to +175°C
Storage Temperature Range	−65°C to +200°C
Thermal Resistance Θ_{JL} @ L = 3/8″	38°C/W See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX 5614 JAN & JANTX 5616 JAN & JANTX 5618 JAN & JANTX 5620 JAN & JANTX 5622



BODY A

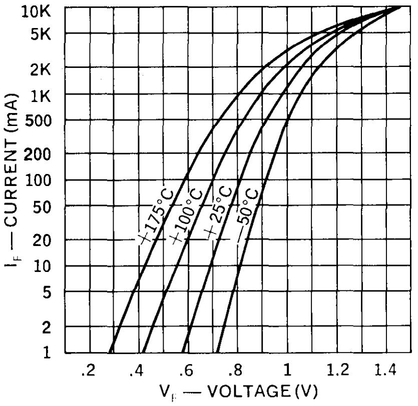
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

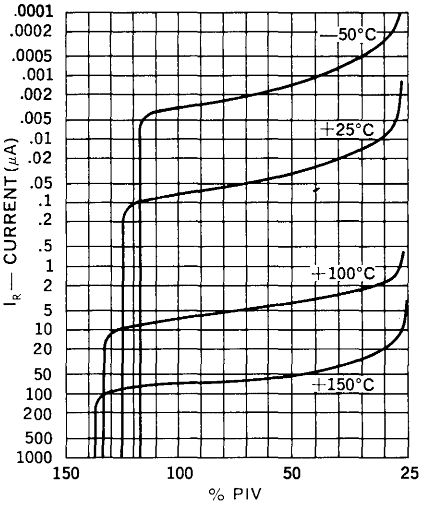
Type	PIV	Minimum Reverse Breakdown Voltage @ 50μA	Forward Voltage Min.	Forward Voltage Max.	Maximum Reverse Current 25°C	Maximum Reverse Current 100°C	Maximum Reverse Recovery Time*
JAN & JANTX 1N5614	200V	220V	0.8	1.3V(pk) @ 3.0A tp = 300μs	0.5μA	25μA	2.0μs
JAN & JANTX 1N5616	400V	440V					
JAN & JANTX 1N5618	600V	660V					
JAN & JANTX 1N5620	800V	880V					
JAN & JANTX 1N5622	1000V	1100V					

*Measured in Circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

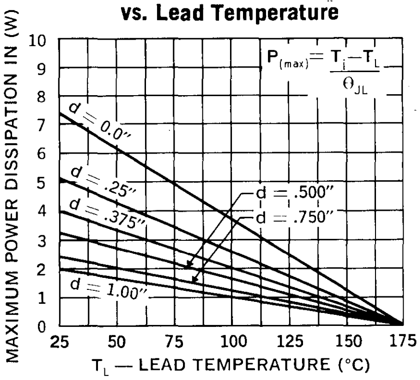
Forward Voltage vs. Forward Current



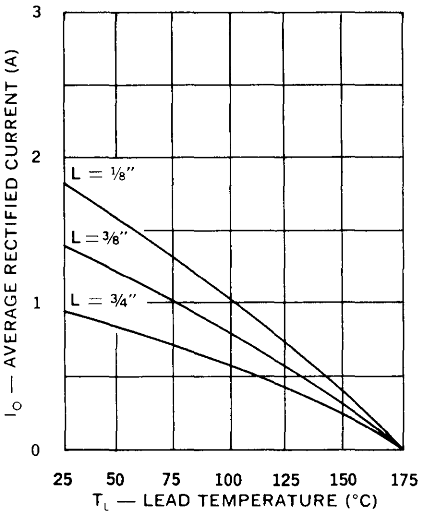
Typical Reverse Current vs. PIV



Maximum Power Dissipation vs. Lead Temperature



Maximum Current vs Lead Temperature



RECTIFIERS

Military Approved, Fast Recovery, 1 Amp

JAN & JANTX 1N5615
JAN & JANTX 1N5617
JAN & JANTX 1N5619

FEATURES

- Qualified to MIL-S-19500/429
- JAN and JANTX Available
- PIV: to 600V
- Controlled Avalanche

DESCRIPTION

This series of military approved rectifiers is useful in many military applications where fast recovery and medium power are required. The 100% screening requirements in the "TX" version combined with the unique Unitrode construction assures the highest degree of reliability.

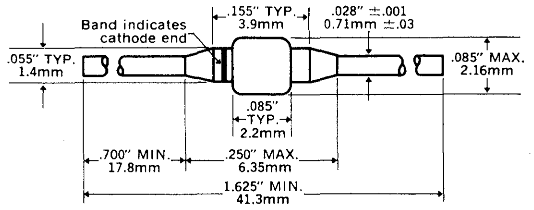
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
200V	JAN & JANTX 1N5615
400V	JAN & JANTX 1N5617
600V	JAN & JANTX 1N5619

Maximum Average D.C. Output Current	
@ $T_A = 55°C$	1.0A
@ $T_A = 100°C$	0.75A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	25A
Operating Temperature Range	−65°C to +175°C
Storage Temperature Range	−65°C to +200°C
Thermal Resistance Θ_{JL}	38°C/W
	See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX 1N5615 JAN & JANTX 1N5617 JAN & JANTX 1N5619



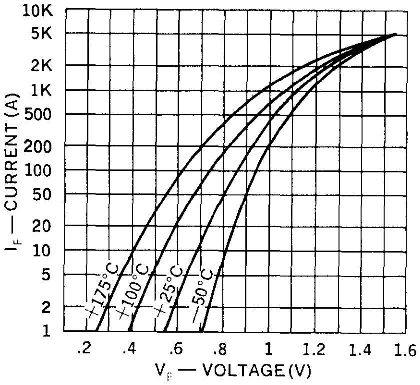
BODY A

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

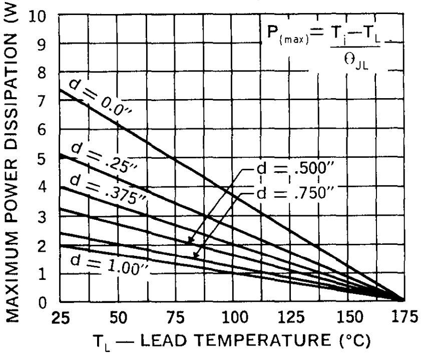
Type	PIV	Minimum Reverse Breakdown Voltage @ 50μA	Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*	Capacitance @ $V_R = 12V$ f = 1MHz
			Min.	Max.	25°C	100°C		
JAN & JANTX 1N5615	200V	220V	0.8V	1.6V(pk)	0.5μA	25μA	150ns	45pf
JAN & JANTX 1N5617	400V	440V	@ 3.0 Adc				150ns	35pf
JAN & JANTX 1N5619	600V	660V	tp = 300μs				250ns	25pf

*Measured in Circuit $I_F = ½A$, $I_R = 1A$, $I_{REC} = ¼A$

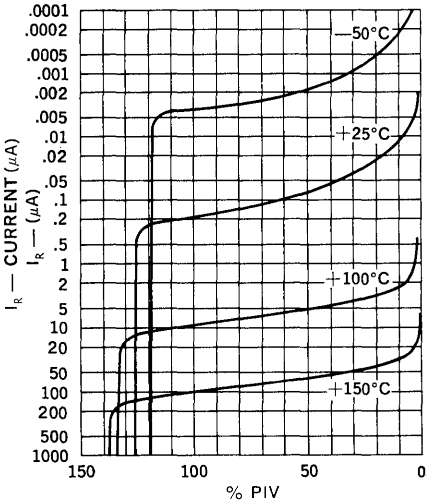
Forward Voltage vs. Forward Current



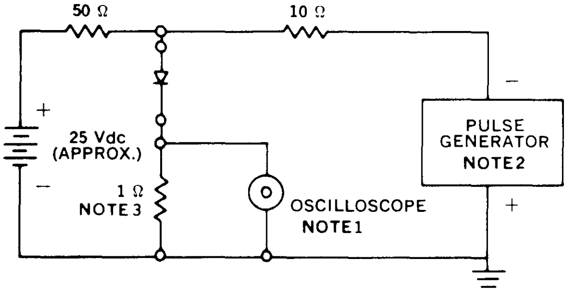
Maximum Power vs. Lead Temperature



Typical Reverse Current vs. PIV



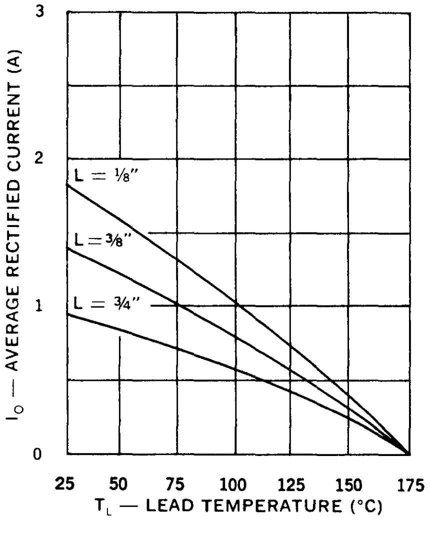
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Maximum Current vs Lead Temperature



POWER ZENERS
Transient Suppressor Diodes

1N5629-1N5650
1N5629A-1N5650A
1N5907

FEATURES
- 1500W for 1ms Pulse Power Capability
- 6.8 to 50V
- DO-13 Hermetically Sealed Package

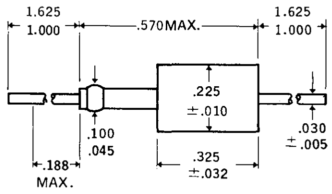
DESCRIPTION
Unitrode's 1N5629 series of transient suppressors features oxide passivated zener chips with full-faced bonds on both sides to achieve high surge capability.

ABSOLUTE MAXIMUM RATINGS at 25°C

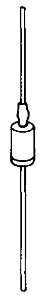
Zener Voltage, V_Z	6.0 to 50V
Reverse Stand-off Voltage	See Table
Forward Surge Current (8.3ms half sinewave)	200A
Peak Zener Pulse Current	See Table
Peak Pulse Power	See Graphs
Power, Continuous	1W
Storage and Operating Temperature	—65°C to +175°C

MECHANICAL SPECIFICATIONS

1N5629-1N5650 1N5629A-1N5650A 1N5907



DO-13



Derating Curve

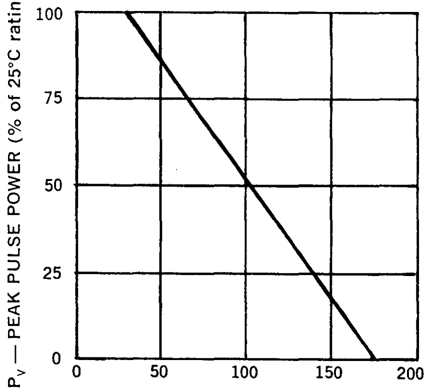


FIGURE 1

Pulse Waveform

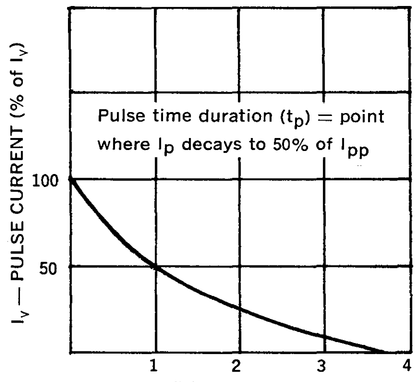


FIGURE 2

Peak Pulse Power vs. Pulse Duration

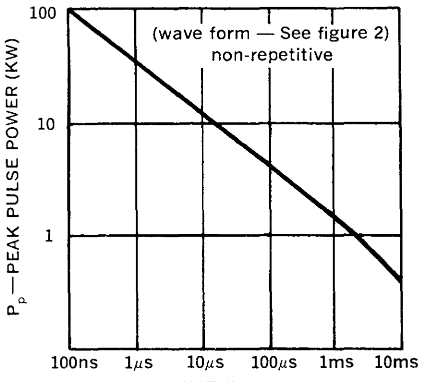


FIGURE 3

UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

JEDEC Type No.	Breakdown Voltage BV @	I_T	Reverse Stand-Off Voltage V_R	Maximum Clamping Voltage V_C @ I_{PP}	Maximum Reverse Leakage I_R @ V_R	Maximum Peak Pulse Current I_{PP}	Maximum Temp. Coef. of BV
	Volts	mA	Volts	Volts	μA	A	%/°C
1N5907	6.00 - —	1	5.00	8.5	300	150	.057
1N5629	6.12 - 7.48	10	5.50	10.8	1000	139	.057
1N5629A	6.45 - 7.14	10	5.80	10.5	1000	143	.057
1N5630	6.75 - 8.25	10	6.05	11.7	500	128	.061
1N5630A	7.13 - 7.88	10	6.40	11.3	500	132	.061
1N5631	7.38 - 9.02	10	6.63	12.5	200	120	.065
1N5631A	7.79 - 8.61	10	7.02	12.1	200	124	.065
1N5632	8.19 - 10.0	1	7.37	13.8	50	109	.068
1N5632A	8.65 - 9.55	1	7.78	13.4	50	112	.068
1N5633	9.00 - 11.0	1	8.10	15.0	10	100	.073
1N5633A	9.5 - 10.5	1	8.55	14.5	10	103	.073
1N5634	9.9 - 12.1	1	8.92	16.2	5	93	.075
1N5634A	10.5 - 11.6	1	9.40	15.6	5	96	.075
1N5635	10.8 - 13.2	1	9.72	17.3	5	87	.078
1N5635A	11.4 - 12.6	1	10.2	16.7	5	90	.078
1N5636	11.7 - 14.3	1	10.5	19.0	5	79	.081
1N5636A	12.4 - 13.7	1	11.1	18.2	5	82	.081
1N5637	13.5 - 16.5	1	12.1	22.0	5	68	.084
1N5637A	14.3 - 15.8	1	12.8	21.2	5	71	.084
1N5638	14.4 - 17.6	1	12.9	23.5	5	64	.086
1N5638A	15.2 - 16.8	1	13.6	22.5	5	67	.086
1N5639	16.2 - 19.8	1	14.5	26.5	5	56.5	.088
1N5639A	17.1 - 18.9	1	15.3	25.2	5	59.5	.088
1N5640	18.0 - 22.0	1	16.2	29.1	5	51.5	.090
1N5640A	19.0 - 21.0	1	17.1	27.7	5	54	.090
1N5641	19.8 - 24.2	1	17.8	31.9	5	47	.092
1N5641A	20.9 - 23.1	1	18.8	30.6	5	49	.092
1N5642	21.6 - 26.4	1	19.4	34.7	5	43	.094
1N5642A	22.8 - 25.2	1	20.5	33.2	5	45	.094
1N5643	24.3 - 29.7	1	21.8	39.1	5	38.5	.096
1N5643A	25.7 - 28.4	1	23.1	37.5	5	40	.096
1N5644	27.0 - 33.0	1	24.3	43.5	5	34.5	.097
1N5644A	28.5 - 31.5	1	25.6	41.4	5	36	.097
1N5645	29.7 - 36.3	1	26.8	47.7	5	31.5	.098
1N5645A	31.4 - 34.7	1	28.2	45.7	5	33	.098
1N5646	32.4 - 39.6	1	29.1	52.0	5	29	.099
1N5646A	34.2 - 37.8	1	30.8	49.9	5	30	.099
1N5647	35.1 - 42.9	1	31.6	56.4	5	26.5	.100
1N5647A	37.1 - 41.0	1	33.3	53.9	5	28	.100
1N5648	38.7 - 47.3	1	34.8	61.9	5	24	.101
1N5648A	40.9 - 45.2	1	36.8	59.3	5	25.3	.101
1N5649	42.3 - 51.7	1	38.1	67.8	5	22.2	.101
1N5649A	44.7 - 49.4	1	40.2	64.8	5	23.2	.101
1N5650	45.9 - 56.1	1	41.3	73.5	5	20.4	.102
1N5650A	48.5 - 53.6	1	43.6	70.1	5	21.4	.102

Forward Voltage, V_f at 100A, (8.3ms sinewave) is 3.5V max.

*Pulse Waveform graph defines shape of the peak current pulse (I_{PP}) to be applied.

ABBREVIATIONS & SYMBOLS

V_R	Stand-Off Voltage. Maximum rated reverse voltage which can be applied with non-conducting condition.
I_{PP}	Peak Pulse Current
P_P	Peak Pulse Power
I_R	Reverse Leakage
BV	Breakdown Voltage at I_T
V_C	Maximum Clamping Voltage. The maximum peak voltage appearing across the device when subjected to the peak pulse current in a 1 millisecond time interval.

RECTIFIERS

High Efficiency, ESP, 2.5 Amp to 20 Amp

1N5802-1N5806
1N5807-1N5811
1N5812-1N5816

FEATURES

- Exceptional Efficiency
- Low Forward Voltage
- Extremely Fast Reverse Recovery Time
- Extremely Fast Forward Recovery Time
- High Surge
- Small Size
- Rugged, High Current Termination
- Radiation Tolerant

DESCRIPTION

This series of High Efficiency Power Rectifiers allows circuit designers to design high current, high frequency supplies to 500 kHz with very low diode losses. The high forward surge capability makes these devices useful in protective circuits.

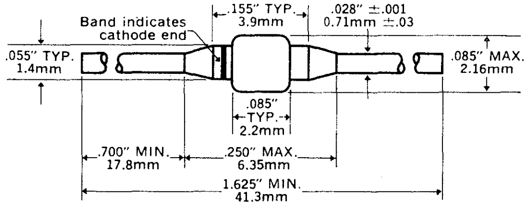
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2.5 Amp Series	6 Amp Series	20 Amp Series
50V	1N5802	1N5807	1N5812
75V	1N5803	1N5808	1N5813
100V	1N5804	1N5809	1N5814
125V	1N5805	1N5810	1N5815
150V	1N5806	1N5811	1N5816

	2.5 AMP SERIES	6.0 AMP SERIES	20 AMP SERIES
Maximum Average D.C. Output Current @ $T_L = 75°C$, $L = 3/8''$	2.5A	6.0A	—
@ $T_C = 100°C$			20.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	35A	125A	250A
Operating and Storage Temperature Range		—65°C to +175°C	
Thermal Resistance 2.5A and 6A Series	See Lead Temperature Derating Curve		
20A Series			3.0°C/W

MECHANICAL SPECIFICATIONS

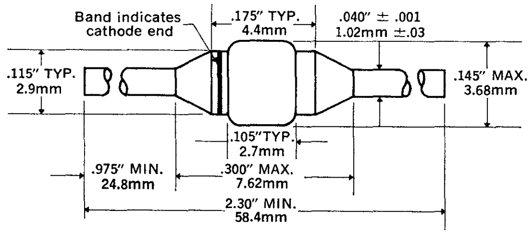
1N5802-1N5806



Typical Weight — 0.22 grams

BODY A

1N5807-1N5811



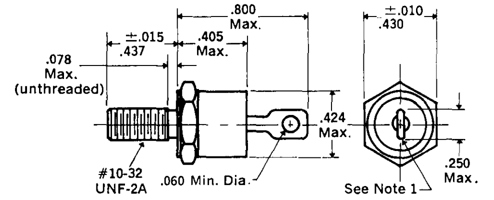
Typical Weight — 0.75 grams

BODY B

UNITRODE

MECHANICAL SPECIFICATIONS

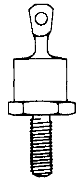
1N5812-1N5816



Part Identification: Type number printed on metal case.
Polarity: Cathode to stud end; for reverse polarity (anode to stud) use suffix "R". Polarity indicated by diode symbol
Max. Weight: 7.0 Grams
Installation Precautions: Maximum unlubricated stud torque: 10 inch pounds
Thermal Resistance: 3.0°C/A

Dimensions in inches.

DO-4

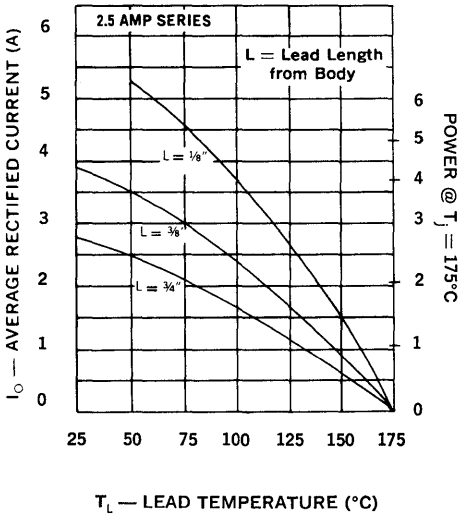


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

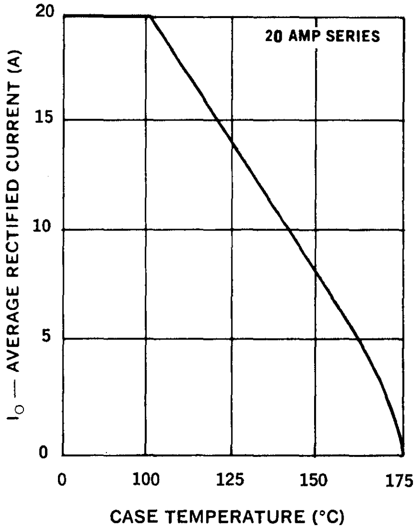
Type	PIV	Maximum Forward Voltage Drop*	Leakage Current @ PIV		Maximum Reverse Recovery Time I_F, I_R, I_{REC}	Typical Forward Recovery Time @ 1A Recover to 1V	Typical Forward Recovery Voltage @ 1A tr = 8ns	Typical Junction Capacitance @ —10V
			25°C	100°C				
1N5802	50V	.875 @ 1A	1μA	50μA	25ns, 0.5A-0.5A-0.05A	15ns	1.5V	15pf
1N5803	75V							
1N5804	100V							
1N5805	125V							
1N5806	150V							
1N5807	50V	.875 @ 4A	5μA	150μA	30ns, 1.0-1.0-0.1A	15ns	1.5V	45pf
1N5808	75V							
1N5809	100V							
1N5810	125V							
1N5811	150V							
1N5812	50V	.900 @ 10A	10μA	500μA	35ns, 1.0-1.0-0.1A	15ns	1.5V	90pf
1N5813	75V							
1N5814	100V							
1N5815	125V							
1N5816	150V							

*Pulse width = 250ms

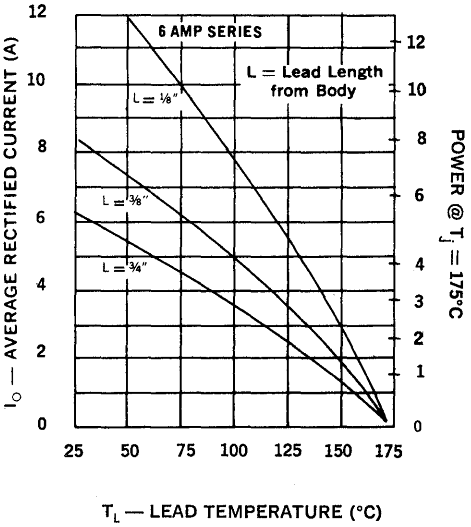
Output Current vs. Lead Temp.



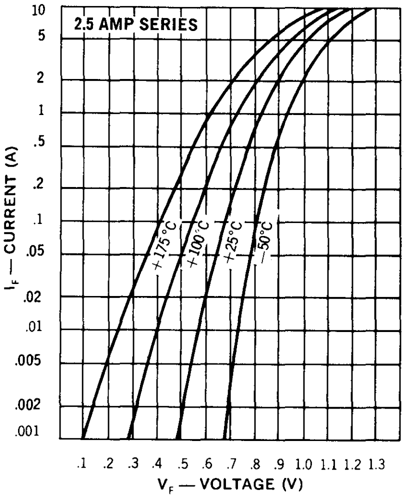
Output Current vs. Case Temp.



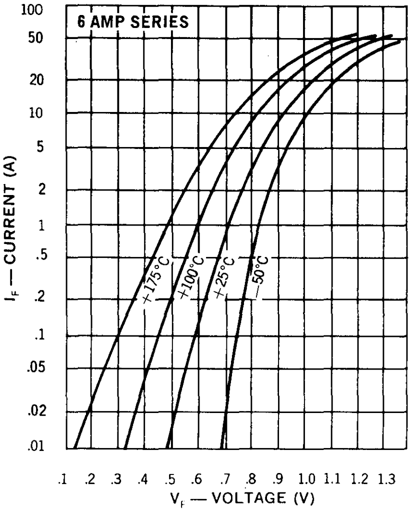
Output Current vs. Lead Temp.



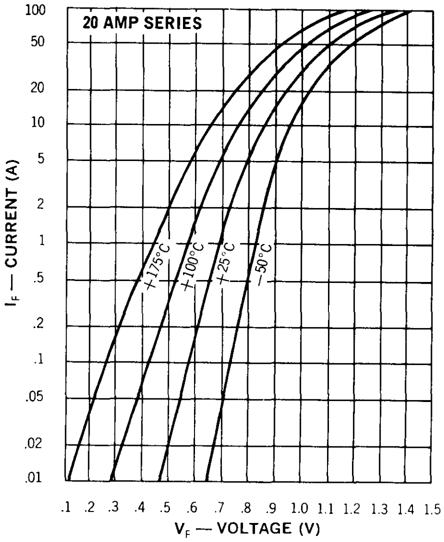
Typical Forward Current vs. Forward Voltage



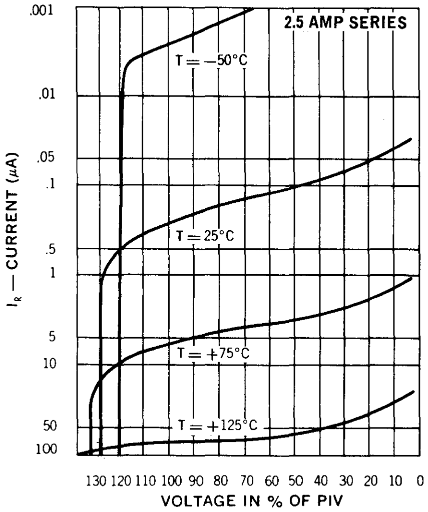
Typical Forward Current vs. Forward Voltage



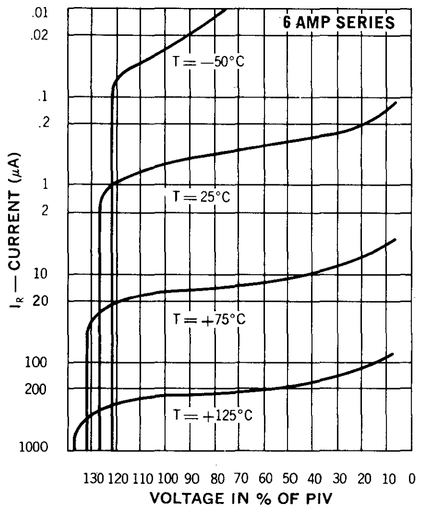
Typical Forward Current vs. Forward Voltage



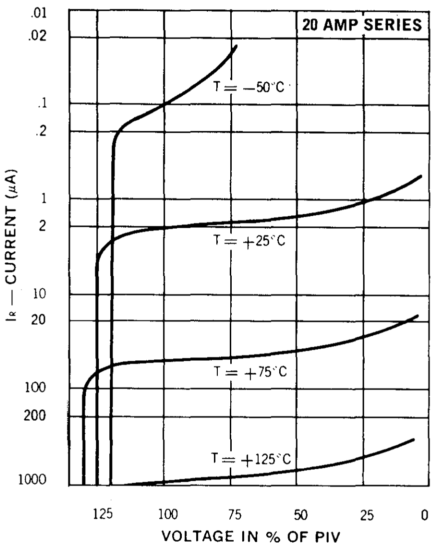
Typical Reverse Current vs. Voltage



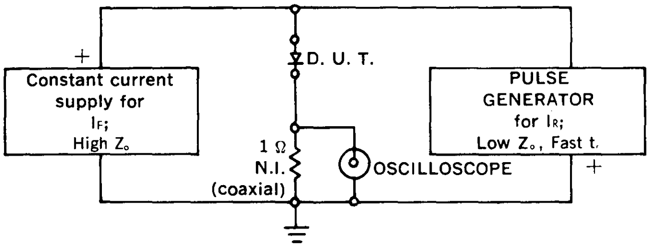
Typical Reverse Current vs. Voltage



Typical Reverse Current vs. Voltage



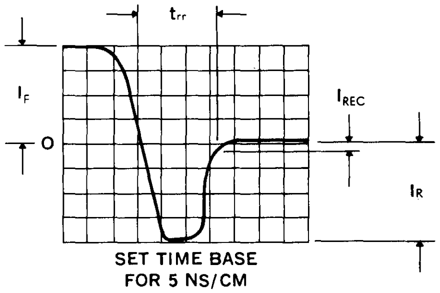
Reverse-Recovery Time Circuit



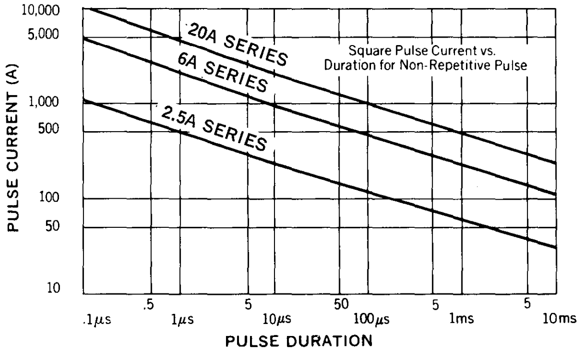
NOTES:

1. Oscilloscope: Rise time ≤ 3 ns; input impedance = 50 Ω.
2. Pulse Generator: Rise time ≤ 8 ns; source impedance 10 Ω.

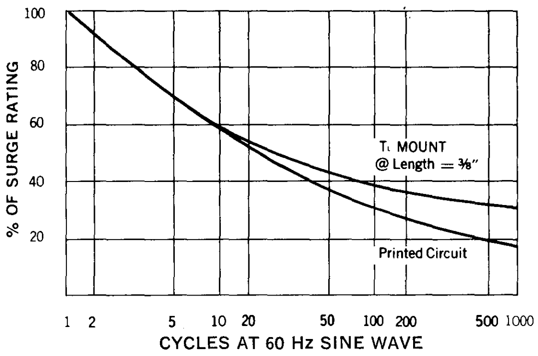
Characteristic Waveform



Forward Pulse Current vs. Duration



Multiple Surge Current vs. Duration



RECTIFIERS

Military Approved, High Efficiency, 2.5 Amp and 6.0 Amp

JAN & JANTX 1N5802-1N5806
JAN & JANTX 1N5807-1N5811

FEATURES
- Qualified to MIL-S-19500/477
- JAN and JANTX Available
- PIV: to 150V
- Low Forward Voltage

DESCRIPTION
This series of high efficiency power rectifiers are particularly applicable to switching regulator power supplies where extremely fast switching and low forward losses are most important.

ABSOLUTE MAXIMUM RATINGS

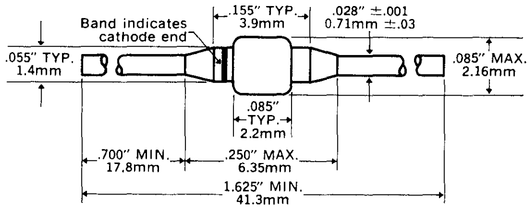
Peak Inverse Voltage	2.5A Series	6.A Series
50V	JAN & JANTX 1N5802	JAN & JANTX 1N5807
100V	JAN & JANTX 1N5804	JAN & JANTX 1N5809
150V	JAN & JANTX 1N5806	JAN & JANTX 1N5811

	2.5A SERIES	6A SERIES
Maximum Average D.C. Output Current		
@ $T_L = 75°C$, $L = 3/8''$	2.5A	6.0A
@ $T_A = 55°C$	1.0A	3.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	35A	125A
Operating Temperature Range	—65°C to +175°C	
Storage Temperature Range	—65°C to +200°C	
Thermal Resistance, θ_{JL} @ $L = 3/4''$	59°C/W	35.5°C/W

See lead temperature derating curve

MECHANICAL SPECIFICATIONS

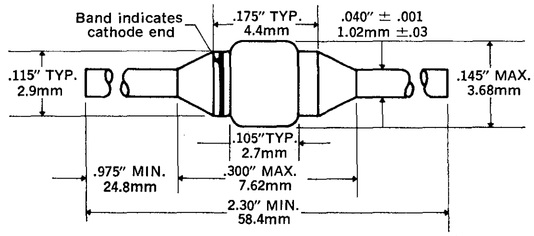
JAN & JANTX 1N5802-1N5806



Dimensions in inches.

BODY A

JAN & JANTX 1N5807-1N5811



Dimensions in inches.

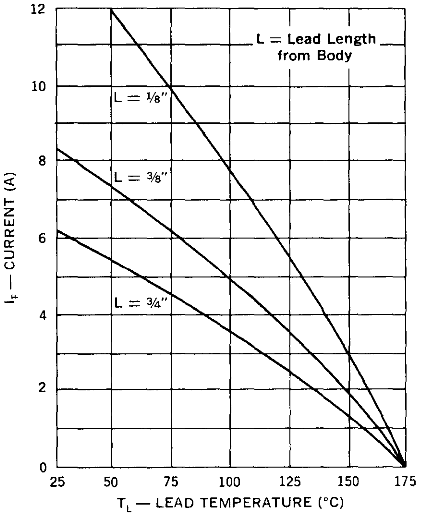
BODY B

UNITRODE

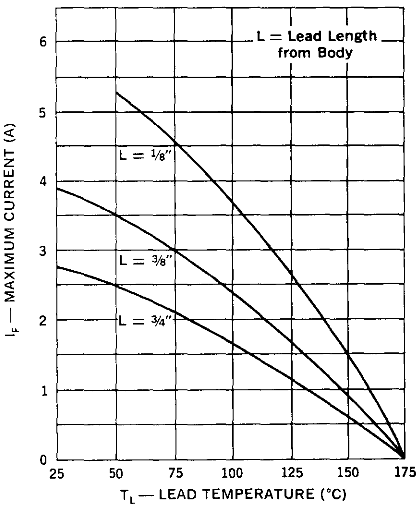
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

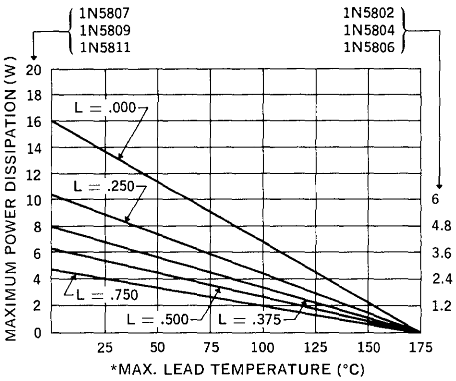
Type	PIV	Minimum Breakdown Voltage @ 100μA	Forward Voltage @ 25°C	Forward Voltage @ 100°C	Maximum Reverse Current @ PIV 25°C	Maximum Reverse Current @ PIV 100°C	Maximum Reverse Recovery Time
JAN & JANTX 1N5807	50V	60V	.875V Max. @ 4A (pk) .925V Max. @ 6A (pk)	.8V Max. @ 4A (pk)	5μA	150μA	30ns $I_F = I_R = 1.0A$ $I_{REC} = 0.1A$ di/dt = 100A/μs min.
JAN & JANTX 1N5809	100V	110V					
JAN & JANTX 1N5811	150V	160V					
JAN & JANTX 1N5802	50V	60V	.875V Max. @ 1A (pk) .975V Max. @ 2.5A (pk)	.8V Max. @ 1A (pk)	1μA	50μA	25ns $I_F = I_R = 0.5A$ $I_{REC} = 0.05A$ di/dt = 65A/μs min.
JAN & JANTX 1N5804	100V	110V					
JAN & JANTX 1N5806	150V	160V					

Output Current vs. Lead Temperature JAN & JANTX1N5807-5811



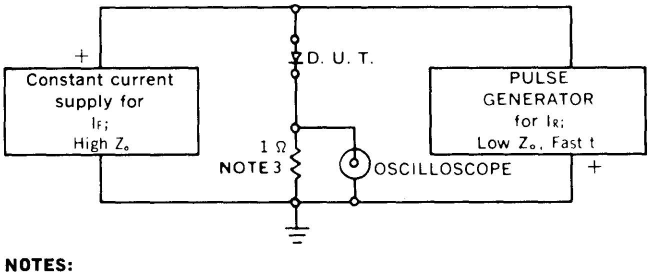
Output Current vs. Lead Temperature JAN & JANTX1N5802-5806



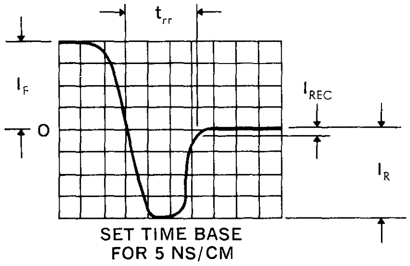


*Maximum lead temperature in °C (T_L) at point "L" from body. (For maximum operating junction temperature of 175°C with equal two-lead conditions.)

Reverse-Recovery Circuit

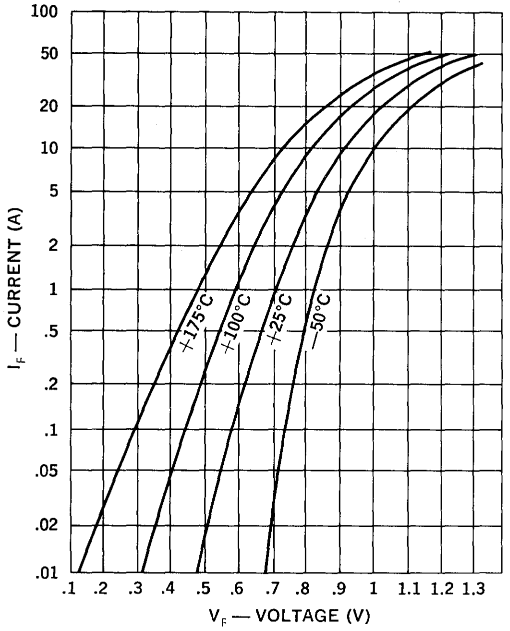


Characteristic Waveform

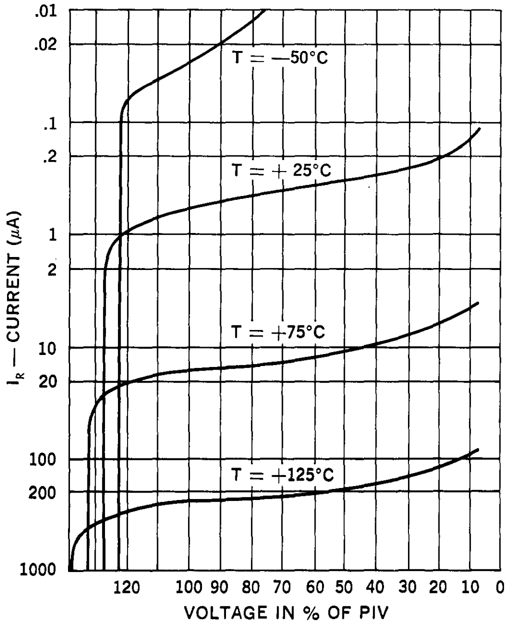


NOTES:

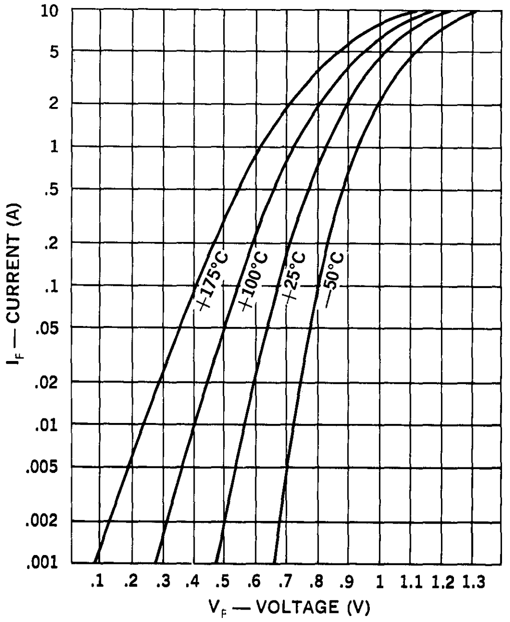
1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.



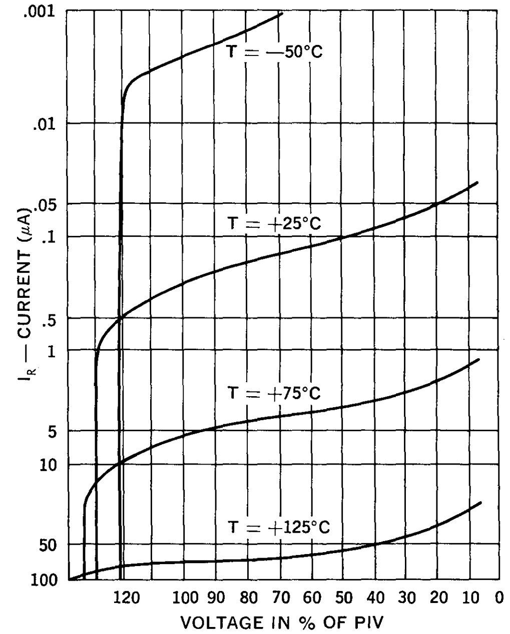
**Typical Forward Current vs. Forward Voltage
JAN & JANTX 1N5807-5811**



**Typical Reverse Current vs. Voltage
JAN & JANTX 1N5807-5811**



**Typical Forward Current vs. Forward Voltage
JAN & JANTX 1N5802-5806**



**Typical Reverse Current vs. Voltage
JAN & JANTX 1N5802-5806**

POWER TRANSISTORS

5 Amp, 120V, Planar NPN

2N1724
2N1725

FEATURES

- Collector-Base Voltage: up to 120V
- Low Saturation Voltages
- Beta Guaranteed at 3 Current Levels

DESCRIPTION

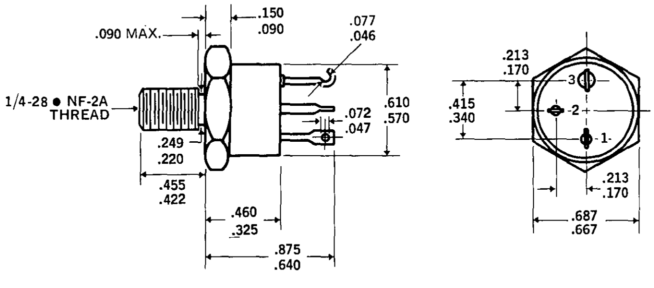
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N1724 2N1725
Collector-Base Voltage, V_{CBO}	120V
Collector-Emitter Voltage, V_{CEO}	80V
Emitter-Base Voltage, V_{EBO}	10V
D.C. Collector Current, I_C	5A
Peak Collector Current, I_C	5A
Power Dissipation	
25°C Ambient	3W
100°C Case	50W
Operating and Storage Temperature Range	—65°C to 200°C

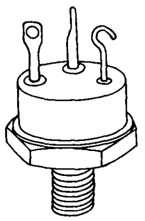
MECHANICAL SPECIFICATIONS

2N1724 2N1725



Dimensions in inches.

TO-61



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	2N1724		2N1725		Units	Test Conditions
		Min.	Max.	Min.	Max.		
D.C. Current Gain	h_{FE}	20	—	50	—	—	$I_C = 100mA$, $V_{CE} = 15V$
D.C. Current Gain (Note 2)	h_{FE}	20	90	50	150	—	$I_C = 2A$, $V_{CE} = 15V$
D.C. Current Gain (Note 2)	h_{FE}	12	—	25	—	—	$I_C = 2A$, $V_{CE} = 15V$, $T_A = -55°C$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	1.0	—	1.0	V	$I_C = 2A$, $I_B = 200mA$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	2.0	—	2.0	V	$I_C = 2A$, $I_B = 200mA$
Collector-Emitter Sustaining Voltage (Note 2)	V_{CEO} (sus)	80	—	80	—	V	$I_C = 200mA$, $I_B = 0$
Emitter-Base Breakdown Voltage	BV_{EBO}	10	—	10	—	V	$I_E = 10mA$, $I_C = 0$
Collector Cutoff Current	I_{CES}	—	1	—	1	mA	$V_{CE} = 60V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}	—	2	—	2	mA	$V_{CE} = 60V$, $R_{BE} = 0$, $T = 150°C$
Collector Cutoff Current, 150°C	I_{CES}	—	10	—	10	mA	$V_{CE} = 120V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance	C_{ob}	—	550	—	550	pf	$V_{CB} = 15V$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain	h_{fe}	1	—	1	—	—	$I_C = 500mA$, $V_{CE} = 15V$, $f = 10MHz$

Notes:

1. The device may be switched between maximum rated collector current and maximum rated collector — emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Pulse length = 300 μs; duty cycle ≤2%.

† All values in this table are JEDEC registered.

SCRs
1.25 Amp, Planar

2N1870A-2N1874A

FEATURES
- Available as Either "JAN" or Standard Types
- Operating D.C. Current Range: 5 to 1250mA
- Pulse Currents: to 30A
- Voltage Ratings: to 200V
- Maximum Trigger Current: 0.2mA
- Maximum Trigger Voltage: 0.8V
- All Leads Isolated from Case
- Maximum θ_{J-C}: 20°C/W

DESCRIPTION
These are premium PNPN controlled switches intended for use in applications requiring a high degree of reliability assurance. The JAN types are specified under MIL-S-19500/198, and are included in MIL-STD-701 as recommended types for military usage.

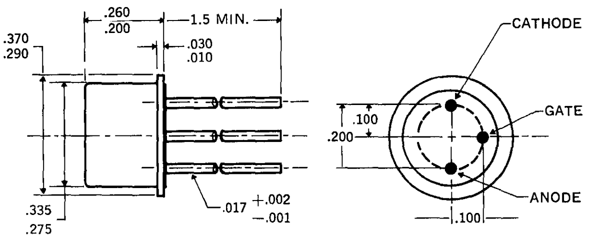
This series is useful in a wide variety of applications including: safety, arming and detonating circuits; timing and programming circuits; protective and warning circuits; driving relays; driving indicator lamps, encoding and decoding circuits; replacing relays, thyratrons, and magamps; servo motor control; pulse generation; plus many others.

ABSOLUTE MAXIMUM RATINGS

	2N1870A **JAN2N1870A**	**2N1871A** **JAN2N1871A**	**2N1872A** **JAN2N1872A**	**2N1873A** **—**	**2N1874A** **JAN2N1874A**
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V
D.C. On-State Current, I_T					
100°C Ambient	250mA				
100°C Case	1.25A				
Repetitive Peak On-State Current, I_{TRM}	up to 30A				
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	15A				
Peak Gate Current, I_{GM}	250mA				
Average Gate Current, $I_{G(AV)}$	25mA				
Reverse Gate Voltage, V_{GR}	5V				
Thermal Resistance, Junction to Case, $R\theta_{J-C}$	20°C/W				
Operating and Storage Temperature Range	—65°C to +150°C				

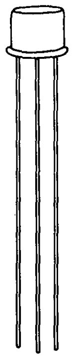
MECHANICAL SPECIFICATIONS

2N1870A-2N1874A



Dimensions in inches.

TO-9



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

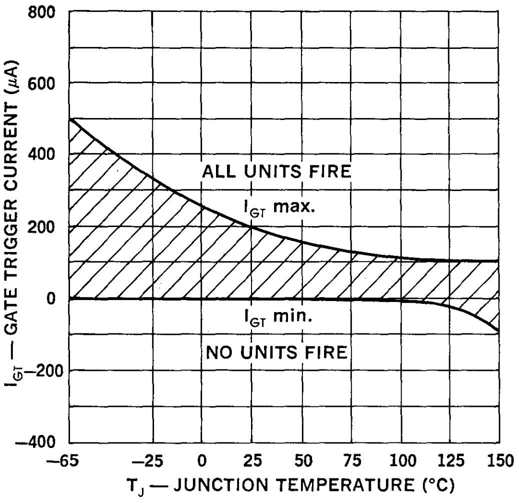
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Subgroup 1 (Visual and Mechanical)						
Subgroup 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	0.5	10	μA	$R_{GK} = 1K$, $V_{DRM} = +$ Rating
Reverse Current	I_{RRM}	—	0.5	10	μA	$R_{GK} = 1K$, $V_{RRM} = -$ Rating
Gate Trigger Voltage	V_{GT}	0.4	0.55	0.8	V	$R_{GS} = 100$ ohms, $V_D = 5V$
Gate Trigger Current	I_{GT}	—	30	200	μA	$R_{GS} > 10K$ ohms, $V_D = 5V$
On-State Voltage	V_{TM}	—	1.8	2.5	V	$I_{TM} = 2A$ (pulse test)
Off-State Voltage — Critical of Rise	dv_c/dt	100	—	—	V/μs	Specified test circuit
Reverse Gate Current	I_{GR}	—	0.5	10	μA	$V_{GRM} = 5V$, anode open
Holding Current	I_H	0.3	—	5.0	mA	$I_G = -150\mu A$, $V_D = 5V$
Subgroup 3 (125°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	15	100	μA	$R_{GK} = 1K$, $V_{DRM} = +$ Rating
High Temp. Reverse Current	I_{RRM}	—	15	100	μA	$R_{GK} = 1K$, $V_{RRM} = -$ Rating
High Temp. Gate Non-Trigger Voltage	V_{GD}	0.2	—	—	V	$R_{GS} = 100$ ohms, $V_D = 5V$
High Temp. Holding Current	I_H	0.2	—	—	mA	$I_G = -150\mu A$, $V_D = 5V$
Subgroup 4 (−65°C Tests)						
Low Temp. Gate Trigger Voltage	V_{GT}	—	—	1.0	V	$R_{GK} = 100$ ohms, $V_D = 5V$
Low Temp. Gate Trigger Current	I_{GT}	—	—	500	μA	$R_{GK} > 10K$ ohms, $V_D = 5V$
Low Temp. Holding Current	I_H	—	—	15	mA	$I_G = -150\mu A$, $V_{AA} = 5V$

†All values in this table are JEDEC registered.

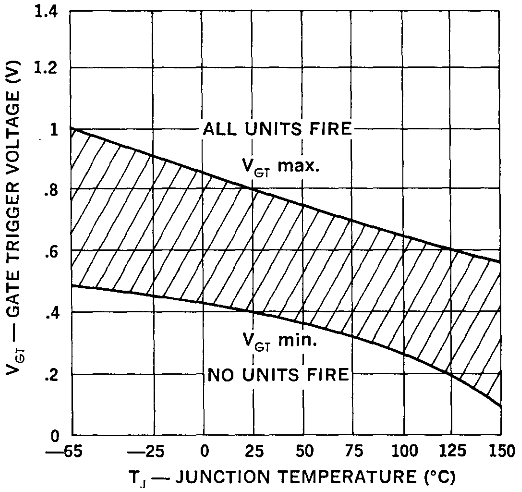
Note: Voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1 K or smaller, or other adequate gate bias is used.

Triggering and Bias Stabilization

1. Gate Trigger Current

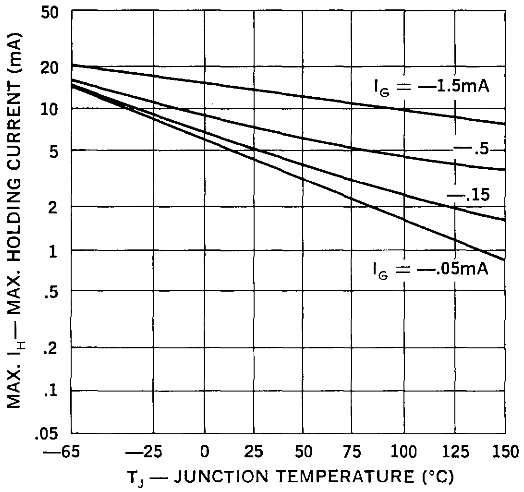


2. Gate Trigger Voltage

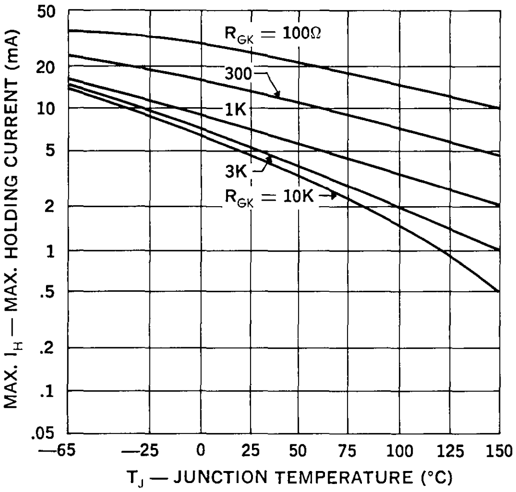


Holding Current

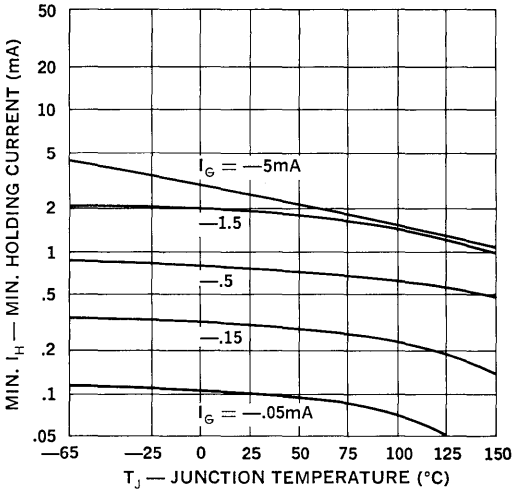
1. Max. Holding Current (Current Bias)



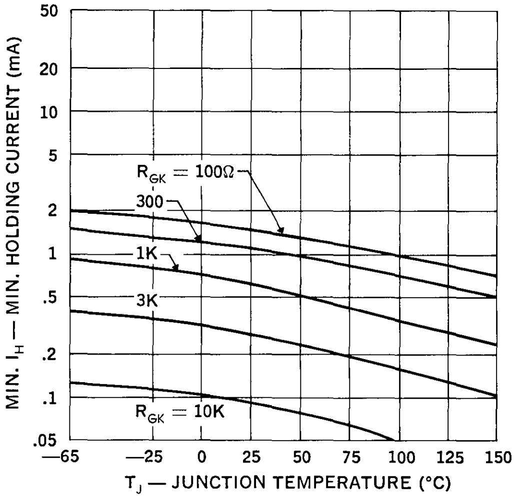
2. Max. Holding Current (Resistor Bias)



3. Min. Holding Current (Current Bias)

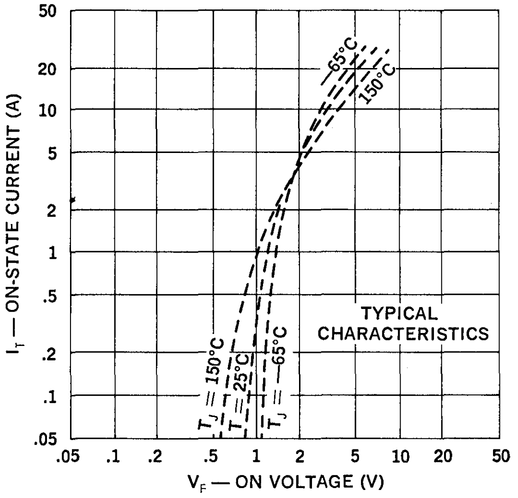


4. Min. Holding Current (Resistor Bias)

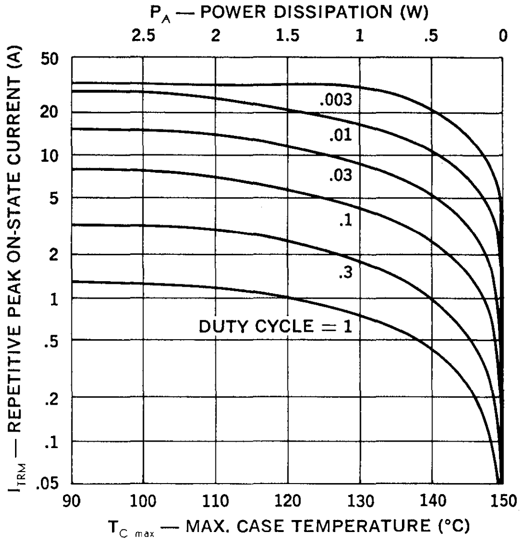


Current Ratings — Thermal Design

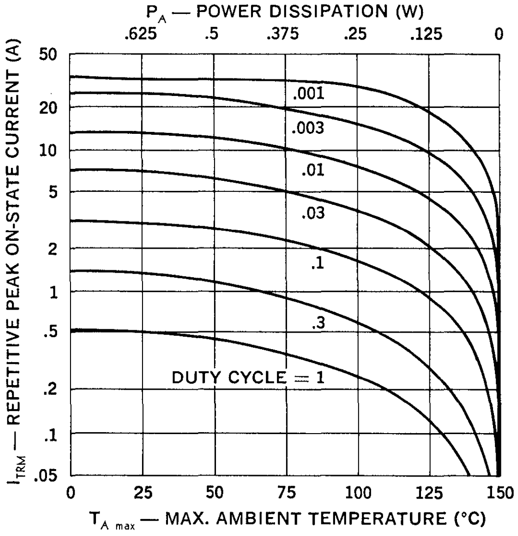
1. On-State Current vs. Voltage



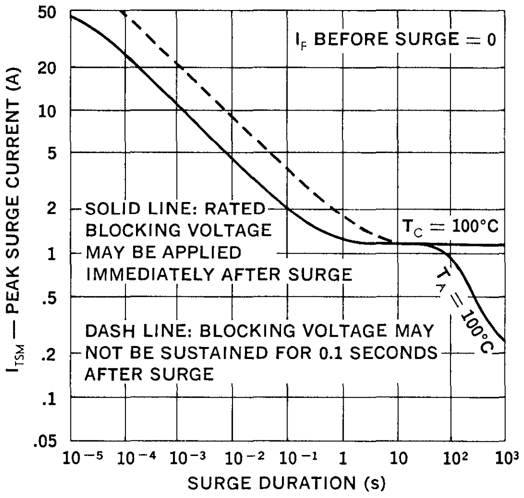
2. Peak Current vs. Case Temperature



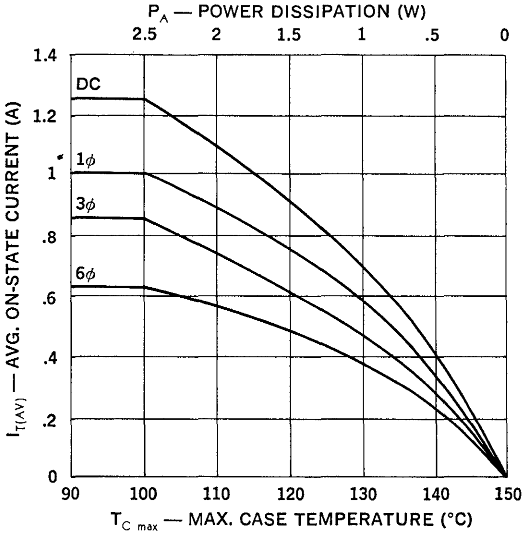
3. Peak Current vs. Ambient Temperature



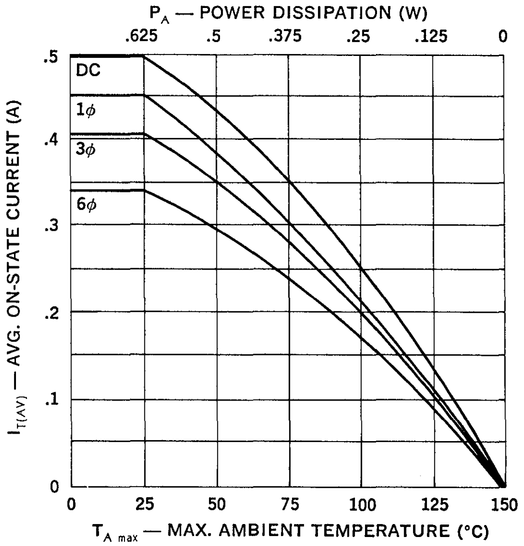
4. Surge Current vs. Time



5. Average Current vs. Case Temperature



6. Average Current vs. Ambient Temperature



SCRs

2N1875-2N1880

1.25 Amp, Planar

FEATURES

- Operating D.C. Current Range: 10-1250mA
- Peak Pulse Current: to 30A
- Maximum Gate Current to Fire: 20μA
- Firing Voltage: .52±.08V
- Voltage Ratings: to 200V
- "Turn-on" Time: Typically 0.1μs
- Low On Voltage: 2.5V Maximum at 2A

DESCRIPTION

This high sensitivity series, featuring very precise control of triggering characteristics, is particularly useful for timing and time delay circuits, voltage limit detectors, high gain static switching, logic circuits, pulse and sweep generators, and related applications.

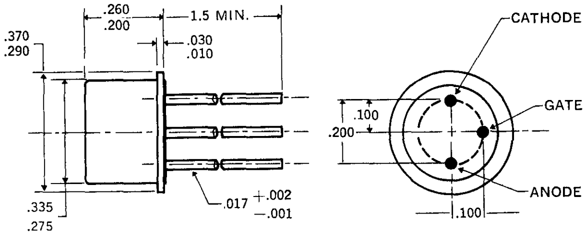
This series is available in a TO-9 package, with all leads isolated from the case, providing a maximum thermal resistance of 20°C/Watt between junction and case.

ABSOLUTE MAXIMUM RATINGS

	2N1875	2N1876	2N1877	2N1878	2N1879	2N1880
Repetitive Peak Off-State Voltage, V_{DRM}	15V	30V	60V	100V	150V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	15V	30V	60V	100V	150V	200V
D.C. On-State Current, I_T						
100°C Ambient	250mA					
100°C Case	1.25A					
Repetitive Peak On-State Current, I_{TRM}	up to 30A					
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	15A					
Peak Gate Current, I_{GM}	250mA					
Average Gate Current, $I_{G(AV)}$	25mA					
Reverse Gate Voltage, V_{GR}	5V					
Thermal Resistance, Junction to Case, $R\Theta_{J-C}$	20°C/W					
Operating and Storage Temperature Range	−65°C to +150°C					

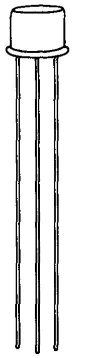
MECHANICAL SPECIFICATIONS

2N1875-2N1880



Dimensions in inches.

TO-9



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Subgroup 1 (Visual and Mechanical)						
Subgroup 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	0.5	5	μA	V_{DRM} = Rating, R_{GK} = 1K
Reverse Current	I_{RRM}	—	0.5	10	μA	V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	0.5	10	μA	V_{GR} = 2V
Gate Trigger Current	I_{GT}	—	5	20	μA	V_D = 5V, R_{GS} = 10K
Gate Trigger Voltage	V_{GT}	.44	.52	.60	V	V_D = 5V, R_{GS} = 100Ω
Anode Trigger Current (Note 2)	I_{AT}	—	100	—	μA	V_D = 5V
On-State Voltage	V_T	0.8	1.8	2.5	V	I_T = 2A (Pulse Test)
Holding Current	I_H	0.3	1.0	3	mA	I_G = —150μA, V_{AA} = 5V
Subgroup 3 (25°C Tests)						
Turn-on Time	t_{on}	—	0.1	—	μs	I_G = 20mA
Turn-off Time	t_{off}	—	0.5	—	μs	I_T = .5A
Gate Trigger — on Pulse Width	$t_{pg(on)}$	—	0.5	—	μs	V_D = 30V
Circuit Commutated Turn-off Time	t_q	—	10	—	μs	I_T = .5A, i_R = .5A, R_{GK} = 1K
Subgroup 4 (125°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	5	20	μA	V_D = Rating, R_{GK} = 1K
High Temp. Reverse Current	I_{RRM}	—	15	100	μA	V_{RRM} = Rating

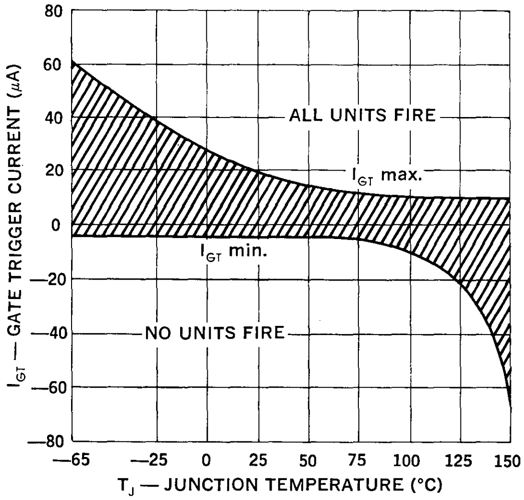
Note : 1. Voltage ratings apply over the operating temperature range, provided the gate is connected to the cathode through an appropriate resistor, or adequate gate bias is used.

2. For a maximum limit of 50μA, use suffix "—1" and drop "2N". Example: 1877-1.

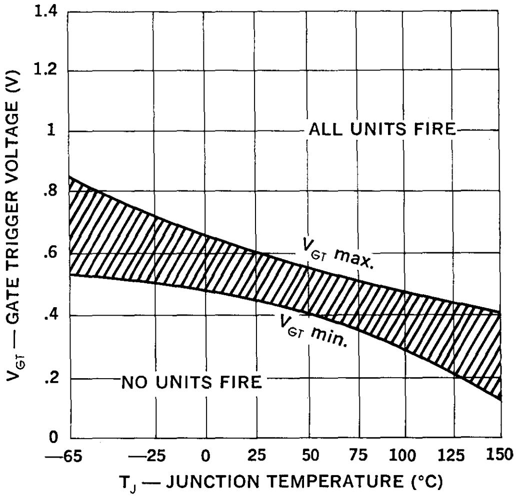
† All values in this table are JEDEC registered.

TRIGGERING AND BIAS STABILIZATION

1. Gate Trigger Current

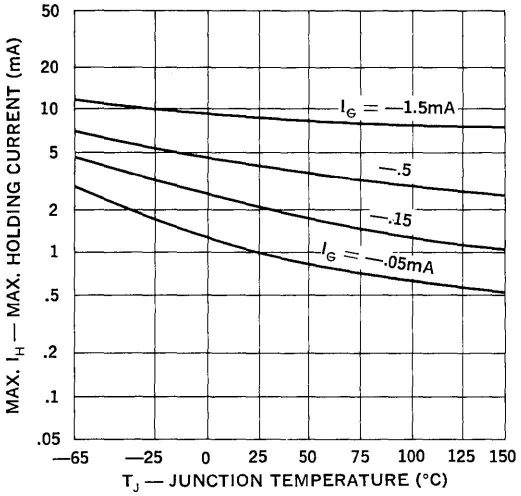


2. Gate Trigger Voltage

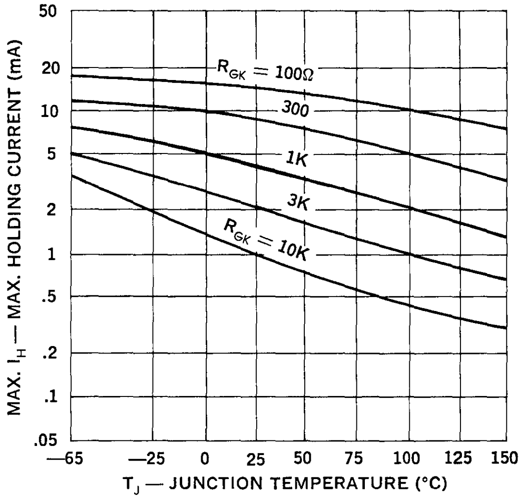


HOLDING CURRENT

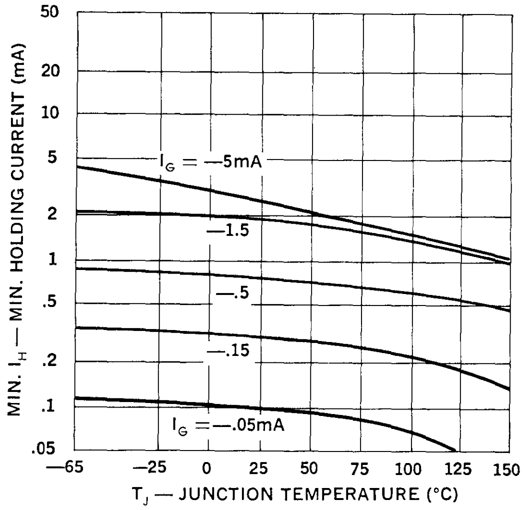
1. Max. Holding Current (Current Bias)



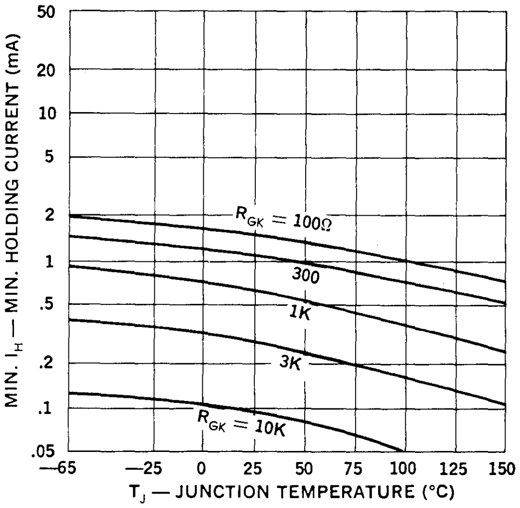
2. Max. Holding Current (Resistor Bias)



3. Min. Holding Current (Current Bias)

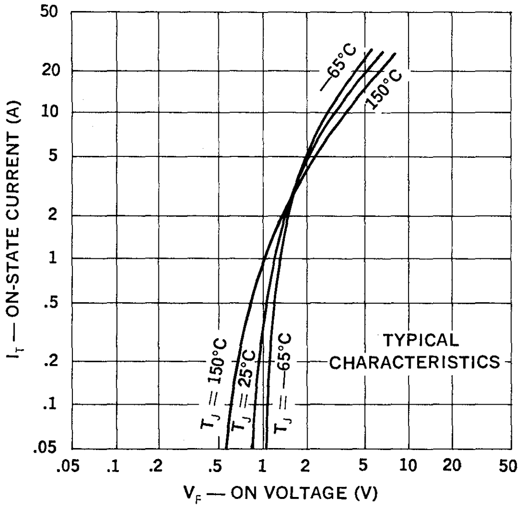


4. Min. Holding Current (Resistor Bias)

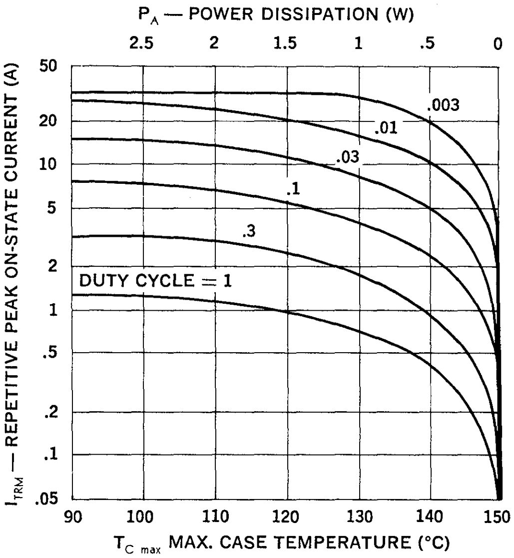


CURRENT RATINGS — THERMAL DESIGN

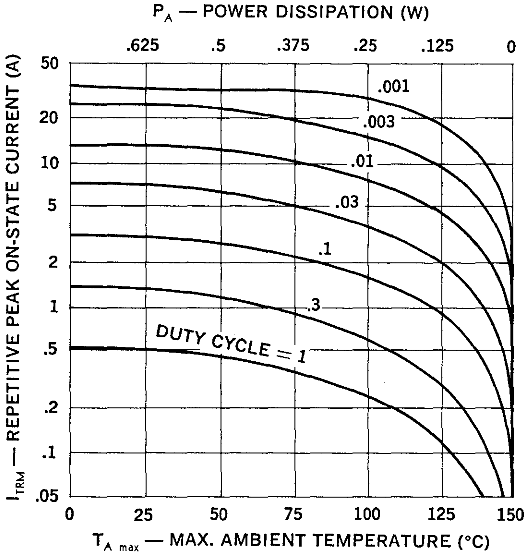
1. On-State Current vs. Voltage



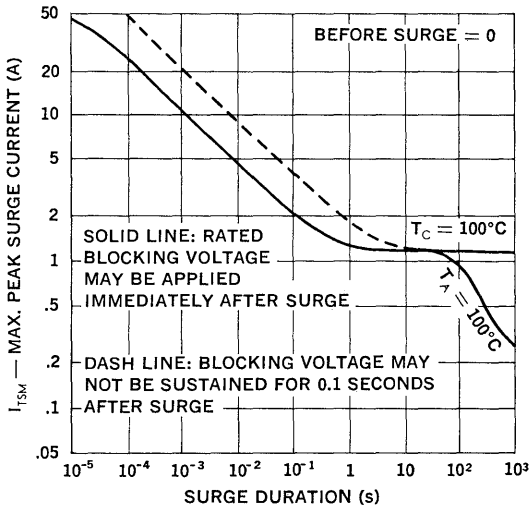
2. Peak Current vs. Case Temperature



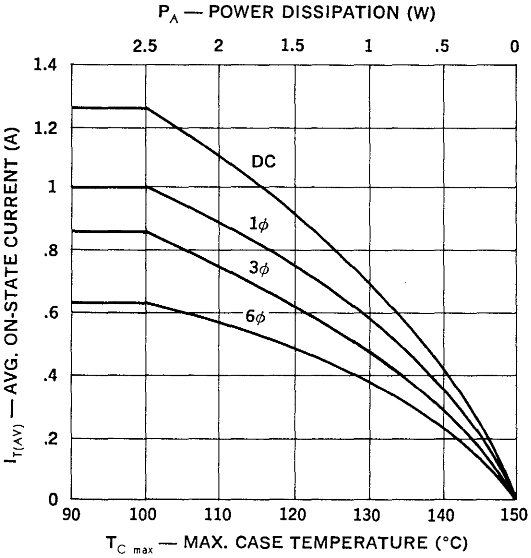
3. Peak Current vs. Ambient Temperature



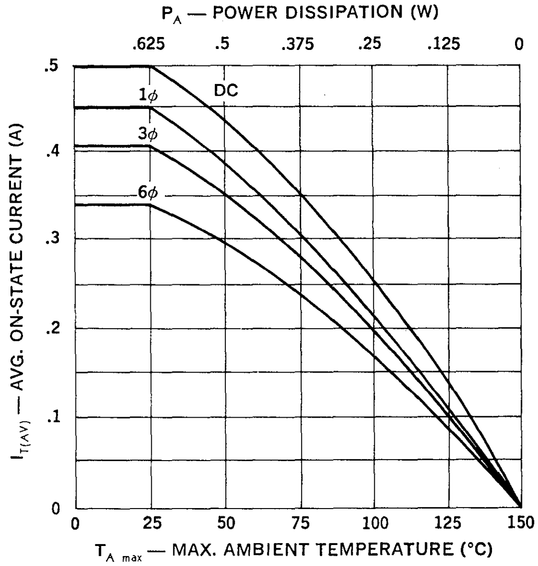
4. Surge Current vs. Time



5. Average Current vs. Case Temperature



6. Average Current vs. Ambient Temperature



SCRs

1 Amp, Planar

2N1881-2N1885

FEATURES

- One Cycle Surge Current: 15A
- Voltage Ratings: to 200V
- Low "On-Voltage": 2V Max. at 1A
- Operation: to 150°C Junction Temperature
- All Leads Isolated for Design Flexibility

DESCRIPTION

These types are useful in AC and DC static switching, proportioning control, relay and thyratron replacement, DC to AC converters, servo motor driving, protective circuits, and related applications.

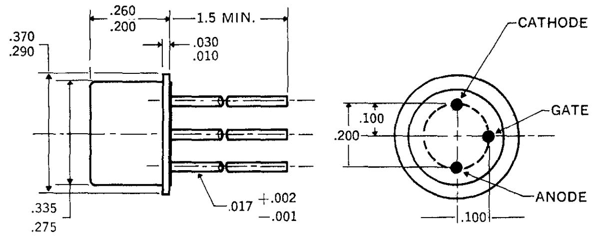
This series is available in a TO-9 package, with all leads isolated from the case, providing a maximum thermal resistance of 20°C/Watt between junction and case.

ABSOLUTE MAXIMUM RATINGS

	2N1881	2N1882	2N1883	2N1884	2N1885
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V
D.C. On-State Current, I_T					
100°C Ambient			250mA		
100°C Case			1.0A		
Repetitive Peak On-State Current, I_{TRM}			up to 30A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}			15A		
Peak Gate Current, I_{GM}			250mA		
Average Gate Current $I_{G(AV)}$			25mA		
Reverse Gate Voltage, V_{GR}			3V		
Thermal Resistance, Junction to Case, $R\Theta_{J-C}$			20°C/W		
Operating and Storage Temperature Range			—65°C to +150°C		

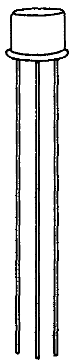
MECHANICAL SPECIFICATIONS

2N1881-2N1885



Dimensions in inches.

TO-9



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Subgroup 1 (Visual and Mechanical)						
Subgroup 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	0.5	10	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	0.5	10	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	0.5	10	μA	$V_{GRM} = 2V$
Gate Trigger Current	I_{GT}	—	0.2	2	mA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.40	1	2	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.5	2	V	$I_T = 1A$ (pulse test)
Holding Current	I_H	—	2	—	mA	$I_G = -150\mu A$, $V_D = 5V$
Anode Trigger Current	I_{AT}	—	0.5	—	mA	$R_{GS} = 10K$, $V_D = 5V$
Subgroup 3 (25°C Tests)						
Turn-on Time	t_{on}	—	0.2	—	μs	$I_G = 20mA$, $I_T = 0.5A$, $V_D = 30V$
Gate Trigger — on Pulse Width	t_{pg} (on)	—	1	—	μs	$I_G = 20mA$, $I_T = 0.5A$, $V_D = 30V$
Turn-off Time	t_{off}	—	1	—	μs	$I_T = 1A$, $I_R = IA$, $R_{GK} = IK$
Circuit Commutated Turn-off Time	t_q	—	10	—	μs	$I_T = 1A$, $I_R = IA$, $R_{GK} = IK$
Subgroup 3 (125°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	15	200	μA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	15	200	μA	$R_{GK} = 1K$, V_{RRM} = Rating

† All values in this table are JEDEC registered.

Note: Voltage ratings apply over the operating temperature range, provided the gate is connected to the cathode through an appropriate resistor, or adequate gate bias is used.

POWER TRANSISTORS

2 Amp, 80V, Planar NPN

JAN & JANTX 2N2151

FEATURES

- Meets MIL-S-19500/277
- Collector-Base Voltage: up to 150V
- D.C. Collector Current: 2A
- Beta Guaranteed at 3 Current Levels
- Characterized for Safe Operating Area

DESCRIPTION

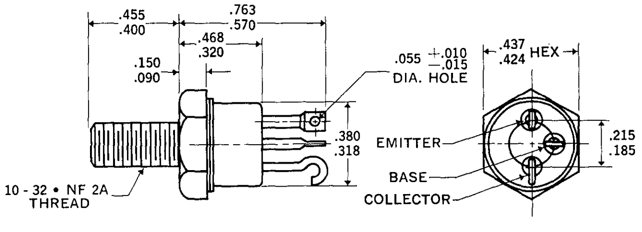
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	JAN & JANTX 2N2151
Collector-Base Voltage, V_{CBO}	150V
Collector-Emitter Voltage, V_{CEO}	100V
Emitter-Base Voltage, V_{EBO}	8V
D.C. Collector Current, I_C	2A
Base Current, I_B	2A
Power Dissipation	
100°C Case	30W
Operating Temperature Range	—55°C to 175°C
Storage Temperature Range	—65°C to 200°C

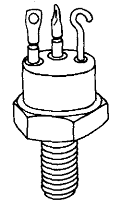
MECHANICAL SPECIFICATIONS

JAN & JANTX2N2151



Dimensions in inches.

TO-59

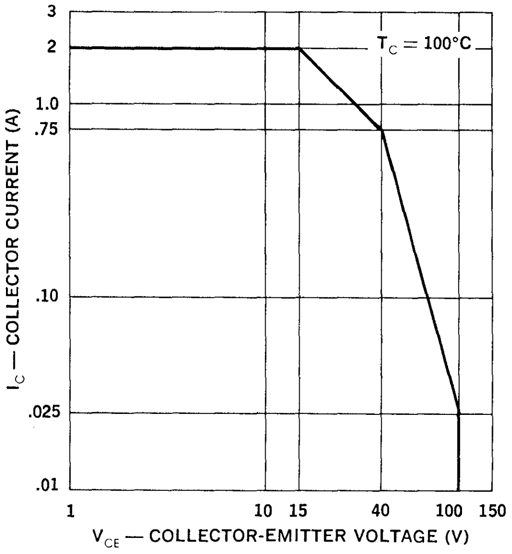


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Max.	Units	/277C Sub-group	Method	MIL-STD-750 Test Conditions
25°C							
Collector-Base Breakdown Voltage	BV_{CBO}	150	—	Vdc	A-2	3001	$I_C = 100uAdc$, Cond. D
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}	100	—	Vdc	A-2	3011	$I_C = 50mAdc$, Cond. D
Collector-Emitter Cutoff Current	I_{CES}	—	5	uAdc	A-2	3041	$V_{CE} = 120Vdc$, $V_{BE} = 0$, Cond. C
Collector-Emitter Cutoff Current	I_{CEX}	—	5	uAdc	A-2	3041	$V_{CE} = 120Vdc$, $V_{EB} = 1Vdc$, Cond. A
Collector-Emitter Cutoff Current	I_{CEO}	—	10	uAdc	A-2	3041	$V_{CE} = 80Vdc$, Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	5	uAdc	A-2	3036	$V_{CB} = 120Vdc$, Cond. D
Emitter-Base Cutoff Current	I_{EBO}	—	2	uAdc	A-2	3061	$V_{EB} = 8Vdc$, Cond. D
D.C. Current Gain (Note 1)	h_{FE}	40	120	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	40	120	—	A-3	3076	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	40	—	—	A-3	3076	$I_C = 0.1Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	0.1	1.0	Vdc	A-3	3071	$I_C = 1Adc$, $I_B = 0.1Adc$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $I_B = 0.1Adc$, Cond. A
Base-Emitter Voltage (Note 1)	V_{BE}	—	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $V_{CE} = 5Vdc$, Cond. B
A.C. Current Gain	h_{fe}	40	160	—	A-5	3206	$I_C = 0.1Adc$, $V_{CE} = 30Vdc$, $f = 1kHz$
Gain-Bandwidth Product	f_T	10	70	MHz	A-5	3306	$I_C = 0.1Adc$, $V_{CE} = 30Vdc$, $f = 10MHz$
Output Capacitance	C_{ob}	—	160	pf	A-5	3236	$V_{CB} = 20Vdc$, $I_E = 0$, $f = 1MH_Z$
Thermal Resistance	$\Theta_{J\text{-}C}$	—	2.5	$^{o}C/_{W}$	C-1	3151	
100°C							
Forward-Biased Second Breakdown	$I_{S/B}$	2	—	Adc	B-9	—	$V_{CE} = 15Vdc$, $t = 60$ sec, see curve
Forward-Biased Second Breakdown	$I_{S/B}$	200	—	mAdc	B-9	—	$V_{CE} = 57Vdc$, $t = 60$ sec, see curve
Forward-Biased Second Breakdown	$I_{S/B}$	25	—	mAdc	B-9	—	$V_{CE} = 100Vdc$, $t = 60$ sec, see curve
Unclamped Inductive Sweep	$E_{S/B}$	20	—	mj	B-5	—	$I_C = 2Adc$, $L = 10mh$
Clamped Inductive Sweep	$E_{S/B}$	80	—	mj	B-6	—	$I_C = 2Adc$, $L = 40mh$, $V_{clamp} = 150V$
150°C							
Collector-Emitter Cutoff Current	I_{CES}	—	100	uAdc	A-4	3041	$V_{CE} = 120Vdc$, $V_{BE} = 0$, Cond. C
Collector-Emitter Cutoff Current	I_{CEX}	—	100	uAdc	A-4	3041	$V_{CE} = 120Vdc$, $V_{EB} = 1Vdc$
Emitter-Base Cutoff Current	I_{EBO}	—	20	uAdc	A-4	3061	$V_{EB} = 8Vdc$, Cond. D
–55°C							
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	A-4	3076	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$

Note: 1. Pulse length = 300 μs; duty cycle $\leqslant 2\%$.

Maximum Safe Operating Area



SCRs

1.6 Amp, Planar

2N2322-2N2329
2N2323A-2N2328A

FEATURES

- Available as JAN & JANTX Types
- 1.6A D.C. Current
- Peak Currents: to 30A
- Voltage Ratings: to 400V
- 20μA Max. Trigger Current ("A" types)
- 0.6V Max. Trigger Voltage ("A" types)

DESCRIPTION

These are premium thyristor switches intended for use in high performance industrial, military and space applications requiring a high degree of reliability assurance. This series is useful in a wide variety of applications including timing and programming circuits, protective and warning circuits, driving relays, driving indicator lamps, encoding and decoding circuits, replacing relays, thyratrons, and magamps, servo motor control, pulse generation, plus many others. The high surge current rating (15A - 1 cycle) makes this series particularly useful for squib firing.

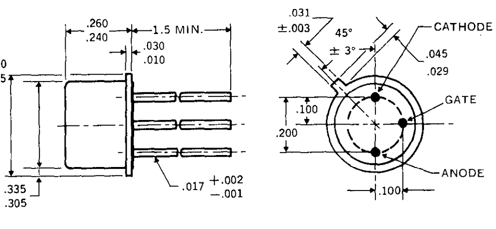
The following JAN and JANTX types are specified under Mil-S-19500/276A and are included in Mil-STD-701 as recommended types for military usage:

ABSOLUTE MAXIMUM RATINGS

	2N2322	**2N2323** **JAN2N2323** **JANTX2N2323** **2N2323A** **JAN2N2323A** **JANTX2N2323A**	**2N2324** **JAN2N2324** **JANTX2N2324** **2N2324A** **JAN2N2324A** **JANTX2N2324A**	**2N2325** **2N2325A**	**2N2326** **JAN2N2326** **JANTX2N2326** **2N2326A** **JAN2N2326A** **JANTX2N2326A**	**2N2327** **2N2327A**	**2N2328** **JAN2N2328** **JANTX2N2328** **2N2328A** **JAN2N2328A** **JANTX2N2328A**	**2N2329** **JAN2N2329** **JANTX2N2329**
Repetitive Peak Off-State Voltage, V_{DRM}	25V	50V	100V	150V	200V	250V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	25V	50V	100V	150V	200V	250V	300V	400V
Non-Repetitive Peak Reverse Voltage, V_{RSM} (< 5ms)	40V	75V	150V	225V	300V	350V	400V	500V
D.C. On-State Current, I_T								
80°C Ambient	300mA							
85°C Case	1.6A							
One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	15A							
Repetitive Peak On-State Current, I_{TM}	30A							
Gate Power Dissipation, P_{GM}	0.1W							
Gate Power Dissipation, $P_{GM(AV)}$	0.01W							
Peak Gate Current, I_{GM}	100mA							
Peak Gate Voltage, Forward and Reverse	6V							
Reverse Gate Current, I_{GR}	3mA							
Storage Temperature Range	−65°C to +150°C							
Operating Temperature Range	−65°C to +125°C							

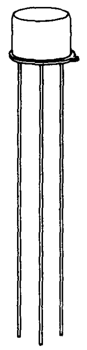
MECHANICAL SPECIFICATIONS

2N2322-2N2329 2N2323A-2N2328A



Dimensions in inches.

TO-5



ELECTRICAL SPECIFICATIONS

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Visual and Mechanical						MIL-STD-750, Method 2071
25°C						
Off-State Current	I_{DRM}	—	0.1	10	µA	V_{DRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Reverse Current	I_{RRM}	—	0.1	10	µA	V_{RRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Gate Trigger Current	I_{GT}					
"A" Types		—	2	20	µA	$V_D = 6V$, $R_L = 100\Omega$
non-"A" Types		—	50	200	µA	$V_D = 6V$, $R_L = 100\Omega$
Gate Trigger Voltage	V_{GT}					
"A" Types		0.35	0.52	0.60	V	$V_D = 6V$, $R_{GK} = 2K$, $R_L = 100\Omega$
non-"A" Types		0.35	0.55	0.80	V	$V_D = 6V$, $R_{GK} = 1K$, $R_L = 100\Omega$
On-State Voltage	V_{TM}	—	2.0	2.2	V	$I_{TM} = 4A$ (pulse test)
Holding Current	I_H	—	0.3	2.0	mA	$V_D = 6V$, R_{GK} = 1K (2K for "A" Types)
Reverse Gate Current	I_{GR}	—	1	200*	µA	$V_{GR} = 6V$
Delay Time	t_d	—	0.6	—	µs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.4	—	µs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-Off Time	t_q	—	20	—	µs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
125°C						
Off-State Current	I_{DRM}	—	1	100	µA	V_{DRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Reverse Current	I_{RRM}	—	1	100	µA	V_{RRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Gate Trigger Voltage	V_{GT}	0.1	0.3	—	V	V_D = Rated V_D, R_{GK} = 1K (2K for "A" Types)
Holding Current	I_H					
"A" Types		0.1†	—	—	mA	$V_D = 6V$, $R_{GK} = 2K$
non-"A" Types		0.15†	—	—	mA	$V_D = 6V$, $R_{GK} = 1K$
Off-State Voltage — Critical Rate of Rise	dv/dt					
"A" Types		0.7*			V/µs	V_D = Rating, $R_{GK} = 2K$
non-"A" Types		1.8*			V/µs	V_D = Rating, $R_{GK} = 1K$
−65°C						
Off-State Current	I_{DRM}	—	.05	5.0*	µA	V_{DRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Reverse Current	I_{RRM}	—	.05	5.0*	µA	V_{RRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Gate Trigger Current	I_{GT}					
"A" Types		—	50	75	µA	$V_D = 6V$, $R_L = 100\Omega$
non-"A" Types		—	100	350	µA	$V_D = 6V$, $R_L = 100\Omega$
Gate Trigger Voltage	V_{GT}					
"A" Types		—	0.7	0.8*	V	$V_D = 6V$, $R_{GK} = 2K$, $R_L = 100\Omega$
				0.9†	V	$V_D = 6V$, $R_{GK} = 2K$, $R_L = 100\Omega$
non-"A" Types		—	0.75	1.0	V	$V_D = 6V$, $R_{GK} = 1K$, $R_L = 100\Omega$
Holding Current	I_H	—	—	3.0†	mA	$V_D = 6V$, R_{GK} = 1K (2K for "A" Types)

* JAN and JANTX Types only.
† Industrial Types only.

JAN and JANTX Acceptance Tests

100% Screening TX-Types

High Temperature Storage
Temperature Cycling
Constant Acceleration
Fine & Gross Hermetic Seal
Electrical Test
Burn-in
Electrical Test

Group B Tests

Subgroup 1 — Reverse Gate Current
Surge Current
Non-Repetitive Reverse Voltage

Subgroup 2 — Low Temp. Reverse Blocking Current
Low Temp. Forward Blocking Current
Low Temp. Gate Trigger Voltage
Low Temp. Gate Trigger Current

Subgroup 3 — Temperature Cycling
Thermal Shock
Moisture Resistance
Solderability

Subgroup 4 — Blocking Life Test

Group C Tests

Subgroup 1 — Physical Dimensions

Subgroup 2 — Shock
Constant Acceleration
Vibration, Variable Frequency

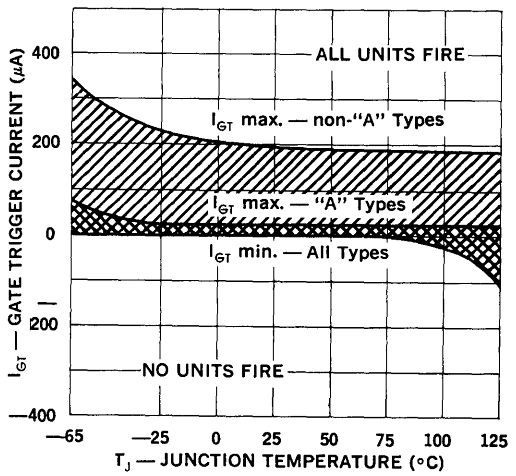
Subgroup 3 — Barometric Pressure, Reduced

Subgroup 4 — Salt Atmosphere

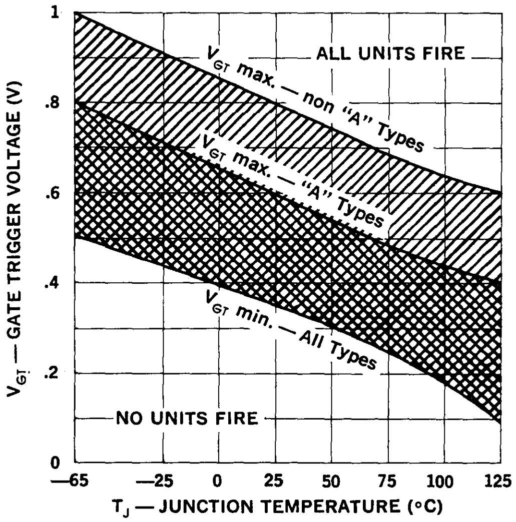
Subgroup 5 — Terminal Strength

Subgroup 6 — Intermittent Operating Life Test

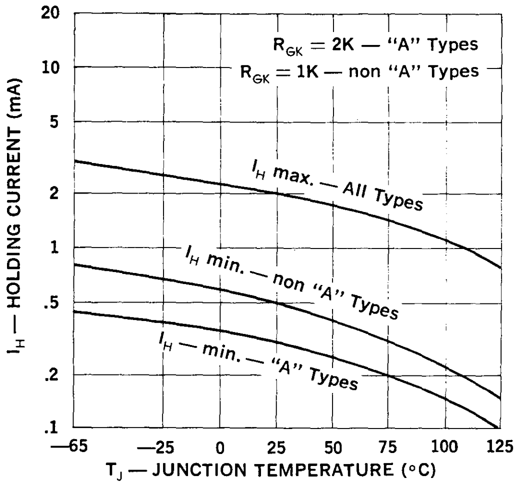
Gate Trigger Current



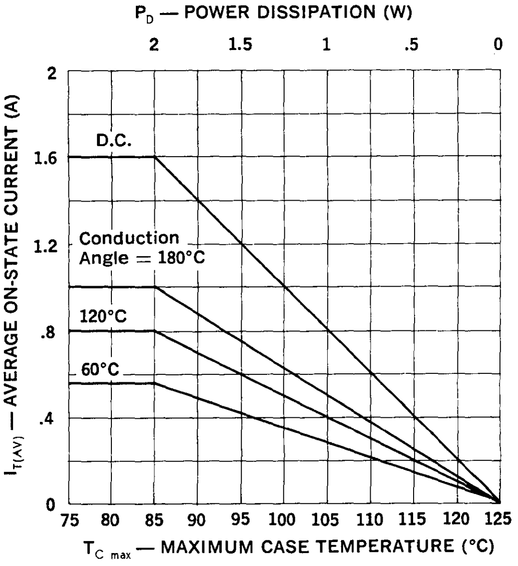
Gate Trigger Voltage



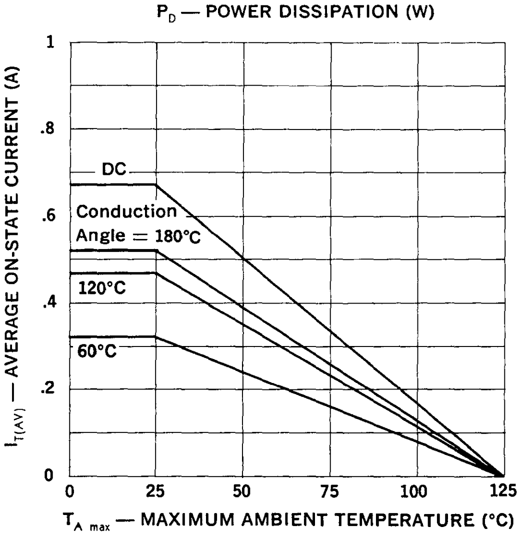
Holding Current



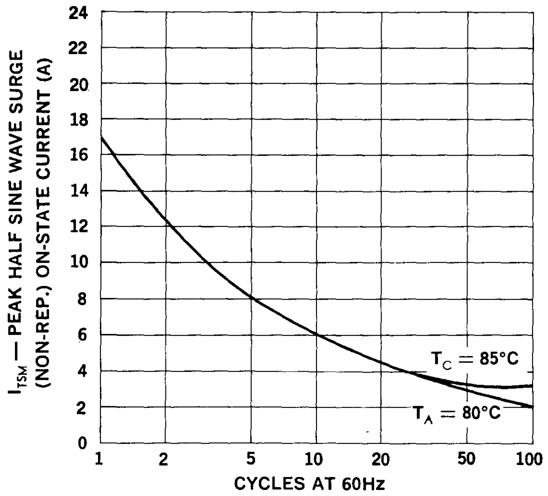
Average Current vs. Case Temperature



Average Current vs. Ambient Temperature



Surge Current



POWER TRANSISTORS

10 Amp, 120V, Planar NPN

2N2811
2N2812
2N2813
2N2814

FEATURES

- Collector-Base Voltage: up to 120V
- D.C. Collector Current: 10A
- Fast Switching
- Low Saturation Voltage

DESCRIPTION

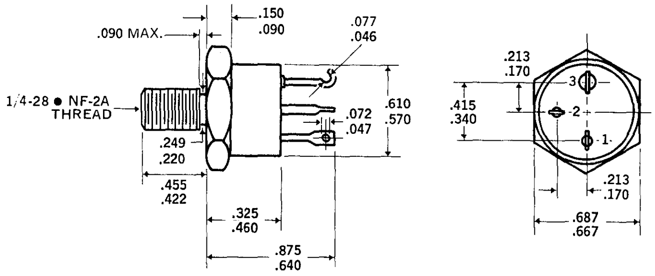
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N2811 2N2812	2N2813 2N2814
Collector-Base Voltage, V_{CBO}	80	120
Collector-Emitter Voltage, V_{CEO}	50	70
Emitter-Base Voltage, V_{EBO}	8V	8V
D.C. Collector Current, I_C	10A	10A
Power Dissipation		
25°C Ambient	3W	3W
100°C Case	50W	50W
Operating and Storage Temperature Range	—65°C to 200°C	

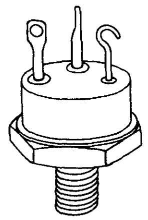
MECHANICAL SPECIFICATIONS

2N2811 2N2812 2N2813 2N2814



Dimensions in inches.

TO-61



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

		2N2811 2N2813		2N2812 2N2814			
Test	Symbol	Min.	Max.	Min.	Max.	Units	Test Conditions
D.C. Current Gain	h_{FE}	10	—	10	—	—	$I_C = 10mA$, $V_{CE} = 5V$
D.C. Current Gain (Note 2)	h_{FE}	20	60	40	120	—	$I_C = 5A$, $V_{CE} = 5V$
D.C. Current Gain (Note 2)	h_{FE}	15	—	15	—	—	$I_C = 10A$, $V_{CE} = 5V$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	0.5	—	0.5	V	$I_C = 5A$, $I_B = 500mA$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	1.5	—	1.5	V	$I_C = 10A$, $I_B = 1A$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	1.2	—	1.2	V	$I_C = 5A$, $I_B = 500mA$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	2.0	—	2.0	V	$I_C = 10A$, $I_B = 1A$
Collector-Emitter Sustaining Voltage (Note 2)	V_{CEO} (sus)	50	—	70	—	V	$I_C = 10mA$, $I_B = 0$
Emitter-Base Breakdown Voltage	BV_{EBO}	8	—	8	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current	I_{CEX}	—	10	—	10	μA	$V_{CE} = 70V$, $V_{EB} = .5V$
Collector Cutoff Current, 150°C	I_{CEX}	—	100	—	100	μA	$V_{CE} = 60V$, $V_{EB} = .5V$, $T = 150°C$
Collector Capacitance	C_{ob}	—	350	—	350	pf	$V_{CB} = 10V$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain (small signal)	h_{fe}	20	100	40	200	—	$I_C = 50mA$, $V_{CE} = 5V$, $f = 1KHz$
A.C. Current Gain	h_{fe}	1.5	—	1.5	—	—	$I_C = 1A$, $V_{CE} = 10V$, $f = 10 MHz$
Switching Speeds Rise Time	t_r	—	200	—	150	ns	$V_{CC} = 30V$
Switching Speeds Storage Time	t_s	—	80	—	100	ns	$I_{B1} = 100mA$, $I_{B2} = -100mA$
Switching Speeds Fall Time	t_f	—	100	—	150	ns	$I_C = 1A$

Notes:

1. The device may be switched between maximum rated collector current and maximum rated collector — emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Pulse length = 300 μs; duty cycle $\leqslant$2%.

† All values in this table are JEDEC registered.

POWER TRANSISTORS

5 Amp, 80V, Planar NPN

2N2850 2850-1, -2, -3
2N2851 2851-1, -2, -3
2N2852 2852-1, -2, -3

FEATURES

- Collector-Base Voltage: up to 100V
- D.C. Collector Current: 5A
- Fast Switching
- Low Saturation Voltages

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

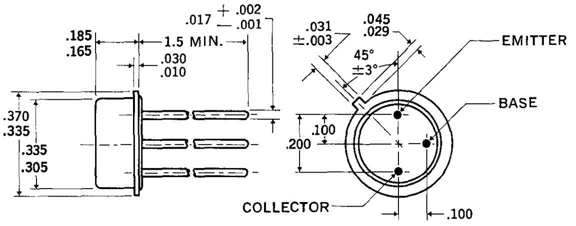
ABSOLUTE MAXIMUM RATINGS

	2N2850 **2N2851** **2N2852**	**2850-1** * **2851-1** **2852-1**	**2850-2** * **2851-2** **2852-2**	**2850-3** * **2851-3** **2852-3**
Collector-Base Voltage, V_{CBO}	100V	100V	100V	100V
Collector-Emitter Voltage, V_{CEO}	80V	80V	80V	80V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V
D.C. Collector Current, I_C	5A	5A	5A	5A
Power Dissipation				
25°C Ambient	.85W	1.25W	2.0W	1.5W
100°C Case	5W	5W	22W	5W
Operating and Storage Temperature Range				–65°C to 200°C

*All dash number types are identical electrically to 2N equivalent except for power dissipation.

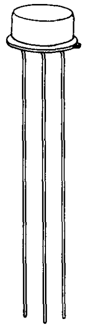
MECHANICAL SPECIFICATIONS

2N2850 — 2N2852

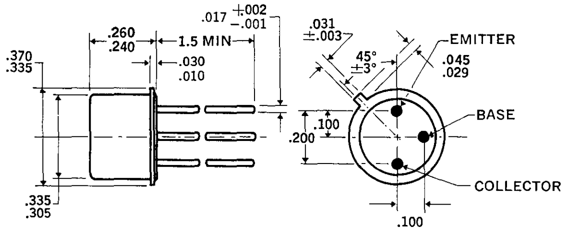


Dimensions in inches.

Pancake TO-5

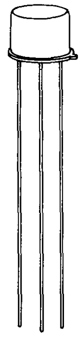


2850-1 — 2852-1



Dimensions in inches.

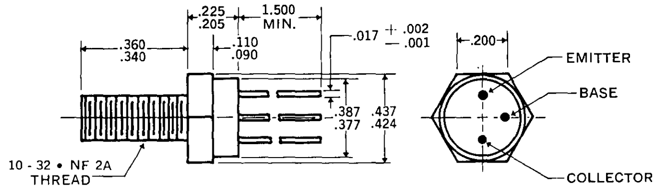
TO-5



UNITRODE

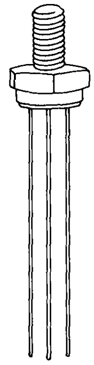
MECHANICAL SPECIFICATIONS

2850-3 — 2852-3

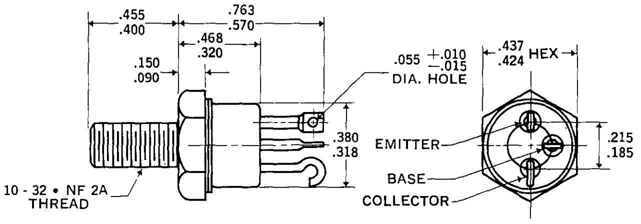


Dimensions in inches.

Low Profile
7/16 Hex

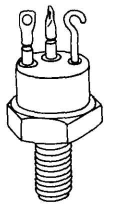


2850-2 — 2852-2



Dimensions in inches.

TO-59



NOTES: Collector internally connected to case. — Mounting position: Any. — Lead Soldering: Leads may be soldered to within 1/16" of base. Heat-sinking not required if temperature is below 230°C.
All tolerances ±0.010 unless otherwise noted. On stud mounted units, Torque Ratings: 12 inch-pounds.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

2N2850

Test		Symbol	Min	Typ	Max	Units	Test Conditions
D.C. Pulse Current Gain (Note 4)		h_{FE}	40	85	120	—	$I_C = 1A$, $V_{CE} = 1V$ (Pulse test)
D.C. Current Gain		h_{FE}	25	50	—	—	$I_C = 50mA$, $V_{CE} = 1V$
D.C. Pulse Current Gain (Note 4)		h_{FE}	—	40	—	—	$I_C = 3A$, $V_{CE} = 3V$ (Pulse test)
Collector Saturation Voltage (Note 7)		V_{CE} (sat)	—	0.15	0.25	V	$I_C = 1A$, $I_q = 50mA$
Base Saturation Voltage (Note 7)		V_{BE} (sat)	—	1.0	1.2	V	$I_C = 1A$, $I_B = 50mA$
Collector-Emitter Breakdown Voltage		BV_{CES}	100	125	—	V	$I_C = 10\mu A$, $R_{BE} = 0$
Collector-Emitter Breakdown Voltage (Note 5)		BV_{CEO}	80	110	—	V	$I_C = 100mA$, $I_B = 0$ (Pulse test)
Emitter-Base Breakdown Voltage		BV_{EBO}	5.0	8.0	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current		I_{CES}	—	.01	0.1	µA	$V_{CE} = 80V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C		I_{CES}	—	5	50	µA	$V_{CE} = 80V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance		C_{ob}	—	60	125	µµf	$V_{CB} = 10V$, $I_E = 0$
Gain-Bandwidth Product		f_T	—	40	—	MHz	$I_C = 500mA$, $V_{CE} = 5V$
Switching Speeds (Note 6)	Delay Time	t_d	—	20	50	ns	$I_C = 1A$ $V_{BE(0)} = -1V$ $V_{CC} = 30V$ (Note 6)
	Rise Time	t_r	—	50	100	ns	
	Storage Time	t_s	—	200	400	ns	
	Fall Time	t_f	—	50	150	ns	

Notes:

1. These ratings are limiting values, above which reliability may be impaired.
2. The device may be switched between maximum rated collector current and maximum rated collector-emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
3. Steady state limits based on a maximum junction temperature of 200°C.
4. Pulse Length = 250 µs; duty cycle ⩽ 1%.
5. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 µs; duty cycle ⩽ 1%. Voltage clamped at maximum collector-emitter voltage.
6. Measured in saturated switching speed test circuit.
7. All electrical measurements are specified within ¼ inch lead length from header.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

2N2851

Test		Symbol	Min	Typ	Max	Units	Test Conditions
D.C. Pulse Current Gain (Note 4)		h_{FE}	40	85	120	—	$I_C = 1A$, $V_{CE} = 1V$ (Pulse test)
D.C. Current Gain		h_{FE}	25	50	—	—	$I_C = 50mA$, $V_{CE} = 1V$
D.C. Pulse Current Gain (Note 4)		h_{FE}	—	40	—	—	$I_C = 3A$, $V_{CE} = 3V$ (Pulse test)
Collector Saturation Voltage (Note 7)		V_{CE} (sat)	—	0.2	0.4	V	$I_C = 1A$, $I_B = 50mA$
Base Saturation Voltage (Note 7)		V_{BE} (sat)	—	1.0	1.2	V	$I_C = 1A$, $I_B = 50mA$
Collector-Emitter Breakdown Voltage		BV_{CES}	100	125	—	V	$I_C = 10\mu A$, $R_{BE} = 0$
Collector-Emitter Breakdown Voltage (Note 5)		BV_{CEO}	80	110	—	V	$I_C = 100mA$, $I_B = 0$ (Pulse test)
Emitter-Base Breakdown Voltage		BV_{EBO}	5.0	8.0	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current		I_{CES}	—	.01	0.1	μA	$V_{CE} = 80V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C		I_{CES}	—	5	50	μA	$V_{CE} = 80V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance		C_{ob}	—	60	125	μμf	$V_{CB} = 10V$, $I_E = 0$
Gain-Bandwidth Product		f_T	—	40	—	MHz	$I_C = 500mA$, $V_{CE} = 5V$
Switching Speeds (Note 6)	Delay Time	t_d	—	20	50	ns	$I_C = 1A$ $V_{BE(0)} = -1V$ $V_{CC} = 30V$ (Note 6)
	Rise Time	t_r	—	50	100	ns	
	Storage Time	t_s	—	200	400	ns	
	Fall Time	t_f	—	50	150	ns	

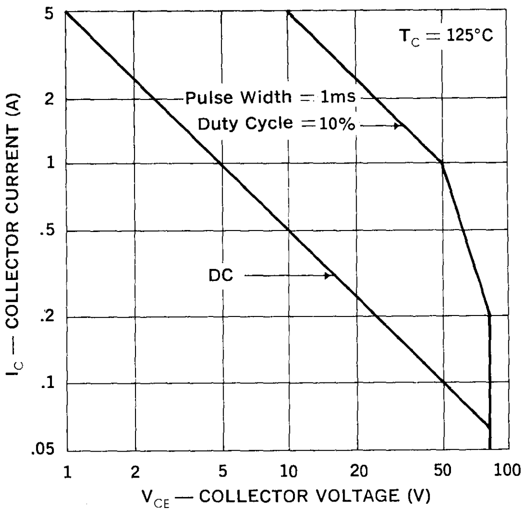
2N2852

Test		Symbol	Min	Typ	Max	Units	Test Conditions
D.C. Pulse Current Gain (Note 4)		h_{FE}	20	45	60	—	$I_C = 1A$, $V_{CE} = 1V$ (Pulse test)
D.C. Current Gain		h_{FE}	15	25	—	—	$I_C = 50mA$, $V_{CE} = 1V$
D.C. Pulse Current Gain (Note 4)		h_{FE}	—	20	—	—	$I_C = 3A$, $V_{CE} = 3V$ (Pulse test)
Collector Saturation Voltage (Note 7)		V_{CE} (sat)	—	0.2	0.4	V	$I_C = 1A$, $I_B = 100mA$
Base Saturation Voltage (Note 7)		V_{BE} (sat)	—	1.0	1.2	V	$I_C = 1A$, $I_B = 100mA$
Collector-Emitter Breakdown Voltage		BV_{CES}	100	125	—	V	$I_C = 10uA$, $R_{BE} = 0$
Collector-Emitter Breakdown Voltage (Note 5)		BV_{CEO}	80	110	—	V	$I_C = 100mA$, $I_B = 0$ (Pulse test)
Emitter-Base Breakdown Voltage		BV_{EBO}	5.0	8.0	—	V	$I_E = 10uA$, $I_C = 0$
Collector Cutoff Current		I_{CES}	—	.01	0.1	μA	$V_{CE} = 80V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C		I_{CES}	—	5	50	μA	$V_{CE} = 80V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance		c_{ob}	—	60	125	μμf	$V_{CB} = 10V$, $I_E = 0$
Gain-Bandwidth Product		f_T	—	30	—	MHz	$I_C = 500mA$, $V_{CE} = 5V$
Switching Speeds (Note 6)	Delay Time	t_d	—	20	50	ns	$I_C = 1A$ $V_{BE(0)} = -1V$ $V_{CC} = 30V$ (Note 6)
	Rise Time	t_r	—	60	100	ns	
	Storage Time	t_s	—	200	400	ns	
	Fall Time	t_f	—	50	150	ns	

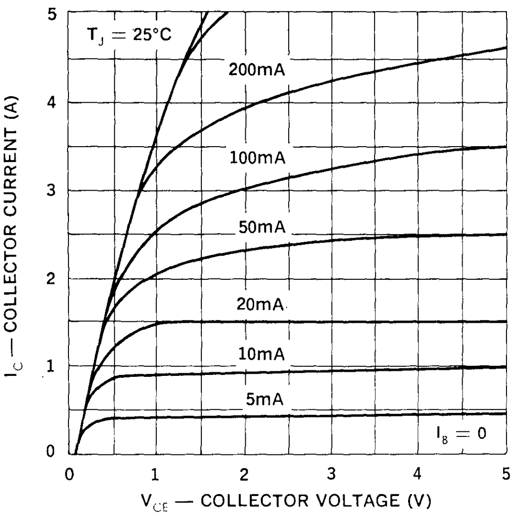
Notes:

1. These ratings are limiting values, above which reliability may be impaired.
2. The device may be switched between maximum rated collector current and maximum rated collector-emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
3. Steady state limits based on a maximum junction temperature of 200°C.
4. Pulse Length = 250 μs; duty cycle ⩽ 1%.
5. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ⩽ 1%. Voltage clamped at maximum collector-emitter voltage.
6. Measured in saturated switching speed test circuit.
7. All electrical measurements are specified within ¼ inch lead length from header.

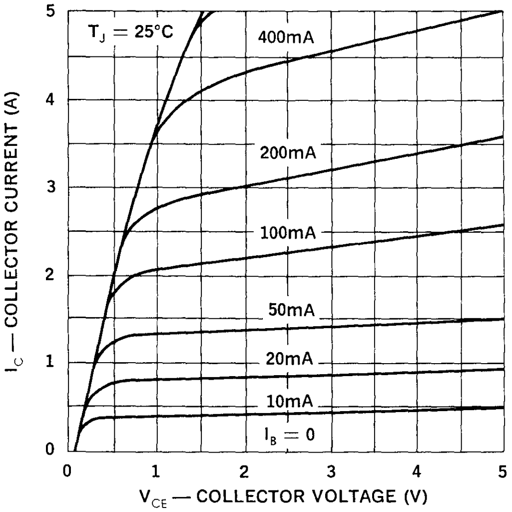
Maximum Safe Operating Area



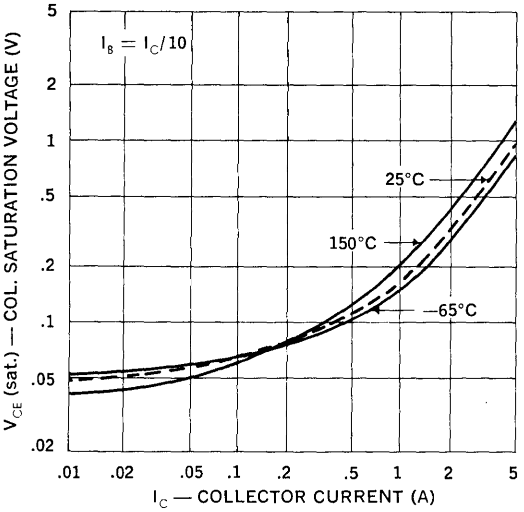
Collector 25°C
2N2850-2N2851



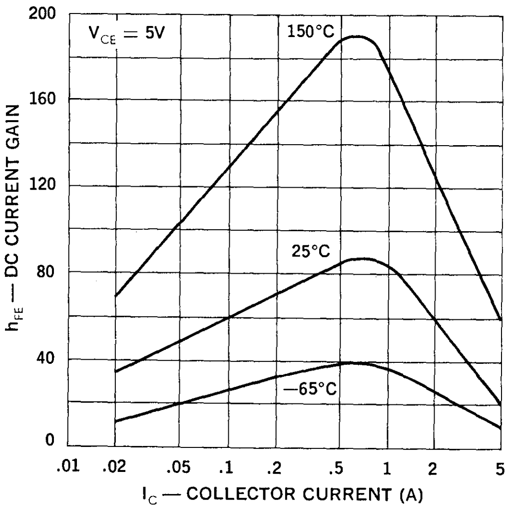
Collector 25°C
2N2852



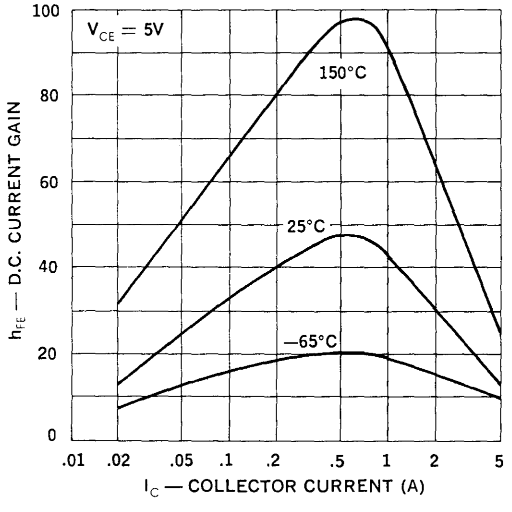
Collector Saturation Voltage vs. Collector Current
2N2850



D.C. Current Gain vs. Collector Current
2N2850-2N2851



D.C. Current Gain vs. Collector Current
2N2852



POWER TRANSISTORS

5 Amp, 40V, Planar NPN

2N2853 2853-1, -2, -3
2N2854 2854-1, -2, -3
2N2855 2855-1, -2, -3
2N2856 2856-1, -2, -3

FEATURES

- Collector-Base Voltage: up to 60V
- D.C. Collector Current: 5A
- Fast Switching
- Low Saturation Voltages

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

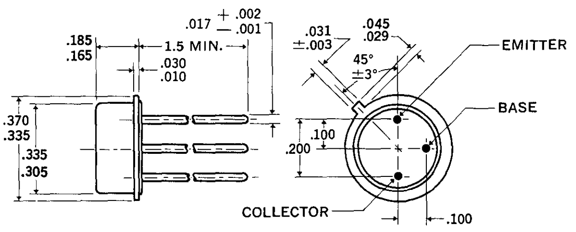
ABSOLUTE MAXIMUM RATINGS

	2N2853 2N2854 2N2855 2N2856	2853-1 * 2854-1 2855-1 2856-1	2853-2 * 2854-2 2855-2 2856-2	2853-3 * 2854-3 2855-3 2856-3
Collector-Base Voltage, V_{CBO}	60V	60V	60V	60V
Collector-Emitter Voltage, V_{CEO}	40V	40V	40V	40V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V
D.C. Collector Current, I_C	10A	10A	10A	10A
Power Dissipation				
25°C Ambient	.85W	1.25W	2.0W	1.5W
100°C Case	5W	5W	22W	5W
Operating and Storage Temperature Range				—65°C to 200°C

*All dash number types are identical electrically to 2N equivalent except for power dissipation.

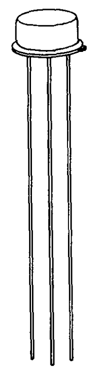
MECHANICAL SPECIFICATIONS

2N2853 — 2N2856

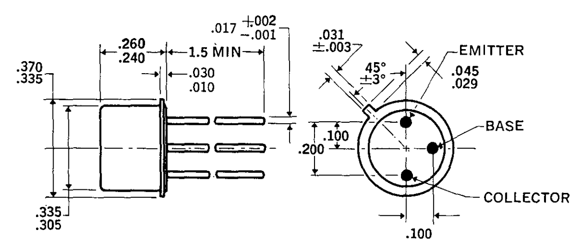


Dimensions in inches.

Pancake TO-5

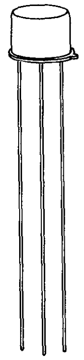


2853-1 — 2856-1



Dimensions in inches.

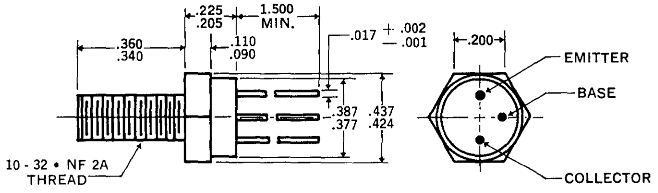
TO-5



UNITRODE

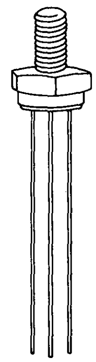
MECHANICAL SPECIFICATIONS

2853-3 — 2856-3

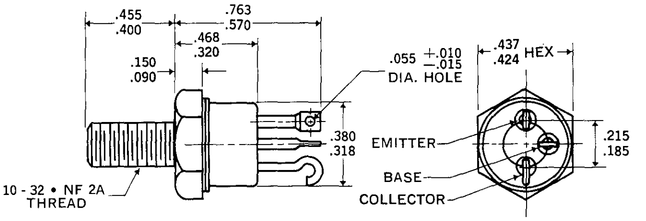


Dimensions in inches.

Low Profile
7/16 Hex

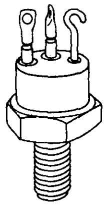


2853-2 — 2856-2



Dimensions in inches.

TO-59



NOTES: Collector internally connected to case. — Mounting position: Any. — Lead Soldering: Leads may be soldered to within 1/16" of base. Heat-sinking not required if temperature is below 230°C.
All tolerances ±0.010 unless otherwise noted. On stud mounted units, Torque Ratings: 12 inch-pounds.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

2N2853

Test	Symbol	Min.	Typ.	Max.	Units	Test Conditions
D.C. Pulse Current Gain (Note 4)	h_{FE}	40	85	—	—	$I_C = 1A$, $V_{CE} = 1V$ (Pulse test)
D.C. Pulse Current Gain (Note 4)	h_{FE}	20	35	—	—	$I_C = 5A$, $V_{CE} = 3V$ (Pulse test)
Collector Saturation Voltage (Note 7)	V_{CE} (sat)	—	1.0	1.5	V	$I_C = 5A$, $I_B = 500mA$
Base Saturation Voltage (Note 7)	V_{BE} (sat)	—	1.5	2.0	V	$I_C = 5A$, $I_B = 500mA$
Collector-Emitter Breakdown Voltage	BV_{CES}	60	85	—	V	$I_C = 10\mu A$, $R_{BE} = 0$
Collector-Emitter Breakdown Voltage (Note 5)	BV_{CEC}	40	70	—	V	$I_C = 100mA$, $I_B = 0$ (Pulse test)
Emitter-Base Breakdown Voltage	BV_{EBO}	5.0	8.0	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current	I_{CES}	—	.01	0.1	μA	$V_{CE} = 40V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}	—	5	50	μA	$V_{CE} = 40V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance	C_{ob}	—	60	125	μμf	$V_{CB} = 10V$, $I_E = 0$
Gain-Bandwidth Product	f_r	—	40	—	MHz	$I_C = 500mA$, $V_{CE} = 5V$
Switching Speeds (Note 6) Delay Time	t_d	—	20	50	ns	$I_C = 1A$ $V_{BE(0)} = 1V$ $V_{CC} = 30V$
Rise Time	t_r	—	50	100	ns	
Storage Time	t_s	—	200	400	ns	
Fall Time	t_f	—	50	200	ns	

Notes:

1. These ratings are limiting values, above which reliability may be impaired.
2. The device may be switched between maximum rated collector current and maximum rated collector-emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
3. Steady state limits based on a maximum junction temperature of 200°C.
4. Pulse Length = 250 μs; duty cycle ≤ 1%.
5. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ≤ 1%. Voltage clamped at maximum collector-emitter voltage.
6. Measured in saturated switching speed test circuit.
7. All electrical measurements are specified within ¼ inch lead length from header.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

2N2854

Test		Symbol	Min.	Typ.	Max.	Units	Test Conditions
D.C. Pulse Current Gain (Note 4)		h_{FE}	100	150	300	—	$I_C = 1A$, $V_{CE} = 1V$ (Pulse test)
D.C. Current Gain		h_{FE}	50	90	—	—	$I_C = 50mA$, $V_{CE} = 1V$
D.C. Pulse Current Gain (Note 4)		h_{FE}	—	60	—	—	$I_C = 3A$, $V_{CE} = 3V$ (Pulse test)
Collector Saturation Voltage (Note 7)		V_{CE} (sat)	—	0.2	0.4	V	$I_C = 1A$, $I_B = 20mA$
Base Saturation Voltage (Note 7)		V_{BE} (sat)	—	1.0	1.2	V	$I_C = 1A$, $I_B = 20mA$
Collector-Emitter Breakdown Voltage		BV_{CES}	60	85	—	V	$I_C = 10\mu A$, $R_{BE} = 0$
Collector-Emitter Breakdown Voltage (Note 5)		BV_{CEO}	40	70	—	V	$I_C = 100mA$, $I_B = 0$ (Pulse test)
Emitter-Base Breakdown Voltage		BV_{EBO}	5.0	8.0	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current		I_{CES}	—	.01	0.1	μA	$V_{CE} = 40V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C		I_{CES}	—	5	50	μA	$V_{CE} = 40V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance		C_{ob}	—	60	125	μμf	$V_{CB} = 10V$, $I_E = 0$
Gain-Bandwidth Product		f_r	—	50	—	MHz	$I_C = 500mA$, $V_{CE} = 5V$
Switching Speeds (Note 6)	Delay Time	t_d	—	20	50	ns	$I_C = 1A$ $V_{BE(0)} = -1V$ $V_{CC} = 30V$
	Rise Time	t_r	—	40	100	ns	
	Storage Time	t_s	—	150	300	ns	
	Fall Time	t_f	—	50	150	ns	

2N2855

Test		Symbol	Min.	Typ.	Max.	Units	Test Conditions
D.C. Pulse Current Gain (Note 4)		h_{FE}	40	85	120	—	$I_C = 1A$, $V_{CE} = 1V$ (Pulse test)
D.C. Current Gain		h_{FE}	25	50	—	—	$I_C = 50mA$, $V_{CE} = 1V$
D.C. Pulse Current Gain (Note 4)		h_{FE}	—	40	—	—	$I_C = 3A$, $V_{CE} = 3V$ (Pulse test)
Collector Saturation Voltage (Note 7)		V_{CE} (sat)	—	0.2	0.4	V	$I_C = 1A$, $I_B = 50mA$
Base Saturation Voltage (Note 7)		V_{BE} (sat)	—	1.0	1.2	V	$I_C = 1A$, $I_B = 50mA$
Collector-Emitter Breakdown Voltage		BV_{CES}	60	85	—	V	$I_C = 10\mu A$, $R_{BE} = 0$
Collector-Emitter Breakdown Voltage (Note 5)		BV_{CEO}	40	70	—	V	$I_C = 100mA$, $I_B = 0$ (Pulse test)
Emitter-Base Breakdown Voltage		BV_{EBO}	5.0	8.0	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current		I_{CES}	—	.01	0.1	μA	$V_{CE} = 40V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C		I_{CES}	—	5	50	μA	$V_{CE} = 40V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance		C_{ob}	—	60	125	μμf	$V_{CB} = 10V$, $I_E = 0$
Gain-Bandwidth Product		f_r	—	40	—	MHz	$I_C = 500mA$, $V_{CE} = 5V$
Switching Speeds (Note 6)	Delay Time	t_d	—	20	50	ns	$I_C = 1A$ $V_{BE(0)} = -1V$ $V_{CC} = 30V$
	Rise Time	t_r	—	50	100	ns	
	Storage Time	t_s	—	200	400	ns	
	Fall Time	t_f	—	50	150	ns	

Notes:

1. These ratings are limiting values, above which reliability may be impaired.
2. The device may be switched between maximum rated collector current and maximum rated collector-emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
3. Steady state limits based on a maximum junction temperature of 200°C.
4. Pulse Length = 250 μs; duty cycle ⩽ 1%.
5. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ⩽ 1%. Voltage clamped at maximum collector-emitter voltage.
6. Measured in saturated switching speed test circuit.
7. All electrical measurements are specified within ¼ inch lead length from header.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

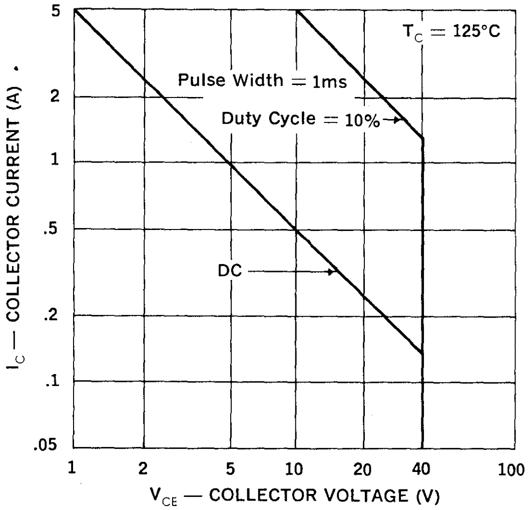
2N2856

Test		Symbol	Min.	Typ.	Max.	Units	Test Conditions
D.C. Pulse Current Gain (Note 4)		h_{FE}	20	45	60	—	$I_C = 1A, V_{CE} = 1V$ (Pulse test)
D.C. Current Gain		h_{FE}	15	25	—	—	$I_C = 50mA, V_{CE} = 1V$
D.C. Pulse Current Gain (Note 4)		h_{FE}	—	20	—	—	$I_C = 3A, V_{CE} = 3V$ (Pulse test)
Collector Saturation Voltage (Note 7)		V_{CE} (sat)	—	0.2	0.4	V	$I_C = 1A, I_B = 100mA$
Base Saturation Voltage (Note 7)		V_{BE} (sat)	—	1.0	1.2	V	$I_C = 1A, I_B = 100mA$
Collector-Emitter Breakdown Voltage		BV_{CES}	60	85	—	V	$I_C = 10\mu A, R_{BE} = 0$
Collector-Emitter Breakdown Voltage (Note 5)		BV_{CEO}	40	70	—	V	$I_C = 100mA, I_B = 0$ (Pulse test)
Emitter-Base Breakdown Voltage		BV_{EBO}	5.0	8.0	—	V	$I_E = 10\mu A, I_C = 0$
Collector Cutoff Current		I_{CES}	—	.01	0.1	μA	$V_{CE} = 40V, R_{BE} = 0$
Collector Cutoff Current, 150°C		I_{CES}	—	5	50	μA	$V_{CE} = 40V, R_{BE} = 0, T = 150°C$
Collector Capacitance		C_{ob}	—	60	125	μμf	$V_{CB} = 10V, I_E = 0$
Gain-Bandwidth Product		f_r	—	30	—	MHz	$I_C = 500mA, V_{CE} = 5V$
Saturated Switching Speeds (Note 6)	Delay Time	t_d	—	20	50	ns	$I_C = 1A$ $V_{BE(0)} = -1V$ $V_{CC} = 30V$
	Rise Time	t_r	—	60	100	ns	
	Storage Time	t_s	—	200	400	ns	
	Fall Time	t_f	—	50	150	ns	

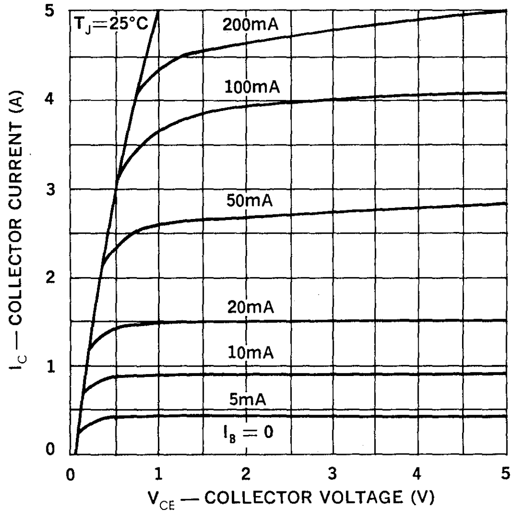
Notes:

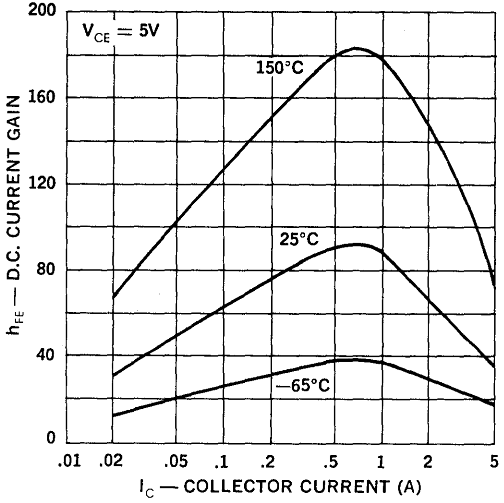
1. These ratings are limiting values, above which reliability may be impaired.
2. The device may be switched between maximum rated collector current and maximum rated collector-emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
3. Steady state limits based on a maximum junction temperature of 200°C.
4. Pulse Length = 250 μs; duty cycle ≤ 1%.
5. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ≤ 1%. Voltage clamped at maximum collector-emitter voltage.
6. Measured in saturated switching speed test circuit.
7. All electrical measurements are specified within ¼ inch lead length from header.

Maximum Safe Operating Area

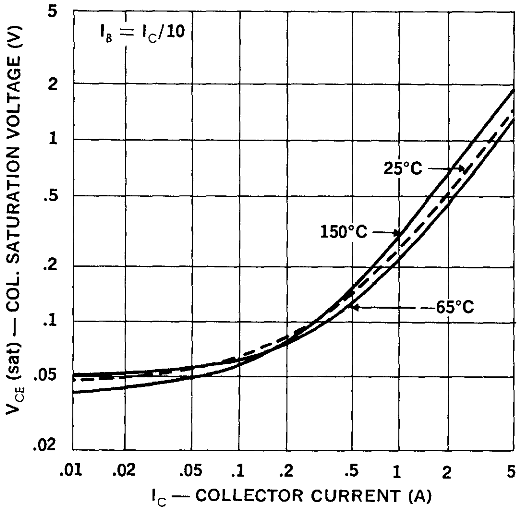


Collector 25°C
2N2853

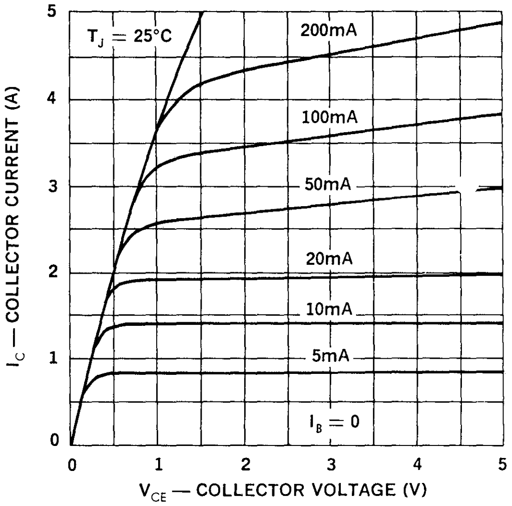




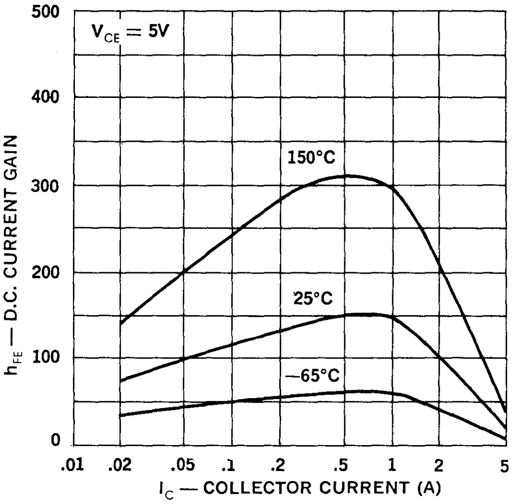
D.C. Current Gain vs. Collector Current
2N2853



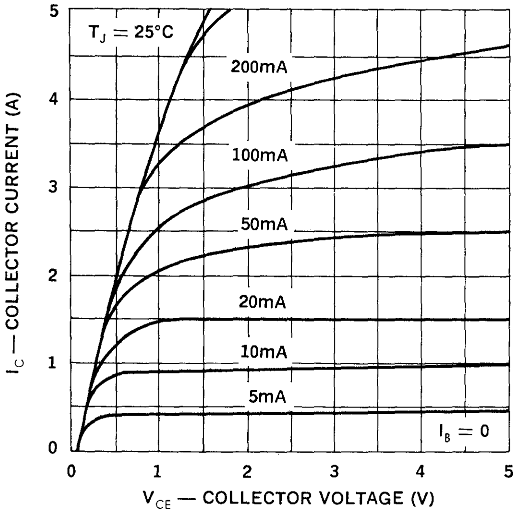
Collector Saturation Voltage vs. Collector Current
2N2853-56



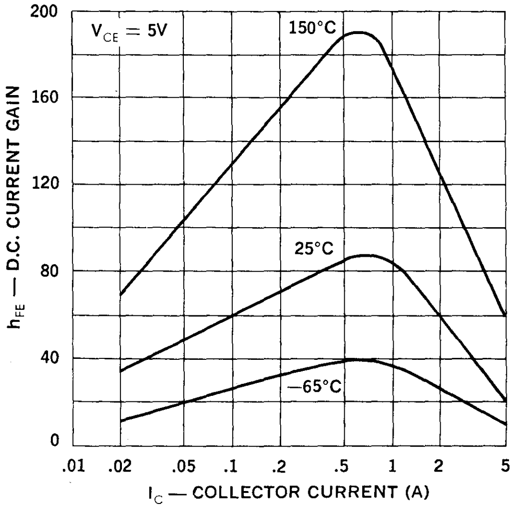
Collector 25°C
2N2854



D.C. Current Gain vs. Collector Current
2N2854

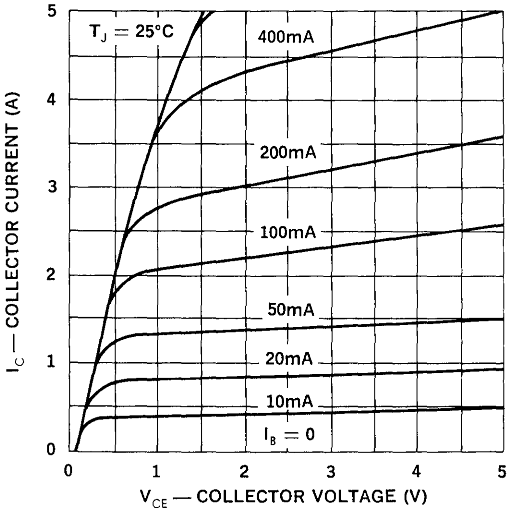


Collector 25°C
2N2855

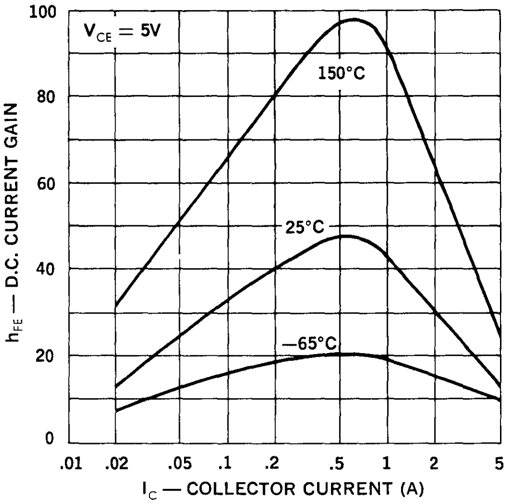


DC Current Gain vs. Collector Current
2N2855

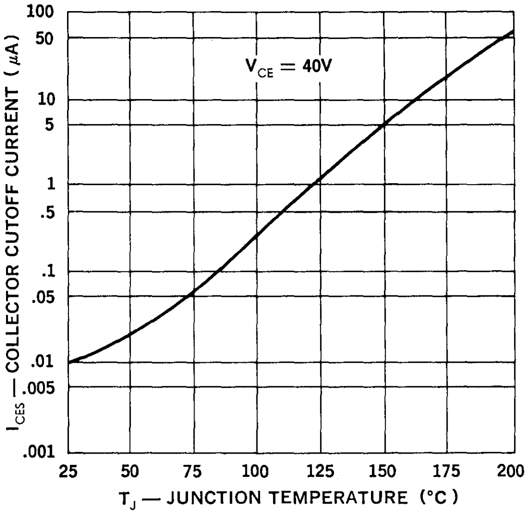
Collector 25°C
2N2856



D.C. Current Gain vs. Collector Current
2N2856



Collector Cutoff Current vs. Temperature
2N2856



SCRs

0.5 Amp, Planar

2N3027-2N3032

FEATURES

- JAN and JANTX Types Available
- Fully Characterized for "Worst Case" Design
- Passivated Planar Construction for Maximum Reliability and Parameter Uniformity
- Low On-State Voltage and Fast Switching at High Current Levels
- Typical Turn-On Time: 0.12μs
- Typical Recovery Time: 0.7μs
- Pulse Currents: to 30A

DESCRIPTION

The 2N3027 series of planar SCRs (controlled switches) are intended for use in military and space applications requiring a high degree of reliability. They offer a unique combination of extremely fast switching, precise triggering, high pulse power, small size, intrinsic parameter stability, and high radiation tolerance.

The JAN and JANTX types are specified under MIL-S-19500/419, and are included in MIL-STD-701 as recommended types for military usage.

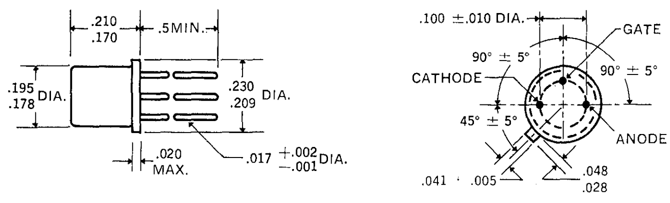
ABSOLUTE MAXIMUM RATINGS

	2N3027, JAN, JANTX **2N3030, JAN, JANTX**	**2N3028, JAN, JANTX** **2N3031, JAN, JANTX**	**2N3029, JAN, JANTX** **2N3032, JAN, JANTX**
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V
D.C. On-State Current, I_T			
100°C Case		500mA	
75°C Ambient		250mA	
Repetitive Peak On-State Current, I_{TRM}		30A	
Surge (Non-Rep.) On-State Current, I_{TSM}			
50ms		5A	
8ms		8A	
Peak Gate Current, I_{GM}		250mA	
Average Gate Current, $I_{G(AV)}$		25mA	
Reverse Gate Voltage		5V	
Reverse Gate Current		3mA	
Storage Temperature Range		−65°C to +200°C	
Operating Temperature Range		−65°C to +150°C	

Note: Blocking voltage ratings apply over the operating temperature range, provided the gate is connected to the cathode through an appropriate resistor, or adequate gate bias is used. (See section on bias stabilization.)

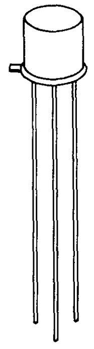
MECHANICAL SPECIFICATIONS

2N3027-2N3032



Dimensions in inches.

TO18



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

2N3027 — 2N3028 — 2N3029

Parameter	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1 Visual and Mechanical	—	—	—	—	—	MIL-STD-750 Method 2071
SUBGROUP 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	.002	0.1	μA	$R_{GK} = 1K$, $V_{DRM} =$ Rating
Reverse Current	I_{RRM}	—	.002	0.1	μA	$R_{GK} = 1K$, $V_{RRM} =$ Rating
Reverse Gate Voltage	V_{GR}	5	8	—	V	$I_{GR} = 0.1mA$
Gate Trigger Current	I_{GT}	−5	50	200	μA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	.40	.55	.80	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	0.8	1.2	1.5	V	$i_T = 1A$ (pulse test)
Holding Current	I_H	0.3	1.0	5.0	mA	$R_{GK} = 1K$, $V_D = 5V$
SUBGROUP 3 (25°C Tests)						
Off-State Voltage — Critical Rate of Rise	dv_c/dt	30	60	—	v/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger-on Pulse Width	t_{pg} (on)	—	.07	0.2	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.1	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	.05	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_q	—	0.7	2.0	μs	$I_T = 1A$, $i_R = 1A$, $R_{GK} = 1K$
SUBGROUP 4 (150°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	2	20	μA	$R_{GK} = 1K$, $V_{DRM} =$ Rating
High Temp. Reverse Current	I_{RRM}	—	20	50	μA	$R_{GK} = 1K$, $V_{RRM} =$ Rating
High Temp. Gate Trigger Voltage	V_{GT}	.10	.15	0.6	V	$R_{GS} = 100\Omega$, $V_D = 5V$
High Temp. Holding Current	I_H	.05	.30	2.0	mA	$R_{GK} = 1K$, $V_D = 5V$
SUBGROUP 5 (−65°C Tests)						
Low Temp. Gate Trigger Voltage	V_{GT}	0.6	0.8	1.1	V	$R_{GS} = 100\Omega$, $V_D = 5V$
Low Temp. Gate Trigger Current	I_{GT}	0	0.4	1.2	mA	$R_{GS} = 10K$, $V_D = 5V$
Low Temp. Holding Current	I_H	0.5	5.0	10	mA	$R_{GK} = 1K$, $V_D = 5V$

High Reliability Processing

The 2N3027-2N3032 series provides a complete range of high reliability processing from the standard devices that undergo extensive electrical testing, through JAN and JANTX levels. 100% processing, Group B, and Group C tests for JAN and JANTX devices is shown below. For further details, see MIL-S-19500/419(EL).

100% Screening TX-Types

High Temperature Storage
Temperature Cycling
Constant Acceleration
Fine & Gross Hermetic Seal
Electrical Test
Burn-in
Electrical Test

Group B Tests

Subgroup 1 — Physical Dimensions
Subgroup 2 — Solderability
    Temperature Cycling
    Thermal Shock
    Constant Acceleration
    Moisture Resistance
Subgroup 3 — Surge Current
Subgroup 4 — Blocking Life Test
Subgroup 5 — Storage Life Test
Subgroup 6 — Operating Life Test

Group C Tests

Subgroup 1 — Shock
    Vibration, Variable Frequency
Subgroup 2 — Salt Atmosphere
Subgroup 3 — Terminal Strength
Subgroup 4 — High Temp. Anode Voltage — Critical rate or rise
Subgroup 5 — Storage Life Test
Subgroup 6 — Operating Life Test

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

2N3030 — 2N3031 — 2N3032

Parameter	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						MIL-STD-750
Visual and Mechanical	—	—	—	—	—	Method 2071
SUBGROUP 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	.002	0.1	μA	$R_{GK} = 1K, V_{DRM} =$ Rating
Reverse Current	I_{RRM}	—	.002	0.1	μA	$R_{GK} = 1K, V_{RRM} =$ Rating
Reverse Gate Voltage	V_{GR}	5	8	—	V	$I_{GR} = 0.1mA$
Gate Trigger Current	I_{GT}	–5	8	20	μA	$R_{GS} = 10K, V_D = 5V$
Gate Trigger Voltage	V_{GT}	.44	.52	.60	V	$R_{GS} = 100\Omega, V_D = 5V$
On-State Voltage	V_T	0.8	1.2	1.5	V	$i_T = 1A$ (pulse test)
Holding Current	I_H	0.3	0.7	4.0	mA	$R_{GK} = 1K, V_D = 5V$
SUBGROUP 3 (25°C Tests)						
Off-State Voltage — Critical Rate of Rise	dv_c/dt	30	60	—	v/μs	$R_{GK} = 1K, V_D = 30V$
Gate Trigger–on Pulse Width	$t_{pg\,(on)}$	—	.05	0.1	μs	$I_G = 10mA, I_T = 1A, V_{DM} = 30V$
Delay Time	t_d	—	.08	—	μs	$I_G = 10mA, I_T = 1A, V_D = 30V$
Rise Time	t_r	—	.04	—	μs	$I_G = 10mA, I_T = 1A, V_D = 30V$
Circuit Commutated Turn-off Time	t_q	—	0.7	2.0	μs	$I_T = 1A, i_R = 1A, R_{GK} = 1K$
SUBGROUP 4 (150°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	2	20	μA	$R_{GK} = 1K, V_{DRM} =$ Rating
High Temp. Reverse Current	I_{RRM}	—	20	50	μA	$R_{GK} = 1K, V_{RRM} =$ Rating
High Temp. Gate Trigger Voltage	V_{GT}	.10	.15	0.4	V	$R_{GS} = 100\Omega, V_D = 5V$
High Temp. Holding Current	I_H	.05	.20	1.0	mA	$R_{GK} = 1K, V_D = 5V$
SUBGROUP 5 (–65°C Tests)						
Low Temp. Gate Trigger Voltage	V_{GT}	.44	0.75	0.95	V	$R_{GS} = 100\Omega, V_D = 5V$
Low Temp. Gate Trigger Current	I_{GT}	0	150	500	μA	$R_{GS} = 10K, V_D = 5V$
Low Temp. Holding Current	I_H	0.5	3.5	8.0	mA	$R_{GK} = 1K, V_D = 5V$

High Reliability Processing

The 2N3027-2N3032 series provides a complete range of high reliability processing from the standard devices that undergo extensive electrical testing, through JAN and JANTX levels. 100% processing, Group B, and Group C tests for JAN and JANTX devices is shown below. For further details, see MIL-S-19500/419(EL).

100% Screening TX-Types

High Temperature Storage
Temperature Cycling
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Fine & Gross Hermetic Seal
Electrical Test
Burn-in
Electrical Test

Group B Tests

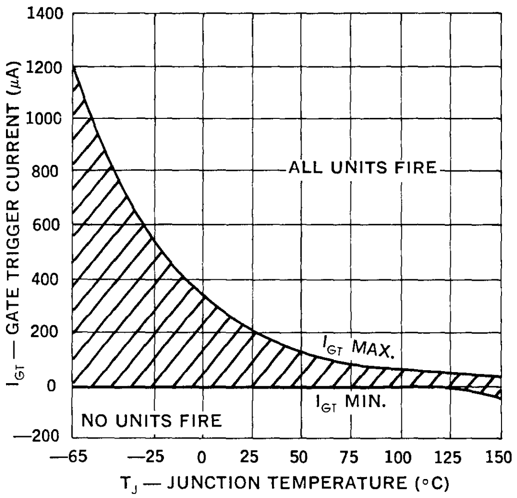
Subgroup 1 — Physical Dimensions
Subgroup 2 — Solderability
Temperature Cycling
Thermal Shock
Constant Acceleration
Moisture Resistance
Subgroup 3 — Surge Current
Subgroup 4 — Blocking Life Test
Subgroup 5 — Storage Life Test
Subgroup 6 — Operating Life Test

Group C Tests

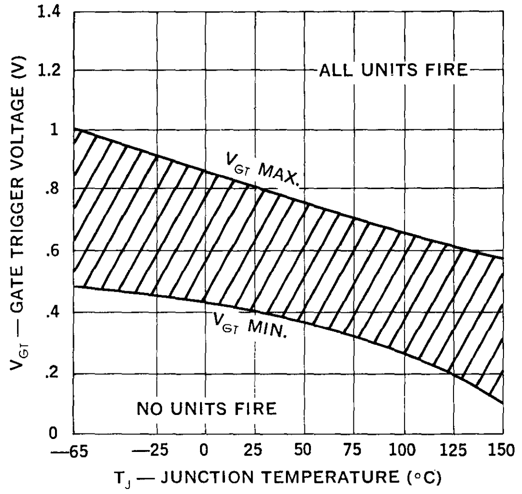
Subgroup 1 — Shock
Vibration, Variable Frequency
Subgroup 2 — Salt Atmosphere
Subgroup 3 — Terminal Strength
Subgroup 4 — High Temp. Anode Voltage — Critical rate or rise
Subgroup 5 — Storage Life Test
Subgroup 6 — Operating Life Test

TYPICAL CHARACTERISTICS
2N3027 — 2N3028 — 2N3029

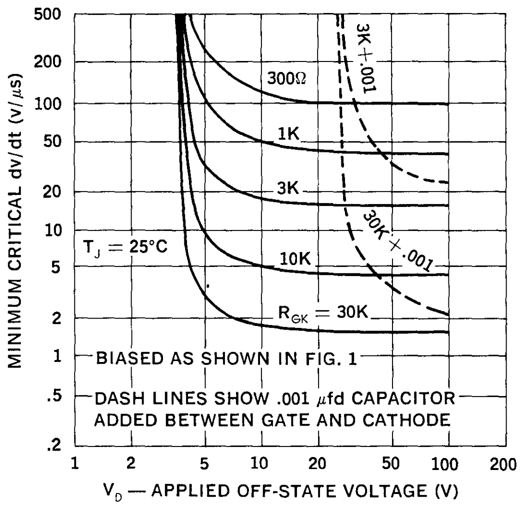
1 **Gate Trigger Current**



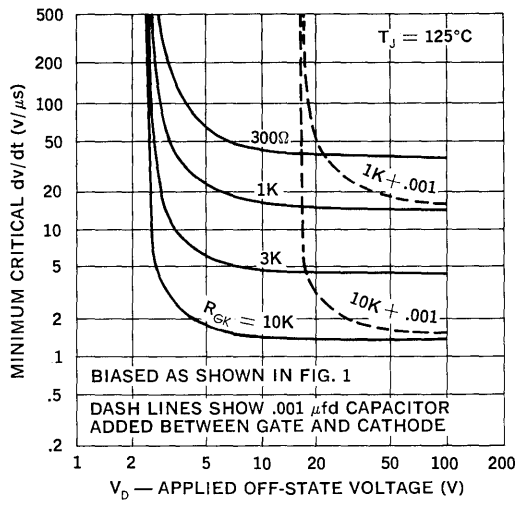
2 **Gate Trigger Voltage**



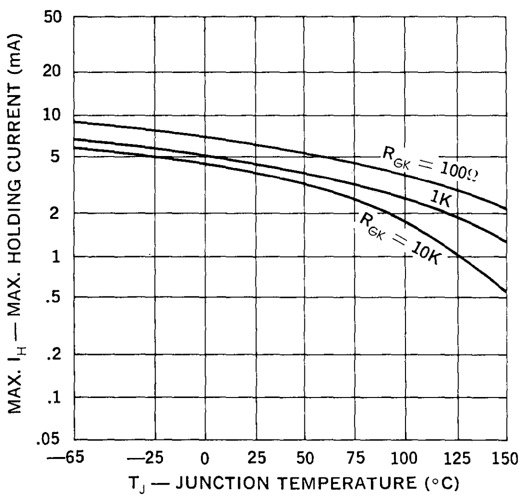
3 **Min. Critical dv/dt (25°C — R Bias)**



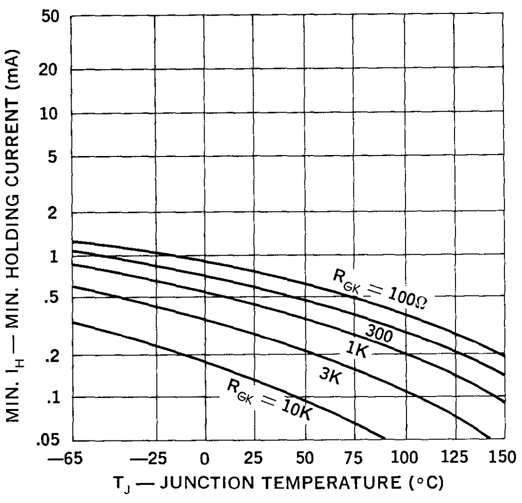
4 **Min. Critical dv/dt (125°C — R Bias)**



5 **Max. Holding Current (Resistor Bias)**

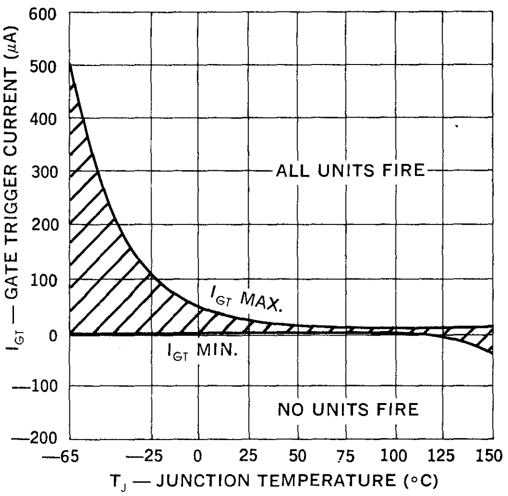


6 **Min. Holding Current (Resistor Bias)**

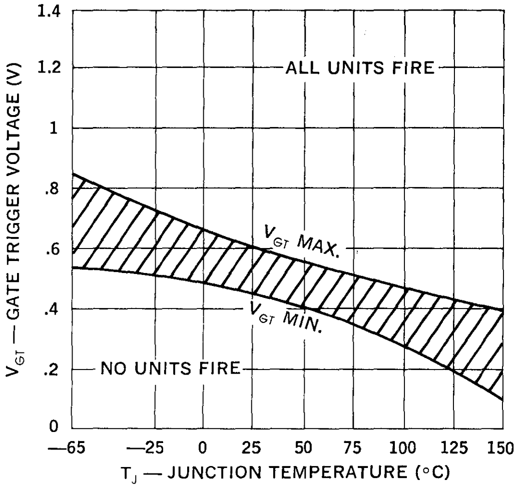


TYPICAL CHARACTERISTICS
2N3030 — 2N3031 — 2N3032

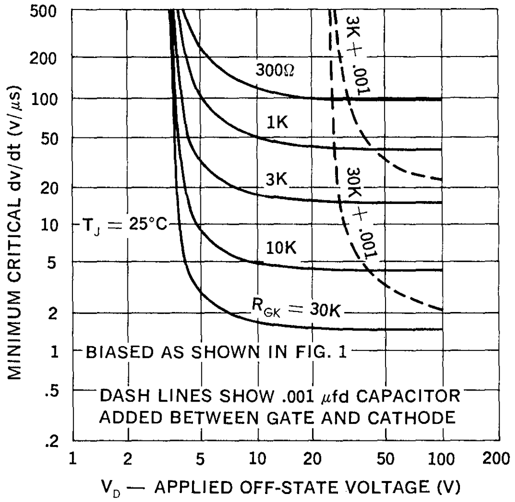
1 Gate Trigger Current



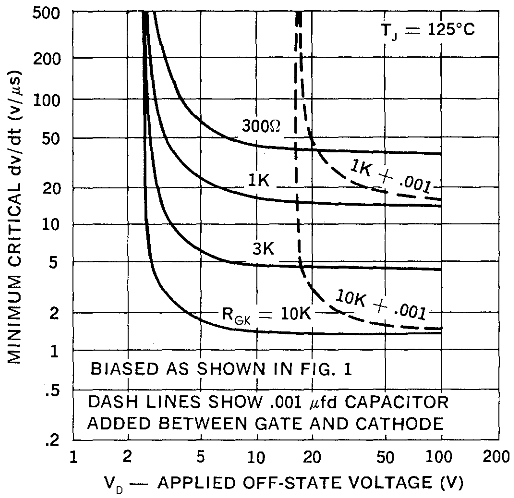
2 Gate Trigger Voltage



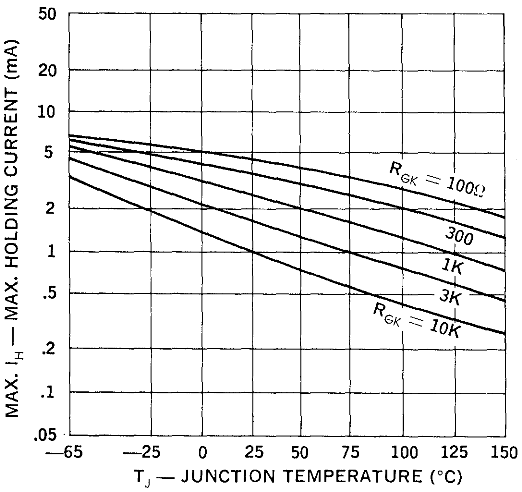
3 Min. Critical dv/dt (25°C — R Bias)



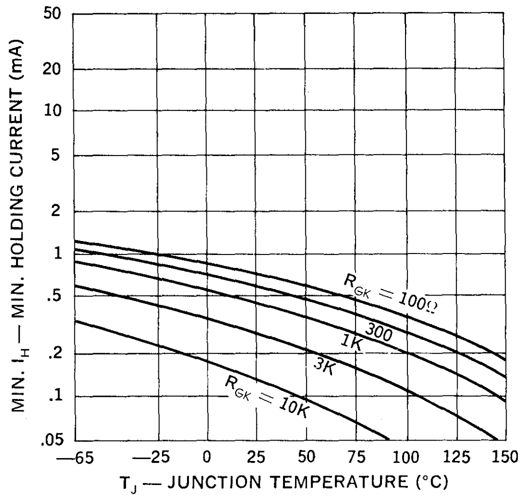
4 Min. Critical dv/dt (125°C — R Bias)



5 Max. Holding Current (Resistor Bias)

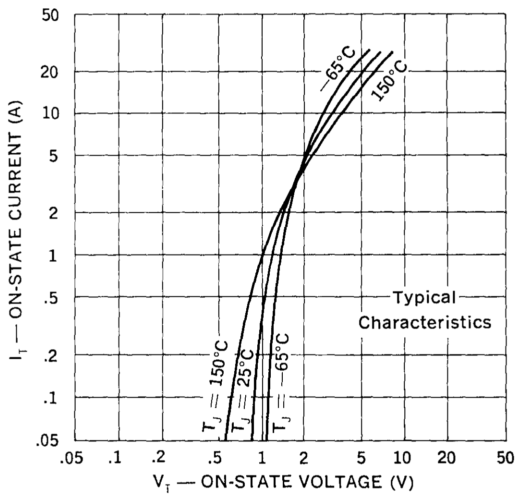


6 Min. Holding Current (Resistor Bias)

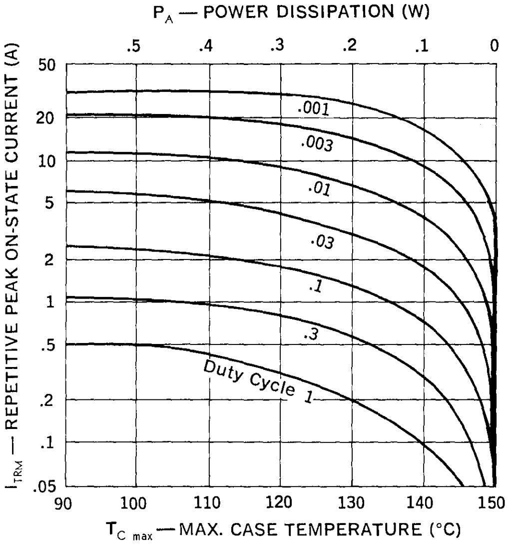


CURRENT RATINGS

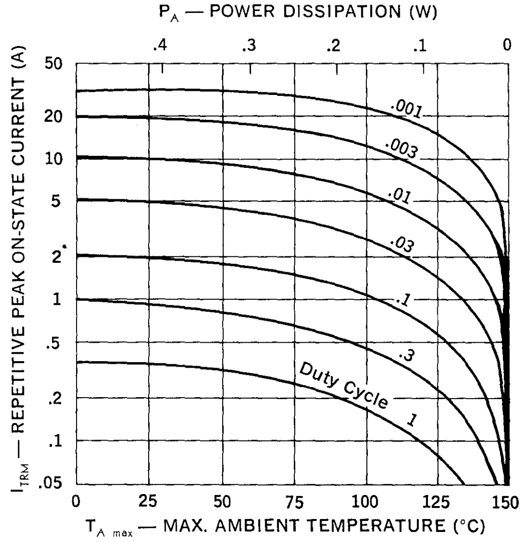
C1 Forward on Current vs. Voltage



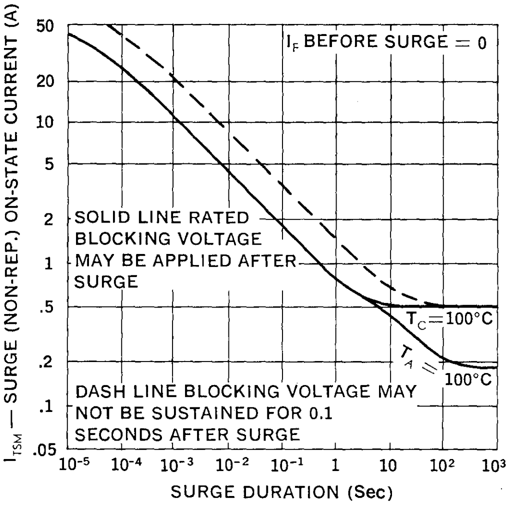
C2 Peak Current vs. Case Temperature



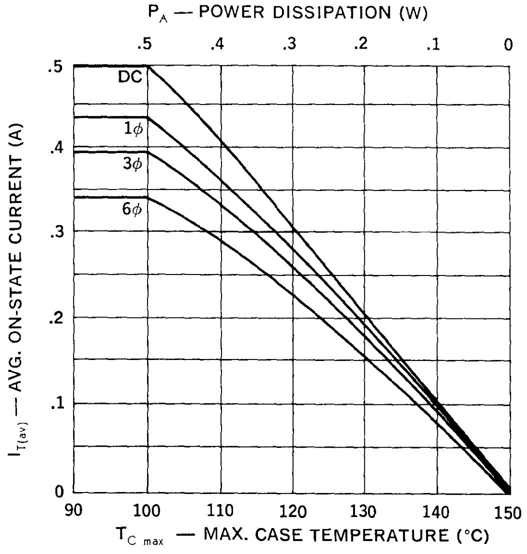
C3 Peak Current vs. Ambient Temperature TO-18 Ratings (see note)



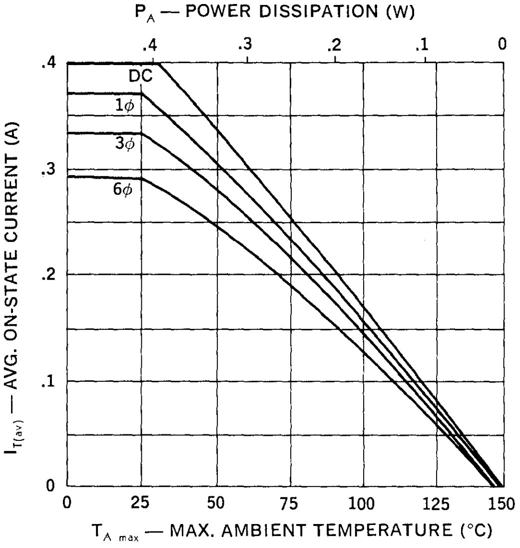
C4 Surge Current vs. Time



C5 Average Current vs. Case Temperature

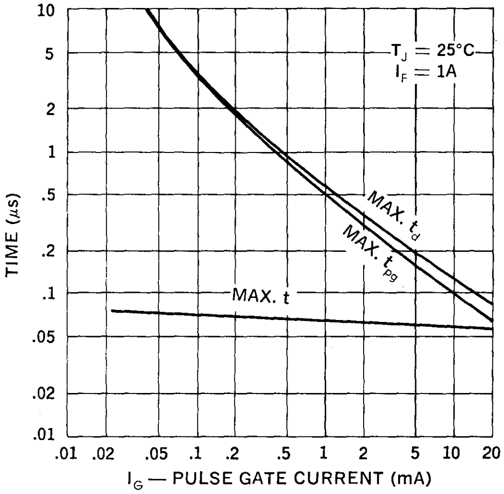


C6 Average Current vs. Ambient Temperature TO-18 Ratings (see note)

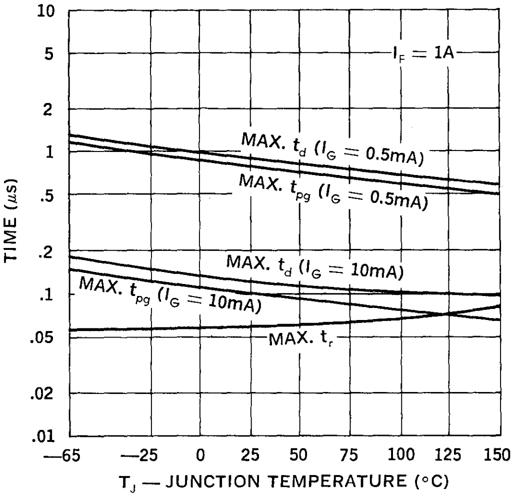


SWITCHING SPEEDS

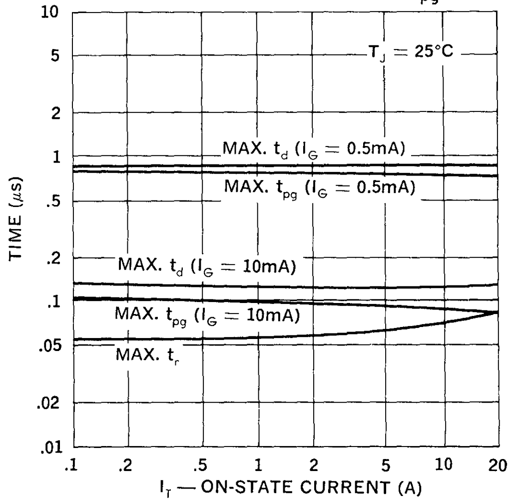
S1 Maximum Delay Time t_d, Rise Time t_r, and Gate Trigger Pulse Width t_{pg} (on)



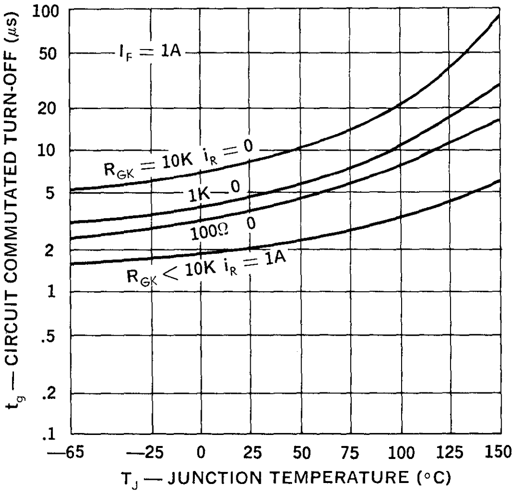
S2 Maximum Delay Time t_d, Rise Time t_r, and Gate Trigger Pulse Width t_{pg} (on)



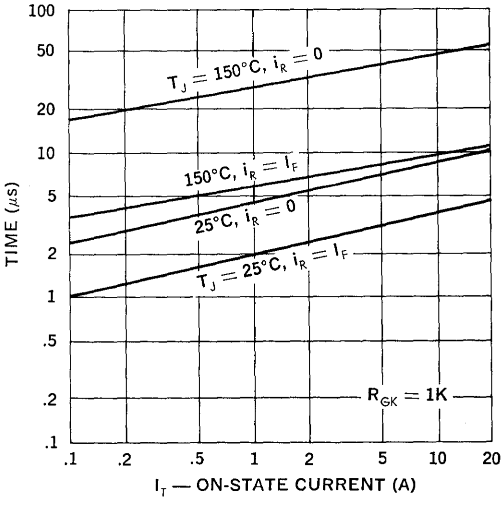
S3 Maximum Delay Time t_d, Rise Time t_r, and Gate Trigger Pulse Width t_{pg} (on)



S4 Maximum Circuit Commutated Turn-off Time t_q



S5 Maximum Circuit Commutated Turn-off Time t_q



POWER TRANSISTORS

5 Amp, 80V, Planar NPN

2N3850
2N3851
2N3852
2N3853

FEATURES

- Collector-Base Voltage: up to 100V
- D.C. Collector Current: 5A
- Fast Switching
- Low Saturation Voltages
- High Gain

DESCRIPTION

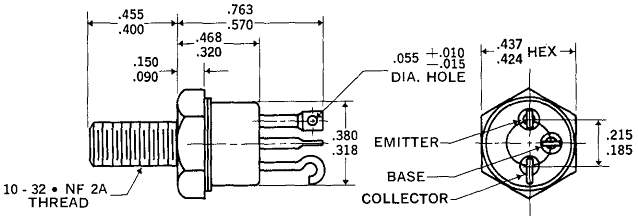
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N3850 **2N3851**	**2N3852** **2N3853**
Collector-Base Voltage, V_{CBO}	100V	60V
Collector-Emitter Voltage, V_{CER}	80V	40V
Emitter-Base Voltage, V_{EBO}	5V	5V
D.C. Collector Current, I_C	5A	5A
Power Dissipation		
125°C Case	30W	30W
Operating and Storage Temperature Range	—65°C to 200°C	

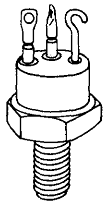
MECHANICAL SPECIFICATIONS

2N3850 2N3851 2N3852 2N3853



Dimensions in inches.

TO-59



UNITRODE

Electrical Specifications (at 25°C unless noted)†

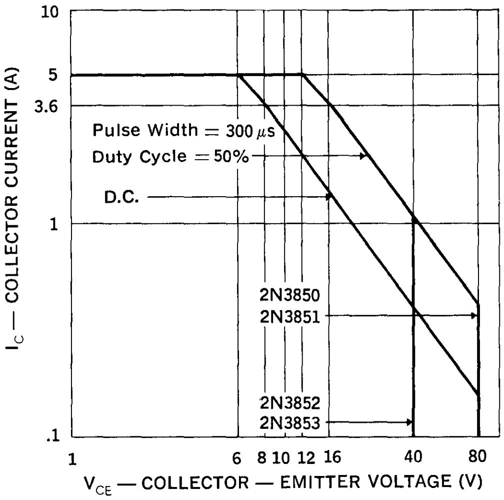
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}				
2N3850, 3852		50	150	—	I_C=1A, V_{CE}=1V
2N3851, 3853		30	90	—	
D.C. Current Gain (Note 1)	h_{FE}				
2N3850, 3852		30	—	—	I_C=2A, V_{CE}=2V
2N3851, 3853		20	—	—	
D.C. Current Gain (Note 1)	h_{FE}				
2N3850, 3852		15	—	—	I_C=5A, V_{CE}=5V
2N3851, 3853		12	—	—	
Collector Saturation Voltage (Note 1)	V_{CE} (sat)				
2N3850, 3852		—	0.25	V	I_C=1A, I_B=50mA
2N3851, 3853		—	0.25	V	I_C=1A, I_B=100mA
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	0.5	V	I_C=2A, I_B=200mA
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	2	V	I_C=5A, I_B=500mA
Base Saturation Voltage (Note 1)	V_{BE} (sat)				
2N3850, 3852		—	1.2	V	I_C=1A, I_B=50mA
2N3851, 3853		—	1.2	V	I_C=1A, I_B=100mA
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.3	V	I_B=2A, I_B=200mA
Collector-Emitter Breakdown Voltage	BV_{CES}				
2N3850, 3851		100	—	V	I_C=10μA, R_{BE}=0
2N3852, 3853		60	—	V	
Collector-Emitter Sustaining Voltage (Note 1)	V_{CEO} (sus)				
2N3850, 3851		80	—	V	I_C=100mA, I_B=0
2N3852, 3853		40	—	V	
Emitter-Base Breakdown Voltage	BV_{EBO}	5	—	V	I_E=10μA, I_C=0
Collector Cutoff Current	I_{CES}				
2N3850, 3851		—	0.1	μA	V_{CE}=80V, R_{BE}=0
2N3852, 3853		—	0.1	μA	V_{CE}=40V, R_{BE}=0
Collector Cutoff Current, 150°C	I_{CES}				
2N3850, 3851		—	50	μA	V_{CE}=80V, R_{BE}=0, T=150°C
2N3852, 3853		—	50	μA	V_{CE}=40V, R_{BE}=0, T=150°C
Collector Capacitance	C_{ob}	—	75	pf	V_{CE}=10V, I=0
Gain-Bandwidth Product	f_T	20	—	MHz	I_C=0.5A, V_{CE}=5V, f=20MHz
Switching Speeds					I_C=1A, $V_{BE(0)}$=1V
Delay Time	t_d	—	50	ns	2N3850, 3852
Rise Time	t_r	—	150	ns	see figure 1
Storage Time	t_s	—	700	ns	2N3851, 3853
Fall Time	t_f	—	200	ns	see figure 2

Notes

1. Pulse length = 250 μs; duty cycle ⩽1%.
2. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs ; duty cycle ⩽1%. Voltage clamped at maximum collector-emitter voltage.

† All values in this table are JEDEC registered.

Maximum Safe Operating Area



Switching Speed Circuit

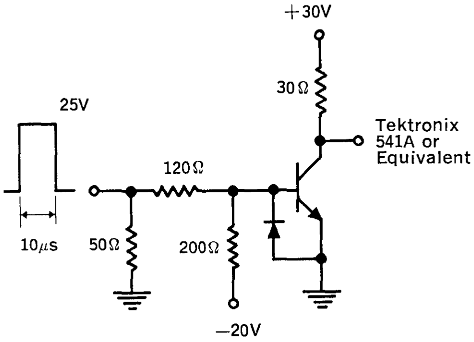


Figure 1

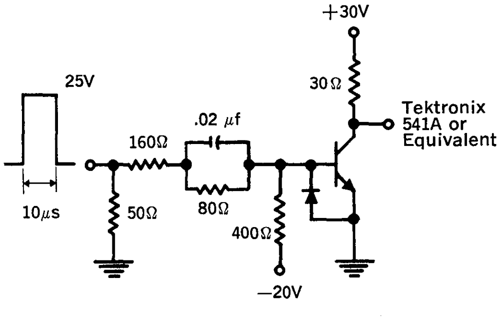


Figure 2

POWER TRANSISTORS

7 Amp, 90V, Planar NPN

2N3878
2N3879

FEATURES

- Collector-Base Voltage: up to 90V
- D.C. Collector Current: 7A
- Fast Switching
- Low Saturation Voltages

DESCRIPTION

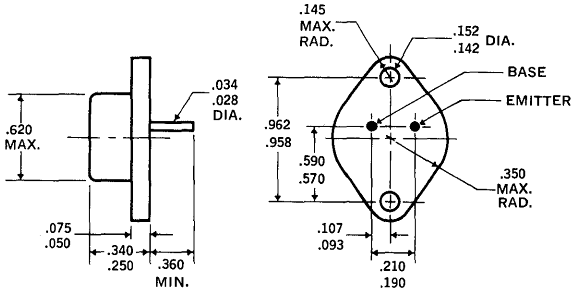
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N3878	2N3879
Collector-Base Voltage, V_{CBO}	120V	120V
Collector-Emitter Voltage, V_{CER}	65V	90V
Emitter-Base Voltage, V_{EBO}	7V	7V
D.C. Collector Current, I_C	7A	7A
Power Dissipation		
100°C Case	20W	20W
Operating and Storage Temperature Range	—65°C to 200°C	

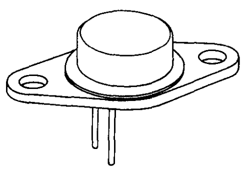
MECHANICAL SPECIFICATIONS

2N3878 2N3879



Dimensions in inches.

TO-66



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	2N3878		2N3879		Units	Test Conditions
		Min.	Max.	Min.	Max.		
D.C. Pulse Current Gain	h_{FE}	50	200	40	—	—	$I_C=0.5A$, $V_{CE}=5V$
D.C. Pulse Current Gain (Note 1)	h_{FE}	20	—	20	80	—	$I_C=4A$, $V_{CE}=5V$
D.C. Pulse Current Gain (Note 1)	h_{FE}	8	—	12	—	—	$I_C=4A$, $V_{CE}=2V$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	2	—	1	V	$I_C=4A$, $I_B=400mA$
Base-Emitter Voltage (Note 1)	V_{BE}	—	2.5	—	2	V	$I_C=4A$, $V_{CE}=2V$
Collector-Emitter Sustaining Voltage	$V_{CEO}(sus)$	50	—	75	—	V	$I_C=200mA$, $I_B=0$ (pulse test)
Collector-Emitter Sustaining Voltage	$V_{CER}(sus)$	65	—	90	—	V	$I_C=200mA$, $I_B=0$, $R_{BE}=50\Omega$ (pulse test)
Emitter-Base Breakdown Voltage	BV_{EBO}	7	—	7	—	V	$I_E=10mA$, $I_C=0$
Collector Cutoff Current	I_{CEX}	—	4	—	4	mA	$V_{CE}=100V$, $V_{EB}=-1.5V$
Collector Cutoff Current, 150°C	I_{CEX}	—	4	—	4	mA	$V_{CE}=100V$, $V_{EB}=-1.5V$
Emitter-Base Cutoff Current	I_{EBO}	—	4	—	2	mA	$V_{EB}=4V$, $I_C=0$
Emitter-Collector Cutoff Current	I_{CEO}	—	5	—	5	mA	$V_{CE}=40V$, $I_B=0$
Collector Capacitance	C_{ob}	—	175	—	175	μμf	$V_{CB}=10V$, $I_E=0$, $f=10MHz$
Gain-Bandwidth Product	f_t	40	—	40	—	MHz	$I_C=500mA$, $V_{CE}=10V$, $f=10MHz$
Switching Speeds Delay Time	t_d	—	—	—	40	ns	$I_C=4A$, $V_{CC}=30V$ $I_{B1}=-I_{B2}=400mA$
Rise Time	t_r	—	—	—	400	ns	
Storage Time	t_s	—	—	—	800	ns	
Fall Time	t_f	—	—	—	400	ns	

Note: 1. Pulse width = 300 μs; duty cycle ⩽ 2%.

POWER TRANSISTORS

5 Amp, 80V,Planar NPN

2N3996
2N3997
2N3998
2N3999

FEATURES

- Meets MIL-S-19500/374*
- Collector-Base Voltage: p to 100V
- D.C. Collector Current: 5A
- Fast Switching
- Beta Guaranteed at 3 Current Levels

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

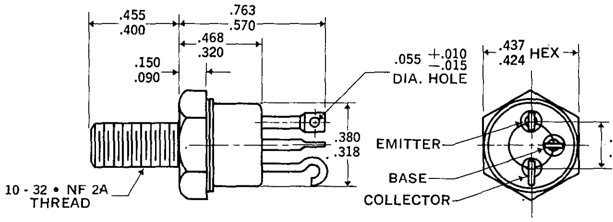
ABSOLUTE MAXIMUM RATINGS

	2N3996 **2N3997** **2N3998** **2N3999**
Collector-Base Voltage, V_{CBO}	100V
Collector-Emitter Voltage, V_{CER}	80V
Emitter-Base Voltage, V_{EBO}	8V
D.C. Collector Current, I_C	5V
Power Dissipation	
25°C Ambient	2W
100°C Case	30W
Operating and Storage Temperature Range	—65°C to 200°C

*This series also available as JAN and JANTX types fully tested to MIL-S-19500/374

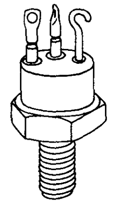
MECHANICAL SPECIFICATIONS

2N3996 2N3997

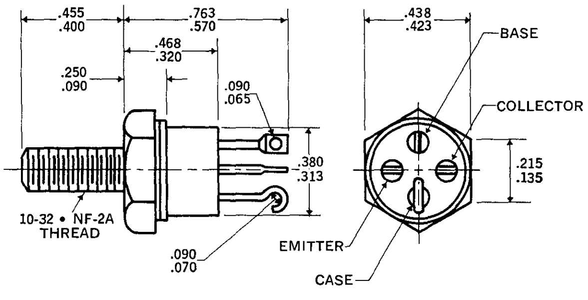


Dimensions in inches.

TO-59

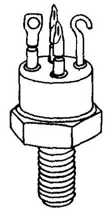


2N3998 2N3999



Dimensions in inches.

TO-111



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	2N3996* 2N3998*		2N3997* 2N3999*		Units	Test Conditions
		Min.	Max.	Min.	Max.		
D.C. Current Gain	h_{FE}	30	—	60	—	—	I_C=50 mA, V_{CE}=2V
D.C. Current Gain (Note 1)	h_{FE}	40	120	80	240	—	I_C=1A, V_{CE}=2V
D.C. Current Gain (Note 1)	h_{FE}	15	—	20	—	—	I_C=5A, V_{CE}=5V
D.C. Current Gain, —55°C (Note 1)	h_{FE}	10	—	20	—	—	I_C=1A, V_{CE}=2V
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	0.25	—	0.25	V	I_C=1A, I_B=100 mA
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	2	—	2	V	I_C=5A, I_B=500 mA
Base Saturation Voltage (Note 1)	V_{BE} (sat)	0.6	1.2	0.6	1.2	V	I_C=1A, I_B=100 mA
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.6	—	1.6	V	I_C=5A, I_B=500 mA
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}	80	—	80	—	V	I_C=50 mA, I_B=0
Emitter-Base Cutoff Current	I_{EBO}	—	0.5	—	0.5	μA	V_{BE}=5V, I_C=0
Emitter-Base Cutoff Current	I_{EBO}	—	10	—	10	μA	V_{BE}=8V, I_C=0
Collector Cutoff Current	I_{CES}	—	5	—	5	μA	V_{CE}=90V, R_{BE}=0
Collector Cutoff Current	I_{CEO}	—	10	—	10	μA	V_{CE}=60V, I_B=0
Collector Cutoff Current, 150°C	I_{CES}	—	50	—	50	μA	V_{CE}=90, R_{BE}=0
Collector Capacitance	C_{ob}	—	150	—	150	pf	V_{CB}=10V, I_E=0, f=1 MHz
A.C. Current Gain (High Frequency)	h_{fe}	4	—	4	—	—	I_C=1A, V_{CE}=5V, f=10 MHz
Switching Speeds Turn-on Time	t_{on}	—	0.3	—	0.3	μs	I_C=1A
Turn-off Time	t_{off}	—	1.5	—	2	μs	I_{b1}=100mA, I_{b2}= —100 mA

Notes:

1. Pulse Length=300μs; duty cycle ⩽2%

† All Values in This Table are JEDEC Registered

*Also applicable to JAN and JANTX versions

POWER TRANSISTORS

10 Amp, 70V, Planar NPN

2N4150

FEATURES

- Collector-Base Voltage: 100V
- Peak Collector Current: 10A
- Fast Switching
- Low Saturation Voltage
- 15 Watt Capability

DESCRIPTION

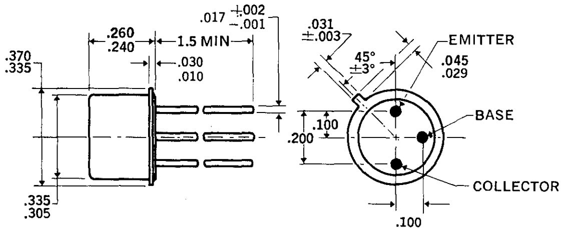
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

Collector-Base Voltage, V_{CBO}	100V
Collector-Emitter Voltage, V_{CEO}	70V
Emitter-Base Voltage, V_{EBO}	5V
Peak Collector Current, I_C	10A
Power Dissipation	
25°C Ambient	1.25W
100°C Case	15W
Operating and Storage Temperature Range	—65°C to 200°C

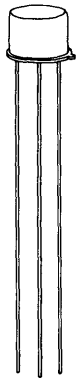
MECHANICAL SPECIFICATIONS

2N4150



Dimensions in inches.

TO-5



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test		Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 2)		h_{FE}	50	—	—	$I_C = 1A$, $V_{CE} = 1V$
D.C. Current Gain (Note 2)		h_{FE}	40	120	—	$I_C = 5A$, $V_{CE} = 2V$
D.C. Current Gain (Note 2)		h_{FE}	10	—	—	$I_C = 10A$, $V_{CE} = 5V$
Collector Saturation Voltage (Note 2)		V_{CE} (sat)	—	0.6	V	$I_C = 5A$, $I_B = .5A$
Collector Saturation Voltage (Note 2)		V_{CE} (sat)	—	2.5	V	$I_C = 10A$, $I_B = 1A$
Base Saturation Voltage (Note 2)		V_{BE} (sat)	—	1.5	V	$I_C = 5A$, $I_B = .5A$
Base Saturation Voltage (Note 2)		V_{BE} (sat)	—	2.5	V	$I_C = 10A$, $I_B = 1A$
Collector-Emitter Sustaining Voltage (Note 2)		V_{CEO} (sus)	70	—	V	$I_C = 100mA$, $I_B = 0$
Emitter-Base Breakdown Voltage		BV_{EBO}	5	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current		I_{CEX}	—	10	μA	$V_{CE} = 100V$, $V_{BE} = -.5V$
Collector Cutoff Current		I_{CBO}	—	0.1	μA	$V_{CE} = 60V$, $I_E = 0$
Collector Cutoff Current, 150°C		I_{CEX}	—	100	μA	$V_{CE} = 60V$, $V_{BE} = -.5V$, $T = 150°C$
A.C. Current Gain		h_{fe}	1.5	—	—	$I_C = .2A$, $V_{CE} = 10V$, $f = 10MHz$
Switching Speeds	Rise Time	t_r	—	0.2	μs	$V_{CC} = 30V$ $I_C = 5A$ $I_{b1} = -I_{b2} = 0.5A$
	Storage Time	t_s	—	2.0	μs	
	Fall Time	t_f	—	0.2	μs	

Notes:

1. The device may be switched between maximum rated collector current and maximum rated collector — emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Pulse length = 300 μs; duty cycle ⩽2%.

†All values in this table are JEDEC registered.

POWER TRANSISTORS

10 Amp, 70V, Planar NPN

JAN & JANTX 2N4150

FEATURES

- Meets MIL-S-19500/394
- Collector-Base Voltage: up to 100V
- Peak Collector Current: 10A
- Fast Switching
- Low Saturation Voltage

DESCRIPTION

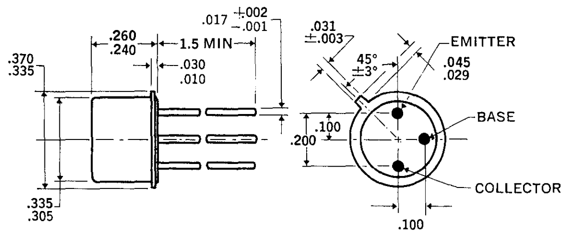
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	JAN & JANTX 2N4150
Collector-Base Voltage, V_{CBO}	100V
Collector-Emitter Voltage, V_{CER}	70V
Emitter-Base Voltage, V_{EBO}	5V
Peak Collector Current, I_C	10A
Power Dissipation	
25°C Ambient	1.5W
100°C Case	5W
Operating and Storage Temperature Range	—65°C to 200°C

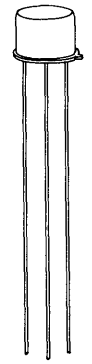
MECHANICAL SPECIFICATIONS

JAN & JANTX 2N4150



Dimensions in inches.

TO-5



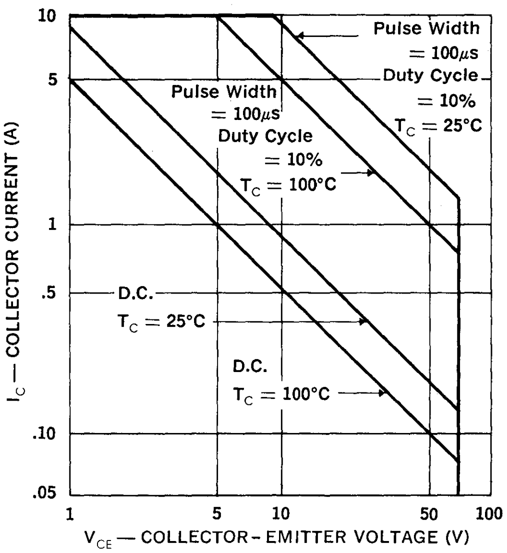
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

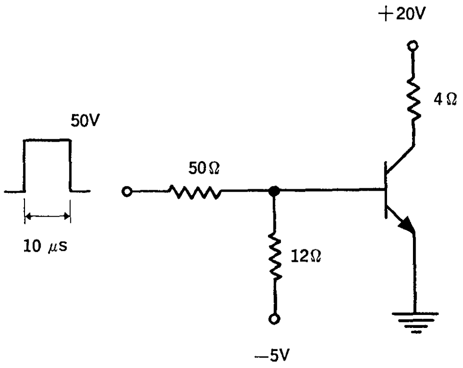
Test	Symbol	Min.	Max.	Units	/394 Sub group	Method	MIL-STD-750
							Test conditions
Visual and Mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Base Breakdown Voltage	BV_{CBO}	100	—	Vdc	A-2	3001	I_C = 10uAdc; Cond. D
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}	70	—	Vdc	A-2	3011	I_C = 0.1Adc; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}	7	—	Vdc	A-2	3026	I_E = 10uAdc; Cond. D
Collector-Emitter Cutoff Current	I_{CEO}	—	10	μAdc	A-2	3041	V_{CE} = 60Vdc; Cond. D
Collector-Emitter Cutoff Current	I_{CEX}	—	10	μAdc	A-2	3041	V_{CE} = 10Vdc, V_{EB} = 0.5Vdc; Cond. A
Collector-Base Cutoff Current	I_{CBO}	—	0.1	μAdc	A-2	3036	V_{CB} = 80Vdc; Cond. D
Emitter-Base Cutoff Current	I_{EBO}	—	0.1	μAdc	A-2	3061	V_{EB} = 5Vdc; Cond. D
D.C. Current Gain (Note 1)	h_{FE}	40	120	—	A-3	3076	I_C = 5Adc, V_{CE} = 5Vdc
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	A-3	3076	I_C = 10Adc, V_{CE} = 5Vdc
D.C. Current Gain (Note 1)	h_{FE}	50	—	—	A-3	3076	I_C = 1Adc, V_{CE} = 5Vdc
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	0.6	Vdc	A-4	3071	I_C = 5Adc, I_B = 0.5Adc
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	2.5	Vdc	A-4	3071	I_C = 10Adc, I_B = 1Adc
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	A-4	3066	I_C = 5Adc, I_B = 0.5Adc; Cond. A
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	2.5	Vdc	A-4	3066	I_C = 10Adc, I_B = 1Adc; Cond. A
A.C. Current Gain	h_{fe}	40	160	—	A-4	3206	I_C = 50mAdc, V_{CE} = 5Vdc, f = 1KHz
Gain-Bandwidth Product	f_T	15	75	MHz	A-4	3306	I_C = 0.2Adc, V_{CE} = 10Vdc, f = 10MHz
Output Capacitance	C_{ob}	—	350	pf	A-4	3236	V_{CB} = 10Vdc, I_E = 0, f = 1MHz
Thermal Resistance	θ_{J-C}	—	20	^{o}C/w	C-1	3151	
Switching Speeds Delay Time	t_d	—	50	ns	A-4	—	V_{CC} = 20V I_C = 5A I_{B1} = I_{B2}, I_{B1} = 0.5A
Rise Time	t_r	—	500	ns	A-4	—	
Storage Time	t_s	—	1.5	μs	A-4	—	
Fall Time	t_f	—	500	ns	A-4	—	
100°C							
Forward-Biased Second Breakdown	$I_{S/B}$	5	—	Adc	B-6	3005	V_{CE} — 1Vdc, t = 60Sec,
Forward-Biased Second Breakdown	$I_{S/B}$	70	—	mAdc	B-6	3005	V_{CE} — 70Vdc, t = 60Sec,
Unclamped Reverse Biased Second Breakdown	$E_{S/B}$	12.5	—	mj	B-7	—	I_C = 5Adc, L = 1mh
Clamped Reverse Biased Second Breakdown	$E_{S/B}$	200	—	mj	B-8	—	I_C = 5Adc, L = 40mh, V_{clamp} = 70V
150°C							
Collector-Emitter Cutoff Current	I_{CEX}	—	100	μAdc	A-5	3041	V_{CE} = 80Vdc, V_{EB} = 0.5Vdc, Cond. A
—55°C							
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	A-5	3076	I_C = 5Adc, V_{CE} = 5Vdc

Note: 1. **Pulse length = 300μs; duty cycle ⩽2%.**

D.C. Safe Operating Area Curve



Switching Speed Circuit



$I_C = 5A,\ I_{B1} = -I_{B2} = .5A$

SCRs

.8 Amp RMS, Plastic

2N5060-2N5064

FEATURES

- Voltage Ratings: to 200V
- Forward Current: 0.8A RMS
- Surge Current: 6A, 8ms
- Gate Sensitivity: 200μa max.
- Planar Passivated Process
- TO-92 Plastic Package

DESCRIPTION

This plastic series features very fast switching performance, low forward voltage drop and a high degree of reliability and parameter stability. All units are fully planar passivated and are packaged in a rugged TO-92 case, constructed from a special epoxy compound that features excellent moisture resistance providing stable performance under high humidity conditions and good thermal transfer characteristics.

TYPICAL APPLICATIONS

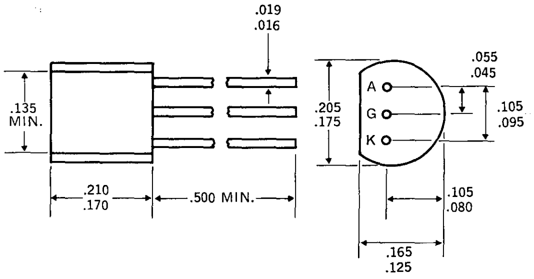
Lamp Driving
Relay Driving
Relay Replacement
Alarm Systems
Counters
Process Controls
Pressure Controls
Display Systems
Touch Switches
Remote Controls
High Current SCR Driving
Timers
Temperature Controls
and many other current sensing and control applications.

ABSOLUTE MAXIMUM RATINGS

	2N5060	2N5061	2N5062	2N5063	2N5064
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V
On-State Current, $I_{T(RMS)}$	0.8A				
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	6A				
Peak Gate Current, I_{GM}	1.0A				
Peak Gate Power, P_{GM}	1W				
Average Gate Power·$P_{G(AV)}$	0.01W				
Reverse Gate Voltage, V_{GR}	6V				
Storage Temperature Range	−65°C to +150°C				
Operating Temperature Range	−65°C to +125°C				

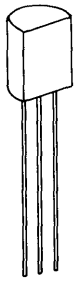
MECHANICAL SPECIFICATIONS

2N5060-2N5064



Dimensions in inches.

TO92



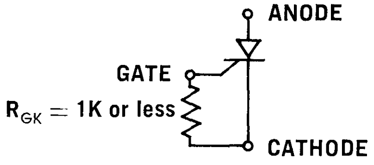
ELECTRICAL SPECIFICATIONS (at 25°C unless noted, $R_{GK} = 1000$ ohms)

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	— —	0.1 —	1.0 50	µA µA	V_{DRM} = Rating V_{DRM} = Rating, T = 125°C
Reverse Current	I_{RRM}	— —	0.1 —	1.0 50	µA µA	V_{RRM} = Rating V_{RRM} = Rating, T = 125°C
Gate Trigger Current	I_{GT}	— —	— —	200 350	µA µA	V_D = 7V, R_L = 100 ohms V_D = 7V, R_L = 100 ohms, T = −65°C
Gate Trigger Voltage	V_{GT}	— — 0.1	0.6 — —	0.8 1.2 —	V V V	V_D = 7V, R_L = 100 ohms V_D = 7V, R_L = 100 ohms, T = −65°C V_D = Rating, R_L = 100 ohms, T = 125°C
Peak On-State Voltage	V_{TM}	—	1.2	1.7	V	I_{TM} = 1 Amp Pulse
Holding Current	I_H	— —	0.7 —	5.0 10.0	mA mA	V_D = 7V, T = 25°C V_D = 7V, T = −65°C
Critical Rate of Rise — Off-State Voltage	dv/dt	—	75	—	V/µs	V_D = Rated
Turn-on Time	t_{on}	—	0.1	—	µs	I_G = 10mA, I_T = 1A, V_D = 30V
Circuit Commutated Turn-off Time	t_q	—	8	—	µs	$I_T = I_R$ = 1A

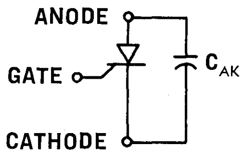
Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

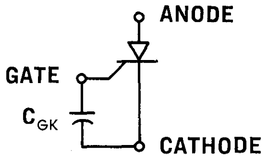
DESIGN CONSIDERATIONS

1. The 2N5060 Series SCRs are guaranteed to block their rated voltage over the rated operating temperature when a resistance of 1000 ohms or less is connected from gate to cathode as shown.

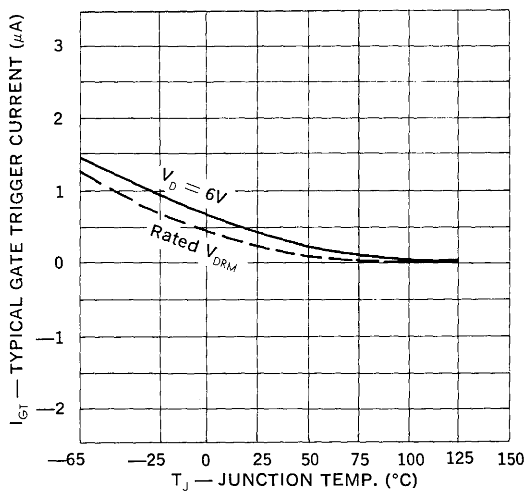


2. In cases where the SCR may be subjected to fast rising anode voltages a capacitor can be connected between anode or gate and cathode as shown, to serve as protection against dv/dt firing.

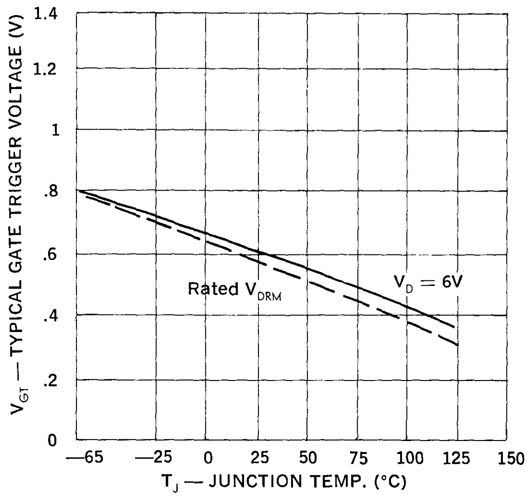




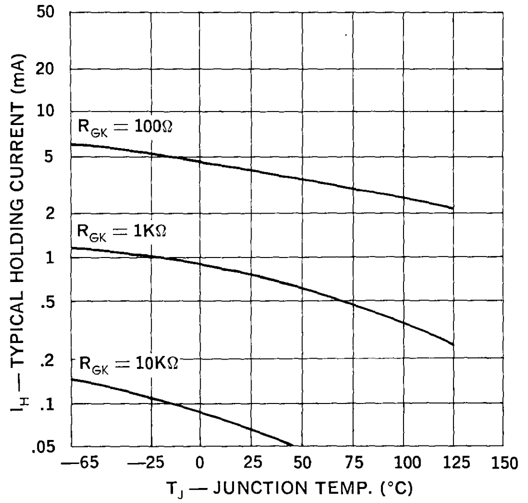
Gate Trigger Current vs. Junction Temp.



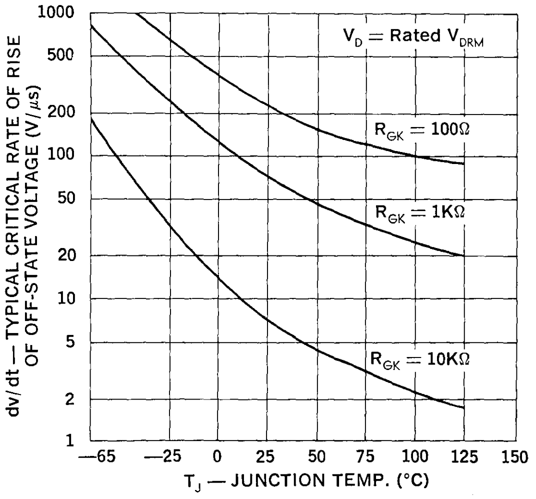
Gate Trigger Voltage vs. Junction Temp.



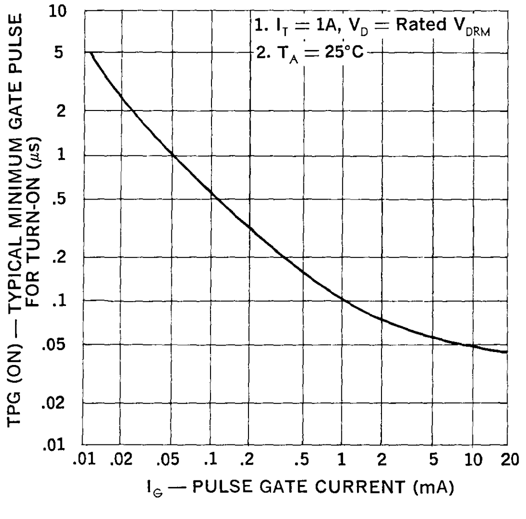
Holding Current vs. Junction Temp.



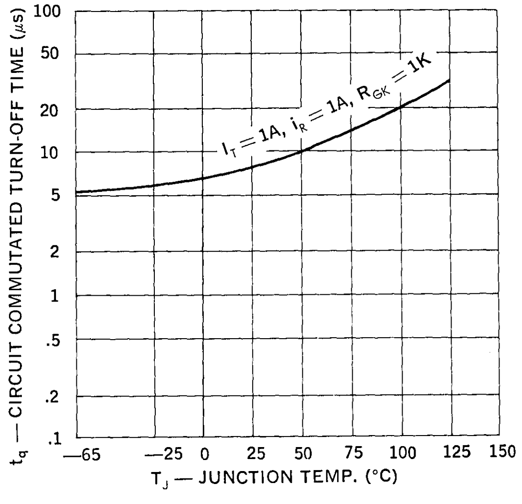
dv/dt vs. Junction Temp.



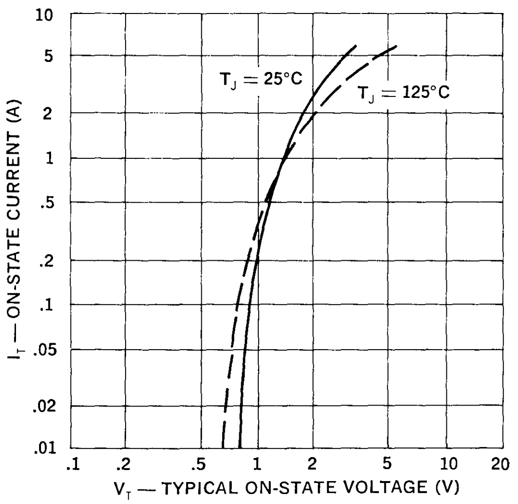
Gate Pulse For Turn-On
vs. Pulse Gate Current



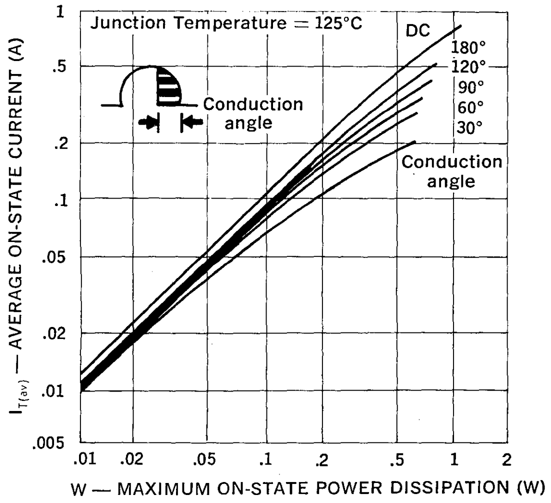
Forward Blocking Recovery Time
vs. Junction Temp.



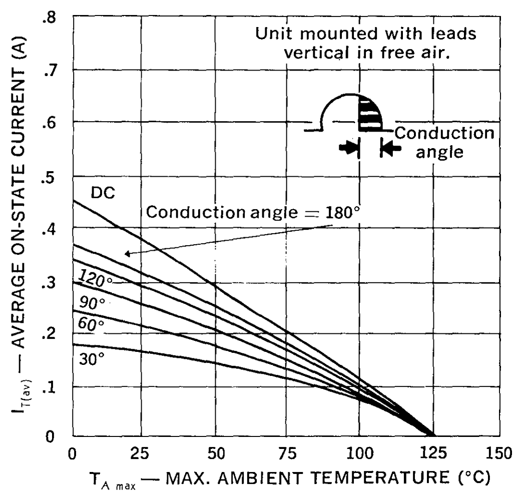
Current vs. On-State Voltage



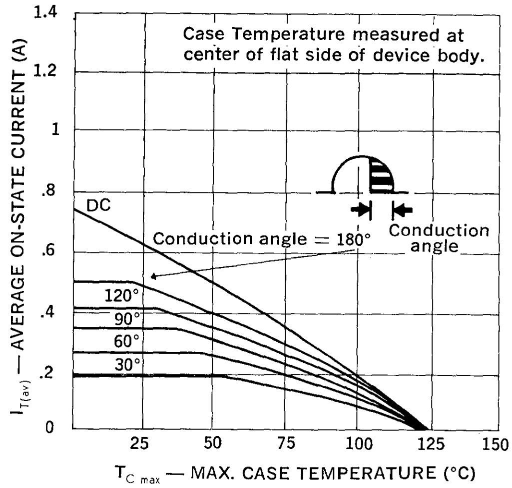
Current vs. Power Dissipation



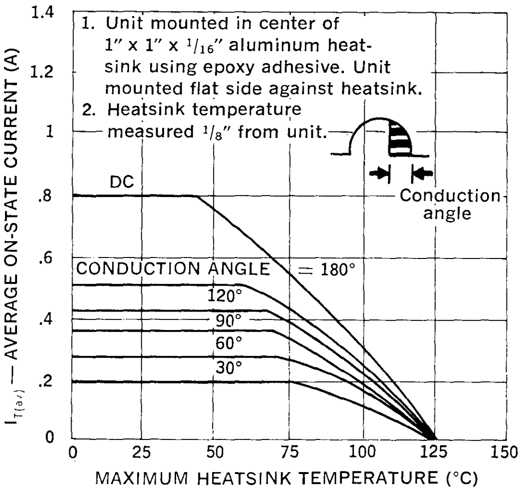
Current vs. Ambient Temp.



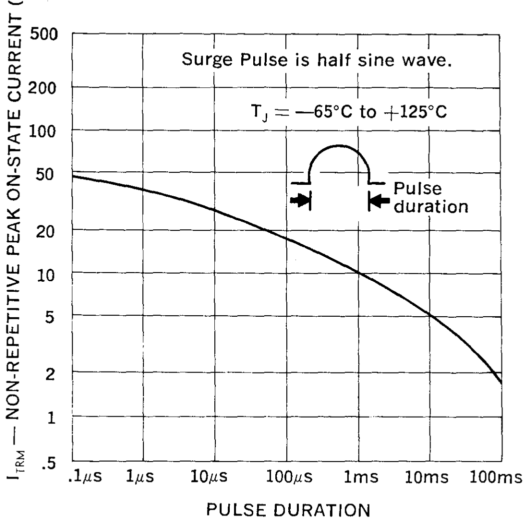
Current vs. Case Temp.



Current vs. Heatsink Temp.



Surge Rating vs. Pulse Duration



POWER TRANSISTORS

5 Amp, 150V, Planar NPN

2N5487 2N5488 5487-1 5487-3 5488-1 5488-3

FEATURES

- Collector-Base Voltage: up to 150V
- D.C. Collector Current: 5A
- Peak Collector Current: 10A
- Fast Switching
- Low Saturation Voltage
- High Gain

DESCRIPTION

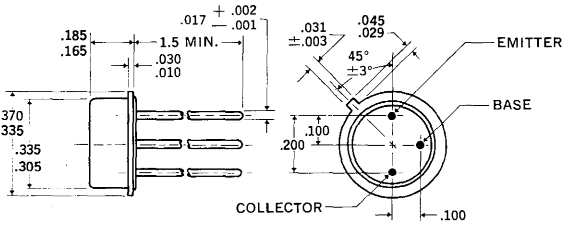
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N5487 5487-1 5487-3	2N5488 5488-1 5488-3
Collector-Base Voltage, V_{CBO}	120V	150V
Collector-Emitter Voltage, V_{CER}	120V	150V
Emitter-Base Voltage, V_{EBO}	8V	8V
D.C. Collector Current, I_C	5A	10A
Peak Collector Current, I_C	10A	10A
Power Dissipation		
25°C Ambient	1.25W	1.25W
100°C Case	15W	15W
Operating and Storage Temperature Range	–65°C to 200°C	

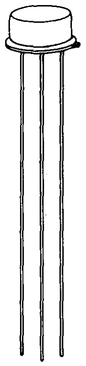
MECHANICAL SPECIFICATIONS

2N5487 2N5488

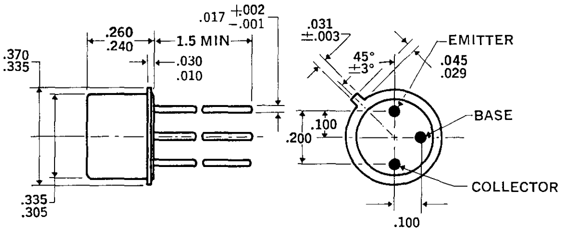


Dimensions in inches.

Pancake TO-5

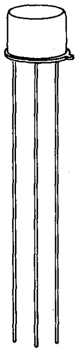


5487-1 5488-1



Dimensions in inches.

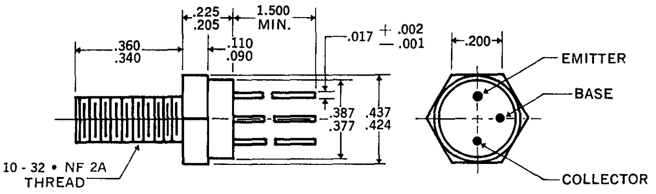
TO-5



UNITRODE

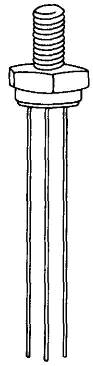
MECHANICAL SPECIFICATIONS

5487-3 5488-3



Dimensions in inches.

Low Profile
7/16 Hex



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

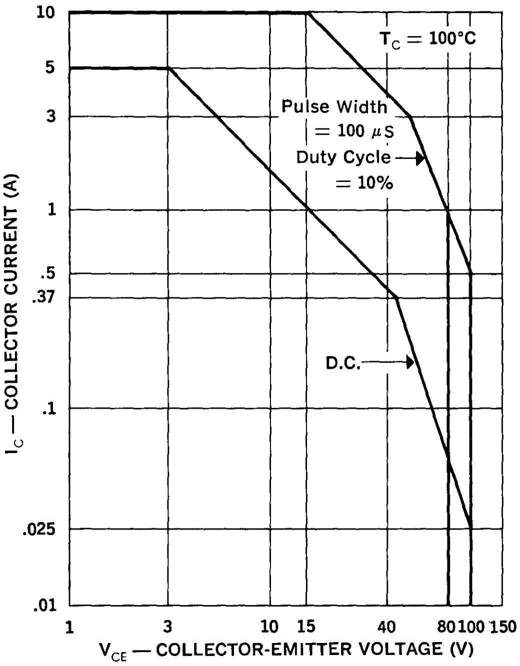
Test	Symbol	2N5487 Min.	2N5487 Max.	2N5488 Min.	2N5488 Max.	Units	Test Conditions
D.C. Current Gain (Note 3)	h_{FE}	100	300	40	120	—	$I_C = 1A, V_{CE} = 2V$
D.C. Current Gain	h_{FE}	80		35		—	$I_C = 50mA, V_{CE} = 2V$
D.C. Current Gain (Note 3)	h_{FE}	25		15		—	$I_C = 5A, V_{CE} = 5V$
Collector Saturation Voltage (Note 3)	V_{CE} (sat)		0.25		0.25	V	$I_C = 1A, I_B = 100mA$
Collector Saturation Voltage (Note 3)	V_{CE} (sat)		1.0		1.0	V	$I_C = 5A, I_B = 500mA$
Base Saturation Voltage (Note 3)	V_{BE} (sat)		1.2		1.2	V	$I_C = 1A, I_B = 100mA$
Base Saturation Voltage (Note 3)	V_{BE} (sat)		1.8		1.8	V	$I_C = 5A, I_B = 500mA$
Collector-Emitter Breakdown Voltage (Note 3)	BV_{CER}	120		150		V	$I_C = 10mA, R_{BE} = 10$ ohms
Collector-Emitter Breakdown Voltage (Note 3)	BV_{CEO}	80		100		V	$I_C = 100mA, I_B = 0$
Emitter-Base Breakdown Voltage	BV_{EBO}	8		8		V	$I_E = 10\mu A, I_C = 0$
Collector Cutoff Current	I_{CES}		0.1			μA	$V_{CE} = 80V, R_{BE} = 0$
Collector Cutoff Current	I_{CES}				0.1	μA	$V_{CE} = 100V, R_{BE} = 0$
Collector Cutoff Current	I_{CES}		10			μA	$V_{CE} = 120V, R_{BE} = 0$
Collector Cutoff Current	I_{CES}				10	μA	$V_{CE} = 150V, R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}		50			μA	$V_{CE} = 80V, R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}				50	μA	$V_{CE} = 100V, R_{BE} = 0$
Collector Capacitance	C_{ob}		75		75	pf	$V_{CB} = 10V, I_E = 0$
A.C. Current Gain	h_{fe}	4		4			$I_C = 200mA, V_{CE} = 5V, f = 10MHz$
Switching Turn-on Time	t_{on}		125		125	ns	$I_C = 1A$ 2N5487 See Fig. 1
Speeds Turn-off Time	t_{off}		450		550	ns	2N5488 See Fig. 2

Notes:

1. The device may be switched between maximum rated collector current and maximum rated collector-emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Steady state limits based on a maximum junction temperature of 200°C. High pulse power dissipation may cause second breakdown. Consult the factory on high power, low duty cycle application.
3. Pulse length = 300 μs; duty cycle ⩽2%.

†All values in this table are JEDEC registered.

Maximum Safe Operating Area



Switching Speed Circuit

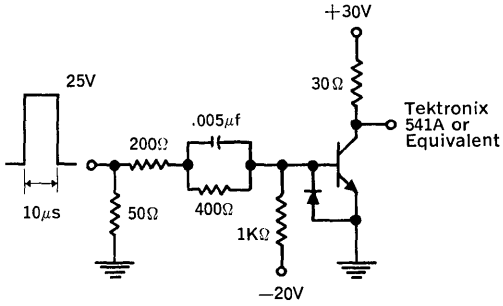


Figure 1

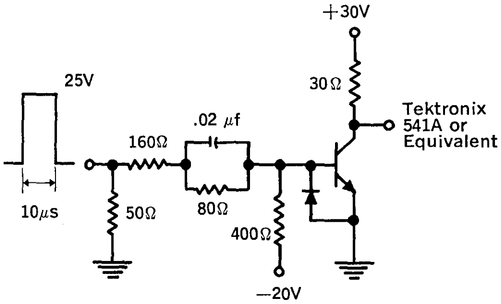


Figure 2

POWER TRANSISTORS

10 Amp, 120V, Planar NPN

2N5552 5552-4

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 10A
- Fast Switching
- Beta Guaranteed at 3 Current Levels

DESCRIPTION

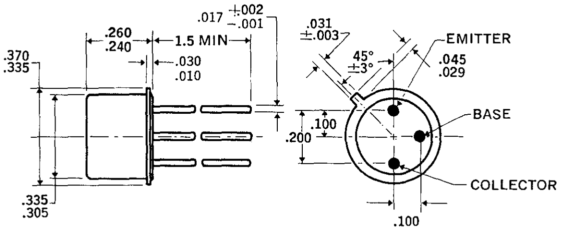
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N5552 **5552-4**
Collector-Base Voltage, V_{CBO}	120V
Collector-Emitter Voltage, V_{CEO}	80V
Emitter-Base Voltage, V_{EBO}	7V
D.C. Collector Current, I_C	10A
Power Dissipation	
25°C Ambient	1.25W
100°C Case	15W
Operating and Storage Temperature Range	–65°C to 200°C

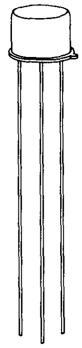
MECHANICAL SPECIFICATIONS

2N5552

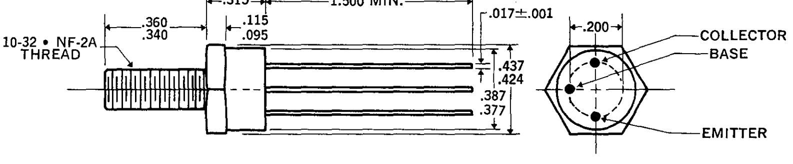


Dimensions in inches.

TO-5

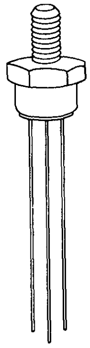


5552-4



Dimensions in inches.

TO-5 (Stud)



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

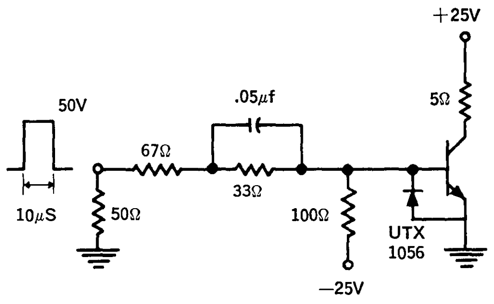
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain	h_{FE}	40	250	—	$I_C = 0.5A$, $V_{CE} = 2V$
D.C. Current Gain (Note 2)	h_{FE}	50	150	—	$I_C = 5A$, $V_{CE} = 5V$
D.C. Current Gain (Note 2)	h_{FE}	30	—	—	$I_C = 10A$, $V_{CE} = 5V$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	0.5	V	$I_C = 5A$, $I_B = 0.5A$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	1.0	V	$I_C = 10A$, $I_B = 1A$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	1.3	V	$I_C = 5A$, $I_B = 0.5A$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	1.8	V	$I_C = 10A$, $I_B = 1A$
Collector-Emitter Sustaining Voltage (Note 2)	BV_{CER}	120	—	V	$I_C = 100mA$, $R_{BE} = 10\Omega$
Collector-Emitter Sustaining Voltage (Note 2)	V_{CEO} (sus)	80	—	V	$I_C = 100mA$, $I_B = 0$
Collector-Emitter Voltage (Note 2)	BV_{CES}	120	—	V	$I_C = 0.2\mu A$, $R_{BE} = 0$
Emitter-Base Breakdown Voltage	BV_{EBO}	7	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current	I_{CES}	—	0.2	μA	$V_{CE} = 120V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}	—	0.1	mA	$V_{CE} = 80$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance	C_{obo}	—	150	pf	$V_{CB} = 10$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain	h_{fe}	3	—	—	$I_C = 0.5A$, $V_{CE} = 5V$ $f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	—	100	ns	$I_C = 5A$
Turn-off Time	t_{off}	—	700	ns	$I_{b1} = 250ma$ $I_{b2} = -250ma$

Notes:

1. The device may be switched between maximum rated collector current and maximum rated collector — emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Pulse length = 300 μs; duty cycle ⩽2%.

† All values in this table are JEDEC registered.

Switching Speed Circuit



POWER TRANSISTORS

20 Amp, 80V, Planar NPN

2N5658
2N5659

FEATURES

- Collector-Base Voltage: up to 120V
- Peak Collector Current: 20A
- High Gain
- Fast Switching

DESCRIPTION

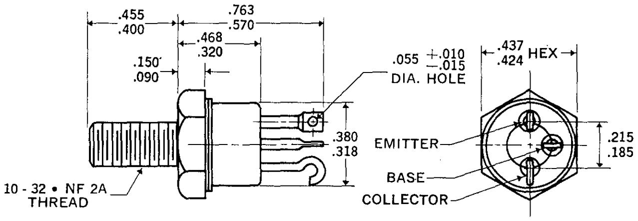
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N5658 **2N5659**
Collector-Base Voltage, V_{CBO}	120V
Collector-Emitter Voltage, V_{CEO}	80V
Emitter-Base Voltage, V_{EBO}	7V
Peak Collector Current, I_C	20A
Power Dissipation	
100°C Case	30W
Operating and Storage Temperature Range	—65°C to 200°C

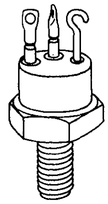
MECHANICAL SPECIFICATIONS

2N5658

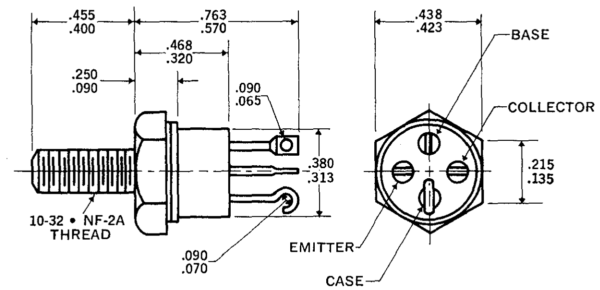


Dimensions in inches.

TO-59



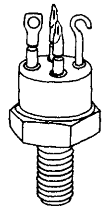
2N5659



Dimensions in inches.

Collector Isolated from Case.

TO-111



Electrical Specifications (at 25°C unless noted)†

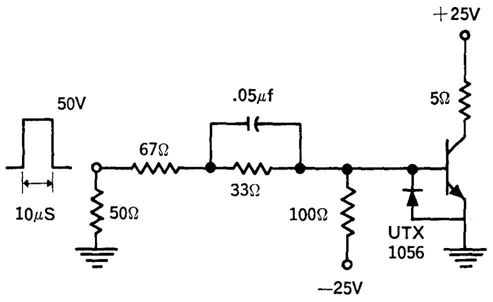
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain	h_{FE}	40	250	—	$I_C = 0.5A$, $V_{CE} = 2V$
D.C. Current Gain	h_{FE}	50	150	—	$I_C = 5A$, $V_{CE} = 5V$ (Note 1)
D.C. Current Gain	h_{FE}	30		—	$I_C = 10A$, $V_{CE} = 5V$ (Note 1)
Collector Saturation Voltage	V_{CE} (sat)		.5	V	$I_C = 5A$, $I_B = 0.5A$ (Note 1)
Collector Saturation Voltage	V_{CE} (sat)		1.0	V	$I_C = 10A$, $I_B = 1A$ (Note 1)
Base Saturation Voltage	V_{BE} (sat)		1.3	V	$I_C = 5A$, $I_B = 0.5A$ (Note 1)
Base Saturation Voltage	V_{BE} (sat)		1.8	V	$I_C = 10A$, $I_B = 1A$ (Note 1)
Collector-Emitter Breakdown Voltage	BV_{CER}	120		V	$I_C = 100mA$, $R_{BE} = 10\Omega$
Collector-Emitter Breakdown Voltage	BV_{CES}	120		V	$I_C = 0.2\mu A$, $R_{BE} = 0$
Collector-Emitter Breakdown Voltage	BV_{CEO}	80		V	$I_C = 100mA$, $I_B = 0$ (Note 1)
Emitter-Base Breakdown Voltage	BV_{EBO}	7		V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current	I_{CES}		0.2	µA	$V_{CE} = 120V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}		0.1	mA	$V_{CE} = 80V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance	C_{obo}		150	pf	$V_{CB} = 10V$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain	h_{fe}	3			$I_C = 0.5A$, $V_{CE} = 5V$, $f = 10MHz$
Switching Speeds Turn-on Time	t_{on}		150	ns	$I_C = 5A$
Switching Speeds Turn-off Time	t_{off}		800	ns	$I_{b1} = 250mA$ $I_{b2} = -250mA$ Note 2.

Notes:

1. Pulse length = 300 µs; duty cycle ≤2%
2. Measured in saturated switching speed circuit.

† All Values in This Table are JEDEC Registered.

Switching Speed Circuit



POWER TRANSISTORS
1 Amp, 300V, Planar NPN

2N5660
2N5661
2N5662
2N5663

FEATURES
- Collector-Base Voltage: up to 400V
- D.C. Collector Current: 1A
- Peak Collector Current: 3A
- Fast Switching

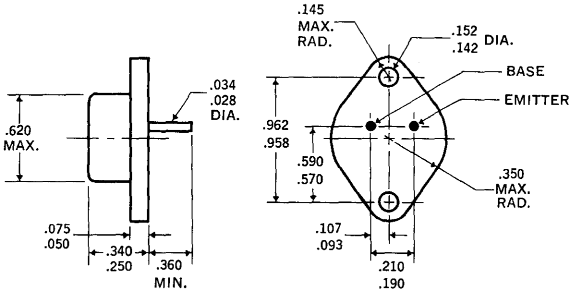
DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

ABSOLUTE MAXIMUM RATINGS

	2N5660	2N5661	2N5662	2N5663
Collector-Base Voltage, V_{CBO}	250V	400V	250V	400V
Collector-Emitter Voltage, V_{CEO}	200V	300V	200V	300V
Emitter-Base Voltage, V_{EBO}	6V	6V	6V	6V
D.C. Collector Current, I_C	1A	1A	1A	1A
Peak Collector Current, I_C	3A	3A	3A	3A
Power Dissipation				
25°C Ambient	—	—	1.2W	1.2W
100°C Case	20W	20W	15W	15W
Operating and Storage Temperature Range				−65°C to 200°C

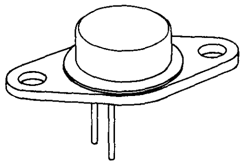
MECHANICAL SPECIFICATIONS

2N5660 2N5661

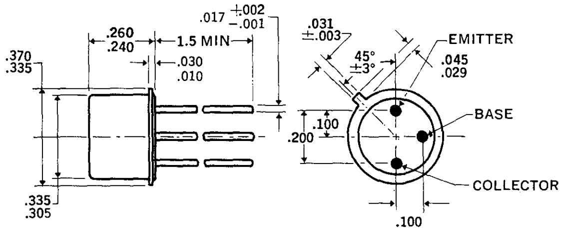


Dimensions in inches.

TO-66

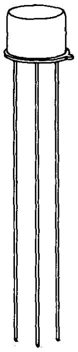


2N5662 2N5663



Dimensions in inches.

TO-5



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	2N5660 2N5662 Min.	Max.	2N5661 2N5663 Min.	Max.	Units	Test Conditions
D.C. Current Gain	h_{FE}	40	—	25	—	—	$I_C = 50mA, V_{CE} = 2V$
D.C. Current Gain (Note 2)	h_{FE}	40	120	25	75	—	$I_C = 0.5A, V_{CE} = 5V$
D.C. Current Gain (Note 2)	h_{FE}	15	—	15	—	—	$I_C = 1.0A, V_{CE} = 5V$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	0.4	—	0.4	V	$I_C = 1.0A, I_B = 0.1A$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	1.2	—	1.2	V	$I_C = 1.0A, I_B = 0.1A$
Collector-Emitter Breakdown Voltage (Note 2)	V_{CER} (sus)	250	—	400	—	V	$I_C = 10mA, R_{BE} = 100\ \Omega$
Collector-Emitter Breakdown Voltage (Note 2)	V_{CEO} (sus)	200	—	300	—	V	$I_C = 10mA, I_B = 0$
Emitter-Base Breakdown Voltage	V_{EBO}	6	—	6	—	V	$I_E = .01mA, I_C = 0$
Collector Cutoff Current	I_{CES}*	—	0.2	—	—	μA	$V_{CE} = 175V, V_{EB} = 0$
Collector Cutoff Current	I_{CES}*	—	—	—	0.2	μA	$V_{CE} = 250V, V_{EB} = 0$
Collector Cutoff Current, 150°C	I_{CES}	—	.1	—	—	mA	$V_{CE} = 175V, V_{EB} = 0$
Collector Cutoff Current, 150°C	I_{CES}	—	—	—	.1	mA	$V_{CE} = 250V, V_{EB} = 0$
Collector Capacitance	C_{OBO}	—	60	—	60	pf	$V_{CB} = 10V, f = 1MHz$
Gain-Bandwidth Product	f_t	20	—	20	—	MHz	$I_C = 0.1A, V_{CE} = 5V, f = 10MHz$
Switching Speeds Turn-on Time	t_{ON}	—	250	—	250	ns	$I_C = 0.5A$
Switching Speeds Turn-off Time	t_{OFF}	—	850	—	1200	ns	

Notes:

1. The device may be switched between maximum rated collector current and maximum rated collector — emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Pulse length = 300 μs; duty cycle ≤2%.
3. Measured in saturated switching speed circuit, fig. A for 2N5660, 2N5662 and fig. B for 2N5661, 2N5663.

† All values in this table are JEDEC registered except those marked with an *.

Switching Speed Circuits

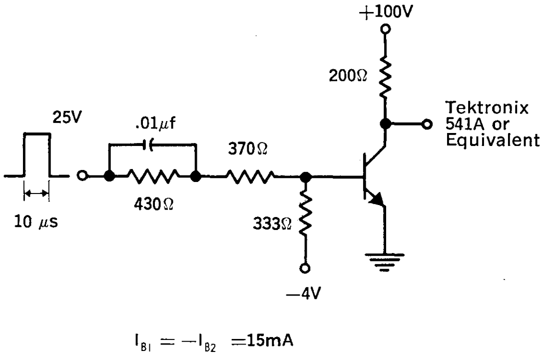


Figure A

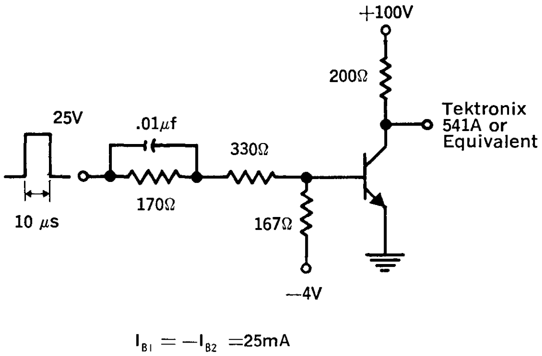


Figure B

POWER TRANSISTORS
2 Amp, 300V, Planar NPN

JAN & JANTX 2N5660
JAN & JANTX 2N5661
JAN & JANTX 2N5662
JAN & JANTX 2N5663

FEATURES
- Meets MIL-S-19500/454
- Collector-Base Voltage: up to 400V
- D.C. Collector Current: 5A
- Peak Collector Current: 10A
- Fast Switching

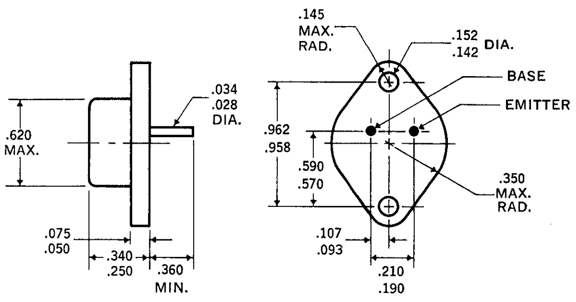
DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

ABSOLUTE MAXIMUM RATINGS

	JAN & JANTX 2N5660	JAN & JANTX 2N5661	JAN & JANTX 2N5662	JAN & JANTX 2N5663
Collector-Base Voltage, V_{CBO}	250V	400V	250V	400V
Collector-Emitter Voltage, V_{CEO}	200V	300V	200V	300V
Emitter-Base Voltage, V_{EBO}	6V	6V	6V	6V
D.C. Collector Current, I_C	1A	1A	1A	1A
Peak Collector Current, I_C	5A	5A	5A	5A
Power Dissipation				
25°C Ambient	2.0W	2.0W	1.2W	1.2W
100°C Case	20W	20W	15W	15W
Operating and Storage Temperature Range	—65°C to 200°C			

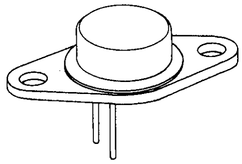
MECHANICAL SPECIFICATIONS

JAN & JANTX 2N5660 JAN & JANTX 2N5661

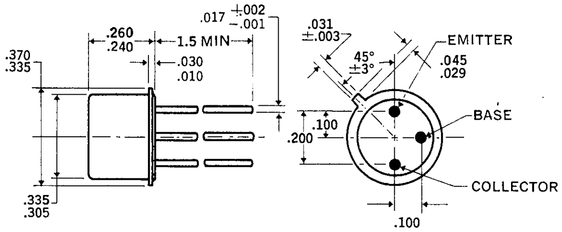


Dimensions in inches.

TO-66

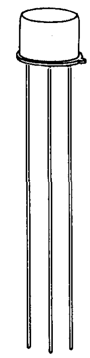


JAN & JANTX 2N5662 JAN & JANTX 2N5663



Dimensions in inches.

TO-5



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

2N5660, 2N5662

Test	Symbol	Min.	Max.	Units	/454 Sub group	MIL-STD-750	
						Method	Test conditions
Visual and mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}*	250	—	Vdc	A-2	3011	$I_C = 10mAdc$; $R_{BE} = 100\Omega$; Cond. B
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}*	200	—	Vdc	A-2	3011	$I_C = 10mAdc$; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}*	6	—	Vdc	A-2	3026	$I_E = 10\mu Adc$; Cond. D
Collector-Emitter Cutoff Current	I_{CES}*	—	0.2	μAdc	A-2	3041	$V_{CE} = 200Vdc$; Cond. C
Collector-Base Cutoff Current	I_{CBO}	—	0.1	μAdc	A-2	3036	$V_{CB} = 200Vdc$; Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	1.0	mAdc	A-2	3036	$V_{CB} = 250Vdc$; Cond. D
D.C. Current Gain (Note 1)	h_{FE}*	40	—	—	A-3	3076	$I_C = 50mAdc$, $V_{CE} = 2Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	40	120	—	A-3	3076	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	15	—	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	A-3	3076	$I_C = 2Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$*	—	0.4	Vdc	A-3	3071	$I_C = 1Adc$, $I_B = 0.1Adc$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	0.8	Vdc	A-3	3071	$I_C = 2Adc$, $I_B = 0.4Adc$
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$*	—	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $I_B = 0.1Adc$; Cond. A
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$	—	1.5	Vdc	A-3	3066	$I_C = 2Adc$, $I_B = 0.4Adc$; Cond. A
Gain-Bandwidth Product	f_T*	20	70	MHz	A-4	3306	$I_C = 0.1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Output Capacitance	C_{ob}	—	45	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Thermal Resistance	θ_{J-C}				C-1	3151	
2N5660		—	5.0	°C/W			
2N5662		—	6.7	°C/W			
Switching Speeds Turn-on time	t_{on}*	—	0.25	μs	A-4	—	$I_C = 0.5Adc$
Turn-off time	t_{off}*	—	0.85	μs	A-4	—	
100°C							
Forward Biased Second Breakdown							
2N5660	$I_{s/b}$	2	—	Adc	B-6	3051	$V_{CE} = 10Vdc$, $t = 1Sec$
	$I_{s/b}$	0.5	—	Adc	B-6	3051	$V_{CE} = 40Vdc$, $t = 1Sec$
	$I_{s/b}$	36	—	mAdc	B-6	3051	$V_{CE} = 200Vdc$, $t = 1Sec$
2N5662	$I_{s/b}$	2	—	Adc	B-7	3051	$V_{CE} = 7.5 Vdc$, $t = 1Sec$
	$I_{s/b}$	0.6	—	Adc	B-7	3051	$V_{CE} = 25Vdc$, $t = 1Sec$
	$I_{s/b}$	27	—	mAdc	B-7	3051	$V_{CE} = 200Vdc$, $t = 1Sec$
Unclamped Reverse Biased Second Breakdown	$E_{s/b}$	1.0	—	mj	B-8	3053	$I_C = 2Adc$, $L = 0.5mh$
Clamped Reverse Biased Second Breakdown	$E_{s/b}$	80	—	mj	B-9	3053	$I_C = 2Adc$, $L = 40mh$, $V_{clamp} = 200V$
150°C							
Collctor-Emitter Cutoff Current	I_{CES}*	—	100	μAdc	A-5	3041	$V_{CE} = 200Vdc$, Cond. C
—65°C							
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	A-6	3076	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$

Notes

1. Pulse length = 300 μs; duty cycle ≤2%.

* Those parameters marked with a * are JEDEC registered and devices meeting these specifications are available as commercial 2N devices.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

2N5661, 2N5663

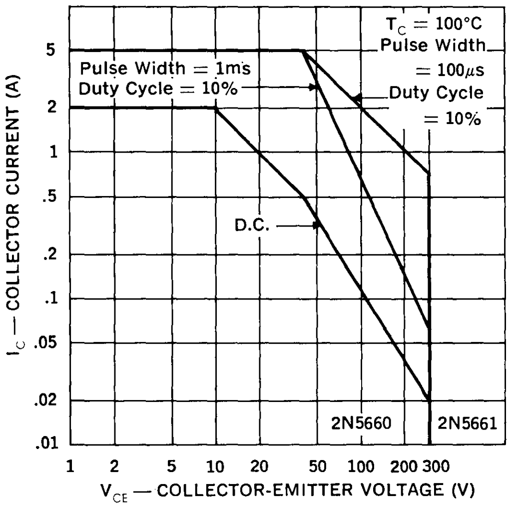
Test	Symbol	Min.	Max.	Units	/454 Sub group	MIL-STD-750	
						Method	Test conditions
Visual and mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}*	400	—	Vdc	A-2	3011	$I_C = 10mAdc$; $R_{BE} = 100\Omega$; Cond. B
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}*	300	—	Vdc	A-2	3011	$I_C = 10mAdc$; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}*	6	—	Vdc	A-2	3026	$I_E = 10\mu Adc$; Cond. D
Collector-Emitter Cutoff Current	I_{CES}*	—	0.2	μAdc	A-2	3041	$V_{CE} = 300Vdc$; Cond. C
Collector-Base Cutoff Current	I_{CBO}	—	0.1	μAdc	A-2	3036	$V_{CB} = 300Vdc$; Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	1.0	mAdc	A-2	3036	$V_{CB} = 400Vdc$; Cond. D
D.C. Current Gain (Note 1)	h_{FE}*	25	—	—	A-3	3076	$I_C = 50mAdc$, $V_{CE} = 2Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	25	75	—	A-3	3076	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	15	—	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	A-3	3076	$I_C = 2Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$*	—	0.4	Vdc	A-3	3071	$I_C = 1Adc$, $I_B = 0.1Adc$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	0.8	Vdc	A-3	3071	$I_C = 2Adc$, $I_B = 0.4Adc$
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$*	—	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $I_B = 0.1Adc$; Cond. A
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$	—	1.5	Vdc	A-3	3066	$I_C = 2Adc$, $I_B = 0.4Adc$; Cond. A
Gain-Bandwith Product	f_T*	20	70	MHz	A-4	3306	$I_C = 0.2Adc$, $V_{CE} = 10Vdc$, $f = 10MHz$
Output Capacitance	C_{ob}	—	45	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Thermal Resistance	θ_{J-C}				C-1	3151	
2N5661		—	5.0	°C/W			
2N5663		—	6.7	°C/W			
Switching Speeds Turn-on time	t_{on}*	—	0.25	μs	A-4	—	$I_C = 0.5Adc$
Switching Speeds Turn-off time	t_{off}*	—	1.2	μs	A-4	—	
100°C							
Forward Biased Second Breakdown							
2N5661	$I_{S/B}$	2	—	Adc	B-6	3051	$V_{CE} = 10Vdc$, $t = 1Sec$
	$I_{S/B}$	0.5	—	Adc	B-6	3051	$V_{CE} = 40Vdc$, $t = 1Sec$
	$I_{S/B}$	19	—	mAdc	B-6	3051	$V_{CE} = 300Vdc$, $t = 1Sec$
2N5663	$I_{S/B}$	2	—	Adc	B-7	3051	$V_{CE} = 7.5 Vdc$, $t = 1Sec$
	$I_{S/B}$	0.6	—	Adc	B-7	3051	$V_{CE} = 25Vdc$, $t = 1Sec$
	$I_{S/B}$	14	—	mAdc	B-7	3051	$V_{CE} = 300Vdc$, $t = 1Sec$
Unclamped Reverse Biased Second Breakdown	$E_{S/B}$	1.0	—	mj	B-8	3053	$I_C = 2Adc$, $L = 0.5mh$
Clamped Reverse Biased Second Breakdown	$E_{S/B}$	80	—	mj	B-9	3053	$I_C = 2Adc$, $L = 40mh$, $V_{clamp} = 300V$
150°C							
Collector-Emitter Cutoff Current	I_{CES}*	—	100	μAdc	A-5	3041	$V_{CE} = 300Vdc$, Cond. C
−65°C							
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	A-6	3076	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$

Notes

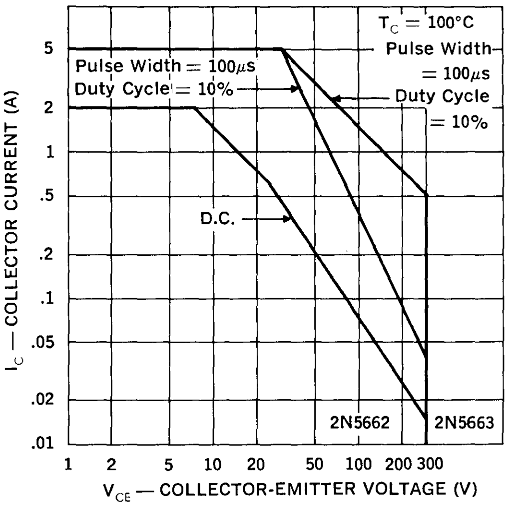
1. Pulse length = 300 μs; duty cycle ⩽2%.

* Those parameters marked with a * are JEDEC registered and devices meeting these specifications are available as commercial 2N devices.

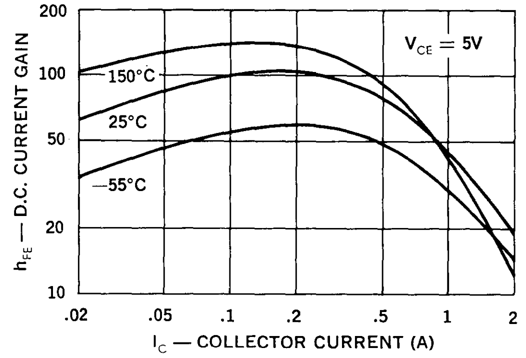
Safe Operating Area Curves
2N5660, 2N5661



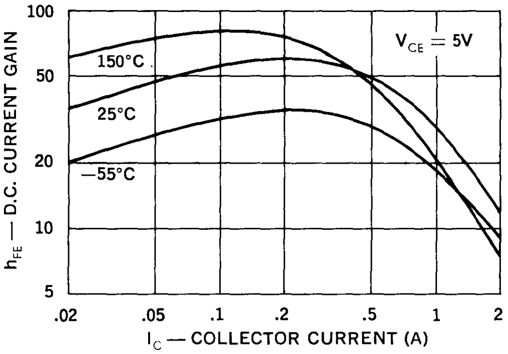
Safe Operating Area Curves
2N5662, 2N5663



D.C. Current Gain Typical Characteristics
2N5660, 2N5662

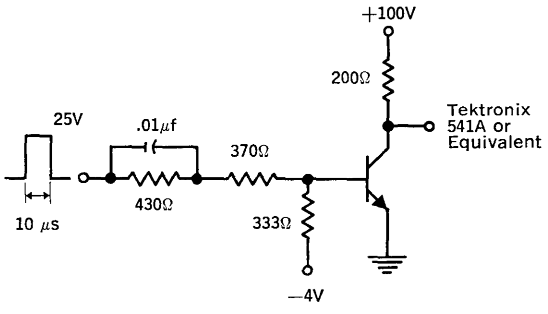


D.C. Current Gain Typical Characteristics
2N5661, 2N5663



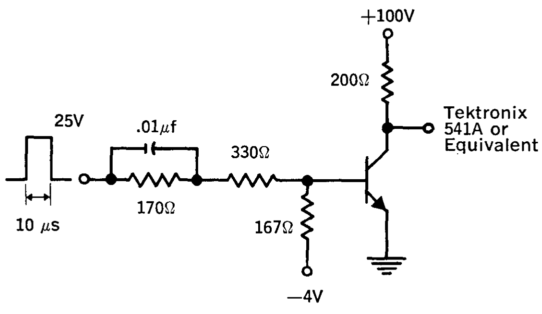
Switching Speed Circuits

2N5660, 2N5661



$I_{B1} = -I_{B2}$ =25mA

2N5662, 2N5663



$I_{B1} = -I_{B2}$ =25mA

POWER TRANSISTORS
5 Amp, 300V, Planar NPN

JAN & JANTX 2N5664
JAN & JANTX 2N5665
JAN & JANTX 2N5666
JAN & JANTX 2N5667

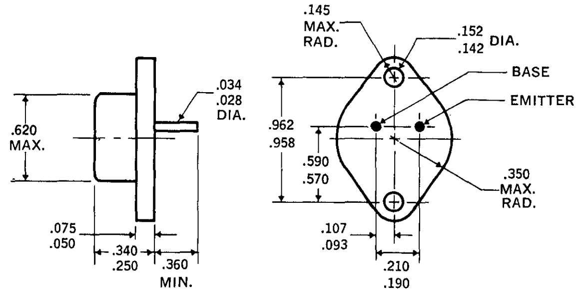
FEATURES
- Meets MIL-S-19500/455
- Collector-Base Voltage: up to 400V
- D.C. Collector Current: 5A
- Peak Collector Current: 10A
- Fast Switching

DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

ABSOLUTE MAXIMUM RATINGS	JAN & JANTX 2N5664	JAN & JANTX 2N5665	JAN & JANTX 2N5666	JAN & JANTX 2N5667
Collector-Base Voltage, V_{CBO}	250V	400V	250V	400V
Collector-Emitter Voltage, V_{CEO}	200V	300V	200V	300V
Emitter-Base Voltage, V_{EBO}	6V	6V	6V	6V
D.C. Collector Current, I_C	5A	5A	5A	5A
Peak Collector Current, I_C	10A	10A	10A	10A
Power Dissipation				
25°C Ambient	2.5W	2.5W	1.2W	1.2W
100°C Case	30W	30W	15W	15W
Operating and Storage Temperature Range	—65°C to 200°C			

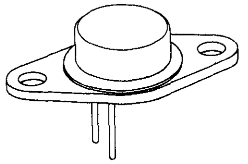
MECHANICAL SPECIFICATIONS

JAN & JANTX 2N5664 JAN & JANTX 2N5665

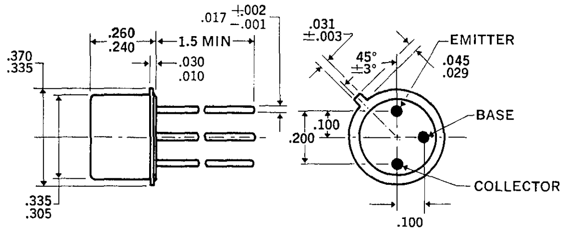


Dimensions in inches.

TO-66

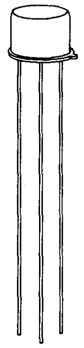


JAN & JANTX 2N5666 JAN & JANTX 2N5667



Dimensions in inches.

TO-5



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)
2N5664, 2N5666

Test	Symbol	Min.	Max.	Units	/455 Sub group	MIL-STD-750	
						Method	Test conditions
Visual and mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}*	250	—	Vdc	A-2	3011	$I_C = 10mAdc$; $R_{BE} = 100\,\Omega$, Cond. B
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}*	200	—	Vdc	A-2	3011	$I_C = 10mAdc$; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}*	60	—	Vdc	A-2	3026	$I_E = 10\mu Adc$; Cond. D
Collector-Emitter Cutoff Current	I_{CES}*	—	0.2	μAdc	A-2	3041	$V_{CE} = 200Vdc$; Cond. C
Collector-Base Cutoff Current	I_{CBO}	—	0.1	μAdc	A-2	3036	$V_{CB} = 200Vdc$; Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	1.0	mAdc	A-2	3036	$V_{CB} = 250Vdc$; Cond. D
D.C. Current Gain (Note 1)	h_{FE}*	25	—	—	A-3	3076	$I_C = 0.5Adc$. $V_{CE} = 2Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	30	90	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	10	—	—	A-3	3076	$I_C = 3Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	A-3	3076	$I_C = 5Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)*	—	0.4	Vdc	A-3	3071	$I_C = 3Adc$, $I_B = 0.6Adc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	A-3	3071	$I_C = 5Adc$, $I_B = 1Adc$
Base Saturation Voltage (Note 1)	V_{BE} (sat)*	—	1.2	Vdc	A-3	3066	$I_C = 3Adc$, $I_B = 0.6Adc$; Cond. A
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	A-3	3066	$I_C = 5Adc$, $I_B = 1Adc$; Cond. A
Gain-Bandwith Product	f_T*	20	70	MHz	A-4	3306	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Output Capacitance	C_{ob}	—	90	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Thermal Resistance	θ_{J-C}				C-1	3151	
2N5664		—	3.3	°C/W			
2N5666		—	6.7	°C/W			
Switching Speeds Turn-on Time	t_{on}*	—	0.25	μs	A-4	—	$I_C = 1Adc$
Turn-off Time	t_{off}*	—	2.0	μs	A-4	—	
100°C							
Forward Biased Second Breakdown 2N5664	$I_{S/B}$	5	—	Adc	B-6	3051	$V_{CE} = 6Vdc$, $t = 1sec$
	$I_{S/B}$	0.75	—	Adc	B-6	3051	$V_{CE} = 40Vdc$, $t = 1sec$
	$I_{S/B}$	43	—	mAdc	B-6	3051	$V_{CE} = 200Vdc$, $t = 1sec$
2N5666	$I_{S/B}$	5	—	Adc	B-7	3051	$V_{CE} = 3Vdc$, $t = 1sec$
	$I_{S/B}$	0.4	—	Adc	B-7	3051	$V_{CE} = 37.5Vdc$, $t = 1sec$
	$I_{S/B}$	27	—	mAdc	B-7	3051	$V_{CE} = 200Vdc$, $t = 1sec$
Unclamped Reverse Biased Second Breakdown	$E_{S/B}$	1.25	—	mj	B-8	3053	$I_C = 5Adc$, $L = 0.1mh$
Clamped Reverse Biased Second Breakdown	$E_{S/B}$	200	—	mj	B-9	3053	$I_C = 5Adc$, $L = 40mh$, $V_{clamp} = 200V$
150°C							
Collector-Emitter Cutoff Current	I_{CES}*	—	100	μAdc	A-5	3041	$V_{CE} = 200Vdc$, Cond. C
−65°C							
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	A-6	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$

Notes
1. Pulse length = 300 μs; duty cycle ≲2%.
* Those parameters marked with a * are JEDEC registered and devices meeting these specifications are available as commercial 2N devices.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)
2N5665, 2N5667

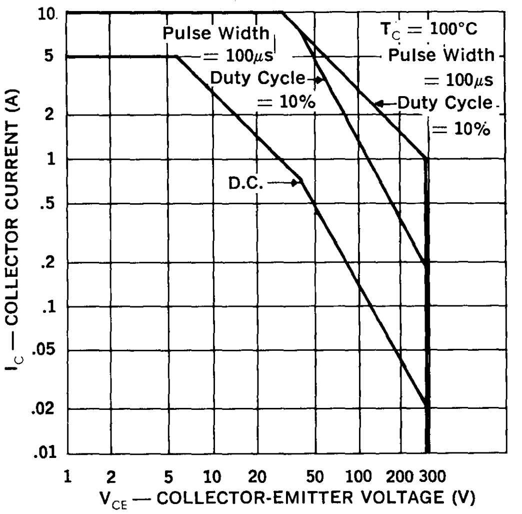
Test	Symbol	Min.	Max.	Units	/455 Sub group	MIL-STD-750	
						Method	Test conditions
Visual and mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}*	400	—	Vdc	A-2	3011	$I_C = 10mAdc$; $R_{BE} = 100\,\Omega$, Cond. B
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}*	300	—	Vdc	A-2	3011	$I_C = 10mAdc$; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}*	6	—	Vdc	A-2	3026	$I_E = 10\mu Adc$; Cond. D
Collector-Emitter Cutoff Current	I_{CES}*	—	0.2	μAdc	A-2	3041	$V_{CE} = 300Vdc$; Cond. C
Collector-Base Cutoff Current	I_{CBO}	—	0.1	μAdc	A-2	3036	$V_{CB} = 300Vdc$; Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	1.0	mAdc	A-2	3036	$V_{CB} = 400Vdc$; Cond. D
D.C. Current Gain (Note 1)	h_{FE}*	25	—	—	A-3	3076	$I_C = 0.5Adc$, $V_{CE} = 2Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	30	90	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	10	—	—	A-3	3076	$I_C = 3Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	A-3	3076	$I_C = 5Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)*	—	0.4	Vdc	A-3	3071	$I_C = 3Adc$, $I_B = 0.6Adc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	A-3	3071	$I_C = 5Adc$, $I_B = 1Adc$
Base Saturation Voltage (Note 1)	V_{BE} (sat)*	—	1.2	Vdc	A-3	3066	$I_C = 3Adc$, $I_B = 0.6Adc$; Cond. A
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	A-3	3066	$I_C = 5Adc$, $I_B = 1Adc$; Cond. A
Gain-Bandwith Product	f_T*	20	70	MHz	A-4	3306	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$, f = 10MHz
Output Capacitance	C_{ob}	—	90	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, f = 1MHz
Thermal Resistance	θ_{J-C}				C-1	3151	
2N5665		—	3.3	°C/W			
2N5667		—	6.7	°C/W			
Switching Speeds Turn-on time	t_{on}*	—	0.25	μs	A-4	—	$I_C = 1Adc$
Turn-off time	t_{off}*	—	2.0	μs	A-4	—	
100°C							
Forward Biased Second Breakdown 2N5665	$I_{S/B}$	5	—	Adc	B-6	3051	$V_{CE} = 6Vdc$, t = 1sec
	$I_{S/B}$	0.75	—	Adc	B-6	3051	$V_{CE} = 40Vdc$, t = 1 sec
	$I_{S/B}$	21	—	mAdc	B-6	3051	$V_{CE} = 300Vdc$, t = 1sec
2N5667	$I_{S/B}$	5	—	Adc	B-7	3051	$V_{CE} = 3Vdc$, t = 1sec
	$I_{S/B}$	0.4	—	Adc	B-7	3051	$V_{CE} = 37.5Vdc$, t = 1sec
	$I_{S/B}$	14	—	nAdc	B-7	3051	$V_{CE} = 300Vdc$, t = 1sec
Unclamped Reverse Biased Second Breakdown	$E_{S/B}$	0.9	—	mj	B-8	3053	$I_C = 5Adc$, L = 0.1mh
Clamped Reverse Biased Second Breakdown	$E_{S/B}$	200	—	mj	B-9	3053	$I_C = 5Adc$, L = 40mh, $V_{clamp} = 300V$
150°C							
Collector-Emitter Cutoff Current	I_{CES}*	—	100	μAdc	A-5	3041	$V_{CE} = 300Vdc$, Cond. C
−65°C							
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	A-6	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$

Notes

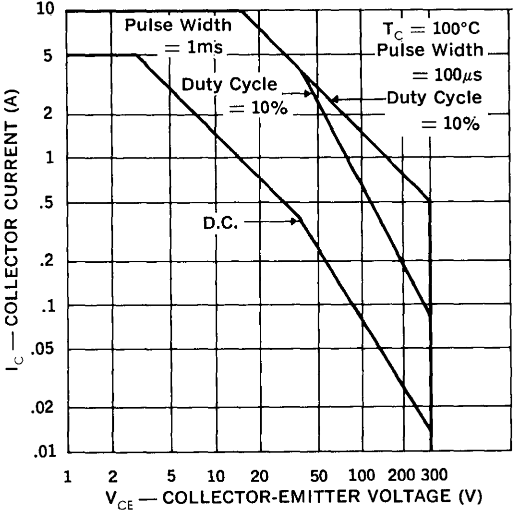
1. Pulse length = 300 μs; duty cycle ≤2%.

* Those parameters marked with a * are JEDEC registered and devices meeting these specifications are available as commercial 2N devices.

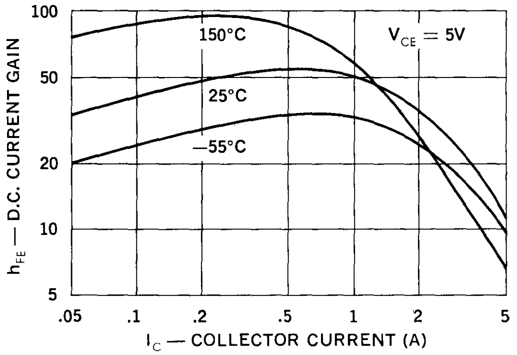
Maximum Safe Operating Area
2N5664, 2N5665



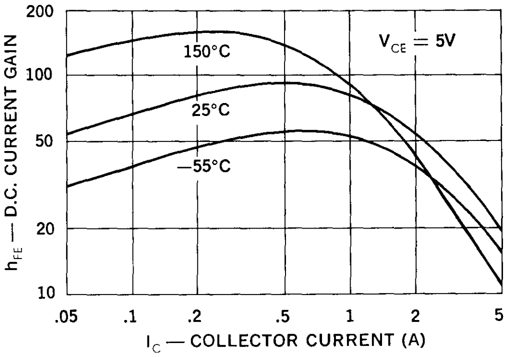
Maximum Safe Operating Area
2N5666, 2N5667



D.C. Current Gain vs. Collector Current
2N5664, 2N5666

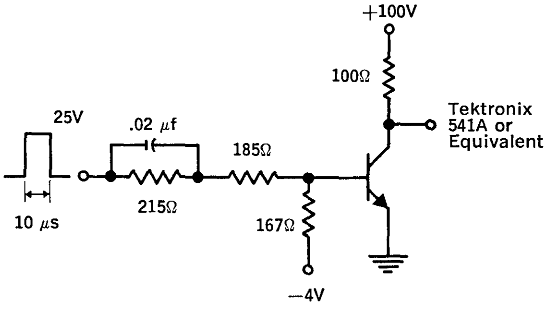


D. C. Current Gain vs. Collector Current
2N5665, 2N5667



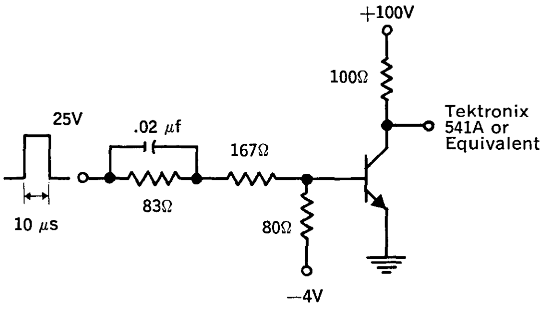
Switching Speed Circuits

2N5664, 2N5666



$I_{B1} = -I_{B2}$ =30mA

2N5665, 2N5667



$I_{B1} = -I_{B2}$ = 50mA

SCRs

.5 Amp, Planar

2N5719-2N5723

FEATURES

- Max. Gate Trigger Current: 20μA
- Closely Controlled Gate Trigger Voltage: .44 to .6V
- Operating Current Range: 2mA to 500mA
- Voltage Ratings: to 400V
- Low Blocking Current
- Low "On-State" Voltage
- Specified for dv/dt and Switching Time

DESCRIPTION

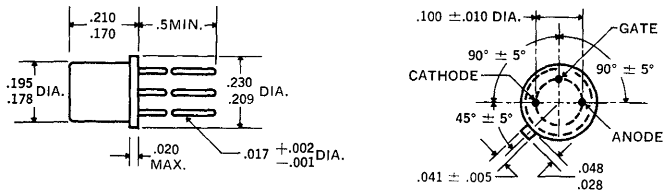
These devices are intended for general purpose usage in Military/aerospace or severe industrial environments. Major design parameters are specified at the temperature extremes, thus permitting worst case design on the basis of guaranteed values. These devices undergo 100% preconditioning, which includes high temperature storage and temperature cycling followed by a fine leak test as a regular part of the manufacturing procedure.

ABSOLUTE MAXIMUM RATINGS

	2N5719	2N5720	2N5721	2N5722	2N5723
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V
Non-Repetitive Peak Off-State Voltage, V_{DSM}	500V				
DC On-State Current, I_T					
75°C Ambient	250mA				
100°C Case	500mA				
Repetitive Peak On-State Current, I_{TRM}	up to 30A				
Peak One Cycle Surge (Non-Rep) On-State Current, I_{TSM}	8A				
Peak Gate Current, I_{GM}	250mA				
Average Gate Current, $I_{G(AV)}$	25mA				
Reverse Gate Current, I_{GR}	3mA				
Reverse Gate Voltage, V_{GR}	6V				
Operating and Storage Temperature Range	—65°C to +150°C				

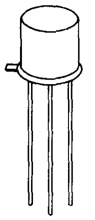
MECHANICAL SPECIFICATIONS

2N5719-2N5723



Dimensions in inches.

TO-18



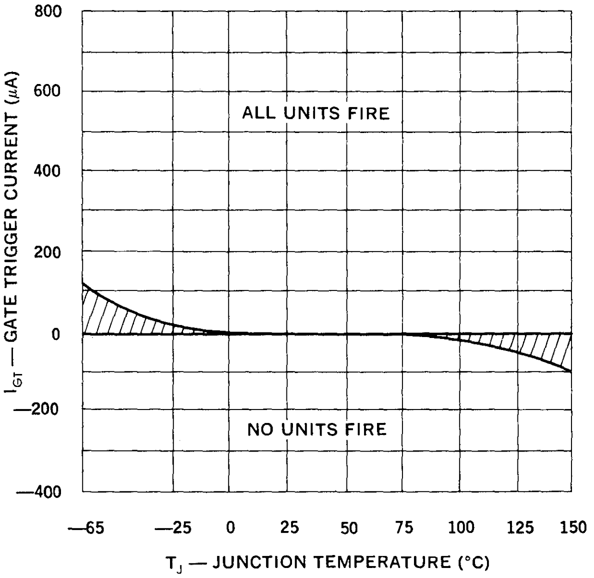
ELECTRICAL SPECIFICATIONS

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						
Visual and Mechanical	—	—	—	—	—	
SUBGROUP 2 (25°C TESTS)						
Off-State Current	I_{DRM}	—	.01	0.1	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	.01	0.1	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Voltage	V_{GR}	5	8	—	V	$I_{GR} = 0.1mA$
Gate Trigger Current	I_{GT}	—	2	20	μA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.44	0.50	0.6	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.2	1.5	V	$i_T = 0.5A$ (pulse test)
Holding Current	I_H	0.3	0.8	2.0	mA	$R_{GK} = 1K$, $V_D = 5V$
SUBGROUP 3 (25°C TESTS)						
Off-State Voltage — Critical Rate of Rise	dv/dt	100	150	—	v/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger — on Pulse Width	$t_{pg(on)}$	—	0.1	0.5	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.1	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.3	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-Off Time						
2N5724, 2N5725, 2N5726,	t_q	—	15	30	μs	$I_T = 1A$, $i_R = 1A$, $R_{GK} = 1K$
2N5727, 2N5728		—	30	50	μs	
SUBGROUP 4 (150° TESTS)						
High Temp. Off-State Current	I_{DRM}	—	10	100	μA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	20	100	μA	$R_{GK} = 1K$, V_{RRM} = Rating
High Temp. Gate Trigger Voltage	V_{GT}	0.10	0.15	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
High Temp. Holding Current	I_H	0.10	0.15	—	mA	$R_{GK} = 1K$, $V_D = 5V$
SUBGROUP (—65°C TESTS)						
Low Temp. Gate Trigger Voltage	V_{GT}	—	0.7	0.9	V	$R_{GS} = 100\Omega$, $V_D = 5V$
Low Temp. Gate Trigger Current	I_{GT}	—	50	125	μA	$R_{GS} = 10K$, $V_D = 5V$
Low Temp. Holding Current	I_H	—	1.2	3.0	mA	$R_{GK} = 1K$, $V_D = 5V$

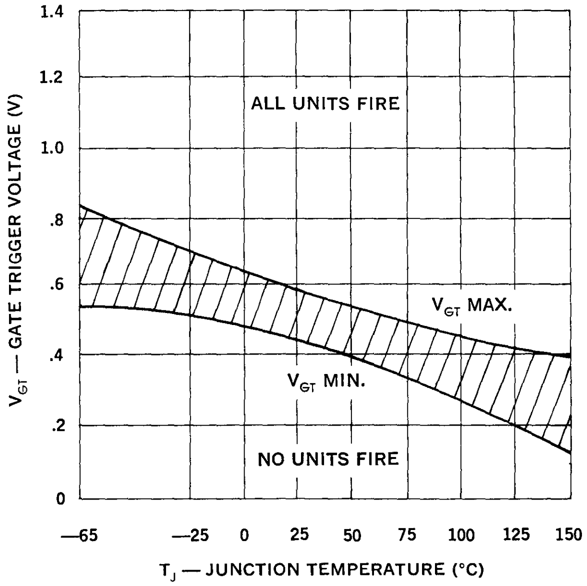
Note 1. See rating curves for full rating information.

2. Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1K or smaller, or other adequate gate bias is used.

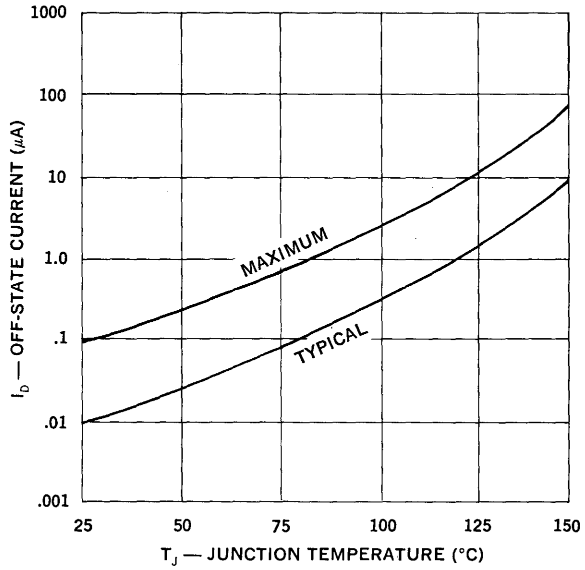
Gate Trigger Current



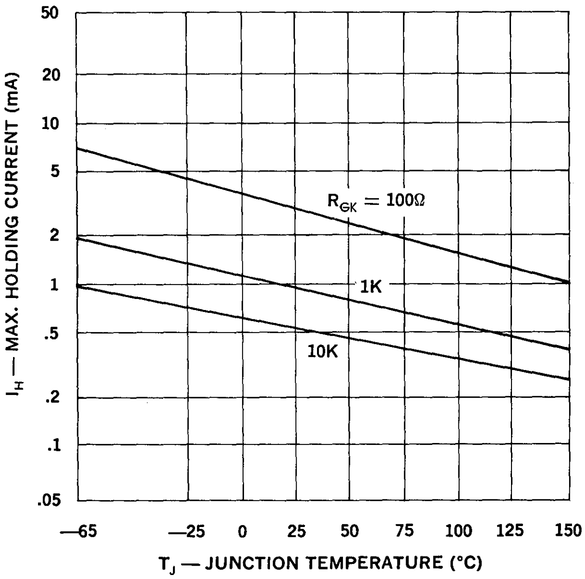
Gate Trigger Voltage



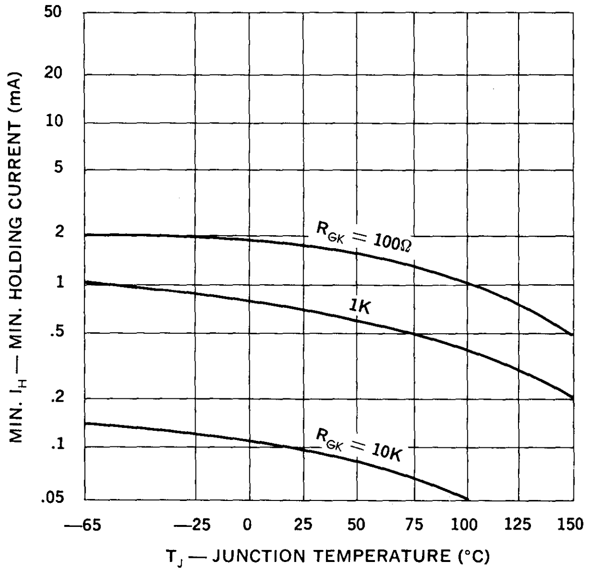
Off-State Current



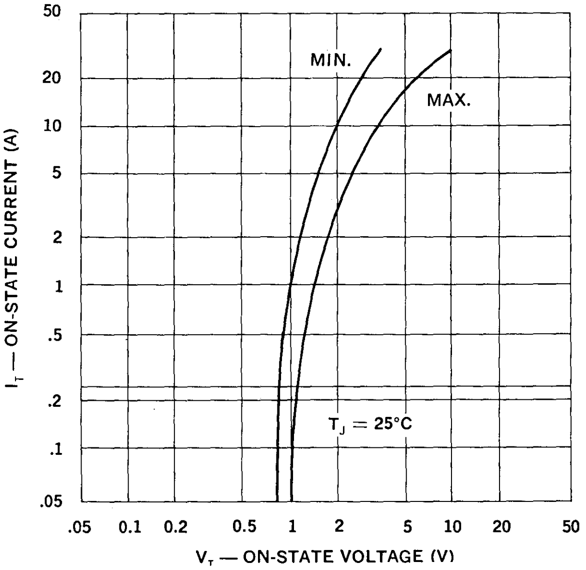
Max. Holding Current



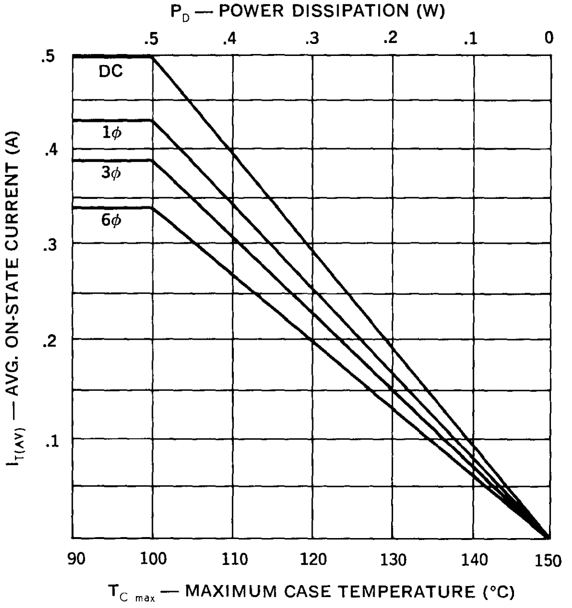
Min. Holding Current



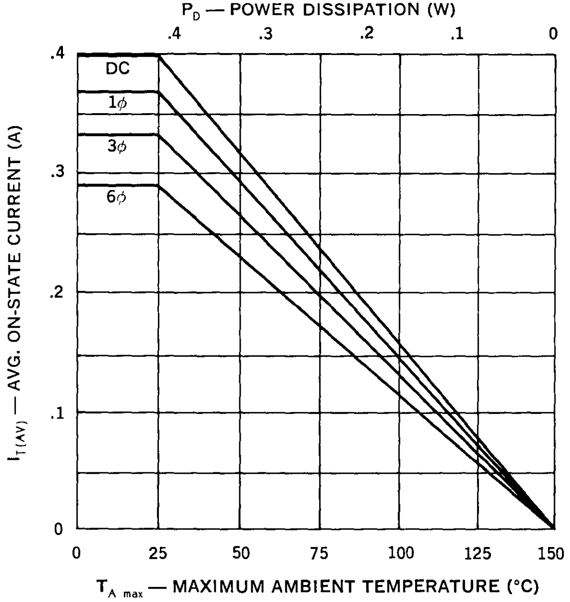
On-State Current vs. Voltage



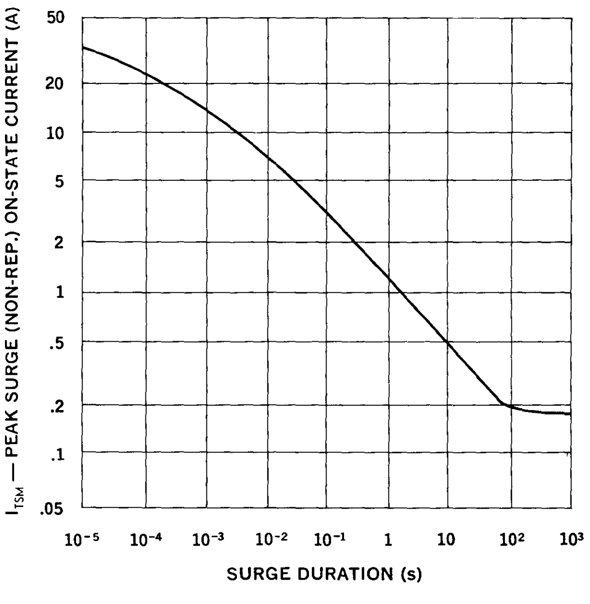
Average Current vs. Case Temperature



Average Current vs. Ambient Temperature



Surge Current



SCRs

1.6 Amp, Planar

2N5724-2N5728

FEATURES

- Maximum Gate Trigger Current: 20μA
- Closely Controlled Gate Trigger Voltage: .44 to .6V
- Operating Current Range: 2mA to 1.6A
- Voltage Ratings: to 400V
- Low On-State Voltage
- Specified for dv/dt and Switching Time

DESCRIPTION

These devices are intended for general purpose usage in Military/aerospace or severe industrial environments. Major design parameters are specified at the temperature extremes, thus permitting worst case design on the basis of guaranteed values. These devices undergo 100% preconditioning, which includes high temperature storage and temperature cycling followed by a fine leak test as a regular part of the manufacturing procedure.

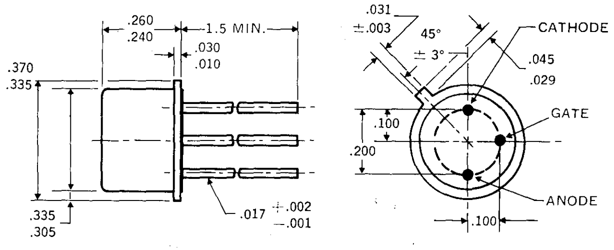
The high voltage types of the 2N5724 series are especially useful as pulse modulator switches in low to medium power pulse modulator applications. Specific parameters such as rise time, delay time, holding current, and recovery time can be selected for optimum performance in a pulse modulator circuit.

ABSOLUTE MAXIMUM RATINGS

	2N5724	2N5725	2N5726	2N5727	2N5728
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V
Non-Repetitive Peak Off-State Voltage, V_{DSM}	500V				
D.C. On-State Current, I_T					
75°C Ambient	450mA				
85°C Case	1.6A				
Repetitive Peak On-State Current, I_{TRM}	up to 30A				
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	15A				
Peak Gate Current, I_{GM}	250mA				
Average Gate Current, $I_{G(AV)}$	25mA				
Reverse Gate Current, I_{GR}	3mA				
Reverse Gate Voltage, V_{GR}	6V				
Operating and Storage Temperature Range	—65°C to +150°C				

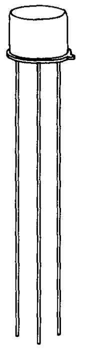
MECHANICAL SPECIFICATIONS

2N5724-2N5728



Dimensions in inches.

TO5



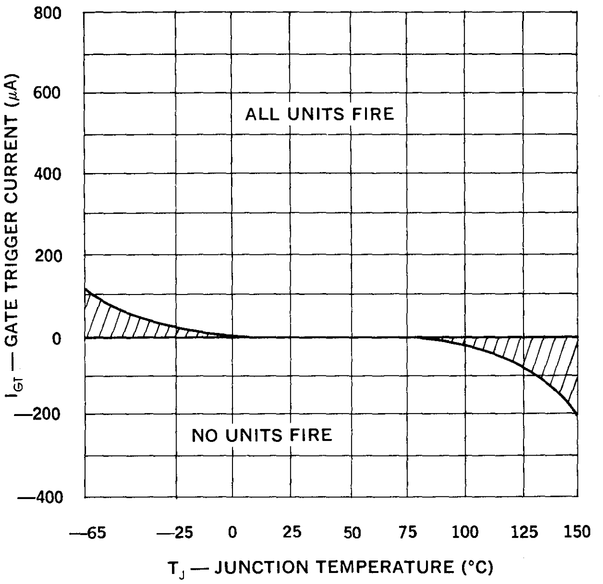
ELECTRICAL SPECIFICATIONS

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						
Visual and Mechanical	—	—	—	—	—	
SUBGROUP 2 (25°C TESTS)						
Off-State Current	I_{DRM}	—	.05	0.1	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	.05	0.1	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Voltage	V_{GR}	5	8	—	V	$I_{GR} = 0.1mA$
Gate Trigger Current	I_{GT}	—	2	20	μA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.44	0.5	0.6	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	2.3	2.5	V	$I_T = 5A$ (pulse test)
Holding Current	I_H	0.3	0.8	2.0	mA	$R_{GK} = 1K$, $V_D = 5V$
SUBGROUP 3 (25°C TESTS)						
Off-State Voltage — Critical Rate of Rise	dv/dt	100	150	—	v/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger — on Pulse Width	t_{pg} (on)	—	0.1	0.5	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.1	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.3	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time						
2N5724, 2N5725, 2N5726,	t_q	—	15	30	μs	$I_T = 1A$, $i_R = 1A$, $R_{GK} = 1K$
2N5727, 2N5728		—	30	50	μs	
SUBGROUP 4 (150°C TESTS)						
High Temp. Off-State Current	I_{DRM}	—	50	200	μA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	80	200	μA	$R_{GK} = 1K$, V_{RRM} = Rating
High Temp. Gate Trigger Voltage	V_{GT}	0.10	0.15	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
High Temp. Holding Current	I_H	0.10	0.15	—	mA	$R_{GK} = 1K$, $V_D = 5V$
SUBGROUP 5 (—65°C TESTS)						
Low Temp. Gate Trigger Voltage	V_{GT}	—	0.7	0.9	V	$R_{GS} = 100\Omega$, $V_D = 5V$
Low Temp. Gate Trigger Current	I_{GT}	—	50	125	μA	$R_{GS} = 10K$, $V_D = 5V$
Low Temp. Holding Current	I_H	—	1.2	3.0	mA	$R_{GK} = 1K$, $V_D = 5V$

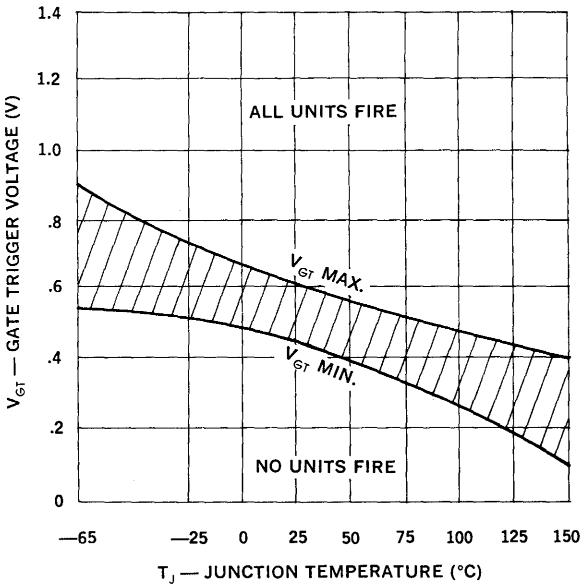
Note 1 See rating curves for full rating information.

Note 2 Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1K or smaller, or other adequate gate bias is used.

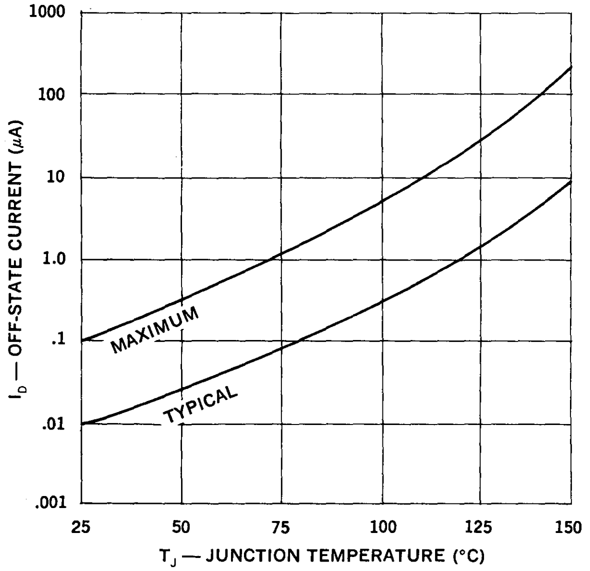
Gate Trigger Current



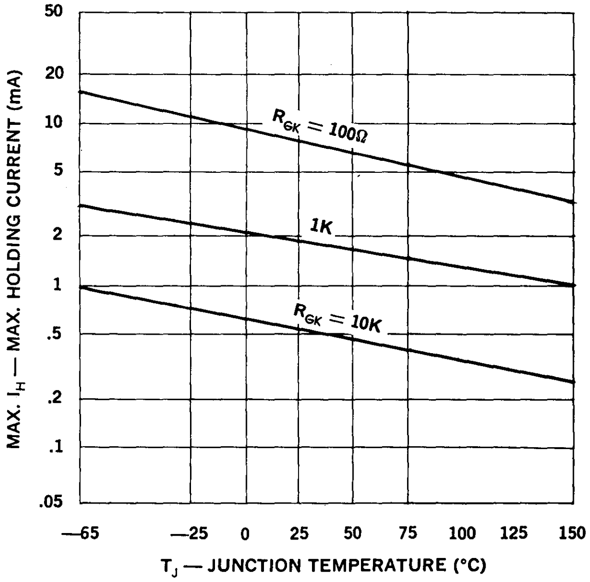
Gate Trigger Voltage



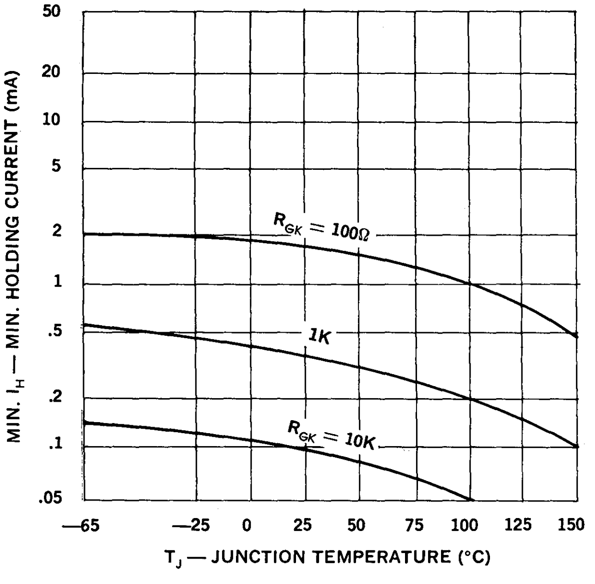
Off-State Current



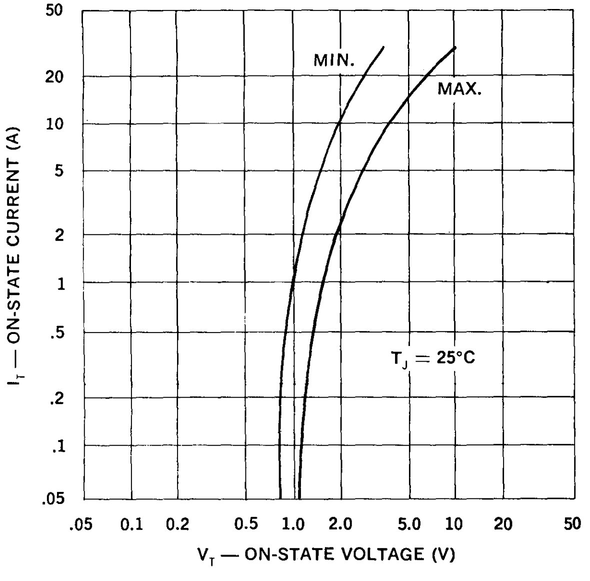
Max. Holding Current



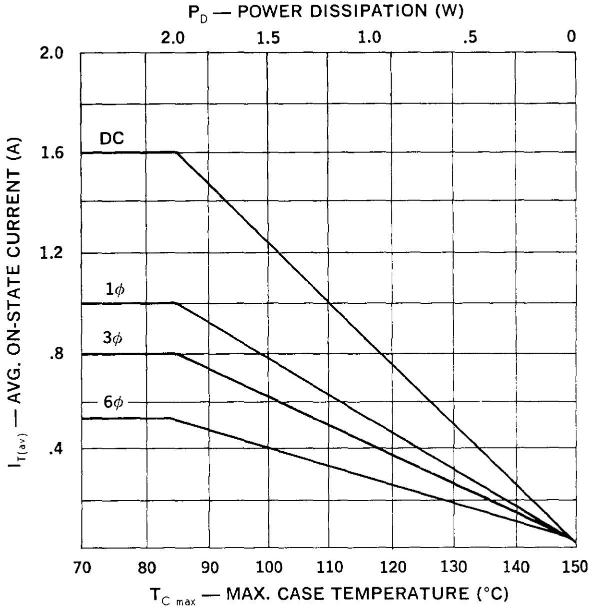
Min. Holding Current



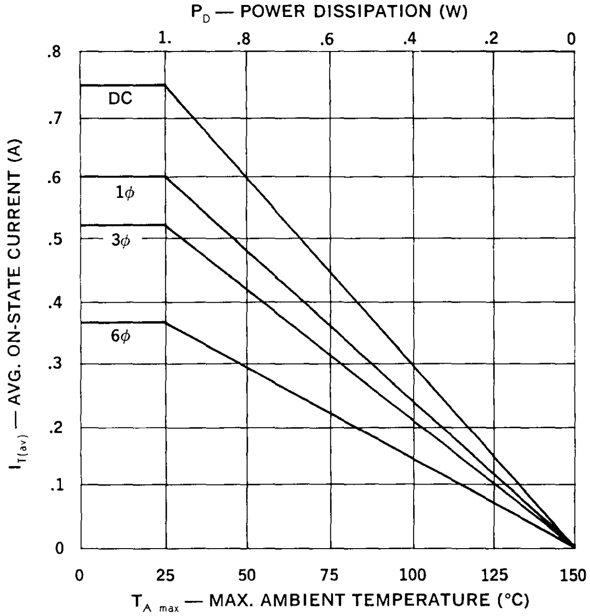
On-State Current vs. Voltage



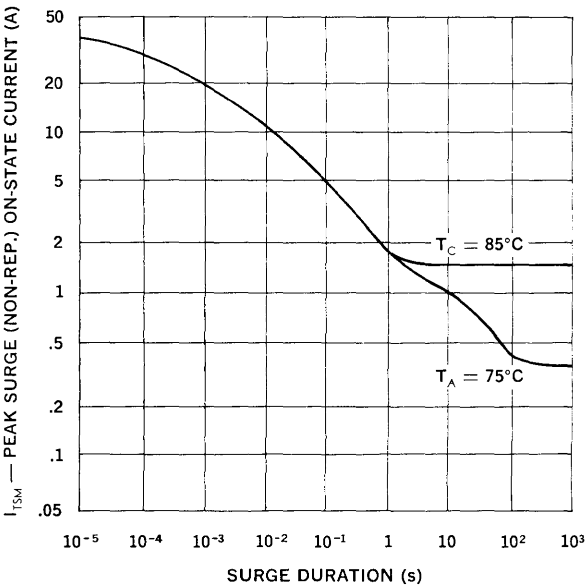
Avg. Current vs. Case Temperature



Avg. Current vs. Ambient Temperature



Surge Current



PUTs

Planar, TO-98, Plastic

2N6027-2N6028

FEATURES

- TO-98 Plastic Package
- Maximum Peak Current: 150nA
- Minimum Valley Current: 1.5mA
- Peak Forward Current: 5A
- Programmable Eta, R_{BB}, I_P and I_V
- Planar Passivated Construction for Maximum Reliability and Parameter Uniformity

DESCRIPTION

The Unitrode Programmable Unijunction Transistor is today's preferred device for low cost timing circuits, oscillators, sensing circuits and a wide range of other applications where a variable voltage level threshold is desired. Functionally equivalent to standard unijunction transistors, the Unitrode PUT offers the distinct advantage of versatile programming. External resistors can be added to meet the designer's needs in programming the Eta, R_{BB}, I_P, and I_V functions. For additional information see Unitrode Application Note U-66.

TYPICAL FEATURES

Programmable Turn-on
Programmable Turn-off
Low Leakage Current
High Output Pulse

TYPICAL APPLICATIONS

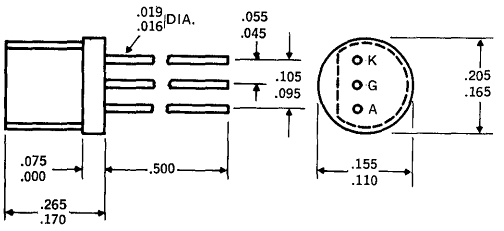
SCR Triggers
Timing Circuits
Oscillators
Sweep Circuits
Delay Circuits
Sampling Circuits
Relay Drivers
Smoke Detectors

ABSOLUTE MAXIMUM RATINGS

Anode-to-Cathode Voltage, V_{AK}	±40V
Gate-to-Cathode Forward Voltage, V_{GK}	40V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V
Gate-to-Cathode Reverse Voltage, V_{GKR}	−5V
Peak Recurrent Forward Current	
20μs, 1% Duty Cycle	2A
100μs, 1% Duty Cycle	1A
Peak Non-recurrent Forward Current, 10μs	5A
Power Dissipation	
25°C Ambient	375mW
Derating Factor	5mW/°C
Storage Temperature	−55°C to +125°C
Operating Temperature Range	−55°C to +100°C

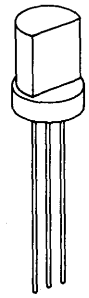
MECHANICAL SPECIFICATIONS

2N6027-2N6028



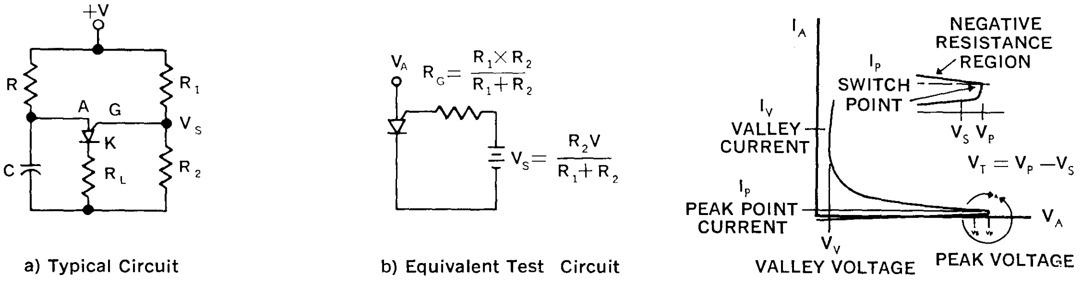
Dimensions in inches.

TO-98



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Fig.	2N6027		2N6028		Units	Test Conditions
			Min.	Max.	Min.	Max.		
Peak Current	I_P	1	— —	2 5	— —	0.15 1.0	μA μA	$R_G = 1M\Omega, V_S = 10V$ $R_G = 10k\Omega, V_S = 10V$
Valley Current	I_V	1	— 70 1.5	50 — —	— 25 1.0	25 — —	μA μA mA	$R_G = 1M\Omega, V_S = 10V$ $R_G = 10k\Omega, V_S = 10V$ $R_G = 200\Omega, V_S = 10V$
Offset Voltage	V_T	1	0.2 0.2	0.6 1.6	0.2 0.2	0.6 0.6	V V	$R_G = 10, V_S = 10V$ $R_G = 1M\Omega, V_S = 10V$
Gate-to-Anode Leakage	I_{GAO}	2	— —	10 100	— —	10 100	nA nA	$T = 25°C, V_S = 40V$ $T = 75°C, V_S = 40V$
Gate-to-Cathode Leakage	I_{GKS}	3	—	100	—	100	nA	$V_S = 40V$
Forward Voltage	V_F	4	—	1.5	—	1.5	V	$I_F = 50mA$
Pulse Output Voltage	V_O	5	6	—	6	—	V	
Pulse Output Rise Time	t_r	5	—	80	—	80	ns	



a) Typical Circuit

b) Equivalent Test Circuit

Figure 1

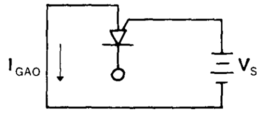


Figure 2

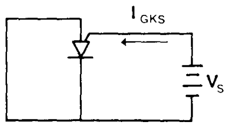


Figure 3

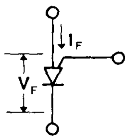


Figure 4

Note: Conditions for oscillation

$$\frac{V_{BB} - V_P}{R} > I_P$$

$$\frac{V_{BB} - V_V}{R} < I_V$$

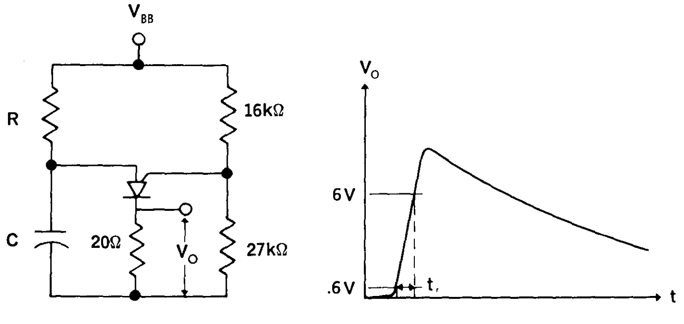
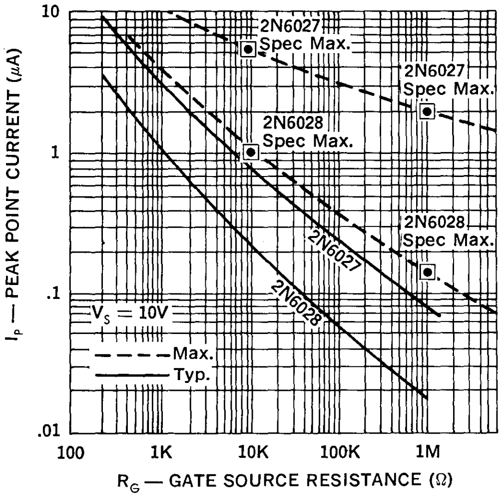
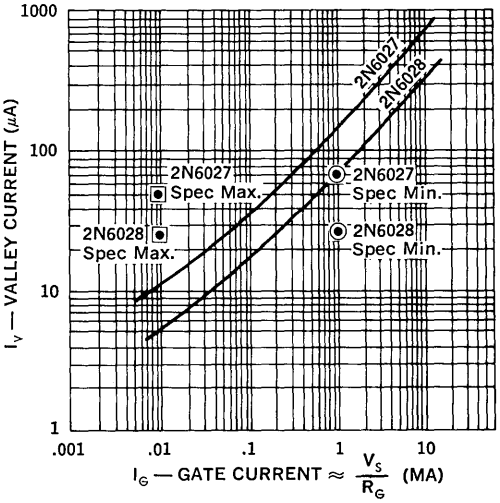


Figure 5

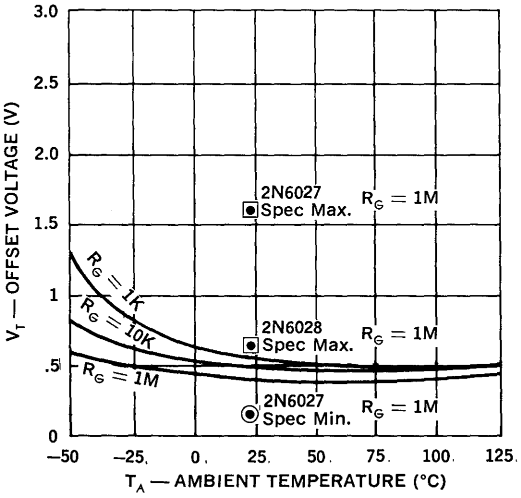
Peak Point Current vs. Gate Source Resistance



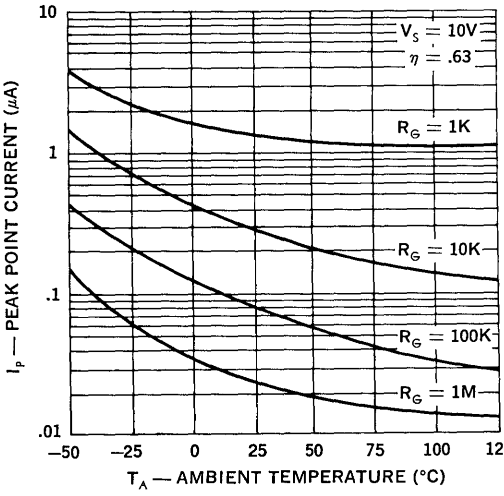
Valley Current vs. Gate Current



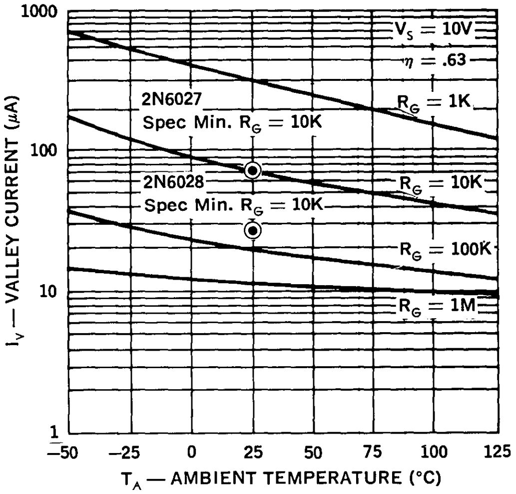
Offset Voltage vs. Ambient Temperature



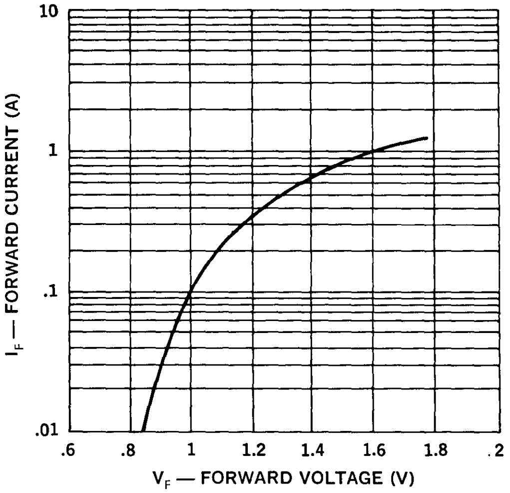
Peak Point Current vs. Ambient Temperature



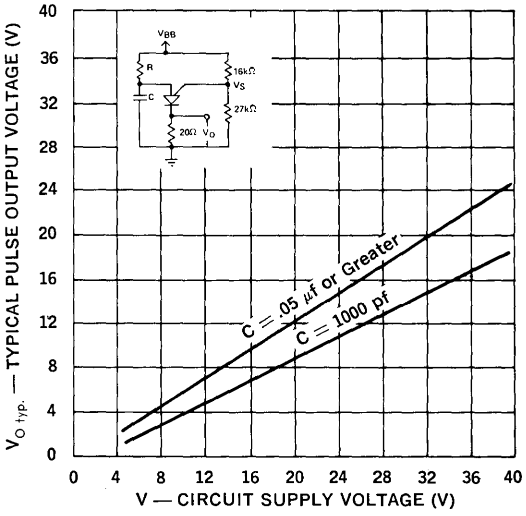
Valley Current vs. Ambient Temperature



Forward Current vs. Forward Voltage



Typical Pulse Output vs. Circuit Supply Voltage



PUTs

2N6119-2N6120

Planar, TO-18, Hermetic

FEATURES

- Hermetically Sealed TO-18 Metal Can
- Programmable Eta, R_{BB}, I_P and I_V
- Maximum Peak Point Current: 150nA
- Minimum Valley Current to 1.5mA
- Nano-Amp Leakage
- Passivated Planar Construction for Maximum Reliability and Parameter Uniformity

DESCRIPTION

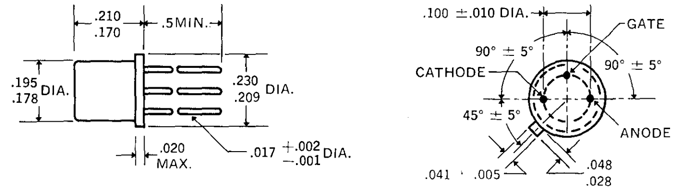
Functionally equivalent to standard unijunction transistors, Unitrode's Programmable Unijunction Transistors offer the distinct advantage of versatile programming. External resistors can be added to meet the designer's needs in programming Eta, R_{BB}, I_P and I_V functions. This series also features a hermetically sealed TO-18 package for optimum reliability in all environmental conditions. Applications include pulse and timing circuits, SCR trigger circuits, relaxation oscillators and sensing circuits. For additional information see Unitrode Application Note U-66.

ABSOLUTE MAXIMUM RATINGS

Anode-to-Cathode Voltage, V_{AK}	±40V
Gate-to-Cathode Forward Voltage, V_{GK}	40V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V
Gate-to-Cathode Reverse Voltage, V_{GKR}	—5V
Peak Recurrent Forward Current	
10μs, 1% Duty Cycle	8A
100μs, 1% Duty Cycle	5A
Power Dissipation	
25°C Ambient	400mW
Derating Factor	3.2mW/°C
Storage Temperature	—55°C to +125°C
Operating Temperature Range	—55°C to +125°C

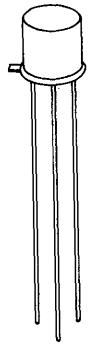
MECHANICAL SPECIFICATIONS

2N6119-2N6120



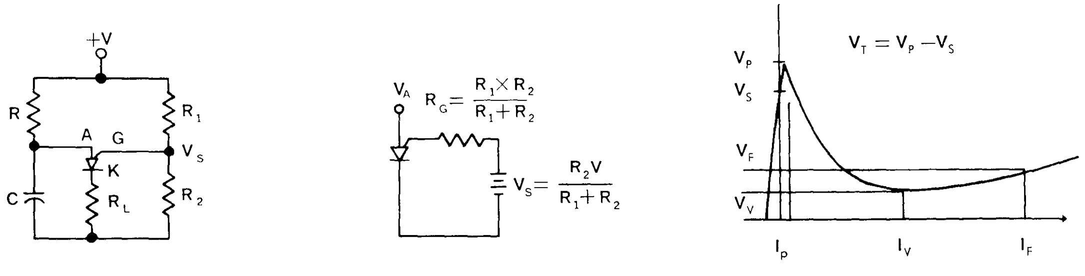
Dimensions in inches.

TO-18



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Fig.	2N6119		2N6120		Units	Test Conditions
			Min.	Max.	Min.	Max.		
Peak Current	I_P	1	— —	5 2	— —	1.0 0.15	μA μA	$R_G = 10k, V_S = 10V$ $R_G = 1$ Meg.
Valley Current	I_V	1	70 — 1.5	— 50 —	25 — 1.0	— 25 —	μA μA mA	$R_G = 10k, V_S = 10V$ $R_G = 1$ Meg. $R_G = 200\Omega$
Offset Voltage	V_T	1	0.2 0.2	0.6 1.6	0.2 0.2	0.6 0.6	V V	$R_G = 10k, V_S = 10V$ $R_G = 1$ Meg.
Gate-to-Anode Leakage	I_{GAO}	2	— —	10 100	— —	10 100	nA nA	$T = 25°C, V_S = 40V$ $T = 75°C$
Gate-to-Cathode Leakage	I_{GKS}	3	—	100	—	100	nA	$V_S = 40V$
Forward Voltage	V_F	4	—	1.0	—	1.0	V	$I_F = 50mA$
Pulse Output Voltage	V_o	5	9	—	9	—	V	
Pulse Output Rate of Rise	t_r	5	—	80	—	80	ns	



a) Typical Circuit

b) Equivalent Test Circuit

c) Characteristic Curve

Figure 1

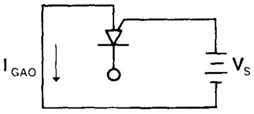


Figure 2

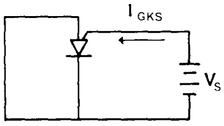


Figure 3

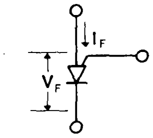


Figure 4

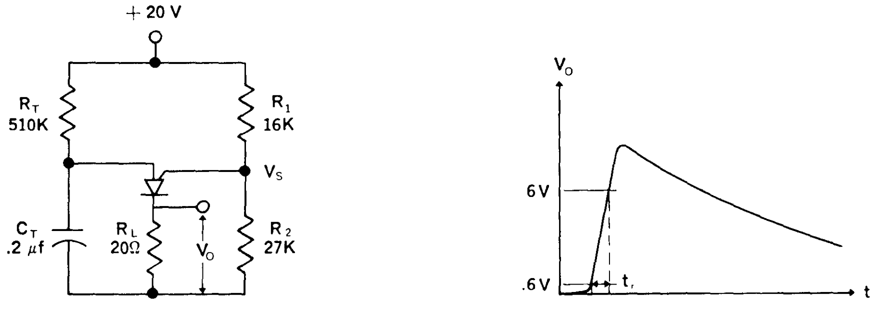
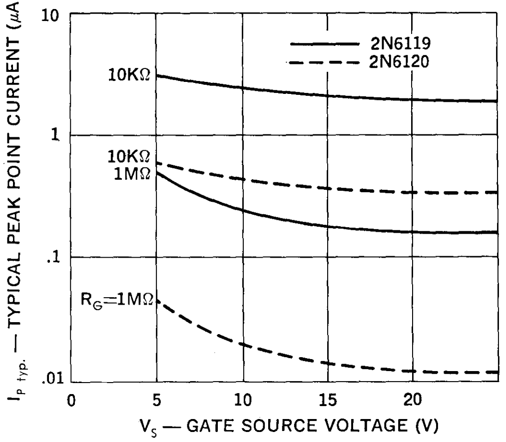
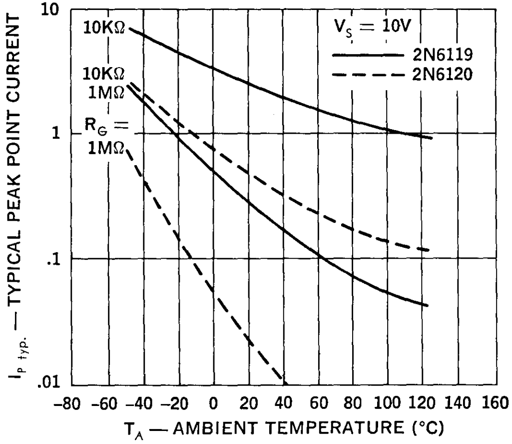


Figure 5

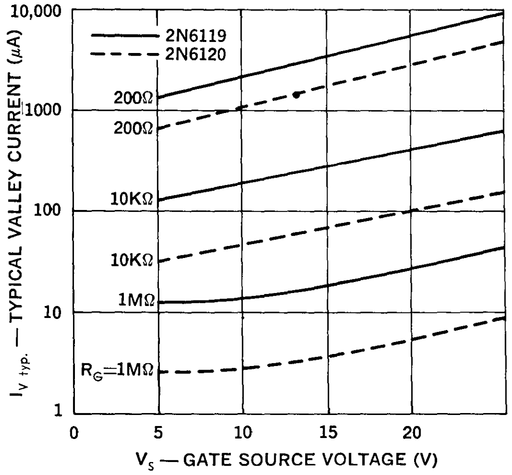
Typical Peak Point Current
vs. Gate Source Voltage



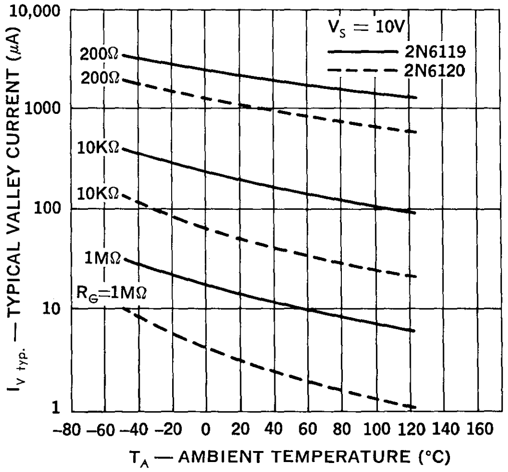
Typical Peak Point Current
vs. Ambient Temperature



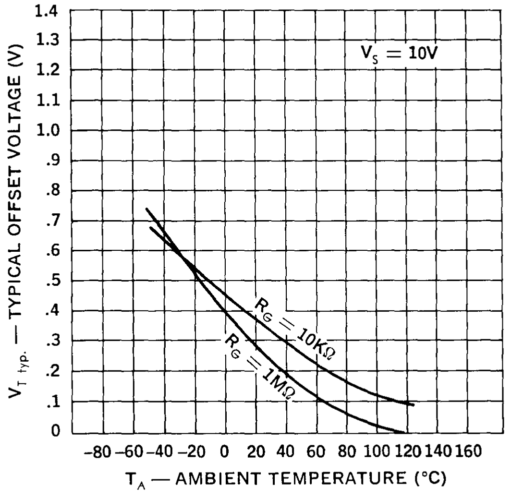
Typical Valley Current
vs. Gate Source Voltage



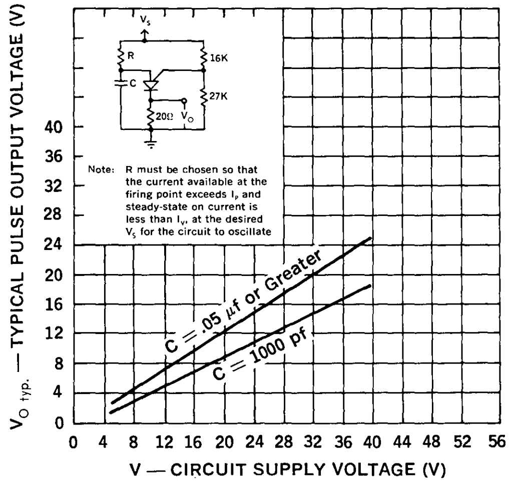
Typical Valley Current
vs. Ambient Temperature



Typical Offset Voltage vs. Ambient Temperature

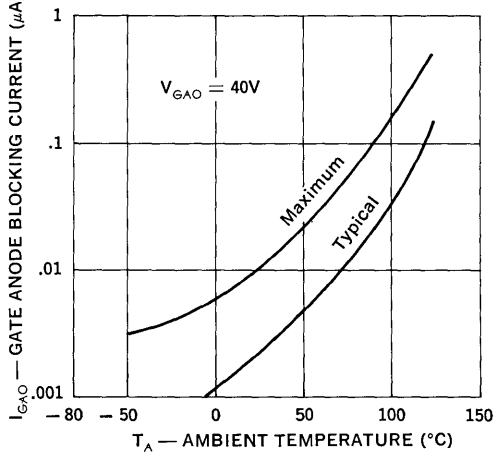


Typical Pulse Output vs. Circuit Supply Voltage

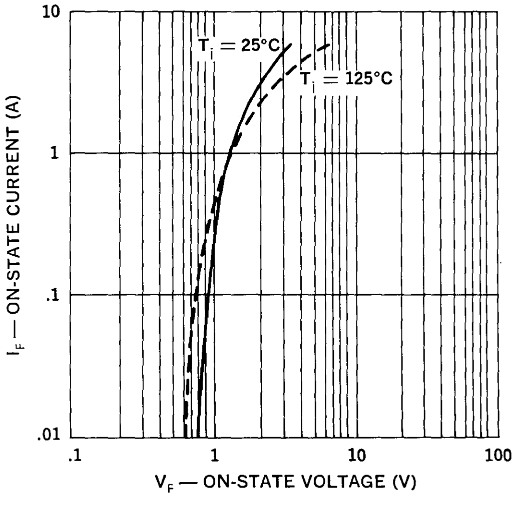


Note: R must be chosen so that the current available at the firing point exceeds I_P and steady-state on current is less than I_V, at the desired V_S for the circuit to oscillate

Gate-Anode Blocking Current vs. Ambient Temperature



Typical On-State Current vs. Voltage



PUTs

2N6137-2N6138

Military, Planar, TO-18, Hermetic

FEATURES

- Available as JAN and JAN TX types
- −55°C to +125°C Temperature Range for Timing and Oscillator Circuits
- $I_P \leqslant 10\mu A$ at $T = -55°C$
  $I_V \geqslant 40\mu A$ at $T = +125°C$
- Programmable η, R_{BB}, I_P and I_V
- Peak Recurrent Current: of 5A
- Low On-State Voltage Drop
- Hermetically Sealed Metal Case and Planar Passivated Construction for Maximum Reliability and Parameter Stability.

DESCRIPTION

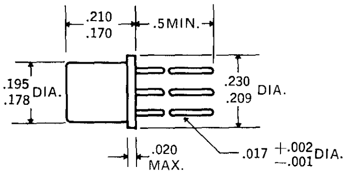
The Programmable Unijunction Transistor is functionally equivalent to a standard unijunction transistor with the advantage that external resistors can be used to program η, R_{BB}, I_P, and I_V, depending upon the designer's needs. The Unitrode device, in addition to allowing programmable versatility, is completely planar passivated and packaged in a TO-18 hermetically sealed package, which offers an order of magnitude improvement in inherent reliability over many similar devices. Applications include pulse and timing circuits, SCR trigger circuits, relaxation oscillators, and sensing circuits. For further application information see Unitrode Application Note U-66.

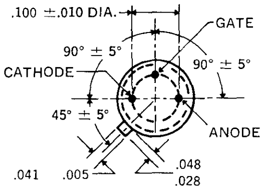
ABSOLUTE MAXIMUM RATINGS

	2N6137	2N6138
Anode-to-Cathode Forward Voltage, V_{AK}	40V	100V
Anode-to-Cathode Reverse Voltage, V_{AKR}	40V	100V
Gate-to-Cathode Forward Voltage, V_{GK}	40V	100V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V	100V
Gate-to-Cathode Reverse Voltage, V_{GKR}	5V	5V
Peak Recurrent Forward Current, 10µs 1% Duty Cycle	5A	5A
Peak Gate Current, I_{GM}	250mA	250mA
Average Gate Current, $I_{G(AV)}$	50mA	50mA
Power Dissipation		
25°C Ambient	300mW	300mW
Derating Factor	2.4mW/°C	2.4mW/°C
Storage Temperature Range	−55°C to +125°C	
Operating Temperature Range	−55°C to +125°C	

MECHANICAL SPECIFICATIONS

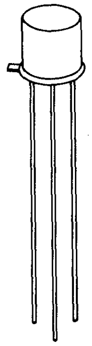
2N6137-2N6138





Dimensions in inches.

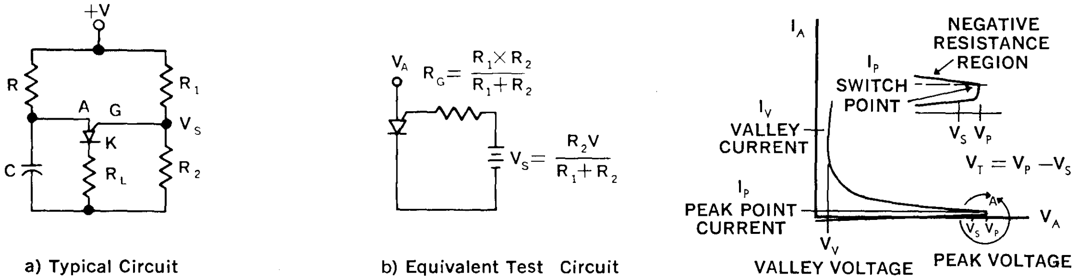
TO-18



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	Figure	Minimum	Typical	Maximum	Units	Test Conditions
SUBGROUP 1 Visual and Mechanical	—	—	—	—	—	—	—
SUBGROUP 2							
Gate-anode blocking current	I_{GAO}	2	—	2	10	nA	V_{GA} = Rating
Gate-cathode blocking current	I_{GKS}	3	—	5	100	nA	V_{GK} = Rating
SUBGROUP 3							
Peak-point anode current	I_P	1	— —	1 2.5	2 5	μA μA	R_G = 1 Meg R_G = 10K } V_S = 10V
Peak-point offset voltage	V_T	1	0.2 0.2	0.26 0.35	1.6 0.6	V V	R_G = 1 Meg R_G = 10K } V_S = 10V
Valley-point anode current	I_V	1	— 70 1.5	15 200 2	50 — —	μA μA mA	R_G = 1 Meg R_G = 10K R_G = 200Ω } V_S = 10V
SUBGROUP 4							
Forward on-state voltage	V_F	4	—	0.85	1.5	V	I_F = 50mA
Peak pulse voltage	V_o	5	9	12	—	V	
Peak pulse voltage rise time	t_r	5	—	50	80	ns	
SUBGROUP 5							
Gate-anode blocking current (125°C Test)	I_{GAO}	2	—	150	500	nA	V_{GA} = Rating
Valley-point anode current (125°C Test)	I_V	1	40	100	—	μA	R_G = 10K, V_S = 10V
Peak-point anode current (—55°C Test)	I_P	1	—	7.5	10	μA	R_G = 10K, V_S = 10V

† All values in table are JEDEC registered



a) Typical Circuit

b) Equivalent Test Circuit

Figure 1

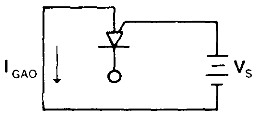


Figure 2

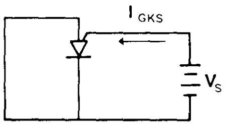


Figure 3

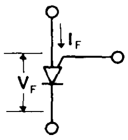


Figure 4

Note: Conditions for oscillation

$$\frac{V_{BB} - V_P}{R} > I_P$$

$$\frac{V_{BB} - V_V}{R} < I_V$$

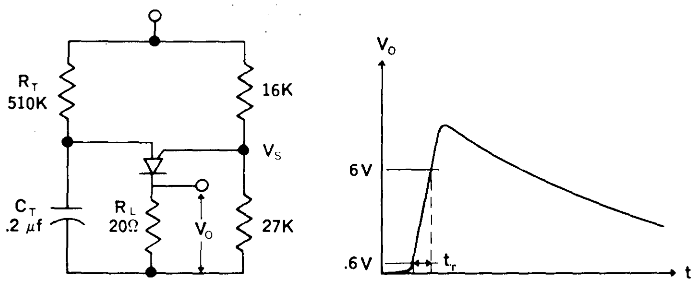
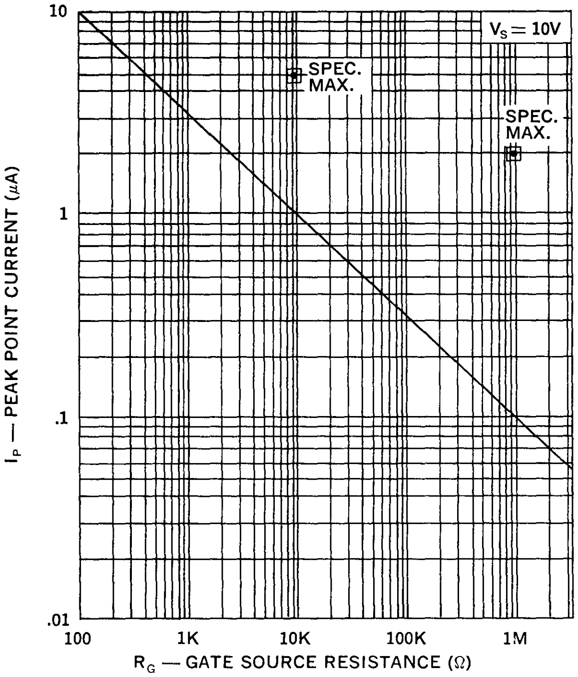
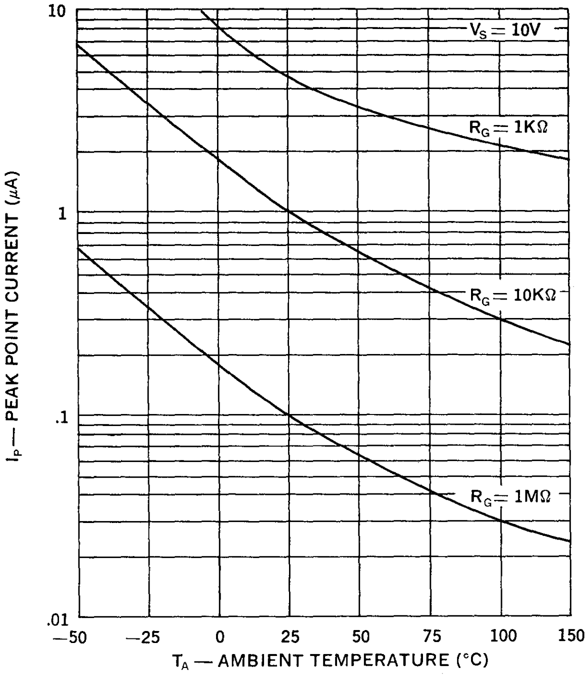


Figure 5

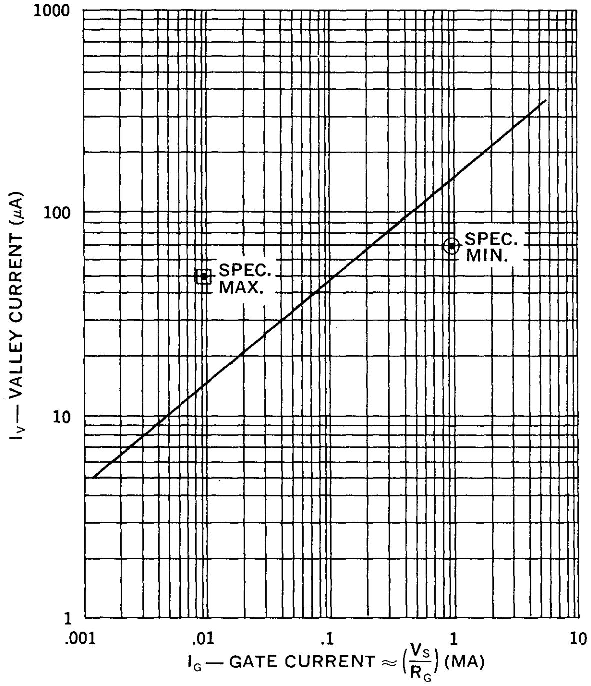
Peak Point Current vs. Gate Source Resistance



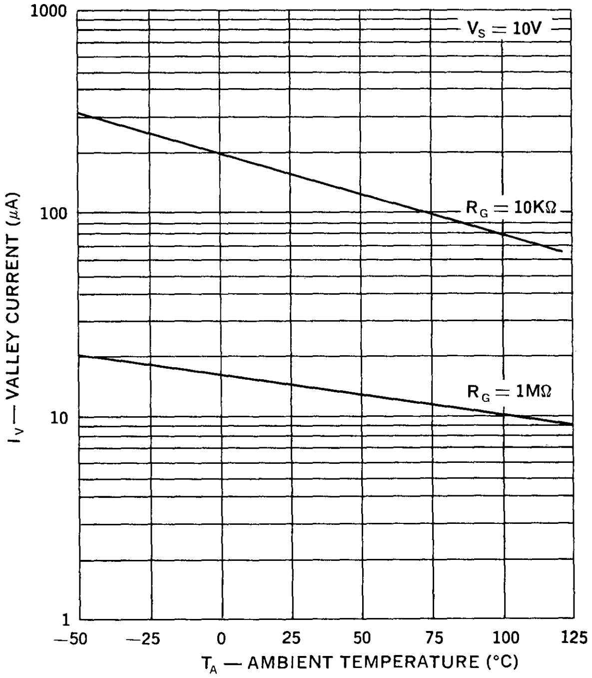
Peak Point Current vs. Ambient Temperature



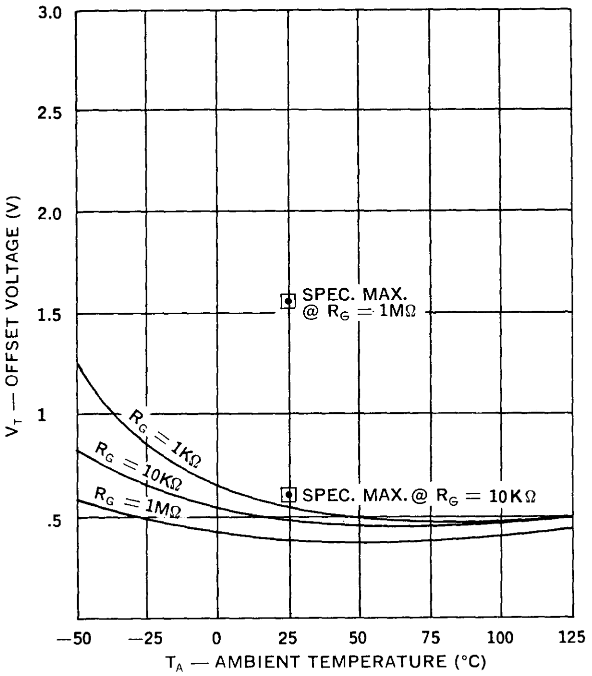
Valley Current vs. Gate Current



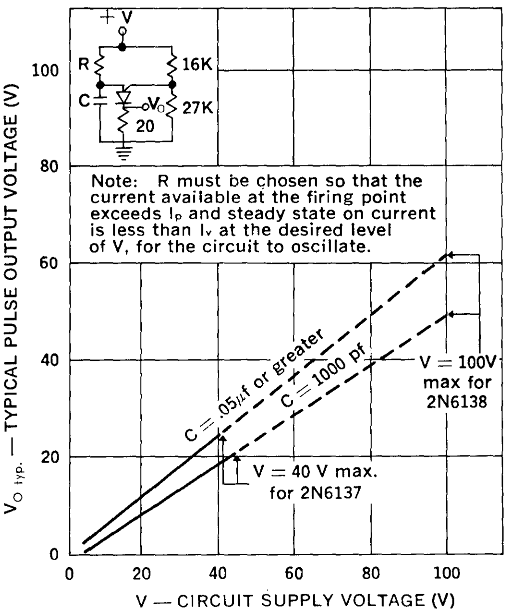
Valley Current vs. Ambient Temperature



Offset Voltage vs. Ambient Temperature

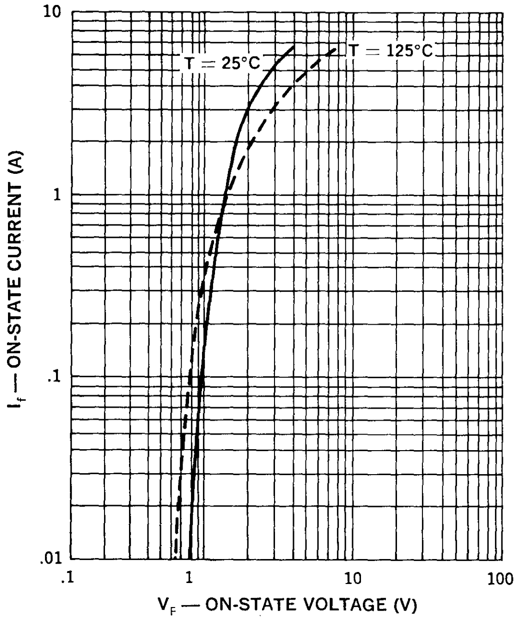


Typical Pulse Output Voltage vs. Circuit Supply Voltage

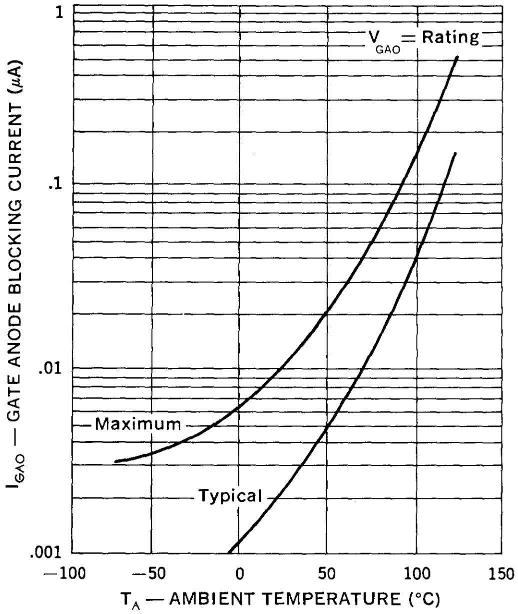


Note: R must be chosen so that the current available at the firing point exceeds I_P and steady state on current is less than I_V at the desired level of V, for the circuit to oscillate.

Typical Current vs. On-State Voltage



Gate-Anode Blocking Current vs. Ambient Temperature



POWER TRANSISTORS

2N6232 6232-4

10 Amp, 100V, Planar NPN

FEATURES

- Collector-Base Voltage: up to 140V
- D.C. Collector Current: 10A
- Fast Switching
- Low Saturation Voltage

DESCRIPTION

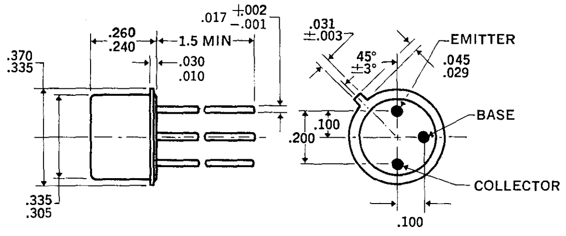
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply, pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N6232 6232-4
Collector-Base Voltage, V_{CBO}	140V
Collector-Emitter Voltage, V_{CEO}	100V
Emitter-Base Voltage, V_{EBO}	7V
D.C. Collector Current, I_C	10A
Power Dissipation	
25°C Ambient	1.25W
100°C Case	15W
Operating and Storage Temperature Range	—65°C to 200°C

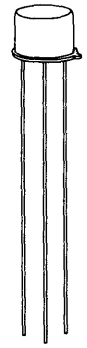
MECHANICAL SPECIFICATIONS

2N6232

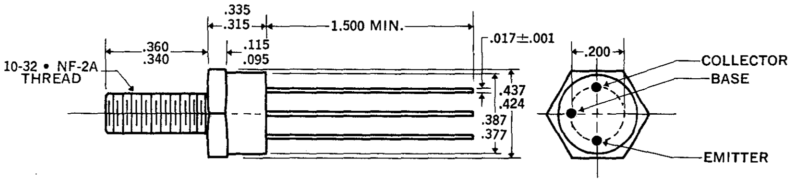


Dimensions in inches.

TO-5

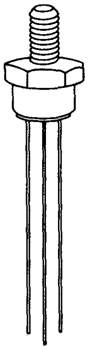


6232-4



Dimensions in inches.

TO-5 (Stud)



UNITRODE

Electrical Specification (at 25°C unless noted) †

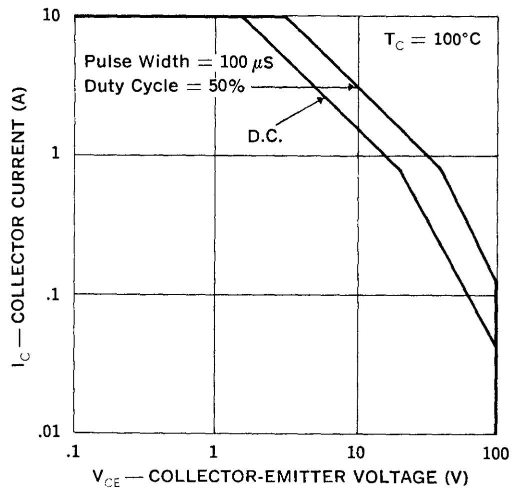
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain	h_{FE}	40	250	—	$I_C = 0.5A, V_{CE} = 2V$
D.C. Current Gain (Note 2)	h_{FE}	25	100	—	$I_C = 5A, V_{CE} = 2V$
D.C. Current Gain (Note 2)	h_{FE}	20	—	—	$I_C = 10A, V_{CE} = 5V$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	0.7	V	$I_C = 5A, I_B = 0.5A$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	1.4	V	$I_C = 10A, I_B = 1A$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	1.4	V	$I_C = 5A, I_B = 0.5A$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	1.8	V	$I_C = 10A, I_B = IA$
Collector-Emitter Sustaining Voltage (Note 2)	BV_{CER}	140	—	V	$I_C = 10mA, R_{BE} = 10\Omega$
Collector-Emitter Sustaining Voltage (Note 2)	V_{CEO} (sus)	100	—	V	$1_C = 100mA, I_B = 0$
Emitter-Cutoff Current	I_{EBO}	—	10	µA	$V_{EB} = 7V$
Collector Cutoff Current	I_{CES}	—	0.2	µA	$V_{CE} = 140V, R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}	—	0.1	mA	$V_{CE} = 100V, R_{BE} = 0$
Collector Capacitance	C_{obo}	—	150	pf	$V_{CB} = 10, I_E = 0, f = 1MHz$
A.C. Current Gain	h_{fe}	3	—	—	$I_C = 0.5A, V_{CE} = 5V$ $f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	—	250	ns	$I_C = 5A$
Switching Speeds Turn-off Time	t_{off}	—	1.2	µs	$I_{b1} = 500mA$ $I_{b2} = -500mA$

Notes:

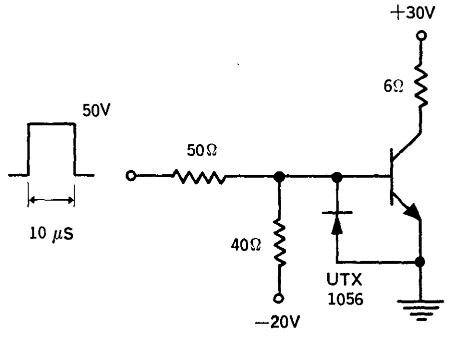
1. The device may be switched between maximum rated collector current and maximum rated collector — emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Pulse length = 300 µs; duty cycle ≤2%.
3. Measured in saturated switching speed circuit.

† All values in this table are JEDEC registered.

Maximum Safe Operating Area



Switching Speed Circuit



POWER DARLINGTONS

5 Amp, 150V, NPN

2N6350
2N6351
2N6352
2N6353

FEATURES

- High Current Gain: up to 2000 min. @ $I_C = 5A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 2A$
- Peak Current: to 10A
- JAN/JANTX versions meet MIL-S-19500/472

DESCRIPTION

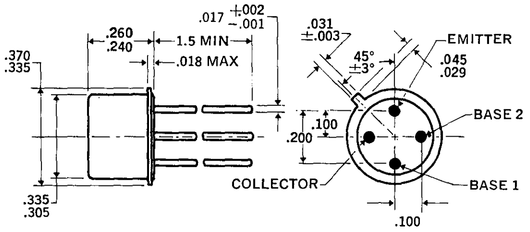
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip. The 2N6350 series is characterized for fast switching applications.

ABSOLUTE MAXIMUM RATINGS

	TO-33		3 PIN TO-66	
	2N6350	**2N6351**	**2N6352**	**2N6353**
Collector — Emitter Voltage	80V	150V	80V	150V
Emitter — Base Voltages				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	5A	5A	5A	5A
Peak Collector Current	10A	10A	10A	10A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2W	2W
100°C Case	5W	5W	20W	20W
Thermal Resistance				
Junction-to-Case	20°C/W		4°C/W	
Operating and Storage Temperature Range	−65°C to 200°C		−65°C to 200°C	

MECHANICAL SPECIFICATIONS

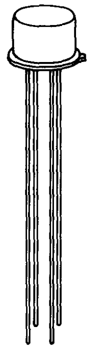
2N6350 2N6351



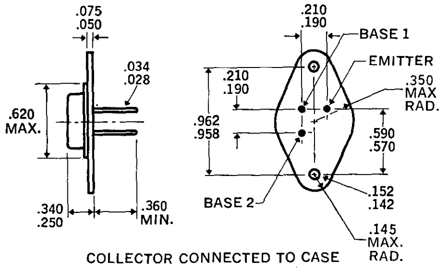
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO-33



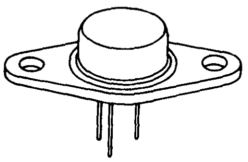
2N6352 2N6353



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-66

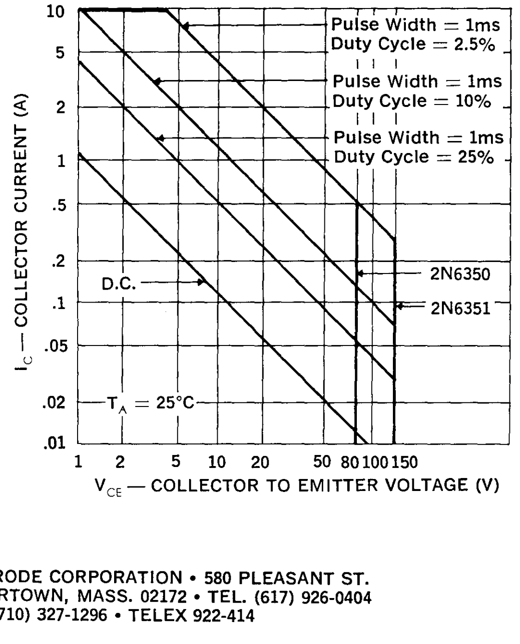


UNITRODE

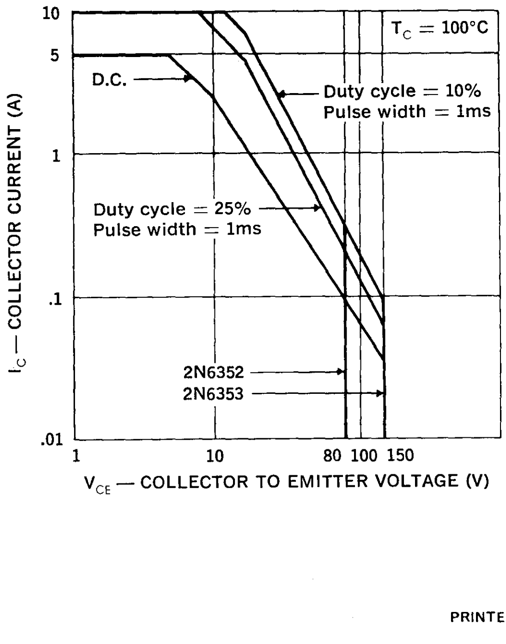
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Max.	Units	MIL-STD-750	
					Method	Test Conditions
Visual and Mechanical					2071	See Mechanical Data
25°C Collector–Emitter Breakdown Voltage 2N6350, 2N6352 2N6351, 2N6353	BV_{CEO}	 80 150		 Vdc Vdc	3011	$I_C = 25mA$, $R_{BE1} = 2.2K$, $R_{BE2} = 100$ Ohms
Emitter Base Breakdown Voltage, Base 1	BV_{EBO1}	12		Vdc	3026	$I_E = 10\mu Adc$ Base 1 Open
Emitter Base Breakdown Voltage, Base 2	BV_{EBO2}	6		Vdc	3026	$I_E = 10\mu Adc$ Base 2 Open
Collector — Emitter Cutoff Current	I_{CEX}		1.0	µAdc	3041	$V_{CE} = BV_{CEO}$ Rating
D.C. Current Gain 2N6350, 2N6352 2N6351, 2N6353	h_{FE}	 2000 1000			3076	$V_{CE} = 5Vdc$; $I_C = 1.0A$ (pulse) $R_{BE2} = 1K$
D.C. Current Gain 2N6350, 2N6352 2N6351, 2N6353	h_{FE}	 2000 1000	 10000 10000		3076	$V_{CE} = 5Vdc$; $I_C = 5.0Adc$ (pulse) $R_{BE2} = 100$ Ohms
D.C. Current Gain 2N6350, 2N6352 2N6351, 2N6353	h_{FE}	 400 200			3076	$V_{CE} = 5Vdc$; $I_C = 10Adc$ (pulse) $R_{BE2} = 100$ Ohms
Collector Saturation Voltage 2N6350, 2N6352 2N6351, 2N6353	V_{CE} (sat)		 1.5 1.5	 Vdc Vdc	3071	$I_C = 5.0Adc$, $R_{BE2} = 100$ Ohms $I_{B1} = 5mAdc$ (pulse) $I_{B1} = 10mAdc$ (pulse)
Base Saturation Voltage	V_{BE1} (on)		2.5	Vdc	3066	$I_C = 5.0Adc$ (pulse), $V_{CE} = 5Vdc$ $R_{BE2} = 100$ Ohms
A.C. Current Gain	$\lvert h_{FE} \rvert$	5	25		3066	$V_{CE} = 10Vdc$, $I_C = 1.0Adc$, $f = 10MHz$ $R_{BE2} = 100$ Ohms
Output Capacitance	C_{OBO1}		40	pf	3236	$V_{CB1} = 10Vdc$, $100KHz \leqslant f \leqslant 1MHz$ Base 2 open
Turn-on Time	t_{on}		0.5	µs	3251	$V_{CC} = 30Vdc$; $I_C = 5.0Adc$ See Switching Speed Circuit
Turn-off Time	t_{off}		1.2	µs	3251	$V_{CC} = 30Vdc$; $I_C = 5.0Adc$ See Switching Speed Circuit
150°C Collector-Emitter Cutoff Current	I_{CEX}		1.0	µAdc	3041	$V_{EB1} = 2Vdc$, $R_{BE2} = 100$ Ohms $V_{CE} = BV_{CEO}$ Rating
—65°C D.C. Current Gain 2N6350, 2N6352 2N6351, 2N6353	h_{FE}	 400 200			3076	$V_{CE} = 5Vdc$, $I_C = 5.0Adc$ (pulse) $R_{BE2} = 100$ Ohms

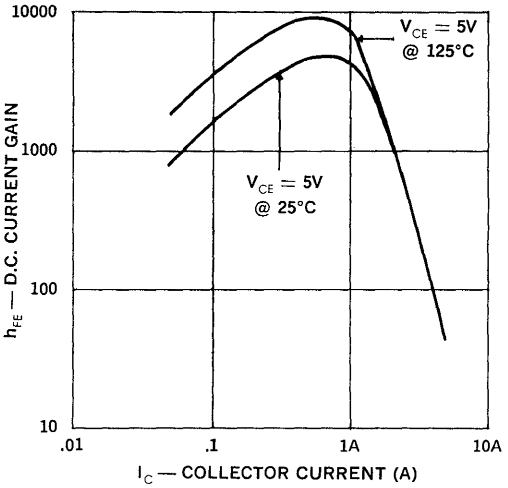
Maximum Safe Operating Area
2N6350 & 2N6351



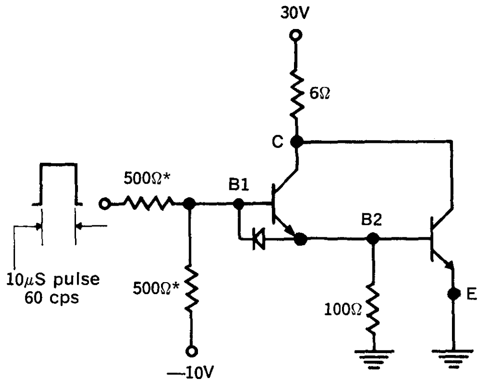
Maximum Safe Operating Area
2N6352 & 2N6353



D.C. Current Gain vs. Collector Current
2N6350 - 2N6353



Switching Speed Circuit



I_B (on) = I_B (off) = 25mA
I_C = 5A
*These resistor values are 1000 ohms for 2N6350 and 2N6352

RECTIFIER ASSEMBLIES
Single Phase Bridges, 10 Amp, Military Approved

JAN & JANTX 469-1
JAN & JANTX 469-2
JAN & JANTX 469-3

FEATURES
- Qualified to MIL-S-19500/469
- Current Rating: to 10A
- PIV: from 200 to 600V
- Surge Ratings: to 100A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Aluminum Heat Sink Case, Electrically Insulated

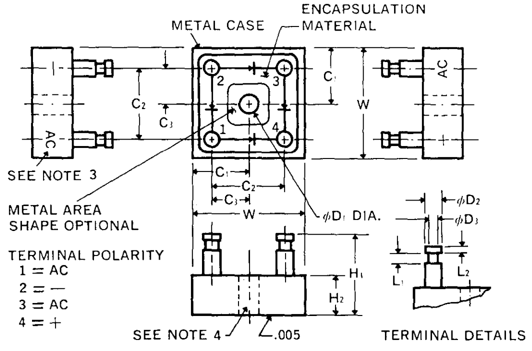
DESCRIPTION
This series of military high-current single-phase bridge offer the utmost in reliability as required in military system designs. This series is assembled with diodes which have been subjected to TX type screening tests.

ABSOLUTE MAXIMUM RATINGS
Peak Inverse Voltage .... 200 to 600V
Maximum Average D.C. Output Current
@ $T_C = 55°C$ 10A
@ $T_C = 100°C$ 6A
Non-Repetitive Sinusoidal Surge (8.3ms)
@ $T_C = 55°C$ 100A
Operating and Storage Temperature Range .... —65°C to +150°C
Thermal Resistance Junction to Ambient .... 25°C/W
Junction to Case .... 5°C/W

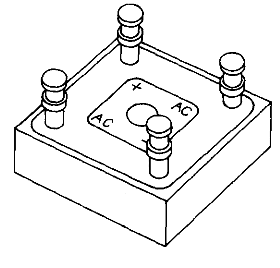
Dimensions				
Ltr	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
C_1	.367	.375	9.32	9.53
C_2	.350	.450	8.89	11.43
C_3	.175	.225	4.45	5.72
ϕD_1	.139	.149	3.53	3.78
ϕD_2	.091	.101	2.31	2.57
ϕD_3	.066	.076	1.68	1.93
H_1		.570		14.48
H_2		.370		9.40
L_1	.088	.098	2.24	2.49
L_2	.020	.030	.51	.76
W	.735	.750	18.67	19.05

MECHANICAL SPECIFICATIONS

JAN & JANTX 469-1 JAN & JANTX 469-2 JAN & JANTX 469-3



See table above



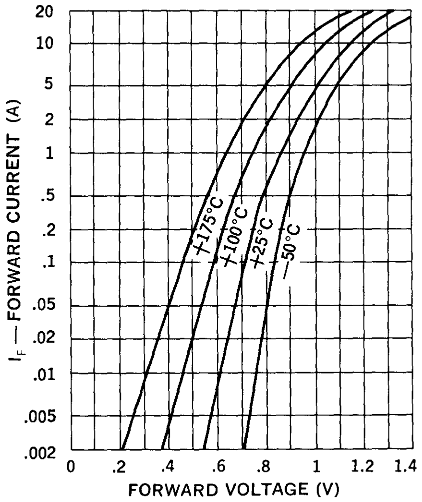
NOTES:
1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. Terminals shall be tinned.
3. Polarity shall be marked on the bridge body adjacent to terminals. Terminal numbers are for reference and do not have to be marked on the bridge; however, terminal (1) shall be indicated by a mechanical index such as a line, flattened corner, etc., visible from the top (terminal surface) of the device.
4. Point at which T_C is read shall be in metal part of a case as shown on drawing.

Electrical Specification (at 25°C unless noted)

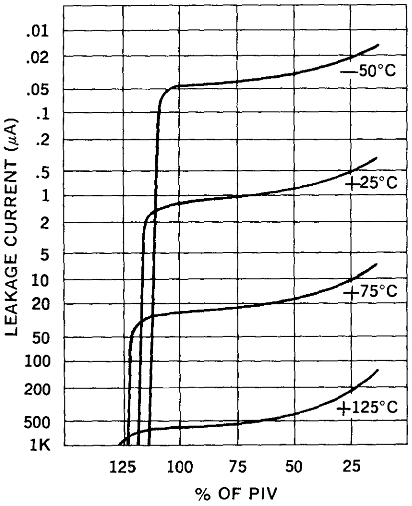
Type	PIV Per Leg	Maximum Forward Voltage Drop Per Leg*	Maximum Leakage Current Per Leg @ PIV	
			T_C = 25°C	T_C = 100°C
	Volts		μA	μA
JAN & JANTX 469-1	200	1.35V @ 15.7A(pk)	2	125
JAN & JANTX 469-2	400			
JAN & JANTX 469-3	600			

*Maximum forward voltage drop is measured at a pulse width of 8.3ms.

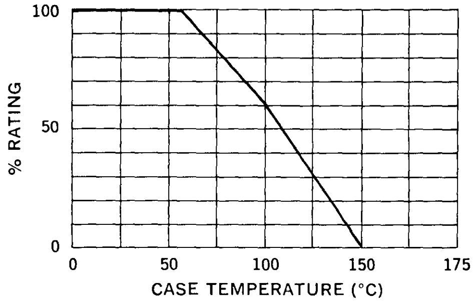
Typical Forward Voltage Per Leg vs. Forward Current

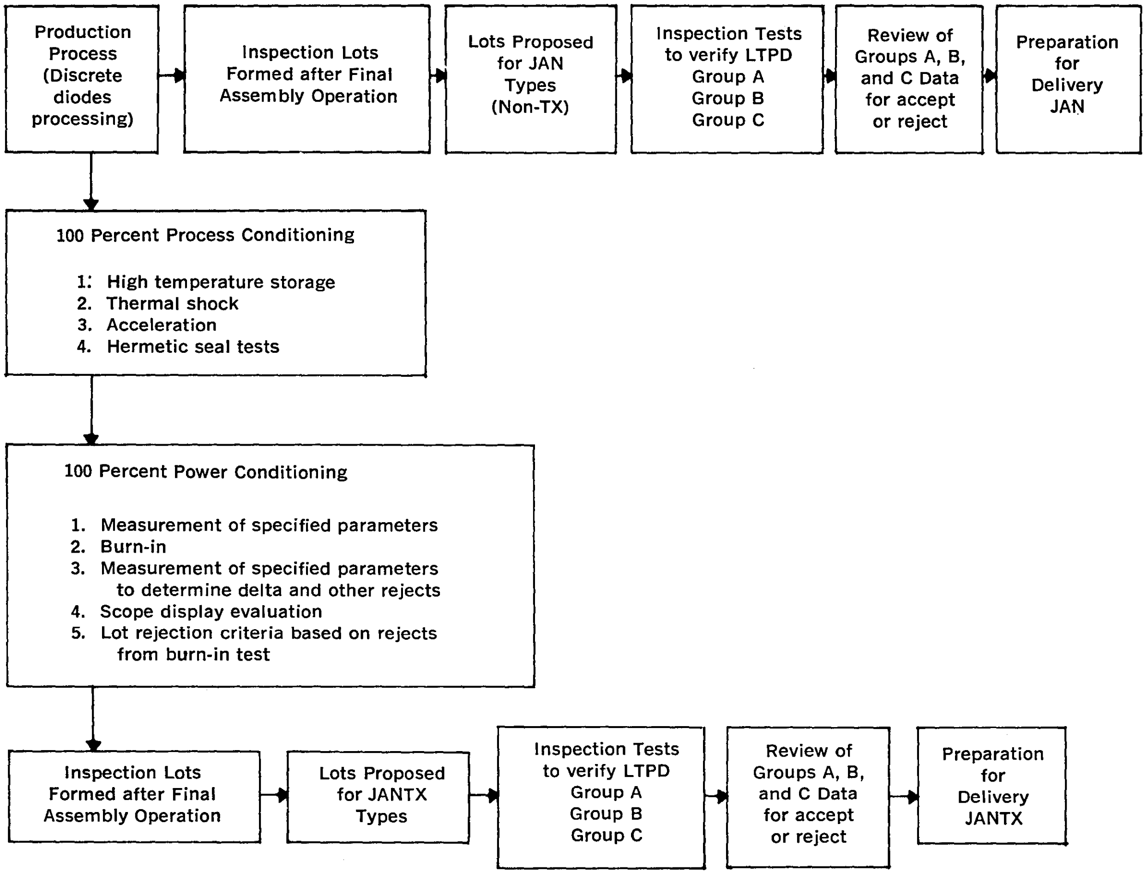


Typical Leakage Current vs. PIV



Current Derating Curve





RECTIFIER ASSEMBLIES

673, 676, 677 SERIES

Single Phase Bridges, 1.5Amp, Standard, Fast and Ultra-Fast Recovery

FEATURES
- Miniature Package
- Surge Ratings: to 25A
- PIV's: from 50 to 600V
- Recovery Times: to 75ns
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used

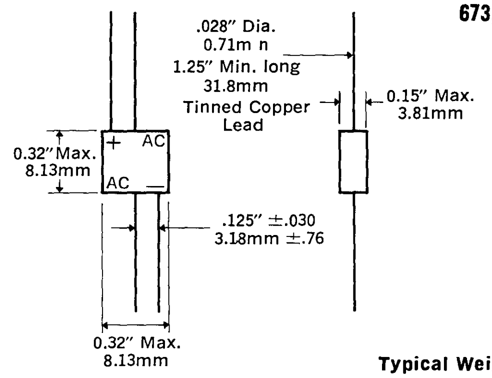
DESCRIPTION
These miniature transfer-molded single-phase power bridges are designed for universal application in power supplies. One basic bridge assembly comes in a choice of lead configurations for mounting in wired chassis or on printed boards.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	50 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3mS)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	50°C/W

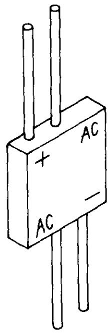
MECHANICAL SPECIFICATIONS

673, 676, 677 SERIES

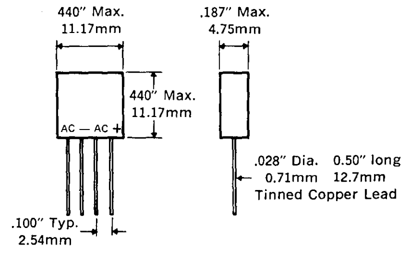


Typical Weight G: 1.4 grams

G BODY



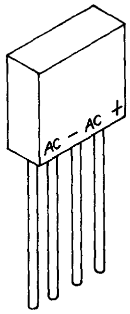
673, 676, 677 SERIES



When specifying S body, add suffix S i.e., 673-1S

Typical Weight S: 3.1 grams

S BODY



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

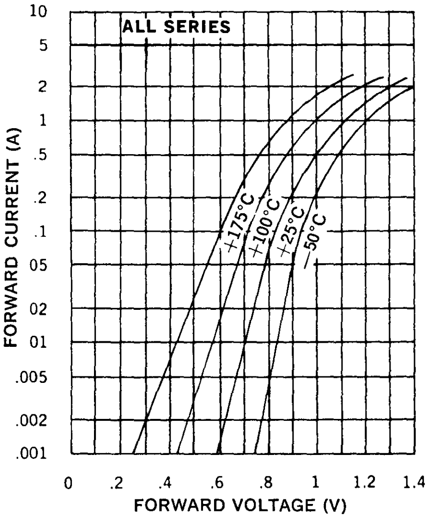
Part number is printed on the body.

UNITRODE

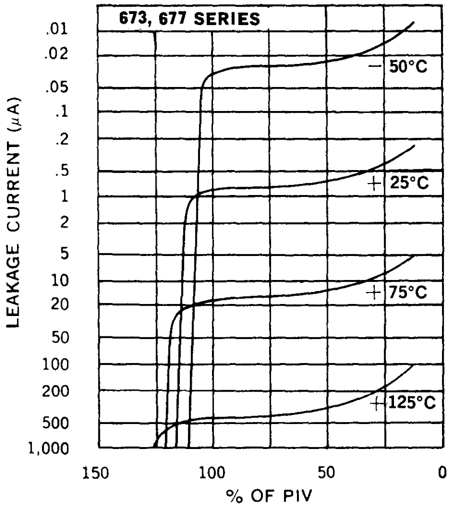
Electrical Specifications (at 25°C unless noted)							Maximum Ratings	
Type		PIV Per Leg	Maximum Forward Drop Per Leg	Leakage Current Per Leg		Maximum Reverse Recovery Time†	Maximum Average D.C. Output Current T_A = 25°C	Non-Repetitive Sinusoidal Surge (8.3mS)
				T_A = 25°C	T_A = 100°C			
		Volts		μA	μA	ns	Amps	Amps
Standard	673-1	100	1.1V @ 0.5A	2	100	—	1.5	25
Recovery	673-2	200						
	673-3	300						
	673-4	400						
	673-5	500						
	673-6	600						
Fast	676-1	100	1.1V @ 0.5A	3	150	500	1.0	20
Recovery	676-2	200						
	676-3	300						
	676-4	400						
	676-5	500						
	676-6	600						
Ultra-Fast	677-1	50	1.1V @ 0.5A	2	100	75	1.0	20
Recovery	677-2	100						
	677-3	150						
	677-4	200						

†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

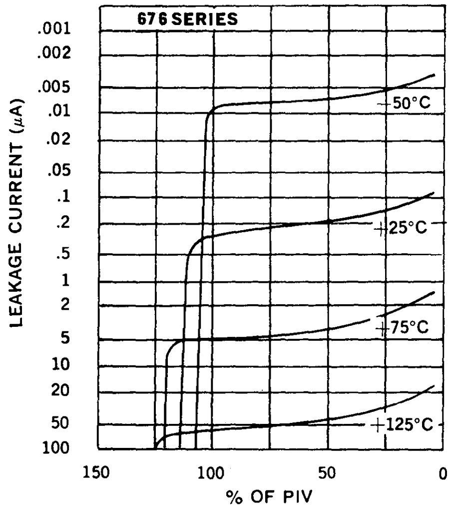
Typical Forward Voltage Per Leg vs. Forward Current



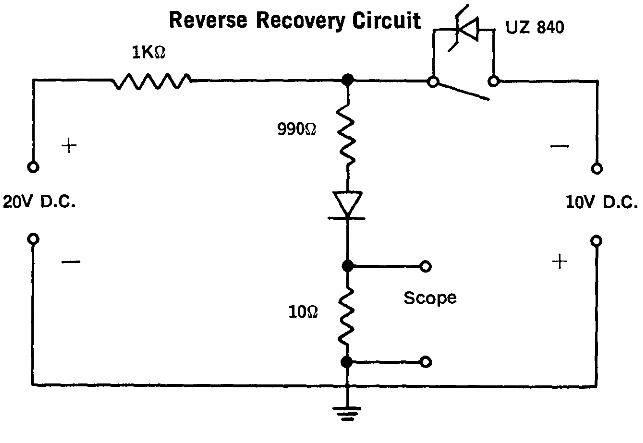
Typical Leakage Current vs. PIV



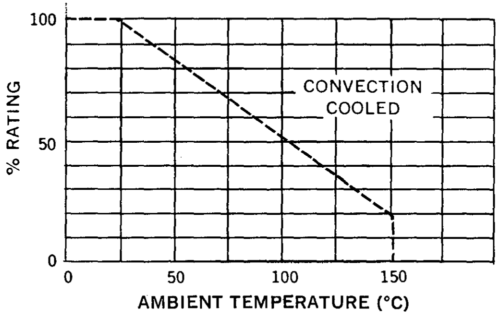
Typical Leakage Current vs. PIV



Reverse Recovery Circuit



Current Derating Curve



RECTIFIER ASSEMBLIES

Single Phase Bridges, Standard and Fast Recovery

673, 676 SERIES

FEATURES

- Miniature High Voltage Bridges
- Continuous Ratings: to 0.6A
- Surge Ratings: to 15A
- PIV's: from 1200 to 5000V
- Recovery Times: to 500ns
- Controlled Avalanche Characteristics
- Only Fused in Glass Diodes Used

DESCRIPTION

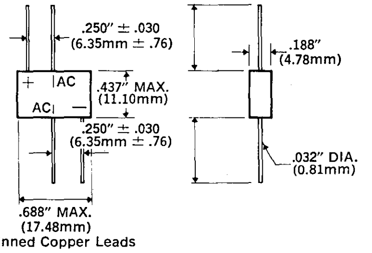
These miniature molded high-voltage single phase bridges are designed for universal application in power supplies. The miniature package is shatterproof and is capable of handling extremes in temperature, vibration and shock. These bridges, therefore are ideally suited for miniaturized, tightly packaged equipment operating in extreme environments.

ABSOLUTE MAXIMUM RATINGS

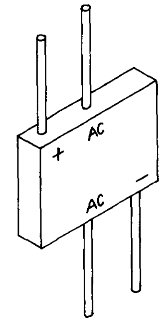
Peak Inverse Voltage	1200 to 5000V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	−65°C to +150°C
Thermal Resistance Junction-to-Ambient	50°C/W

MECHANICAL SPECIFICATIONS

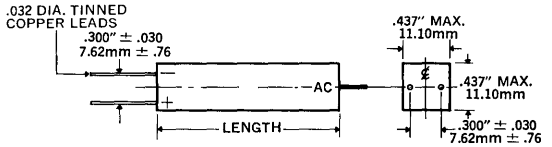
673-7



Body H



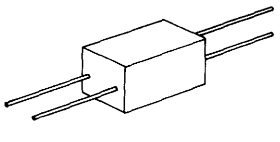
673, 676 SERIES



MAX. LENGTHS

J	K	L	M	N	O	P
.562"	.688"	.875"	1.125"	1.25"	1.375"	1.625"
14.27mm	17.48mm	22.23mm	28.58mm	31.75mm	34.92mm	41.28mm

BODY J through P



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative Output	—

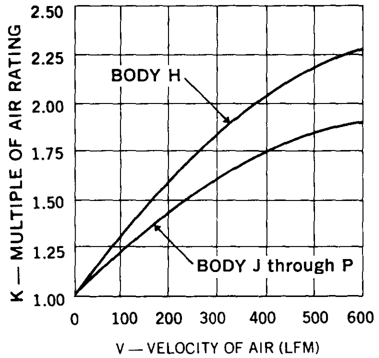
Part number is printed on the body.

UNITRODE

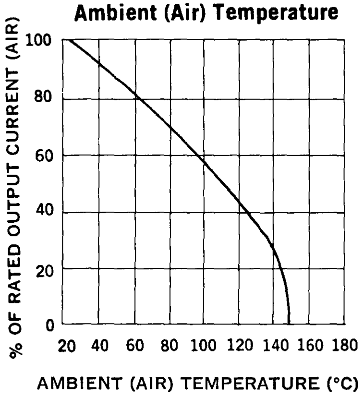
Type		Electrical Specifications at 25°C						Maximum Ratings		
		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Body Size	Maximum Average D.C. Output Current		Non-repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$			$T_A = 25°C$ Air	$T_A = 50°C$ Oil	
		Volts		μA	μA	ns		Amps	Amps	Amps
Standard Recovery	673-7	1200	2.2V @ 0.4A	2	100		H	0.6	1.5	15
	673-75	1800	3.3V @ 0.4A				J	0.5	1.25	
	673-8	2400	4.4V @ 0.4A				K	0.4	1.0	
	673-85	3000	5.5V @ 0.3A				L	0.3	0.75	
	673-9	3600	6.6V @ 0.2A				M	0.2	0.5	
	673-10	4200	7.7V @ 0.2A				N	0.18	0.45	
	673-11	4800	8.8V @ 0.15A				O	0.16	0.4	
	673-12	5000	9.0V @ 0.15A				O	0.16	0.4	
Fast Recovery	676-12	1200	3.3V @ 0.3A	5	150	500	J	0.4	1.0	10
	676-18	1800	4.4V @ 0.2A				K	0.35	0.85	
	676-24	2400	5.5V @ 0.2A				L	0.325	0.8	
	676-30	3000	7.7V @ 0.2A				M	0.25	0.625	
	676-36	3600	8.8V @ 0.15A				N	0.175	0.425	
	676-42	4200	9.9V @ 0.15A				O	0.15	0.375	
	676-48	4800	11V @ 0.15A				P	0.135	0.325	
	676-50	5000	11V @ 0.15A				P	0.125	0.3	

†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

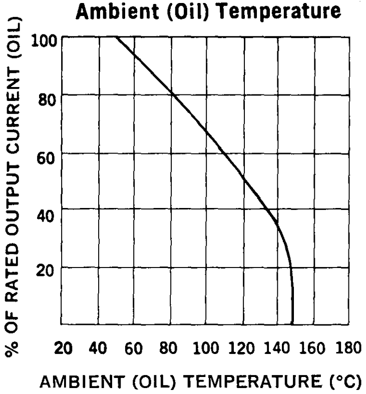
Output Current Ratio vs Velocity of Air Flow



Output Current vs Ambient (Air) Temperature

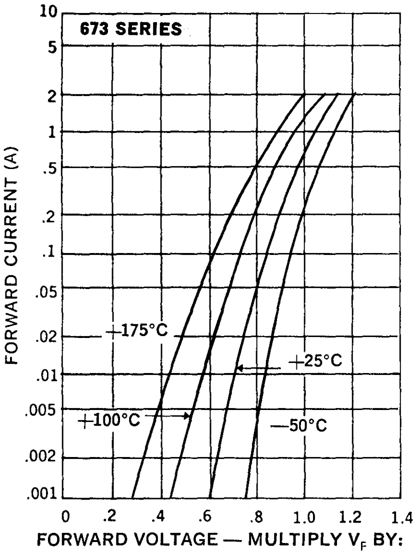


Output Current vs Ambient (Oil) Temperature

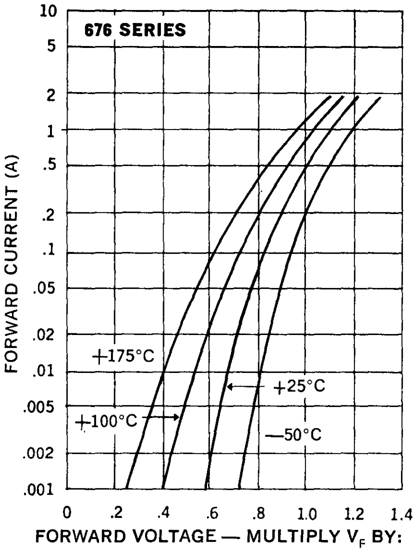


Application example: The rectifier is to be used in a cabinet at 60°C with ambient air moving at 400 LFM. The rating is reduced (Fig. 2) by a factor of 0.81 due to the elevated temperature, but is enhanced by 2.X (Fig. 1) due to the air flow. Hence the DC output current is 0.81 x 2, or 1.6 times the 25°C air rating.

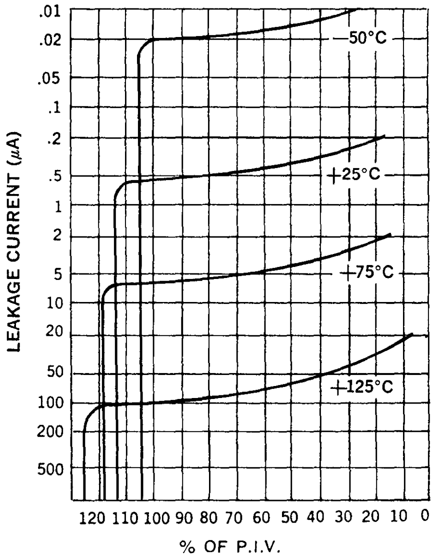
Typical Forward Voltage vs Forward Current



Typical Forward Voltage vs Forward Current



Typical Leakage Current vs. Voltage



RECTIFIER ASSEMBLIES

Three Phase Bridges, 15-25 Amp, Standard and Fast Recovery Magnum®

678, 682, 695
696 SERIES

FEATURES

- Current Rating: to 25A
- PIVs: from 100 to 600V
- Only Fused-in-Glass Diodes Used
- Recovery Times: to 500ns
- Controlled Avalanche Characteristics
- Surge Ratings: to 150A
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

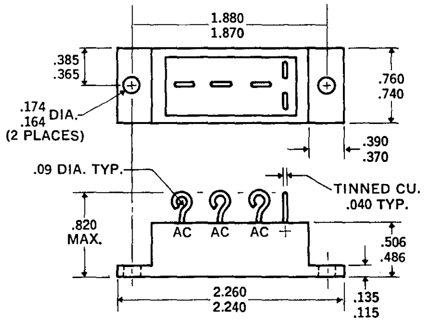
This series of three phase MAGNUM® bridges offer the ultimate in high current power supply applications. The fast recovery series allows operation at full power at high frequencies (up to 40KHz squarewave), often used in choppers, inverters and converters in aircraft, missiles, etc., equipment.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient, All Series	20°C/W
Junction to Case, 678, 682 Series	2.5°C/W
Junction to Case, 695, 696 Series	3.0°C/W

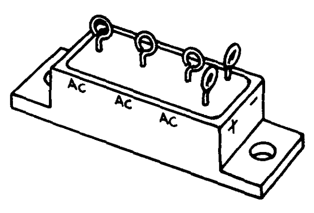
MECHANICAL SPECIFICATIONS

678, 682, 695, 696 SERIES



Dimensions in inches.

Typical Weight — 30 grams



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

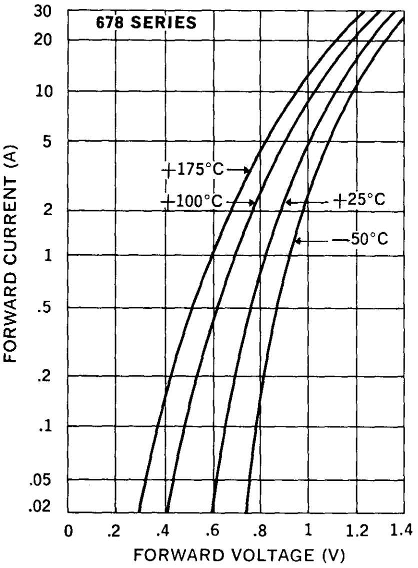
Part number is printed on the body.

UNITRODE

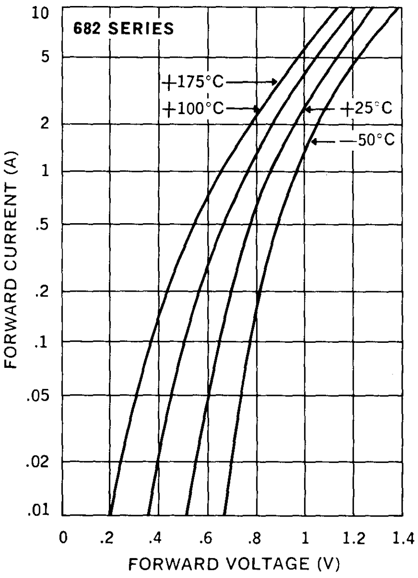
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				T_A = 25°C	T_A = 100°C		T_C = 55°C	T_C = 100°C	T_A = 100°C
		Volts		µA	µA	ns	Amps	Amps	Amps
Standard Recovery	678-1	100	1.2V @ 10A	10	200	—	25	18.5	150
	678-2	200							
	678-3	300							
	678-4	400							
	678-5	500							
	678-6	600							
Standard Recovery	695-1	100	1.2V @ 2A	5	150	—	15	9	80
	695-2	200							
	695-3	300							
	695-4	400							
	695-5	500							
	695-6	600							
Fast Recovery	682-1	100	1.2V @ 6A	10	200	500	20	14	150
	682-2	200							
	682-3	300							
	682-4	400							
	682-5	500							
	682-6	600							
Fast Recovery	696-1	100	1.2V @ 2A	5	150	500	15	9	60
	696-2	200							
	696-3	300							
	696-4	400							
	696-5	500							
	696-6	600							

*Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

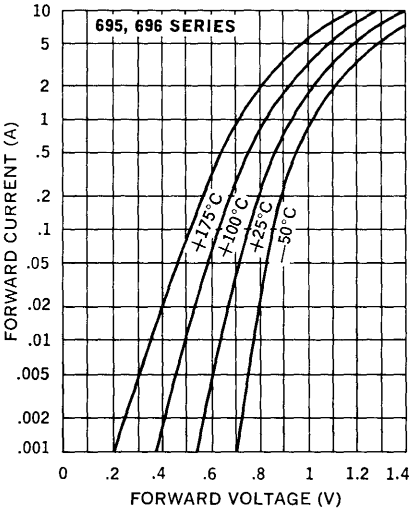
Typical Forward Voltage Per Leg vs. Forward Current



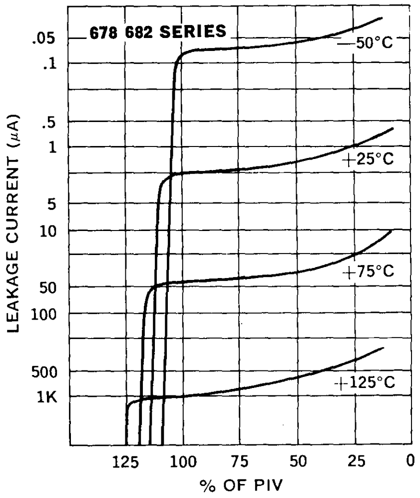
Typical Forward Voltage Per Leg vs. Forward Current



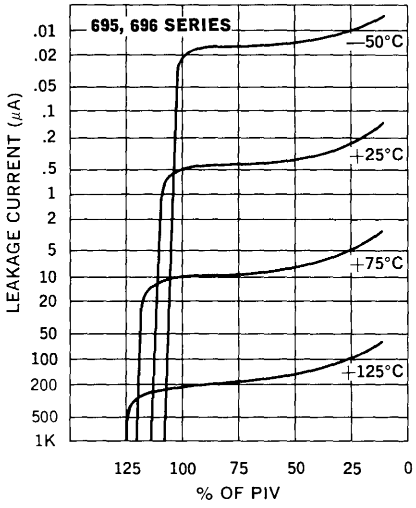
Typical Forward Voltage Per Leg vs. Forward Current



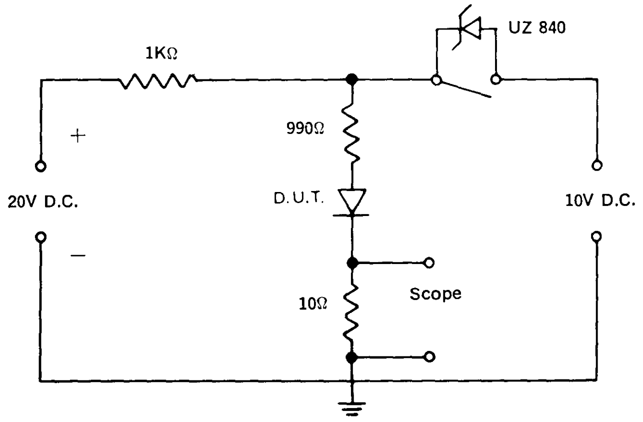
Typical Leakage Current vs. PIV



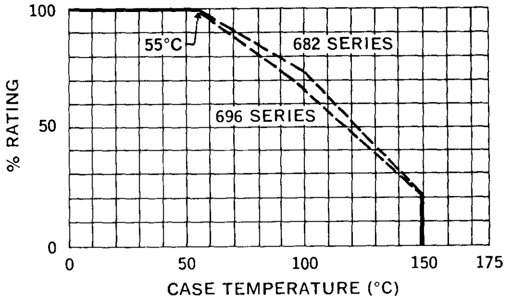
Typical Leakage Current vs. PIV



Reverse-Recovery Circuit

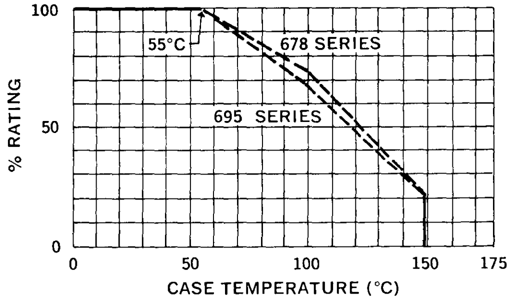


Current Derating Curve



Fast Recovery Series

Current Derating Curve



Standard Recovery Series

RECTIFIER ASSEMBLIES

679, 680, 683, 684 SERIES

Single Phase Bridges, 25 Amp, Standard and Fast Recovery Magnum™

FEATURES

- Current Ratings: to 25A
- Recovery Time: to 500ns
- PIVs: from 100 to 600V
- Surge Ratings: to 150A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

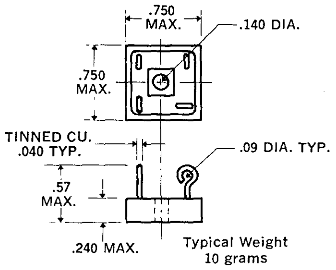
This series of single phase MAGNUM™ bridge offers the designer the ultimate in high current power supply applications. The fast recovery series allows operation at full power at high frequencies, up to 40kHz square wave, which is often used in chopper, inverters and converters in aircraft, missiles, etc., equipment.

ABSOLUTE MAXIMUM RATINGS

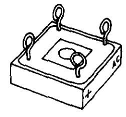
Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient, 679, 683 Series	20°C/W
Junction to Ambient, 680, 684 Series	25°C/W
Junction to Case, 679, 683 Series	2.5°C/W
Junction to Case, 680, 684 Series	5.0°C/W

MECHANICAL SPECIFICATIONS

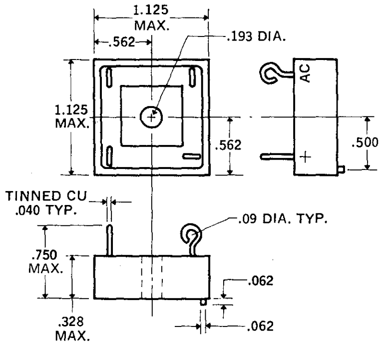
680, 684 SERIES



Dimensions in inches.



679, 683 SERIES



Dimensions in inches.

MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

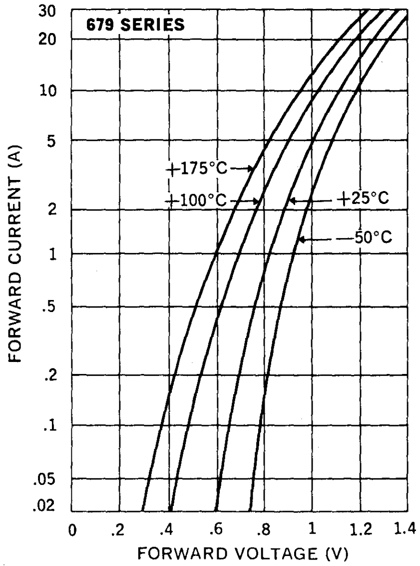
Part number is printed on the body.

UNITRODE

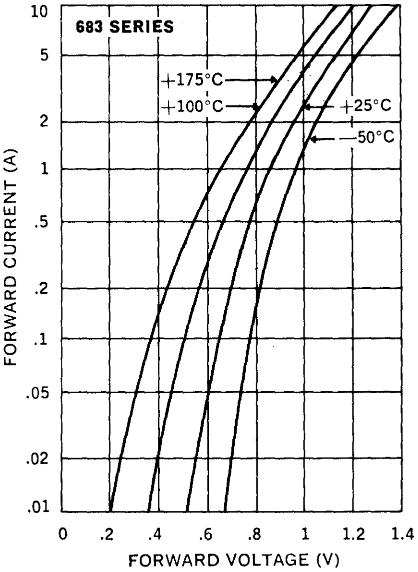
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				T_A = 25°C	T_A = 100°C		T_C = 55°C	T_C = 100°C	T_A = 100°C
		Volts		µA	µA	ns	Amps	Amps	Amps
Standard Recovery	679-1	100	1.2V @ 10A	10	200	—	25	18.5	150
	679-2	200							
	679-3	300							
	679-4	400							
	679-5	500							
	679-6	600							
Standard Recovery	680-1	100	1.2V @ 2A	2	50	—	10	6	50
	680-2	200							
	680-3	300							
	680-4	400							
	680-5	500							
	680-6	600							
Fast Recovery	683-1	100	1.2V @ 6A	10	200	500	20	14	150
	683-2	200							
	683-3	300							
	683-4	400							
	683-5	500							
	683-6	600							
Fast Recovery	684-1	100	1.2V @ 2A	5	100	500	10	6	50
	684-2	200							
	684-3	300							
	684-4	400							
	684-5	500							
	684-6	600							

*Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

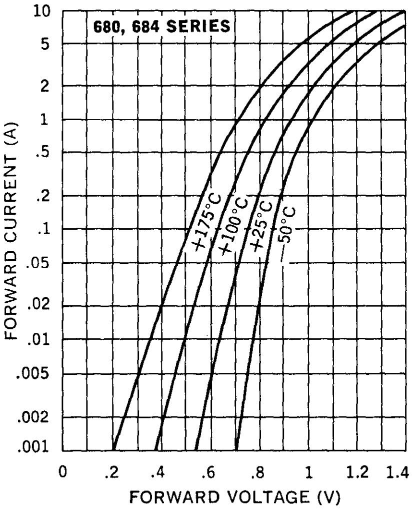
Typical Forward Voltage Per Leg vs. Forward Current



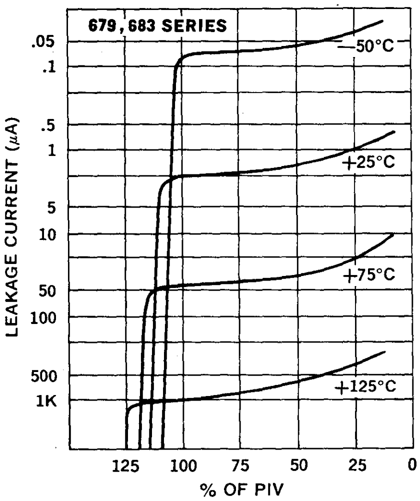
Typical Forward Voltage Per Leg vs. Forward Current



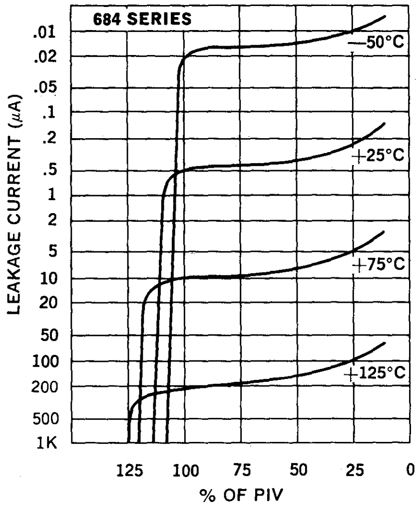
Typical Forward Voltage Per Leg vs. Forward Current



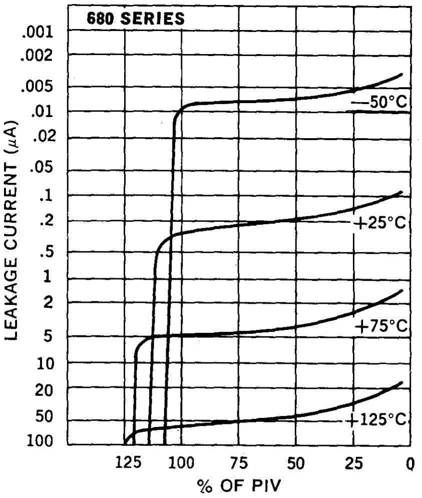
Typical Leakage Current vs. PIV



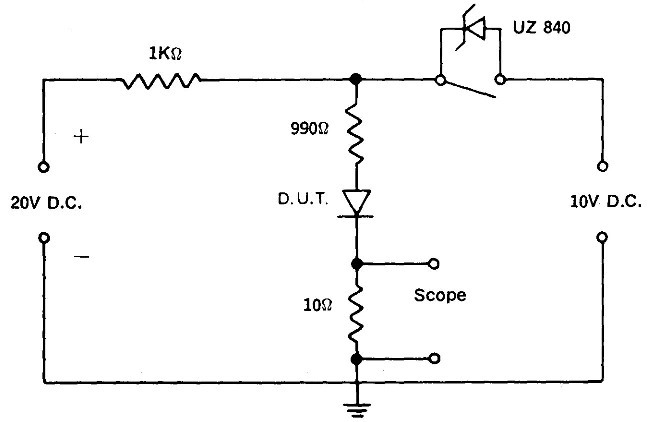
Typical Leakage Current vs. PIV



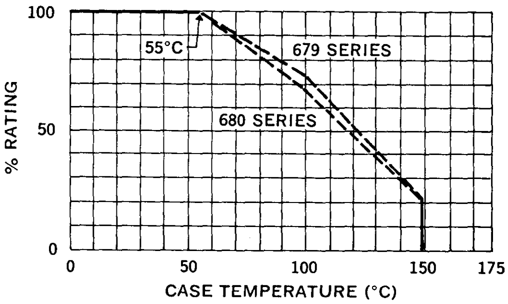
Typical Leakage Current vs. PIV



Reverse-Recovery Circuit

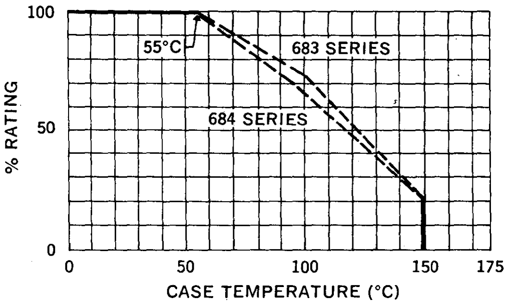


Current Derating Curve



Standard Recovery Series

Current Derating Curve



Fast Recovery Series

RECTIFIER ASSEMBLIES

Doubler and Center Tap, 15 Amp, Standard Recovery, Magnum®

FEATURES

- Current Ratings: to 15A
- Aluminum Heat Sink Case, Electrically Insulated
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- PIV: 100 to 600V
- Surge Ratings: to 150A

DESCRIPTION

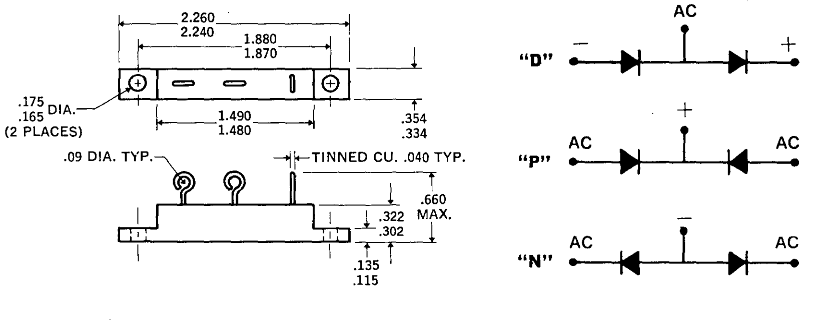
This series of MAGNUM® doublers and center tap rectifiers offers high current and high thermal conductivity needed in high current power supply applications. The MAGNUM® package is virtually indestructable and lends its use to high environmental stresses, as seen in aircraft, missile and satellite equipment.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltages	100 to 600V
Maximum Average D.C. Output Current	
@ $T_C = +55°C$	15A
@ $T_C = +100°C$	10A
Non-Repetitive Sinusoidal Surge (8.3ms)	
@ $T_A = +100°C$	150A
Operating and Storage Temperature Range	−65°C to +150°C
Thermal Resistance Junction to Ambient	10°C/W
Junction to Case	3.0°C/W

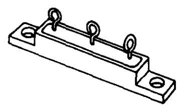
MECHANICAL SPECIFICATIONS

681 SERIES



Dimensions in inches.

Typical Weight — 10 grams



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

† Add suffix P, N, or D for terminal configuration P, N, or D. For example, for center tap configuration, P, order 681-IP.

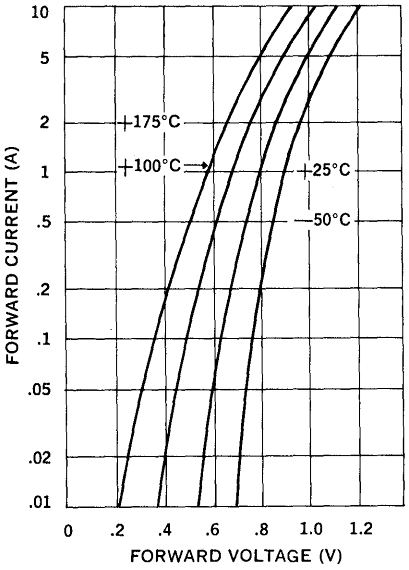
Magnum® is a registered trademark of Unitrode Corporation

UNITRODE

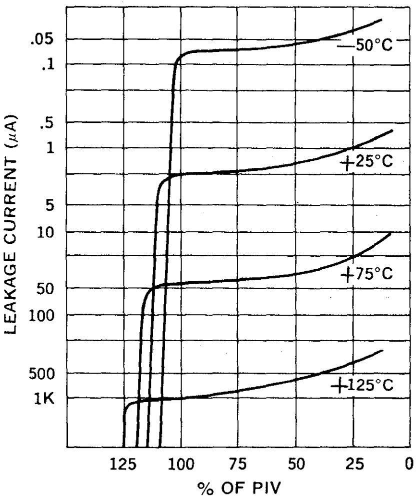
Electrical Specifications (at 25°C unless noted)

Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV	
				$T_A = 25°C$	$T_A = 100°C$
		Volts		μA	μA
Standard	681-1	100	1.2V @ 10A	10	200
Recovery	681-2	200			
	681-3	300			
	681-4	400			
	681-5	500			
	681-6	600			

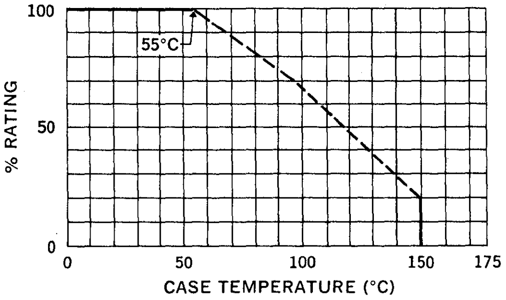
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV



Current Derating Curve



RECTIFIER ASSEMBLIES

685 SERIES

Three Phase Bridges, High Voltage, Standard and Fast Recovery

FEATURES

- Current Ratings: to 1A
- Recovery Time: available to 500ns
- Surge Ratings: to 20A
- PIV: from 2.5KV to 7KV
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Bonded Plate Package For Maximum Heat Transfer

DESCRIPTION

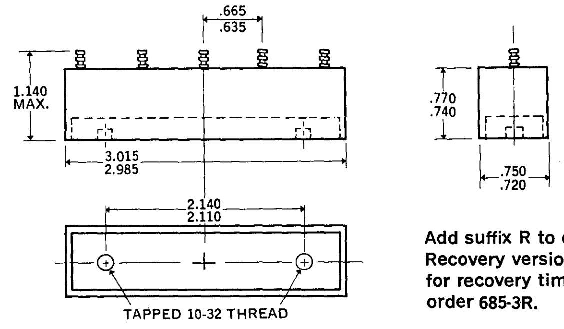
This series of three-phase bridges has a unique packaging design that provides characteristics not obtainable in conventional molded epoxy packages. This series, therefore, is ideally suited for high voltage power supply applications.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2.5KV to 7KV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	20A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	25°C/W
Junction to Case	10°C/W

MECHANICAL SPECIFICATIONS

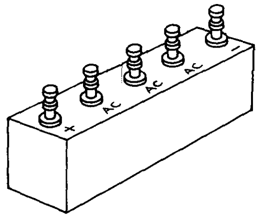
685 SERIES



Add suffix R to denote Fast Recovery version. For example, for recovery time, t_{rr} = 500ns; order 685-3R.

Dimensions in inches.

Typical Weight — 70 grams



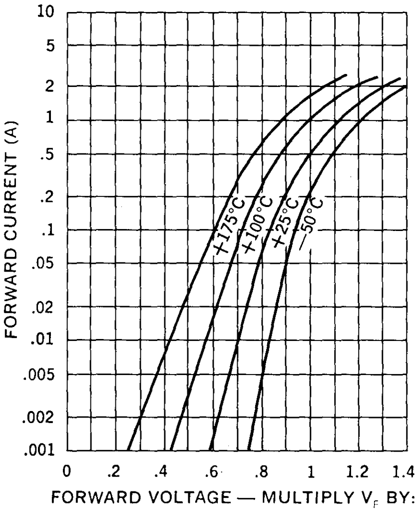
MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

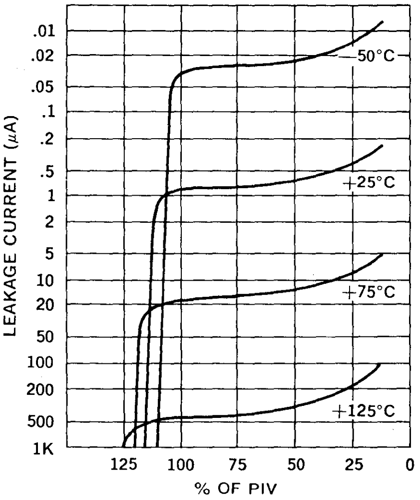
Part number is printed on the body.

Electrical Specifications (at 25°C unless noted)						Maximum Ratings
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Average D.C. Output Current
				T_A = 25°C	T_A = 100°C	T_C = 100°C
		kV		μA	μA	Amps
Standard And Fast Recovery	685-2.5	2.5	5V @ .4A	2	100	1.00
	685-3	3	6V @ .4A			0.90
	685-4	4	8V @ .4A			0.80
	685-5	5	9V @ .4A			0.65
	685-7	7	12V @ .4A			0.50

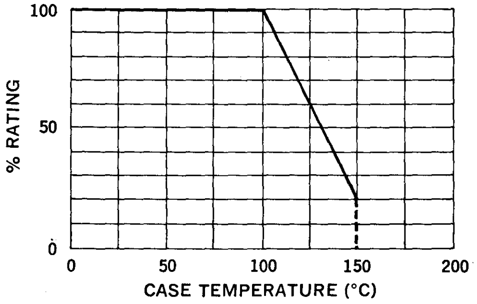
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV



Current Derating Curve



RECTIFIER ASSEMBLIES

686 SERIES

Single Phase Bridges, 0.5-1.2 Amp
Standard and Fast Recovery

FEATURES

- Current Ratings: to 1.2A
- PIV: from 2.5kV to 7kV
- Surge Ratings: to 20A
- Recovery Time: Available to 500ns
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Bonded Plate Package For Maximum Heat Transfer

DESCRIPTION

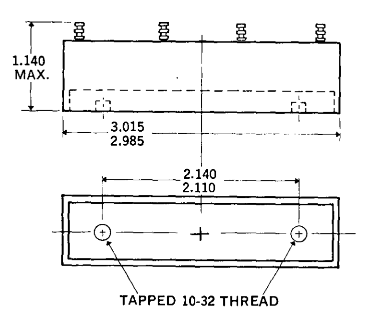
This series of single phase bridges has a unique packaging design providing characteristics not obtainable in conventional molded epoxy packages. This series is ideally suited for high-voltage power supply applications.

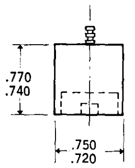
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2.5kV to 7kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	20A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	25°C/W
Junction to Case	10°C/W

MECHANICAL SPECIFICATIONS

686 SERIES

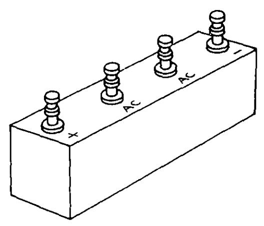




Add suffix R to denote Fast Recovery version for example: for recovery time, T_{rr} = 500ns, order 686-2.5R.

Dimensions in inches.

Typical Weight — 70 grams



MARKING

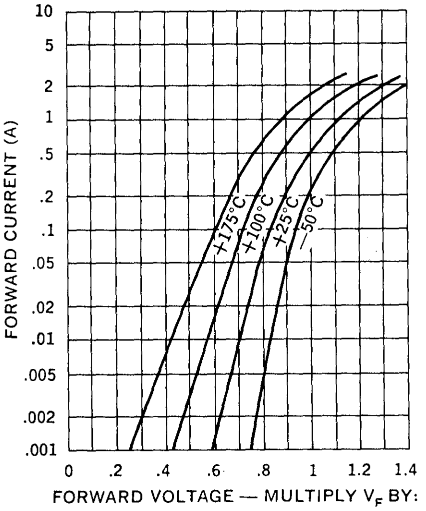
Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

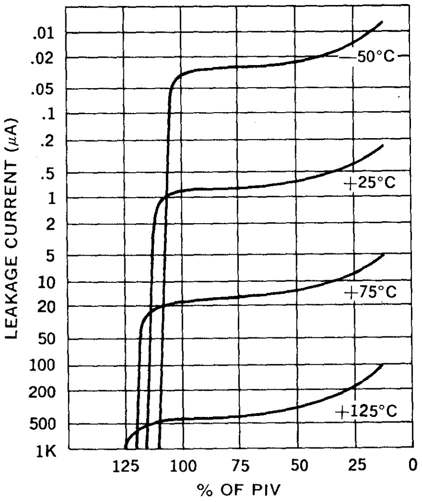
UNITRODE

Electrical Specifications (at 25°C unless noted)						Maximum Ratings
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Average D.C. Output Current
				$T_A = 25°C$	$T_A = 100°C$	@ $T_C = 100°C$
		kV		µA	µA	Amps
Standard and Fast Recovery	686-2.5	2.5	4V @ .4A	2	100	1.20
	686-3	3	5V @ .4A			1.00
	686-4	4	7V @ .4A			0.75
	686-5	5	9V @ .4A			0.60
	686-7	7	12V @ .4A			0.50

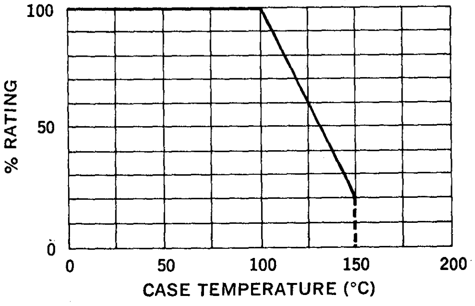
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV



Current Derating Curve



RECTIFIER ASSEMBLIES

687 SERIES

Doubler and Center Tap, 0.4-0.9 Amp, Standard and Fast Recovery

FEATURES

- Surge Rating: to 20A
- PIVs: from 5K to 12KV
- Current Ratings: to 0.9A
- Recovery Time Available to 500ns
- Bonded Plate for Maximum Heat Transfer
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics

DESCRIPTION

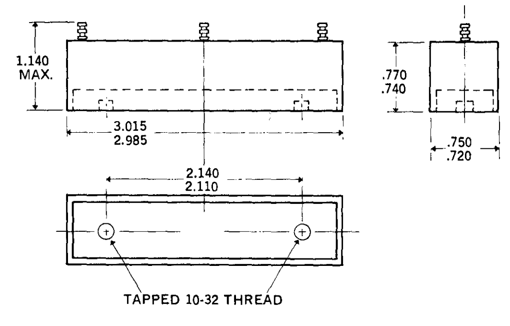
This series of doubler and center tap rectifiers has a unique packaging design that provides characteristics not obtainable in conventional molded epoxy packages. This series, therefore, is ideally suited for high voltage power supply applications.

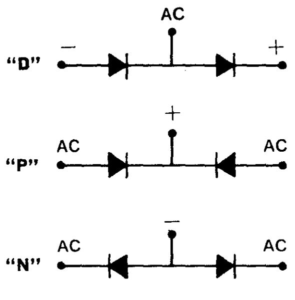
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage		5 kV to 12 kV
Maximum Average D.C. Output Current		See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)		20A
Operating and Storage Temperature Range		−65°C to +150°C
Thermal Resistance	Junction to Ambient	25°C/W
	Junction to Case	10°C/W

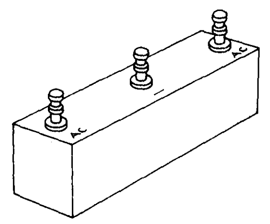
MECHANICAL SPECIFICATIONS

687 SERIES





Dimensions in inches.



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

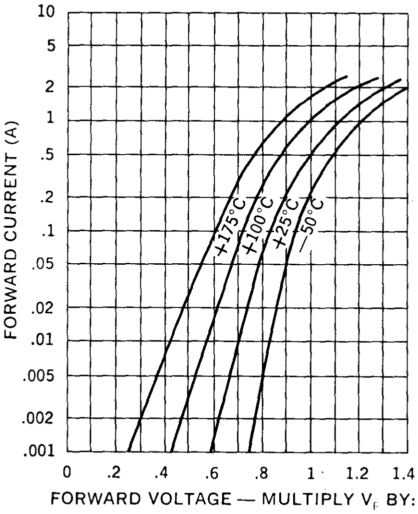
Part number is printed on the body.

Add suffix P, N or D for polarity configuration desired, e.g., for center tap configuration P order 687-5P

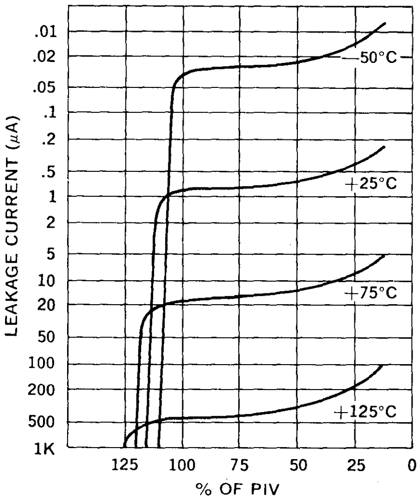
Add suffix R to denote Fast Recovery version. For example, for recovery time $t_{rr} = 500$ns with center tap configuration P order 687-5PR.

Electrical Specifications (at 25°C unless noted)						Maximum Rating
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Average D.C. Output Current
		kV		$T_A = 25°C$	$T_A = 100°C$	$T_C = 100°C$
				μA	μA	Amps
Standard	687-5	5	9V @ .4A	2	100	0.9
and Fast	687-6	6	10V @ .4A			0.8
Recovery	687-8	8	13V @ .4A			0.6
	687-10	10	17V @ .4A			0.5
	687-12	12	20V @ .4A			0.4

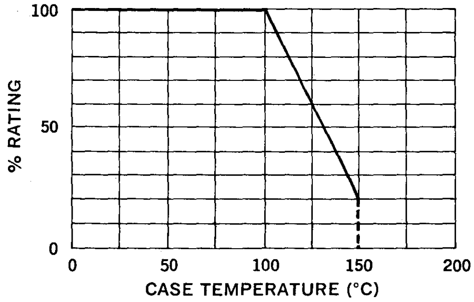
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV



Current Derating Curve



RECTIFIER ASSEMBLIES

688 SERIES

High Voltage Stacks,
Standard and Fast Recovery

FEATURES

- PIV: from 10kV to 25kV
- Surge Rating: to 20A
- Recovery Time Available: to 500ns
- Current Ratings: to 0.6A
- Bonded Plate for Maximum Heat Transfer
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used

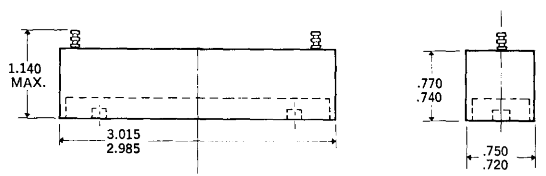
DESCRIPTION

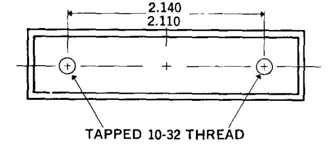
This series of high power stacks has a unique packaging design that provides characteristics not obtainable in conventional molded epoxy packages. This series, therefore, is ideally suited for high-voltage, high-power applications.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	10kV to 25kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-repetitive Sinusoidal Surge (8.3ms)	20A
Operating and Storage Temperature Range	−65°C to +150°C
Thermal Resistance Junction to Ambient	25°C/W
Junction to Case	10°C/W

688 SERIES

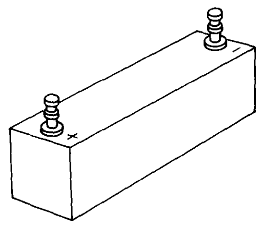




Add suffix R to denote Fast Recovery version. For example, for recovery time, $t_{rr} = 500$ns; order 688-10R.

Dimensions in inches.

Typical Weight – 70 grams



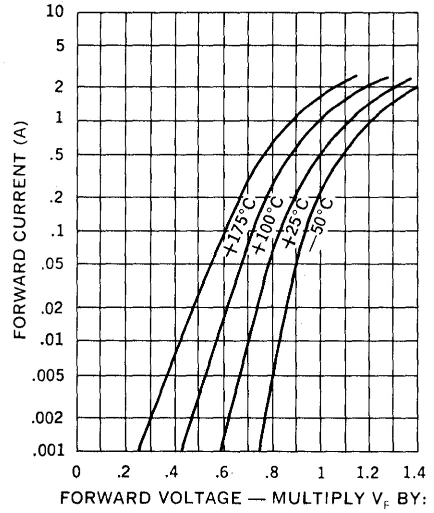
MARKING

Cathode — Positive Output	+
Anode — Negative	—

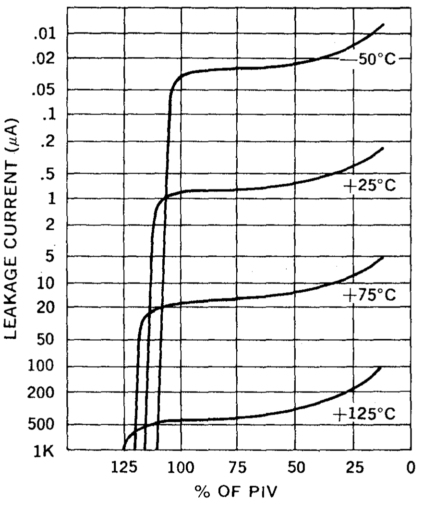
Part number is printed on the body.

Electrical Specifications (at 25°C unless noted)						Maximum Ratings
Type		PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV		Maximum Average D.C. Output Current
				$T_A = 25°C$	$T_A = 100°C$	$T_C = 100°C$
		kV		µA	µA	Amps
Standard	688-10	10	17V @ 0.4A	2	100	0.60
And Fast	688-12	12	20V @ 0.4A			0.50
Recovery	688-15	15	25V @ 0.4A			0.40
	688-18	18	30V @ 0.4A			0.35
	688-20	20	34V @ 0.4A			0.30
	688-25	25	42V @ 0.4A			0.20

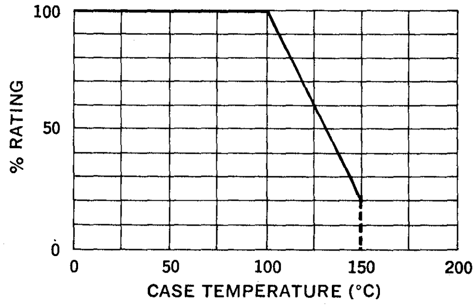
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV



Current Derating Curve



RECTIFIER ASSEMBLIES

Three Phase Bridges, 0.5 Amp, Standard and Fast Recovery

FEATURES

- Current Ratings: to 500mA
- Recovery Time: available to 500ns
- Surge Ratings: to 15A
- PIV: from 8K to 15KV
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used

DESCRIPTION

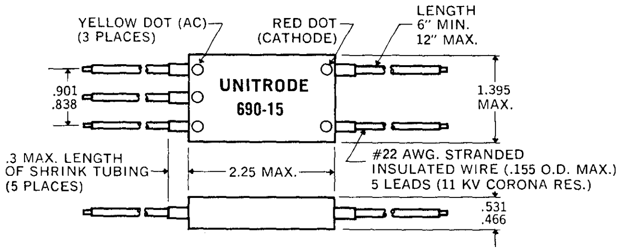
These miniature transfer-molded high-voltage three-phase power bridges are designed for universal application in power supplies.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	8kV to 15kV
Maximum Average D.C. Output Current	See Electrical Specification
Non-Repetitive Sinusoidal Surge (8.3ms)	15A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Air	25°C/W
Junction to Case	10°C/W

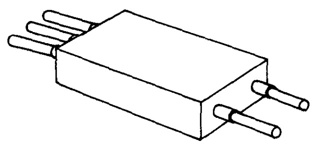
MECHANICAL SPECIFICATIONS

690 SERIES



Dimensions in inches.

Typical Weight —90 grams



MARKING

Part number is printed on the body.

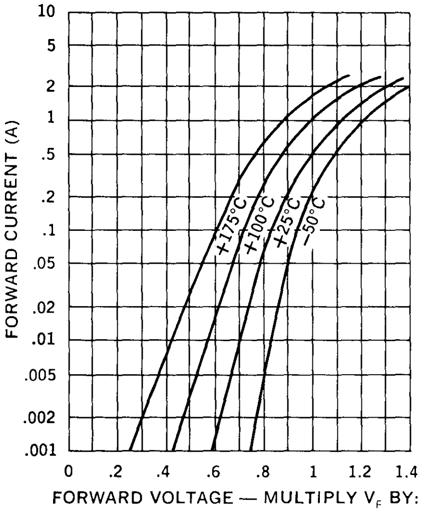
Add suffix R to denote Fast Recovery version, e.g., for recovery time t_{rr} = 500ns order 690-8R.

Add suffix T to denote Turret Terminals version, e.g., for turret terminal order 690-8T.

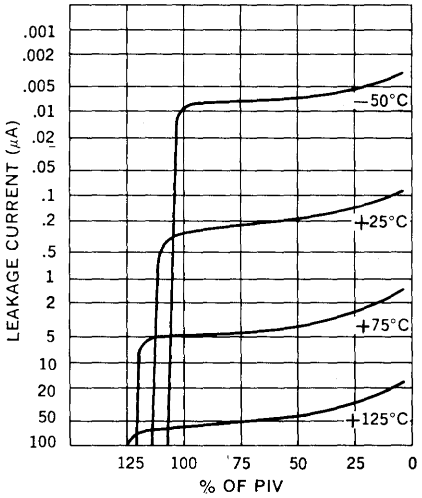
Add suffix TR to denote Turret Terminals and Fast Recovery version, e.g., order 690-8TR.

Electrical Specifications (at 25°C unless noted)						Maximum Ratings	
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Average D.C. Output Current	
				T_A = 25°C	T_A = 100°C	T_A = 25°C AIR	T_A = 50°C OIL
		kV		μA	μA	Amps	Amps
Standard	690-8	8	16V @ 0.2A	2	75	0.250	0.500
And Fast	690-10	10	20V @ 0.2A	2	75	0.225	0.450
Recovery	690-12	12	24V @ 0.2A	2	75	0.180	0.360
	690-15	15	30V @ 0.2A	2	75	0.150	0.300

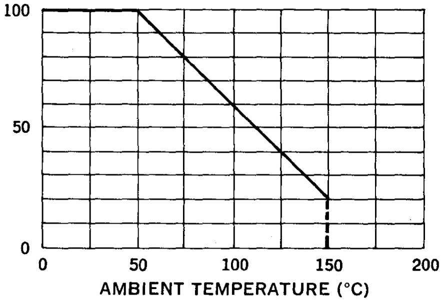
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV

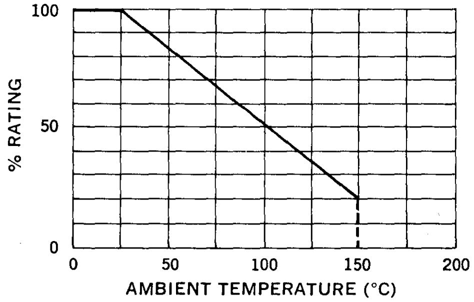


Current Derating Curve



Oil Immersed

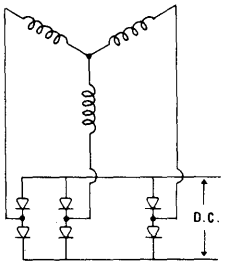
Current Derating Curve



Air Cooled

Multiplying Factors to Be Applied to No-Load D.C. Output Voltage

Knowing the maximum no-load D.C. output voltage required from a rectifier, this table gives multiplying factors to obtain A.C input voltage, actual operating PIV of the rectifier, and a suggested PIV rating using a conservative safety factor.

Type of Circuit	Schematic	A.C. Input Voltage	Actual PIV	Rated PIV Using Safety Factor
Three Phase Full Wave Bridge		Peak RMS 1.05 .735	1.05	1.5

RECTIFIER ASSEMBLIES

Single Phase Bridges, 4.5 Amp, Standard and Fast Recovery

691, 692 SERIES

FEATURES

- Current Ratings: to 4.5A
- Recovery Times: to 500ns
- Surge Ratings: to 25A
- PIV: from 100 to 600V
- Only Fused-in Glass Diodes
- Controlled Avalanche Characteristics
- Simplified Installation, Mounts Directly to Heat Sink

DESCRIPTION

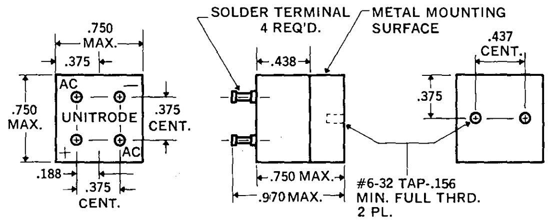
These compact transfer molded single phase bridges are designed for universal applications in power supplies. They are ideally suited for miniaturized, tightly packaged equipment operating in extreme environments.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-repetitive Sinusoidal Surge (8.3 ms)	See Electrical Specifications
Operating and Storage Temperature Range	−65°C to +150°C
Thermal Resistance Junction-to-Case	12°C/W

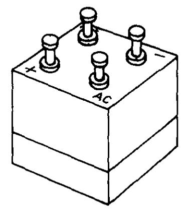
MECHANICAL SPECIFICATIONS

691, 692 SERIES



Dimensions in inches.

Typical Weight—18.0 grams



MARKING

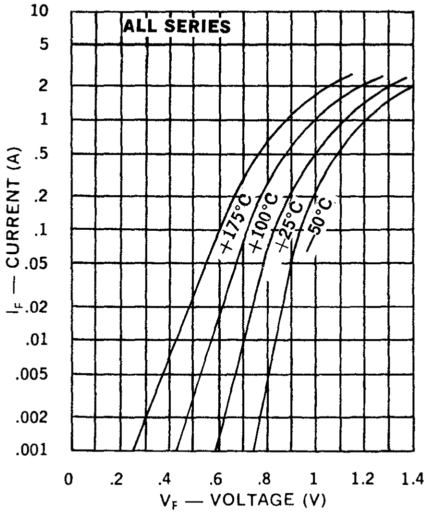
Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

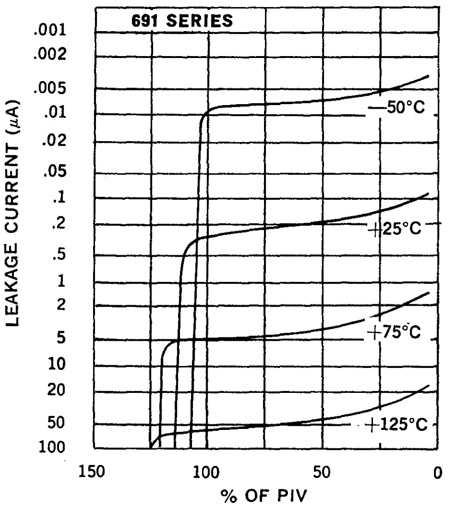
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_C = 55°C$	$T_C = 100°C$	
		Volts		μA	μA	ns	Amps	Amps	Amps
Standard Recovery	691-1	100	1.2V @ 1A	2	100		4.5	3.0	25
	691-2	200							
	691-3	300							
	691-4	400							
	691-5	500							
	691-6	600							
Fast Recovery	692-1	100	1.2V @ 1A	3	150	500	3.5	2.5	20
	692-2	200							
	692-3	300							
	692-4	400							
	692-5	500							
	692-6	600							

*Measured in a reverse recovery circuit switching from 10ma forward to 10ma reverse current recovering to 5mA.

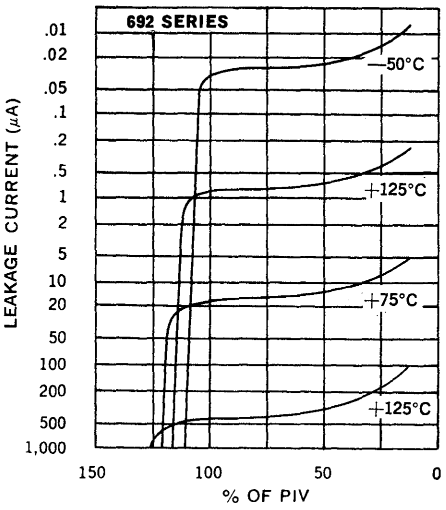
Typical Forward Voltage vs. Forward Current



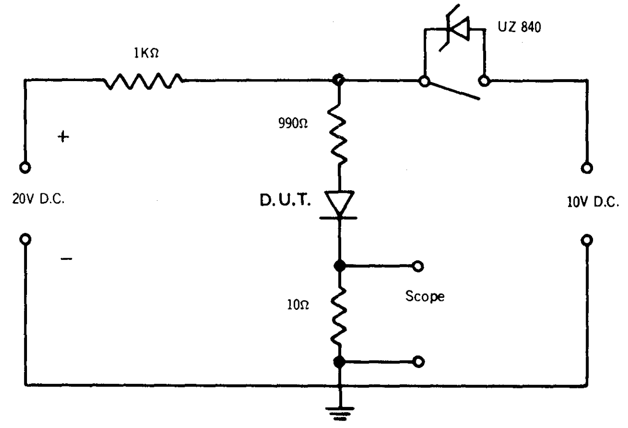
Typical Leakage Current vs. PIV



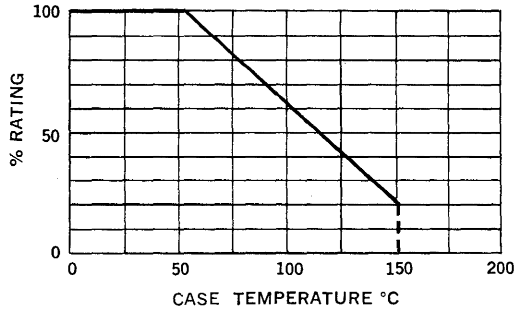
Typical Leakage Current vs. PIV



Reverse Recovery Circuit



Current Derating Curve



RECTIFIER ASSEMBLIES

Three Phase Bridges, 3.5 Amp, Standard and Fast Recovery

693, 694 SERIES

FEATURES

- High Average Output Current
- Recovery Time: to 500ns
- Surge Rating: to 25A
- PIV: from 100 to 600V
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used
- Simplified Installation, Mounts Directly to Heat Sink

DESCRIPTION

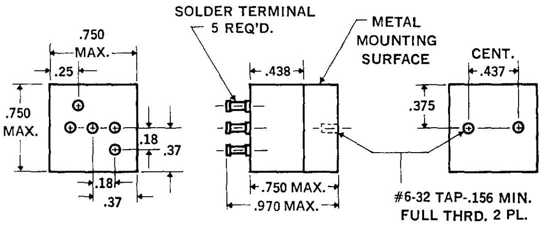
These compact transfer molded three phase bridges are designed for universal application in power supply. These bridges are ideally suited for miniaturized, tightly packaged equipment operating in extreme environments.

ABSOLUTE MAXIMUM RATINGS

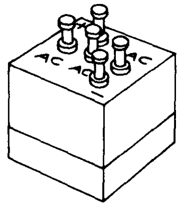
Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	–65°C to +150°C
Thermal Resistance Junction-to-Case	12°C/W

MECHANICAL SPECIFICATIONS

693, 694 SERIES



Dimensions in inches. **Typical Weight** — 17.1 grams



MARKING

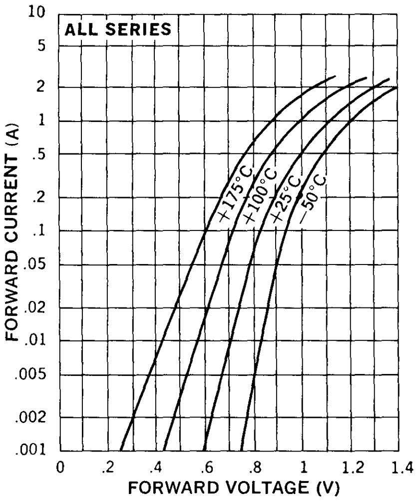
Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

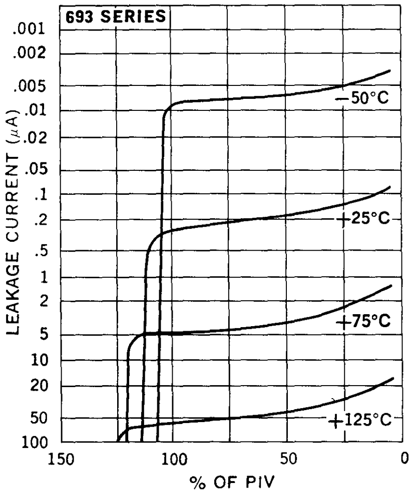
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_C = 55°C$	$T_C = 100°C$	
		Volts		μA	μA	ns	Amps	Amps	Amps
Standard	693-1	100	1.2V @ 1A	2	100	–	3.5	2.5	25
Recovery	693-2	200							
	693-3	300							
	693-4	400							
	693-5	500							
	693-6	600							
Fast	694-1	100	1.2V @ 1A	3	150	500	3.0	2.0	20
Recovery	694-2	200							
	694-3	300							
	694-4	400							
	694-5	500							
	694-6	600							

†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

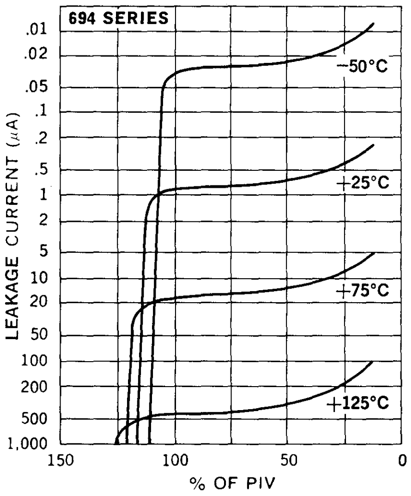
Typical Forward Voltage Per Leg vs. Forward Current



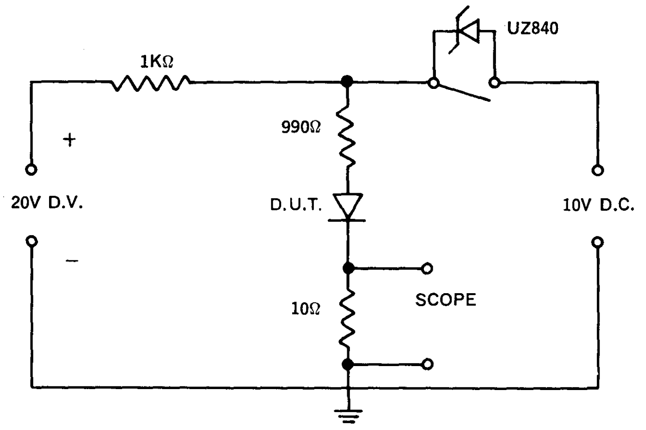
Typical Leakage Current vs. PIV



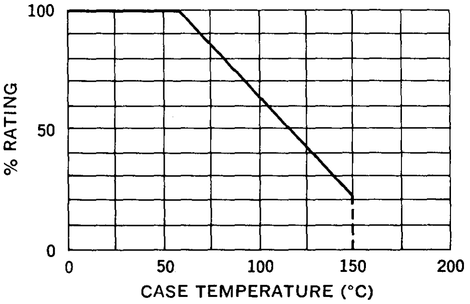
Typical Leakage Current vs. PIV



Reverse-Recovery Circuit



Current Derating Curve



RECTIFIER ASSEMBLIES

Single Phase Bridges, 7.5 Amp, Standard and Fast Recovery

697, 698 SERIES

FEATURES

- Miniature High Current Assemblies
- Continuous Ratings: to 7.5A
- Surge Ratings: to 80A
- PIV's: from 100V to 600V
- Recovery Times: to 500ns
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics

DESCRIPTION

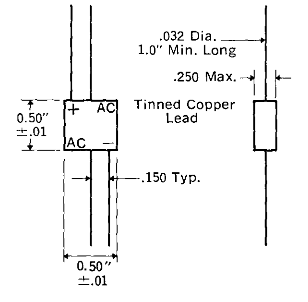
These miniature molded high-current single-phase bridges are designed for universal application in power supplies. One basic bridge fills current requirements up to 7.5A, with PIV's from 100 to 600 volts and recovery times of standard, and 500ns max.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	25°C/W
Junction to Case	5°C/W

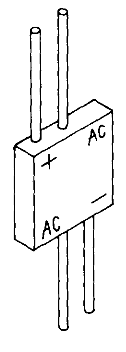
MECHANICAL SPECIFICATIONS

697, 698 SERIES



Dimensions in inches.

Typical Weight — 4.0 grams



MARKING

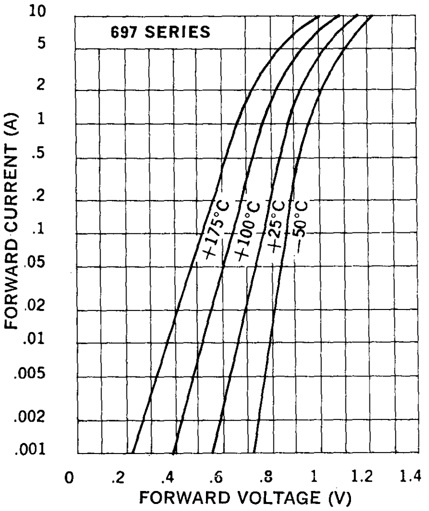
Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

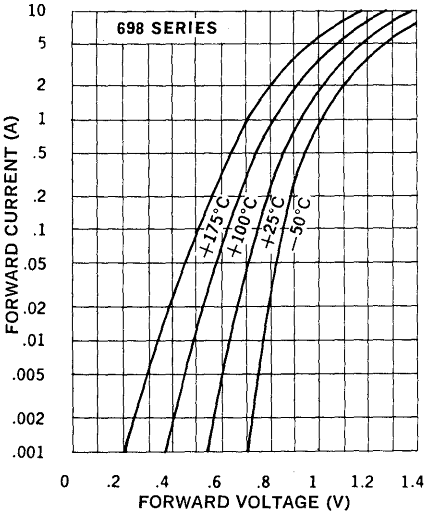
Part number is printed on the body.

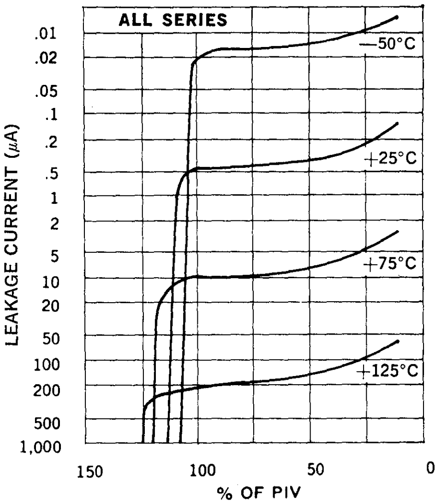
UNITRODE

Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time†	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				T_A = 25°C	T_A = 100°C		T_A = 25°C	T_C = 55°C	
		Volts		µA	µA	ns	Amps	Amps	Amps
Standard Recovery	697-1	100	1.0V @ 2A	5	200		2.5	7.5	80
	697-2	200							
	697-3	300							
	697-4	400							
	697-5	500							
	697-6	600							
Fast Recovery	698-1	100	1.1V @ 2A	5	200	500	2.25	7.0	70
	698-2	200							
	698-3	300							
	698-4	400							
	698-5	500							
	698-6	600							

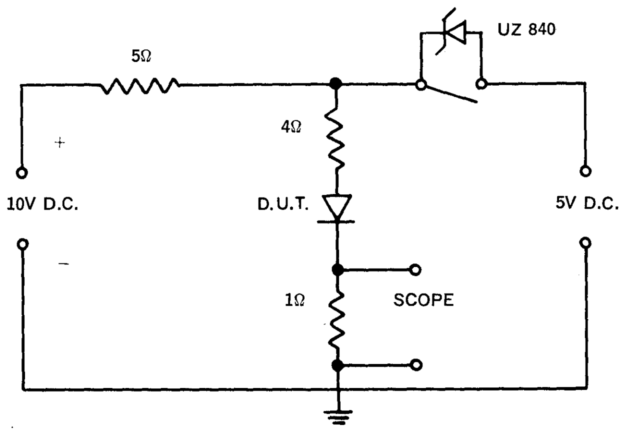
†Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to .5A.


Typical Forward Voltage Per Leg vs. Forward Current

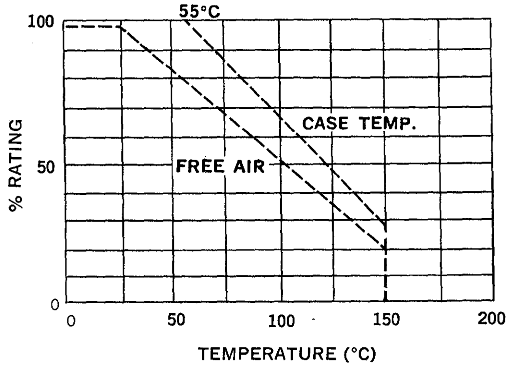

Typical Forward Voltage Per Leg vs. Forward Current


Typical Leakage Current vs. PIV

Reverse Recovery Circuit



Current Derating Curve



RECTIFIER ASSEMBLIES

700, 701 SERIES

Three Phase Bridges, 2.5 Amp, Standard and Fast Recovery

FEATURES

- Miniature Package
- Recovery Time: to 500ns
- Surge Ratings: to 25A
- PIV: from 100 to 600V
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used

DESCRIPTION

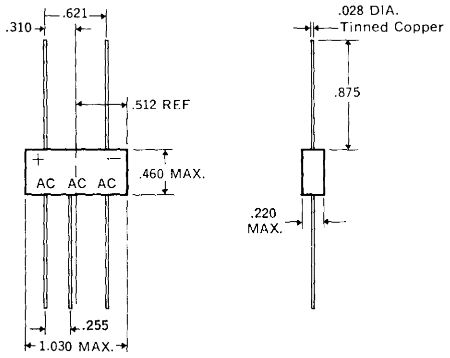
These miniature transfer-molded high-voltage three-phase power bridges are designed for universal application in power supplies. One basic bridge fills current requirements up to 2.5A, with PIV's from 100 to 600 volts and recovery times of standard and 500ns.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction-to-Ambient	25°C/W

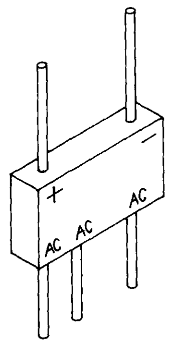
MECHANICAL SPECIFICATIONS

700, 701 SERIES



Dimensions in inches.

Typical Weight — 3.5 grams



MARKING

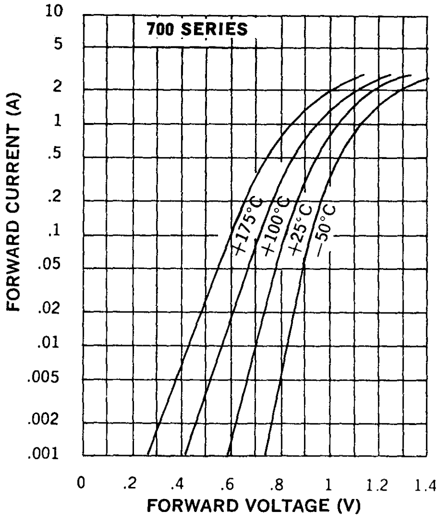
Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

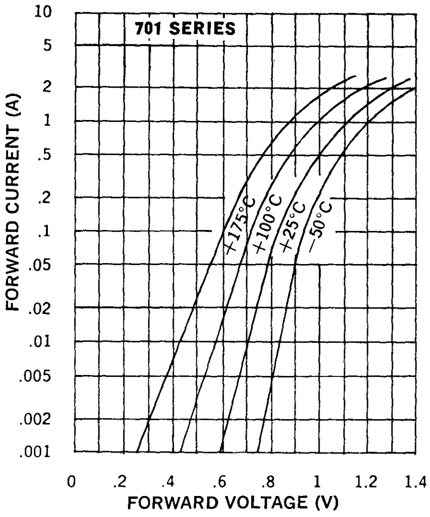
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time†	Maximum Average D.C. Output Current	Non-Repetitive Sinusoidal Surge (8.3ms)
Electrical Specifications (at 25°C unless noted)							**Maximum Ratings**	
				$T_A = 25°C$	$T_A = 100°C$		$T_A = 55°C$	
		Volts		μA	μA	ns	Amps	Amps
Standard Recovery	700-1	100	1.0V @ 0.5A	2	100		2.5	25
	700-2	200						
	700-3	300						
	700-4	400						
	700-5	500						
	700-6	600						
Fast Recovery	701-1	100	1.1V @ 0.5A	2	100	500	2.25	20
	701-2	200						
	701-3	300						
	701-4	400						
	701-5	500						
	701-6	600						

†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

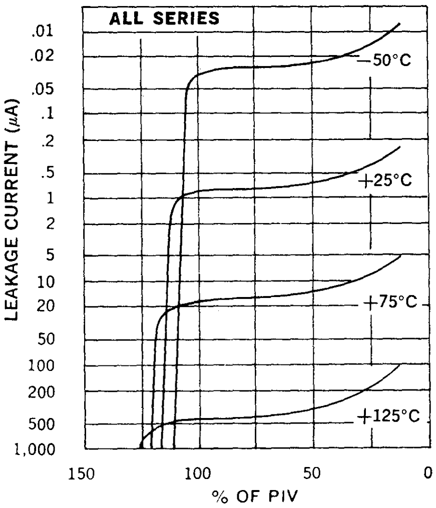
Typical Forward Voltage Per Leg vs. Forward Current



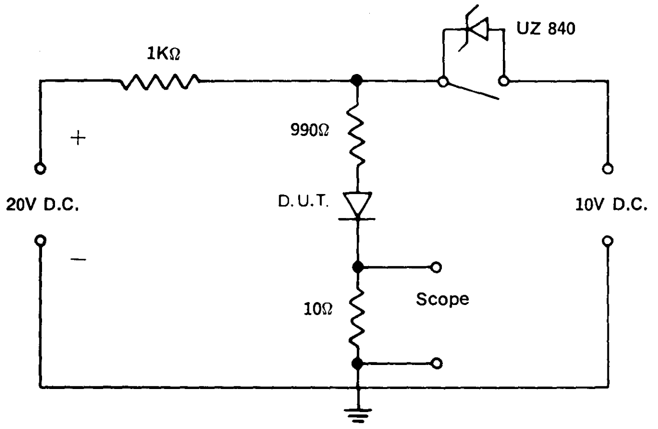
Typical Forward Voltage Per Leg vs. Forward Current



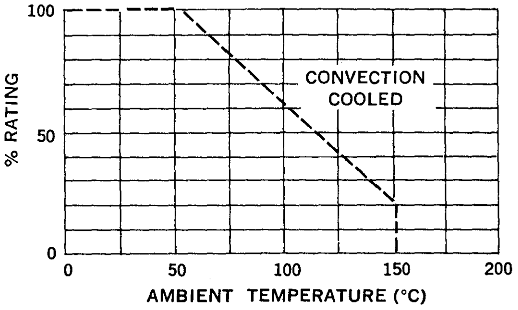
Typical Leakage Current vs. PIV



Reverse Recovery Circuit



Current Derating Curve



RECTIFIER ASSEMBLIES

800, 801 SERIES

Three Phase Bridges, 20-40 Amp, High Efficiency, ESP

FEATURES

- Current Ratings: to 40A
- Recovery Time: 50ns
- Surge Ratings: to 250A
- PIVs: from 50 to 150V
- Only Fused-in-Glass Diodes Used
- Exceptionally High Efficiency
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

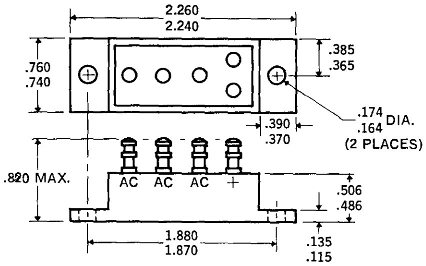
This series of three phase bridges offers the highest efficiency possible for applications where nothing else will do. The series allows operation at full power at high frequencies.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltages	50 to 150V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient, All Series	20°C/W
Junction to Case, 800 Series	2.5°C/W
Junction to Case, 801 Series	3.0°C/W

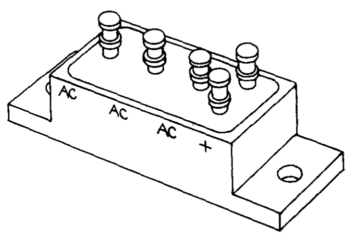
MECHANICAL SPECIFICATIONS

800, 801 SERIES



Typical Weight — 30 grams

Dimensions in inches.



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

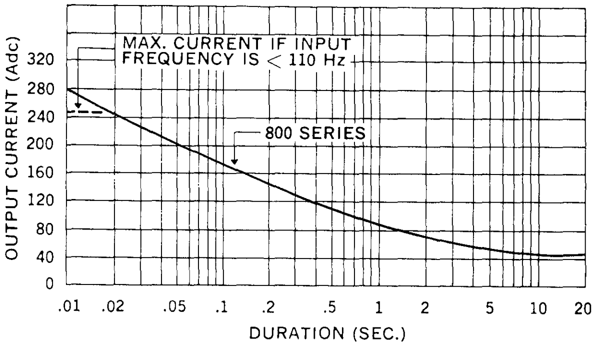
Part number is printed on the body.

UNITRODE

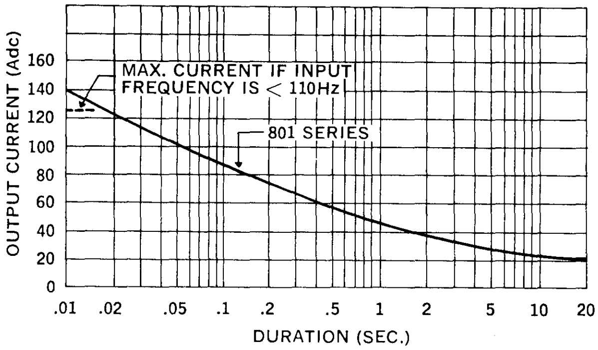
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Reverse Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_C = 55°C$	$T_C = 100°C$	$T_A = 100°C$
		Volts		µA	µA	ns	Amps	Amps	Amps
ESP	800-1	50	.95V @ 10A	20	1000	50	40	25	250
Recovery	800-2	100							
	800-3	125							
	800-4	150							
ESP	801-1	50	.95V @ 6A	10	300	50	20	16	125
Recovery	801-2	100							
	801-3	125							
	801-4	150							

*Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to 0.5A.

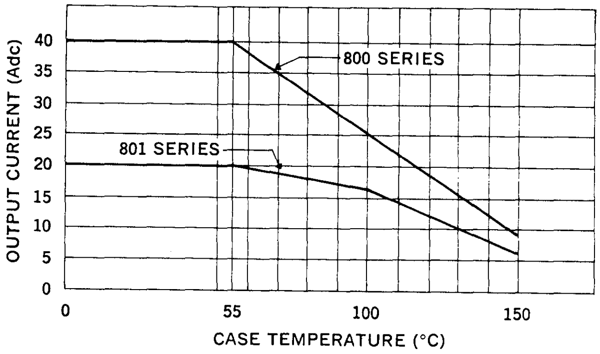
Forward Pulse Current vs Pulse Duration



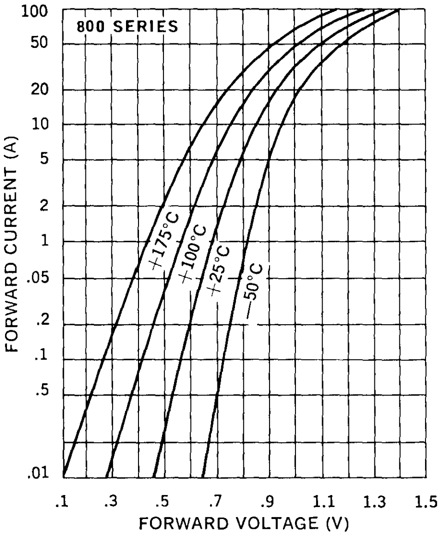
Forward Pulse Current vs Pulse Duration



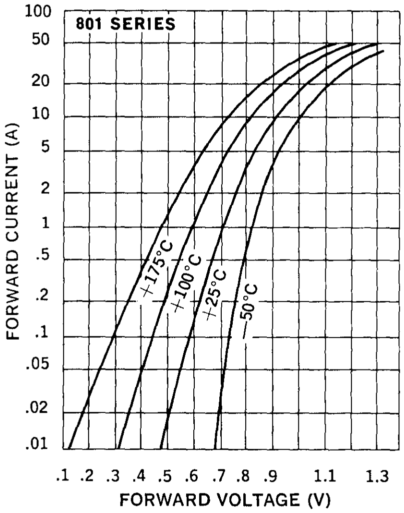
Current Derating Curve



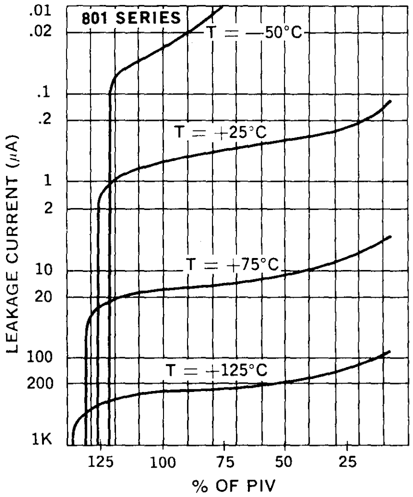
Typical Forward Voltage Per Leg vs. Forward Current



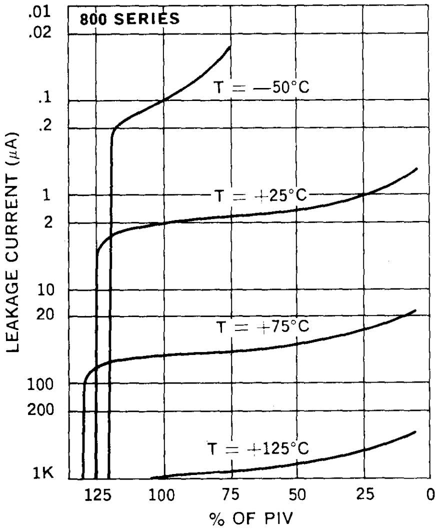
Typical Forward Voltage Per Leg vs. Forward Current



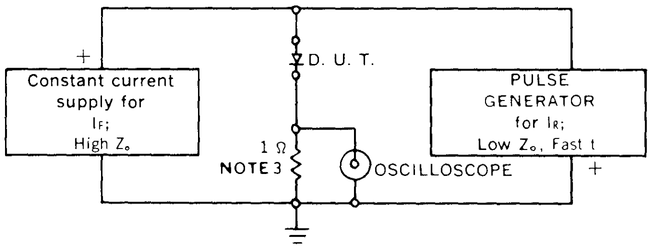
Typical Leakage Current vs. PIV



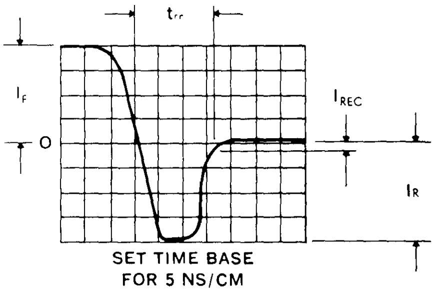
Typical Leakage Current vs. PIV



Reverse-Recovery Circuit



Characteristic Waveform



NOTES:

1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIER ASSEMBLIES

Single Phase Bridges, 20-35 Amp, High Efficiency ESP Series

802, 803 SERIES

FEATURES

- Current Ratings: to 35A
- Recovery Time: 50ns
- Surge Ratings: to 250A
- PIVs: from 50 to 150V
- Only Fused-in-Glass Diodes Used
- Exceptional High Efficiency
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

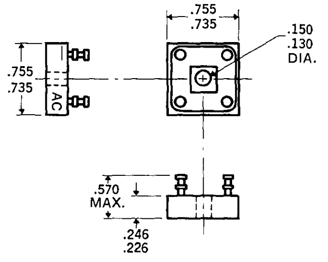
This series of single phase bridges offer the highest efficiency possible for applications where nothing else will do. The series allow operation at full power at very high frequency.

ABSOLUTE MAXIMUM RATINGS

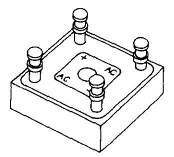
Peak Inverse Voltage	50 to 150V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient, 802 Series	20°C/W
803 Series	25°C/W
Junction to Case, 802 Series	2.5°C/W
803 Series	5°C/W

MECHANICAL SPECIFICATIONS

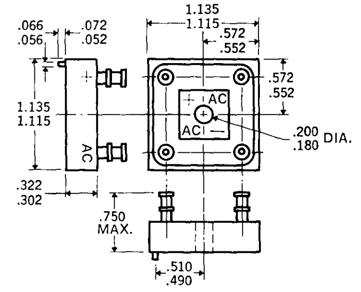
802 SERIES



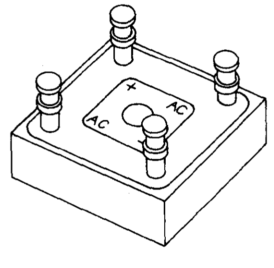
Dimensions in inches. **Typical Weight** — 10 grams



803 SERIES



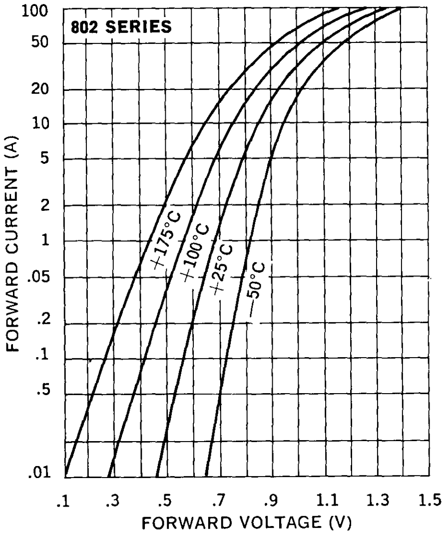
Dimensions in inches. **Typical Weight** — 20 grams



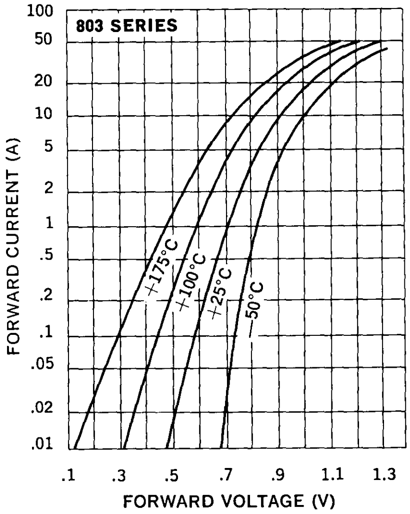
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Reverse Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_C = 55°C$	$T_C = 100°C$	$T_A = 100°C$
		Volts		μA	μA	ns	Amps	Amps	Amps
ESP	802-1	50							
Recovery	802-2	100	.95V @ 10A	20	1000	50	35	22.5	250
	802-3	125							
	802-4	150							
ESP	803-1	50							
Recovery	803-2	100	.95V @ 6A	10	300	50	20	16	125
	803-3	125							
	803-4	150							

*Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to 0.5A.

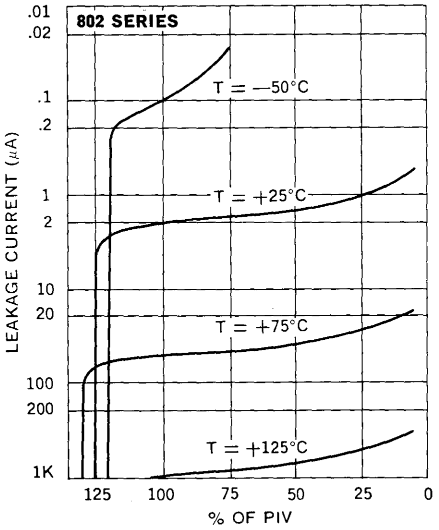
Typical Forward Voltage Per Leg vs. Forward Current



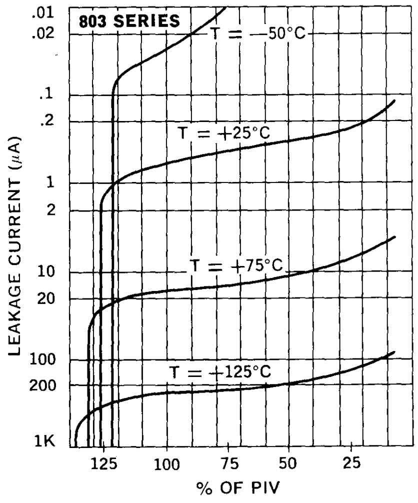
Typical Forward Voltage Per Leg vs. Forward Current



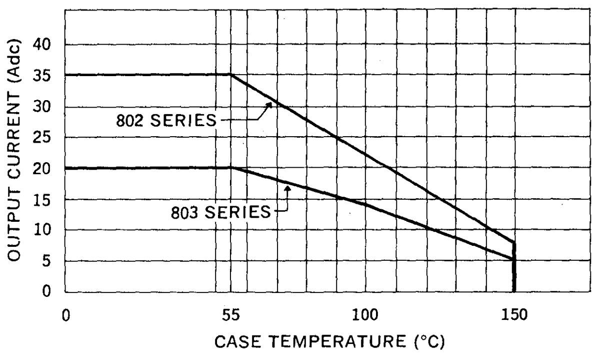
Typical Leakage Current vs. PIV



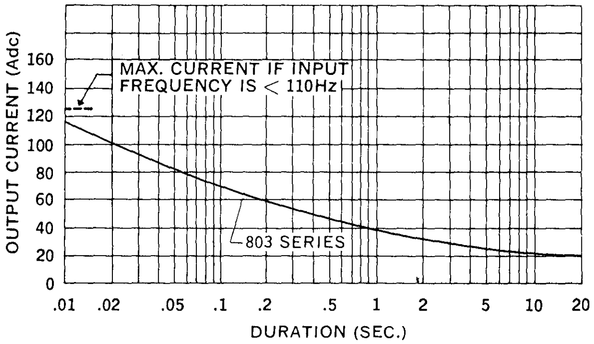
Typical Leakage Current vs. PIV



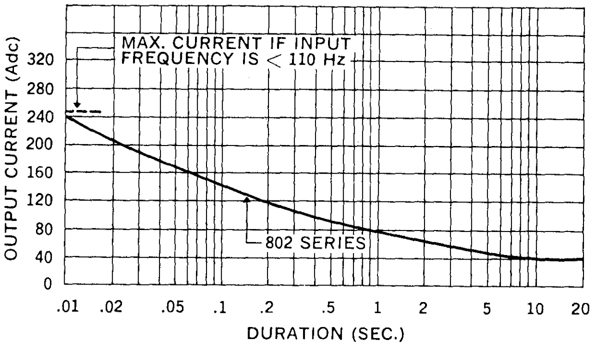
Current Derating Curve



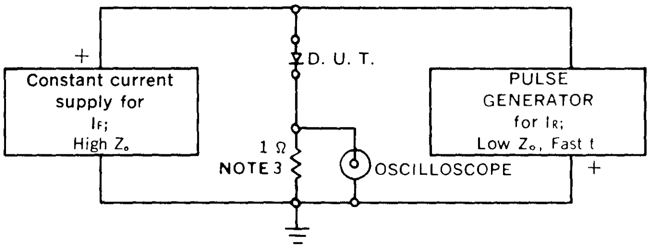
Overload Current vs. Duration



Overload Current vs. Duration



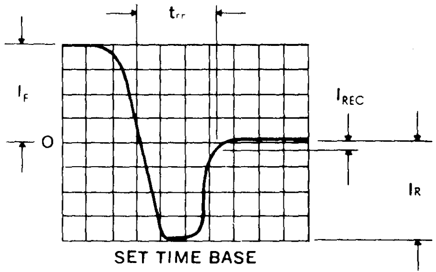
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform



SET TIME BASE FOR 5 NS/CM

RECTIFIER ASSEMBLIES

804 SERIES

Doublers and Center Tap, 20 Amp, High Efficiency, ESP

FEATURES

- Current Rating: to 20A
- Aluminum Heat Sink Case, Electrically Insulated
- Recovery Time: 50ns
- Surge Rating: to 250A
- PIVs: from 50 to 150V
- Only Fused-in-Glass Diodes Used
- Exceptional High Efficiency

DESCRIPTION

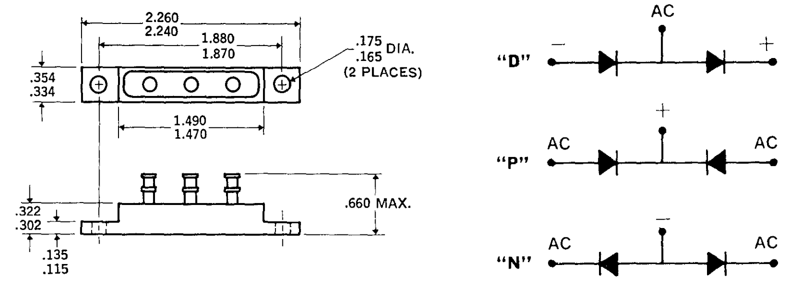
This series of doublers and center tap rectifiers offer the ultimate in high efficiency application. The rectifiers are particularly suited to switching regulator supplies where very fast recovery time and low forward drop are of prime importance.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	50 to 150V
Maximum Average D.C. Output Current	
@ $T_C = +55°C$	20A
@ $T_C = +100°C$	14A
Non-Repetitive Sinusoidal Surge (8.3ms)	
@ $T_A = +100°C$	250A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	10°C/W
Junction to Case	3.0°C/W

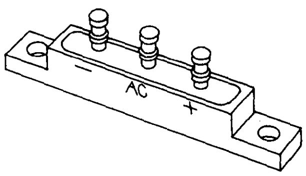
MECHANICAL SPECIFICATIONS

804 SERIES



Dimensions in inches.

Typical Weight — 10 grams



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

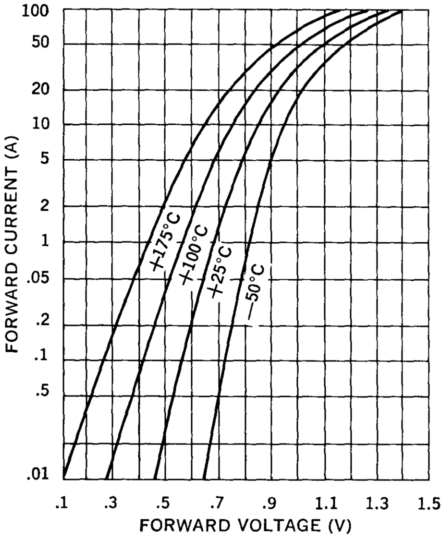
† Add suffix P, N, or D for terminal configuration P, N, or D. For example, for center tap configuration, P, order 804-IP

Electrical Specifications (at 25°C unless noted)

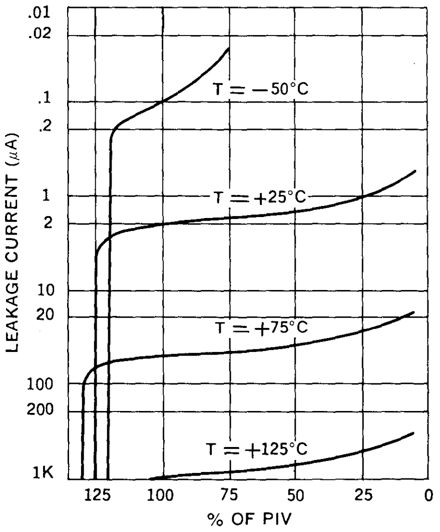
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current (μA) Per Leg @ PIV		Maximum Reverse Recovery Time*
				T_A = 25°C	T_A = 100°C	
		Volts		μA	μA	ns
ESP Recovery	804-1	50	.95V @ 10A	10	500	50
	804-2	100				
	804-3	125				
	804-4	150				

*Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to 0.5A.

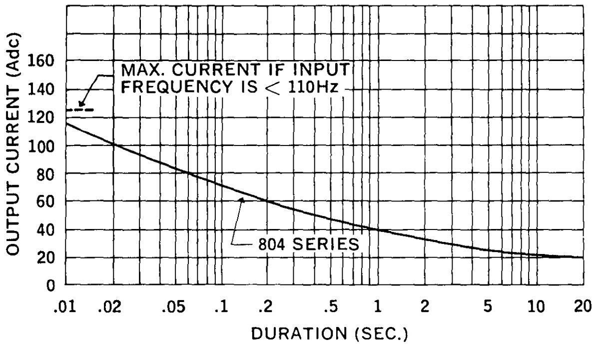
Typical Forward Voltage Per Leg vs. Forward Current



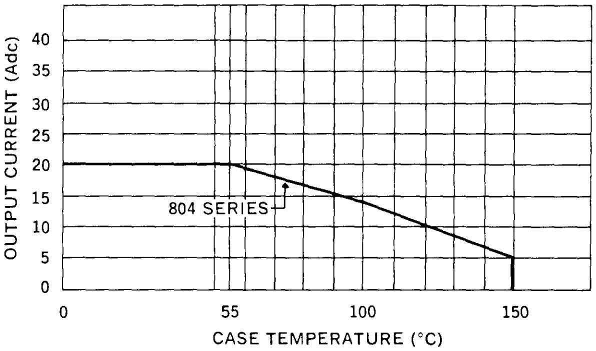
Typical Leakage Current vs. PIV



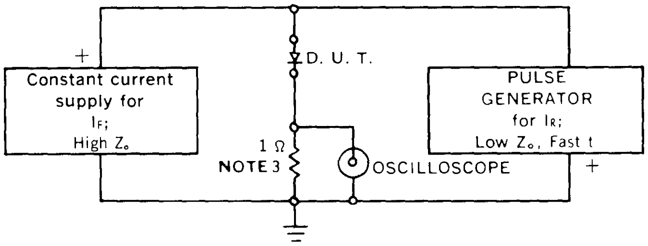
Forward Surge Current vs. Duration



Current Derating Curve



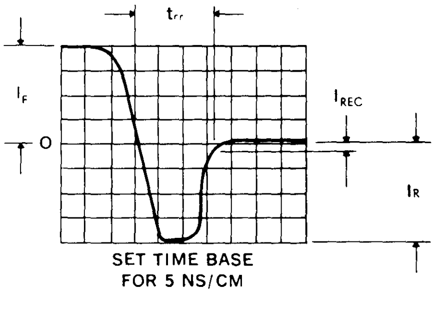
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform



SCRs

.5A, Planar

AA100-AA104
AA107-AA111
AA114-AA118

FEATURES

- Maximum Gate Trigger Current: 2, 20 or 200μA
- Tight Gate Trigger Voltage Range: .44 to .6V
- Voltage Ratings: to 400V
- Specified for dv/dt and Switching Time

DESCRIPTION

This data sheet describes Unitrode's AA Series 0.5A SCRs designed for low-current sensing applications. Units are available in a complete range of blocking voltages from 60 to 400 volts.

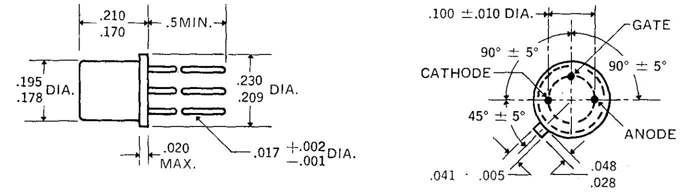
The AA100 series offers a maximum gate trigger current of 2.0 microamps making it the most sensitive device of its type. The AA107 series has a maximum I_{GT} of 20μA while this parameter is specified at 200μA for the AA114 series.

ABSOLUTE MAXIMUM RATINGS

	AA100 **AA107** **AA114**	**AA101** **AA108** **AA115**	**AA102** **AA109** **AA116**	**AA103** **AA110** **AA117**	**AA104** **AA111** **AA118**
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V
Non-Repetitive Peak Reverse Voltage, V_{RSM}	80V	150V	300V	400V	500V
Non-Repetitive Peak Off-State Voltage, V_{DSM}	500V				
D.C. On-State Current, I_T					
75°C Ambient	250mA				
100°C Case	500mA				
Repetitive Peak On-State Current, I_{TRM}	up to 30A				
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	5A				
Peak Gate Current, I_{GM}	250mA				
Average Gate Current, $I_{G(AV)}$	25mA				
Reverse Gate Voltage V_{GR}	6V				
Operating and Storage Temperature Range	−65°C to +150°C				

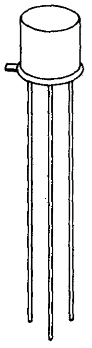
MECHANICAL SPECIFICATIONS

AA100-AA104 AA107-AA111 AA114-AA118



Dimensions in inches.

TO-18

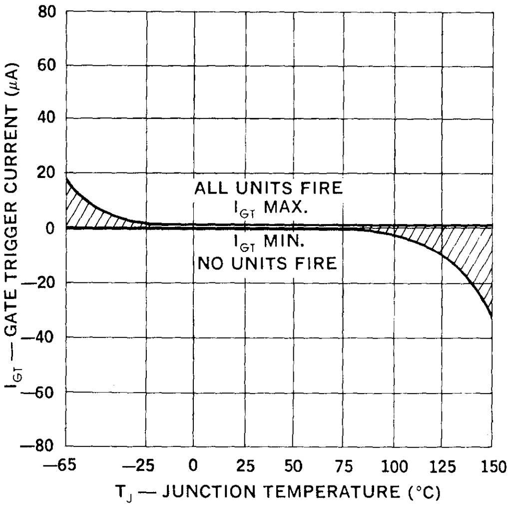


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

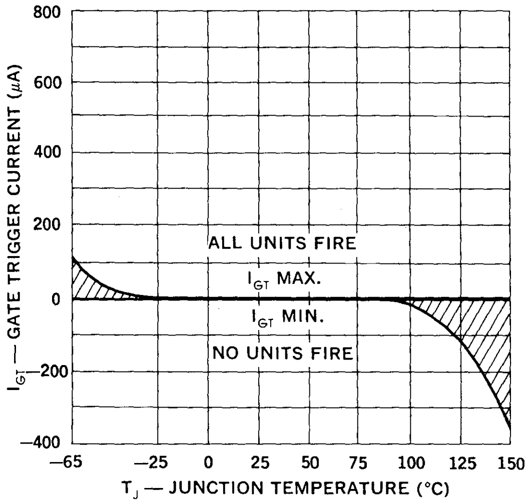
Parameter	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						
Visual & Mechanical	—	—	—	—	—	—
SUBGROUP 2 (25°C TESTS)						
Off-State Current	I_{DRM}	—	.01	0.1	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	.01	0.1	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	0.1	0.2	μA	$V_{GR} = 2V$
Gate Trigger Current	I_{GT}					$R_{GS} = 10K$, $V_D = 5V$
AA100-104		—	0.2	2.0	μA	
AA107-111		—	2.0	20	μA	
AA114-118		—	20	200	μA	
Gate Trigger Voltage	V_{GT}	0.44	0.52	0.60	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.1	1.5	V	$I_T = 1.0$ A (pulse)
Holding Current	I_H	0.3	0.5	2.0	mA	$R_{GK} = 1K$
SUBGROUP 3 (25°C TESTS)						
Off-State Voltage — Critical Rate of Rise	dv/dt	50	100	—	V/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger — on Pulse Width	t_{pg} (on)	—	0.5	2.0	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.6	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.4	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_q	—	20	50	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
SUBGROUP 4 (125°C TESTS)						
Off-State Current	I_{DRM}	—	10	20	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	30	100	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Gate Trigger Voltage	V_{GT}	0.15	0.2	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
Holding Current	I_H	0.2	0.4	1.5	mA	$R_{GK} = 1K$

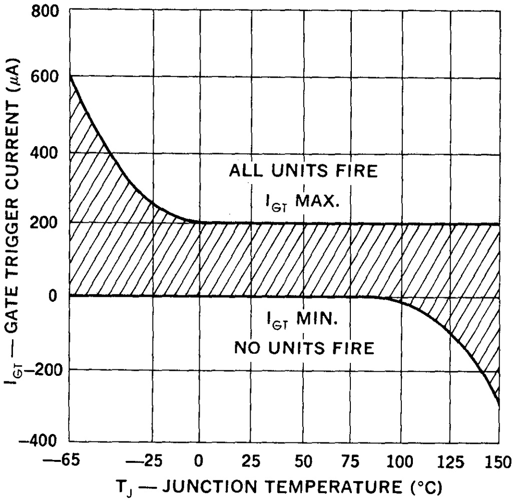
Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

Gate Trigger Current AA100 Series

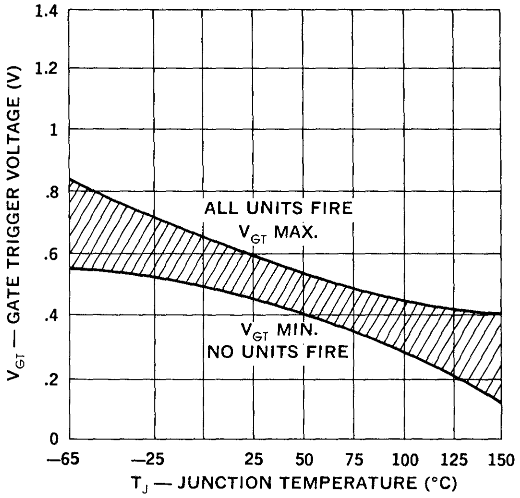


Gate Trigger Current AA107 Series

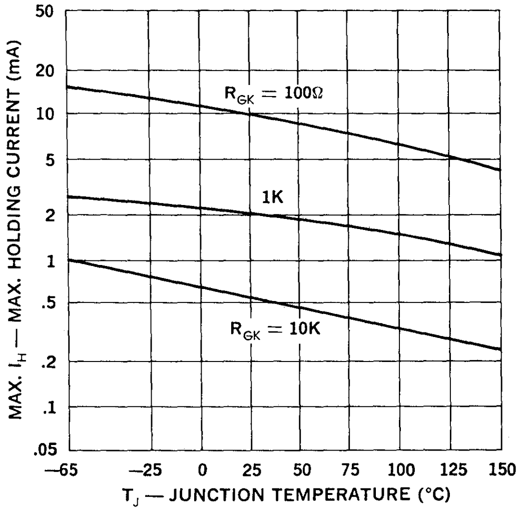




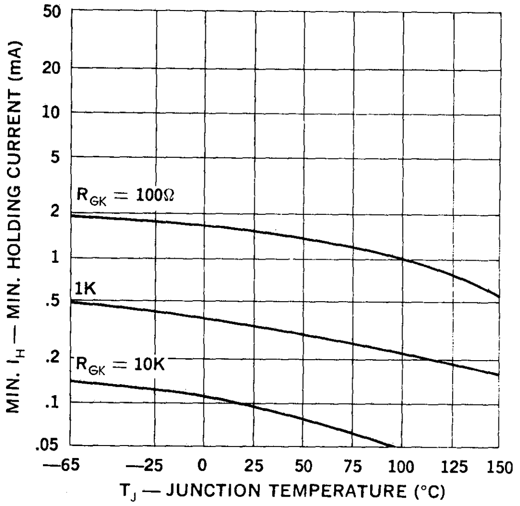
Gate Trigger Current
AA114 Series



Gate Trigger Voltage

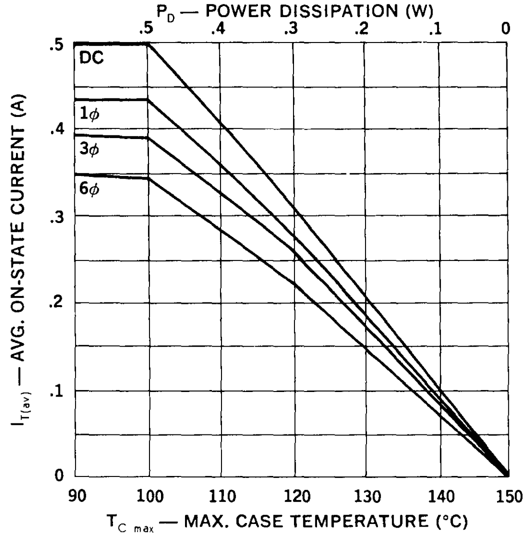


Max. Holding Current

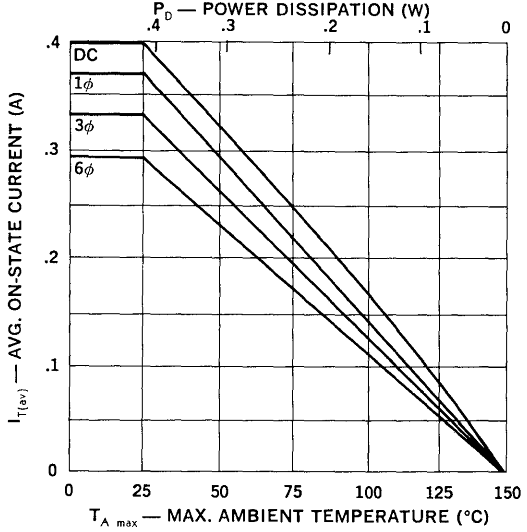


Min. Holding Current

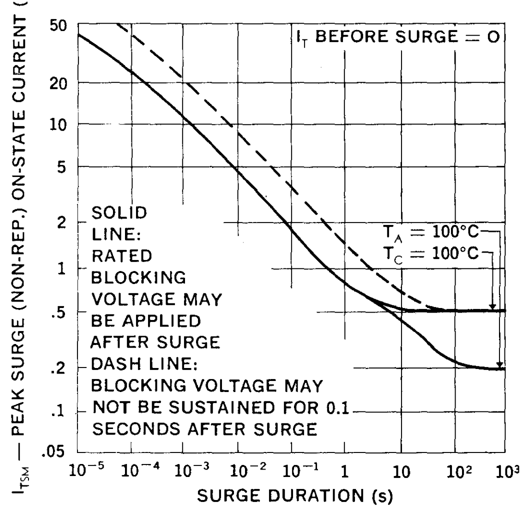
Avg. Current vs. Case Temperature



Avg. Current vs. Ambient Temperature



Surge Current



SOLID LINE: RATED BLOCKING VOLTAGE MAY BE APPLIED AFTER SURGE

DASH LINE: BLOCKING VOLTAGE MAY NOT BE SUSTAINED FOR 0.1 SECONDS AFTER SURGE

SCRs
1.6 Amp, Planar

AD100-AD104
AD107-AD111
AD114-AD118

FEATURES

- Maximum Gate Trigger Current: 2, 20 or 200μA
- Tight Gate Trigger Voltage Range: .44 to .6V
- Voltage Ratings: to 400V
- Specified for dv/dt and Switching Time

DESCRIPTION

This data sheet describes Unitrode's AD Series 1.6A SCRs designed for medium-current control and sensing applications. Units are available in a complete range of blocking voltages from 60 to 400 volts.

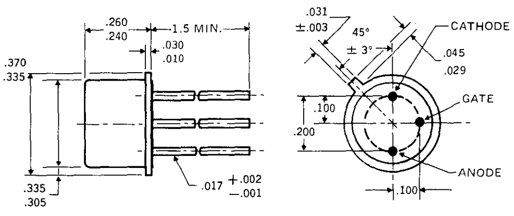
The AD100 series offers a maximum gate trigger current of 2.0 microamps making it the most sensitive device of its type. The AD107 series has a maximum I_{GT} of 20μA while this parameter is specified at 200μA for the AD114 series.

ABSOLUTE MAXIMUM RATINGS

	AD100 AD107 AD114	AD101 AD108 AD115	AD102 AD109 AD116	AD103 AD110 AD117	AD104 AD111 AD118
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V
Non-Repetitive Peak Reverse Voltage, V_{RSM}	80V	150V	300V	400V	500V
Non-Repetitive Peak Off-State Voltage, V_{DSM}	500V				
D.C. On-State Current, I_T					
75°C Ambient	450mA				
85°C Case	1.6A				
Repetitive Peak On-State Current, I_{TRM}	up to 30A				
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	15A				
Peak Gate Current, I_{GM}	250mA				
Average Gate Current, $I_{G(AV)}$	25mA				
Reverse Gate Voltage, V_{GR}	6V				
Operating and Storage Temperature Range	—65°C to +150°C				

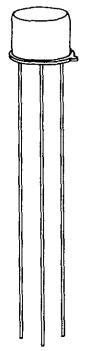
MECHANICAL SPECIFICATIONS

AD100-AD104 AD107-AD111 AD114-AD118



Dimensions in inches.

TO-5

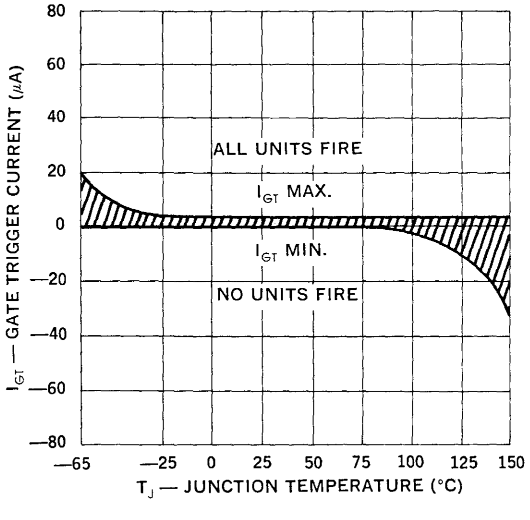


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

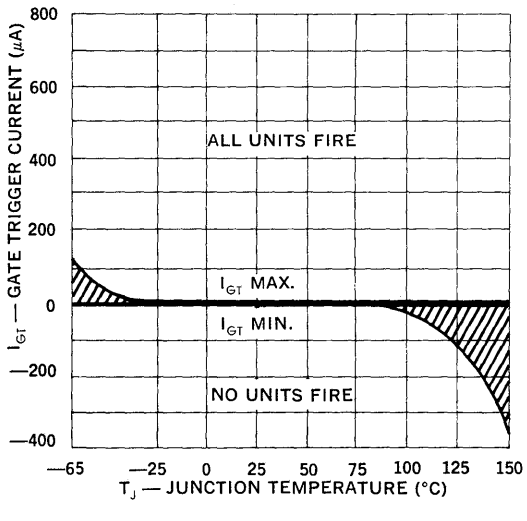
Parameter	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1 Visual & Mechanical	—	—	—	—	—	
SUBGROUP 2 (25°C TESTS)						
Off-State Current	I_{DRM}	—	.01	0.1	μA	$R_{GK} = 1K$, $V_{DRM} =$ Rating
Reverse Current	I_{RRM}	—	.01	0.1	μA	$R_{GK} = 1K$, $V_{RRM} =$ Rating
Reverse Gate Current	I_{GR}	—	0.1	0.2	μA	$V_{GR} = 2V$
Gate Trigger Current	I_{GT}					$R_{GS} = 10K$, $V_D = 5V$
AD100-104		—	0.2	2.0	μA	
AD107-111		—	2.0	20	μA	
AD114-118		—	20	200	μA	
Gate Trigger Voltage	V_{GT}	0.44	0.52	0.60	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.1	1.5	V	$I_T = 1.0$ Amp (pulse)
Holding Current	I_H	0.3	0.5	2.0	mA	$R_{GK} = 1K$
SUBGROUP 3 (25°C TESTS)						
On-State Voltage-Critical Rate of Rise	dv/dt	50	100	—	V/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger-on Pulse Width	t_{pg} (on)	—	0.5	2.0	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.6	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.4	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_g	—	20	50	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
SUBGROUP 4 (125°C TESTS)						
Off-State Current	I_{DRM}	—	10	100	μA	$R_{GK} = 1K$, $V_{DRM} =$ Rating
Reverse Current	I_{RRM}	—	30	100	μA	$R_{GK} = 1K$, $V_{RRM} =$ Rating
Gate Trigger Voltage	V_{GT}	0.15	0.2	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
Holding Current	I_H	0.2	0.4	1.5	mA	$R_{GK} = 1K$

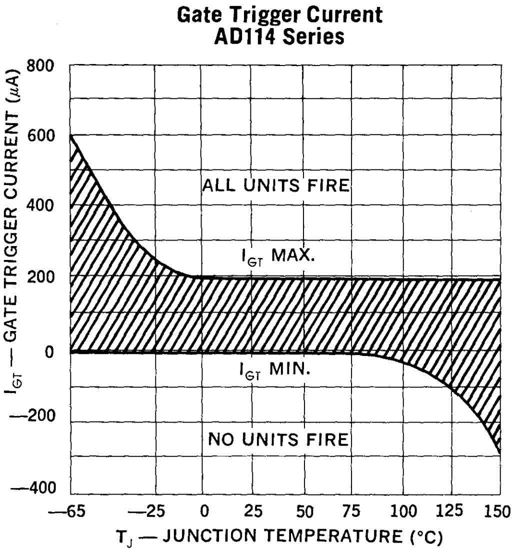
Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

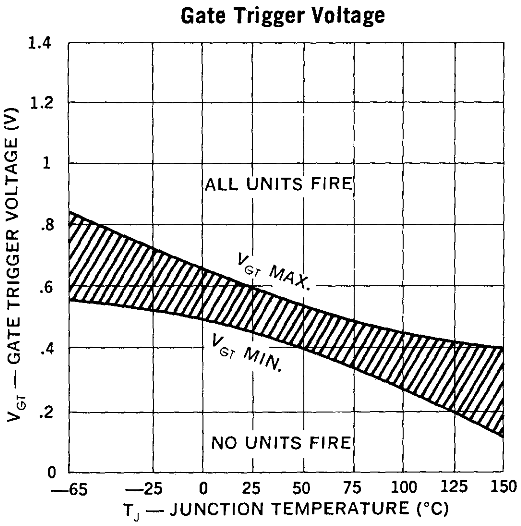
Gate Trigger Current
AD100 Series

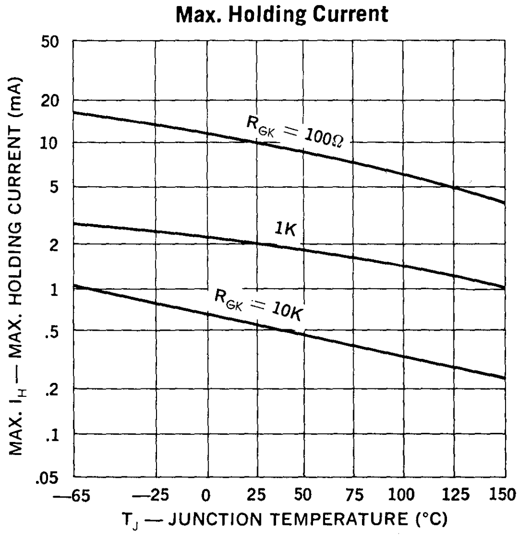


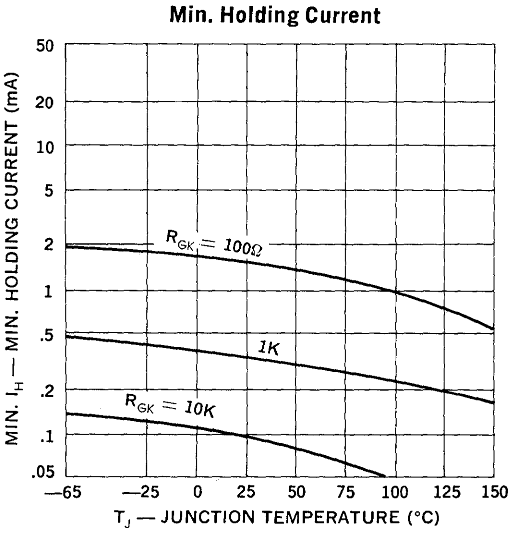
Gate Trigger Current
AD107 Series



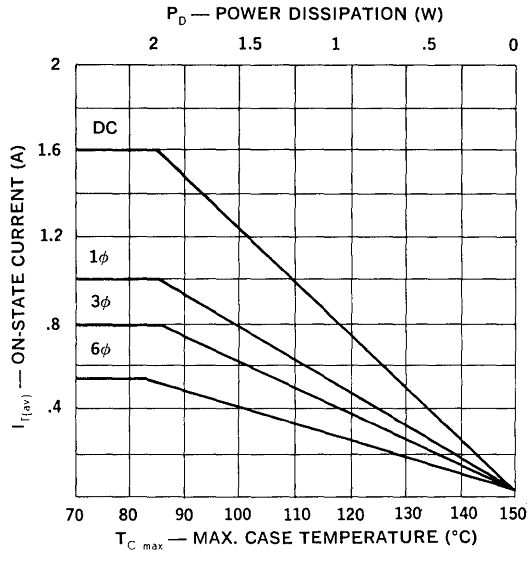

Gate Trigger Current
AD114 Series
I_{GT} — GATE TRIGGER CURRENT (μA)
800
600
400
200
0
—200
—400
ALL UNITS FIRE
I_{GT} MAX.
I_{GT} MIN.
NO UNITS FIRE
—65
—25
0
25
50
75
100
125
150
T_J — JUNCTION TEMPERATURE (°C)


Gate Trigger Voltage
V_{GT} — GATE TRIGGER VOLTAGE (V)
1.4
1.2
1
.8
.6
.4
.2
0
ALL UNITS FIRE
V_{GT} MAX.
V_{GT} MIN.
NO UNITS FIRE
—65
—25
0
25
50
75
100
125
150
T_J — JUNCTION TEMPERATURE (°C)

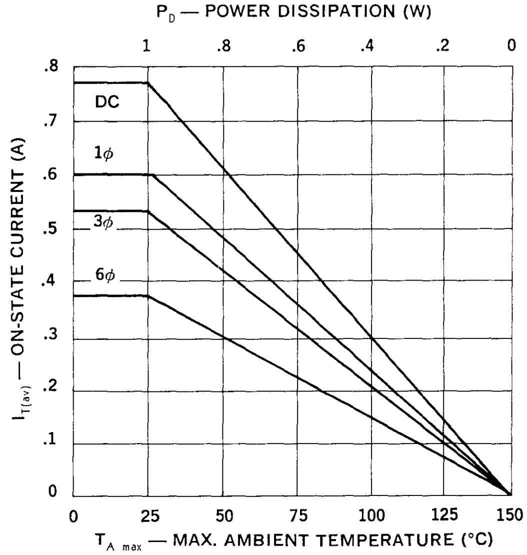

Max. Holding Current
MAX. I_H — MAX. HOLDING CURRENT (mA)
50
20
10
5
2
1
.5
.2
.1
.05
R_{GK} = 100Ω
1K
R_{GK} = 10K
—65
—25
0
25
50
75
100
125
150
T_J — JUNCTION TEMPERATURE (°C)


Min. Holding Current
MIN. I_H — MIN. HOLDING CURRENT (mA)
50
20
10
5
2
1
.5
.2
.1
.05
R_{GK} = 100Ω
1K
R_{GK} = 10K
—65
—25
0
25
50
75
100
125
150
T_J — JUNCTION TEMPERATURE (°C)

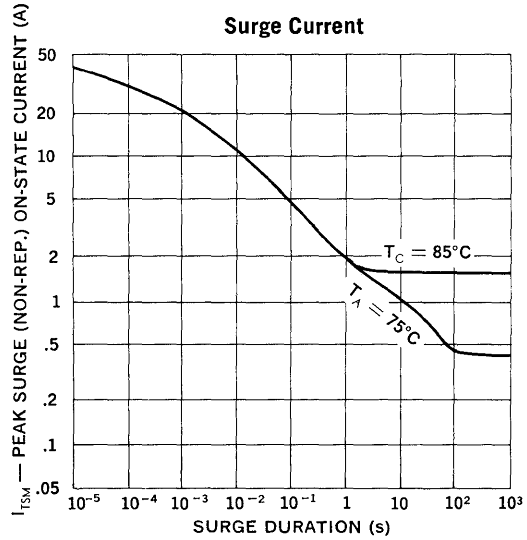
Avg. Current vs. Case Temperature



Avg. Current vs. Ambient Temperature



Surge Current



SCRs

.5 Amp, Planar

FEATURES

- Maximum Gate Trigger Current: 400μA
- Voltage Rating: to 200V
- Typical Blocking Current: 0.02μA
- Gate Trigger Voltage: 0.4 to 0.8V

DESCRIPTION

The CB200 Series are low cost/high performance thyristors (SCRs) for use in data processing and industrial systems requiring first quality-mass produced components.

This design uses a hermetically sealed metal case with Unitrode's unique oxide passivated junctions to ensure reliability and parameter stability. Industry standard TO-18 outline simplifies mounting and ensures interchangeability.

TYPICAL APPLICATIONS

Lamp Driving
Relay Driving
Relay Replacement
Alarm Systems
Counters

Process Controls
Pressure Controls
Display Systems
Touch Switches
and many other current sensing and control applications

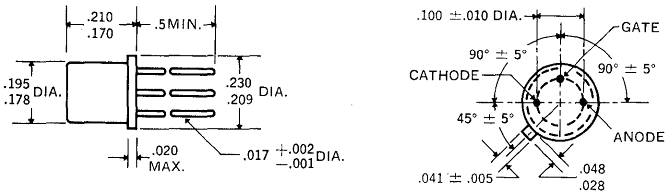
Remote Controls
High Current SCR Driving
Timers
Temperature Controls

ABSOLUTE MAXIMUM RATINGS

	CB200	CB201	CB202	CB203
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	200V
Non-Repetitive Peak Reverse Voltage, V_{RSM}	45V	90V	150V	300V
Non-Repetitive Peak Off-State Voltage, V_{DSM}	500V			
On-State Current, I_T				
100°C Case	0.5A			
75°C Ambient	0.25A			
Repetitive Peak On-State Current, I_{TRM}	up to 30A			
Surge (Non-Rep.) On-State Current, I_{TSM}	5A			
Peak Gate Current, I_{GM}	0.25A			
Average Gate Current, $I_{G(AV)}$	25mA			
Reverse Gate Current, I_{GR}	3mA			
Reverse Gate Voltage, V_{GR}	6V			
Operating and Storage Temperature Range	—65°C to +150°C			

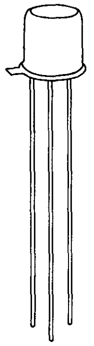
MECHANICAL SPECIFICATIONS

CB200-CB203



Dimensions in inches.

TO-18



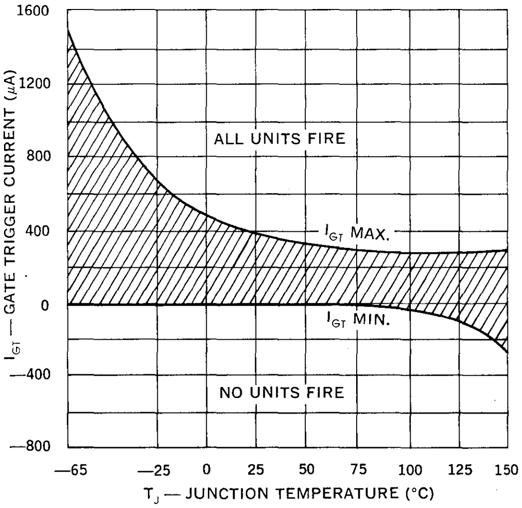
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Subgroup 1 Visual and Mechanical						
Subgroup 2 (25°C)						
Off-State Current	I_{DRM}	—	0.02	0.5	μA	$R_{GK} = 1K$, V_{DRM} = RATING
Reverse Current	I_{RRM}	—	0.02	0.5	μA	$R_{GK} = 1K$, V_{RRM} = RATING
Gate Trigger Current	I_{GT}	—	20	400	μA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.4	0.52	0.8	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.1	1.5	V	$I_T = 0.5A$ (PULSE TEST)
Holding Current	I_H	0.3	0.8	3.0	mA	$R_{GK} = 1K$
Subgroup 3 (25°C)						
Off-State Voltage-Critical Rate of Rise	dv_c/dt	50	100	—	V/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger-on Pulse Width	t_{pg} (on)	—	0.5	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.6	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.4	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_q	—	20	—	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
Subgroup 4 (125°C)						
High Temp. Off-State Current	I_{DRM}	—	10	100	μA	$R_{GK} = 1K$, V_{DRM} = RATING
High Temp. Blocking Current	I_{RRM}	—	10	100	μA	$R_{GK} = 1K$, V_{RRM} = RATING
High Temp. Gate Trigger Voltage	V_{GT}	0.12	0.2	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
High Temp. Holding Current	I_H	0.2	—	2.0	mA	$R_{GK} = 1K$

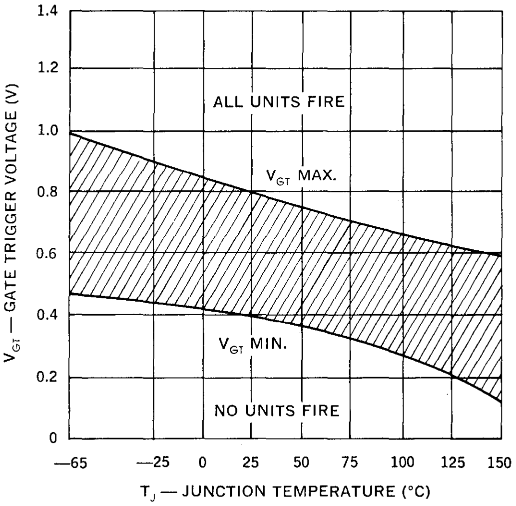
Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

TYPICAL CHARACTERISTICS

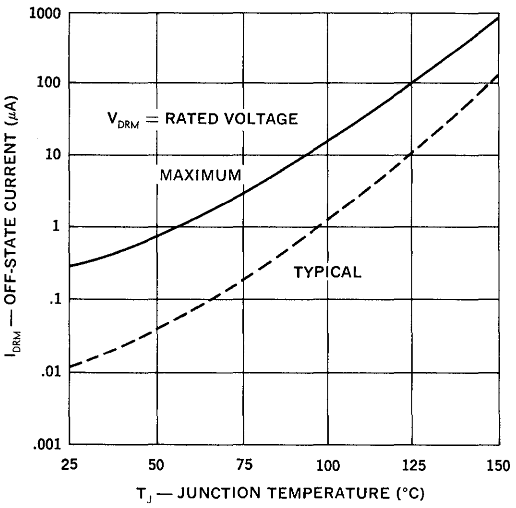
1. **Gate Trigger Current**



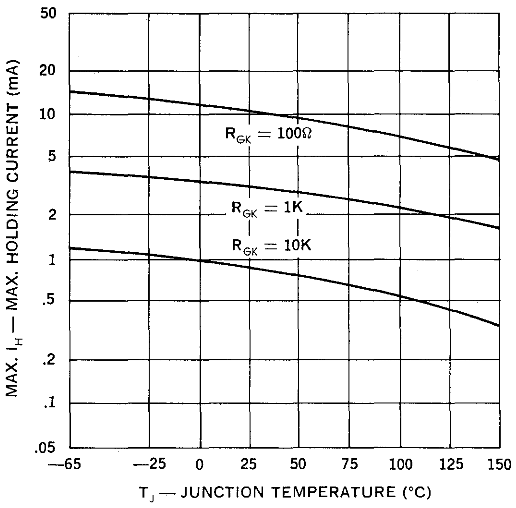
2. **Gate Trigger Voltage**



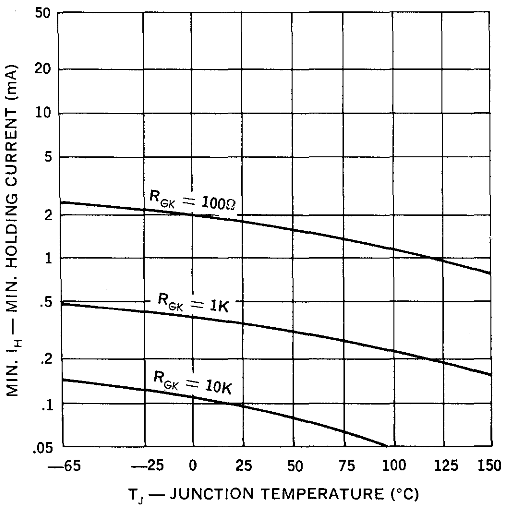
3. Off-State Current



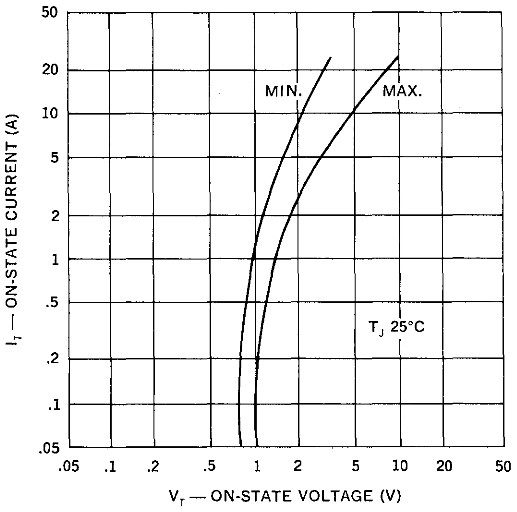
4. Maximum Holding Current



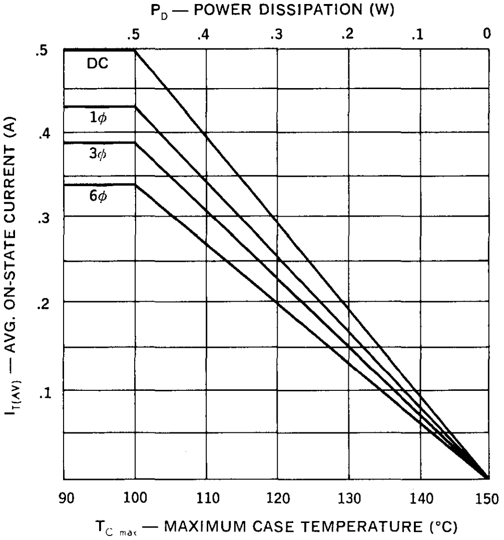
5. Minimum Holding Current



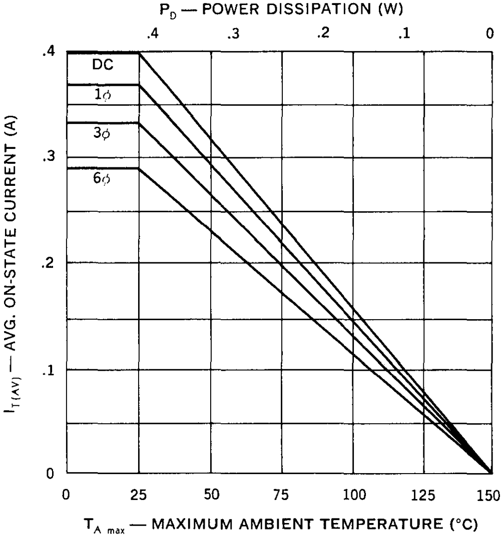
6. On-State Current vs. Voltage



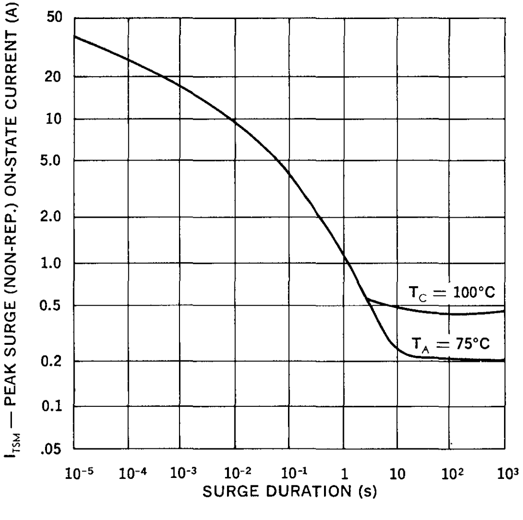
7. Average Current vs. Case Temperature



8. Average Current vs. Ambient Temperature



9. Surge (Non-Repetitive) On-State Current



SCRs

1.6 Amp, Planar

CD200-CD203

FEATURES

- Maximum Gate Trigger Current: 400μA
- Voltage Rating: to 200V
- Typical Blocking Current: 0.02μA
- Gate Trigger Voltage: 0.4 to 0.8V

DESCRIPTION

The CD200 Series are low cost/high performance thryristors (SCRs) for use in data processing and industrial systems requiring first quality-mass produced components.

TYPICAL APPLICATIONS

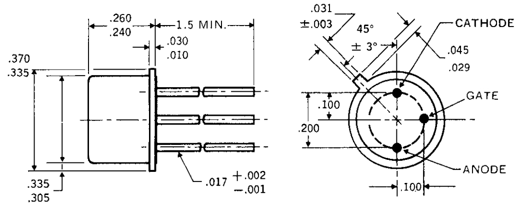
Lamp Driving	Process Controls	Remote Controls
Relay Driving	Pressure Controls	High Current SCR Driving
Relay Replacement	Display Systems	Timers
Alarm Systems	Touch Switches	Temperature Controls
Counters	and many other current sensing and control applications	

ABSOLUTE MAXIMUM RATINGS

	CD200	CD201	CD202	CD203
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	200V
Non-Repetitive Peak Reverse Voltage, V_{RSM}	45V	90V	150V	300V
Non-Repetitive Peak Off-State Voltage, V_{DSM}	500V			
D.C. On-State Current, I_T				
75°C Ambient	0.45A			
85°C Case	1.6A			
Repetitive Peak On-State Current, I_{TRM}	up to 30A			
Peak Surge (non-rep.) On-State Current, I_{TSM}	15A			
I^2t (For Times Exceeding 1.5ms)	0.83A²Sec			
Peak Gate Current, I_{GM}	250mA			
Average Gate Current, $I_{G(AV)}$	25mA			
Reverse Gate Current, I_{GR}	3mA			
Reverse Gate Voltage, V_{GR}	6V			
Operating and Storage Temperature Range	−65°C to +150°C			

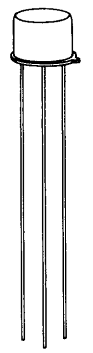
MECHANICAL SPECIFICATIONS

CD200-CD203



Dimensions in inches.

TO-5



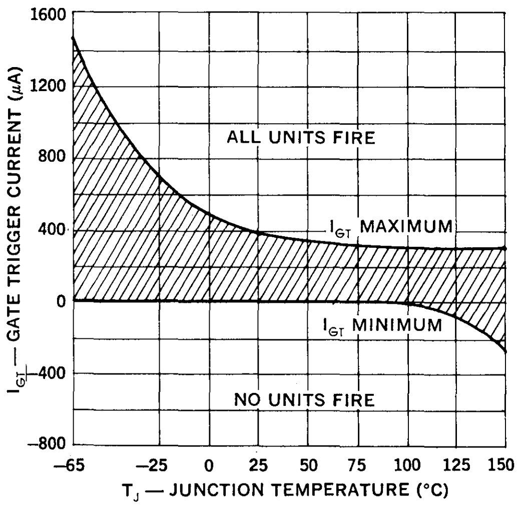
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

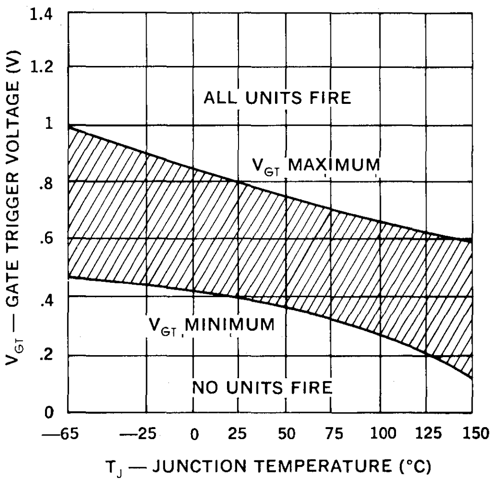
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Subgroup 1						
Visual and Mechanical						
Subgroup 2 (25°C)						
Off-State Current	I_{DRM}	—	0.02	0.5	μA	$R_{GK} = 1K$, $V_{DRM} =$ RATING
Reverse Current	I_{RRM}	—	0.02	0.5	μA	$R_{GK} = 1K$, $V_{RRM} =$ RATING
Gate Trigger Current	I_{GT}	—	20	400	μA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.4	0.52	0.8	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.1	1.4	V	$I_T = 0.5A$ (PULSE TEST)
Holding Current	I_H	0.3	0.5	3.0	mA	$R_{GK} = 1K$
Subgroup 3 (25°C)						
Off-State Voltage-Critical Rate of Rise	dv_c/dt	50	100	—	V/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger-on Pulse Width	t_{pg} (on)	—	0.5	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.6	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.4	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_q	—	20	—	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
Subgroup 4 (125°C)						
High Temp. Off-State Current	I_{DRM}	—	10	100	μA	$R_{GK} = 1K$, $V_{DRM} =$ RATING
High Temp. Reverse Current	I_{RRM}	—	10	100	μA	$R_{GK} = 1K$, $V_{RRM} =$ RATING
High Temp. Gate Trigger Voltage	V_{GT}	0.12	0.2	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
High Temp. Holding Current	I_H	0.2	—	2.0	mA	$R_{GK} = 1K$

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

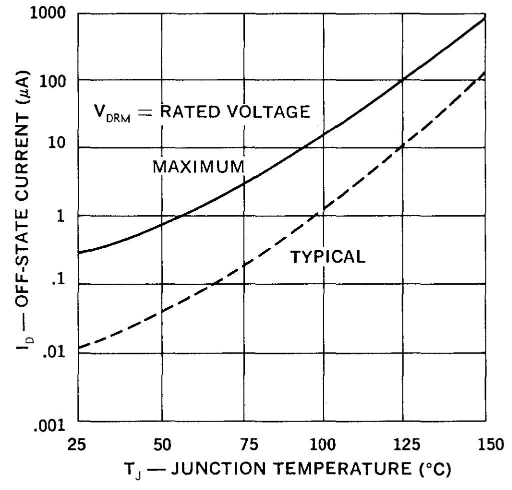
Gate Trigger Current



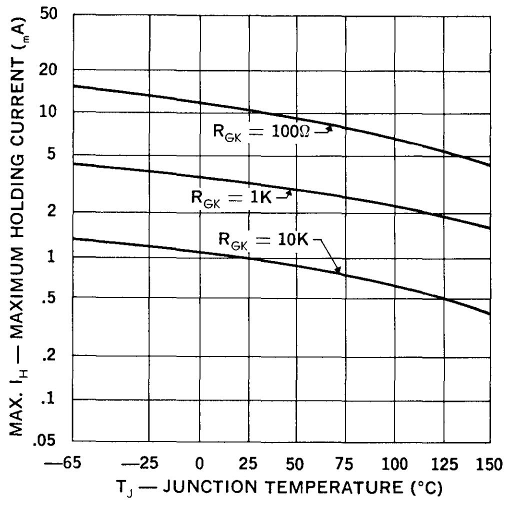
Gate Trigger Voltage



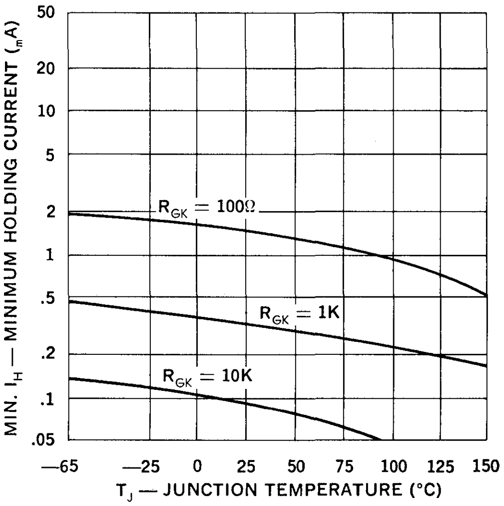
Off-State Current



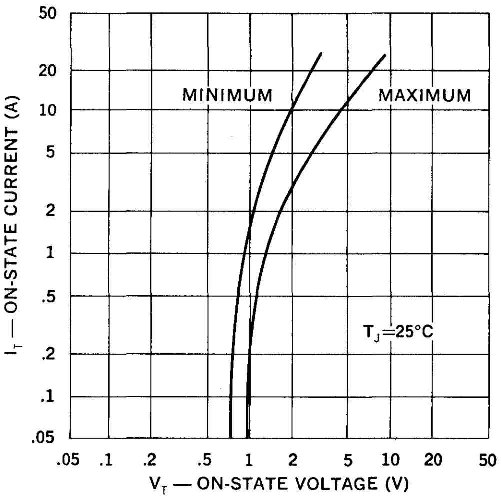
Maximum Holding Current



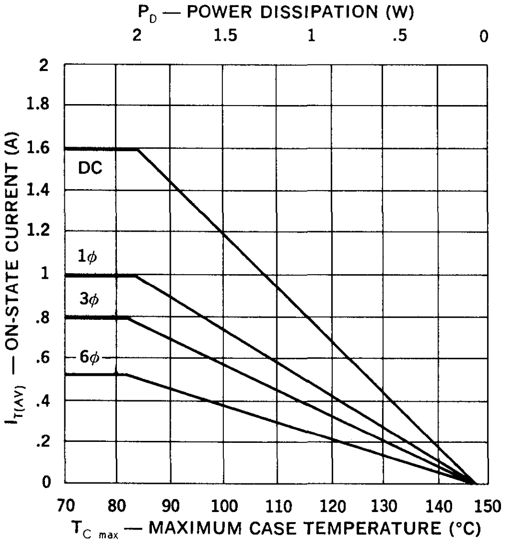
Minimum Holding Current



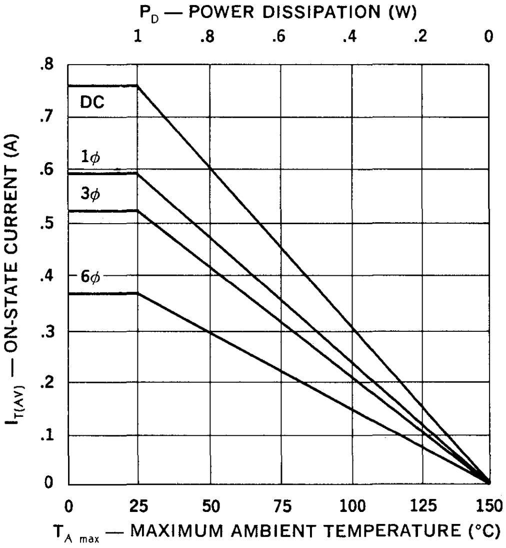
On-State Current vs. Voltage



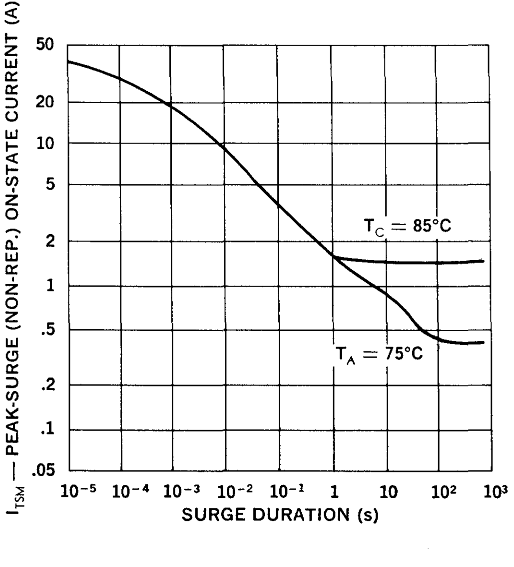
Average Current vs. Case Temperature



Average Current vs. Ambient Temperature



Surge (Non-Rep) On-State Current



SCRs

CM100-CM104

Military/Aerospace, 5 Amp, Planar

FEATURES

- Holding Current: less than 3mA
- Turn-on Time: 0.5μs
- Maximum Gate Trigger Current: 200μa
- Specified for dv/dt
- Voltage Rating: to 400V
- Pulse Current: to 50A
- Designed for Operation −65°C to +150°C
- Available in Hermetic TO-59 Package

DESCRIPTION

Unitrode's CM 100 Series 5A SCR has been designed specifically for Military-Aerospace applications.

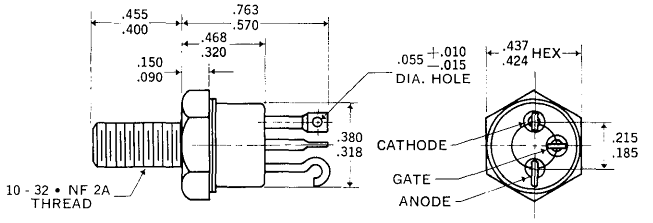
A unique combination of planar passivation and stud mounting in a TO-59 package enables this 5A SCR to operate with a peak recurrent forward pulse current capability of up to 50A. These devices are ideal for AC and DC switching operations, pulse modulator discharge devices, converters and inverters, and squib firing applications.

ABSOLUTE MAXIMUM RATINGS

	CM100	CM101	CM102	CM103	CM104
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V
D.C. On-State Current, I_T					
100°C Case	5A				
Repetitive Peak On-State Current, I_{TRM}	up to 50A				
Peak One Cycle Surge (non-rep) On-State Current, I_{TSM}	30A				
Peak Gate Current, I_{GM}	250mA				
Average Gate Current, $I_{G(AV)}$	25mA				
Reverse Gate Current, I_{GR}	3mA				
Reverse Gate Voltage, V_{GR}	6V				
Thermal Resistance (junction to case) $R\theta_{J-C}$	3.3°C/W				
Storage Temperature Range	−65°C to +200°C				
Operating Temperature Range	−65°C to +150°C				

MECHANICAL SPECIFICATIONS

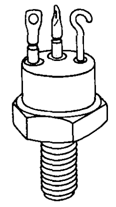
CM100-CM104



Dimensions in inches.

NOTE: Anode internally connected to case.

TO-59



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Max.	Units	Test Conditions
Subgroup 1 Visual & Mechanical					
Subgroup 2 (25°C Tests)					
Off-State Current	I_{DRM}	—	0.5	µA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	0.5	µA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	1.0	mA	$V_{GR} = 5V$, Anode Open
Gate Trigger Current	I_{GT}	—	200	µA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.4	0.8	V	R_{GS} = 100 ohms; $V_D = 5V$
On-State Voltage	V_T	—	2.5	V	$I_T = 5A$, (Pulse Test)
Holding Current	I_H	0.3	3.0	mA	$R_{GK} = 1K$
Subgroup 3 (25°C Tests)					
Off-State Voltage — Critical Rate of Rise	dv/dt	100	—	V/µs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger — On Pulse Width	t_{pg} (on)	—	0.5	µs	$I_G = 10mA$, $V_D = 30V$, $I_T = 1A$
Delay Time	t_d	—	0.5	µs	$I_G = 10mA$, $V_D = 30V$, $I_T = 1A$
Rise Time	t_r	—	0.5	µs	$I_G = 10mA$, $V_D = 30V$, $I_T = 1A$
Circuit Commutated Turn-off Time	t_q	—	50	µs	$I_T = 1A$, $R_{GK} = 1K$, $i_R = 1A$
Subgroup 4 (150°C Tests)					
High Temp. Off-State Current	I_{DRM}	—	200	µA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	300	µA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Gate Trigger Voltage	V_{GT}	0.15	—	V	R_{GS} = 100 ohms; $V_D = 5V$
High Temp. Holding Current	I_H	0.1	—	mA	$R_{GK} = 1K$
Subgroup 5 (—65°C Tests)					
Low Temp. Gate Trigger Voltage	V_{GT}	—	1.0	V	R_{GS} = 100 ohms; $V_D = 5V$
Low Temp. Gate Trigger Current	I_{GT}	—	1.0	mA	$R_{GS} = 10K$, $V_D = 5V$
Low Temp. Holding Current	I_H	—	5.0	mA	$R_{GK} = 1K$

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

SCRs

Nuclear Radiation Resistant, Planar

GA100
GA101
GA102

FEATURES

- Optimized for Radiation Resistance
- Fully Characterized for "Worst Case" Design
- Post Radiation Design Limits Specified
- Passivated Planar Construction for Maximum Reliability and Parameter Uniformity
- Pulse Currents: to 30A
- Max. Trigger Current 20mA after 3 X 10^{14} NVT
- Max. Holding Current 30mA after 3 X 10^{14} NVT

DESCRIPTION

The GA100 Series of Radiation Hard SCRs have been designed to provide significantly greater radiation tolerance than conventional SCRs or Transistors with the same current handling ability. This Series is capable of operation after exposure to 10^{15} NVT.

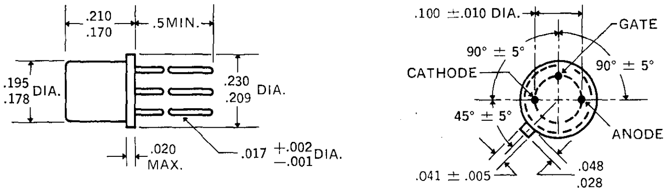
The radiation resistant characteristics of the GA100 series devices make them particularly desirable for use under radiation environments in squib firing circuits; inverters and converters; pulse generators; relay drivers; and modulator discharge switches.

ABSOLUTE MAXIMUM RATINGS

	GA100	GA101	GA102
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	80V
D.C. On-State Current, I_T			
75°C Ambient		200mA	
100°C Case		400mA	
Repetitive Peak On-State Current, I_{TRM}		up to 30A	
Surge (non-rep.) On-State Current, I_{TSM} (Sq. Pulse-50ms)		5A	
Peak Gate Current, I_{GM}		250mA	
Average Gate Current, $I_{G(AV)}$		25mA	
Reverse Gate Voltage, V_{GR}		5V	
Reverse Gate Current, I_{GR}		3mA	
Storage Temperature Range		—65°C to +200°C	
Operating Temperature Range		—65°C to +150°C	

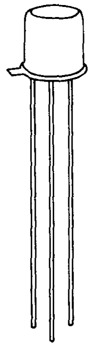
MECHANICAL SPECIFICATIONS

GA100 GA101 GA102



Dimensions in inches.

TO-18



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

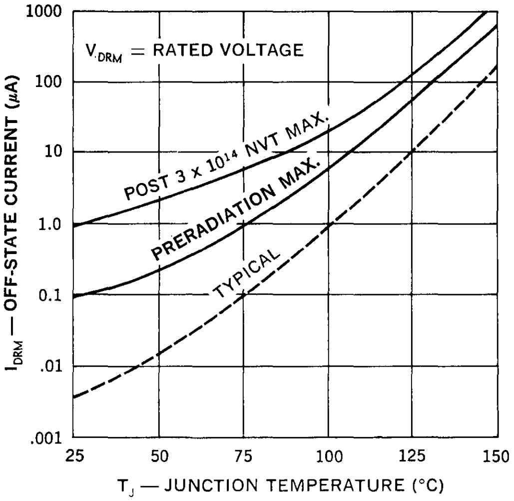
Test	Symbol	Preradiation Limits			Post 3 x 10^{14} NVT Design Limits		Units	Test Conditions
		Min.	Typ.	Max.	Min.	Max.		
SUBGROUP 1 Visual and Mechanical	—	—	—	—	—	—	—	MIL-STD-750 Method 2071
SUBGROUP 2 (25°C Tests)								
Off-State Current	I_{DRM}	—	.005	0.1	—	1.0	μA	$R_{GK} = 220\Omega$, V_{DRM} = Rating
Reverse Gate Current	I_{GR}	—	.01	0.1	—	1.0	μA	$V_{GR} = 2V$
Input Trigger Current (Note 2)	I_{ST}	1.8	2.3	3.5	—	20	mA	$R_{GK} = 220\Omega$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.4	0.5	0.7	—	1.5	V	$R_{GK} = 220\Omega$, $V_D = 5V$
On-State Voltage	V_T	0.8	1.1	1.5	—	3.0	V	$i_T = 1A$ (pulse test)
Holding Current	I_H	0.3	0.7	10	—	30	mA	$R_{GK} = 220\Omega$
SUBGROUP 3 (25°C Tests)								
Off-State Voltage-Critical Rate of Rise	dv_c/dt	20	40	—	—	—	v/μs	$R_{GK} = 220\Omega$, $V_D = 30V$
Gate Trigger-on Pulse Width	t_{pg} (on)	—	.02	.05	—	0.1	μs	$I_G = 25mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	.02	—	—	—	μs	$I_G = 25mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	.05	—	—	—	μs	$I_G = 25mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_q	—	1.5	2.5	—	1.0	μs	$I_T = 1A$, $i_R = 1A$, $R_{GK} = 220\Omega$
SUBGROUP 4 (125°C Tests)								
High Temp Off-State Current	I_{DRM}	—	10	100	—	100	μA	$R_{GK} = 220\Omega$, V_{DRM} = Rating
High Temp Gate Trigger Voltage	V_{GT}	0.1	.17	—	0.1	—	V	$R_{GK} = 220\Omega$, $V_D = 5V$

Notes: 1. Off-State voltage ratings apply over the operating temperature range provided the gate is connected to the cathode through an appropriate resistor, or other adequate bias is used.
2. Total Input Trigger Current, including current required by 220Ω gate bias resistance.

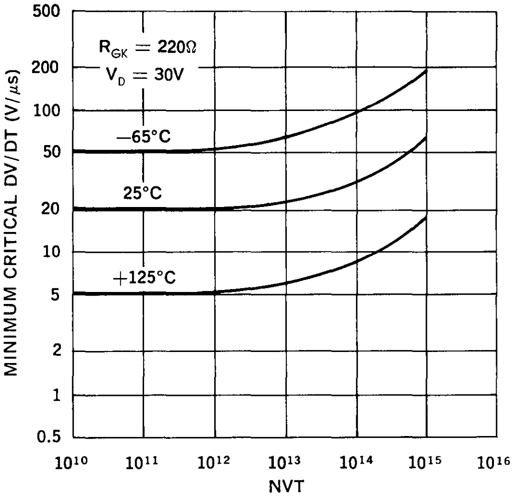
DESIGN CONSIDERATIONS

1. Curve 1 shows the off-state current, I_{DRM} of the SCR as a function of temperature. I_{DRM} is increased by radiation damage, but is not a design consideration at the recommended gate bias levels.
   In order to optimize for radiation tolerance, reverse blocking capability has not been retained as a design feature. Devices with reverse blocking capability can be provided.
2. Minimum critical dv/dt levels are defined in Curve 2. The dv/dt capability is improved after radiation because of reduced triggering sensitivity. dv/dt is therefore a design consideration only prior to radiation.
3. Curves 3 and 4 show the limits of Gate Trigger Voltage and Total Input Trigger Current prior to radiation. Maximum design limits after a total radiation dosage of 3 x 10^{14} NVT is also shown. Curves 5 and 6 show the maximum limits of Gate Trigger Voltage and Total Input Trigger Currents as a junction of neutron dosage. The minimum level of Trigger current prior to radiation is established by the shunting effect of a 220 ohm resistor between gate and cathode. After radiation the device is less sensitive and Total Trigger Current will increase to a level relatively independent of the bias resistance. The 220 ohm resistor is recommended since it raises the minimum preradiation trigger current to a level that is closer to the past radiation limit and minimizes the percentage change in this parameter.
4. Current ratings shown in Curves 10, 11, and 12 apply after the device has been subjected to 3 x 10^{14} NVT. Current ratings prior to radiation are greater than the values indicated.
5. Gamma radiation produces a reversible ionization (leakage) current within the device which is directly proportional to the Gamma flux level. When the Gamma flux level is in the range of 10 to 100 Roentgens per microsecond for burst durations greater than 1 microsecond, the device will self trigger ON. For the radiation bursts associated with nuclear explosions, the Gamma flux level will invariably cause device triggering at radiation levels significantly below the levels that would produce detectable permanent device damage due to cumulative neutron dosage. In applications where the burst effect triggering cannot be tolerated, it is necessary to reset the device after the radiation burst. Special circuit approaches such as additional SCRs to crowbar or otherwise cancel the output function may be used.

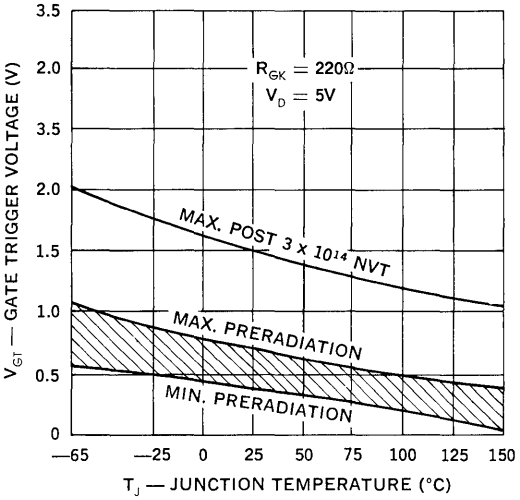
1. **Off-State Current**



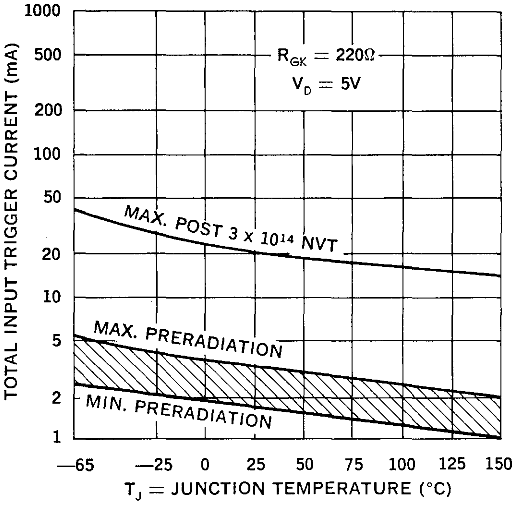
2. **Minimum Critical DV/DT vs. Neutron Dosage**



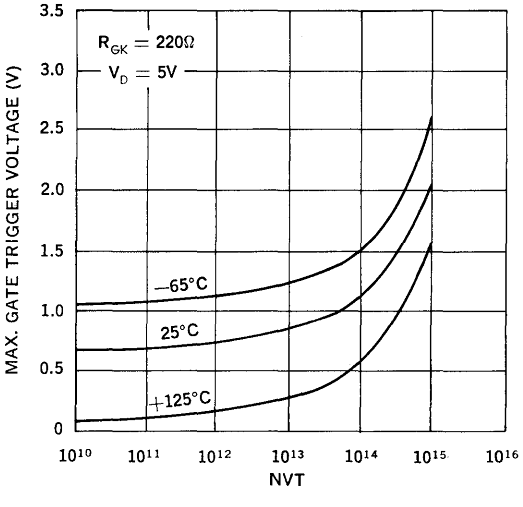
3. **Gate Trigger Voltage**



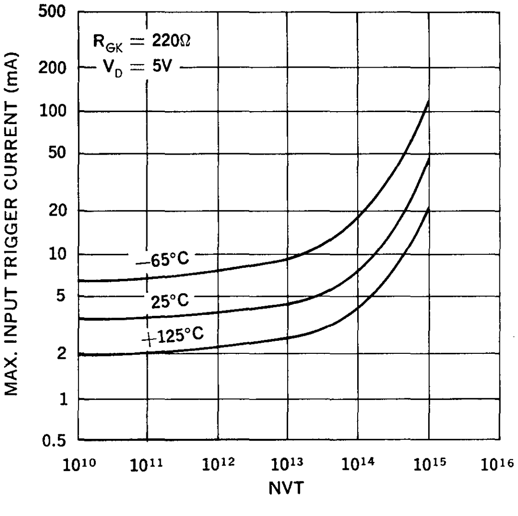
4. **Input Trigger Current**



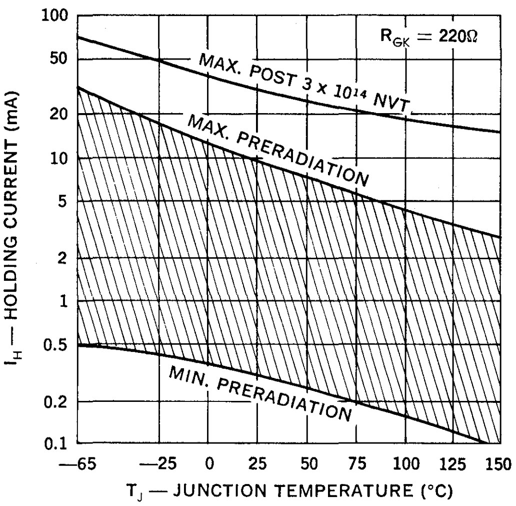
5. **Max. Gate Trigger Voltage vs. Neutron Dosage**



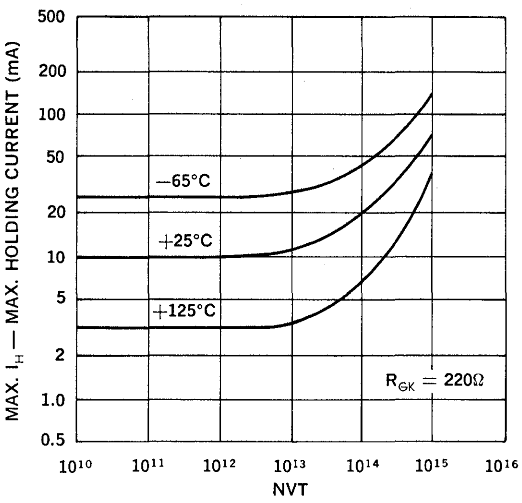
6. **Max. Input Trigger Current vs. Neutron Dosage**



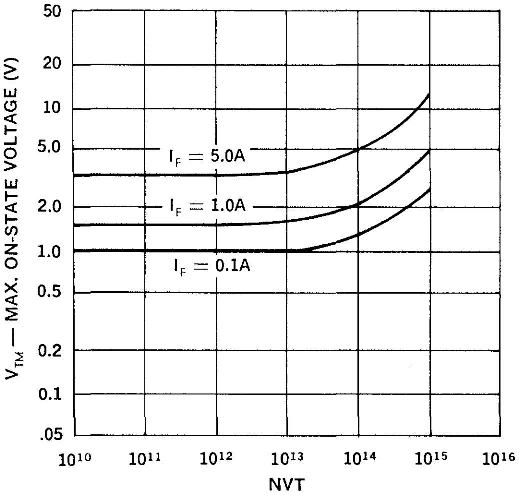
7. Holding Current



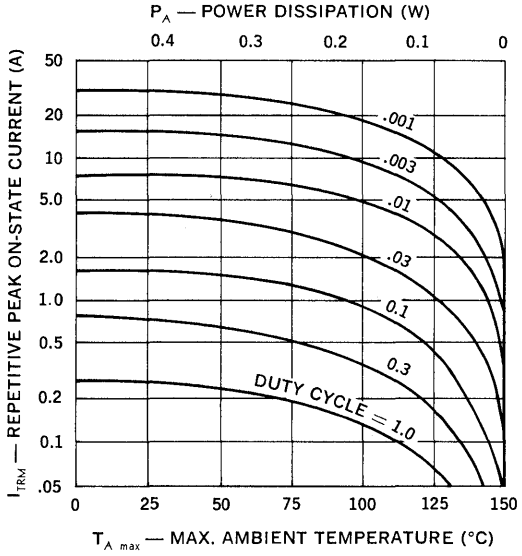
8. Max. Holding Current vs. Neutron Dosage



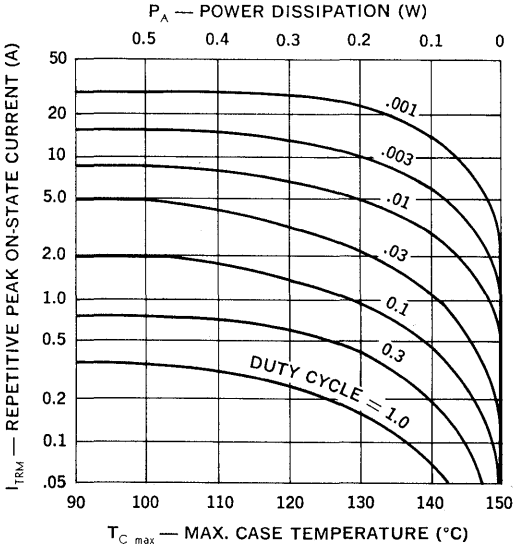
9. Max. On-State Voltage vs. Neutron Dosage



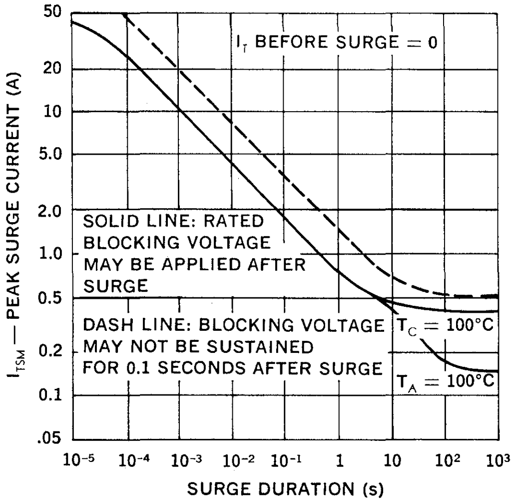
10. Peak Current vs. Ambient Temperature



11. Peak Current vs. Case Temperature



12. Surge Current vs. Time



SCRs

Nanosecond Switching, Planar

GA200 GB200
GA200A GB200A
GA201 GB201
GA201A GB201A

FEATURES

- Rise Time: 10ns
- Delay Time: 10ns
- Recovery Time: 0.5 μs
- Pulse Current: to 100A
- Turn-on with 20ns, 10 mA Gate Pulse

DESCRIPTION

The Unitrode Nanosecond Thyristor Switch combines the turn-on speed of logic level transistors with the high current switching capability inherent in SCRs. With this device engineers can now design circuits capable of switching pulse currents of 1A in less than 10ns or up to 30A in less than 20ns.

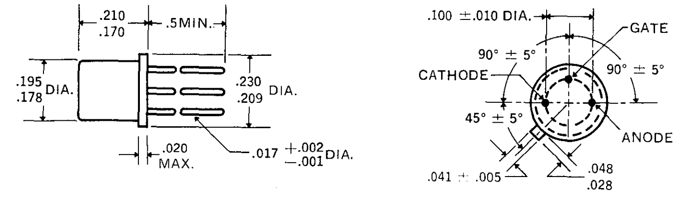
The GA/GB200 series is specifically designed for use as switching elements in high speed, low-to-medium power radar pulse modulators. Other applications include switching elements for phased array radars, laser pulse drivers, harmonic wave-form generators, line drivers and high current replacements for avalanche transistors. For applications requiring higher voltage levels, Unitrode has developed several "series string" circuits which allow the series connection of virtually an unlimited number of devices for voltages as high as 2000V with no significant decrease in speed. These circuits are described in Unitrode New Design Idea #21.

ABSOLUTE MAXIMUM RATINGS

	GA200 GA200A	GA201 GA201A	GB200 GB200A	GB201 GB201B
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	60V	100V
Repetitive Peak On-State Current, I_{TRM}	up to 100A		up to 100A	
D.C. On-State Current, I_T				
70°C Ambient	200mA		—	
70°C Case	400mA		6A	
Peak Gate Current, I_{GM}	250mA		250mA	
Average Gate Current, $I_{G(AV)}$	25mA		50mA	
Reverse Gate Current, I_{GR}	3mA		3mA	
Reverse Gate Voltage, V_{GR}	5V		5V	
Storage Temperature Range	—65°C to +200°C			
Operating Temperature Range	—65°C to +150°C			

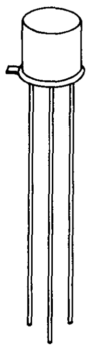
MECHANICAL SPECIFICATIONS

GA200 GA200A GA201 GA201A

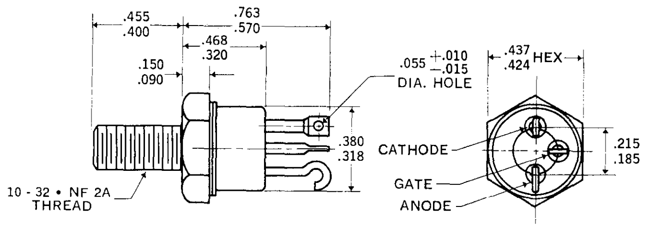


Dimensions in inches.

TO-18

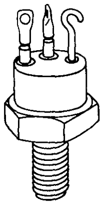


GB200 GB200A GB201 GB201A



Dimensions in inches.

TO-59



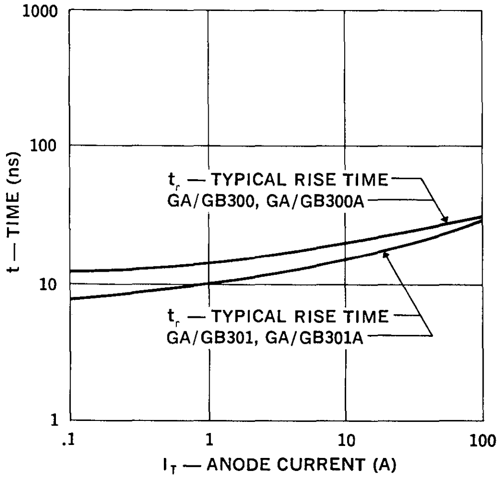
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Delay Time	t_d	— —	20 10	30 —	ns ns	$I_G = 10mA, I_T = 1A$ $I_G = 30mA, I_T = 1A$
Rise Time GA200, 200A, GB200, 200A	t_r	— —	15 25	25 —	ns ns	$V_D = 60V, I_T = 1A$ (1) $V_D = 60V, I_T = 30A$ (1)
Rise Time GA201, 201A, GB201, 201A	t_r	— —	10 20	20 —	ns ns	$V_D = 100V, I_T = 1A$ (1) $V_D = 100V, I_T = 30A$ (1)
Gate Trigger on Pulse Width	$t_{pg(on)}$	—	.02	.05	μs	$I_G = 10mA, I_T = 1A$
Circuit Commutated Turn-off Time GA200, 201, GB200, 201, GA200A, 201A, GB200A, 201A	t_q	— —	0.8 0.3	2.0 0.5	μs μs	$I_T = 1A, I_R = 1A, R_{GK} = 1K$
Off-State Current	I_{DRM}	— —	.01 20	0.1 100	μA μA	V_{DRM} = Rating, $R_{GK} = 1K$ V_{DRM} = Rating, $R_{GK} = 1K$, 150°C
Reverse Current	I_{RRM}	—	1.0	10	mA	$V_{RRM} = 30V, R_{GK} = 1K$ (2)
Reverse Gate Current	I_{GR}	—	.01	0.1	mA	$V_{GRM} = 5V$
Gate Trigger Current	I_{GT}	—	10	200	μA	$V_D = 5V, R_{GS} = 10K$
Gate Trigger Voltage	V_{GT}	0.4 0.10	0.6 0.2	0.75 —	V V	$V_D = 5V, R_{GS} = 100\Omega$
On-State Voltage	V_T	—	1.1	1.5	V	$I_T = 2A$
Holding Current	I_H	0.3 0.05	2.0 0.2	5.0 —	mA mA	$V_D = 5V, R_{GK} = 1K$
Off-State Voltage-Critical Rate of Rise	dv/dt	20	40	—	V/μs	$V_D = 30V, R_{GK} = 1K$

Notes: 1. $I_G = 10mA$; Pulse Test, Duty Cycle <1%.

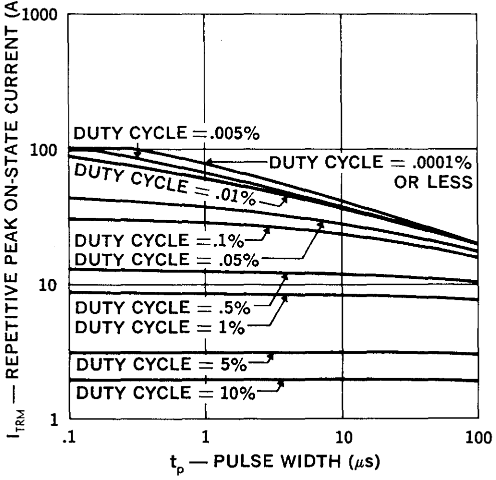
2. Pulse test intended to guarantee reverse anode voltage capability for pulse commutation. Device should not be operated in the reverse blocking mode on a continuous basis.

Switching Speed (Typical)
GA/GB200 Series



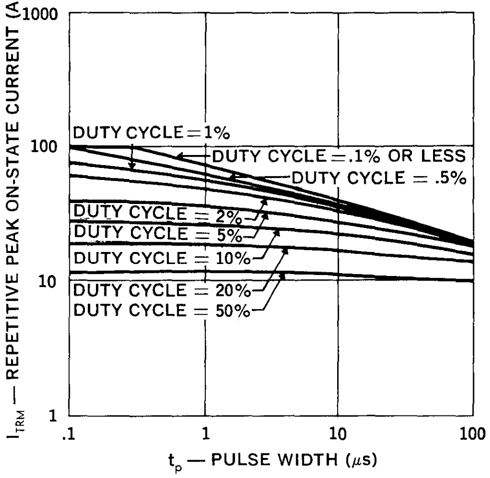
NOTES: 1. V_D = Rated V_{DRM}
2. $T_A = 25°C$
3. $I_G = 10mA$
4. $T_D = 10ns$ TYPICALLY FOR ALL TYPES INDEPENDENT OF ANODE CURRENT

Peak Current vs. Pulse Width
GA200 Series



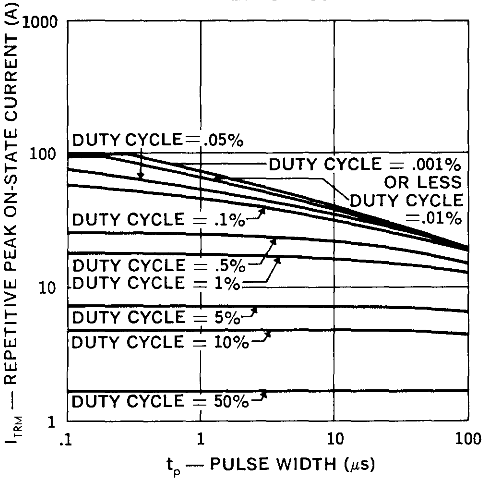
NOTES: 1. DATA BASED ON ON-STATE VOLTAGE GRAPH AT $T_j = 150°C$. BLOCKING VOLTAGE MAY BE APPLIED IMMEDIATELY AFTER TERMINATION OF CURRENT PULSE.
2. $T_A = 75°C$

Peak Current vs. Pulse Width GB200 Series



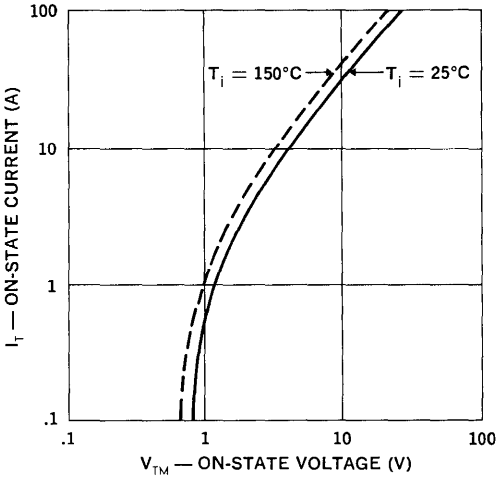
NOTES: 1. DATA BASED ON ON-STATE VOLTAGE GRAPH AT $T_j = 150°C$. BLOCKING VOLTAGE MAY BE APPLIED IMMEDIATELY AFTER TERMINATION OF CURRENT PULSE.
2. $T_A = 75°C$

Peak Current vs. Pulse Width GB200 Series

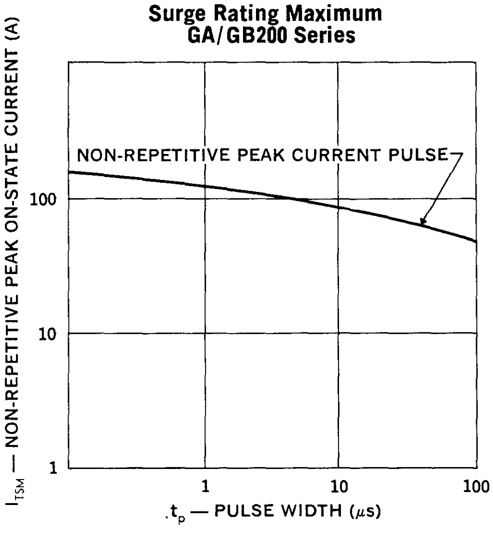


NOTES: 1. DATA BASED ON ON-STATE VOLTAGE GRAPH AT $T_j = 150°C$. BLOCKING VOLTAGE MAY BE APPLIED IMMEDIATELY AFTER TERMINATION OF CURRENT PULSE.
2. $T_A = 75°C$

On-State Current vs. Voltage GA/GB200 Series



Surge Rating Maximum GA/GB200 Series



NOTES: 1. BLOCKING VOLTAGE MAY NOT BE APPLIED FOR .001 SEC. AFTER TERMINATION OF SURGE PULSE AS JUNCTION TEMPERATURE WILL EXCEED 150°C.
2. $T_A = 75°C$

SCRs

Nanosecond Switching, Planar

GA300 GB300
GA300A GB300A
GA301 GB301
GA301A GB301A

FEATURES

- Rise Time: 10ns
- Delay Time: 10ns
- Recovery Time: 0.5μs
- Pulse Current: to 100A
- Turn-on with 20ns, 10mA gate pulse

DESCRIPTION

Unitrode's Nanosecond Thyristor Switch combines the turn-on speed of logic level transistors with the high current switching capability inherent in SCRs. With this device, engineers can now design circuits capable of switching pulse currents of 1A in less than 10ns or up to 30A in less than 20ns.

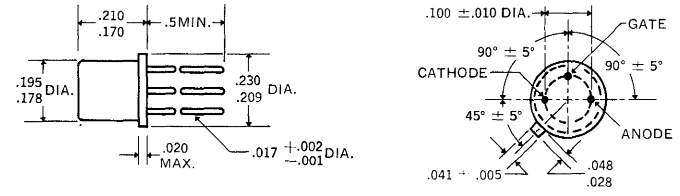
The GA300, GB300 Series is specifically designed for use as the switching element in high speed laser diode pulse drivers. Other applications include electronic crowbars, harmonic wave-form generators, line drivers and general purpose replacements for avalanche transistors. For applications requiring higher voltage levels, Unitrode has developed several "series string" circuits which allow the series connection of an unlimited number of devices for voltages as high as 2000V with no significant decrease in speed. These circuits are described in Unitrode's New Design Idea #21.

ABSOLUTE MAXIMUM RATINGS

	GA300 GA300A	GA301 GA301A	GB300 GB300A	GB301A GB301
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	60V	100V
Repetitive Peak On-State Current, I_{TRM}	up to 100A		up to 100A	
Peak Gate Current, I_{GM}	250mA		250mA	
Average Gate Current, $I_{G(AV)}$	25mA		50mA	
Reverse Gate Current, I_{GR}	3mA		3mA	
Reverse Gate Voltage, V_{GR}	5V		5V	
Storage Temperature Range	−65°C to +150°C			
Operating Temperature Range	0°C to +125°C			

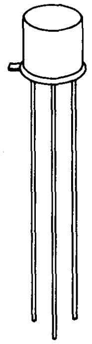
MECHANICAL SPECIFICATIONS

GA300 GA300A GA301 GA301A

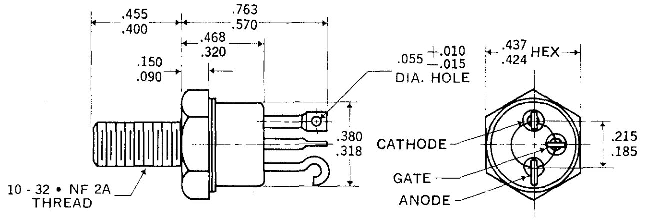


Dimensions in inches.

TO-18

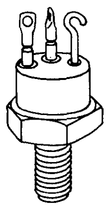


GB300 GB300A GB301 GB301A



Dimensions in inches.

TO-59



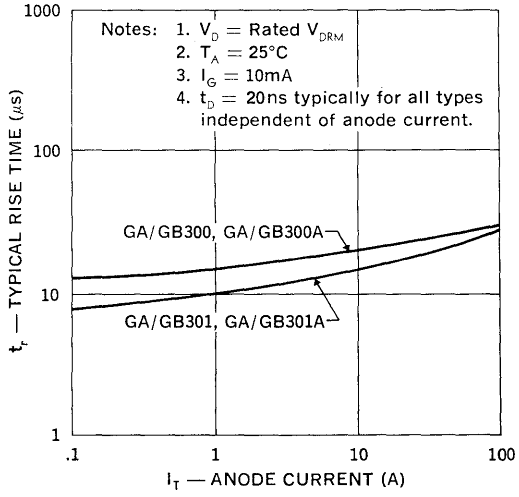
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

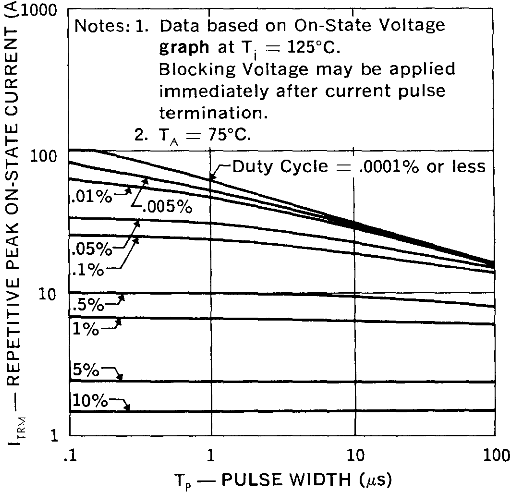
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Delay Time	t_d	—	20 10	30 —	ns	$I_G = 10mA, I_T = 1A$ $I_G = 30mA, I_T = 1A$
Rise Time (Note 1) GA300, 300A, GB300, 300A	t_r	—	15 25	25 —	ns	$V_D = 60V, I_T = 1A$ $V_D = 60V, I_T = 30A$ (Note 1)
Rise Time (Note 1) GA301, 301A, GB301, 301A	t_r	—	10 20	20 —	ns	$V_D = 100V, I_T = 1A$ $V_D = 100V, I_T = 30A$ (Note 1)
Circuit Commutated Turn-off Time GA300, 301, GB300, 301 GA300A, 301A, GB300A, 301A	t_q	—	0.8 0.3	2.0 0.5	μs μs	$I_T = 1A, I_R = 1A, R_{GK} = 1K$ $I_T = 1A, I_R = 1A, R_{GK} = 1K$
Gate Trigger-on Pulse Width	$t_{pg\ (on)}$	—	0.02	0.05	μs	$I_G = 10mA, I_T = 1A$
Off-state Current	I_{DRM}	— —	0.01 20	0.1 100	μA μA	V_{DRM} = Rating, $R_{GK} = 1K, T = 25°C$ V_{DRM} = Rating, $R_{GK} = 1K, T = 125°C$
Reverse Current (Note 2)	I_{RRM}	—	1.0	10	mA	$V_{RRM} = 30V, R_{GK} = 1K$ (Note 2)
Gate Trigger Voltage	V_{GT}	0.4 0.10	0.6 0.2	0.75 —	V V	$V_D = 5V, R_{GS} = 100\Omega, T = 25°C$ $V_D = 5V, R_{GS} = 100\Omega, T = 125°C$
Gate Trigger Current	I_{GT}	—	10	200	μA	$V_D = 5V, R_{GS} = 10K$
On-state Voltage	V_T	—	1.1	1.5	V	$I_T = 2A$
Off-state Voltage — Critical Rate of Rise	dv/dt	15	30	—	V/μs	$V_D = 30V, R_{GK} = 1K$
Reverse Gate Current	I_{GR}	—	0.01	0.1	mA	$V_{GR} = 5V$
Holding Current	I_H	0.3 0.05	2.0 0.4	5.0 —	mA mA	$V_D = 5V, R_{GK} = 1K, T = 25°C$ $V_D = 5V, R_{GK} = 1K, T = 125°C$

Notes: 1. $I_G = 10mA$; Pulse Test, Duty Cycle < 1%.
2. Pulse test intended to guarantee reverse anode voltage capability for pulse commutation. Device should not be operated in the reverse blocking mode on a continuous basis.

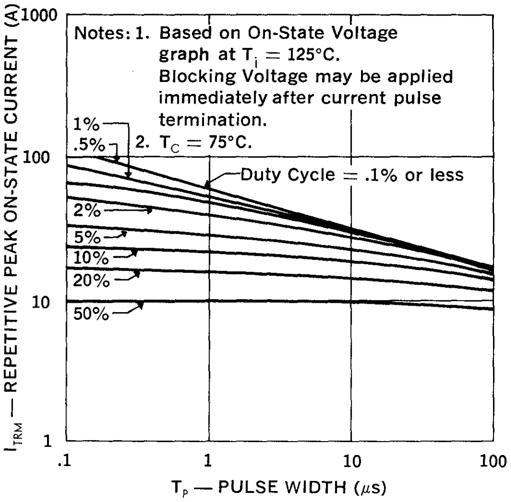
Switching Speed vs. Current
GA/GB300 Series



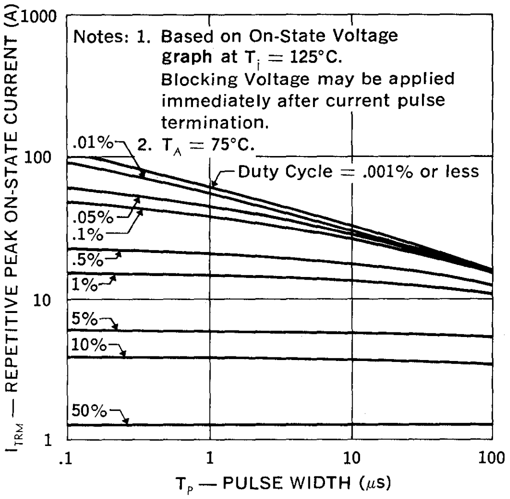
Peak Current vs. Pulse Width
GA300 Series



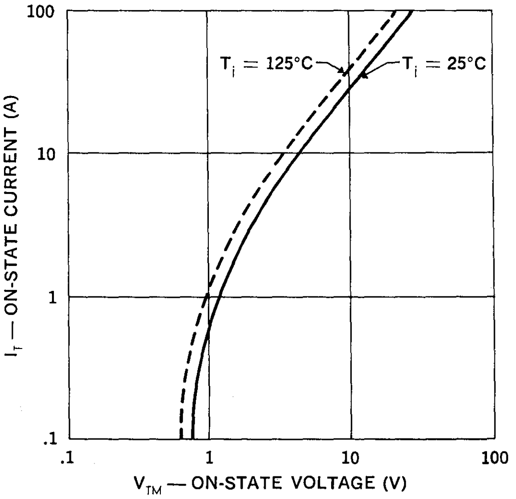
Peak Current vs. Pulse Width
GB300 Series


Notes: 1. Based on On-State Voltage graph at $T_j = 125°C$. Blocking Voltage may be applied immediately after current pulse termination.
2. $T_C = 75°C$.

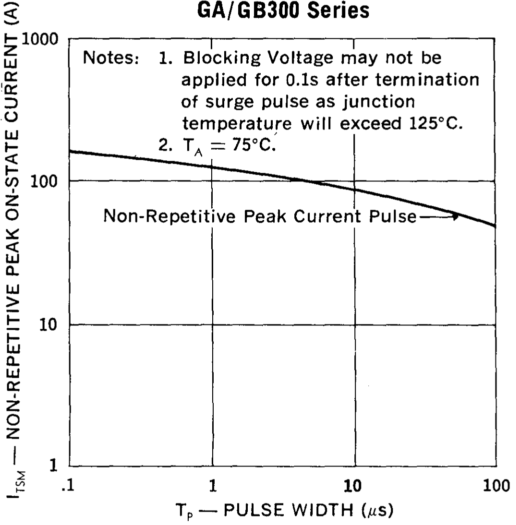
Peak Current vs. Pulse Width
GB300 Series


Notes: 1. Based on On-State Voltage graph at $T_j = 125°C$. Blocking Voltage may be applied immediately after current pulse termination.
2. $T_A = 75°C$.

On-State Voltage vs. Current
GA/GB300 Series



Surge Rating
GA/GB300 Series


Notes: 1. Blocking Voltage may not be applied for 0.1s after termination of surge pulse as junction temperature will exceed 125°C.
2. $T_A = 75°C$.

SCRs

.5 Amp, Planar

ID100-ID106

FEATURES

- Voltage Ratings: to 400V
- Maximum Gate Trigger Current: 200μA
- Hermetically Sealed TO-18 Metal Can
- Planar Passivated Construction

DESCRIPTION

This Data Sheet describes Unitrode's line of hermetically sealed industrial SCRs designed for low-voltage, low-current sensing application. The ID 100 Series is packaged in a TO-18 metal case with Unitrode's unique oxide passivated junctions, offering the highest degree of reliability and parameter stability for any device in its price range.

Typical applications include lamp driving, relay driving, sensor, pulse-generating and timing circuits.

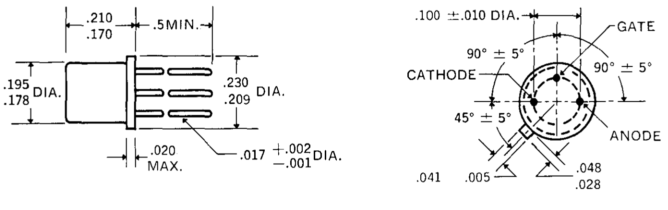
ABSOLUTE MAXIMUM RATINGS

	ID100	ID101	ID102	ID103	ID104	ID105	ID106
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V	300V	400V

On-State Current, I_T	
75°C Ambient	250mA
100°C Case	0.5A
Repetitive Peak On-State Current, I_{TRM}	up to 30A
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	6A
Peak Gate Current, I_{GM}	250mA
Average Gate Current, $I_{G(AV)}$	25mA
Reverse Gate Voltage, V_{GR}	6V
Storage Temperature Range	—65°C to +150°C
Operating Temperature Range	—65°C to +125°C

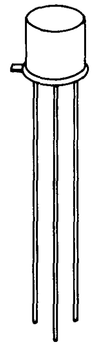
MECHANICAL SPECIFICATIONS

ID100-ID106



Dimensions in inches.

TO-18



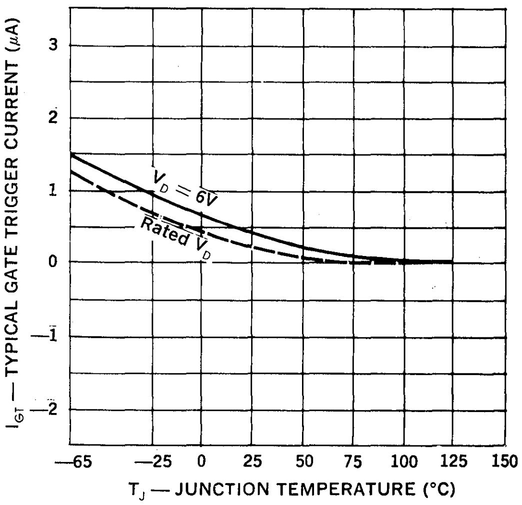
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

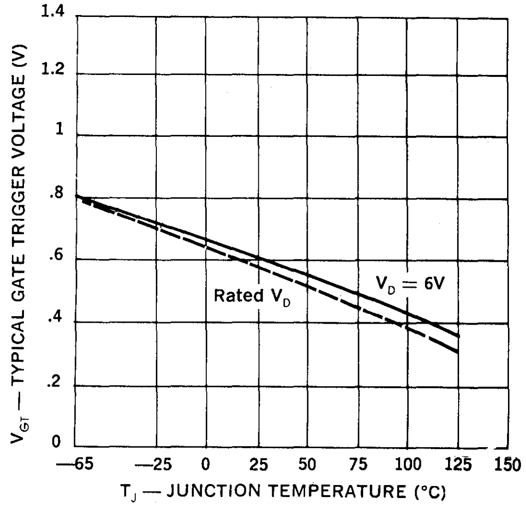
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	— —	5.0 10.0	50 100	µA µA	V_{DRM} = Rating, R_{GK} = 1K, T = 125°C, ID100-ID104 V_{DRM} = Rating, R_{GK} = 1K, T = 125°C, ID105-ID106
Reversing Current	I_{RRM}	— —	10 15	50 100	µA µA	V_{RRM} = Rating, R_{GK} = 1K, T = 125°C, ID100-ID104 V_{RRM} = Rating, R_{GK} = 1K, T = 125°C, ID105-ID106
Gate Trigger Current	I_{GT}	— —	5.0 —	200 500	µA µA	V_D = 5V, R_{GS} = 10K V_D = 5V, R_{GS} = 10K, T = —65°C
Gate Trigger Voltage	V_{GT}	0.4 — 0.10	0.55 — —	0.8 1.0 —	V V V	V_D = 5V, R_{GS} = 100Ω V_D = 5V, R_{GS} = 100Ω, T = —65°C V_D = 5V, R_{GS} = 100Ω, T = 125°C
Peak On-State Voltage	V_{TM}	—	—	1.7	V	I_{TM} = 1 Amp Pulse
Holding Current	I_H	— —	1.0 —	5.0 10.0	mA mA	R_{GK} = 1K R_{GK} = 1K, T = —65°C
Turn-on Time	t_{on}	—	0.5	—	µs	I_G = 10mA, I_T = 1A, V_D = 30V
Circuit Commutated Turn-off Time	t_q	— —	8.0 15.0	— —	µs µs	I_T = I_R = 1A, R_{GK} = 1K, ID100-ID104 I_T = I_R = 1A, R_{GK} = 1K, ID105-ID106

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

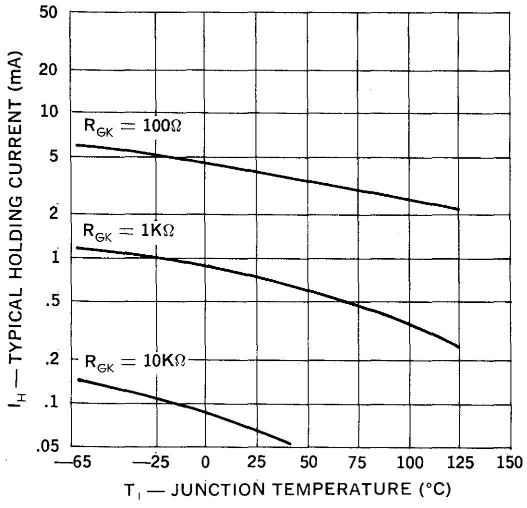
Gate Trigger Current vs. Junction Temp.



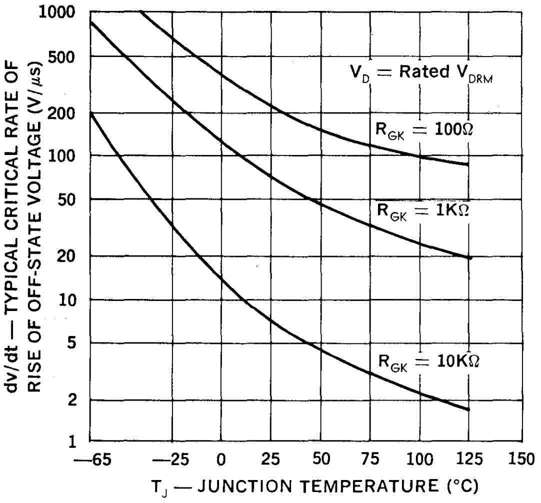
Gate Trigger Voltage vs. Junction Temp.



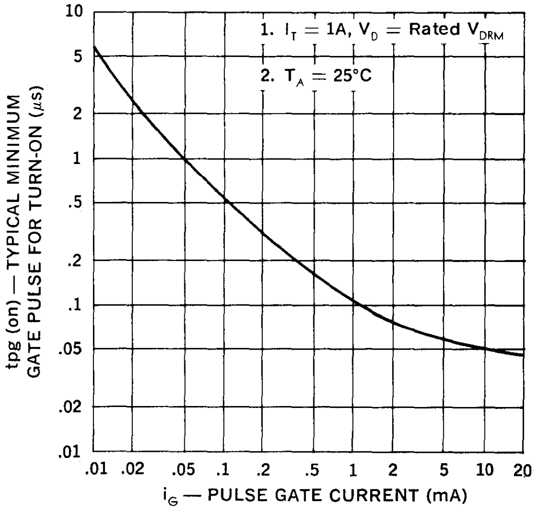
Holding Current vs. Junction Temp.



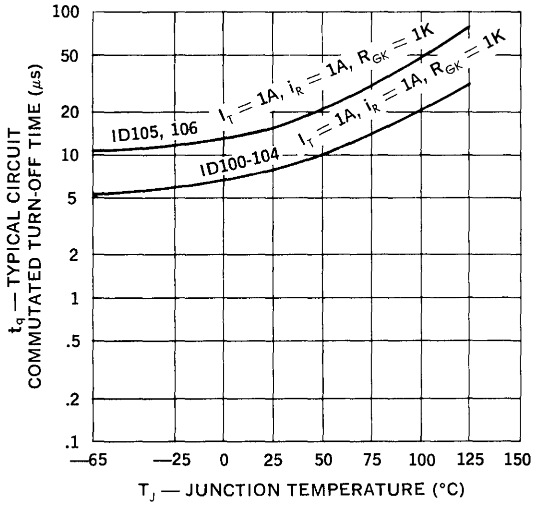
dv/dt vs. Junction Temp.



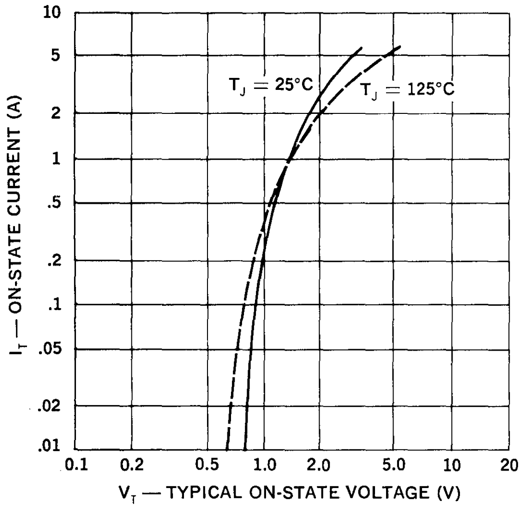
Gate Pulse for Turn-On vs. Pulse Gate Current



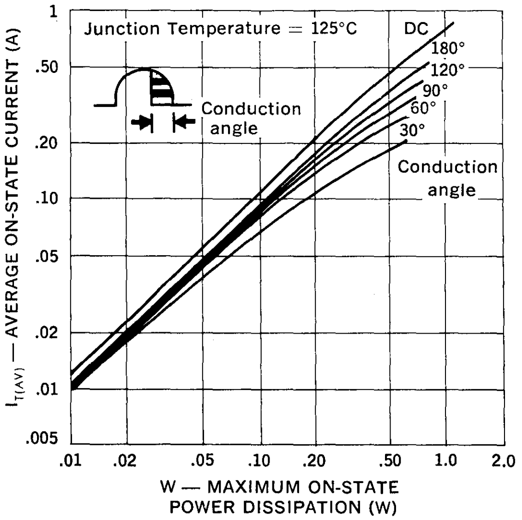
Circuit Commutated Turn-Off Time vs. Junction Temp.



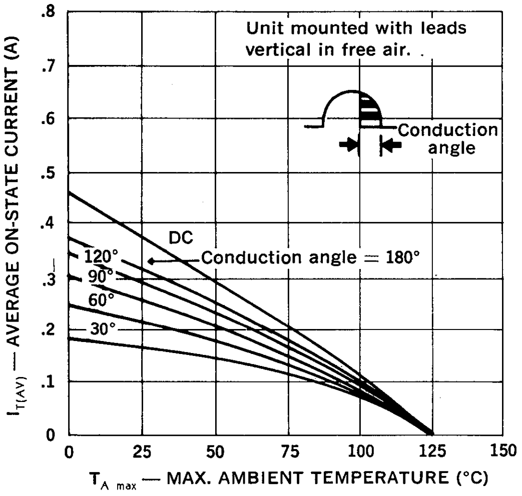
Current vs. On State Voltage



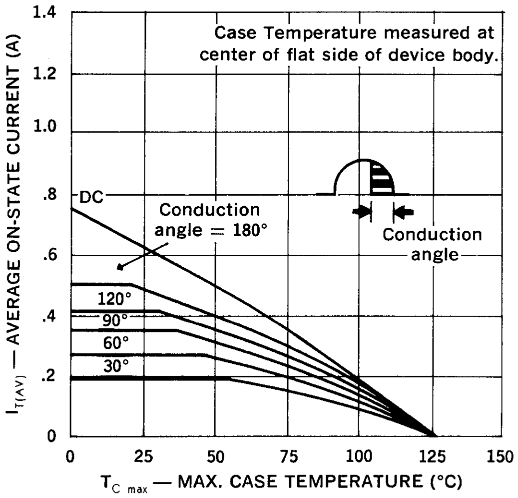
Current vs. Power Dissipation



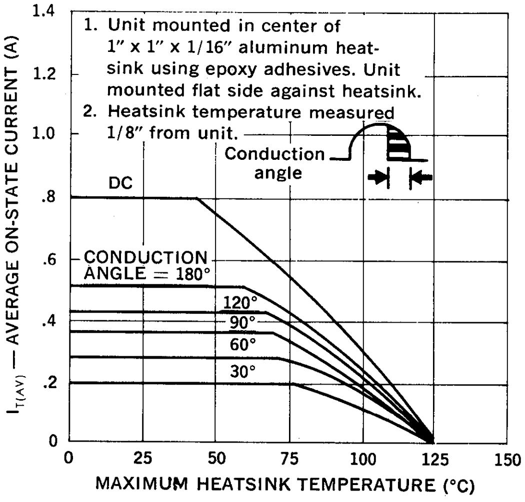
Current vs. Ambient Temp.



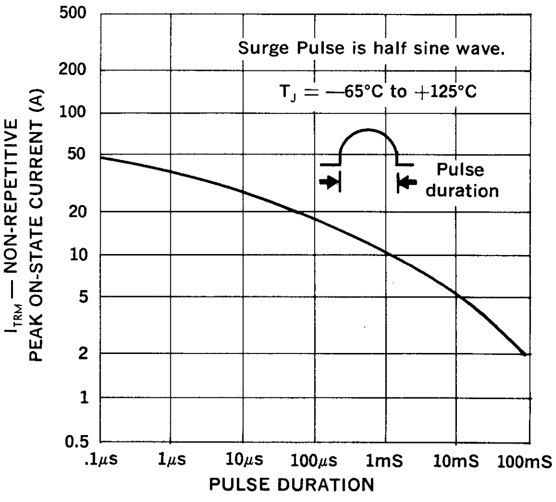
Current vs. Case Temp.



Current vs. Heatsink Temp.



Surge Rating vs. Pulse Duration



SCRs

1.6 Amp, Planar

ID200-ID203
ID300-ID301

FEATURES

- Voltage Rating: to 200V
- Max. Gate Trigger Current: 200μA
- Hermetically Sealed Metal Can
- Planar Passivated Construction

DESCRIPTION

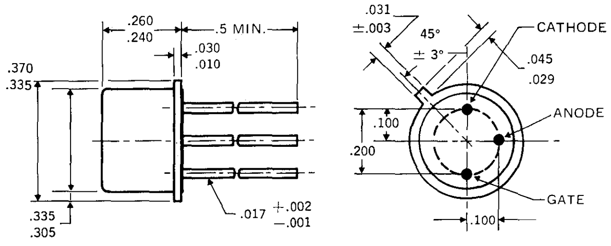
This Data Sheet describes Unitrode's line of hermetically sealed industrial SCRs designed for high-voltage, medium-current control applications. The Series is packaged in a TO-39 metal case with Unitrode's unique oxide passivated junctions to ensure reliability and parameter stability.
Typical applications include relay equipment, motor controls, process controllers and pulse generators.

ABSOLUTE MAXIMUM RATINGS

	ID200	ID201	ID202	ID203	ID300	ID301
Repetitive Peak Off-State Voltage, V_{DRM}	50V	100V	150V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	50V	100V	150V	200V	300V	400V
Non-Repetitive Peak Reverse Voltage, V_{RSM} (<5ms)	75V	150V	225V	300V	400V	500V
On-State Current, $I_{T(RMS)}$						
70°C Case	1.6A					
75°C Ambient	450mA					
Peak One Cycle Surge (Non-Repetitive) On-State Current, I_{TSM}	15A					
Repetitive Peak On-State Current, I_{TRM}	up to 30A					
Rate of Rise of On-State Current, di/dt	100A/μs					
I^2t (for times > 1.5 ms)	0.83A^2s					
Peak Gate Current, I_{GM}	250mA					
Average Gate Current, $I_{G(AV)}$	25mA					
Reverse Gate Voltage, V_{GR}	6V					
Storage Temperature Range	−65°C to +150°C					
Operating Temperature Range	−40°C to +110°C					

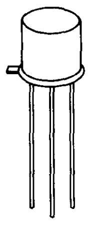
MECHANICAL SPECIFICATIONS

ID200-ID203 ID300-ID301



Dimensions in inches.

TO-39



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	10	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 25°C
		—	5	100	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 110°C
Reverse Current	I_{RRM}	—	—	10	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 25°C
		—	10	100	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 110°C
Gate Trigger Current	I_{GT}	—	—	200	μA	V_D = 5V, R_{GS} = 10K, T = 25°C
		—	—	500	μA	V_D = 5V, R_{GS} = 10K, T = –40°C
On-State Voltage	V_{GT}	0.4	0.52	0.8	V	V_D = 5V, R_{GS} = 100Ω, T = 25°C
		0.5	0.7	1.0	V	V_D = 5V, R_{GS} = 100Ω, T = –40°C
		0.2	—	—	V	V_D = 5V, R_{GS} = 100Ω, T = 110°C
Peak On — Voltage	V_{TM}	—	—	2.2	V	I_T = 4 Amp Pulse, T = 25°C
Holding Current	I_H	0.3	0.7	3.0	mA	R_{GK} = 1K, T = 25°C
		0.4	—	6.0	mA	R_{GK} = 1K, T = –40°C
		0.2	—	—	mA	R_{GK} = 1K, T = 110°C
Off-State Voltage — Critical Rate of Rise	dv/dt	—	20	—	V/μs	V_{DRM} = Rated, R_{GK} = 1K, T = 110°C
Turn-on Time	t_{on}	—	1.0	—	μs	I_G = 10mA, I_T = I_A, V_D = 30V, T = 25°C
Circuit Commutated Turn-off Time	t_q	—	—	40	μs	I_T = i_R = 1A, R_{GK} = 1K, T = 25°C

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

SCRs

.8 Amp RMS, Plastic

IP100-IP106

FEATURES

- Voltage Ratings: to 400V
- Forward Current: 0.8A RMS
- Surge Current: 6A, 8 ms
- Gate Sensitivity: 200 μA max.
- Planar Passivated Process
- TO-92 Plastic Package

DESCRIPTION

This plastic series features very fast switching performance, low forward voltage drop and a high degree of reliability and parameter stability. All units are fully planar passivated and are packaged in a rugged TO-92 case, constructed from a special epoxy compound that features excellent moisture resistance providing stable performance under high humidity conditions and good thermal transfer characteristics.

TYPICAL APPLICATIONS

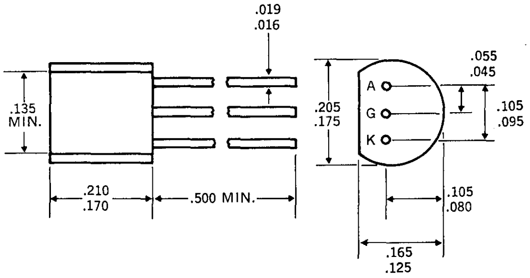
Lamp Driving
Relay Driving
Relay Replacement
Alarm Systems
Counters
Process Controls
Pressure Controls
Display Systems
Touch Switches
Remote Controls
High Current SCR Driving
Timers
Temperature Controls
and many other current sensing and control applications.

ABSOLUTE MAXIMUM RATINGS

	IP100	IP101	IP102	IP103	IP104	IP105	IP106
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V	300V	400V
On-State Current, I_T	0.8A						
Surge (Non-Rep.) On-State Current, I_{TSM}	6A						
Peak Gate Current, I_{GM}	1.0A						
Peak Gate Power, P_{GM}	1W						
Average Gate Power, P_G (Av.)	0.01W						
Reverse Gate Voltage, V_{GR}	6V						
Storage Temperature Range	−65°C to +150°C						
Operating Temperature Range	−65°C to +125°C						

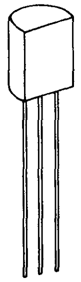
MECHANICAL SPECIFICATIONS

IP100-IP106



Dimensions in inches.

TO-92

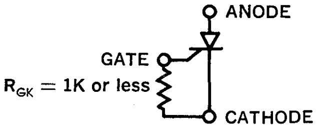


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

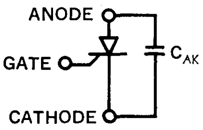
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	0.1	1.0	μA	V_{DRM} = Rating, R_{GK} = 1K
		—	—	50	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 125°C, IP100-IP104
		—	—	100	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 125°C, IP105, IP106
Reverse Current	I_{RRM}	—	0.1	1.0	μA	V_{RRM} = Rating, R_{GK} = 1K
		—	—	50	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 125°C, IP100-IP104
		—	—	100	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 125°C, IP105, IP106
Gate Trigger Current	I_{GT}	—	0.4	200	μA	V_D = 6V, R_{GS} = 10K,
		—	—	500	μA	V_D = 6V, R_{GS} = 10K, T = –65°C
Gate Trigger Voltage	V_{GT}	—	0.6	0.8	V	V_D = 6V, R_{GS} = 100Ω
		—	—	1.0	V	V_D = 6V, R_{GS} = 100Ω, T = –65°C
		0.1	—	—	V	V_D = 6V, R_{GS} = 100Ω, T = 125°C
Peak On-State Voltage	V_{TM}	—	1.2	1.5	V	I_{TM} = 1 Amp Pulse
Holding Current	I_{HX}	—	0.7	5.0	mA	R_{GK} = 1K, T = 25°C
		—	—	10.0	mA	R_{GK} = 1K, T = –65°C
Critical Rate of Rise — Off-State Voltage	dv/dt	—	75	—	V/μs	V_D = Rating, R_{GK} = 1K,
Turn-on Time	t_{on}	—	0.1	—	μs	I_G = 10mA, $I_{T'}$ = 1A, V_D = 30V, IP100-IP104
		—	0.5	—	μs	I_G = 10mA, $I_{T'}$ = 1A, V_D = 30V, IP105, IP106
Circuit Commutated Turn-off Time	t_q	—	8.0	—	μs	I_T = I_R = 1A, R_{GK} = 1K, IP100-IP104
		—	15.0	—	μs	I_T = I_R = 1A, R_{GK} = 1K, IP105, IP106

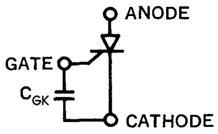
DESIGN CONSIDERATIONS

1. The IP100 Series SCRs are guaranteed to block their rated voltage over their rated operating temperature when a resistance of 1000 ohms or less is connected from gate to cathode as shown.

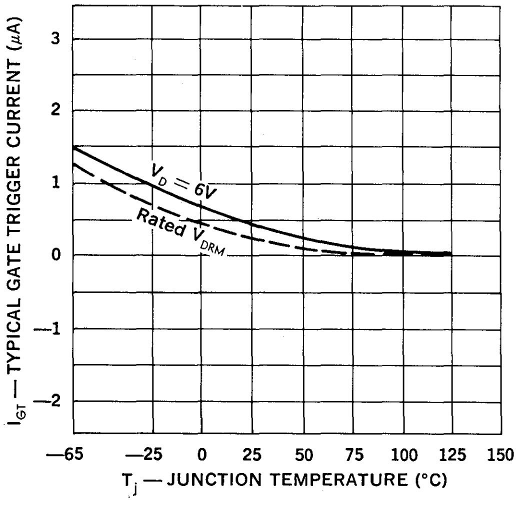


2. In cases where the SCR may be subjected to fast rising anode voltages a capacitor can be connected between anode or gate and cathode as shown, to serve as protection against dv/dt firing.

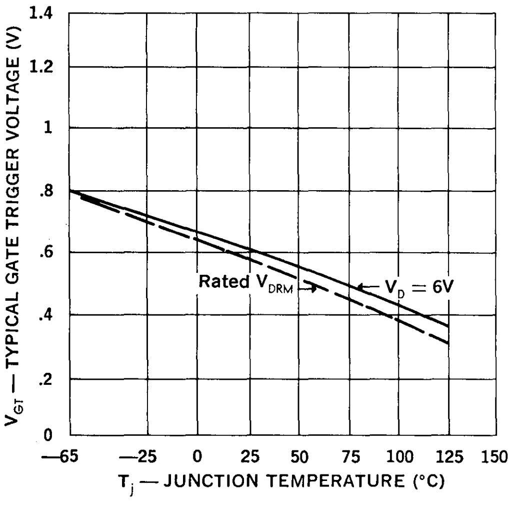




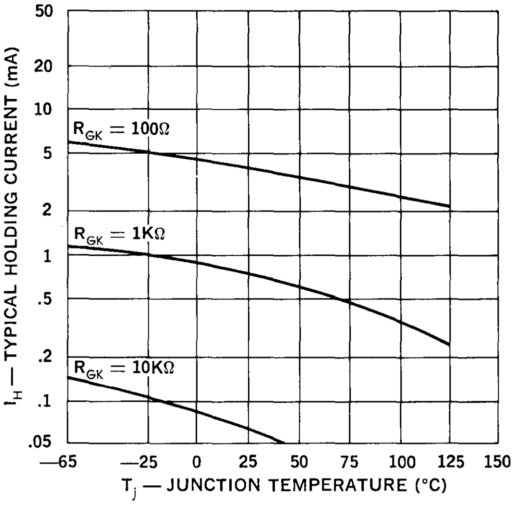
Gate Trigger Current vs. Junction Temp.



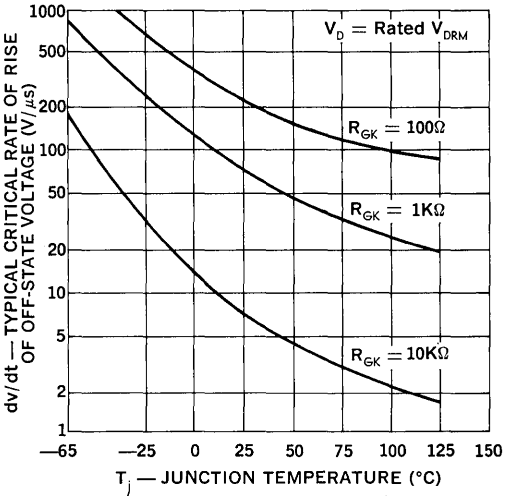
Gate Trigger Voltage vs. Junction Temp.



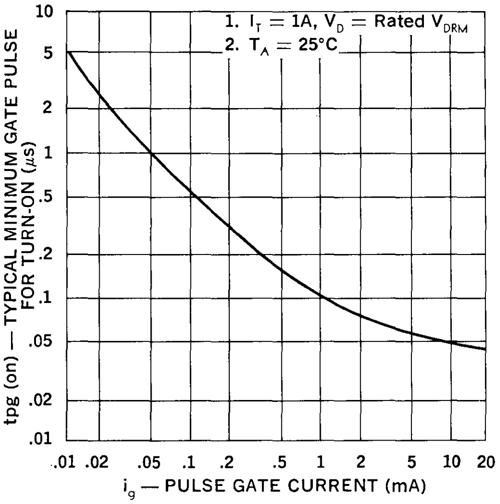
Holding Current vs. Junction Temp.



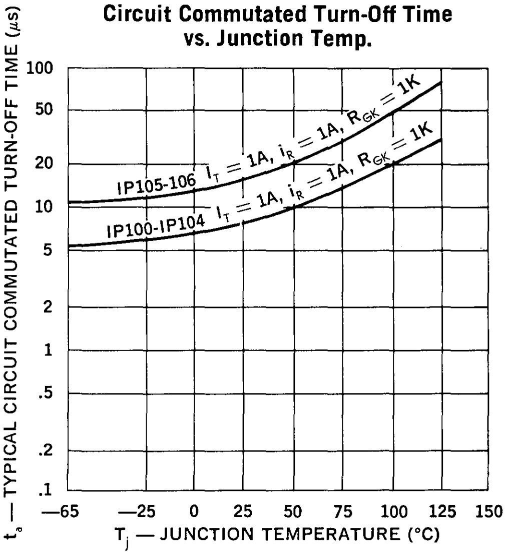
dv/dt vs. Junction Temp.



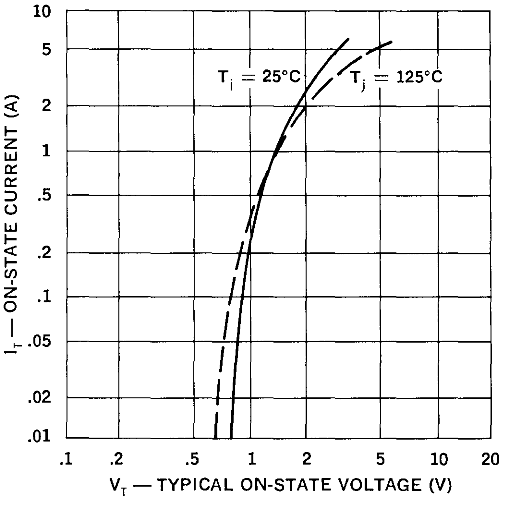
Gate Pulse For Turn-On vs. Pulse Gate Current



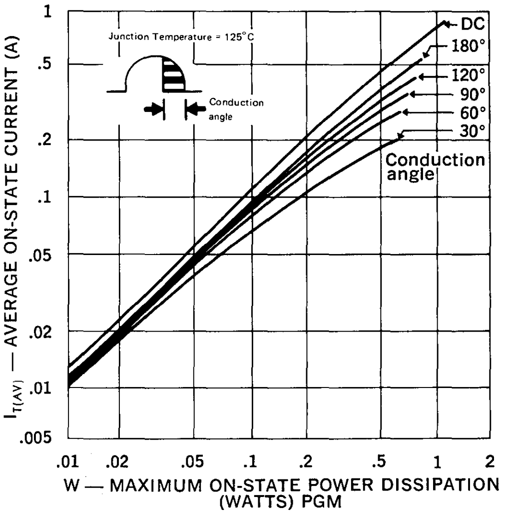
Circuit Commutated Turn-Off Time vs. Junction Temp.



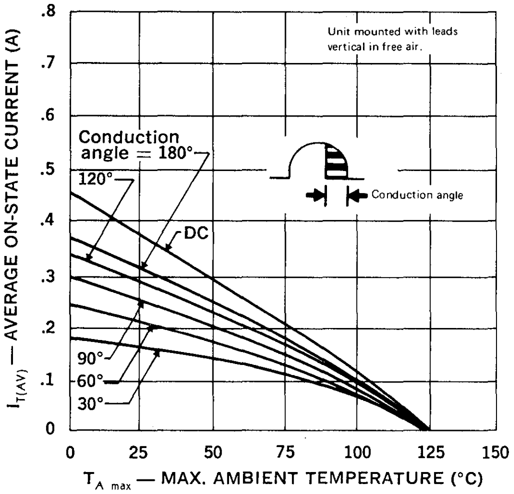
Current vs. On-State Voltage



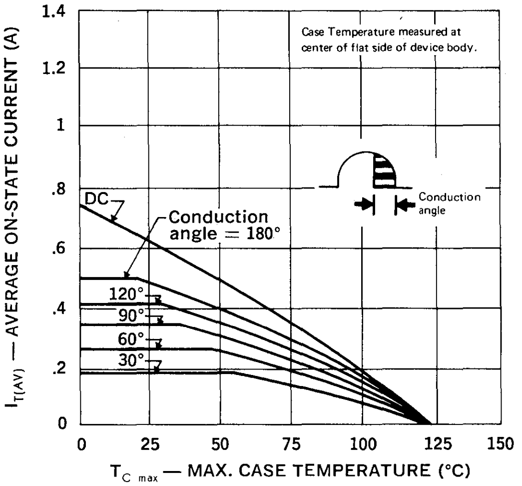
Current vs. Power Dissipation



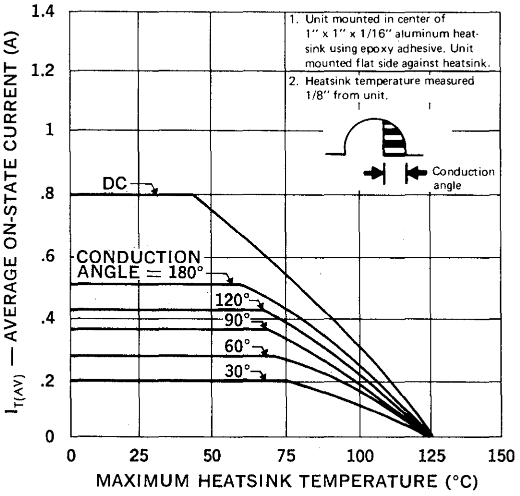
Current vs. Ambient Temp.



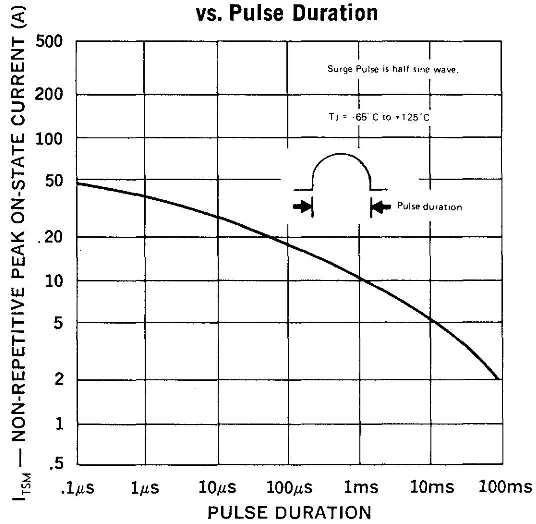
Current vs. Case Temp.



Current vs. Heatsink Temp.



Surge Rating vs. Pulse Duration



PUTs

Planar, TO-92, Plastic

P13T1-P13T2

FEATURES

- TO-92 Plastic Package
- Maximum Peak Current: 0.15 μA
- Minimum Valley Current: 70 μA
- Peak Forward Current: 5A
- Programmable Eta, R_{BB}, I_p and I_V
- Passivated Planar Construction for Maximum Reliability and Parameter Uniformity

DESCRIPTION

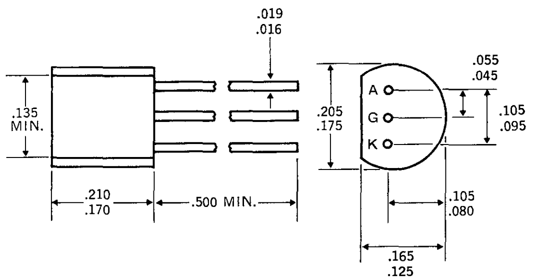
Functionally equivalent to standard unijunction transistors, Unitrode's Programmable Unijunction Transistors offer the distinct advantage of versatile programming. External resistors can be added to meet the designer's needs in programming Eta, R_{BB}, I_P and I_V functions. Applications include pulse and timing circuits, SCR trigger circuits, relaxation oscillators and sensing circuits. For additional information see Unitrode Application Note U-66.

ABSOLUTE MAXIMUM RATINGS

Anode-to-Cathode Voltage, V_{AK}	±40V
Gate-to-Cathode Forward Voltage, V_{GK}	40V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V
Gate-to-Cathode Reverse Voltage, V_{GKR}	—5V
Peak Recurrent Forward Current	
10μs, 1% Duty Cycle	5A
100μs, 1% Duty Cycle	1A
Power Dissipation	
25°C Ambient	375mW
Derating Factor	5mW/°C
Storage Temperature	—55°C to +150°C
Operating Temperature Range	—55°C to +100°C

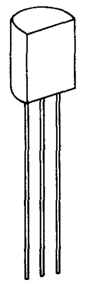
MECHANICAL SPECIFICATIONS

P13T1-P13T2



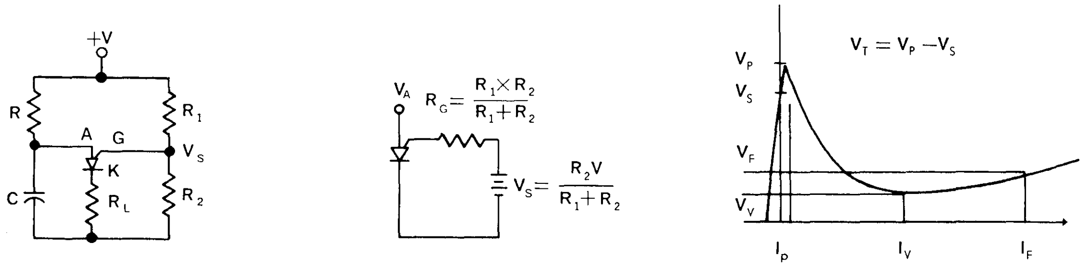
Dimensions in inches.

TO-92



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Fig.	P13T1		P13T2		Units	Test Conditions
			Min.	Max.	Min.	Max.		
Peak Current	I_P	1	— —	5 2	— —	1.0 0.15	μA μA	$R_G = 10k$, $V_s = 10V$ $R_G = 1\ M\Omega$
Valley Current	I_V	1	70 —	— 50	25 —	— 25	μA μA	$R_G = 10k$, $V_s = 10V$ $R_G = 1\ M\Omega$
Offset Voltage	V_T	1	0.2 0.2	0.6 1.6	0.2 0.2	0.6 0.6	V V	$R_G = 10k$, $V_s = 10V$ $R_G = 1\ M\Omega$
Gate-to-Anode Leakage	I_{GAO}	2	— —	10 100	— —	10 100	nA nA	$T = 25°C$, $V_s = 40V$ $T = 75°C$
Gate-to-Cathode Leakage	I_{GKS}	3	—	100	—	100	nA	$V_s = 40V$
Forward Voltage	V_F	4	—	1.0	—	1.0	V	$I_F = 50mA$
Pulse Output Voltage	V_o	5	9	—	9	—	V	
Pulse Output Rise Time	t_r	5	—	80	—	80	ns	



a) Typical Circuit

b) Equivalent Test Circuit

c) Characteristic Curve

Figure 1

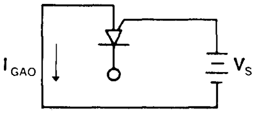


Figure 2

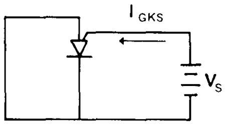


Figure 3

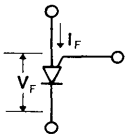


Figure 4

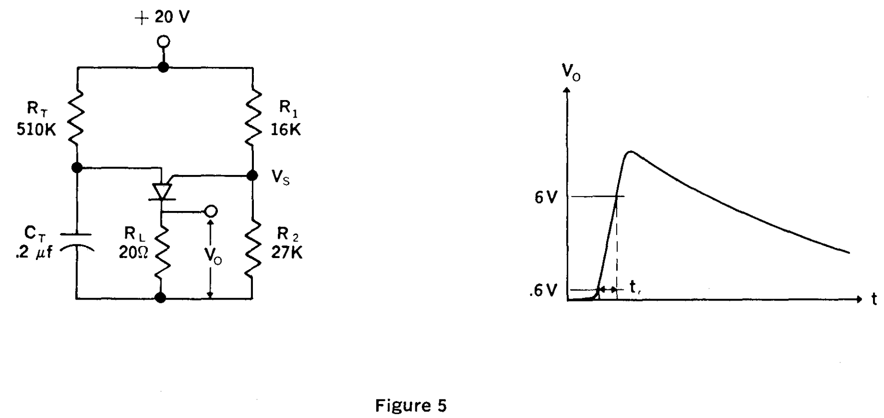
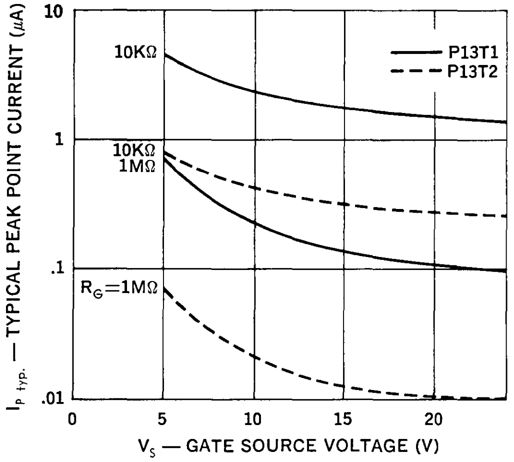
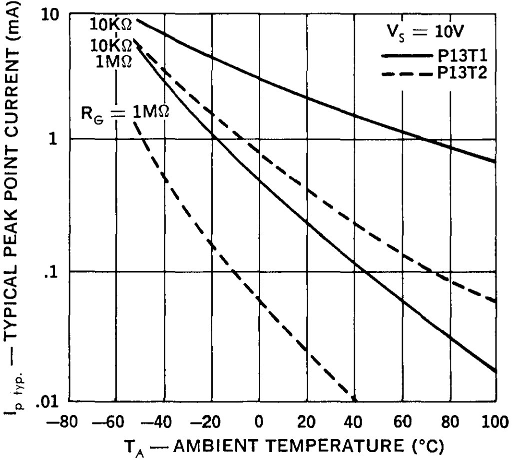


Figure 5

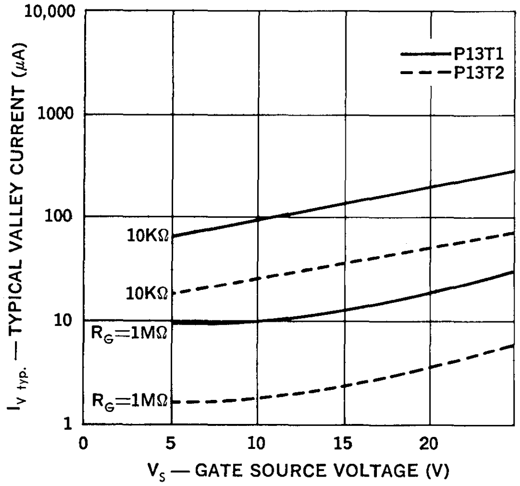
Typical Peak Point Current vs. Gate Source Voltage



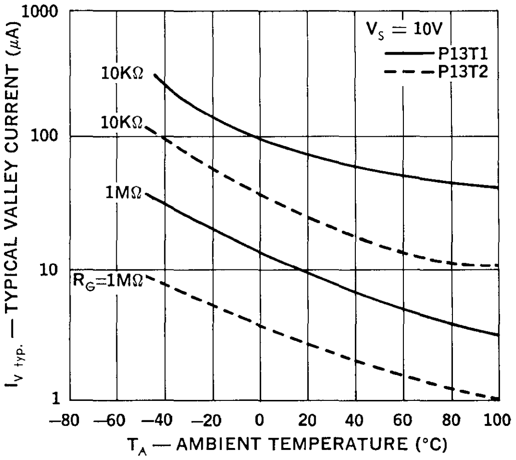
Typical Peak Point Current vs. Ambient Temperature

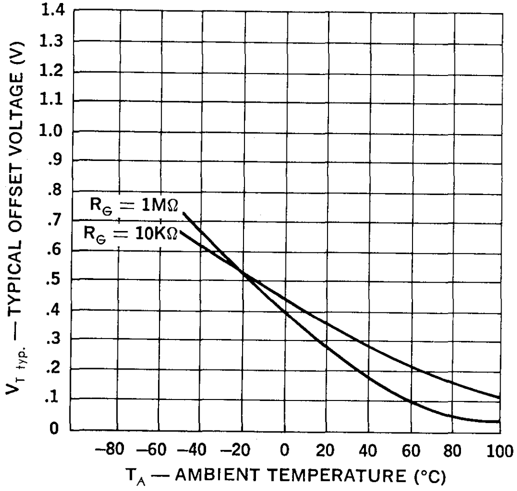


Typical Valley Current vs. Gate Source Voltage

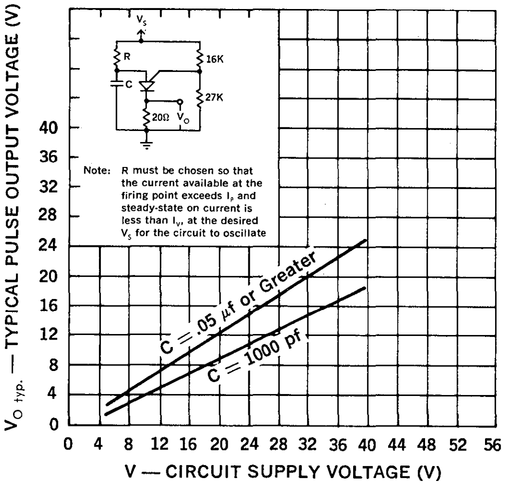


Typical Valley Current vs. Ambient Temperature

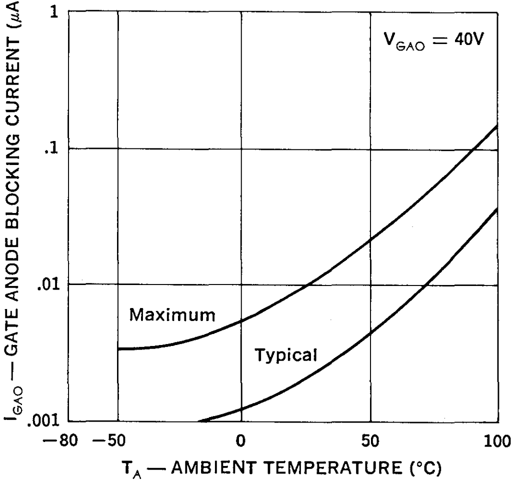




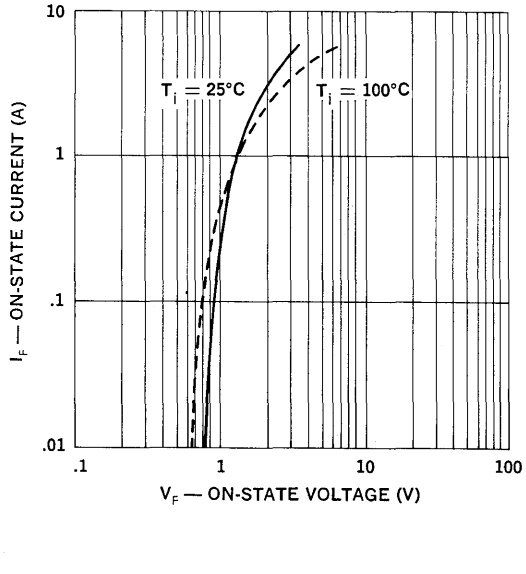
Typical Offset Voltage vs. Ambient Temperature



Typical Pulse Output vs. Circuit Supply Voltage



Gate-Anode Blocking Current vs. Ambient Temperature



Typical On-State Current vs. Voltage

PHOTO-SCRs

Planar, Light Activated Switches

PF30-PF400
PF30A-PF400A
PR30-PR400
PR30A-PR400A

FEATURES

- Highest Light Sensitivity: 10 FC max.
- Narrow Range of LTI: 2.5:1 in "A" Series
- High Noise Immunity: dv/dt of 50V/μs
- Inherent Binary Memory
- Trigger Level Set by Bias
- Flat Lens Permits Aperture Masking (PF Series)
- Available to 400V

DESCRIPTION

The PF 30 Series has a flat lens for wide-angle response. The PR 30 Series has a round lens for increased sensitivity.

The Photo SCR is an extremely efficient light-activated bi-stable switch. A single Photo SCR can often perform the dual role of light sensing and load actuating. With inherent binary memory the Photo SCR latches "on" with a light or electrical pulse and latches "off" when load current is momentarily interrupted. Light triggering level is set electrically with gate bias.

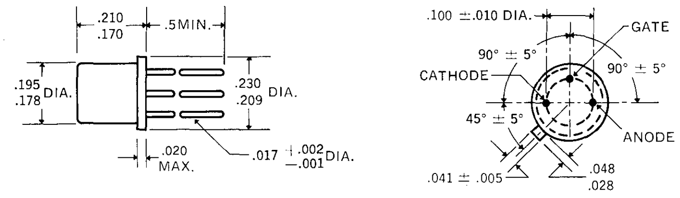
These Photo SCRs are ideal for use in punched tape and card readers, meter position sensing, intrusion alarms, flame detectors, optical tachometers and shaft encoders, level controls, slave flashes, watt-hour meters, isolation switches, and a wide variety of other light sensing applications.

ABSOLUTE MAXIMUM RATINGS

	PF30 **PF30A** **PR30** **PR30A**	**PF60** **PF60A** **PR60** **PR60A**	**PF100** **PF100A** **PR100** **PR100A**	**PF200** **PF200A** **PR200** **PR200A**	**PF300** **PF300A** **PR300** **PR300A**	**PF400** **PF400A** **PR400** **PR400A**
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	200V	300V	400V
DC On-State Current, I_T						
50°C Case	300mA					
50°C Ambient	150mA					
Peak One-Cycle Surge (Non-Repetitive) On-State Current, I_{TSM}	5A					
Peak Gate Current, I_{GM}	250mA					
Average Gate Current, $I_{G(AV)}$	25mA					
Reverse Gate Voltage, V_{GR}	5V					
Operating and Storage Temperature Range	—65°C to +125°C					

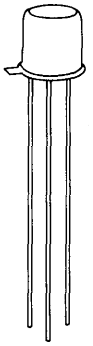
MECHANICAL SPECIFICATIONS

PF SERIES

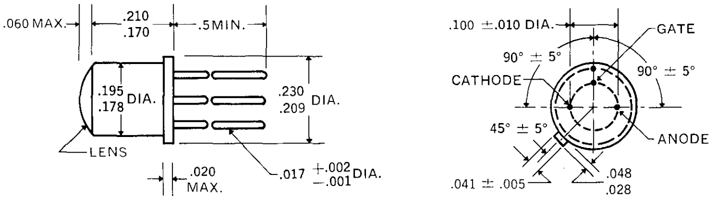


Dimensions in inches.

TO-18
(FLAT LENS)

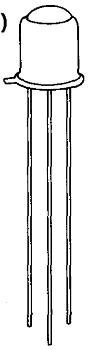


PR SERIES



Dimensions in inches.

TO-18
(ROUND LENS)



ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	0.1	0.5	μA	V_{DRM} = Rating, $R_{GK} = 4.7K$
Reverse Current	I_{RRM}	—	0.1	0.5	μA	V_{RRM} = Rating, $R_{GK} = 4.7K$
Reverse Gate Current	I_{GR}	—	0.1	1.0	μA	$V_{GR} = 2V$
On-State Voltage	V_{TM}	—	1.0	1.5	V	$I_T = 300mA$ (Pulsed)
Holding Current	I_H	50	500	1000	μA	$R_{GK} = 4.7K$
Light Trigger Intensity PF Series						
		20	30	50	ft. candles	$V_D = +10V, R_{GK} = 27K$
"A" Types	λ_T	0.27	0.40	0.67	mW/cm^2	
		125	200	300	ft. candles	$V_D = +10V, R_{GK} = 4.7K$
		1.7	2.7	4.0	mW/cm^2	
		10	20	50	ft. candles	$V_D = +10V, R_{GK} = 27K$
Non "A" Types	λ_T	0.13	0.27	0.67	mW/cm^2	
		50	150	300	ft. candles	$V_D = +10V, R_{GK} = 4.7K$
		0.67	2.0	4.0	mW/cm^2	
Light Trigger Intensity PR Series						
		4	6	10	ft. candles	$V_D = +10V, R_{GK} = 27K$
"A" Types	λ_T	0.053	0.080	0.13	mW/cm^2	
		60	90	150	ft. candles	$V_D = +10V, R_{GK} = 1.8K$
		0.80	1.2	2.0	mW/cm^2	
		2	4	10	ft. candles	$V_D = +10V, R_{GK} = 27K$
Non "A" Types	λ_T	0.027	0.053	0.13	mW/cm^2	
		30	70	150	ft. candles	$V_D = +10V, R_{GK} = 1.8K$
		0.40	0.93	2.0	mW/cm^2	
Anode Voltage — Critical Rate of Rise	dv/dt	—	50	—	V/μs	$V_D = 30V, R_{GK} = 1.8K$
		—	20	—	V/μs	$V_D = 30V, R_{GK} = 4.7K$
125°C Forward Blocking Current	I_{DRM}	—	2	25	μA	V_{DRM} = Rating, $R_{GK} = 4.7K$
125°C Reverse Blocking Current	I_{RRM}	—	2	25	μA	V_{RRM} = Rating, $R_{GK} = 4.7K$

Notes:

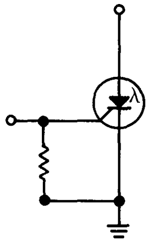
1. Voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through an appropriate size resistor, or other adequate bias is used. See below for specific biasing techniques.
2. Color temperature of unfiltered incandescent light source is 2870°K.
3. 1 mw / cm^2 ≈ 75 foot candles at stated color temperature.

GATE BIAS CONSIDERATIONS

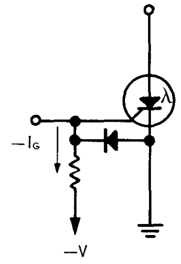
The Photo SCR is a very high gain device and should not be operated or tested with the gate open or floating. For operation up to 100°C junction temperature, a 27K resistor between gate and cathode, (See Figure 1), will provide adequate bias. For 125°C operation a 4.7K will suffice. Sensitivity can be reduced by decreasing this resistance.

Sensitivity can be maximized, and made more uniform, over a wider range of ambient temperature by means of negative gate biasing as shown in Figure 2. Reducing gate bias current will increase light sensitivity, while increased gate bias can be employed to inhibit light triggering.

For electrical triggering, the gate trigger current (I_{GT}) is dependent on the bias used and the light incident on the photo SCR. With resistor bias, and no light, $I_{GT} = \frac{V_{GT}}{R_{GK}}$. When negative gate current ($-I_G$) bias is used with no light, the trigger current must first overcome I_G and an additional current of approximately 2μA will cause triggering.



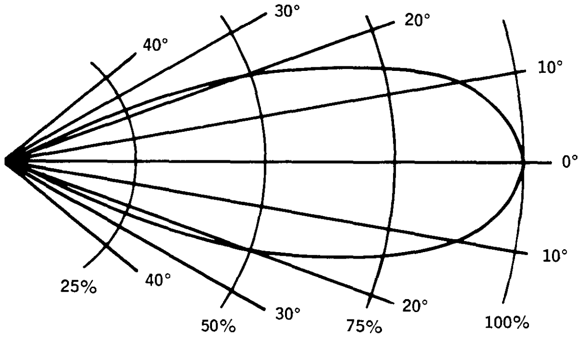
Resistor Bias
Figure 1



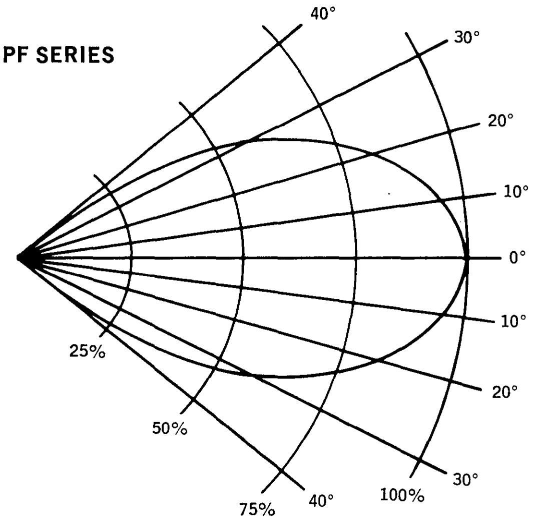
Negative Gate Bias
Figure 2

ANGULAR RESPONSE

PR SERIES

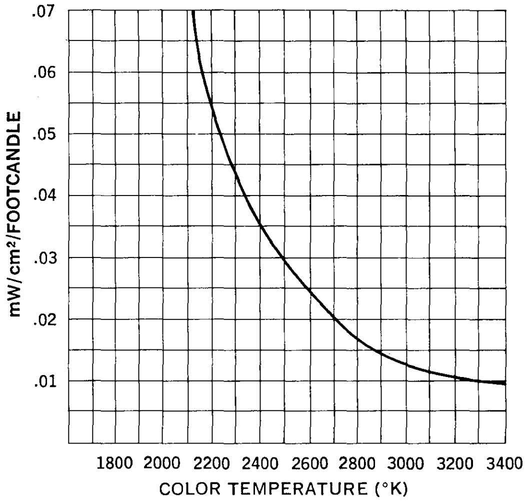


PF SERIES

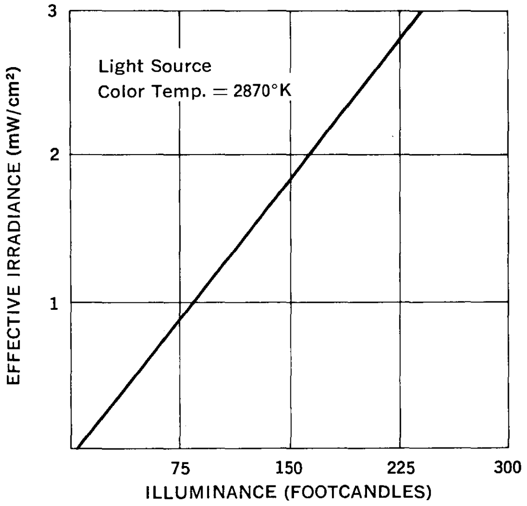


LIGHT SOURCE CHARACTERISTICS

1. Effective Irradiance/Footcandles for a Tungston Lamp vs. Color Temperature

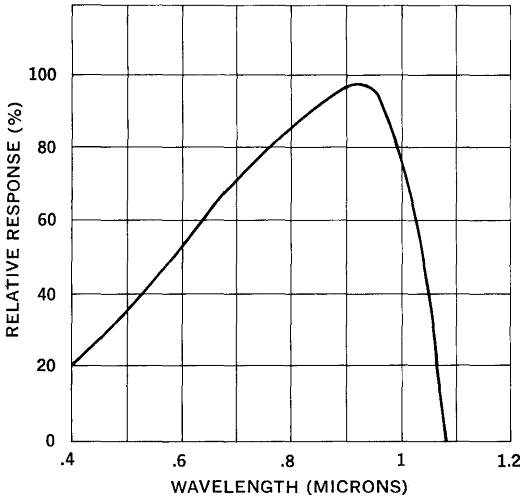


2. Effective Irradiance vs. Illuminance

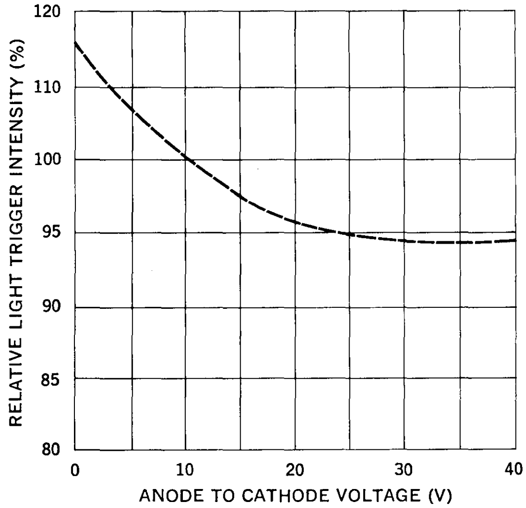


TYPICAL CHARACTERISTICS (Note 2)

1. Spectral Response

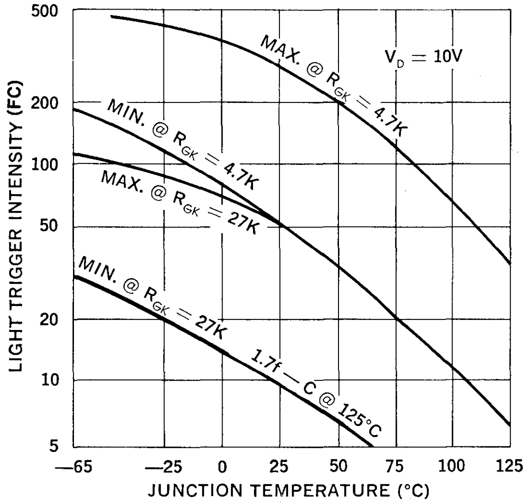


2. Relative Light Trigger Intensity vs. Anode Voltage

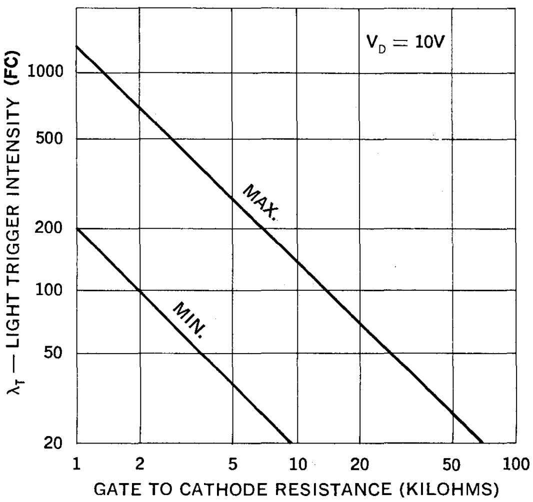


TYPICAL CHARACTERISTICS

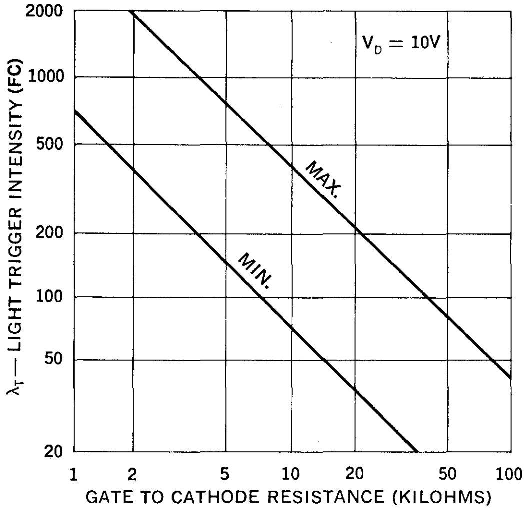
3. **Light Trigger Intensity PF Series**



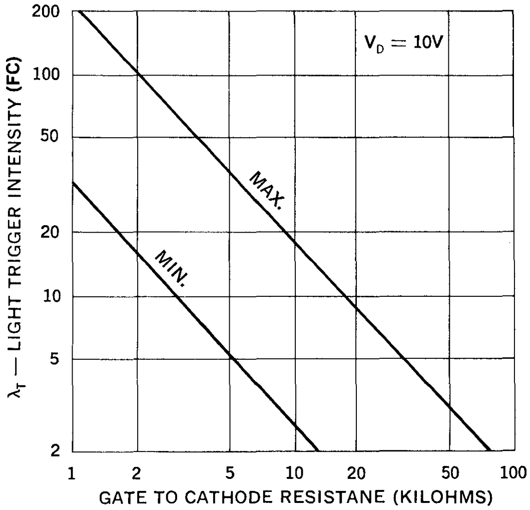
4. **Light Trigger Intensity PF Series 25°C**



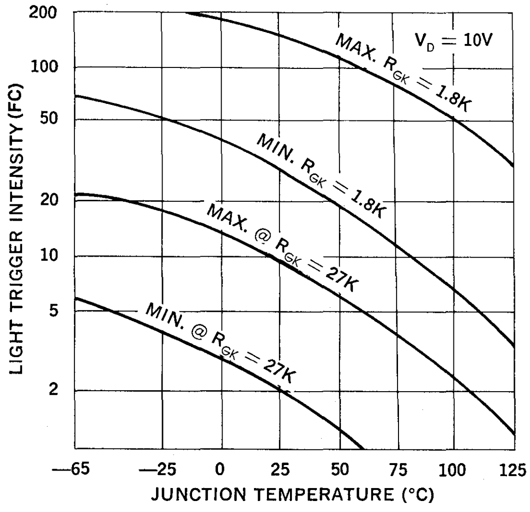
5. **Light Trigger Intensity PF —55°C Series**



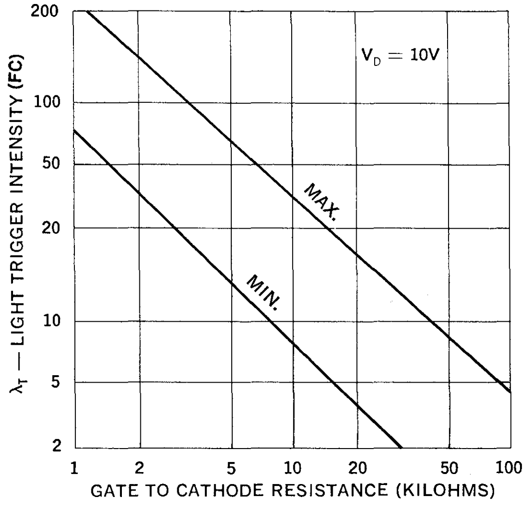
6. **Light Trigger Intensity PF Series 125°C**



7. **Light Trigger Intensity PR Series**

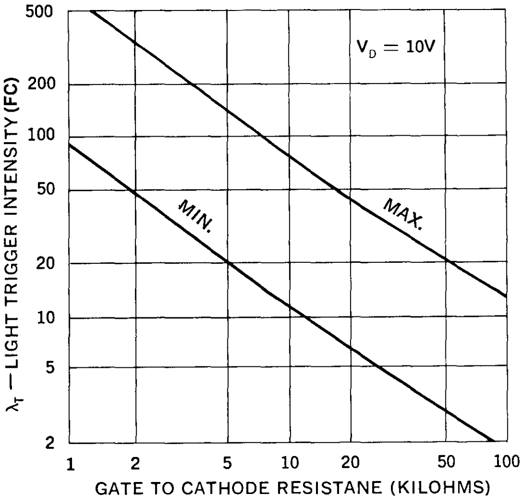


8. **Light Trigger Intensity PR Series 25°C**

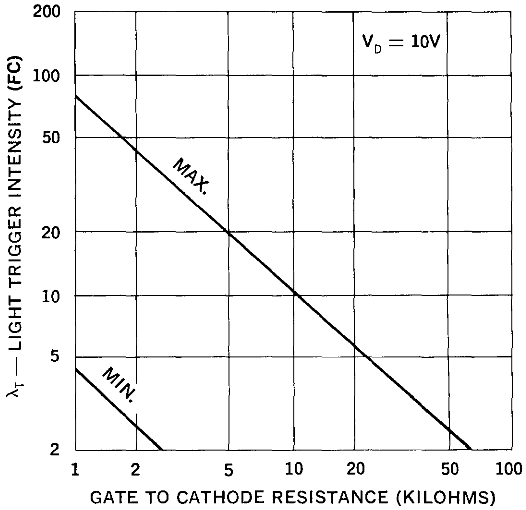


TYPICAL CHARACTERISTICS

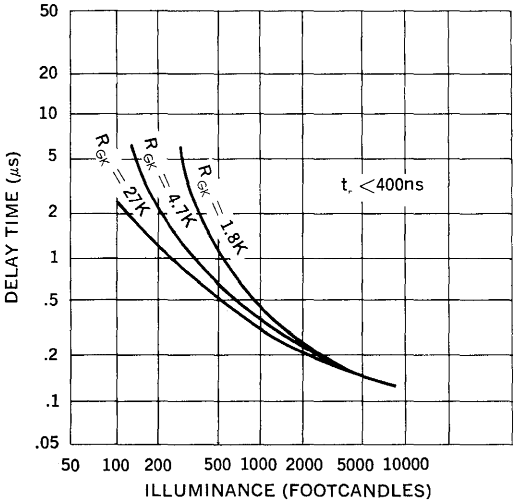
9. Light Trigger Intensity PR Series 55°C



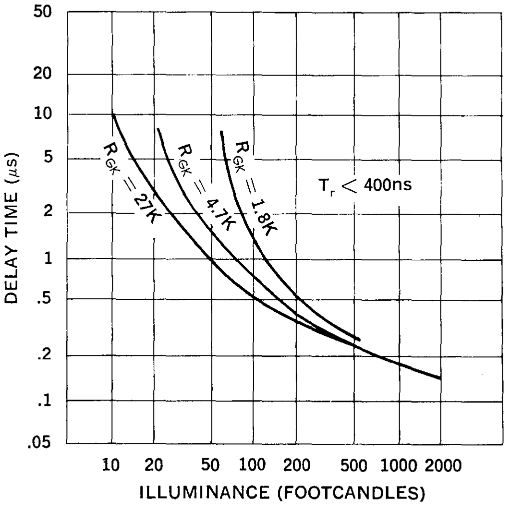
10. Light Trigger Intensity PR Series 125°C



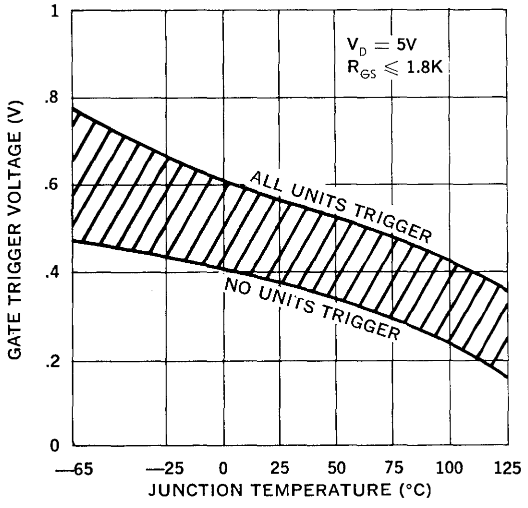
11. Delay Time vs. Illuminance PF Series



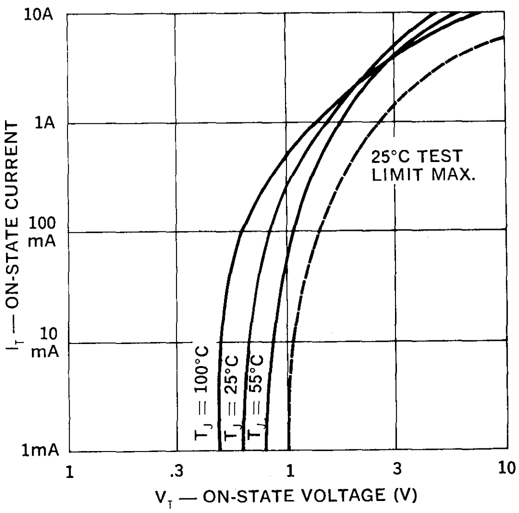
12. Delay Time vs. Illuminance PR Series



13. Gate Trigger Voltage

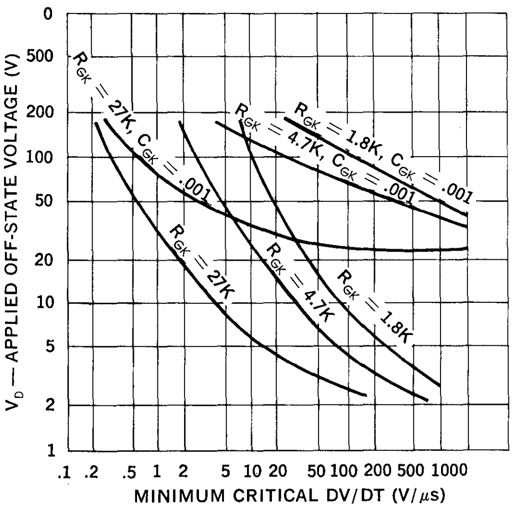


14. On-State Characteristics

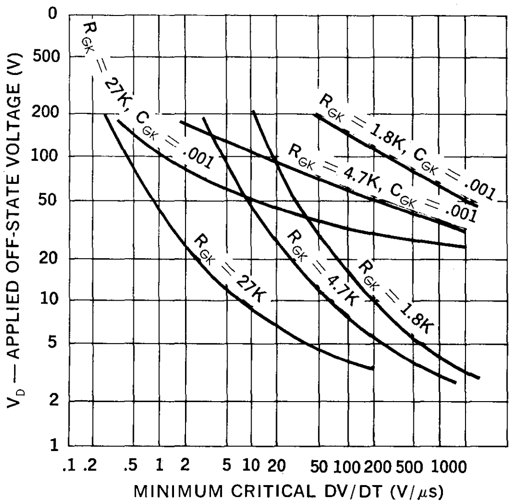


TYPICAL CHARACTERISTICS

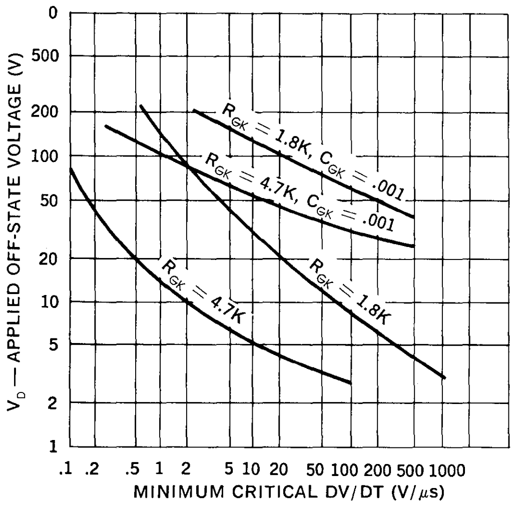
15. dv/dt at 25°C



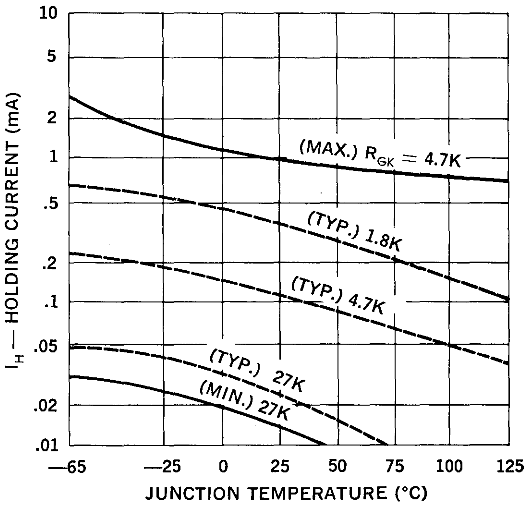
16. dv/dt at −55°C



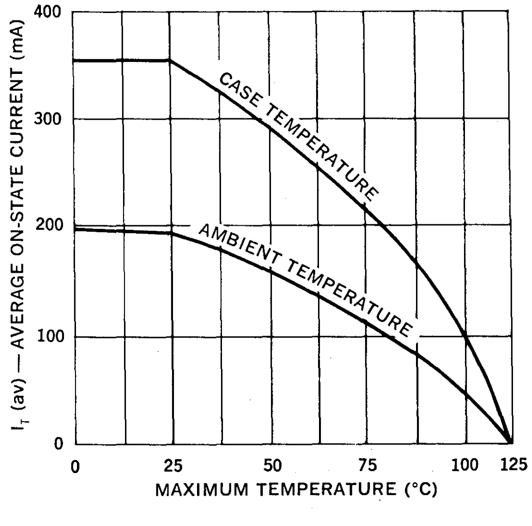
17. dv/dt at +125°C



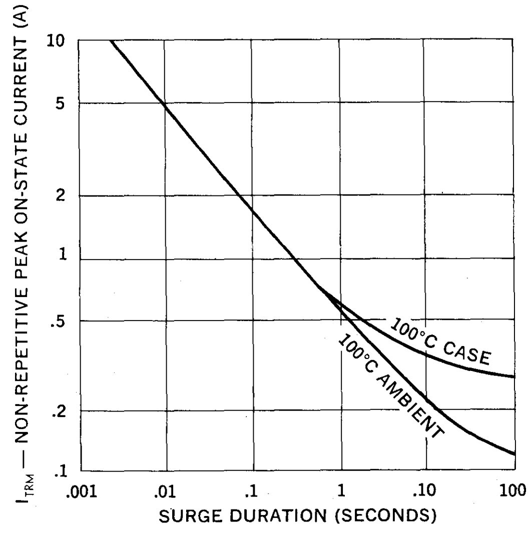
18. Holding Current
(Resistor Bias)



19. Continuous Current
Ratings



20. Surge Current Ratings



POWER INTEGRATED CIRCUITS

Solid State AC Switches

PIC100
PIC101
PIC102
PIC103

FEATURES

- High Operating Frequency: 0 to 20 kHz
- Excellent Sensitivity: 2mA, max. gate trigger current
- Operates at Very Low Load Current Level: 1.5mA minimum
- Operates in Both Direct and Proportional Mode
- Can Operate Continuously up to 400 Volts, 0.8 Amps, or be Pulsed at 400 Volts, 30A
- No External Biasing Required
- Designed for Operation Over the Entire Military Temperature Range: —65°C to +150°C
- Also available in TO-59 (Stud) power package rated at 4A (PIC120-PIC123)

DESCRIPTION

This data sheet describes the Solid State AC Switch, which is designed to control the switching of high frequency alternating current.

The Solid State AC Switch has two load control modes; direct control and proportional control. In the direct control mode, the application of a positive signal to the gate terminal will turn the AC Switch ON and apply alternating current to the load for as long as the turn-on signal is applied. Removing this signal will turn the AC Switch OFF at the instant the AC load passes through zero. In the proportional mode, the application of a one-microsecond pulse to the gate terminal will cause the AC Switch to pass alternating current having a conduction angle which is directly proportional to the delay angle of the triggering pulse. By varying the delay angle, proportional control of a load can be achieved.

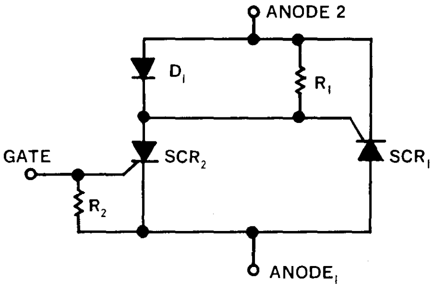
In both modes, the switch can be turned on with as little as 2.0 milliamps. Further, for this device, latching current and holding current are exactly equal, namely 1.5 milliamps. This low latching and holding current is in sharp contrast to other AC switching devices, such as the Triac, where latching current can be several orders of magnitude greater than holding current.

Unitrode's Solid State AC Switch will switch any frequency from DC to 20 kHz in either the direct or proportional mode. The unit is also designed for military environments and is operational over the temperature range of —65°C to +155°C.

This versatile circuit has wide application as a relay replacement, and as a controlling switch for servo mechanisms, guidance and control drives, process control equipment, static and proportional controls and timers.

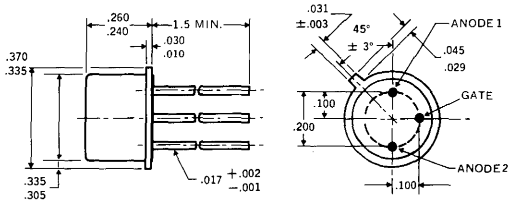
The hybrid IC technology developed by Unitrode combines discrete SCR and power transistor chips with precise thick film passive components. All SCR and power transistor chips are produced using Unitrode's advanced hard glass passivated planar process. And, the ultimate in hybrid circuit reliability is achieved by packaging the circuits in hermetically sealed TO-5 cans.

SIMPLIFIED SCHEMATIC



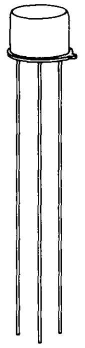
MECHANICAL SPECIFICATIONS

PIC100 PIC101 PIC102 PIC103



Dimensions in inches.

TO-5



UNITRODE

ABSOLUTE MAXIMUM RATINGS

	PIC100 PIC101	PIC102 PIC103
V_{DRM}	200V	400V
RMS Forward Current, T = 100°C Case	800mA	
Peak Recurrent Forward Current	Up to 30A	
Surge Current, ½ Sine wave, 8ms, Peak	15A	
Peak Gate Current	250mA	
Average Gate Current	25mA	
Reverse Gate Current	3mA	
Reverse Gate Voltage	6V	
Storage Temperature Range	—65°C to +200°C	
Operating Temperature Range	—65°C to +150°C	

Note: Blocking voltage ratings apply over the full operating temperature range without the need for external bias resistors or other bias conditions.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	PIC100, PIC102			PIC101, PIC103			Units	Test Conditions
		Min.	Typ.	Max.	Min.	Typ.	Max.		
Off-State Blocking Current	I_D	—	.005	1.0	—	.02	1.0	μA	V_D = Ratings
Gate Trigger Current	I_{GT}	—	0.6	2.0	—	0.8	5.0	mA	$(A_2 +); V_D = 5\,V$
Gate Trigger Current	I_{GT}	—	1.5	2.0	—	3.0	5.0	mA	$(A_2 -); V_D = 5\,V$
Gate Trigger Voltage	V_{GT}	.45	0.6	1.0	0.4	0.7	1.0	V	$V_D = \pm 5\,V$
On-State Voltage	V_t	—	2.1	2.5	—	2.2	2.5	V	$i_t = 1\,A\,(A_2 +, A_1 -)$; $I_G = 2mA$ (Pulse Test)
On-State Voltage	V_t	—	1.3	2.5	—	1.5	2.5	V	$i_t = 1\,A\,(A_2 -, A_1 +)$; $I_G = 2mA$ (Pulse Test)
Holding Current	I_{HD}	.4	.7	1.5	.3	1.7	3.0	mA	Gate Open
Anode Voltage — Critical Rate of Change	dv/dt	—	50	—	—	45	—	V/μs	V_D = Ratings
Gate Trigger-On Pulse Width	$t_{pg(on)}$	—	0.2	1.0	—	0.2	1.0	μs	$I_G = +10mA$ $i_t = \pm 1\,A; V_D = \pm 200\,V$
Forward Blocking Recovery Time	t_{fbr}	—	20	—	—	20	—	μs	$i_t = \pm 1\,A; i_R = \pm 1\,A$
Off-State Blocking Current	I_D	—	8	200	—	10	200	μA	$T_A = 150°C; V_D$ = Ratings
Gate Trigger Voltage	V_{GT}	.01	0.2	—	0.1	0.2	—	V	$T_A = 150°C; V_D$ = Ratings

Letter Symbols

V_D; L_D: Off-State Blocking Voltage, Current
V_t; i_t: Peak On-State Voltage, Current
A_1; A_2: Anode 1, Anode 2

Note: AC switches are also available in the TO-59 package rated at 4A RMS (PIC120-PIC123). Electrical specifications are the same as for the PIC100-PIC103.

POWER INTEGRATED CIRCUITS

PIC400, 401

Oneshot Power Pulse Generator
8A, 60V Output
0.5-50ms Output Pulse Width

FEATURES

- Output Pulse Width Temperature Coefficient: —0.04%/°C
- DTL, TTL, RTL Input Compatibility
- Inhibit Capability
- Input/Output Isolation
- Low Standby Current
- Hermetically Sealed TO-3 Package

DESCRIPTION

The Unitrode Power Pulser is a unique hybrid integrated circuit designed to switch high power loads for a precisely timed interval when triggered by a logic level input. The Power Pulser is capable of impulse driving a wide variety of inductive and resistive loads including solenoid actuators, print hammers, ferrite phase shifters, impulse motors and incandescent lamps.

The 2 volt positive input change required to trigger the Power Pulser is compatible with the output of standard TTL, DTL or RTL logic gates. The output pulse duration for the standard product may be specified in the range of 0.5 to 50 milliseconds and is functionally laser-trimmed to within 1% of the specified value. Output pulse width temperature coefficient for the PIC400 series is —.04%/°C. Inherent fast recovery of the timing circuit permits operation at duty cycles up to 90% with no significant effect on output pulse duration.

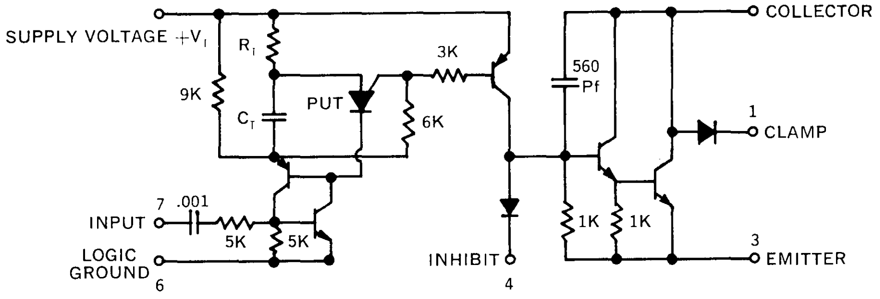
A PNP transistor coupling the input and output circuits within the Power Pulser provides isolation which permits considerable flexibility in output circuit configuration and minimizes noise coupling to the input. Rate of change of output voltage is controlled to minimize RFI.

Standby current drain is minimal — less than 10 microamperes. A terminal is provided whereby the output pulse may be inhibited by externally sinking the current drive to the output circuit. A built-in diode facilitates clamping inductive loads when the output pulse is terminated.

The Unitrode Power Pulser is supplied in a modified TO-3 package hermetically sealed for high reliability. Hybrid circuit construction utilizes thick film resistors and monolithic ceramic capacitors on a ceramic substrate. All active circuit elements, including the Programmable Unijunction Transistor in the timing circuit and the monolithic Darlington output transistor are planar passivated.

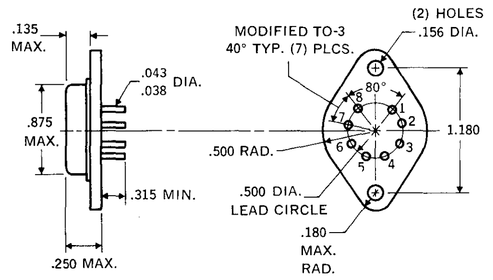
Application Note U-65 provides a detailed functional description of the hybrid circuit and design guidance for specific circuit applications.

SIMPLIFIED SCHEMATIC



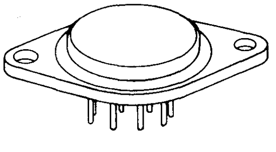
MECHANICAL SPECIFICATIONS

PIC400-401



Dimensions in inches.

8 PIN TO-3



ABSOLUTE MAXIMUM RATINGS

Collector-to-Emitter Voltage, V_{2-3}	60V
Supply Voltage, V_T, V_{8-6} (Note 1)	20V
Clamp Diode Reverse Voltage, V_{1-2}	60V
Emitter-to-Ground Voltage Range, V_{3-6} (Note 2)	—60V to 20V
Collector Current, I_2	8A
Power Dissipation	
75°C Case	5W
75°C Ambient	1W
Storage Temperature Range	—65°C to +150°C
Operating Temperature Range	0°C to +125°C
Lead Temperature, Soldering — 10 Seconds	260°C

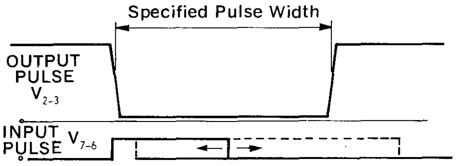
ELECTRICAL SPECIFICATIONS ($T_A = 25°C$, $V_T = 15V$)

		Min.	Typ.	Max.	Units
Output Pulse Width Tolerance (Note 3)	PIC400 0.5 - 2.0ms	—	—	1.0	%
	PIC401 2.0 - 50ms	—	—	2.5	
Output Pulse Width Temperature Coefficient	PIC400	—	—0.04	—	%/°C
	PIC401	—	—0.15	—	%/°C
On-State Voltage, V_{2-3} at $I_2 = 5A$		—	1.3	1.8	V
Off-State Current I_2 at $V_{2-3} = 60V$		—	0.1	10	μA
Input Trigger Voltage, Positive Edge (Note 4)		1.0	1.4	1.8	V
Collector Voltage Rate of Change, V_{2-3}	Turn-On	5.0	15	30	V/μs
	Turn-Off	2.0	5	10	V/μs
V_T Supply Current I_8 (Note 5)		—	12	18	mA
Inhibit Current I_4 (Note 5, 6)		—	10	15	mA

NOTES:

1. Operation at V_T less than +10V, not recommended.
2. Max. positive emitter voltage must not exceed $+V_T$ supply.
3. Output Pulse Width is functionally laser trimmed to value specified.
4. Minimum positive voltage change required at input to cause triggering, with rise time less than 0.5 microseconds. No power pulser will trigger with positive edge change less than 1.0 volts, all will trigger with positive edge change greater than 1.8 volts. All power pulsers will trigger from TTL to DTL output with pull-up resistor up to 6K, and +5V logic supply.
5. Supply and inhibit currents specified are peak values which occur only during timed output pulse interval. The average supply and inhibit currents can be determined by multiplying by the duty cycle.
6. Output pulse may be inhibited by sinking the drive current pulse to the Darlington output transistor through the inhibit terminal. The inhibit terminal must be maintained at +.25 volts or less, with respect to the emitter terminal to prevent the Darlington transistor from turning on. Diode decoupling is provided to permit the connection of the inhibit terminals of several power pulsers to a common inhibit bus.

INPUT-OUTPUT WAVEFORMS



Output pulse width is independent of input pulse width

HOW TO ORDER THE POWER PULSER

The PIC400 utilizes a high stability NPO ceramic timing capacitor and is available with output pulse width specified anywhere in the range of 0.5 to 2.0 milliseconds. The PIC401 employs a high dielectric constant timing capacitor and is available with output pulse widths from 2.0 to 50 milliseconds. The desired pulse width in milliseconds is specified as a suffix to the type designation; for example, PIC400 — 1.5 specifies 1.5 milliseconds pulse width. If the required pulse width is not yet determined, one of the Power Pulser Prototypers described below can be used for design evaluation.

OPTIONS

Considerable flexibility in performance specification and circuit configuration is available on a non-standard basis.

Options include: output voltage up to 120V
pulse widths below 0.5 milliseconds
pulse widths above 50 milliseconds
current mode switching
faster or slower controlled rate
of change of output voltage

Your inquiry is invited on these and any other special requirements.

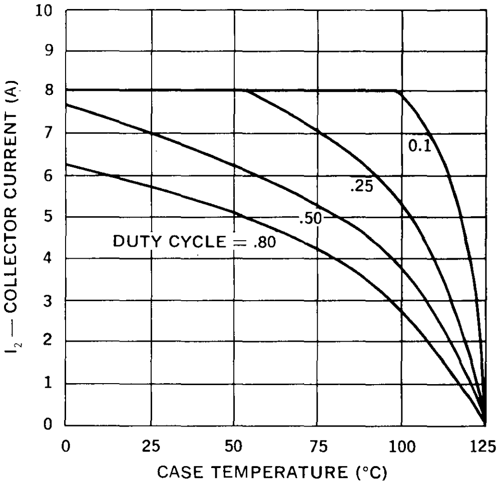
POWER PULSER PROTOTYPER

The standard Power Pulser described in this data sheet has a fixed output pulse width determined by an internal timing network. The Power Pulser Prototyper is identical to the standard Power Pulser except that the output pulse width is externally programmable. It is intended for use during system design when the exact pulse width required for proper functioning of the load is not yet known. Once the pulse width is known, a standard Power Pulser with a fixed pulse width can easily be specified.

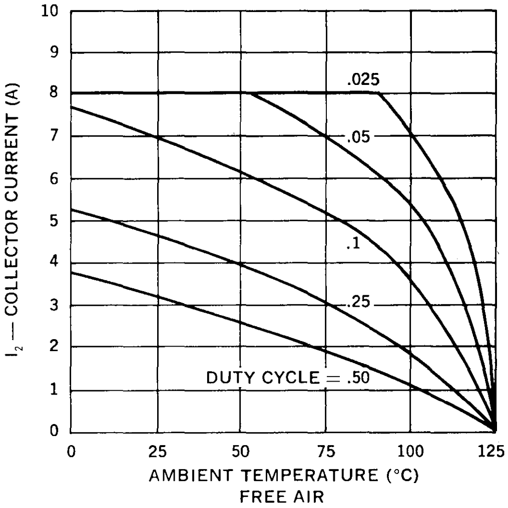
Description: The Power Pulser Prototyper is programmed by connecting an external adjustable timing resistor between pins #5 and #8. Five prototypers are available to cover the pulse width ranges shown below.

Type	Output Pulse Width Range	Timing Resistor Range*	Max. Output Voltage	Max. Output Current
PIC400A	0.5 to 2ms	50 - 500KΩ	60V	8A
PIC401A	1.0 to 4	50 - 500	60	8
PIC401B	2.5 to 10	50 - 500	60	8
PIC401C	6.0 to 25	50 - 500	60	8
PIC401D	12.0 to 50	50 - 500	60	8

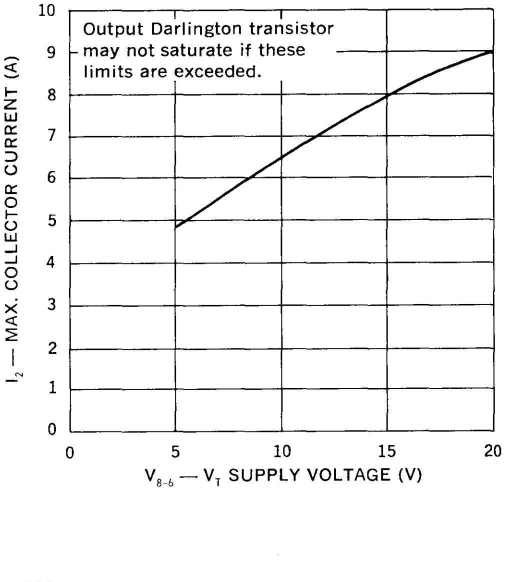
*To assure proper functioning of the Power Pulser Prototyper the timing resistor must be restricted to the impedance range specified.



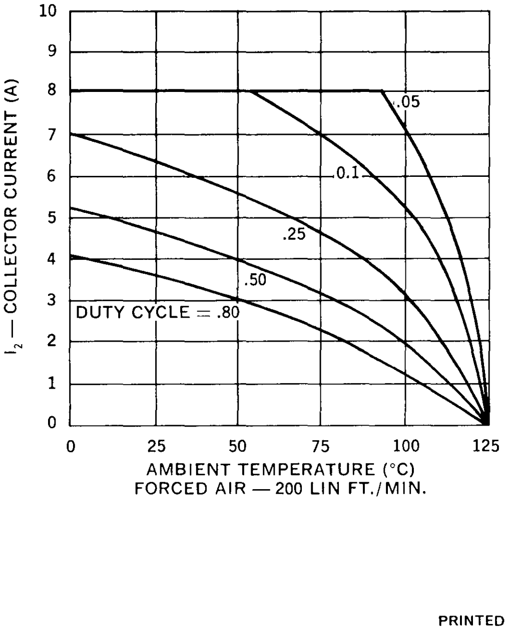
Case Temp. Current Rating



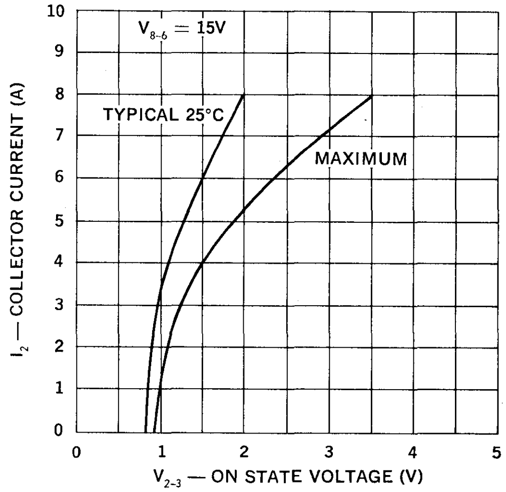
Ambient Temp. Current Rating



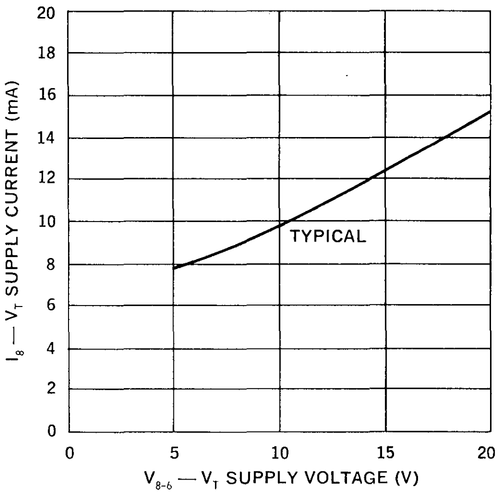
Current Rating vs. V_T Supply Voltage



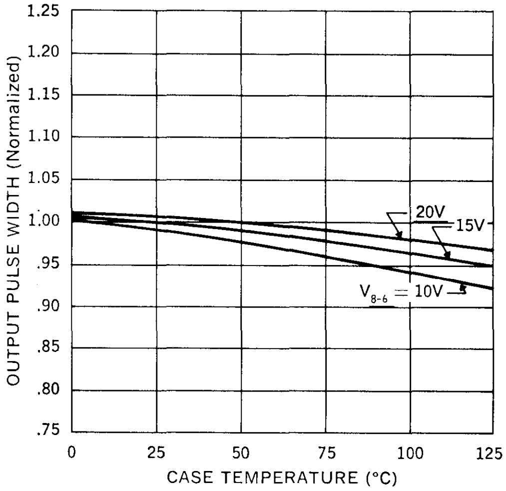
Forced Air Current Rating



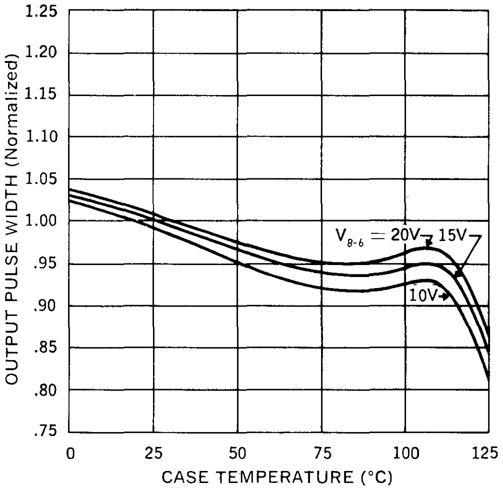
On State Output Characteristics



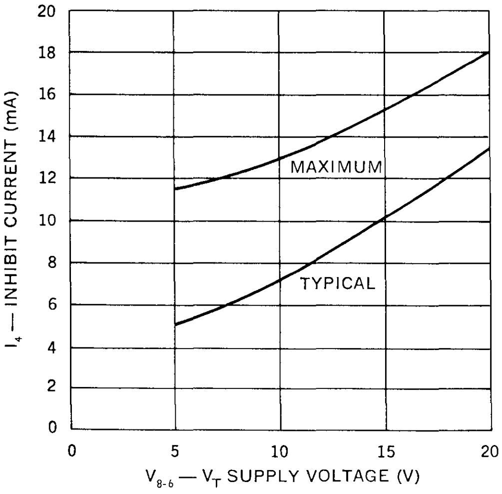
V_T Supply Current vs. Supply Voltage



Output Pulse Width vs. Case Temp. (PIC400)



Output Pulse Width vs. Case Temp. (PIC401)



Inhibit Current vs. Supply Voltage

POWER DARLINGTONS

10 Amp Dual Darlingtons, Planar NPN

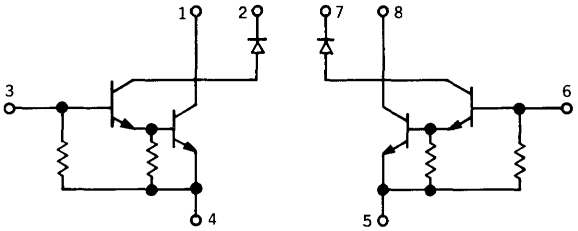
PIC500
PIC501
PIC502

FEATURES

- Cost-Saving Dual Design Reduces Size and Improves Efficiency
- High Current Gain: 2000 min. @ $I_C = 5A$ for PIC500
- Low Saturation Voltage: 1.5V max. @ $I_C = 5A$ for PIC500
- High Voltage: up to 100V min. V_{CEO}
- High Energy Capability: 1 Joule @ $I_C = 5A$
- Monolithic Darlington Design Insures Higher Reliability
- Planar Construction Throughout
- Electrically Isolated Case

DESCRIPTION

Unitrode's PIC500 series of Power Integrated Circuits offers the advantage of two monolithic Darlingtons and their associated commutating diodes in a single hermetically sealed 8-pin TO-3 package. This affords the designer a significant cost-savings as well as a reduction in size of more than 50% in applications such as full-wave bridge circuits for converters and stepper-motor drives. Incorporating chips from Unitrode's U2T101 Darlington series, these devices offer outstanding performance and economy of operation.

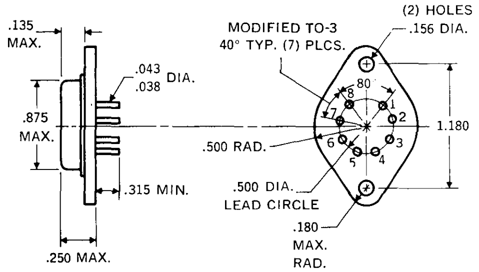


ABSOLUTE MAXIMUM RATINGS

	PIC500	PIC501	PIC502
Darlington Transistors			
Collector — Emitter Voltage	100V	100V	80V
Collector — Base Voltage	100V	100V	80V
Emitter — Base Voltage	10V	10V	10V
D.C. Collector Current	5A	5A	5A
Peak Collector Current	10A	10A	8A
Base Current	0.2A	0.2A	0.2A
Commutating Diodes			
Peak Inverse Voltage	100V	100V	80V
Peak Forward Current	25A	25A	20A
D.C. Forward Current	5A	5A	5A
Power Dissipation @ $T_C = 25°C$			
Total	60W	40W	40W
Per Darlington	30W	20W	20W
Operating Temperature Range	−65°C to +200°C		−55° to +150°C
Storage Temperature Range	−65°C to +200°C		

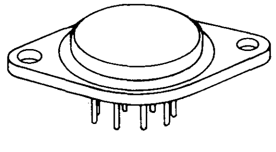
MECHANICAL SPECIFICATIONS

PIC500 PIC501 PIC502



Dimensions in inches.

TO-3 (8-PIN)

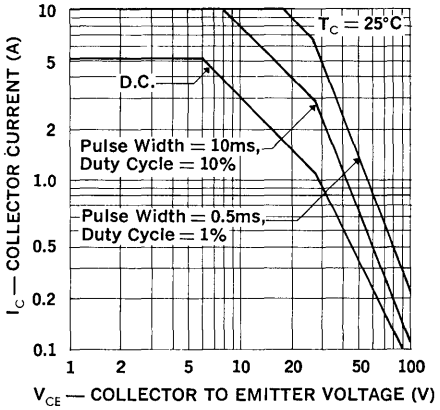


UNITRODE

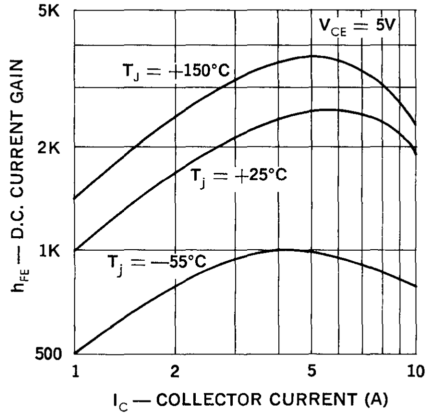
PIC500
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Max.	Units	Test Conditions
Darlington Transistors					
Collector – Emitter Sustaining Voltage	$V_{CEO}(sus)$	100	—	V	$I_C = 10mA, I_B = 0$
Collector – Base Breakdown Voltage	BV_{CBO}	100	—	V	$I_C = 1mA, I_E = 0$
Emitter – Base Breakdown Voltage	BV_{EBO}	5	—	V	$I_E = 5mA, I_C = 0$
D.C. Current Gain	h_{FE}	2000	—	—	$I_C = 5A, V_{CE} = 5V$
D.C. Current Gain	h_{FE}	1000	—	—	$I_C = 2A, V_{CE} = 2V$
Collector Saturation Voltage	$V_{CE}(sat)$	—	1.5	V	$I_C = 5A, I_B = 10mA$
Base Saturation Voltage	$V_{BE}(sat)$	—	2.0	V	$I_C = 5A, I_B = 10mA$
Collector Cut-Off Current	I_{CEO}	—	0.1	μA	$V_{CE} = 60V, I_B = 0$
Collector Cut-Off Current	I_{CEO}	—	200	μA	$V_{CE} = 60V, I_B = 0, T = 150°C$
Base Cut-Off Current	I_{EBO}	3.2	5.0	mA	$V_{EBO} = 5V, I_C = 0$
Delay Time Rise Time Storage Time Fall Time	t_d t_r t_s t_f	— — — —	50 250 1.5 500	ns ns μs ns	See Figure 1 $V_{CC} = 30V$ $I_C = 5A$ $I_{B1} = I_{B2} = 10mA$
Switching Energy	E_{SB}	1.0	—	J	$I_C = 5A$, L = 80mh See Figure 2
Commutating Diodes					
Peak Inverse Voltage	PIV	100	—	V	$I_R = 100\mu A$
Reverse Leakage Current	I_R	—	0.5	μA	$V_R = 60V$
Reverse Leakage Current	I_R	—	500	μA	$V_R = 60V, T = 150°C$
Forward Voltage Drop	V_F	—	1.5	V	$I_F = 5A$
Reverse Recovery Time	t_{rr}	—	50	ns	$I_F = 1A, —1A$

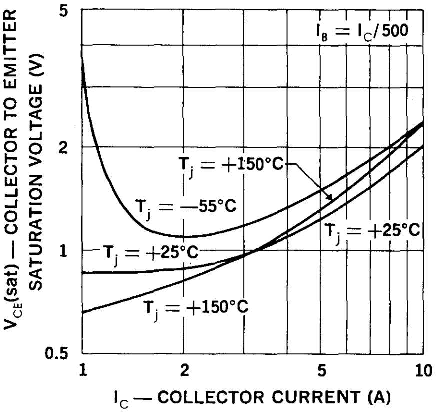
Safe Operating Area for Each Darlington



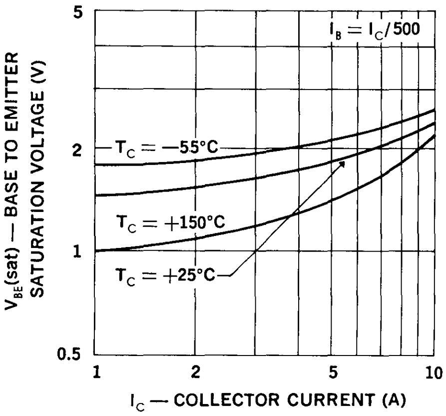
Typical D.C. Current Gain vs. Collector Current



Typical $V_{CE}(sat)$ vs. Collector Current



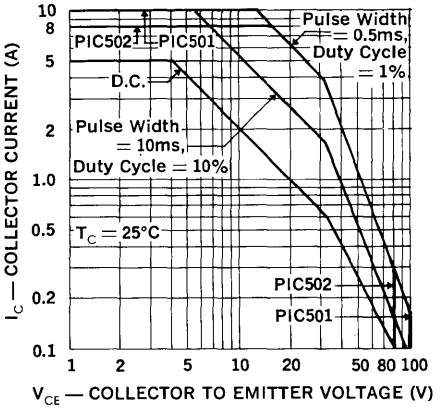
Typical $V_{BE}(sat)$ vs. Collector Current



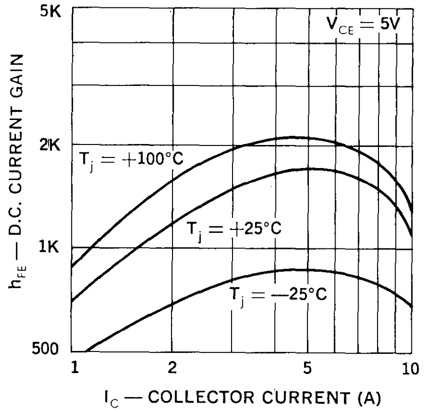
PIC501 & 502
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	PIC501		PIC502		Units	Test Conditions
		Min.	Max.	Min.	Max.		
Darlington Transistors							
Collector – Emitter Sustaining Voltage	$V_{CEO}(sus)$	100	—	80	—	V	$I_C = 10mA, I_B = 0$
Collector – Base Breakdown Voltage	BV_{CBO}	100	—	80	—	V	$I_C = 1mA, I_E = 0$
Emitter – Base Breakdown Voltage	BV_{EBO}	5	—	5	—	V	$I_E = 5mA, I_C = 0$
D.C. Current Gain	h_{FE}	1000	—	750	—	—	$I_C = 5A, V_{CE} = 5V$
Collector Saturation Voltage	$V_{CE}(sat)$	—	2.0	—	2.0	V	$I_C = 5A, I_B = 10mA$
Base Saturation Voltage	$V_{BE}(sat)$	—	2.0	—	2.0	V	$I_C = 5A, I_B = 10mA$
Collector Cut-Off Current	I_{CEO}	—	100	—	100	μA	$V_{CE} = 60V, I_B = 0$
Collector Cut-Off Current	I_{CEO}	—	500	—	500	μA	$V_{CE} = 60V, I_B = 0, T = 100°C$
Base Cut-Off Current	I_{EBO}	3.2	5.0	3.2	5.0	mA	$V_{EBO} = 5V, I_C = 0$
Delay Time	t_d	—	150	—	150	ns	See Figure 1
Rise Time	t_r	—	500	—	500	ns	$V_{CC} = 30V$
Storage Time	t_s	—	3.0	—	3.0	μs	$I_C = 5A$
Fall Time	t_f	—	600	—	600	ns	$I_{B1} = I_{B2} = 10mA$
Switching Energy	E_{SB}	1.0	—	1.0	—	J	$I_C = 5A, L = 80mh$ See Figure 2
Commutating Diodes							
Peak Inverse Voltage	PIV	100	—	80	—	V	$I_R = 100\mu A$
Reverse Leakage Current	I_R	—	50	—	50	μA	$V_R = 60V$
Reverse Leakage Current	I_R	—	500	—	500	μA	$V_R = 60V, T = 100°C$
Forward Voltage Drop	V_F	—	2.0	—	2.0	V	$I_F = 5A$
Reverse Recovery Time	t_{rr}	—	50	—	50	ns	$I_F = 1A, —1A$

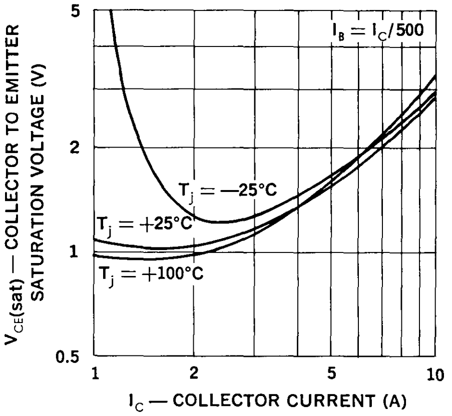
Safe Operating Area for Each Darlington



Typical D.C. Current Gain vs. Collector Current



Typical $V_{CE}(sat)$ vs. Collector Current



Typical $V_{BE}(sat)$ vs. Collector Current

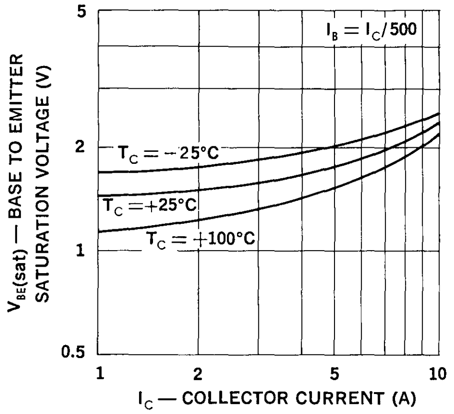
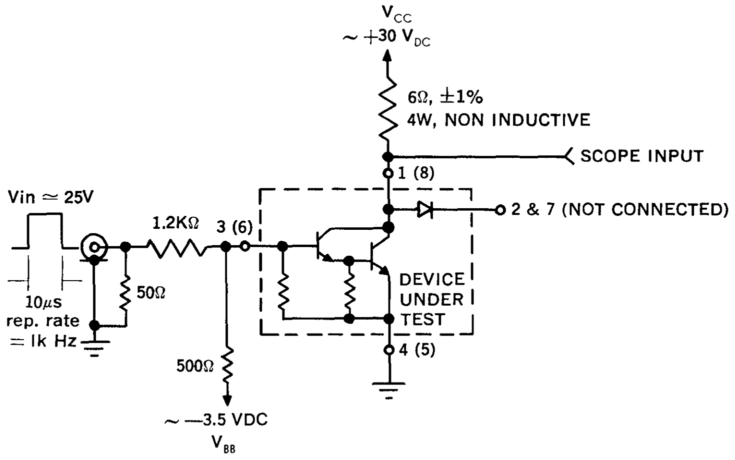
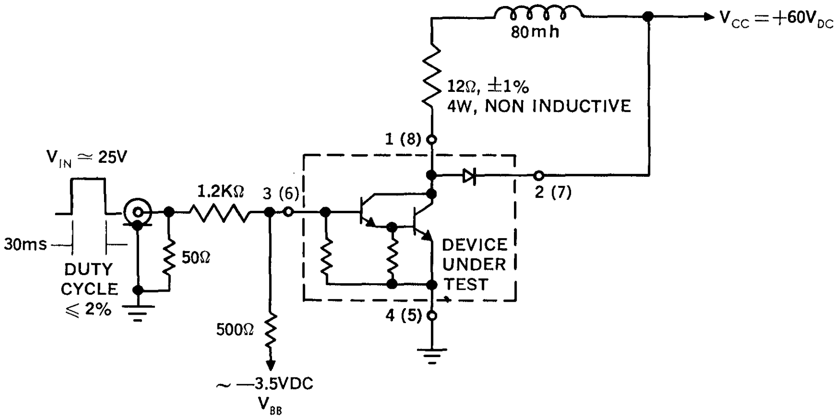


Figure 1
PIC500, PIC501, PIC502
Switching Speed Circuit



NOTE: The V_{IN}, V_{CC} and V_{BB} voltages are only approximate and should be adjusted to give $I_C = 5.0A$, $I_{B1} = 10mA$ and $I_{B2} = 10mA$.

Figure 2
PIC500, PIC501, PIC502
Switching Energy Circuit



NOTE: The V_{IN} voltage is only approximate and should be adjusted to give $I_C = 5.0A$.

POWER INTEGRATED CIRCUIT

Switching Regulator 5 Amp Positive and Negative Power Output Stages

PIC600
PIC601
PIC610
PIC611

FEATURES

- Designed and characterized for switching regulator applications
- Cost saving design reduces size, improves efficiency, reduces noise and RFI (See note 4.)
- High operating frequency (to > 100kHz) results in smaller inductor-capacitor filter and improved power supply response time
- High operating efficiency: Typical 2A circuit performance —
  Rise and Fall time <75ns
  Efficiency >85%
- No reverse recovery spike generated by commutating diode (See note 4. and Fig. 2.)
- Electrically isolated, 4-Pin, TO-66 hermetic case

DESCRIPTION

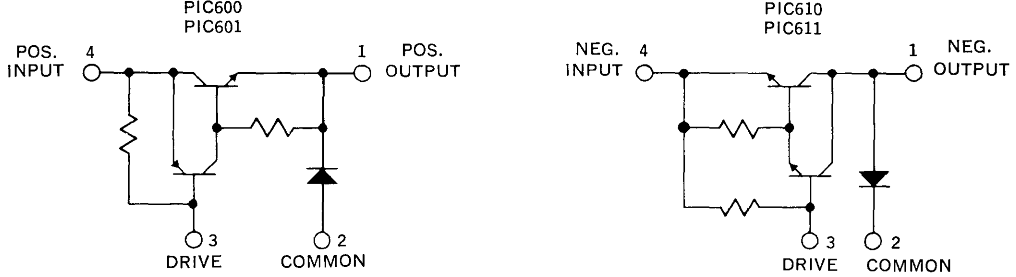
The Unitrode ESP Switching Regulator is a unique hybrid transistor circuit, specifically designed, constructed and specified for use in high current switching regulator applications. The designer is thus relieved of one of the most time consuming, tedious and critical aspects of switching regulator design: choosing the appropriate switching transistors and commutating diode, and empirically determining the optimum drive and bias conditions.

Switching regulators, when compared to conventional regulators, result in significant reductions in size, weight, and internal power losses and a major decrease in overall cost. Using the Unitrode PIC600 series, the designer can achieve further improvements in size, weight, efficiency, and costs. At the same time, because of the PIC600 series design and packaging, the designer is aided in overcoming two of the most significant drawbacks to switching regulators: noise generation and slow response time; there is, in fact, no diode reverse recovery spike (see note 4.).

The PIC600 series switching regulators are designed and characterized to be driven with standard integrated circuit voltage regulators. They are completely characterized over their entire operating range of —55°C to +125°C. The devices are enclosed in a special 4-pin TO-66 package, hermetically sealed for high reliability. The hybrid circuit construction utilizes thick film resistors on a beryllia substrate for maximum thermal conductivity and resultant low thermal impedance. All of the active elements in the hybrid are fully passivated.

Application Note U-68 provides a detailed description of the hybrid circuit and design guidance for specific circuit applications.

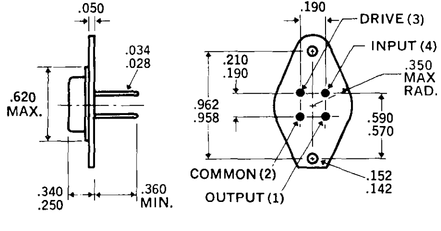
SCHEMATIC



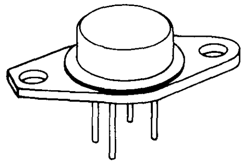
MECHANICAL SPECIFICATIONS

PIC600 PIC601 PIC610 PIC611

4-Pin TO-66



NOTES:
1. Case is electrically isolated.
2. Loads may be soldered to within 1/16" of base provided temperature-time exposure is less than 260°C for 10 seconds.



UNITRODE

ABSOLUTE MAXIMUM RATINGS

	PIC600	PIC601	PIC610	PIC611
Input Voltage, V_{4-2}	60V	80V	—60V	—80V
Output Voltage, V_{1-2}	60V	80V	—60V	—80V
Drive-Input Reverse Voltage, V_{3-4}	5V	5V	—5V	—5V
Output Current, I_1	5A	5A	—5A	—5A
Drive Current, I_3	—0.2A	—0.2A	0.2A	0.2A

Thermal Resistance

Junction to Case, θ_{J-C}

Power Switch .... 4.0°C/W

Commutating Diode .... 4.0°C/W

Case to Ambient, θ_{C-A} .... 60.0°C/W

Operating Temperature Range, T_C .... —55°C to +125°C

Maximum Junction Temperature, T_J .... +150°C

Storage Temperature Range .... —65°C to +150°C

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	PIC600 & 601 Min.	PIC600 & 601 Typ.	PIC600 & 601 Max.	PIC610 & 611 Min.	PIC610 & 611 Typ.	PIC610 & 611 Max.	Units	Conditions
Current Delay Time	t_{di}	—	20	40	—	20	40	ns	$V_{in} = 25V(—25V)$
Current Rise Time	t_{ri}	—	50	75	—	50	75	ns	$V_{out} = 5V(—5V)$
Voltage Rise Time	t_{rv}	—	30	50	—	30	50	ns	$I_{out} = 2A(—2A)$
Voltage Storage Time	t_{sv}	—	175	500	—	150	500	ns	$I_3 = —20mA(20mA)$
Voltage Fall Time	t_{fv}	—	50	75	—	50	75	ns	See Figure 2.
Current Fall Time	t_{fi}	—	70	150	—	70	150	ns	See notes 1., 2., 4.
Efficiency (Notes 2. & 4.)	η	—	85	—	—	85	—	%	
On-State Voltage (Note 3.)	$V_{4-1(on)}$	—	1.0	1.5	—	–1.0	–1.5	V	$I_4 = 2A(—2A)$, $I_3 = —.02A(.02A)$
On-State Voltage (Note 3.)	$V_{4-1(on)}$	—	2.5	3.5	—	–2.5	–3.5	V	$I_4 = 5A(—5A)$, $I_3 = —.02A(.02A)$
Diode Forward Voltage (Note 3.)	$V_{2-1(on)}$	—	.8	1.0	—	–.8	–1.0	V	$I_2 = 2A(—2A)$
Diode Forward Voltage (Note 3.)	$V_{2-1(on)}$	—	1.0	1.5	—	–1.0	–1.5	V	$I_2 = 5A(—5A)$
Off-State Current	I_{4-1}	—	0.1	10	—	–0.1	–10	μA	V_4 = Rated input voltage
Off-State Current	I_{4-1}	—	10	—	—	–10	—	μA	V_4 = Rated input voltage, $T_A = 100°C$
Diode Reverse Current	I_{1-2}	—	1.0	10	—	–1.0	–10	μA	V_1 = Rated output voltage
Diode Reverse Current	I_{1-2}	—	500	—	—	500	—	μA	V_1 = Rated output voltage, $T_A = 100°C$

Notes:

1. In switching an inductive load, the current will lead the voltage on turn-on and lag the voltage on turn-off (see Figure 2). Therefore, Voltage Delay Time (t_{DV}) $\cong t_{di} + t_{ri}$ and Current Storage Time (t_{si}) $\cong t_{sv} + t_{fv}$.
2. The efficiency is a measure of internal power losses and is equal to Output Power divided by Input Power. The switching speed circuit of Figure 1, in which the efficiency is measured, is representative of typical operating conditions for the PIC600 series switching regulators.
3. Pulse test: Duration = 300ms, Duty Cycle ⩽2%.
4. As can be seen from the switching waveforms shown in Figure 2, no reverse or forward recovery spike is generated by the commutating diode during switching! This reduces self-generated noise, since no current spike is fed through the switching regulator. It also improves efficiency and reliability, since the power switch only carries current during turn-on.

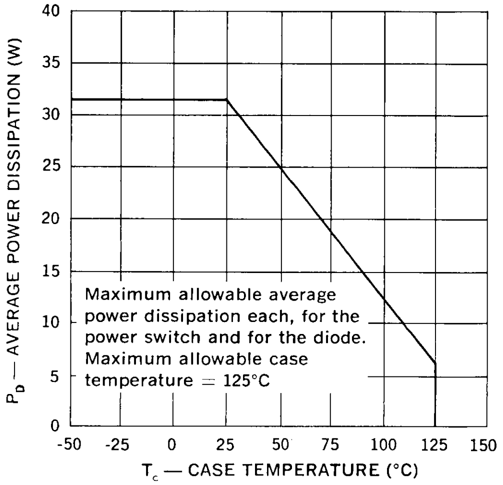
POWER DISSIPATION CONSIDERATIONS

The total power losses in the switching regulator is the sum of the switching losses, and the power switch and diode D.C. losses. Once total power dissipation has been determined, the Power Dissipation curve, or thermal resistance data may be used to determine the allowable case or ambient temperature for any operating condition.

The switching losses curve presents data for a frequency of 20KHz. To find losses at any other frequency, multiply by f/20KHz.

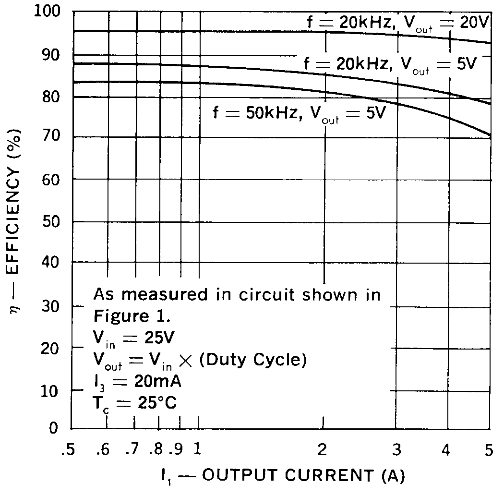
The D.C. losses curves present data for a duty cycle of .2. To find D.C. losses at any other duty cycle, multiply by D/.2 for the power switch and by (1-D)/.8 for the diode.

At frequencies much below 10KHz the above method for determining the allowable case or ambient temperature becomes invalid and a detailed transient thermal analysis must be performed. Unitrode will supply transient thermal impedance information on request.



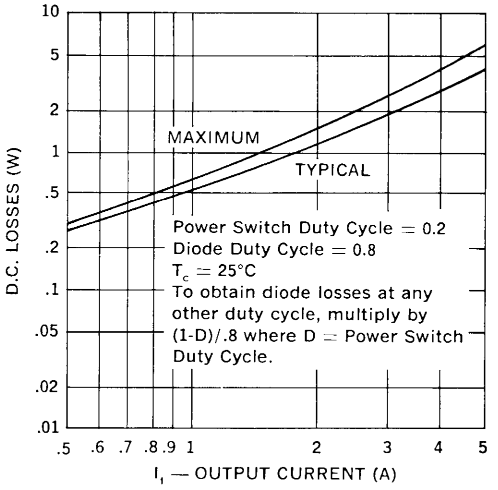
Power Dissipation

Maximum allowable average power dissipation each, for the power switch and for the diode. Maximum allowable case temperature = 125°C



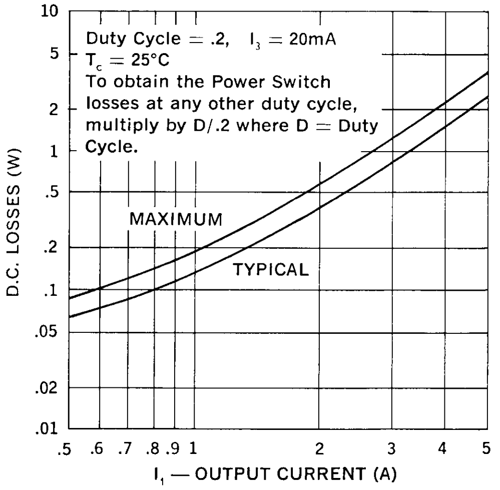
Efficiency

As measured in circuit shown in Figure 1.
$V_{in} = 25V$
$V_{out} = V_{in} \times$ (Duty Cycle)
$I_3 = 20mA$
$T_c = 25°C$



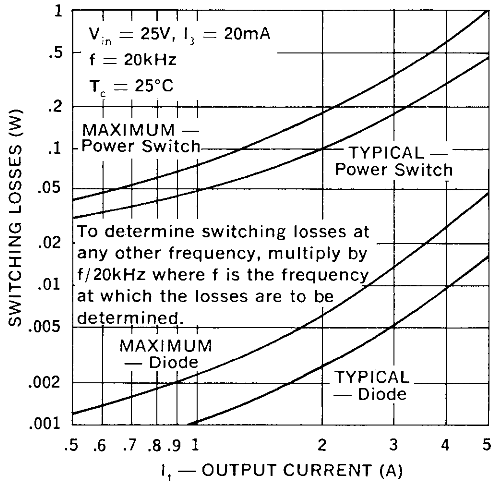
Diode D.C. Losses

Power Switch Duty Cycle = 0.2
Diode Duty Cycle = 0.8
$T_c = 25°C$
To obtain diode losses at any other duty cycle, multiply by (1-D)/.8 where D = Power Switch Duty Cycle.



Power Switch D.C. Losses

Duty Cycle = .2, $I_3 = 20mA$
$T_c = 25°C$
To obtain the Power Switch losses at any other duty cycle, multiply by D/.2 where D = Duty Cycle.



Switching Losses

$V_{in} = 25V$, $I_3 = 20mA$
f = 20kHz
$T_c = 25°C$

To determine switching losses at any other frequency, multiply by f/20kHz where f is the frequency at which the losses are to be determined.

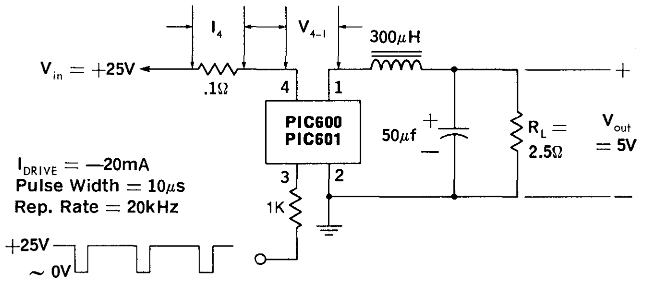


Figure 1. PIC600,601 Switching Speed Circuit

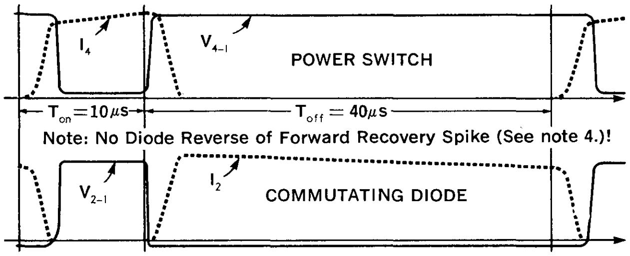
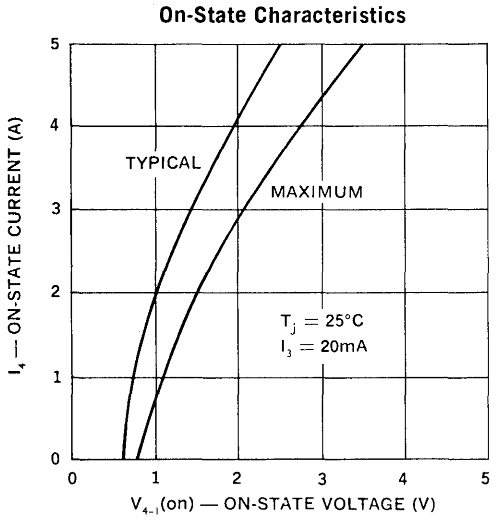
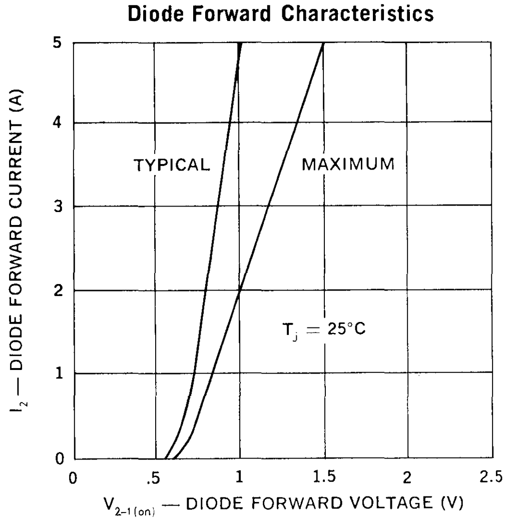


Figure 2. PIC600, PIC601 Switching Waveforms

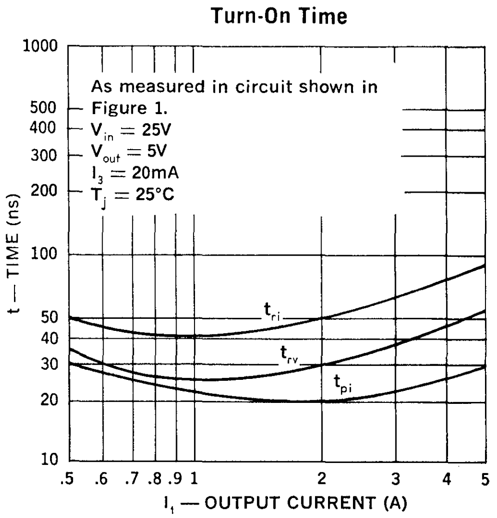
Note: PIC610, PIC611 Test Circuit and waveforms are identical but of opposite polarity (V_{in} = —25V, V_{out} = —5V, I_{DRIVE} = +20mA).



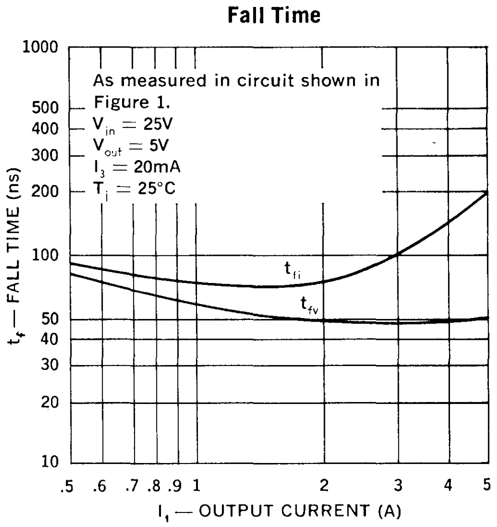
On-State Characteristics



Diode Forward Characteristics



Turn-On Time



Fall Time

POWER INTEGRATED CIRCUIT

Switching Regulator 15 Amp Positive and Negative Power Output Stages

PIC625
PIC626
PIC635
PIC636

FEATURES

- Designed and characterized for switching regulator applications
- Cost saving design reduces size, improves efficiency, reduces noise and RFI (See note 4.)
- High operating frequency (to >100kHz) results in smaller inductor-capacitor filter and improved power supply response time
- High operating efficiency: Typical 7A circuit performance —
  Rise and Fall time <300 ns
  Efficiency >85%
- No reverse recovery spike generated by commutating diode (See note 4. and Fig. 2.)
- Electrically isolated, 4-Pin, TO66 hermetic case

DESCRIPTION

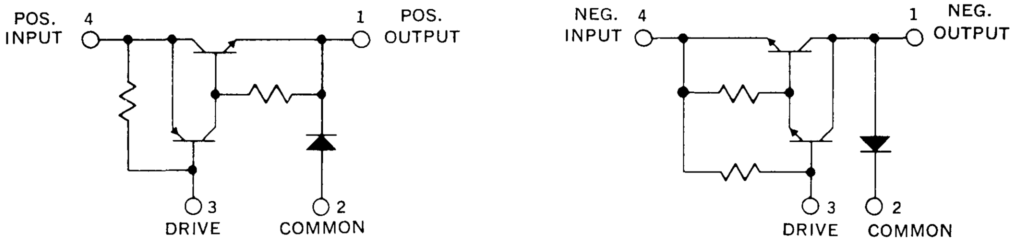
The Unitrode ESP Switching Regulator is a unique hybrid transistor circuit, specifically designed, constructed and specified for use in high current switching regulator applications. The designer is thus relieved of one of the most time consuming, tedious and critical aspects of switching regulator design: choosing the appropriate switching transistors and commutating diode, and empirically determining the optimum drive and bias conditions.

Switching regulators, when compared to conventional regulators, result in significant reductions in size, weight, and internal power losses and a major decrease in overall cost. Using the Unitrode PIC600 series the designer can achieve further improvements in size, weight, efficiency, and costs. At the same time, because of the PIC600 series design and packaging, the designer is aided in overcoming two of the most significant drawbacks to switching regulators: noise generation and slow response time; there is, in fact, no diode reverse recovery spike (See note 4.).

The PIC600 series switching regulators are designed and characterized to be driven wih standard integrated circuit voltage regulators. They are completely characterized over their entire operating range of —55°C to +125°C. The devices are enclosed in a special 4-pin TO66 package, hermetically sealed for high reliability. The hybrid circuit construction utilizes thick film resistors on a beryllia substrate for maximum thermal conductivity and resultant low thermal impedance. All of the active elements in the hybrid are fully passivated.

Application Note U-68 provides a detailed description of the hybrid circuit and design guidance for specific circuit applications.

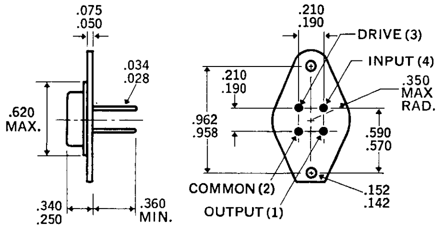
SCHEMATIC


PIC625
PIC626

PIC635
PIC636

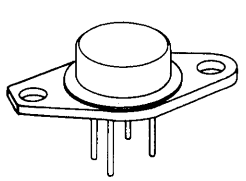
MECHANICAL SPECIFICATIONS

PIC625 PIC626 PIC635 PIC636



NOTES:
1. Case is electrically isolated.
2. Loads may be soldered to within 1/16″ of base provided temperature-time exposure is less than 260°C for 10 seconds.

4-Pin TO-66



ABSOLUTE MAXIMUM RATINGS

	PIC625	PIC626	PIC635	PIC636
Input Voltage, V_{4-2}	60V	80V	—60V	—80V
Output Voltage, V_{1-2}	60V	80V	—60V	—80V
Drive-Input Reverse Voltage, V_{3-4}	5V	5V	—5V	—5V
Output Current, I_1	15A	15A	—15A	—15A
Drive Current, I_3	—0.4A	—0.4A	0.4A	0.4A

Thermal Resistance

Junction to Case, θ_{J-C}

Power Switch .... 4.0°C/W

Commutating Diode .... 4.0°C/W

Case to Ambient, θ_{C-A} .... 60.0°C/W

Operating Temperature Range, T_C .... —55°C to +125°C

Maximum Junction Temperature, T_j .... +150°C

Storage Temperature Range .... —65°C to +150°C

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	PIC625/626			PIC635/636			Units	Conditions
		Min.	Typ.	Max.	Min.	Typ.	Max.		
Current Delay Time	t_{di}	—	35	60	—	35	60	ns	$V_{in} = 25V(-25V)$
Current Rise Time	t_{ri}	—	65	150	—	65	175	ns	$V_{out} = 5V(-5V)$
Voltage Rise Time	t_{rv}	—	40	60	—	40	60	ns	$I_{out} = 7A(-7A)$
Voltage Storage Time	t_{sv}	—	200	600	—	200	800	ns	$I_3 = -30mA(30mA)$
Voltage Fall Time	t_{fv}	—	70	175	—	100	300	ns	See Figure 2
Current Fall Time	t_{fi}	—	175	300	—	175	300	ns	See notes 1, 2, 4
Efficiency (Notes 2 and 4)	η	—	85	—	—	85	—	%	
On-State Voltage (Note 3)	$V_{4-1(on)}$	—	1.0	1.5	—	—1.0	—1.5	V	$I_4 = 7A(-7A)$, $I_3 = -.03A(.03A)$
On-State Voltage (Note 3)	$V_{4-1(on)}$	—	2.5	3.5	—	—2.5	—3.5	V	$I_4 = 15A(-15A)$, $I_3 = -.03A(.03A)$
Diode Fwd. Voltage (Note 3)	$V_{2-1(on)}$	—	.85	1.25	—	—.85	—1.25	V	$I_2 = 7A(-7A)$
Diode Fwd. Voltage (Note 3)	$V_{2-1(on)}$	—	.95	1.75	—	—.95	—1.75	V	$I_2 = 15A(-15A)$
Off-State Current	I_{4-1}	—	0.1	10	—	—0.1	—10	µA	V_4 = Rated input voltage
Off-State Current	I_{4-1}	—	10	—	—	—10	—	µA	V_4 = Rated input voltage, $T_A = 100°C$
Diode Reverse Current	I_{1-2}	—	1.0	10	—	—1.0	—10	µA	V_1 = Rated output voltage
Diode Reverse Current	I_{1-2}	—	500	—	—	500	—	µA	V_1 = Rated output voltage, $T_A = 100°C$

Notes:

1. In switching an inductive load, the current will lead the voltage on turn-on and lag the voltage on turn-off (see Figure 2.). Therefore, Voltage Delay Time (t_{DV}) ≅ $t_{di} + t_{ri}$ and Current Storage Time (t_{si}) ≅ $t_{sv} + t_{fv}$.
2. The efficiency is a measure of internal power losses and is equal to Output Power divided by Input Power. The switching speed circuit of Figure 1., in which the efficiency is measured, is representative of typical operating conditions for the PIC600 series switching regulators.
3. Pulse test: Duration = 300ms, Duty Cycle ≤2%.
4. As can be seen from the switching waveforms shown in Figure 2., no reverse or forward recovery spike is generated by the commutating diode during switching! This reduces self-generated noise, since no current spike is fed through the switching regulator. It also improves efficiency and reliability, since the power switch only carries current during turn-on.

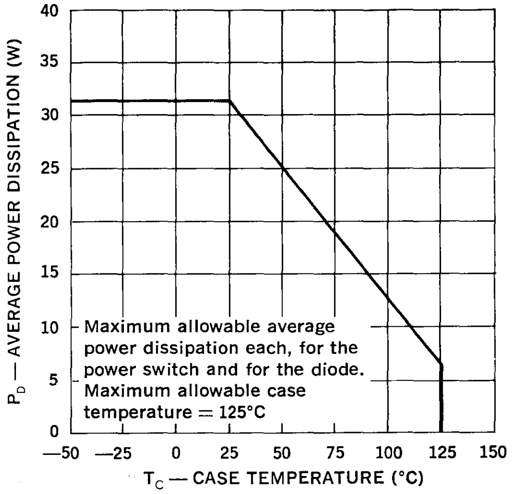
POWER DISSIPATION CONSIDERATIONS

The total power losses in the switching regulator is the sum of the switching losses, and the power switch and diode D.C. losses. Once total power dissipation has been determined, the Power Dissipation curve, or thermal resistance data may be used to determine the allowable case or ambient temperature for any operating condition.

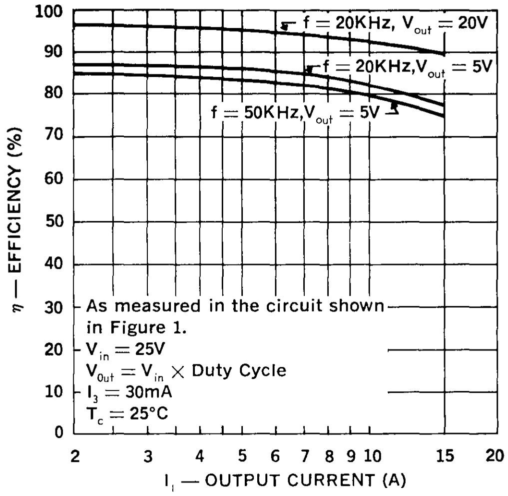
The switching losses curve presents data for a frequency of 20KHz. To find losses at any other frequency, multiply by f/20KHz.

The D.C. losses curves present data for a duty cycle of .2. To find D.C. losses at any other duty cycle, multiply by D/.2 for the power switch and by (1-D)/.8 for the diode.

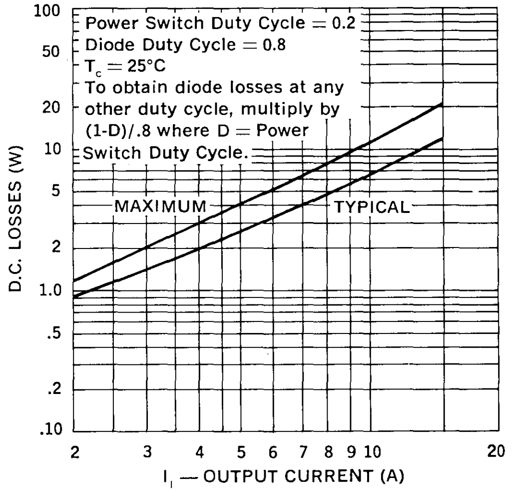
At frequencies much below 10KHz the above method for determining the allowable case or ambient temperature becomes invalid and a detailed transient thermal analysis must be performed. Unitrode will supply transient thermal impedance information on request.



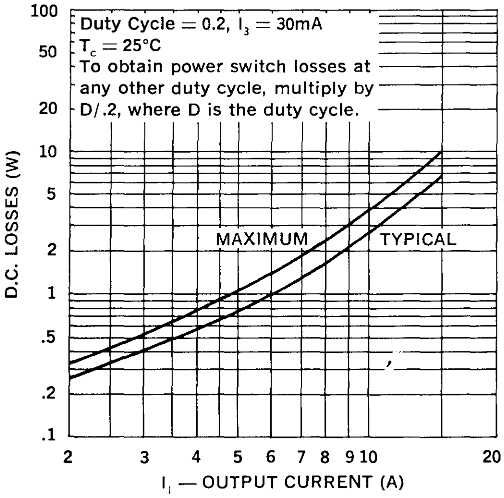
Power Dissipation



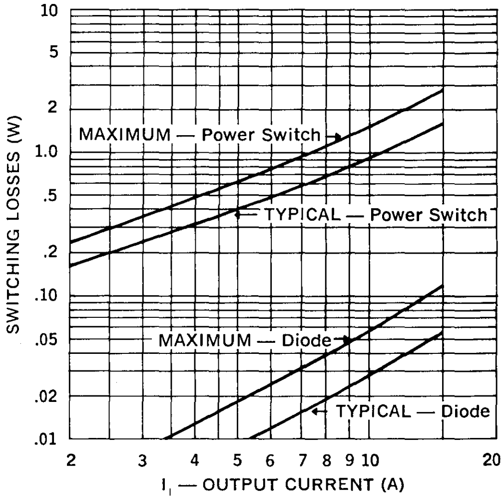
Efficiency



Diode D.C. Losses

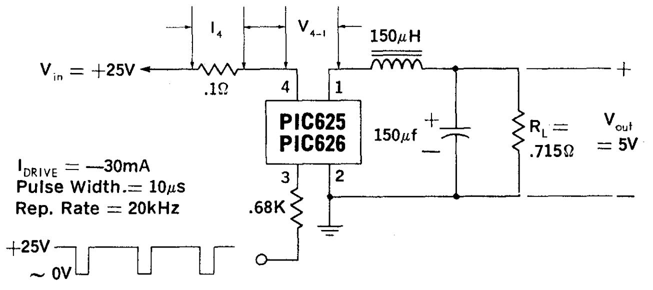


Power Switch D.C. Losses



Switching Losses

V_{in} = 25V, I_3 = 30mA
f = 20KHz
T_C = 25°C
To determine switching losses at any other frequency, multiply by f/20KHz where f is the frequency at which the losses are to be determined.



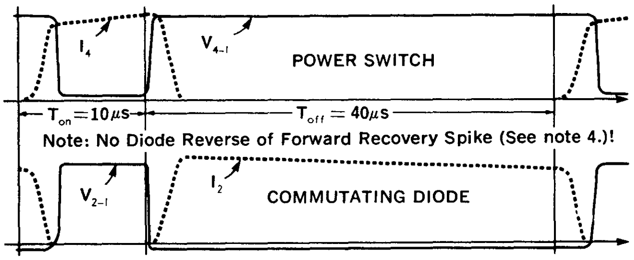
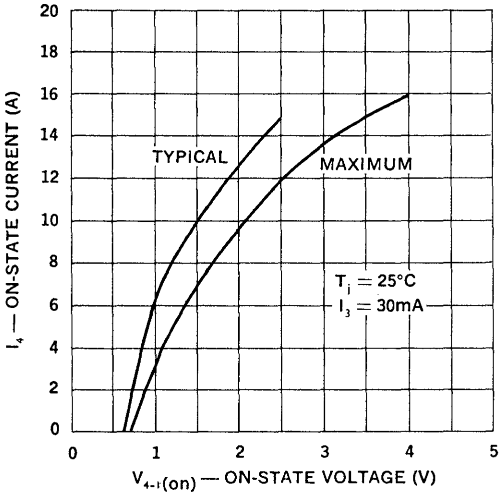


Figure 1. PIC625, 626 Switching Speed Circuit

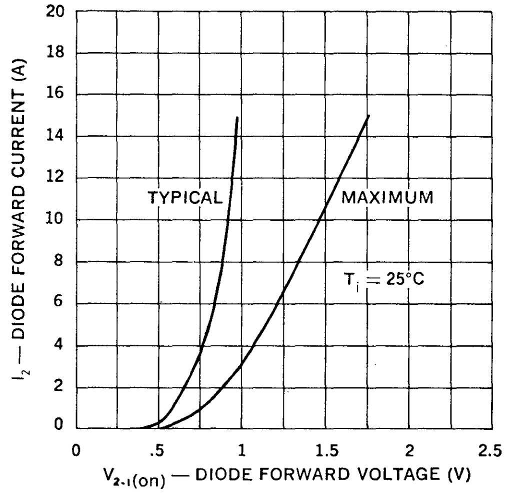
Figure 2. PIC625, 626 Switching Waveforms

Note: PIC635, PIC636 Circuit and waveforms are identical but of opposite polarity (V_{in} = —25V, V_{out} = —5V, I_{DRIVE} = +30mA).

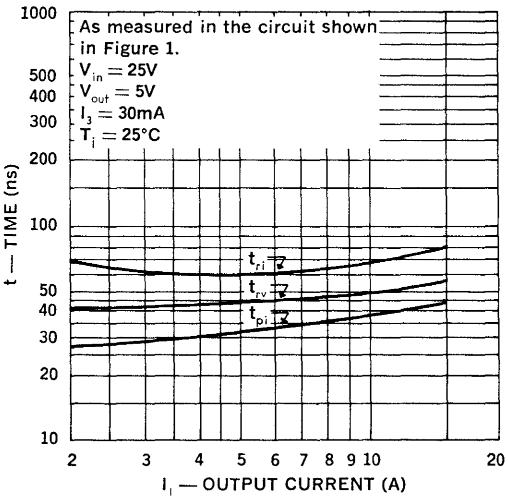
On-State Characteristics



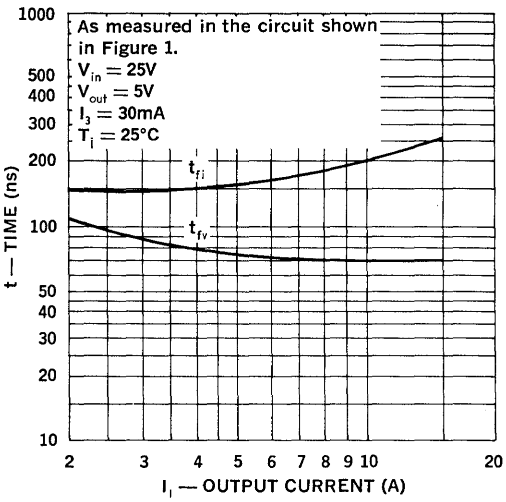
Diode Forward Characteristics



Turn-on Time



Fall Time



RECTIFIER ASSEMBLIES
Single Phase Bridges, 25 Amp, Military Approved

JAN SPA25
JAN SPB25
JAN SPC25
JAN SPD25

FEATURES
- Qualified to MIL-S-19500/446
- Current Rating: to 25A
- PIV: from 100 to 600V
- Surge Ratings: to 150A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION
This series of military high-current single-phase bridges offer the utmost in reliability as required in military system designs. This series is assembled with diodes which have been subjected to TX type screening tests.

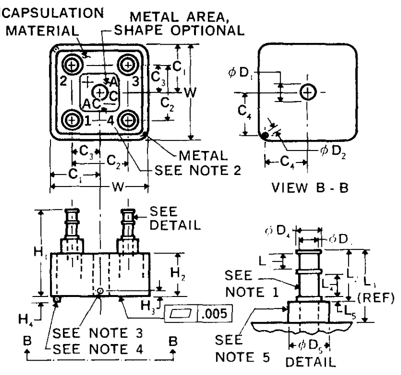
ABSOLUTE MAXIMUM RATINGS

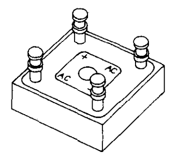
Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	
@ $T_C = 55°C$	25A
@ $T_C = 100°C$	15A
Non-Repetitive Sinusoidal Surge (8.3ms)	
@ $T_C = 55°C$	150A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	20°C/W
Junction to Case	2.5°C/W

Dimensions				
Ltr	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
C_1	.552	.572	14.02	14.53
C_2	.624	.760	15.85	19.30
C_3	.312	.380	7.92	9.65
C_4	.495	.512	12.57	13.00
ϕD_1	.189	.195	4.80	4.95
ϕD_2	.057	.067	1.45	1.70
ϕD_3	.108	.118	2.74	3.00
ϕD_4	.141	.151	3.58	3.84
ϕD_5	.225	.235	5.72	5.97
H_1	.669	1.060	17.53	26.92
H_2	.300	.500	7.62	12.70
H_3	.040	.060	1.02	1.52
H_4	.042	.062	1.07	1.57
L_1	.370	.560	9.40	14.22
L_2	.307	.365	7.80	9.27
L_3	.089	.099	2.26	2.49
L_4	.132	.142	3.35	3.61
L_5	.026	.036	.66	.91
W	1.104	1.144	28.04	29.06

MECHANICAL SPECIFICATIONS

SPA25 SPB25 SPC25 SPD25





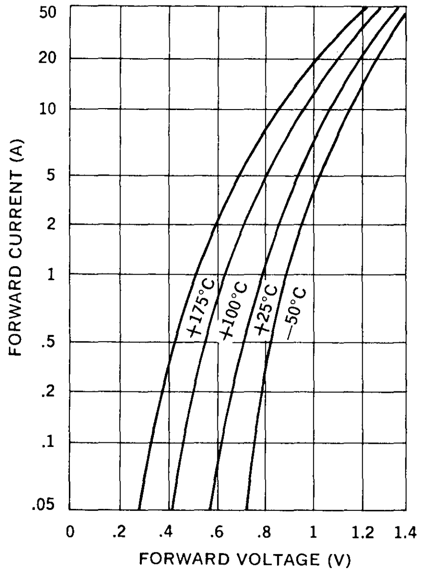
NOTES:
1. Terminals shall be hot tin dipped or silver plated.
2. Polarity shall be marked on terminal side of device.
3. Point at which T_C is read (must be in metal part of case).
4. Locating pin shall be adjacent to positive terminal.
5. Insulating sleeve shall be alumina (AL_2O_3) or equivalent.

Electrical Specifications (at 25°C unless noted)

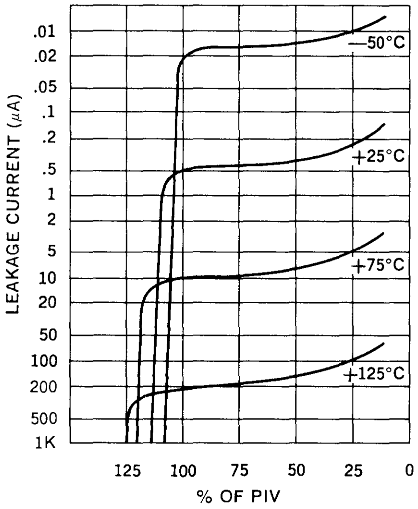
Type	PIV Per Leg	Peak Forward Voltage Drop*		Maximum Leakage Current Per Leg @ PIV	
				$T_C = 25°C$	$T_C = 150°C$
	Volts	Minimum	Maximum	µA	µA
JAN SPA25	100	0.9V @ 39A(pk)	1.4V	2	250
JAN SPB25	200				
JAN SPC25	400				
JAN SPD25	600				

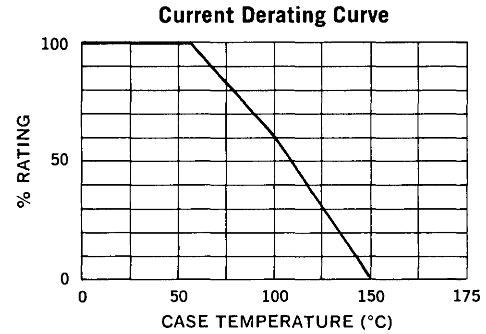
***Peak forward voltage drop is measured at a pulse width of 8.3ms.**

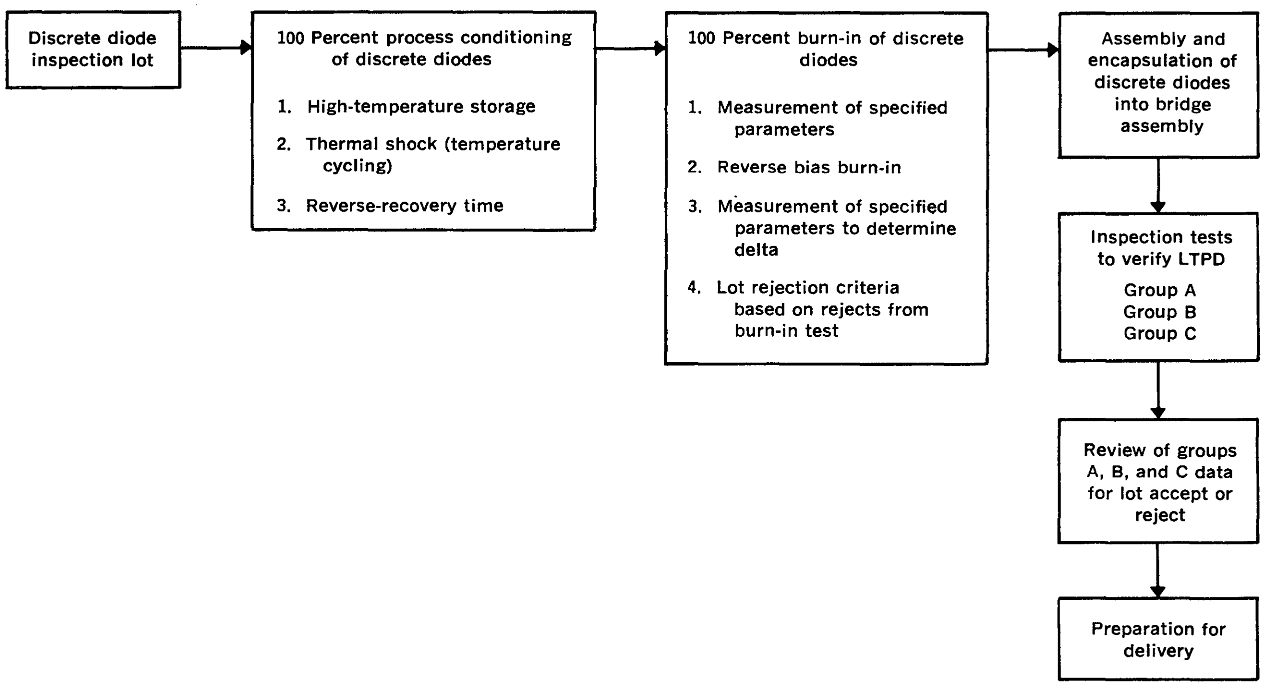
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV




Current Derating Curve



PUTs

Planar, TO-18 Hermetic

U13T1-U13T4

FEATURES

- Voltage Ratings: to 100V
- Maximum Peak Current: 150nA
- Valley Current: as low as 25 μA
- Low Forward Voltage Drop
- Nano-Amp Leakage
- Hermetically Sealed TO-18 Metal Can

DESCRIPTION

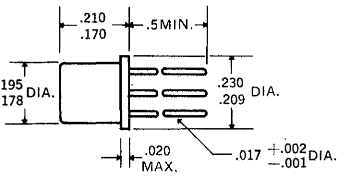
The Unitrode hermetically sealed TO-18 metal can series of programmable unijunction transistors feature blocking voltages to 100V, the highest available to designers. These PUTs are functionally equivalent to standard unijunction transistors, with the added advantages of programming versatility. External resistors can be added to program η, R_{BB}, I_p and I_v, depending upon your design requirements. All units are fully planar passivated. This series features a hermetically sealed TO-18 package for optimum reliability in all environmental conditions. Applications include pulse and timing circuits, SCR trigger circuits, relaxation oscillators, and sensing circuits. For further application information see Unitrode's Application Note U-66.

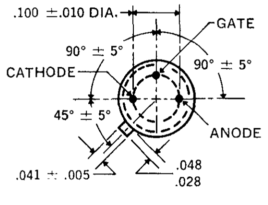
ABSOLUTE MAXIMUM RATINGS

	U13T1 U13T2	U13T3 U13T4
Anode-to-Cathode Forward Voltage, V_{AK}	40V	100V
Anode-to-Cathode Reverse Voltage, V_{AKR}	40V	100V
Gate-to-Cathode Forward Voltage, V_{GK}	40V	100V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V	100V
Gate-to-Cathode Reverse Voltage, V_{GKR}	5V	5V
Peak Recurrent Forward Current		
10 μs 1% Duty Cycle	8A	8A
100 μs 1% Duty Cycle	5A	5A
Power Dissipation		
25°C Ambient	400mW	400mW
Derating Factor	3.2mW/°C	3.2mW/°C
Storage Temperature Range		−55°C to +150°C
Operating Temperature Range		−55°C to +150°C

MECHANICAL SPECIFICATIONS

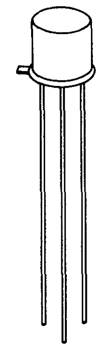
U13T1-U13T4





Dimensions in inches.

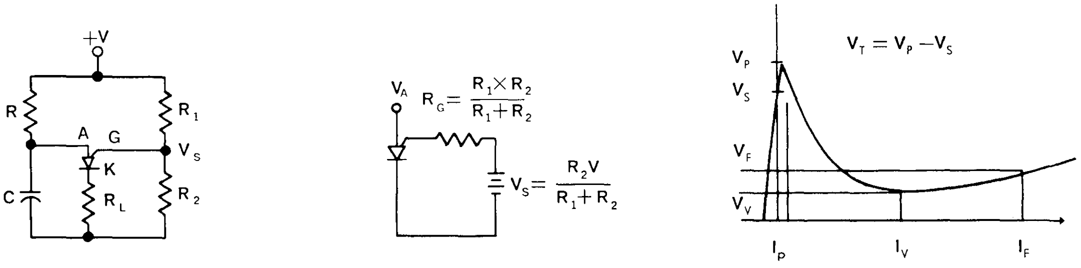
TO-18



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Fig.	U13T1, 3 Min.	U13T1, 3 Max.	U13T2, 4 Min.	U13T2, 4 Max.	Units	Test Conditions
Peak Current	I_P	1	— —	5 2	— —	1.0 0.15	µA µA	$R_G = 10k, V_s = 10V$ $R_G = 1$ Meg.
Valley Current	I_V	1	70 —	— 50	25 —	— 25	µA µA	$R_G = 10k, V_s = 10V$ $R_G = 1$ Meg.
Offset Voltage	V_T	1	0.2 0.2	0.6 1.6	0.2 0.2	0.6 0.6	V V	$R_G = 10k, V_s = 10V$ $R_G = 1$ Meg.
Gate-to-Anode Leakage	I_{GAO}	2	— —	10 100	— —	10 100	nA nA	$T = 25°C, V_s =$ rating $T = 75°C$
Gate-to-Cathode Leakage	I_{GKS}	3	—	100	—	100	nA	$V_s =$ rating
Forward Voltage	V_F	4	—	1.5	—	1.5	V	$I_F = 50mA$
Pulse Output Voltage	V_o	5	6	—	6	—	V	
Pulse Output Rate of Rise	t_r	5	—	80	—	80	ns	



a) Typical Circuit b) Equivalent Test Circuit c) Characteristic Curve

Figure 1

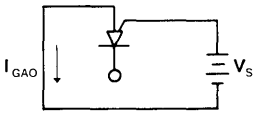


Figure 2

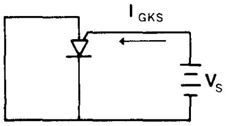


Figure 3

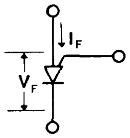


Figure 4

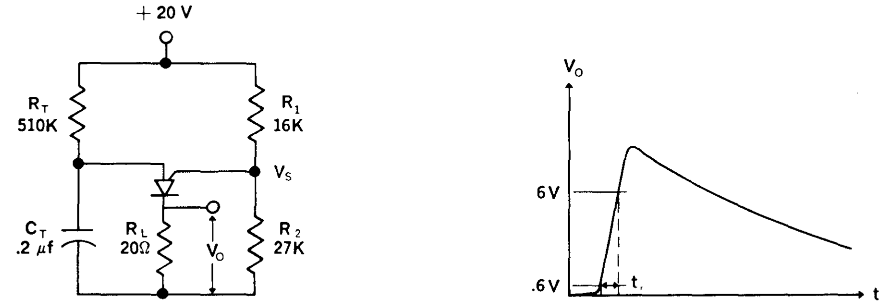


Figure 5

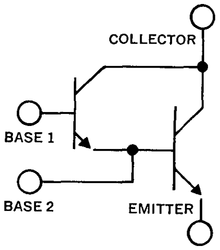
POWER DARLINGTONS

10 Amp, 150V, Planar NPN

U2T101
U2T105
U2T201
U2T205

FEATURES

- High Current Gain: up to 2000 min @ $I_C = 5A$
- Low Saturation Voltage: as low as 1.5V max @ $I_C = 5A$
- High Voltage: up to 150V min V_{CER}
- Monolithic Design Incorporating Multiple-Emitter Techniques
- Triple-Diffused Planar Construction



DESCRIPTION

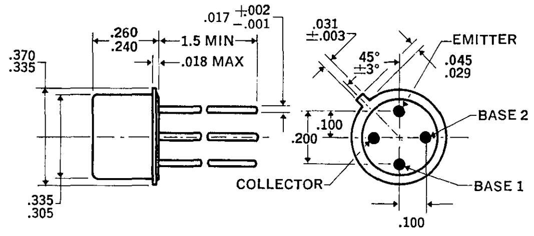
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	TO-33		3 PIN TO-66	
	U2T101	**U2T105**	**U2T201**	**U2T205**
Collector-Emitter Voltage	80V	150V	80V	150V
Emitter Base Voltages,				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	5A	5A	5A	5A
Peak Collector Current	10A	10A	10A	10A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2.5W	2.5W
100°C Case	5W	5W	25W	25W
Thermal Resistance, Junction to Case	20°C/W		4°C/W	
Operating and Storage Temperature Range	—65°C to 200°C		—65°C to 200°C	

MECHANICAL SPECIFICATIONS

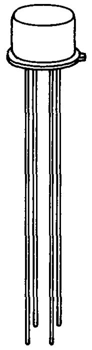
U2T101 U2T105



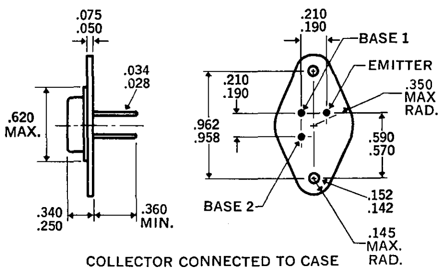
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO33



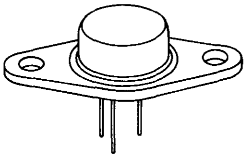
U2T201 U2T205



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 Pin TO-66

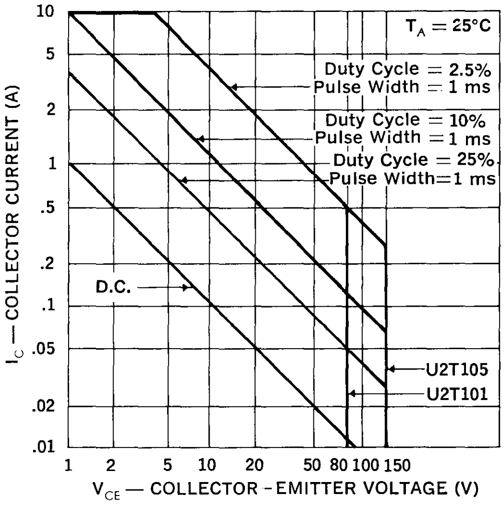


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

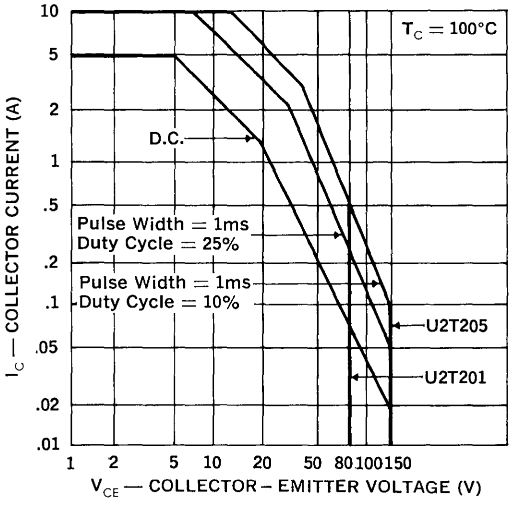
Test	Symbol	U2T101 & U2T201 Min.	U2T101 & U2T201 Max.	U2T105 & U2T205 Min.	U2T105 & U2T205 Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	2000	—	1000	—	—	$I_C = 1.0A, V_{CE} = 2V, R_{B2E} = 1K$
D.C. Current Gain (Note 1)	h_{FE}	2000	—	1000	—	—	$I_C = 5A, V_{CE} = 5V, R_{B2E} = 100$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	—	2.5	V	$I_C = 5A, R_{B2E} = 100$ U2T101, 201: $I_{B1} = 5mA$ U2T105, 205: $I_{B1} = 10mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}	80	—	150	—	V	$I_C = 25mA, R_{B1E} = 2.2K, R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	μA	$R_{B1E} = 2.2K, R_{B2E} = 100$ U2T101, 201: $V_{CE} = 80V$ U2T105, 205: $V_{CE} = 150V$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	mA	$R_{B1E} = 2.2K, R_{B2E} = 100, T = 150°C$ U2T101, 201: $V_{CE} = 80V$ U2T105, 205: $V_{CE} = 150V$
Collector Capacitance	C_{obo}	—	100	—	100	pf	$V_{CB1} = 10, I_E = 0, f = 1MHz$
A.C. Current Gain	h_{fe}	5	—	5	—	—	$I_C = 1.0A, V_{CE} = 10V, f = 10MHz, R_{B2E} = 100$
Switching Speeds Delay Time	t_d	100 Typ.		100 Typ.		ns	$V_{CC} = 30V$, $I_C = 5A$, U2T101, 201: I_B (on) = I_B (off) = 5mA, U2T105, 205: I_B (on) = I_B (off) = 10mA, $R_{B2E} = 100$
Rise Time	t_r	300 Typ.		400 Typ.		ns	
Storage Time	t_s	600 Typ.		500 Typ.		ns	
Fall Time	t_f	500 Typ.		500 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

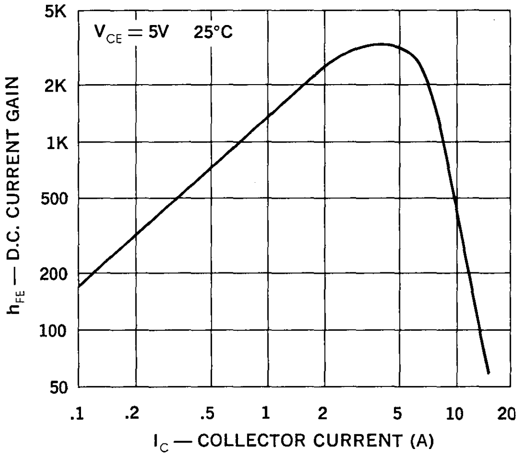
Maximum Safe Operating Area
U2T101 & 105



Maximum Safe Operating Area
U2T201 & 205



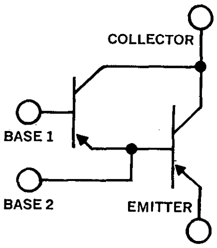
D.C. Current Gain vs. Collector Current
U2T201



POWER DARLINGTONS

10 Amp, 120V, Planar PNP

U2T151
U2T155
U2T251
U2T255



FEATURES

- High Current Gain: up to 1000 min. @ $I_C = 1A$
- Peak Current: to 10A
- Monolithic Planar Chip Construction

DESCRIPTION

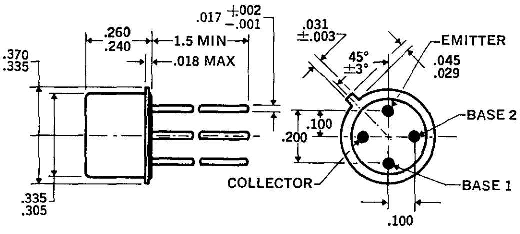
Unitrode-PNP Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	TO-33		3 PIN TO-66	
	U2T151	U2T155	U2T251	U2T255
Collector — Emitter Voltage	80V	120V	80V	120V
Emitter — Base Voltages				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	5A	5A	5A	5A
Peak Collector Current	10A	10A	10A	10A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2.5W	2.5W
100°C Case	5W	5W	25W	25W
Thermal Resistance				
Junction-to-Case	20°C/W		4°C/W	
Operating and Storage Temperature Range	—65°C to +200°C		—65°C to +200°C	

MECHANICAL SPECIFICATIONS

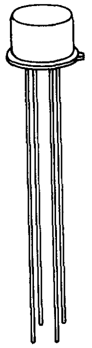
U2T151 U2T155



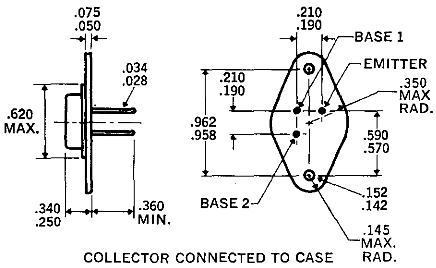
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO-33



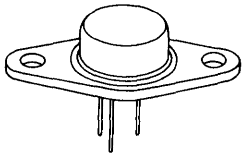
U2T251 U2T255



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-66



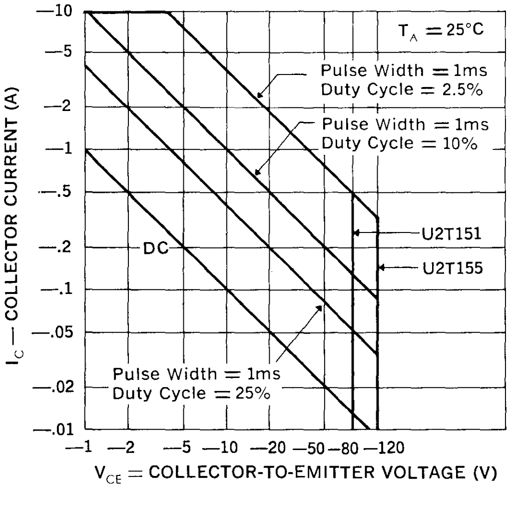
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

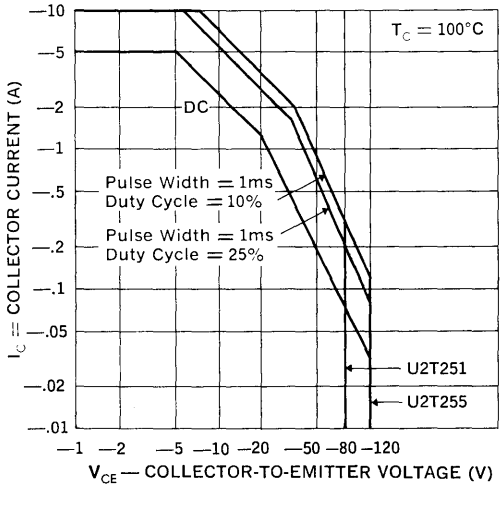
Test	Symbol	U2T151 & U2T251 Min.	Max.	U2T155 & U2T255 Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	2000	—	1000	—	—	$I_C = -1A, V_{CE} = -2V, R_{B2E} = 1K$
D.C. Current Gain (Note 1)	h_{FE}	1500	—	1000	—	—	$I_C = -5A, V_{CE} = -5V, R_{B2E} = 100$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	—2.5	—	—3.0	V	$I_C = -5A, R_{B2E} = 100, I_{B1} = -10mA$
Collector — Emitter Breakdown Voltage (Note 1)	BV_{CER}	—80	—	—120	—	V	$I_C = -25mA, R_{B1E} = 2.2K, R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	—1.0	—	—1.0	μA	$R_{B1E} = 2.2K, R_{B2E} = 100$ U2T151,251: $V_{CE} = -80V$ U2T155,255: $V_{CE} = -120V$
Collector Cutoff Current	I_{CER}	—	—1.0	—	—1.0	mA	$R_{B1E} = 2.2K, R_{B2E} = 100, T = 150°C$ U2T151,251: $V_{CE} = -80V$ U2T155,255: $V_{CE} = -150V$
Collector Capacitance	C_{obo}	—	100	—	100	pf	$V_{CB1} = -10V, I_E = 0, f = 1MHz$
A. C. Current Gain	h_{fe}	5	—	5	—	—	$I_C = -1A, V_{CE} = -10V, f = 10MHz$ $R_{B2E} = 100$
Delay Time	t_d	100 Typ.		100 Typ.		ns	$V_{CC} = -30V$
Rise Time	t_r	200 Typ.		250 Typ.		ns	$I_C = -5A$
Storage Time	t_s	500 Typ.		400 Typ.		ns	U2T151, 251: $I_B(on) = I_B(off) = -5mA$ U2T155, 255: $I_B(on) = I_B(off) = -10mA$
Fall Time	t_f	400 Typ.		400 Typ.		ns	$R_{B2E} = 100$

Note 1: Pulse width = 300 μs ; duty cycle ⩽ 2%.

Maximum Safe Operating Area
U2T151 & 155



Maximum Safe Operating Area
U2T251 & 255



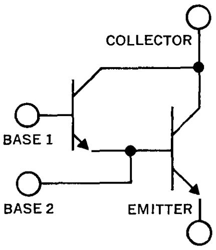
POWER DARLINGTONS

5 Amp, 150V, Planar NPN

U2T301	U2T401
U2T302	U2T402
U2T303	U2T403
U2T304	U2T404
U2T305	U2T405

FEATURES

- High Current Gain: 1000 min. @ $I_C = 2A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 2A$
- High Voltage: up to 150V min. V_{CER}
- Monolithic Design Incorporating Multiple-Emitter Techniques
- Triple-Diffused Planar Construction



DESCRIPTION

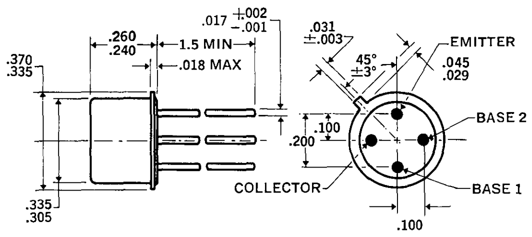
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	TO-33		3 PIN TO-66	
	U2T301	U2T305	U2T401	U2T405
Collector-Emitter Voltage	60V	150V	60V	150V
Emitter Base Voltages,				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	2A	2A	2A	2A
Peak Collector Current	5A	5A	5A	5A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2W	2W
100°C Case	4W	4W	16W	16W
Thermal Resistance				
Junction to Case	25°C/W		6°C/W	
Operating and Storage Temperature Range	−65°C to 200°C		−65°C to 200°C	

MECHANICAL SPECIFICATIONS

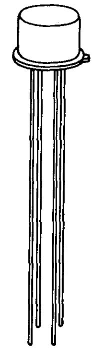
U2T301 U2T305



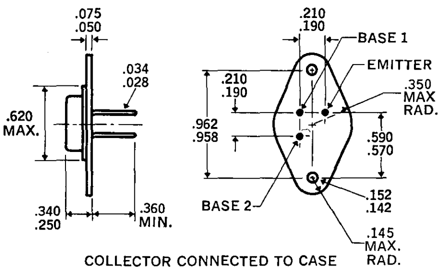
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO-33



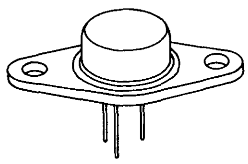
U2T401 U2T405



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 Pin TO-66



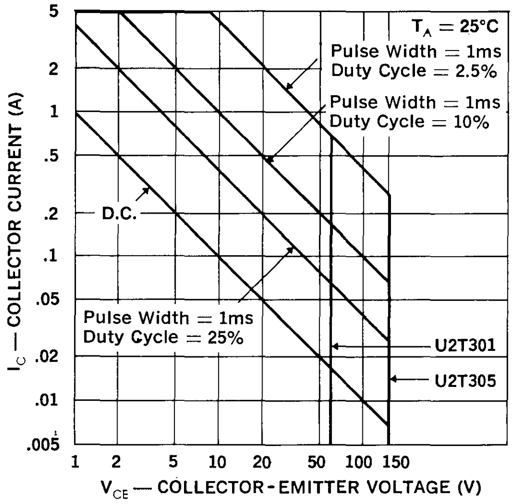
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

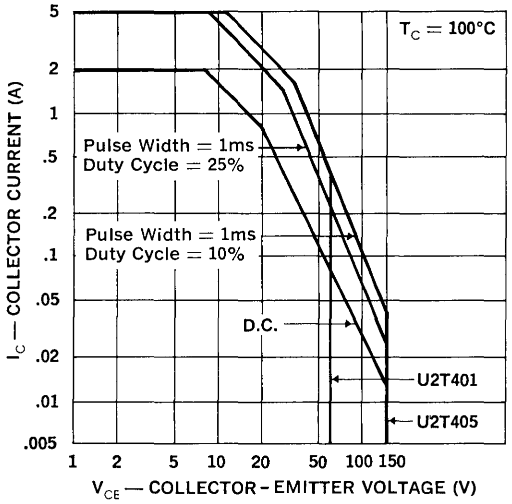
Test	Symbol	U2T301 & U2T401 Min.	Max.	U2T305 & U2T405 Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	1000	10,000	1000	10,000	—	$I_C = 1A, V_{CE} = 2V, R_{B2E} = 100$
D.C. Current Gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 2A, V_{CE} = 5V, R_{B2E} = 100$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	—	2.5	V	$I_C = 2A, R_{B2E} = 100, I_{B1} = 4mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}	60	—	150	—	V	$I_C = 25mA, R_{B1E} = 2.2K, R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	μA	$R_{B1E} = 2.2K, R_{B2E} = 100$ U2T301, 401: $V_{CE} = 60V$ U2T305, 405: $V_{CE} = 150V$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	mA	$R_{B1E} = 2.2K, R_{B2E} = 100, T = 150°C$ U2T301, 401: $V_{CE} = 60V$ U2T305, 405: $V_{CE} = 150V$
Collector Capacitance	C_{obo}	—	60	—	60	pf	$V_{CB1} = 10V, I_E = 0, f = 1MHz$
A.C. Current Gain	h_{fe}	5	—	5	—	—	$I_C = 0.5A, V_{CE} = 10V, f = 10MHz, R_{B2E} = 100$
Switching Speeds Delay Time	t_d	100 Typ.		100 Typ.		ns	
Rise Time	t_r	200 Typ.		300 Typ.		ns	$V_{CC} = 30V, I_C = 2A, I_B$ (on) $= I_B$ (off) $= 4mA$
Storage Time	t_s	800 Typ.		800 Typ.		ns	
Fall Time	t_f	300 Typ.		300 Typ.		ns	$R_{B2E} = 100$

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

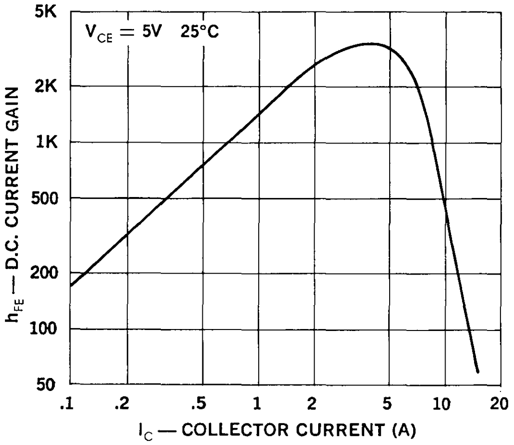
Maximum Safe Operating Area U2T301 & 305



Maximum Safe Operating Area U2T401 & 405



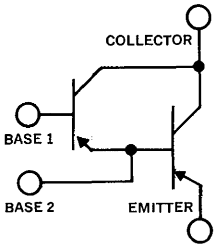
D.C. Current Gain vs. Collector Current U2T301



POWER DARLINGTONS
5 Amp, 120V, Planar PNP

U2T351
U2T355
U2T451
U2T455

FEATURES
- High Current Gain: up to 1000 min. @ $I_C = 2A$
- Peak Current: to 5A
- Monolithic Planar Chip Construction



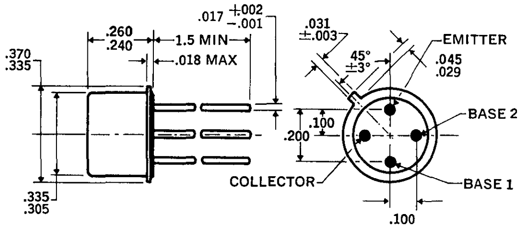
DESCRIPTION
Unitrode PNP Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	TO-33		3 PIN TO-66	
	U2T351	U2T355	U2T451	U2T455
Collector — Emitter Voltage	60V	120V	60V	120V
Emitter — Base Voltages				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	2A	2A	2A	2A
Peak Collector Current	5A	5A	5A	5A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2W	2W
100°C Case	4W	4W	16W	16W
Thermal Resistance				
Junction-to-Case	25°C/W		6°C/W	
Operating and Storage Temperature Range	—65°C to 200°C		—65°C to 200°C	

MECHANICAL SPECIFICATIONS

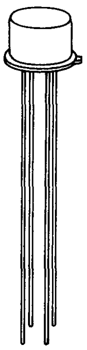
U2T351 & U2T355



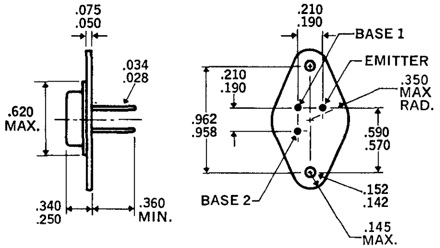
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO-33



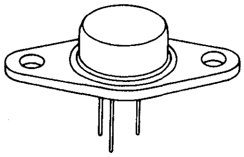
U2T451 & U2T455



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-66



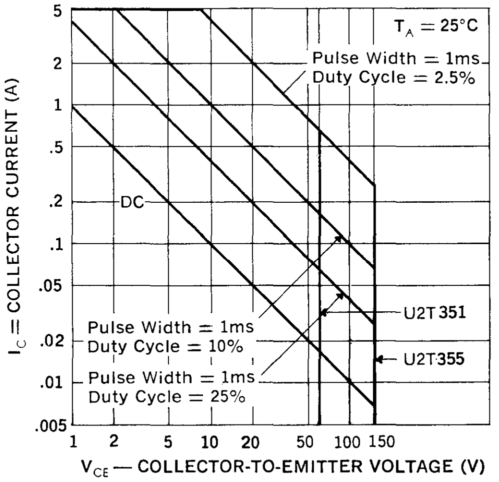
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

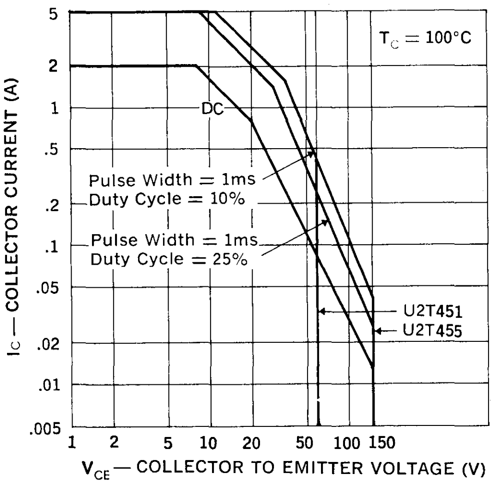
Test	Symbol	U2T351 & U2T451 Min.	Max.	U2T355 & U2T455 Min.	Max.	Units	Test Conditions
D.C. Current gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 1A, V_{CE} = 2V, R_{B2E} = 1K$
D.C. Current gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 2A, V_{CE} = 5V, R_{B2E} = 100$
Collector saturation voltage (Note 1)	$V_{CE}(sat)$	—	1.5	—	2.5	V	$I_C = 2A, R_{B2E} = 100, I_{B1} = 4mA$
Collector-Emitter breakdown voltage (Note 1)	BV_{CER}	60	—	120	—	V	$I_C = 25mA, R_{B1E} = 2.2K, R_{B2E} = 100$
Collector cutoff current	I_{CER}	—	1.0	—	1.0	μA	$R_{B1E} = 2.2K, R_{B2E} = 100$ U2T301, 401: $V_{CE} = 60V$ U2T305, 405: $V_{CE} = 150V$
Collector cutoff current	I_{CER}	—	1.0	—	1.0	mA	$R_{B1E} = 2.2K, R_{B2E} = 100, T = 150°C$ U2T301, 401: $V_{CE} = 60V$ U2T305, 405: $V_{CE} = 150V$
Collector capacitance	C_{obo}	—	60	—	60	pf	$V_{CB1} = 10V, I_E = 0, f = 1MHz$
A.C. current gain	h_{fe}	5	—	5	—	—	$I_C = 0.5A, V_{CE} = 10V, f = 10MHz$ $R_{B2E} = 100$
Delay time	t_d	100 Typ.		100 Typ.		ns	$V_{CC} = 30V$
Rise time	t_r	200 Typ.		300 Typ.		ns	$I_C = 2A$
Storage time	t_s	800 Typ.		800 Typ.		ns	$I_B(on) = I_B(off) = 4mA$
Fall time	t_f	300 Typ.		300 Typ.		ns	$R_{B2E} = 100$

Note 1: Pulse width = 300μs; duty cycle ⩽ 2%.

Maximum Safe Operating Area
U2T351 & 355



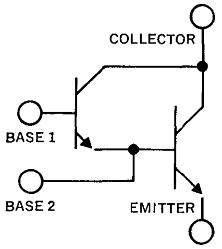
Maximum Safe Operating Area
U2T451 & 455



POWER DARLINGTONS

20 Amp, 150V, Planar NPN

U2T501
U2T505
U2T601
U2T605



FEATURES

- High Current Gain: up to 2000 min. @ $I_C = 10A$
- Low Saturation Voltage: as low as 2.0V max. @ $I_C = 10A$
- High Voltage: up to 150V min. V_{CER}
- Monolithic Design Incorporating Multiple-Emitter Techniques
- Triple-Diffused Planar Construction

DESCRIPTION

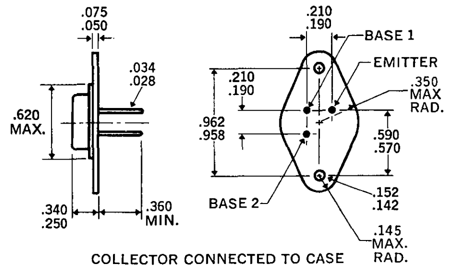
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	3 PIN TO-66		3 PIN TO-3	
	U2T501	U2T505	U2T601	U2T605
Collector-Emitter Voltage	80V	150V	80V	150V
Emitter Base Voltages,				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	10A	10A	10A	10A
Peak Collector Current	20A	20A	20A	20A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	2.5W	2.5W	3.5W	3.5W
100°C Case	30W	30W	50W	50W
Thermal Resistance				
Junction to Case	3.3°C/W		2°C/W	
Operating and Storage Temperature Range	—65°C to 200°C		—65°C to 200°C	

MECHANICAL SPECIFICATIONS

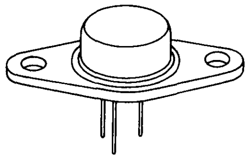
U2T501 U2T505



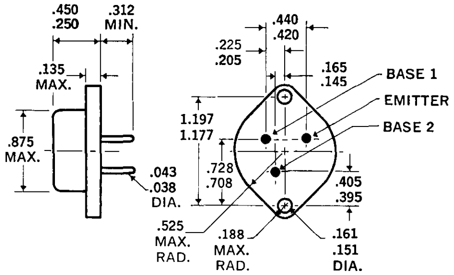
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 Pin TO-66



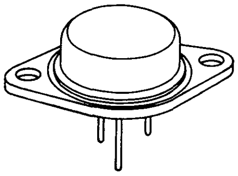
U2T601 U2T605



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 Pin TO-3

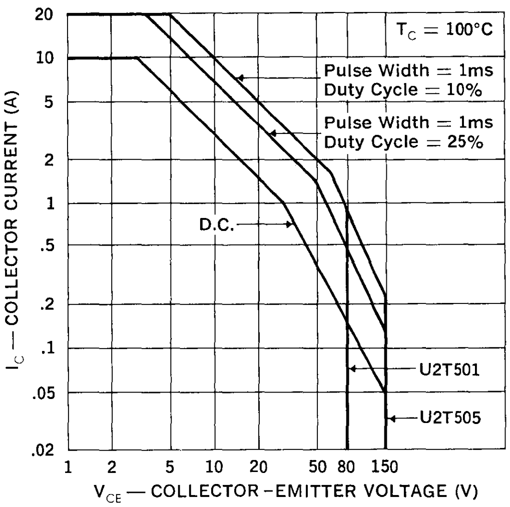


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

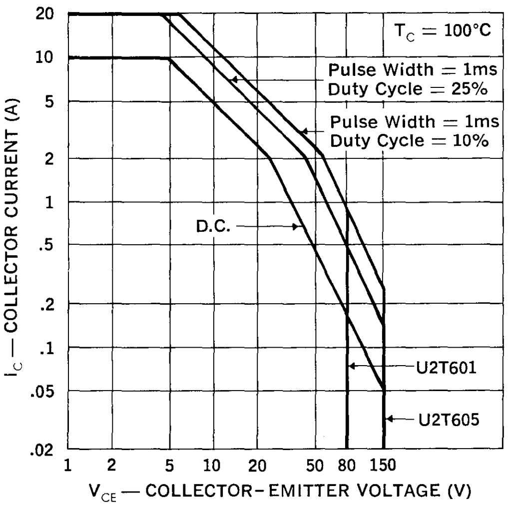
Test	Symbol	U2T501 & U2T601 Min.	U2T501 & U2T601 Max.	U2T505 & U2T605 Min.	U2T505 & U2T605 Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	2000	—	1000	—	—	$I_C = 5A, V_{CE} = 2V, R_{B2E} = 100$
D.C. Current Gain (Note 1)	h_{FE}	2000	10,000	1000	10,000	—	$I_C = 10A, V_{CE} = 5V, R_{B2E} = 100$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	2.0	—	2.5	V	$I_C = 10A, R_{B2E} = 100, I_{B1} = 20mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}	80	—	150	—	V	$I_C = 25mA, R_{B1E} = 22K, R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	μA	$R_{B1E} = 2.2K, R_{B2E} = 100$ U2T501, 601: $V_{CE} = 80V$ U2T505, 605: $V_{CE} = 150V$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	mA	$R_{B1E} = 2.2K, R_{B2E} = 100, T = 150°C$ U2T501, 601: $V_{CE} = 80V$ U2T505, 605: $V_{CE} = 150V$
Collector Capacitance	C_{obo}	—	200	—	200	pf	$V_{CB1} = 10V, I_E = 0, f = 1MHz$
A.C. Current Gain	h_{fe}	5	—	5	—	—	$I_C = 5A, V_{CE} = 10V, f = 10MHz, R_{B2E} = 100$
Switching Speeds Delay Time	t_d	100 Typ.		100 Typ.		ns	$V_{CC} = 30V, I_C = 10A, I_B (on) = I_B (off) = 20mA$
Rise Time	t_r	300 Typ.		400 Typ.		ns	
Storage Time	t_s	600 Typ.		500 Typ.		ns	
Fall Time	t_f	500 Typ.		500 Typ.		ns	$R_{B2E} = 100$

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

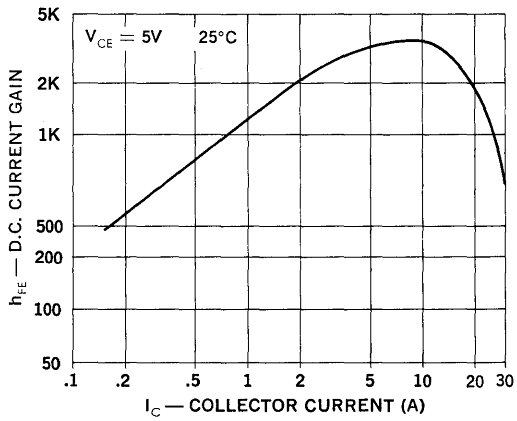
Maximum Safe Operating Area U2T501 & 505



Maximum Safe Operating Area U2T601 & 605



D.C. Current Gain vs. Collector Current U2T501



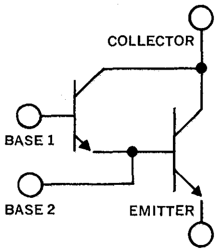
POWER DARLINGTONS

2 Amp, 300V, Planar NPN

U2T712
U2T713
U2T722
U2T723

FEATURES

- High Current Gain: up to 1000 min. @ $I_C = 1A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 2A$
- High Voltage: up to 300V. min. V_{CEO}
- Peak Current: to 5A
- Monolithic Planar Chip Construction



DESCRIPTION

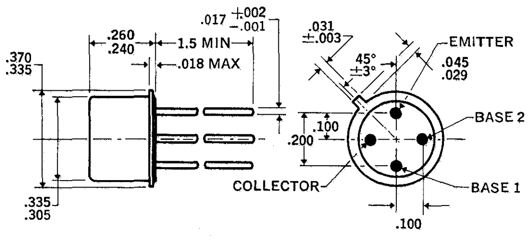
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	TO-33		3 PIN TO-66	
	U2T712	U2T713	U2T722	U2T723
Collector — Emitter Voltage	200V	300V	200V	300V
Emitter — Base Voltages				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	2A	2A	2A	2A
Peak Collector Current	5A	5A	5A	5A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2W	2W
100°C Case	5W	5W	20W	20W
Thermal Resistance				
Junction-to-Case	20°C/W		5°C/W	
Operating and Storage Temperature Range	−65°C to 200°C		−65°C to 200°C	

MECHANICAL SPECIFICATIONS

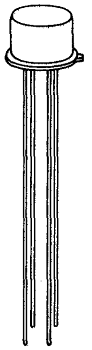
U2T712 U2T713



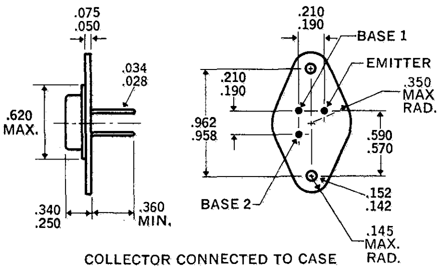
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO-33



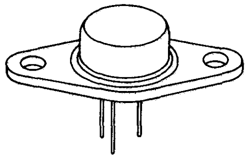
U2T722 U2T723



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-66

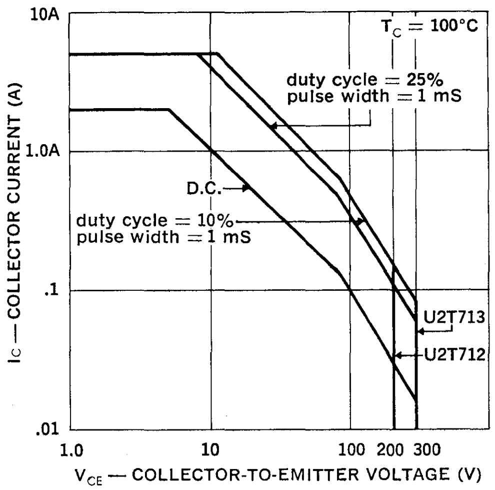


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

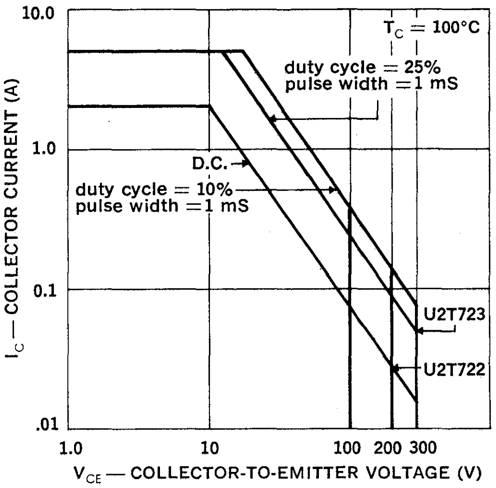
Test	Symbol	U2T712 & 722 Min.	U2T712 & 722 Max.	U2T713 & 723 Min.	U2T713 & 723 Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 1A$, $V_{CE} = 5V$, $R_{B2E} = 1K$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	—	1.5	V	$I_C = 2A$, $R_{B2E} = 100$, $I_{BI} = 20mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}	200	—	300	—	V	$I_C = 10mA$
	BV_{CER}	250 Typ.	—	350 Typ.	—	V	$I_C = 10mA$, $R_{BIE} = 2.2K$, $R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	10.0	—	10.0	µA	$R_{BIE} = 2.2K$, $R_{B2E} = 100$ U2T712 & 722: $V_{CE} = 200$ U2T713 & 723: $V_{CE} = 300$
Collector Capacitance	C_{obo}	—	100	—	100	pf	$V_{CBI} = 10V$, $I_E = 0$, f = 1mHz
A.C. Current Gain	h_{fe}	4.0 Typ.	—	4.0 Typ.	—	—	$I_C = 0.5A$, $V_{CE} = 10V$, f = 20mHz, $R_{B2E} = 100$
Rise Time Storage Time Fall Time	t_r t_s t_f	0.6 Typ. 1.5 Typ. 1.0 Typ.		0.6 Typ. 1.5 Typ. 1.0 Typ.		µS µS µS	$V_{CC} = 100V$, I_B (on) = I_B (off) = 25mA, $I_C = 2A$, $R_{B2E} = 100$

Note 1. Pulse width = 300 µS; duty cycle ⩽ 2%

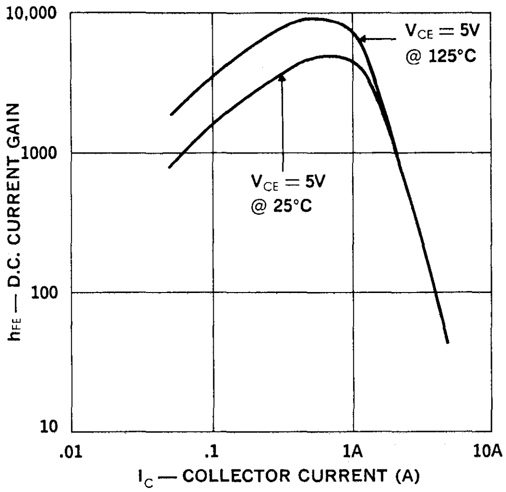
Maximum Safe Operating Area U2T712 & 713



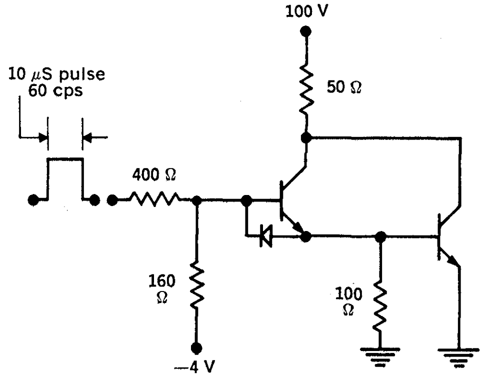
Maximum Safe Operating Area U2T722 & 723



D. C. Current Gain vs. Collector Current U2T712, 713, 722 & 723



Switching Speed Circuit



I_B(on) = I_B(off) = 25mA
I_C = 2A

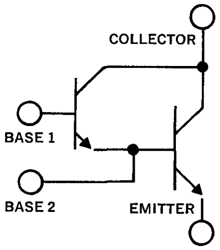
POWER DARLINGTONS

5 Amp, 300 V, Planar NPN

U2T822
U2T823
U2T832
U2T833

FEATURES

- High Current Gain: up to 1000 min. @ $I_C = 3A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 5A$
- High Voltage: up to 300V. min. V_{CEO}
- Peak Current: to 10A
- Monolithic Planar Chip Construction



DESCRIPTION

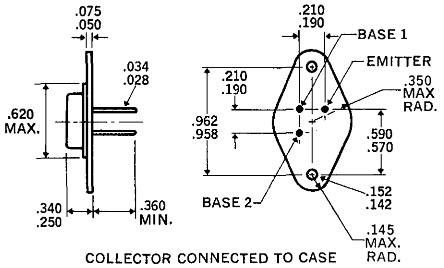
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	3 PIN TO-66		3 PIN TO-3	
	U2T822	U2T823	U2T832	U2T833
Collector — Emitter Voltage	200V	300V	200V	300V
Emitter — Base Voltages				
V_{EB2}	6V	6V	6V	6V
V_{EBI}	12V	12V	12V	12V
D.C. Collector Current	5A	5A	5A	5A
Peak Collector Current	10A	10A	10A	10A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	2.5W	2.5W	3.5W	3.5W
100°C Case	35W	35W	60W	60W
Thermal Resistance				
Junction-to-Case	2.9°C/W		1.7°C/W	
Operating and Storage Temperature Range	−65°C to 200°C		−65°C to 200°C	

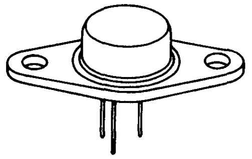
MECHANICAL SPECIFICATIONS

U2T822 & 823

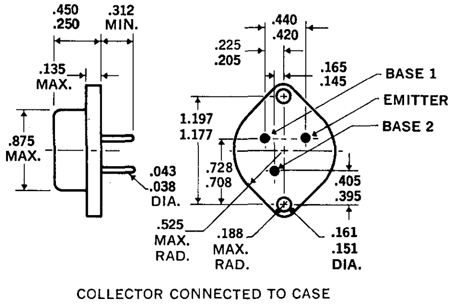


Dimensions in inches.

3 PIN TO-66



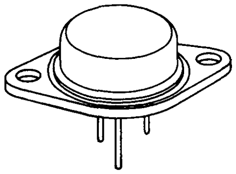
U2T832 & 833



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-3

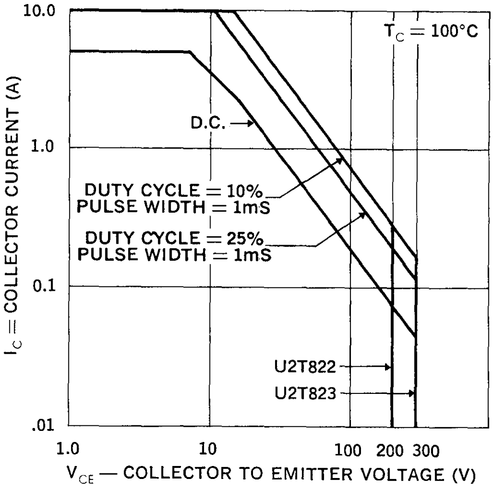


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

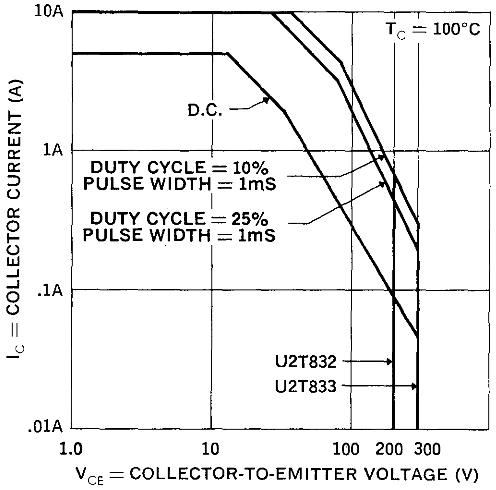
Test	Symbol	U2T822 & 832 Min.	Max.	U2T823 & 833 Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 3A, V_{CE} = 5V, R_{B2E} = 100$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	1.5	—	1.5	V	$I_C = 5A, R_{B2E} = 100, I_{B1} = 50mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO} BV_{CER}	200 250 Typ.	— —	300 350 Typ.	— —	V V	$I_C = 10mA$ $I_C = 10mA, R_{B1E} = 22K, R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	10	—	10	μA	$R_{B1E} = 2.2K, R_{B2E} = 100$ U2T 822 & 832 : $V_{CE} = 200V$ U2T 823 & 833 : $V_{CE} = 300V$
Collector Capacitance	C_{obo}	—	200	—	200	pf	$V_{CB1} = 10V, I_E = 0, f = 1mHz$
A.C. Current Gain	h_{fe}	4.0 Typ.	—	4 Typ.		—	$I_C = 5A, V_{CE} = 10V, f = 20mHz, R_{B2E} = 100$
Rise Time Storage Time Fall Time	t_r t_s t_f	0.6 Typ. 2.0 Typ. 1.0 Typ.		0.6 Typ. 2.0 Typ. 1.0 Typ.		μs μs μs	$V_{CC} = 100V, I_C = 5A, I_B (on) = I_B (off) = 50mA, R_{B2E} = 100$

Note 1: Pulse width = 300 μS; duty cycle $\leqslant$ 2%.

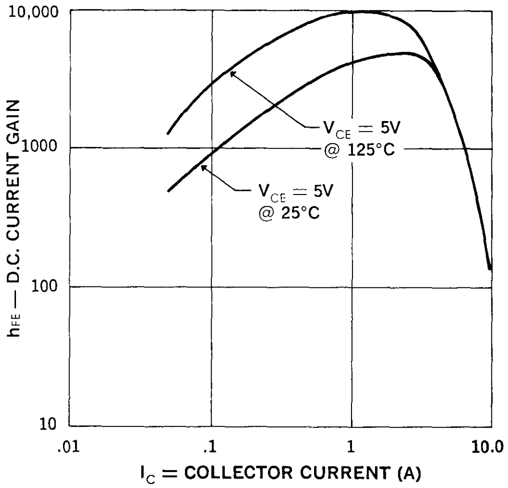
Maximum Safe Operating Area
U2T822 & 823



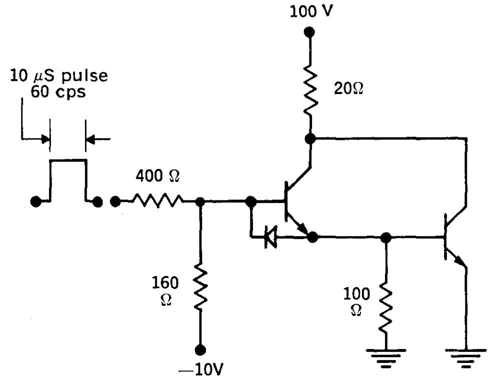
Maximum Safe Operating Area
U2T832 & 833



D.C. Current Gain vs. Collector Current
U2T822, 823, 832 & 833



Switching Speed Circuit



I_B (on) = I_B (off) = 50mA
I_C = 5A

RECTIFIER ASSEMBLIES
High Voltage Doorbell® Modules, Standard and Fast Recovery

UDA, UDB, UDC, UDD, UDE, UDF SERIES

FEATURES
- PIV: from 2.5kV to 15kV
- Stackable to 600kV
- Current Ratings: to 7.7A
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used
- Recovery Time: to 500ns
- Modular Package For Easy Stacking

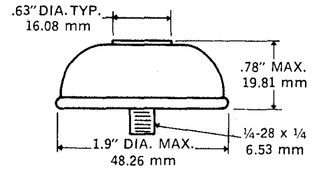
DESCRIPTION
This series of high-voltage, high-current stacks that incorporate a unique modular design makes it ideally suited for high power applications such as in radar systems as charger, hold-off and clipper diodes.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	
UDA, UDC Series	5kV to 15kV
UDB, UDD Series	2.5kV to 7.5kV
UDE, UDF Series	2.5kV to 5kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C

MECHANICAL SPECIFICATIONS

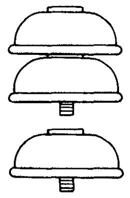
UDA, UDB, UDC, UDD, UDE, UDF SERIES



1 Polarity — Cathode connected to base.
2. Part Number — On base of unit.

Typical Weight — 60 grams

Dimensions in inches.



Doorbell® is a registered trademark of Unitrode Corporation

UNITRODE

Electrical Specifications (at 25°C unless noted) **Maximum Ratings**

Type		PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV	Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current			Non-Repetitive Sinusoidal Surge† (8.3ms) $T_C = 100°C$	Maximum Reverse Transient Energy Absorption
						$T_C = 75°C$ Air	$T_C = 60°C$ Air with Extender Plate**	$T_C = 50°C$ Oil		
		kV		μA	ns	Amps	Amps	Amps	Amps	joules
Standard Recovery	UDE-2.5	2.5	5V @ 3.00A	10	—	‡ 6.00	7.00	7.70	200	8
	UDB-2.5	2.5	4V @ 1.50A	5		3.00	3.75	4.25	100	4
	UDE-5	5	10V @ 2.20A	10		‡ 4.50	5.00	5.50	200	14
	UDB-5	5	8V @ 1.00A	5		2.00	2.50	2.75	100	8
	UDA-5	5	8V @ 0.82A	2		1.65	2.00	2.20	30	1.5
	UDB-7.5	7.5	12V @ 0.70A	5		1.33	1.65	2.00	100	12
	UDA 7.5	7.5	12V @ 0.60A	2		1.25	1.55	1.75	30	2.5
	UDA-10	10	16V @ 0.50A	2		1.00	1.25	1.40	30	3
	UDA-15	15	25V @ 0.33A	2		0.67	0.80	0.90	30	5
Fast Recovery	UDF-2.5	2.5	6V @ 2.20A	10	500	4.50	5.00	5.30	150	8
	UDD-2.5	2.5	6V @ 1.20A	5		2.25	2.80	3.30	80	4
	UDF-5	5	11V @ 1.60A	10		3.30	4.00	4.40	150	14
	UDD-5	5	11V @ 0.75A	5		1.50	1.85	2.00	80	8
	UDC-5	5	10V @ 0.70A	2		1.20	1.50	1.70	25	1.5
	UDD-7.5	7.5	17V @ 0.50A	5		1.00	1.25	1.50	80	12
	UDC-7.5	7.5	15V @ 0.50A	2		0.90	1.10	1.25	25	2.5
	UDC-10	10	20V @ 0.37A	2		0.75	0.90	1.00	25	3
	UDC-15	15	30V @ 0.25A	2		0.50	0.60	0.70	25	5

*Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

**These ratings are based on using "extender plates" that provide additional surface area to radiate heat. Because of possible corona effects caused by scratches on these plates, extreme care is necessary in their handling and they are not recommended where the working voltage exceeds 7.5KV/module. They should be carefully polished prior to installation.

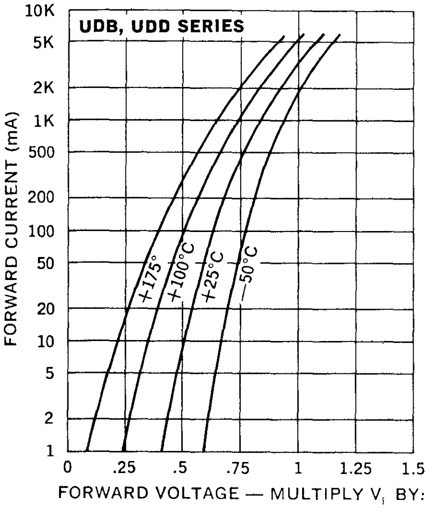
‡These ratings are based on $T_C = 100°C$.

† Forward Surge Ratings

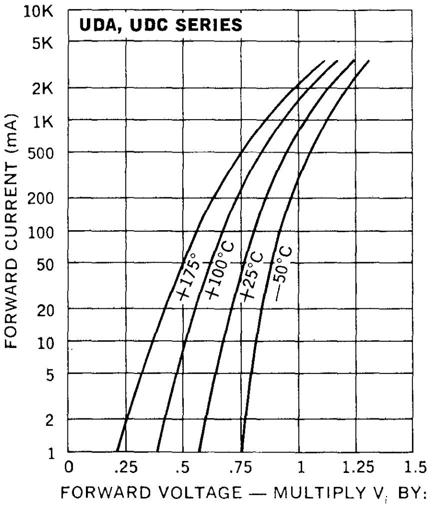
The single cycle peak surge rating for an 8.3ms sinusoidal surge is shown. For repetitive surges at 60Hz the following factors apply to the single cycle rating.

1 cycle	1.00
5 cycles	0.72
10 cycles	0.62
50 cycles	0.45
100 cycles	0.42

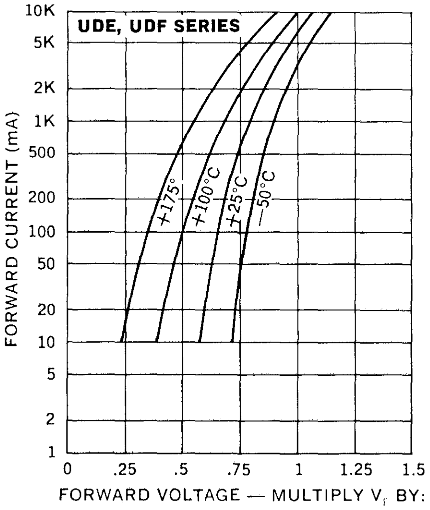
Typical Forward Voltage vs. Forward Current



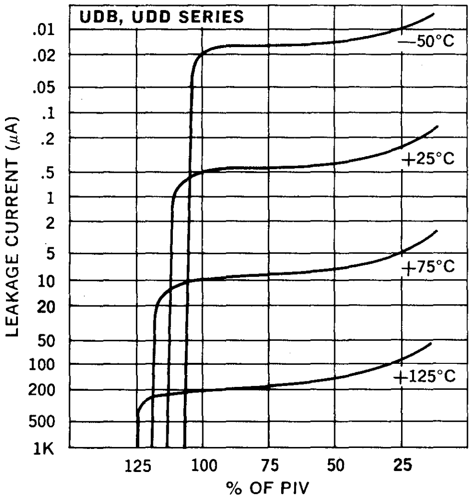
Typical Forward Voltage vs. Forward Current



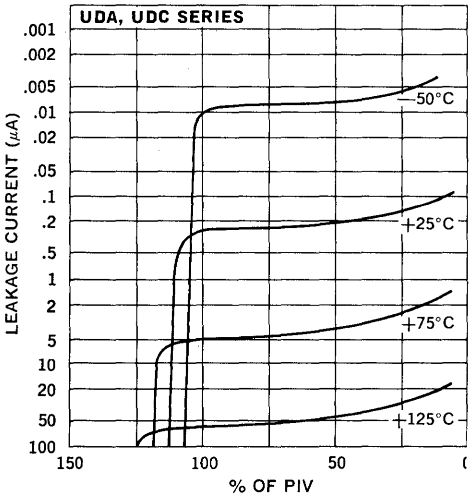
Typical Forward Voltage vs. Forward Current



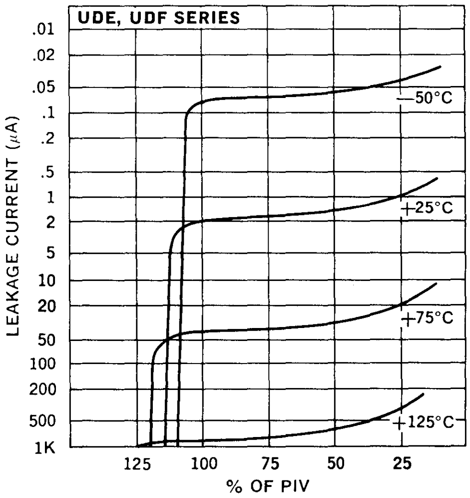
Typical Leakage Current vs. PIV



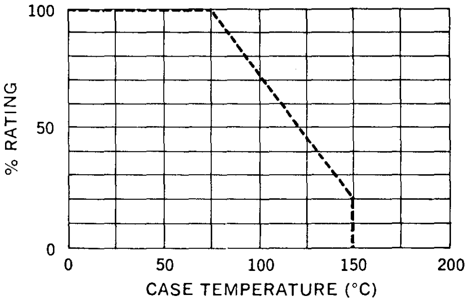
Typical Leakage Current vs. PIV



Typical Leakage Current vs. PIV

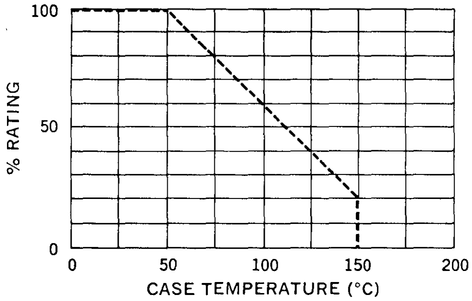


Current Derating Curve



Air Cooled

Current Derating Curve



Oil Immersed

AC POWER ZENERS
1, 3, 5, and 6 Watt Types

UDZ807 SERIES
UDZ5807 SERIES
UDZ7807 SERIES
UDZ8807 SERIES

FEATURES
- Zener Characteristics in Both Directions
- 7.5 to 300V
- High Surge Ratings
- Small Physical Size

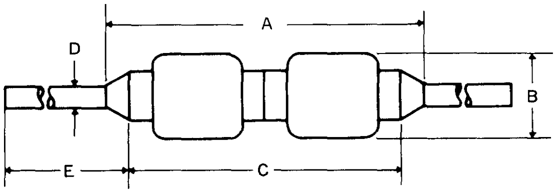
DESCRIPTION
These devices consist of two fused-in-glass zeners brazed anode-to-anode to provide zener action in both directions.

ABSOLUTE MAXIMUM RATINGS

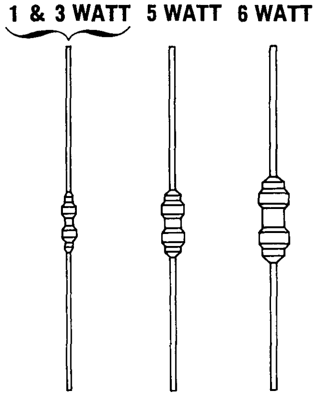
Zener Voltage	7.5 to 300V
Continuous Current	See Tables
Surge Current (8.3ms)	See Tables
Surge Power	See Graph
Power	See Data Sheets for Related Series (UZ8807, UZ807, UZ5807, and UZ7807)
Storage and Operating Temperature	—65°C to +175°C

MECHANICAL SPECIFICATIONS

UDZ807 SERIES UDZ5807 SERIES UDZ7807 SERIES UDZ8807 SERIES



MARKING: "D," followed by last 3 to 4 digits and part number. *Example: 7.5 volt ±10%, 1 watt type would be marked: "D8807".*



Dimensions

1 Watt UDZ8807 Series	3 Watt UDZ807 Series	5 Watt UDZ5807 Series	6 Watt UDZ7807 Series
A. .475″ max.	A. .450″ max.	A. .500″ max.	A. .600″ max.
B. .104″ max.	B. .085″ max.	B. .145″ max.	B. .185″ max.
C. .300″ typical	C. .275″ typical	C. .325″ typical	C. .430″ typical
D. .028″ ± .001″	D. .028″ ± .001″	D. .040″ ± .001″	D. .040″ ± .001″
E. .975″ min.	E. .700″ min.	E. .975″ min.	E. .925″ min.

Type	Electrical Specifications at 25°C						Maximum Ratings**	
	Nominal Zener Voltage† Vz @ Izt	Test Current Izt	Max. Zener Imped § Zz @ Izt	Maximum Leakage Current	@ Reverse Voltage · ±10%	±5%	Maximum Cont. Current Izm	Maximum Surge Current‡ Is
±10% Tolerance*	Volts	mA	Ohms	µA	Volts	Volts	mA	Amps
1 WATT ZENERS — Specifications apply for both directions.								
UDZ8807	7.5	34	6	50	4.9	5.2	125	5
UDZ8808	8.2	31	7	30	5.4	5.7	115	4.5
UDZ8809	9.1	28	8	10	5.9	6.2	105	3.9
UDZ8810	10	25	8.5	3	6.6	6.9	95	3.37
UDZ8812	12	23	9	1	8.6	9.1	85	2.25
UDZ8815	15	17	14	0.5	10.8	11.4	63	1.65
UDZ8818	18	14	20	0.5	12.9	13.7	52	1.12
UDZ8820	20	12.5	23	0.5	14.4	15.2	47	1.12
UDZ8824	24	10.5	25	0.5	17.3	18.2	40	0.825
UDZ8827	27	9.5	35	0.5	19.4	20.6	35	0.825
UDZ8830	30	8.5	40	0.5	21.6	22.8	31	0.825
UDZ8833	33	7.5	45	0.5	23.7	25.1	28	0.675
UDZ8836	36	7.0	50	0.5	25.9	27.4	26	0.562
UDZ8840	40	6.5	62	0.5	28.8	30.4	24	0.562
UDZ8845	45	6	75	0.5	32.4	34.2	22	0.450
UDZ8860	60	4	125	0.5	43.2	45.6	15	0.337
3 WATT ZENERS — Specifications apply for both directions.								
UDZ807	7.5	75	3	500	4.9	5.2	400	10
UDZ808	8.2	75	4	300	5.4	5.7	360	8
UDZ809	9.1	75	4	200	5.9	6.2	330	7
UDZ810	10	75	5	100	6.6	6.9	300	5
UDZ812	12	65	5	10	8.6	9.1	250	4
UDZ815	15	50	6	10	10.8	11.4	200	3
UDZ818	18	40	8	5	12.9	13.7	170	2
UDZ820	20	40	9	5	14.4	15.2	150	2
UDZ824	24	30	10	5	17.3	18.2	125	1.5
UDZ827	27	25	12	1	19.4	20.6	110	1.5
UDZ830	30	25	15	1	21.6	22.8	100	1.5
UDZ833	33	20	21	1	23.7	25.1	90	1.2
UDZ836	36	20	21	1	25.9	27.4	85	1
UDZ840	40	20	27	1	28.8	30.4	75	1
UDZ845	45	15	37	1	32.4	34.7	65	0.8
UDZ860	60	10	70	1	43.2	45.6	50	0.6
UDZ210	100	5	175	1	72	76	30	0.4
UDZ222	220	3	325	1	158.4	167.2	15	0.1
UDZ230	300	3	1900	1	216	228	10	0.07

*For ±5% voltage tolerance change the 3rd number from the right from 8 to 7 or from 2 to 1. i.e. UDZ8807 to UDZ8707, UDZ210 to UDZ110, etc.

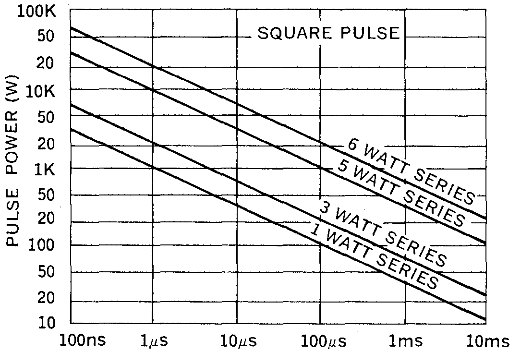
†All zener voltages are measured with an automated test set using a 35ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

**D.C. Ratings are based on the lead temperature conditions shown in the data sheets covering the UDZ8807, UDZ807, UDZ5807, and UDZ7807 series devices. Other conditions will affect the power ratings of all the families except the 1 watt zener family. However, the surge values given apply for any mounting conditions including printed circuit board mounting.

‡Figures shown are for peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

Typical Reverse Surge Power vs. Surge Duration



For Sinusoidal Pulse, Peak Value
is 1.4 Times Value Shown

	Electrical Specifications at 25°C						Maximum Ratings**	
Type	Nominal Zener Voltage† V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Imped § Z_Z @ I_{ZT}	Maximum Leakage Current	@ Reverse Voltage ±10%	±5%	Maximum Cont. Current I_{ZM}	Maximum Surge Current‡ I_S
±10% Tolerance*	Volts	mA	Ohms	μA	Volts	Volts	mA	Amps
5 WATT ZENERS — Specifications apply for both directions.								
UDZ5807	7.5	175	1.8	500	4.9	5.2	620	40
UDZ5808	8.2	150	1.8	400	5.4	5.7	570	32
UDZ5809	9.1	150	2.5	200	5.9	6.2	510	24
UDZ5810	10	125	2.5	100	6.6	6.9	470	22
UDZ5812	12	100	2.5	50	8.6	9.1	385	18
UDZ5815	15	75	3.5	15	10.8	11.4	300	12
UDZ5818	18	65	4	10	12.9	13.7	255	9
UDZ5820	20	65	4.5	10	14.4	15.2	220	8
UDZ5824	24	50	5	10	17.3	18.2	180	6.5
UDZ5827	27	50	6	10	19.4	20.6	155	6
UDZ5830	30	40	8	10	21.6	22.8	140	5.5
UDZ5833	33	40	10	5	23.7	25.1	130	5
UDZ5836	36	30	11	5	25.9	27.4	120	4.5
UDZ5840	40	30	14	5	28.8	30.4	105	4
UDZ5845	45	30	20	5	32.4	34.2	95	3.5
UDZ5860	60	20	40	5	43.2	45.6	75	2.5
UDZ5210	100	10	100	5	72	76	45	1.4
UDZ5222	220	5	550	5	158.4	167.2	20	0.5
UDZ5230	300	5	950	5	216	228	15	0.25
6 WATT ZENERS — Specifications apply for both directions.								
UDZ7807	7.5	325	0.9	1000	4.9	5.2	1250	50
UDZ7808	8.2	300	1.0	800	5.4	5.7	1150	41
UDZ7809	9.1	275	1.2	200	5.9	6.2	1020	31
UDZ7810	10	250	1.2	150	6.6	6.9	950	29
UDZ7812	12	200	1.3	75	8.6	9.1	770	17
UDZ7815	15	150	2.0	30	10.8	11.4	600	17
UDZ7818	18	130	3.5	20	12.9	13.7	500	13
UDZ7820	20	120	4.0	20	14.4	15.2	440	12
UDZ7824	24	100	5.0	20	17.3	18.2	360	10
UDZ7827	27	90	6.0	20	19.4	20.6	310	9
UDZ7830	30	80	8.0	20	21.6	22.8	280	8.5
UDZ7833	33	70	10	10	23.9	25.1	260	7.5
UDZ7836	36	60	12	10	25.9	27.4	240	7
UDZ7840	40	60	15	10	28.8	30.4	210	6.4
UDZ7845	45	50	20	10	32.4	34.2	180	5.5
UDZ7860	60	40	35	10	43.2	45.6	150	3.7
UDZ7210	100	20	90	10	72	76	90	2.3

*For ±5% voltage tolerance change the 3rd number from the right from 8 to 7 or from 2 to 1. i.e. UDZ8807 to UDZ8707, UDZ210 to UDZ110, etc.

†All zener voltages are measured with an automated test set using a 35ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

**D.C. Ratings are based on the lead temperature conditions shown in the data sheets covering the UDZ8807, UDZ807, UDZ5807, and UDZ7807 series devices. Other conditions will affect the power ratings of all the families except the 1 watt zener family. However, the surge values given apply for any mounting conditions including printed circuit board mounting.

‡Figures shown are for peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

RECTIFIERS

High Efficiency ESP, 50 Amp

UES501-UES505

FEATURES

- 50A Continuous Rating at Case Temperature of 125°C
- Exceptional Efficiency
- Low Forward Voltage
- Extremely Fast Reverse Recovery Time
- Extremely Fast Forward Recovery Time
- High Surge
- Radiation Tolerant
- Rugged, High Current Termination

DESCRIPTION:

This series of High Efficiency Power Rectifiers allows circuit designers to design high current, high frequency supplies with very low diode losses. Reverse recovery time is typically 1/10 - 1/100th of equivalent power rectifiers, with no compromise on forward voltage.

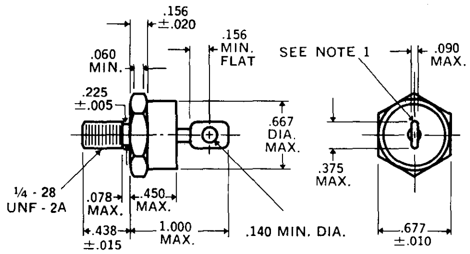
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
50V	UES501
75V	UES502
100V	UES503
125V	UES504
150V	UES505

Maximum Average D.C. Output Current @ $T_C = 125°C$	50A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	600A
Operating Temperature Range	−65°C to +175°C
Storage Temperature Range	−65°C to +175°C
Thermal Resistance	1°C/W

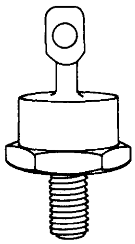
MECHANICAL SPECIFICATIONS

UES501-UES505



Dimensions in inches.

DO-5



Notes:

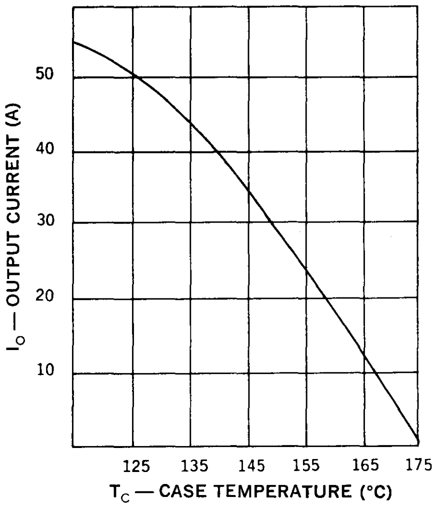
1. Angular orientation of terminal is undefined
2. All metal surfaces nickel plated
3. Maximum unlubricated stud torque 20 inch pounds
4. All dimensions in inches
5. Polarity is cathode to stud; for anode to stud add suffix "R"

UNITRODE

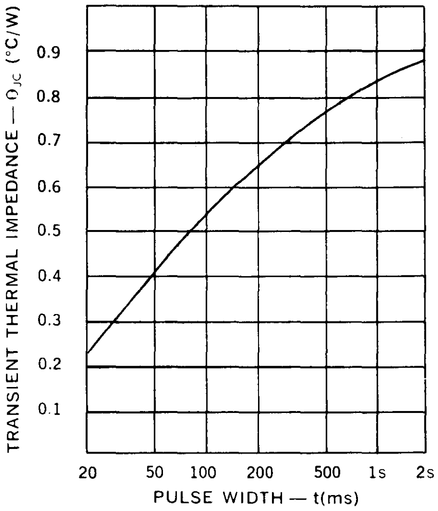
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Peak Inverse Voltage	Maximum Forward Voltage Drop	Maximum Leakage Current		Maximum Reverse Recovery Time t_{rr} @ I_F-I_R-I_{REC}
			25°C	125°C	
UES501	50V	.95V @ 50A (pw = 250ms)	25μA	10mA	50ns. 1A-1A-0.5A
UES502	75V				
UES503	100V				
UES504	125V				
UES505	150V				

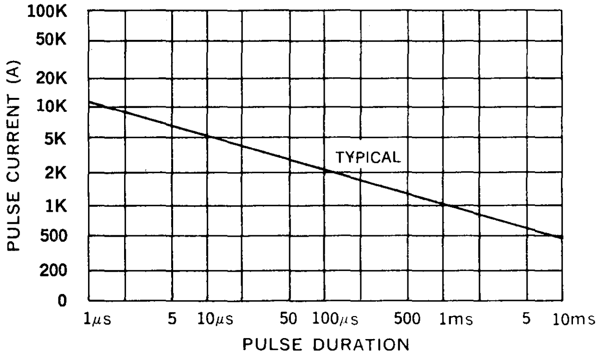
Output Current vs. Case Temp.



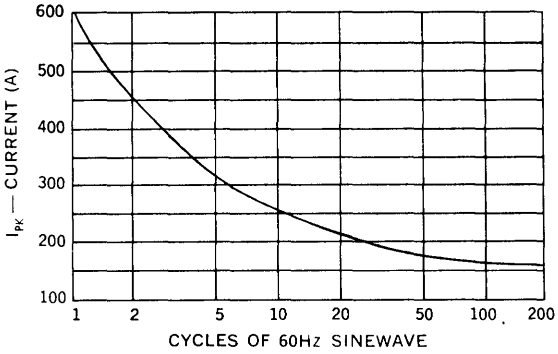
Pulse Thermal Impedance vs. Pulse Width



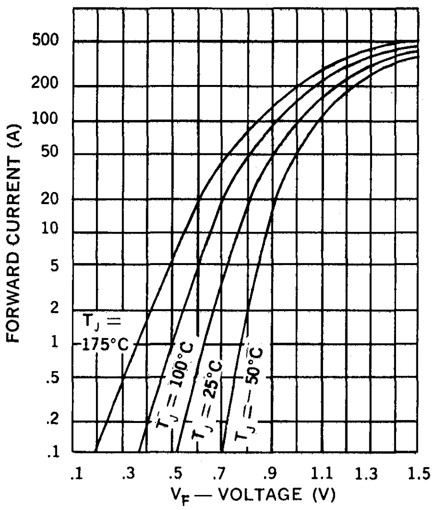
Square Pulse Current vs. Duration for Non-Repetition Square Wave



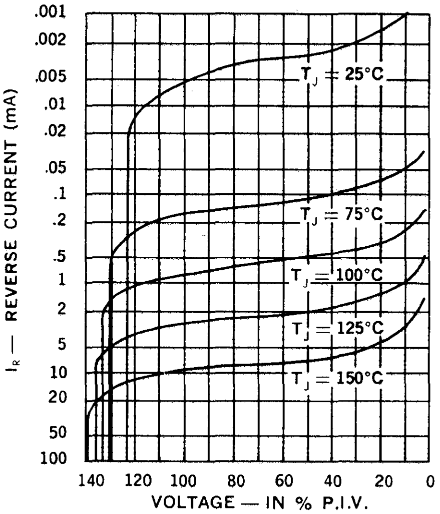
Multiple Surge Current vs. Duration



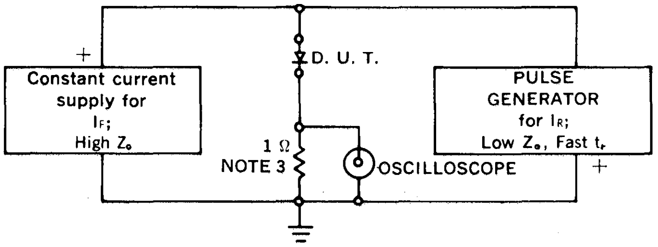
Typical Forward Current vs. Forward Voltage



Typical Reverse Current vs. Voltage



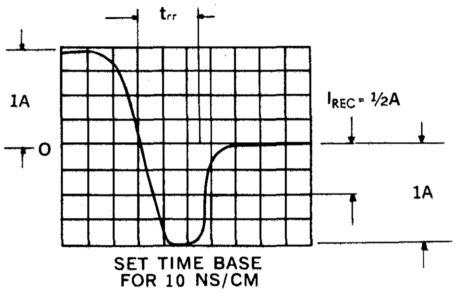
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3 ns; input impedance = 50 Ω.
2. Pulse Generator: Rise time ⩽ 8 ns; source impedance 10 Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform



RECTIFIER ASSEMBLIES

High Voltage Stacks, Standard and Fast Recovery

UFB, UFS, USB, USS SERIES

FEATURES

- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used
- High Forward and Reverse Surge Capability
- Transfer Molded for Voidless Construction
- Modular for Easy Stacking
- PIV: from 2.5 kV to 15 kV
- Recovery Times: to 500ns
- Continuous Ratings: to 2.3A

DESCRIPTION

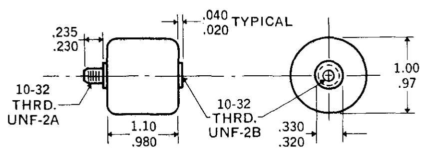
These assemblies uniquely combine a versatile stackable design with all the requirements for reliable high voltage operation. All modules are suitable for bridge or series operations.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, USS Series	5.0 kV to 15 kV
Peak Inverse Voltage, USB Series	2.5 kV to 10 kV
Peak Inverse Voltage, UFS Series	5.0 kV to 10 kV
Peak Inverse Voltage, UFB Series	2.5 kV to 7.5 kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C

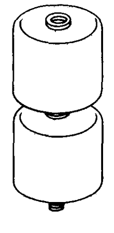
MECHANICAL SPECIFICATIONS

UFB, UFS, USB, USS SERIES



Typical Weight: USS & UFS Series — 28 grams
USB & UFB Series — 31 grams

Dimensions in inches.



MARKING

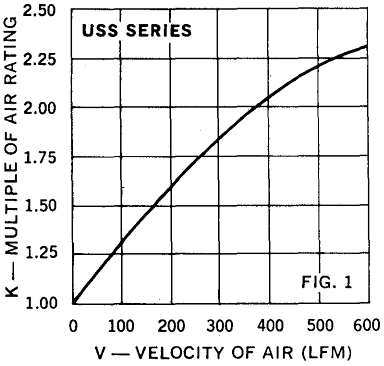
Type number marked on unit.

Polarity — Cathode connected to stud.

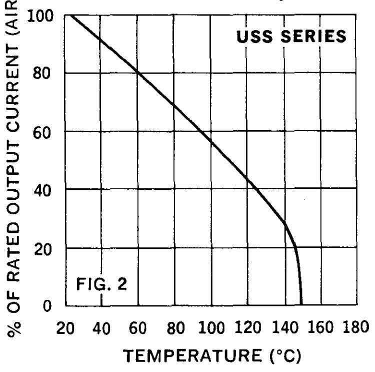
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV	Maximum Forward Voltage Drop	Leakage Current @ PIV	Maximum Reverse Recovery Time	Maximum Reverse Transient Energy Absorption	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
							$T_A = 25°C$ AIR	$T_A = 50°C$ OIL	
		kV		µA	ns	joules	Amps	Amps	Amps
Standard	USS 5	5.0	9V @ 0.6A	5	—	1.5	0.60	1.1	25
Recovery	USS 7.5	7.5	13V @ 0.5A			2.5	0.45	0.91	
	USS 10	10	17V @ 0.3A			3.0	0.35	0.71	
	USS 15	15	25V @ 0.2A			5.0	0.25	0.51	
Standard	USB 2.5	2.5	5V @ 1.1A	10	—	3.0	1.1	2.3	80
Recovery	USB 5	5.0	9V @ 0.7A			6.0	0.68	1.5	
	USB 7.5	7.5	13V @ 0.5A			9.0	0.53	1.2	
	USB 10	10	17V @ 0.4A			12	0.43	1.0	
Fast	UFS 5	5.0	12V @ 0.5A	5	500* 350†	1.5	0.50	0.90	20
Recovery	UFS 7.5	7.5	18V @ 0.4A			2.5	0.38	0.75	
	UFS 10	10	23V @ 0.3A			3.0	0.30	0.58	
Fast	UFB 2.5	2.5	6V @ 0.9A	10	500* 350†	3.0	0.90	2.0	70
Recovery	UFB 5	5.0	12V @ 0.6A			6.0	0.58	1.3	
	UFB 7.5	7.5	18V @ 0.4A			9.0	0.45	1.0	

*Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to 0.5A.
†Measured in a reverse recovery circuit switching from .5A foward current to 1A reverse current, recovery to .25A.

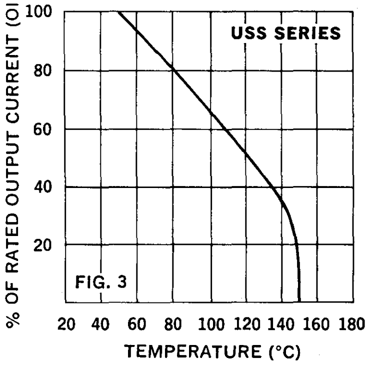
Output Current Ratio vs. Velocity of Air Flow



Output Current vs. Ambient (Air) Temperature

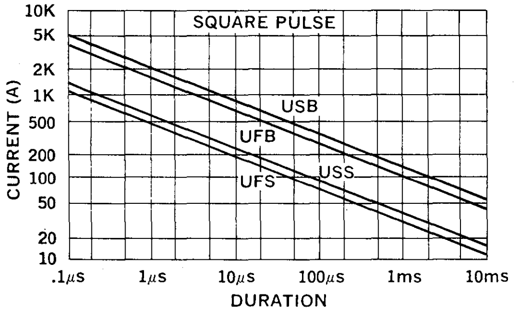


Output Current vs. Ambient (Oil) Temperature

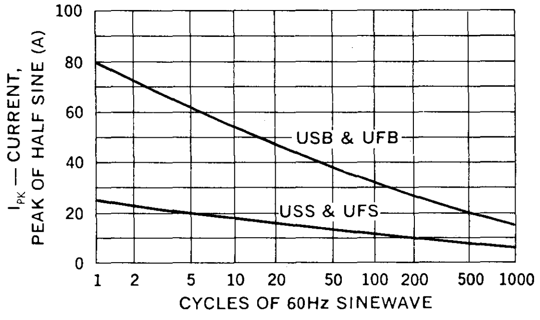


Application example: The rectifier is to be used in a cabinet at 60°C with ambient air moving at 400 LFM. The rating is reduced (Fig. 2) by a factor of 0.81 due to the elevated temperature, but it is enhanced by 2X (Fig. 1) due to the air flow. Hence the DC output current is 0.81 x 2, or 1.6 times the 25°C air rating.

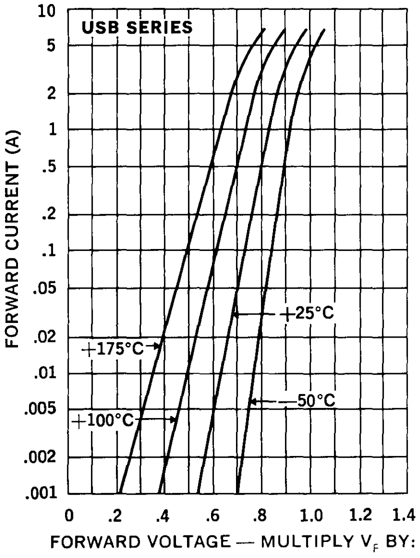
Forward Pulse Current vs. Duration



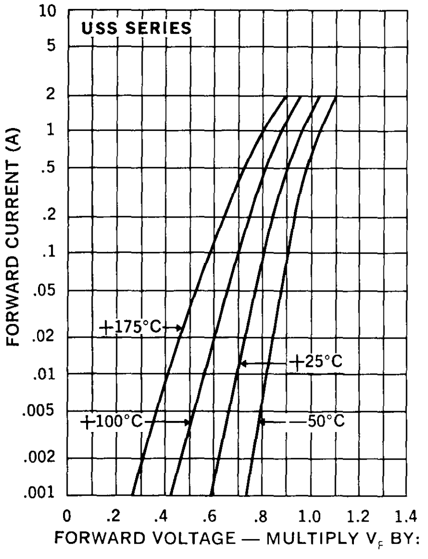
Multiple Surge Current vs. Duration



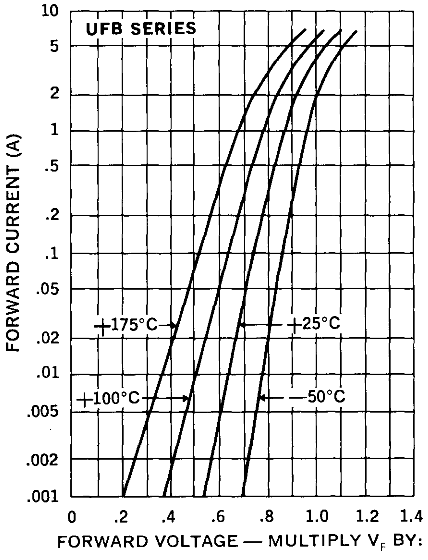
Typical Forward Voltage vs. Forward Current



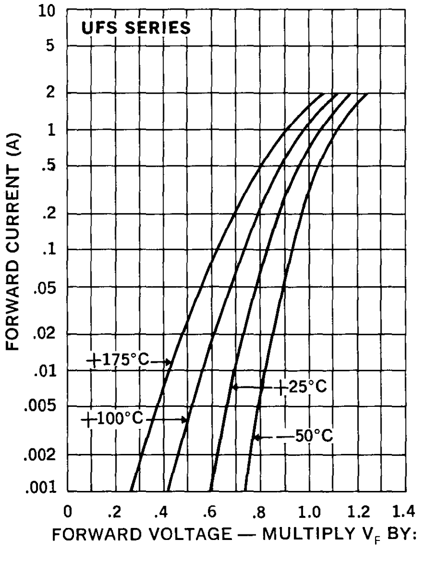
Typical Forward Voltage vs. Forward Current



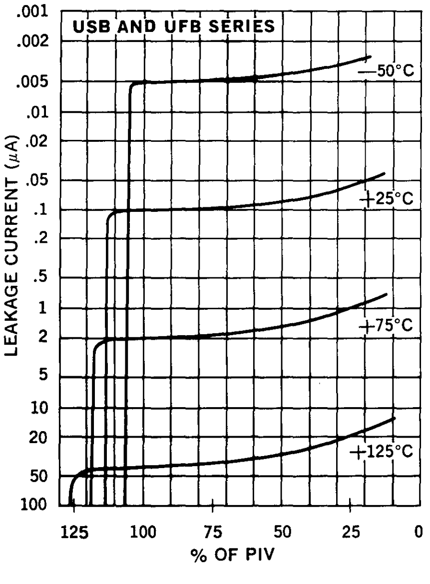
Typical Forward Voltage vs. Forward Current



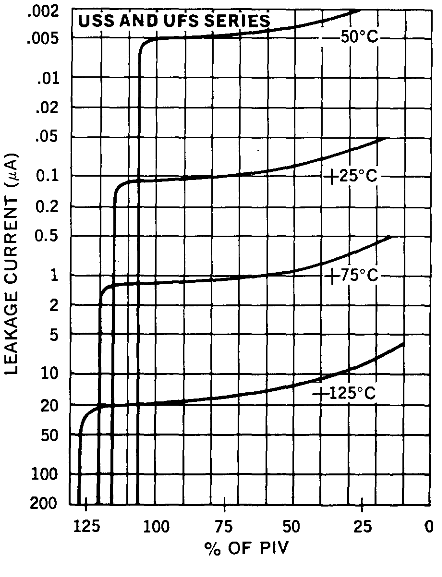
Typical Forward Voltage vs. Forward Current



Typical Leakage Current vs. PIV



Typical Leakage Current vs. PIV



RECTIFIER ASSEMBLIES

UGB, UGD, UGE, UGF SERIES

High Voltage Doorbell® Modules
Standard and Fast Recovery

FEATURES

- Current Ratings: to 10A
- PIV: 2.5 kV to 10kV
- Recovery Times: to 500ns
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Stackable to 600KV
- Modular Package for Easy Stacking

DESCRIPTION

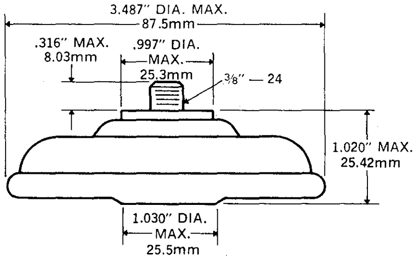
This series of high-voltage, high-current stacks that incorporate a unique modular design makes it particularly well-suited for high power applications such as in radar systems as charge, hold-off and clipper diodes.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	
UGB, UGD Series	5 kV to 10 kV
UGS, UGF Series	2.5 kV to 7.5 kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	–65°C to +150°C

MECHANICAL SPECIFICATIONS

UGB, UGD, UGE, UGF SERIES

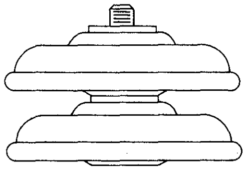


Typical Weight — 200 grams

Polarity — Cathode connected to base.

Part Number — On base of unit.

Dimensions in inches.



Doorbell® is a registered trademark of Unitrode Corporation

UNITRODE

Electrical Specifications (at 25°C unless noted)						Maximum Ratings				
Type		PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV	Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current			Non-repetitive Sinusoidal Surge† (8.3ms)	Maximum Reverse Transient Energy Absorption
						T_C = 75°C Air	T_C = 60°C Air with Extender Plate**	T_C = 50°C Oil	T_C = 100°C	
		kV		μA	ns	Amps	Amps	Amps	Amps	joules
Standard Recovery	UGE-2.5	2.5	5V @ 3.30A	10	—	6.60	8.25	10.00	200	8
	UGE-5	5	10V @ 2.50A	15		5.00	6.25	7.50	200	14
	UGB-5	5	9V @ 2.20A	5		4.40	5.50	6.60	100	7
	UGE-7.5	7.5	13V @ 1.60A	10		3.30	4.10	5.00	200	20
	UGB-7.5	7.5	13V @ 1.50A	5		3.00	3.75	5.00	100	10
	UGB-10	10	17V @ 1.10A	5		2.30	2.85	3.50	100	14
Fast Recovery	UGF-2.5	2.5	6V @ 2.50A	10	500	5.00	6.25	8.00	150	8
	UGF-5	5	11V @ 1.80A	10		3.75	4.70	6.00	150	14
	UGD-5	5	11V @ 1.60A	5		3.30	4.10	4.80	80	7
	UGF-7.5	7.5	17V @ 1.20A	10		2.50	3.10	4.00	150	20
	UGD-7.5	7.5	17V @ 1.10A	5		2.25	2.80	3.50	80	10
	UGD-10	10	22V @ 0.85A	5		1.75	2.20	2.50	80	14

*Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

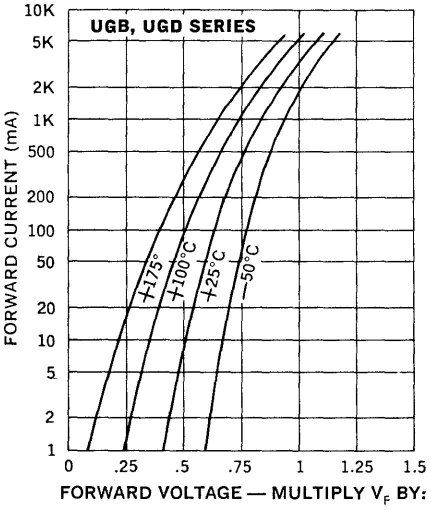
**These ratings are based on using "extender plates" that provide additional surface area to radiate heat. Because of possible corona effects caused by scratches on these plates, extreme care is necessary in their handling and they are not recommended where the working voltage exceeds 7.5KV/module. They should be carefully polished prior to installation.

†Forward Surge Ratings

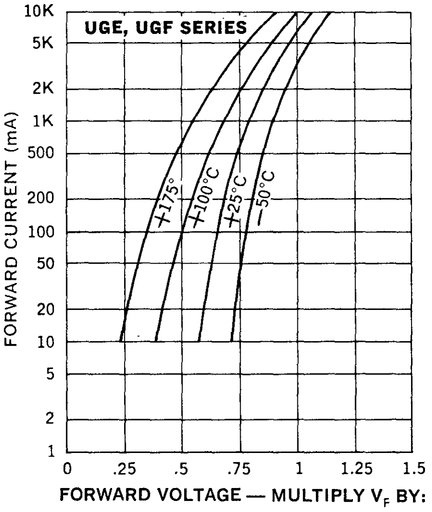
The single cycle peak surge rating for an 8.3ms sinusoidal surge is shown. For repetitive surges at 60H_z the following factors apply to the single cycle rating.

1 cycle	1.00
5 cycles	0.72
10 cycles	0.62
50 cycles	0.45
100 cycles	0.42

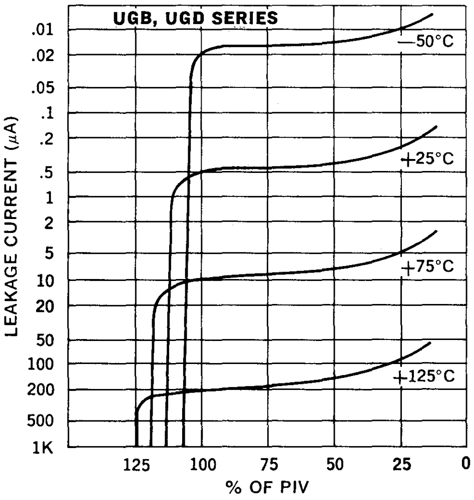
Typical Forward Voltage vs. Forward Current



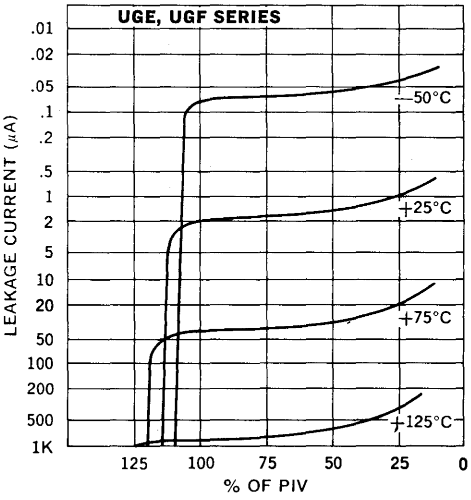
Typical Forward Voltage vs. Forward Current



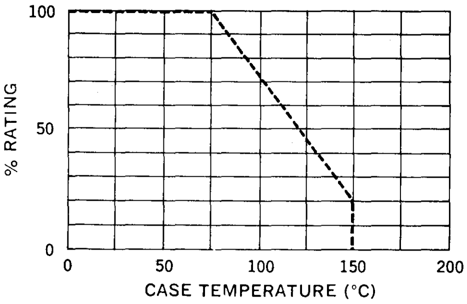
Typical Leakage Current vs. PIV



Typical Leakage Current vs. PIV

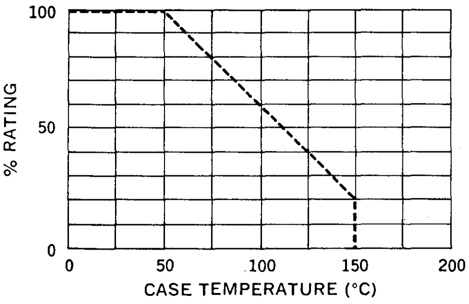


Current Derating Curve



Air Cooled

Current Derating Curve



Oil Immersed

POWER TRANSISTORS
0.5 Amp, 400V, Planar NPN

UPT011 UPT021
UPT012 UPT022
UPT013 UPT023
UPT014 UPT024
UPT015 UPT025

FEATURES
- Collector-Base Voltage: up to 400V
- Peak Collector Current: 1A
- Turn-on Time: 50ns
- Turn-off Time: 400ns

DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

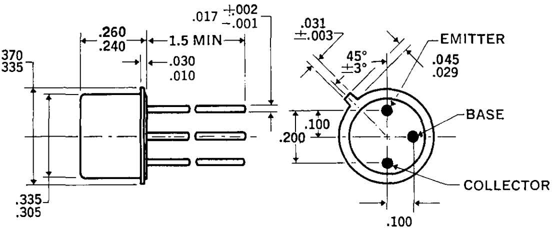
ABSOLUTE MAXIMUM RATINGS

	UPT011 **UPT021**	**UPT012** **UPT022**	**UPT013** **UPT023**	**UPT014** **UPT024**	**UPT015** **UPT025**
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	0.5A	0.5A	0.5A	0.5A	0.5A
Peak Collector Current, I_C	1A	1A	1A	1A	1A
Base Current, I_B	0.2A	0.2A	0.2A	0.2A	0.2A

Power Dissipation	**UPT011-015**	**UPT021-025**
25°C Ambient	.85W	1.6W
100°C Case	4W	16W
Thermal Resistance, θ_{J-C}	25°C/W	6.7°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

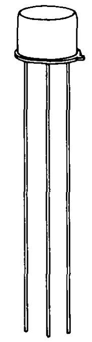
MECHANICAL SPECIFICATIONS

UPT011 UPT012 UPT013 UPT014 UPT015

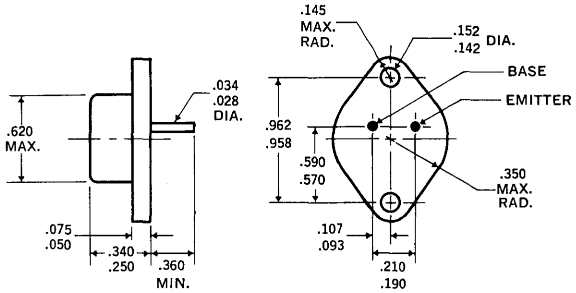


Dimensions in inches.

TO-5

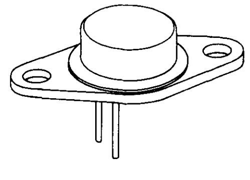


UPT021 UPT022 UPT023 UPT024 UPT025



Dimensions in inches.

TO-66



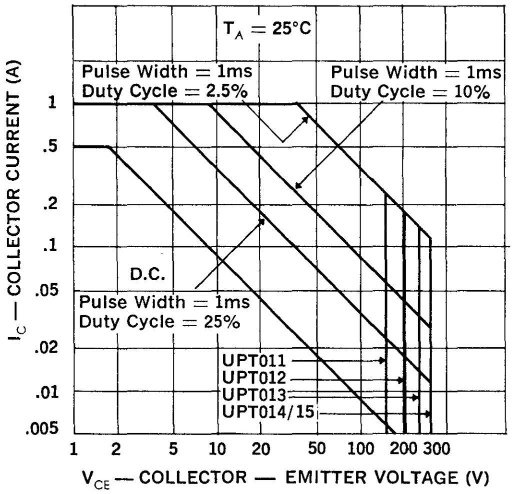
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

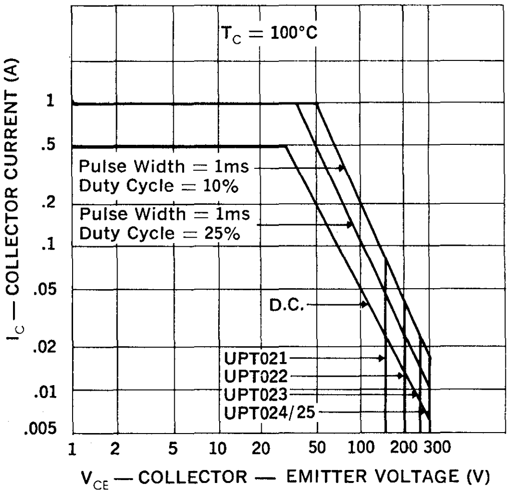
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 0.1A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 0.5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5 Typ.		—	$I_C = 1A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 0.5A$, $I_B = 0.1A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = 0.5A$, $I_B = 0.1A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT011, UPT021		200	—		
UPT012, UPT022		250	—		
UPT013, UPT023		300	—		
UPT014, UPT024		350	—		
UPT015 UPT025		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT011, UPT021		150	—		
UPT012, UPT022		200	—		
UPT013, UPT023		250	—		
UPT014-5, UPT024-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	20	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	40 Typ.		MHz	$I_C = 0.1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	50 Typ.		ns	$I_C = 0.5A$
Turn-off Time	t_{off}	400 Typ.		ns	

Note: 1.Pulse width = 300 μs; duty cycle ≤2%.

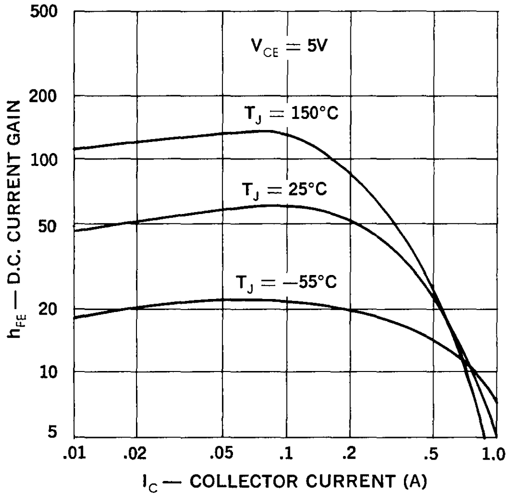
Maximum Safe Operating Area
UPT011-015



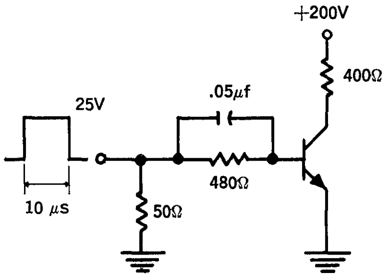
Maximum Safe Operating Area
UPT021–025



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

1 Amp, 150V, Planar NPN

UPT111 UPT121
UPT112 UPT122
UPT113 UPT123
UPT114 UPT124
UPT115 UPT125

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 2A
- Turn-on Time: 100ns
- Turn-off Time: 250ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

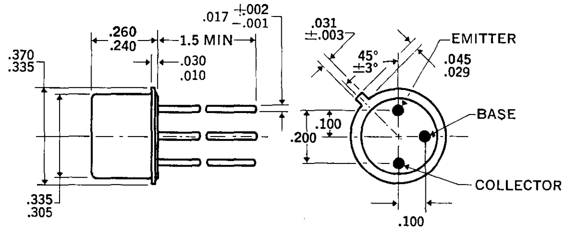
ABSOLUTE MAXIMUM RATINGS

	UPT111 UPT121	UPT112 UPT122	UPT113 UPT123	UPT114 UPT124	UPT115 UPT125
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	1A	1A	1A	1A	1A
Peak Collector Current, I_C	2A	2A	2A	2A	2A
Base Current, I_B	0.5A	0.5A	0.5A	0.5A	0.5A

Power Dissipation	UPT111-115	UPT121-125
25°C Ambient	.85W	1.6W
100°C Case	4W	16W
Thermal Resistance, Θ_{J-C}	25°C/W	6.7°C/W
Operating and Storage Temperature Range	−65°C to 200°C	−65°C to 200°C

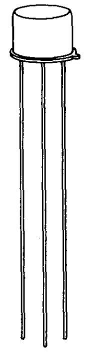
MECHANICAL SPECIFICATIONS

UPT111 UPT112 UPT113 UPT114 UPT115

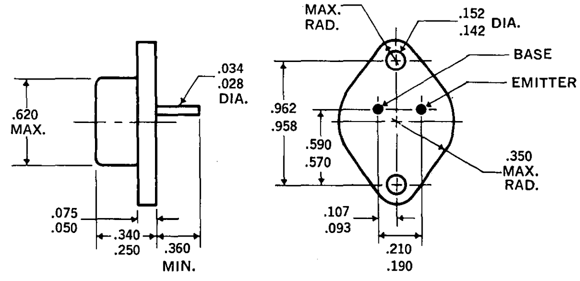


Dimensions in inches.

TO-5

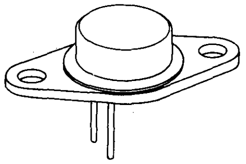


UPT121 UPT122 UPT123 UPT124 UPT125



Dimensions in inches.

TO-66



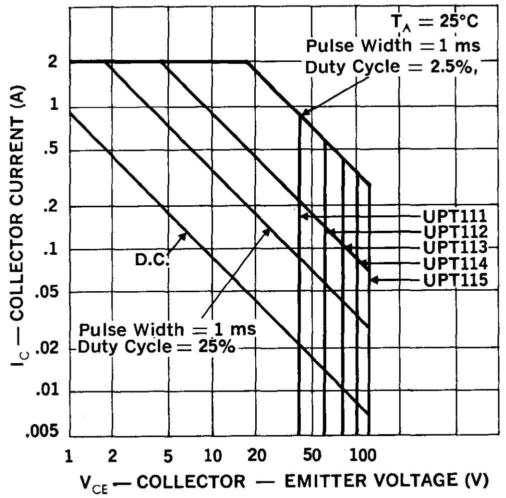
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

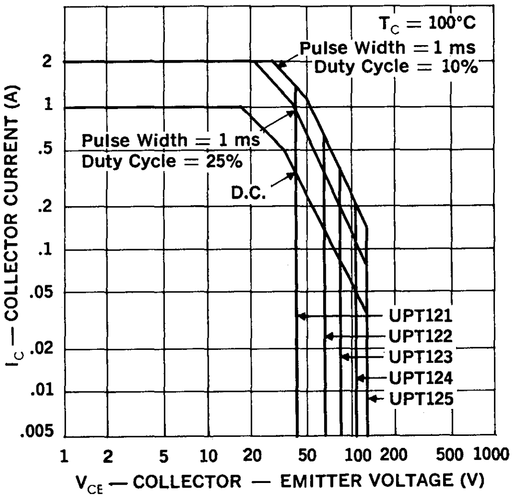
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 0.5A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	$I_C = 1A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15 Typ.		—	$I_C = 2A, V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 1A, I_B = 0.1A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.2	Vdc	$I_C = 1A, I_B = 0.1A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc; R_{BE} = 100\Omega$
UPT111, UPT121		60	—		
UPT112, UPT122		80	—		
UPT113, UPT123		100	—		
UPT114, UPT124		120	—		
UPT115, UPT125		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT111, UPT121		40	—		
UPT112, UPT122		60	—		
UPT113, UPT123		80	—		
UPT114-5, UPT124-5		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, T = 150°C
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	40	pf	$V_{CB} = 10Vdc, I_E = 0, f = 1MHz$
Gain-Bandwidth Product	f_T	50 Typ.		MHz	$I_C = 0.1Adc, V_{CE} = 5Vdc, f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	100 Typ.		ns	$I_C = 1A$
Switching Speeds Turn-off Time	t_{off}	250 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

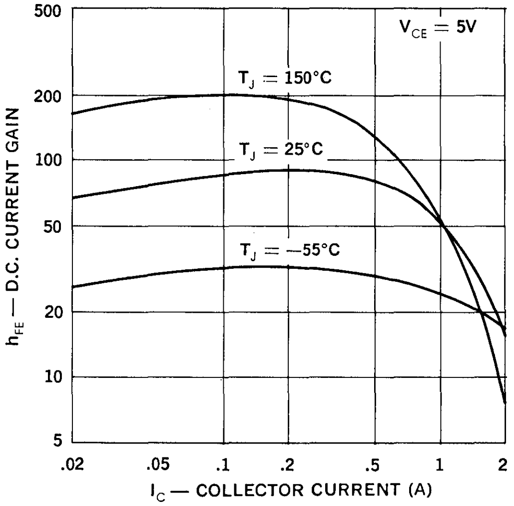
Maximum Safe Operating Area
UPT111 - 115



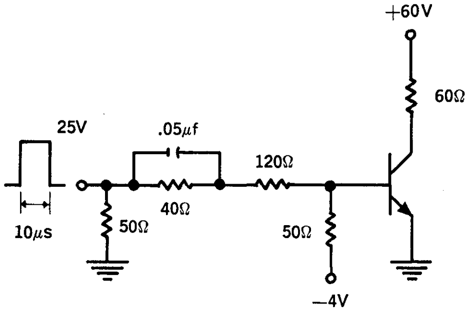
Maximum Safe Operating Area
UPT121-125



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

2 Amp, 150V, Planar NPN

UPT211 UPT221
UPT212 UPT222
UPT213 UPT223
UPT214 UPT224
UPT215 UPT225

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 5A
- Turn-on Time: 130ns
- Turn-off Time: 300ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply, pulse amplifier and similar high efficiency power switching applications.

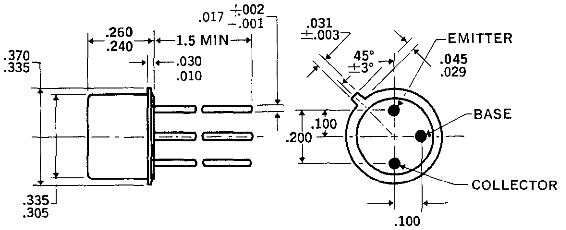
ABSOLUTE MAXIMUM RATINGS

	UPT211 **UPT221**	**UPT212** **UPT222**	**UPT213** **UPT223**	**UPT214** **UPT224**	**UPT215** **UPT225**
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	2A	2A	2A	2A	2A
Peak Collector Current, I_C	5A	5A	5A	5A	5A
Base Current, I_B	1A	1A	1A	1A	1A

Power Dissipation	**UPT211-215**	**UPT221-225**
25°C Ambient	.85W	1.6W
100°C Case	4W	16W
Thermal Resistance, θ_{J-C}	25°C/W	6.7°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

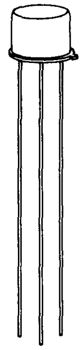
MECHANICAL SPECIFICATIONS

UPT211 UPT212 UPT213 UPT214 UPT215

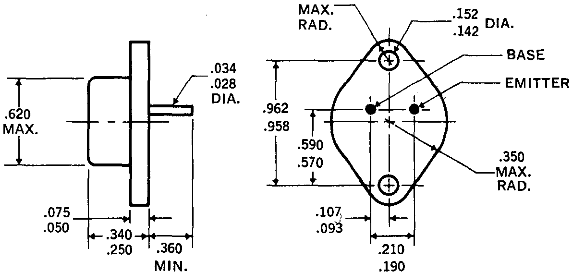


Dimensions in inches.

TO-5

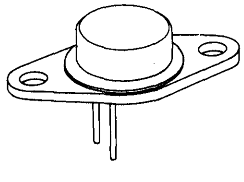


UPT221 UPT222 UPT223 UPT224 UPT225



Dimensions in inches.

TO-66



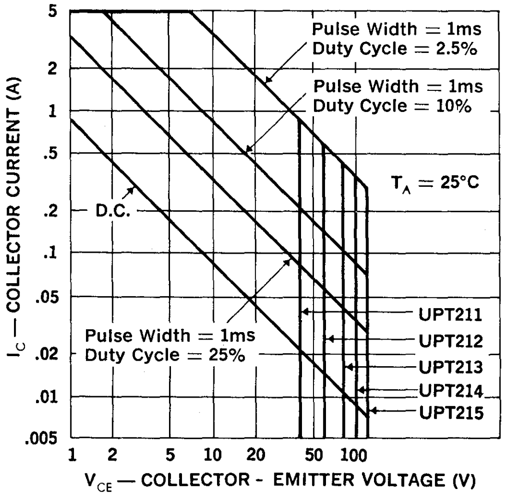
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

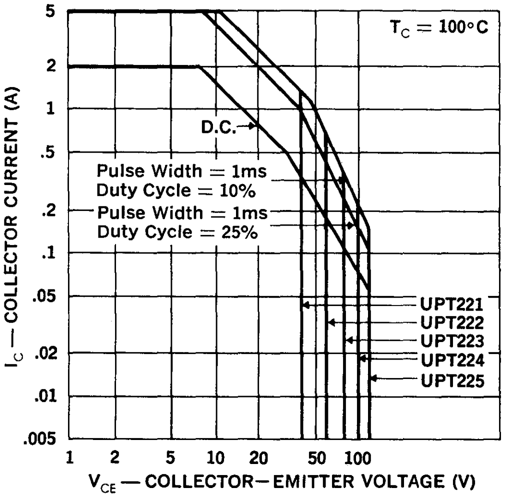
Test		Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)		h_{FE}	30	—	—	$I_C = 0.5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)		h_{FE}	20	—	—	$I_C = 2A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)		h_{FE}	10 Typ.		—	$I_C = 5A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)		V_{CE} (sat)	—	1.0	Vdc	$I_C = 2A$, $I_B = 0.2A$
Base Saturation Voltage (Note 1)		V_{BE} (sat)	—	1.2	Vdc	$I_C = 2A$, $I_B = 0.2A$
Collector-Emitter Breakdown Voltage (Note 1)		BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT211, UPT221			60	—		
UPT212, UPT222			80	—		
UPT213, UPT223			100	—		
UPT214, UPT224			120	—		
UPT215, UPT225			150	—		
Collector-Emitter Breakdown Voltage (Note 1)		BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT211, UPT221			40	—		
UPT212, UPT222			60	—		
UPT213, UPT223			80	—		
UPT214-5, UPT224-5			100	—		
Collector-Emitter Cutoff Current		I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C		I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current		I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance		C_{ob}	—	40	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product		f_T	70 Typ.		MHz	$I_C = 0.1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds	Turn-on Time	t_{on}	130 Typ.		ns	$I_C = 2A$
	Turn-off Time	t_{off}	300 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ⩽2%.

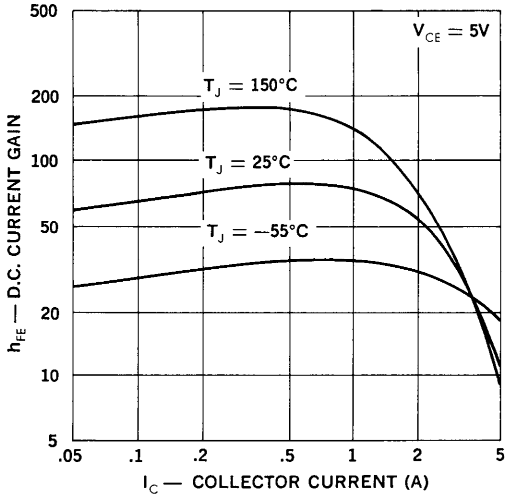
Maximum Safe Operating Area
UPT211-215



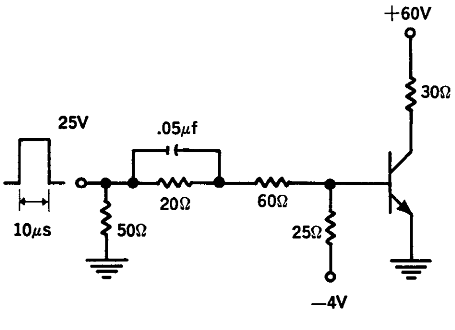
Maximum Safe Operating Area
UPT221-225



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

2 Amp, 400V, Planar NPN

UPT311 UPT321
UPT312 UPT322
UPT313 UPT323
UPT314 UPT324
UPT315 UPT325

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 3A
- Turn-on Time: 200 ns
- Turn-off Time: 800 ns

DESCRIPTION

Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

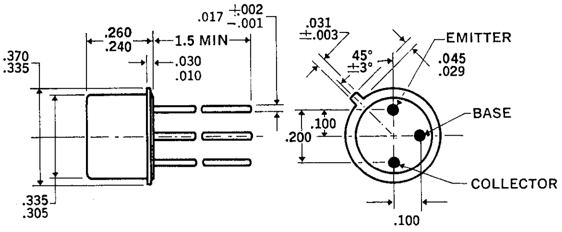
ABSOLUTE MAXIMUM RATINGS

	UPT311 UPT321	UPT312 UPT322	UPT313 UPT323	UPT314 UPT324	UPT315 UPT325
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	2A	2A	2A	2A	2A
Peak Collector Current, I_C	3A	3A	3A	3A	3A
Base Current, I_B	1A	1A	1A	1A	1A

	UPT311-315	UPT321-325
Power Dissipation		
25°C Ambient	1W	2W
100°C Case	10W	16W
Thermal Resistance, Θ_{J-C}	10°C/W	6.7°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

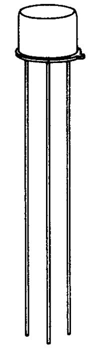
MECHANICAL SPECIFICATIONS

UPT311 UPT312 UPT313 UPT314 UPT315

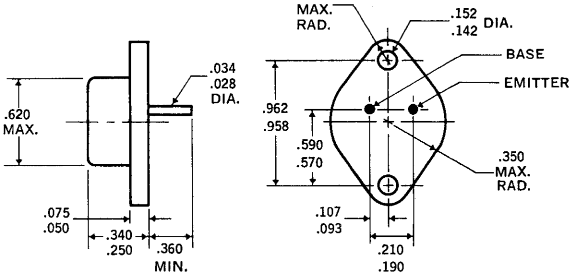


Dimensions in inches.

TO-5

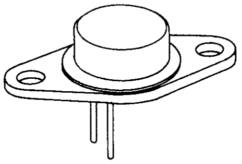


UPT321 UPT322 UPT323 UPT324 UPT325



Dimensions in inches.

TO-66



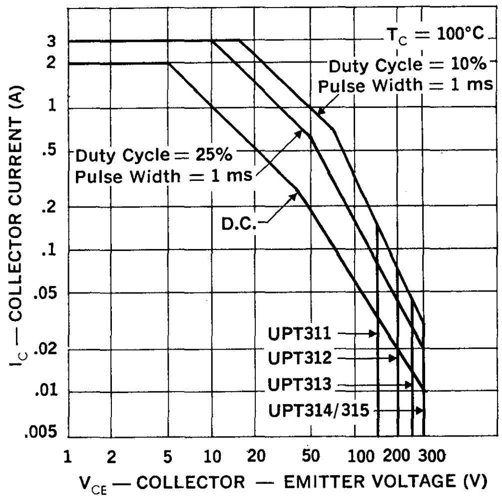
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

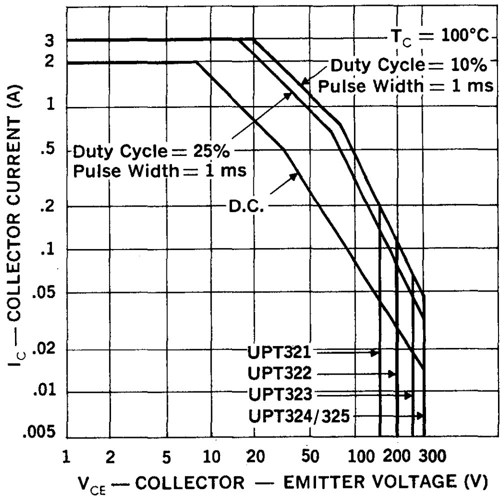
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 0.5A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 2A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 3A, V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 2A, I_B = 0.4A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = 2A, I_B = 0.4A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc; R_{BE} = 100\Omega$
UPT311, UPT321		200	—		
UPT312, UPT322		250	—		
UPT313, UPT323		300	—		
UPT314, UPT324		350	—		
UPT315, UPT325		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT311, UPT321		150	—		
UPT312, UPT322		200	—		
UPT313, UPT323		250	—		
UPT314-5, UPT324-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, T = 150°C
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc, I_E = 0, f = 1MHz$
Gain-Bandwidth Product	f_T	40 Typ.		MHz	$I_C = 0.5Adc, V_{CE} = 5Vdc, f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	200 Typ.		ns	$I_C = 1A$
Switching Speeds Turn-off Time	t_{off}	800 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

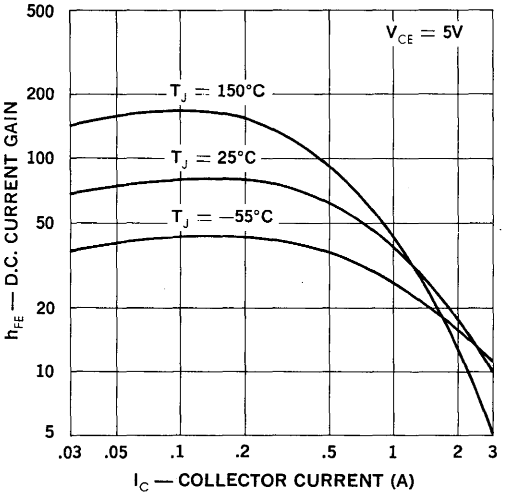
Maximum Safe Operating Area
UPT311 – 315



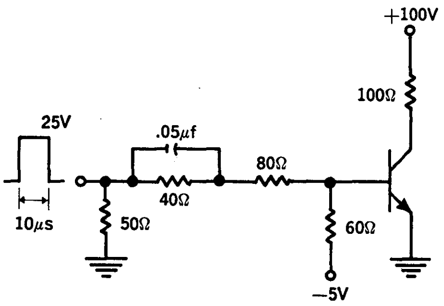
Maximum Safe Operating Area
UPT321 – 325



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

3 Amp, 400V, Planar NPN

UPT521	UPT531
UPT522	UPT532
UPT523	UPT533
UPT524	UPT534
UPT525	UPT535

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 5A
- Turn-on Time: 200ns
- Turn-off Time: 900ns

DESCRIPTION

Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

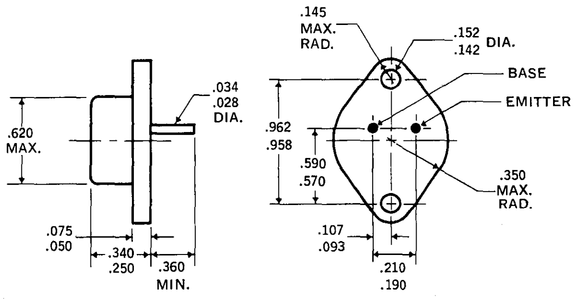
ABSOLUTE MAXIMUM RATINGS

	UPT521 UPT531	UPT522 UPT532	UPT523 UPT533	UPT524 UPT534	UPT525 UPT535
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	3A	3A	3A	3A	3A
Peak Collector Current, I_C	5A	5A	5A	5A	5A
Base Current, I_B	2A	2A	2A	2A	2A

	UPT521-525	UPT531-535
Power Dissipation		
25°C Ambient	2W	3W
100°C Case	25W	50W
Thermal Resistance, Θ_{J-C}	4°C/W	2°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

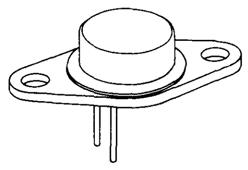
MECHANICAL SPECIFICATIONS

UPT521 UPT522 UPT523 UPT524 UPT525

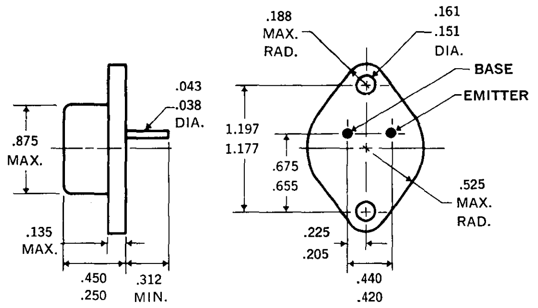


Dimensions in inches.

TO-66

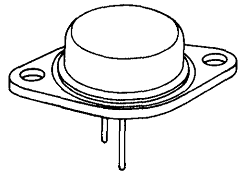


UPT531 UPT532 UPT533 UPT534 UPT535



Dimensions in inches.

TO-3

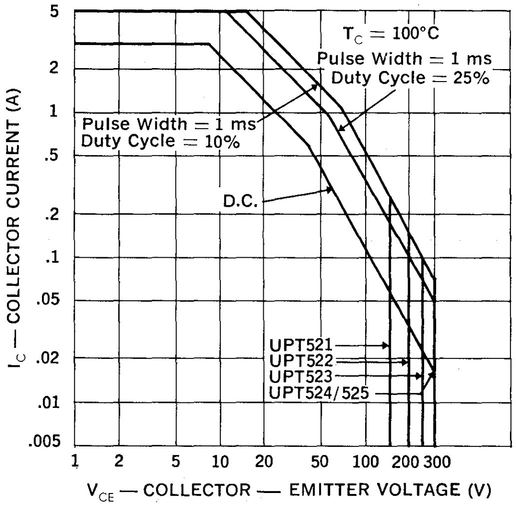


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

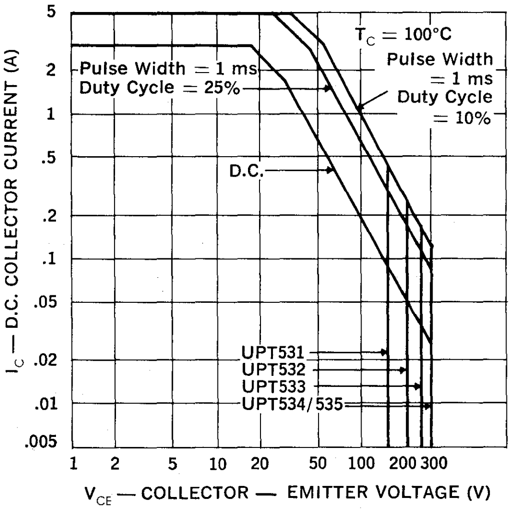
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	25	—	—	$I_C = 1.0A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 3A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 5A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 3A$, $I_B = 0.6A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = 3A$, $I_B = 0.6A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT521, UPT531		200	—		
UPT522, UPT532		250	—		
UPT523, UPT533		300	—		
UPT524, UPT534		350	—		
UPT525, UPT535		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT521, UPT531		150	—		
UPT522, UPT532		200	—		
UPT523, UPT533		250	—		
UPT524-5, UPT534-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	120	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	30 Typ.		MHz	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	200 Typ.		ns	$I_C = 3A$
Switching Speeds Turn-off Time	t_{off}	900 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ⩽2%.

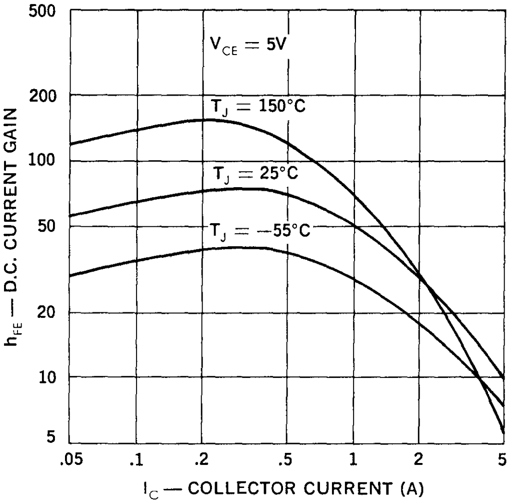
Maximum Safe Operating Area
UPT521 – 525



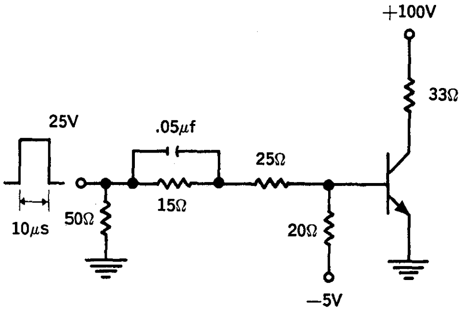
Maximum Safe Operating Area
UPT531 – 535



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

5 Amp, 150V, Planar NPN

UPT611 UPT621
UPT612 UPT622
UPT613 UPT623
UPT614 UPT624
UPT615 UPT625

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 10A
- Turn-on Time: 250ns
- Turn-off Time: 550ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply, pulse amplifier and similar high efficiency power switching applications.

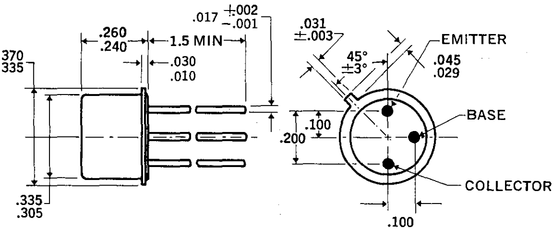
ABSOLUTE MAXIMUM RATINGS

	UPT611 UPT621	UPT612 UPT622	UPT613 UPT623	UPT614 UPT624	UPT615 UPT625
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	5A	5A	5A	5A	5A
Peak Collector Current, I_C	10A	10A	10A	10A	10A
Base Current, I_B	2A	2A	2A	2A	2A

	UPT611-615	UPT621-625
Power Dissipation		
25°C Ambient	1W	2W
100°C Case	5W	20W
Thermal Resistance, θ_{J-C}	20°C/W	5°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

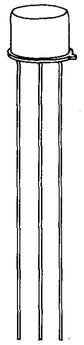
MECHANICAL SPECIFICATIONS

UPT611 UPT612 UPT613 UPT614 UPT615

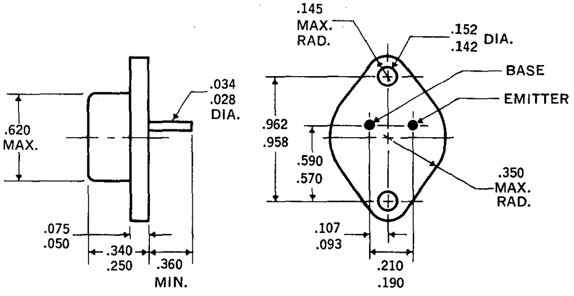


Dimensions in inches.

TO-5

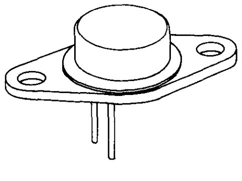


UPT621 UPT622 UPT623 UPT624 UPT625



Dimensions in inches.

TO-66

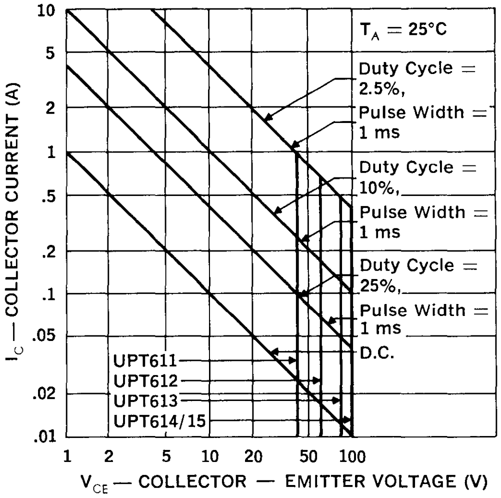


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

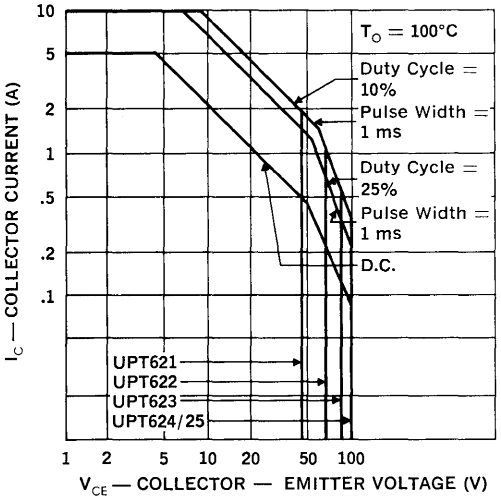
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 1A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	$I_C = 5A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	12 Typ.		—	$I_C = 10A, V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—			$I_C = 5A, I_B = 0.5A$
UPT611-3, UPT621-3		—			
UPT614-15, UPT624-5		—	1.0	Vdc	
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = 5A, I_B = 0.5A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}		1.5	Vdc	$I_C = 10mAdc; R_{BE} = 100\Omega$
UPT611, UPT621		60	—	Vdc	
UPT612, UPT622		80	—		
UPT613, UPT623		100	—		
UPT614, UPT624		120	—		
UPT615, UPT625		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT611, UPT621		40	—		
UPT612, UPT622		60	—		
UPT613, UPT623		80	—		
UPT614-5, UPT624-5		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	$V_{CE} =$ rated $BV_{CEO}, R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	$V_{CE} =$ rated $BV_{CEO}, R_{BE} = 100\Omega, T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	120	pf	$V_{CB} = 10Vdc, I_E = 0, f = 1MHz$
Gain-Bandwidth Product	f_T	40 Typ.		MHz	$I_C = 0.5Adc, V_{CE} = 5Vdc, f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	250 Typ.		ns	$I_C = 5A$
Switching Speeds Turn-off Time	t_{off}	500 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

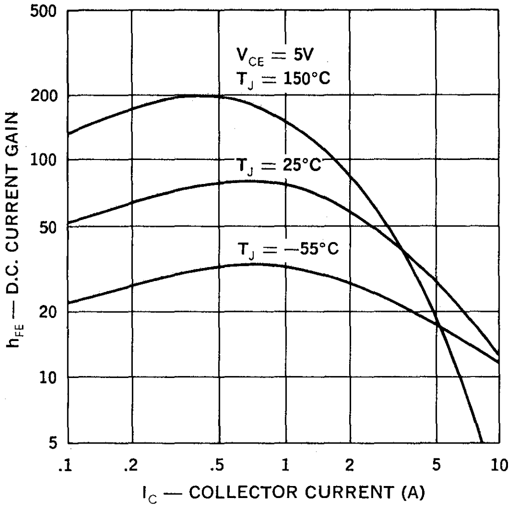
Maximum Safe Operating Area
UPT611 — 615



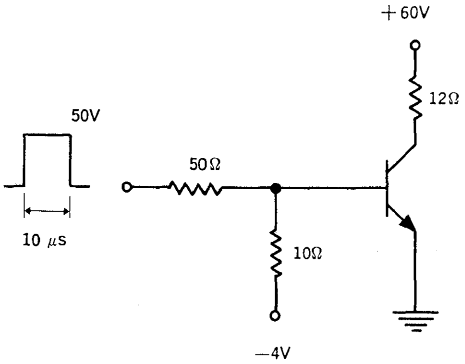
Maximum Safe Operating Area
UPT621 — 625



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

5 Amp, 400V, Planar NPN

UPT721 UPT731
UPT722 UPT732
UPT723 UPT733
UPT724 UPT734
UPT725 UPT735

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 10A
- Turn-on Time: 250ns
- Turn-off Time: 800ns

DESCRIPTION

Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

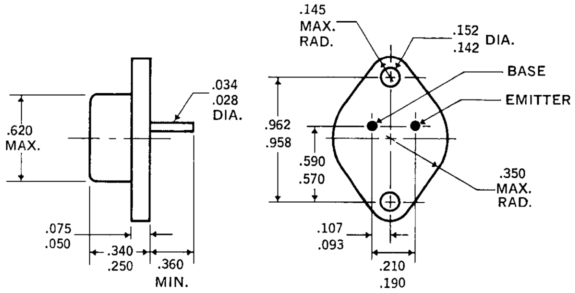
ABSOLUTE MAXIMUM RATINGS

	UPT721 UPT731	UPT722 UPT732	UPT723 UPT733	UPT724 UPT734	UPT725 UPT735
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	5A	5A	5A	5A	5A
Peak Collector Current, I_C	10A	10A	10A	10A	10A
Base Current, I_B	3A	3A	3A	3A	3A

	UPT721-725	UPT731-735
Power Dissipation		
25°C Ambient	2W	3W
100°C Case	25W	50W
Thermal Resistance, θ_{J-C}	4°C/W	2°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

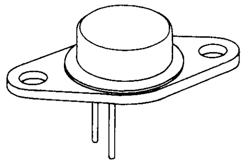
MECHANICAL SPECIFICATIONS

UPT721 UPT722 UPT723 UPT724 UPT725

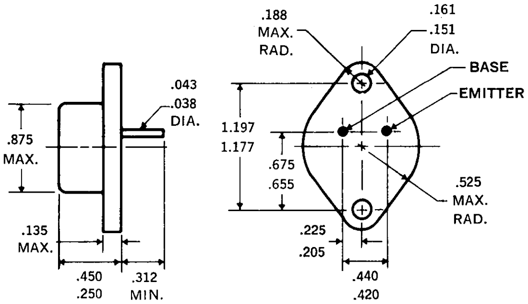


Dimensions in inches.

TO-66

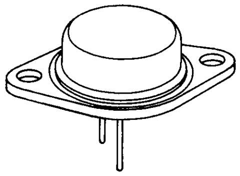


UPT731 UPT732 UPT733 UPT734 UPT735



Dimensions in inches.

TO-3



UNITRODE

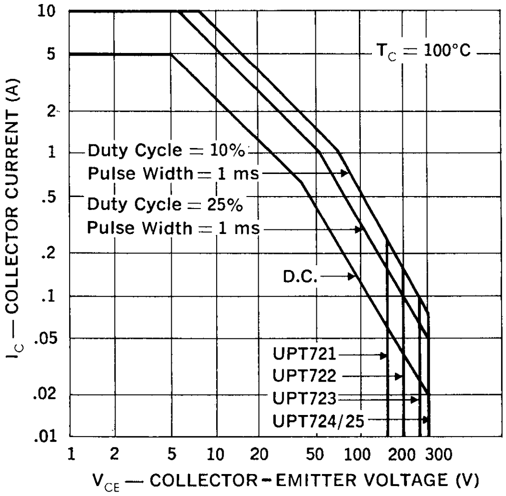
UPT721 UPT722 UPT723 UPT724 UPT725
UPT731 UPT732 UPT733 UPT734 UPT735

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

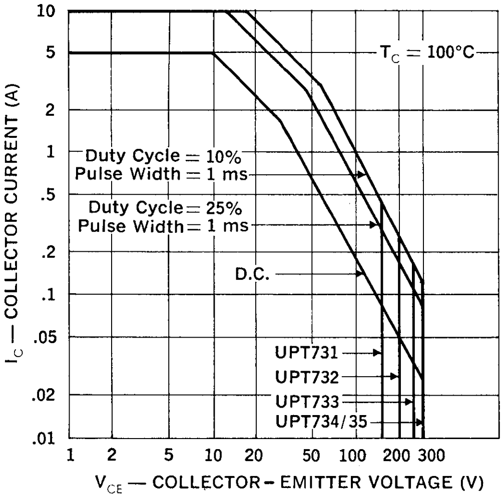
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	25	—	—	$I_C = 1A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 5A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5 Typ.		—	$I_C = 10A, V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 5A, I_B = 1A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.8	Vdc	$I_C = 5A, I_B = 1A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc; R_{BE} = 100\Omega$
UPT721, UPT731		200	—		
UPT722, UPT732		250	—		
UPT723, UPT733		300	—		
UPT724, UPT734		350	—		
UPT725, UPT735		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT721, UPT731		150	—		
UPT722, UPT732		200	—		
UPT723, UPT733		250	—		
UPT724-5, UPT734-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	120	pf	$V_{CB} = 10Vdc, I_E = 0, f = 1MHz$
Gain-Bandwidth Product	f_T	30 Typ.		MHz	$I_C = 0.5Adc, V_{CE} = 5Vdc, f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	250 Typ.		ns	$I_C = 5A$
Switching Speeds Turn-off Time	t_{off}	800 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

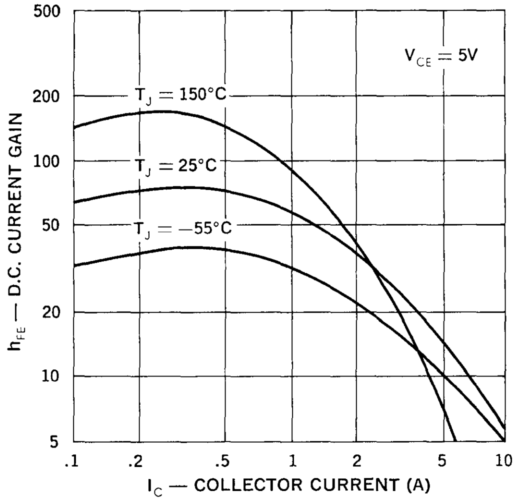
Maximum Safe Operating Area
UPT721-725



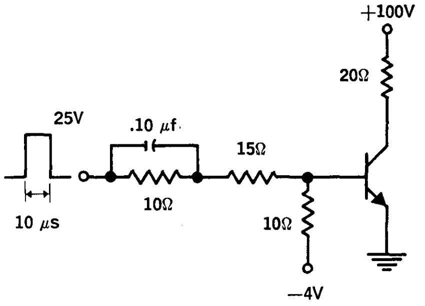
Maximum Safe Operating Area
UPT731-735



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

10 Amp, 150V, Planar NPN

UPT821 UPT831
UPT822 UPT832
UPT823 UPT833
UPT824 UPT834
UPT825 UPT835

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 15A
- Turn-on Time: 250ns
- Turn-off Time: 550ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply, pulse amplifier and similar high efficiency power switching applications.

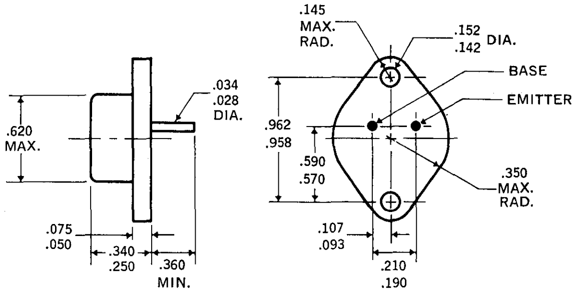
ABSOLUTE MAXIMUM RATINGS

	UPT821 UPT831	UPT822 UPT832	UPT823 UPT833	UPT824 UPT834	UPT825 UPT835
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	10A	10A	10A	10A	10A
Peak Collector Current, I_C	15A	15A	15A	15A	15A
Base Current, I_B	5A	5A	5A	5A	5A

	UPT821-825	UPT831-835
Power Dissipation		
25°C Ambient	2W	3W
100°C Case	25W	50W
Thermal Resistance, θ_{J-C}	4°C/W	2°C/W
Operating and Storage Temperature Range	−65°C to 200°C	−65°C to 200°C

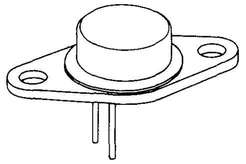
MECHANICAL SPECIFICATIONS

UPT821 UPT822 UPT823 UPT824 UPT825

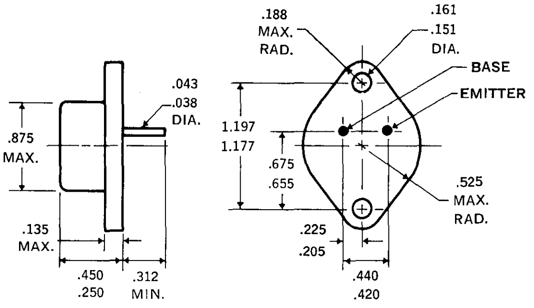


Dimensions in inches.

TO-66

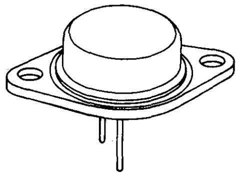


UPT831 UPT832 UPT833 UPT834 UPT835



Dimensions in inches.

TO-3



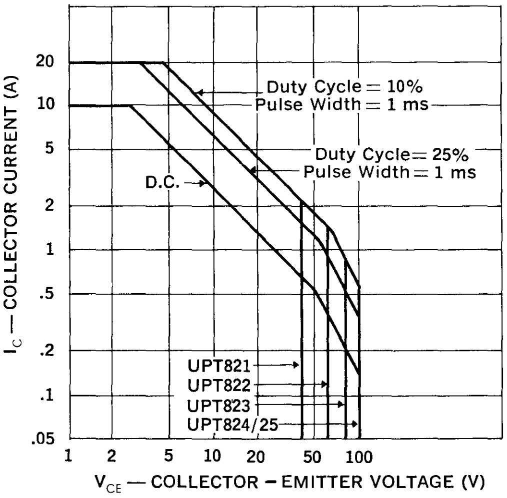
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

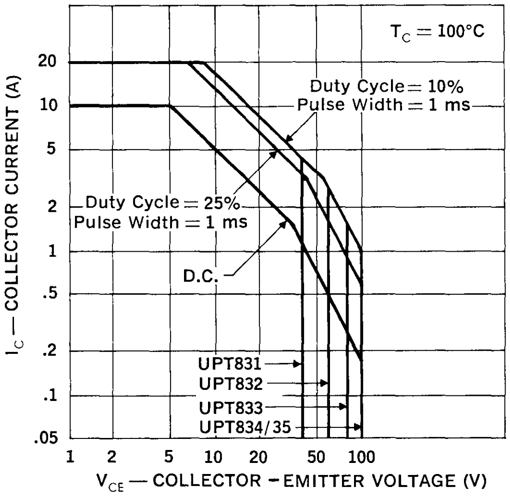
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 5A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	$I_C = 10A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15 Typ.		—	$I_C = 15A, V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—		Vdc	$I_C = 10A, I_B = 1A$
UPT821-3, UPT831-5			1.0	Vdc	
UPT824-5, UPT834-5			1.5	Vdc	
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.8	Vdc	$I_C = 10A, I_B = 1A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc; R_{BE} = 100\Omega$
UPT821, UPT831		60	—		
UPT822, UPT832		80	—		
UPT823, UPT833		100	—		
UPT824, UPT834		120	—		
UPT825, UPT835		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT821, UPT831		40	—		
UPT822, UPT832		60	—		
UPT823, UPT833		80	—		
UPT824-5, UPT834-5		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	150	pf	$V_{CB} = 10Vdc, I_E = 0, f = 1MHz$
Gain-Bandwidth Product	f_T	60 Typ.		MHz	$I_C = 1Adc, V_{CE} = 5Vdc, f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	250 Typ.		ns	$I_C = 10A$
Turn-off Time	t_{off}	550 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ⩽2%.

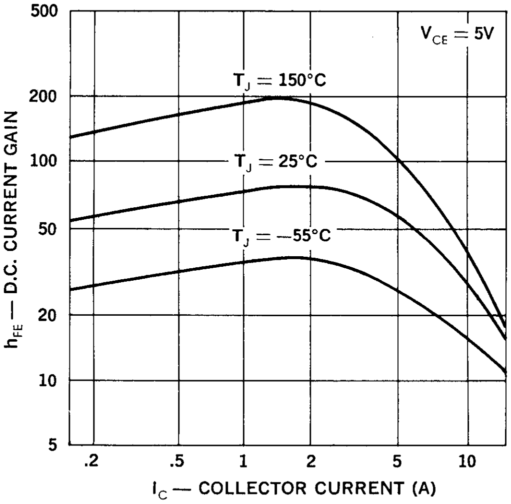
Maximum Safe Operating Area
UPT821 - 825



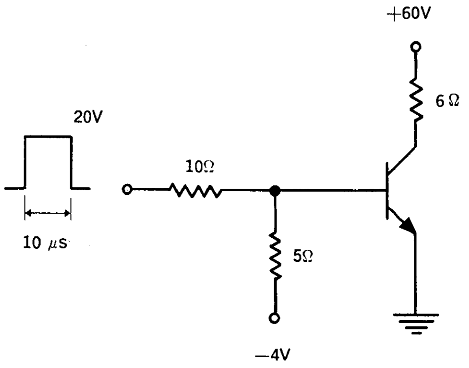
Maximum Safe Operating Area
UPT831 - 835



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

10 Amp, 400V, Planar NPN

UPT931
UPT932
UPT933
UPT934
UPT935

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 15A
- Turn-on Time: 500ns
- Turn-off Time: 1200ns

DESCRIPTION

Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

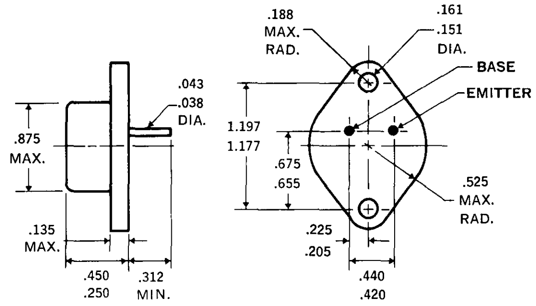
ABSOLUTE MAXIMUM RATINGS

	UPT931	UPT932	UPT933	UPT934	UPT935
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	10A	10A	10A	10A	10A
Peak Collector Current, I_C	15A	15A	15A	15A	15A
Base Current, I_B	5A	5A	5A	5A	5A

	UPT931-935
Power Dissipation	
25°C Ambient	3.5W
100°C Case	70W
Thermal Resistance, θ_{J-C}	1.43°C/W
Operating and Storage Temperature Range	—65°C to 200°C

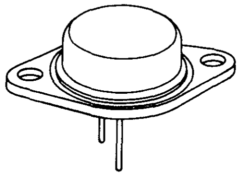
MECHANICAL SPECIFICATIONS

UPT931 UPT932 UPT933 UPT934 UPT935



Dimensions in inches.

TO-3

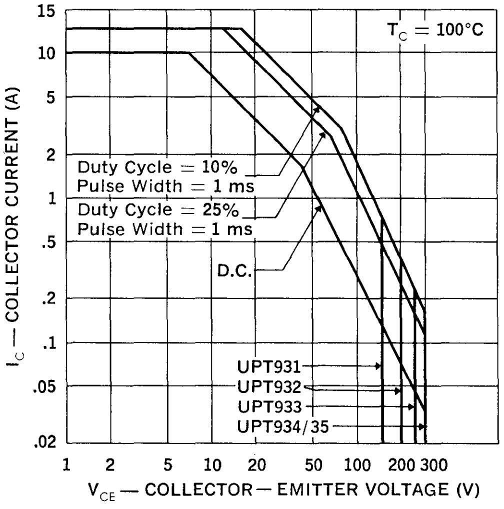


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

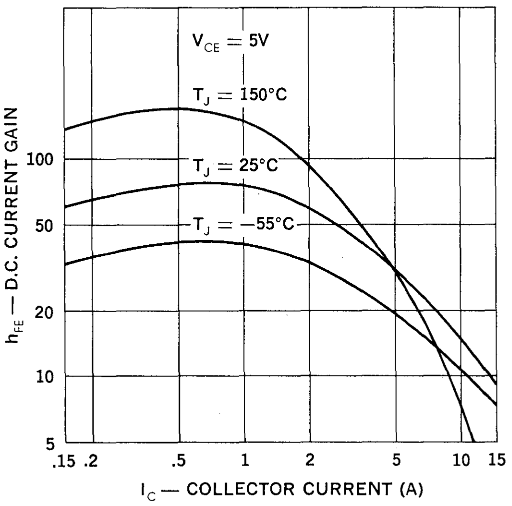
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	$I_C = 5A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 10A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 15A, V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	Vdc	$I_C = 10A, I_B = 2A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	2.2	Vdc	$I_C = 10A, I_B = 2A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc; R_{BE} = 100\Omega$
UPT931		200	—		
UPT932		250	—		
UPT933		300	—		
UPT934		350	—		
UPT935		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT931		150	—		
UPT932		200	—		
UPT933		250	—		
UPT934-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc, I_E = 0, f = 1MHz$
Gain-Bandwidth Product	f_T	30 Typ.		MHz	$I_C = 1Adc, V_{CE} = 5Vdc, f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	500 Typ.		ns	$I_C = 10A$
Switching Speeds Turn-off Time	t_{off}	1200 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

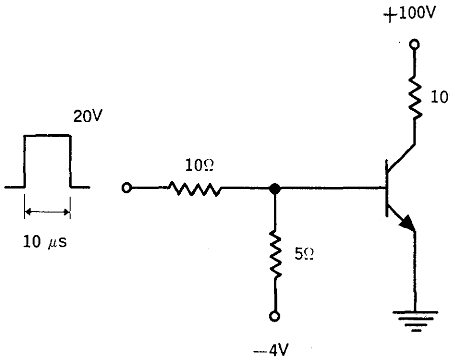
Maximum Safe Operating Area UPT931—935



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

15 Amp, 150V, Planar NPN

UPT1021 UPT1031
UPT1022 UPT1032
UPT1023 UPT1033
UPT1024 UPT1034
UPT1025 UPT1035

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 20A
- Turn-on Time: 450ns
- Turn-off Time: 350ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

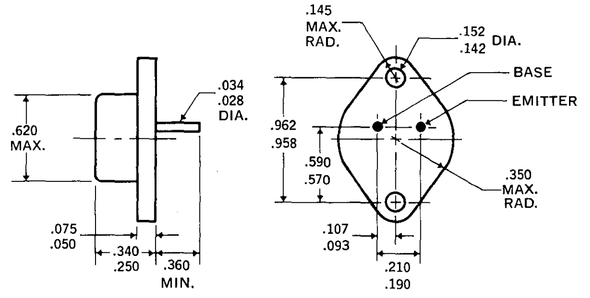
ABSOLUTE MAXIMUM RATINGS

	UPT1021 UPT1031	UPT1022 UPT1032	UPT1023 UPT1033	UPT1024 UPT1034	UPT1025 UPT1035
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	15A	15A	15A	15A	15A
Peak Collector Current, I_C	20A	20A	20A	20A	20A
Base Current, I_B	5A	5A	5A	5A	5A

Power Dissipation	UPT1021-1025	UPT1021-1025
25°C Ambient	2.5W	3.5W
100°C Case	30W	60W
Thermal Resistance, θ_{J-C}	3.3°C/W	1.65°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

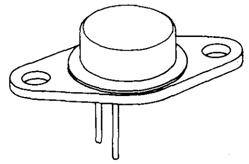
MECHANICAL SPECIFICATIONS

UPT1021 UPT1022 UPT1023 UPT1024 UPT1025

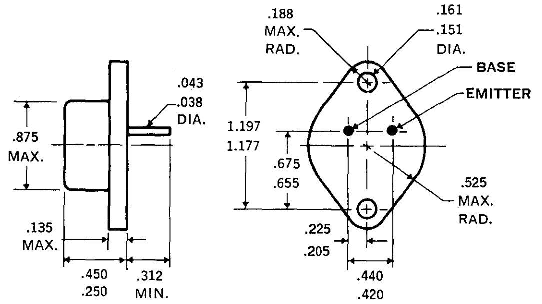


Dimensions in inches.

TO-66

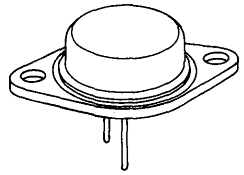


UPT1031 UPT1032 UPT1033 UPT1034 UPT1035



Dimensions in inches.

TO-3



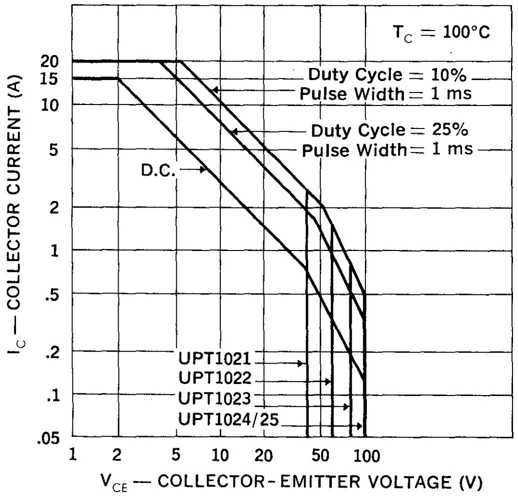
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

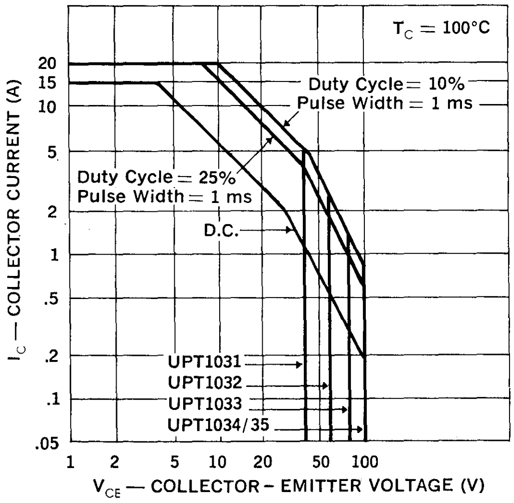
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	40	—	—	$I_C = 5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	$I_C = 15A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 20A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—			$I_C = 15A$, $I_B = 1.5A$
UPT1021-3, UPT1031-3			1.5	Vdc	
UPT1024-5, UPT1034-5			2.0	Vdc	
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	2.2	Vdc	$I_C = 15A$, $I_B = 1.5A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT1021, UPT1031		60	—		
UPT1022, UPT1032		80	—		
UPT1023, UPT1033		100	—		
UPT1024, UPT1034		120	—		
UPT1025, UPT1035		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT1021, UPT1031		40	—		
UPT1022, UPT1032		60	—		
UPT1023, UPT1033		80	—		
UPT1024-5, UPT1034-5		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	50 Typ.		MHz	$I_C = 1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	450 Typ.		ns	$I_C = 15A$
Switching Speeds Turn-off Time	t_{off}	350 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

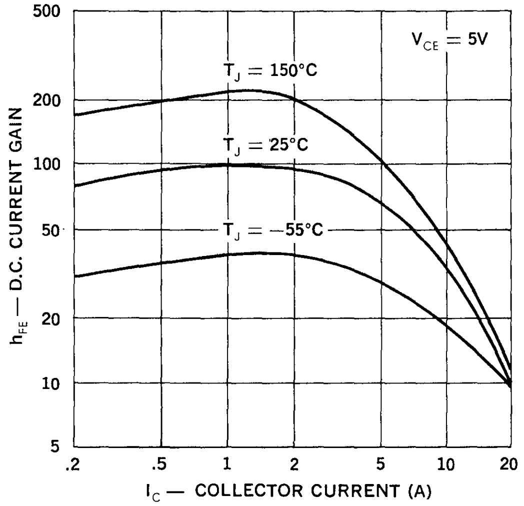
Maximum Safe Operating Area
UPT1021–1025



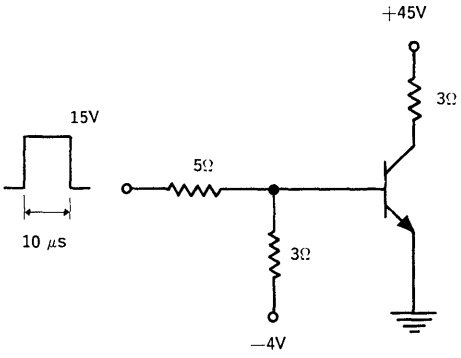
Maximum Safe Operating Area
UPT1031–1035



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

20 Amp, 150V, Planar NPN

UPT1131
UPT1132
UPT1133
UPT1134
UPT1135

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 30A
- Turn-on Time: 300ns
- Turn-off Time: 600ns

DESCRIPTION

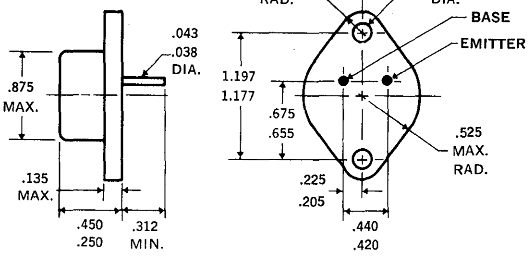
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	UPT1131	UPT1132	UPT1133	UPT1134	UPT1135
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	20A	20A	20A	20A	20A
Peak Collector Current, I_C	30A	30A	30A	30A	30A
Base Current, I_B	7A	7A	7A	7A	7A
Power Dissipation					
25°C Ambient					3.5W
100°C Case					70W
Thermal Resistance, Θ_{J-C}					1.43°C/W
Operating and Storage Temperature Range					—65°C to 200°C

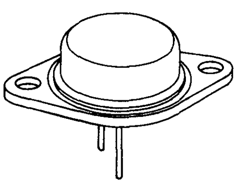
MECHANICAL SPECIFICATIONS

UPT1131 UPT1132 UPT1133 UPT1134 UPT1135



Dimensions in inches.

TO-3

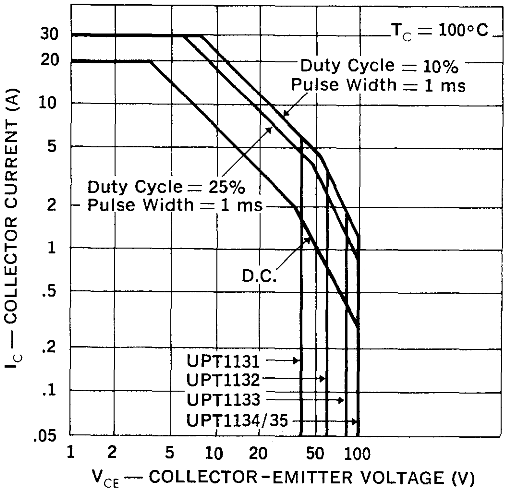


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

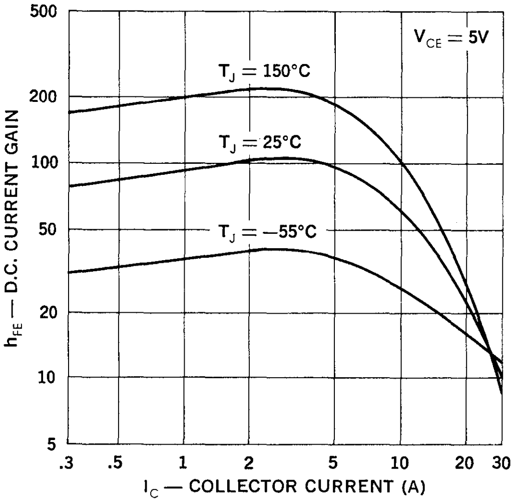
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 10A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	$I_C = 20A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 30A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	Vdc	$I_C = 20A$, $I_B = 2A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	2.2	Vdc	$I_C = 20A$, $I_B = 2A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT1131		60	—		
UPT1132		80	—		
UPT1133		100	—		
UPT1134		120	—		
UPT1135		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT1131		40	—		
UPT1132		60	—		
UPT1133		80	—		
UPT1134-35		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	60 Typ.		MHz	$I_C = 2Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	300 Typ.		ns	$I_C = 20A$
Switching Speeds Turn-off Time	t_{off}	600 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

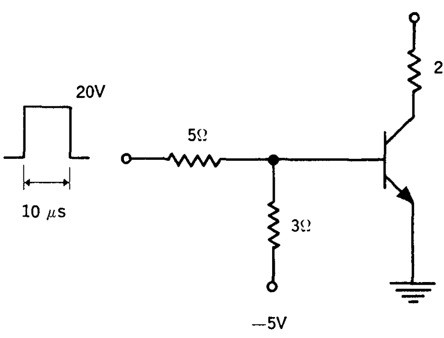
Maximum Safe Operating Area
UPT1131-1135



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



RECTIFIERS
Radiation Tolerant, 1 Amp-2 Amp

UR105-UR125
UR205-UR225

FEATURES
- Radiation Tolerant: to 10^{16} NVT
- Continuous Rating: to 2A
- Controlled Avalanche
- Surge Rating: to 25A
- Miniature Package

DESCRIPTION
These devices are particularly suited to applications where radiation is present. These units have unique ability to withstand high levels of neutron, gamma and electron radiation.

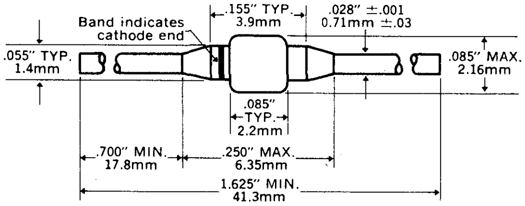
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	1 Amp Series	2 Amp Series
50V	UR105	UR205
100V	UR110	UR210
150V	UR115	UR215
200V	UR120	UR220
250V	UR125	UR225

	1 AMP SERIES	2 AMP SERIES
Maximum Average D.C. Output Current		
@ $T_A = 25°C$	1A	2A
@ $T_A = 100°C$	0.5A	1A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	20A	25A
Operating Temperature Range	−195°C to +175°C	
Storage Temperature Range	−195°C to +200°C	
Thermal Resistance	See Lead Temperature Derating Curve	

MECHANICAL SPECIFICATIONS

UR105-UR125 UR205-UR225



Part Identification: White band indicates "UR." Part number printed on body.

Polarity: Denoted by white band.

Weight: 0.26 grams, typical.

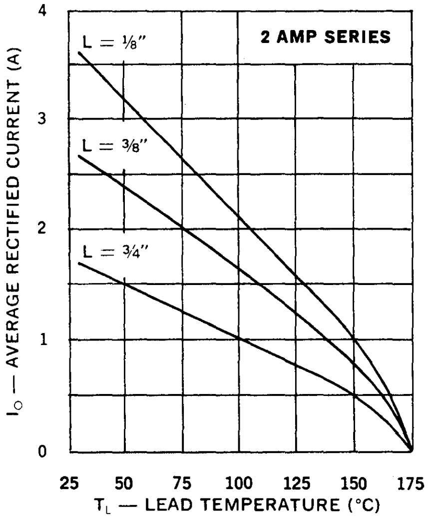
BODY A

UNITRODE

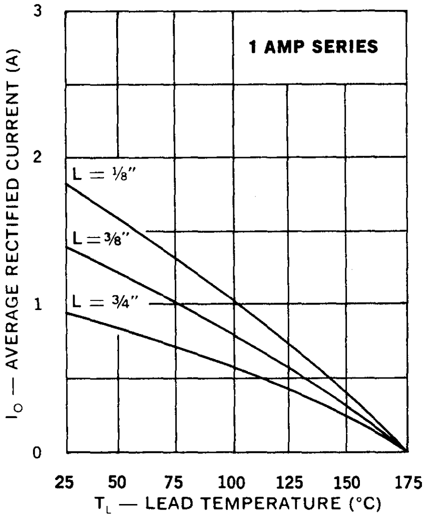
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV		Maximum Radiation Tolerance
			25°C	100°C	
UR205 UR210 UR215 UR220 UR225	50V 100V 150V 200V 250V	1.0V @ 1A	3μA	50μA	10^{16} NVT 10^{16} 10^{15} 10^{14} 10^{14}
UR105 UR110 UR115 UR120 UR125	50V 100V 150V 200V 250V	1.0V @ 0.5A	3μA	50μA	10^{16} 10^{16} 10^{15} 10^{14} 10^{14}

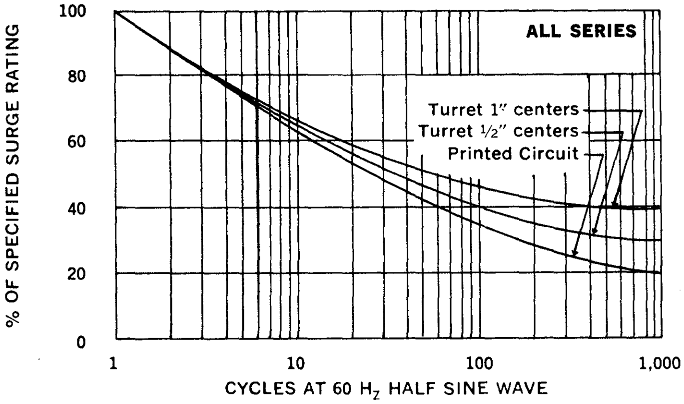
Maximum Current vs Lead Temperature



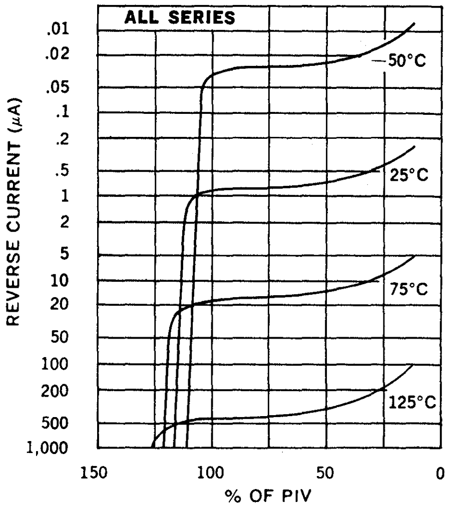
Maximum Current vs Lead Temperature



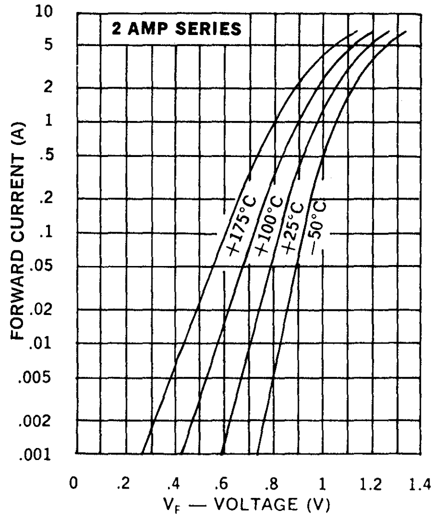
Allowable Forward Surge vs Number of Cycles



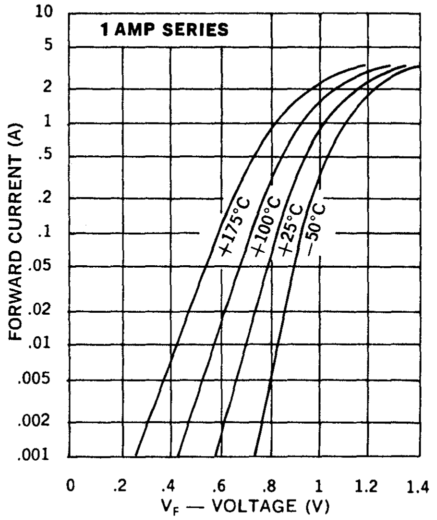
Typical Reverse Current vs PIV



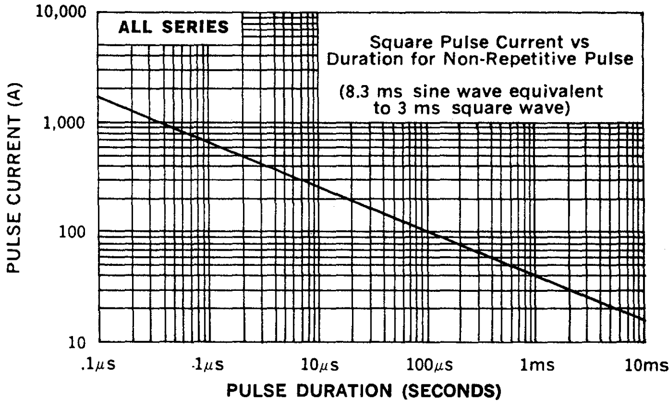
Typical Forward Current vs Forward Voltage



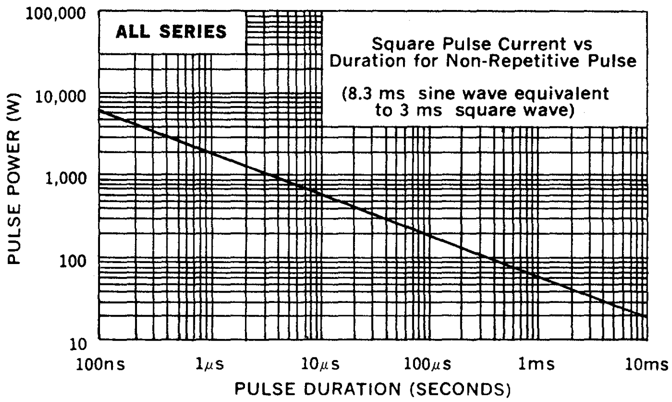
Typical Forward Current vs Forward Voltage



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIER ASSEMBLIES

High Voltage Stacks, .125 Amp to 1 Amp, Standard and Fast Recovery

US12–US200A
USR12–USR180A

FEATURES

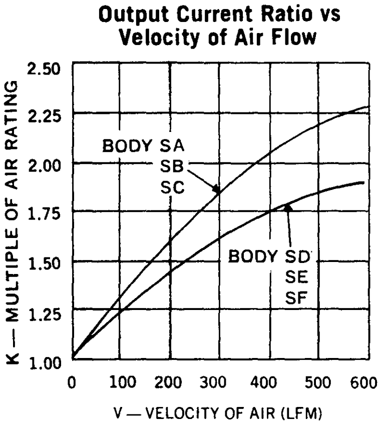
- Controlled Avalanche Characteristics
- Recovery Times: to 500ns
- Transfer Molded for Voidless Encapsulation
- High Forward and Reverse Surge Capability
- PIV: from 1200 to 20,000V
- Only Fused-in-Glass Diodes Used

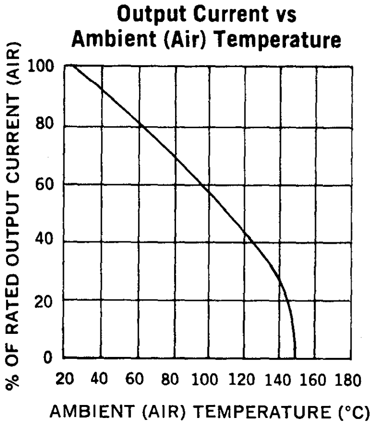
DESCRIPTION

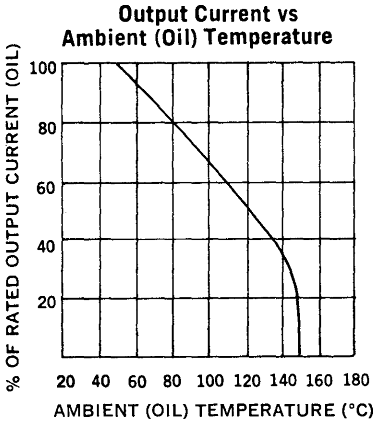
This series of High Voltage, Medium Current Stacks are assembled from hermetically sealed, controlled avalanche individual diodes. Therefore, they offer the ultimate in reliability for such applications as clipper diodes, back swing diodes and hold-off diodes in pulse modulators.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	1200 to 20,000V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	20A
Operating and Storage Temperature Range	−65°C to +150°C


Output Current Ratio vs Velocity of Air Flow

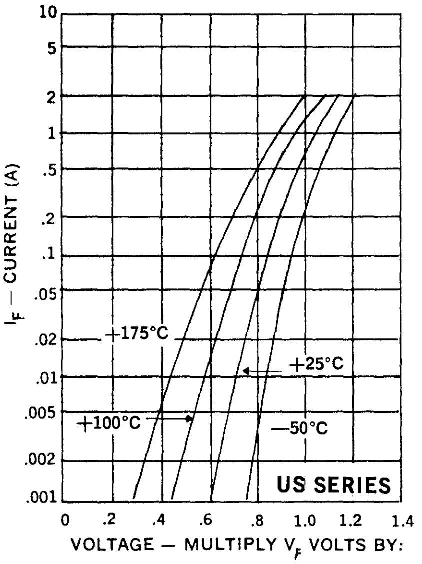

Output Current vs Ambient (Air) Temperature


Output Current vs Ambient (Oil) Temperature

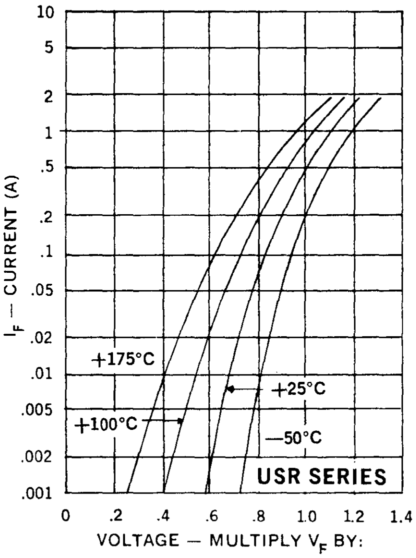
Electrical Specifications (at 25°C unless noted)							Maximum Ratings	
Type	PIV	Maximum Leakage Current at PIV		Maximum Forward Voltage Drop	Maximum Reverse Recovery Time†	Body Size	Max. Avg. D.C. Output Current	
		$T_A = 25°C$	$T_A = 100°C$				$T_A = 25°C$ (Air)	$T_A = 50°C$ (Oil)
	V	μA	μA		ns		mA	mA
Standard Recovery								
US 12	1200	2	100	2.0V @ 400mA	——	SA	1000	2500
US 15	1500	2	100	3.0V @ 400mA		SA	800	2000
US 18	1800	2	100	3.0V @ 400mA		SA	700	1750
US 20	2000	2	100	4.0V @ 400mA		SA	600	1500
US 25	2500	2	100	5.0V @ 400mA	——	SB	600	1500
US 30	3000	2	100	6.0V @ 400mA		SB	500	1250
US 35	3500	2	100	7.0V @ 200mA	——	SC	400	1000
US 40	4000	2	100	7.0V @ 200mA		SC	350	850
US 45A	4500	2	100	8.0V @ 200mA	——	SD	330	750
US 50A	5000	2	100	9.0V @ 200mA		SD	330	750
US 60A	6000	2	100	10.0V @ 200mA		SD	300	620
US 70A	7000	2	100	12.0V @ 200mA		SD	300	620
US 80A	8000	2	100	14.0V @ 100mA	——	SE	250	500
US 100A	10000	2	100	17.0V @ 100mA		SE	250	500
US 120A	12000	2	100	21.0V @ 100mA		SE	200	400
US 150A	15000	2	100	26.0V @ 100mA	——	SF	200	400
US 180A	18000	2	100	31.0V @ 100mA		SF	180	360
US 200A	20000	2	100	34.0V @ 100mA		SF	180	360
Fast Recovery								
USR 12	1200	5	150	3.3V @ 400mA	500	SA	750	1850
USR 15	1500	5	150	4.0V @ 400mA	500	SA	600	1500
USR 20	2000	5	150	5.5V @ 400mA	500	SB	500	1250
USR 25	2500	5	150	6.6V @ 400mA	500	SB	400	1000
USR 30	3000	5	150	7.7V @ 400mA	500	SC	400	1000
USR 35	3500	5	150	8.8V @ 200mA	500	SC	350	850
USR 40A	4000	5	150	9.9V @ 200mA	500	SD	300	750
USR 45A	4500	5	150	11.0V @ 100mA	500	SD	250	625
USR 50A	5000	5	150	13.0V @ 100mA	500	SD	250	625
USR 60A	6000	5	150	15.4V @ 100mA	500	SD	220	500
USR 70A	7000	5	150	17.6V @ 100mA	500	SE	220	500
USR 80A	8000	5	150	20.0V @ 100mA	500	SE	200	400
USR 100A	10000	5	150	24.0V @ 100mA	500	SE	200	400
USR 120A	12000	5	150	31.0V @ 100mA	500	SF	150	300
USR 150A	15000	5	150	33.0V @ 100mA	500	SF	150	300
USR 180A	18000	5	150	35.0V @ 100mA	500	SF	125	250

†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

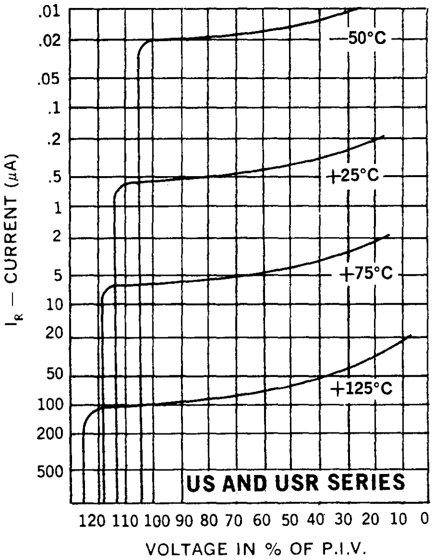
Typical Forward Current vs. Forward Voltage



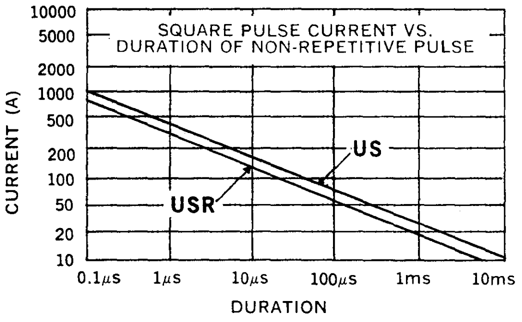
Typical Forward Current vs. Forward Voltage



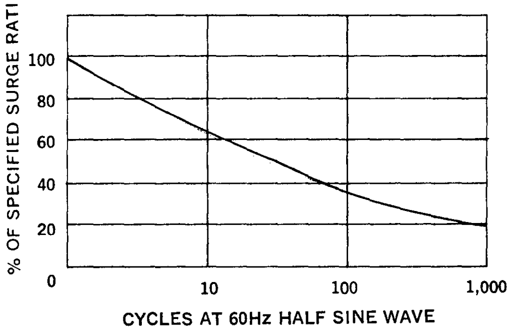
Typical Leakage Current vs. Voltage



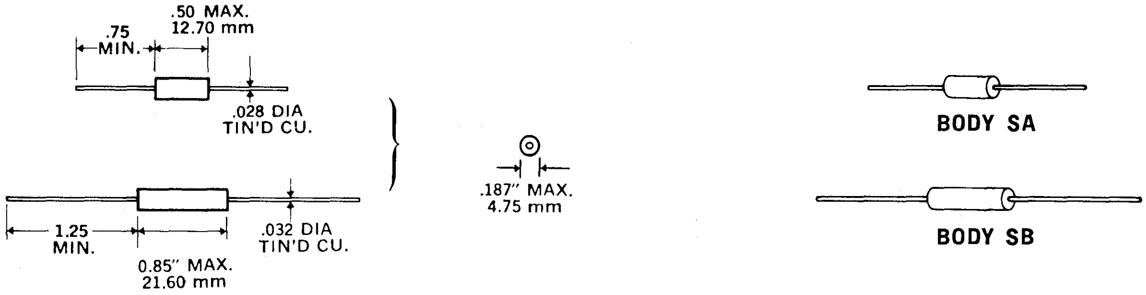
Forward Pulse Current vs Duration



Multiple Forward Surge Rating

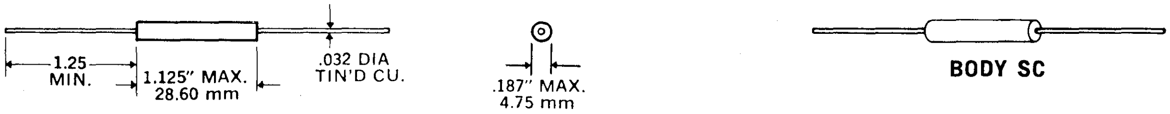


MECHANICAL SPECIFICATIONS

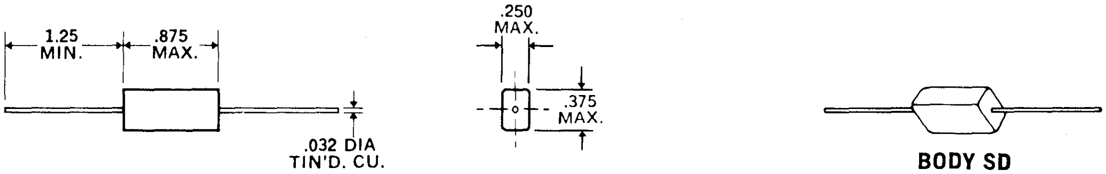


BODY SA

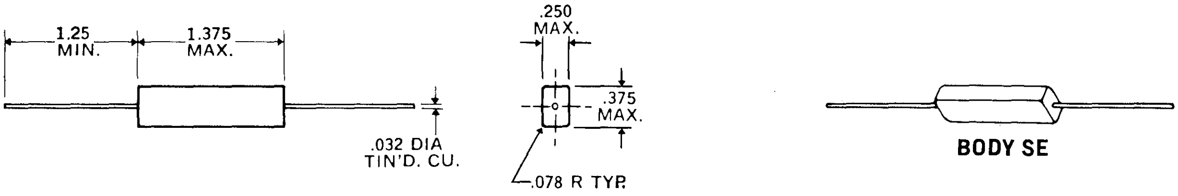
BODY SB



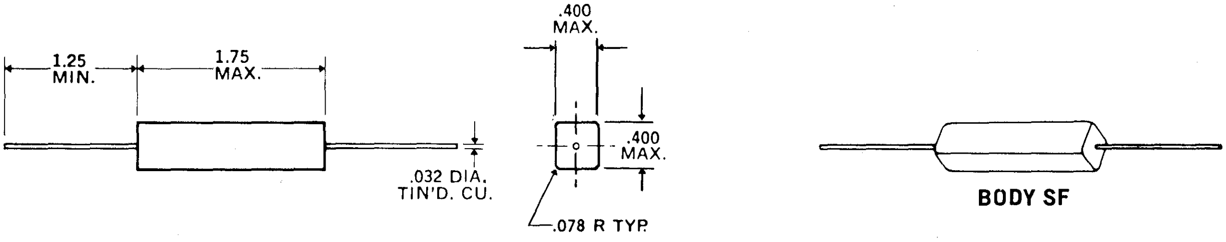
BODY SC



BODY SD



BODY SE



BODY SF

RECTIFIERS

Standard Recovery, 1 Amp to 2 Amp

UT236-UT347
UT249-UT363
UT251-UT364
UT261-UT268

FEATURES

- Continuous Rating: to 2A
- Controlled Avalanche
- Surge Rating: to 30A
- PIV: to 1000V
- Miniature Package

DESCRIPTION

These miniature power rectifiers offer the user extreme reliability for high-rel military supplies.

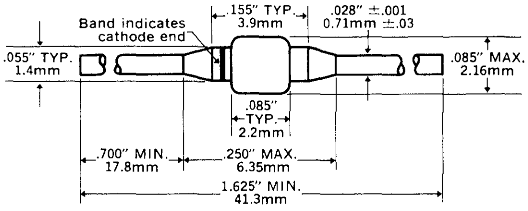
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	1 Amp Series	1.25 Amp Series	1.5 Amp Series	2 Amp Series
100V	UT236	UT249	UT251	UT261
200V	UT234	UT242	UT252	UT262
400V	UT235	UT244	UT254	UT264
500V	UT237	UT245	UT255	UT265
600V	UT238	UT247	UT257	UT267
800V	UT361	UT362	UT258	UT268
1000V	UT347	UT363	UT364	

Maximum Average D.C. Output Current	1 AMP SERIES	1.25 AMP SERIES	1.5 AMP SERIES	2 AMP SERIES
@ $T_A = 25°C$	1.0A	1.25A	1.5A	2.0A
@ $T_A = 100°C$	0.5A	0.65A	0.75A	1.0A
Non-Repetitive Sinuosoidal Surge (8.3ms)	20A	20A	25A	30A
Operating Temperature Range	—195°C to +175°C			
Storage Temperature Range	—195°C to +175°C			
Thermal Resistance	See lead temperature derating curve			

MECHANICAL SPECIFICATIONS

UT236-UT347 UT249-UT363 UT251-UT364 UT261-UT268



Part Identification: Orange band indicates "UT." Part number printed on body.

Polarity: Denoted by orange band.

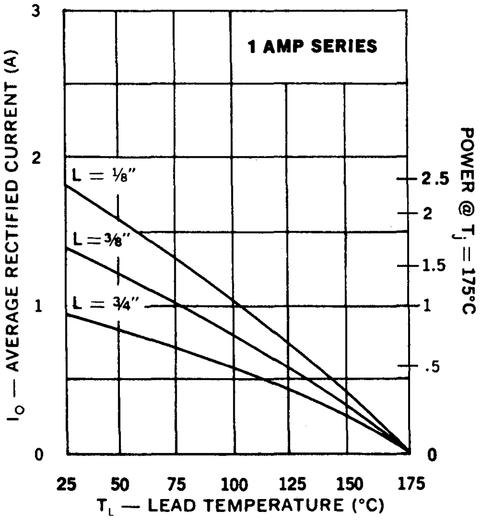
Weight: 0.26 grams, typical.

BODY A

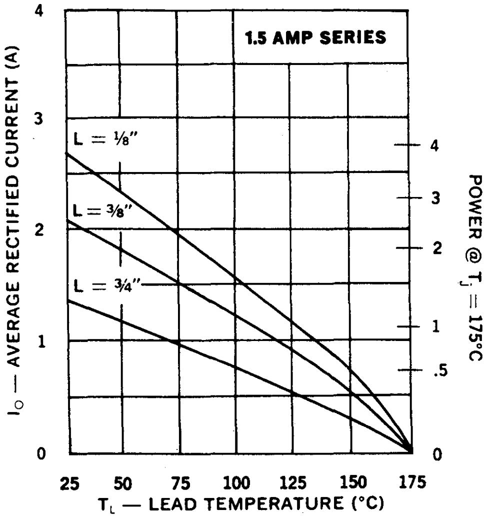
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV	
			25°C	100°C
UT261	100V	1V @ 900mA	2μA	75μA
UT262	200V			
UT264	400V			
UT265	500V			
UT267	600V			
UT268	800V			
UT251	100V	1V @ 750mA	2μA	75μA
UT252	200V			
UT254	400V			
UT255	500V			
UT257	600V			
UT258	800V			
UT364	1000V			
UT249	100V	1V @ 500mA	2μA	75μA
UT242	200V			
UT244	400V			
UT245	500V			
UT247	600V			
UT362	800V			
UT363	1000V			
UT236	100V	1V @ 400mA	2μA	75μA
UT234	200V			
UT235	400V			
UT237	500V			
UT238	600V			
UT361	800V			
UT347	1000V			

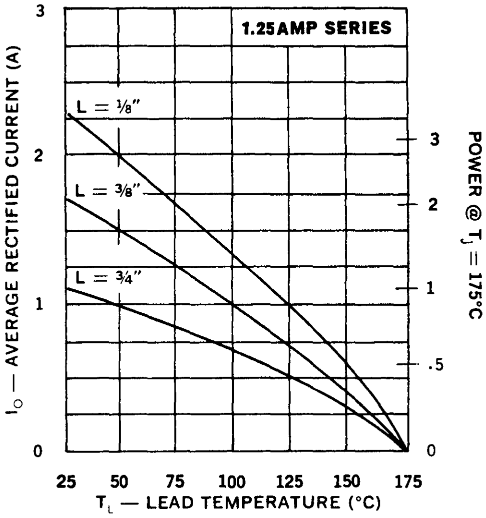
Maximum Current vs Lead Temperature



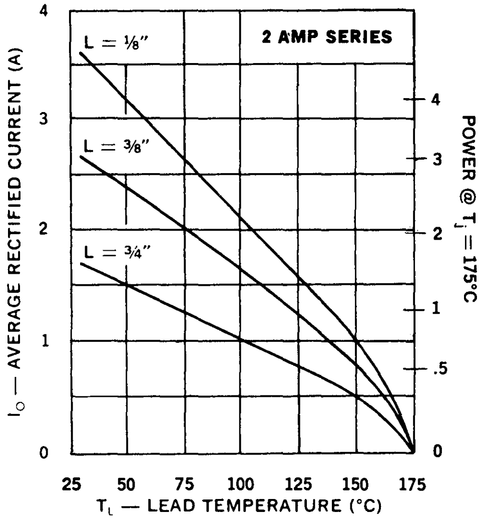
Maximum Current vs Lead Temperature



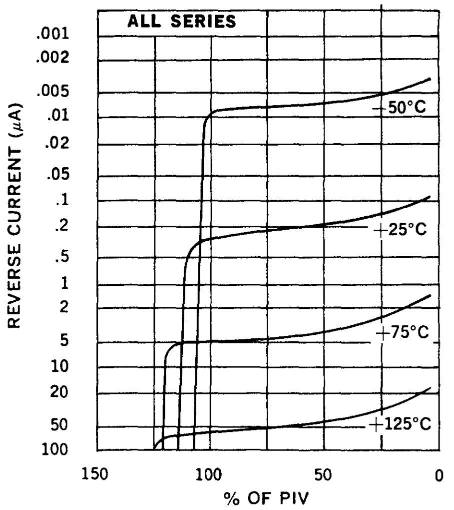
Maximum Current vs Lead Temperature



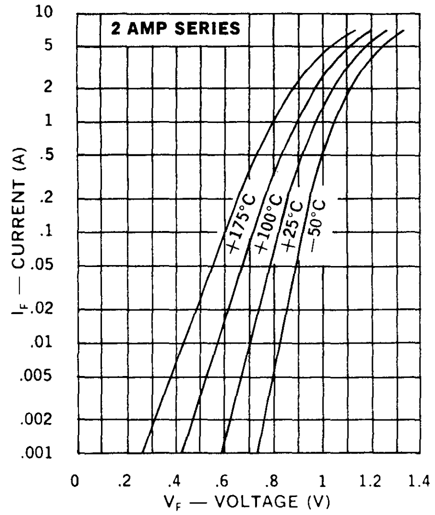
Maximum Current vs Lead Temperature



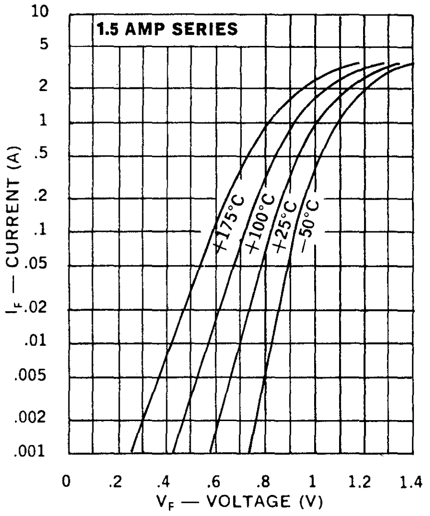
Typical Leakage Current vs. PIV



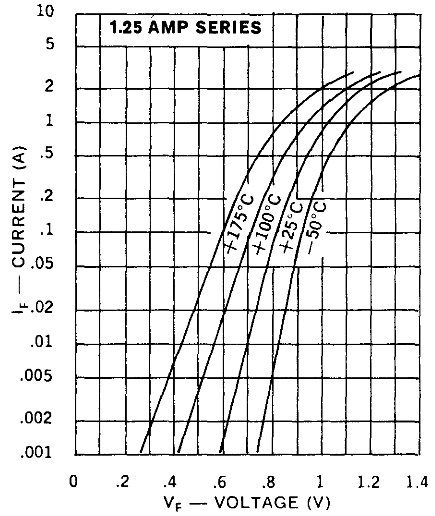
Typical Forward Current vs Forward Voltage



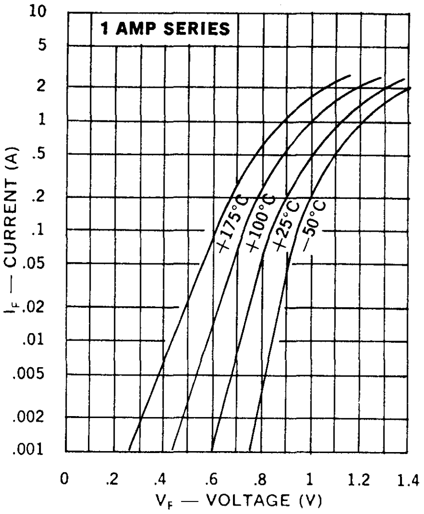
Typical Forward Current vs Forward Voltage



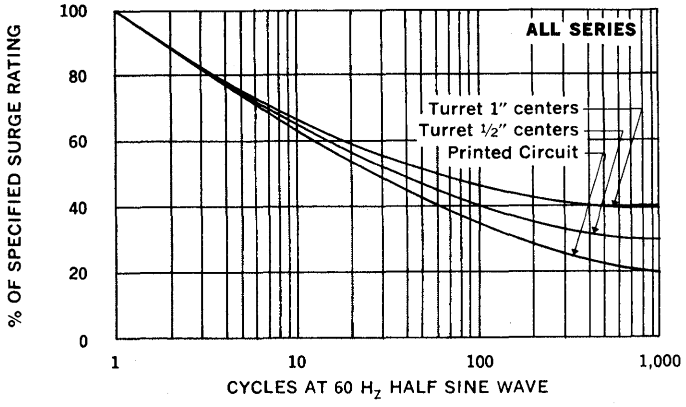
Typical Forward Current vs Forward Voltage



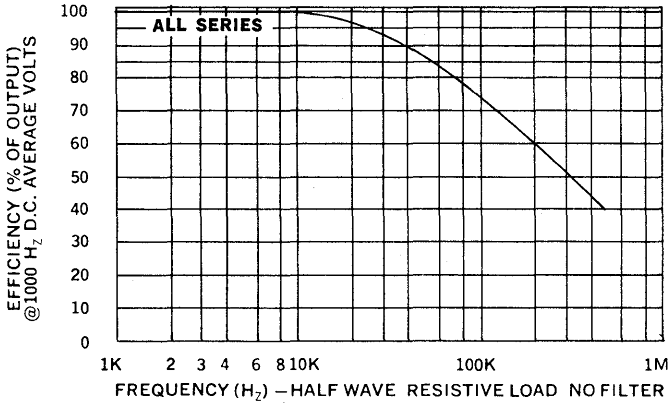
Typical Forward Current vs Forward Voltage



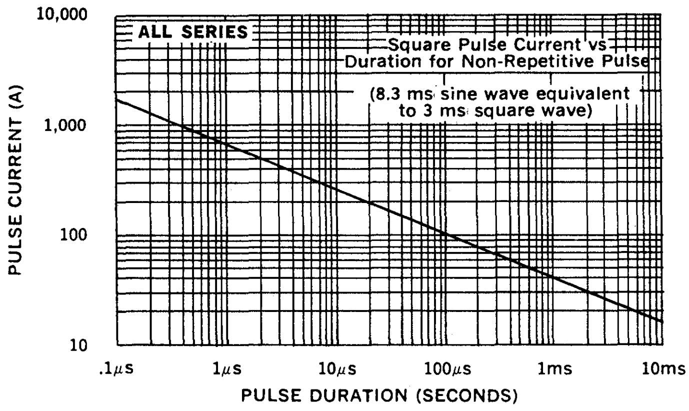
Allowable Forward Surge vs Number of Cycles



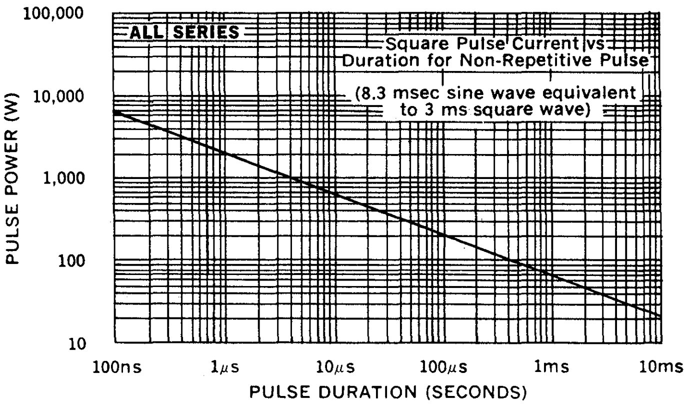
Efficiency vs Frequency at Rated Current (Sine Wave)



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIERS

Standard Recovery, 2 Amp to 4 Amp

UT2005-UT2060
UT3005-UT3060
UT4005-UT4060

FEATURES

- Continuous Rating: to 4A
- Controlled Avalanche
- Surge Rating: to 100A
- PIV: to 600 V
- Miniature Package

DESCRIPTION

High average power and surge capability make these series of devices attractive in many high-rel applications.

All Unitrode rectifiers have a sleeve of pure hard glass fused to the silicon junction. Since the silicon sees only this glass, electrical characteristics are permanently stable. This voidless, monolithic package is totally unaffected by the most severe moisture or temperature testing.

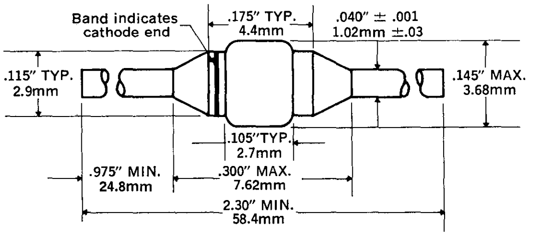
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2 Amp Series	3 Amp Series	4 Amp Series
50V	UT2005	UT3005	UT4005
100V	UT2010	UT3010	UT4010
200V	UT2020	UT3020	UT4020
400V	UT2040	UT3040	UT4040
600V	UT2060	UT3060	UT4060

	2 AMP SERIES	3 AMP SERIES	4 AMP SERIES
Maximum Average D.C. Output Current			
@ $T_A = 25°C$	2.0A	3.0A	4.0A
@ $T_A = 100°C$	1.0A	1.5A	2.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	60A	80A	100A
Operating Temperature Range	—195°C to +175°C		
Storage Temperature Range	—195°C to +200°C		
Thermal Resistance	See lead temperature derating curve		

MECHANICAL SPECIFICATIONS

UT2005-UT2060 UT3005-UT3060 UT4005-UT4060



Part Identification: Orange band indicates "UT." Part number printed on body.

Polarity: Denoted by orange band.

Weight: 0.75 grams, typical.

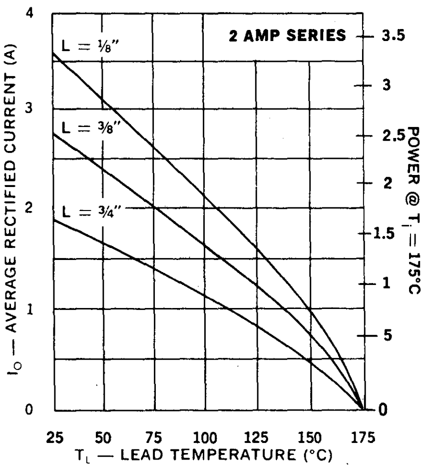
BODY B

UNITRODE

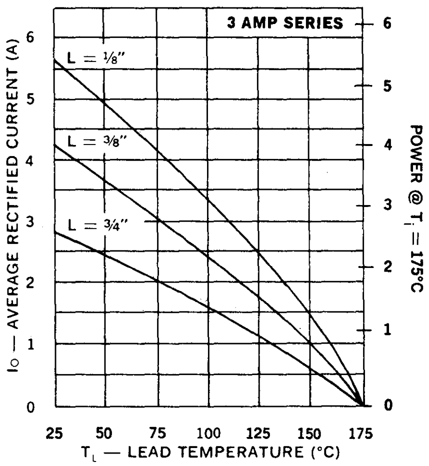
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV	
			25°C	100°C
UT4005 UT4010 UT4020 UT4040 UT4060	50V 100V 200V 400V 600V	1V @ 3A	5μA	100μA
UT3005 UT3010 UT3020 UT3040 UT3060	50V 100V 200V 400V 600V	1V @ 2A	5μA	100μA
UT2005 UT2010 UT2020 UT2040 UT2060	50V 100V 200V 400V 600V	1V @ 1A	5μA	100μA

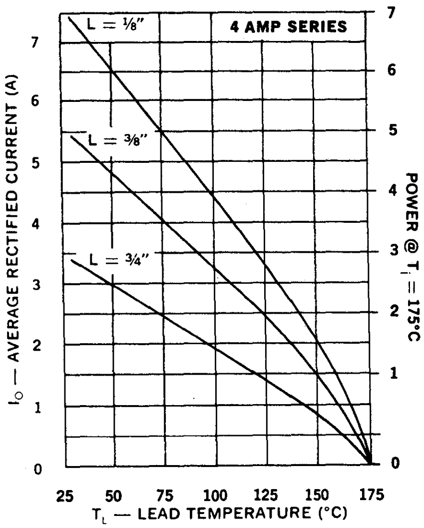
Maximum Current vs Lead Temperature



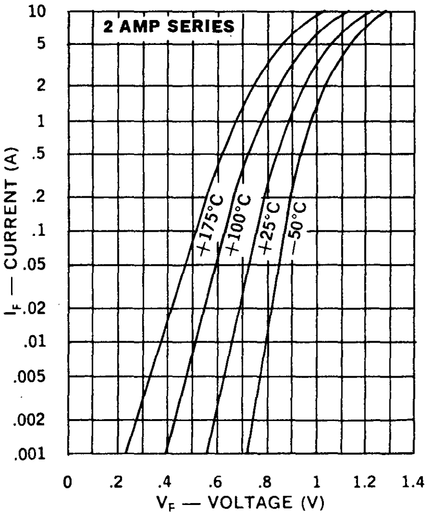
Maximum Current vs Lead Temperature



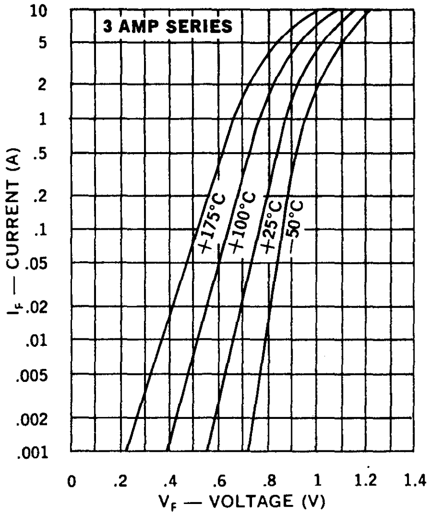
Maximum Current vs Lead Temperature



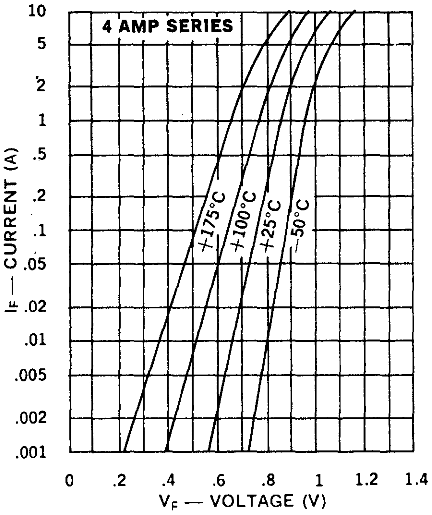
Typical Forward Current vs Forward Voltage



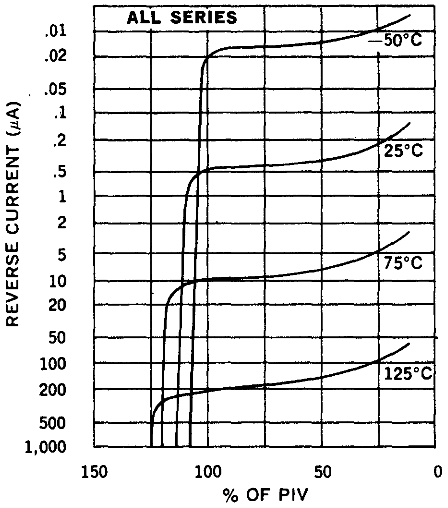
Typical Forward Current vs Forward Voltage



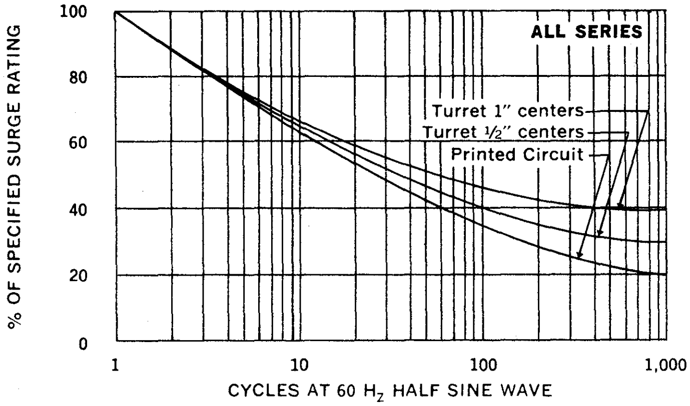
Typical Forward Current vs Forward Voltage



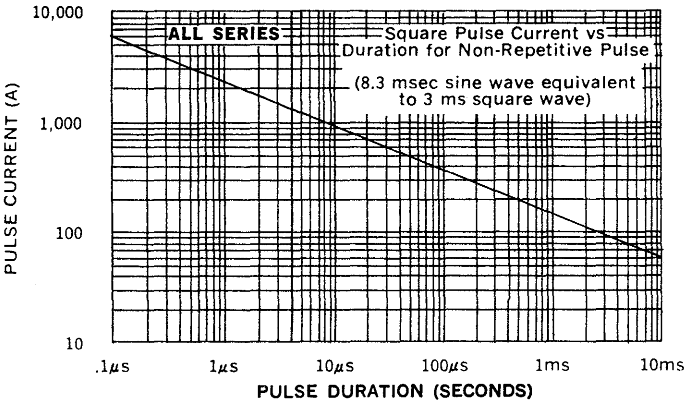
Typical Reverse Current vs PIV



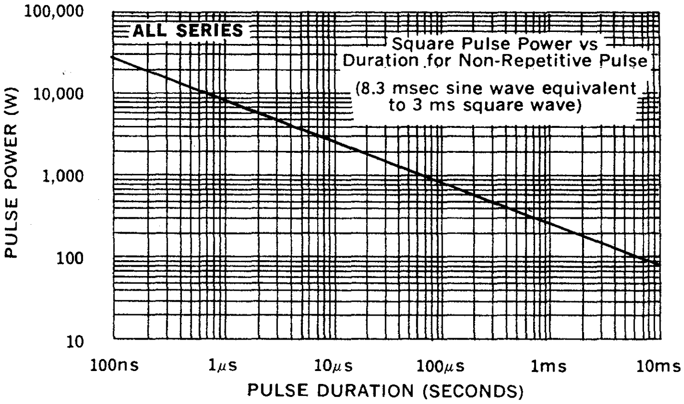
Allowable Forward Surge vs Number of Cycles



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIERS

Standard Recovery, 7.5 Amp to 12 Amp

UT5105-UT5160
UT6105-UT6160
UT8105-UT8160

FEATURES

- Rating: 12A
- Controlled Avalanche
- Miniature Package
- Surge Rating: 200A

DESCRIPTION

These series of high current rectifiers offers opportunity for size and weight reduction in high power supplies.

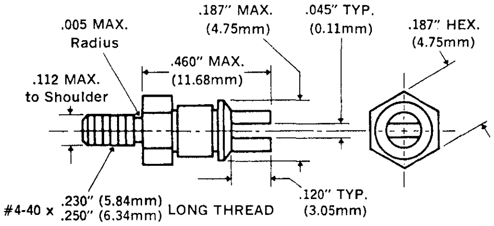
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	12 Amp Series	9 Amp Series	7.5 Amp Series
50V	UT8105	UT6105	UT5105
100V	UT8110	UT6110	UT5110
200V	UT8120	UT6120	UT5120
400V	UT8140	UT6140	UT5140
600V	UT8160	UT6160	UT5160

	12 AMP SERIES	9 AMP SERIES	7.5 AMP SERIES
Maximum Average D.C. Output Current			
@ $T_C = 100°C$	12.0A	9.0A	7.5A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	200A	175A	150A
Operating and Storage Temperature Range	—65°C to +175°C		
Thermal Resistance, Junction to Case	7.5°C/Watt		
Current Derating	See current vs. case temperature curve		

MECHANICAL SPECIFICATIONS

UT5105-UT5160 UT6105-UT6160 UT8105-UT8160



Part Identification: Numerals and polarity letter indicate "UT" type number; e.g., 8105R.

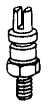
Polarity: Cathode to Stud is standard. Reverse polarity denoted by "R" Suffix.

Finish: Metal parts gold plated per MIL-G-45204, Type II.

Max. Weight: 1.5 grams.

Also available with insulated stud.

BODY C — Stud Mount

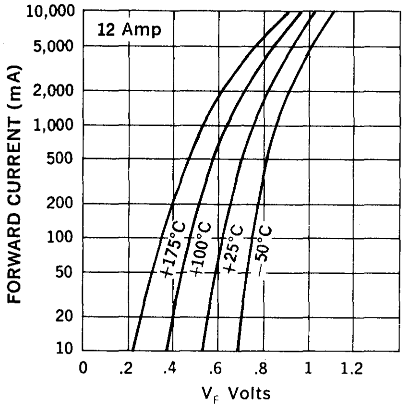


Installation
Maximum unlubricated stud torque: 28 inch-ounces.
Insulating hardware supplied.
Do not use a screwdriver in the turret slot for installation purposes, or damage may result.

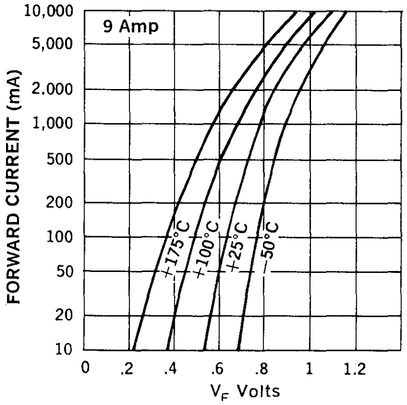
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Peak Inverse Voltage	Maximum Forward Voltage	Max. Reverse Current at PIV	
			25°C	100°C
UT8105	50V	1V @ 8A	10μA	300μA
UT8110	100V			
UT8120	200V			
UT8140	400V			
UT8160	600V			
UT6105	50V	1V @ 6A	10μA	300μA
UT6110	100V			
UT6120	200V			
UT6140	400V			
UT6160	600V			
UT5105	50V	1V @ 5A	10μA	300μA
UT5110	100V			
UT5120	200V			
UT5140	400V			
UT5160	600V			

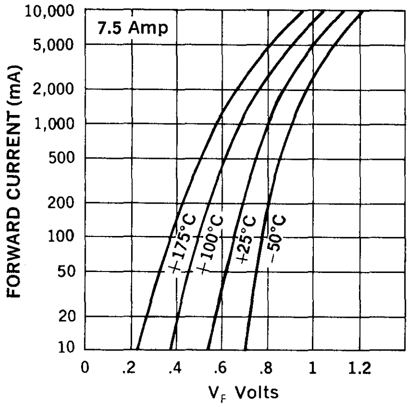
Typical Forward Voltage vs Forward Current



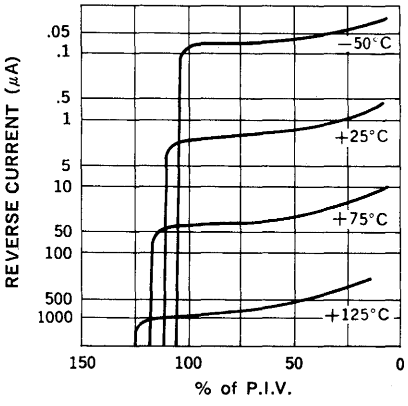
Typical Forward Voltage vs Forward Current



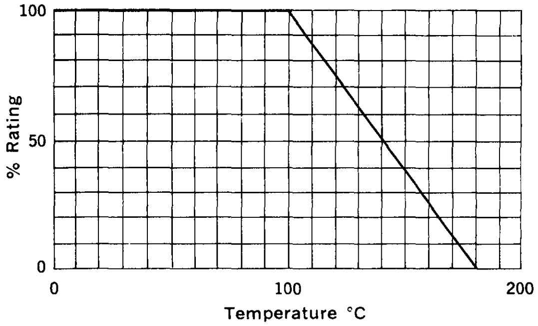
Typical Forward Voltage vs Forward Current



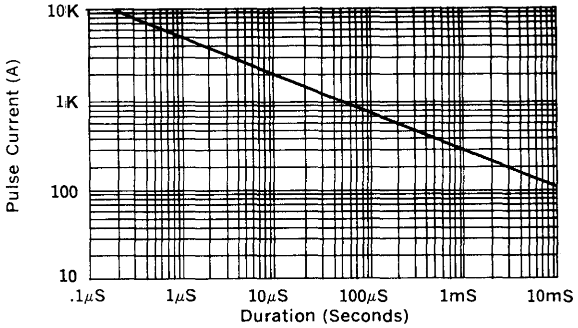
Typical P.I.V. vs Reverse Current



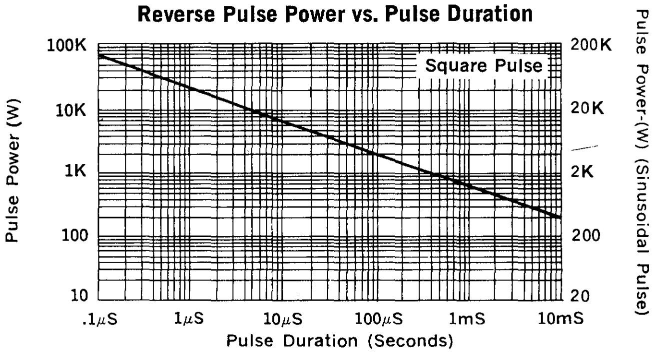
Current Rating vs Case Temperature



Forward Pulse Current vs. Pulse Duration



Reverse Pulse Power vs. Pulse Duration



RECTIFIERS

Fast Recovery, 0.5 Amp to 2 Amp

UTR10-UTR60
UTR01-UTR61
UTR02-UTR62

FEATURES

- Continuous Rating: to 2 A
- Controlled Avalanche
- Surge Rating: to 25 A
- Fast Recovery 40kHz Operation
- PIV: to 600V
- Miniature Package

DESCRIPTION

These miniature fast recovery rectifiers permit operation at full frequencies as high as 40kHz square wave. They have the unique Unitrode Fused in Glass construction.

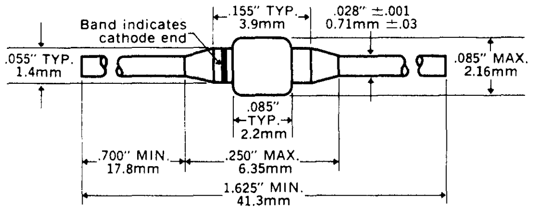
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	½ Amp Series	1 Amp Series	2 Amp Series
50V		UTR01	UTR02
100V	UTR10	UTR11	UTR12
200V	UTR20	UTR21	UTR22
300V	UTR30	UTR31	UTR32
400V	UTR40	UTR41	UTR42
500V	UTR50	UTR51	UTR52
600V	UTR60	UTR61	UTR62

	½ AMP SERIES	1 AMP SERIES	2 AMP SERIES
Maximum Average D.C. Output Current			
@ T_A = 25°C	0.5A	1.0A	2.0A
@ T_A = 100°C	0.25A	0.5A	1.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	15A	20A	25A
Operating Temperature Range	−195°C to +175°C		
Storage Temperature Range	−195°C to +200°C		
Thermal Resistance	See lead temperature derating curves		

MECHANICAL SPECIFICATIONS

UTR10-UTR60 UTR01-UTR61 UTR02-UTR62



Part Identification: Green band indicates "UTR." Part number printed on body.

Polarity: Denoted by Green band.

Weight: 0.26 grams, typical.

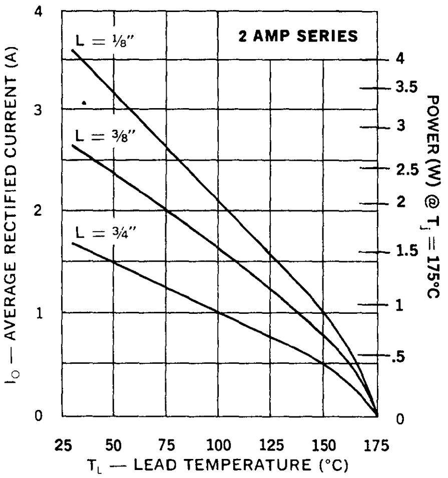
BODY A

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

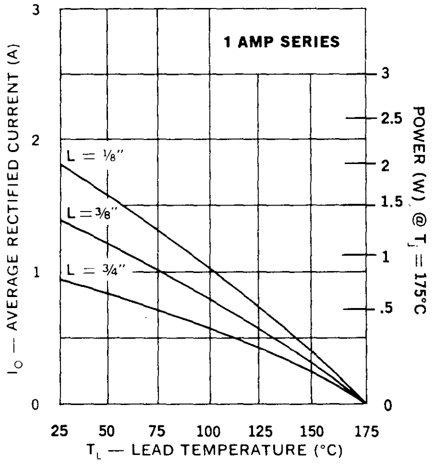
Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV		Maximum Reverse Recovery Time*	Maximum Junction Capacitance @ 25°C	
			25°C	100°C		0V	—10V
UTR02	50V	1.1V @ 1000mA	3μA	100μA	250ns	150pf	60pf
UTR12	100V				250ns	100pf	40pf
UTR22	200V				250ns	80pf	32pf
UTR32	300V				300ns	70pf	28pf
UTR42	400V				350ns	60pf	24pf
UTR52	500V				400ns	50pf	20pf
UTR62	600V				400ns	40pf	16pf
UTR01	50V	1.1V @ 500mA	3μA	100μA	250ns	150pf	60pf
UTR11	100V				250ns	100pf	40pf
UTR21	200V				250ns	80pf	32pf
UTR31	300V				300ns	70pf	28pf
UTR41	400V				350ns	60pf	24pf
UTR51	500V				400ns	50pf	20pf
UTR61	600V				400ns	40pf	16pf
UTR10	100V	1.1V @ 200mA	3μA	100μA	250ns	100pf	40pf
UTR20	200V				250ns	80pf	32pf
UTR30	300V				300ns	70pf	28pf
UTR40	400V				350ns	60pf	24pf
UTR50	500V				400ns	50pf	20pf
UTR60	600V				400ns	40pf	16pf

*Recovery time is measured from 10.0mA to 10.0mA recovery to 5.0mA

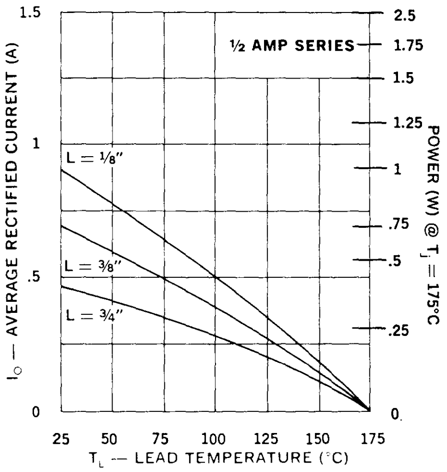
Maximum Current vs Lead Temperature



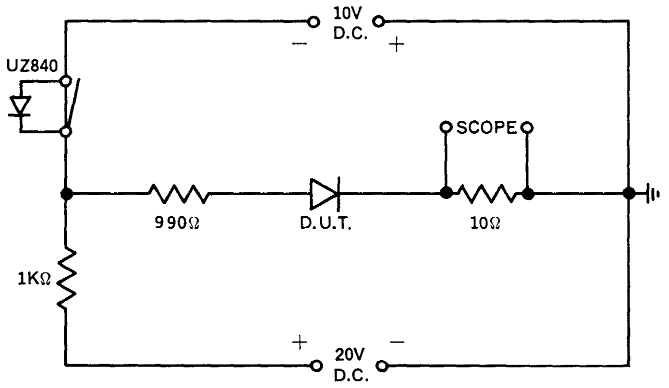
Maximum Current vs Lead Temperature



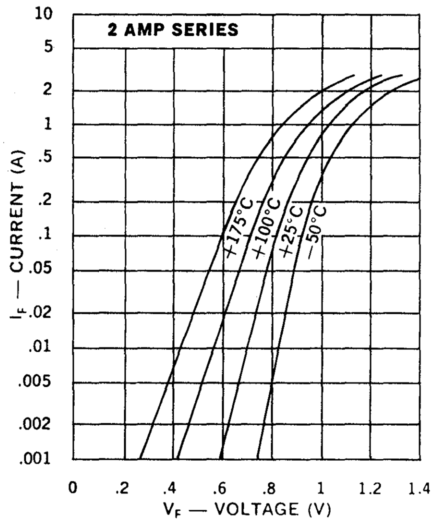
Maximum Current vs Lead Temperature



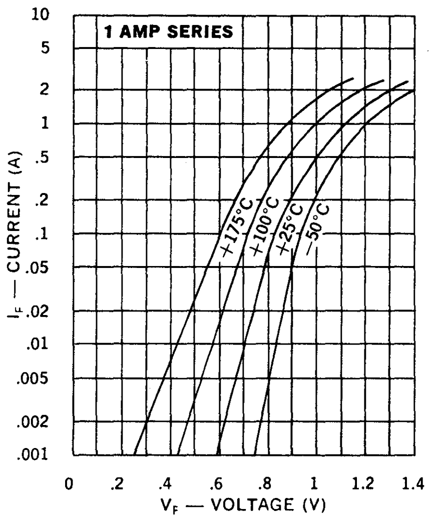
Reverse-Recovery Circuit



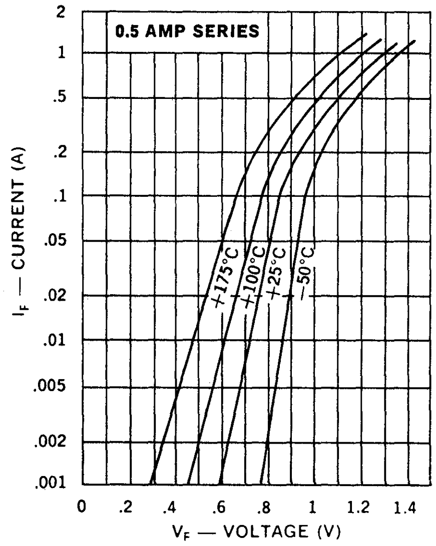
Typical Forward Current vs Forward Voltage



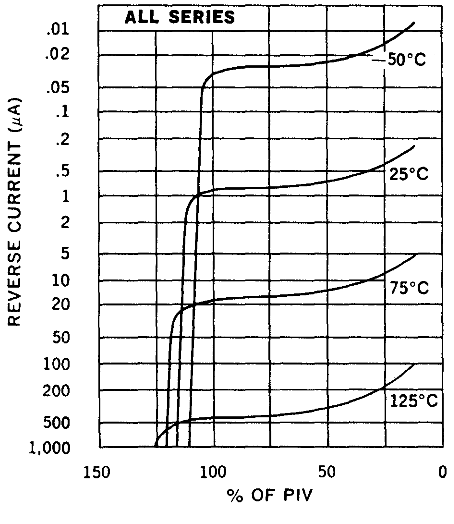
Typical Forward Current vs Forward Voltage



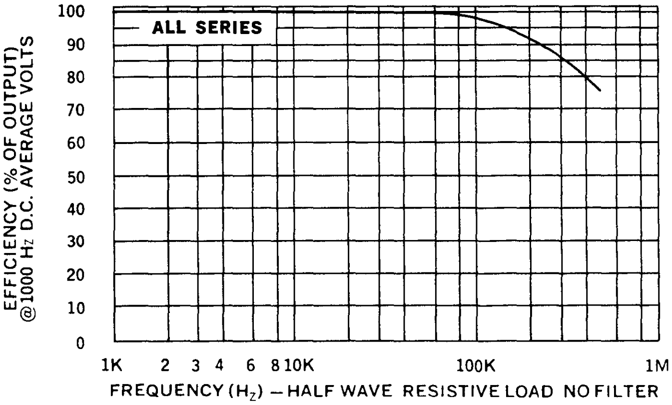
Typical Forward Current vs Forward Voltage



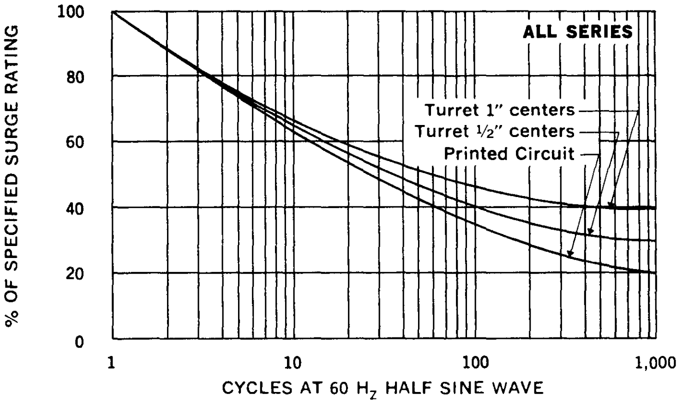
Typical Reverse Current vs PIV



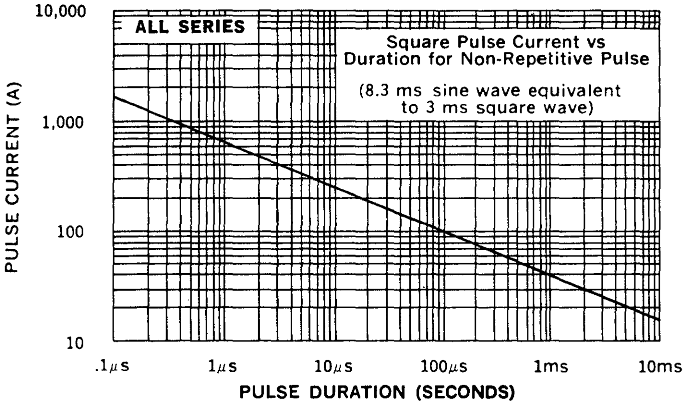
Efficiency vs Frequency at Rated Current (Sine Wave)



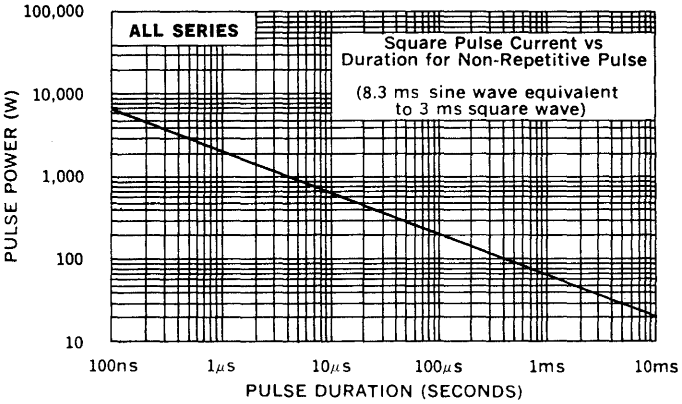
Allowable Forward Surge vs Number of Cycles



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIERS

Fast Recovery, 2 Amp to 4 Amp

UTR2305-UTR2360
UTR3305-UTR3360
UTR4305-UTR4360

FEATURES

- Continuous Rating: to 4A
- Controlled Avalanche
- Surge Rating: to 100A
- PIV: to 600V
- Miniature Package

DESCRIPTION

Small size and high surge capability make this series of power switching rectifiers desirable for power supplies where size, weight and reliability are important.

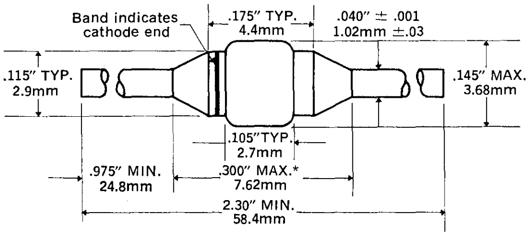
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2 Amp Series	3 Amp Series	4 Amp Series
50V	UTR2305	UTR3305	UTR4305
100V	UTR2310	UTR3310	UTR4310
200V	UTR2320	UTR3320	UTR4320
400V	UTR2340	UTR3340	UTR4340
500V	UTR2350	UTR3350	UTR4350
600V	UTR2360	UTR3360	UTR4360

Maximum Average D.C. Output Current	2 AMP SERIES	3 AMP SERIES	4 AMP SERIES
@ $T_A = 25°C$	2.0A	3.0A	4.0A
@ $T_A = 100°C$	1.0A	1.5A	2.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	60A	80A	100A
Operating Temperature Range	—195°C to +175°C		
Storage Temperature Range	—195°C to +200°C		
Thermal Resistance	See lead temperature derating curve		

MECHANICAL SPECIFICATIONS

UTR4305-UTR4360 UTR3305-UTR3360 UTR2305-UTR2360



Part Identification: Green band indicates "UTR." Part number printed on body.

Polarity: Denoted by Green band.

Weight: 0.75 grams, typical.

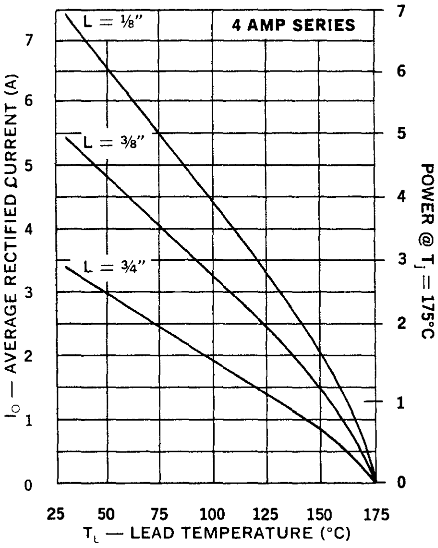
BODY B

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

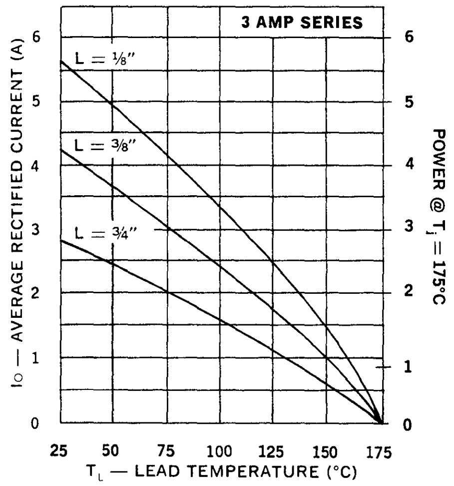
Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV		Maximum Reverse Recovery Time*	Maximum Junction Capacitance @ 25°C	
			25°C	100°C		0V	—10V
UTR4305	50V	1.1V @ 4A	5μA	100μA	250ns	600pf	240pf
UTR4310	100V				250ns	400pf	160pf
UTR4320	200V				250ns	320pf	128pf
UTR4340	400V				400ns	240pf	96pf
UTR4350	500V				400ns	200pf	80pf
UTR4360	600V				400ns	160pf	64pf
UTR3305	50V	1.1V @ 3A	5μA	100μA	250ns	600pf	240pf
UTR3310	100V				250ns	400pf	160pf
UTR3320	200V				250ns	320pf	128pf
UTR3340	400V				300ns	240pf	96pf
UTR3350	500V				350ns	200pf	80pf
UTR3360	600V				400ns	160pf	64pf
UTR2305	50V	1.1V @ 2A	5μA	100μA	250ns	600pf	240pf
UTR2310	100V				250ns	400pf	160pf
UTR2320	200V				250ns	320pf	128pf
UTR2340	400V				300ns	240pf	96pf
UTR2350	500V				350ns	200pf	80pf
UTR2360	600V				400ns	160pf	64pf

*Recovery time is measured from 1A to 1A recovering to 0.5A.

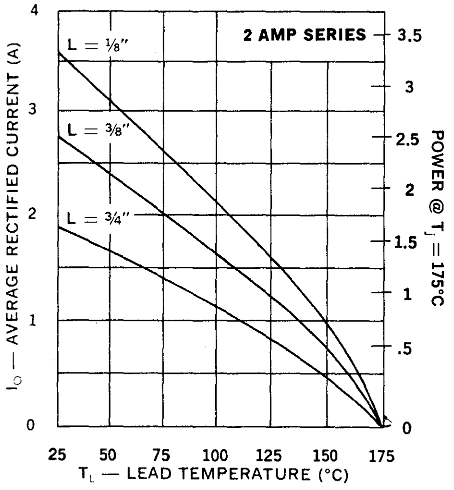
Maximum Current vs Lead Temperature



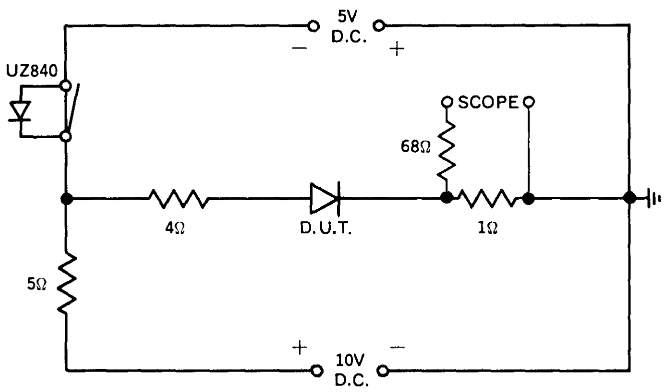
Maximum Current vs Lead Temperature



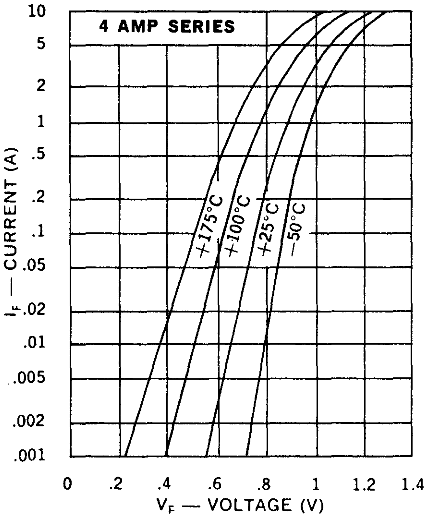
Maximum Current vs Lead Temperature



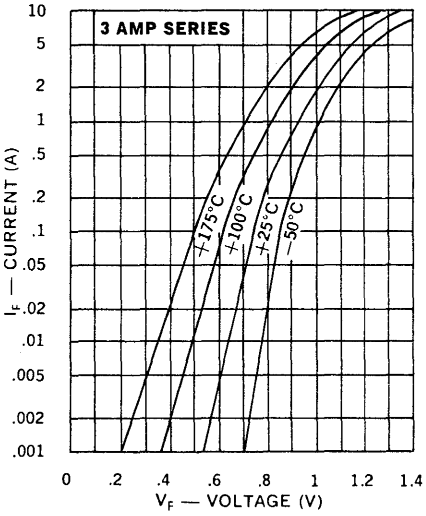
Reverse Recovery Circuit



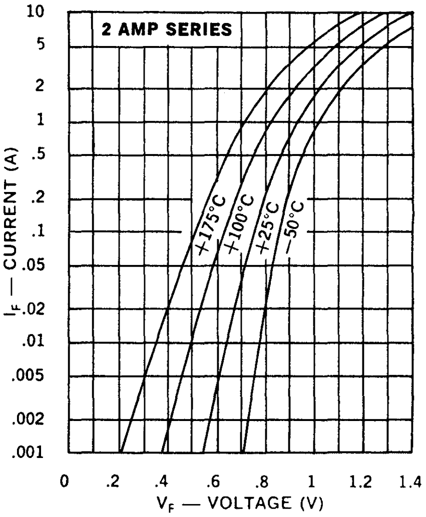
Typical Forward Current vs Forward Voltage



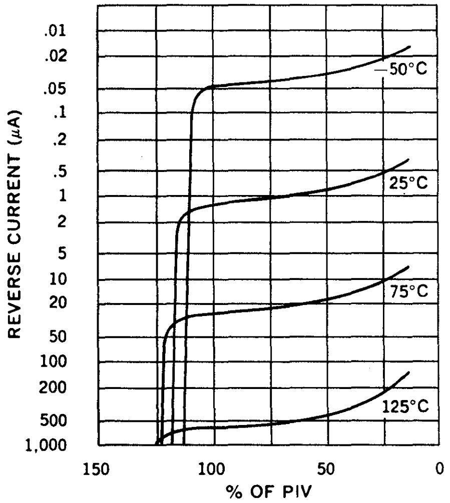
Typical Forward Current vs Forward Voltage



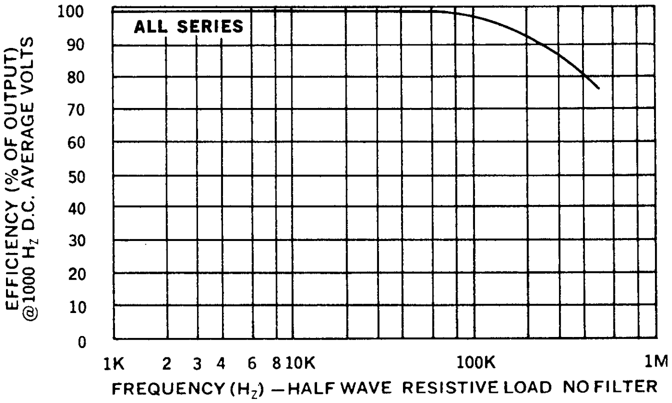
Typical Forward Current vs Forward Voltage



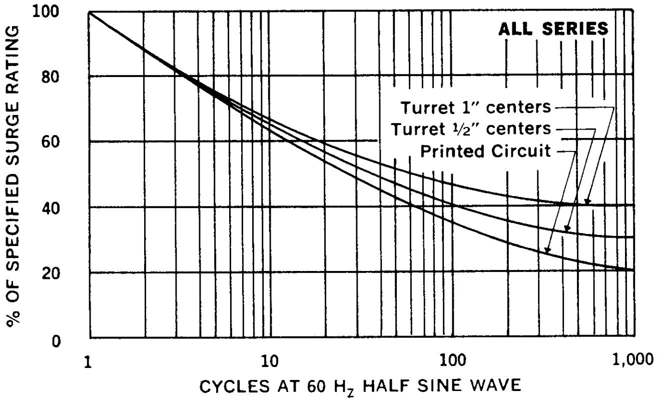
Typical Reverse Current vs PIV



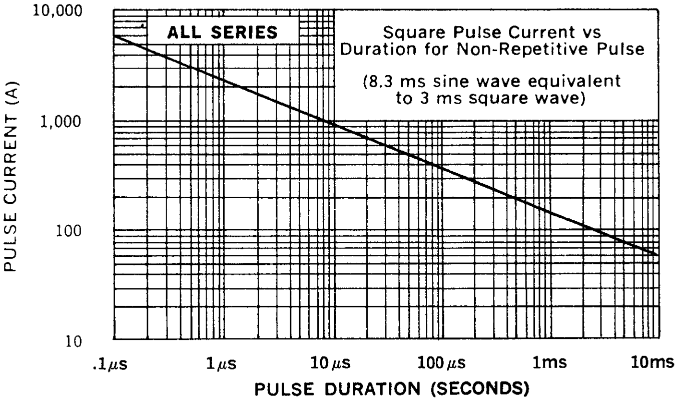
Efficiency vs Frequency at Rated Current (Sine Wave)



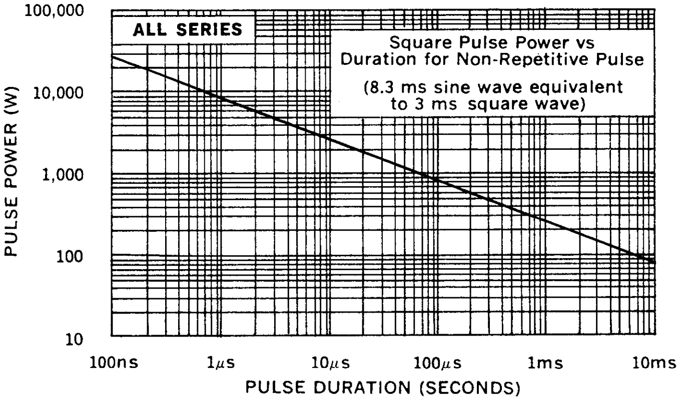
Allowable Forward Surge vs Number of Cycles



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIERS
Fast Recovery, 6 Amp to 9 Amp

UTR4405-UTR4440
UTR5405-UTR5440
UTR6405-UTR6440

FEATURES

- Continuous Rating: to 9A
- Controlled Avalanche
- Surge Rating: to 150A
- Fast Recovery, 40kHz Operation
- PIV: to 400V
- Miniature Package

DESCRIPTION

The same basic construction as all Unitrode diodes, but using a miniature stud mounting and larger junction area, provides a 9 Amp continuous and 150 Amp surge rating in a package only one fifth the weight and one quarter the volume of conventional types.

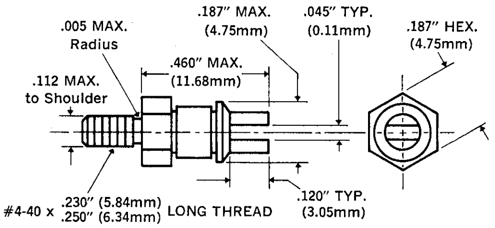
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	6 Amp Series	7.5 Amp Series	9 Amp Series
50V	UTR4405	UTR5405	UTR6405
100V	UTR4410	UTR5410	UTR6410
200V	UTR4420	UTR5420	UTR6420
400V	UTR4440	UTR5440	UTR6440

	6 AMP SERIES	7.5 AMP SERIES	9.0 AMP SERIES
Maximum Average D.C. Output Current @ $T_C = 100°C$	6.0A	7.5A	9.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	120A	135A	150A
Operating Temperature Range	−195°C to +175°C		
Storage Temperature Range	−195°C to +200°C		
Thermal Resistance	7.5°C/W		

MECHANICAL SPECIFICATIONS

UTR6405-UTR6440 UTR5405-UTR5440 UTR4405-UTR4440



Part Identification: Numerals and polarity letter indicate UTR type number, e.g., UTR 4405.

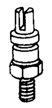
Polarity: Cathode to Stud is standard. Reverse polarity denoted by "R" suffix.

Finish: Metal parts gold plated per MIL-G-45204, Type II.

Weight: 1.5 grams, typical.

Also available with insulated stud.

BODY C — Stud Mount



Installation

Maximum unlubricated stud torque: 28 inch-ounces.
Insulating hardware supplied.
Do not use a screwdriver in the turret slot for installation purposes, or damage may result.

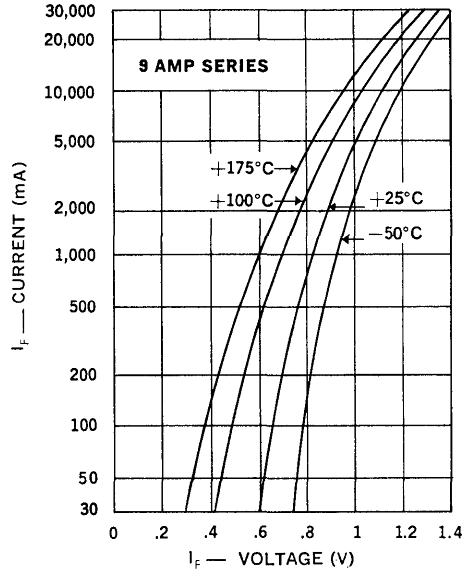
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

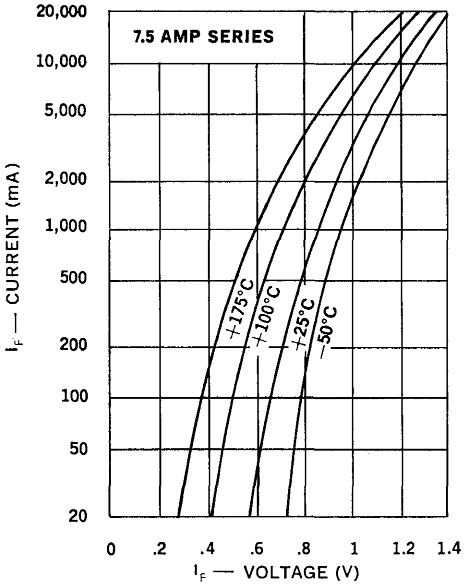
Type	PIV	Maximum Forward Voltage Drop	Maximum Reverse Current @ PIV		Maximum Reverse Recovery Time*
			25°C	100°C	
UTR6405 UTR6410 UTR6420 UTR6440	50V 100V 200V 400V	1.1V @ 6.0A	10μA	300μA	300ns 300ns 400ns 500ns
UTR5405 UTR5410 UTR5420 UTR5440	50V 100V 200V 400V	1.1V @ 5.0A	10μA	300μA	300ns 300ns 400ns 500ns
UTR4405 UTR4410 UTR4420 UTR4440	50V 100V 200V 400V	1.1V @ 4.0A	10μA	300μA	300ns 300ns 400ns 500ns

*Recovery time is measured from 1A to 1A, recovering to 0.5A.

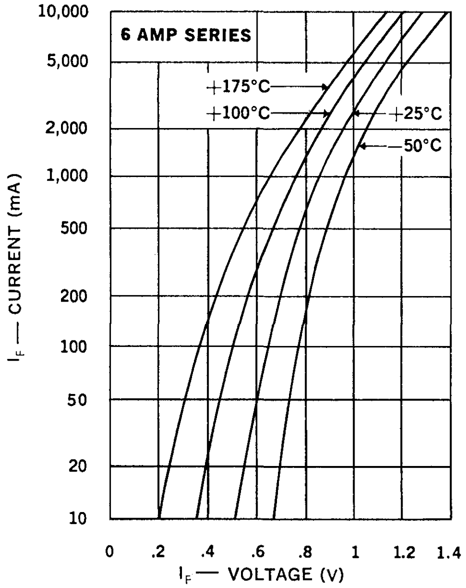
Typical Forward Voltage vs Forward Current



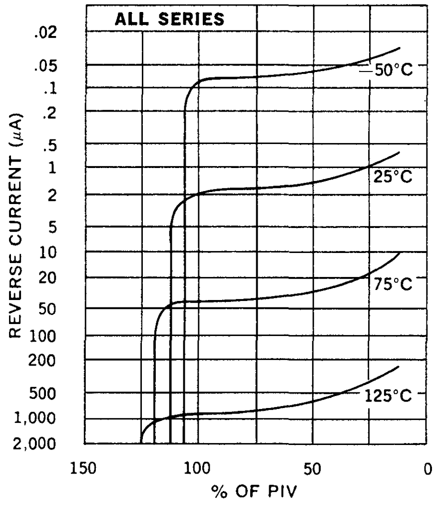
Typical Forward Voltage vs Forward Current

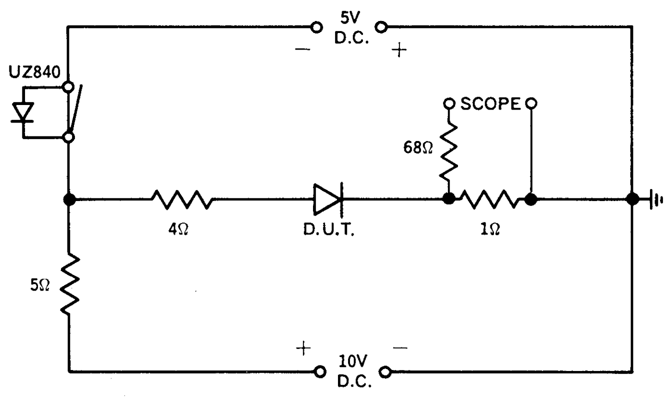


Typical Forward Voltage vs Forward Current

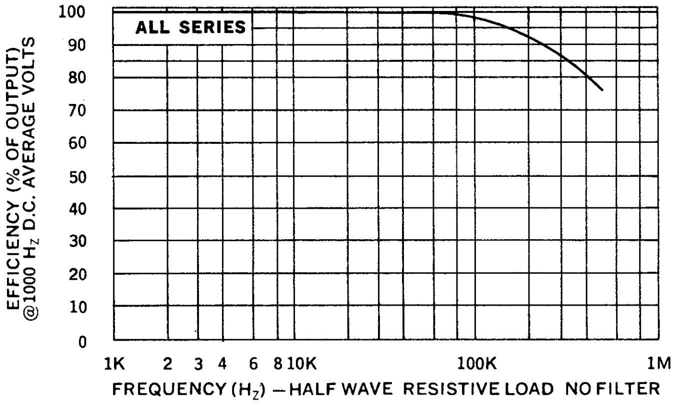


Typical Reverse Current vs PIV

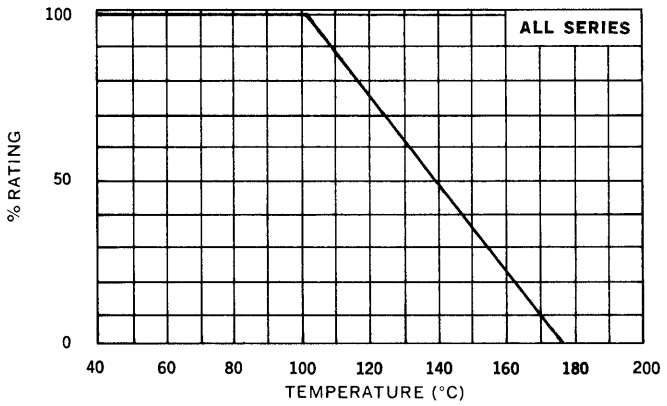




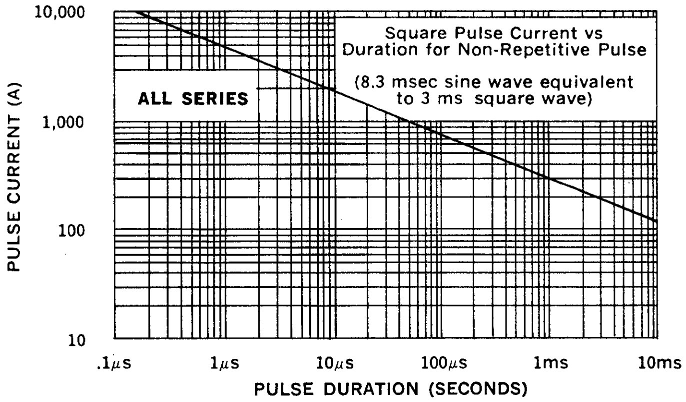
Reverse Recovery Circuit



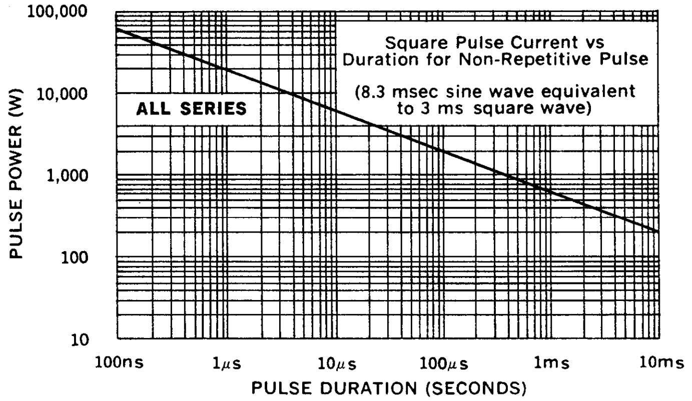
Efficiency vs Frequency at Rated Current (Sine Wave)



Current Rating vs Case Temperature



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration

RECTIFIERS

Ultra-Fast Recovery, 1 Amp and 2 Amp

UTX105-UTX125
UTX205-UTX225

FEATURES

- Continuous Rating: to 2A
- Controlled Avalanche
- Surge: to 25A
- Recovery Time less than 75ns
- Miniature Package

DESCRIPTION

These miniature ultra-fast recovery rectifiers permit operation at full power at frequencies as high as 100kHz square wave. They may be used as half wave rectifiers or as legs of a bridge.

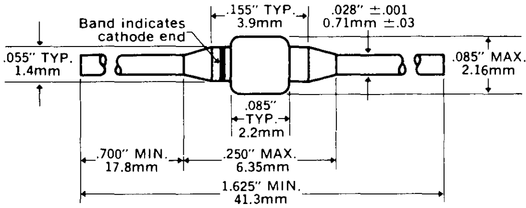
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	1 Amp Series	2 Amp Series
50V	UTX105	UTX205
100V	UTX110	UTX210
150V	UTX115	UTX215
200V	UTX120	UTX220
250V	UTX125	UTX225

Maximum Average D.C. Output Current	1 AMP SERIES	2 AMP SERIES
@ $T_A = 25°C$	1.0A	2.0A
@ $T_A = 100°C$	0.5A	1.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	20A	25A
Operating Temperature Range	—195°C to +175°C	
Storage Temperature Range	—195°C to +200°C	
Thermal Resistance	See Lead Temperature Derating Curve	

MECHANICAL SPECIFICATIONS

UTX105-UTX125 UTX205-UTX225



Part Identification: Green band indicates "UTX." Part number printed on body.

Polarity: Denoted by green band.

Weight: 0.26 grams. typical.

BODY A

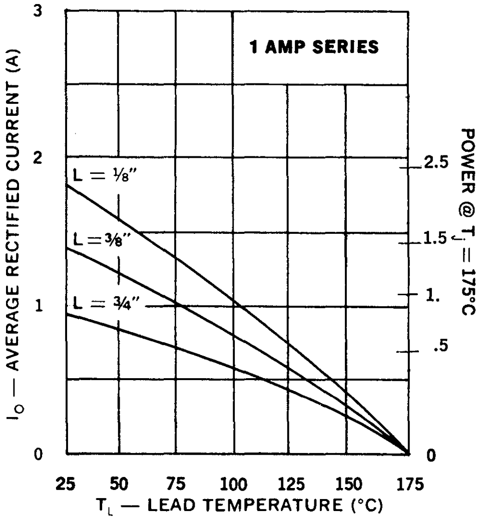
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

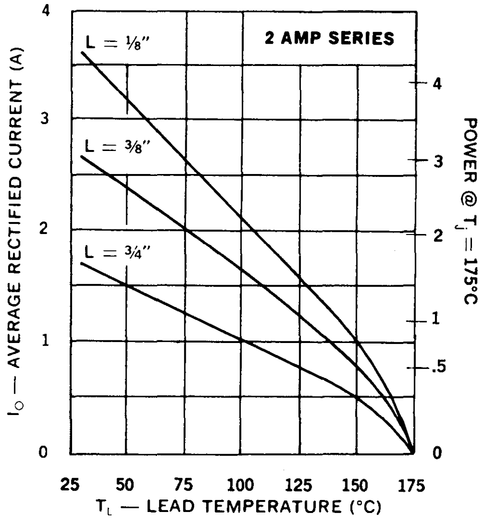
Type	PIV	Maximum Voltage Forward Drop	Leakage Current @ PIV		Max. Reverse Recovery Time*
			25°C	100°C	
UTX 205	50V	1.0V @ 1 Adc	3μA	50μA	75ns
UTX 210	100V				
UTX 215	150V				
UTX 220	200V				
UTX 225	250V				
UTX 105	50V	1.0V @ 0.5 Adc	3μA	50μA	75ns
UTX 110	100V				
UTX 115	150V				
UTX 120	200V				
UTX 125	250V				

*Recovery time is measured from 10.0mA to 10.0mA recovery to 5.0mA.

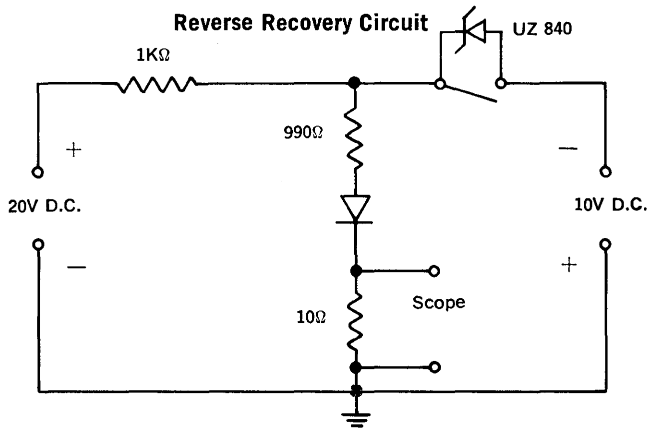
Maximum Current vs Lead Temperature



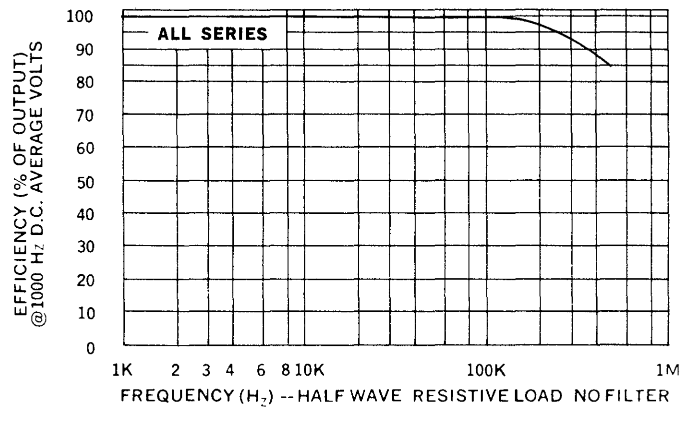
Maximum Current vs Lead Temperature



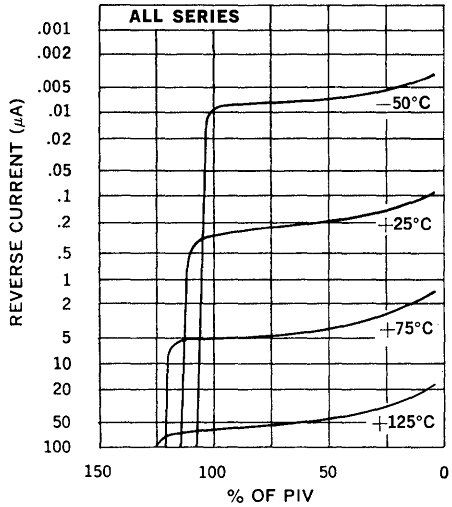
Reverse Recovery Circuit



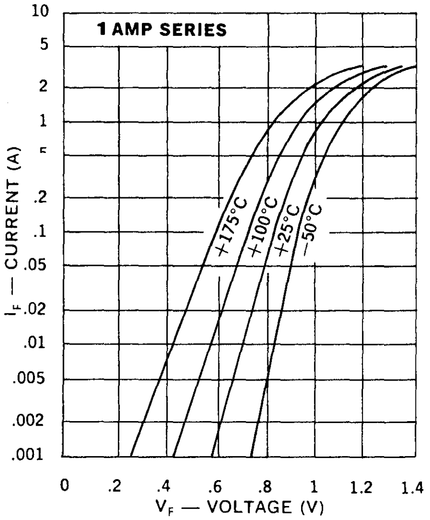
Efficiency vs Frequency at Rated Current (Sine Wave)



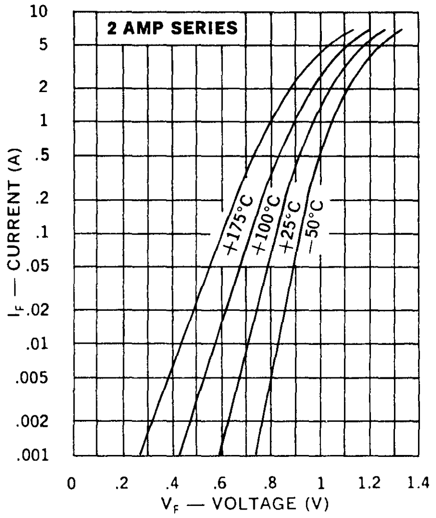
Typical Leakage Current vs. PIV



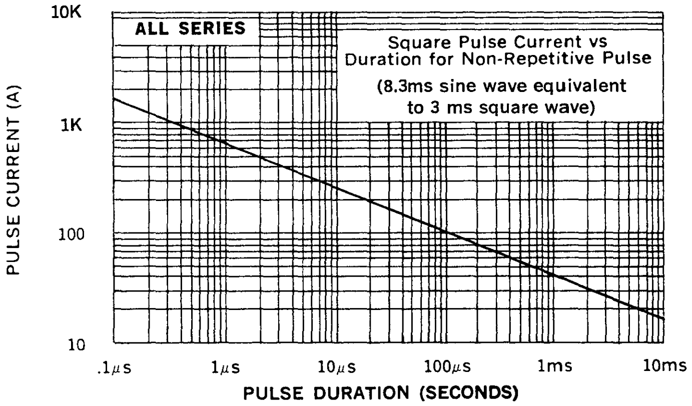
Typical Forward Current vs Forward Voltage



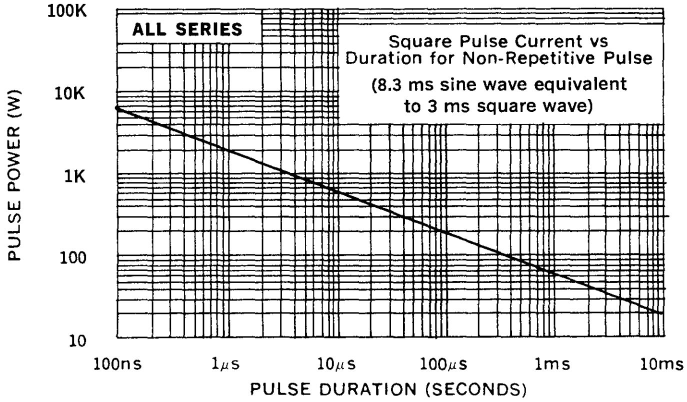
Typical Forward Current vs Forward Voltage



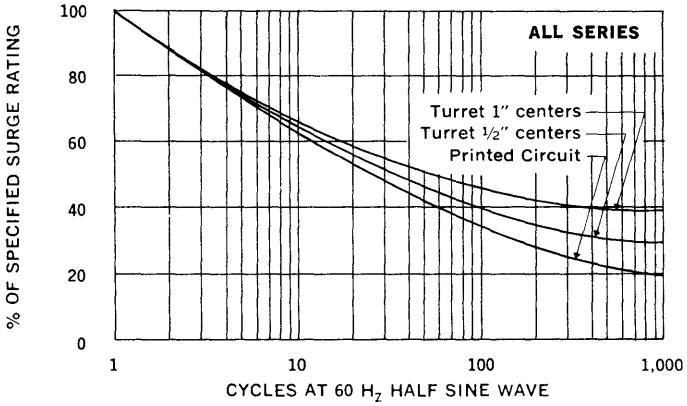
Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



Allowable Forward Surge vs Number of Cycles



RECTIFIERS

Ultra-Fast Recovery, 3 Amp and 4 Amp

UTX 3105-UTX 3120
UTX 4105-UTX 4120

FEATURES

- Continuous Rating: to 4A
- Controlled Avalanche
- Surge: to 80A
- Recovery Time less than 100ns
- Miniature Package

DESCRIPTION

These miniature ultra-fast recovery rectifiers permit operation at full power at frequencies as high as 100kHz square wave. They have the same unique Unitrode construction as the familiar 2 amp UTX series, but are scaled up in size to provide higher continuous and surge current capability.

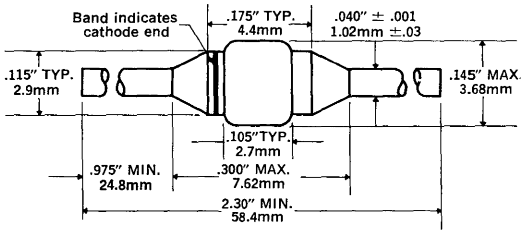
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	**3 Amp Series**	**4 Amp Series**
50V	UTX 3105	UTX 4105
100V	UTX 3110	UTX 4110
150V	UTX 3115	UTX 4115
200V	UTX 3120	UTX 4120

Maximum Average D.C. Output Current	**3 AMP SERIES**	**4 AMP SERIES**
@ T_A = 25°C	3.0A	4.0A
@ T_A = 100°C	1.5A	2.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	60A	80A
Operating Temperature Range	—195°C to +175°C	
Storage Temperature Range	—195°C to +200°C	
Thermal Resistance	See Lead Temperature Derating Curve	

MECHANICAL SPECIFICATIONS

UTX 3105-UTX 3120 UTX 4105-UTX 4120



UTX Prefix is identified by a Green Cathode Band

BODY B

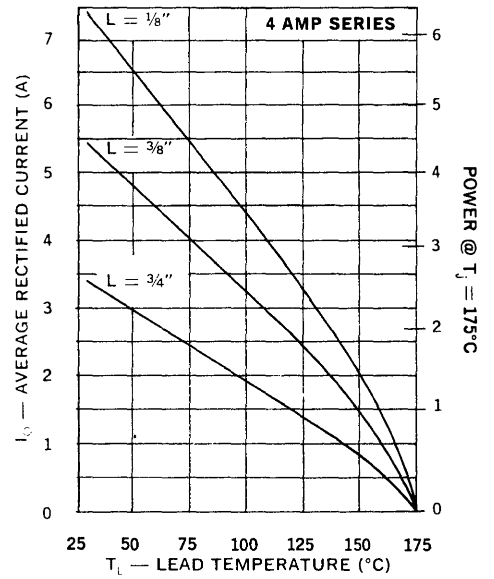
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

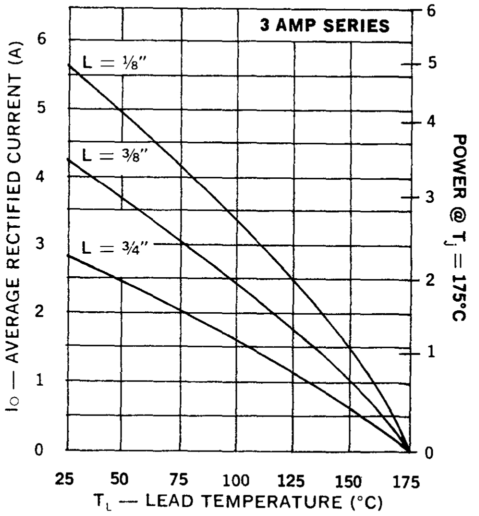
Type	PIV	Maximum Forward Voltage Drop*	Maximum Leakage Current @ PIV		Maximum Reverse Recovery Time**
			25°C	100°C	
UTX 4105	50V	1V @ 3 Adc	5μA	75μA	100ns
UTX 4110	100V				
UTX 4115	150V				
UTX 4120	200V				
UTX 3105	50V	1V @ 2 Adc	5μA	75μA	100ns
UTX 3110	100V				
UTX 3115	150V				
UTX 3120	200V				

*Forward voltage is measured at least 1 second after application of current.
**Recovery time is measured from 1A to 1A recovering to 0.5A.

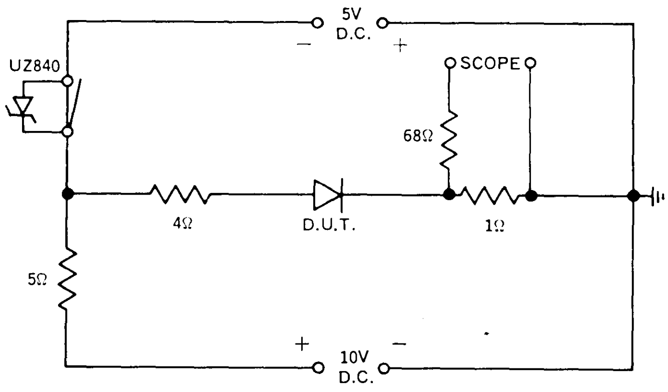
Maximum Current vs Lead Temperature



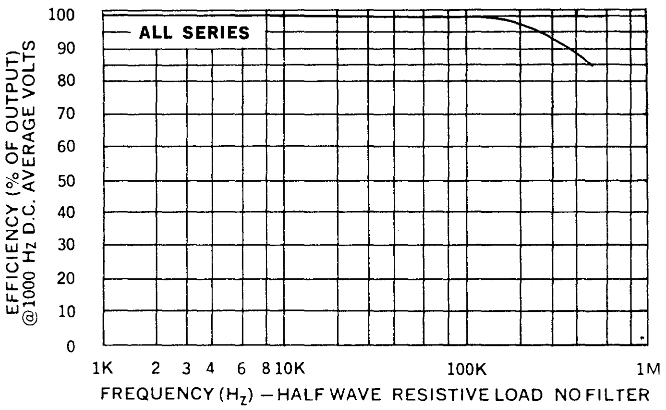
Maximum Current vs Lead Temperature



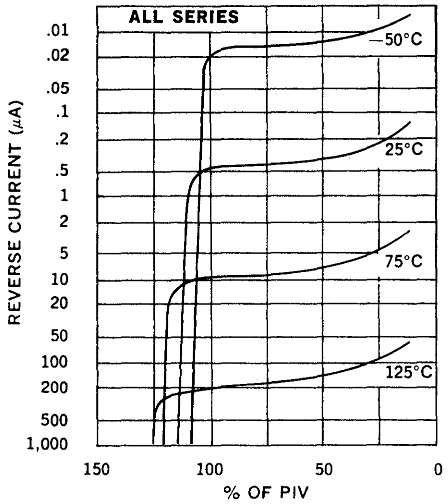
Reverse Recovery Circuit



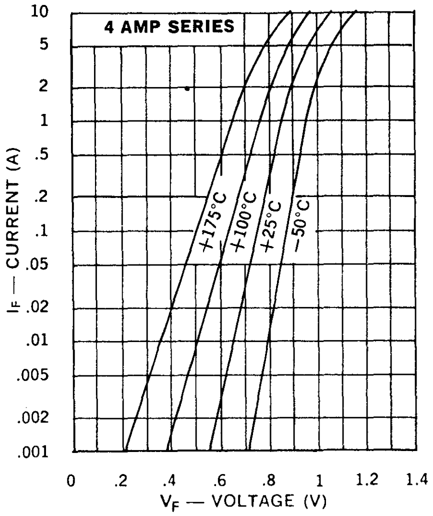
Efficiency vs Frequency at Rated Current (Sine Wave)



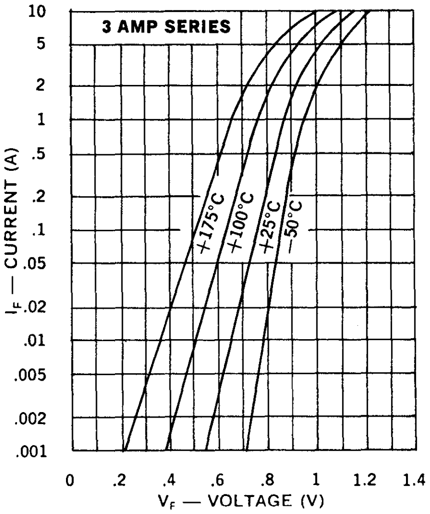
Typical Leakage Current vs PIV



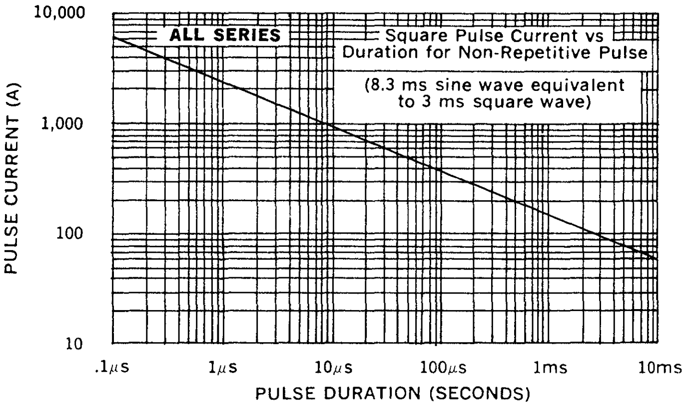
Typical Forward Current vs Forward Voltage



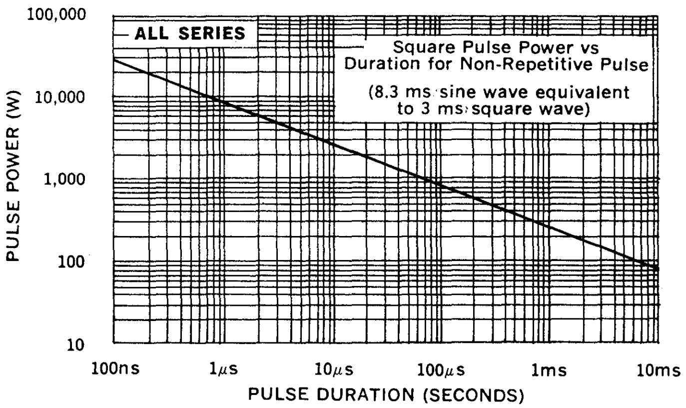
Typical Forward Current vs Forward Voltage



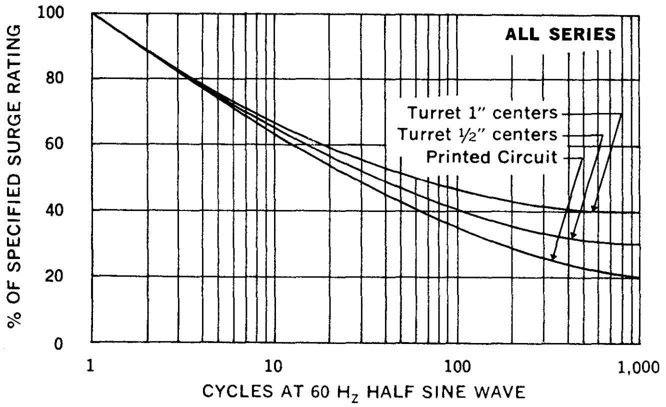
Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



Allowable Forward Surge vs Number of Cycles



POWER ZENERS
3 Watt, Military

UZ706 SERIES
UZ806 SERIES

FEATURES

- 10 Times Greater Surge Rating than Conventional 1 Watt Types
- Small Physical Size

DESCRIPTION

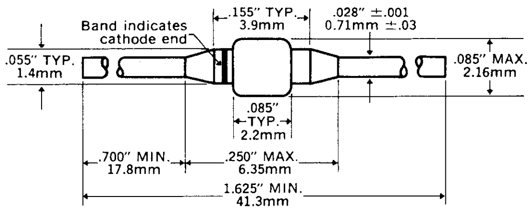
Fused-in-glass metallurgically bonded 3 watt zener diodes.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 400V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	—65°C to +175°C

MECHANICAL SPECIFICATIONS

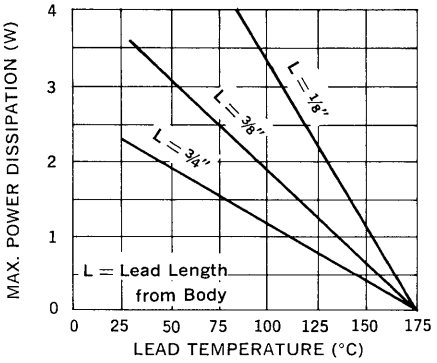
UZ706 SERIES UZ806 SERIES



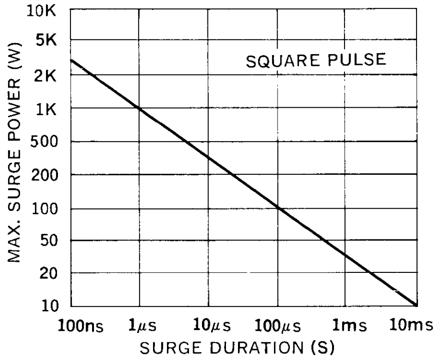
UZ Prefix is identified by a Blue Cathode Band

BODY A

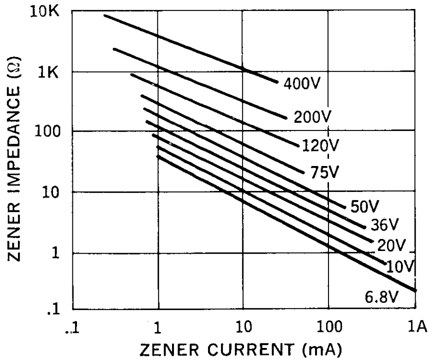
Power Dissipation vs. Lead Temperature Derating Curve



Max. Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



PRINTED IN U.S.A.

Type *		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance § Z_Z @ I_{ZT}	Maximum Reverse Leakage Current I_R @ V_R	± 5% V_R	± 10% V_R	Typ. Temp. Coefficient T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current‡ I_S
±5% Tolerance	Jedec** Registration	Volts	mA	Ohms	µA	Volts	Volts	%/°C	mA	Amps
UZ706	1N5063	6.8	75	2	500	5.2	4.9	.04	440	10.0
UZ707	1N5064	7.5	75	2	300	5.7	5.4	.04	400	8.0
UZ708	1N5065	8.2	75	3	200	6.2	5.9	.05	360	7.0
UZ709	1N5066	9.1	75	3	100	6.9	6.6	.05	330	6.0
UZ710	1N5067	10.0	75	4	40	7.6	7.2	.06	300	5.0
UZ712	1N4883	12	65	5	10	9.1	8.6	.07	250	4.0
UZ713	1N5069	13	50	6	10	9.9	9.3	.07	230	4.0
UZ714	1N5070	14	50	6	10	10.6	10.1	.07	210	4.0
UZ715	1N5071	15	50	6	10	11.4	10.8	.07	200	3.0
UZ716	1N5072	16	50	7	5	12.2	11.5	.07	185	3.0
UZ718	1N5073	18	40	8	5	13.7	12.9	.08	170	2.0
UZ720	1N4884	20	40	9	5	15.2	14.4	.08	150	2.0
UZ722	1N5074	22	30	10	5	16.7	15.8	.08	135	2.0
UZ724	1N5075	24	30	10	5	18.2	17.3	.08	125	1.5
UZ727	1N5076	27	25	12	1	20.6	19.4	.09	110	1.5
UZ730	1N5077	30	25	15	1	22.8	21.6	.090	100	1.5
UZ733	1N5078	33	20	21	1	25.1	23.7	.090	90	1.2
UZ736	1N5079	36	20	21	1	27.4	25.9	.090	85	1.0
UZ740	1N5081	40	20	27	1	30.4	28.8	.095	75	1.0
UZ745	1N5083	45	15	37	1	34.2	32.4	.095	65	0.8
UZ750	1N5085	50	15	50	1	38.0	36.0	.095	60	0.8
UZ756	1N5087	56	10	70	1	42.6	40.3	.095	55	0.7
UZ760	1N5088	60	10	70	1	45.7	43.2	.095	50	0.6
UZ770	1N5091	70	10	90	1	53.3	50.5	.095	45	0.6
UZ775	1N5092	75	10	100	1	56.0	54.0	.095	40	0.5
UZ780	1N5093	80	10	115	1	60.8	57.7	.095	35	0.4
UZ790	1N4096	90	8.0	150	1	68.5	64.8	.095	30	0.4
UZ110	1N4097	100	5.0	175	1	76.0	72.0	.100	30	0.4
UZ111	1N5096	110	5.0	250	1	83.6	79.2	.100	25	0.3
UZ112	1N5097	120	5.0	325	1	91.2	86.4	.100	25	0.2
UZ113	1N5098	130	5.0	375	1	98.8	93.6	.100	20	0.20
UZ114	1N5099	140	5.0	550	1	106	101	.100	20	0.20
UZ115	1N4098	150	5.0	650	1	114	108	.100	20	0.20
UZ116	1N5100	160	4.0	700	1	122	115	.100	20	0.15
UZ117	1N5101	170	4.0	750	1	129	122	.100	18	0.15
UZ118	1N5102	180	4.0	850	1	137	129	.100	18	0.10
UZ119	1N5103	190	4.0	900	1	144	137	.100	15	0.10
UZ120	1N5104	200	4.0	950	1	152	144	.100	15	0.10
UZ122	1N5105	220	3.0	1100	1	167	158	.100	15	0.09
UZ124	1N5106	240	3.0	1300	1	182	173	.105	12	0.09
UZ126	1N5107	260	3.0	1500	1	198	187	.105	12	0.08
UZ128	1N5109	280	3.0	1700	1	213	202	.105	10	0.08
UZ130	1N5110	300	3.0	1900	1	228	216	.105	10	0.07
UZ132	1N5111	320	2.0	2100	1	243	230	.105	9	0.07
UZ134	1N5113	340	2.0	2400	1	258	245	.110	9	0.06
UZ136	1N5114	360	2.0	2700	1	274	259	.110	8	0.06
UZ138	1N5115	380	2.0	3000	1	289	274	.110	8	0.06
UZ140	1N5117	400	2.0	3500	1	304	288	.110	7	0.06

* Specify 20% voltage tolerance by changing first numeral of type number from 7 to 9. (UZ709 becomes UZ909) or from 1 to 3 (UZ111 becomes UZ311).
Specify 10% voltage tolerance by changing first numeral of type number from 7 to 8. (UZ709 becomes UZ809) or from 1 to 2 (UZ111 becomes UZ211).

** Jedec registration applies to ±5% tolerance zeners only.

† All zener voltages are measured with an automated test set using a 35 ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60-cycle AC voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

★ Maximum current based on 3 watt rating. See lead temperature derating curves for proper mounting methods.

‡ Figures shown are for a peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

POWER ZENERS
5 Watt, Industrial

UZ4706 SERIES
UZ4806 SERIES

FEATURES
- 2 Times Greater Surge Rating than Plastic Types
- Small Physical Size
- Impervious to Moisture

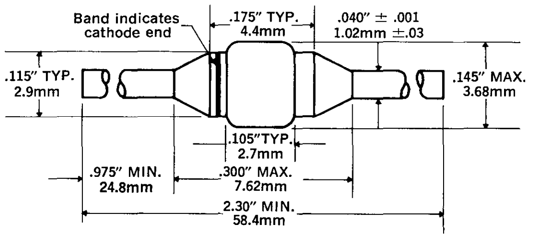
DESCRIPTION
Fused-in-glass 5 watt zeners with the same electrical specs as the 1N5342-1N5388 series.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 200V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	–65°C to +175°C

MECHANICAL SPECIFICATIONS

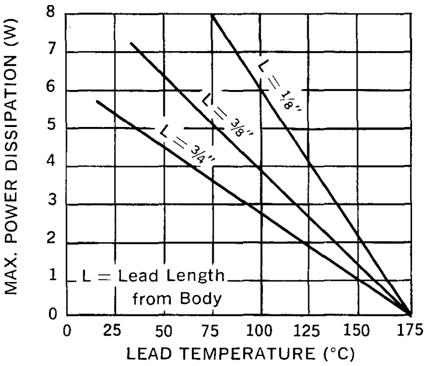
UZ4706 SERIES UZ4806 SERIES



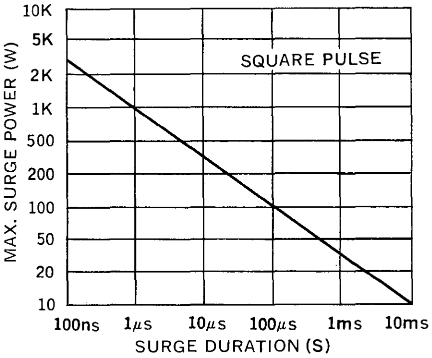
UZ Prefix is identified by a Blue Cathode Band

BODY B

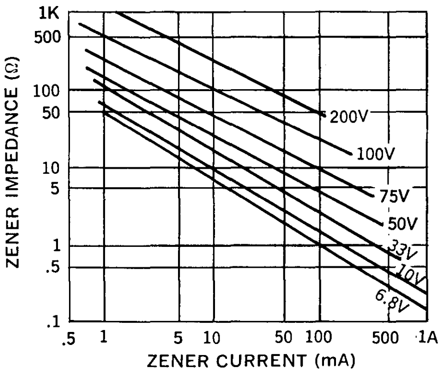
Power Dissipation vs. Lead Temperature Derating Curve



Max. Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



Type		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance §		Reverse Voltage			Maximum Cont. Current I_{ZM}	Maximum Surge Current ‡ I_S
				Z_Z @ I_{ZT}	Z_{ZK} @ I_{ZK} = lmA	Maximum Leakage Current	@ Reverse Voltage ±10%	±5%		
±5% Tolerance	±10% Tolerance	Volts	mA	Ohms	Ohms	µA	Volts	Volts	mA	Amps
UZ4706	UZ4806	6.8	175	1	1000	500	4.9	5.2	675	32
UZ4707	UZ4807	7.5	175	1.5	800	400	5.4	5.7	620	26.5
UZ4708	UZ4808	8.2	150	1.5	600	200	5.9	6.2	570	19.2
UZ4709	UZ4809	9.1	150	2	400	100	6.6	6.9	510	17.6
UZ4710	UZ4810	10	125	2	125	75	7.2	7.6	470	16
UZ4712	UZ4812	12	100	2.5	140	50	8.6	9.1	385	14.4
UZ4713	UZ4813	13	100	3	145	25	9.3	9.9	350	12.8
UZ4715	UZ4815	15	75	3.5	150	15	10.8	11.4	300	9.6
UZ4716	UZ4816	16	75	3.5	155	10	11.5	12.2	275	8
UZ4718	UZ4818	18	65	4	160	10	12.9	13.7	255	7.2
UZ4720	UZ4820	20	65	4.5	165	10	14.4	15.2	220	6.4
UZ4722	UZ4822	22	50	5	170	10	15.8	16.7	195	5.6
UZ4724	UZ4824	24	50	5	175	10	17.3	18.2	180	5.2
UZ4727	UZ4827	27	50	6	180	10	19.4	20.6	155	4.8
UZ4730	UZ4830	30	40	8	190	10	21.6	22.8	140	4.4
UZ4733	UZ4833	33	40	10	200	5	23.7	25.1	130	4.0
UZ4736	UZ4836	36	30	11	220	5	25.9	27.4	120	3.6
UZ4739	UZ4839	39	30	14	230	5	28.1	29.7	105	3.2
UZ4743	UZ4843	43	30	20	240	5	31	32.7	100	2.8
UZ4747	UZ4847	47	25	25	250	5	33.8	35.8	96	2.6
UZ4751	UZ4851	51	25	27	270	5	36.7	38.8	85	2.4
UZ4756	UZ4856	56	20	35	320	5	40.3	42.6	81	2.2
UZ4762	UZ4862	62	20	42	400	5	44.6	47.1	73	2.0
UZ4768	UZ4868	68	20	50	500	5	49.0	51.7	61	1.8
UZ4775	UZ4875	75	20	55	620	5	54.0	56	60	1.6
UZ4782	UZ4882	82	15	80	720	5	59.0	62.2	55	1.4
UZ4791	UZ4891	91	15	90	760	5	65.5	69.2	50	1.3
UZ4110	UZ4210	100	12	100	800	5	72.0	76.0	45	1.1
UZ4111	UZ4211	110	12	125	1000	5	79.2	83.6	40	1.0
UZ4112	UZ4212	120	10	170	1150	5	86.4	91.2	38	.8
UZ4113	UZ4213	130	10	190	1250	5	93.6	98.8	35	.64
UZ4115	UZ4215	150	8	330	1500	5	108	114.0	31	.60
UZ4116	UZ4216	160	8	350	1650	5	115	121.6	30	.56
UZ4118	UZ4218	180	5	450	1750	5	129	136.8	25	.48
UZ4120	UZ4220	200	5	500	1850	5	144	152.0	22	.40

Maximum V_F @ 1.0 Amp = 1.2 Volts for all types

†All zener voltages are measured with an automated test set using a 35 ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

‡Figures shown are for peak sinusoidal surge current of 8.3 ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

POWER ZENERS
5 Watt

UZ5706 SERIES
UZ5806 SERIES

FEATURES
- 2 Times Greater Surge Rating than Conventional 10 Watt Zeners
- Small Physical Size

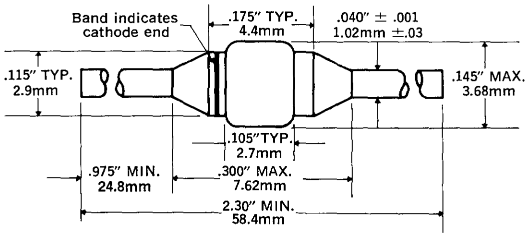
DESCRIPTION
Fused-in-glass, metallurgically-bonded 5 watt zeners.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 400V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	—65°C to +175°C

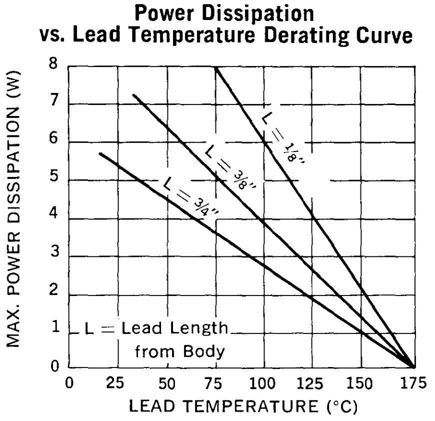
MECHANICAL SPECIFICATIONS

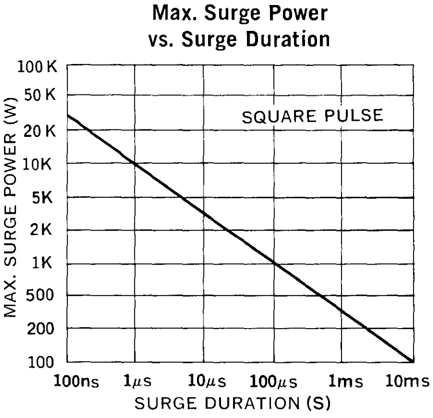
UZ5706 SERIES UZ5806 SERIES

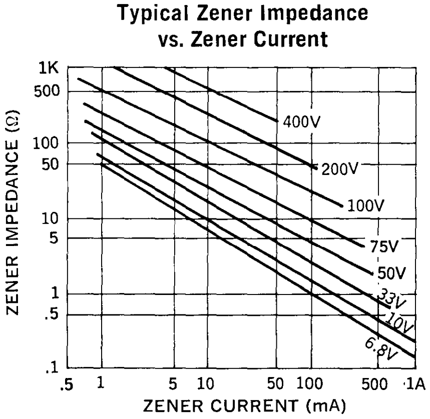


UZ Prefix is identified by a Blue Cathode Band

BODY B







UNITRODE

Type *		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance § Z_Z @ I_{ZT}	Maximum Reverse Leakage Current			Typ. Temp. Coeff. T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current ‡ I_S
					I_R	± 5% V_R	± 10% V_R			
±5% Tolerance	±10% Tolerance	Volts	mA	Ohms	µA	Volts	Volts	%/°C	mA	Amps
UZ5706	UZ5806	6.8	175	1.0	500	5.2	4.9	.05	675	40
UZ5707	UZ5807	7.5	175	1.5	400	5.7	5.4	.06	620	32
UZ5708	UZ5808	8.2	150	1.5	200	6.2	5.9	.06	570	24
UZ5709	UZ5809	9.1	150	2.0	100	6.9	6.6	.06	510	22
UZ5710	UZ5810	10.0	125	2.0	75	7.6	7.2	.07	470	20
UZ5712	UZ5812	12	100	2.5	50	9.1	8.6	.07	385	18
UZ5713	UZ5813	13	100	3.0	25	9.9	9.3	.08	350	16
UZ5714	UZ5814	14	100	3.0	20	10.6	10.1	.08	320	14
UZ5715	UZ5815	15	75	3.5	15	11.4	10.8	.08	300	12
UZ5716	UZ5816	16	75	3.5	10	12.2	11.5	.08	275	10
UZ5718	UZ5818	18	65	4.0	10	13.7	12.9	.085	255	9.0
UZ5720	UZ5820	20	65	4.5	10	15.2	14.4	.085	220	8.0
UZ5722	UZ5822	22	50	5.0	10	16.7	15.8	.085	195	7.0
UZ5724	UZ5824	24	50	5.0	10	18.2	17.3	.090	180	6.5
UZ5727	UZ5827	27	50	6.0	10	20.6	19.4	.090	155	6.0
UZ5730	UZ5830	30	40	8	10	22.8	21.6	.09	140	5.5
UZ5733	UZ5833	33	40	10	5	25.1	23.7	.09	130	5.0
UZ5736	UZ5836	36	30	11	5	27.4	25.9	.095	120	4.5
UZ5740	UZ5840	40	30	14	5	30.4	28.8	.095	105	4.0
UZ5745	UZ5845	45	30	20	5	34.2	32.4	.095	95	3.5
UZ5750	UZ5850	50	25	25	5	38.0	36.0	.095	85	3.0
UZ5756	UZ5856	56	20	35	5	42.6	40.3	.095	80	2.8
UZ5760	UZ5860	60	20	40	5	45.7	43.2	.100	75	2.5
UZ5770	UZ5870	70	20	50	5	53.3	50.5	.100	65	2.3
UZ5775	UZ5875	75	15	55	5	56.0	54.0	.100	60	2.0
UZ5780	UZ5880	80	15	80	5	60.8	57.7	.100	55	1.8
UZ5790	UZ5890	90	15	90	5	68.5	64.8	.100	50	1.6
UZ5110	UZ5210	100	10	100	5	76.0	72.0	.100	45	1.4
UZ5111	UZ5211	110	10	125	5	83.6	79.2	.100	40	1.2
UZ5112	UZ5212	120	10	170	5	91.2	86.4	.100	38	1.0
UZ5113	UZ5213	130	10	190	5	98.8	93.6	.105	35	0.80
UZ5114	UZ5214	140	8	230	5	106.0	101.0	.105	33	0.80
UZ5115	UZ5215	150	8	330	5	114.0	108.0	.105	31	0.75
UZ5116	UZ5216	160	8	350	5	122.0	115.0	.105	30	0.70
UZ5117	UZ5217	170	8	380	5	129.0	122.0	.105	27	0.65
UZ5118	UZ5218	180	5	450	5	137	129	.110	25	0.60
UZ5119	UZ5219	190	5	470	5	144	137	.110	24	0.55
UZ5120	UZ5220	200	5	500	5	152	144	.110	22	0.50
UZ5122	UZ5222	220	5	550	5	167	158	.115	20	0.45
UZ5124	UZ5224	240	5	650	5	182	173	.115	18	0.40
UZ5126	UZ5226	260	5	750	5	198	187	.120	17	0.35
UZ5128	UZ5228	280	4	850	5	213	202	.120	16	0.30
UZ5130	UZ5230	300	4	950	5	228	216	.120	15	0.25
UZ5132	UZ5232	320	4	1100	5	243	230	.120	14	0.24
UZ5134	UZ5234	340	4	1200	5	258	245	.120	13	0.23
UZ5136	UZ5236	360	3	1400	5	274	259	.120	12	0.22
UZ5138	UZ5238	380	3	1500	5	289	274	.120	12	0.21
UZ5140	UZ5240	400	3	1800	5	304	288	.120	11	0.20

Temperature Range: Operating and Storage —65°C to +175°C.

* Specify 20% tolerance by changing the second numeral of type number from 8 to 9 (UZ5809 becomes UZ5909) or from 2 to 3 (UZ5211 becomes UZ5311).

† All zener voltages are measured with an automated test set using a 35 millisecond test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60-cycle AC voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

★ Maximum current based on 5 watt rating. See lead temperature derating curves for proper mounting methods.

‡ Figures shown are for a peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

POWER ZENERS
6 Watt, Military, 10 Watt Military

UZ7706L and UZ7806L SERIES
UZ7706 and UZ7806 SERIES

FEATURES
- High Surge Rating
- Small Physical Size
- Leaded and Stud Packages Available

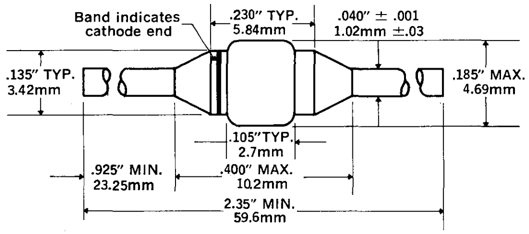
DESCRIPTION
Fused-in-glass, metallurgically bonded 6 watt leaded zeners and 10 watt stud-type zeners.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z		6.8 to 100V
Continuous Current		See Table
Surge Current (8.3ms)		See Table
Surge Power		See Graph
Power	UZ7706L & UZ7806L	See Lead Temperature Derating Curve
	UZ7706 & UZ7806 @100°C Case	10W
Storage and Operating Temperature		—65°C to +175°C

MECHANICAL SPECIFICATIONS

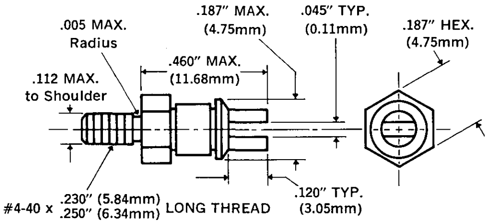
UZ7706L and UZ7806L SERIES



UZ Prefix is identified by a Blue Cathode Band

BODY C — Lead Mount

UZ7706 and UZ7806 SERIES



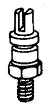
POLARITY: Cathode to Stud is standard. Reverse polarity denoted by "R" suffix.

FINISH: Metal parts gold plated per MIL-G-45204, Type II.

WEIGHT: 1.5 grams (max.)

INSTALLATION PRECAUTIONS: Maximum unlubricated stud torque: 28 inch-ounces. Do not use a screwdriver in the turret slot for installation purposes, or damage may result.
UZ Prefix is identified by a Blue Cathode Band

BODY C — Stud Mount



Type *		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance § Z_Z @ I_{ZT}	Maximum Reverse Leakage Current			Typ. Temp. Coeff. T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current ‡ I_S
					I_R @ V_R	± 5% V_R	± 10% V_R			
±5% Tolerance	±10% Tolerance	Volts	mA	Ohms	µA	Volts	Volts	%/°C	mA	Amps
UZ7706	UZ7806	6.8	350	0.6	1000	5.2	4.9	.04	1350	50
UZ7707	UZ7807	7.5	325	0.7	800	5.7	5.4	.04	1250	41
UZ7708	UZ7808	8.2	300	0.8	200	6.2	5.9	.05	1150	31
UZ7709	UZ7809	9.1	275	1.0	150	6.9	6.6	.05	1020	29
UZ7710	UZ7810	10.0	250	1.0	100	7.6	7.2	.06	950	26
UZ7712	UZ7812	12	200	1.3	75	9.1	8.6	.07	770	23
UZ7713	UZ7813	13	200	1.5	50	9.9	9.3	.07	700	21
UZ7714	UZ7814	14	175	1.5	40	11.4	10.8	.07	640	20
UZ7715	UZ7815	15	150	2.0	30	12.2	11.5	.07	600	17
UZ7716	UZ7816	16	150	2.5	20	13.7	12.9	.07	550	15
UZ7718	UZ7818	18	130	3.5	20	15.2	14.4	.08	500	13
UZ7720	UZ7820	20	120	4.0	20	16.7	15.8	.08	440	12
UZ7722	UZ7822	22	100	4.5	20	18.2	17.3	.08	390	11
UZ7724	UZ7824	24	100	5.0	20	20.6	19.4	.08	360	10
UZ7727	UZ7827	27	90	6.0	20	22.8	21.6	.09	310	9
UZ7730	UZ7830	30	80	8	20	25.1	23.7	.090	280	8.5
UZ7733	UZ7833	33	70	10	10	27.4	25.9	.090	260	7.5
UZ7736	UZ7836	36	60	12	10	29.7	28.1	.090	240	7.0
UZ7740	UZ7840	40	60	15	10	32.7	31.0	.095	210	6.4
UZ7745	UZ7845	45	50	20	10	35.8	33.8	.095	180	5.5
UZ7750	UZ7850	50	50	22	10	38.8	36.7	.095	170	4.6
UZ7756	UZ7856	56	40	30	10	42.6	40.3	.095	160	4.1
UZ7760	UZ7860	60	40	35	10	47.1	44.6	.095	150	3.7
UZ7770	UZ7870	70	35	40	10	51.7	49.0	.095	130	3.3
UZ7775	UZ7875	75	30	45	10	56.0	54.0	.095	120	3.1
UZ7780	UZ7880	80	30	60	10	62.2	59.0	.095	110	2.9
UZ7790	UZ7890	90	25	75	10	69.2	65.5	.095	100	2.6
UZ7110	UZ7210	100	20	90	10	76.0	72.0	.100	90	2.3

Power Rating: Stud Mounted: 10 Watts at 100°C Case derate linearly to zero at 175°C Case.
Lead Mounted: See lead temperature derating curve.
Temperature Range: Operating and storage —65°C to 175°C.

* Specify 20% tolerance by changing the second numeral of type number from 8 to 9 (UZ7809 becomes UZ7909) or from 2 to 3 (UZ7210 becomes UZ7310). Specify leaded version by adding an L suffix (UZ7809 becomes UZ7809L).

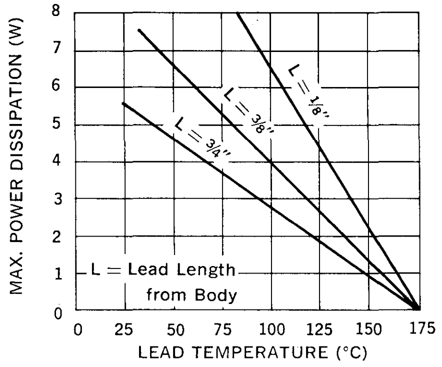
† All zener voltages are measured with an automated test set using a 35 msec test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

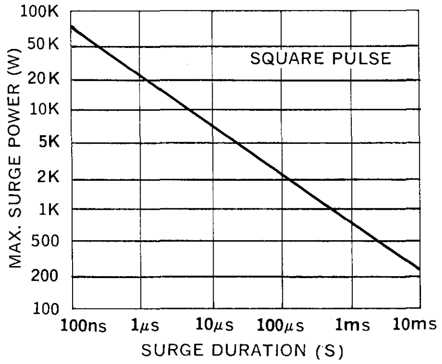
★ Ratings Based on 100°C Case temperature.

‡ Figures shown are for peak sinusoidal surge current of 8.3 msec duration using 60 cycle AC. The 8.3 ms square pulse rating is 71% of the value shown.

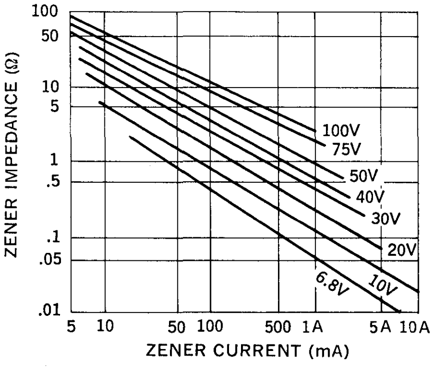
Power Dissipation vs. Lead Temperature Derating Curve



Max. Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



POWER ZENERS

1 Watt, Industrial

UZ8706 SERIES
UZ8806 SERIES

FEATURES

- High Surge Ratings
- A Quarter the Size of Conventional 1 Watt Zeners
- Impervious to Moisture

DESCRIPTION

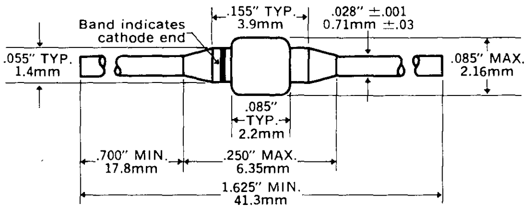
Fused-in-glass 1 watt zeners.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 200V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	—65°C to +175°C

MECHANICAL SPECIFICATIONS

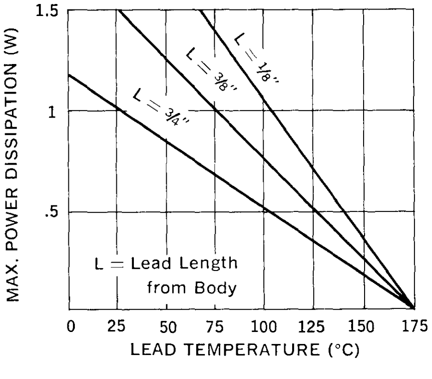
UZ8706 SERIES UZ8806 SERIES



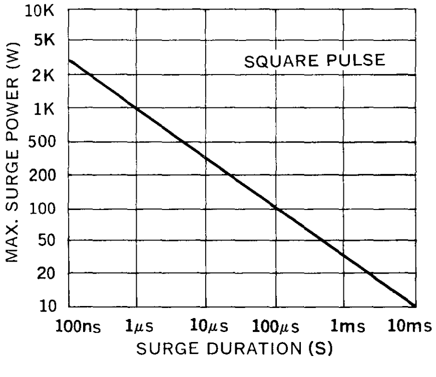
UZ Prefix is identified by a Blue Cathode Band

BODY A

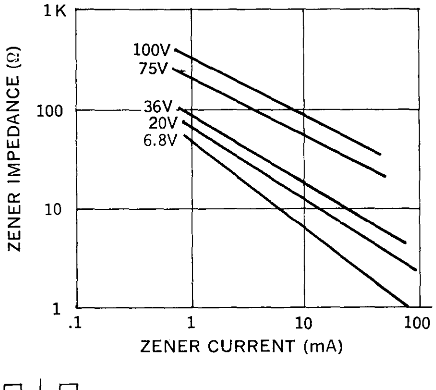
Power Dissipation vs. Lead Temperature Derating Curve



Max. Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



UNITRODE

Type		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage †	Test Current	Max. Zener Impedance §	Maximum Reverse Leakage Current			Typ. Temp. Coefficient	Maximum Continuous Current ★	Maximum Surge Current ‡
		V_Z @ I_{ZT}	I_{ZT}	Z_Z @ I_{ZT}	I_R @ V_R	± 5% V_R	± 10% V_R	T.C. @ I_{ZT}	I_{ZM}	I_S
± 5% Tolerance	± 10% Tolerance	Volts	mA	Ohms	μA	Volts	Volts	%/°C	mA	Amps
UZ 8706	UZ 8806	6.8	37	3.5	50	5.2	4.9	0.04	140	5.00
UZ 8707	UZ 8807	7.5	34	4.0	30	5.7	5.4	0.04	125	4.50
UZ 8708	UZ 8808	8.2	31	4.5	10	6.2	5.9	0.05	115	3.90
UZ 8709	UZ 8809	9.1	28	5.0	3.0	6.9	6.6	0.05	105	3.37
UZ 8710	UZ 8810	10	25	7.0	2.0	7.6	7.2	0.06	95	2.77
UZ 8712	UZ 8812	12	23	9.0	1.0	9.1	8.6	0.07	85	2.25
UZ 8713	UZ 8813	13	21	10	0.5	9.9	9.3	0.07	80	2.25
UZ 8714	UZ 8814	14	19	12	0.5	10.6	10.1	0.07	74	2.25
UZ 8715	UZ 8815	15	17	14	0.5	11.4	10.8	0.07	63	1.65
UZ 8716	UZ 8816	16	15.5	16	0.5	12.1	11.5	0.07	60	1.65
UZ 8718	UZ 8818	18	14.0	20	0.5	13.7	12.9	0.08	52	1.12
UZ 8720	UZ 8820	20	12.5	22	0.5	15.2	14.4	0.08	47	1.12
UZ 8722	UZ 8820	22	11.5	23	0.5	16.7	15.8	0.08	43	1.12
UZ 8724	UZ 8824	24	10.5	25	0.5	18.2	17.3	0.08	40	0.825
UZ 8727	UZ 8827	27	9.5	35	0.5	20.5	19.4	0.09	35	0.825
UZ 8730	UZ 8830	30	8.5	40	0.5	22.8	21.6	0.09	31	0.825
UZ 8733	UZ 8833	33	7.5	45	0.5	25.1	23.7	0.09	28	0.675
UZ 8736	UZ 8836	36	7.0	50	0.5	27.3	25.9	0.09	26	0.562
UZ 8740	UZ 8840	40	6.5	62	0.5	30.4	28.8	0.095	24	0.562
UZ 8745	UZ 8845	45	6.0	75	0.5	34.2	32.4	0.095	22	0.450
UZ 8750	UZ 8850	50	5.0	85	0.5	38.0	36.0	0.095	20	0.450
UZ 8756	UZ 8856	56	4.5	110	0.5	42.5	40.3	0.095	17	0.390
UZ 8760	UZ 8860	60	4.0	125	0.5	45.6	43.2	0.095	15	0.337
UZ 8770	UZ 8870	70	3.7	150	0.5	53.2	50.4	0.095	14	0.337
UZ 8775	UZ 8875	75	3.3	175	0.5	57.0	54.0	0.095	12	0.277
UZ 8780	UZ 8880	80	3.0	200	0.5	60.8	57.6	0.095	11	0.225
UZ 8790	UZ 8890	90	2.8	250	0.5	68.4	64.8	0.095	10	0.225
UZ 8110	UZ 8210	100	2.5	350	0.5	76.0	72.0	0.10	9.5	0.225
UZ 8111	UZ 8211	110	2.3	450	0.5	83.6	79.2	0.10	8.5	0.165
UZ 8112	UZ 8212	120	2.0	550	0.5	91.2	86.4	0.10	8.0	0.112
UZ 8113	UZ 8213	130	1.9	700	0.5	98.8	93.6	0.10	7.2	0.112
UZ 8114	UZ 8214	140	1.8	850	0.5	106	100	0.10	6.8	0.112
UZ 8115	UZ 8215	150	1.7	1000	0.5	114	108	0.10	6.3	0.112
UZ 8116	UZ 8216	160	1.6	1100	0.5	121	115	0.10	5.9	0.082
UZ 8117	UZ 8217	170	1.5	1200	0.5	129	122	0.10	5.6	0.082
UZ 8118	UZ 8218	180	1.4	1300	0.5	137	129	0.10	5.2	0.056
UZ 8119	UZ 8219	190	1.3	1400	0.5	144	137	0.10	5.0	0.056
UZ 8120	UZ 8220	200	1.2	1500	0.5	152	144	0.10	4.7	0.056

†All zener voltages are measured with an automated test set using a 35 millisecond test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§Zener impedance is derived from the 60-cycle AC voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

★Ratings are based on free air. T_A is 25°C. For use at 1.5 watts see derating curve.

‡Figures shown are for a peak sinusoidal surge current of 8.3 ms duration using 60 cycle AC. The 8.3 ms square pulse rating is 71% of the value shown.

V. APPLICATIONS

APPLICATION NOTE LIST

SUBJECT	PUBLICATION
Antenna Switches Using PIN Diodes	UM9401
Doorbell® High Voltage Stacking	N-136B
Doorbell® Tube Replacement	N-130B
PIN Diodes in RF Applications	MW-70-1
Power Darlington Transistors	U-67
Power Darlingtons as Switching Devices	U-70
Power Pulse Generator	U-65
Programmable Unijunction Transistors	U-66
RF Attenuator Design Curves	MW-70-3
RF Switch Design Curves	MW-70-2
SCR New Design Ideas	NDI
Switching Regulator Design Guide	U-68

Applications engineering assistance for state-of-the-art product design is readily available from the factory.

THERMAL DESIGN CONSIDERATIONS

POWER RATINGS

The power rating of a device is defined as the average power required to raise the junction temperature to its rated maximum. This temperature is given in the individual data sheets. The temperature the junction reaches as the device dissipates power depends on ambient temperature and thermal resistances between the junction and some point at which temperature may be used as a reference. For purposes of specifications and making comparative evaluations between devices, the individual data sheets include thermal resistance between junction and case, or current and/or power derating curves as a function of lead temperature for a family of different lead lengths.

In most applications, an upper bound on the ambient temperature is the reference to which the power rating must be related, so that the appropriate power rating equation becomes:

$$P_{RATING} = \frac{T_{j(max)} - T_{AMBIENT\ (max)}}{\theta_{JA}}$$

Thermal resistance from junction to ambient, θ_{JA}, may be separated into numerous series or parallel combinations.

a. For case-mounted devices, a useful separation is:

$$\theta_{JA} = \theta_{JC} + \theta_{CA}$$

where θ_{JC} is thermal resistance from junction to case, θ_{CA} is thermal resistance from case to ambient of heat sink employed by the user. This includes the thermal resistance across the boundary between case and heat sink.

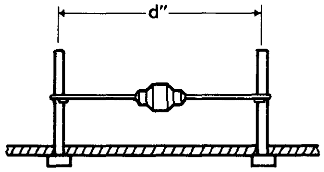
b. For lead-mounted devices that employ leads as an integral part of the heat flow path, a useful separation for thermal resistance is:

$$\theta_{JA} = \theta_{JL} + \theta_{LA}$$

where θ_{JL} is thermal resistance from junction to point on the leads where heat sinking is used, θ_{LA} includes the thermal resistance of the user's mounting hardware.

θ_{JL} varies with lead length, because the longer the lead, the longer the heat-flow path, and therefore the higher the thermal resistance. If the total lead length (sum of the two leads) is less than 1¾ inches, the relationship between thermal resistance and lead length is reasonably linear, particularly if convection cooling is suppressed. This linear relationship is given here for all Unitrode leaded devices.

$$\theta_{JL} = Ad + B$$

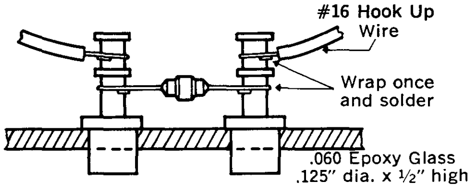


	A	B
Device	$\frac{°C}{W}$/in.	$\frac{°C}{W}$
1N3611-1N3614	34	20
1N4245-1N4249	34	20
1N4461-1N4489	0*	30*
1N4461-1N4489	75**	0**
1N4736-1N4764	64	40
1N4942-1N4946	30	15
1N4954-1N4996	16	7
1N5063-1N5117	25	14
1N5186-1N5189	16	7
1N5415-1N5420	17	4
1N5550-1N5553	16	7
1N5614-1N5622	30	10
1N5802-1N5806	25	14
1N5807-1N5811	16	7
UES101-UES104	25	14
UES201-UES204	16	7
UR105-UR125	58	45
UR205-UR225	30	15
UT236-UT347	48	35
UT249-UT363	45	20
UT251-UT364	34	20
UT261-UT268	30	15
UT2005-UT2060	34	20
UT3005-UT3060	30	10

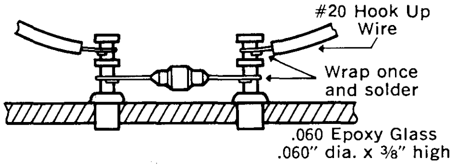
*For 0.2" ⩽ d ⩽ 0.4"
**For 0.4" ⩽ d ⩽ 1.75"

The thermal resistance from lead to ambient (θ_{LA}) depends on the mounting conditions employed by the user, and is beyond the manufacturers' control. However, it is appropriate to provide examples of useful mounting conditions, and to indicate what thermal resistances have been measured for these mounting conditions.

Device	A $\frac{°C}{W}$/in.	B $\frac{°C}{W}$
UT4005-UT4060	20	10
UTR01-UTR61	48	35
UTR02-UTR62	30	15
UTR10-UTR60	126	45
UTR2305-UTR2360	34	20
UTR3305-UTR3360	30	10
UTR4305-UTR4360	20	10
UTX105-UTX125	58	45
UTX205-UTX225	30	15
UTX3105-UTX3120	30	10
UTX4105-UTX4120	20	10
UZ706-UZ140	25	14
UZ806-UZ240	25	14
UZ4706-UZ4120	16	7
UZ4806-UZ4220	16	7
UZ5706-UZ5140	16	7
UZ5806-UZ5240	16	7
UZ7706L-UZ7710L	13	7
UZ7806L-UZ7210L	13	7
UZ8706-UZ8120	64	40
UZ8806-UZ8220	64	40

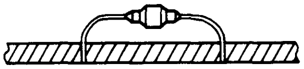


CAMBION 2110-2
$\theta_{LA} = 20°C/W$



CAMBION 1724-2
$\theta_{LA} = 30°C/W$

Lead temperature measured at post



.060 Epoxy Glass

$\theta_{LA} = 100°C/W$
Lead temperature at the board

PACKAGING DATA (Rectifiers & Zener Diodes)

LEAD MATERIALS

Unitrode offers a wide choice of lead materials for soldering or welding because the leads are furnace brazed to the pins outside the glass seal. Since the leads do not pass through a glass-to-metal seal, there is no need to match the thermal coefficient of expansion of the leads to the glass.

Solderable Leads — Silver plated copper is the standard lead material. These leads meet the solderability requirements of MIL-STD-202C Method 208A.

Solid silver leads meeting the requirements of MIL-S-13282 Grade A are available on special order.

Weldable Leads — Three types are available to meet the welding requirements of MIL-STD-1276A. The pure grade A nickel leads meet the requirements of type N-1. The gold-plated nickel leads meet the requirements of type N-2. Gold-plating is in accordance with MIL-G-45204, Type 1.

The copper leads (tin-coated) meet the requirements of type C. Types N-2 and C are solderable as well as weldable.

The following table lists standard lead lengths and materials. Weights of the diodes with various leads are also shown. In the event other lead materials are required, please consult Unitrode.

Body	Material	Usage	Lead		Suffix Letter	Typical Weight Body Plus Leads (mg)
			Length (in.)	Dia. (in.)		
A	Silver plated Copper (standard)	Solderable	1.0	.028	None	260
	Silver	Solderable	0.7	.028	M	215
	Copper, tinned	Solderable or weldable	1.0	.028	S	260
	Nickel-clad silver, gold-plated	Solderable or weldable	0.7	.028	T	215
	Nickel-clad silver	Weldable	0.7	.028	U	215
	Nickel, gold-plated	Solderable or weldable	1.0	.020	V	165
	Nickel	Weldable	1.0	.020	W	165
	Copper, tinned	Solderable or weldable	1.0	.020	R	165
A-1	Silver (standard)	Solderable	1.0	.020	None	150
	Nickel, gold-plated	Solderable or weldable	1.0	.020	V	150
	Nickel	Weldable	1.0	.020	W	150
B	Silver plated Copper (standard)	Solderable	1.0	.040	None	740
	Silver	Solderable	1.0	.040	N	740
	Copper, tinned	Solderable or weldable	1.0	.040	Q	740
	Nickel-clad silver, gold-plated	Solderable or weldable	0.7	.028	T	500
	Nickel-clad silver	Weldable	0.7	.028	U	500

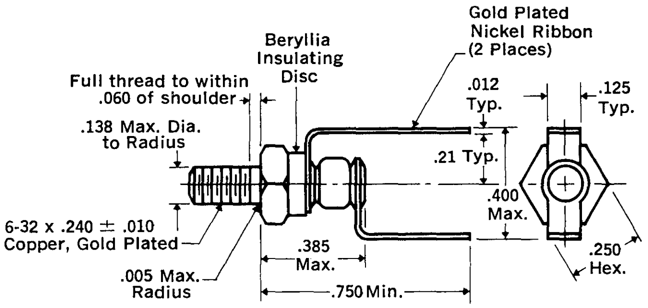
ORDERING INFORMATION

Optional lead materials can be ordered by adding the appropriate suffix letter to the part number. Example: UZ806T would be UZ806 with gold-plated nickel-clad silver leads.

INSULATED STUD PACKAGES

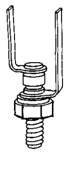
Unitrode's three stud-mounted devices, 10W high-surge zener diodes, 12A standard recovery rectifiers, and 9A fast-recovery rectifiers, are also available as shown here with insulated studs having the same high ratings as the standard non-insulated devices.

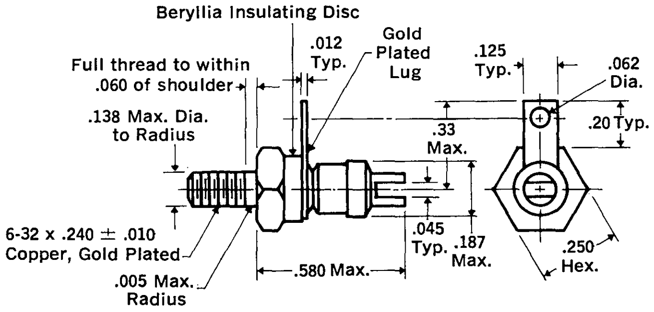
MECHANICAL SPECIFICATIONS



Dimensions in inches.

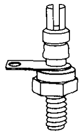
Style W





Dimensions in inches.

Style V



Part Identification: Style W: Part number printed on ribbon lead. Style V: Part number printed on body. Numerals are unique and indicate 10W Zener Series (UZ), 12A rectifier series (UT), or 9A fast-recovery rectifier series (UTR).
Polarity: Cathode to stud end.
Max. Weight: Styles W & V: 2.3 grams.
Installation Precautions: Maximum unlubricated stud torque: 36 inch-ounces.
Note: Do not use a screwdriver in turret slot for installation purposes, or damage may result.

ORDERING INFORMATION

The type numbers that apply to the standard studs also apply to the insulated studs with the addition of suffix W or V for style W or V (see outline drawings). For example, to specify insulated stud style W for a 6.8V zener, order UZ7806W; for a 50V 12A rectifier, order UT8105W; and for a 100V 9A fast-recovery rectifier, order UTR6410W.

VI RELIABILITY PROCESSING

HR-201 SCREENING

Unitrode semiconductors are inherently high-reliability devices; however, some users may want the ultimate assurance of reliability. The HR-201 screening specification is intended to satisfy this need. It should be emphasized that, although these tests are not likely to stress a Unitrode device to failure, they are recommended for those applications which require extreme degrees of reliability assurance — such as man-rated space vehicles, special weapons systems, or other critical applications.
Specific screening specifications and the products to which they are applicable follow:

Product	Specification	Specification with Delta's
Rectifiers	HR201	HR201-D
Zeners	HR201Z	HR201Z-D
Surge Suppressors	HR201S	HR201S-D
Transistors	HR201T	

All units are subject to 100% screening tests per above specifications as follows:

1. **Reverse Bias Operation** — Full rated PIV for rectifiers (80% of minimum voltage for zeners and surge suppressors; 80% of V_{CEO} for transistors) applied for 168 hours at 125°C. Temperature is then reduced to 25°C over a period of not less than one hour with full voltage maintained.
2. **Thermal Fatigue** — Ten cycles. Each cycle consists of 15 minutes at 200°C ambient, immediate transfer to —65°C ambient for 15 minutes, and immediate return to 200°C.
3. **Case Integrity** — 100 p.s.i. is applied while submerged in a fluorescent dye such as Zyglo ZL-1C for 30 minutes. After rinsing in clear water, the device is examined under ultraviolet light for evidence of a defective seal.
4. **Power Operation**
   Rectifiers — Each rectifier is subjected to 5 seconds overload current as follows:
   2A through 0.75A rated, Body A — 5 Adc applied
   4A through 2A rated, Body B — 8 Adc applied
   12A through 7.5A rated, Body C — 8 Adc applied
   Zeners — Each zener diode is subjected to 168 hours of direct current operation in avalanche at $T_A = 25°C$ with sufficient power to raise the junction temperature to 175°C.
   Surge Suppressors — Each device is subjected to 10 pulses at the rate of one pulse per minute at 25°C at rated surge current.
   Transistors — Each device is operated at rated power at 25°C ambient for 168 hours.
   In each of above situations, the device is mounted on 1-inch center clips.
5. **Room Temperature Measurements** — All parameters are measured to ensure conformance with specification. All diodes are 100% oscilloscope-tested to ensure controlled-avalanche characteristics. Any parts exceeding specified limits or exhibiting unusual characteristics are removed from the lot.

JANTX and JANTXV Devices — A number of rectifiers, zeners, transistors, and SCRs plus some rectifier assemblies and surge suppressors are available with JANTX and JANTXV screening and visual inspections. See the individual product sections under the Product Selection Guide for part numbers and specifications.

NOTES

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