DISCRETE POWER DEVICES

DATABOOK

SGS ATES 1975/76

DISCRETE POWER DEVICES

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SGS-ATES 1975/76

INTRODUCTION

This databook contains data sheets on the SGS-ATES range of discrete power devices for professional, industrial and consumer applications.
To permit ease of consultation, this book has been divided into five main sections: General Information, Germanium Transistors, Germanium Diodes, Silicon Transistors, and Accessories and Mounting Instructions. The General Information section contains definitions of symbols, and terms used in order to facilitate correct technical interpretation of the data sheets, as well as an alphanumerical list of types.
The information on each product has been specially presented in order that the performance of the product can be readily evaluated within any required equipment design.
An arrow (→) at left hand side of table indicates parameter which has been modified since previous data sheet issue.

OTHER SGS-ATES DATABOOKS

Data sheets on the SGS-ATES range of discrete devices and integrated circuits for professional and consumer applications can be found in the following databooks:

SGS-ATES Professional Databook 1 - Small Signal Discrete Devices

SGS-ATES Professional Databook 2 - Bipolar Digital ICs

SGS-ATES Professional Databook 3 - Linear, MOS & COS/MOS ICs

SGS-ATES Consumer Databook - Transistors & ICs

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GENERAL INFORMATION

GERMANIUM TRANSISTORS

GERMANIUM DIODES

SILICON TRANSISTORS

ACCESSORIES AND MOUNTING INSTRUCTIONS

GENERAL INFORMATION

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1. LETTER SYMBOLS FOR SEMICONDUCTOR DEVICES

(referred to diodes, transistors and linear integrated circuits)

1.1. QUANTITY SYMBOLS

a. Instantaneous values of current, voltage and power, which vary with time are represented by the appropriate lower case letter.

Examples: i, v, p

b. Maximum (peak), average, d.c. and root-mean-square values are represented by appropriate upper case letter.

Examples: I, V, P

1.2. SUBSCRIPTS FOR QUANTITY SYMBOLS

a. Total values are indicated by upper case subscripts.

Examples: I_C, i_C, V_{EB}, P_C, p_C

b. Values of varying components are indicated by lower case subscripts.

Examples: i_c, I_c, v_{eb}, p_c, P_c

c. To distinguish between maximum (peak), average, d.c. and root-mean-square values, it is possible to represent maximum and average values adding the subscripts m or M and respectively av or AV.

Examples: I_{cm}, I_{CM}, I_{cav}, I_{CAV}

It is possible to represent R.M.S. values by adding the subscripts (rms) and (RMS)

Examples: $I_{c\ (rms)}$, $I_{C\ (RMS)}$

d. List of subscripts (for examples see figure 1 and the fundamental symbols schedule e.)

A, a = Anode terminal

K, k = Cathode terminal

E, e	= Emitter terminal
B, b	= Base terminal
C, c	= Collector terminal
J, j	= Generic terminal
(BR)	= Primary break-down
X, x	= Specified circuit
M, m	= Maximum (peak) value
Min, min	= Minimum value
AV, av	= Average value
(RMS), (rms)	= R.M.S. value
F, f	= Forward
R, r	= As first subscript: Reverse. As second subscript: Repetitive
O, o	= As third subscript: The terminal not mentioned is open circuited
S, s	= As second subscript: Non repetitive. As third subscript: Short circuit between the terminal not mentioned and the reference terminal
Z	= Zener. (Replaces R to indicate the actual zener voltage, current or power of voltage reference or voltage regulator diodes)

e. Fundamental symbols schedule (meaning of symbol with subscript)

	i v p	I V P
e b c	istantaneus value of the variable component	R.M.S. value of the variable component, or (with appropriate supplementary subscripts) the maximum or average value (direct current) of the variable component
E B C	istantaneus total value	average value (direct current and without signal) or (with appropriate supplementary subscripts) the total average value (with signal), or the total maximum value

f. Examples of the application of the rules:

Figure 1 represents a transistor collector current, consisting of a direct current and a variable component as a function of time.

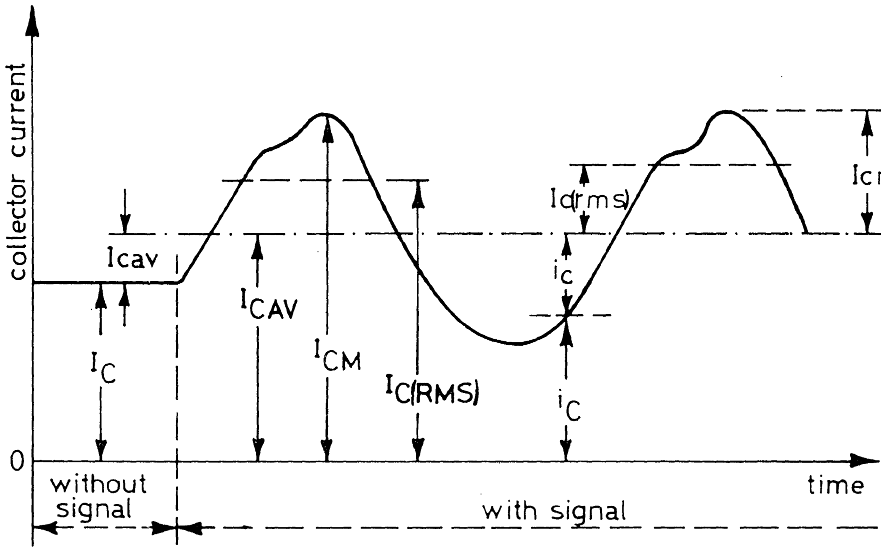

fig. 1

I_C	- DC value, no signal
I_{CAV}	- Average total value
I_{CM}	- Maximum total value
$I_{C(RMS)}$	- R.M.S. total value
I_{cav}	- Average value of the variable component
$I_{c\,(rms)}$	- R.M.S. value of the variable component
I_{cm}	- Maximum value of the variable component
i_C	- Instantaneous total value
i_c	- Instantaneous volue of the variable component

1.3. CONVENTIONS FOR SUBSCRIPT SEQUENCE

a. Currents

For transistor the first subscript indicates the terminal carrying the current (conventional current flow from the external circuit into the terminal is positive).

Instead for diodes a forward current (conventional current flow into the anode terminal) is represented by the subscript F or f; a reverse current (conventional current flow out of the anode terminal) is represented by the subscript R or r.

b. Voltages

For transistors normally, two subscripts are used to indicate the points between which the voltage is measured. The first subscript indicates one terminal point and the second the reference terminal.
Where there is no possibility of confusion, the second subscript may be omitted.
Instead for diodes a forward voltage (anode positive with respect to cathode) is represented by the subscript F or f and a reverse voltage (anode negative with respect to cathode) by the subscript R or r.

c. Supply voltages
Supply voltages may be indicated by repeating the terminal subscript.

Examples: V_{EE}, V_{CC}, V_{BB}

The reference terminal may then be indicated by a third subscript.

Examples: V_{EEB}, V_{CCB}, V_{BBC}

d. In devices having more than one terminal of the same type, the terminal subscripts are modified by adding a number following the subscript and on the same line.

Example: B_{B2-E} voltage between second base and emitter

In multiple unit devices, the terminal subscripts are modified by a number preceding the terminal subscripts:

Example: V_{1B-2B} voltage between the base of the first unit and that of the second one.

1.4. ELECTRICAL PARAMETER SYMBOLS

a. The values of four pole matrix parameters or other resistances, impedances admittances, etc., inherent in the device, are represented by the lower case symbol with the appropriate subscripts.

Examples: h_{ib}, z_{fb}, y_{oc}, h_{FE}

Note: The symbol of the capacitances that is represented by the upper case (C) is an exception to this rule.

b. The four pole matrix parameters of external circuits and of circuits in which the device forms only a part are represented by the upper case symbols with the appropriate subscripts.

Examples: H_i, Z_o, H_F, Y_R

1.5. SUBSCRIPTS FOR PARAMETER SYMBOLS

a. The static values of parameters are indicated by upper case subscripts.

Examples: h_{IB}, h_{FE}

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

b. The small-signal values of parameters are indicated by lower case subscripts.

Examples: h_{ib}, Z_{ob}

c. The first subscript, in matrix notation identifies the element of the four pole matrix.

i (for 11) = input

o (for 22) = output

f (for 21) = forward transfer

r (for 12) = reverse transfer

Examples: $V_1 = h_i I_1 + h_r V_2$
$I_2 = h_f I_1 + h_o V_2$

Notes

1 - The voltage and current symbols in matrix notation are indicated by a single digit subscript.
The subscript 1 = input; the subscript 2 = output.

2 - The voltages and currents in these equations may be complex quantities.

d. The second subscript identifies the circuit configuration.

e = common emitter

b = common base

c = common collector

j = common terminal, general

Examples: (common base)

$$I_1 = y_{ib} V_{1b} + y_{rb} V_{2b}$$
$$I_2 = y_{fb} V_{1b} + y_{ob} V_{2b}$$

When the common terminal is understood, the second subscript may be omitted.

e. If it is necessary to distinguish between real and imaginary parts of the four pole parameters, the following notations may be used.

$Re(h_{ib})$ etc... for the real part

$Im(h_{ib})$ etc... for the imaginary part

2. ALPHABETICAL LIST OF SYMBOLS

B	Bandwidth
C_{CBO}	Collector-base capacitance (emitter open to a.c. and d.c.)
d	Distortion
$E_{s/b}$	Second breakdown energy (with base-emitter junction reverse biased)
f	Frequency
f_T	Transition frequency
G_v	Voltage gain
h_{fe}	Common emitter, small-signal value of the short-circuit forward current transfer ratio
h_{FE}	Common emitter, static value of the forward current transfer ratio
h_{FE1}/h_{FE2}	Common emitter, static value of the forward current transfer
I_B	Base current matched pair ratio
I_{B1}	Turn-on-current
I_{B2}	Turn-off-current
I_{BF}	Base forward current
I_{BFM}	Base forward peak current
I_{BM}	Base peak current
I_{BR}	Base reverse current
I_{BRM}	Base reverse peak current
I_C	Collector current
I_{CBO}	Collector cut-off current with emitter open
I_{CEO}	Collector cut-off current with base open
I_{CER}	Collector cut-off current with specified resistance between emitter and base
I_{CES}	Collector cut-off current with emitter short-circuited to base
I_{CEV}	Collector cut-off current with specified reverse voltage between emitter and base
I_{CM}	Collector peak current

I_d	Drain current
I_E	Emitter current
I_{EBO}	Emitter cut-off current with collector open
I_F	Continuous DC forward current
I_{FM}	Peak forward current
I_R	Continuous DC reverse current
$I_{s/b}$	Second breakdown collector current (with base-emitter junction forward biased)
P_o	Output power of a specified circuit
P_{tot}	Total power dissipation
R_{BB}	Base dropping resistance
R_{BE}	Resistance between base and emitter
R_{CC}	Collector dropping resistance
R_{EE}	Emitter dropping resistance
R_L	Load resistance
R_{th}	Thermal resistance
$R_{th\ j\text{-}amb}$ ($R_{th\ j\text{-}a}$)	Thermal resistance junction-to-ambient
$R_{th\ j\text{-}case}$ ($R_{th\ j\text{-}c}$)	Thermal resistance junction-to-case
t	Time
T_{amb} (T_a)	Ambient temperature
T_{case} (T_c)	Case temperature
t_f	Fall time
T_j	Junction temperature
t_{off}	Turn-off-time
t_{on}	Turn-on-time
t_r	Rise time
t_s	Storage time
T_{stg} (T_s)	Storage temperature
V_{BE}	Base-emitter voltage
$V_{BE\ (sat)}$	Base-emitter saturation voltage

$V_{(BR)\,CBO}$	Collector-base breakdown voltage with emitter open
$V_{(BR)\,CEO}$	Collector-emitter breakdown voltage with base open
$V_{(BR)\,CER}$	Collector-emitter breakdown voltage with specified resistance
$V_{(BR)\,CES}$	Collector-emitter breakdown voltage with emitter short-circuited to base
$V_{(BR)\,CEV}$	Collector-emitter breakdown voltage with specified reverse voltage between emitter and base
$V_{(BR)\,EBO}$	Emitter-base breakdown voltage with collector open
V_{CB}	Collector-base voltage
V_{CBO}	Collector-base voltage with emitter open
V_{CE}	Collector-emitter voltage
V_{CEK}	Knee voltage at specified condition
V_{CEO}	Collector-emitter voltage with base open
$V_{CEO\,(sus)}$	Collector-emitter sustaining voltage with base open
V_{CER}	Collector-emitter voltage with specified resistance between emitter and base
$V_{CER\,(sus)}$	Collector-emitter sustaining voltage with specified resistance between emitter and base
$V_{CE\,(sat)}$	Collector-emitter saturation voltage
V_{CES}	Collector-emitter voltage with emitter short-circuited to base
V_{CEV}	Collector-emitter voltage with specified reverse voltage between emitter and base
$V_{CEV\,(sus)}$	Collector-emitter sustaining voltage with specified reverse voltage between emitter and base
$V_{CEX\,(sus)}$	Collector-emitter sustaining voltage with specified circuit between emitter and base
V_{EB}	Emitter-base voltage
V_{EBO}	Emitter-base voltage with collector open
V_F	Continuous DC forward voltage
V_i	Input voltage of a specified circuit
V_R	Continuous DC reverse voltage
V_{RM}	Peak reverse voltage

Z_{BE}	Impedance between base and emitter
Z_i	Input impedance

3. RATING SYSTEMS FOR ELECTRONIC DEVICES

3.1. DEFINITIONS OF TERMS USED

a. **Electronic device.** An electronic tube or valve, transistor or other semi-conductor device.
Note: This definition excludes inductors, capacitors, resistors and similar components.

b. **Characteristic.** A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

c. **Bogey electronic device.** An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

d. **Rating.** A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determinated for specified values of environment and operation, and may be stated in any suitable terms.
Note: Limiting conditions may be either maxima or minima.

e. **Rating system.** The set of principles upon which ratings are established and which determins their interpretation.
Note: The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

3.2. ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

3.3. DESIGN - MAXIMUM RATING SYSTEM

Design-maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.
The equipment manufacturer should design so that, initially and throughout life, no design-maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

3.4. DESIGN - CENTRE RATING SYSTEM

Design-centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined type as defined by its published data, and should not be exceeded under normal conditions.
These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.
The equipment manufacturer should design so that, initially, no design-centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply-voltage.

The Absolute Maximum Rating System is commonly used for semiconductor devices.

4. TYPE DESIGNATION CODE

The type number for "discrete" semiconductor devices consists of:
TWO LETTERS FOLLOWED BY A SERIAL NUMBER

The first letter gives information about the **material** used for the active part of the devices:

A Material with a band gap of 0.6 to 1.0eV, such as germanium

B Material with a band gap of 1.0 to 1.3eV, such as silicon

C Material with a band gap of 1,3eV and more, such as gallium arsenide

D Material with a band gap of less than 0.6eV, such as indium antimonide

R Compound material as employed in Hall generators and photoconductive cells, such as cadmium-sulphide, lead-selenide

The second letter indicates the **function** according with the applications and the construction:

A Detection diode, switching diode, mixer diode

B Variable capacitance diode

C Transistor for a.f. applications (Rth j-c$>$15°C/W)

D Power transistor for a.f. applications (Rth j-c$\leq$15°C/W)

E Tunnel diode

F Transistor for h.f. applications (Rth j-c$>$15°C/W)

G Multiple of dissimilar devices (1); Miscellaneous

H Magnetic sensitive diode; Field probe

K Hall generator in an open magnetic circuit, e.g. magnetogram or signal probe

L Power transistor for h.f. applications (Rth j-c$\leq$15°C/W)

M Hall generator in a closed electrically energised magnetic circuit, e.g. Hall modulator or multiplier

P Radiation sensitive device

Q Radiation generating device

R Electrically triggered controlling and switching device having a breakdown characteristic (Rth j-c$>$15°C/W)

S Transistor for switching applications (Rth j-c$>$15°C/W)

T Electrically, or by means of light, triggered controlling and switching power device having a breakdown characteristic (Rth j-c$\leq$15°C/W)

U Power transistor for switching applications (Rth j-c$\leq$15°C/W)

X Multiplier diode, e.g. varactor, step recovery diode

Y Rectifying diode, booster diode, efficiency diode

Z Voltage reference or voltage regulator diode

1) A multiple device is defined as a combination of similar or dissimilar active devices, contained in a common encapsulation that cannot be dismantled, and of which all electrodes of the individual devices are accessible from the outside.
   Multiples of similar devices as well as multiples consisting of a main device and an auxiliary device are designated according to the code for the discrete devices described above.
   Multiples of dissimilar devices of other nature are designated by the second letter G.

The serial number is formed by:

Three figures for semiconductor devices which are primarily intended for use in domestic equipment.
Two figures and a letter (this letter starts back from z through y, x, etc. bears no signification).

Version letter

A version letter can be used, for instance, for a diode with up-rated voltage, for a sub-division of a transistor type in different gain ranges, a low noise version of an existing transistor and for a diode, transistor, or thyristor with minor mechanical differences, such as finish of the leads, length of the leads etc. The letters never have a fixed meaning, the only exception being the letter R which indicates reverse polarity.

Examples

BC 107 Silicon low power audio frequency transistor primarily intended for domestic equipment
BUY 46 Silicon power transistor for switching applications in professional equipment.

5. ALPHA-NUMERICAL LIST OF TYPES

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GERMANIUM TRANSISTORS

AD 142

GERMANIUM ALLOY PNP

AUDIO POWER AMPLIFIER

The AD 142 is a germanium alloy junction PNP transistor in a Jedec TO-3 metal case. It is designed specifically for use in class A power amplifier and in push-pull class B amplifiers.

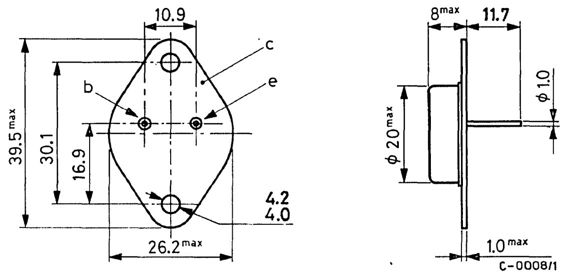
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-80	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-80	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-10	V
I_C	Collector current	-10	A
I_B	Base current	-3	A
P_{tot}	Total power dissipation at $T_c \leq 55\,°C$	30	W
T_s	Storage temperature	-65 to 100	°C
T_j	Junction temperature	100	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

AD 142

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = -0.5 V			-0.1	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -10 V			-2	mA
V_{CBO}	Collector-base voltage (I_E = 0)	I_C = -5 mA	-80			V
V_{CEO}	Collector-emitter voltage (I_B = 0)	I_C = -600 mA	-50			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = -5 A I_B = -250 mA		-0.3		V
h_{FE}	DC current gain Gr. 4	I_C = -1 A V_{CE} = -2 V	30		60	—
	Gr. 5	I_C = -1 A V_{CE} = -2 V	50		110	—
	Gr. 6	I_C = -1 A V_{CE} = -2 V	100		200	—
		I_C = -5 A V_{CE} = -2 V		45		—
h_{FE_1}/h_{FE_2}	Matched pair	I_C = -1 A V_{CE} = -2 V			1.4	—
f_T	Transition frequency	I_C = -0.5 A V_{CE} = -2 V		450		kHz

AD 143

GERMANIUM ALLOY PNP

AUDIO POWER AMPLIFIER

The AD 143 is a germanium alloy junction PNP transistor in a Jedec TO-3 metal case. It is designed specifically for use in class A power amplifiers and in push-pull class B amplifiers.

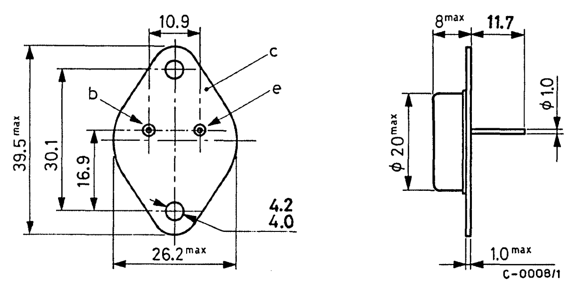
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-40	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-40	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-10	V
I_C	Collector current	-10	A
I_B	Base current	-3	A
P_{tot}	Total power dissipation at $T_c \leq 55\,°C$	30	W
T_s	Storage temperature	-65 to 100	°C
T_j	Junction temperature	100	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter			Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)		$V_{CB} = -0.5$ V			-0.1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)		$V_{EB} = -10$ V			-2	mA
V_{CBO}	Collector-base voltage ($I_E = 0$)		$I_C = -5$ mA	-40			V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)		$I_C = -0.6$ A	-35			V
$V_{CE(sat)}$	Collector-emitter saturation voltage		$I_C = -5$ A $I_B = -250$ mA		-0.3		V
h_{FE}	DC current gain	Gr. 4	$I_C = -1$ A $V_{CE} = -2$ V	30		60	—
		Gr. 5	$I_C = -1$ A $V_{CE} = -2$ V	50		110	—
		Gr. 6	$I_C = -1$ A $V_{CE} = -2$ V	100		200	—
			$I_C = -5$ A $V_{CE} = -2$ V		45		—
h_{FE_1}/h_{FE_2}	Matched pair		$I_C = -1$ A $V_{CE} = -2$ V			1.4	—
f_T	Transition frequency		$I_C = -0.5$ A $V_{CE} = -2$ V		450		KHz

AD 262

GERMANIUM ALLOY PNP

AUDIO POWER AMPLIFIER

The AD 262 is a germanium alloy junction PNP transistor in a SOT-9 metal case. It is designed specifically for series and shunt regulators, driver and output stages and, for use in class A and in class B, audio amplifiers.
The complementary NPN type is the BD 162.

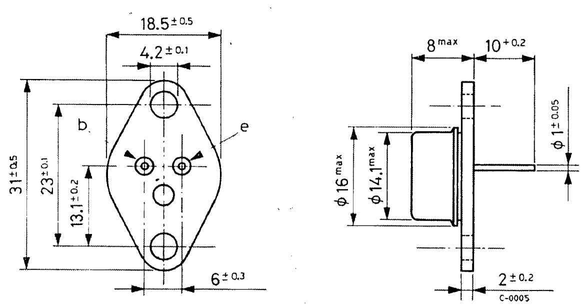
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-35	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	-20	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-10	V
I_C	Collector current	-4	A
I_B	Base current	-2	A
P_{tot}	Total power dissipation at $T_c \leq 60\ °C$	10	W
T_s	Storage temperature	-65 to 100	°C
T_j	Junction temperature	100	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



SOT-9

AD 262

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	4	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test Conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = -35 V			-5	mA
		V_{CB} = -0.5 V			-0.1	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE} = -13 V			-15	mA
V_{EBO}	Emitter-base voltage ($I_C = 0$)	I_{EBO} = -2 mA	-10			V
$V_{CEO(sus)}$*	Collector-emitter voltage ($I_B = 0$)	I_C = -0.6 A	-20			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -1.5 A I_B = -0.15 A			-0.2	V
V_{CEK}*(1)	Collector-emitter knee voltage	I_C = -1.5 A		-0.3		V
V_{BE}*	Base-emitter voltage	I_C = -1.5 A V_{CE} = -2 V			-0.9	V
h_{FE}*	DC current gain	I_C = -1.5 A V_{CE} = -2 V	30			—
		I_C = -0.5 A V_{CE} = -2 V	40		180	—
f_T	Transition frequency	I_C = -0.2 A V_{CE} = -2 V	200	315		kHz

* Pulsed; pulse duration = 300 μs, duty factor = 1.5%.

(1) Choose the characteristic (I_C, V_{CE}) passing through the point I_C = -1.65 A, V_{CE} = -1 V and read the V_{CE} value at I_C = -1.5 A

GERMANIUM ALLOY PNP

AD 263

AUDIO POWER AMPLIFIER

The AD 263 is a germanium alloy junction PNP transistor in a SOT-9 metal case. It is designed specifically for series and shunt regulators, driver and output stages and, for use in class A and in class B, audio amplifiers.
The complementary NPN type is the BD 163.

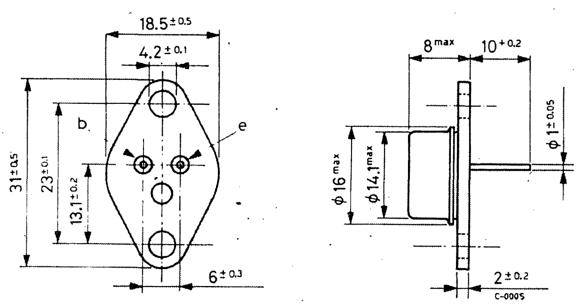
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-60	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	-40	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-10	V
I_C	Collector current	-4	A
I_B	Base current	-2	A
P_{tot}	Total power dissipation at $T_{case} \leq 60$ °C	10	W
T_{stg}	Storage temperature	-65 to 100	°C
T_j	Junction temperature	100	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



SOT-9

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	4	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = -60$ V $V_{CB} = -0.5$ V			-5 -0.1	mA mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	$V_{CE} = -28$ V			-15	mA
V_{EBO}	Emitter-base voltage ($I_C = 0$)	$I_{EBO} = -2$ mA	-10			V
$V_{CEO(sus)}$*	Collector-emitter voltage ($I_B = 0$)	$I_C = -0.6$ A	-40			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	$I_C = -1.5$ A $I_B = -0.15$ A			-0.2	V
V_{CEK}*(1)	Collector-emitter knee voltage	$I_C = -1.5$ A		-0.3		V
V_{BE}*	Base-emitter voltage	$I_C = -1.5$ A $V_{CE} = -2$ V			-0.9	V
h_{FE}	DC current gain	$I_C = -1.5$ A $V_{CE} = -2$ V $I_C = -0.5$ A $V_{CE} = -2$ V	20 25		 180	— —
f_T	Transition frequency	$I_C = -0.2$ A $V_{CE} = -2$ V	200	315		kHz

* Pulsed; pulse duration = 300 µs, duty factor = 1.5%

(1) Chose the characteristic (I_C, V_{CE}) passing through the point $I_C = -1.65$ A, $V_{CE} = -1$ V and read the V_{CE} value at $I_C = -1.5$ A

AL 102

GERMANIUM DIFFUSED COLLECTOR PNP

HI-FI HIGH POWER AMPLIFIER

The AL 102 is a germanium diffused-collector, graded-base, PNP transistor in a Jedec TO-3 metal case. It is particularly indicated for use in output stages of high fidelity power amplifiers where wide frequency response, linear power gain characteristics and high voltage rating are required.

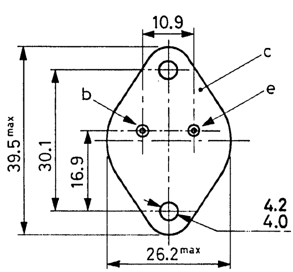
ABSOLUTE MAXIMUM RATINGS

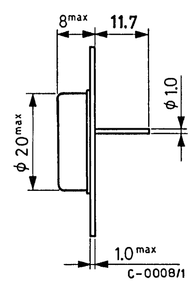
V_{CBO}	Collector-base voltage ($I_E = 0$)	-130	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-130	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-2	V
I_C	Collector current	-6	A
I_{CM}	Collector peak current	-10	A
I_B	Base current	-1	A
P_{tot}	Total power dissipation at $T_c \leq 55$ °C	30	W
T_s	Storage temperature	-65 to 100	°C
T_j	Junction temperature	100	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case





(sim. to **TO-3**)

AL 102

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = -0.5$ V			-0.1	mA
		$V_{CB} = -40$ V			-1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -2$ V			-7	mA
V_{CBO}	Collector-base voltage ($I_E = 0$)	$I_C = -10$ mA	-130			V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	$I_C = -100$ mA	-60			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$I_C = -5$ A, $I_B = -250$ mA			-0.5	V
$V_{BE(sat)}$	Base-emitter saturation voltage	$I_C = -5$ A, $I_B = -250$ mA		-0.7		V
h_{FE}	DC current gain Gr. 4	$I_C = -1$ A $V_{CE} = -2$ V	40		70	—
	Gr. 5	$I_C = -1$ A $V_{CE} = -2$ V	60		140	—
	Gr. 6	$I_C = -1$ A $V_{CE} = -2$ V	120		250	—
h_{FE_1}/h_{FE_2}	Matched pair	$I_C = -1$ A $V_{CE} = -2$ V			1.4	—
f_T	Transition frequency	$I_C = -0.5$ A $V_{CE} = -5$ V		4		MHz

AL 103

GERMANIUM DIFFUSED COLLECTOR PNP

HI-FI HIGH POWER AMPLIFIER

The AL 103 is a germanium diffused-collector, graded-base, PNP transistor in a Jedec TO-3 metal case. It is particularly indicated for use in output stages of high fidelity power amplifiers where wide frequency response and linear gain characteristics are required.

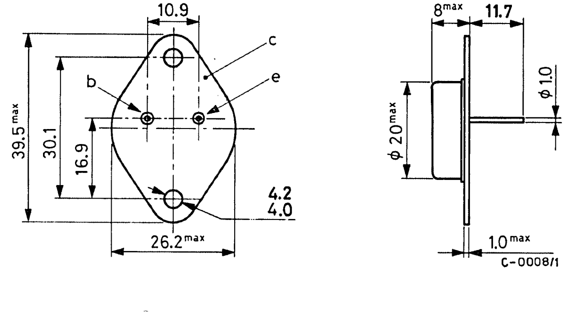
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-100	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-100	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-1.5	V
I_C	Collector current	-6	A
I_{CM}	Collector peak current	-10	A
I_B	Base current	-1	A
P_{tot}	Total power dissipation at $T_c \leq 55$ °C	30	W
T_s	Storage temperature	-65 to 100	°C
T_j	Junction temperature	100	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

AL 103

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = -0.5$ V			-0.1	mA
		$V_{CB} = -40$ V			-1	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = -1.5$			-25	mA
V_{CBO}	Collector-base voltage ($I_E = 0$)	$I_C = -10$ mA	-100			V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	$I_C = -100$ mA	-40			V
$V_{BE(sat)}$	Base-emitter saturation voltage	$I_C = -5$ A, $I_B = -250$ mA		-0.7		V
h_{FE}	DC current gain Gr. 4	$I_C = -1$ A $V_{CE} = -2$ V	40		70	—
	Gr. 5	$I_C = -1$ A $V_{CE} = -2$ V	60		140	—
	Gr. 6	$I_C = -1$ A $V_{CE} = -2$ V	120		250	—
h_{FE_1}/h_{FE_2}	Matched pair	$I_C = -1$ A $V_{CE} = -2$ V			1.4	—
f_T	Transition frequency	$I_C = -0.5$ A $V_{CE} = -5$ V		3		MHz

AL 112

GERMANIUM DIFFUSED COLLECTOR PNP

HI-FI POWER AMPLIFIER

The AL 112 is a germanium diffused-collector, graded-base, PNP transistor in a SOT-9 metal case. It is intended for use in output stages of Hi-Fi power amplifiers where wide frequency response and linear gain characteristics are required.

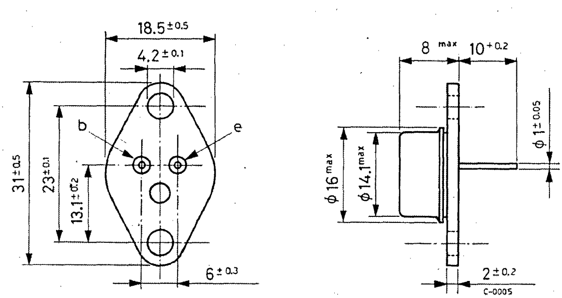
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-130	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-130	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	-60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-2	V
I_C	Collector current	-6	A
I_{CM}	Collector peak current	-10	A
I_B	Base current	-1	A
P_{tot}	Total power dissipation at $T_c \leq 60$ °C	10	W
T_s	Storage temperature	-65 to 100	°C
T_j	Junction temperature	100	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



SOT-9

AL 112

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	4	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = -0.5 V V_{CB} = -40 V V_{CB} = -130 V			-120 -1 -10	μA mA mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -3 V			-70	mA
V_{CBO}*	Collector-base voltage ($I_E = 0$)	I_C = -10 mA	-130			V
$V_{CEO\,(sus)}$*	Collector-emitter voltage ($I_B = 0$)	I_C = -100 mA	-60			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = -1.5 A I_B = -0.15 A			-0.25	V
V_{CEK}*(1)	Collector-emitter knee voltage	I_C = -1.5 A		-0.3		V
V_{BE}*	Base-emitter voltage	I_C = -1.5 A V_{CE} = -2 V			-0.9	V
h_{FE}*	DC current gain	I_C = -500 mA V_{CE} = -2 V I_C = -1.5 A V_{CE} = -2 V	20 40		220	— —
f_T	Transition frequency	I_C = -0.5 A V_{CE} = -5 V		3		MHz

* Pulsed: pulse duration = 300 μs, duty factor = 1.5%

(1) Choose the characteristic (I_C; V_{CE}) passing through the point I_C = -1.65 A, V_{CE} = -1 V and read the V_{CE} value at I_C = -1.5 A

AL 113

GERMANIUM DIFFUSED COLLECTOR PNP

HI-FI POWER AMPLIFIER

The AL 113 is a germanium diffused-collector, graded base, PNP transistor in a SOT-9 metal case. It is intended for use in output stages of Hi-Fi power amplifiers where wide frequency response and linear gain characteristics are required.

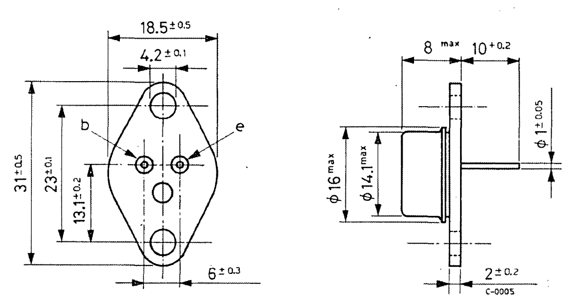
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-100	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-100	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	-40	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-1.5	V
I_C	Collector current	-6	A
I_{CM}	Collector peak current	-10	A
I_B	Base current	-1	A
P_{tot}	Total power dissipation at $T_c \leq 60\ °C$	10	W
T_s	Storage temperature	-65 to 100	°C
T_j	Junction temperature	100	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



SOT-9

AL 113

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	4	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = -0.5 V			-120	µA
		V_{CB} = -40 V			-1	mA
		V_{CB} = -100 V			-10	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -1.5 V			-25	mA
V_{CBO}*	Collector-base voltage ($I_E = 0$)	I_C = -10 mA	-100			V
V_{CEO}*(sus)	Collector-emitter voltage ($I_B = 0$)	I_C = -100 mA	-40			V
V_{CE}*(sat)	Collector emitter saturation voltage	I_C = -1.5 A I_B = -0.15 A			-0.25	V
V_{CEK}*(1)	Collector-emitter knee voltage	I_C = -1.5 A		-0.3		V
V_{BE}*	Base-emitter voltage	I_C = -1.5 A V_{CE} = -2 V			-0.9	V
h_{FE}*	DC current gain	I_C = -500 mA V_{CE} = -2 V	40		220	—
		I_C = -1.5 A V_{CE} = -2 V	50			—
f_T	Transition frequency	I_C = -0.5 A V_{CE} = -5 V		3		MHz

* Pulsed: pulse duration = 300 µs, duty factor = 1.5%

(1) Choose the characteristic (I_C; V_{CE}) passing through the point I_C = -1.65 A, V_{CE} = -1 V and read the V_{CE} value at I_C = -1.5 A

AU 106

GERMANIUM DIFFUSED COLLECTOR PNP

HORIZONTAL LARGE SCREEN TV DEFLECTOR

The AU 106 is a germanium diffused-collector, graded-base, PNP power transistor in a Jedec TO-3 metal case. It is primarily intended for use as horizontal output amplifier in high energy systems of picture tubes having deflection angles up to 114°, anode voltage ratings up to 18 kV and neck diameter up to 28 mm. This transistor is also suitable for use as high voltage and high speed switch.

ABSOLUTE MAXIMUM RATINGS

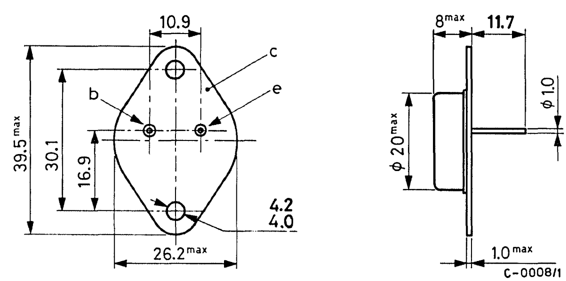
V_{CBO}	Collector-base voltage ($I_E = 0$)	-320	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-320	V
V_{EBO}*	Emitter-base voltage ($I_C = 0$)	-2	V
I_{BR}	Base reverse current	4	A
I_{BF}	Base forward current	-1	A
I_C	Collector current	-10	A
P_{tot}**	Total power dissipation at $T_c \leq 55$ °C	5	W
T_s	Storage temperature	-65 to 90	°C
T_j	Junction temperature	90	°C

* Momentary operation in excess of these values is permissible
** In horizontal output stages

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

AU 106

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = -10 V			-0.2	mA
		V_{CB} = -320 V			-15	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -2 V			-200	mA
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = -6 A I_B = -0.4 A			-1	V
$V_{BE(sat)}$	Base-emitter saturation voltage	I_C = -6 A I_B = -0.4 A			-1.5	V
f_T	Transition frequency	I_C = -0.5 A V_{CE} = -2 V		2		MHz
→ t_{off}	Turn-off time	I_C = -6 A I_{B1} = -0.4 A I_{B2} = 2.5 A			0.75	µs

AU 107

GERMANIUM DIFFUSED COLLECTOR PNP

VERTICAL LARGE SCREEN TV DEFLECTOR

The AU 107 is a germanium diffused-collector, graded-base, PNP power transistor in a Jedec TO-3 metal case. It is primarily intended for use as vertical output amplifier in high energy deflection systems of large screen television receivers. This transistor is also suitable for use as high speed switch.

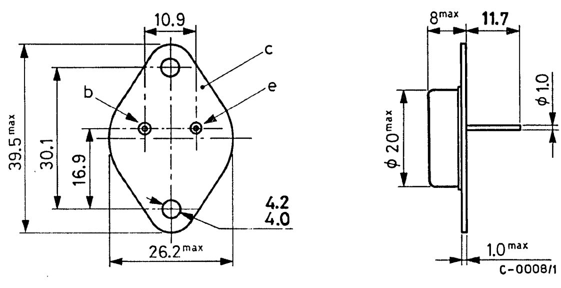
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-200	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-2	V
I_C	Collector current	-10	A
I_B	Base current	-1	A
P_{tot}	Total power dissipation at $T_c \leq 45\,°C$	30	W
T_s	Storage temperature	-65 to 90	°C
T_j	Junction temperature	90	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = -10 V			-0.2	mA
		V_{CB} = -200 V			-5	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -2 V			-200	mA
h_{FE}	DC current gain	I_C = -50 mA V_{CE} = -1 V	10			—
		I_C = -0.7 A V_{CE} = -2 V	35		120	—
f_T	Transition frequency	I_C = -0.5 A V_{CE} = -2 V		2		MHz

AU 110

GERMANIUM DIFFUSED COLLECTOR PNP

TV OUTPUT AMPLIFIER

The AU 110 is a germanium diffused - collector, graded - base PNP transistor in a Jedec TO-3 metal case. It is primarily intended for use in horizontal deflection stages with 90° deflection angle.

ABSOLUTE MAXIMUM RATINGS

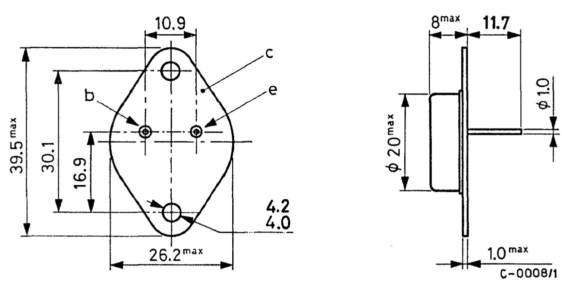
V_{CBO}	Collector-base voltage ($I_E = 0$)	-140	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-140	V
V_{EBO}*	Emitter-base voltage ($I_C = 0$)	-2	V
I_C*	Collector current	-10	A
I_B	Base current	-3	A
P_{tot}	Total power dissipation at $T_c \leq 45\ ^\circ C$	30	W
T_s	Storage temperature	-65 to 90	°C
T_j	Junction temperature	90	°C

* Momentary operation in excess of these values is permissible

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

AU 110

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = -10 V			-0.2	mA
		V_{CB} = -140 V			-4	mA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -2 V			-200	mA
$V_{CE\ (sat)}$	Collector-emitter saturation voltage	I_C = -5A I_B = -0.4 A			-0.5	V
$V_{BE\ (sat)}$	Base-emitter saturation voltage	I_C = -5A I_B = -0.4 A			-1.1	V
→ t_{off}	Turn-off time	I_C = -5A I_{B1} = -0.4 A I_{B2} = 2 A			2	μs

AU 111

GERMANIUM DIFFUSED COLLECTOR PNP

HORIZONTAL TV DEFLECTOR

The AU 111 is a germanium diffused-collector, graded-base, PNP transistor in a Jedec TO-3 metal case. It is primarily intended for use as horizontal output amplifier in high energy deflection systems for TV receivers. This transistor is also suitable for use as high voltage and high speed switch.

ABSOLUTE MAXIMUM RATINGS

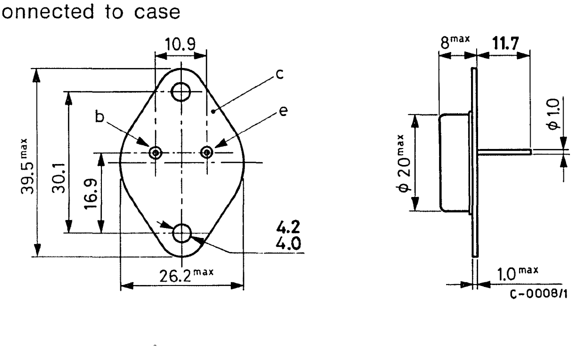
V_{CBO}	Collector-base voltage ($I_E = 0$)	-320	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-320	V
V_{EBO}*	Emitter-base voltage ($I_C = 0$)	-2	V
I_{BR}	Base reverse current	4	A
I_{BF}	Base forward current	-1	A
I_C	Collector current	-10	A
P_{tot}**	Total power dissipation at $T_c \leq 55\ °C$	5	W
T_s	Storage temperature	-65 to 90	°C
T_j	Junction temperature	90	°C

* Momentary operation in excess of these values is permissible
** In horizontal output stages

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

AU 111

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25° C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = -10 V			-0.2	mA
		V_{CB} = -320 V			-15	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -2 V			-200	mA
$V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = -6 A I_B = -0.4 A			-1	V
$V_{BE(sat)}$	Base-emitter saturation voltage	I_C = -6 A I_B = -0.4 A			-1.5	V
f_T	Transition frequency	I_C = -0.5 A V_{CE} = -2 V		2		MHz
→ t_{off}	Turn-off time	I_C = -6 A I_{B1} = -0.4 A I_{B2} = 2.5 A			1.2	μs

AU 113

GERMANIUM DIFFUSED COLLECTOR PNP

HORIZONTAL TV DEFLECTOR

The AU 113 is a germanium diffused-collector, graded base, power PNP transistor in a Jedec TO-3 metal case. It is primarily intended for use in horizontal deflection systems of television receivers using picture tubes with deflection angles up to 110°, neck diameters up to 20 mm, and anode voltages up to 12 kV.

ABSOLUTE MAXIMUM RATINGS

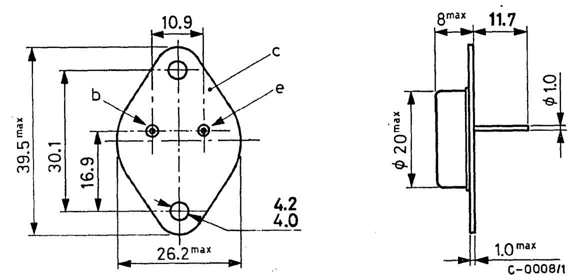
V_{CBO}	Collector-base voltage ($I_E = 0$)	-250	V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-250	V
V_{EBO}*	Emitter-base voltage ($I_C = 0$)	-2	V
I_{BRM}	Base reverse peak current	4	A
I_{BFM}	Base forward peak current	-1	A
I_{CM}	Collector peak current	-10	A
P_{tot}**	Total power dissipation at $T_c \leq 55$ °C	5	W
T_s	Storage temperature	-65 to 90	°C
T_j	Junction temperature	90	°C

* Momentary operation in excess of these values is permissible
** In horizontal output stages

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

AU 113

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5 °C/W

ELECTRICAL CHARACTERISTICS (T$_{c}$ = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = -10 V			-0.2	mA
		V_{CB} = -250 V			-15	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -2 V			-200	mA
$V_{CE\ (sat)}$	Collector-emitter saturation voltage	I_C = -5 A I_B = -0.4 A			-0.8	V
$V_{BE\ (sat)}$	Base-emitter saturation voltage	I_C = -5 A I_B = -0.4 A			-1.4	V
→ t_{off}	Turn-off time	I_C = -5 A I_{B1} = -0.4 A I_{B2} = 2.5 A			1.5	μs

GERMANIUM DIODES

GERMANIUM DIFFUSED DIODE

AY 102

HIGH VOLTAGE TV DAMPER DIODE

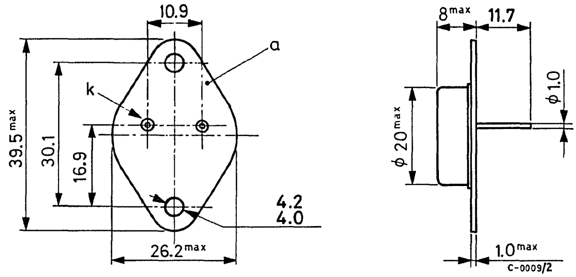
The AY 102 is a diffused germanium diode in a Jedec TO-3 metal case. It is particularly designed as damper diode in horizontal TV deflection stages coupled with AU 106, AU 112 and AU 111 transistors.

ABSOLUTE MAXIMUM RATINGS

V_{RM}	Peak reverse voltage	320	V
V_R	Reverse voltage	60	V
→ I_{FM}	Peak forward current (repetitive)	10	A
I_F	Forward current	7	A
T_s	Storage temperature	-65 to 90	°C
T_j	Junction temperature	90	°C

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-3**)

AY 102

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_{RM}	Peak reverse voltage	I_R = 1 mA	320			V
V_R	Reverse voltage	I_R = 0.3 mA	175			V
I_R	Reverse current	V_R = 10 V			150	μA
V_F	Forward voltage	I_F = 7 A		0.7	0.77	V

GERMANIUM DIFFUSED DIODE

AY 106

TV BOOSTER DIODE

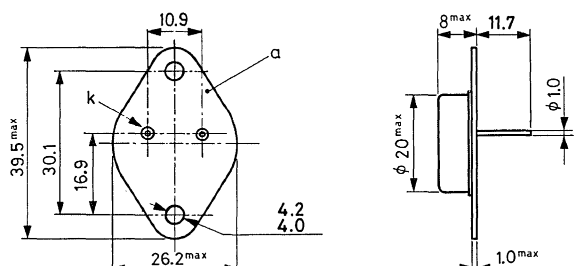
The AY 106 is a germanium diffused diode, in a Jedec TO-3 metal case. It is primarily intended as booster diode in horizontal deflection systems of television receivers using picture tubes with deflection angles up to 110°, neck diameters up to 20 mm and anode voltages up to 12 kV.

ABSOLUTE MAXIMUM RATINGS

V_{RM}	Peak reverse voltage	200	V
V_R	Continuos reverse voltage	60	V
→ I_{FM}	Peak forward current (repetitive)	10	A
I_F	Average forward current	7	A
T_s	Storage temperature	-65 to 90	°C
T_j	Junction temperature	90	°C

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-3**)

AY 106

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_{RM}	Peak reverse voltage	I_R = 1 mA	200			V
V_F	Forward voltage	I_F = 7 A			0.77	V
I_R	Reverse current	V_R = 10 V			150	μA

SILICON TRANSISTORS

BD 142

SILICON HOMETAXIAL* NPN

AUDIO POWER AMPLIFIER

The BD 142 is a single diffused « hometaxial » silicon NPN transistor in a Jedec TO-3 metal case. It is intended for a wide variety of intermediate and high power applications and particularly used as audio power amplifier.

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

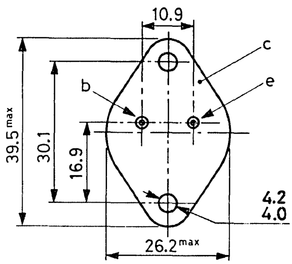
ABSOLUTE MAXIMUM RATINGS

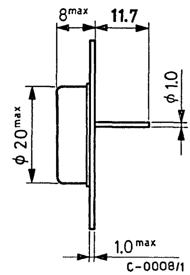
V_{CBO}	Collector-base voltage ($I_E = 0$)	50	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45	V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5$ V)	50	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_c \leq 25$ °C	117	W
T_s	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case





(sim. to **TO-3**)

BD 142

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

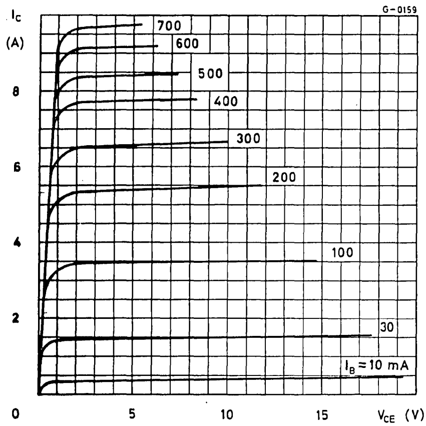
ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

	Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current		V_{CE} = 40 V				2	mA
I_{EBO}	Emitter cutoff current (I_C = 0)		V_{EB} = 7 V				1	mA
V_{CEO}*	Collector-emitter voltage (I_B = 0)		I_C = 200 mA		45			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage		I_C = 4 A	I_B = 400 mA			1.1	V
V_{CEV}*	Collector-emitter voltage (V_{BE} = -1.5 V)		I_C = 100 mA		50			V
V_{BE}*	Base-emitter voltage		I_C = 4 A	V_{CE} = 4 V			1.5	V
→ h_{FE}*	DC current gain	Gr. 4	I_C = 500 mA	V_{CE} = 4 V	20		50	—
		Gr. 5	I_C = 500 mA	V_{CE} = 4 V	35		75	—
		Gr. 6	I_C = 500 mA	V_{CE} = 4 V	60		145	—
		Gr. 7	I_C = 500 mA	V_{CE} = 4 V	120		250	—
			I_C = 4 A	V_{CE} = 4 V	12	35	160	—
h_{FE_1}/h_{FE_2}	Matched pair		I_C = 500 mA	V_{CE} = 4 V			1.6	—
f_T	Transition frequency		I_C = 500 mA	V_{CE} = 4 V		1.3		MHz
→ $I_{s/b}$**	Second breakdown collector current		V_{CE} = 39 V		3			A

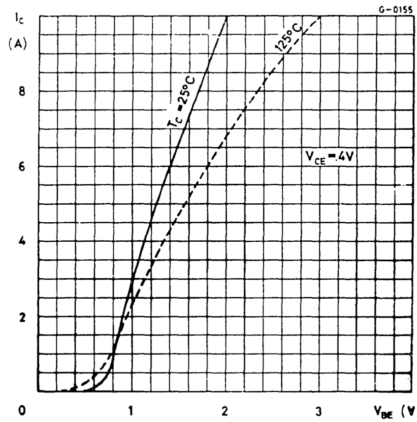
* Pulsed: pulse duration = 300 μs, duty factor = 1.5 %

** Pulsed: 1s non repetitive pulse

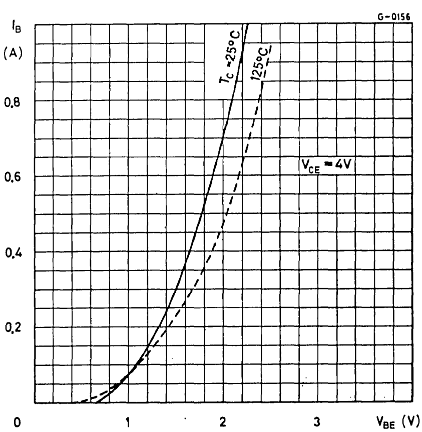
Typical output characteristics



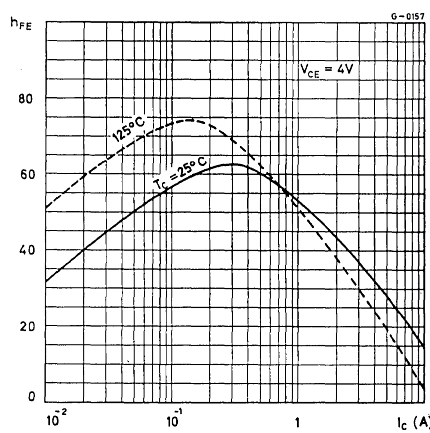
Typical DC transconductance



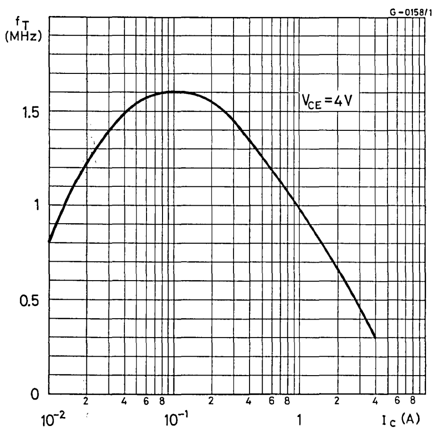
Typical input characteristics



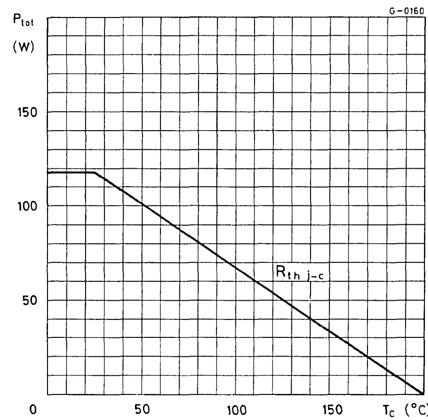
Typical DC current gain



Transition frequency



Rating chart



BD 162

SILICON HOMETAXIAL* NPN

AUDIO POWER AMPLIFIER

The BD 162 is a silicon "Hometaxial" NPN transistor in a SOT-9 metal case. It is suitable for power switching circuits, series and shunt regulators, driver and output stages and for use in class A and class B audio amplifiers.

The complementary PNP type is the AD 262.

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

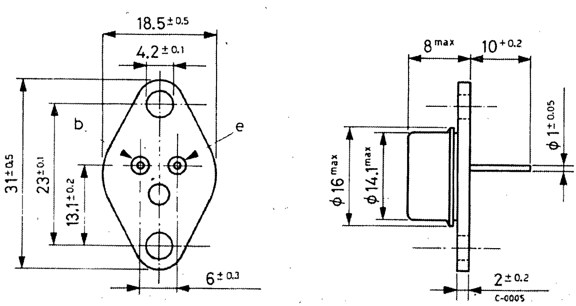
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	40	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	20	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	4	A
I_B	Base current	2	A
P_{tot}	Total power dissipation at $T_c \leq 60$ °C	23	W
T_s	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



SOT-9

BD 162

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	6	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 40 V V_{CB} = 40 V T_c = 150 °C			1 5	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 20 V			2.5	mA
V_{EBO}	Emitter base voltage (I_C = 0)	I_E = 1 mA	7			V
$V_{CEO(sus)}$*	Collector-emitter voltage (I_B = 0)	I_C = 100 mA	20			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_B = 0.15 A I_C = 1.5 A			0.5	V
V_{CEK}*(1)	Collector-emitter knee voltage	I_C = 1.5 A		0.3		V
V_{BE}*	Base-emitter voltage	I_C = 1.5 A V_{CE} = 2 V			1.2	V
h_{FE}*	DC current gain	I_C = 500 mA V_{CE} = 2 V I_C = 1.5 A V_{CE} = 2 V	40 30		180	— —
f_T	Transition frequency	I_C = 0.2 A V_{CE} = 4 V	0.8	1.75		MHz

* Pulsed; pulse duration = 300 μs, duty factor = 1.5%

(1) Choose the characteristic (I_C, V_{CE}) passing through the point I_C = 1.65 A, V_{CE} = 1 V and read the V_{CE} value at I_C = 1.5 A

BD 163

SILICON HOMETAXIAL* NPN

AUDIO POWER AMPLIFIER

The BD 163 is a silicon "Hometaxial" NPN transistor in a SOT-9 metal case. It is suitable for power switching circuits, series and shunt regulators. driver and output stages and for use in class A and class B audio amplifiers.
The complementary PNP type is the AD 263.

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

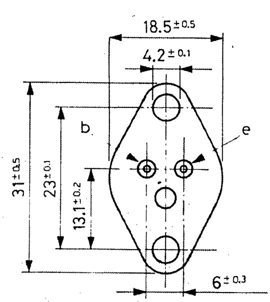
ABSOLUTE MAXIMUM RATINGS

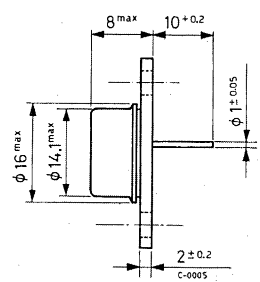
V_{CBO}	Collector-base voltage ($I_E = 0$)	60	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	40	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	4	A
I_B	Base current	2	A
P_{tot}	Total power dissipation at $T_{case} \leq 60\ °C$	23	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case





SOT-9

BD 163

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	6	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = 60 V			1	mA
		V_{CB} = 60 V T_{case} = 150 °C			5	mA
I_{CEO}	Collector cutoff current ($I_B = 0$)	V_{CE} = 50 V			2.5	mA
V_{EBO}	Emitter base voltage ($I_C = 0$)	I_E = 1 mA	7			V
$V_{CEO(sus)}$*	Collector-emitter voltage ($I_B = 0$)	I_C = 100 mA	40			V
V_{CEK}*(1)	Collector-emitter knee voltage	I_C = 1.5 A		0.3		V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1.5 A I_B = 0.15 A			0.5	V
V_{BE}*	Base-emitter voltage	I_C = 1.5 A V_{CE} = 2 V			1.2	V
h_{FE}*	DC current gain	I_C = 0.5 A V_{CE} = 2 V	25		180	—
		I_C = 1.5 A V_{CE} = 2 V	20			—
f_T	Transition frequency	I_C = 0.2 A V_{CE} = 4 V	0.8	1.75		MHz

* Pulsed; pulse duration = 300 μs, duty factor = 1.5%

(1) Choose the characteristic (I_C, V_{CE}) passing through the point I_C = 1.65 A, V_{CE} = 1 V and read the V_{CE} value at I_C = 1.5 A

SILICON PLANAR NPN

BD 375
BD 377
BD 379

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING CIRCUITS

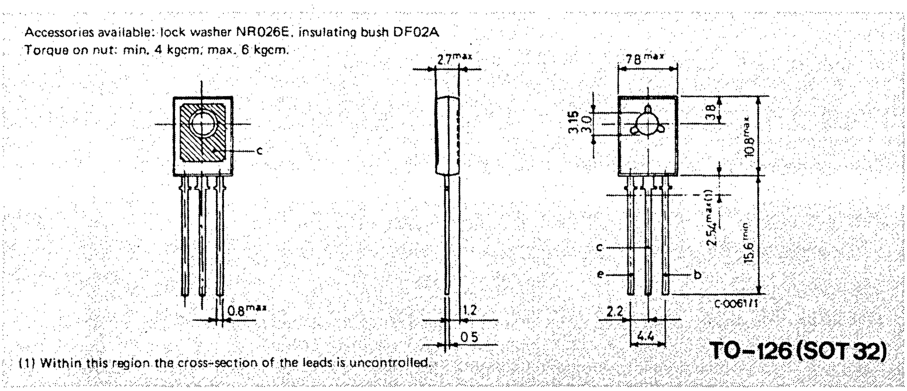
The BD 375, BD 377 and BD 379 are silicon planar epitaxial NPN power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are respectively the BD 376, BD 378 and BD 380.

ABSOLUTE MAXIMUM RATINGS

		BD 375	BD 377	BD 379
V_{CBO}	Collector-base voltage ($I_E = 0$)	50 V	75 V	100 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45 V	60 V	80 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5 V		
I_C	Collector current	2 A		
→ I_{CM}	Collector peak current (repetitive)	3 A		
I_B	Base current	1 A		
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C	25 W		
T_{stg}	Storage temperature	-55 to 150 °C		
T_j	Junction temperature	150 °C		

MECHANICAL DATA

Dimensions in mm



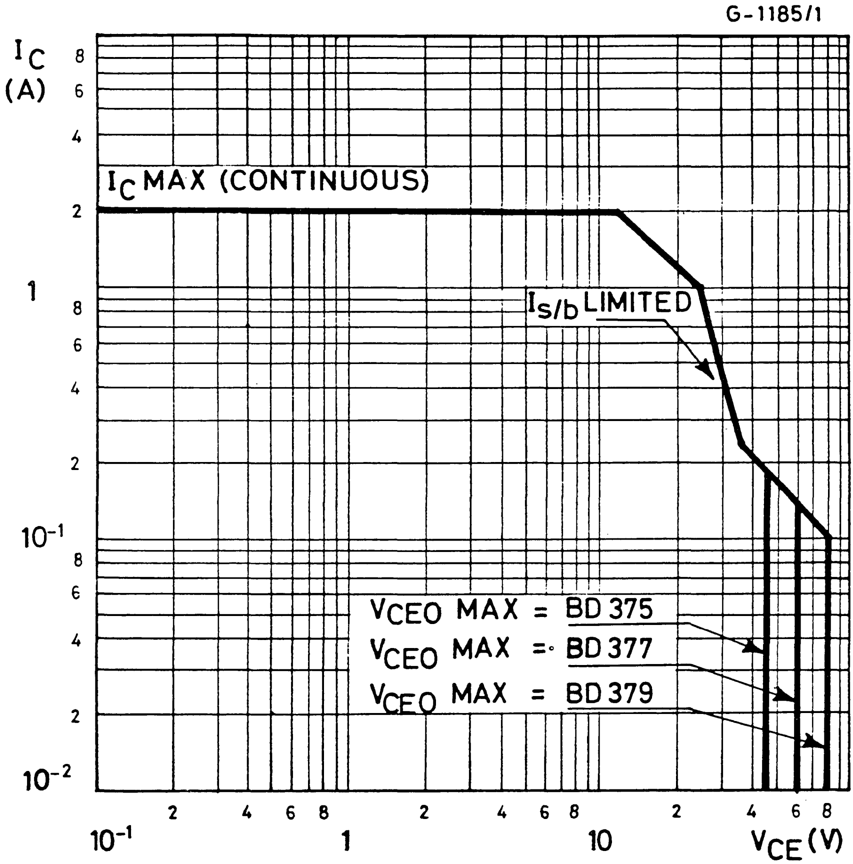
THERMAL DATA

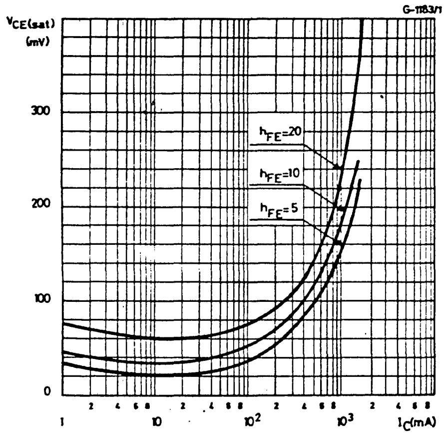
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD 375**				
		V_{CB} = 45V			2	μA
		V_{CB} = 45V T_{case} = 150°C			10	μA
		for **BD 377**				
		V_{CB} = 60V			2	μA
		V_{CB} = 60V T_{case} = 150°C			10	μA
		for **BD 379**				
		V_{CB} = 80V			2	μA
		V_{CB} = 80V T_{case} = 150°C			10	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V			100	μA
V_{CBO}	Collector-base voltage (I_E = 0)	I_C = 100 μA				
		for **BD 375**	50			V
		for **BD 377**	75			V
		for **BD 379**	100			V
$V_{CEO(sus)}$	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA				
		for **BD 375**	45			V
		for **BD 377**	60			V
		for **BD 379**	80			V
→ $V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = 1A I_B = 0.1A			1	V
→ V_{BE}	Base-emitter voltage	I_C = 1A V_{CE} = 2V			1.5	V
→ h_{FE}	DC current gain Gr. 6	I_C = 0.15A V_{CE} = 2V	40		100	–
	Gr. 10	I_C = 0.15A V_{CE} = 2V	63		160	–
	Gr. 16	I_C = 0.15A V_{CE} = 2V	100		250	–
	Gr. 25	I_C = 0.15A V_{CE} = 2V	150		375	–
		I_C = 1A V_{CE} = 2V	20			–
t_{on}	Turn-on time	I_C = 0.5A I_{B1} = 0.05A		50		ns
t_{off}	Turn-off time	I_C = 0.5A I_{B1} = $-I_{B2}$ = 0.05A		500		ns

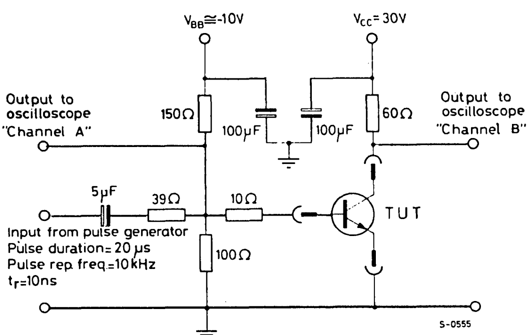
Safe operating areas

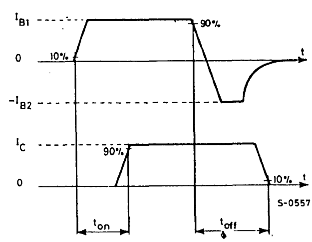




Typical collector-emitter saturation voltage

Test circuit for measurement of switching times, with waveforms





SILICON PLANAR PNP

BD 376
BD 378
BD 380

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING CIRCUITS

The BD 376, BD 378 and BD 380 are silicon planar epitaxial PNP power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are respectively the BD 375, BD 377 and BD 379.

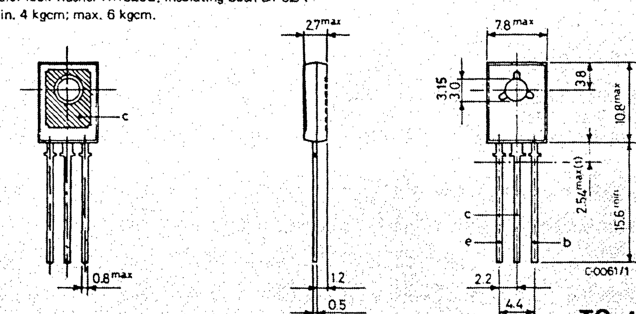
ABSOLUTE MAXIMUM RATINGS

		BD 376	BD 378	BD 380
V_{CBO}	Collector-base voltage ($I_E = 0$)	-50 V	-75 V	-100 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45 V	-60 V	-80 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5 V	
I_C	Collector current		-2 A	
→ I_{CM}	Collector peak current (repetitive)		-3 A	
I_B	Base current		-1 A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C		25 W	
T_{stg}	Storage temperature		-55 to 150 °C	
T_j	Junction temperature		150 °C	

MECHANICAL DATA

Dimensions in mm

Accessories available: lock washer NR026E, insulating bush DF02A
Torque on nut: min. 4 kgcm; max. 6 kgcm.



(1) Within this region the cross-section of the leads is uncontrolled.

TO-126 (SOT 32)

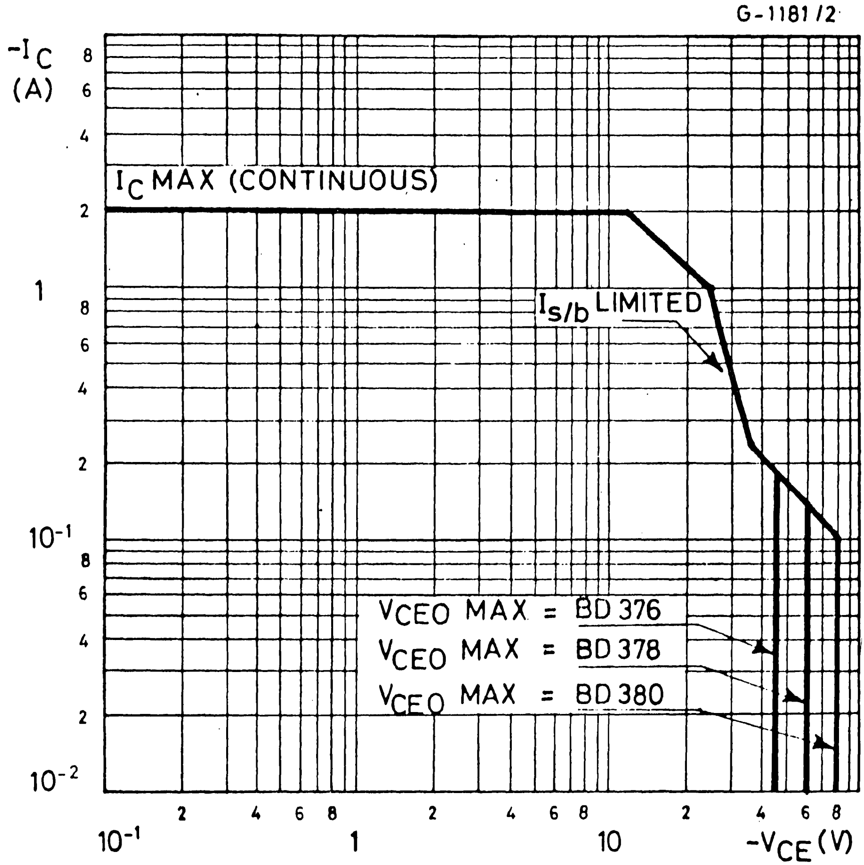
THERMAL DATA

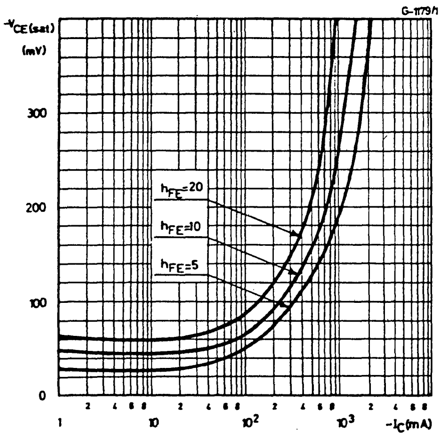
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD 376**				
		V_{CB} = -45V			-2	μA
		V_{CB} = -45V T_{case} = 150°C			-10	μA
		for **BD 378**				
		V_{CB} = -60V			-2	μA
		V_{CB} = -60V T_{case} = 150°C			-10	μA
		for **BD 380**				
		V_{CB} = -80V			-2	μA
		V_{CB} = -80V T_{case} = 150°C			-10	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5V			-100	μA
V_{CBO}	Collector-base voltage (I_E = 0)	I_C = -100 μA				
		for **BD 376**	-50			V
		for **BD 378**	-75			V
		for **BD 380**	-100			V
$V_{CEO(sus)}$	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100 mA				
		for **BD 376**	-45			V
		for **BD 378**	-60			V
		for **BD 380**	-80			V
→ $V_{CE(sat)}$	Collector-emitter saturation voltage	I_C = -1A I_B = -0.1A			-1	V
→ V_{BE}	Base-emitter voltage	I_C = -1A V_{CE} = -2V			-1.5	V
→ h_{FE}	DC current gain Gr. 6	I_C = -0.15A V_{CE} = -2V	40		100	–
	Gr. 10	I_C = -0.15A V_{CE} = -2V	63		160	–
	Gr. 16	I_C = -0.15A V_{CE} = -2V	100		250	–
	Gr. 25	I_C = -0.15A V_{CE} = -2V	150		375	–
		I_C = -1A V_{CE} = -2V	20			–
t_{on}	Turn-on time	I_C = -0.5A I_{B1} = -0.05A		75		ns
t_{off}	Turn-off time	I_C = -0.5A I_{B1} = $-I_{B2}$ = -0.05A		500		ns

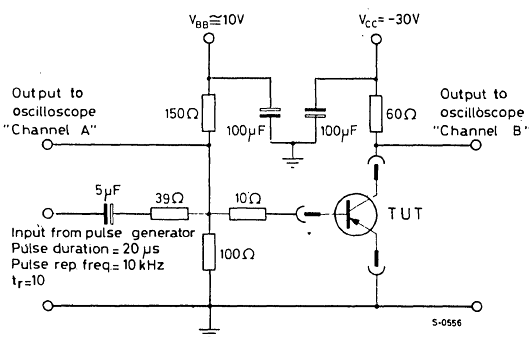
Safe operating areas

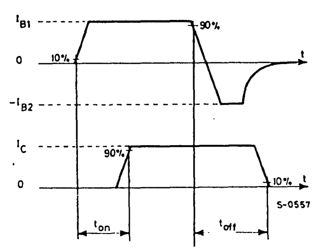




Typical collector-emitter saturation voltage

Test circuit for measurement of switching times, with waveforms





SILICON EPITAXIAL-BASE NPN

BD 433
BD 435

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING CIRCUITS

The BD 433 and BD 435 are silicon epitaxial-base NPN power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The BD 433 is especially suitable for use in output stages of car radios.
The complementary PNP types are respectively the BD 434 and BD 436.

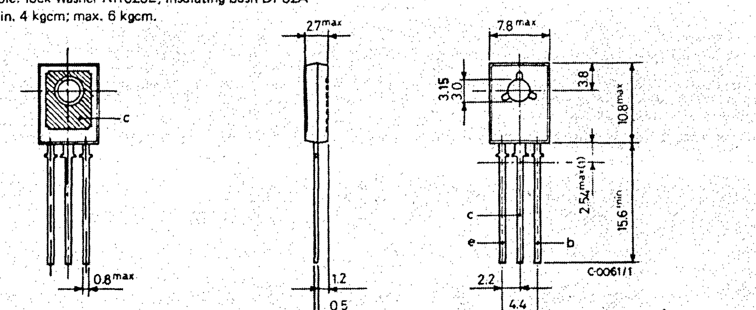
ABSOLUTE MAXIMUM RATINGS

		BD 433	BD 435
V_{CBO}	Collector-base voltage ($I_E = 0$)	22 V	32 V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	22 V	32 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	22 V	32 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5 V	
I_C	Collector current	4 A	
I_{CM}	Collector peak current ($t \leq 10$ ms)	7 A	
I_B	Base current	1 A	
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	36 W	
T_{stg}	Storage temperature	-55 to 150 °C	
T_j	Junction temperature	150 °C	

MECHANICAL DATA

Dimensions in mm

Accessories available: lock washer NR026E, insulating bush DF02A
Torque on nut: min. 4 kgcm; max. 6 kgcm.



(1) Within this region the cross-section of the leads is uncontrolled.

TO-126 (SOT 32)

BD 433
BD 435

THERMAL DATA

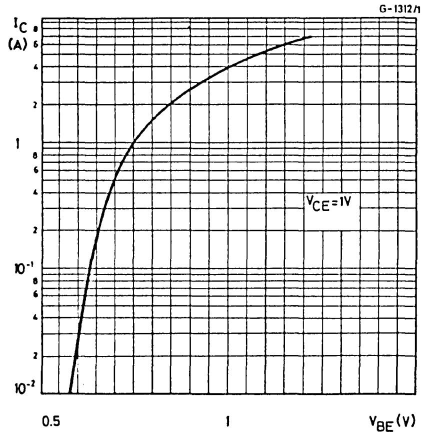
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

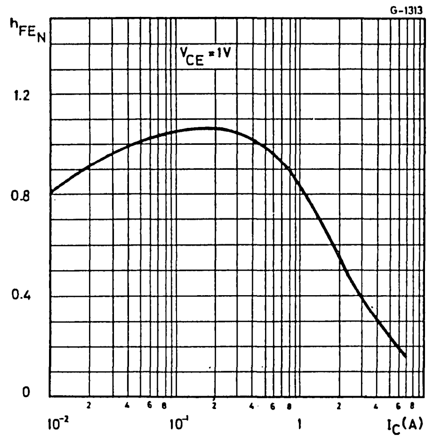
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD 433**	$V_{CB} = 22V$			100	μA
		for **BD 435**	$V_{CB} = 32V$			100	μA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 433**	$V_{CE} = 22V$			100	μA
		for **BD 435**	$V_{CE} = 32V$			100	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	$V_{EB} = 5V$				1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 100$ mA	for **BD 433**	22			V
			for **BD 435**	32			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 2A$	$I_B = 0.2A$			0.5	V
V_{BE}*/**	Base-emitter voltage	$I_C = 10$ mA	$V_{CE} = 5V$		0.58		V
		$I_C = 2A$	$V_{CE} = 1V$			1.1	V
h_{FE}*	DC current gain	$I_C = 10$ mA	$V_{CE} = 5V$	40			–
		$I_C = 500$ mA	$V_{CE} = 1V$	85			–
		$I_C = 2A$	$V_{CE} = 1V$	50			–
h_{FE1}/h_{FE2}*	Matched pair	$I_C = \|500$ mA$\|$	$V_{CE} = \|1V\|$			1.4	–
f_T	Transition frequency	$I_C = 250$ mA	$V_{CE} = 1V$	3			MHz

* Pulsed, pulse duration = 300 μs, duty cycle = 1.5%
** V_{BE} decreases by typ. 2.3 mV/°C with increasing of temperature

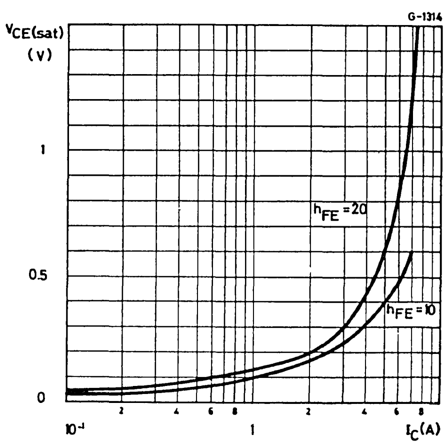
Typical DC transconductance



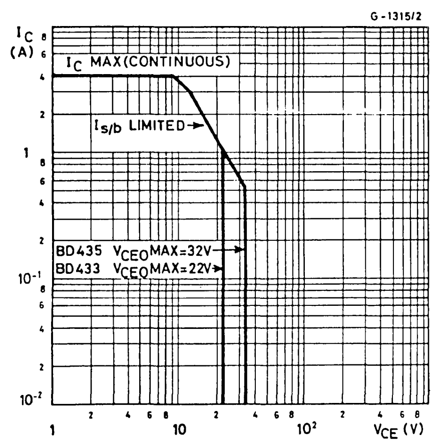
Typical DC normalized current gain



Typical collector-emitter saturation voltage

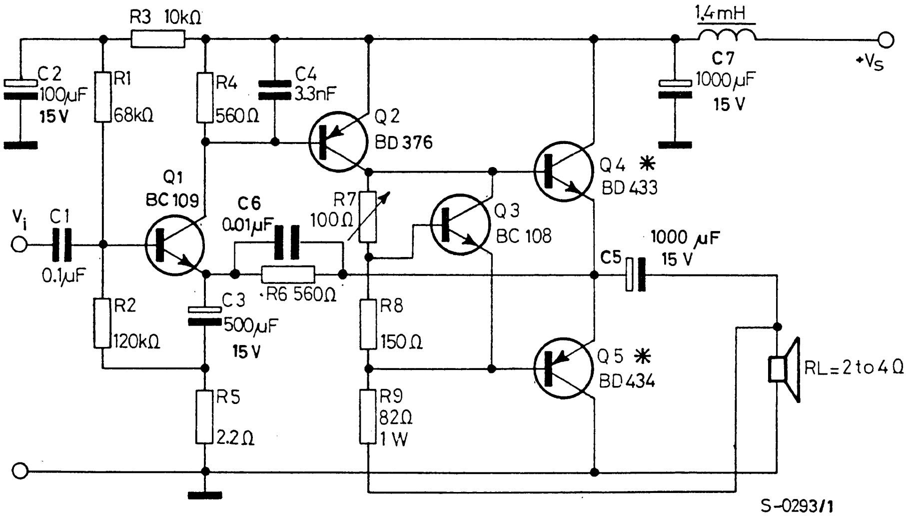


Safe operating areas



APPLICATION INFORMATION

Typical application circuit for 14.4 V, 6.5 W, 2 to 4Ω car-radio audio amplifier



✱ Mounted on heatsink having $R_{th} \leq 16$ °C/W

Typical performance (V_s = 14.4V)

P_o	Output power	at d = 10%	with R_L = 4Ω	≥ 6.5 W
			with R_L = 2Ω	≥ 12 W
V_i	Input voltage	for P_o = 5 W	with R_L = 4Ω	24 mV
			with R_L = 2Ω	20 mV
Z_i	Input impedance			20 kΩ
I_d	Output transistors quiescent drain current			10 mA
I_d	BD 376 drain current			80 mA
I_d	Total drain current	at P_o = 6.5W		660 mA
B	-3 dB frequency response	at P_o = 3 W		100 to 8000 Hz

Continuous stable operation is ensured up to an ambient temperature of 60 °C.
The amplifier is overdrive proof and short-circuit proof.

SILICON EPITAXIAL-BASE PNP

BD 434
BD 436

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING CIRCUITS

The BD 434 and BD 436 are silicon epitaxial-base PNP power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The BD 434 is especially suitable for use in output stages of car radios.
The complementary NPN types are respectively the BD 433 and BD 435.

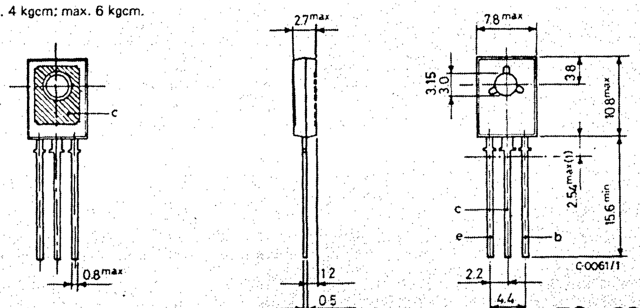
ABSOLUTE MAXIMUM RATINGS

		BD 434	BD 436
V_{CBO}	Collector-base voltage ($I_E = 0$)	-22 V	-32 V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-22 V	-32 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-22 V	-32 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5 V	
I_C	Collector current	-4 A	
I_{CM}	Collector peak current ($t \leq 10$ ms)	-7 A	
I_B	Base current	-1 A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	36 W	
T_{stg}	Storage temperature	-55 to 150 °C	
T_j	Junction temperature	150 °C	

MECHANICAL DATA

Dimensions in mm

Accessories available: lock washer NR026E, insulating bush DF02A
Torque on nut: min. 4 kgcm; max. 6 kgcm.



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

THERMAL DATA

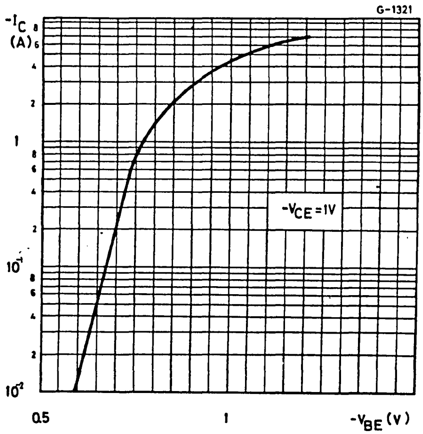
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

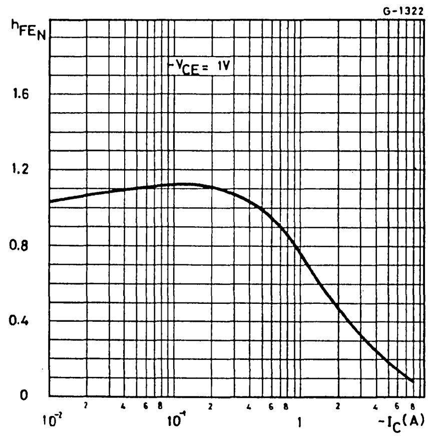
	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD 434**	V_{CB} = -22V			-100	μA
		for **BD 436**	V_{CB} = -32V			-100	μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD 434**	V_{CE} = -22V			-100	μA
		for **BD 436**	V_{CE} = -32V			-100	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5V				-1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100mA					
			for **BD 434**	-22			V
			for **BD 436**	-32			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = -2A	I_B = -0.2A			-0.5	V
V_{BE} */**	Base-emitter voltage	I_C = -10mA	V_{CE} = -5V		-0.58		V
		I_C = -2A	V_{CE} = -1V			-1.1	V
h_{FE}*	DC current gain	I_C = -10mA	V_{CE} = -5V	40			–
		I_C = -500mA	V_{CE} = -1V	85			–
		I_C = -2A	V_{CE} = -1V	50			–
h_{FE1}/h_{FE2}*	Matched pair	I_C = |500mA|	V_{CE} = |1V|			1.4	–
f_T	Transition frequency	I_C = -250mA	V_{CE} = -1V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
**$|V_{BE}|$ drecreases by typ. |2.3 mV/°C| with increasing of temperature

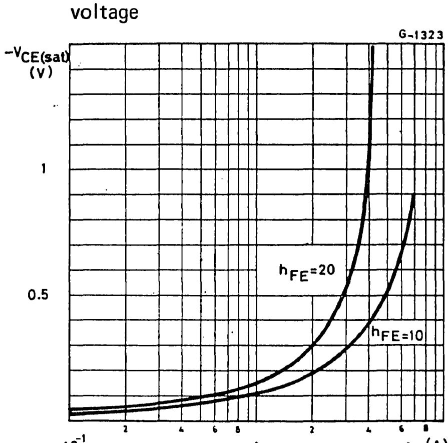
Typical DC transconductance



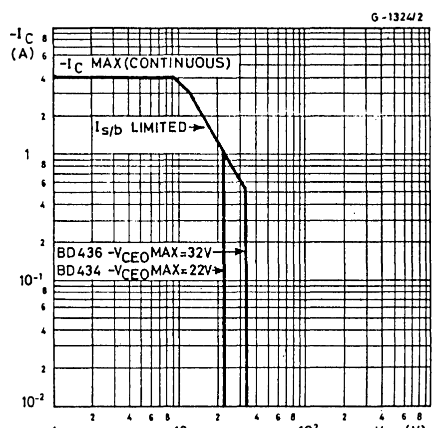
Typical DC normalized current gain



Typical collector-emitter saturation voltage

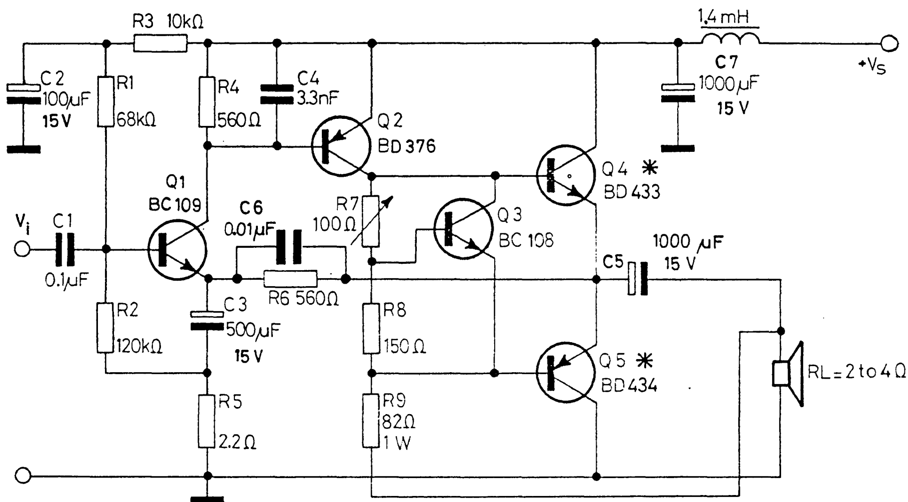


Safe operating areas



APPLICATION INFORMATION

Typical application circuit for 14.4V, 6.5 W, 2 to 4Ω car-radio audio amplifier



✱ Mounted on heatsink having $R_{th} \leq 16$ °C/W

TYPICAL PERFORMANCE (V_s = 14.4V)

P_o	Output power	at d = 10% with R_L = 4Ω	⩾ 6.5	W
		with R_L = 2Ω	⩾ 12	W
V_i	Input voltage	for P_o = 5 W with R_L = 4Ω	24	mV
		with R_L = 2Ω	20	mV
Z_i	Input impedance		20	kΩ
I_d	Output transistors quiescent drain current		10	mA
I_d	BD 376 drain current		80	mA
I_d	Total drain current	at P_o = 6.5W	660	mA
B	-3 dB frequency response	at P_o = 3 W	100 to 8000	Hz

Continuous stable operation is ensured up to an ambient temperature of 60°C.
The amplifier is overdrive proof and short-circuit proof.

BD 437
BD 439
BD 441

SILICON EPITAXIAL-BASE NPN

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING CIRCUITS

The BD 437, BD 439 and BD 441 are silicon epitaxial-base NPN power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications. The complementary PNP types are respectively the BD 438, BD 440, BD 442.

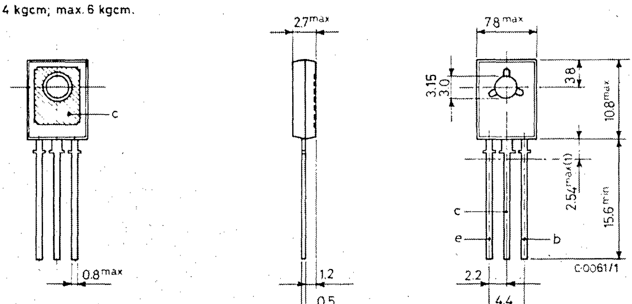
ABSOLUTE MAXIMUM RATINGS

		BD 437	BD 439	BD 441
V_{CBO}	Collector-base voltage ($I_E = 0$)	45 V	60 V	80 V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	45 V	60 V	80 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45 V	60 V	80 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		5 V	
I_C	Collector current		4 A	
I_{CM}	Collector peak current ($t \leq 10$ ms)		7 A	
I_B	Base current		1 A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$		36 W	
T_{stg}	Storage temperature		-55 to 150 °C	
T_j	Junction temperature		150 °C	

MECHANICAL DATA

Dimensions in mm

Accessories available: lock washer NR026E, insulating bush DF02A
Torque on nut: min. 4 kgcm; max. 6 kgcm.



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled

THERMAL DATA

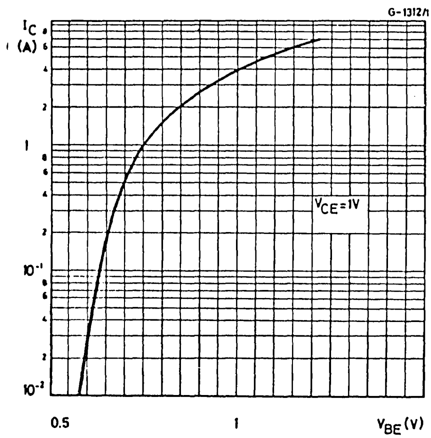
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

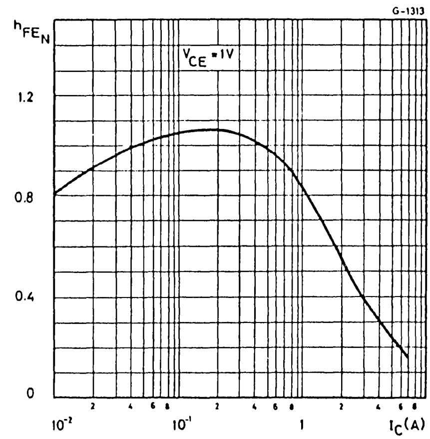
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD 437**	V_{CB} = 45V			100	μA
		for **BD 439**	V_{CB} = 60V			100	μA
		for **BD 441**	V_{CB} = 80V			100	μA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 437**	V_{CB} = 45V			100	μA
		for **BD 439**	V_{CB} = 60V			100	μA
		for **BD 441**	V_{CB} = 80V			100	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5V				1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100 mA	for **BD 437**	45			V
			for **BD 439**	60			V
			for **BD 441**	80			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 2 A	I_B = 0.2A				
		for **BD 437**				0.6	V
		for **BD 439** and	**BD 441**			0.8	V
V_{BE} */**	Base-emitter voltage	I_C = 10 mA	V_{CE} = 5V		0.58		V
		for **BD 437**					
		I_C = 2A	V_{CE} = 1V			1.2	V
		for **BD 439** and	**BD 441**				
		I_C = 2A	V_{CE} = 1V			1.5	V
h_{FE}*	DC current gain	I_C = 10 mA	V_{CE} = 5V				
			for **BD 437**	30			–
			for **BD 439**	20			–
			for **BD 441**	15			–
		I_C = 500 mA	V_{CE} = 1V				
			for **BD 437**	85			–
			for **BD 439**	40			–
			for **BD 441**	40			–
		I_C = 2A	V_{CE} = 1V				
			for **BD 437**	40			–
			for **BD 439**	25			–
			for **BD 441**	15			–
h_{FE_1}/h_{FE_2}	Matched pair	I_C = |500 mA|	V_{CE} = |1V|			1.4	–
f_T	Transition frequency	I_C = 250 mA	V_{CE} = 1V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** V_{BE} decreases by typ. 2.3 mV/°C with increasing temperature

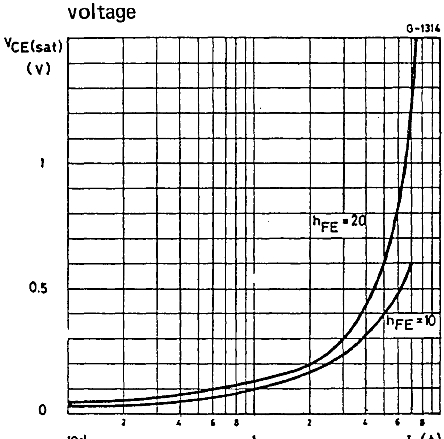
Typical DC transconductance



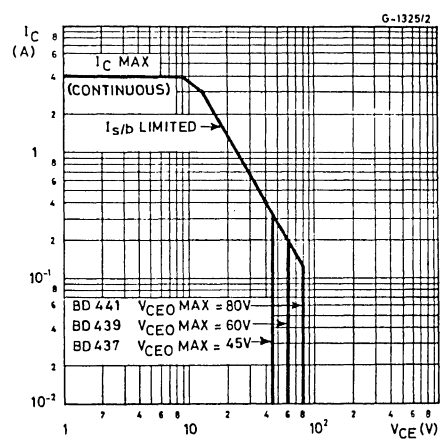
Typical DC normalized current gain



Typical collector-emitter saturation voltage

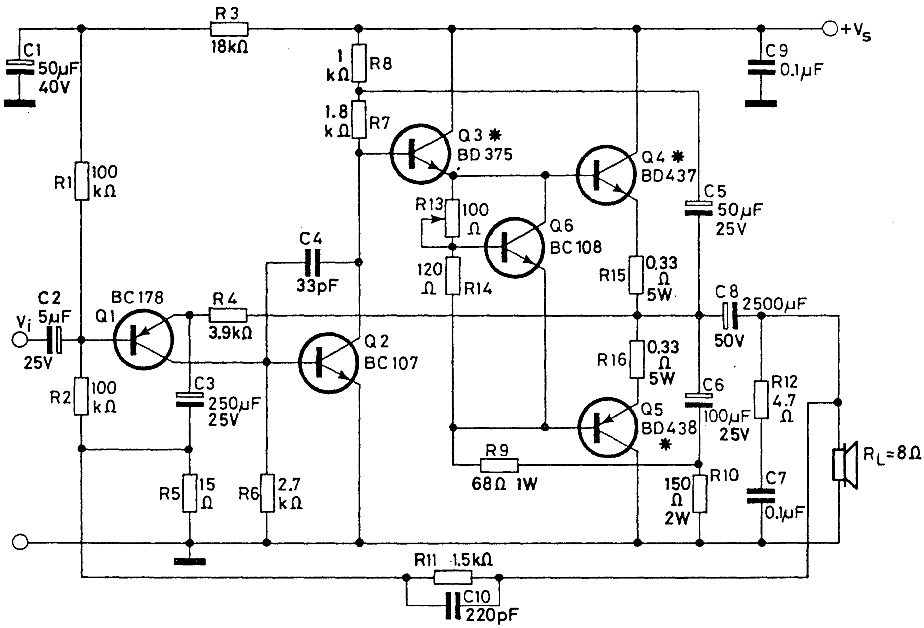


Safe operating areas



APPLICATION INFORMATION

Typical application circuit for 36V, 15W, 8 Ω Hi-Fi amplifier



* Mounted on heatsink having $R_{th} \leq 6°C/W$

S-0793/2

Typical performance (V_s = 36V)

P_o	Output power	at d = 10% f = 1 kHz	⩾ 20 W
		at d = 1% f = 40 Hz to 12.5 kHz	⩾ 15 W
V_i	Input voltage	for P_o = 20 W	190 mV
		for P_o = 15 W	150 mV
Z_i	Input impedance		100 kΩ
I_d	Output transistors quiescent drain current		10 mA
I_d	BD 375 drain current		75 mA
I_d	Total drain current	at P_o = 15 W	850 mA
B	-3 dB frequency response	at P_o = 15 W	10Hz to 100 kHz

Continuous stable operation is ensured up to an ambient temperature of 45°C

SILICON EPITAXIAL-BASE PNP

BD 438
BD 440
BD 442

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING CIRCUITS

The BD 438, BD 440, BD 442 are silicon epitaxial-base PNP power transistors in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications. The complementary NPN types are respectively the BD 437, BD 439, BD 441.

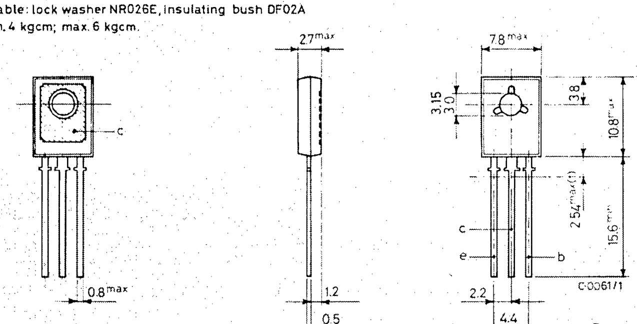
ABSOLUTE MAXIMUM RATINGS

		BD 438	BD 440	BD 442
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45 V	-60 V	-80 V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45 V	-60 V	-80 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45 V	-60 V	-80 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5 V		
I_C	Collector current	-4 A		
I_{CM}	Collector peak current ($t \leq 10$ ms)	-7 A		
I_B	Base current	-1 A		
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	36 W		
T_{stg}	Storage temperature	-55 to 150 °C		
T_j	Junction temperature	150 °C		

MECHANICAL DATA

Dimensions in mm

Accessories available: lock washer NR026E, insulating bush DF02A
Torque on nut: min. 4 kgcm; max. 6 kgcm.



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled

BD 438
BD 440
BD 442

THERMAL DATA

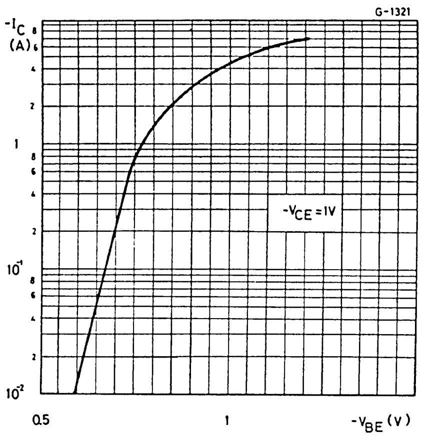
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

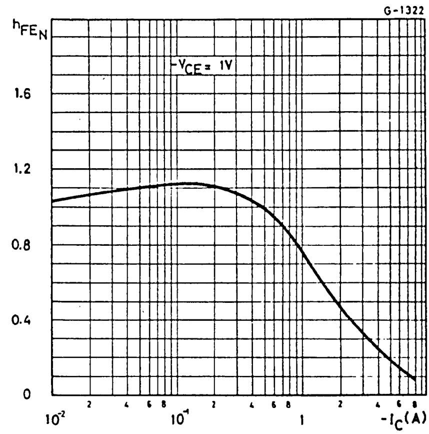
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD 438**	V_{CB} = -45V			-100	μA
		for **BD 440**	V_{CB} = -60V			-100	μA
		for **BD 442**	V_{CB} = -80V			-100	μA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 438**	V_{CB} = -45V			-100	μA
		for **BD 440**	V_{CB} = -60V			-100	μA
		for **BD 442**	V_{CB} = -80V			-100	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = -5V				-1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100 mA	for **BD 438**	-45			V
			for **BD 440**	-60			V
			for **BD 442**	-80			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -2A	I_B = -0.2A				
		for **BD 438**				-0.6	V
		for **BD 440** and **BD 442**				-0.8	V
V_{BE}*/**	Base-emitter voltage	I_C = -10 mA	V_{CE} = -5V		-0.58		V
		for **BD 438**					
		I_C = -2A	V_{CE} = -1V			-1.2	V
		for **BD 440** and **BD 442**					
		I_C = -2A	V_{CE} = -1V			-1.5	V
h_{FE}*	DC current gain	I_C = -10 mA	V_{CE}= -5V				
			for **BD 438**	30			–
			for **BD 440**	20			–
			for **BD 442**	15			–
		I_C = -500 mA	V_{CE} = -1V				
			for **BD 438**	85			–
			for **BD 440**	40			–
			for **BD 442**	40			–
		I_C = -2A	V_{CE} = -1V				
			for **BD 438**	40			–
			for **BD 440**	25			–
			for **BD 442**	15			–
h_{FE_1}/h_{FE_2}	Matched pair	I_C = |500 mA|	V_{CE} = |1V|			1.4	–
f_T	Transition frequency	I_C = -250 mA	V_{CE} = -1V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** $|V_{BE}|$ decreases by typ. |2.3 mV/°C| with increasing of temperature

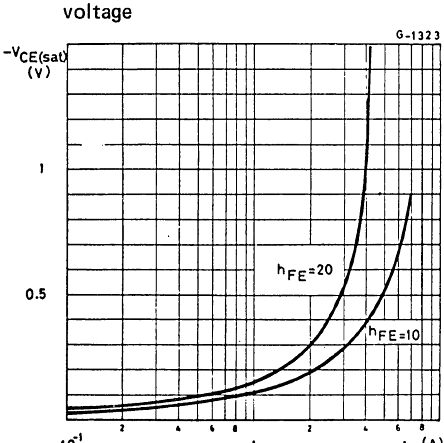
Typical DC transconductance



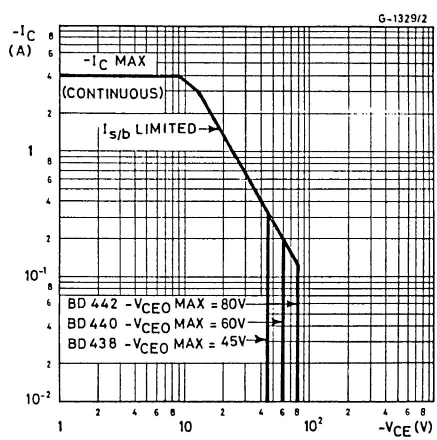
Typical DC normalized current gain



Typical collector-emitter saturation voltage

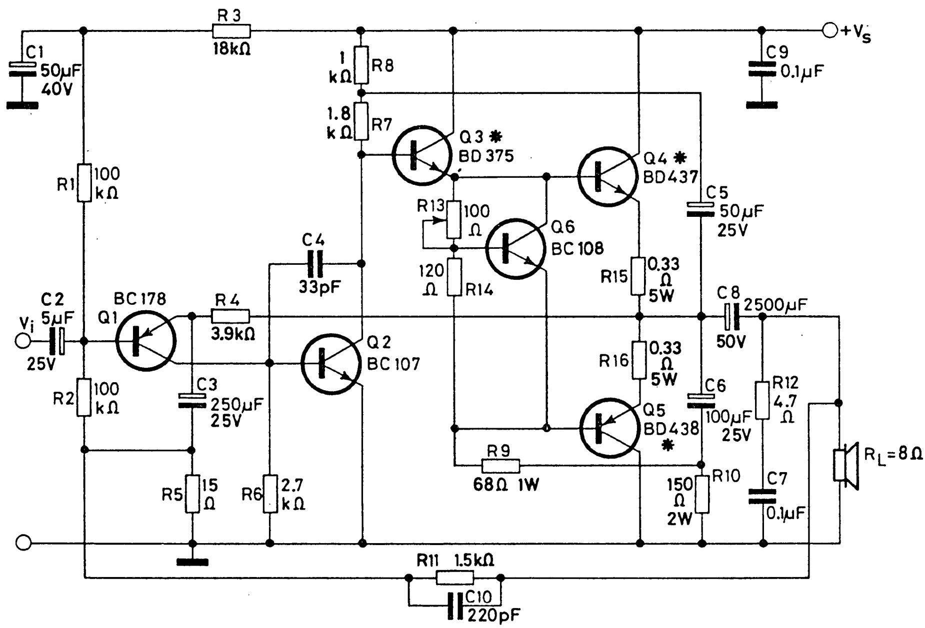


Safe operating areas



APPLICATION INFORMATION

Typical application circuit for 36V, 15W, 8Ω Hi-Fi amplifier



S-0793/2

✱ Mounted on heatsink having $R_{th} \leq 6^{\circ}C/W$

Typical performance (V_s = 36V)

P_o	Output power	at d = 10% f = 1 kHz	⩾ 20	W
		at d = 1% f = 40 Hz to 12.5 kHz	⩾ 15	W
V_i	Input voltage	for P_o = 20 W	190	mV
		for P_o = 15 W	150	mV
Z_i	Input impedance		100	kΩ
I_d	Output transistors quiescent drain current		10	mA
I_d	BD 375 drain current		75	mA
I_d	Total drain current	at P_o = 15W	850	mA
B	-3 dB frequency response	at P_o = 15W	10 Hz to 100	kHz

Continuous stable operation is ensured up to an ambient temperature of 45°C

SILICON EPITAXIAL-BASE NPN

BD 533
BD 535
BD 537

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING CIRCUITS

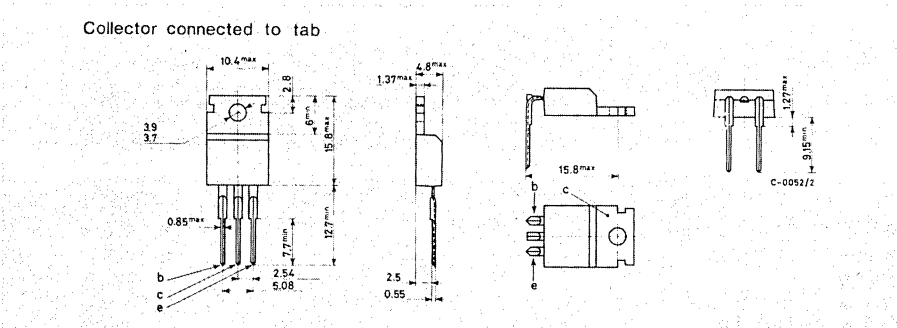
The BD 533, BD 535 and BD 537 are silicon epitaxial-base NPN power transistors in Jedec TO-220A plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are respectively the BD 534, BD 536 and BD 538.

ABSOLUTE MAXIMUM RATINGS

		BD 533	BD 535	BD 537
V_{CBO}	Collector-base voltage ($I_E = 0$)	45 V	60 V	80 V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	45 V	60 V	80 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45 V	60 V	80 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5 V		
I_C	Collector current	4 A		
I_{CM}	Collector peak current ($t \leqslant 10$ ms)	8 A		
I_B	Base current	1 A		
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C	50 W		
T_{stg}	Storage temperature	-55 to 150 °C		
T_j	Junction temperature	150 °C		

MECHANICAL DATA

Dimensions in mm



TO-220 AB TO-220 AA

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BD 533**	V_{CB} = 45V			100	μA
		for **BD 535**	V_{CB} = 60V			100	μA
		for **BD 537**	V_{CB} = 80V			100	μA
I_{CES}	Collector cutoff current (V_{BE} = 0)	for **BD 533**	V_{CE} = 45V			100	μA
		for **BD 535**	V_{CE} = 60V			100	μA
		for **BD 537**	V_{CE} = 80V			100	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5V				1	mA
$V_{CEO\ (sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 100 mA					
			for **BD 533**	45			V
			for **BD 535**	60			V
			for **BD 537**	80			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 2A	I_B = 0.2A			0.8	V
		I_C = 6A	I_B = 0.6A		0.8		V
V_{BE}*/**	Base-emitter voltage	I_C = 2A	V_{CE} = 2V			1.5	V
h_{FE}*	DC current gain	I_C = 10 mA	V_{CE} = 5V				
			for **BD 533**	20			–
			for **BD 535**	20			–
			for **BD 537**	15			–
		I_C = 500 mA	V_{CE} = 2V	40			–
		I_C = 2A	V_{CE} = 2V				
			for **BD 533**	25			–
			for **BD 535**	25			–
			for **BD 537**	15			–
h_{FE1}/h_{FE2}	Matched pair	I_C = $\lvert$500 mA$\rvert$	V_{CE} = $\lvert$2V$\rvert$			1.4	–
f_T	Transition frequency	I_C = 250 mA	V_{CE} = 1V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** V_{BE} decreases by typ. 2.3 mV/°C with increasing temperature

SILICON EPITAXIAL-BASE PNP

BD 534
BD 536
BD 538

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING CIRCUITS

The BD 534, BD 536 and BD 538 are silicon epitaxial-base PNP power transistors in Jedec TO-220A plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are respectively the BD 533, BD 535 and BD 537.

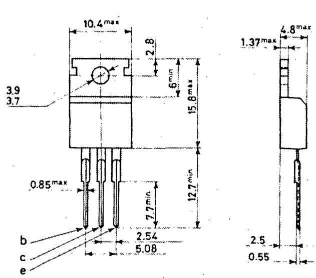
ABSOLUTE MAXIMUM RATINGS

		BD 534	BD 536	BD 538
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45 V	-60 V	-80 V
V_{CES}	Collector-emitter voltage ($V_{BE} = 0$)	-45 V	-60 V	-80 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45 V	-60 V	-80 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)		-5 V	
I_C	Collector current		-4 A	
I_{CM}	Collector peak current ($t \leqslant 10$ ms)		-8 A	
I_B	Base current		-1 A	
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C		50 W	
T_{stg}	Storage temperature		-55 to 150 °C	
T_j	Junction temperature		150 °C	

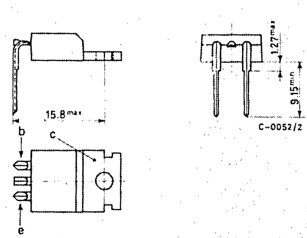
MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220 AB



TO-220 AA

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.5	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD 534**	V_{CB}= -45V			-100	μA
		for **BD 536**	V_{CB}= -60V			-100	μA
		for **BD 538**	V_{CB}= -80V			-100	μA
I_{CES}	Collector cutoff current ($V_{BE} = 0$)	for **BD 534**	V_{CE}= -45V			-100	μA
		for **BD 536**	V_{CE}= -60V			-100	μA
		for **BD 538**	V_{CE}= -80V			-100	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB}= -5V				-1	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -100 mA					
			for **BD 534**	-45			V
			for **BD 536**	-60			V
			for **BD 538**	-80			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -2A	I_B = -0.2A			-0.8	V
		I_C = -6A	I_B = -0.6A		-0.8		V
V_{BE}*/**	Base-emitter voltage	I_C = -2A	V_{CE}= -2V			-1.5	V
h_{FE}*	DC current gain	I_C = -10 mA	V_{CE}= -5V				
			for **BD 534**	20			–
			for **BD 536**	20			–
			for **BD 538**	15			–
		I_C = -500 mA	V_{CE}= -2V	40			–
		I_C = -2A	V_{CE}= -2V				
			for **BD 534**	25			–
			for **BD 536**	25			–
			for **BD 538**	15			–
h_{FE1}/h_{FE2}	Matched pair	I_C = | 500 mA |	V_{CE}= | 2V |			1.4	–
f_T	Transition frequency	I_C = -250 mA	V_{CE}= -1V	3			MHz

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** | V_{BE} | decreases by typ. | 2.3 mV/°C | with increasing of temperature

BD 663

SILICON HOMETAXIAL NPN

PRELIMINARY DATA

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The BD 663 is a single diffused "hometaxial" silicon NPN transistor in Jedec TO-220 A plastic case .

It is intended for a wide variety of medium-power linear and switching applications.

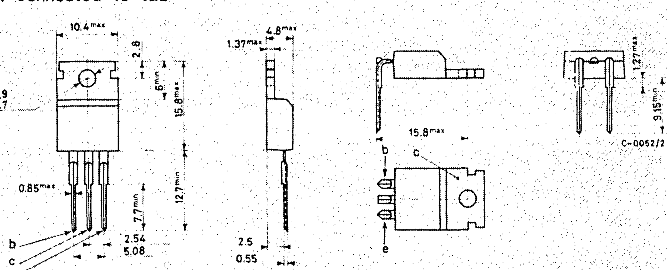
ABSOLUTE MAXIMUM RATINGS

$V_{CEV\ (sus)}$	Collector-emitter voltage (V_{BE} = -1.5 V)	60	V
$V_{CEO\ (sus)}$	Collector-emitter voltage (I_B = 0)	45	V
V_{EBO}	Emitter-base voltage (I_C = 0)	5	V
I_C	Collector current	10	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25\ °C$	1.8	W
	at $T_{case} \leq 25\ °C$	75	W
T_{stg}	Storage temperature	-65 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220 AB

TO-220 AA

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.67	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

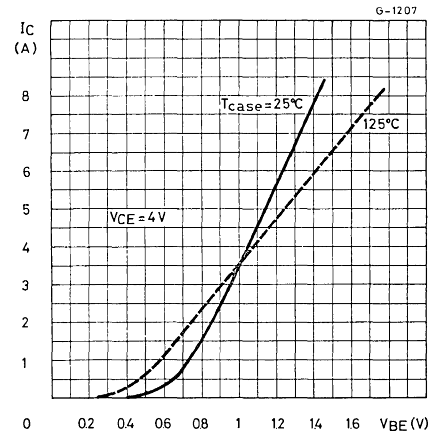
ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	V_{CE} = 40 V				5	mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 30 V				5	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 5 V				1	mA
$V_{CEV(sus)}$*	Collector-emitter voltage (V_{BE} = -1.5 V)	I_C = 100 mA		60			V
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = 200 mA		45			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 4 A	I_B = 0.8 A			1	V
V_{BE}*	Base-emitter voltage	I_C = 4 A	V_{CE} = 4 V			1.7	V
h_{FE}*	DC current gain	I_C = 2 A	V_{CE} = 2 V	20			—
		I_C = 0.5 A	V_{CE} = 4 V	25		250	—
		I_C = 4 A	V_{CE} = 4 V	10			—
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 20 V		1.8			A

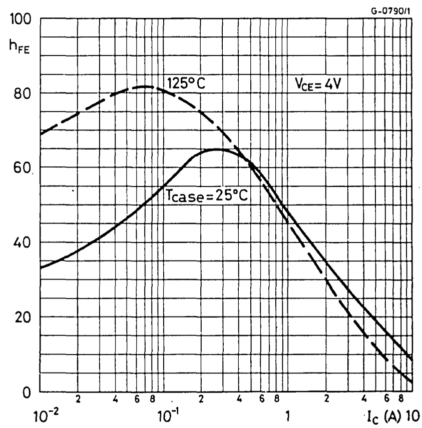
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

** Pulsed: 0.5 s non repetitive pulse

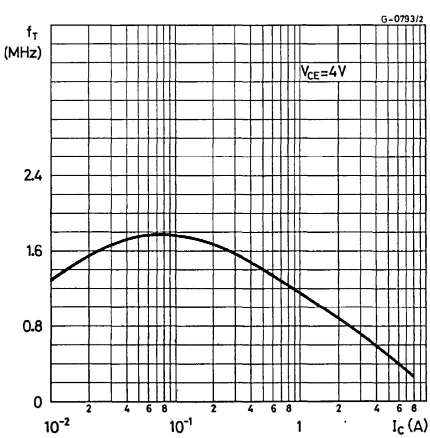
Typical DC transconductance



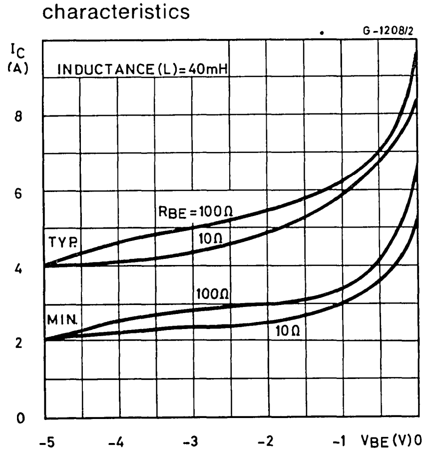
Typical DC current gain



Typical transition frequency

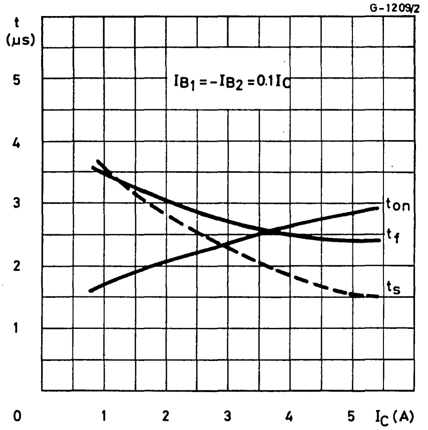


Reverse-bias second breakdown characteristics

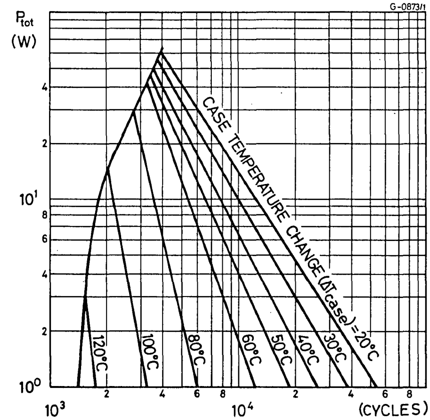


BD 663

Typical saturated switching characteristics



Thermal-cycle rating chart



BD 675A BD 677
BD 677A BD 679
BD 679A BD 681

SILICON EPITAXIAL-BASE NPN

PRELIMINARY DATA

MEDIUM POWER DARLINGTONS

The BD 675A, BD 677, BD 677A, BD 679, BD 679A and BD 681 are silicon epitaxial-base NPN power transistors in monolithic Darlington configuration in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The complementary PNP types are respectively the BD 676A, BD 678, BD 678A, BD 680, BD 680A and BD 682.

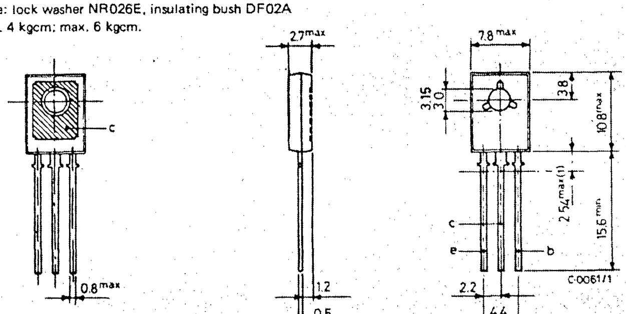
ABSOLUTE MAXIMUM RATINGS

		BD 675A	BD 677 BD 677A	BD 679 BD 679A	BD 681
V_{CBO}	Collector-base voltage ($I_E = 0$)	45 V	60 V	80 V	100 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45 V	60 V	80 V	100 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5 V			
I_C	Collector current	4 A			
I_{CM}	Collector peak current (repetitive)	6 A			
I_B	Base current	100 mA			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C	40 W			
T_{stg}	Storage temperature	-55 to 150 °C			
T_j	Junction temperature	150 °C			

MECHANICAL DATA

Dimensions in mm

Accessories available: lock washer NR026E, insulating bush DF02A
Torque on nut: min. 4 kgcm; max. 6 kgcm.



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

THERMAL DATA

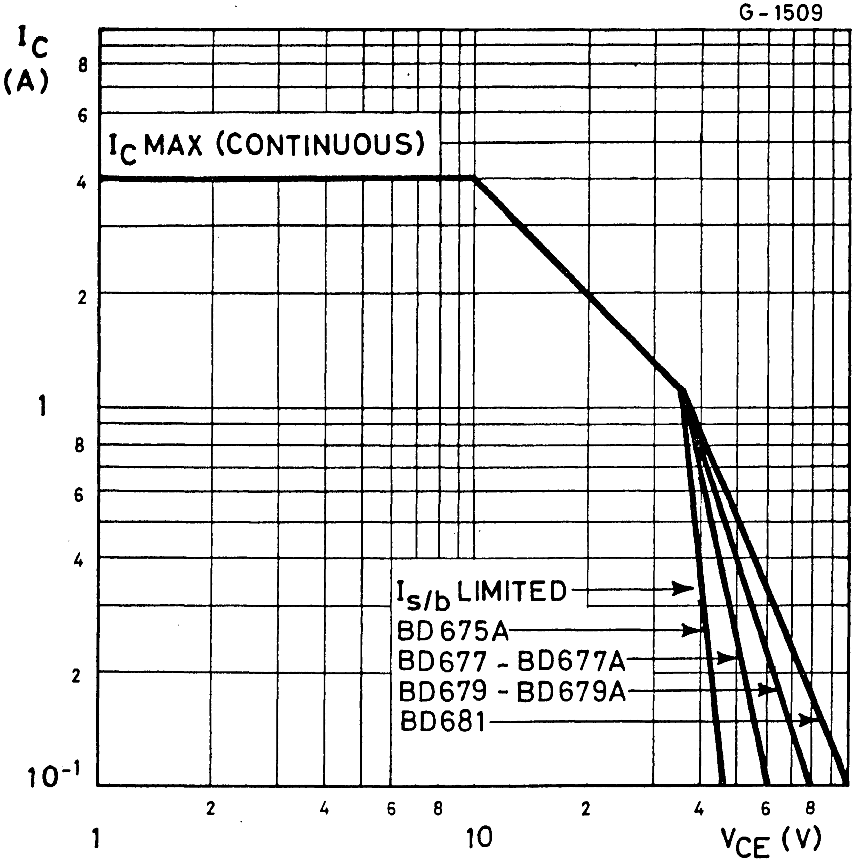
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

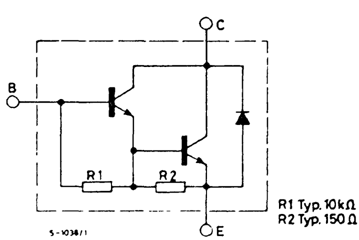
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD 675A** V_{CB}= 45V for **BD 677/677A** V_{CB}= 60V for **BD 679/679A** V_{CB}= 80V for **BD 681** V_{CB}=100V			200 200 200 200	μA μA μA μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD 675A** V_{CE}= 22V for **BD 677/677A** V_{CE}= 30V for **BD 679/679A** V_{CE}= 40V for **BD 681** V_{CE}= 50V			500 500 500 500	μA μA μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB}= 5V			2	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 50 mA for **BD 675A** for **BD 677/677A** for **BD 679/679A** for **BD 681**	45 60 80 100			V V V V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	for **BD 677/679/681** I_C = 1.5A I_B = 30 mA for **BD 675A/677A/679A** I_C = 2A I_B = 40 mA			2.5 2.8	V V
V_{BE}	Base-emitter voltage	for **BD 677/679/681** I_C = 1.5A V_{CE}= 3V for **BD 675A/677A/679A** I_C = 2A V_{CE}= 3V			2.5 2.5	V V
h_{FE}*	DC current gain	for **BD 677/679/681** I_C = 1.5A V_{CE}= 3V for **BD 675A/677A/679A** I_C= 2A V_{CE}= 3V	750 750			– –
h_{fe}	Small signal current gain	I_C = 1.5A V_{CE}= 3V f = 1 MHz	1			

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

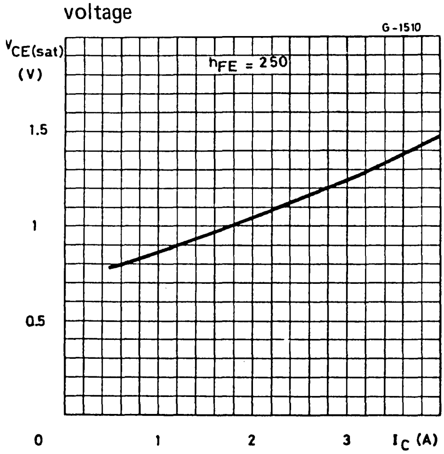
Safe operating areas



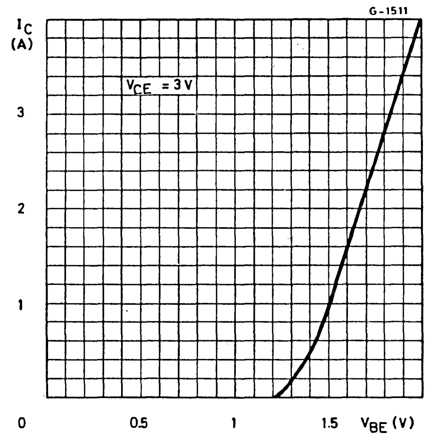
Internal circuit diagram



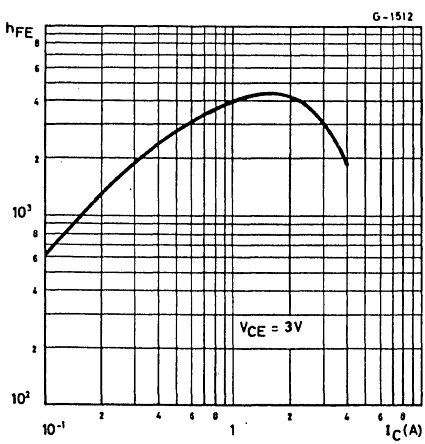
Typical collector-emitter saturation voltage



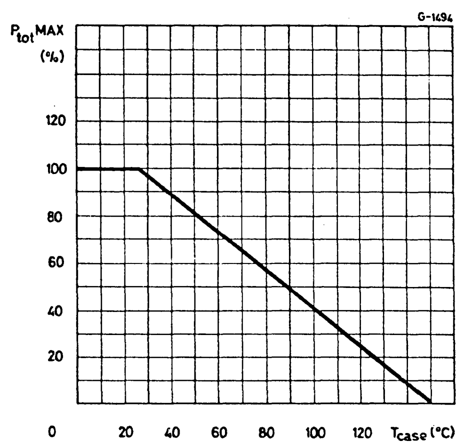
Typical DC transconductance



Typical DC current gain



Power rating chart



SILICON EPITAXIAL-BASE PNP

BD 676 A BD 678
BD 678 A BD 680
BD 680 A BD 682

PRELIMINARY DATA

MEDIUM POWER DARLINGTONS

The BD 676A, BD 678, BD 678A, BD 680, BD 680A and BD 682 are silicon epitaxial-base PNP power transistors in monolithic Darlington configuration in Jedec TO-126 plastic package, intended for use in medium power linear and switching applications.
The complementary NPN types are respectively the BD 675A, BD 677, BD 677A, BD 679, BD 679A and BD 681.

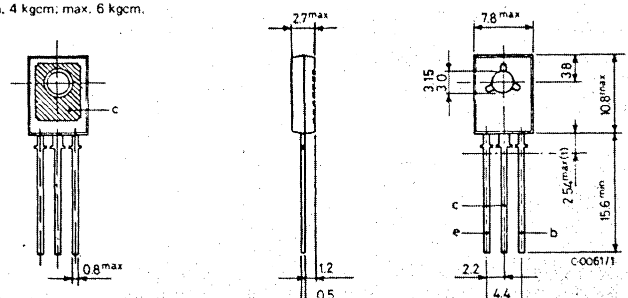
ABSOLUTE MAXIMUM RATINGS

		BD 676A	BD 678 BD 678A	BD 680 BD 680A	BD 682
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45 V	-60 V	-80 V	-100 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45 V	-60 V	-80 V	-100 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5 V			
I_C	Collector current	-4 A			
I_{CM}	Collector peak current (repetitive)	-6 A			
I_B	Base current	-100 mA			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C	40 W			
T_{stg}	Storage temperature	-55 to 150 °C			
T_j	Junction temperature	150 °C			

MECHANICAL DATA

Dimensions in mm

Accessories available: lock washer NR026E, insulating bush DF02A
Torque on nut: min. 4 kgcm; max. 6 kgcm.



TO-126 (SOT 32)

(1) Within this region the cross-section of the leads is uncontrolled.

THERMAL DATA

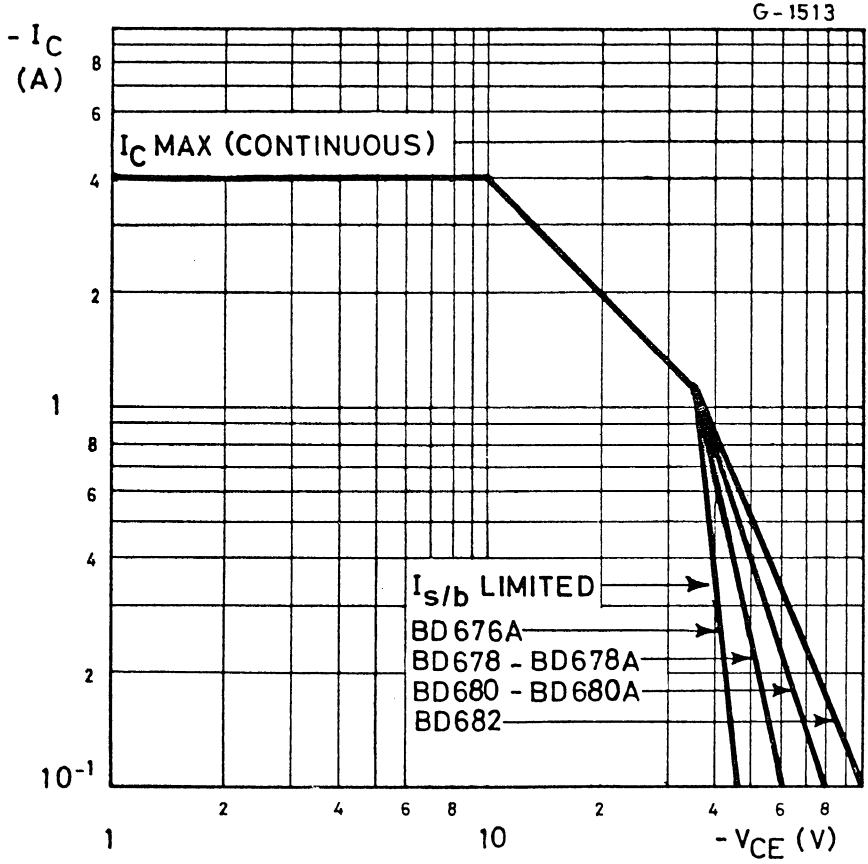
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3.12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	100	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

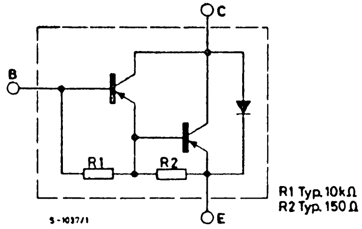
	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BD 676A** V_{CB}= -45V for **BD 678/678A** V_{CB}= -60V for **BD 680/680A** V_{CB}= -80V for **BD 682** V_{CB}=-100V			-200 -200 -200 -200	μA μA μA μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BD 676A** V_{CE}= -22V for **BD 678/678A** V_{CE}= -30V for **BD 680/680A** V_{CE}= -40V for **BD 682** V_{CE}= -50V			-500 -500 -500 -500	μA μA μA μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB}= -5V			-2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = -50 mA for **BD 676A** for **BD 678/678A** for **BD 680/680A** for **BD 682**	 -45 -60 -80 -100			 V V V V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BD 678/680/682** I_C = -1.5A I_B = -30 mA for **BD 676A/678A/680A** I_C = -2A I_B = -40 mA			 -2.5 -2.8	 V V
V_{BE}	Base-emitter voltage	for **BD 678/680/682** I_C = -1.5A V_{CE}= -3V for **BD 676A/678A/680A** I_C = -2A V_{CE}= -3V			 -2.5 -2.5	 V V
h_{FE}*	DC current gain	for **BD 678/680/682** I_C = -1.5A V_{CE}= -3V for **BD 676A/678A/680A** I_C = -2A V_{CE}= -3V	 750 750			 – –
h_{fe}	Small signal current gain	I_C = -1.5A V_{CE}= -3V f = 1 MHz	1			–

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

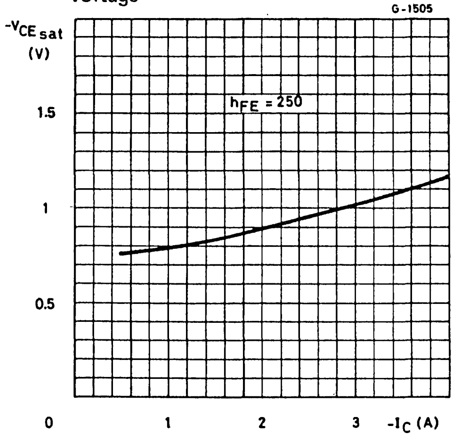
Safe operating areas



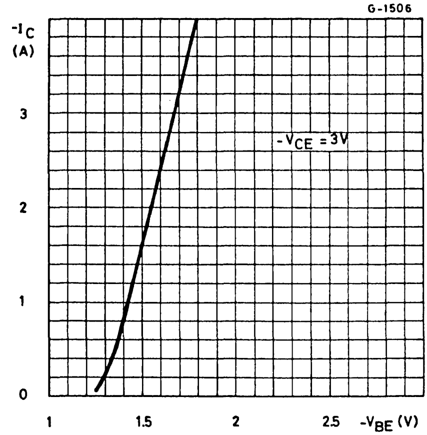
Internal circuit diagram



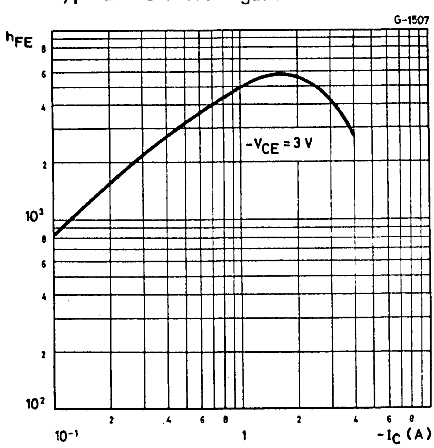
Typical collector-emitter saturation voltage



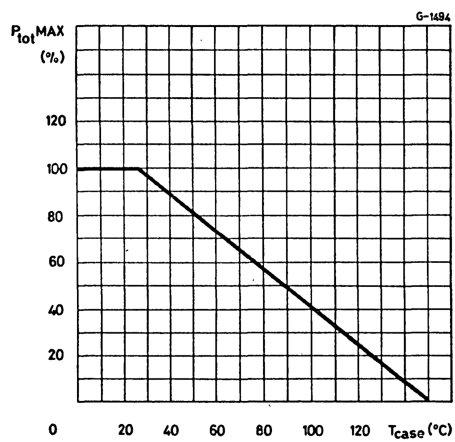
Typical DC transconductance



Typical DC current gain



Power rating chart



SILICON EPITAXIAL-BASE NPN

BDX 53
BDX 53A
BDX 53B
BDX 53C

PRELIMINARY DATA

POWER DARLINGTONS

The BDX 53, BDX 53A, BDX 53B and BDX 53C are silicon epitaxial-base NPN transistors in monolithic Darlington configuration in Jedec TO-220 A plastic package, intended for use in hammer drivers, audio amplifiers and other medium power linear and switching applications.
The complementary PNP types are respectively the BDX 54, BDX 54A, BDX 54B and BDX 54C.

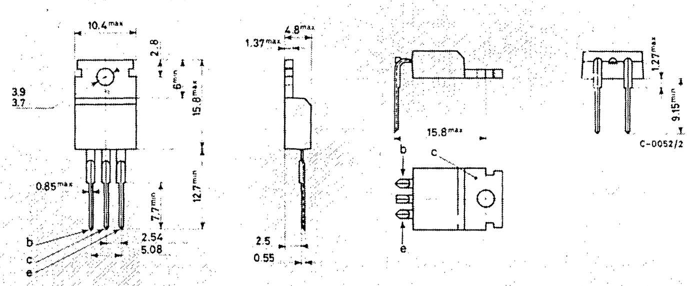
ABSOLUTE MAXIMUM RATINGS

		BDX 53	BDX 53A	BDX 53B	BDX 53C
V_{CBO}	Collector-base voltage ($I_E = 0$)	45 V	60 V	80 V	100 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	45 V	60 V	80 V	100 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5 V			
I_C	Collector current	8 A			
I_{CM}	Collector peak current (repetitive)	12 A			
I_B	Base current	0.2 A			
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	60 W			
T_{stg}	Storage temperature	-55 to 150 °C			
T_j	Junction temperature	150 °C			

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220 AB   TO-220 AA

THERMAL DATA

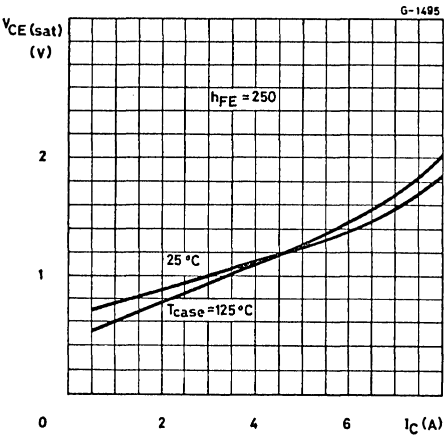
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

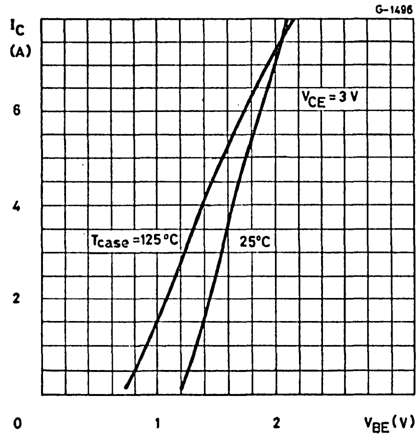
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BDX 53**	V_{CB} = 45V			200	μA
		for **BDX 53A**	V_{CB} = 60V			200	μA
		for **BDX 53B**	V_{CB} = 80V			200	μA
		for **BDX 53C**	V_{CB} = 100V			200	μA
I_{CEO}	Collector cutoff current ($I_B = 0$)	for **BDX 53**	V_{CE} = 22V			500	μA
		for **BDX 53A**	V_{CE} = 30V			500	μA
		for **BDX 53B**	V_{CE} = 40V			500	μA
		for **BDX 53C**	V_{CE} = 50V			500	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB} = 5V				2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100 mA	for **BDX 53**	45			V
			for **BDX 53A**	60			V
			for **BDX 53B**	80			V
			for **BDX 53C**	100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 3A	I_B = 12 mA			2	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 3A	I_B = 12 mA			2.5	V
h_{FE}*	DC current gain	I_C = 3A	V_{CE} = 3V	750			–
V_F	Parallel-diode forward voltage	I_F = 3A				1.8	V
		I_F = 8A			2.5		V

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

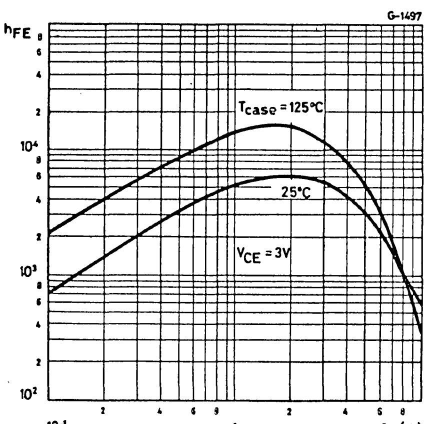
Typical collector-emitter saturation voltage



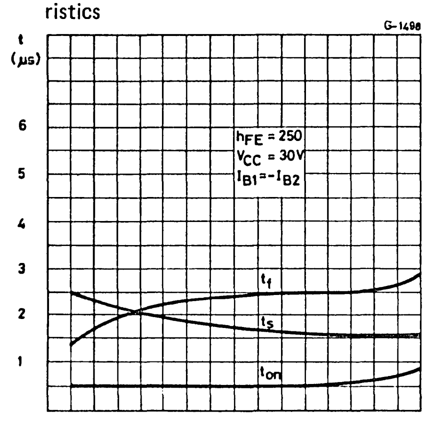
Typical DC transconductance



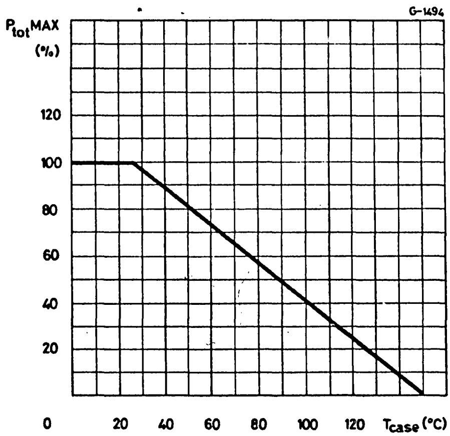
Typical DC current gain



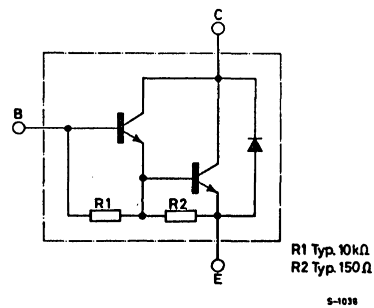
Typical saturated switching characteristics



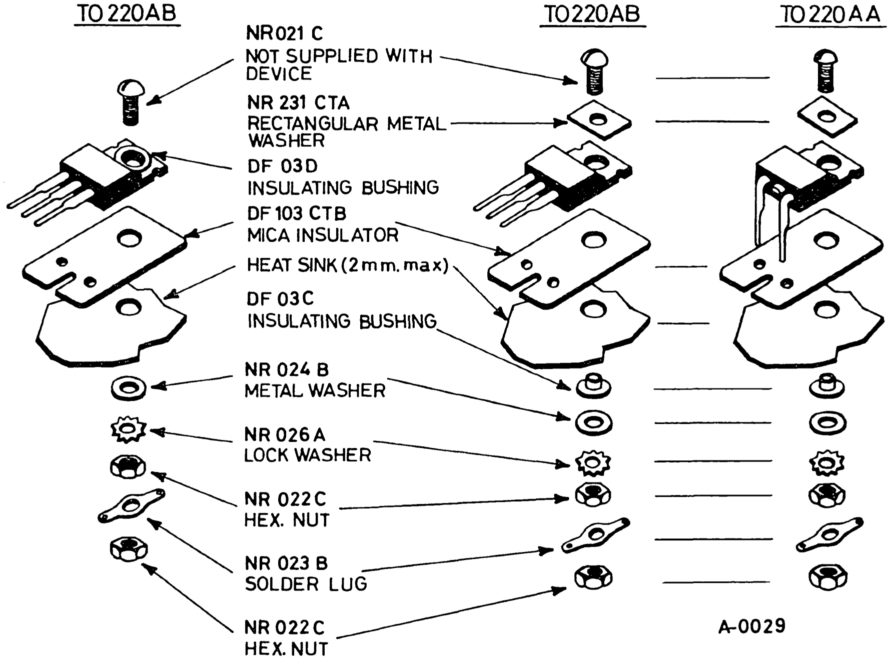
Power rating chart



Internal circuit diagram



Mounting arrangement for VERSAWATT transistors



SILICON EPITAXIAL-BASE PNP

BDX 54
BDX 54A
BDX 54B
BDX 54C

PRELIMINARY DATA

POWER DARLINGTONS

The BDX 54, BDX 54A, BDX 54B and BDX 54C are silicon epitaxial-base PNP transistors in monolithic Darlington configuration in Jedec TO-220 A plastic package, intended for use in hammer drivers, audio amplifiers and other medium power linear and switching applications.
The complementary NPN types are respectively the BDX 53, BDX 53A, BDX 53B and BDX 53C.

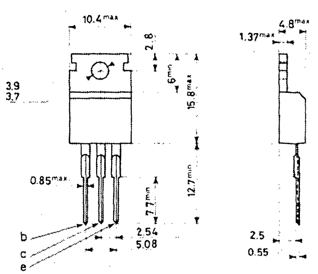
ABSOLUTE MAXIMUM RATINGS

		BDX 54	BDX 54A	BDX 54B	BDX 54C
V_{CBO}	Collector-base voltage ($I_E = 0$)	-45 V	-60 V	-80 V	-100 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-45 V	-60 V	-80 V	-100 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-5 V			
I_C	Collector current	-8 A			
I_{CM}	Collector peak current (repetitive)	-12 A			
I_B	Base current	-0.2 A			
P_{tot}	Total power dissipation at $T_{case} \leqslant 25$ °C	60 W			
T_{stg}	Storage temperature	-55 to 150 °C			
T_j	Junction temperature	150 °C			

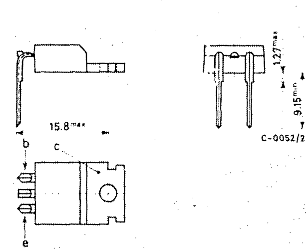
MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220 AB



TO-220 AA

2 '75

THERMAL DATA

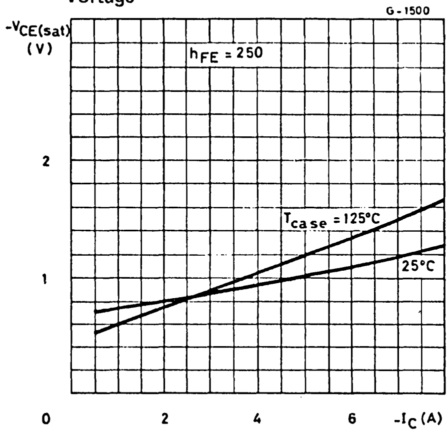
$R_{th\ j-case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j-amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

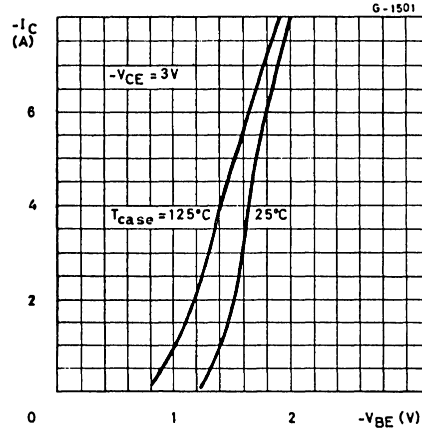
Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0)	for **BDX 54**	V_{CB} = -45V			-200	μA
		for **BDX 54A**	V_{CB} = -60V			-200	μA
		for **BDX 54B**	V_{CB} = -80V			-200	μA
		for **BDX 54C**	V_{CB} = -100V			-200	μA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX 54**	V_{CE} = -22V			-500	μA
		for **BDX 54A**	V_{CE} = -30V			-500	μA
		for **BDX 54B**	V_{CE} = -40V			-500	μA
		for **BDX 54C**	V_{CE} = -50V			-500	μA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = -5V				-2	mA
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -100 mA	for **BDX 54**	-45			V
			for **BDX 54A**	-60			V
			for **BDX 54B**	-80			V
			for **BDX 54C**	-100			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -3A	I_B = -12 mA			-2	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = -3A	I_B = -12 mA			-2.5	V
h_{FE}*	DC current gain	I_C = -3A	V_{CE} = -3V	750			–
V_F	Parallel-diode forward voltage	I_F = -3A				-1.8	V
		I_F = -8A			-2.5		V

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

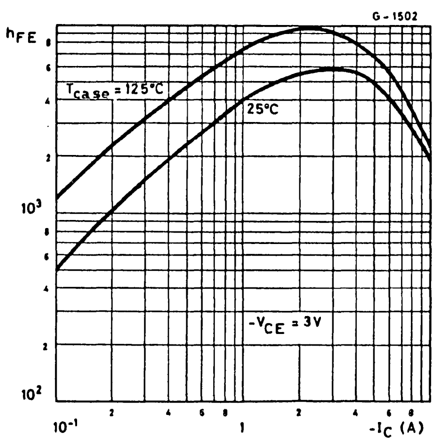
Typical collector-emitter saturation voltage



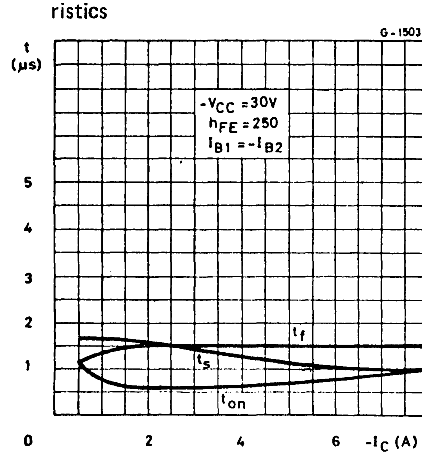
Typical DC transconductance



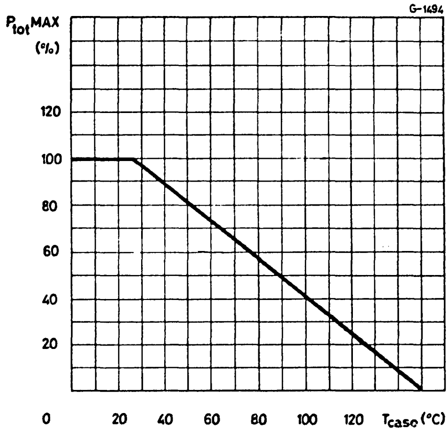
Typical DC current gain



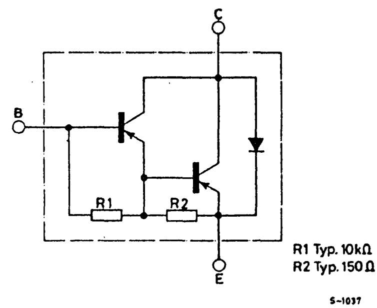
Typical saturated switching characteristics



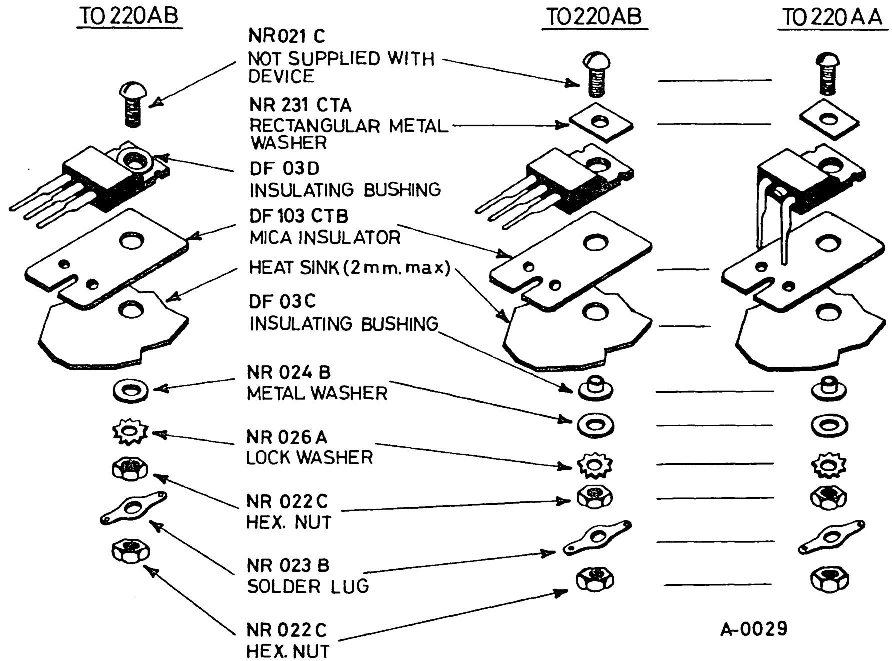
Power rating chart



Internal circuit diagram



Mounting arrangement for VERSAWATT transistors



BDX 54
BDX 54A
BDX 54B
BDX 54C

BDX 70 to 75
2N6098 to 6103

SILICON HOMETAXIAL* NPN

MEDIUM POWER LINEAR AND SWITCHING APPLICATIONS

The BDX 70/2N 6098, BDX 71/2N 6099, BDX 72/2N 6100, BDX 73/2N 6101, BDX 74/2N 6102 and BDX 75/2N 6103 are single diffused "hometaxial" silicon NPN transistors. Even type numbers are in Jedec TO-220 AA plastic case; odd type numbers are in Jedec TO-220 AB plastic case. All types are intended for a wide variety of medium-power switching and linear applications, such as series and shunt regulators, solenoid drivers, motor-speed controllers and driver and output stages of high-fidelity amplifiers.

The design ensures freedom from second breakdown at maximum ratings.

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

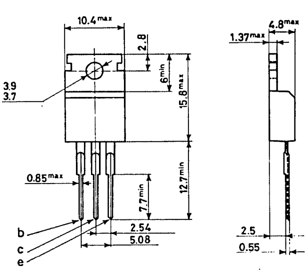
ABSOLUTE MAXIMUM RATINGS

		BDX 70 / BDX 71	BDX 72 / BDX 73	BDX 74 / BDX 75
V_{CBO}	Collector-base voltage ($I_E = 0$)	70 V	80 V	45 V
$V_{CER\ (sus)}$	Collector-emitter voltage ($R_{BE} \leq 100\ \Omega$)	65 V	75 V	45 V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	60 V	70 V	40 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	8 V	8 V	5 V
I_C	Collector current	10 A	10 A	16 A
I_B	Base current	4 A		
P_{tot}	Total power dissipation at $T_{amb} \leq 25$ °C	1.8 W		
	at $T_{case} \leq 25$ °C	75 W		
T_{stg}	Storage temperature	-65 to 150 °C		
T_j	Junction temperature	150 °C		

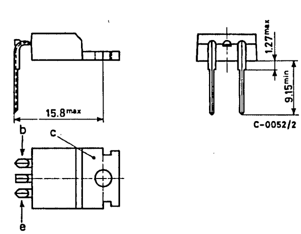
MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220 AB



TO-220 AA

THERMAL DATA

$R_{th\ j-case}$	Thermal resistance junction-case	max	1.67	°C/W
$R_{th\ j-amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

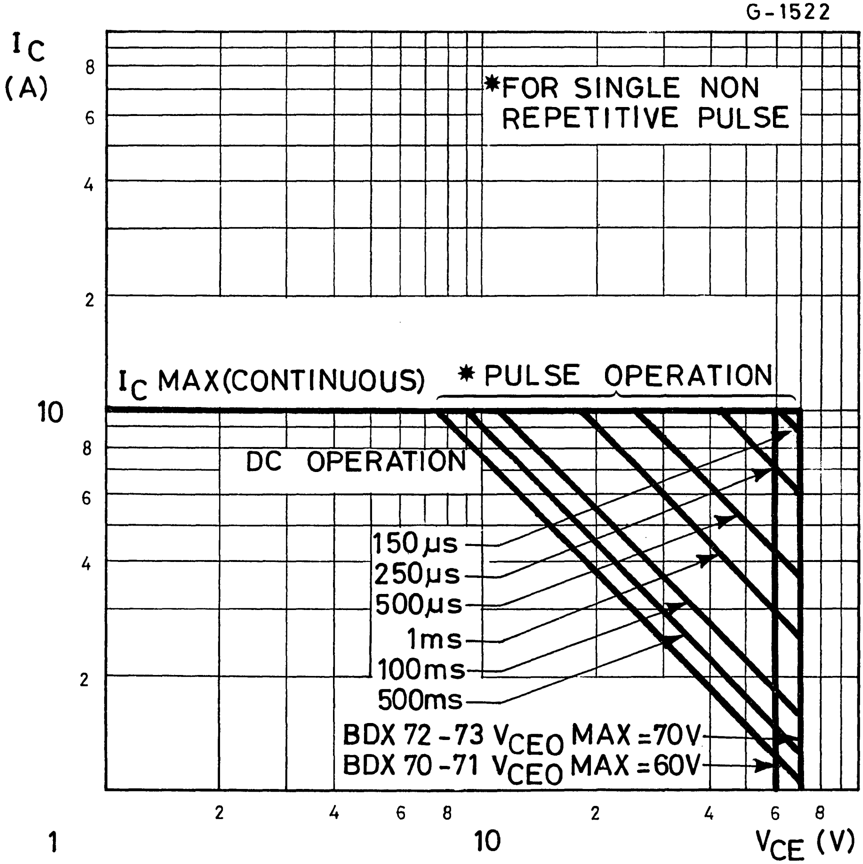
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = −1.5 V)	for **BDX 70-71**				
		V_{CE} = 65 V			2	mA
		V_{CE} = 65 V T_{case} = 150 °C			10	mA
		for **BDX 72-73**				
		V_{CE} = 75 V			2	mA
		V_{CE} = 75 V T_{case} = 150 °C			10	mA
		for **BDX 74-75**				
		V_{CE} = 40 V			2	mA
		V_{CE} = 40 V T_{case} = 150 °C			10	mA
I_{CEO}	Collector cutoff current (I_B = 0)	for **BDX 70-71**				
		V_{CE} = 50 V			2	mA
		for **BDX 72-73**				
		V_{CE} = 60 V			2	mA
		for **BDX 74-75**				
		V_{CE} = 30 V			2	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	for **BDX 70-71-72-73**				
		V_{EB} = 8 V			1	mA
		for **BDX 74-75**				
		V_{EB} = 5 V			1	mA
$V_{CER(sus)}$*	Collector-emitter voltage (R_{BE} = 100 Ω)	I_C = 200 mA				
		for **BDX 70-71**	65			V
		for **BDX 72-73**	75			V
		for **BDX 74-75**	45			V

ELECTRICAL CHARACTERISTICS (continued)

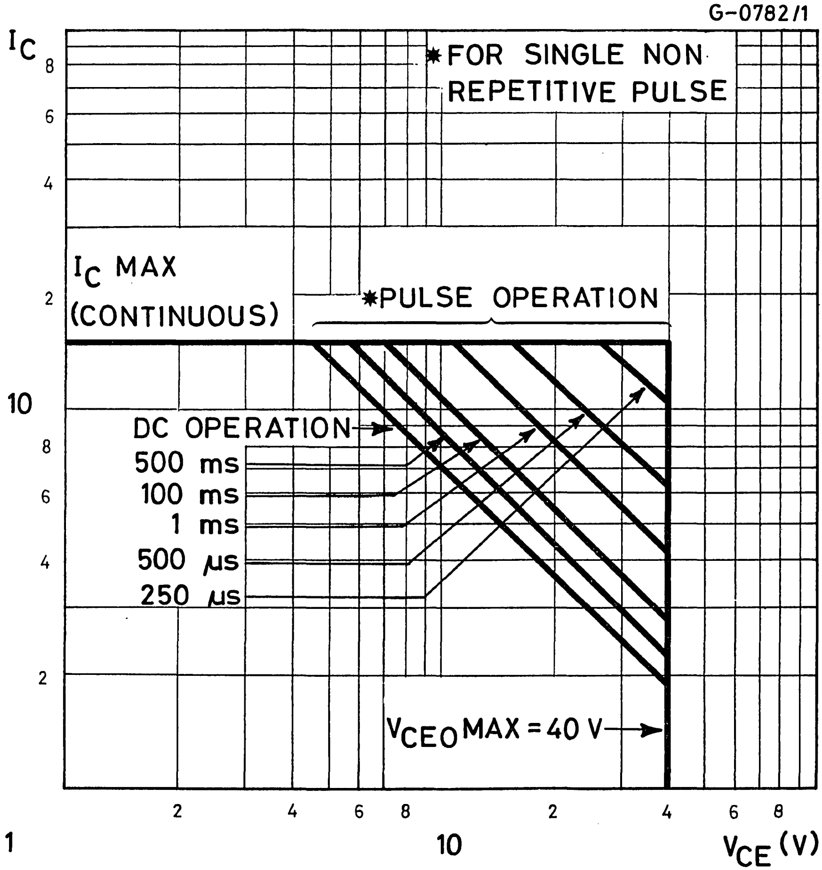
Parameter		Test conditions	Min.	Typ.	Max.	Unit
$V_{CEO(sus)}$*	Collector-emitter voltage ($I_B = 0$)	I_C = 200 mA				
		for **BDX 70-71**	60			V
		for **BDX 72-73**	70			V
		for **BDX 74-75**	40			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	for **BDX 70-71-72-73**				
		I_C = 10 A I_B = 2 A			2.5	V
		for **BDX 74-75**				
		I_C = 16 A I_B = 3.2 A			2.5	V
V_{BE}*	Base-emitter voltage	for **BDX 70-71**				
		I_C = 4 A V_{CE} = 4 V			1.7	V
		for **BDX 72-73**				
		I_C = 5 A V_{CE} = 4 V			1.7	V
		for **BDX 74-75**				
		I_C = 8 A V_{CE} = 4 V			1.7	V
h_{FE}*	DC current gain	for **BDX 70-71**				
		I_C = 4 A V_{CE} = 4 V	20		80	—
		I_C = 10 A V_{CE} = 4 V	5			—
		for **BDX 72-73**				
		I_C = 5 A V_{CE} = 4 V	20		80	—
		I_C = 10 A V_{CE} = 4 V	5			—
		for **BDX 74-75**				
		I_C = 8 A V_{CE} = 4 V	15		60	—
		I_C = 16 A V_{CE} = 4 V	5			—
→ h_{fe}	Small signal current gain	I_C = 500 mA V_{CE} = 4 V				
		f = 1 kHz	15			—
		f = 100 kHz	8		28	—

* Pulsed: pulse duration = 300 µs, duty factor = 1.5 %

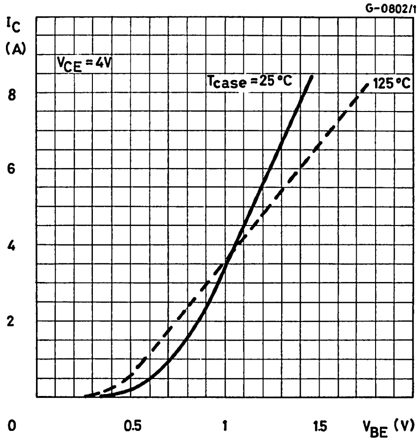
Safe operating areas (for **BDX 70-71-72-73** only)



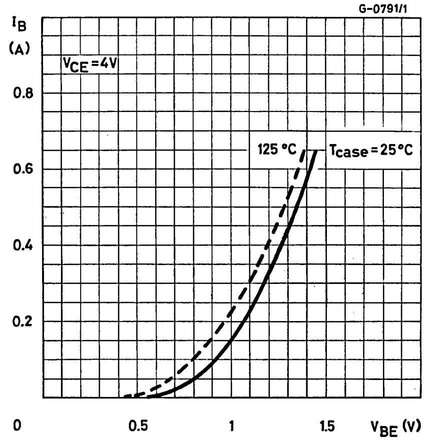
Safe operating areas (for **BDX 74-75** only)



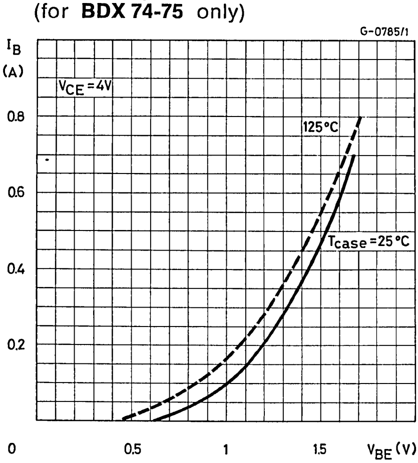
Typical DC transconductance



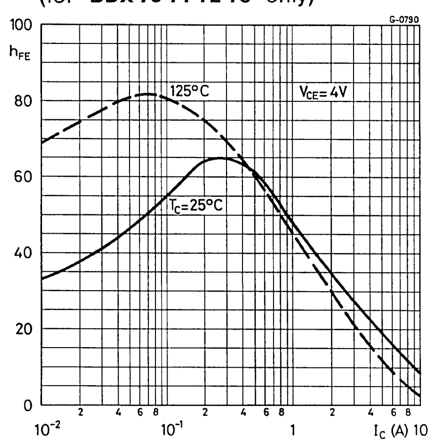
Typical input characteristics
(for **BDX 70-71-72-73** only)



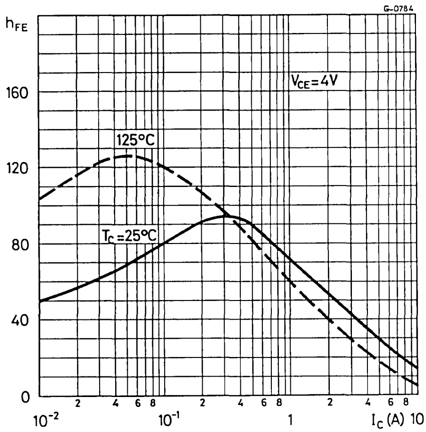
Typical input characteristics
(for **BDX 74-75** only)



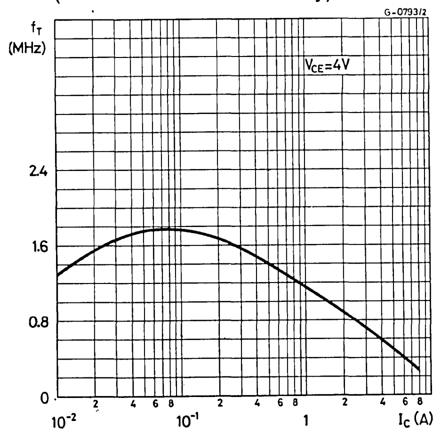
Typical DC current gain
(for **BDX 70-71-72-73** only)



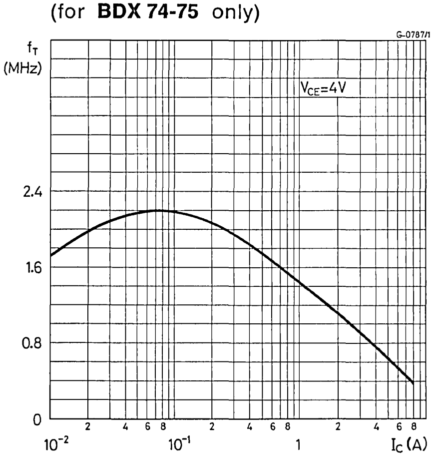
Typical DC current gain
(for **BDX 74-75** only)



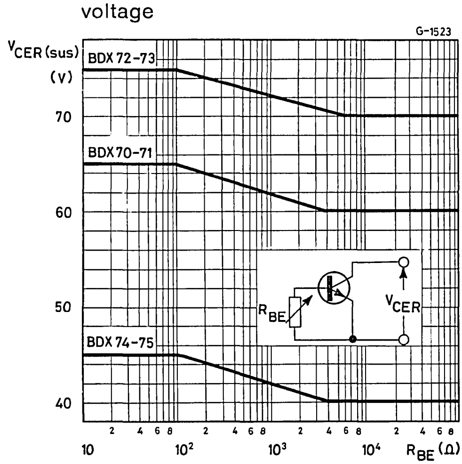
Typical transition frequency
(for **BDX 70-71-72-73** only)



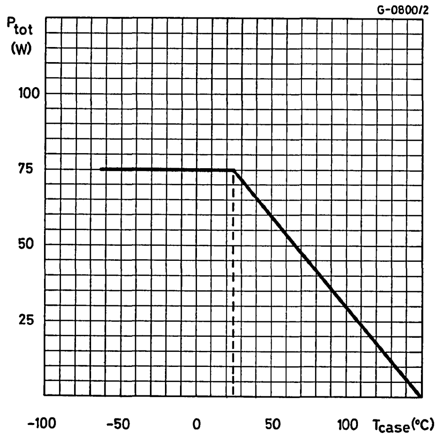
Typical transition frequency
(for **BDX 74-75** only)



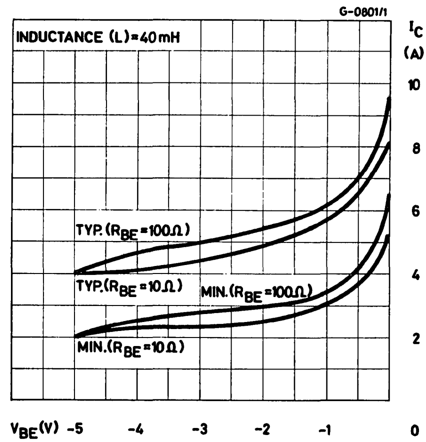
Collector-emitter breakdown
voltage



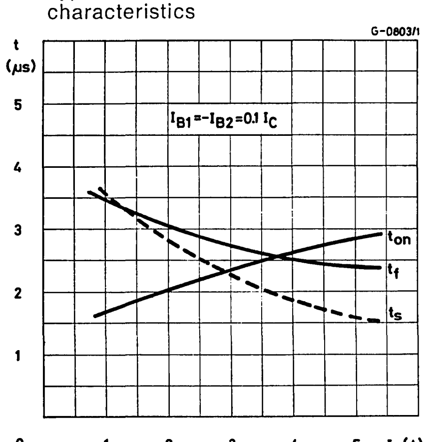
Power rating chart



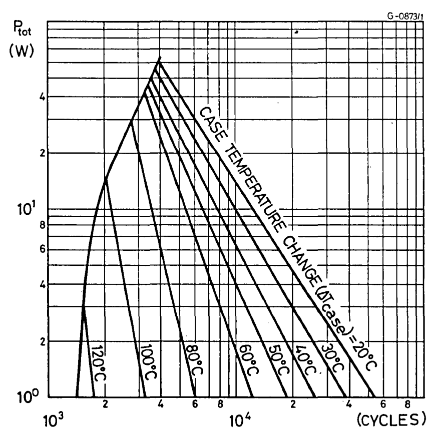
Reverse-bias second breakdown characteristics



Typical saturated switching characteristics



Thermal-cycle rating chart



SILICON PLANAR PNP

BSS 44

PRELIMINARY DATA

HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

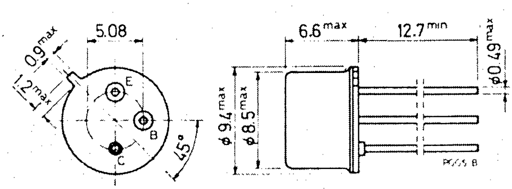
The BSS 44 is a silicon planar epitaxial PNP transistor in Jedec TO-39 metal case. It is used for high-current switching and power amplifier applications up to 5A.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	-65	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	-60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	-6	V
I_C	Collector current	-5	A
P_{tot}	Total power dissipation at $T_{amb} \leqslant 25$ °C	0.87	W
	at $T_{case} \leqslant 25$ °C	5	W
T_{stg}	Storage temperature	-55 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



(sim. to TO-39)

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	35	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	200	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = -60V				-0.5	μA
$V_{(BR)CBO}$	Collector-base breakdown voltage	I_C = -1 mA		-65			V
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage (I_B = 0)	I_C = -50 mA		-60			V
$V_{(BR)EBO}$*	Emitter-base breakdown voltage (I_C = 0)	I_E = -1 mA		-6			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = -0.5A I_C = -5A	I_B = -50 mA I_B = -0.5A		-0.1 -0.4	 -1	V V
$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = -0.5A I_C = -5A	I_B = -50 mA I_B = -0.5A		-0.8 -1.25	 -1.6	V V
h_{FE}*	DC current gain	I_C = -0.5A I_C = -2A I_C = -5A	V_{CE} = -2V V_{CE} = -2V V_{CE} = -2V	30 40	 70 45		– – –
f_T	Transition frequency	I_C = -0.5A	V_{CE} = -5V		80		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 f = 1 MHz	V_{CB} = -10V			100	pF
t_{on}	Turn-on time	I_C = -0.5A	I_{B1} = -50 mA		0.08		μs
t_{off}	Turn-off time	I_C = -0.5A I_{B1} = $-I_{B2}$ = -50 mA			0.45		μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1%

SILICON PLANAR NPN

BSW 67
BSW 68

PRELIMINARY DATA

HIGH VOLTAGE SWITCH

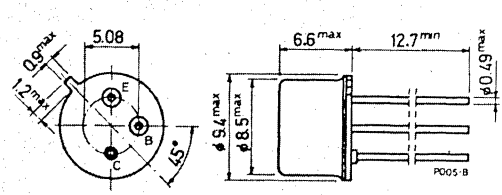
The BSW 67 and BSW 68 are silicon planar epitaxial NPN transistors in Jedec TO-39 metal case. They are intended for high voltage inductive load switching application.

ABSOLUTE MAXIMUM RATINGS

		BSW 67	BSW 68
V_{CBO}	Collector-base voltage ($I_E = 0$)	120 V	150 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	120 V	150 V
I_C	Collector current	1.5 A	
I_{CM}	Collector peak current (repetitive)	2 A	
P_{tot}	Total power dissipation at $T_{amb} \leqslant 45\ °C$	0.7 W	
	$T_{case} \leqslant 25\ °C$	5 W	
	$T_{case} \leqslant 100\ °C$	2.85 W	
T_{stg}	Storage temperature	-55 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-39**)

BSW 67
BSW 68

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	35	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	220	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

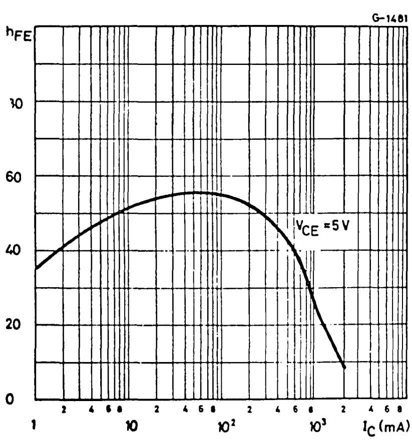
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BSW 67**				
		V_{CB} = 60V			100	nA
		V_{CB} = 60V T_{case} = 150 °C			50	μA
		for **BSW 68**				
		V_{CB} = 75V			100	nA
		V_{CB} = 75V T_{case} = 150 °C			50	μA
$V_{(BR)CBO}$	Collector-base breakdown voltage	I_C = 100 μA				
		for **BSW 67**	120			V
		for **BSW 68**	150			V
$V_{CEO(sus)}^{*}$	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 100 mA				
		for **BSW 67**	120			V
		for **BSW 68**	150			V
$V_{(BR)EBO}$	Emitter-base breakdown voltage ($I_C = 0$)	I_E = 100 μA	6			V
$V_{CE(sat)}^{*}$	Collector-emitter saturation voltage	I_C = 0.1A I_B = 0.01A			0.15	V
		I_C = 0.5A I_B = 0.05A			0.5	V
		I_C = 1A I_B = 0.15A			1	V
V_{BE}^{*}	Base-emitter voltage	I_C = 0.1A I_B = 0.01A			0.9	V
		I_C = 0.5A I_B = 0.05A			1.1	V
		I_C = 1A I_B = 0.15A			1.2	V

ELECTRICAL CHARACTERISTICS (continued)

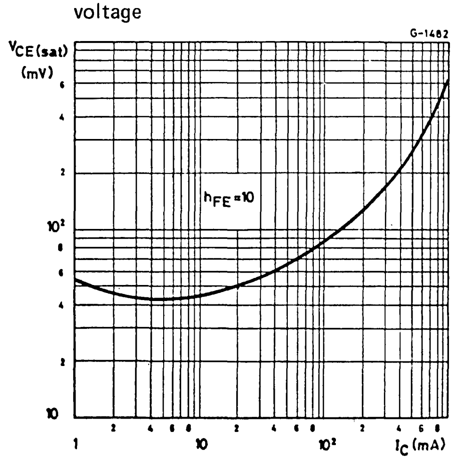
Parameter		Test conditions	Min. Typ. Max.	Unit
h_{FE}*	DC current gain	$I_C = 0.1A$ $V_{CE} = 5V$ $I_C = 0.5A$ $V_{CE} = 5V$ $I_C = 1A$ $V_{CE} = 5V$	40 30 15	– – –
f_T	Transition frequency	$I_C = 100\ mA$ $V_{CE} = 20V$	80	MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = 10V$ $f = 1\ MHz$	35	pF
t_{on}	Turn-on time	$I_C = 0.5A$ $I_{B1} = 0.05A$	0.5	μs
t_{off}	Turn-off time	$I_C = 0.5A$ $I_{B1} = -I_{B2} = 0.05A$	1	μs

* Pulsed: pulse duration = 300 μs, duty cycle = 1%

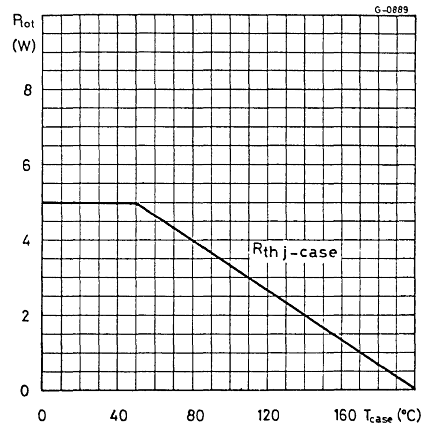
Typical DC current gain



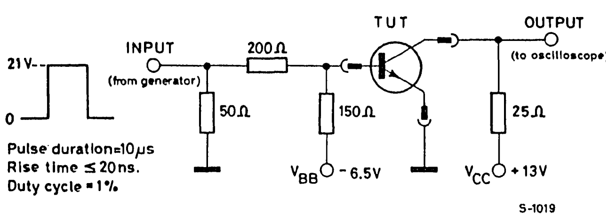
Typical collector-emitter saturation voltage



Power rating chart



Test circuit for measurement of switching times



SILICON PLANAR NPN

BU 100A

TV HORIZONTAL DEFLECTION OUTPUT TRANSISTOR

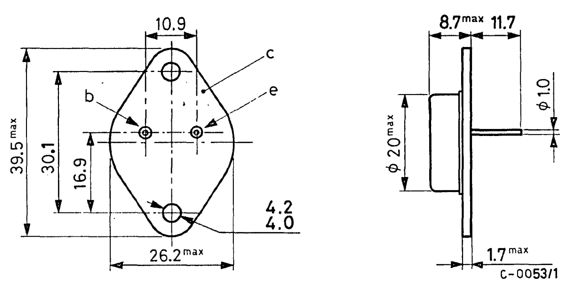
The BU 100A is a silicon planar epitaxial NPN transistor in Jedec TO-3 metal case. It is used in high voltage power applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	150	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	100	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	10	A
P_{tot}	Total power dissipation at $T_{case} \leq 25\,°C$	62	W
	at $T_{case} \leq 100\,°C$	25	W
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Junction temperature	150	°C

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-3**)

BU 100 A

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

	Parameter		Test conditions		Min.	Typ.	Max.	Unit
→	I_{CBO}	Collector cutoff current (I_E = 0)	V_{CB} = 100 V V_{CB} = 100 V	 T_{amb} = 100 °C			100 1	μA mA
	$V_{(BR)CBO}$*	Collector-base breakdown voltage (I_E = 0)	I_C = 1 mA		150			V
	$V_{(BR)CEO}$*	Collector-emitter breakdown voltage (I_B = 0)	I_C = 50 mA		100			V
	$V_{(BR)EBO}$*	Emitter-base breakdown voltage (I_C = 0)	I_E = 1 mA		5			V
→	$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1 A I_C = 5 A	I_B = 0.1 A I_B = 0.5 A		0.1 0.3	 1.5	V V
	$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 1 A I_C = 5 A	I_B = 0.1 A I_B = 0.5 A		0.85 1.1	 1.5	V V
→	h_{FE}*	DC current gain	I_C = 0.5 A I_C = 2 A I_C = 5 A	V_{CE} = 5 V V_{CE} = 5 V V_{CE} = 5 V	20 20	100 90 40		— — —
	f_T	Transition frequency	I_C = 0.5 A	V_{CE} = 5 V		100		MHz
	C_{CBO}	Collector-base capacitance	I_E = 0	V_{CB} = 10 V		80		pF
	t_{on}	Turn-on time	I_C = 5 A	I_{B1} = 0.5 A		0.5	1	μs
	t_f	Fall time	I_C = 5 A I_{B1} = -I_{B2} = 0.5 A			0.4	1	μs

* Pulsed: pulse duration = 300 μs, duty factor = 1%

SILICON PLANAR NPN

BU 125

HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

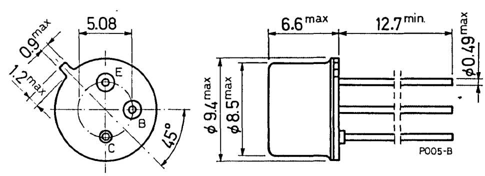
The BU 125 is a silicon planar epitaxial NPN transistor in Jedec TO-39 metal case. It is used in TV horizontal output and general purpose applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	130	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	5	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25\ °C$	0.8	W
	at $T_{amb} \leq 45\ °C$	0.7	W
	at $T_{case} \leq 25\ °C$	7	W
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-39**)

THERMAL DATA

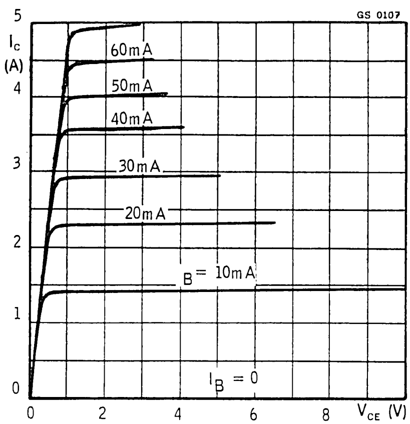
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	25	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	220	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

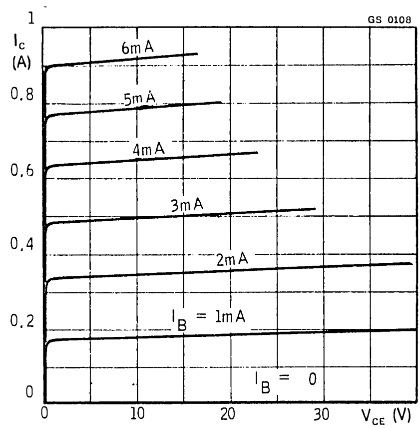
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB} = 100 V		0.02	10	μA
$V_{(BR)CBO}$*	Collector-base breakdown voltage ($I_E = 0$)	I_C = 1 mA	130			V
$V_{(BR)CES}$*	Collector-emitter breakdown voltage ($V_{BE} = 0$)	I_C = 1 mA	130			V
$V_{(BR)CEO}$*	Collector-emitter breakdown voltage ($I_B = 0$)	I_C = 50 mA	60			V
$V_{(BR)EBO}$*	Emitter-base breakdown voltage ($I_C = 0$)	I_E = 1 mA	5			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 1 A I_B = 0.1 A I_C = 5 A I_B = 0.5 A		0.1 0.4	0.2 1	V V
$V_{BE\ (sat)}$*	Base-emitter saturation voltage	I_C = 1 A I_B = 0.1 A I_C = 5 A I_B = 0.5 A		0.8 1.3	1 1.6	V V
h_{FE}*	DC current gain	I_C = 0.1 A V_{CE} = 2 V I_C = 5 A V_{CE} = 2 V	40 15	170 70		— —
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 5 V		100		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V			80	pF
t_{off}	Turn-off time	I_C = 5 A I_{B1} = $-I_{B2}$ = 0.5 A			0.65	μs

* Pulsed: pulse duration = 300 μs, duty factor = 1%

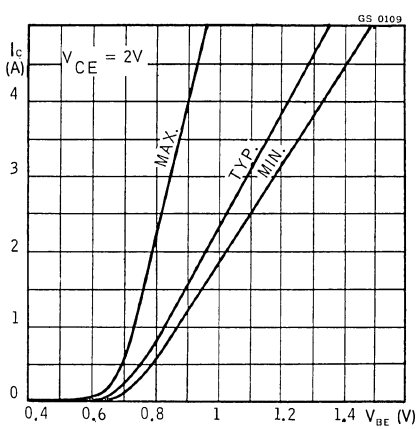
Typical output characteristics



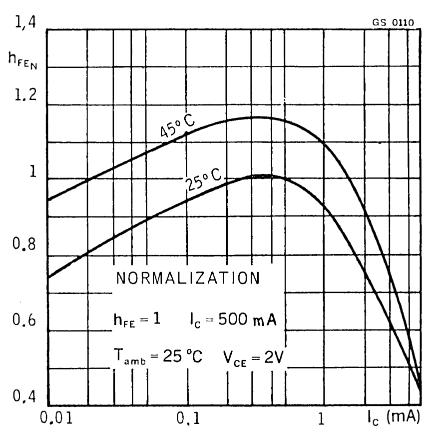
Typical output characteristics



DC transconductance

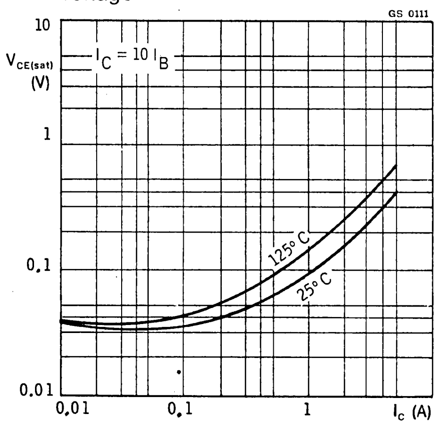


Normalized DC current gain

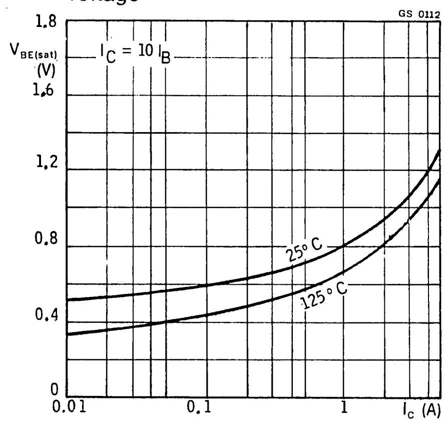


BU 125

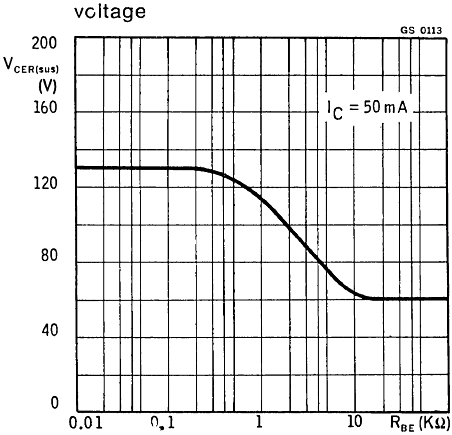
Typical collector-emitter saturation voltage



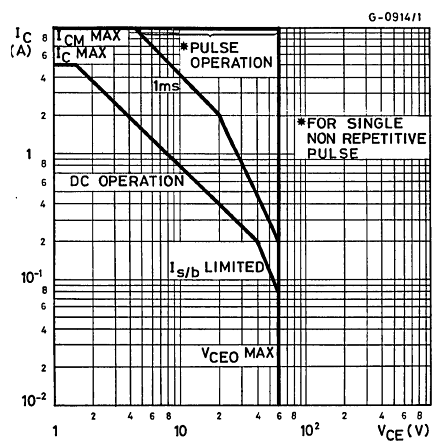
Typical base-emitter saturation voltage



Typical collector-emitter breakdown voltage



Safe operating areas



SILICON PLANAR NPN

BU 125 S

PRELIMINARY DATA

HIGH VOLTAGE POWER AMPLIFIER

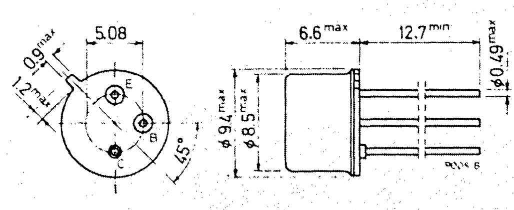
The BU 125 S is a silicon planar epitaxial NPN transistor in Jedec TO-39 metal case. It is intended for vertical output amplifier in the deflection systems of television receivers and for general purpose applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CEV}	Collector-emitter voltage (V_{BE} = -1.5V)	250	V
$V_{CEO(sus)}$	Collector-emitter voltage ($I_B = 0$)	150	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	1.5	A
I_{CM}	Collector peak current (repetitive)	2	A
I_B	Base current	0.5	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25$ °C	1	W
	at $T_{case} \leq 75$ °C	5	W
T_{stg}	Storage temperature	-55 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-39**)

2/75

THERMAL DATA

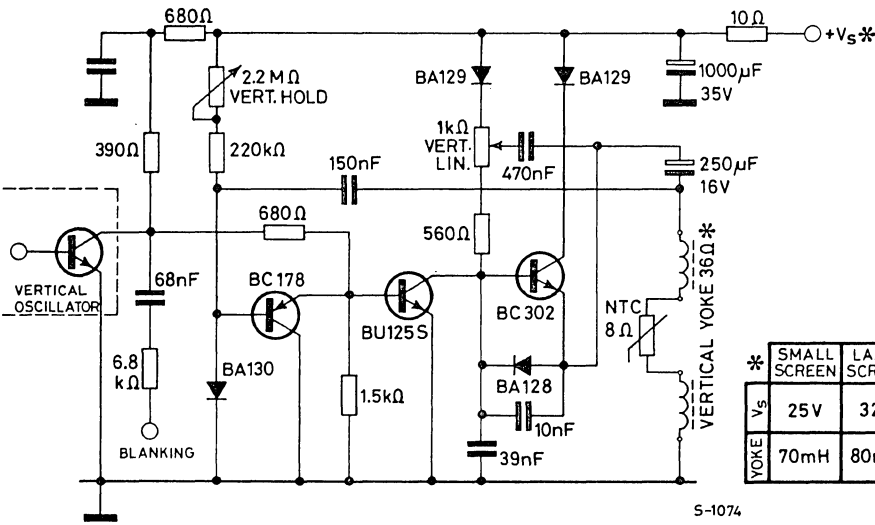
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	25	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB}= 200V				10	μA
I_{EBO}	Emitter cutoff current ($I_C = 0$)	V_{EB}= 6V				1	mA
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 20 mA		150			V
$V_{CE\,(sat)}$	Collector-emitter saturation voltage	I_C = 500 mA	I_B = 50 mA		0.3	1.5	V
h_{FE}	DC current gain	I_C = 5 mA	V_{CE}= 10V	30			–
	*	I_C = 250 mA	V_{CE}= 3V	30	60		–
f_T	Transition frequency	I_C = 100 mA	V_{CE}= 10V	15			MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$, f = 1 MHz	V_{CB}= 10V			35	pF

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%

Typical application circuit



*	SMALL SCREEN	LARGE SCREEN
V_s	25 V	32 V
YOKE	70mH	80mH

SILICON EPITAXIAL NPN

BU 406
BU 407

PRELIMINARY DATA

HORIZONTAL TV DEFLECTORS

The BU 406 and BU 407 are silicon planar epitaxial NPN transistors in Jedec TO-220A plastic package. These are fast switching, high voltage devices for use in horizontal deflection output stages of MTV receivers with 110° CRT. The BU 406 is primarily intended for large screen, while the BU 407 is for medium and small screens.

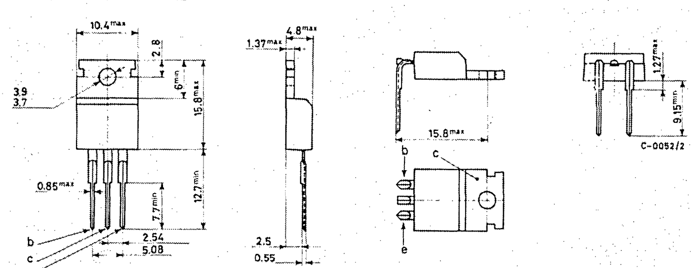
ABSOLUTE MAXIMUM RATINGS

		BU 406	BU 407
V_{CBO}	Collector-base voltage ($I_E = 0$)	400 V	330 V
V_{CEV}	Collector-emitter voltage ($V_{BE} = -1.5V$)	400 V	330 V
→ V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200 V	
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6 V	
I_C	Collector current	7 A	
I_{CM}	Collector peak current (repetitive)	10 A	
→ I_{CM}	Collector peak current ($t = 10$ ms)	15 A	
I_B	Base current	4 A	
P_{tot}	Total power dissipation at $T_{case} \leq 25°C$	60 W	
T_{stg}	Storage temperature	-55 to 150 °C	
T_j	Junction temperature	150 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to tab



TO-220 AB

TO-220 AA

BU 406
BU 407

THERMAL DATA

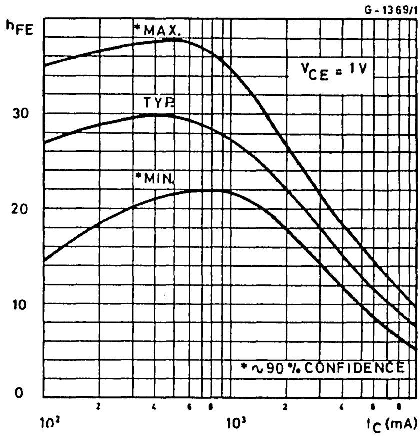
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2.08	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	70	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

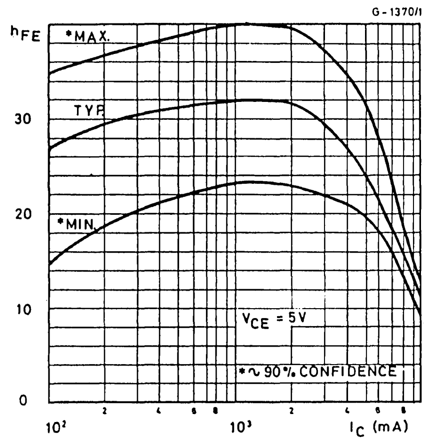
	Parameter		Test conditions		Min.	Typ.	Max.	Unit
→	I_{CES}*	Collector cutoff current (V_{BE} = 0)	for **BU 406** for **BU 407**	V_{CE} = 400V V_{CE} = 330V			15 15	mA mA
→	I_{CES}	Collector cutoff current (V_{BE} = 0)	V_{CE} = 300V V_{CE} = 300V	 T_{case} = 100°C			100 1	μA mA
	I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 6V				1	mA
	$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 5A	I_B = 0.5A			1	V
	$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 5A	I_B = 0.5A			1.2	V
	t_{off}**	Turn-off time	I_C = 5A	I_B = 0.5A			0.75	μs
	f_T	Transition frequency	I_C = 0.5A	V_{CE} = 10V	10			MHz
	$I_{s/b}$	Second breakdown collector current	V_{CE} = 40V	t = 10 ms	4			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** See test circuit

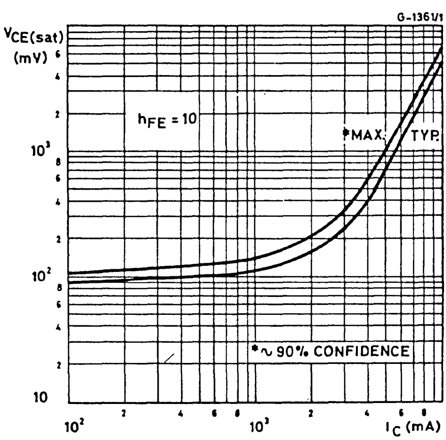
DC current gain



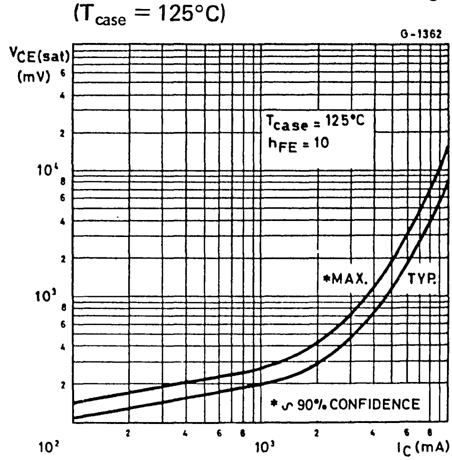
DC current gain



Collector-emitter saturation voltage

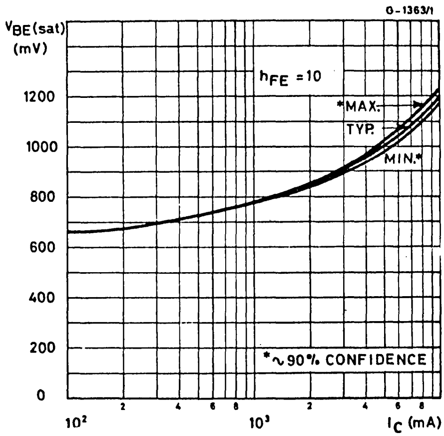


Collector-emitter saturation voltage (T_{case} = 125°C)

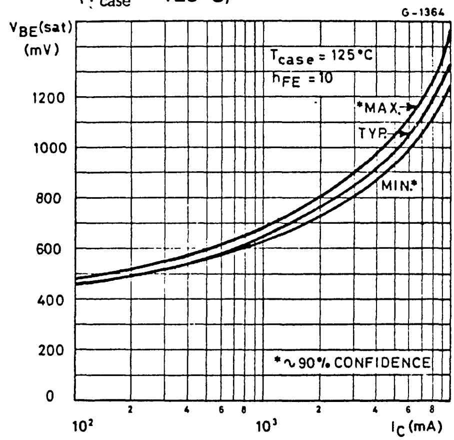


BU 406
BU 407

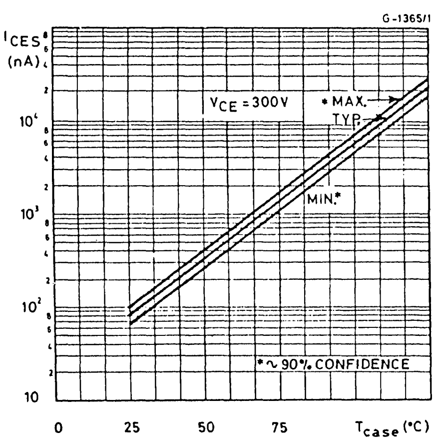
Base-emitter saturation voltage



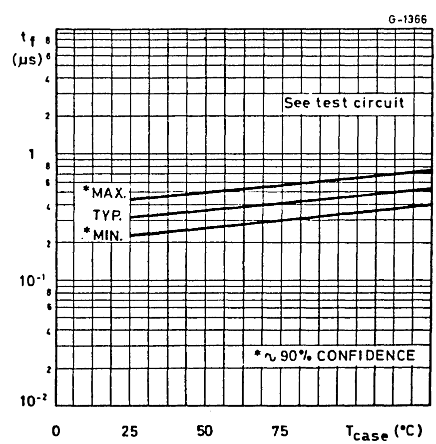
Base-emitter saturation voltage (T_{case} = 125°C)



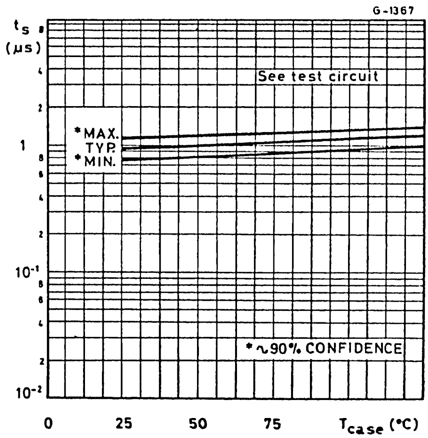
Collector cutoff current



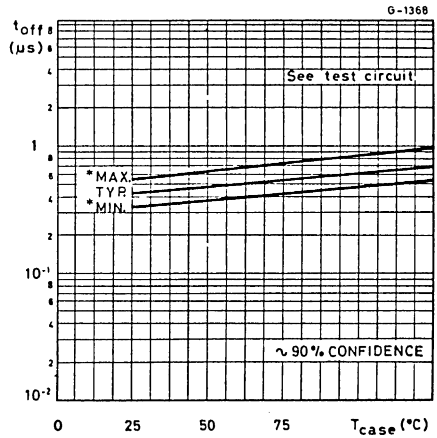
Fall time



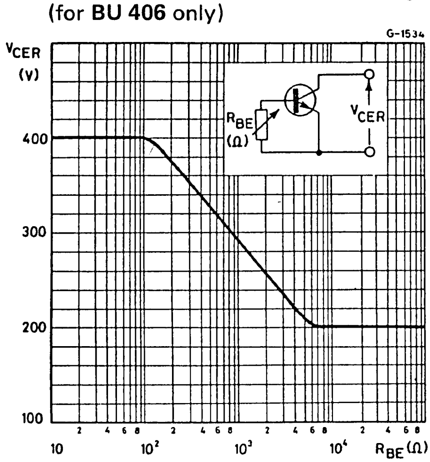
Storage time



Turn-off time



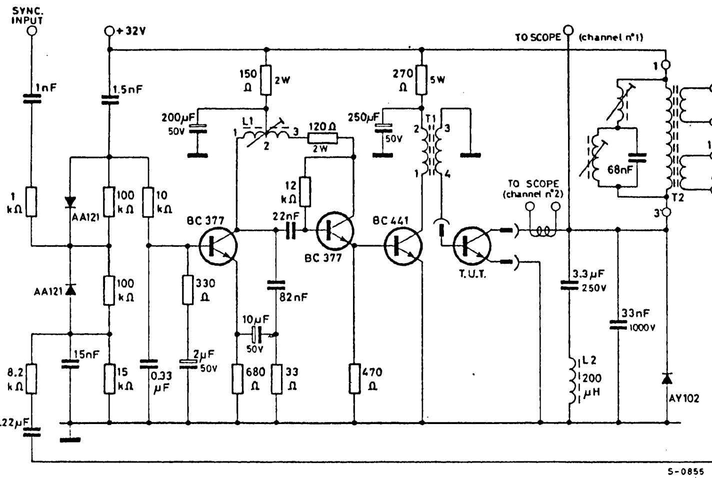
Collector-emitter breakdown voltage (for **BU 406** only)



BU 406
BU 407

SWITCHING TIMES

Test circuit (fall, storage and turn-off time)



L1 Horizontal hold coil: Pins 1-2=75 turns Ø 0.2mm; R=1.5Ω; L min=0.62mH
Pins 2-3=293 turns Ø 0.2mm; R=4.8Ω; L max=4.1 mH Core=siferrit B 62120 25×4×2

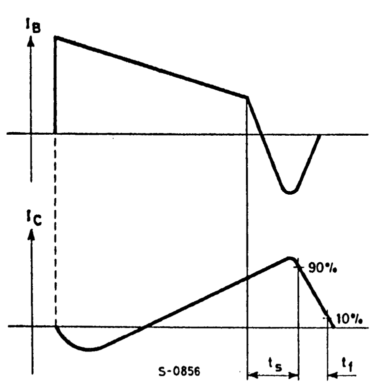
L2 Horizontal yoke=200 μH

T1 Driver transformer: Pins 1-2=125 turns Ø 0.2mm;
Pins 3-4=25 turns Ø 0.4mm; Gap =0.12mm; Core=3E3 double E 19×15×5

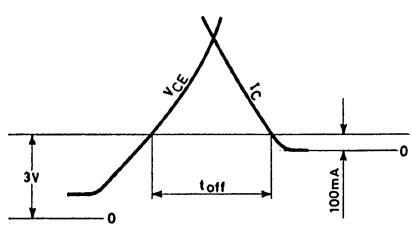
T2 EHT transformer manufacturer ARCO type 249.065/035

Waveforms

Fall and storage time



Turn-off time



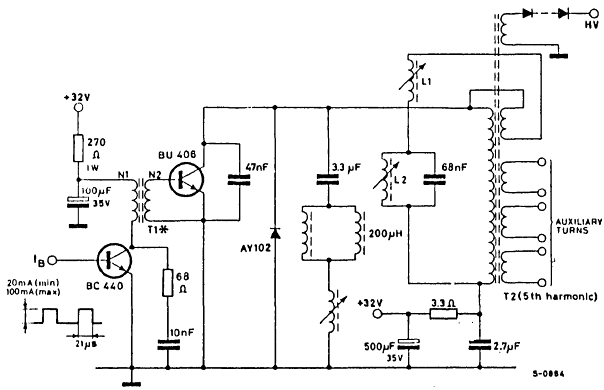
Turn-off time is the time for the collector current I_C to decrease to 100mA after the collector to emitter voltage V_{CE} has risen 3V into its flyback excursion

S-0857

APPLICATION INFORMATION

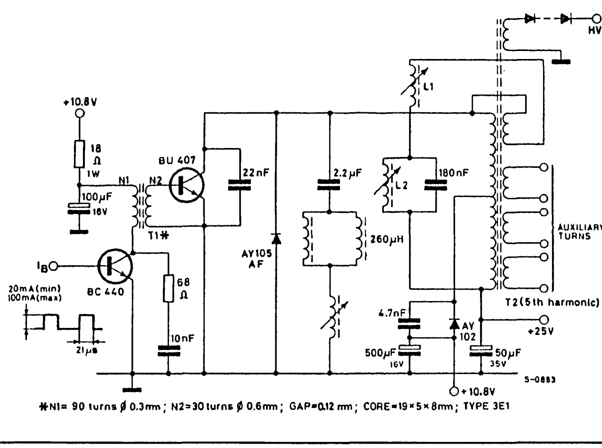
Three examples are given of the BU 406 and BU 407 in conventional MTV horizontal deflection circuits.

BU 406-application circuit for 17" to 24"-110°-28 mm neck picture tubes



*N1=125 turns ∅ 0.3mm; N2=25 turns ∅ 0.8mm; GAP=0.12mm; CORE=19×5×8mm; TYPE 3E1

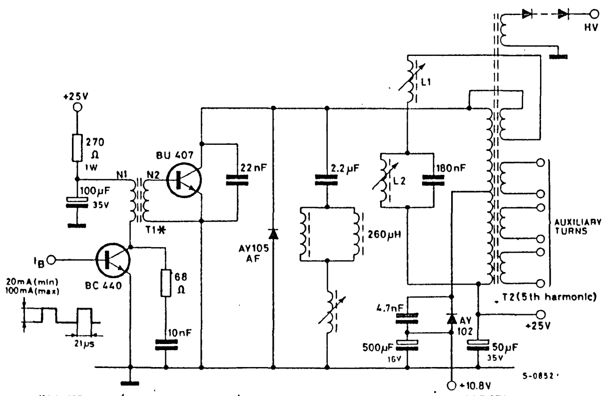
BU 407-application circuit for 12" to 17"-110°-20 mm neck picture tubes (driver supply voltage = 10.8V)



*N1= 90 turns ∅ 0.3mm; N2=30 turns ∅ 0.6mm; GAP=0.12 mm; CORE=19×5×8mm; TYPE 3E1

APPLICATION INFORMATION (continued)

BU 407-application circuit for 12" to 17"-110°-20 mm neck picture tubes
(driver supply voltage = 25V)



*N1=125 turns ∅ 0.3mm; N2=25 turns ∅ 0.6mm; GAP=0.12mm; CORE=19×5×8mm; TYPE 3E1

BUY 18S

SILICON PLANAR NPN

FAST SWITCHING HIGH VOLTAGE POWER

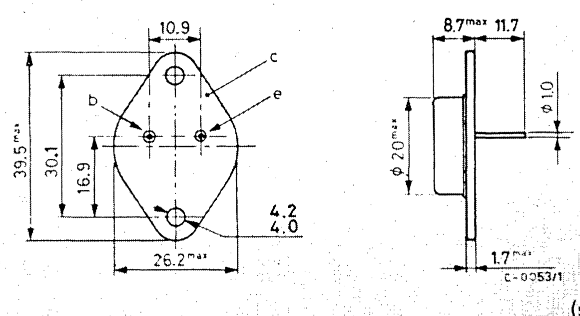
The BUY 18S is a silicon planar epitaxial NPN transistor in Jedec. TO-3 metal case. It is intended for high-voltage switching power applications.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	400	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	7	A
I_{CM}	Collector peak current (repetitive)	10	A
I_{CM}	Collector peak current ($t \leq 10$ ms)	15	A
I_B	Base current	4	A
P_{tot}	Total power dissipation at $T_{case} \leq 75$ °C	50	W
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Junction temperature	175	°C

MECHANICAL DATA

Dimensions in mm



(sim. to TO-3)

BUY 18S

THERMAL DATA

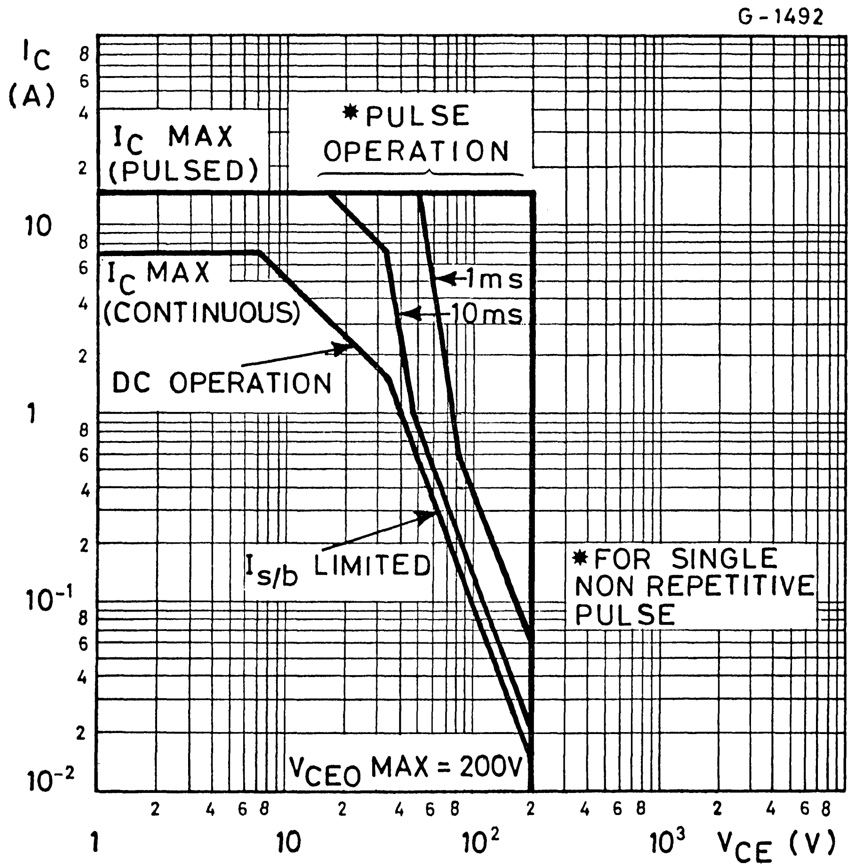
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	2	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	V_{CB}= 200V V_{CB}= 200V T_{amb}= 100°C			10 2	μA mA
$V_{(BR)CBO}$*	Collector-base breakdown voltage ($I_E = 0$)	I_C = 5 mA	400			V
$V_{(BR)EBO}$*	Emitter-base breakdown voltage ($I_C = 0$)	I_E = 1 mA	6			V
$V_{CEO\,(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	I_C = 20 mA	200			V
$V_{CE\,(sat)}$*	Collector-emitter saturation voltage	I_C = 5A I_B = 0.5A I_C = 7A I_B = 0.7A		 0.6	1 	V V
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 5A I_B = 0.5A I_C = 7A I_B = 0.7A		 1.2	1.4 1.6	V V
h_{FE}*	DC current gain	I_C = 1A V_{CE}= 5V	20	40		–
f_T	Transition frequency	I_C = 0.5 V_{CE}= 10V		50		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB}= 50V f = 1 MHz		55		pF
t_{on}	Turn-on time	I_C = 5A I_{B1}= 0.5A			1	μs
t_{off}	Turn-off time	I_C = 5A I_{B1}= -I_{B2}= 0.5A		0.3	1	μs
$I_{s/b}$**	Second breakdown collector current	V_{CE}= 40V			1	A

* Pulsed: pulse duration = 300 μs, duty cycle = 1%
** Pulsed: 1s, non repetitive pulse

Safe operating areas



SILICON PLANAR NPN

BUY 47
BUY 48

HIGH VOLTAGE, HIGH CURRENT SWITCH

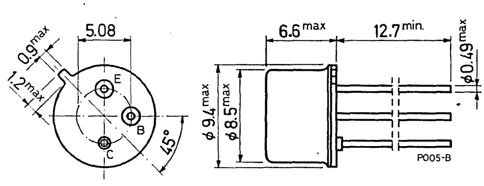
The BUY 47 and BUY 48 are silicon planar epitaxial NPN transistors in Jedec TO-39 metal case. They are used in high-voltage, high-current switching applications up to 5 A.

ABSOLUTE MAXIMUM RATINGS

		BUY 47	BUY 48
V_{CBO}	Collector-base voltage ($I_E = 0$)	150 V	200 V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	120 V	170 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6 V	
→ I_C	Collector current	7 A	
→ I_{CM}	Collector peak current (repetitive)	10 A	
P_{tot}	Total power dissipation at $T_{amb} \leq 25\ °C$	1 W	
	at $T_{case} \leq 25\ °C$	7 W	
T_{stg}	Storage temperature	-55 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-39**)

BUY 47
BUY 48

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	25	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	for **BUY 47**				
		$V_{CB} = 80$ V			10	μA
		$V_{CB} = 80$ V $T_{amb} = 125$ °C			1	mA
		for **BUY 48**				
		$V_{CB} = 100$ V			10	μA
		$V_{CB} = 100$ V $T_{amb} = 125$ °C			1	mA
$V_{(BR)CBO}$*	Collector-base breakdown voltage ($I_E = 0$)	$I_C = 1$ mA				
		for **BUY 47**	150			V
		for **BUY 48**	200			V
$V_{(BR)CEO}$*	Collector-emitter breakdown voltage ($I_B = 0$)	$I_C = 20$ mA				
		for **BUY 47**	120			V
		for **BUY 48**	170			V
$V_{(BR)EBO}$*	Emitter-base breakdown voltage ($I_C = 0$)	$I_E = 1$ mA	6			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 0.5$ A $I_B = 50$ mA		0.1		V
		$I_C = 2$ A $I_B = 0.2$ A		0.2	0.45	V
		$I_C = 5$ A $I_B = 0.5$ A		0.55	1	V

ELECTRICAL CHARACTERISTICS (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
$V_{BE\,(sat)}$*	Base-emitter saturation voltage	I_C = 0.5 A I_B = 50 mA		0.75		V
		I_C = 2 A I_B = 0.2 A		1	1.1	V
		I_C = 5 A I_B = 0.5 A		1.15	1.5	V
h_{FE}*	DC current gain	I_C = 50 mA V_{CE} = 5 V		130		—
		I_C = 0.5 A V_{CE} = 5 V	40	150		—
		I_C = 2 A V_{CE} = 5 V	40	130		—
		I_C = 5 A V_{CE} = 5 V	15	45		—
f_T	Transition frequency	I_C = 100 mA V_{CE} = 10 V		90		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 50 V		45	80	pF
t_{on}	Turn-on time	I_C = 5 A I_{B1} = 0.5 A		0.5	1	µs
t_{off}	Turn-off time	I_C = 5 A I_{B1} = $-I_{B2}$ = 0.5 A		1.2	2	µs

* Pulsed: pulse duration = 300 µs, duty factor = 1 %

BUY 49S

SILICON PLANAR NPN

PRELIMINARY DATA

HIGH VOLTAGE, MEDIUM CURRENT SWITCH

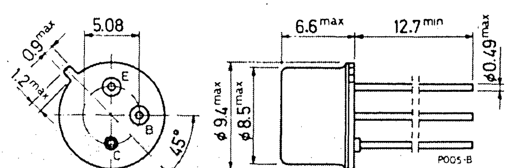
The BUY 49S is a silicon planar epitaxial NPN transistor in Jedec TO-39 metal case. It is used in high-voltage, high-current switching applications up to 2A.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	250	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	200	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	1.5	A
I_{CM}	Collector peak current (repetitive)	2	A
P_{tot}	Total power dissipation at $T_{amb} \leqslant 25$ °C	1	W
	at $T_{case} \leqslant 75$ °C	7	W
T_{stg}	Storage temperature	-55 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-39**)

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	18	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	175	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$)	$V_{CB} = 200V$ $V_{CB} = 200V$ $T_{amb} = 150$ °C			0.1 50	μA μA
$V_{(BR)CBO}$	Collector-base breakdown voltage ($I_E = 0$)	$I_C = 100\ \mu A$	250			V
$V_{CEO(sus)}$*	Collector-emitter sustaining voltage ($I_B = 0$)	$I_C = 20$ mA	200			V
$V_{(BR)EBO}$*	Emitter-base breakdown voltage ($I_C = 0$)	$I_E = 1$ mA	6			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	$I_C = 0.5A$ $I_B = 50$ mA			0.2	V
$V_{BE(sat)}$*	Base-emitter saturation voltage	$I_C = 0.5A$ $I_B = 50$ mA			1.1	V
h_{FE}*	DC current gain	$I_C = 20$ mA $V_{CE} = 5V$ $I_C = 0.5A$ $V_{CE} = 5V$	40 40	 80		– –
f_T	Transition frequency	$I_C = 100$ mA $V_{CE} = 10V$	50	80		MHz
C_{CBO}	Collector-base capacitance	$I_E = 0$ $V_{CB} = 10V$ f = 1 MHz			35	pF
t_{on}	Turn-on time	$I_C = 0.5A$ $I_{B1} = 50$ mA		0.5		μs
t_{off}	Turn-off time	$I_C = 0.5A$ $I_{B1} = -I_{B2} = 50$ mA		1		μs
$I_{s/b}$**	Second breakdown collector current	$V_{CE} = 50V$	0.2			A

* Pulsed: pulse duration = 300 μs, duty cycle = 1%
** Pulsed: 1s, non repetitive pulse

SILICON PLANAR NPN

BUY 68

HIGH CURRENT, GENERAL PURPOSE TRANSISTOR

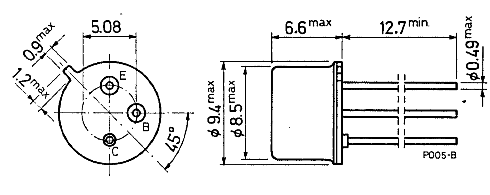
The BUY 68 is a silicon planar epitaxial NPN transistor in Jedec TO-39 metal case. It is used for high-current switching applications and in power amplifiers. The BUY 68 is available in 3 h_{FE} gain bands.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	100	V
V_{CER}	Collector-emitter voltage ($R_{BE} \leq 10\ \Omega$)	80	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	5	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25\ °C$	0.8	W
	at $T_{case} \leq 25\ °C$	7	W
T_{stg}	Storage temperature	-55 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



(sim. to **TO-39**)

BUY 68

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	25	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	220	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

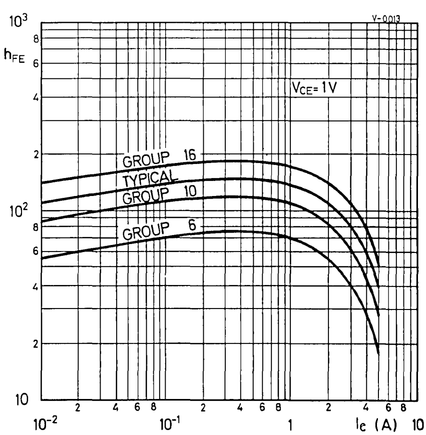
Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO} Collector cutoff current ($I_E = 0$)	$V_{CB} = 60$ V			1	µA
$V_{(BR)CBO}$* Collector-base breakdown voltage ($I_E = 0$)	$I_C = 1$ mA	100			V
$V_{(BR)CEO}$* Collector-emitter breakdown voltage ($I_B = 0$)	$I_C = 50$ mA	60			V
$V_{CER(sus)}$* Collector-emitter sustaining voltage ($R_{BE} = 10\ \Omega$)	$I_C = 50$ mA	80			V
$V_{(BR)EBO}$* Emitter-base breakdown voltage ($I_C = 0$)	$I_E = 1$ mA	6			V
$V_{CE\ (sat)}$* Collector-emitter saturation voltage	$I_C = 2$ A $I_B = 0.2$ A		0.2	0.6	V
	$I_C = 5$ A $I_B = 0.5$ A		0.4	1	V
$V_{BE\ (sat)}$* Base-emitter saturation voltage	$I_C = 2$ A $I_B = 0.2$ A		1	1.3	V
	$I_C = 5$ A $I_B = 0.5$ A		1.2	1.6	V

ELECTRICAL CHARACTERISTICS (continued)

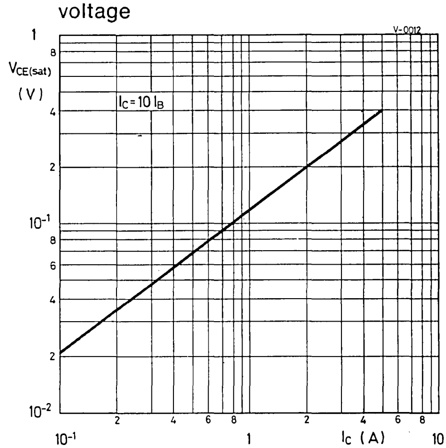
Parameter		Test conditions	Min.	Typ.	Max.	Unit
→ h_{FE}*	DC current gain	I_C = 0.1 A V_{CE} = 1 V	40	130		—
		Group 6	40	70		—
		Group 10	63	110		—
		Group 16	100	170		—
		I_C = 1 A V_{CE} = 1 V	40	130	250	—
		Group 6	40	70	100	—
		Group 10	63	110	160	—
		Group 16	100	170	250	—
f_T	Transition frequency	I_C = 0.5 A V_{CE} = 5 V	50	100		MHz
C_{CBO}	Collector-base capacitance	I_E = 0 V_{CB} = 10 V		40	80	pF
t_{on}	Turn-on time	I_C = 5 A I_{B1} = 0.5 A		0.1	0.35	µs
t_{off}	Turn-off time	I_C = 5 A, I_{B1} = $-I_{B2}$ = 0.5 A		0.55	0.75	µs

* Pulsed: pulse duration = 300 µs, duty factor = 1%

Typical DC current gain

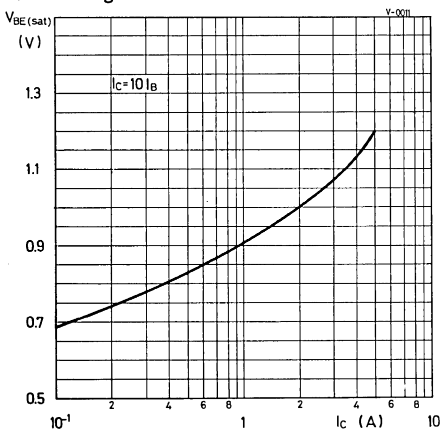


Typical collector-emitter saturation voltage

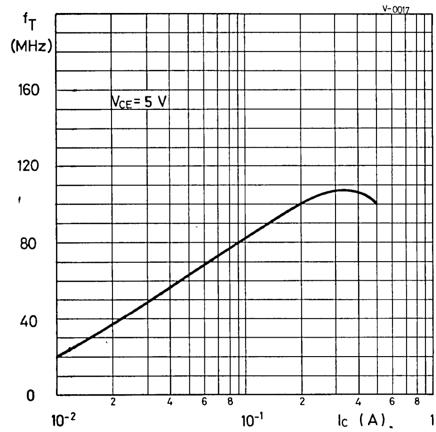


BUY 68

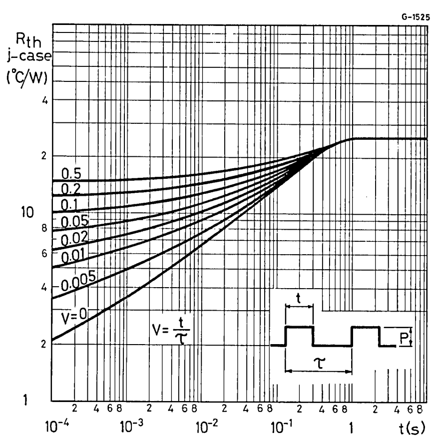
Typical base-emitter saturation voltage



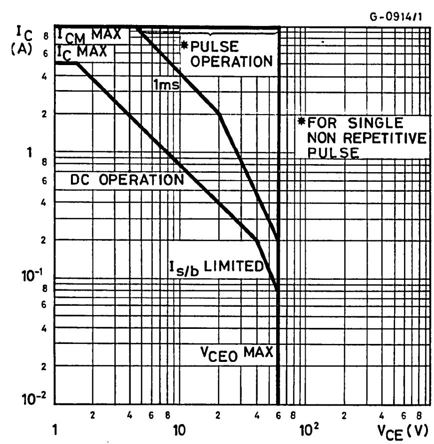
Typical transition frequency



Typical thermal response



Safe operating areas



2N 3055
BDX 10

SILICON HOMETAXIAL* NPN

POWER LINEAR AND SWITCHING APPLICATIONS

The 2N 3055/BDX 10 is a single diffused « hometaxial » silicon NPN transistor in a Jedec TO-3 metal case. It is useful for power switching circuits, series and shunt regulator output stages and high fidelity amplifiers.
Designed to assure freedom from second breakdown at maximum ratings.

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

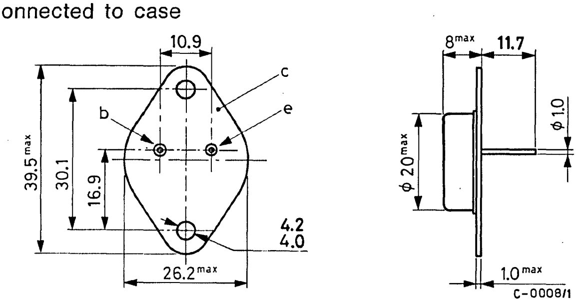
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	100	V
$V_{CEV\ (sus)}$	Collector-emitter voltage ($V_{BE} = -1.5$ V)	90	V
$V_{CER\ (sus)}$	Collector-emitter voltage ($R_{BE} \leq 100\ \Omega$)	70	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_c \leq 25$ °C	117	W
T_s	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

THERMAL DATA

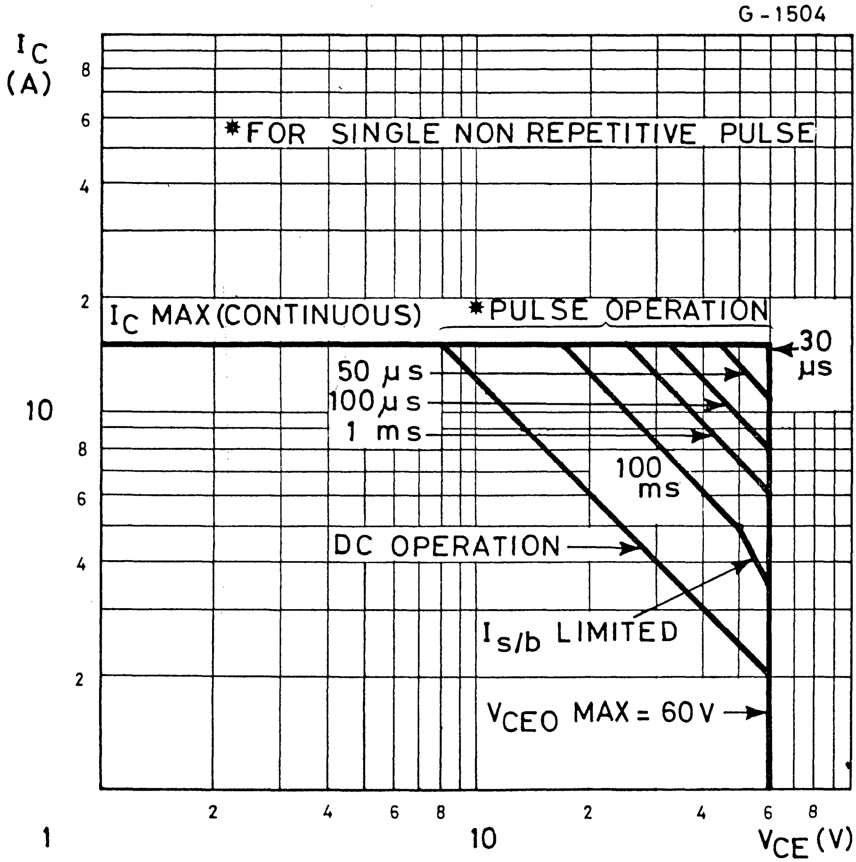
$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	V_{CE} = 100 V V_{CE} = 100 V T_c = 150 °C			5 30	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 30 V			0.7	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			1	mA
$V_{CEV(sus)}$*	Collector-emitter voltage (V_{BE} = -1.5 V)	I_C = 100 mA	90			V
$V_{CER(sus)}$*	Collector-emitter voltage (R_{BE} = 100 Ω)	I_C = 200 mA	70			V
$V_{CEO(sus)}$*	Collector-emitter voltage (I_B = 0)	I_C = 200 mA	60			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 4 A I_B = 400 mA I_C = 10 A I_B = 3.3 A			1 3	V V
V_{BE}*	Base-emitter voltage	I_C = 4 A V_{CE} = 4 V			1.5	V
h_{FE}*	DC current gain Gr. 4 Gr. 5 Gr. 6 Gr. 7	I_C = 500 mA V_{CE} = 4 V I_C = 500 mA V_{CE} = 4 V I_C = 500 mA V_{CE} = 4 V I_C = 500 mA V_{CE} = 4 V I_C = 4 A V_{CE} = 4 V I_C = 10 A V_{CE} = 4 V	20 35 60 120 20 5		50 75 145 250 70	— — — — — —
h_{FE1}/h_{FE2}	Matched pair	I_C = 500 mA V_{CE} = 4 V			1.6	—
f_T	Transition frequency	I_C = 1 A V_{CE} = 4 V	800			kHz
→ $I_{s/b}$**	Second breakdown collector current	V_{CE} = 60 V	1.95			A

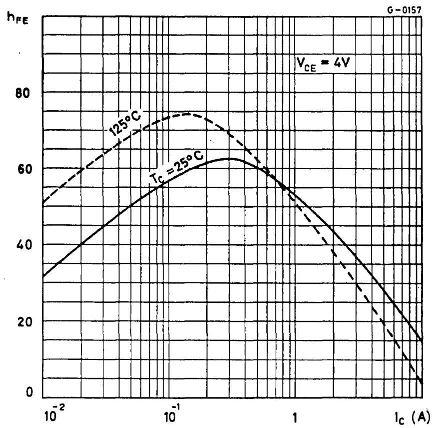
* Pulsed: pulse duration = 300 μs, duty factor = 1.5 %
** Pulsed: 1 s, non repetitive pulse

Safe operating areas

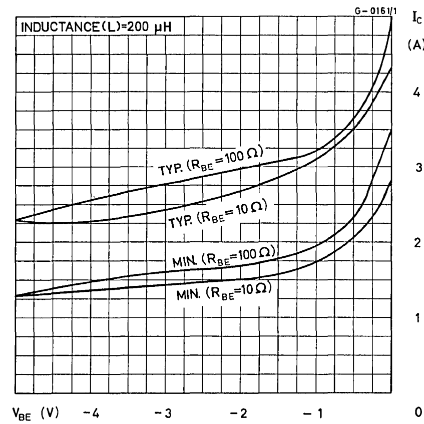


2N 3055
BDX 10

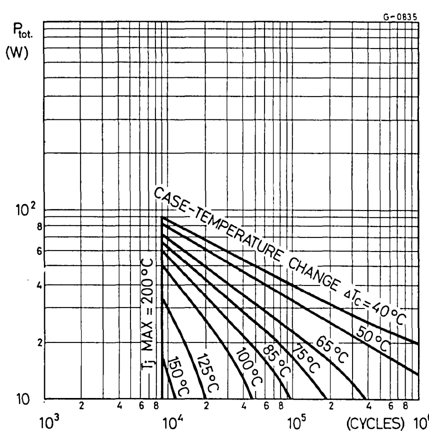
Typical DC current gain



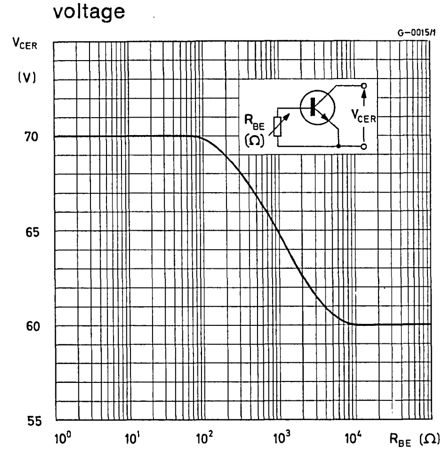
Reverse-bias second breakdown characteristics



Thermal-cycle rating chart



Collector-emitter breakdown voltage



2N 3055C

SILICON HOMETAXIAL* NPN

POWER LINEAR AND SWITCHING APPLICATIONS

The 2N3055C is a single diffused "hometaxial" silicon NPN transistor in Jedec TO-3 metal case. It is useful for power switching circuits, series and shunt regulator output stages and high fidelity amplifiers.

Designed to assure freedom from second breakdown at maximum ratings.

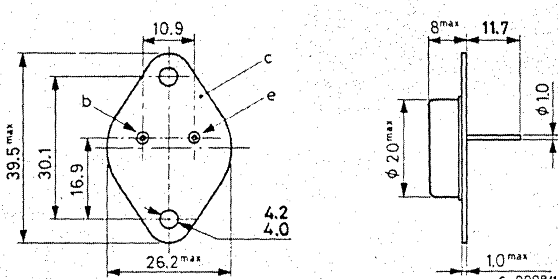
* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	80	V
$V_{CEV\ (sus)}$	Collector-emitter voltage ($V_{BE} = -1.5V$)	70	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	60	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_{case} \leq 25$ °C	117	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm



(sim. to TO-3)

2N 3055C

THERMAL DATA

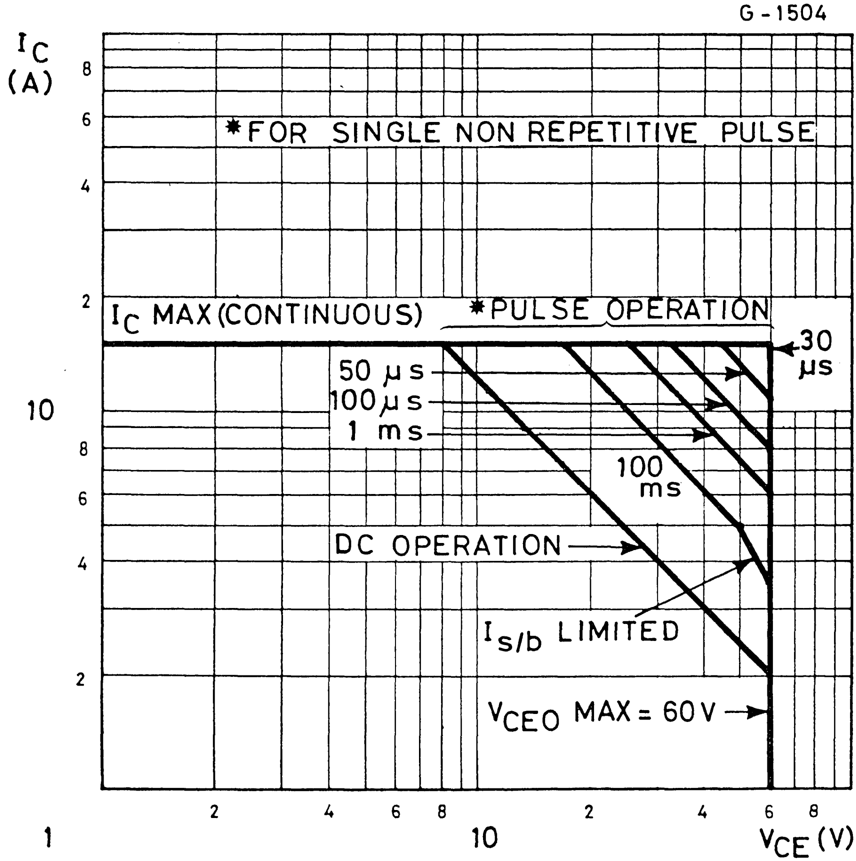
$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5V)	V_{CE} = 80V V_{CE} = 80V T_{case} = 150 °C			5 30	mA mA
I_{CEO}	Collector cutoff current (I_B = 0)	V_{CE} = 30V			0.7	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7V			1	mA
$V_{CEV\ (sus)}$*	Collector-emitter voltage (V_{BE} = -1.5V)	I_C = 100 mA	70			V
$V_{CEO\ (sus)}$*	Collector-emitter voltage (I_B = 0)	I_C = 200 mA	60			V
$V_{CE\ (sat)}$*	Collector-emitter saturation voltage	I_C = 4A I_B = 400mA			1.1	V
V_{BE}*	Base-emitter voltage	I_C = 4A V_{CE} = 4V			1.5	V
h_{FE}*	DC current gain	I_C = 500 mA V_{CE} = 4V I_C = 2A V_{CE} = 2V I_C = 4A V_{CE} = 4V	20 20 12		250 160	– – –
f_T	Transition frequency	I_C = 1A V_{CE} = 4V	800			kHz
$I_{s/b}$**	Second breakdown collector current	V_{CE} = 60V	1.95			A

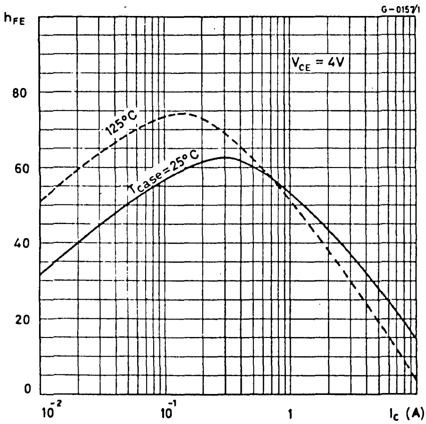
* Pulsed: pulse duration = 300 μs, duty cycle = 1.5%
** Pulsed: 1s, non repetitive pulse

Safe operating areas

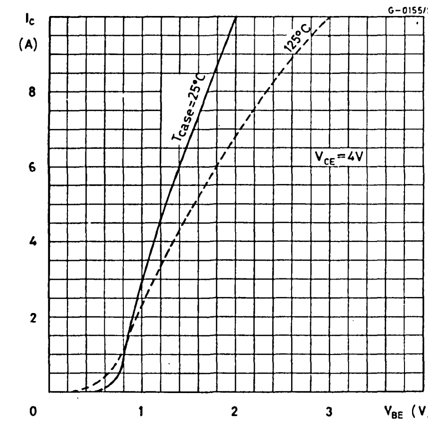


2N 3055C

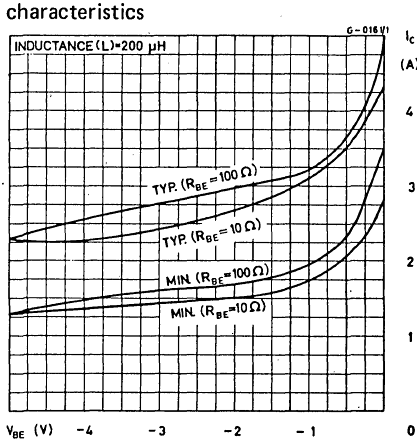
Typical DC current gain



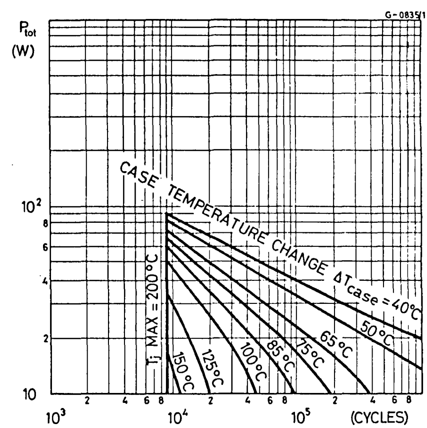
Typical DC transconductance



Reverse-bias, second breakdown characteristics



Thermal-cycle rating chart



SILICON HOMETAXIAL* NPN

2N 3055U
BDX 60

HIGH CURRENT, HIGH POWER APPLICATIONS

The 2N 3055U/BDX 60 is a single diffused « hometaxial* » silicon NPN transistor in a Jedec TO-3 metal case, with high gain, low saturation voltage at high collector current (up to 15 A) and high breakdown voltage. It is intended for a wide variety of high-power applications. **Designed to assure freedom from second breakdown at maximum ratings.**

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

ABSOLUTE MAXIMUM RATINGS

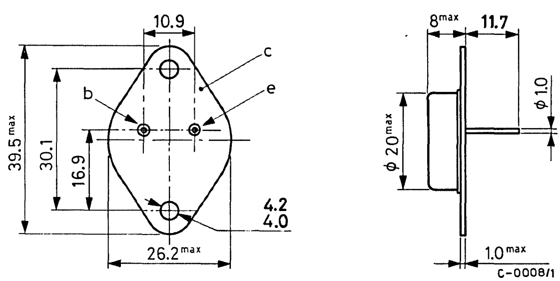
V_{CBO}	Collector-base voltage ($I_E = 0$)	100	V
$V_{CEV\,(sus)}$	Collector-emitter voltage ($V_{BE} = -1.5$ V)	90	V
→ $V_{CER\,(sus)}$	Collector-emitter voltage ($R_{BE} \leq 100\ \Omega$)	80	V
→ $V_{CEO\,(sus)}$	Collector-emitter voltage ($I_B = 0$)	70	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7	V
I_C*	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_c \leq 25°$ C	150	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

* The emitter current may reach 30 A peak with collector-base junction short-circuited

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

2N 3055U
BDX 60

THERMAL DATA

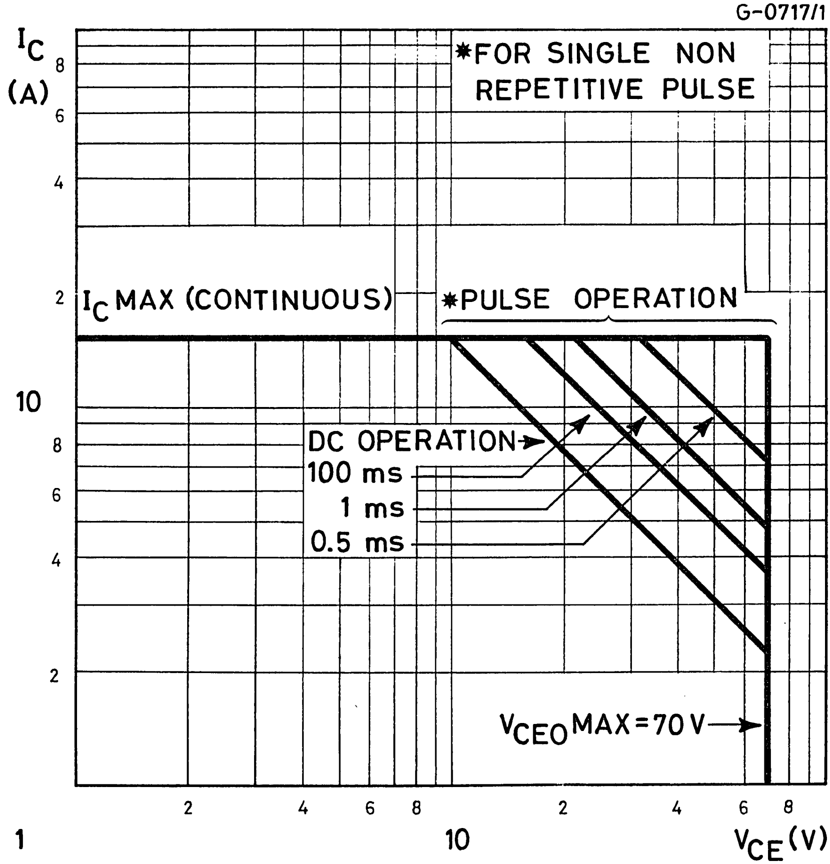
$R_{th\ j\text{-}c}$	Thermal resistance junction-case	max	1.17	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

	Parameter		Test conditions	Min.	Typ.	Max.	Unit
→	I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	V_{CE} = 100 V			5	mA
	I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			1	mA
→	$V_{CEV(sus)}$*	Collector-emitter voltage (V_{BE} = -1.5 V)	I_C = 100 mA	90			V
→	$V_{CER(sus)}$*	Collector-emitter voltage (R_{BE} = 100 Ω)	I_C = 200 mA	80			V
→	$V_{CEO(sus)}$*	Collector-emitter voltage (I_B = 0)	I_C = 200 mA	70			V
→	$V_{CE(sat)}$*	Collector-emitter saturation voltage	I_C = 4 A I_B = 0.4 A I_C = 8 A I_B = 1.6 A I_C = 15 A I_B = 3 A			0.5 1.5 4	V V V
	V_{BE}*	Base-emitter voltage	I_C = 4 A V_{CE} = 4 V			1.2	V
→	$V_{BE(sat)}$*	Base-emitter saturation voltage	I_C = 4 A I_B = 0.4 A I_C = 8 A I_B = 1.6 A I_C = 15 A I_B = 3 A			1.6 3 5.5	V V V
→	h_{FE}*	DC current gain	I_C = 0.5 A V_{CE} = 4 V I_C = 5 A V_{CE} = 4 V I_C = 8 A V_{CE} = 4 V	30 20 10		250 70	— — —
	h_{FE1}/h_{FE2}	Matched pair	I_C = 0.5 A V_{CE} = 4 V			1.6	—
	f_T	Transition frequency	I_C = 1 A V_{CE} = 4 V	0.8			MHz
→	$I_{s/b}$**	Second breakdown collector current	V_{CE} = 70 V	2.14			A

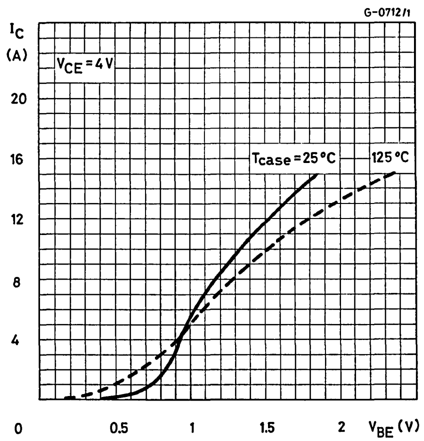
* Pulsed: pulse duration = 300 µs, duty factor = 1.5 %
** Pulsed: 1s, non repetitive pulse

Safe operating areas

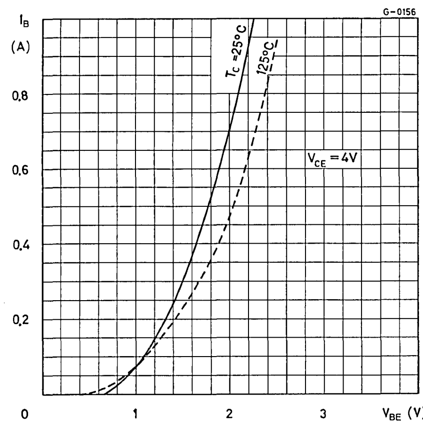


2N 3055U
BDX 60

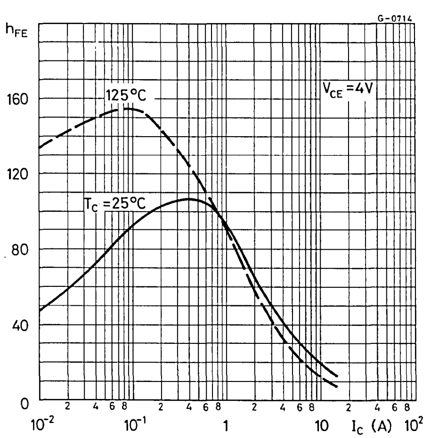
Typical DC transconductance



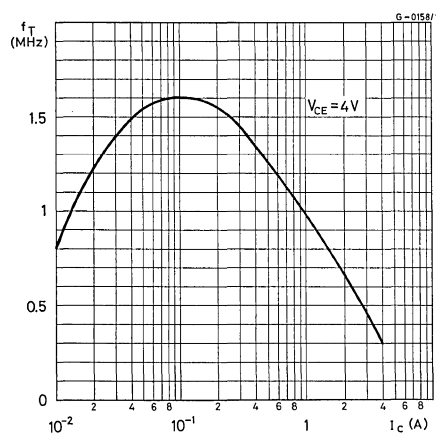
Typical input characteristics



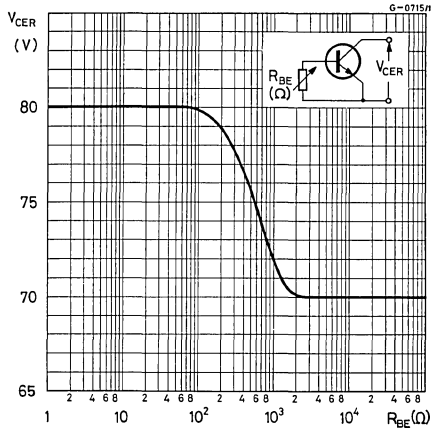
Typical DC current gain



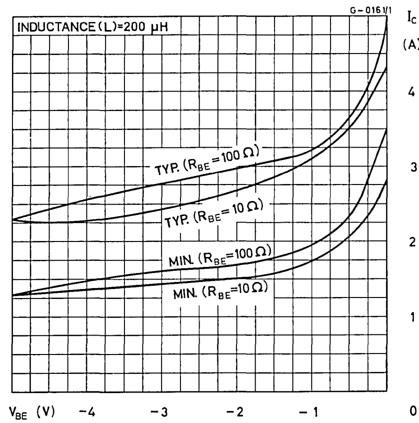
Typical transition frequency



Collector-emitter breakdown voltage



Reverse-bias second breakdown characteristics



SILICON HOMETAXIAL* NPN

2N 3442/BDX 11
2N 4347/BDX 12

HIGH POWER HIGH VOLTAGE APPLICATIONS

The 2N 3442/BDX 11 and 2N 4347/BDX 12 are high voltage, « hometaxial » NPN transistors in Jedec TO-3 metal case. They are intended for use as power switches, regulators, dc-dc converters, inverters and audio amplifiers.

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

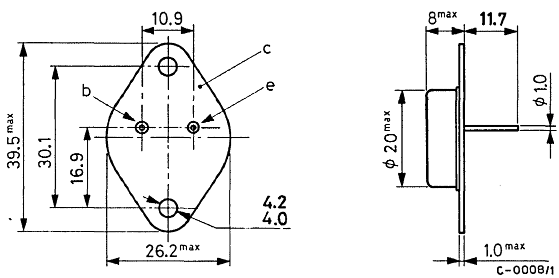
ABSOLUTE MAXIMUM RATINGS

		2N 4347	2N 3442
V_{CBO}	Collector-base voltage ($I_E = 0$)	140 V	160 V
$V_{CEV(sus)}$	Collector-emitter voltage ($V_{BE} = -1.5$ V)	140 V	160 V
→ $V_{CER(sus)}$	Collector-emitter voltage ($R_{BE} \leq 100\ \Omega$)	130 V	150 V
$V_{CEO(sus)}$	Collector-emitter voltage ($I_B = 0$)	120 V	140 V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	7 V	
I_C	Collector current	10 A	
→ I_{CM}	Collector peak current (repetitive)	15 A	
I_B	Base current	7 A	
P_{tot}	Total power dissipation at $T_c \leq 25$ °C for **2N 3442**	117 W	
	for **2N 4347**	100 W	
T_{stg}	Storage temperature	-65 to 200 °C	
T_j	Junction temperature	200 °C	

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

2N 3442/BDX 11
2N 4347/BDX 12

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	for **2N 3442**	max	1.5	°C/W
		for **2N 4347**	max	1.75	°C/W

ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

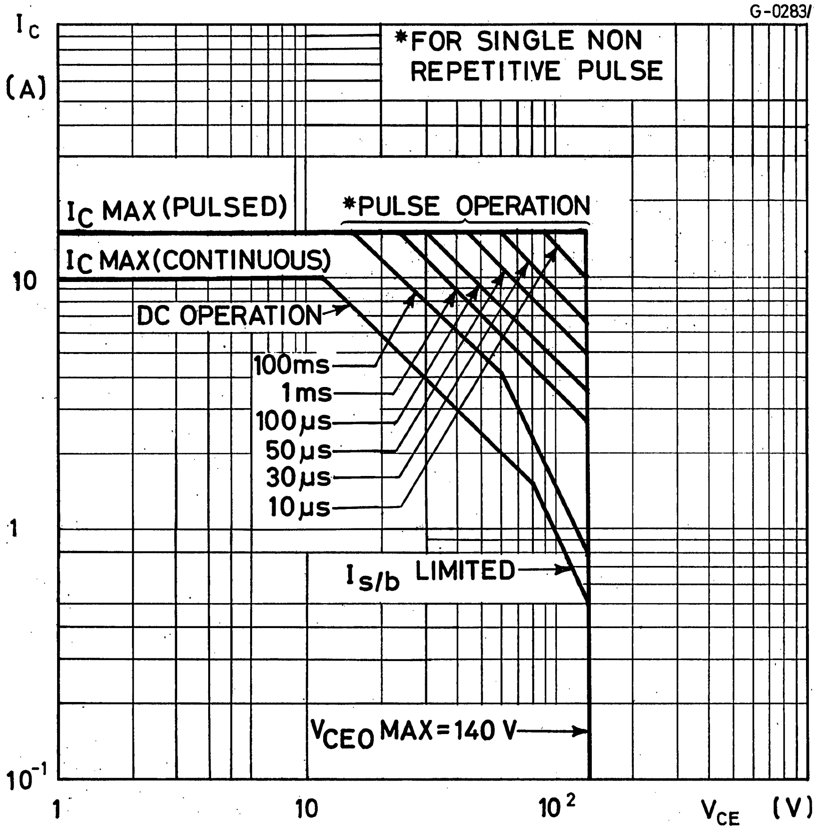
Parameter		Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current (I_E = 0) (for **2N 3442** only)	V_{CB} = 140 V			1	mA
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)	for **2N 3442**				
		V_{CE} = 140 V			1	mA
		V_{CE} = 140 V T_C = 150 °C			10	mA
		for **2N 4347**				
		V_{CE} = 120 V			2	mA
		V_{CE} = 120 V T_C = 150 °C			10	mA
I_{EBO}	Emitter cutoff current (I_C = 0)	V_{EB} = 7 V			5	mA
$V_{CEV(sus)}$	Collector-emitter voltage (V_{BE} = -1.5V)	I_C = 100 mA				
		for **2N 3442**	160			V
		for **2N 4347**	140			V
→ $V_{CER(sus)}$	Collector-emitter voltage (R_{BE} = 100 Ω)	I_C = 100 mA				
		for **2N 3442**	150			V
		for **2N 4347**	130			V
$V_{CEO(sus)}$	Collector-emitter voltage (I_B = 0)	I_C = 200 mA				
		for **2N 3442**	140			V
		for **2N 4347**	120			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	for **2N 3442**				
		I_C = 3 A I_B = 0.3 A			1	V
		for **2N 4347**				
		I_C = 2 A I_B = 0.2 A			1	V

ELECTRICAL CHARACTERISTICS (continued)

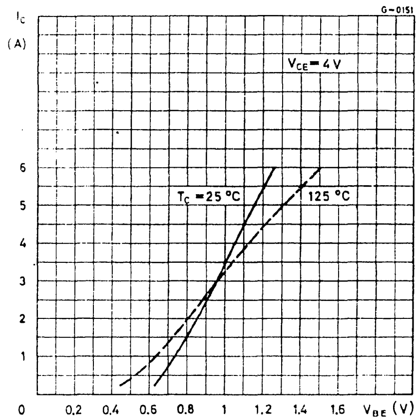
Parameter			Test conditions		Min.	Typ.	Max.	Unit
V_{BE}*	Base-emitter voltage		for **2N 3442**					
			I_C = 3 A	V_{CE} = 4 V			1.7	V
			for **2N 4347**					
			I_C = 2 A	V_{CE} = 4 V			2	V
h_{FE}*	DC current gain		for **2N 3442**					
		Gr. 4	I_C = 0.5 A	V_{CE} = 4 V	20		50	—
		Gr. 5	I_C = 0.5 A	V_{CE} = 4 V	35		75	—
		Gr. 6	I_C = 0.5 A	V_{CE} = 4 V	60		145	—
		Gr. 7	I_C = 0.5 A	V_{CE} = 4 V	120		250	—
			I_C = 3 A	V_{CE} = 4 V	20		70	—
			for **2N 4347**					
			I_C = 2 A	V_{CE} = 4 V	20		70	—
h_{FE1}/h_{FE2}	Matched pair (for **2N 3442** only)		I_C = 0.5 A	V_{CE} = 4 V			1.6	—
→ $I_{s/b}$**	Second breakdown collector current							
			V_{CE} = 78 V	for **2N 3442**	1.5			A
			V_{CE} = 67 V	for **2N 4347**	1.5			A

* Pulsed: pulse duration = 30 μs, duty factor = 1.5 %
** Pulsed: 1s, non repetitive pulse

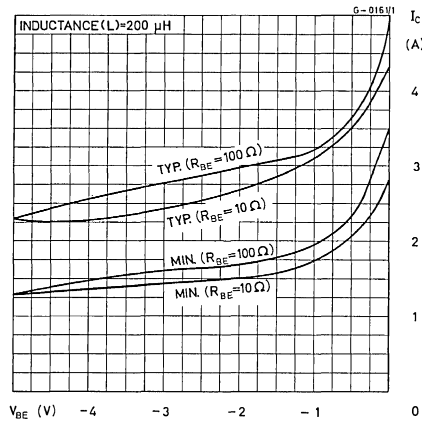
Safe operating areas (for **2N 3442** only)



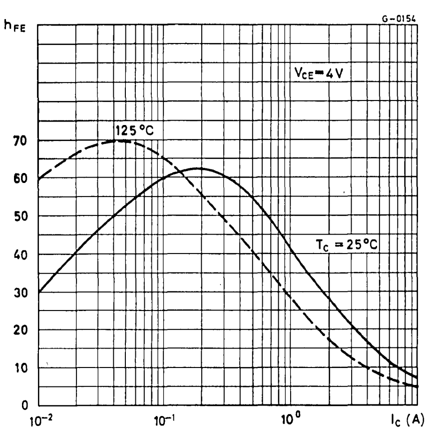
Typical DC transconductance



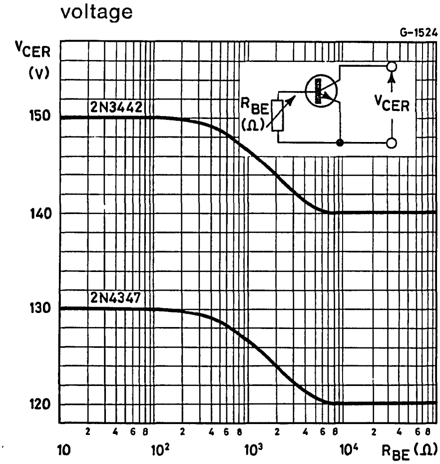
Reverse-bias second breakdown characteristics



Typical DC current gain



Collector-emitter breakdown voltage



SILICON HOMETAXIAL* NPN

40251
BDX 13

HIGH CURRENT POWER APPLICATIONS

The 40251/BDX 13 is a single diffused « hometaxial » silicon NPN transistor in Jedec TO-3 metal case. It is intended for a wide variety of high power applications **because of very low collector saturation voltage up to 8 A.**

* Hometaxial types employ a structure in which the base region has homogeneous resistivity silicon material in the axial direction (emitter-to-collector).

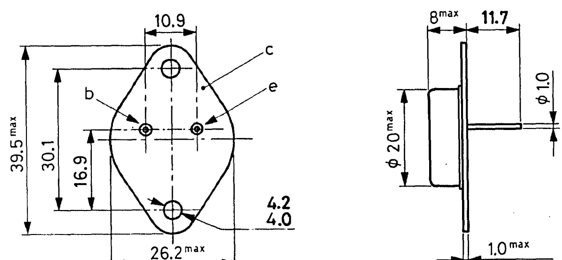
ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	50	V
$V_{CEV\ (sus)}$	Collector-emitter voltage ($V_{BE} = -1.5$ V)	50	V
$V_{CEO\ (sus)}$	Collector-emitter voltage ($I_B = 0$)	40	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	5	V
I_C	Collector current	15	A
I_B	Base current	7	A
P_{tot}	Total power dissipation at $T_c \leq 25$ °C	117	W
T_s	Storage temperature	-65 to 200	°C
T_j	Junction temperature	200	°C

MECHANICAL DATA

Dimensions in mm

Collector connected to case



(sim. to **TO-3**)

40251
BDX 13

THERMAL DATA

$R_{th\ j-c}$	Thermal resistance junction-case	max	1.5	°C/W

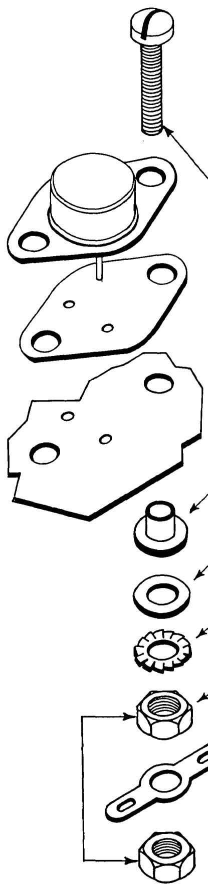
ELECTRICAL CHARACTERISTICS (T_c = 25 °C unless otherwise specified)

	Parameter		Test conditions		Min.	Typ.	Max.	Unit
I_{CEV}	Collector cutoff current (V_{BE} = -1.5 V)		V_{CE} = 40 V				2	mA
			V_{CE} = 40 V	T_C = 150 °C			10	mA
I_{EBO}	Emitter cutoff current (I_C = 0)		V_{EB} = 5 V				10	mA
→ V_{CBO}*	Collector-base voltage (I_E = 0)		I_C = 100 mA		50			V
V_{CEV}*(sus)	Collector-emitter voltage (V_{BE} = -1.5 V)		I_C = 100 mA		50			V
V_{CEO}*(sus)	Collector-emitter voltage (I_B = 0)		I_C = 200 mA		40			V
$V_{CE(sat)}$*	Collector-emitter saturation voltage		I_C = 8 A	I_B = 0.8 A			1.5	V
V_{BE}*	Base-emitter voltage		I_C = 8 A	V_{CE} = 4 V			2.2	V
h_{FE}*	DC current gain	Gr. 4	I_C = 500 mA	V_{CE} = 4 V	20		50	—
		Gr. 5	I_C = 500 mA	V_{CE} = 4 V	35		75	—
		Gr. 6	I_C = 500 mA	V_{CE} = 4 V	60		145	—
		Gr. 7	I_C = 500 mA	V_{CE} = 4 V	120		250	—
			I_C = 8 A	V_{CE} = 4 V	15		60	—
h_{FE_1}/h_{FE_2}	Matched pair		I_C = 500 mA	V_{CE} = 4 V			1.6	—
f_T	Transition frequency		I_C = 1 A	V_{CE} = 4 V		0.5		MHz
→ $I_{s/b}$**	Second breakdown collector current		V_{CE} = 39 V		3			A

* Pulsed: pulse duration = 300 μs, duty factor = 1.5%
** Pulsed: 1s, non repetitive pulse

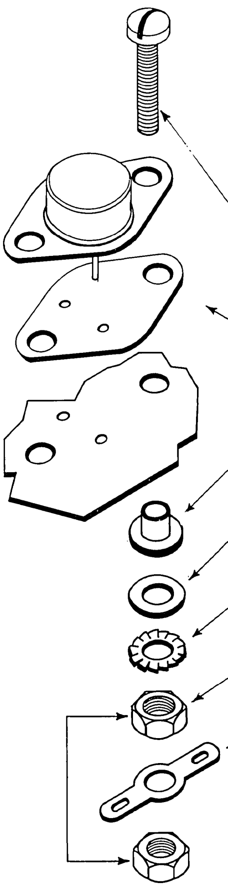
ACCESSORIES AND MOUNTING INSTRUCTIONS

SOT-9



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	2	NR 021D		M4x14 UNI 242	STEEL NICKEL PLATED	
MICA WASHER	1	DF 05 A	DF 05 A		MICA	175
INSULATING BUSHES	2	DF 03B	DF 03B		NYLON	174
WASHERS	2	NR 024A			STEEL NICKEL PLATED	177
LOCK WASHERS	2	NR 026 B		4 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	4	NR 022D		M4 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023A			BRASS TIN PLATED	176

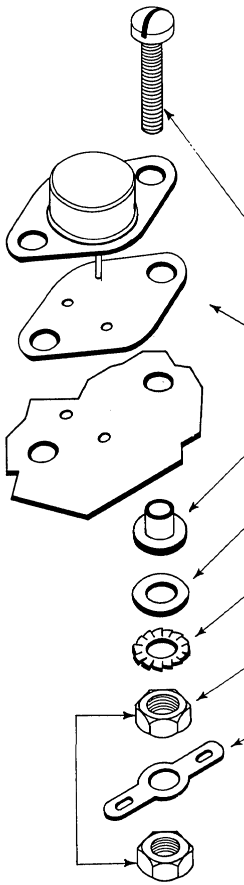
S-0328/1



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	2	NR 021 D		M4x14 UNI 242	STEEL NICKEL PLATED	
MICA WASHER	1	495320-CT2	495320-CT2		MICA	178
INSULATING BUSHES	2	DF 03 B	DF 03 B		NYLON	174
WASHERS	2	NR 024 A			STEEL NICKEL PLATED	177
LOCK WASHERS	2	NR 026 B		4 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	4	NR 022 D		M4 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 A			BRASS TIN PLATED	176

S-0375/1

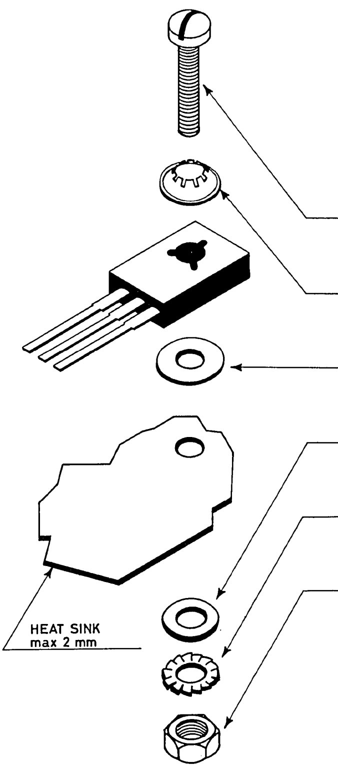
TO-66



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	2	NR 021 C		M3x14 UNI 242	STEEL NICKEL PLATED	
MICA WASHER	1	DF 31 CTA	DF 31 CTA		MICA	175
INSULATING BUSHES	2	DF 03 C	DF 03 C		NYLON	174
WASHERS	2	NR 024 B			STEEL NICKEL PLATED	177
LOCK WASHERS	2	NR 026 A		3 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	4	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 B			BRASS TIN PLATED	176

S-0376/1

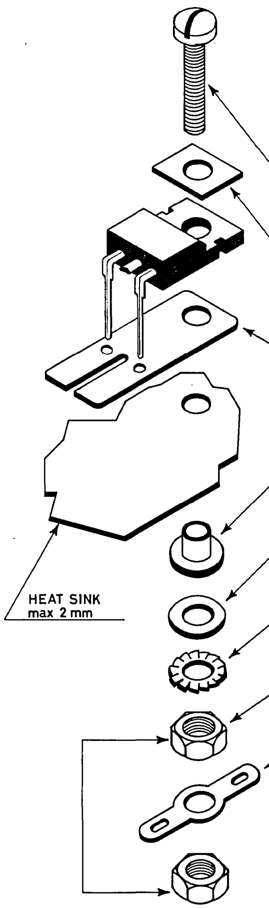
TO-126 (SOT-32)



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREW SLOTTED	1	NR 021C		M3 x 14 UNI 242	STEEL NICKEL PLATED	
LOCK WASHER	1	NR 026E			STEEL C72 UNI 3545	177
INSULATING BUSHE	1	DF 02 A	DF 02 A		MICA	174
WASHER	1	NR 024 B			STEEL NICKEL PLATED	177
LOCK WASHER	1	NR 026 A		3UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUT	1	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	

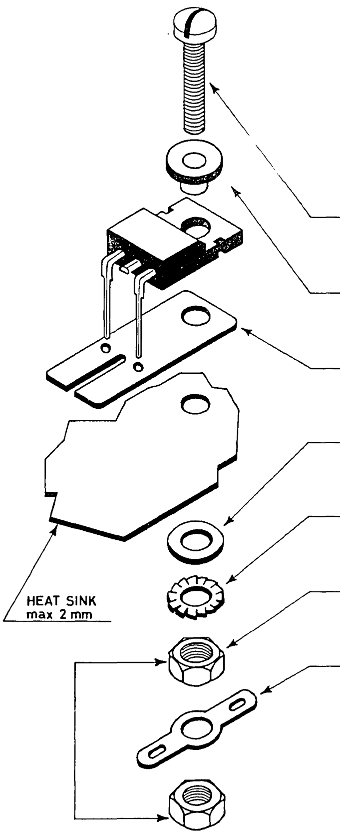
S-0340/1

TO-220AA



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREW SLOTTED	1	NR 021 C		M3x14 UNI 242	STEEL NICKEL PLATED	
RECTANGULAR WASHER	1	NR 231 CTA			STEEL NICKEL PLATED	178
MICA WASHER	1	DF 103 CTB	DF 103 CTB		MICA	176
INSULATING BUSHE	1	DF 03 C	DF 03 C		NYLON	174
WASHER	1	NR 024 B			STEEL NICKEL PLATED	177
LOCK WASHER	1	NR 026 A		3UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	2	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 B			BRASS TIN PLATED	176

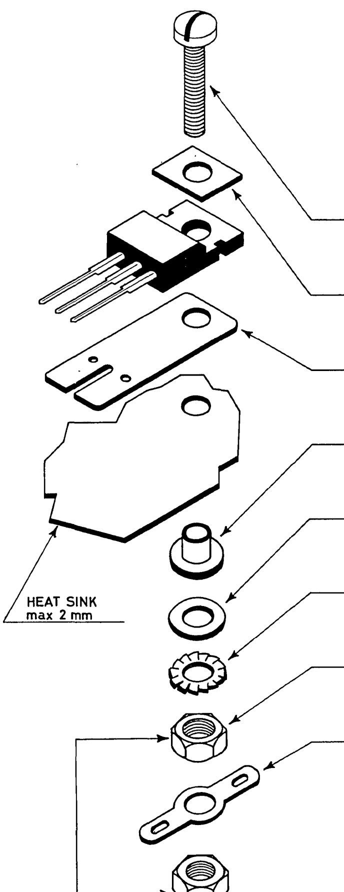
S-0387/1



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREW SLOTTED	1	NR 021 C		M3x14 UNI 242	STEEL NICKEL PLATED	
INSULATING BUSHE	1	DF 03 D	DF 03 D		NYLON	174
MICA WASHER	1	DF 103 CTB	DF 103 CTB		MICA	176
WASHER	1	NR 024 B			STEEL NICKEL PLATED	177
LOCK WASHER	1	NR 026 A		3 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	2	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 B			BRASS TIN PLATED	176

S-1114

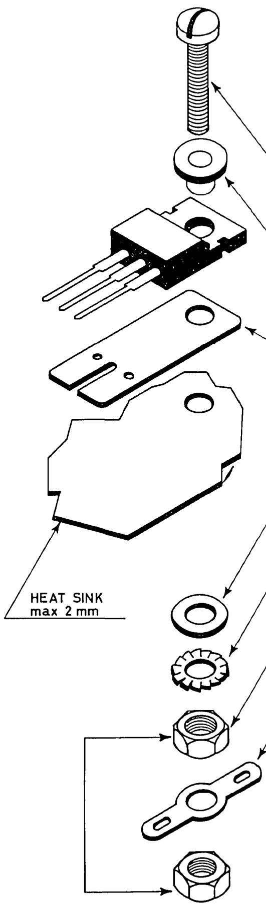
TO-220AB



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREW SLOTTED	1	NR 021 C		M3x14 UNI 242	STEEL NICKEL PLATED	
RECTANGULAR WASHER	1	NR 231 CTA			STEEL NICKEL PLATED	178
MICA WASHER	1	DF 103 CTB	DF 103 CTB		MICA	176
INSULATING BUSHE	1	DF 03 C	DF 03 C		NYLON	174
WASHER	1	NR 024 B			STEEL NICKEL PLATED	177
LOCK WASHER	1	NR 026 A		3 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	2	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 B			BRASS TIN PLATED	176

S-0388/1

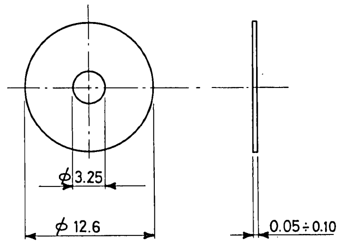
TO-220AB



ACCESSORY TYPE	Q.ty	ASSEMBLY NUMBER KIT 1	KIT 2	UNI-CODE	MATERIAL	MECH. DATA Page
CHEESE HEAD SCREWS SLOTTED	1	NR 021 C		M3x14 UNI 242	STEEL NICKEL PLATED	
INSULATING BUSHING	1	DF 03 D	DF 03 D		NYLON	174
MICA INSULATOR	1	DF 103 CTB	DF 103 CTB		MICA	176
METAL WASHER	1	NR 024 B			STEEL NICKEL PLATED	177
LOCK WASHER	1	NR 026 A		3 UNI 3703	STEEL NICKEL PLATED	
HEXAGON NUTS	2	NR 022 C		M3 UNI 5590	STEEL NICKEL PLATED	
SOLDER LUG	1	NR 023 B			BRASS TIN PLATED	176

S-0389/1

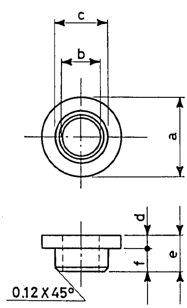
DF 02 A



A-0025

TYPE	MATERIAL	NOTE
DF 02 A	MICA	

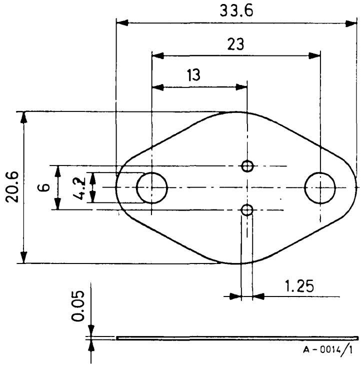
DF 03



A-0024/1

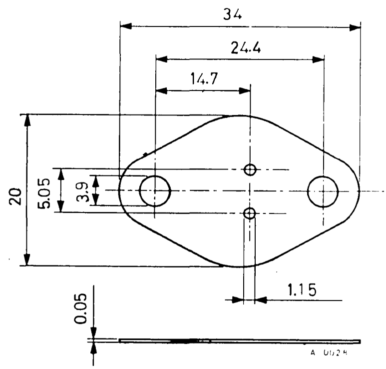
TYPE	MATERIAL	a	b	c	d	e	f	NOTE
DF 03 B	Nylon	8 max	4.1	5.6	1.1 max	1.6		
DF 03 C	Nylon	8 max	3.1	4.1	1.1 max	1.6		
DF 03 D	Nylon	5.5 max	3.1	3.88		1.8	1.2	

DF 05 A



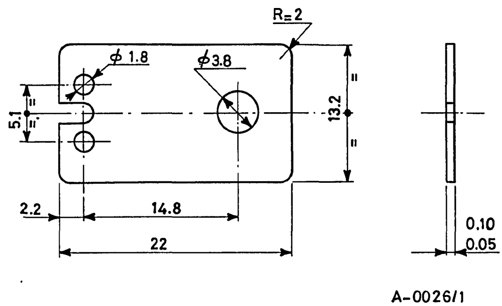
TYPE	MATERIAL	NOTE
DF 05 A	Mica ASTM D351-57T(V5)	-

DF 31 CTA



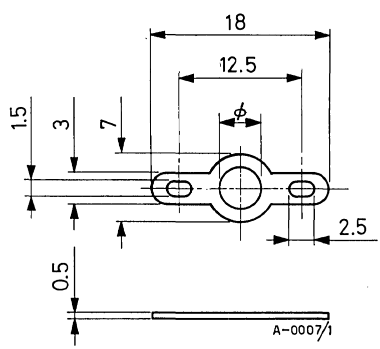
TYPE	MATERIAL	NOTE
DF 31CTA	Mica ASTM D351-57 T (V5)	-

DF 103 CTB



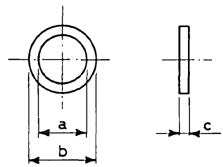
TYPE	MATERIAL	NOTE
DF 103 CTB	MICA	

NR 023



TYPE	MATERIAL	ϕ	NOTE
NR 023 A	Brass Tin plated	4.2	
NR 023 B	" "	3.2	

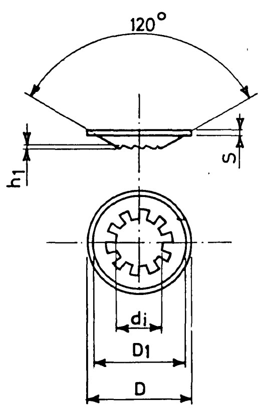
NR 024



A-0027

TYPE	MATERIAL	a	b	c	NOTE
NR 024 A	Steel nickel plated	4,10	6,5	1	
NR 024 B	" " "	3,10	5,3	1	

NR 026 E

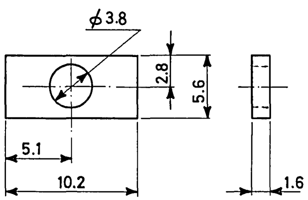


A-0022

TYPE	max di	min di	max D	min D	D_1	S	h_1	NOTE
NR 026E	3.3	3,1	7.1	6.8	5.2	0.4	0.8	

MATERIAL: Steel nickel plated

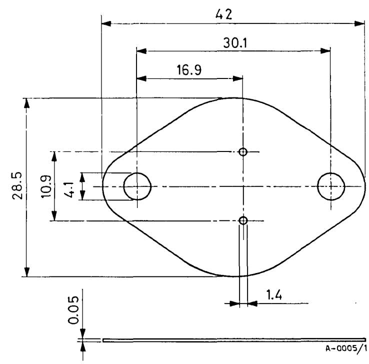
NR 231 CTA



A-0023/1

TYPE	MATERIAL	NOTE
NR 231 CTA	Steel nickel plated	

495320 CT 2



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