RCA 4102/4102S MODULE MANUAL

TP 1200

RCA 4102/4102S

MODULE MANUAL

TP 1200

INTRODUCTION

This manual contains the description and circuit parameters of the modules used in the 4100 Series Computers designed and fabricated by RCA, Aerospace Systems Division, Van Nuys, California. Also included is general maintenance information, applying to all module types unless otherwise specified in the detailed description of the module.

The circuit parameters, parts list, and schematic diagram for a particular module are grouped in one section.

GENERAL MAINTENANCE

SCOPE

This section describes the materials, equipment, and procedures required to repair and maintain modules used in RCA 4100 Series Computers and consists of five parts: (a) materials and equipment required, (b) precautions taken in the repair of modules, (c) disassembly and reassembly of modules, (d) inspection and cleaning of modules, and (e) repair of modules.

MATERIALS AND EQUIPMENT REQUIRED.

Table 1 lists the materials required to repair and maintain modules.

Table 1. Materials Required

NOMENCLATURE	DESCRIPTION	FSN	RCA PART NO.	RCA DRAWING NO.
Solder	63-37, 0.031 in dia	3432-163-4347	2010858	NA
Bus wire, flat, tinned	0.010 x 0.032 in	NSL	201-0105-24	8945405
Alcohol, isopropyl	Cleaning agent	6810-223-2726	NA	882116-34
Toluol	Solvent	6810-281-2002	2010040	NA
AT-N wax	Filler	NSL	NA	90481-31
Lacquer	Fungus-resistant	3110-120-3104	2016139-1	NA
Silicone compound	Heat conductor	6850-597-5327	NA	90481-18
Paper, carbon		7530-285-3837	NA	NA
		MANUFACTURER	MFG. STOCK NO.	
Foil, copper	Thermo-plastic backing	Walsco Electronic Mfg. Co.	9535-647	

Table 2 lists equipment required to repair and maintain module boards.

Table 2. Equipment Required

NOMENCLATURE	FSN
Iron, soldering, 35 watts or less	3439-240-5639
Cutters, diagonal	5110-596-7164
Cleaner, vacuum	7910-223-7687
Pliers, long nose	5120-298-3481

Table 2. Equipment Required (cont)

NOMENCLATURE	FSN
Aid, soldering, Hytron 3C35314	NSL
Scribe	5120-293-3408
Knife, small	7340-241-7915
Knife X-ACTO No. 3 M	NSL
Brush, hog bristle, small	7920-514-2417
Brush, camel hair	8020-262-9089
Rod, burnishing	5120-255-4458
Drill	5130-293-1386
Bit, wire gauge, No. 55	5133-189-9033
Pot, solder, (DEE Elect. Co. Model No. 265)	NSL
Kit, desoldering, (UNGAR 270)	NSL

PRECAUTIONS NECESSARY IN HANDLING MODULES

Mounted module boards have ample strength; unmounted boards are relatively weak. The following precautions should be taken to help reduce handling damage.

a. Handle module boards only by the edges. This precaution minimizes cracks and breaks, and reduces soldering difficulties caused by oil from the skin.

b. Do not handle modules by the components. This action may break or tear the copper conductors.

c. Do not wiggle leads or components to test the mechanical strength of solder joints. This action may break or loosen solder connections, or tear wiring.

d. Do not bend warped boards to straighten them. This action may break or crack the boards. Warped boards will usually straighten when they are remounted in a chassis.

e. Do not use force to remove a component.

f. Lay module on copper side when removed from cabinet. Use protective surface such as a rubber mat.

PRECAUTIONS NECESSARY IN APPLYING HEAT TO MODULES

When an excess of heat is applied with a soldering iron, the adhesive (holding the copper foil to the base material) loses its adhesive properties; and the copper foil detaches itself from the base material. The module board is then non-repairable and should be replaced. Thus, heat should be applied intermittently and briefly during the soldering process.

a. Make sure the soldering iron is at full operating temperature. Apply heat just long enough to make the solder flow.

b. To help dissipate heat, attach an alligator clip at the point to be soldered. Figure 1 illustrates an adequate heat sink fabricated from an alligator clip and small copper inserts. The copper inserts increase the heat dissipation rate, and in addition protect the surface of the attached object from being marred by the teeth of the alligator clip.

INSPECTION FOR CORROSION. Corrosion appears as a discoloration (blue or green stain on copper). If not corrected the corrosion formed on metal parts causes short circuits, open circuits, impaired operation of relays, and decreased reliability of the modules.

INSPECTION FOR OVERHEATING. Overheating is usually indicated by discoloration, blisters, bulging parts, or leakage of insulating compounds. Overheating can be caused by overloaded circuits or insufficient ventilation.

INSPECTION FOR MECHANICAL SECURITY. Inspect and tighten all connections, terminals and mountings on module. (Do not over tighten.)

CLEANING PROCEDURES

a. General

(1) Remove dust from module compartments with vacuum cleaner.

(2) Wipe surfaces with a clean, dry cloth.

(3) Use vacuum cleaner to remove any lint that has adhered to the module.

b. Component Cleaning

NOTE

Use only clean alcohol. The cleaning action of alcohol is improved if preheated. Do not overheat or allow alcohol to come in direct contact with source of heat.

(1) Transformers and chokes. Clean the cases and all terminals and connections with alcohol using a hog bristle brush. Dry with a source of low pressure (5 psi) compressed air.

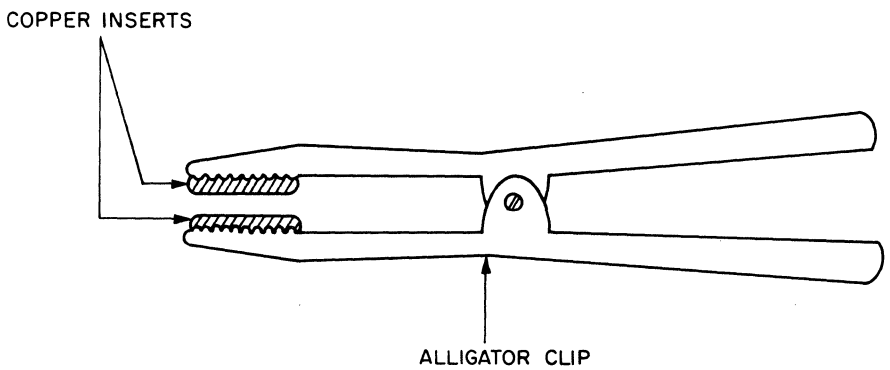

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Figure 1. Heat Sink

(2) Plugs, Jacks, and Receptacles. Remove any corrosion or dirt from contacts with alcohol and hog bristle brush.

c. Corrosion Control

(1) Modules are protected from corrosion by a coating of fungus-resistant lacquer. However, should corrosion occur, remove with alcohol and hog bristle brush. Reapply fungus-resistant lacquer.

(2) The steel frames of modules are cadmium plated and coated with Iridite, to guard against corrosion.

(3) The connector pins are silver- and gold-plated to guard against corrosion.

REASSEMBLY

Reassembly of modules is discussed in the following paragraphs containing repair procedures for each type of module construction.

MODULE REPAIRS AND REPLACEMENT

Module repairs are of three types:

a. module component repairs,

b. module conductor repairs, and

c. module board repairs.

DEFECTIVE COMPONENTS (AXIAL-LEAD TYPE) SOLDERED SIDE ACCESSIBLE

a. Cut the component leads where they bend to enter the component.

CAUTION

Do not allow toluol to come in contact with component side of board or the component markings may be removed.

b. Remove protective coating from area of component mounting pads and component leads with toluol and a hog bristle brush.

CAUTION

Do not heat the copper conductor directly or the copper conductor may separate from the board.

c. Place the tip of the soldering iron on the soldered lead (in the mounting hole) on the under side of the board. The solder and component lead should fall through the component mounting hole.

d. Use soldering aid or scribe to hasten the removal of the cut leads.

e. Bend the leads of the replacement component to fit the board.

f. Insert the leads of the replacement component through the component mounting holes.

g. Bend leads flat on copper side of board, with leads bent in direction of the widest part of the conductor. (See Figure 2.)

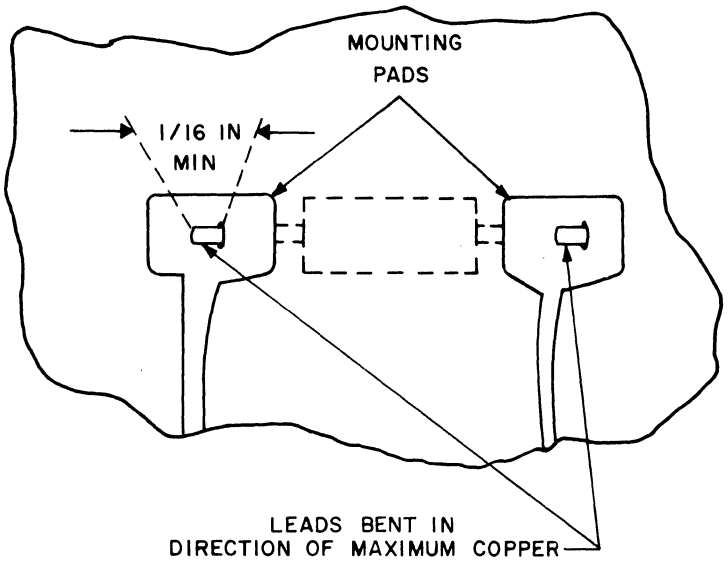


Figure 2. Proper Bending of Leads

h. Cut any excess wire from the leads and solder the leads.

i. Clean repaired area with alcohol and a hog bristle brush.

j. Check the electrical continuity of the circuit with an ohmmeter.

k. Reapply fungus-resistant lacquer with camel hair brush.

l. See Figure 3 for proper mounting illustration.

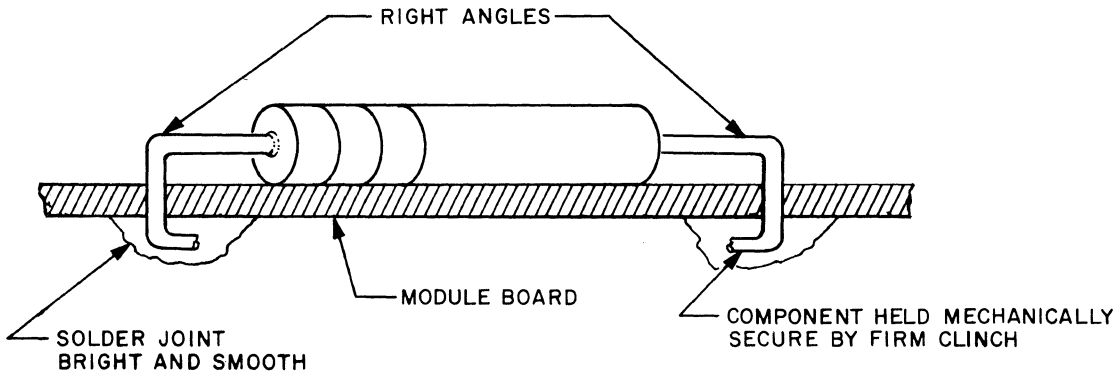


Figure 3. Proper Component Mounting

DEFECTIVE COMPONENTS (AXIAL-LEAD TYPE) SOLDERED SIDE NOT ACCESSIBLE

CAUTION

Do not allow the toluol to come in contact with component side of board or the component markings may be removed.

a. Prepare surfaces of leads by removing fungus-resistant lacquer with toluol and hog bristle brush.

b. If the leads from the defective component are long enough to solder to a replacement component, cut the leads where they enter the defective component.

c. If the leads are too short for the method described, cut the component in half and break it away from the lead. (See Figure 4.)

d. Bend the old component leads into loops.

e. Bend the new component leads into the loops and solder.

f. Cut any excess wire from the component leads.

g. Clean repaired area, with alcohol and a hog bristle brush.

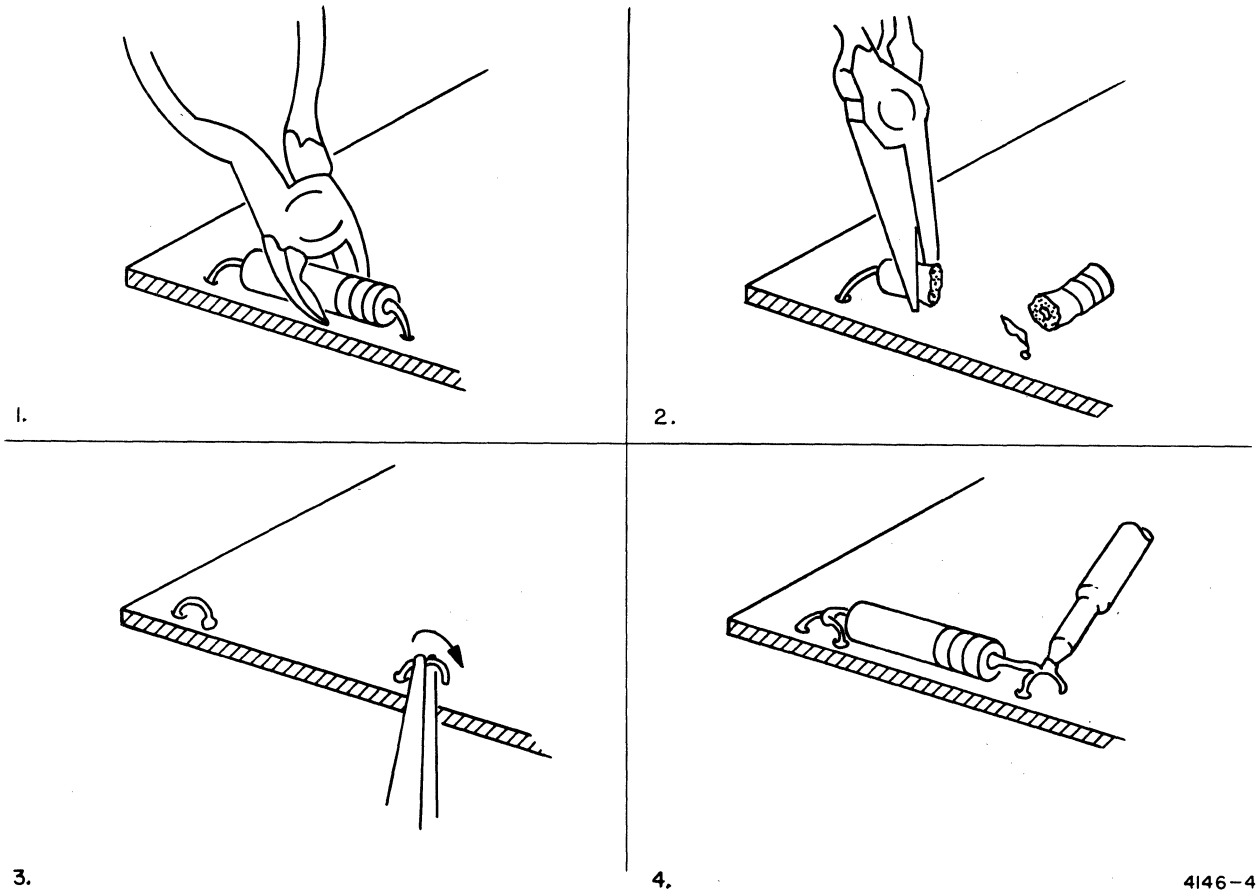


Figure 4. Double-Ended Component Replacement

h. Check electrical continuity of circuit with an ohmmeter.

i. Reapply fungus-resistant lacquer with camel hair brush to repaired area.

DEFECTIVE COMPONENTS (MULTI-LEAD TYPE)

a. Prepare surface of damaged area by removing fungus-resistant lacquer coating with toluol and hog bristle brush.

b. Apply soldering iron to mounting tabs and leads on copper side of board, brushing the solder away as soon as it melts, with hog bristle brush.

c. Carefully straighten mounting tabs and leads.

d. Cut the tabs and leads flush with the board.

e. Apply the soldering iron to the tabs one at a time, while pulling gently on the component.

f. Remove solder splashes with small knife to prevent possible short circuits.

g. Install new component in the appropriate mounting holes.

h. Bend the tabs and leads to their applicable positions and solder.

i. Clean repaired area with alcohol and hog bristle brush.

j. Check electrical continuity of soldered connections with an ohmmeter.

k. Reapply fungus-resistant lacquer to repaired area with a camel hair brush.

PRINTED CIRCUIT REPAIR USING FLAT TINNED BUS WIRE (See Figure 5.)

a. Prepare surface of damaged area by removing fungus-resistant coating with toluol and a hog bristle brush.

b. Place bus wire over the damaged area of conductor to extend a minimum of 1/8 inch in both directions over damaged area.

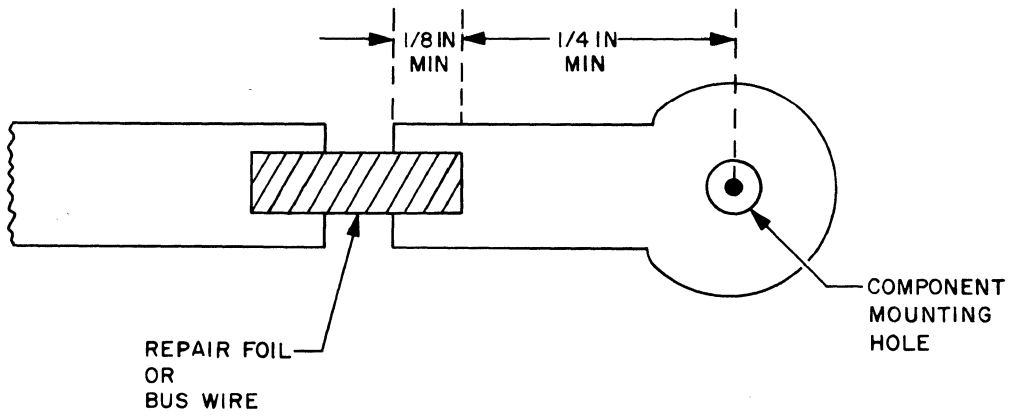


Figure 5. Printed Circuit Repair

c. If either end of the bus wire is less then 1/4 inch from center of mounting hole, the module board is non-repairable and should be replaced.

CAUTION

Do not apply excessive heat or conductor may separate from the board.

d. Solder entire length of bus wire to conductor, holding bus wire firmly with soldering aid or scribe.

e. Remove soldering iron as soon as bond is made.

f. Clean repaired area with alcohol and hog bristle brush.

g. Reapply fungus-resistant lacquer with camel hair brush.

PRINTED CIRCUIT REPAIR USING REPAIR FOIL (See Figure 5.)

a. Using tracing paper, outline that portion of conductor to be replaced.

b. Transfer this outline to the repair foil with carbon paper.

c. Cut the foil along the outline pattern, extending the foil at least 1/8 inch beyond outline but no closer than 1/4 inch to the center of any mounting hole.

d. Prepare surface of damaged area by removing fungus-resistant coating with toluol and a hog bristle brush.

e. Place foil over damaged area of conductor to extend a minimum of 1/8 inch in both directions over damaged area, but no closer than 1/4 inch to the center of any mounting hole. If the end of the foil is closer than 1/4 inch to the center of a mounting hole, the board is non-repairable and should be replaced.

CAUTION

Do not apply excessive heat or conductor may separate from the board.

f. Heat entire length of foil with the soldering iron. Remove heat as soon as bond is made.

g. Clean repaired area with alcohol and a hog bristle brush.

h. Reapply fungus-resistant lacquer with camel hair brush.

BOARD CRACKS UNDER CIRCUIT PATH (See Figure 6.)

a. Remove the fungus-resistant coating around damaged area with toluol and hog bristle brush.

CAUTION

When drilling holes in modules, use protective insulation (rubber insulation) between vise jaws and module board to prevent damage to module.

b. Drill a hole with a No. 55 bit at each end of the crack to prevent extending the crack.

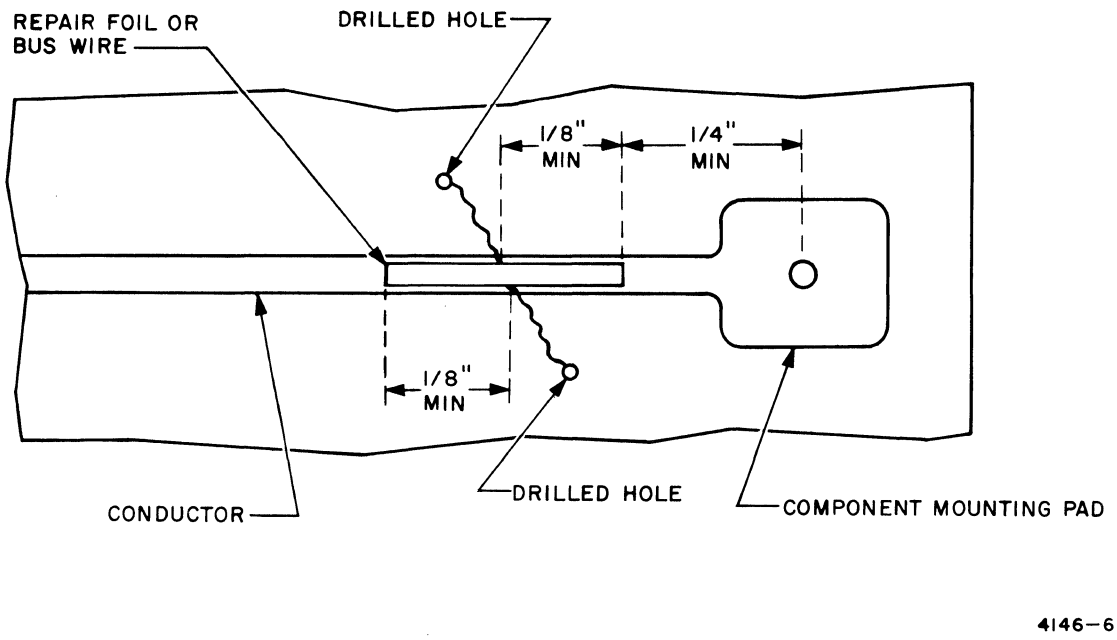


Figure 6. Board Cracks Under Circuit Path

c. Repair the printed circuit, using either bus wire or repair foil, as illustrated in Figure 5.

OTHER MODULE BOARD CRACKS

a. If a crack occurs on the board but does not interfere with holes or components, drill two holes with a No. 55 wire bit, one at each end of the crack.

b. If the crack passes under component mounting pad or through holes of any types the cracks are non-repairable and the board should be replaced.

c. If the cracks originate at edge of board or are caused by inserting components into sockets, the board is considered non-repairable and should be replaced.

MODULE BOARD BLISTERS IN OPEN AREAS

a. Peel blistered area with razor blade.

b. Fill peeled area with AT-N wax.

c. Smooth wax level with board.

d. Apply fungus-resistant lacquer with camel hair brush.

MODULE BOARD BLISTERS UNDER CONDUCTORS

a. If blister is 1/4 inch or less in diameter, peel off blister and affected part of conductor with razor blade.

b. Fill peeled area with AT-N wax.

c. Smooth wax level with board.

d. Repair the printed circuit, using either bus wire or repair foil, as illustrated in Figure 7.

e. If blister is under component mounting pad, module board is non-repairable and should be replaced.

f. If blister is greater than 1/4 inch in diameter, module board is non-repairable and should be replaced.

REPLACING MULTI-PIN CONNECTORS

a. General

(1) Multi-pin connectors may be replaced using either a soldering iron or a soldering pot.

(2) Follow procedures.

b. Using Soldering Iron

(1) Remove fungus-resistant lacquer on connector pins on soldered side of board with toluol and hog bristle brush.

(2) Apply the soldering iron to the connector pins one at a time, brushing away the molten solder with hog bristle brush.

(3) When all solder has been removed from the pins the connector should come away from the board.

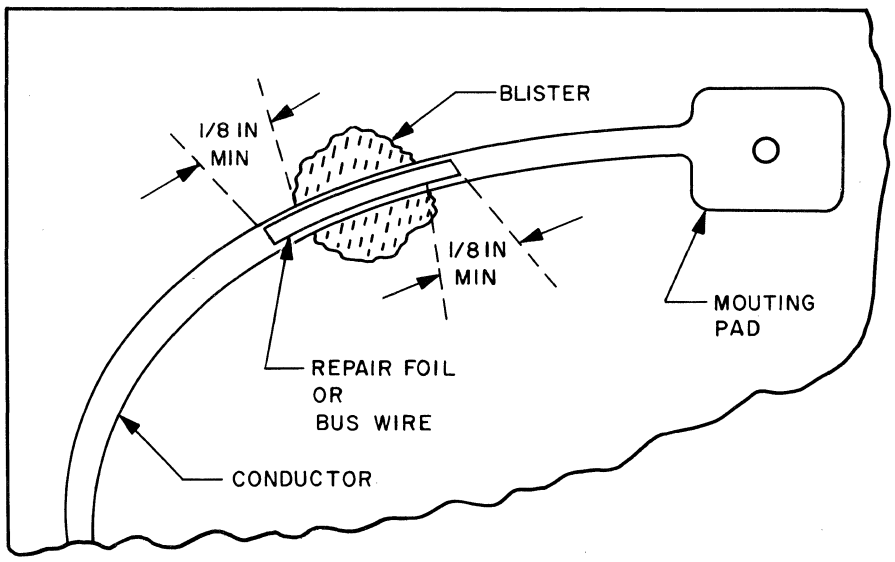


Figure 7. Board Blisters Under Conductors

(4) Replace with new connector, and solder pins one at a time into module board.

(5) Clean repaired area with alcohol and hog bristle brush.

(6) Reapply fungus-resistant lacquer to repaired area with camel hair brush.

c. Using Soldering Pot

NOTE

To remove residue that accumulates on the surface of the molten solder in the pot, drag the edge of a piece of flat metal across the molten surface. Also, care should be taken to maintain the pot at the proper temperature. If the temperature is too high, the board will blister; if too low, excess solder will cling to the printed circuit conductors in the form of peaks. The best means of establishing the correct temperature is to use a discarded module board for test dipping and observing the results.

(1) Remove fungus-resistant lacquer on connector pins on soldered side of board with toluol and hog bristle brush.

(2) Immerse connector pins on soldered side of board into molten solder in pot.

(3) Remove pins from pot, when solder in connector pins turns molten.

(4) Remove connector from module board with long nose pliers.

(5) Replace with new connector, and solder pins one at a time into module board.

(6) Clean repaired area with alcohol and hog bristle brush.

(7) Clean repaired area with alcohol and hog bristle brush.

(8) Reapply fungus-resistant lacquer with camel hair brush to repaired area.

WIRING

The following paragraphs describe general wiring methods which must be used so that the output timing relationships specified for each module are met. Special rules and exceptions for individual modules are included in the description for each module, when required.

OPEN WIRE

Open wire is point-to-point wiring with a minimum of tight bunching of wires, using no cables or harnesses. To keep all wires as short as possible, inputs should be connected to an output on a nearby module; therefore associated modules must be grouped as close together as possible. A maximum length applies to the greatest length of a wire connecting a single input to a single output, or to the combined length from a single output to a set of common jumpered inputs. A maximum fan-out length applies to the greatest total length of wire from an output to several inputs not jumpered. No single wire of the fan-out set can exceed the maximum length. Open wire must be at least No. 24 gauge insulated wire (RCA No. 999127).

TWISTED PAIR

When twisted pair wire (RCA No. 2182166-9) is used, each end of the return wire must be grounded at the modules which are being interconnected. Open wire may be used to connect loads to a twisted pair line provided the loads so connected are located on the module to which the return wire of the twisted pair is grounded, or on a module immediately adjacent to that module. In this case, no open wire may be more than six inches long.

EXTENDER POINTS

The following rules apply when connecting extender points on gates to auxiliary diodes.

a. Not more than three sets of auxiliary diodes shall be used on one gate.

b. Point-to-point wiring shall be used for all auxiliary diodes.

c. The maximum length of wire between a gate extender point and auxiliary diodes shall be less than six inches.

LAMP (SUBMODULE 154)

RCA 2110154-501

DESCRIPTION

The 154 submodule contains three identical indicator lamp circuits. These indicator lamps are turned on or off by outputs of logic circuits.

CIRCUIT ANALYSIS

A common 1.0 v source is applied to all filaments. A common +50 v source is applied to all plates. The grid inputs are connected, through 100 K resistors, to the outputs of logic circuits. When the logic input level is -3 v, the lamp is off; when the logic input level is 0 v, the lamp is on.

CIRCUIT CHARACTERISTICS

The input to each indicator lamp circuit is the output of a gate.

LOADING

The load of a single indicator lamp circuit on a gate output is negligible.

POWER REQUIREMENTS

Nominal heater power for a single indicator lamp circuit is 0.03 watt nominal at 1.0 v. Nominal plate power is 0.03 watt nominal at +50 v.

WIRING

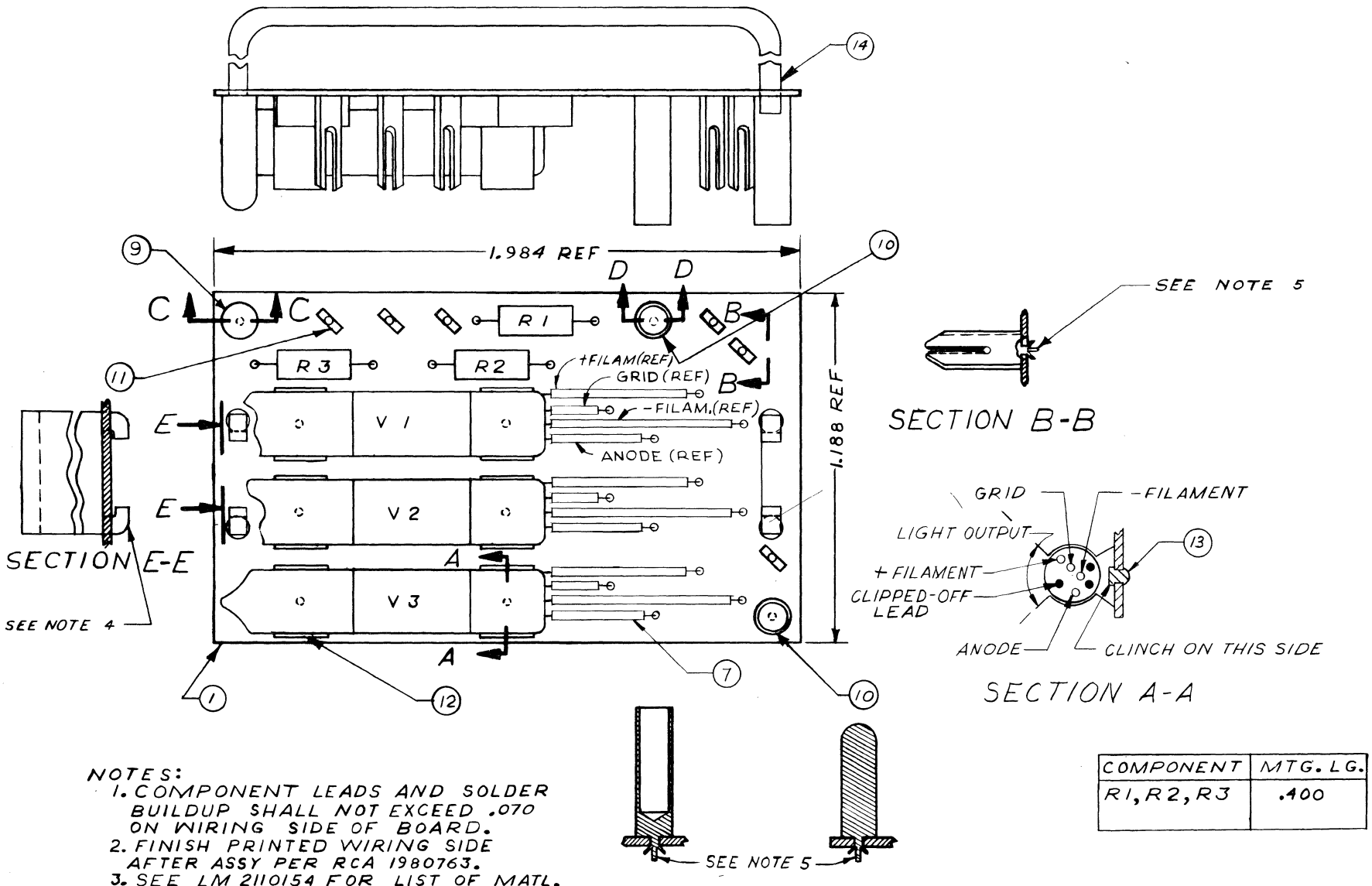
The 154 submodule is connected to a related assembly without wiring. Wiring to the assembly from logic modules must conform to the requirements of the logic module.

PARTS LIST

Table 1 lists parts for the 154 submodule. The 154 submodule assembly is illustrated in Figure 1, and the schematic diagram is illustrated in Figure 2.

Table 1. Lamp (Submodule 154) Parts List

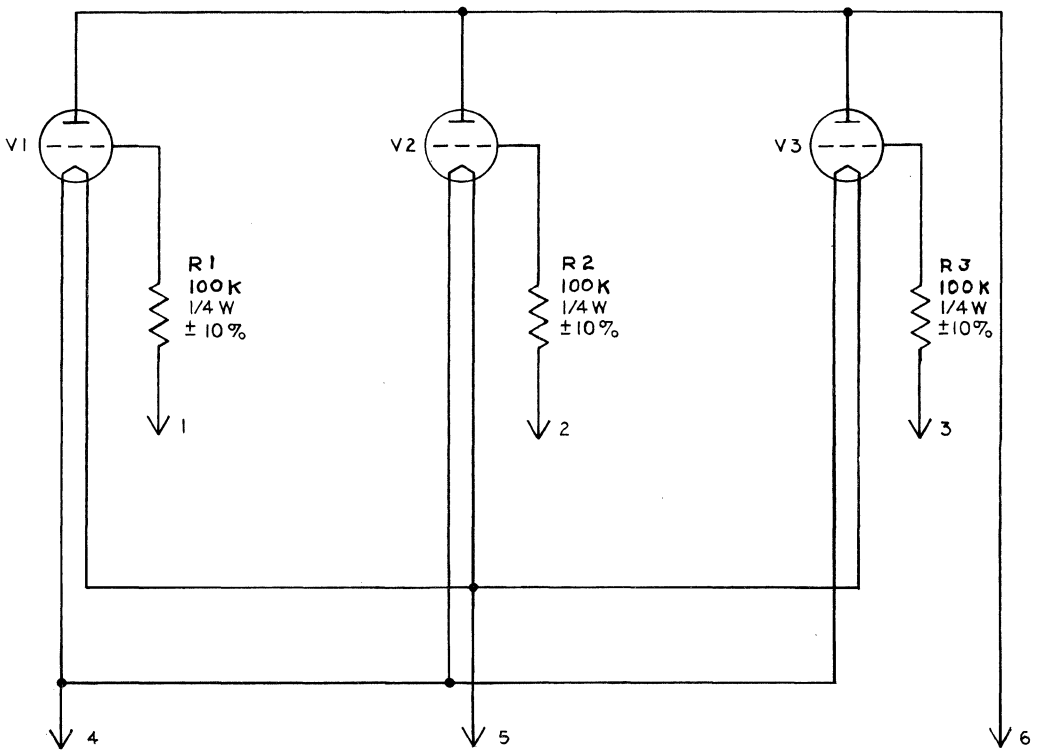
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R1	RC07GF104K	Resistor, fixed, composition, 100 k, 1/4 w, ±10%
1	R2	RC07GF104K	Resistor, fixed, composition, 100 k, 1/4 w, ±10%
1	R3	RC07GF104K	Resistor, fixed, composition, 100 k, 1/4 w, ±10%
1	V1	2180898-1	Light, indicator
1	V2	2180898-1	Light, indicator
1	V3	2180898-1	Light, indicator
1	2	2110156-1	Board, printed circuit
AR	7	2010823-451	Sleeving
AR	8	2010164-2	Solder
1	9	2183294-1	Guide pin (male)
2	10	2183294-2	Guide pin (female)
6	11	1710297-1	Contact, printed circuit board
6	12	1005603-47	Clip, component
6	13	MS16535-22	Rivet, tubular
1	14	2141606-1	Handle, lamp submodule



NOTES:
1. COMPONENT LEADS AND SOLDER BUILDUP SHALL NOT EXCEED .070 ON WIRING SIDE OF BOARD.
2. FINISH PRINTED WIRING SIDE AFTER ASSY PER RCA 1980763.
3. SEE LM 2110154 FOR LIST OF MATL.
4. CRIMP HANDLE AFTER DIP SOLDERING.
5. SEE 2020343 FOR STAKING SPECIFICATION.
6. WIPE DIRECTION TO FOLLOW DIRECTION OF ELONGATED COPPER PAD.
7. INSTALL SLEEVING, ITEM 7, OVER WIRES ON V1, V2, AND V3 FROM LAMP TO PAD BEFORE DIP SOLDERING.

COMPONENT	MTG. LG.
R1, R2, R3	.400

Figure 1. Lamp (Submodule 154), Assembly Drawing



NOTE:
1. ALL RESISTOR VALUES ARE IN OHMS.

Figure 2. Lamp (Submodule 154), Schematic Diagram

HIGH SPEED GATE (MODULE 401)

RCA 2162401-501

DESCRIPTION

The 401 module contains eight multi-input high-speed NOR gates, eight independent collector resistors, one three-diode group having common cathodes, one two-diode group having common cathodes, seven ground connections, and three line filter capacitors. Any gate used must have a collector resistor. The diode groups may be used to modify the input to any gate. Gates may be cross-coupled to form flip-flops.

CIRCUIT ANALYSIS

Operation of each gate is identical. The number of possible inputs is the major difference between any two gates. Detailed operation is described for gate 3.

The nominal level of a logical 0 input is -5.5 v; the nominal level of a logical 1 input is 0 v. When the input to diode CR9, CR10, or CR11 is a logical 1, the junction of all diodes and resistor R6 is held near 0 v. When this condition exists, resistor R7 and diode CR13 hold transistor Q3 cut off by maintaining the base voltage at a positive potential. With transistor Q3 cut off, the collector voltage level is near power supply output of -5.5 v. When the inputs to diodes CR9, CR10, and CR11 are all at the logical 0 level, the junction of the diodes and resistor R6 is held near -5.5 v. When this condition exists, resistor R7 and diode CR13 hold transistor Q3 in saturation by maintaining the base voltage at a negative potential. With transistor Q3 in saturation, the output at the collector is near 0 v.

A diode group may be connected to auxiliary inputs of gates 2, 5, 7, and 8 to increase the number of inputs. The outputs of one or more gates may be connected to a common collector resistor. Gates or diode groups on one 401 module may be connected with gates on another 401 module.

If the output of gate 1 is connected to input 1 of gate 2, and the output of gate 2 connected to input 1 of gate 1, the gates form a flip-flop controlled by the remaining two inputs. However, the system design must be such that these inputs are always at opposite levels to prevent ambiguous changes of state of the flip-flop. The outputs of the gates used to form the flip-flop may drive other circuits in addition to the cross-coupled gate.

Capacitors C1, C2, and C3 are line filter capacitors for the -5.5 v, +12 v, and -16.5 v power supplies, respectively.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Output logic levels are described in Table 2. Current polarity is specified in terms of current flow; OUT indicates current flow from the output terminal, IN indicates current flow to the output terminal. Waveforms and timing are illustrated in Figure 1.

Table 1. Input Logic Levels

LEVEL	VOLTAGE	CURRENT
0	-5.5 v (+1.5 v, -2.5 v)	0 ma maximum
1	0 v (+1.0 v, -0.8 v)	4.0 ma maximum

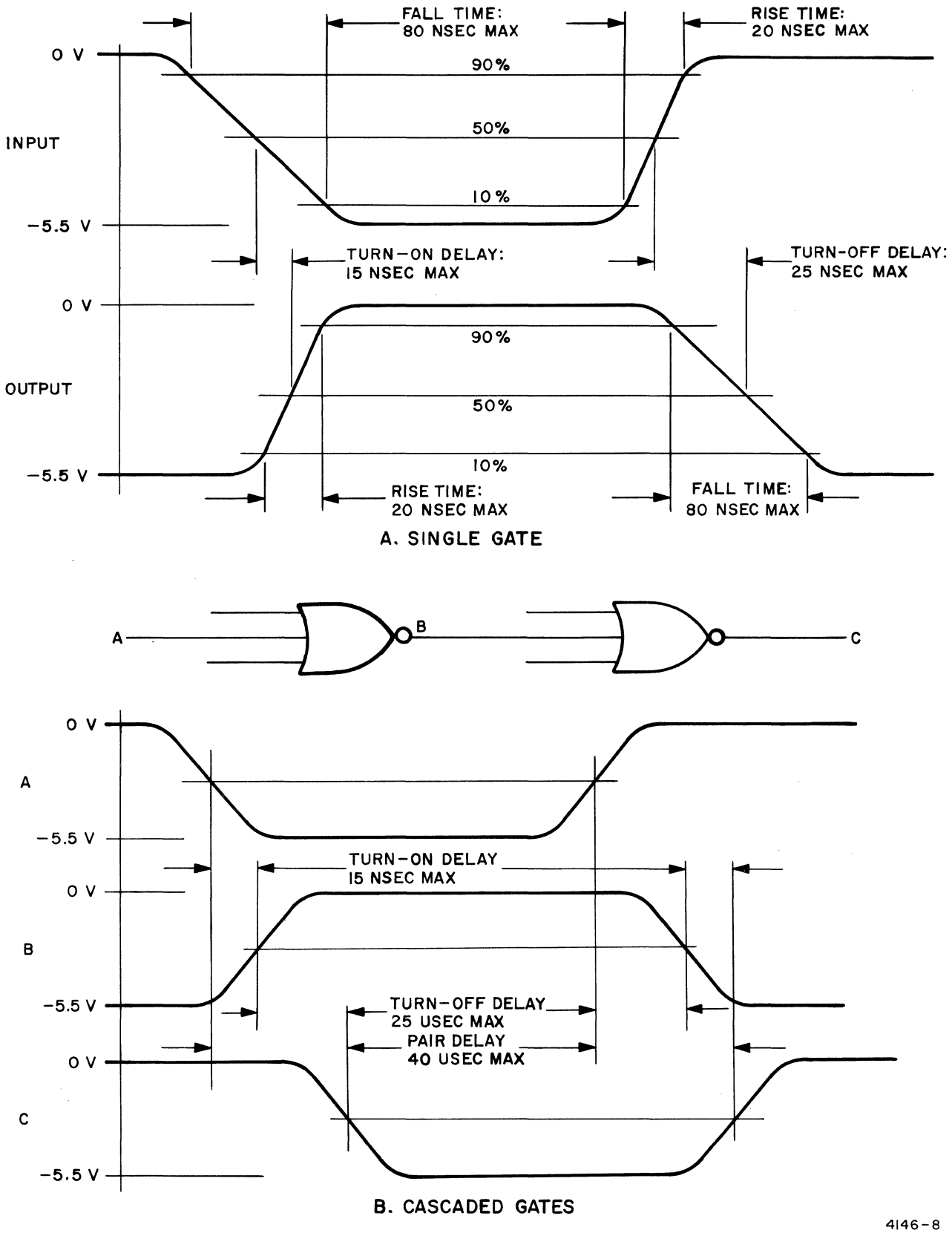


Figure 1. 401 Module, Waveforms and Timing

Table 2. Output Logic Levels

LEVEL	VOLTAGE	CURRENT	
		With Collector Resistor	Without Collector Resistor
0	-5.5 v (+ 0.55 v, -0.55v)	0.0 ma maximum	0.0 maximum
1	0 v, (+ 0.0 v, -0.4 v)	0.0 ma maximum IN 35.4 ma maximum OUT	0.0 ma maximum IN 55.0 ma maximum OUT

LOADING

Each input to a gate is one unit load. Each gate can drive eight unit loads. Gates connected in pairs, as indicated in Figure 2, can drive 21 unit loads, and the common input is two unit loads. Gates connected in triplicate, as indicated in Figure 2, can drive 36 unit loads, and the common input is three unit loads. The illustrations show identical inputs to each gate. If the inputs can be arranged so that all gates are always activated identically, identical inputs are not necessary.

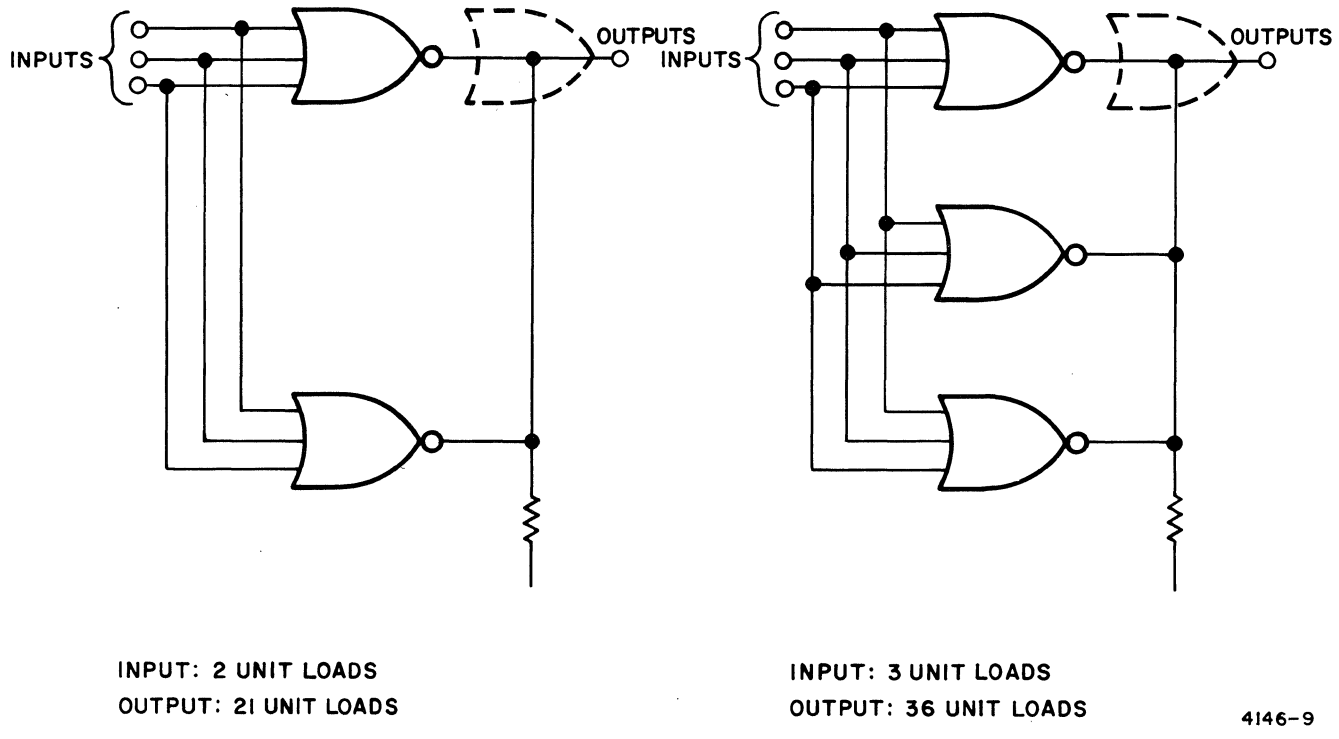


Figure 2. 401 Module Multiple Connections

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT All Transistors Saturated	CURRENT All Transistors Cut OFF
+12 v ± 5%	2.26 ma maximum 1.96 ma nominal	1.87 ma maximum 1.65 ma nominal
-16.5 v ± 5%	26.8 ma maximum 23.84 ma nominal	31.04 ma maximum 27.28 ma nominal
-5.5 v ± 10%	156.8 ma maximum 128 ma nominal	0 ma maximum 0 ma nominal

WIRING

Table 4 lists maximum lengths of wire which may be used.

Table 4. Wiring

OPEN WIRE	
Maximum length	21 Inches
Fan-out length	72 Inches
TWISTED PAIR	
Maximum length	96 Inches
Single load	120 Inches

PARTS LIST

Table 5 lists parts for the 401 module. The 401 module assembly is illustrated in Figure 3, and the schematic diagram is illustrated in Figure 4.

Table 5. High Speed Gate (Module 401) Parts List

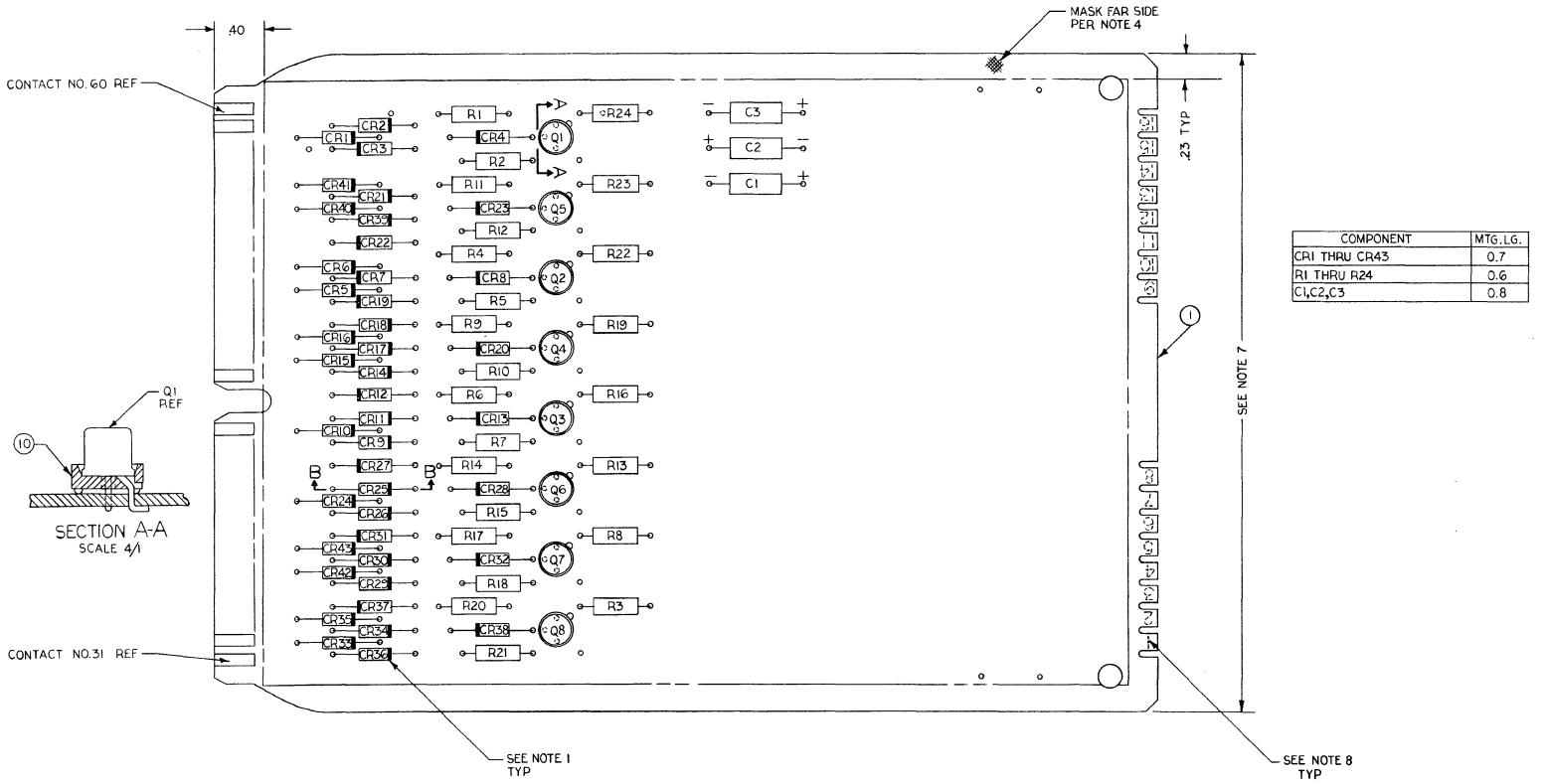
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-25	Capacitor, tantalum, fixed, 6.8 μf, ±20%, 10 vdc
1	C3	8412778-95	Capacitor, tantalum, fixed, 6.8 μf, ±20%, 35 vdc
1	C4	8412778-95	Capacitor, tantalum, fixed, 6.8 μf, ±20%, 35 vdc
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2180816-3	Semiconductor device, diode
1	CR5	2180820-1	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180816-3	Semiconductor device, diode
1	CR9	2180820-1	Semiconductor device, diode
1	CR10	2180820-1	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180816-3	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	CR17	2180820-1	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2180820-1	Semiconductor device, diode
1	CR20	2180816-3	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2180820-1	Semiconductor device, diode
1	CR23	2180816-3	Semiconductor device, diode
1	CR24	2180820-1	Semiconductor device, diode

Table 5. High Speed Gate (Module 401) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR25	2180820-1	Semiconductor device, diode
1	CR26	2180820-1	Semiconductor device, diode
1	CR27	2180820-1	Semiconductor device, diode
1	CR28	2180816-3	Semiconductor device, diode
1	CR29	2180820-1	Semiconductor device, diode
1	CR30	2180820-1	Semiconductor device, diode
1	CR31	2180820-1	Semiconductor device, diode
1	CR32	2180816-3	Semiconductor device, diode
1	CR33	2180820-1	Semiconductor device, diode
1	CR34	2180820-1	Semiconductor device, diode
1	CR35	2180820-1	Semiconductor device, diode
1	CR36	2180820-1	Semiconductor device, diode
1	CR37	2180820-1	Semiconductor device, diode
1	CR38	2180816-3	Semiconductor device, diode
1	CR39	2180820-1	Semiconductor device, diode
1	CR40	2180820-1	Semiconductor device, diode
1	CR41	2180820-1	Semiconductor device, diode
1	CR42	2180820-1	Semiconductor device, diode
1	CR43	2180820-1	Semiconductor device, diode
1	Q1	2180811-1	Semiconductor device, transistor
1	Q2	2180811-1	Semiconductor device, transistor
1	Q3	2180811-1	Semiconductor device, transistor
1	Q4	2180811-1	Semiconductor device, transistor
1	Q5	2180811-1	Semiconductor device, transistor
1	Q6	2180811-1	Semiconductor device, transistor
1	Q7	2180811-1	Semiconductor device, transistor
1	Q8	2180811-1	Semiconductor device, transistor

Table 5. High Speed Gate (Module 401) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R1	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, ½ w
1	R2	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, ½ w
1	R3	2182165-20	Resistor, fixed, film, 330 ohms, ±2%, ½ w
1	R4	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, ½ w
1	R5	2182165-73	Resistor, fixed, film, 51 k ohms ±2%, ½ w
1	R6	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, ½ w
1	R7	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, ½ w
1	R8	2182165-20	Resistor, fixed, film, 330 ohms, ±2%, ½ w
1	R9	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, ½ w
1	R10	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, ½ w
1	R11	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, ½ w
1	R12	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, ½ w
1	R13	2182165-20	Resistor, fixed, film, 330 ohms, ±2%, ½ w
1	R14	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, ½ w
1	R15	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, ½ w
1	R16	2182165-20	Resistor, fixed, film, 330 ohms, ±2%, ½ w
1	R17	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, ½ w
1	R18	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, ½ w
1	R19	2182165-20	Resistor, fixed, film, 330 ohms, ±2%, ½ w
1	R20	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, ½ w
1	R21	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, ½ w
1	R22	2182165-20	Resistor, fixed, film, 330 ohms, ±2%, ½ w
1	R23	2182165-20	Resistor, fixed, film, 330 ohms, ±2%, ½ w
1	R24	2182165-20	Resistor, fixed, film, 330 ohms, ±2%, ½ w
1	1	2161394-1	Board printed circuit
8	10	2180896-2	Pad, transistor mounting

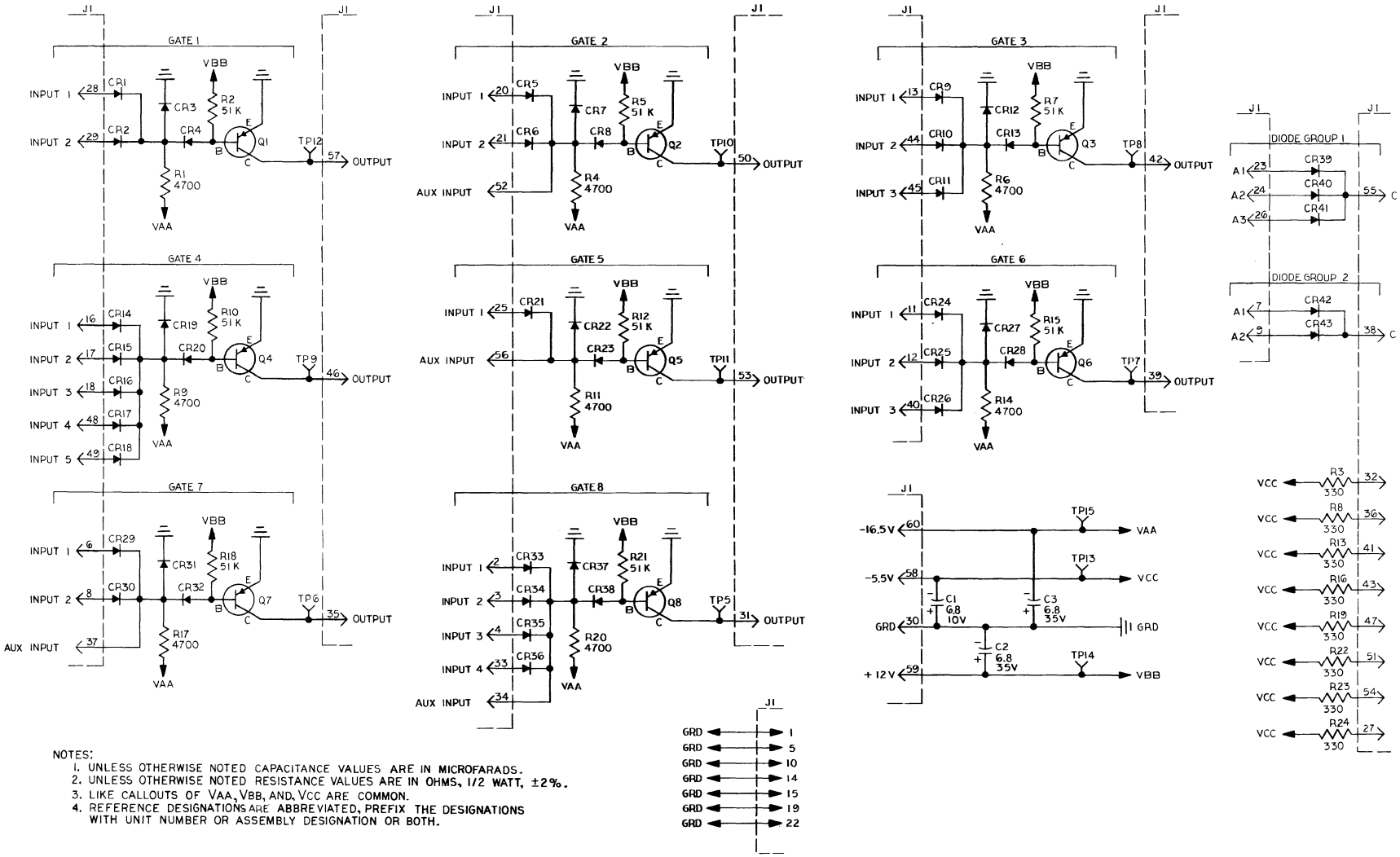


COMPONENT	MTG.LG.
CR1 THRU CR43	0.7
R1 THRU R24	0.6
C1,C2,C3	0.8

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON WIRING SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 (USING EPOXY POLYAMIDE PER 2020341.)
5. ASSEMBLE PER 8030660
6. SOLDER PER 8030526
7. VARIATION FROM FLATNESS SHALL NOT EXCEED 0.050 AS SPECIFIED IN 8030675 FOR THE BOARD DEMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER PER 2181314.
9. FOR LIST OF MATERIALS SEE LM2162401
10. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.

Figure 3. High Speed Gate (Module 401), Assembly Drawing



NOTES:
1. UNLESS OTHERWISE NOTED CAPACITANCE VALUES ARE IN MICROFARADS.
2. UNLESS OTHERWISE NOTED RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, ±2%.
3. LIKE CALLOUTS OF VAA, VBB, AND VCC ARE COMMON.
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

Figure 4. High Speed Gate (Module 401), Schematic Diagram

LOW SPEED GATE (MODULE 402)

RCA 2162402-501

DESCRIPTION

The 402 module contains eight low-speed gates, two two-diode groups having common cathodes, one independent diode, a regulated power supply, two line filter capacitors, and five ground connections. The gates include four 2-input NAND gates and four 4-input NAND gates. Each of the 4-input NAND gates consists of 2-input OR gates forming two of its NAND inputs, a 1-input OR gate forming one of its NAND inputs, and a 1-input OR gate with an auxiliary input forming one of its NAND inputs. The diode groups may be used at auxiliary inputs to increase the number of inputs.

CIRCUIT ANALYSIS

The logic equation for gates 1, 3, 5, and 7 is:

$$\overline{(\text{IN } 1) \cdot (\text{IN } 2)} = (\text{OUT})$$

The logic equation for gates 2, 4, 6, and 8 is:

$$\overline{(\text{IN } 1 + \text{IN } 2) \cdot (\text{IN } 3 + \text{IN } 4) \cdot (\text{IN } 5 + \text{AUX IN}) \cdot (\text{IN } 6)} = (\text{OUT})$$

The major difference between the two sets of gates is the number and variety of inputs. Operation of each gate is similar; therefore only gate 1 is described in detail, and major differences are explained.

The nominal level of a logical 0 input is -4.5 v; the nominal level of a logical 1 input is 0 v. When the input to diode CR1 is a logical 0, the junction of diodes CR1 and CR3, and resistor R1, is held near -4.5 v, and the junction of diodes CR3, CR4, and CR5 is held at a negative potential. If at this time the input to diode CR2 is a logical 1, the junction of diodes CR2 and CR4, and resistor R2 is held near 0 v, so that diode CR4 is back-biased. Thus, if either input is a logical 0, the junction of diodes CR3, CR4, and CR5 is held at a negative potential, for even if the other input is a logical 1, its associated diode (CR3 or CR4) will be back-biased. With the cathode of diode CR5 held at a negative potential, transistor Q1 is saturated, and its collector voltage is near 0 v. When each input is a logical 1, the junction of diodes CR3, CR4, and CR5 is at a positive potential, transistor Q1 is cut off, and the collector voltage is clamped at -4.5 v by current flow through resistor R4 and diode CR6.

Gates 2, 4, 6, and 8 have a five-diode junction corresponding to the three-diode junction of gates 1, 3, 5, and 7. For example, the five-diode junction CR13, CR14, CR15, CR16, and CR17 performs the same function in gate 2 that the three-diode junction CR3, CR4, and CR5 performs in gate 1. Diodes CR7, CR8, and CR13, and resistor R5 form a two-input OR gate feeding one input of the NAND gate. If either input is a logical 1, the junction is held near 0 v and the remaining diode is back-biased. The auxiliary input, together with diode CR12 and a diode group, can be used to form a three-input OR gate feeding the NAND input.

Resistor R41, Zener diode CR78, and capacitor C2 form a voltage regulating circuit for -4.5 v. Capacitors C1 and C3 are line filter capacitors for the +12 v supply and the -16.5 v supply, respectively.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Output logic levels are described in Table 2. Current polarity is specified in terms of current flow; OUT indicates current flow from the output terminals, IN indicates current flow to the output terminal. Waveforms and timing are illustrated in Figure 1.

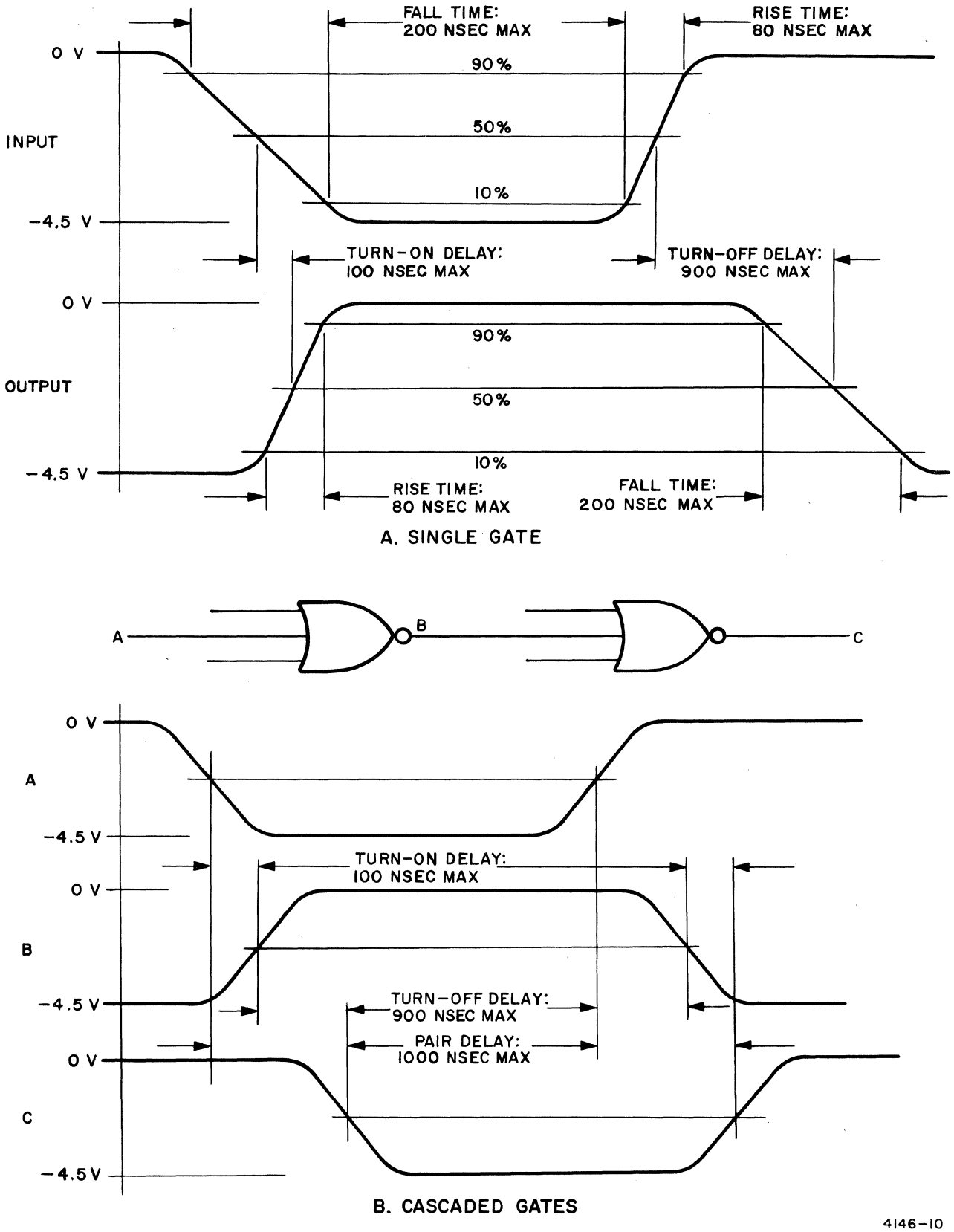


Figure 1. 402 Module, Waveforms and Timing

Table 1. Input Logic Levels

LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.4 v, -3.5 v)	0 ma maximum
1	0.0 v (+0.3 v, -0.8 v)	4.0 ma maximum

Table 2. Output Logic Levels

LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.1 v, -1.1 v)	6.0 ma OUT maximum 5.4 ma IN maximum
1	0.0 v (+0.0 v, -0.5 v)	34.5 ma OUT maximum 5.4 ma IN maximum

LOADING

Each input to a gate is one unit load. Each gate can drive eight unit loads or one steer input or one trigger input of a 403 module flip-flop.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT All Transistors Saturated	CURRENT All Transistors Cut Off
+12 v ± 5%	6.64 ma nominal 7.64 ma maximum	5.45 ma nominal 7.0 ma maximum
-16.5 v ± 5%	148.5 ma nominal 172 ma maximum	135 ma nominal 160 ma maximum

WIRING

Table 4 lists maximum lengths of wire which may be used.

Table 4. Wiring

OPEN WIRE	
Maximum length	36 Inches
Fan-out length	72 Inches
TWISTED PAIR	
Maximum length	96 Inches
Single load	120 Inches

PARTS LIST

Table 5 lists parts for the 402 module. The 402 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 5. Low Speed Gate (Module 402) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-95	Capacitor, tantalum electrolytic
1	C2	8412778-25	Capacitor, tantalum electrolytic
1	C3	8412778-95	Capacitor, tantalum electrolytic
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180816-3	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	2180820-1	Semiconductor device, diode
1	CR10	2180820-1	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180820-1	Semiconductor device, diode

Table 5. Low Speed Gate (Module 402) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	CR17	2180816-3	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2180820-1	Semiconductor device, diode
1	CR20	2180820-1	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2180820-1	Semiconductor device, diode
1	CR23	2180820-1	Semiconductor device, diode
1	CR24	2180820-1	Semiconductor device, diode
1	CR25	2180816-3	Semiconductor device, diode
1	CR26	2180820-1	Semiconductor device, diode
1	CR27	2180820-1	Semiconductor device, diode
1	CR28	2180820-1	Semiconductor device, diode
1	CR29	2180820-1	Semiconductor device, diode
1	CR30	2180820-1	Semiconductor device, diode
1	CR31	2180820-1	Semiconductor device, diode
1	CR32	2180820-1	Semiconductor device, diode
1	CR33	2180820-1	Semiconductor device, diode
1	CR34	2180820-1	Semiconductor device, diode
1	CR35	2180820-1	Semiconductor device, diode
1	CR36	2180820-1	Semiconductor device, diode
1	CR37	2180816-3	Semiconductor device, diode
1	CR38	2180820-1	Semiconductor device, diode
1	CR39	2180820-1	Semiconductor device, diode
1	CR40	2180820-1	Semiconductor device, diode

Table 5. Low Speed Gate (Module 402) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR41	2180820-1	Semiconductor device, diode
1	CR42	2180820-1	Semiconductor device, diode
1	CR43	2180816-3	Semiconductor device, diode
1	CR44	2180820-1	Semiconductor device, diode
1	CR45	2180820-1	Semiconductor device, diode
1	CR46	2180820-1	Semiconductor device, diode
1	CR47	2180820-1	Semiconductor device, diode
1	CR48	2180820-1	Semiconductor device, diode
1	CR49	2180820-1	Semiconductor device, diode
1	CR50	2180820-1	Semiconductor device, diode
1	CR51	2180820-1	Semiconductor device, diode
1	CR52	2180820-1	Semiconductor device, diode
1	CR53	2180820-1	Semiconductor device, diode
1	CR54	2180820-1	Semiconductor device, diode
1	CR55	2180820-1	Semiconductor device, diode
1	CR56	2180816-3	Semiconductor device, diode
1	CR57	2180820-1	Semiconductor device, diode
1	CR58	2180820-1	Semiconductor device, diode
1	CR59	2180820-1	Semiconductor device, diode
1	CR60	2180820-1	Semiconductor device, diode
1	CR61	2180820-1	Semiconductor device, diode
1	CR62	2180816-3	Semiconductor device, diode
1	CR63	2180820-1	Semiconductor device, diode
1	CR64	2180820-1	Semiconductor device, diode
1	CR65	2180820-1	Semiconductor device, diode
1	CR66	2180820-1	Semiconductor device, diode
1	CR67	2180820-1	Semiconductor device, diode

Table 5. Low Speed Gate (Module 402) Parts List (cont)

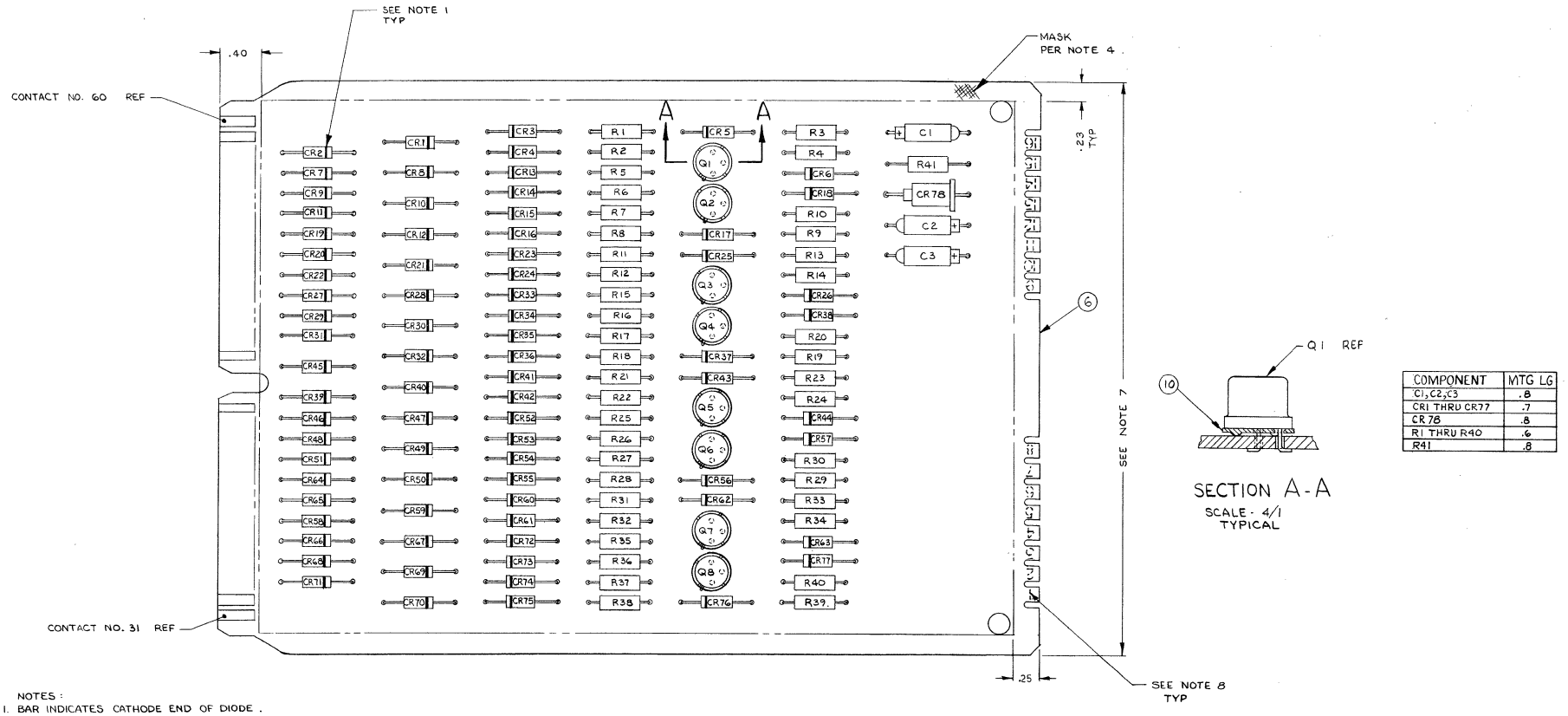
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR68	2180820-1	Semiconductor device, diode
1	CR69	2180820-1	Semiconductor device, diode
1	CR70	2180820-1	Semiconductor device, diode
1	CR71	2180820-1	Semiconductor device, diode
1	CR72	2180820-1	Semiconductor device, diode
1	CR73	2180820-1	Semiconductor device, diode
1	CR74	2180820-1	Semiconductor device, diode
1	CR75	2180820-1	Semiconductor device, diode
1	CR76	2180816-3	Semiconductor device, diode
1	CR77	2180820-1	Semiconductor device, diode
1	CR78	2182181-1	Semiconductor device, diode
1	Q1	2182800-1	Semiconductor device, transistor
1	Q2	2182800-1	Semiconductor device, transistor
1	Q3	2182800-1	Semiconductor device, transistor
1	Q4	2182800-1	Semiconductor device, transistor
1	Q5	2182800-1	Semiconductor device, transistor
1	Q6	2182800-1	Semiconductor device, transistor
1	Q7	2182800-1	Semiconductor device, transistor
1	Q8	2182800-1	Semiconductor device, transistor
1	R1	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ±2%
1	R2	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R3	2182165-60	Resistor, fixed, film, 15 k, 1/2 w, ± 2%
1	R4	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R5	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R6	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R7	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R8	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%

Table 5. Low Speed Gate (Module 402) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R9	2182165-60	Resistor, fixed, film, 15 k, 1/2 w, ± 2%
1	R10	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R11	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R12	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R13	2182165-60	Resistor, fixed, film, 15 k, 1/2 w, ± 2%
1	R14	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R15	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R16	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R17	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R18	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R19	2182165-60	Resistor, fixed, film, 15 k, 1/2 w, ± 2%
1	R20	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R21	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R22	2182165-48	Resistor, fixed, film, 4700 ohms. 1/2 w, ± 2%
1	R23	2182165-60	Resistor, fixed, film, 15 k, 1/2 w, ± 2%
1	R24	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R25	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R26	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R27	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R28	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R29	2182165-60	Resistor, fixed, film, 15 k, 1/2 w, ± 2%
1	R30	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R31	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R32	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R33	2182165-60	Resistor, fixed, film, 15 k, 1/2 w, ± 2%
1	R34	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R35	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R36	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%

Table 5. Low Speed Gate (Module 402) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R37	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R38	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R39	2182165-60	Resistor, fixed, film, 15 k, 1/2 w, ± 2%
1	R40	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R41	2182165-32	Resistor, fixed, film, 1000 ohms, 1/2 w, ± 2%



COMPONENT	MTG LG
C1, C2, C3	.8
CR1 THRU CR77	.7
CR78	.8
R1 THRU R40	.6
R41	.8

NOTES :
1. BAR INDICATES CATHODE END OF DIODE .
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON WIRING SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 (USING EPOXY POLYAMIDE PER 2020341).
5. ASSEMBLE PER 8030660
6. SOLDER PER 8030526
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
9. FOR LIST OF MATERIALS SEE LM 2162402.

Figure 2. Low Speed Gate (Module 402), Assembly Drawing

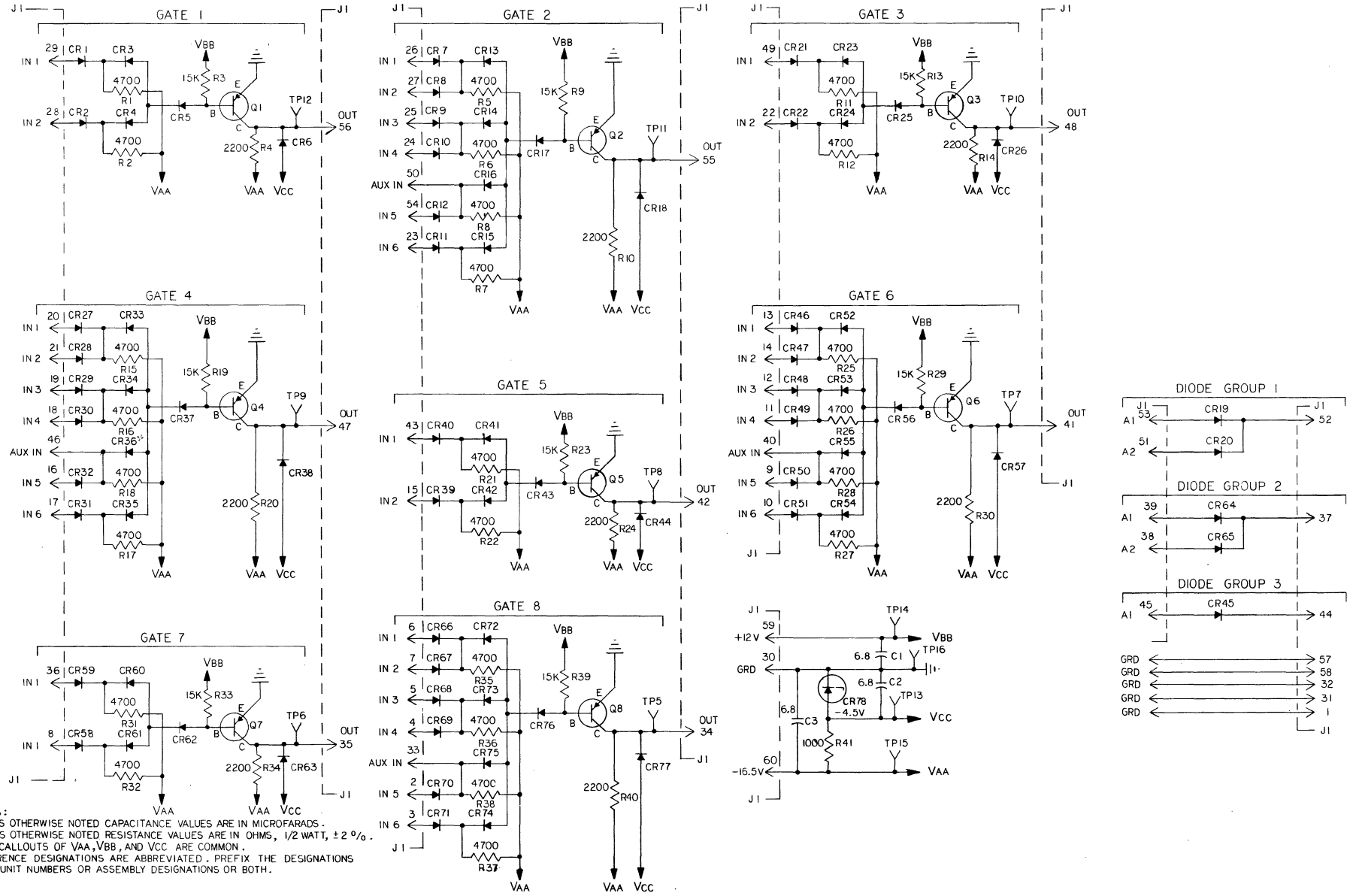


Figure 3. Low Speed Gate (Module 402), Schematic Diagram

MULTIPURPOSE FLIP-FLOP (MODULE 403)

RCA 2162403-501

DESCRIPTION

The 403 module contains 1 high-speed flip-flop, 3 low-speed flip-flops, a regulated power supply, 2 line filter capacitors and 13 ground connections.

CIRCUIT ANALYSIS

All flip-flops operate in a similar manner, therefore only one circuit is described in detail. The nominal level of a logical 0 set or reset input is -4. 5 v; the nominal level of a logical 1 set or reset input is 0 v. When flip-flop 1 is in the set state, transistor Q1 is cut off and transistor Q2 is saturated. The output at the collector of transistor Q1 is clamped at -4. 5 v by current flow through resistor R7 and diode CR5. The base of transistor Q1 is biased at cutoff by current flow through resistors R3 and R1. The output at the collector of transistor Q2 is near 0 v, and its base is biased at saturation by current flow through resistors R6, R4, and R2. The output of transistor Q2 is coupled through diode CR4 to the junction of resistors R3 and R5, holding that junction near the 0 v level; the output of transistor Q1 is coupled through diode CR3 to the junction of resistors R4 and R6, holding that junction near the -4. 5 v level. If both the set and the reset inputs are at the logical 0 level (-4. 5 v), the flip-flop remains in the set state, since diode CR1 is back-biased, and diode CR2 provides an input identical to that provided by the output of transistor Q1. If the set input rises to the logical 1 level (0 v), no change of state will take place, because the same level is supplied from the output of transistor Q2. If the reset input rises to the logical 1 level, the junction of resistors R4 and R6 rises to 0 v, driving transistor Q2 from saturation to cutoff. As transistor Q2 is driven to cutoff, its collector voltage falls from 0 v to -4. 5 v. This negative-going voltage is applied to the junction of resistors R3 and R5, driving transistor Q1 from cutoff to saturation. The collector voltage of transistor Q1 rises from -4. 5 v to 0 v, and is coupled through diode CR3 to the junction of resistors R4 and R6 to complete and maintain the change of state. In the reset state, transistor Q1 is saturated and transistor Q2 is cut off, the outputs are cross-coupled through diodes CR3 and CR4, and the flip-flop changes state if the set input rises to the logical 1 level. Normally, the set input and the reset input are not both at the logical 1 level at the same time.

Changes of state can also be made by a positive-going signal at the trigger input, provided one of the steering inputs is at the logical 1 level. The trigger signal drives the flip-flop to the state corresponding to the steering input which is at the logical 1 level. The two steering inputs are not both at the logical 1 level at the same time.

Flip-flops can be connected as binary counters or as shift registers, as indicated in Figure 1.

Zener diode CR41 and capacitor C18, in combination with portions of the flip-flop circuits, form a regulated -4. 5 v power supply. When resistor R18 and diode CR18 conduct, they feed Zener diode CR41. Of the eight clamping circuits, four will always be conducting to form the regulated -4. 5 v power supply. Capacitors C7 and C19 are line filters for the -16. 5 v supply and the +12 v supply, respectively.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Output logic levels are described in Table 2. Current polarity is specified in terms of current flow; OUT indicates current flow from the terminal, IN indicates current flow to the terminal. Waveforms and timing are illustrated in Figure 2.

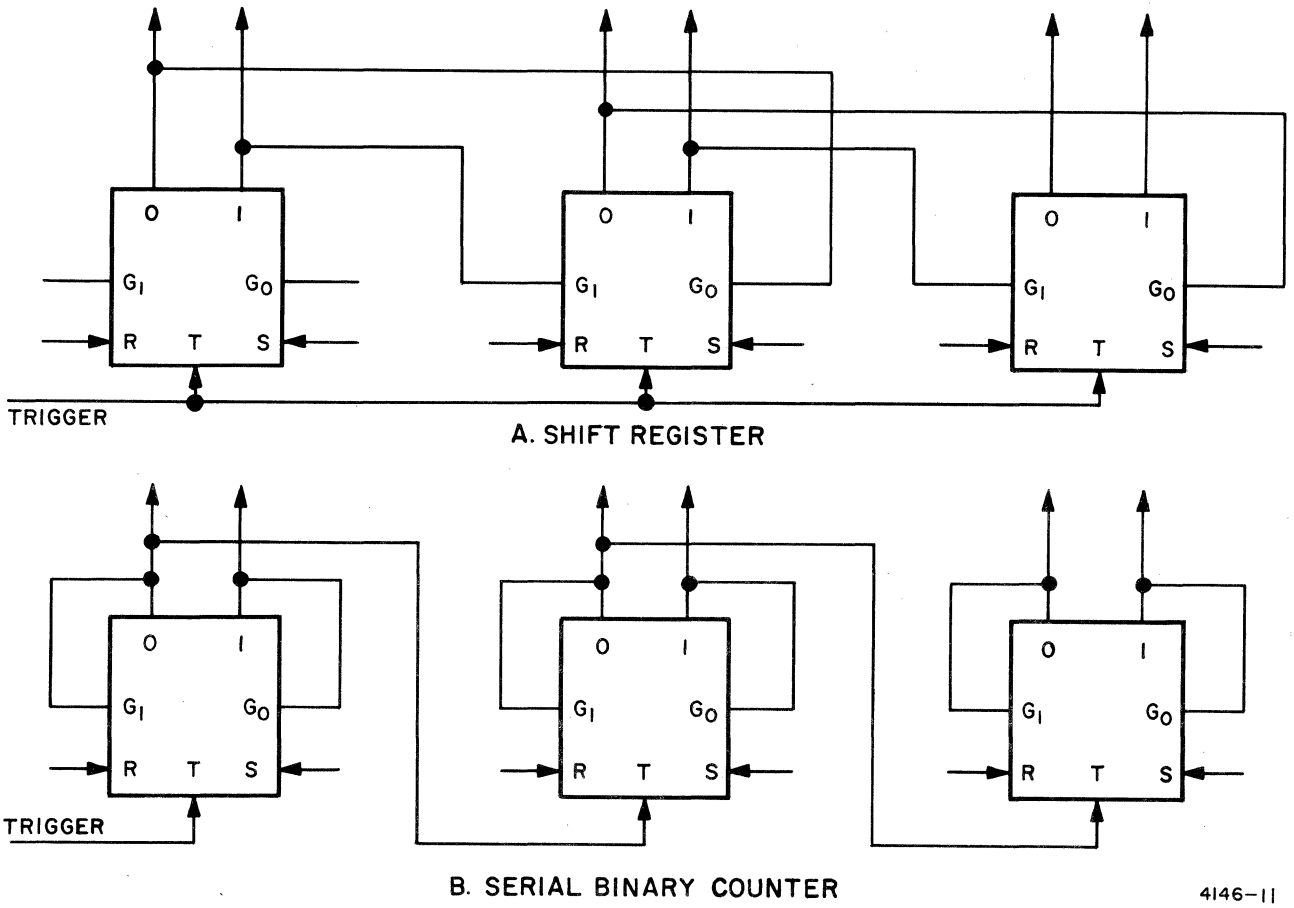


Figure 1. 403 Module, Interconnections

Table 1. Input Logic Levels

SIGNAL	LEVEL	VOLTAGE	CURRENT
Set and Reset	0	-4.5 v (+0.4 v, -3.5 v)	0 ma
	1	0.0 v (+0.3 v, -0.8 v)	4.7 ma
Steer	0	-4.5 v (+0.4 v, -1.4 v)	±5.4 ma peak
	1	0.0 v (+0.3 v, -0.8 v)	±5.4 ma peak
Trigger	Peak-to-peak voltage between 3.9 v minimum and 5.6 v maximum. During positive part of cycle, peak current will not exceed 17 ma into trigger input; during negative part of cycle, peak current will not exceed 5.4 ma out of trigger input.		

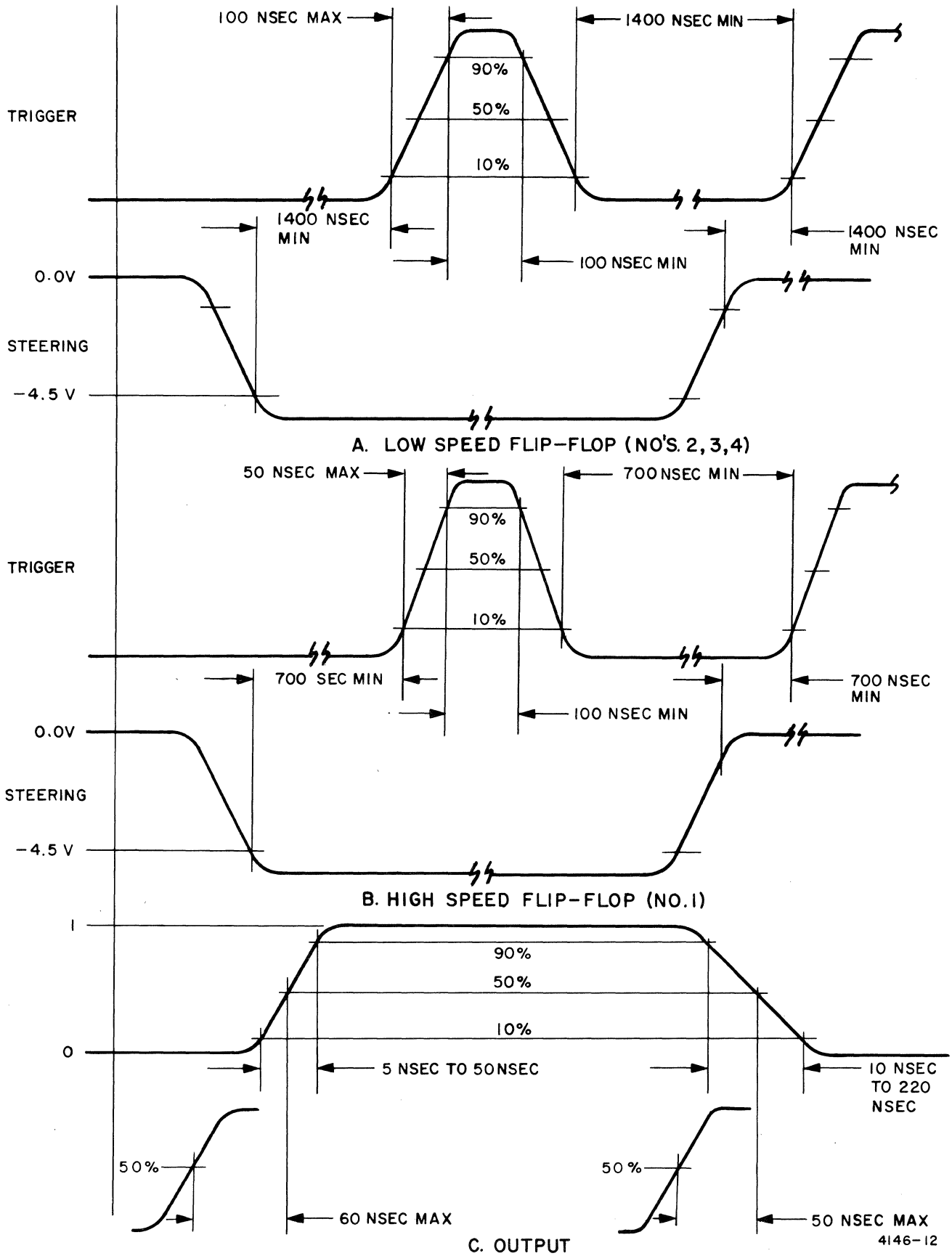


Figure 2. 403 Module, Waveforms and Timing

Table 2. Output Logic Levels

LEVEL	VOLTAGE	CURRENT
0	-4. 5 v (+0. 1 v, -1. 1 v)	9. 0 ma maximum OUT 6. 0 ma maximum IN
1	0. 0 v (+0. 0 v, -0. 4 v)	12. 0 ma maximum OUT

LOADING

A maximum of nine additional diodes may be connected to the set or reset auxiliary inputs. Load combinations for either the 1 or 0 outputs are listed in Table 3.

Table 3. 403 Flip-Flop Output Loads

UNIT LOAD	TRIGGER LOAD	STEER LOAD	TOTAL LENGTH OF TWISTED PAIR WIRE
1	1	1	3 feet maximum
3	0	1	3 feet maximum
1	0	2	3 feet maximum
3	0	0	10 feet maximum

POWER REQUIREMENTS

No power supply sequencing is required, provided the module is connected to ground first. Power supply requirements are listed in Table 4.

Table 4. Power Supply Requirements

VOLTAGE	CURRENT	POWER
+12 v ±5%	10. 4 ma nominal 12. 4 ma maximum	2. 5 watts maximum
-16. 5 v ±5%	120 ma nominal 136 ma maximum	2. 1 watts nominal

WIRING

Table 5 lists maximum lengths of wire which may be used. However, steering and trigger inputs must be open wire less than three feet long, and output wiring must be as listed in Table 3.

Table 5. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	92 Inches
Single Load	120 Inches

PARTS LIST

Table 6 lists parts for the 403 module. The 403 module assembly is illustrated in Figure 3, and the schematic diagram is illustrated in Figure 4.

Table 6. Multipurpose Flip-Flop (Module 403) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C2	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C3	CM15C221JN3	Capacitor, fixed, mica, 220 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C4	CM15C221JN3	Capacitor, fixed, mica, 220 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C5	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C6	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C7	CM15C221JN3	Capacitor, fixed, mica, 220 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C8	CM15C221JN3	Capacitor, fixed, mica, 220 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C9	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C10	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C11	CM15C221JN3	Capacitor, fixed, mica, 220 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C12	CM15C221JN3	Capacitor, fixed, mica, 220 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C13	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C14	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C15	CM15C221JN3	Capacitor, fixed, mica, 220 pf, ± 5%, 500 vdc, (MIL-C-5)

Table 6. Multipurpose Flip-Flop (Module 403) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C16	CM15C221JN3	Capacitor, fixed, mica, 220 pf, ± 5%, 500 vdc, (MIL-C-5)
1	C17	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C18	8412778-25	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 10 vdc
1	C19	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180820-1	Semiconductor device, diode
1	CR6	2182140-1	Semiconductor device, diode
1	CR7	2182140-1	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	2182140-1	Semiconductor device, diode
1	CR10	2182140-1	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180820-1	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2182140-1	Semiconductor device, diode
1	CR17	2182140-1	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2182140-1	Semiconductor device, diode
1	CR20	2182140-1	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2180820-1	Semiconductor device, diode
1	CR23	2180820-1	Semiconductor device, diode

Table 6. Multipurpose Flip-Flop (Module 403) Parts List (cont)

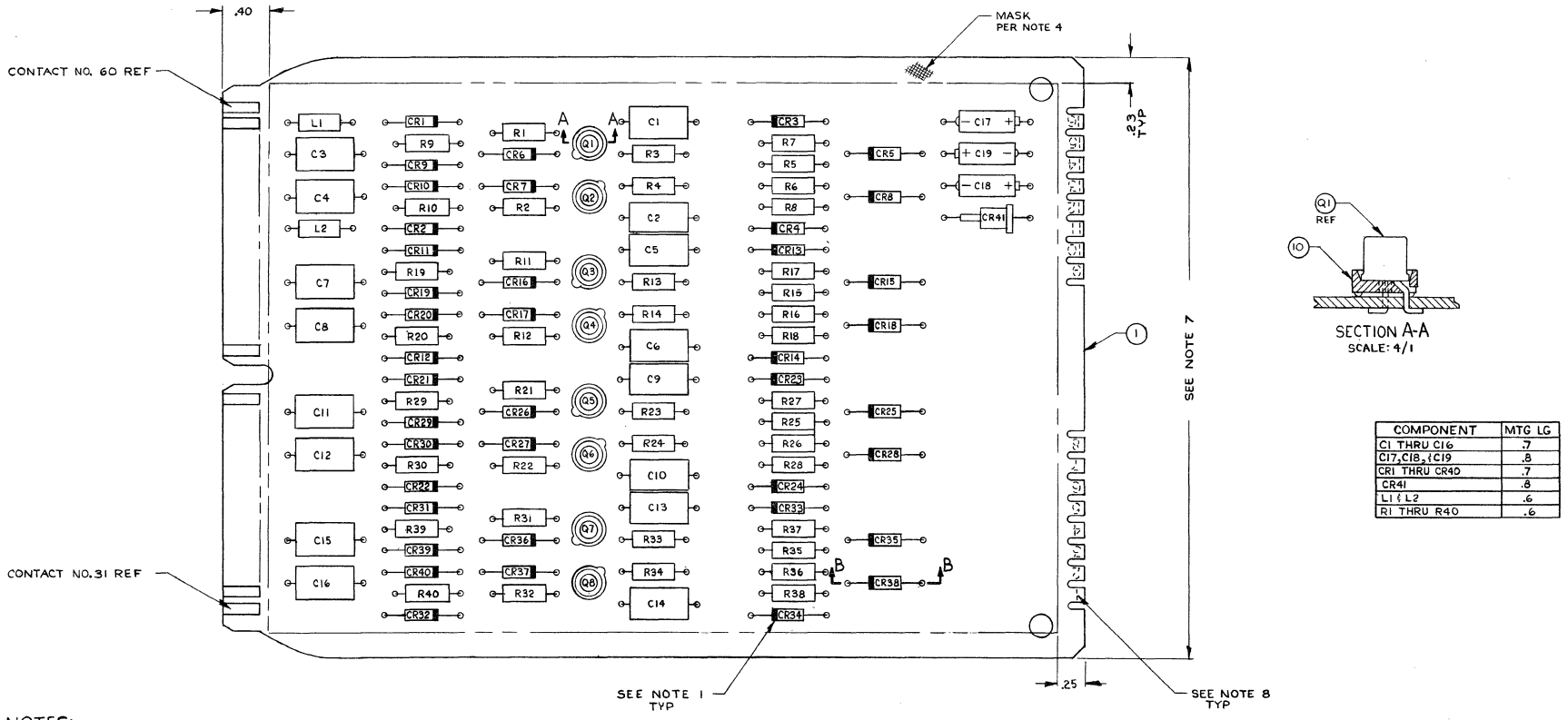
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR24	2180820-1	Semiconductor device, diode
1	CR25	2180820-1	Semiconductor device, diode
1	CR26	2182140-1	Semiconductor device, diode
1	CR27	2182140-1	Semiconductor device, diode
1	CR28	2180820-1	Semiconductor device, diode
1	CR29	2182140-1	Semiconductor device, diode
1	CR30	2182140-1	Semiconductor device, diode
1	CR31	2180820-1	Semiconductor device, diode
1	CR32	2180820-1	Semiconductor device, diode
1	CR33	2180820-1	Semiconductor device, diode
1	CR34	2180820-1	Semiconductor device, diode
1	CR35	2180820-1	Semiconductor device, diode
1	CR36	2182140-1	Semiconductor device, diode
1	CR37	2182140-1	Semiconductor device, diode
1	CR38	2180820-1	Semiconductor device, diode
1	CR39	2182140-1	Semiconductor device, diode
1	CR40	2182140-1	Semiconductor device, diode
1	CR41	2182181-1	Semiconductor device, diode
1	L1	2182137-3	Coil, radio frequency, 150 μh, $\pm$5%
1	L2	2182137-3	Coil, radio frequency, 150 μh, $\pm$5%
1	Q1	2180811-1	Semiconductor device, transistor
1	Q2	2180811-1	Semiconductor device, transistor
1	Q3	2180811-1	Semiconductor device, transistor
1	Q4	2180811-1	Semiconductor device, transistor
1	Q5	2180811-1	Semiconductor device, transistor
1	Q6	2180811-1	Semiconductor device, transistor
1	Q7	2180811-1	Semiconductor device, transistor

Table 6. Multipurpose Flip-Flop (Module 403) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q8	2180811-1	Semiconductor device, transistor
1	R1	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R2	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R3	2182165-26	Resistor, fixed, film, 560 ohms, 1/2 w, ± 2%
1	R4	2182165-26	Resistor, fixed, film, 560 ohms, 1/2 w, ± 2%
1	R5	2182165-42	Resistor, fixed, film, 2700 ohms, 1/2 w, ± 2%
1	R6	2182165-42	Resistor, fixed, film, 2700 ohms, 1/2 w, ± 2%
1	R7	2182165-36	Resistor, fixed, film, 1500 ohms, 1/2 w, ± 2%
1	R8	2182165-36	Resistor, fixed, film, 1500 ohms, 1/2 w, ± 2%
1	R9	2182165-33	Resistor, fixed, film, 1100 ohms, 1/2 w, ± 2%
1	R10	2182165-33	Resistor, fixed, film, 1100 ohms, 1/2 w, ± 2%
1	R11	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R12	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R13	2182165-26	Resistor, fixed, film, 560 ohms, 1/2 w, ± 2%
1	R14	2182165-26	Resistor, fixed, film, 560 ohms, 1/2 w, ± 2%
1	R15	2182165-42	Resistor, fixed, film, 2700 ohms, 1/2 w, ± 2%
1	R16	2182165-42	Resistor, fixed, film, 2700 ohms, 1/2 w, ± 2%
1	R17	2182165-36	Resistor, fixed, film, 1500 ohms, 1/2 w, ± 2%
1	R18	2182165-36	Resistor, fixed, film, 1500 ohms, 1/2 w, ± 2%
1	R19	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R20	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R21	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R22	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R23	2182165-26	Resistor, fixed, film, 560 ohms, 1/2 w, ± 2%
1	R24	2182165-26	Resistor, fixed, film, 560 ohms, 1/2 w, ± 2%
1	R25	2182165-42	Resistor, fixed, film, 2700 ohms, 1/2 w, ± 2%
1	R26	2182165-42	Resistor, fixed, film, 2700 ohms, 1/2 w, ± 2%

Table 6. Multipurpose Flip-Flop (Module 403) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R27	2182165-36	Resistor, fixed, film, 1500 ohms, 1/2 w, ± 2%
1	R28	2182165-36	Resistor, fixed, film, 1500 ohms, 1/2 w, ± 2%
1	R29	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R30	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R31	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R32	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R33	2182165-26	Resistor, fixed, film, 560 ohms, 1/2 w, ± 2%
1	R34	2182165-26	Resistor, fixed, film, 560 ohms, 1/2 w, ± 2%
1	R35	2182165-42	Resistor, fixed, film, 2700 ohms, 1/2 w, ± 2%
1	R36	2182165-42	Resistor, fixed, film, 2700 ohms, 1/2 w, ± 2%
1	R37	2182165-36	Resistor, fixed, film, 1500 ohms, 1/2 w, ± 2%
1	R38	2182165-36	Resistor, fixed, film, 1500 ohms, 1/2 w, ± 2%
1	R39	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	R40	2182165-40	Resistor, fixed, film, 2200 ohms, 1/2 w, ± 2%
1	1	2161394-3	Board, printed circuit
8	10	2180896-2	Pad, transistor mounting



COMPONENT	MTG LG
C1 THRU C16	.7
C17, C18, & C19	.8
CR1 THRU CR40	.7
CR41	.8
L1 & L2	.6
R1 THRU R40	.6

NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 (USING EPOXY POLYAMAIDE PER 2020341).
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7, ON SOLDER SIDE PER 2181314.
~~9. FOR LIST OF MATERIALS SEE LM 2162403.~~
10. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.

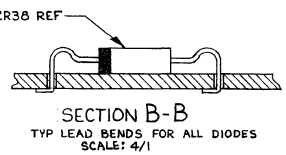
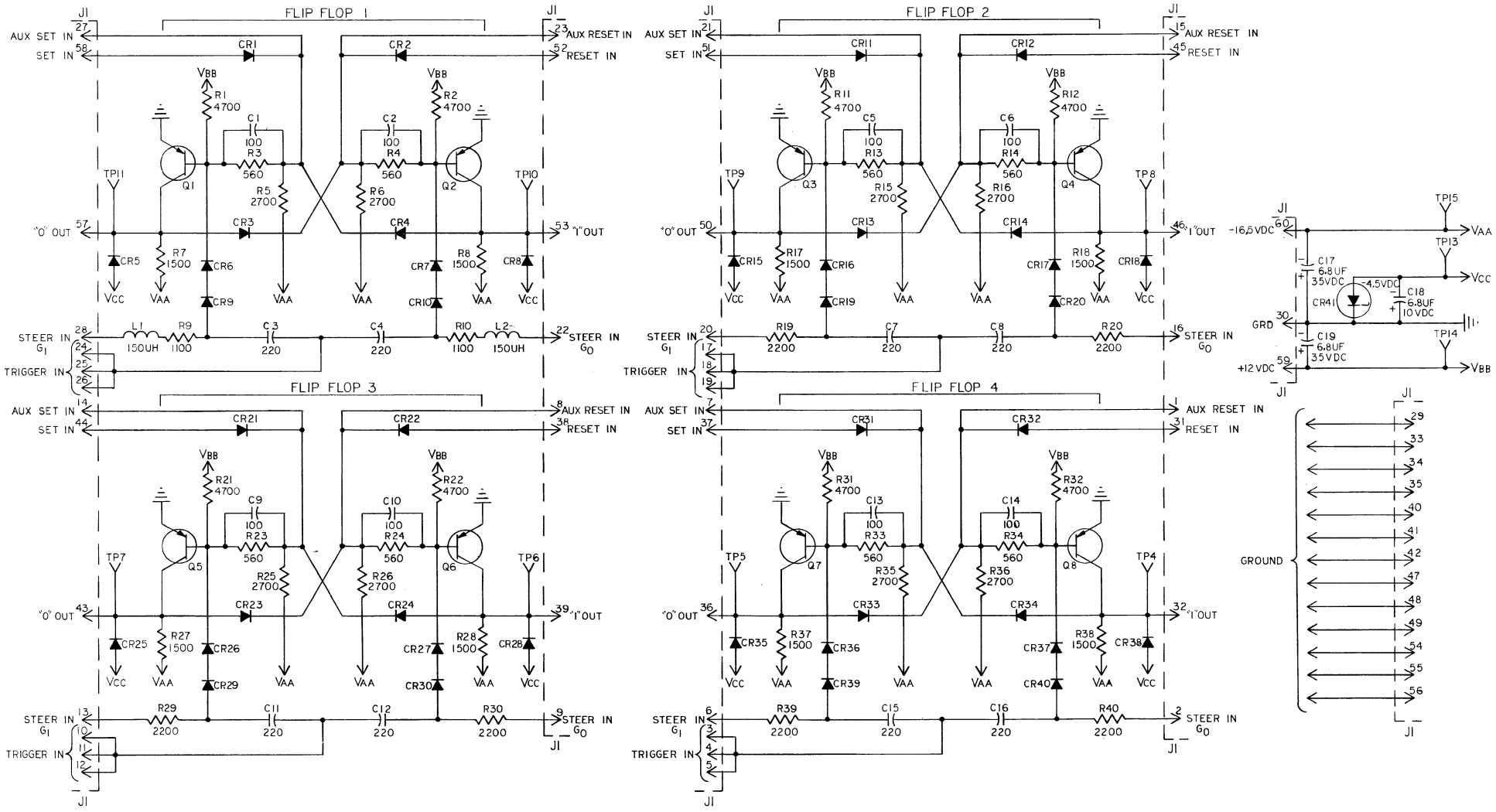


Figure 3. Multipurpose Flip-Flop (Module 403), Assembly Drawing



NOTES:

1. CAPACITANCE VALUES LESS THAN 1.0 ARE IN UF AND 1.0 AND ABOVE ARE IN PF EXCEPT AS INDICATED.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, ±2%.
3. LIKE CALLOUTS OF VAA, VBB, AND VCC ARE COMMON.

Figure 4. Multipurpose Flip-Flop (Module 403), Schematic Diagram

HIGH SPEED POWER GATE (MODULE 404)

RCA 2162404-501

DESCRIPTION

Module 404 contains four identical high-speed OR gates, two identical regulated power supplies, two line filter capacitors, and three independent ground connections.

CIRCUIT ANALYSIS

The four gates are identical, therefore only one gate is described in detail. The nominal level for a logical 0 input is -4.5 v; the nominal level for a logical 1 input is 0 v. When a logical 1 input is applied to diode CR1, the junction of diodes CR1, CR2, CR3, CR4, and resistor R5 is held near 0 v by current flow through resistor R5 and diode CR1. If a logical 0 input is applied to diode CR2, diode CR2 will be back-biased. With the junction of diodes CR1, CR2, CR3, CR4 and resistor R5 near 0 v, the base of transistor Q1 is held at a slight positive potential by current flow through diode CR4 and resistor R1. Transistor Q1 is cut off, and its collector voltage is clamped at -4.5 v by current flow through resistor R6 and diode CR13. The negative potential existing at the collector of transistor Q1 is applied through resistor R7 to the base of transistor Q5, biasing it at cutoff. The junction of diodes CR5 and CR6 is held slightly more negative than the collector of transistor Q1 by current flow through resistor R8 and diode CR5. When the collector voltage of transistor Q1 is clamped at -4.5 v, the base voltage of transistor Q2 is negative, transistor Q2 is saturated, and the output voltage is near 0 v. When both inputs to transistor Q1 are at the logical 0 level, the anode of diode CR4 is held near -4.5 v, transistor Q1 is biased in saturation, and its collector voltage goes to 0 v. The base voltage of transistor Q2 becomes positive, and that transistor is cut-off. Transistor Q5 is saturated, and the output voltage is near -4.5 v.

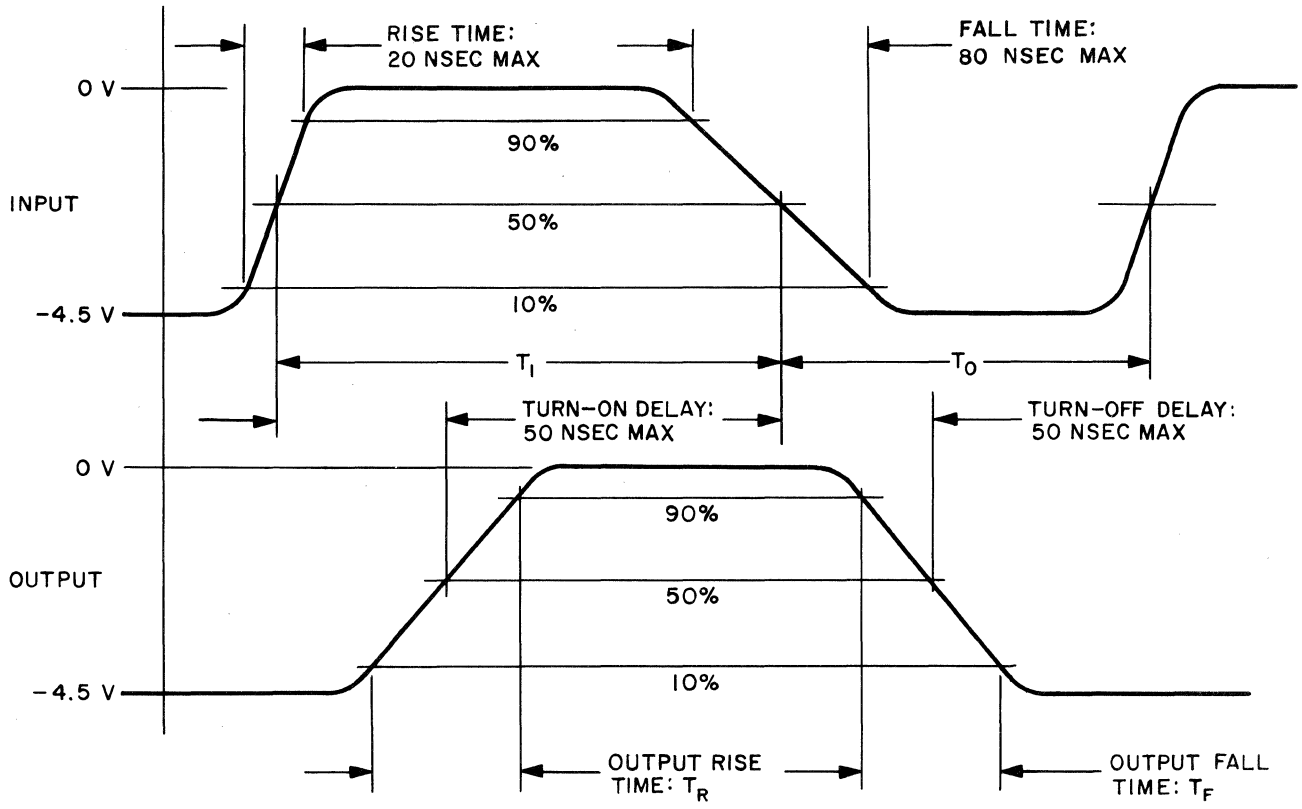
Resistors R25 and R26, Zener diode CR30, and capacitor C12 form a power supply which is the -4.5 v source for two gates. Resistors R27 and R28, Zener diode CR29, and capacitor C10 form an identical source for the remaining two gates. Capacitors C9 and C11 are line filter capacitors for the -16.5 v source and the +12 v source, respectively.

CIRCUIT CHARACTERISTICS

The input logic levels are described in Table 1. The output logic levels are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Input Logic Levels

LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.5 v, -3.5 v)	0.0 ma maximum
1	0.0 v (+0.3 v, -0.8 v)	4.0 ma maximum



CONDITION	INPUT DWELL TIME	
	T_I	T_O
TRIGGER LOADS	100 NSEC MINIMUM	700 NSEC MINIMUM
UP TO 40 UNIT LOADS	100 NSEC MINIMUM	100 NSEC MINIMUM
41 TO 71 UNIT LOADS	100 NSEC MINIMUM 1 MSEC MAXIMUM LESS THAN $T_O/4$	500 NSEC MINIMUM

CONDITION	OUPUT RISE TIME T_R	OUPUT FALL TIME T_F
TRIGGER LOADS	50 NSEC MAX	30 NSEC MAX
LESS THAN 40 UNIT LOADS	20 NSEC MAX	30 NSEC MAX

4146-13

Figure 1. 404 Module, Waveforms and Times

Table 2. Output Logic Levels

LOAD	LEVEL	VOLTAGE	CURRENT
Flip-Flop Trigger Inputs	0	-4.5 v (+0.2 v, -0.6v)	100 ma IN maximum
(403)	1	0.0 v (+0.0 v, -0.2v)	306 ma OUT maximum
Gates (401)	0	-4.5 v (+0.2 v, -0.6v)	20 ma IN maximum
(402)	1	0.0 v (+0.0 v, -0.5v)	288 ma OUT maximum

LOADING

Each input is equivalent to one unit load. The output can drive a maximum of either 18 trigger inputs of 403 module flip-flops or 72 unit loads. An exchange can be made to permit driving 1 to 17 trigger inputs and 1 to 5 unit loads.

POWER REQUIREMENTS

No power supply sequencing is required, provided the module is connected to ground first. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT		POWER	
	OUTPUTS 0 v	OUTPUTS -4.5 v	OUTPUTS 0 v	OUTPUTS -4.5 v
+12 v ±5%	13.7 ma nominal 15.5 ma maximum	11.7 ma nominal 13.7 ma maximum	5.38 watts nominal	5.93 watts nominal
-16.5 v ±5%	316 ma nominal 332 ma maximum	351 ma nominal 412 ma maximum	5.97 watts maximum	7.34 watts maximum

WIRING

Table 4 lists maximum lengths of wire which may be used. However, when driving a 403 module flip-flop, open wire less than 20 inches long must be used.

Table 4. Module 404 Wiring

OPEN WIRE	
Maximum length	21 Inches
Fan-out length	72 Inches
TWISTED PAIR	
Maximum length	96 Inches
Single load	120 Inches

PARTS LIST

Table 5 lists parts for the 404 module. The 404 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 5. High Speed Power Gate (Module 404) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CM15D180JN3	Capacitor, fixed, mica, 180 μf,±5%, 500 vdc (MIL-C-25)
1	C2	CM15D180JN3	Capacitor, fixed, mica, 180 μf,±5%, 500 vdc (MIL-C-25)
1	C3	2182062-7	Capacitor, fixed, 0.1 μf,+80% -20%, 25 vdc
1	C4	2182062-7	Capacitor, fixed, 0.1 μf,+80% -20%, 25 vdc
1	C5	CM15D180JN3	Capacitor, fixed, mica, 180 μf,±5%, 500 vdc (MIL-C-25)
1	C6	CM15D180JN3	Capacitor, fixed, mica, 180 μf,±5%, 500 vdc (MIL-C-25)
1	C7	2182062-7	Capacitor, fixed, 0.1 μf,+80% -20%, 25 vdc
1	C8	2182062-7	Capacitor, fixed, 0.1 μf,+80% -20%, 25 vdc
1	C9	8412778-95	Capacitor, fixed, 6.8 μf, 35 vdc
1	C10	8412778-25	Capacitor, fixed, 6.8 μf, 10 vdc
1	C11	8412778-95	Capacitor, fixed, 6.8 μf, 35 vdc
1	C12	8412778-25	Capacitor, fixed, 6.8 μf, 10 vdc
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2180816-3	Semiconductor device, diode
1	CR5	2180820-1	Semiconductor device, diode
1	CR6	2180816-3	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	2180820-1	Semiconductor device, diode
1	CR10	2180816-3	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180816-3	Semiconductor device, diode
1	CR13	2180820-1	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode

Table 5. High Speed Power Gate (Module 404) Parts List (cont)

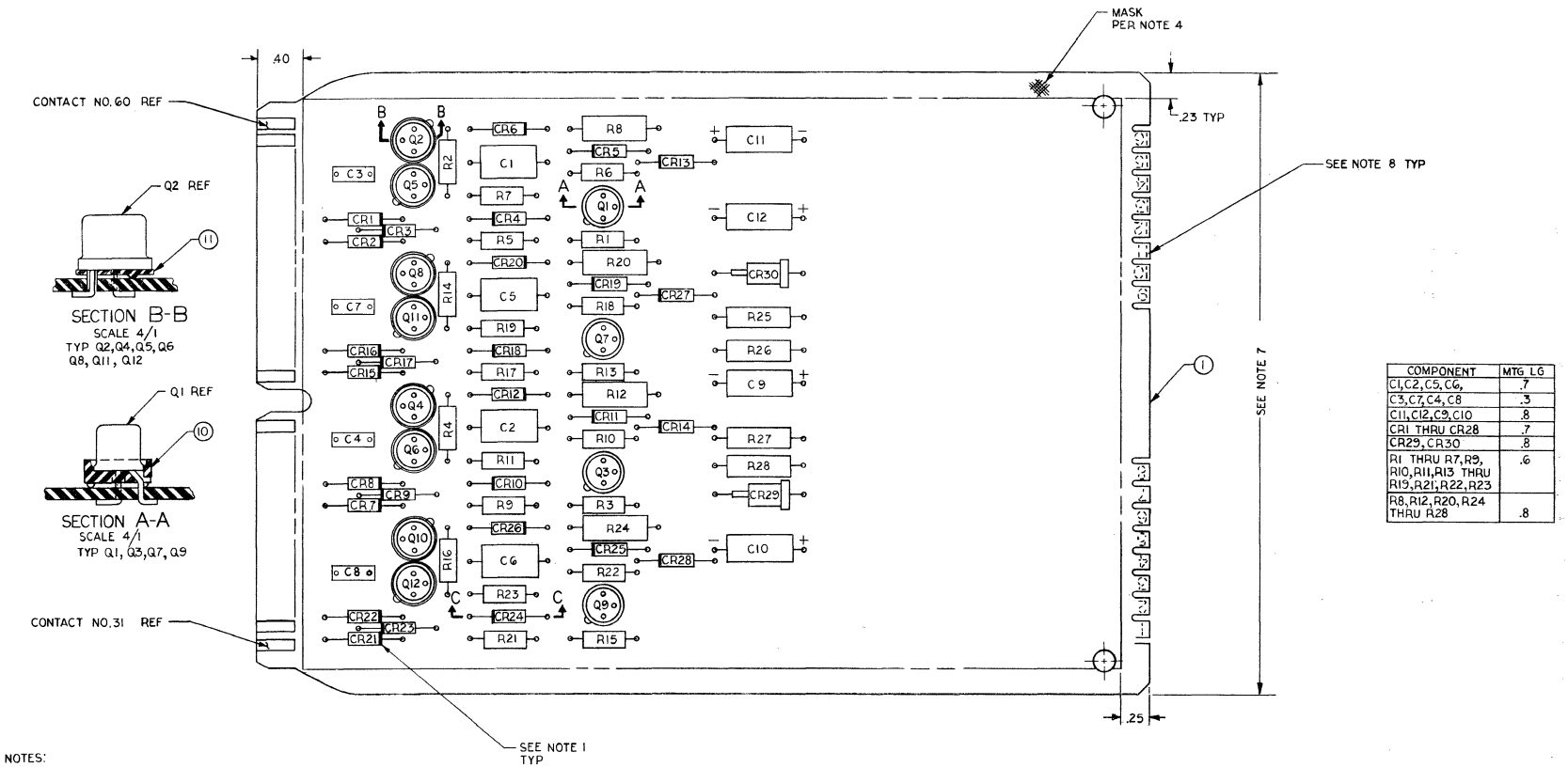
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	CR17	2180820-1	Semiconductor device, diode
1	CR18	2180816-3	Semiconductor device, diode
1	CR19	2180820-1	Semiconductor device, diode
1	CR20	2180816-3	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2180820-1	Semiconductor device, diode
1	CR23	2180820-1	Semiconductor device, diode
1	CR24	2180816-3	Semiconductor device, diode
1	CR25	2180820-1	Semiconductor device, diode
1	CR26	2180816-3	Semiconductor device, diode
1	CR27	2180820-1	Semiconductor device, diode
1	CR28	2180820-1	Semiconductor device, diode
1	CR29	2182181-1	Semiconductor device, diode (Zener)
1	CR30	2182181-1	Semiconductor device, diode (Zener)
1	Q1	2180811-1	Semiconductor device, transistor
1	Q2	2180813-1	Semiconductor device, transistor
1	Q3	2180811-1	Semiconductor device, transistor
1	Q4	2180813-1	Semiconductor device, transistor
1	Q5	2183279-1	Semiconductor device, transistor
1	Q6	2183279-1	Semiconductor device, transistor
1	Q7	2180811-1	Semiconductor device, transistor
1	Q8	2180813-1	Semiconductor device, transistor
1	Q9	2180811-1	Semiconductor device, transistor
1	Q10	2180813-1	Semiconductor device, transistor

Table 5. High Speed Power Gate (Module 404) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q11	2183279-1	Semiconductor device, transistor
1	Q12	2183279-1	Semiconductor device, transistor
1	R1	2182165-73	Resistor, fixed, film, 51 k, 1/2 w, ± 2%
1	R2	2182165-46	Resistor, fixed, film, 3900 ohms, 1/2 w, ± 2%
1	R3	2182165-73	Resistor, fixed, film, 51 k, 1/2 w, ± 2%
1	R4	2182165-46	Resistor, fixed, film, 3900 ohms, 1/2 w, ± 2%
1	R5	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R6	2182165-32	Resistor, fixed, film, 1 k, 1/2 w, ± 2%
1	R7	2182165-27	Resistor, fixed, film, 620 ohms, 1/2 w, ± 2%
1	R8	2182165-126	Resistor, fixed, film, 560 ohms, 1 w, ± 2%
1	R9	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R10	2182165-32	Resistor, fixed, film, 1 k, 1/2 w, ± 2%
1	R11	2182165-27	Resistor, fixed, film, 620 ohms, 1/2 w, ± 2%
1	R12	2182165-126	Resistor, fixed, film, 560 ohms, 1 w, ± 2%
1	R13	2182165-73	Resistor, fixed, film, 51 k, 1/2 w, ± 2%
1	R14	2182165-46	Resistor, fixed, film, 3900 ohms, 1/2 w, ± 2%
1	R15	2182165-73	Resistor, fixed, film, 51 k, 1/2 w, ± 2%
1	R16	2182165-46	Resistor, fixed, film, 3900 ohms, 1/2 w, ± 2%
1	R17	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R18	2182165-32	Resistor, fixed, film, 1 k, 1/2 w, ± 2%
1	R19	2182165-27	Resistor, fixed, film, 620 ohms, 1/2 w, ± 2%
1	R20	2182165-126	Resistor, fixed, film, 560 ohms, 1 w, ± 2%
1	R21	2182165-48	Resistor, fixed, film, 4700 ohms, 1/2 w, ± 2%
1	R22	2182165-32	Resistor, fixed, film, 1k, 1/2 w, ± 2%
1	R23	2182165-27	Resistor, fixed, film, 620 ohms, 1/2 w, ± 2%
1	R24	2182165-126	Resistor, fixed, film, 560 ohms, 1 w, ± 2%

Table 5. High Speed Power Gate (Module 404) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R25	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	R26	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	R27	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	R28	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	1	2161394-1	Board, printed circuit
4	10	2180896-2	Pad, transistor mounting
8	11	2180896-9	Pad, transistor mounting



COMPONENT	MTG LG
C1, C2, C5, C6,	.7
C3, C7, C4, C8	.3
C11, C12, C9, C10	.8
CR1 THRU CR28	.7
CR29, CR30	.8
R1 THRU R7, R9, R10, R11, R13 THRU R19, R21, R22, R23	.6
R8, R12, R20, R24 THRU R28	.8

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON WIRING SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 (USING EPOXY POLYAMIDE PER 2020341.)
5. ASSEMBLY PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
9. ~~FOR LIST OF MATERIALS SEE LM2162404.~~
10. ALL COMPONENTS LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.

Figure 2. High Speed Power Gate (Module 404), Assembly Drawing

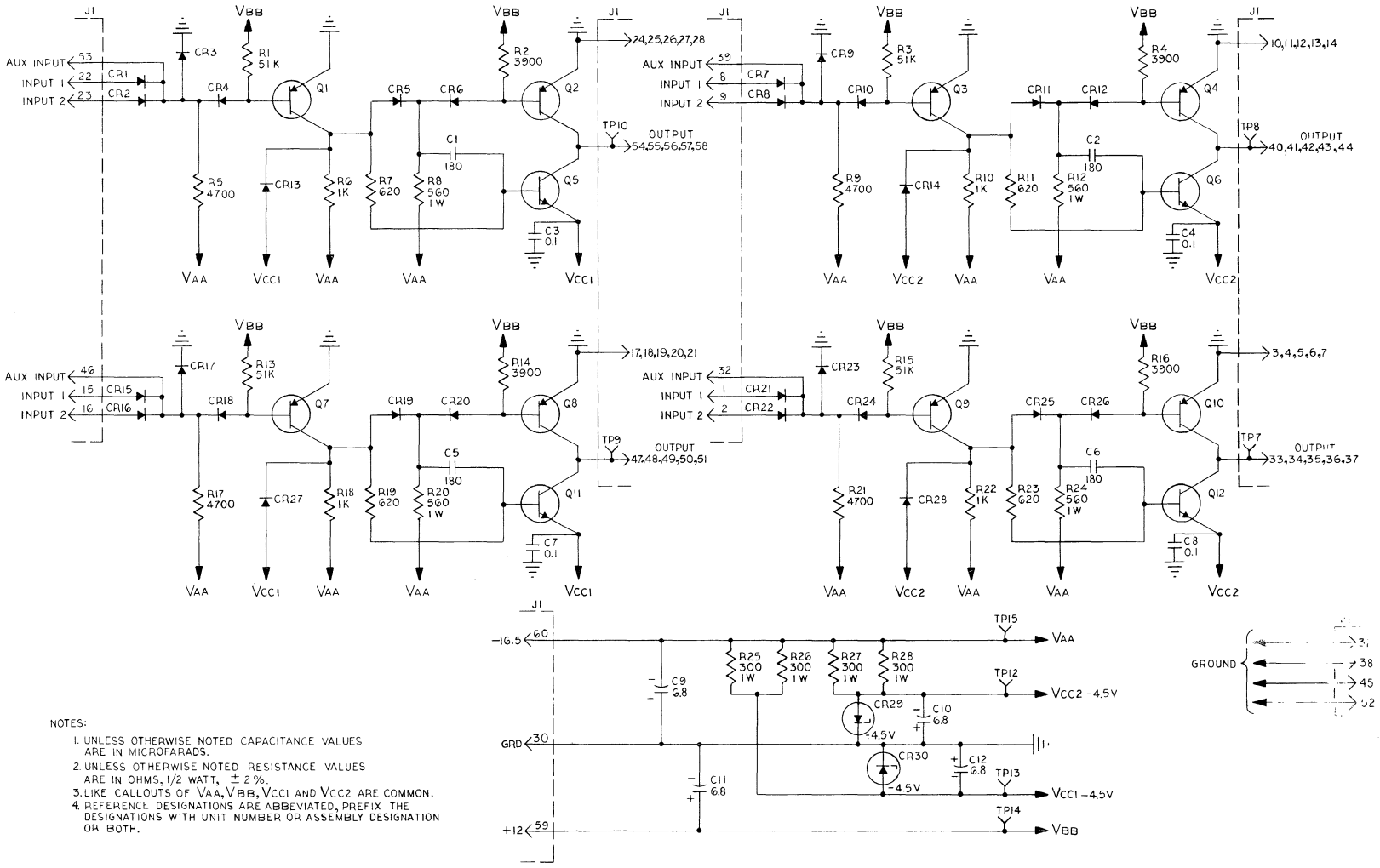


Figure 3. High Speed Power Gate (Module 404), Schematic Diagram

LINE DRIVER (MODULE 405)

RCA 2162405-501

DESCRIPTION

The 405 module contains six identical digital line drivers, three line filter capacitors, and two identical regulated power supplies.

CIRCUIT ANALYSIS

The six line driver circuits are identical, therefore only line driver 1 will be described in detail. The nominal level of a logical 0 input is -4.5 v; the nominal level of a logical 1 input is 0 v. Line driver 1 is a three-stage resistance coupled circuit. The output of the third stage depends upon the type of load, which may be either a 406 module line receiver or an MD16 module line receiver.

When inputs to both diode CR1 and diode CR2 are at the logical 0 level, transistor Q1 is saturated. The output of transistor Q1 is coupled to the base of transistor Q2. Transistor Q2 drives transistor Q3 to saturation. When either input to diode CR1 or diode CR2 is at the logical 1 level, transistor Q1 is cut off, and transistor Q2 drives transistor Q3 to cutoff.

With transistor Q3 cut off, OUTPUT B grounded, and OUTPUT A connected to the input of an MD16 line receiver, the output is held near +8 v by current flow through resistors R5, R6, R7 and R8. With transistor Q3 saturated, its collector is near 0 v and the output is near 0 v.

With transistor Q3 cut off, and OUTPUT C connected to OUTPUT E, and the output connected to a 406 line receiver, the output is held near -2.5 v. With transistor Q3 saturated, the output is held near +2.0 v. The terminating network formed by resistor R19 and R20 shifts the output signal to a negative level.

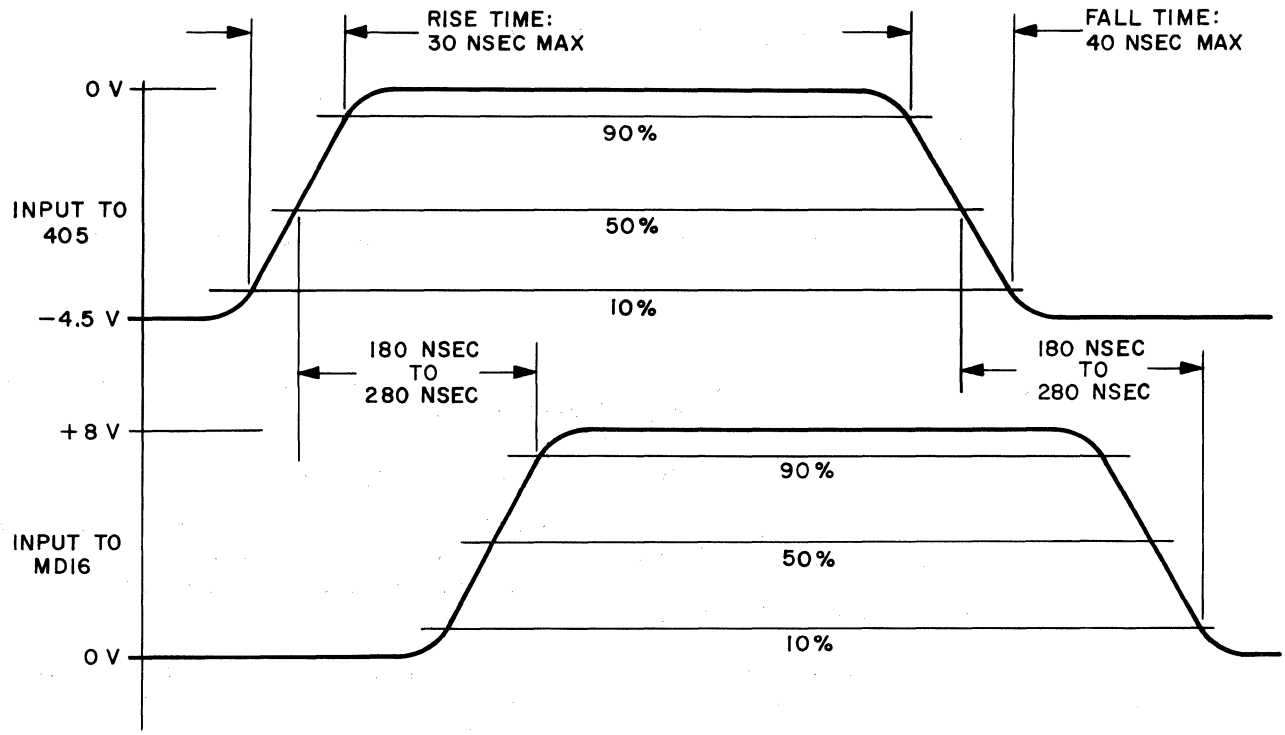
Resistor R49, Zener diode CR49, and capacitor C3 form a +4.5 v voltage regulator for line drivers 1, 2, and 3. Resistor R50, Zener diode CR50, and capacitor C4 form a +4.5 v voltage regulator for line drivers 4, 5, and 6. Capacitors C1, C2, and C5 are line filter capacitors for the -16.5 v, -5.5 v, and +12 v power sources, respectively.

CIRCUIT CHARACTERISTICS

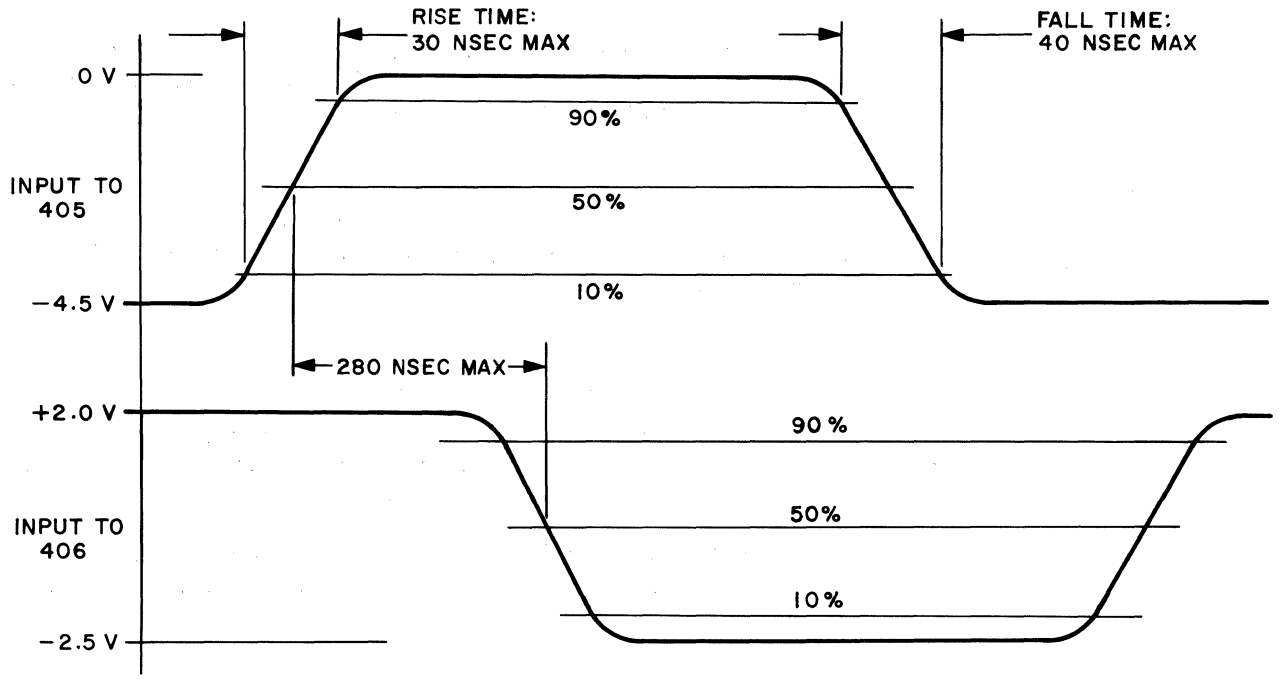
Input logic levels are described in Table 1. Output logic levels are described in Table 2 and Table 3. Waveforms and timing are illustrated in Figure 1.

Table 1. Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.4 v, -3.5 v)	0 ma maximum
1	0.0 v (+0.1 v, -0.7 v)	4 ma maximum IN



A. WAVEFORMS FOR MDI6 LINE RECEIVER LOAD



B. WAVEFORMS FOR 406 LINE RECEIVER LOAD

4146-14

Figure 1. 405 Module, Waveforms and Timing

Table 2. Output Logic Levels For MD16 Line Receiver

OUTPUT	LOGIC LEVEL	VOLTAGE	CURRENT
A with B grounded	0	0.0 v (+0.5 v, -0.2 v)	0.1 ma maximum IN
	1	+8 v (+2 v, -2 v)	15 ma OUT at 6 v 0 ma OUT at 10 v

Table 3. Output Logic Levels For 406 Line Receiver

OUTPUT	LOGIC LEVEL	VOLTAGE	CURRENT
C connected to E	0	-2.5 v (+0.3 v, -0.6 v)	0 ma
	1	+2.0 v (+3.4 v, -0.5 v)	1 ma OUT at +5.4 v 16 ma OUT at +1.5 v

LOADING

Each 405 line driver can drive one MD16 line receiver. The termination network of the MD16 line receiver is not used. Each 405 line driver can drive one 406 module line receiver. Under special conditions a 405 line driver can drive up to eight 406 line receivers and up to seven output circuits of other 405 line drivers. The conditions required are that only one 405 line driver has output C connected to output E, and the dc resistance of the total length of transmission line does not exceed 10 ohms.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 4.

Table 4. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ±5%	517 ma nominal 579 ma maximum
-16.5 v ±5%	175 ma nominal 197 ma maximum
-5.5 v ±10%	420 ma nominal 492 ma maximum

WIRING

Table 5 lists maximum lengths of wire which may be used for input wiring. For output wiring, coaxial cable must be used, with not more than 18 inches of twisted pair wire connecting the coaxial cable to the driver and receiver.

Table 5. Module 405 Wiring

OPEN WIRE	
Maximum length	21 Inches
Fan-out length	72 Inches
TWISTED PAIR	
Maximum length	96 Inches
Single load	120 Inches

PARTS LIST

Table 6 lists parts for the 405 module. The 405 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 6. Line Driver (Module 405) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ±20%, 35 vdc
1	C2	8412778-25	Capacitor, fixed, tantalum, 6.8 μf, ±20%, 10 vdc
1	C3	8412778-25	Capacitor, fixed, tantalum, 6.8 μf, ±20%, 10 vdc
1	C4	8412778-25	Capacitor, fixed, tantalum, 6.8 μf, ±20%, 10 vdc
1	C5	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ±20%, 35 vdc
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180820-1	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	2180820-1	Semiconductor device, diode
1	CR10	2180820-1	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode

Table 6. Line Driver (Module 405) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR13	2180820-1	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	CR17	2180820-1	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2180820-1	Semiconductor device, diode
1	CR20	2180820-1	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2180820-1	Semiconductor device, diode
1	CR23	2180820-1	Semiconductor device, diode
1	CR24	2180820-1	Semiconductor device, diode
1	CR25	2180820-1	Semiconductor device, diode
1	CR26	2180820-1	Semiconductor device, diode
1	CR27	2180820-1	Semiconductor device, diode
1	CR28	2180820-1	Semiconductor device, diode
1	CR29	2180820-1	Semiconductor device, diode
1	CR30	2180820-1	Semiconductor device, diode
1	CR31	2180820-1	Semiconductor device, diode
1	CR32	2180820-1	Semiconductor device, diode
1	CR33	2180820-1	Semiconductor device, diode
1	CR34	2180820-1	Semiconductor device, diode
1	CR35	2180820-1	Semiconductor device, diode
1	CR36	2180820-1	Semiconductor device, diode
1	CR37	2180820-1	Semiconductor device, diode
1	CR38	2180820-1	Semiconductor device, diode
1	CR39	2180820-1	Semiconductor device, diode

Table 6. Line Driver (Module 405) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR40	2180820-1	Semiconductor device, diode
1	CR41	2180820-1	Semiconductor device, diode
1	CR42	2180820-1	Semiconductor device, diode
1	CR43	2180820-1	Semiconductor device, diode
1	CR44	2180820-1	Semiconductor device, diode
1	CR45	2180820-1	Semiconductor device, diode
1	CR46	2180820-1	Semiconductor device, diode
1	CR47	2180820-1	Semiconductor device, diode
1	CR48	2180820-1	Semiconductor device, diode
1	CR49	2182181-1	Semiconductor device, diode
1	CR50	2182181-1	Semiconductor device, diode
1	Q1	2180811-1	Semiconductor device, transistor
1	Q2	2183279-1	Semiconductor device, transistor
1	Q3	2183279-1	Semiconductor device, transistor
1	Q4	2180811-1	Semiconductor device, transistor
1	Q5	2183279-1	Semiconductor device, transistor
1	Q6	2183279-1	Semiconductor device, transistor
1	Q7	2180811-1	Semiconductor device, transistor
1	Q8	2183279-1	Semiconductor device, transistor
1	Q9	2183279-1	Semiconductor device, transistor
1	Q10	2180811-1	Semiconductor device, transistor
1	Q11	2183279-1	Semiconductor device, transistor
1	Q12	2183279-1	Semiconductor device, transistor
1	Q13	2180811-1	Semiconductor device, transistor
1	Q14	2183279-1	Semiconductor device, transistor
1	Q15	2183279-1	Semiconductor device, transistor
1	Q16	2180811-1	Semiconductor device, transistor

Table 6. Line Driver (Module 405) Parts List (cont)

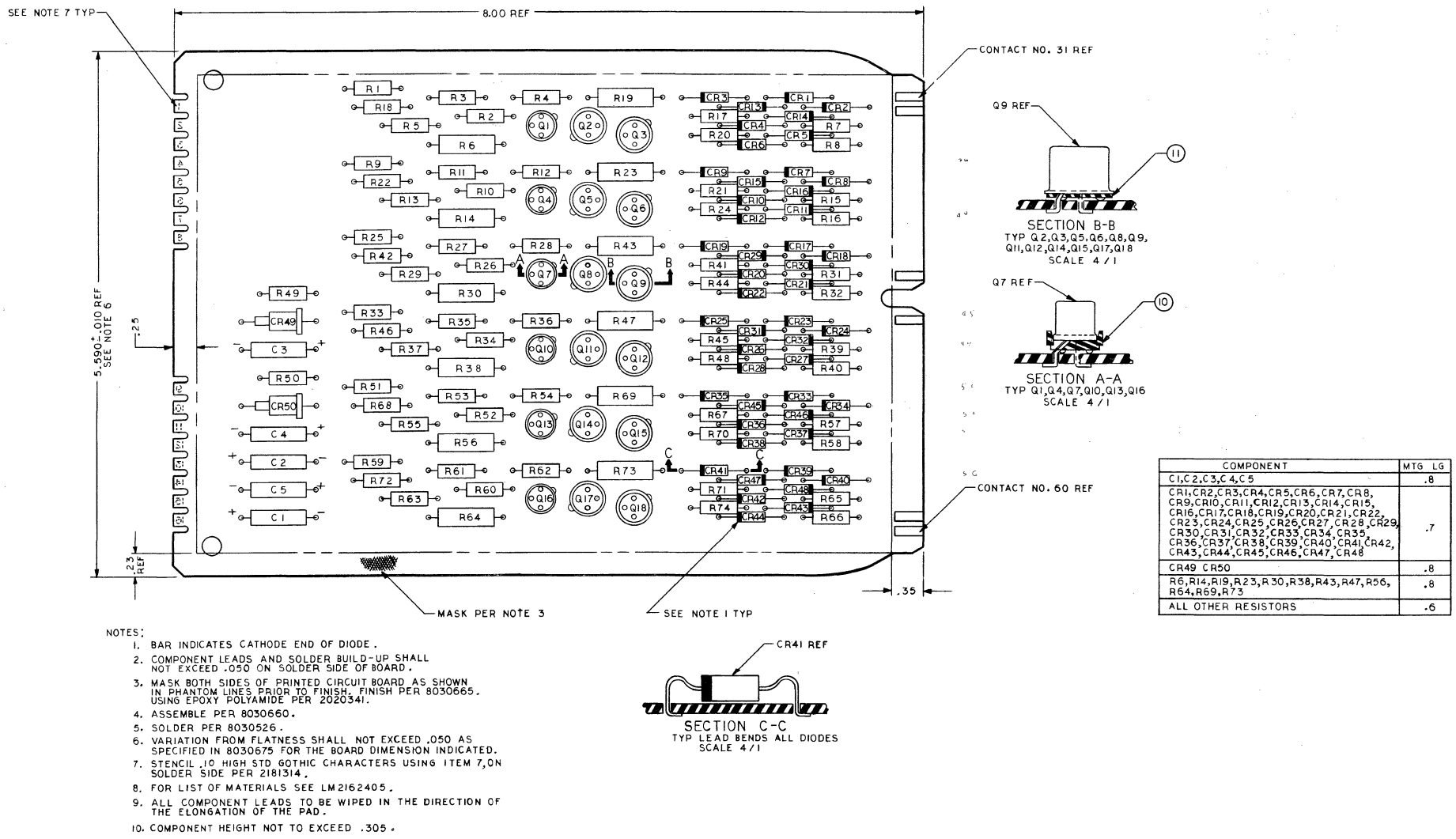
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q17	2183279-1	Semiconductor device, transistor
1	Q18	2183279-1	Semiconductor device, transistor
1	R1	2182165-2	Resistor, fixed, film, 56 ohms, ½ w, ±2%
1	R2	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R3	2182165-36	Resistor, fixed, film, 1500 ohms, ½ w, ±2%
1	R4	2182165-12	Resistor, fixed, film, 150 ohms, ½ w, ±2%
1	R5	2182165-25	Resistor, fixed, film, 510 ohms, ½ w, ±2%
1	R6	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	R7	2182165-7	Resistor, fixed, film, 91 ohms, ½ w, ±2%
1	R8	2182165-18	Resistor, fixed, film, 270 ohms, ½ w, ±2%
1	R9	2182165-2	Resistor, fixed, film, 56 ohms, ½ w, ±2%
1	R10	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R11	2182165-36	Resistor, fixed, film, 1500 ohms, ½ w, ±2%
1	R12	2182165-12	Resistor, fixed, film, 150 ohms, ½ w, ±2%
1	R13	2182165-25	Resistor, fixed, film, 510 ohms, ½ w, ±2%
1	R14	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	R15	2182165-7	Resistor, fixed, film, 91 ohms, ½ w, ±2%
1	R16	2182165-18	Resistor, fixed, film, 270 ohms, ½ w, ±2%
1	R17	2182165-48	Resistor, fixed, film, 4700 ohms, ½ w, ±2%
1	R18	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R19	2182165-132	Resistor, fixed, film, 1 k ohms, 1 w, ±2%
1	R20	2182165-15	Resistor, fixed, film, 200 ohms, ½ w, ±2%
1	R21	2182165-48	Resistor, fixed, film, 4700 ohms, ½ w, ±2%
1	R22	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R23	2182165-132	Resistor, fixed, film, 1 k ohms, 1 w, ±2%
1	R24	2182165-15	Resistor, fixed, film, 200 ohms, ½ w, ±2%
1	R25	2182165-2	Resistor, fixed, film, 56 ohms, ½ w, ±2%

Table 6. Line Driver (Module 405) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R26	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R27	2182165-36	Resistor, fixed, film, 1500 ohms, ½ w, ±2%
1	R28	2182165-12	Resistor, fixed, film, 150 ohms, ½ w, ±2%
1	R29	2182165-25	Resistor, fixed, film, 510 ohms, ½ w, ±2%
1	R30	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	R31	2182165-7	Resistor, fixed, film, 91 ohms, ½ w, ±2%
1	R32	2182165-18	Resistor, fixed, film, 270 ohms, ½ w, ±2%
1	R33	2182165-2	Resistor, fixed, film, 56 ohms, ½ w, ±2%
1	R34	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R35	2182165-36	Resistor, fixed, film, 1500 ohms, ½ w, ±2%
1	R36	2182165-12	Resistor, fixed, film, 150 ohms, ½ w, ±2%
1	R37	2182165-25	Resistor, fixed, film, 510 ohms, ½ w, ±2%
1	R38	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	R39	2182165-7	Resistor, fixed, film, 91 ohms, ½ w, ±2%
1	R40	2182165-18	Resistor, fixed, film, 270 ohms, ½ w, ±2%
1	R41	2182165-48	Resistor, fixed, film, 4700 ohms, ½ w, ±2%
1	R42	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R43	2182165-132	Resistor, fixed, film, 1 k ohms, 1 w, ±2%
1	R44	2182165-15	Resistor, fixed, film, 200 ohms, ½ w, ±2%
1	R45	2182165-48	Resistor, fixed, film, 4700 ohms, ½ w, ±2%
1	R46	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R47	2182165-132	Resistor, fixed, film, 1 k ohms, 1w, ±2%
1	R48	2182165-15	Resistor, fixed, film, 200 ohms, ½ w, ±2%
1	R49	2182165-28	Resistor, fixed, film, 680 ohms, ½ w, ±2%
1	R50	2182165-28	Resistor, fixed, film, 680 ohms, ½ w, ±2%
1	R51	2182165-2	Resistor, fixed, film, 56 ohms, ½ w, ±2%
1	R52	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%

Table 6. Line Driver (Module 405) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R53	2182165-36	Resistor, fixed, film, 1500 ohms, ½ w, ±2%
1	R54	2182165-12	Resistor, fixed, film, 150 ohms, ½ w, ±2%
1	R55	2182165-25	Resistor, fixed, film, 510 ohms, ½ w, ±2%
1	R56	2182165-119	Resistor, fixed, film, 300 ohms, 1 w, ±2%
1	R57	2182165-7	Resistor, fixed, film, 91 ohms, ½ w, ±2%
1	R58	2182165-18	Resistor, fixed, film, 270 ohms, ½ w, ±2%
1	R59	2182165-2	Resistor, fixed, film, 56 ohms, ½ w, ±2%
1	R60	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R61	2182165-36	Resistor, fixed, film, 1500 ohms, ½ w, ±2%
1	R62	2182165-12	Resistor, fixed, film, 150 ohms, ½ w, ±2%
1	R63	2182165-25	Resistor, fixed, film, 510 ohms, ½ w, ±2%
1	R64	2182165-119	Registor, fixed, film, 300 ohms, 1 w, ±2%
1	R65	2182165-7	Resistor, fixed, film, 91 ohms, ½ w, ±2%
1	R66	2182165-18	Resistor, fixed, film, 270 ohms, ½ w, ±2%
1	R67	2182165-48	Resistor, fixed, film, 4700 ohms, ½ w, ±2%
1	R68	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R69	2182165-132	Resistor, fixed, film, 1 k ohms, 1 w, ±2%
1	R70	2182165-15	Resistor, fixed, film, 200 ohms, ½ w, ±2%
1	R71	2182165-48	Resistor, fixed, film, 4700 ohms, ½ w, ±2%
1	R72	2182165-1	Resistor, fixed, film, 51 ohms, ½ w, ±2%
1	R73	2182165-132	Resistor, fixed, film, 1 k ohms, 1 w, ±2%
1	R74	2182165-15	Resistor, fixed, film, 200 ohms, ½ w, ±2%
1	1	2161394-5	Board, printed circuit
6	10	2180896-2	Pad, transistor mounting
12	11	2180896-9	Pad, transistor mounting



COMPONENT	MTG LG
C1,C2,C3,C4,C5	.8
CR1,CR2,CR3,CR4,CR5,CR6,CR7,CR8, CR9,CR10,CR11,CR12,CR13,CR14,CR15, CR16,CR17,CR18,CR19,CR20,CR21,CR22, CR23,CR24,CR25,CR26,CR27,CR28,CR29, CR30,CR31,CR32,CR33,CR34,CR35, CR36,CR37,CR38,CR39,CR40,CR41,CR42, CR43,CR44,CR45,CR46,CR47,CR48	.7
CR49 CR50	.8
R6,R14,R19,R23,R30,R38,R43,R47,R56, R64,R69,R73	.8
ALL OTHER RESISTORS	.6

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665. USING EPOXY POLYAMIDE PER 2020341.
4. ASSEMBLE PER 8030660.
5. SOLDER PER 8030526.
6. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
7. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7,ON SOLDER SIDE PER 2181314.
8. FOR LIST OF MATERIALS SEE LM2162405.
9. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.
10. COMPONENT HEIGHT NOT TO EXCEED .305.

Figure 2. Line Driver (Module 405), Assembly Drawing

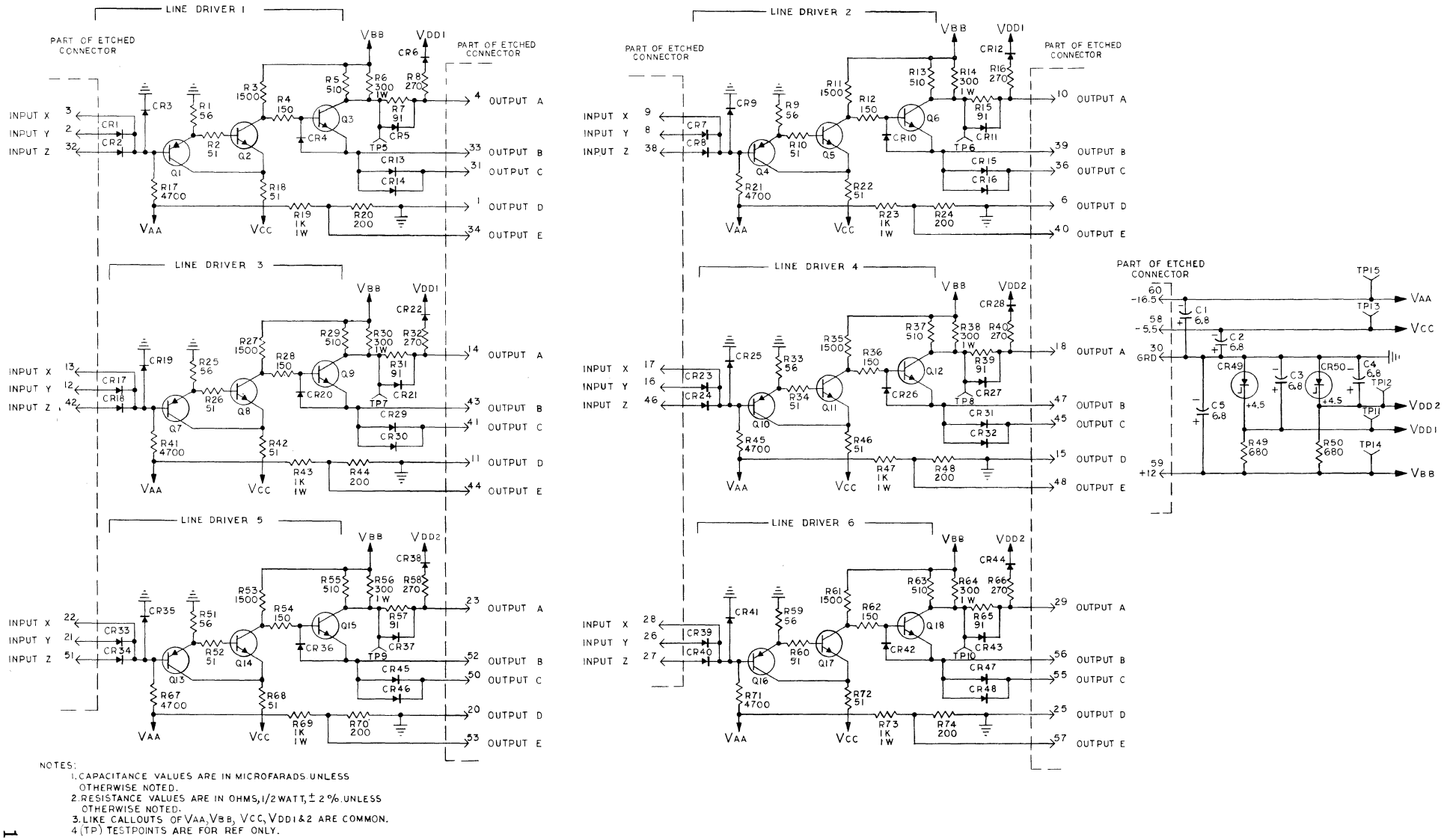


Figure 3. Line Driver (Module 405), Schematic Diagram

LINE RECEIVER (MODULE 406)

RCA 2162406-501

DESCRIPTION

The 406 module contains six identical line receivers, a power supply regulating network, and two line filter capacitors. One line receiver is totally independent of all others; one set of two line receivers have one logic input in common; one set of three line receivers have one logic input in common. The circuit analysis describes the independent line receiver circuit. The nature of the common logic inputs is described in a separate paragraph.

CIRCUIT ANALYSIS

Line receiver 4 has all inputs independent of any other line receiver. Input IN X is used when an MD15 module line driver provides the input; input IN Y is used when a 405 module line driver provides the input. These two types of input are never both connected to the same line receiver. When the input to transistor Q10 is at the logic 0 level (0 v or -2.5 v), the base voltage is at a negative level, transistor Q10 is saturated, and its output is near 0 v. When the input is at the logical 1 level (+8 v or +2.5 v) transistor Q10 is cut off, and its output is near -4.5 v.

When transistor Q10 is cut off and input IN 1 is at the logical 0 level, the junction of diodes CR36 and Zener diode CR38 is held near -4.5 v, transistor Q11 is saturated, and its output is near 0 v. Diodes CR37 and CR39 are back-biased. When transistor Q10 is saturated, or input IN 1 is at the logical 1 level, the junction of diode CR36 and Zener diode CR38 is held near 0 v, transistor Q11 is cut off, and its output is clamped near -4.5 v by current flow through resistor R37 and diode CR39. Diode CR37 clamps the input to ground. Input IN1A can be used to increase the number of inputs to transistor Q11. The inputs, with the input from transistor Q10, make a NOR gate.

The output of transistor Q11 is coupled through diode CR40 to transistor Q12. This output, together with inputs IN2 and IN2A, form a NOR gate identical to the gate of transistor Q11.

If the output of transistor Q12 (OUT 2) is cross-coupled to the input of transistor Q11 (IN 1), the two gates form a flip-flop controlled by the input to transistor Q10 (IN X or IN Y) and the input to transistor Q12 (IN2). When these stages are connected as a flip-flop, the inputs must always be at opposite logic levels. The flip-flop outputs can be used to drive other circuits, but each gate has the other as one of its loads.

Line receiver 5 and line receiver 6 have a common IN 1 input. Line receivers 1, 2, and 3 have a common IN 1 input.

Resistor R61, Zener diode CR67, and capacitor C3, together with parts of the line receiver circuits, form a voltage regulator for the -4.5 v source. When resistor R60 and diode CR66 conduct, they provide a series feed to Zener diode CR67. Six sets of diodes and resistors, each at a clamped output, conduct for all states of the 406 module line receivers. Capacitors C1 and C2 are line filter capacitors.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Output logic levels are described in Table 2. Waveforms and timing are illustrated in Figures 1 and 2.

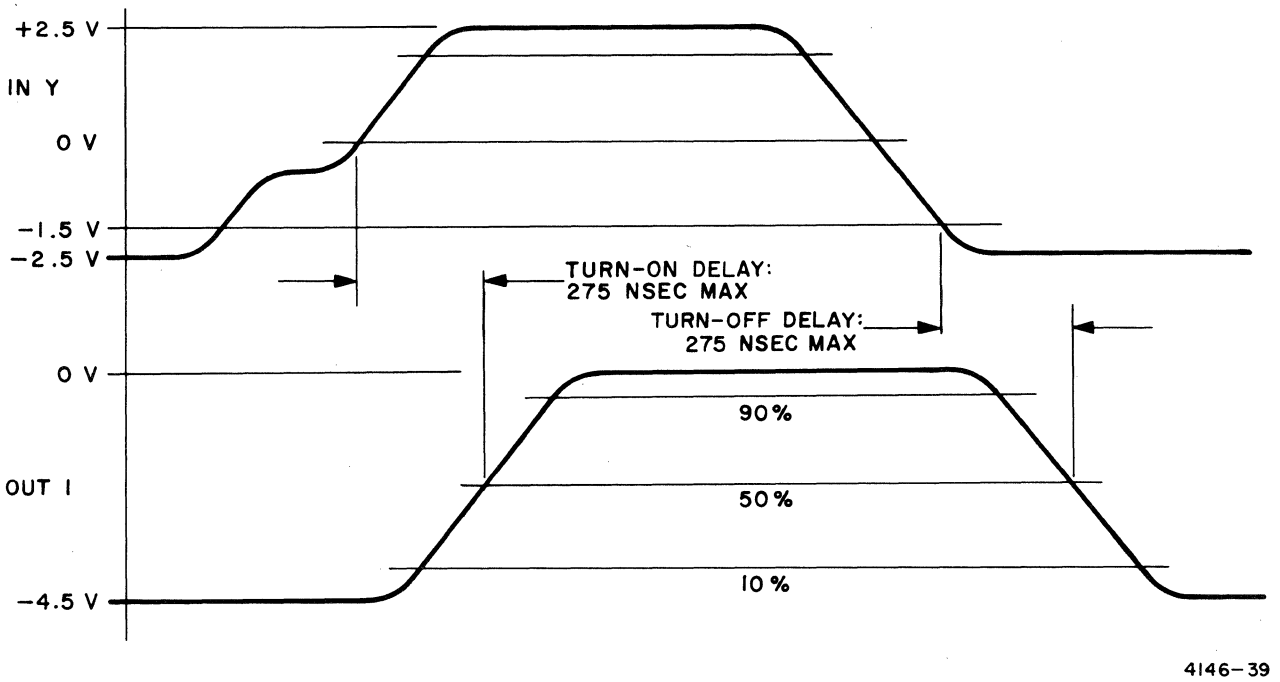


Figure 1. 406 Module, Input Y, Waveforms and Timing

Table 1. Input Logic Levels

INPUT	LEVEL	VOLTAGE	CURRENT
IN X	0	0.0 v (+ 1.0 v, -4.0 v)	0.8 ma maximum IN 1.2 ma maximum OUT
	1	+8.0 v (+7.0 v, -1.3 v)	2.6 ma maximum IN
IN Y	0	-2.5 v (+0.3 v, -2.5 v)	0 ma maximum
	1	+2.5 v (+3.0 v, -1.0 v)	2.4 ma maximum IN
IN 1	0	-5.5 v (+2.05 v, -2.95 v)	0.0 ma maximum
IN 2	1	0.0 v (+0.0 v, -1.25 v)	4.0 ma maximum IN

Table 2. Output Logic Levels

OUTPUT	LEVEL	VOLTAGE	CURRENT
OUT 1	0	-4.5 v (+0.1 v, -1.1 v)	5.4 ma maximum IN
	1	0.0 v (+0.0 v, -0.4 v)	28 ma maximum OUT
OUT 2	0	-4.5 v (+0.1 v, -1.1 v)	5.4 ma maximum IN
	1	0.0 v (+0.0 v, -0.4 v)	32 ma maximum OUT

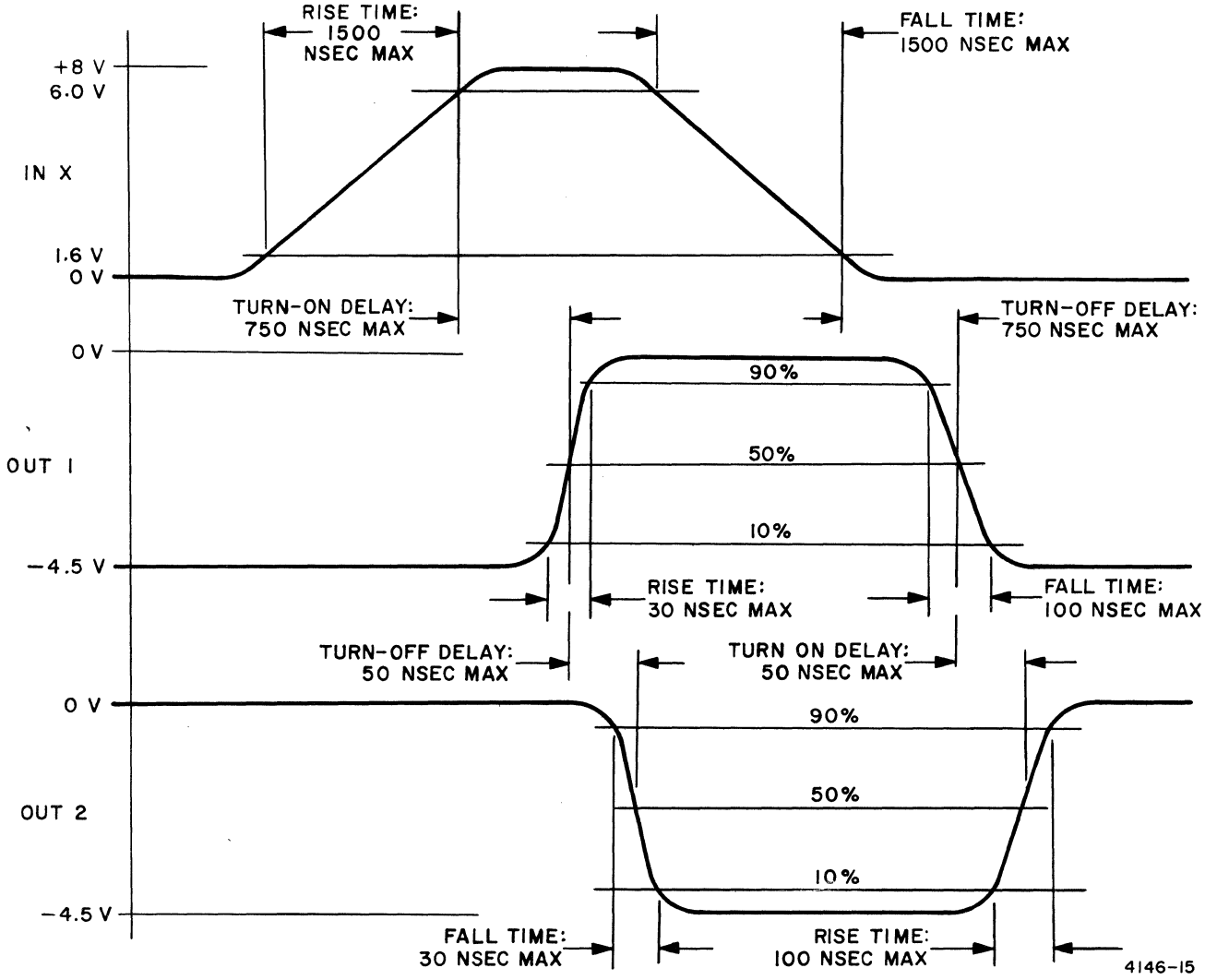


Figure 2. 406 Module, Input X, Waveforms and Timing

LOADING

The maximum number of diodes that can be added at an extender input is nine. Output 1 is capable of driving seven unit loads. Output 2 is capable of driving eight unit loads. When connected as a flip-flop, each output loading is reduced by one. When input IN X is used, each output can drive one trigger load for a 403 module, plus 3 unit loads, or one steering load for a 403 module, plus 3 unit loads.

POWER REQUIREMENTS

No power supply sequencing is required, provided ground is applied to the module first.

Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT	POWER
+12 v ± 5%	2.9 ma nominal 3.24 ma maximum	8.3 watts maximum
-16.5 v ± 5%	320 ma nominal 360 ma maximum into supply	7.2 watts nominal

WIRING

Table 4 lists maximum lengths of wire which may be used for output wiring. For input wiring, coaxial cable must be used.

Table 4. Module 406 Wiring

OPEN WIRE		
	Maximum Length	21 Inches
	Fan-Out Length	72 Inches
TWISTED PAIR		
	Maximum Length	96 Inches
	Single Load	120 Inches

PARTS LIST

Table 5 lists parts for the 406 module. The 406 module assembly is illustrated in Figure 3, and the schematic diagram is illustrated in Figure 4.

Table 5. Line Receiver (Module 406) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-95	Capacitor, fixed, 35 v, 6.8 μf, ±20%
1	C2	8412778-95	Capacitor, fixed, 35 v, 6.8 μf, ±20%
1	C3	8412778-25	Capacitor, fixed, 10 v, 6.8 μf, ±20%
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180816-3	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	2180820-1	Semiconductor device, diode
1	CR10	2180816-3	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180820-1	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2180816-3	Semiconductor device, diode
1	CR17	2180820-1	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2180820-1	Semiconductor device, diode
1	CR20	2180820-1	Semiconductor device, diode
1	CR21	2180816-3	Semiconductor device, diode
1	CR22	2180820-1	Semiconductor device, diode
1	CR23	2180820-1	Semiconductor device, diode
1	CR24	2180820-1	Semiconductor device, diode

Table 5. Line Receiver (Module 406) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR25	2180820-1	Semiconductor device, diode
1	CR26	2180820-1	Semiconductor device, diode
1	CR27	2180816-3	Semiconductor device, diode
1	CR28	2180820-1	Semiconductor device, diode
1	CR29	2180820-1	Semiconductor device, diode
1	CR30	2180820-1	Semiconductor device, diode
1	CR31	2180820-1	Semiconductor device, diode
1	CR32	2180816-3	Semiconductor device, diode
1	CR33	2180820-1	Semiconductor device, diode
1	CR34	2180820-1	Semiconductor device, diode
1	CR35	2180820-1	Semiconductor device, diode
1	CR36	2180820-1	Semiconductor device, diode
1	CR37	2180820-1	Semiconductor device, diode
1	CR38	2180816-3	Semiconductor device, diode
1	CR39	2180820-1	Se miconductor device, diode
1	CR40	2180820-1	Semiconductor device, diode
1	CR41	2180820-1	Semiconductor device, diode
1	CR42	2180820-1	Semiconductor device, diode
1	CR43	2180816-3	Semiconductor device, diode
1	CR44	2180820-1	Semiconductor device, diode
1	CR45	2180820-1	Semiconductor device, diode
1	CR46	2180820-1	Semiconductor device, diode
1	CR47	2180820-1	Semiconductor device, diode
1	CR48	2180820-1	Semiconductor device, diode
1	CR49	2180816-3	Semiconductor device, diode
1	CR50	2180820-1	Semiconductor device, diode
1	CR51	2180820-1	Semiconductor device, diode

Table 5. Line Receiver (Module 406) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR52	2180820-1	Semiconductor device, diode
1	CR53	2180820-1	Semiconductor device, diode
1	CR54	2180816-3	Semiconductor device, diode
1	CR55	2180820-1	Semiconductor device, diode
1	CR56	2180820-1	Semiconductor device, diode
1	CR57	2180820-1	Semiconductor device, diode
1	CR58	2180820-1	Semiconductor device, diode
1	CR59	2180820-1	Semiconductor device, diode
1	CR60	2180816-3	Semiconductor device, diode
1	CR61	2180820-1	Semiconductor device, diode
1	CR62	2180820-1	Semiconductor device, diode
1	CR63	2180820-1	Semiconductor device, diode
1	CR64	2180820-1	Semiconductor device, diode
1	CR65	2180816-3	Semiconductor device, diode
1	CR66	2180820-1	Semiconductor device, diode
1	CR67	2182181-1	Semiconductor device, diode
1	Q1	2182800-1	Semiconductor device, transistor
1	Q2	2180811-1	Semiconductor device, transistor
1	Q3	2180811-1	Semiconductor device, transistor
1	Q4	2182800-1	Semiconductor device, transistor
1	Q5	2180811-1	Semiconductor device, transistor
1	Q6	2180811-1	Semiconductor device, transistor
1	Q7	2182800-1	Semiconductor device, transistor
1	Q8	2180811-1	Semiconductor device, transistor
1	Q9	2180811-1	Semiconductor device, transistor
1	Q10	2182800-1	Semiconductor device, transistor
1	Q11	2180811-1	Semiconductor device, transistor

Table 5. Line Receiver (Module 406) Parts List (cont)

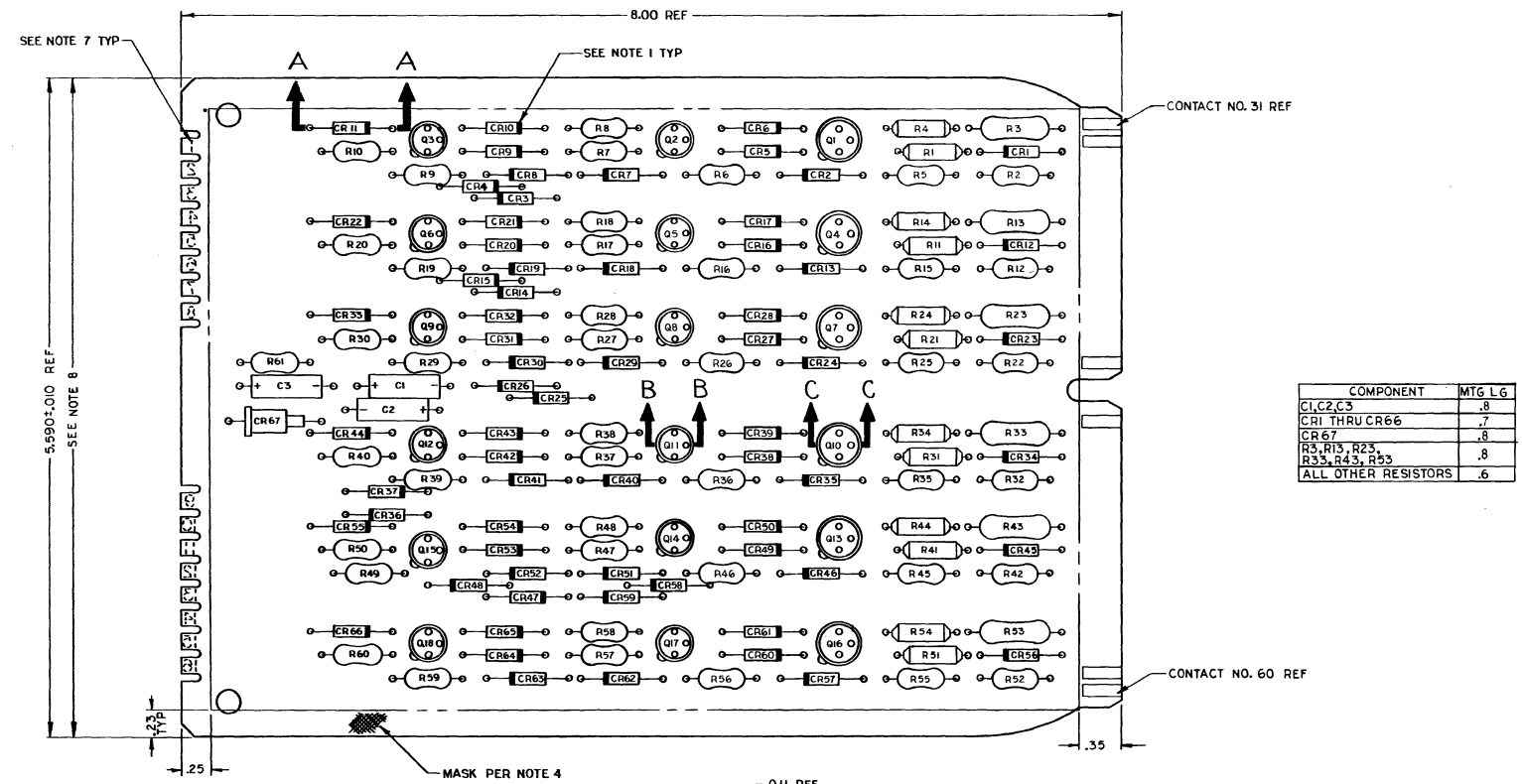
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q12	2180811-1	Semiconductor device, transistor
1	Q13	2182800-1	Semiconductor device, transistor
1	Q14	2180811-1	Semiconductor device, transistor
1	Q15	2180811-1	Semiconductor device, transistor
1	Q16	2182800-1	Semiconductor device, transistor
1	Q17	2180811-1	Semiconductor device, transistor
1	Q18	2180811-1	Semiconductor device, transistor
1	R1	8977933-238	Resistor, fixed, film, 2940 ohms, ±1%, 1/8 w
1	R2	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R3	2182165-132	Resistor, fixed, film, 1 k ohms, ±2%, 1 w
1	R4	8977933-289	Resistor, fixed, film, 10 k ohms, ±1%, 1/8 w
1	R5	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R6	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R7	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R8	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R9	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R10	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R11	8977933-238	Resistor, fixed, film, 2940 ohms, ±1%, 1/8 w
1	R12	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R13	2182165-132	Resistor, fixed, film, 1 k ohms, ±2%, 1 w
1	R14	8977933-289	Resistor, fixed, film, 10 k ohms, ±1%, 1/8 w
1	R15	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R16	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R17	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R18	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R19	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R20	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w

Table 5. Line Receiver (Module 406) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R21	8977933-238	Resistor, fixed, film, 2940 ohms, ±1%, 1/8 w
1	R22	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R23	2182165-132	Resistor, fixed, film, 1 k ohms, ±2%, 1 w
1	R24	8977933-289	Resistor, fixed, film, 10 k ohms, ±1%, 1/8 w
1	R25	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R26	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R27	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R28	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R29	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R30	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R31	8977933-238	Resistor, fixed, film, 2940 ohms, ±1%, 1/8 w
1	R32	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R33	2182165-132	Resistor, fixed, film, 1 k ohms, ±2%, 1 w
1	R34	8977933-289	Resistor, fixed, film, 10 k ohms, ±1%, 1/8 w
1	R35	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R36	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R37	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R38	2182165-48	Resistor, fixed, film, 4700 ohms, ±2 %, 1/2 w
1	R39	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R40	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R41	8977933-238	Resistor, fixed, film, 2940 ohms, ±1%, 1/8 w
1	R42	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R43	2182165-132	Resistor, fixed, film, 1 k ohms, ±2%, 1 w
1	R44	8977933-289	Resistor, fixed, film, 10 k ohms, ±1%, 1/8 w
1	R45	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R46	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R47	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w

Table 5. Line Receiver (Module 406) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R48	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R49	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R50	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R51	8977933-238	Resistor, fixed, film, 2940 ohms, ±1%, 1/8 w
1	R52	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R53	2182165-132	Resistor, fixed, film, 1 k ohms, ±2%, 1 w
1	R54	8977933-289	Resistor, fixed, film, 10 k ohms, ±1%, 1/8 w
1	R55	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R56	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R57	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R58	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R59	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R60	2182165-35	Resistor, fixed, film, 1300 ohms, ±2%, 1/2 w
1	R61	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	1	2161394-6	Board, printed
12	10	2180896-2	Pad, transistor mounting
6	11	2180896-9	Pad, transistor mounting



COMPONENT	MTG LG
C1,C2,C3	.8
CR1 THRU CR66	.7
CR67	.8
R3,R13,R23, R33,R43,R53	.8
ALL OTHER RESISTORS	.6

NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665, USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
8. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BD DIM. INDICATED.
9. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF ELONGATION OF THE PAD.
10. FOR LIST OF MATL SEE LM 2162406.

Figure 3. Line Receiver (Module 406), Assembly Drawing

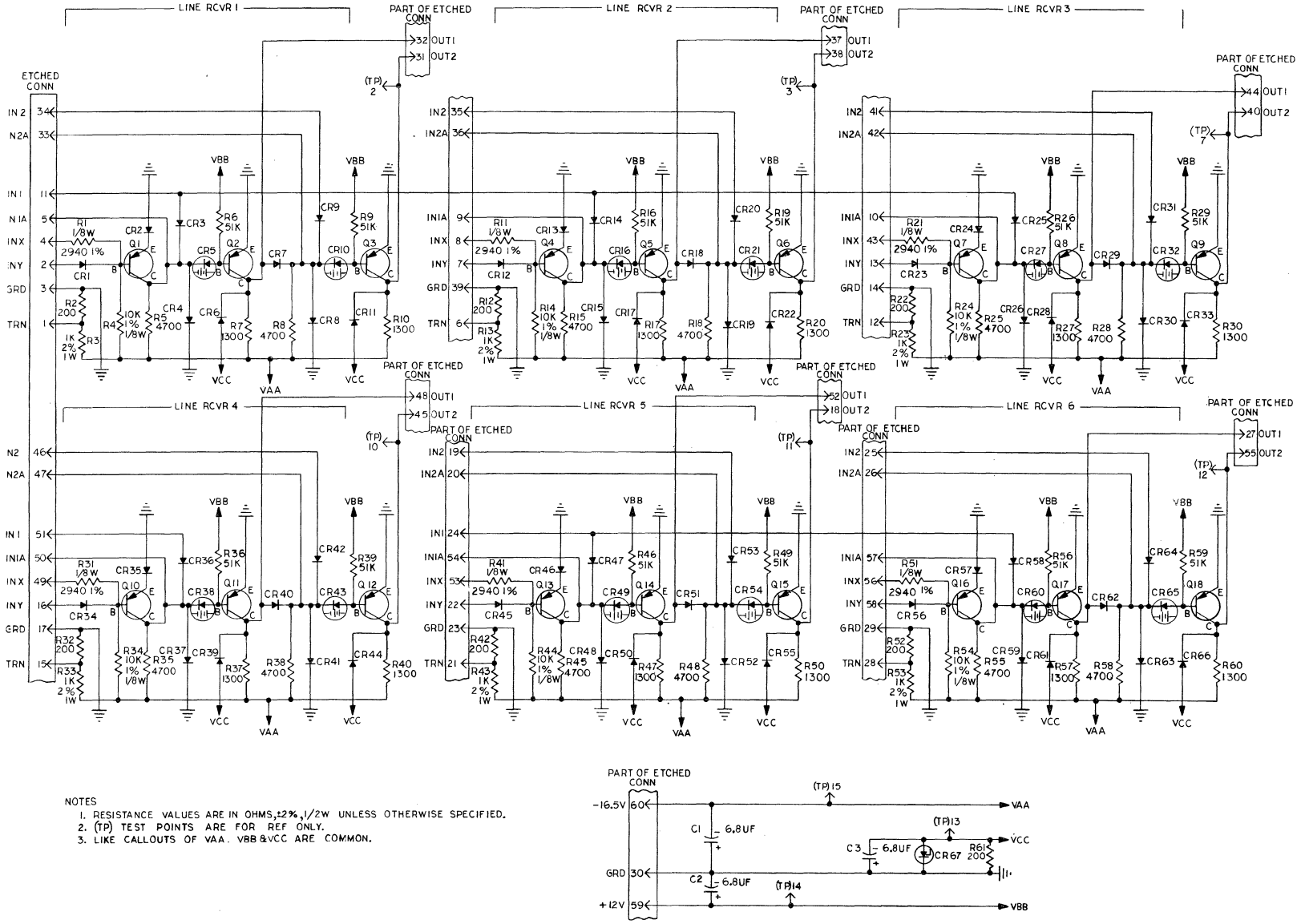


Figure 4. Line Receiver (Module 406), Schematic Diagram

RF OSCILLATOR (MODULE 408)

RCA 2612408-501

DESCRIPTION

The 408 module contains an rf oscillator circuit, a two input NOR gate, and a power supply filtering and regulating network.

CIRCUIT ANALYSIS

Transistor Q1 is a crystal-controlled oscillator circuit which operates at a frequency of 460. 8 kc or 666. 7 kc. The base circuit is tuned with variable inductor L1. Resistors R1 and R2 bias the base at the proper operating voltage.

The output of the rf oscillator is an 8 v peak-to-peak sine wave at test point TP5. Positive peaks are clipped by diode CR1; negative peaks drive transistor Q2 to saturation. As transitor Q2 is driven to saturation, the collector voltage rises from the -4. 5 v at which it is clamped by current flow through resistor R6 and diode CR2. As the collector voltage rises from -4. 5 v to 0 v, transistor Q3 is driven from saturation to cutoff. As transitor Q3 is driven from saturation to cutoff, the collector voltage falls from 0 v, and is clamped at -4. 5 v by current flow through resistor R10 and diode CR3. This output is also fed back through resistor R7 to the base of transistor Q2 hold transistor Q2 in saturation. When the clipped sine wave output of the rf oscillator drives the junction of resistors R5, R4 and R7 near 0 v, transistor Q2 is driven to cutoff and transistor Q3 is driven to saturation, causing the output to rise to near 0 v and hold transistor Q2 at cutoff.

Diodes CR5 and CR6 are inputs to a NOR gate. When either input is near 0 v, transistor Q5 is cut off and the output voltage is clamped near -4. 5 v by current flow through resistor R14 and diode CR9. When both inputs are near -4. 5 v, transistor Q5 is saturated, and the output is held near 0 v.

Resistor R11, Zener diode CR4, and capacitor C10 form a voltage regulator for the -4. 5 v supply. Capacitors C8 and C9 are line filters for the +12 v and -16. 5 v supply, respectively.

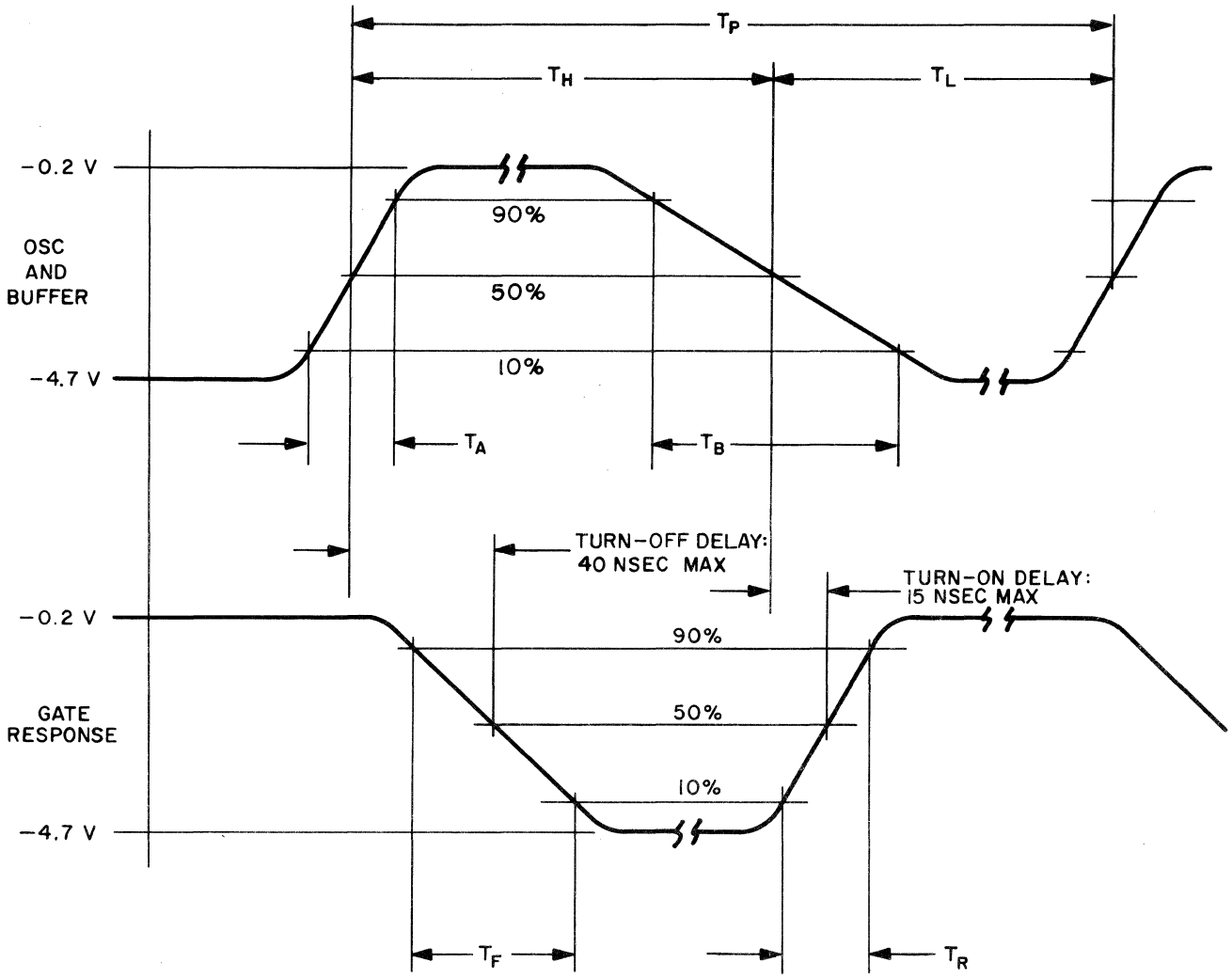
The rf oscillator and buffer may drive the gate or the gate may be used independently. Waveforms and timing are illustrated in Figure 1.

CIRCUIT CHARACTERISTICS

Output logic levels of the oscillator are described in Table 1. Input logic levels of the gate are described in Table 2. Output logic levels of the gate are described in Table 3. Waveforms and timing are illustrated in Figure 1.

Table 1. Oscillator Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4. 7 v (+0. 3 v, -0. 85 v)	0 ma nominal
1	-0. 2 v (+0. 2 v, -0. 2 v)	4 ma nominal



$$\frac{(T_L - T_H)}{(T_L + T_H)} = D$$

D MUST BE LESS THAN 0.08

TIME	MAX NSEC	MIN NSEC
T_P	2200	1450
T_A	25	5
T_B	100	15
T_F	60	0
T_R	25	0

4146-16

Figure 1. 408 Module, Waveforms and Timing

Table 2. Gate Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.7 v (+0.3 v, -0.85 v)	0 ma nominal
1	-0.2 v (+0.2 v, -0.2 v)	4 ma nominal

Table 3. Gate Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.7 v (+0.3 v, -0.85 v)	0 ma nominal
1	-0.2 v (+0.2 v, -0.2 v)	35 ma maximum

LOADING

Each input to the gate is one unit load. The gate can drive eight unit loads.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 4.

Table 4. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ±5%	8.8 ma maximum
-16.5 v ±5%	107 ma maximum

WIRING

Table 5 lists maximum lengths of wire which may be used.

Table 5. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	96 Inches
Single Load	120 Inches

ALIGNMENT PROCEDURE

Each time a crystal of different frequency is used in a particular module, L1 must be aligned. However, different crystals of the same frequency may be substituted without requiring alignment of L1.

TEST EQUIPMENT REQUIRED

The following test equipment is required to align the 408 module:

a. Power supply capable of supplying 8.8 ma maximum at +12 v ±0.6 v.

b. Power supply capable of supplying 107 ma maximum at -16.5 v ± 0.8 v.

c. Toggle switch, Arrow-Hart 20994-EW, or equivalent.

d. Tektronix, Inc., oscilloscope, Model 545A with Type CA plug-in unit or equivalent.

e. Adjustment tool, GC Electronics 8722, or equivalent.

PROCEDURE

Align the 408 module by completing the following steps in the sequence listed:

a. Ensure that power supplies are deenergized.

b. Connect power supplies to 408 module as shown in Figure 2.

c. Open switch S1.

d. Energize +12 volt power supply.

e. Connect oscilloscope to 408 module as shown in Figure 2.

f. Set oscilloscope controls for a continuous sweep using external positive trigger with sweep rate of 50 milliseconds/cm and vertical sensitivity of 0.5 volt/cm.

g. Turn adjustment screw on L1 counterclockwise until it reaches end of travel. Do not force screw beyond this point.

h. Plug crystal to be used into socket XY1 and ensure that crystal is properly held by retaining clip.

i. Connect pin 6 to pin 36 when using a 460.8 kc crystal. Do not make this connection when using a 666.7 kc crystal.

j. Close switch S1.

k. Slowly turn adjustment screw on L1 clockwise until trace widens. Continue adjustment until trace widens no more.

l. Set oscilloscope SWEEP STABILITY control to point where continuous sweep just stops.

m. Open switch S1 and then close it. This should cause trace to appear for one sweep. If sweep does not appear, repeat steps f through l.

n. Alternately open and close switch S1 while simultaneously turning adjustment screw clockwise. The point at which trace widens (Figure 3) will appear at right of oscilloscope face and move to left of face. Continue adjustment until this point is as far left as possible. Continued adjustment in a clockwise direction will cause this point to move back to the right. When this occurs, turn adjustment screw counterclockwise until the point is again as far left as possible. This is the proper adjustment of L1.

o. Close switch S1.

p. Energize -16. 5 volt power supply.

q. Move oscilloscope vertical input probe from test point 5 to test point 11.

r. Set oscilloscope sweep rate for 1. 0 microsecond/cm and adjust for continuous sweep.

s. Observe that waveform is as shown in Figure 4 with portions A and B approximately equal in length.

PARTS LIST

Table 6 lists parts for the 408 module. The 406 module assembly is illustrated in Figure 5, and the schematic diagram is illustrated in Figure 6.

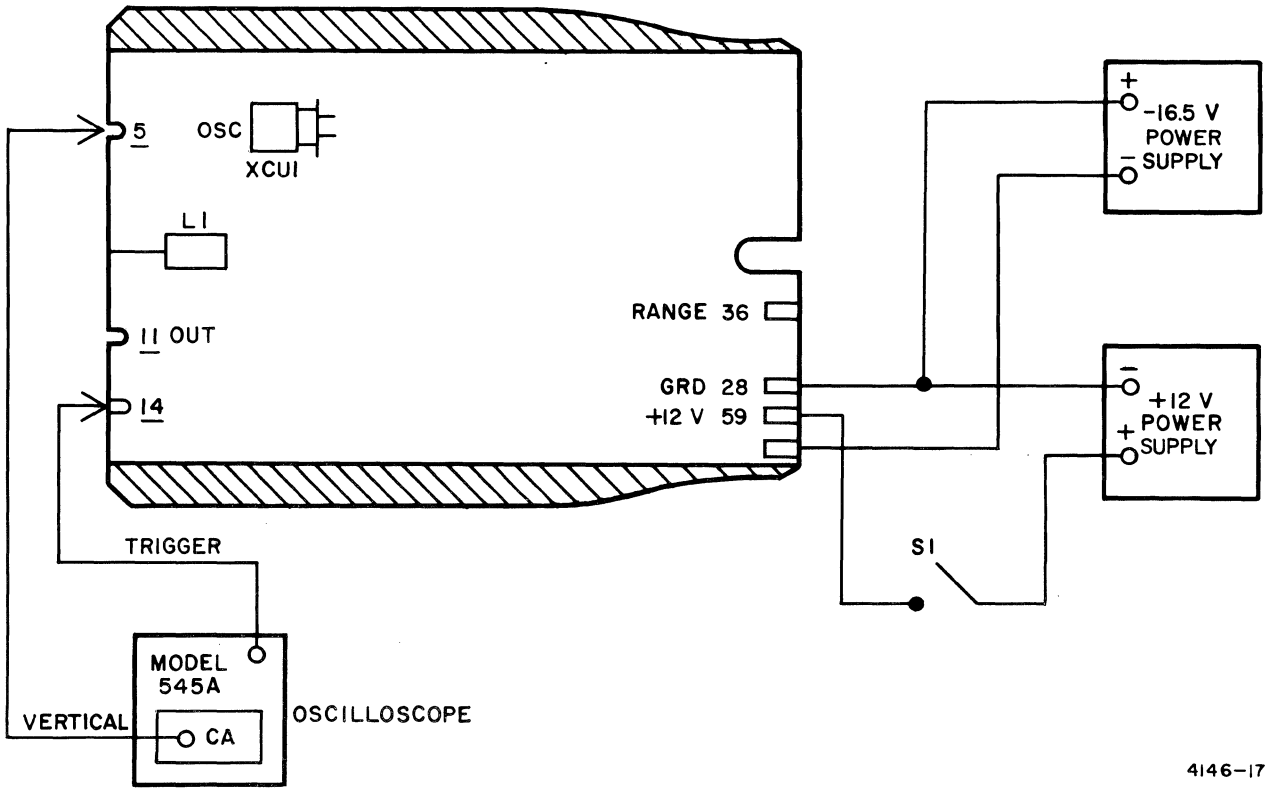


Figure 2. Alignment Test Setup

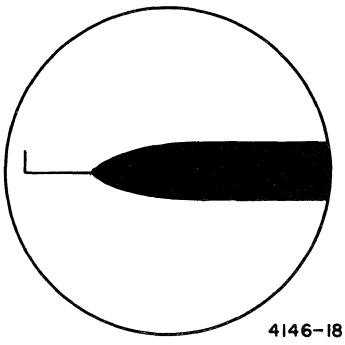


Figure 3. Trace Widening

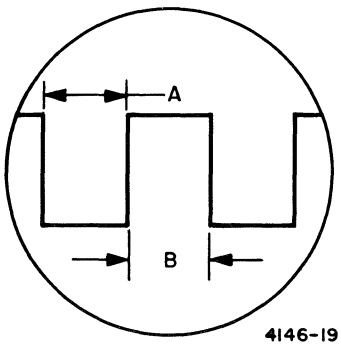


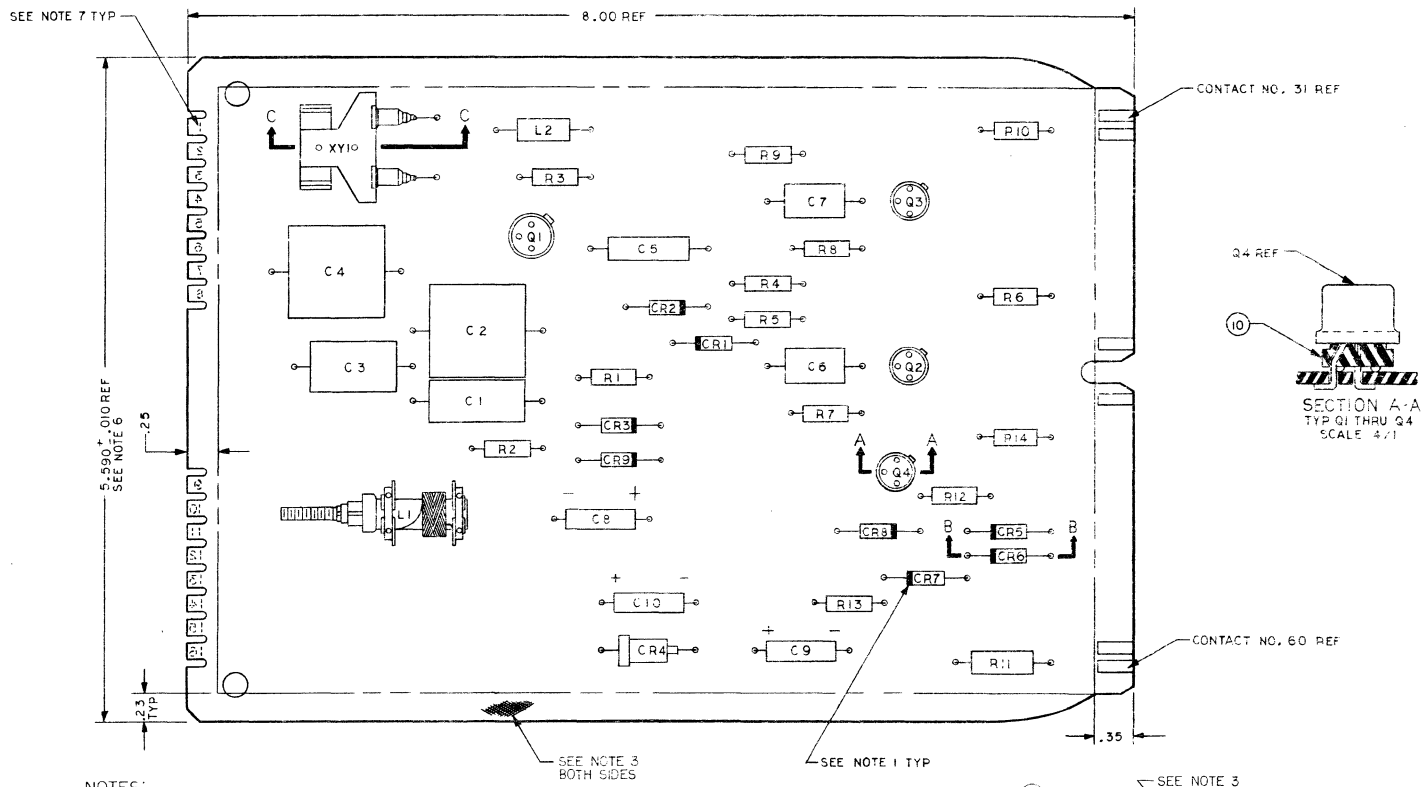
Figure 4. Square Wave

Table 6. RF Oscillator (Module 408) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q1	USN2N1613	Semiconductor device, transistor (MIL-S-19500/181)
1	Q2	2180811-1	Semiconductor device, transistor
1	Q3	2180811-1	Semiconductor device, transistor
1	Q5	2180811-1	Semiconductor device, transistor
1	R1	2182165-46	Resistor, fixed, film, 3.9 k ohms, 1/2 w, ±2%
1	R2	2182165-53	Resistor, fixed, film, 7.5 k ohms, 1/2 w, ±2%
1	R3	2182165-34	Resistor, fixed, film, 1.2 k ohms, 1/2 w, ±2%
1	R4	2182165-34	Resistor, fixed, film, 1.2 k ohms, 1/2 w, ±2%
1	R5	2182165-71	Resistor, fixed, film, 43 k ohms, 1/2 w, ±2%
1	R6	2182165-33	Resistor, fixed, film, 1.1 k ohms, 1/2 w, ±2%
1	R7	2182165-43	Resistor, fixed, film, 3.0 k ohms, 1/2 w, ±2%
1	R8	2182165-31	Resistor, fixed, film, 910 ohms, 1/2 w, ±2%
1	R9	2182165-65	Resistor, fixed, film, 24 k ohms, 1/2 w, ±2%
1	R10	2182165-31	Resistor, fixed, film, 910 ohms, 1/2 w, ±2%
1	R11	2182165-118	Resistor, fixed, film, 270 ohms, 1 w, ±2%
1	R12	2182165-48	Resistor, fixed, film, 4.7 k ohms, 1/2 w, ± 2%
1	R13	2182165-73	Resistor, fixed, film, 51 k ohms, 1/2 w, ±2%
1	R14	2182165-31	Resistor, fixed, film, 910 ohms, 1/2 w, ±2%
1	XY1	2183300-2	Socket, crystal
1	C1	2182067-13	Capacitor, fixed, plastic, 0.068, ±10%, 50 vdc
1	C2	CM30E112GN3	Capacitor, fixed, mica, 1100 pf, ±2%, 500 vdc (MIL-C5)
1	C3	CM20D621GN3	Capacitor, fixed, mica, 620 pf, ±2%, 500 vdc (MIL-C5)
1	C4	CM30E332GN3	Capacitor, fixed, mica, 3300 pf, ±2%, 500 vdc (MIL-C5)
1	C5	2182067-6	Capacitor, fixed, plastic, 0.018, ±10%, 50 vdc
1	C6	CM15C300JN3	Capacitor, fixed, mica, 30 pf, ±5%, 500 vdc (MIL-C5)
1	C7	CM15C101JN3	Capacitor, fixed, mica, 100 pf, ±5%, 500 vdc (MIL-C5)

Table 6. RF Oscillator (Module 408) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C8	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, 35 vdc
1	C9	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, 35 vdc
1	C10	8412778-25	Capacitor, fixed, tantalum, 6.8 μf, 10 vdc
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2182181-1	Semiconductor device, diode
1	CR5	2180820-1	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180816-3	Semiconductor device, diode
1	CR9	2180820-1	Semiconductor device, diode
1	L1	2183302-1	Coil, radio frequency
1	L2	2182820-2	Coil, radio frequency
1	1	2162293-1	Board, printed circuit
2	9	MS16535-52	Rivet
4	10	2180896-1	Pad, transistor mounting

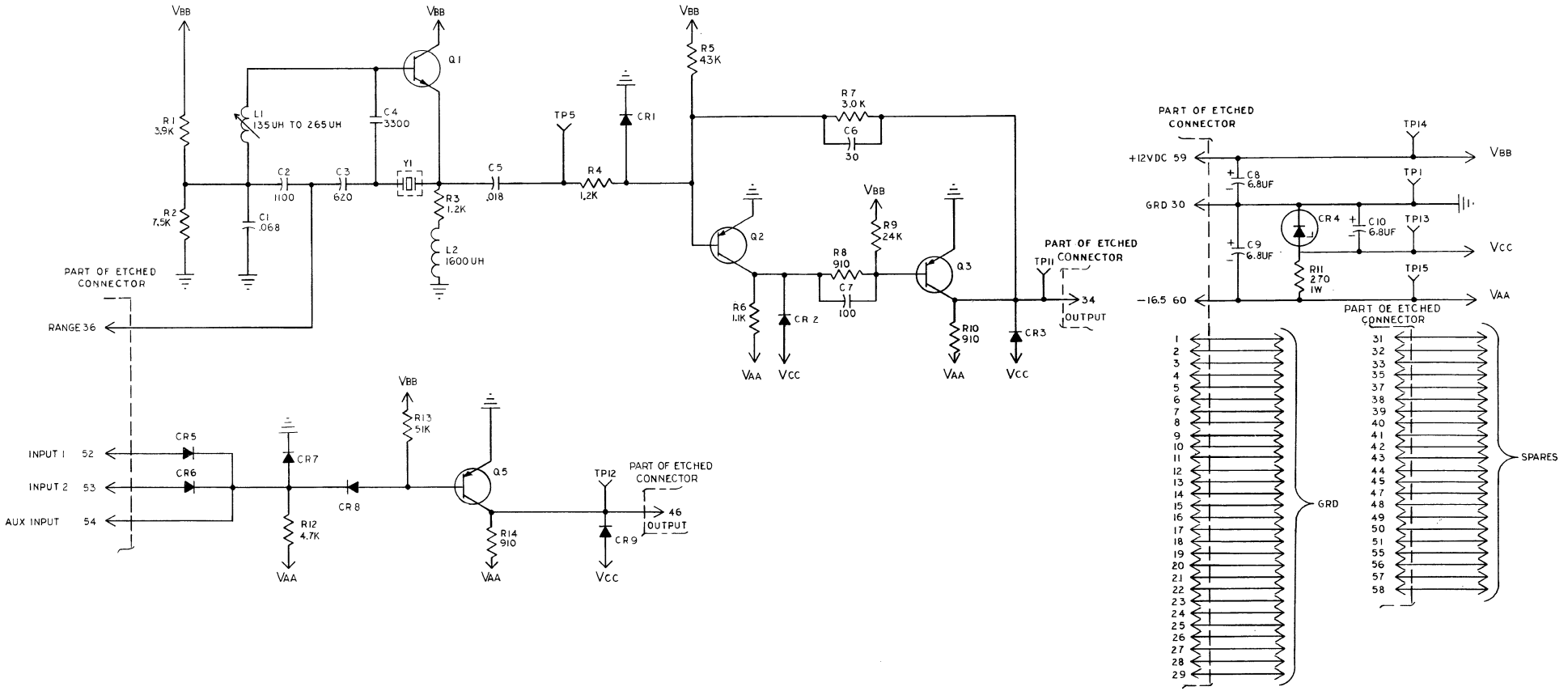


NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. FINISH BOTH SIDES OF CIRCUIT BOARD PER 8030665, USING EPOXY POLYAMIDE PER 2020341, EXCEPT AREA AROUND EDGE OF BOARD NOTED BY PHANTOM LINES. DO NOT ALLOW EPOXY TO ENTER XY1 SOCKET OPENINGS.
4. ASSEMBLE PER 8030660.
5. SOLDER PER 8030526.
6. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
7. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7, ON SOLDER SIDE PER 2181314.
   . ~~FOR LIST OF MATERIALS SEE LM-2162408~~.
8. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.
9. RIVET PER MS16535-52.
10. FOR PROPER SECLECTION OF XY1 SEE USING ASSEMBLY.

COMPONENT	MGT LG
C6,C7,C8,C9, C10	.8
C3,C5	1.0
C1,C2,C4	1.1
CR1,CR2,CR3, CR5,CR6,CR7, CR8,CR9	.7
CR4	.8
R1,R2,R3,R4, R5,R6,R7,R8, R9 R10 R12 R13,R14	.6
R11	.8
L2	.8

Figure 5. RF Oscillator (Module 408), Assembly Drawing



NOTES:

1. CAPACITANCE VALUES LESS THAN 1.0 ARE IN UF AND 1.0 AND ABOVE ARE IN PF EXCEPT AS INDICATED.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, ±2%. EXCEPT AS INDICATED.
3. LIKE CALLOUTS OF VAA, VBB AND VCC ARE COMMON.
4. Y1 IS REFERENCED TO XY1 AT THE USING ASSEMBLY, PREFIX ALL OTHER REFERENCE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
5. (TP) TEST POINTS ARE PART OF ETCHED CIRCUITRY AND ARE FOR REFERENCE ONLY.

Figure 6. RF Oscillator (Module 408), Schematic Diagram

ONE-SHOT (MODULE 410)

RCA 2162410-501

DESCRIPTION

The 410 module contains two identical one-shots, two input networks, nine independent ground connections, two regulated power supplies, and two line filter capacitors. The 410 module produces a positive-going output pulse for a negative-going input trigger. The pulse width can be varied by selecting combinations of eight fixed capacitance values.

CIRCUIT ANALYSIS

The two one-shots are identical and independent, therefore only one circuit is described.

ONE-SHOT STABLE STATE

In the stable state transistors Q1 and Q3 are cut off, and transistor Q2 is in saturation. The base voltage of transistor Q1 is maintained at a slight positive voltage by current flow through resistors R3 and R2. The collector of transistor Q1 is clamped to -6.8 v by current flow through resistor R4 and diode CR2. The collector of transistor Q1 is coupled to the junction of diode CR3 and resistor R5 through one or more of capacitors C1 through C9, which form the timing capacitor for the one-shot. The base voltage of transistor Q2 is controlled by current flow through variable resistor R6, thermistor RT1, resistor R5, diode CR3, and resistor R7. In the stable state, the base voltage is near -4 v and diode CR4 is back-biased. The collector of saturated transistor Q2 is near 0 v, and diode CR5 is reverse biased. The base voltage of transistor Q3 is maintained at a slight positive potential by current flow through resistors R9 and R10. The collector of transistor Q3 is clamped to -4.7 v by current flow through resistor R11 and diode CR6.

ONE-SHOT UNSTABLE STATE

A negative-going level change applied to the input is differentiated by capacitor C10 and resistor R1, and causes current to flow from the base of transistor Q1 through diode CR1 and resistor R1. The base current starts transistor Q1 transition from cutoff to saturation. Transistor Q1 collector voltage rises from the -6.8 v clamped level toward 0 v. This positive-going change is coupled through the timing capacitors to the junction of resistor R5 and diode CR3, driving the junction to a more positive potential, back-biasing diode CR3. The base voltage of transistor Q2 is pulled positive by resistor R7 until diode CR4 conducts, clamping the base voltage to 0 v. Transistor Q2 is driven from saturation to cutoff. The collector voltage of transistor Q2 goes negative until it is clamped at -4.7 v by current flow through resistor R8 and diode CR5. This negative-going pulse is coupled through resistor R9 and capacitor C12 to the base of transistor Q3, which becomes forward-biased, causing transistor Q3 to be saturated. The output voltage rises from the clamped -4.7 v level to near 0 v. The negative-going pulse output of transistor Q2 is also coupled to the base of transistor Q1 through resistor R3 and capacitor C11, holding transistor Q1 in saturation. As the timing capacitor discharges through resistor R5, thermistor RT1, and variable resistor R6, transistor Q2 once again becomes forward biased and saturated. The collector voltage rises from the -4.7 v level to near 0 v and drives transistor Q1 and Q3 to cutoff. The discharge period is primarily determined by the size of the capacitor and the discharge circuit.

TERMINATING NETWORKS

Resistor R26 and diode CR15, and resistor R27 and diode CR16 are identical terminating networks. An input circuit is used for a one-shot driven by a gate circuit on a 401 module, by jumpering the input of the one-shot to the input of the terminating network.

VOLTAGE REGULATORS AND FILTERS

Resistor R23, Zener diode CR13, and capacitor C26 form a voltage-regulated power source for -6.8 v. Resistors R24 and R25, Zener diode CR14, and capacitor C27 form a voltage-regulated power source for -4.5 v. Capacitors C25 and C28 are line filter capacitors for the -16.5 v source and +12 v source, respectively.

CIRCUIT CHARACTERISTICS

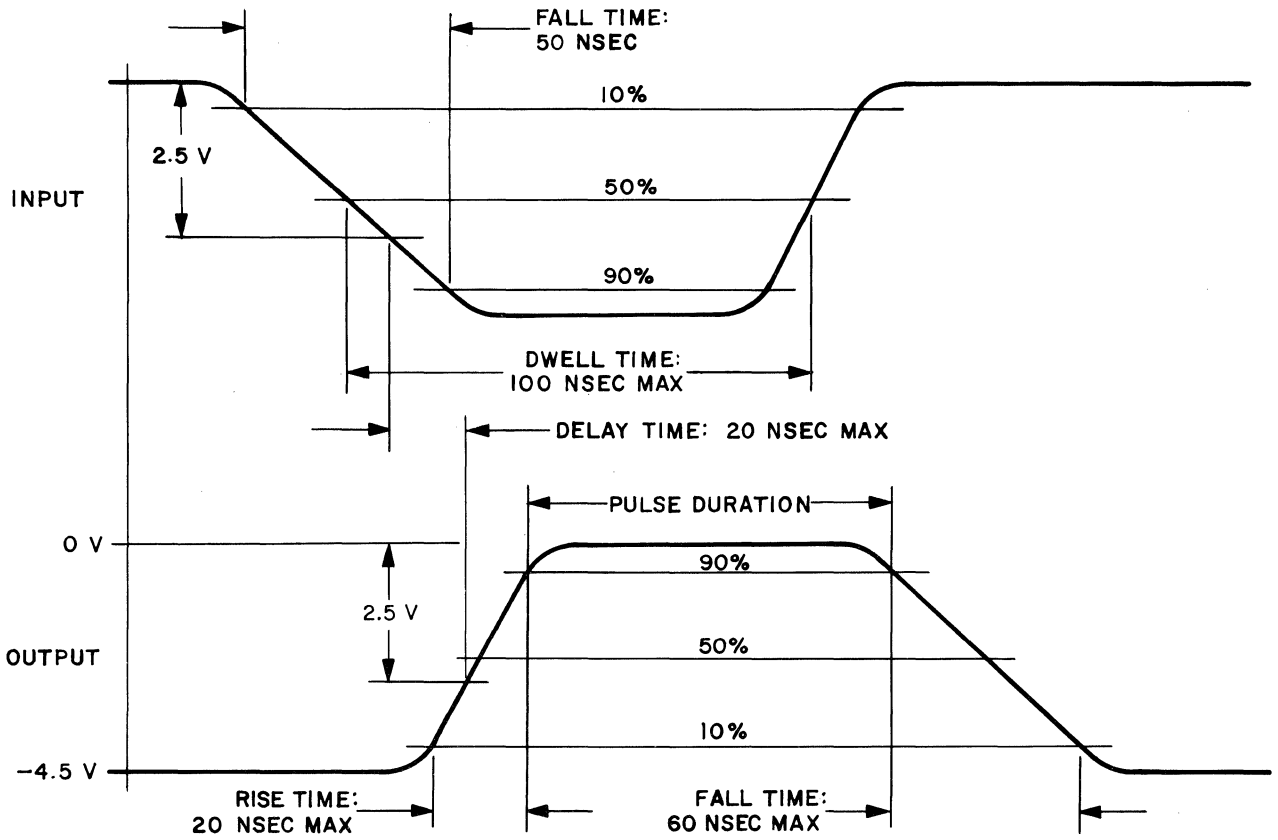
The one-shot is triggered by a negative voltage change greater than 3.25 v and less than 9.0 v. Output logic levels are described in Table 1. Pulse duration for various combinations of timing capacitors are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Output Logic Levels

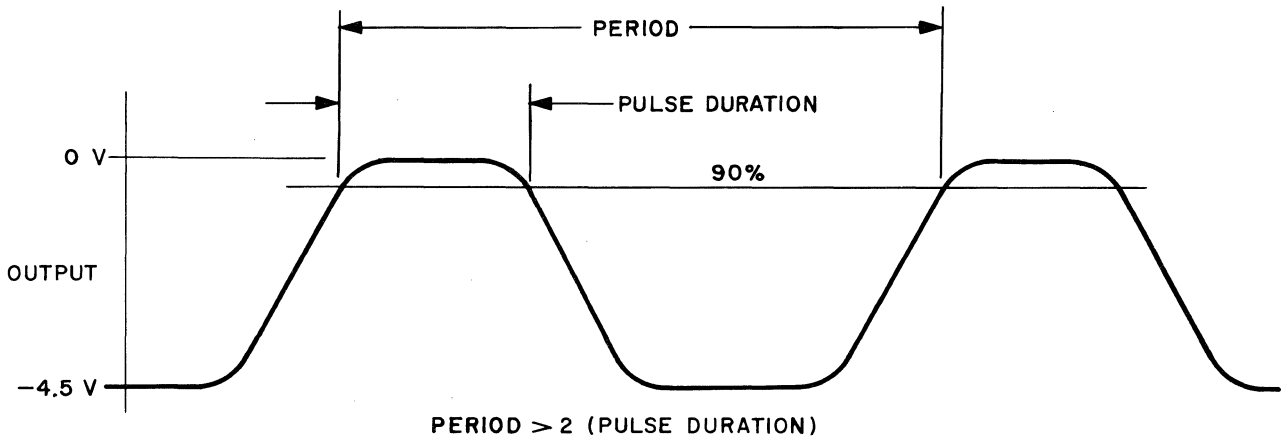
LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2 v, -0.6 v)	0 ma
1	0.0 v (+0.0 v, -0.5 v)	32 ma maximum OUT

Table 2. Output Pulse Duration

PULSE DURATION (Microseconds)		PIN CONNECTIONS	
Minimum	Maximum	No. 1 Circuit	No. 2 Circuit
0.045	0.062	8-44	52-45
0.097	0.130	37-44	22-45
0.143	0.191	37-38, 8-44	22-21, 52-45
0.177	0.240	36-44	23-45
0.222	0.301	36-38, 8-44	23-21, 52-45
0.267	0.362	36-7, 37-44	23-53, 22-45
0.319	0.431	36-7, 37-38, 8-44	23-53, 22-21, 52-45
0.390	0.510	35-44	24-45
0.487	0.640	35-7, 37-44	24-53, 22-45
0.567	0.750	35-6, 36-44	24-54, 23-45
0.664	0.880	35-6, 36-7, 37-44	24-54, 23-53, 22-45
0.800	1.070	34-44	25-45
0.977	1.310	34-6, 36-44	25-54, 23-45
1.190	1.820	34-5, 35-44	25-55, 24-45
1.760	2.380	33-44	26-45
2.150	2.890	33-5, 35-44	26-55, 24-45
2.560	3.450	33-4, 34-6, 36-44	26-56, 25-54, 23-45
2.950	3.960	33-4, 34-5, 35-6, 36-44	26-56, 25-55, 24-54, 23-45
3.217	4.322	33-4, 34-5, 35-6, 36-7, 37-38, 8-44	26-56, 25-55, 24-54, 23-53, 22-21, 52-45
16.6	23.0	32-44	28-45
400	510	39-44	51-45



A. WAVEFORMS



PERIOD > 2 (PULSE DURATION)

B. DUTY CYCLE

4146-20

Figure 1. 410 Module, Waveforms and Timing

LOADING

The input to each one-shot is approximately equivalent to one 401 gate. Each one-shot is capable of driving a maximum of eight 401 gates.

POWER REQUIREMENTS

No power supply sequencing is required, provided that ground is applied to the module first.

Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT	POWER
+12 v ± 5%	5.7 ma minimum 6.4 ma nominal 7.0 ma maximum	2.03 watts nominal
-16.5 v ±5%	144 ma minimum 160 ma nominal 175 ma maximum	2.33 watts maximum

WIRING

Table 4 lists maximum length of wire which may be used.

Table 4. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED WIRE	
Maximum Length	96 Inches
Single Load	120 Inches

PARTS LIST

Table 5 lists parts for the 410 module. The 410 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 5. One-Shot (Module 410) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-59	Capacitor, fixed, tantalum, 0.33 μf, ±10%, 35 vdc
1	C2	CY10C390G	Capacitor, fixed, glass dielectric, 39 pf, ±2%, 500 vdc (MIL-C-11272)
1	C3	CY10C820G	Capacitor, fixed, glass dielectric, 82 pf, ±2%, 500 vdc (MIL-C-11272)
1	C4	CY10C151G	Capacitor, fixed, glass dielectric, 150 pf, ±2%, 500 vdc (MIL-C-11272)
1	C5	CY15C331G	Capacitor, fixed, glass dielectric, 330 pf, ±2%, 500 vdc (MIL-C-11272)
1	C6	CY15C681G	Capacitor, fixed, glass dielectric, 680 pf, ±2%, 500 vdc (MIL-C-11272)
1	C7	CY20C152G	Capacitor, fixed, glass dielectric, 0.0015 μf, ±2%, 500 vdc (MIL-C-11272)
1	C8	CY20C392G	Capacitor, fixed, glass dielectric, 0.0039 μf, ±2%, 300 vdc (MIL-C-11272)
1	C9	CY30C103G	Capacitor, fixed, glass dielectric, 0.01 μf, ±2%, 300 vdc (MIL-C-11272)
1	C10	CM15C470JN3	Capacitor, fixed, mica dielectric, 47 pf, ±5%, 500 vdc (MIL-C-5)
1	C11	CM15C220JN3	Capacitor, fixed, mica dielectric, 22 pf, ±5%, 500 vdc (MIL-C-5)
1	C12	CM15C330JN3	Capacitor, fixed, mica dielectric, 33 pf, ±5%, 500 vdc (MIL-C-5)
1	C13	8412778-59	Capacitor, fixed, tantalum, 0.33 μf, ±10%, 35 vdc
1	C14	CY10C390G	Capacitor, fixed, glass dielectric, 39 pf, ±2%, 500 vdc (MIL-C-11272)
1	C15	CY10C820G	Capacitor, fixed, glass dielectric, 82 pf, ±2%, 500 vdc (MIL-C-11272)
1	C16	CY10C151G	Capacitor, fixed, glass dielectric, 150 pf, ±2%, 500 vdc (MIL-C-11272)
1	C17	CY15C331G	Capacitor, fixed, glass dielectric, 330 pf, ±2%, 500 vdc (MIL-C-11272)
1	C18	CY15C681G	Capacitor, fixed, glass dielectric, 680 pf, ±2%, 500 vdc (MIL-C-11272)
1	C19	CY20C152G	Capacitor, fixed, glass dielectric, 0.0015 μf, ±2%, 500 vdc (MIL-C-11272)
1	C20	CY20C392G	Capacitor, fixed, glass dielectric, 0.0039 μf, ±2%, 300 vdc (MIL-C-11272)

Table 5. One-Shot (Module 410) Parts List (cont)

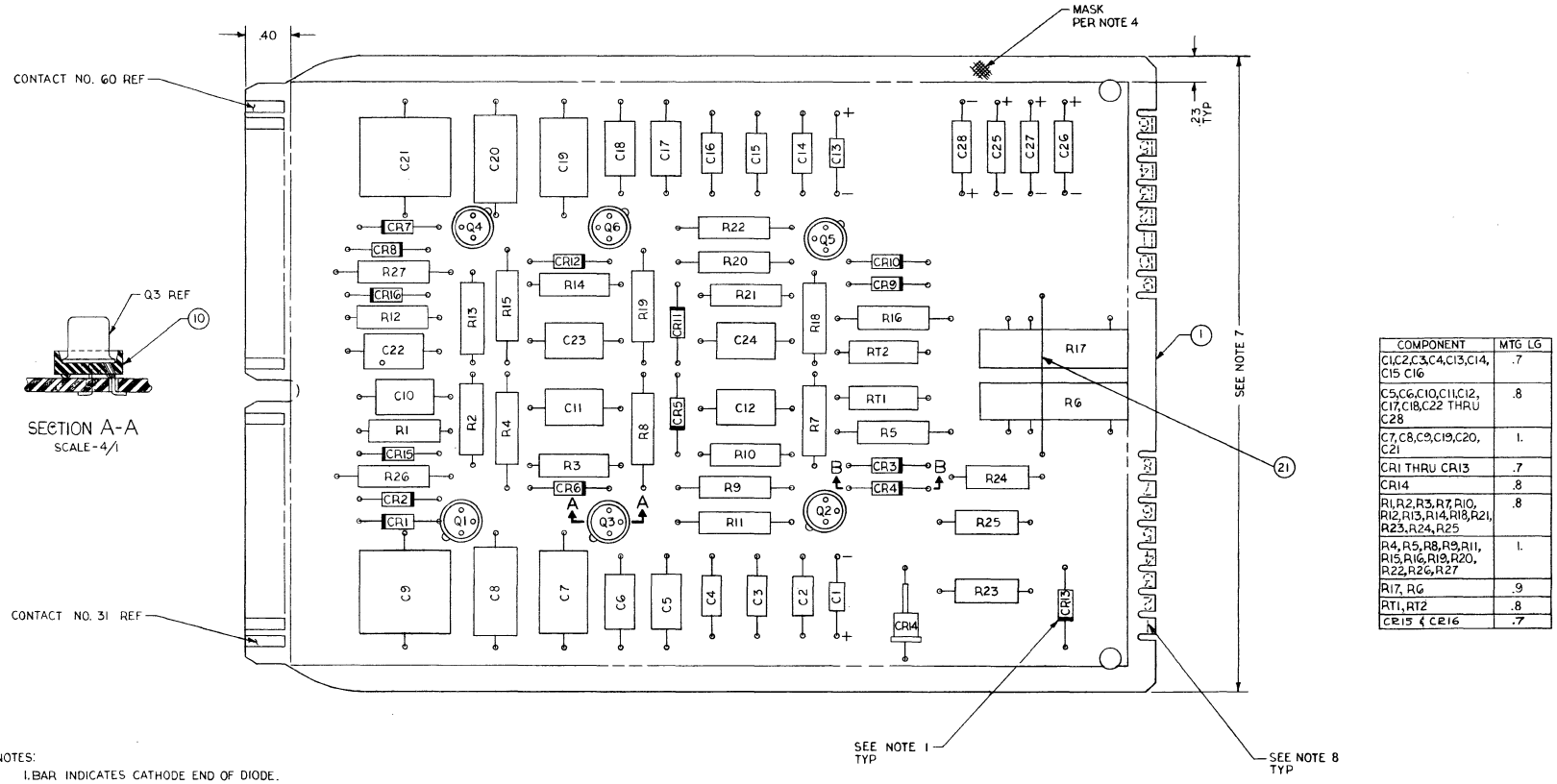
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C21	CY30C103G	Capacitor, fixed, glass dielectric, 0.01 μf, ± 2%, 300 vdc (MIL-C-11272)
1	C22	CM15C470JN3	Capacitor, fixed, mica dielectric, 47 pf, ± 5%, 500 vdc (MIL-C-5)
1	C23	CM15C220JN3	Capacitor, fixed, mica dielectric, 22 pf, ± 5%, 500 vdc (MIL-C-5)
1	C24	CM15C330JN3	Capacitor, fixed, mica dielectric, 33 pf, ± 5%, 500 vdc (MIL-C-5)
1	C25	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C26	8412778-25	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 10 vdc
1	C27	8412778-25	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 10 vdc
1	C28	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	USN 1N914	Semiconductor device, diode (MIL-S-19500/116)
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180820-1	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	USN 1N914	Semiconductor device, diode (MIL-S-19500/116)
1	CR10	2180820-1	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180823-1	Semiconductor device, diode
1	CR14	2182181-1	Semiconductor device, diode
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	Q1	2180801-1	Semiconductor device, transistor
1	Q2	2180801-1	Semiconductor device, transistor
1	Q3	2180801-1	Semiconductor device, transistor

Table 5. One-Shot (Module 410) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q4	2180801-1	Semiconductor device, transistor
1	Q5	2180801-1	Semiconductor device, transistor
1	Q6	2180801-1	Semiconductor device, transistor
1	R1	8977939-301	Resistor, fixed, film, 1470 ohms, 1/4 w, ±1%
1	R2	8977939-209	Resistor, fixed, film, 13.3 k ohms, 1/4 w, ±1%
1	R3	8977939-221	Resistor, fixed, film, 1960 ohms, 1/4 w, ±1%
1	R4	RN65D1331F	Resistor, fixed, film, 1330 ohms, 1/2 w, ±1% (MIL-R-10509/2B)
1	R5	8977939-197	Resistor, fixed, film, 1100 ohms, 1/4 w, ±1%
1	R6	2182836-207	Resistor, variable, wirewound, 10 ohms to 1000 ohms, 1 w, ±5%
1	R7	8977939-317	Resistor, fixed, film, 19.6 k ohms, 1/4 w, ±1%
1	R8	RN65D8250F	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R9	RN65D1001F	Resistor, fixed, film, 1000 ohms, 1/2 w, ±1% (MIL-R-10509/2B)
1	R10	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R11	RN65D8250F	Resistor, fixed, film, 825 ohms, 1/2 w, ±1% (MIL-R-10509/2B)
1	R12	8977939-301	Resistor, fixed, film, 1470 ohms, 1/4 w, ±1%
1	R13	8977939-209	Resistor, fixed, film, 13.3 k ohms, 1/4 w, ±1%
1	R14	8977939-221	Resistor, fixed, film, 1960 ohms, 1/4 w, ±1%
1	R15	RN65D1331F	Resistor, fixed, film, 1330 ohms, 1/2 w, ±1% (MIL-R-10509/2B)
1	R16	8977939-197	Resistor, fixed, film, 1100 ohms, 1/4 w, ±1%
1	R17	2182836-207	Resistor, variable, wirewound, 10 ohms to 1000 ohms, 1 w, ±5%
1	R18	8977939-317	Resistor, fixed, film, 19.6 k ohmes, 1/4 w, ±1%
1	R19	RN65D8250F	Resistor, fixed, film, 825 ohms, 1/2 w, ±1% (MIL-R-10509/2B)
1	R20	RN65D1001F	Resistor, fixed, film, 1000 ohms, 1/2 w, ±1% (MIL-R-10509/2B)
1	R21	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R22	RN65D8250F	Resistor, fixed, film, 825 ohms, 1/2 w, ±1% (MIL-R-10509/2B)
1	R23	2182165-121	Resistor, fixed, film, 360 ohms, 1 w, ±2%
1	R24	2182165-117	Resistor, fixed, film, 240 ohms, 1 w, ±2%

Table 5. One-Shot (Module 410) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R25	2182165-117	Resistor, fixed, film, 240 ohms, 1 w, ± 2%
1	R26	RN65D2001F	Resistor, fixed, film, 2000 ohms, 1/2 w, ± 1% (MIL-R-10509/2B)
1	R27	RN65D2001F	Resistor, fixed, film, 2000 ohms, 1/2 w, ± 1% (MIL-R-10509/2B)
1	RT1	2180888-27	Resistor, thermal, 150 ohms, 1/4 w, ± 5%
1	RT2	2180888-27	Resistor, thermal, 150 ohms, 1/4 w, ± 5%
1	1	2161394-10	Board, printed circuit
6	10	2180896-2	Pad, transistor mounting
1	21	2010105-20	Strap, copper, wirewound, dia. 0.0320

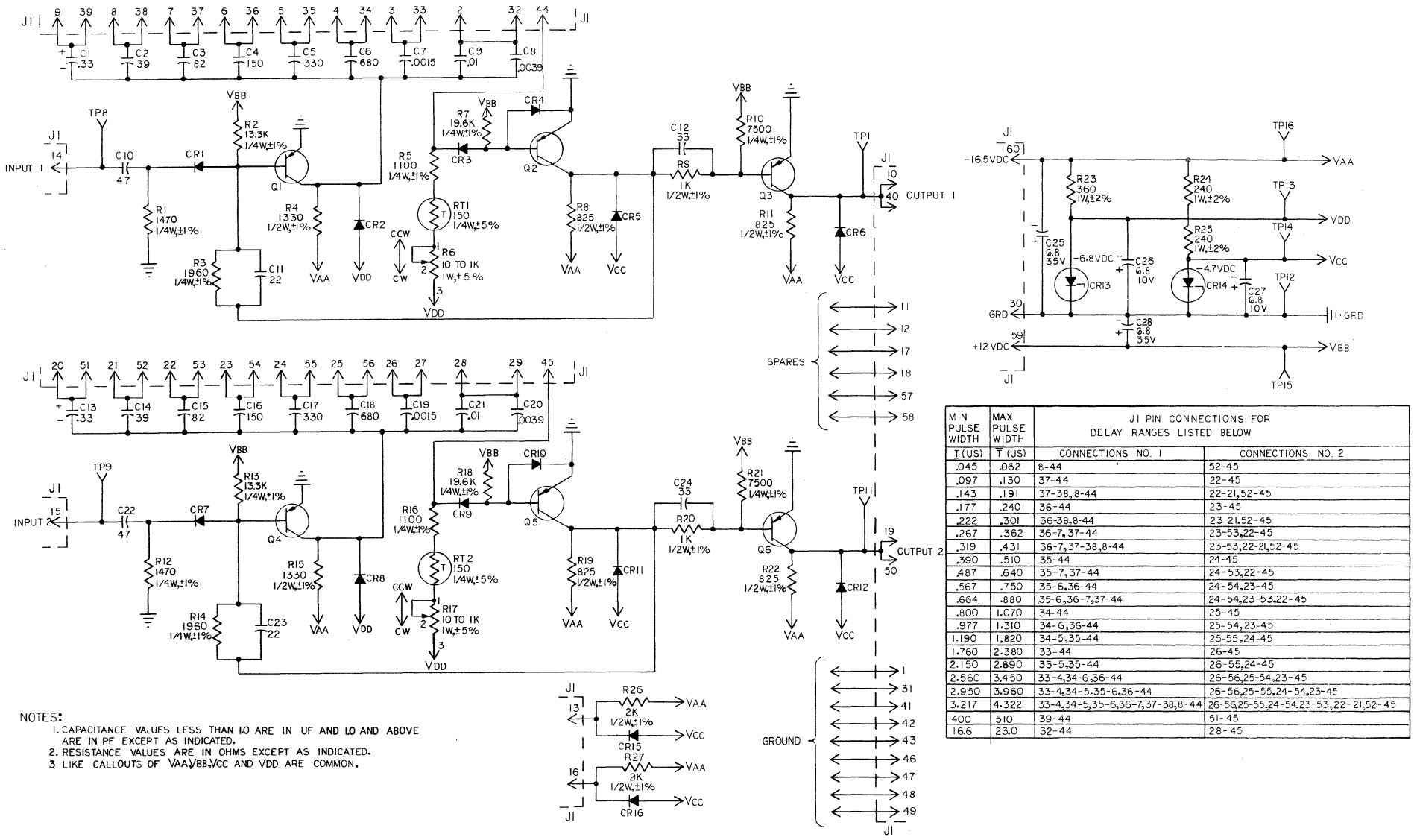


COMPONENT	MTG LG
C1,C2,C3,C4,C13,C14, C15 C16	.7
C5,C6,C10,C11,C12, C17,C18,C22 THRU C28	.8
C7,C8,C9,C19,C20, C21	1.
CR1 THRU CR13	.7
CR14	.8
R1,R2,R3,R7,R10, R12,R13,R14,R18,R21, R23,R24,R25	.8
R4,R5,R8,R9,R11, R15,R16,R19,R20, R22,R26,R27	1.
R17, R6	.9
RT1, RT2	.8
CR15 & CR16	.7

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON WIRING SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 (USING EPOXY POLYAMAIDE PER 2020341.).
5. ASSEMBLY PER 8030660.
6. SOLDER PER 8030526
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
9. FOR LIST OF MATERIALS SEE LM 2162410
10. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.

Figure 2. One-Shot (Module 410), Assembly Drawing



NOTES:
1. CAPACITANCE VALUES LESS THAN 1.0 ARE IN UF AND 1.0 AND ABOVE ARE IN PF EXCEPT AS INDICATED.
2. RESISTANCE VALUES ARE IN OHMS EXCEPT AS INDICATED.
3 LIKE CALLOUTS OF VAA,VBB,VCC AND VDD ARE COMMON.

MIN PULSE WIDTH	MAX PULSE WIDTH	J1 PIN CONNECTIONS FOR DELAY RANGES LISTED BELOW	
T (US)	$\overline{T}$ (US)	CONNECTIONS NO. 1	CONNECTIONS NO. 2
.045	.062	8-44	52-45
.097	.130	37-44	22-45
.143	.191	37-38, 8-44	22-21, 52-45
.177	.240	36-44	23-45
.222	.301	36-38, 8-44	23-21, 52-45
.267	.362	36-7, 37-44	23-53, 22-45
.319	.431	36-7, 37-38, 8-44	23-53, 22-21, 52-45
.390	.510	35-44	24-45
.487	.640	35-7, 37-44	24-53, 22-45
.567	.750	35-6, 36-44	24-54, 23-45
.664	.880	35-6, 36-7, 37-44	24-54, 23-53, 22-45
.800	1.070	34-44	25-45
.977	1.310	34-6, 36-44	25-54, 23-45
1.190	1.820	34-5, 35-44	25-55, 24-45
1.760	2.380	33-44	26-45
2.150	2.890	33-5, 35-44	26-55, 24-45
2.560	3.450	33-4, 34-6, 36-44	26-56, 25-54, 23-45
2.950	3.960	33-4, 34-5, 35-6, 36-44	26-56, 25-55, 24-54, 23-45
3.217	4.322	33-4, 34-5, 35-6, 36-7, 37-38, 8-44	26-56, 25-55, 24-54, 23-53, 22-21, 52-45
400	510	39-44	51-45
16.6	23.0	32-44	28-45

Figure 3. One-Shot (Module 410), Schematic Diagram

RELAY (MODULE 411)

RCA 2162411-501

DESCRIPTION

The 411 module contains six identical relay circuits, each controlled by a two-input driver gate. Each relay has one set of SPDT Form D (make-before-break) mercury-wetted contacts, and is provided with two contact protection networks. A resistor-capacitor filter network and a three-diode voltage stabilizing network are provided at the power supply input line.

CIRCUIT ANALYSIS

All of the six circuits are identical and independent; therefore, only one is described in detail. The nominal voltage of the logical 0 level is -5. 5 v; the nominal voltage of the logical 1 level is 0 v. If the input to either diode CR1 or diode CR2 is at the logical 1 level, the junction of diodes CR1, CR2 and resistors R1, R2 is held near 0 v. Under these conditions, transistor Q1 is cut off, and relay K1 is not energized. If the inputs to both diodes are at the logical 0 level, the junction is held near -5. 5 v. Under these conditions, transistor Q1 is conducting to saturation, and relay K1 is energized. An open-circuit condition at either input is equivalent to a logical 0.

Diode CR3 protects transistor Q1 from the self-induced voltage developed when relay K1 is deenergized. Resistor R3 and capacitor C1, when externally connected to C, form a contact protection network for the normally-closed contacts; resistor R4 and capacitor C2 form a similar network for the normally-open contacts. Resistor R13 and capacitor C7 form a filter network for the -16. 5 v power source. Diodes CR10, CR11, and CR12 hold the emitters of all transistor slightly below ground potentials.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Relay characteristics are described in Table 2.

Table 1. Input Logic Level

LOGIC LEVEL	VOLTAGE	CURRENT
1	0 v (+0. 0 v, -0. 8 v)	3. 1 ma maximum
0	-5. 5 v (+0. 55 v, -0. 55 v)	0 ma

Table 2. Relay Characteristics

Pull-in time	Not more than 3. 5 milliseconds after application of controlling input.
Drop-out time	Not more than 3. 5 milliseconds after application of controlling input
Current	For voltage, less than 160 v, the current shall not exceed 0. 6 amperes. For voltages greater than 160 v but less than 500 v, the contacts shall not carry more than 100 volt-amperes.

LOADING

Each input of a 411 module gate is approximately equivalent to one 401 gate. The output load is limited by the relay contact characteristics listed in Table 2.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT	POWER
-16.5 v ±5%	247 ma maximum	5 watts maximum

WIRING

No wiring restrictions unless used to switch circuit outputs; then rules for that circuit apply.

PARTS LIST

Table 4 lists parts for the 411 module. The 411 module assembly is illustrated in Figure 1, and the schematic diagram is illustrated in Figure 2.

Table 4. Relay (Module 411) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8954838-61	Capacitor, fixed, tantalum elec, 0.4μf, ±20%, 100 v
1	C2	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C3	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C4	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf,±20%, 100 v
1	C5	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C6	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C7	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C8	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C9	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C10	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C11	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C12	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v
1	C13	8954838-61	Capacitor, fixed, tantalum elec, 0.4 μf, ±20%, 100 v

Table 4. Relay (Module 411) Parts List (cont)

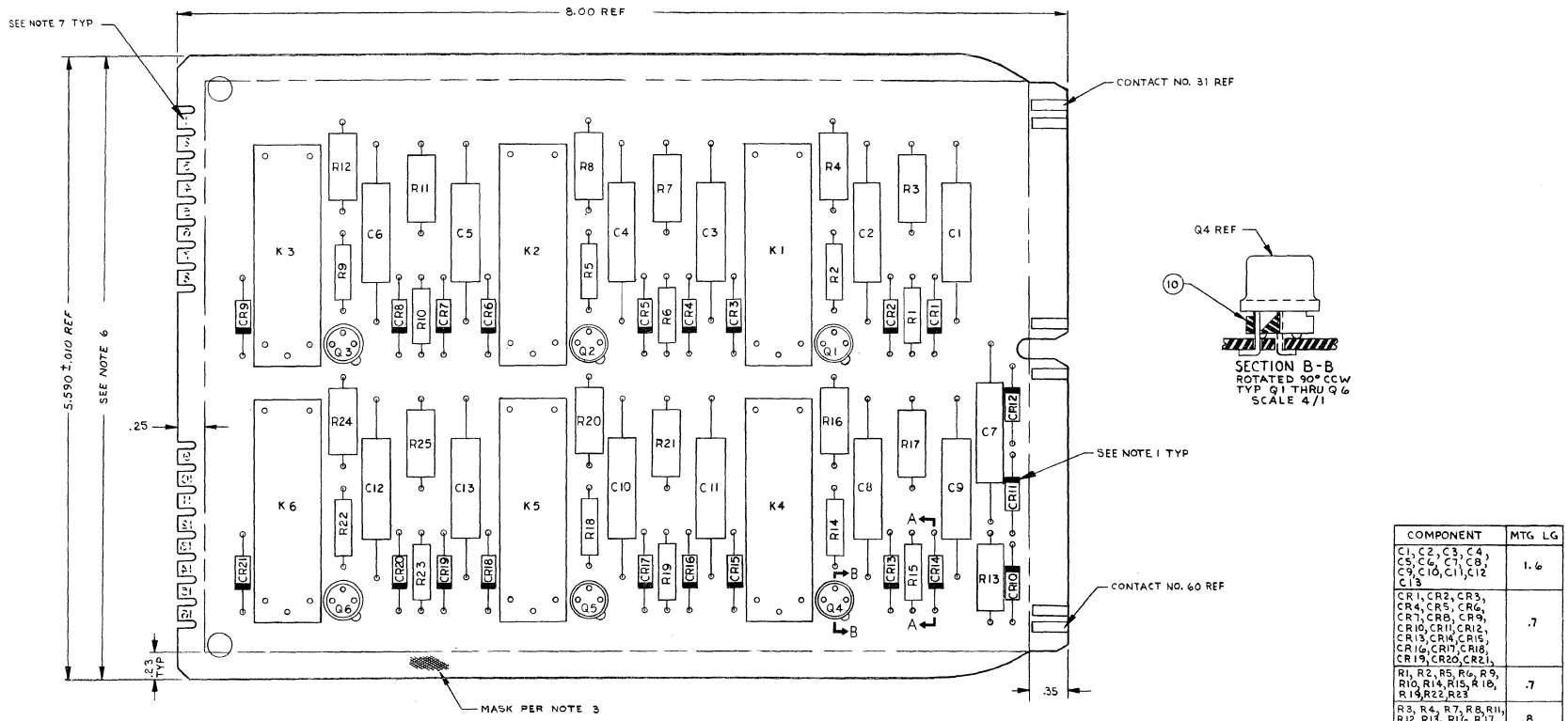
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR1	8935924-1	Semiconductor device, diode, type 24
1	CR2	8935924-1	Semiconductor device, diode, type 24
1	CR3	8935924-1	Semiconductor device, diode, type 24
1	CR4	8935924-1	Semiconductor device, diode, type 24
1	CR5	8935924-1	Semiconductor device, diode, type 24
1	CR6	8935924-1	Semiconductor device, diode, type 24
1	CR7	8935924-1	Semiconductor device, diode, type 24
1	CR8	8935924-1	Semiconductor device, diode, type 24
1	CR9	8935924-1	Semiconductor device, diode, type 24
1	CR10	IN645	Semiconductor device, diode, (MIL-E-1143)
1	CR11	IN645	Semiconductor device, diode, (MIL-E-1143)
1	CR12	IN645	Semiconductor device, diode, (MIL-E-1143)
1	CR13	8935924-1	Semiconductor device, diode, type 24
1	CR14	8935924-1	Semiconductor device, diode,type 24
1	CR15	8935924-1	Semiconductor device, diode, type 24
1	CR16	8935924-1	Semiconductor device, diode, type 24
1	CR17	8935924-1	Semiconductor device, diode, type 24
1	CR18	8935924-1	Semiconductor device, diode, type 24
1	CR19	8935924-1	Semiconductor device, diode, type 24
1	CR20	8935924-1	Semiconductor device, diode, type 24
1	CR21	8935924-1	Semiconductor device, diode, type 24
1	K1	2180987-1	Relay, mercury wetted
1	K2	2180987-1	Relay, mercury wetted
1	K3	2180987-1	Relay, mercury wetted
1	K4	2180987-1	Relay, mercury wetted
1	K5	2180987-1	Relay, mercury wetted
1	K6	2180987-1	Relay, mercury wetted

Table 4. Relay (Module 411) Parts List (cont)

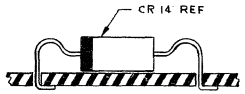
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q1	USN 2N1307	Semiconductor device, transistor (MIL-S-19500/126)
1	Q2	USN 2N1307	Semiconductor device, transistor (MIL-S-19500/126)
1	Q3	USN 2N1307	Semiconductor device, transistor (MIL-S-19500/126)
1	Q4	USN 2N1307	Semiconductor device, transistor (MIL-S-19500/126)
1	Q5	USN 2N1307	Semiconductor device, transistor (MIL-S-19500/126)
1	Q6	USN 2N1307	Semiconductor device, transistor (MIL-S-19500/126)
1	R1	8977933-125	Resistor, fixed, film , 196 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R2	8977933-265	Resistor, fixed, film,5620 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R3	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R4	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R5	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R6	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R7	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w, (MIL-R-11)
1	R8	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w, (MIL-R-11)
1	R9	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R10	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R11	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R12	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R13	RC32GF3R3K	Resistor, fixed, composition, 3. 3 ohms ±10%, 1 w
1	R14	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R15	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R16	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R17	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R18	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R19	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R20	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)

Table 4. Relay (Module 411) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R21	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R22	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R23	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, $\frac{1}{8}$w (MIL-R-10509)
1	R24	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w, (MIL-R-11)
1	R25	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w, (MIL-R-11)
1	1	2161446-1	Board printed
6	10	2180896-1	Pad, transistor mounting



SECTION B-B
ROTATED 90° CCW
TYP Q1 THRU Q6
SCALE 4/1



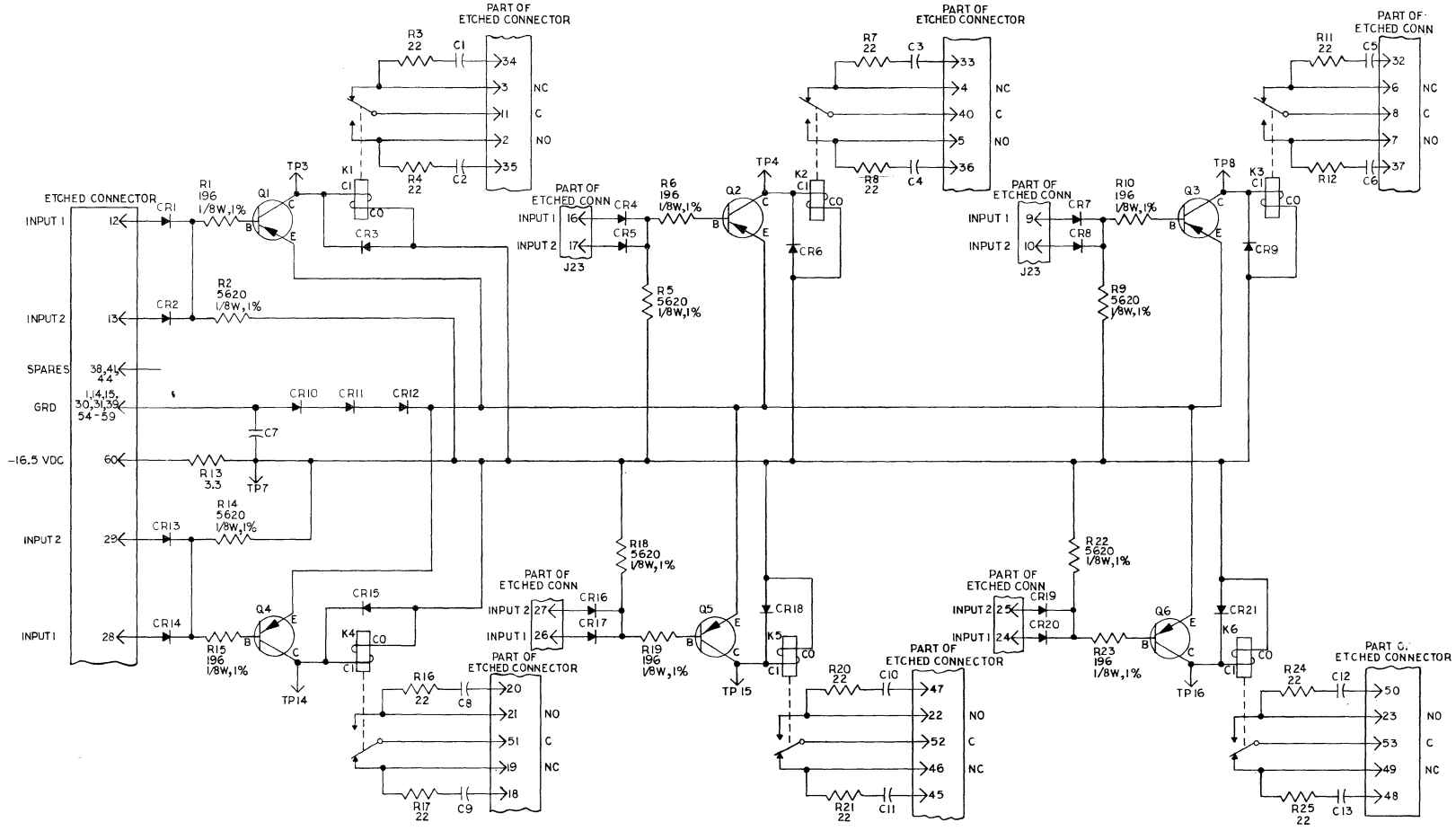
SECTION A-A
ROTATED 90° CW
TYP LEAD BENDS ALL DIODES
SCALE 4/1

COMPONENT	MTG LG
C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12 C13	1.6
CR1, CR2, CR3, CR4, CR5, CR6, CR7, CR8, CR9, CR10, CR11, CR12, CR13, CR14, CR15, CR16, CR17, CR18, CR19, CR20, CR21,	.7
R1, R2, R5, R6, R9, R10, R14, R15, R18, R19, R22, R23	.7
R3, R4, R7, R8, R11, R12, R13, R16, R17, R20, R21, R24, R25	.8

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDED SIDE OF BOARD.
3. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665. USING EPOXY POLYAMIDE PER 2020341.
4. ASSEMBLE PER 8030660.
5. SOLDER PER 8030526.
6. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
7. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7, ON SOLDER SIDE PER 2181314.
8. FOR LIST OF MATERIALS SEE LM2162411.
9. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.

Figure 1. Relay (Module 411), Assembly Drawing



NOTES:

1. RESISTOR VALUES ARE IN OHMS, 10%, 1W, UNLESS OTHERWISE NOTED.
2. CAPACITORS ARE .4 UF, 100 V, 20%, UNLESS OTHERWISE NOTED.
3. (TP) TEST POINTS ARE FOR REF ONLY ASSOCIATED PIN NO. ARE PIN NO. OF ETCHED CONN.

Figure 2. Relay (Module 411), Schematic Diagram

DIODE MATRIX (MODULE 412)

RCA 2162412-501

DESCRIPTION

The 412 module contains 16 passive networks consisting of resistors and diodes. Each network is connected between a selector pair circuit in a 416 module and a set of cores in the memory. The functions of each passive network are to route the read pulse or the write pulse in the proper direction through the cores, and to isolate the read and write sources.

CIRCUIT ANALYSIS

All of the 16 networks are identical; therefore only one is described in detail. Diodes CR1 through CR4, and resistor R1, form a matrix controlled by input 1 and input 5. The read and write current sources are connected to the inputs; the set of cores is connected in parallel with resistor R1. Read pulses and write pulses cannot occur at the same time. When a read pulse is generated for this network, the current flows from the READ SEL A at input 1, through diode CR2, resistor R1 and the core load, and diode CR3, to READ SEL B at input 5. No current flows through diode CR1 to WRITE SEL B at input 1 because no path exists through the associated write circuit. When a write pulse occurs, current flows from the WRITE SEL A at input 5 through diode CR4, resistor R1 and the core load, and diode CR1 to WRITE SEL B at input 1. In this case, no external path exists through diode CR3 and READ SEL B at input 5. Resistor R1 is connected in parallel with the inductive core load to provide a low impedance path during transient conditions. At steady-state conditions, the core load has nearly zero impedance.

CIRCUIT CHARACTERISTICS

Each 412 module diode matrix receives as its input the output of a selector pair circuit on a 416 module.

LOADING

Each 412 module diode matrix, together with a set of cores in the magnetic core memory, forms the load for a 416 module selector pair circuit.

POWER REQUIREMENTS

The 412 module consists entirely of passive circuit elements driven by other circuits. No separate power input is required.

PARTS LIST

Table 1 lists parts for the 412 module. The 412 module assembly is illustrated in Figure 1, and the schematic diagram is illustrated in Figure 2.

Table 1. Diode Matrix (Module 412) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR1	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR2	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR3	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR4	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR5	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR6	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR7	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR8	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR9	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR10	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR11	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR12	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR13	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR14	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR15	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR16	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR17	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR18	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR19	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR20	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR21	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR22	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR23	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR24	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR25	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR26	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)

Table 1. Diode Matrix (Module 412) Parts List (cont)

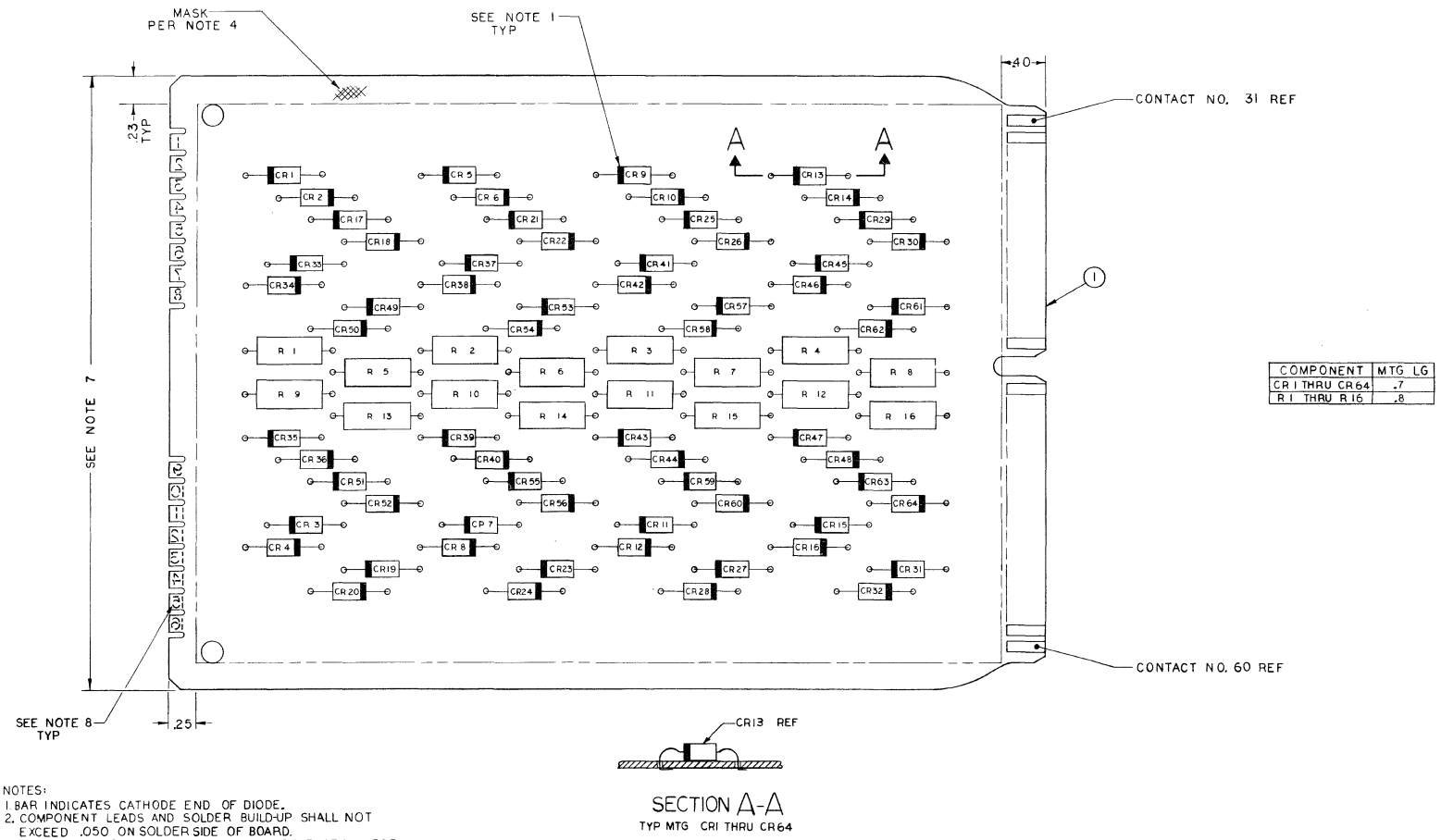
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR27	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR28	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR29	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR30	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR31	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR32	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR33	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR34	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR35	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR36	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR37	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR38	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR39	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR40	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR41	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR42	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR43	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR44	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR45	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR46	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR47	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR48	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR49	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR50	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR51	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR52	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)

Table 1. Diode Matrix (Module 412) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR53	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR54	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR55	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR56	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR57	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR58	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR59	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR60	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR61	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR62	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR63	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR64	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	R1	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R2	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R3	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R4	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R5	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R6	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R7	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R8	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ± 10% (MIL-R-11D)
1	R9	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R10	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)

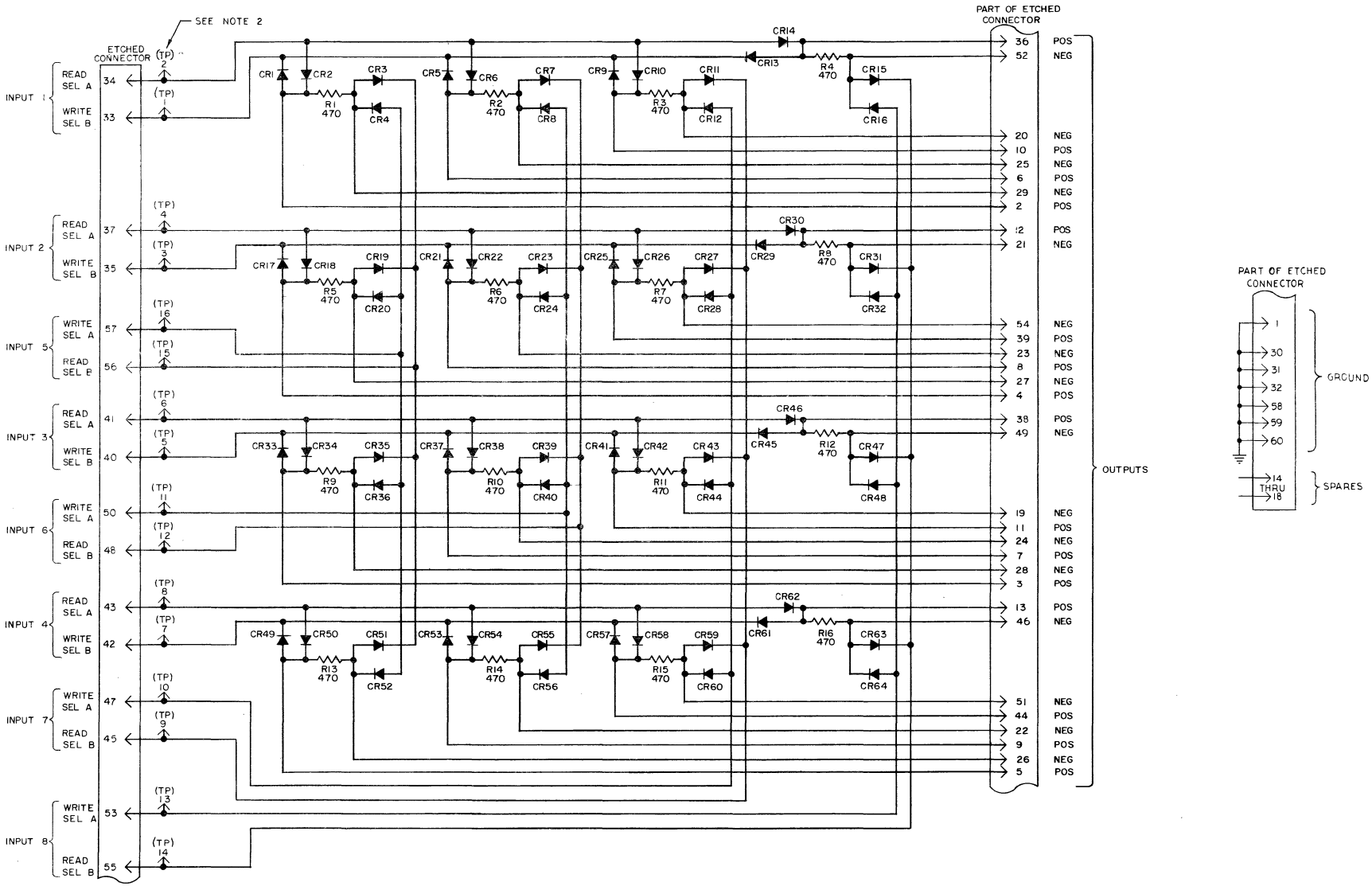
Table 1. Diode Matrix (Module 412) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R11	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R12	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R13	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R14	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R15	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R16	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	1	2162321-1	Board, printed circuit



NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665, USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
9. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.
10. FOR LIST OF MATERIALS SEE LM 2162412.

Figure 1. Diode Matrix (Module 412), Assembly Drawing



NOTES
1. RESISTANCE VALUES ARE IN OHMS, ±10%, 1WATT
2. (TP) TEST POINTS ARE FOR REFERENCE ONLY. ASSOCIATED PIN NUMBERS ARE PIN NUMBERS OF ETCHED CONNECTOR.

Figure 2. Diode Matrix (Module 412), Schematic Diagram

SENSE AMPLIFIER (MODULE 413)

RCA 2162413-501

DESCRIPTION

The 413 module contains four identical sense amplifier circuits, a voltage regulator circuit, and two line filter capacitors. Each sense amplifier receives a signal from a differential preamplifier on a 415 module, and a strobe input. If the signal from the differential preamplifier becomes negative while the strobe input is at the logical 1 level, the sense amplifier generates a positive-going output pulse.

CIRCUIT ANALYSIS

Each sense amplifier operates in the same manner; therefore only one circuit is described in detail. When the voltage at INPUT 1 is positive, transistor Q1 conducts, and its collector voltage is near 0 v. Diode CR2 is back-biased, and the junction of diodes CR3, CR4, and CR5, and resistor R3 is held near 0 v. The base of transistor Q2 is held at a slight positive potential by current flow through diode CR5 and resistor R4. Transistor Q2 is saturated, and its collector voltage is clamped at -4. 5 v by current flow through resistor R5 and diode CR6. If STROBE INPUT 1 goes to the -4. 5 v level, current flow through resistor R3, diode CR3, transistor Q1 diode CR1 and resistor R1 holds the cathode of diode CR4 near 0 v, so that diode CR4 is back-biased. Therefore, the output does not change. If INPUT 1 becomes negative, transistor Q1 is cut off, and its collector voltage is clamped at -4. 7 v by current flow through resistor R2 and diode CR2. If STROBE INPUT 1 goes to the -4. 5 v level, the junction of diodes CR3, CR4, and CR5, and resistor R3, is held at a negative potential. Under these conditions, transistor Q2 is cut off, and the collector voltage is clamped at -4. 5 v by current flow through resistor R5 and diode CR6. Resistor R11 and Zener diode CR13 form a voltage-regulating circuit for the -4. 7 v supply. Capacitors C1 and C2 are line filters for the +12 v supply and the -16. 5 v supply, respectively.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. The data input must be from the output of a 415 module differential preamplifier. Output logic levels are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Strobe Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4. 5 v (+1. 25 v, -4. 5 v)	0 ma
1	0. 0 v (+0. 0 v, -0. 8 v)	3. 8 ma maximum

Table 2. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4. 5 v (+0. 2 v, -1. 2 v)	5 ma maximum OUT 12 ma maximum IN
1	0. 0 v (+0. 0 v, -0. 5 v)	31. 3 ma maximum OUT 15 ma maximum IN

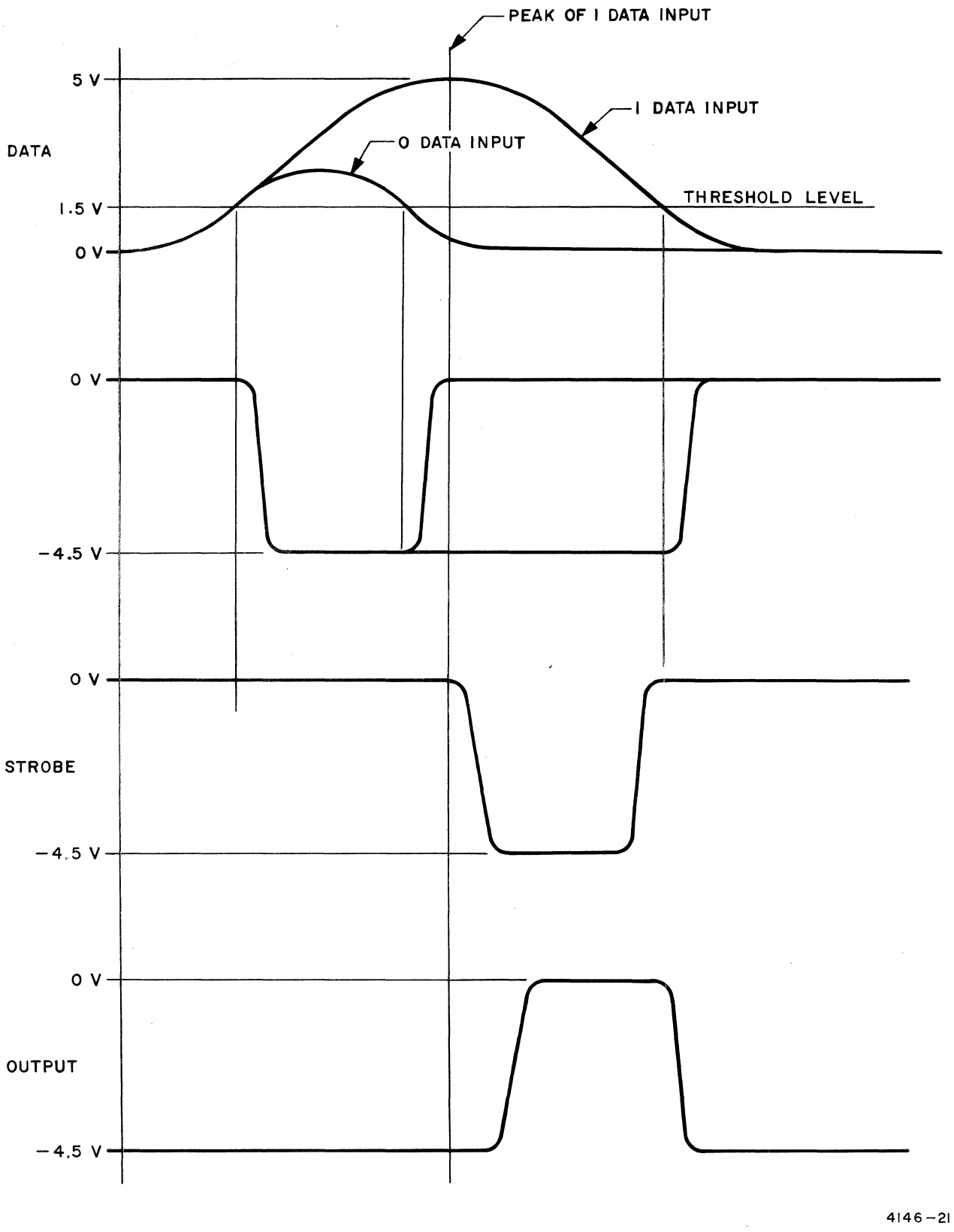


Figure 1. 413 Module, Waveforms and Timing

LOADING

The input to the sense amplifier is from not more than two differential preamplifier circuits. Each sense amplifier is capable of driving a maximum of eight 401 gates.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ±5%	50 ma maximum
-16. 5 v ±5%	110 ma maximum

WIRING

Table 4 lists maximum lengths of wire which may be used.

Table 4. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	96 Inches
Single Load	120 Inches

PARTS LIST

Table 5 lists parts for the 413 module. The 413 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 5. Sense Amplifier (Module 413) Parts List

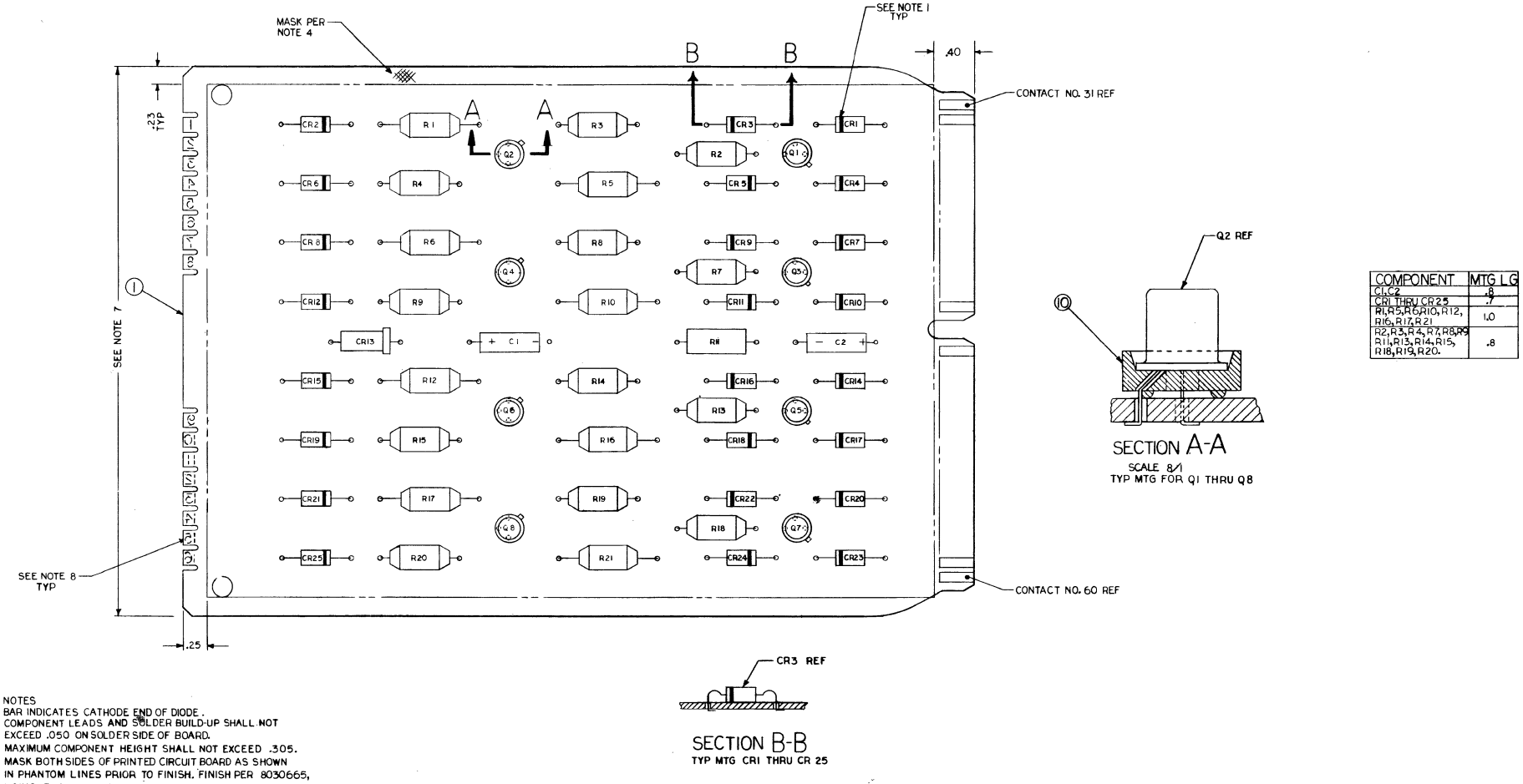
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, 35 v
1	C2	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, 35 v
1	CR1	8935924-1	Semiconductor device, diode
1	CR2	8935924-1	Semiconductor device, diode
1	CR3	8935924-1	Semiconductor device, diode
1	CR4	8935924-1	Semiconductor device, diode
1	CR5	2180816-3	Semiconductor device, diode
1	CR6	8935924-1	Semiconductor device, diode
1	CR7	8935924-1	Semiconductor device, diode
1	CR8	8935924-1	Semiconductor device, diode
1	CR9	8935924-1	Semiconductor device, diode
1	CR10	8935924-1	Semiconductor device, diode
1	CR11	2180816-3	Semiconductor device, diode
1	CR12	8935924-1	Semiconductor device, diode
1	CR13	2182181-1	Semiconductor device, diode
1	CR14	8935924-1	Semiconductor device, diode
1	CR15	8935924-1	Semiconductor device, diode
1	CR16	8935924-1	Semiconductor device, diode
1	CR17	8935924-1	Semiconductor device, diode
1	CR18	2180816-3	Semiconductor device, diode
1	CR19	8935924-1	Semiconductor device, diode
1	CR20	8935924-1	Semiconductor device, diode
1	CR21	8935924-1	Semiconductor device, diode
1	CR22	8935924-1	Semiconductor device, diode
1	CR23	8935924-1	Semiconductor device, diode
1	CR24	2180816-3	Semiconductor device, diode
1	CR25	8935924-1	Semiconductor device, diode

Table 5. Sense Amplifier (Module 413) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q1	2180801-1	Semiconductor device, transistor
1	Q2	2180801-1	Semiconductor device, transistor
1	Q3	2180801-1	Semiconductor device, transistor
1	Q4	2180801-1	Semiconductor device, transistor
1	Q5	2180801-1	Semiconductor device, transistor
1	Q6	2180801-1	Semiconductor device, transistor
1	Q7	2180801-1	Semiconductor device, transistor
1	Q8	2180801-1	Semiconductor device, transistor
1	R1	RN65D1211F	Resistor, fixed, film, 1210 ohms, 1/2 w, ±1% (MIL-R-10509D)
1	R2	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R3	8977939-257	Resistor, fixed, film, 4640 ohms, 1/4 w, ±1%
1	R4	8977939-365	Resistor, fixed, film, 61.9 k ohms, 1/4 w, ±1%
1	R5	RN65D8250F	Resistor, fixed, film, 825 ohms, 1/2 w, ±1% (MIL-R-10509D)
1	R6	RN65D1211F	Resistor, fixed, film, 1210 ohms, 1/2 w, ±1% (MIL-R-10509D)
1	R7	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R8	8977939-257	Resistor, fixed, film, 4640 ohms, 1/4 w, ±1%
1	R9	8977939-365	Resistor, fixed, film, 61.9 k ohms, 1/4 w, ±1%
1	R10	RN65D8250F	Resistor, fixed, film, 825 ohms, 1/2 w, ±1% (MIL-R-10509D)
1	R11	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11D)
1	R12	RN65D1211F	Resistor, fixed, film, 1210 ohms, 1/2 w, ±1% (MIL-R-10509D)
1	R13	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R14	8977939-257	Resistor, fixed, film, 4640 ohms, 1/4 w, ±1%
1	R15	8977939-365	Resistor, fixed, film, 61.9 k ohms, 1/4 w, ±1%
1	R16	RN65D8250F	Resistor, fixed, film, 825 ohms, 1/2 w, ±1% (MIL-R-10509D)
1	R17	RN65D1211F	Resistor, fixed, film, 1210 ohms, 1/2 w, ±1% (MIL-R-10509D)
1	R18	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%

Table 5. Sense Amplifier (Module 413) Parts List (cont)

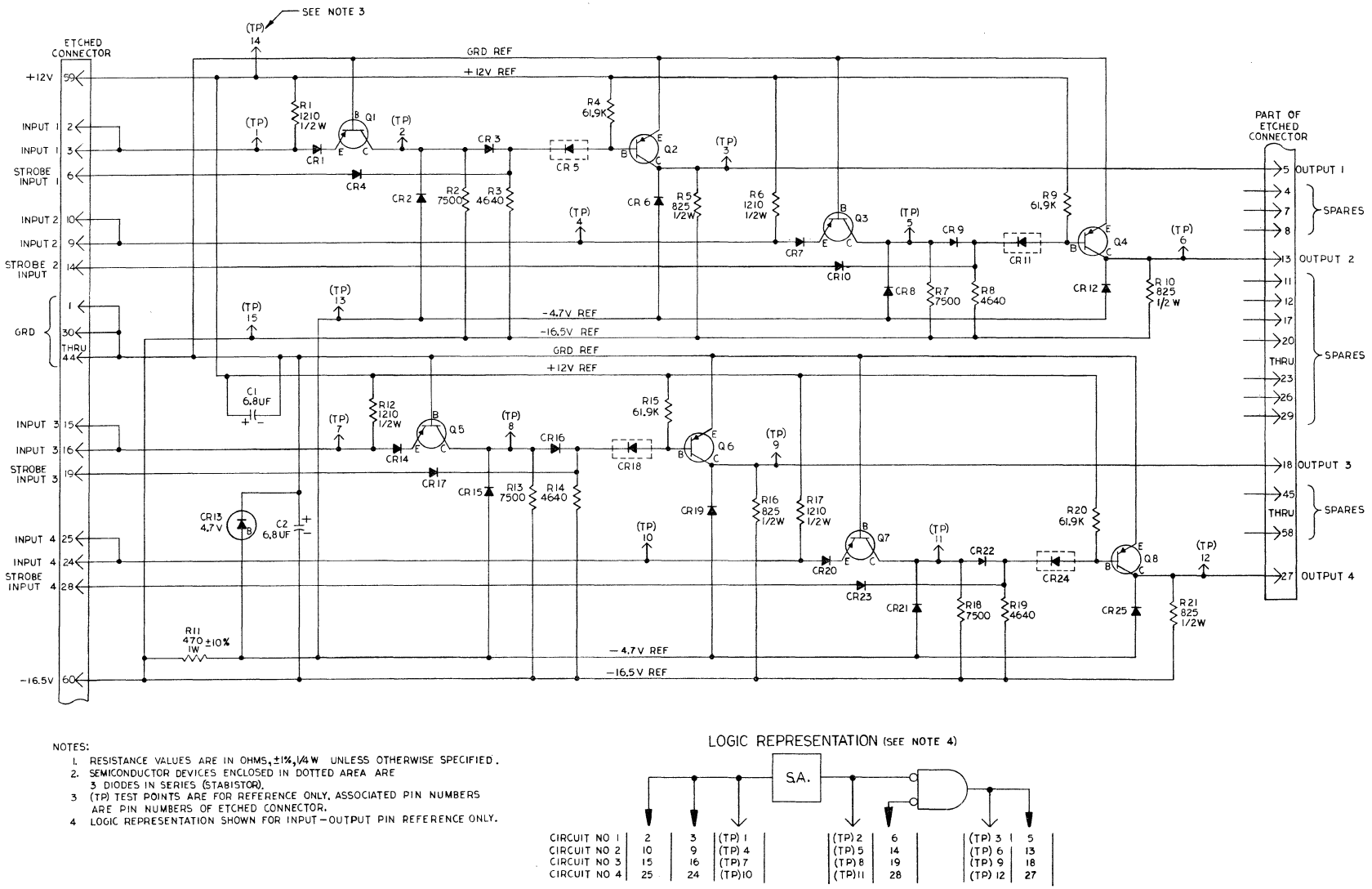
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R19	8977939-257	Resistor, fixed, film, 4640 ohms, 1/4 w, ± 1%
1	R20	8977939-365	Resistor, fixed, film, 61.9 k ohms, 1/4 w, ± 1%
1	R21	RN65D8250F	Resistor, fixed, film, 825 ohms, 1/2 w, ± 1% (MIL-R-10509D)
8	10	2180896-2	Pad, transistor mounting



COMPONENT	MTG LG
C1,C2	.8
CR1 THRU CR25	.7
R1,R5,R6,R10,R12, R16,R17,R21	1.0
R2,R3,R4,R7,R8,R9 R11,R13,R14,R15, R18,R19,R20.	.8

NOTES
1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665, USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660
6. SOLDER PER 8030526
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
9. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.
10. FOR LIST OF MATERIALS SEE LM2162413.

Figure 2. Sense Amplifier (Module 413), Assembly Drawing



NOTES:

1. RESISTANCE VALUES ARE IN OHMS, ±1%, 1/4W UNLESS OTHERWISE SPECIFIED.
2. SEMICONDUCTOR DEVICES ENCLOSED IN DOTTED AREA ARE 3 DIODES IN SERIES (STABISTOR).
3. (TP) TEST POINTS ARE FOR REFERENCE ONLY. ASSOCIATED PIN NUMBERS ARE PIN NUMBERS OF ETCHED CONNECTOR.
4. LOGIC REPRESENTATION SHOWN FOR INPUT–OUTPUT PIN REFERENCE ONLY.

LOGIC REPRESENTATION (SEE NOTE 4)

CIRCUIT NO 1	2	3	(TP) 1	(TP) 2	6	(TP) 3	1	5
CIRCUIT NO 2	10	9	(TP) 4	(TP) 5	14	(TP) 6	13	18
CIRCUIT NO 3	15	16	(TP) 7	(TP) 8	19	(TP) 9	12	18
CIRCUIT NO 4	25	24	(TP) 10	(TP) 11	28	(TP) 12	27	

Figure 3. Sense Amplifier (Module 413), Schematic Diagram

DIGIT DRIVER (MODULE 414)

RCA 2162414-501

DESCRIPTION

The 414 module contains two identical digit driver circuits, two line filter capacitors, and a resistor-capacitor filter circuit. The input and output stages of each digit driver are separated on the module, and must be connected by jumpers.

CIRCUIT ANALYSIS

The two digit driver circuits are identical, therefore only one is described in detail. The nominal level of a logical 0 is -4.5 v; the nominal level of a logical 1 is 0 v. When the input at either diode CR1 or diode CR2 is a logical 1, the junction of diodes CR1, CR2, CR3, and Zener diode CR4 is held near 0 v. The regulating network formed by resistor R3 and Zener diode CR6 holds the emitter of transistor Q1 near +4.7 v. Resistor R2 and diode CR5 hold the base voltage close to the emitter voltage. Under these conditions, Zener diode CR4 is biased in its high impedance region, transistor Q1 is cut off. Current flow through resistor R4 and diode CR7 clamps the collector voltage near 0 v, so that transistors Q2 and Q3 are cut off. When the inputs to diode CR1 and diode CR2 are both at the logical 0 level, the voltage at the anode of Zener diode CR4 goes to -4.5 v. Zener diode CR4 is then biased in low impedance region, and conducts base current, driving transistor Q1 to saturation. The collector voltage of transistor Q1 goes to 4.7 v, back-biasing diode CR7, and conducting base current from transistors Q2 and Q3, driving both to saturation. The circuits of transistors Q2 and Q3 are identical, therefore only the circuit of transistor Q2 is described. The anode of diode CR9 is jumpered to the collector of transistor Q2; the cathode of diode CR9 is jumpered to the +18 v to +22 v supply. The load, which is a set of magnetic cores, is connected between pin 33 and pin 32, so that the cores, resistors R8 and R9, and capacitor C2 are in parallel with diode CR9. When transistor Q2 changes from saturation to cutoff, the resistor-capacitor network and diode CR9 provide a path for dissipating the back emf of the inductive load. Capacitors C4 and C5 are line filters for the +12 v supply and the -16.5 v supply, respectively. Resistor R7 and capacitor C1 form a filter for the +18 v to +22 v supply.

CIRCUIT CHARACTERISTICS

Input logic levels are defined in Table 1. Output levels are defined in Table 2. A typical input waveform is illustrated in Figure 1.

Table 1. Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	0 v (+0.2 v, -0.5v)	0 ma
1	-4.5 v (+0.2 v, -4.5 v)	8.0 ma maximum

Table 2. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
ON	0 v (+1.5 v, -0 v)	250 ma maximum to load
OFF	+16 v to +22 v	0 ma to load

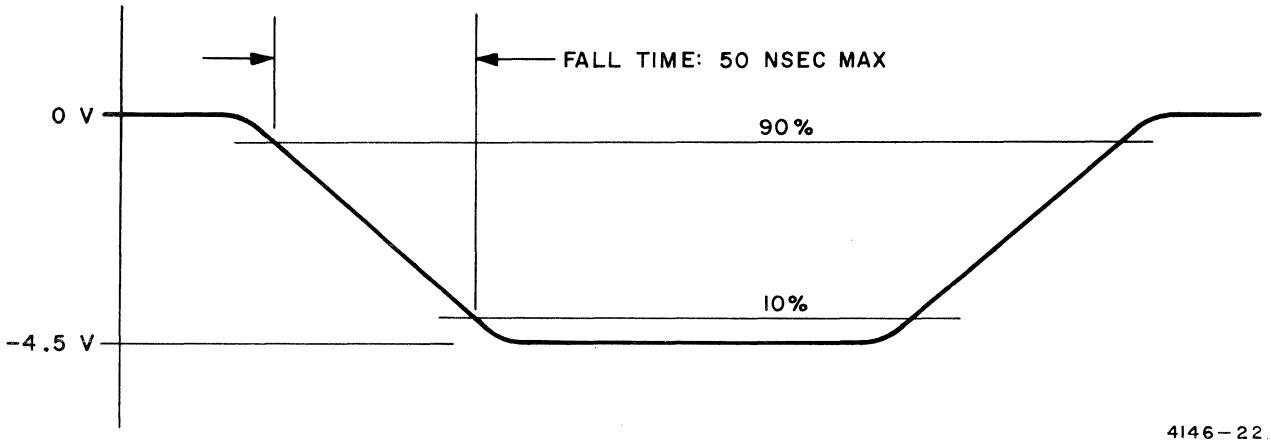


Figure 1. 414 Module, Input Waveform

LOADING

The input to a 414 module digit driver circuit is equivalent to two 401 gates. The output of a 414 module digit driver circuit drives a set of cores in the magnetic core memory.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	200 ma nominal 220 ma maximum
-16.5 v ± 5%	36 ma nominal 40 ma maximum

PARTS LIST

Table 4 lists parts for the 414 module. The 414 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 4. Digit Driver (Module 414) Parts List

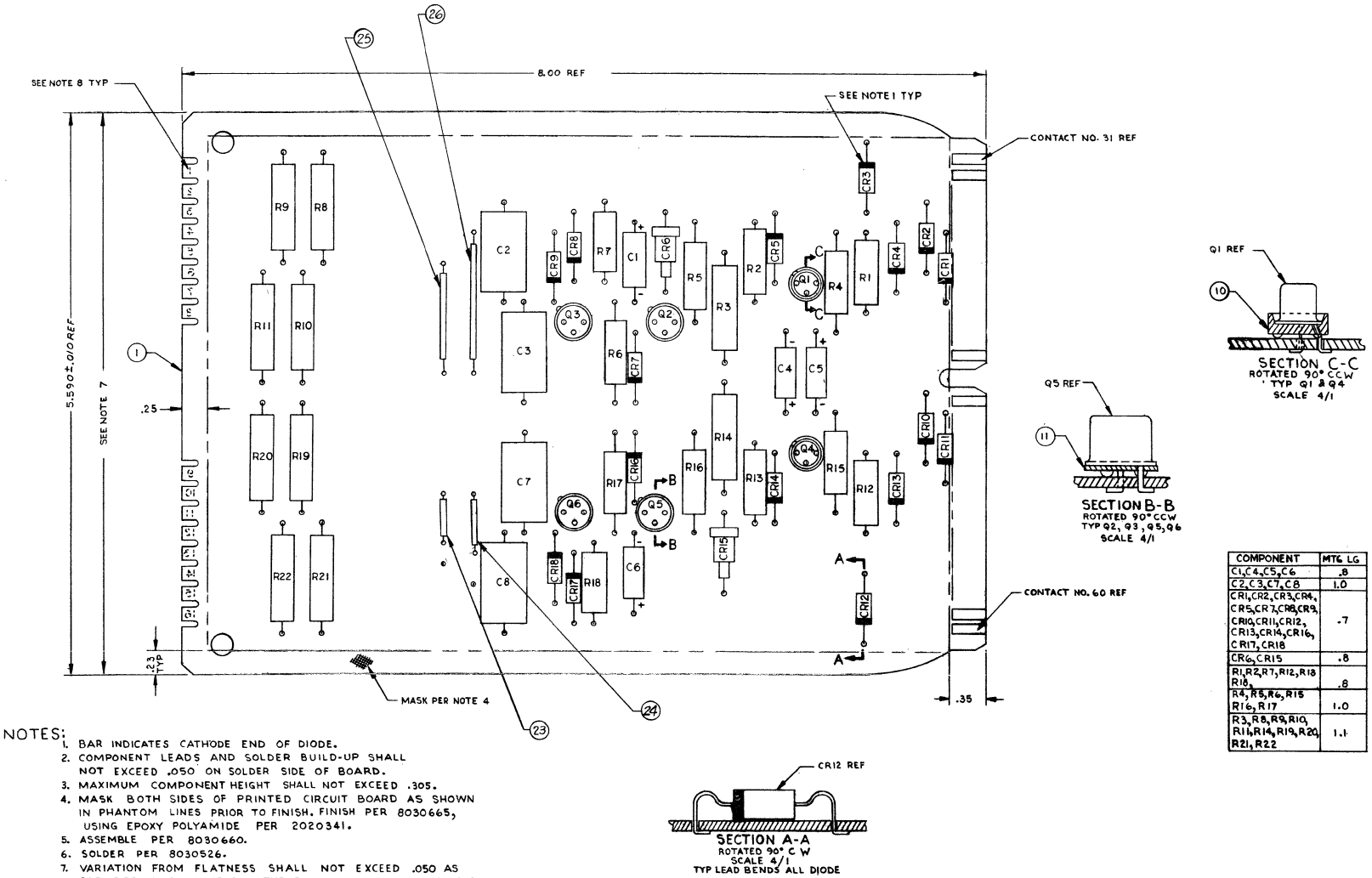
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C2	CM20F681J3	Capacitor, fixed, mica, 680 pf, ± 5%, 500 vdc (MIL-C-5)
1	C3	CM20F681J3	Capacitor, fixed, mica, 680 pf, ± 5%, 500 vdc (MIL-C-5)
1	C4	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C5	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C6	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C7	CM20F681J3	Capacitor, fixed, mica, 680 pf, ± 5%, 500 vdc (MIL-C-5)
1	C8	CM20F681J3	Capacitor, fixed, mica, 680 pf, ± 5%, 500 vdc (MIL-C-5)
1	CR1	8935924-1	Semiconductor device, diode
1	CR2	8935924-1	Semiconductor device, diode
1	CR3	8935924-1	Semiconductor device, diode
1	CR4	2180823-1	Semiconductor device, diode
1	CR5	USN 1N914	Semiconductor device, diode (MIL-S-19500/116)
1	CR6	2182181-1	Semiconductor device, diode
1	CR7	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR8	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR9	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR10	8935924-1	Semiconductor device, diode
1	CR11	8935924-1	Semiconductor device, diode
1	CR12	8935924-1	Semiconductor device, diode
1	CR13	2180823-1	Semiconductor device, diode
1	CR14	USN 1N914	Semiconductor device, diode (MIL-S-19500/116)
1	CR15	2182181-1	Semiconductor device, diode
1	CR16	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR17	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR18	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	Q1	2180801-2	Semiconductor device, transistor

Table 4. Digit Driver (Module 414) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q2	2180804-1	Semiconductor device, transistor
1	Q3	2180804-1	Semiconductor device, transistor
1	Q4	2180801-2	Semiconductor device, transistor
1	Q5	2180804-1	Semiconductor device, transistor
1	Q6	2180804-1	Semiconductor device, transistor
1	R1	8977939-229	Resistor, fixed, film, 2370 ohms, 1/4 w, ± 1%
1	R2	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ± 1%
1	R3	2182177-6	Resistor, fixed, wirewound, 75 k ohms, 2 w, ± 1%
1	R4	RN65D1561F	Resistor, fixed, film, 1620 ohms, 1/2 w, ± 1% (MIL-R-10509D)
1	R5	RN65D1000F	Resistor, fixed, film, 100 ohms, 1/2 w, ± 1% (MIL-R-10509D)
1	R6	RN65D1000F	Resistor, fixed, film, 100 ohms, 1/2 w, ± 1% (MIL-R-10509D)
1	R7	RC32GF102K	Resistor, fixed, composition, 1000 ohms, 1 w, ± 10% (MIL-R-11D)
1	R8	2182177-7	Resistor, fixed, wirewound, 178 ohms, 2 w, ± 1%
1	R9	2182177-7	Resistor, fixed, wirewound, 178 ohms, 2 w, ± 1%
1	R10	2182177-7	Resistor, fixed, wirewound, 178 ohms, 2 w, ± 1%
1	R11	2182177-7	Resistor, fixed, wirewound, 178 ohms, 2 w, ± 1%
1	R12	8977939-229	Resistor, fixed, film, 2370 ohms, 1/4 w, ± 1%
1	R13	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ± 1%
1	R14	2182177-6	Resistor, fixed, wirewound, 75 k ohms, 2 w, ± 1%
1	R15	RN65D1621F	Resistor, fixed, film, 1620 ohms, 1/2 w, ± 1% (MIL-R-10509D)
1	R16	RN65D1000F	Resistor, fixed, film, 100 ohms, 1/2 w, ± 1% (MIL-R-10509D)
1	R17	RN65D1000F	Resistor, fixed, film, 100 ohms, 1/2 w, ± 1% (MIL-R-10509D)
1	R18	RC32GF102K	Resistor, fixed, composition, 1000 ohms, 1 w, ± 10% (MIL-R-11D)
1	R19	2182177-7	Resistor, fixed, wirewound, 178 ohms, 2 w, ± 1%
1	R20	2182177-7	Resistor, fixed, wirewound, 178 ohms, 2 w, ± 1%
1	R21	2182177-7	Resistor, fixed, wirewound, 178 ohms, 2 w, ± 1%

Table 4. Digit Driver (Module 414) Parts List (cont)

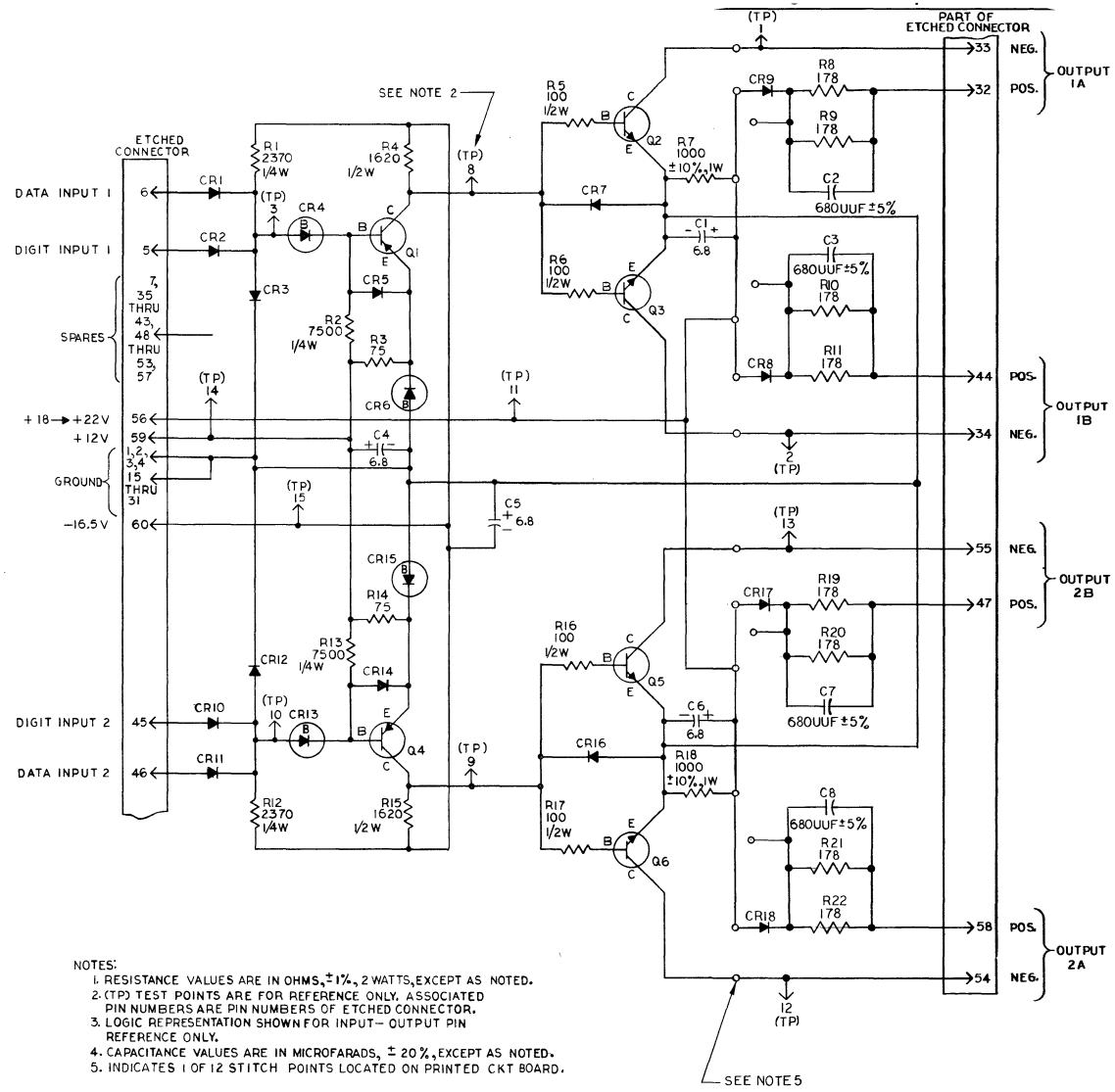
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R22	2182177-7	Resistor, fixed, wirewound, 178 ohms, 2 w, ± 1%
2	10	2180896-2	Pad, transistor mounting
4	11	2180896-9	Pad, transistor mounting



COMPONENT	MTG LG
C1,C4,C5,C6	.8
C2,C3,C7,C8	1.0
CR1,CR2,CR3,CR4, CR5,CR7,CR8,CR9, CR10,CR11,CR12, CR13,CR14,CR16, CR17,CR18	.7
CR6,CR15	.8
R1,R2,R7,R12,R18 R19,	.8
R4,R5,R6,R15 R16,R17	1.0
R3,R8,R9,R10, R11,R14,R19,R20, R21,R22	1.1

NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665, USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
9. FOR LIST OF MATERIALS, SEE LM-2162414.
10. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.

Figure 2. Digit Driver (Module 414), Assembly Drawing



NOTES:
1. RESISTANCE VALUES ARE IN OHMS, ±1%, 2 WATTS, EXCEPT AS NOTED.
2. (TP) TEST POINTS ARE FOR REFERENCE ONLY. ASSOCIATED PIN NUMBERS ARE PIN NUMBERS OF ETCHED CONNECTOR.
3. LOGIC REPRESENTATION SHOWN FOR INPUT– OUTPUT PIN REFERENCE ONLY.
4. CAPACITANCE VALUES ARE IN MICROFARADS, ± 20%, EXCEPT AS NOTED.
5. INDICATES 1 OF 12 STITCH POINTS LOCATED ON PRINTED CKT BOARD.

LOGIC REPRESENTATION – SEE NOTE 3

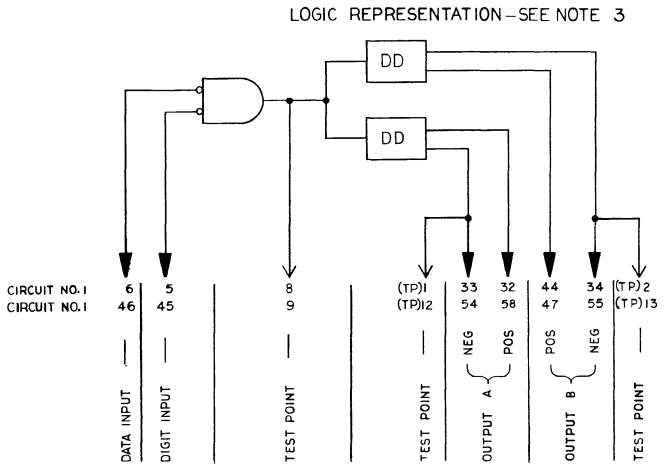


Figure 3. Digit Driver (Module 414), Schematic Diagram

DIFFERENTIAL PREAMPLIFIER (MODULE 415)

RCA 2162415-501

DESCRIPTION

The 415 module contains two identical differential preamplifier circuits, a regulated power supply, and three line filter capacitors. A differential preamplifier circuit receives a pulse output from the magnetic core memory, and provides amplified pulses to the sense amplifiers of module 413.

CIRCUIT ANALYSIS

The two differential preamplifier circuits are identical, therefore only one circuit is described in detail. The input voltage applied between pins 47 and 46 varies from 0 v to a maximum of +50 millivolts or -50 millivolts. A logical 1 may be of either polarity and reaches a value near the maximum voltage; a logical 0 may be of either polarity, reaches a value near 15 mv and is of shorter duration than a logical 1. The output voltage at pin 52 will reach a peak near -5. 0 v for a logical 1 of either polarity, and will reach a peak near -1. 5 v for a logical 0 of either polarity. Resistor R2 and R3 are bias resistors for transistors Q1 and Q3, respectively. Resistor R1 is a terminating network for the input signal. The input signal is amplified by the differential amplifier consisting of transistors Q1 and Q2. The output of transistor Q1 is directly coupled to the base of transistor Q3; the output of transistor Q2 is directly coupled to the base of transistor Q4. Input signals of opposite polarity generate differential outputs of opposite polarity. Transistors Q3 and Q4 form a second differential amplifier with an output coupled to transistors Q5 and Q6 through capacitors C8 and C9. A +1. 5 v bias voltage is applied to the base of transistor Q5 through resistor R17, and to the base of transistor Q6 through resistor R18. Transistor Q5 or Q6 conducts if the output voltage from transistors Q3 and Q4 is outside the range ±1. 5 v. Whichever transistor conducts, the output is a negative-going pulse. Resistors R22 and R23, and Zener diode CR7 form a -6. 8 v regulated power supply. Diodes CR1, CR2 and resistor R16 form a source for the +1. 5 v bias supply. Capacitors C1, C18, and C19 are line filter capacitors for the +12 v, -28. 5 v, and -16. 5 v sources, respectively. Inductor L1 and capacitor C20 form a low impedance bypass circuit for a sense winding oscillation.

CIRCUIT CHARACTERISTICS

The input to the differential preamplifier must be from the magnetic core memory. The load for the differential preamplifier must be sense amplifier of the 413 module. Waveforms are illustrated in Figure 1.

LOADING

The input to each 415 module differential preamplifier circuit is from a set of cores in the magnetic core memory. The 415 module differential preamplifier circuit can drive one sense amplifier circuit.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 1.

PARTS LIST

Table 2 lists parts for the 415 module. The 415 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

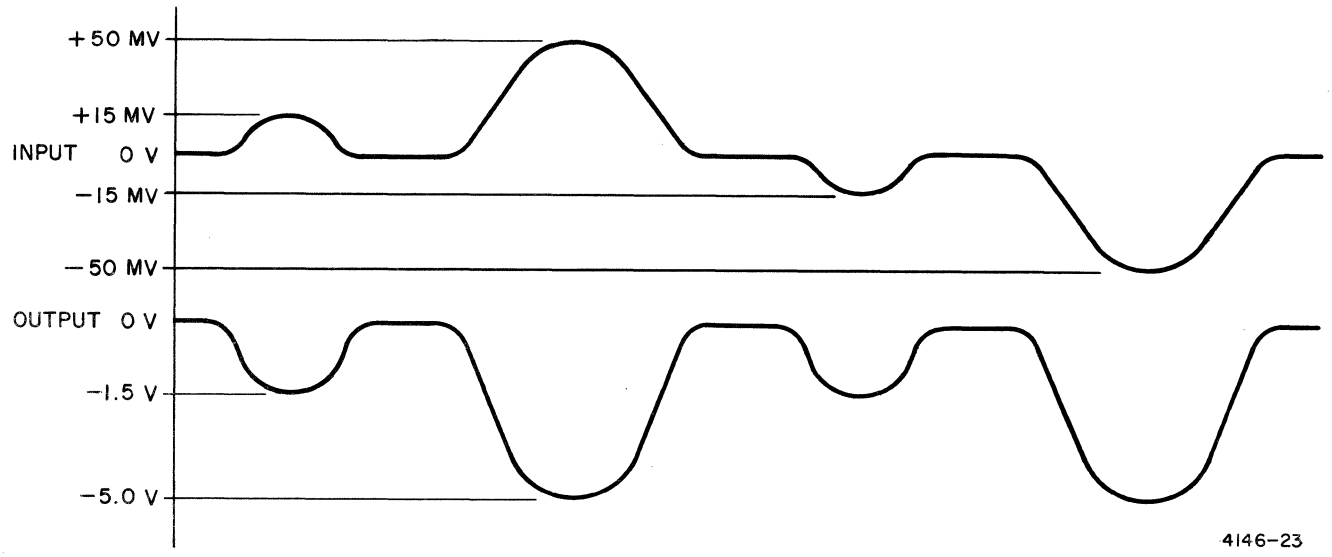


Figure 1. 415 Module, Waveforms

Table 1. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	63. 2 ma maximum
-16. 5 v ±5%	52. 3 ma maximum
-28. 5 v ±5%	17. 4 ma maximum

Table 2. Differential Preamplifier (Module 415) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-95	Capacitor, fixed, tantalum electrolytic, 6. 8 μf, ±20%, 35 v
1	C3	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf,±20%, 3. 75 v
1	C4	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf,±20%, 3. 75 v
1	C5	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf,±20%, 3. 75 v
1	C6	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf,±20%, 3. 75 v
1	C7	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf,±20%, 3. 75 v
1	C8	8412778-95	Capacitor, fixed, tantalum electrolytic, 6. 8 μf,±20%, 35 v

Table 2. Differential Preamplifier (Module 415) Parts List (cont)

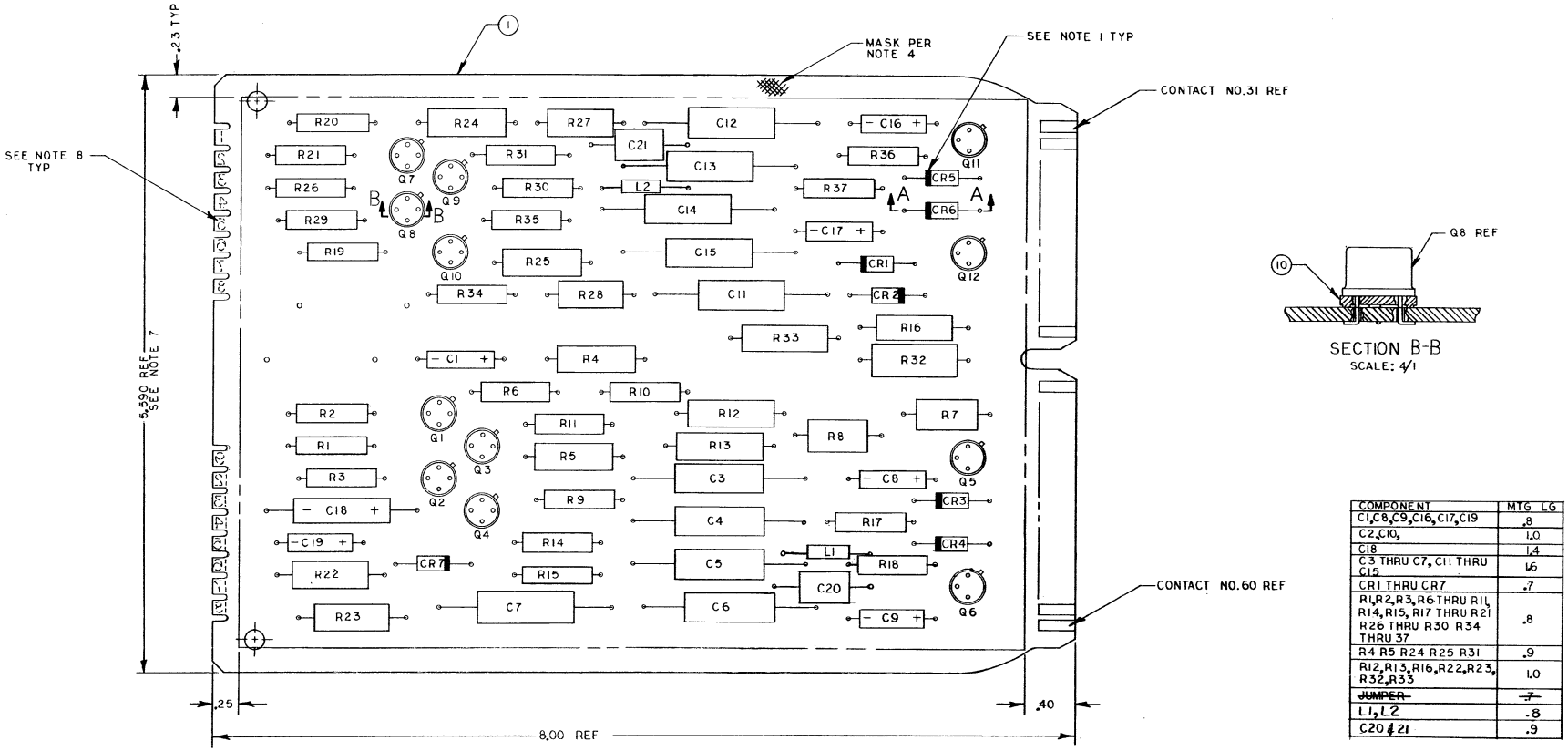
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C9	8412778-95	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 35 v
1	C11	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf, ±20%, 3.75 v
1	C12	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf, ±20%, 3.75 v
1	C13	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf, ±20%, 3.75 v
1	C14	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf, ±20%, 3.75 v
1	C15	8954838-102	Capacitor, fixed, tantalum electrolytic, 45 μf, ±20%, 3.75 v
1	C16	8412778-95	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 35 v
1	C17	8412778-95	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 35 v
1	C18	CL25BJ4R5UP3	Capacitor, fixed, tantalum oxide, 4.5 μf, +75% -15%, 50 v (MIL-C-3965B)
1	C19	8412778-95	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 35 v
1	C20	CM15E820J01	Capacitor, fixed, mica dielectric, 82 μμf, ±5%, 500 v (MIL-C-5B)
1	C21	CM15E820J01	Capacitor, fixed, mica dielectric, 82 μμf, ±5%, 500 v (MIL-C-5B)
1	CR1	99250-152	Semiconductor device, diode
1	CR2	99250-152	Semiconductor device, diode
1	CR3	8935924-1	Semiconductor device, diode
1	CR4	8935924-1	Semiconductor device, diode
1	CR5	8935924-1	Semiconductor device, diode
1	CR6	8935924-1	Semiconductor device, diode
1	CR7	2180823-1	Semiconductor device, diode (Zener)
1	L1	2182137-25	Inductor, fixed, 22 μh
1	L2	2182137-25	Inductor, fixed, 22 μh
1	Q1	2182196-1	Semiconductor device, transistor
1	Q2	2182196-1	Semiconductor device, transistor

Table 2. Differential Preamplifier (Module 415) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q3	2182196-1	Semiconductor device, transistor
1	Q4	2182196-1	Semiconductor device, transistor
1	Q5	2183219-1	Semiconductor device, transistor
1	Q6	2183219-1	Semiconductor device, transistor
1	Q7	2182196-1	Semiconductor device, transistor
1	Q8	2182196-1	Semiconductor device, transistor
1	Q9	2182196-1	Semiconductor device, transistor
1	Q10	2182196-1	Semiconductor device, transistor
1	Q11	2183219-1	Semiconductor device, transistor
1	Q12	2183219-1	Semiconductor device, transistor
1	R1	8977939-157	Resistor, fixed, film, 422 ohms, ±1%, 1/4 w
1	R2	8977939-165	Resistor, fixed, film, 511 ohms, ±1%, 1/4 w
1	R3	8977939-165	Resistor, fixed, film, 511 ohms, ±1%, 1/4 w
1	R4	2180948-1	Resistor, fixed, film, 100 ohms, ±1%, 1/2 w
1	R5	2180948-1	Resistor, fixed, film, 100 ohms, ±1%, 1/2 w
1	R6	8977939-245	Resistor, fixed, film, 3480 ohms, ±1%, 1/4 w
1	R7	RB55AE34800F	Resistor, fixed, wirewound, 3480 ohms, ±1%, 0.15 w (MIL-R-93C)
1	R8	RB55AE34800F	Resistor, fixed, wirewound, 3480 ohms, ±1%, 0.15 w (MIL-R-93C)
1	R9	8977939-245	Resistor, fixed, film, 3480 ohms, ±1%, 1/4 w
1	R10	8977939-237	Resistor, fixed, film, 2870 ohms, ±1%, 1/4 w
1	R11	8945608-107	Resistor, fixed, film, 28.7 k ohms, ±1%, 1/4 w
1	R12	RB54AE46400F	Resistor, fixed, wirewound, 4640 ohms, ±1%, 1/4 w (MIL-R-93C)
1	R13	RB54AE46400F	Resistor, fixed, wirewound, 4640 ohms, ±1%, 1/4 w (MIL-R-93C)
1	R14	8945608-107	Resistor, fixed, film, 28.7 k ohms, ±1%, 1/4 w

Table 2. Differential Preamplifier (Module 415) Parts List (cont)

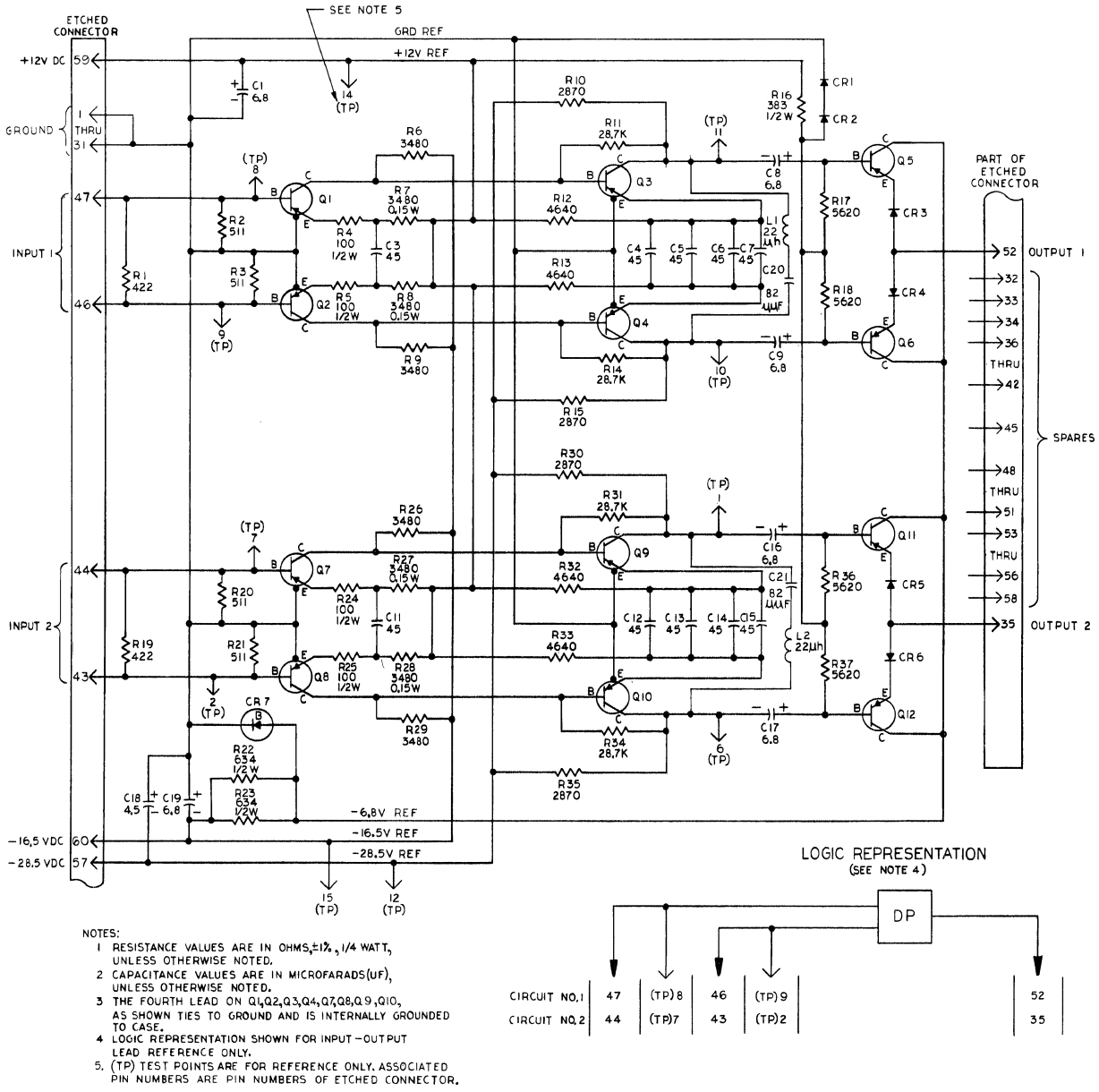
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R15	8977939-237	Resistor, fixed, film 2870 ohms, ±1%, 1/4 w
1	R16	RN65D3830F	Resistor, fixed, film, 383 ohms, ±1%, 1/2 w (MIL-R-10509D)
1	R17	8977939-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/4 w
1	R18	8977939-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/4 w
1	R19	8977939-157	Resistor, fixed, film, 422 ohms, ±1%, 1/4 w
1	R20	8977939-165	Resistor, fixed, film, 511 ohms, ±1%, 1/4 w
1	R21	8977939-165	Resistor, fixed, film, 511 ohms, ±1%, 1/4 w
1	R22	RN65D6340F	Resistor, fixed, film, 634 ohms, ±1%, 1/2 w (MIL-R-10509D)
1	R23	RN65D6340F	Resistor, fixed, film, 634 ohms, ±1%, 1/2 w (MIL-R-10509D)
1	R24	2180948-1	Resistor, fixed, film, 100 ohms, ±1%, 1/2 w
1	R25	2180948-1	Resistor, fixed, film, 100 ohms, ±1%, 1/2 w
1	R26	8977939-245	Resistor, fixed, film, 3480 ohms, ±1%, 1/4 w
1	R27	RB55AE34800F	Resistor, fixed, wirewound, 3480 ohms, ±1%, 0.15 w (MIL-R-93C)
1	R28	RB55AE34800F	Resistor, fixed, wirewound, 3480 ohms, ±1%, 0.15 w (MIL-R-93C)
1	R29	8977939-245	Resistor, fixed, film, 3480 ohms, ±1%, 1/4 w
1	R30	8977939-237	Resistor, fixed, film, 2870 ohms, ±1%, 1/4 w
1	R31	8945608-107	Resistor, fixed, film, 28.7 k ohms, ±1%, 1/4 w
1	R32	RB54AE46400F	Resistor, fixed, wirewound, 4640 ohms, ±1%, 1/4 w (MIL-R-93C)
1	R33	RB54AE46400F	Resistor, fixed, wirewound, 4640 ohms, ±1%, 1/4 w (MIL-R-93C)
1	R34	8945608-107	Resistor, fixed, film, 28.7 k ohms, ±1%, 1/4 w
1	R35	8977939-237	Resistor, fixed, film, 2870 ohms, ± 1%, 1/4 w
1	R36	8977939-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/4 w
1	R37	8977939-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/4 w
1	1	2161394-15	Printed circuit board
12	10	2180896-10	Mounting pad, semiconductor device



COMPONENT	MTG LG
C1,C8,C9,C16,C17,C19	.8
C2,C10,	1.0
C18	1.4
C3 THRU C7, C11 THRU C15	1.6
CR1 THRU CR7	.7
R1,R2,R3,R6 THRU R11, R14,R15, R17 THRU R21 R26 THRU R30 R34 THRU 37	.8
R4 R5 R24 R25 R31	.9
R12,R13,R16,R22,R23, R32,R33	1.0
~~JUMPER~~	~~.7~~
L1, L2	.8
C20 & 21	.9

NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAX COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL JO HIGH STD CHARACTERS USING ITEM 7, ON SOLDER SIDE PER 2181314.
9. FOR LIST OF MATERIALS SEE LM 2162415.
10. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.
11. ~~DRILL MOUNTING HOLE BESIDE SOLDER SIDE PRINTED CIRCUIT. BEND COMPOMENT LEAD ACROSS PRINTED CIRCUIT~~ FOR SOLDERING.
12. ~~MOUNT 1/16 ID FERRULE THROUGH BOARD BEND LEAD OVER ON SOLDER SIDE OF BOARD AND SOLDER BOTH TO FERRULE.~~
13. ~~INSULATE FULL LENGTH WITH TEFLON TUBING.~~

Figure 2. Differential Preamplifier (Module 415), Assembly Drawing



NOTES:
1. RESISTANCE VALUES ARE IN OHMS, ±1%, 1/4 WATT, UNLESS OTHERWISE NOTED.
2. CAPACITANCE VALUES ARE IN MICROFARADS(UF), UNLESS OTHERWISE NOTED.
3. THE FOURTH LEAD ON Q1,Q2,Q3,Q4,Q7,Q8,Q9,Q10, AS SHOWN TIES TO GROUND AND IS INTERNALLY GROUNDED TO CASE.
4. LOGIC REPRESENTATION SHOWN FOR INPUT-OUTPUT LEAD REFERENCE ONLY.
5. (TP) TEST POINTS ARE FOR REFERENCE ONLY. ASSOCIATED PIN NUMBERS ARE PIN NUMBERS OF ETCHED CONNECTOR.

Figure 3. Differential Preamplifier (Module 415), Schematic Diagram

SELECTOR PAIR (MODULE 416)

RCA 2162416-501

DESCRIPTION

The 416 module contains two identical selector pair circuits. These circuits control direction of current flow through the constant current power supply on module 420, the current distribution network on module 421, the diode matrix on module 412 and the cores of the magnetic core memory. For one set of input conditions, current flows through the associated memory cores in one direction; for another set of input conditions current flows through the associated memory core in the opposite direction; for other sets of inputs conditions, no current flows through the associated memory cores.

CIRCUIT ANALYSIS

The two selector pair circuits are identical, therefore only one is described in detail. Diodes CR1, CR2, CR3, and CR4, and transistor Q1 form a four-input AND gate for negative inputs. When all inputs are at the logical 0 level (-4. 5 v), transistor Q1 is saturated, and its collector voltage is clamped at -4. 5 v by current flow through resistor R6 and Zener diode CR5. Diode CR12 clamps the junction of transformers T1 and T2, and resistors R8 and R9, near -4. 5 v, to limit current flow through transistors Q2 and Q3. The emitter voltage, which is near the -4. 5 v level, is applied to diodes CR7 and CR9. These diodes are inputs to two-input gates for transistors Q2 and Q3.

If transistor Q1 is saturated and the input to diode CR8 is at the logical 1 level (0 v), transistor Q2 is cut off. If the input to diode CR8 is driven to the logical 0 level (-4. 5 v), transistor Q2 is driven to saturation, and a pulse of current flows through resistors R8 and R9, the primary of transformer T1, and transistor Q2. The current induced in the secondary of transformer T1 drives transistor Q4 to saturation, and current flows from the load through transistor Q4 to the current source.

If transistor Q1 is saturated and the input to diode CR6 is at the logical 1 level (0 v), transistor Q3 is cut off. If the input to diode CR6 is dirven to the logical 0 level (-4. 5 v), transistor Q3 is driven to saturation, and a current pulse flows through resistors R8 and R9, the primary of transformer T2, and transistor Q3. The current induced in the secondary of transformer T2 drives transistor Q5 to saturation, and current flows through transistor Q5, the load, and the current source.

Two selector pair circuits are connected through a diode matrix on module 412. To send a current pulse through a load, the address gates of both circuits are enabled. The SELECTOR A INPUT of one circuit and the SELECTOR B INPUT of the other circuit are enabled, providing one complete path. When the other SELECTOR A INPUT and SELECTOR B INPUT are enabled, a path through the load is provided for current flow in the opposite direction.

Resistor R11 and inductor L1 substitute for half of the maximum core memory load. When a full core memory load is driven, the load is connected to pin 33 and resistor R11 and inductor L1 are not in the circuit. Capacitors C1, C2, and C3 are line filter capacitors for the +E voltage in the constant current power supply of module 420, the +12 v power supply, and the -16. 5 v power supply, respectively.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Tables 1, 2, and 3. Waveforms are illustrated in Figure 1. Output logic levels are described in Table 4 and Table 5.

Table 1. Address Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2 v, -1.2 v)	0 ma
1	0.0 v (+0.2 v, -0.5 v)	1.8 ma maximum

Table 2. Selector A Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2 v, -1.2 v)	0 ma
1	0.0 v (+0.2 v, -0.5 v)	5.7 ma maximum

Table 3. Selector B Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (0.2 v, -1.2 v)	0 ma
1	0.0 v (+0.2 v, -1.2 v)	5.3 ma maximum

Table 4. Selector A Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
ON	0 to +24 v	0 to 250 ma
OFF	0 to +24 v	0 ma

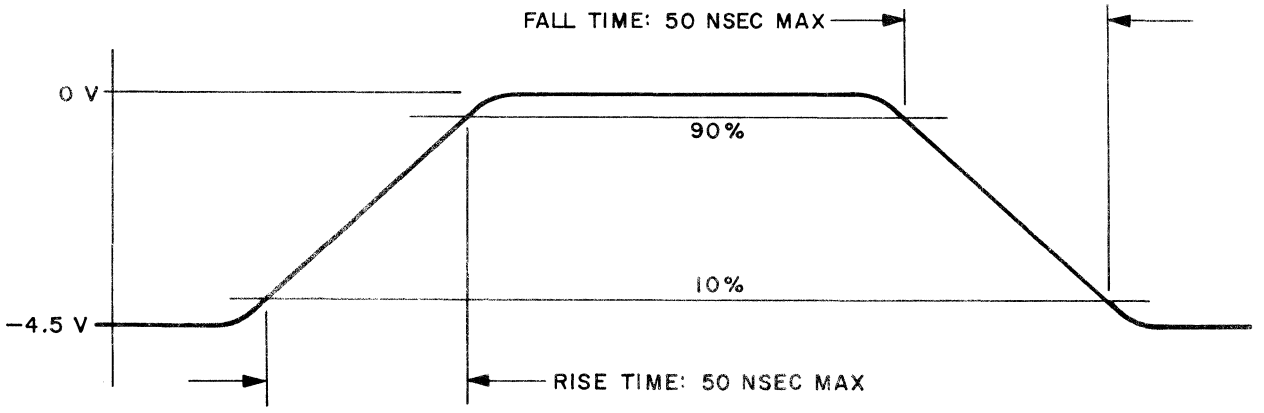


Figure 1. 416 Module, Input Waveform

Table 5. Selector B Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
ON	0 to +1.5 v	0 to 300 ma
OFF	0 to +24 v	0 ma

LOADING

Each address input is equivalent to one-half the load of a 401 gate. Each selector input is equivalent to 1.5 times the load of a 401 gate. The load of a selector pair circuit is a set of cores in the magnetic core memory.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 6.

Table 6. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	187 ma maximum
-16.5 v ± 5%	318 ma maximum

PARTS LIST

Table 7 lists parts for the 416 module. The 416 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 7. Selector Pair (Module 416) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, 35 v
1	C2	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, 35 v
1	C3	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, 35 v
1	CR1	8935924-1	Semiconductor device, diode
1	CR2	8935924-1	Semiconductor device, diode
1	CR3	8935924-1	Semiconductor device, diode
1	CR4	8935924-1	Semiconductor device, diode
1	CR5	2182181-1	Semiconductor device, diode

Table 7. Selector Pair (Module 416) Parts List (cont)

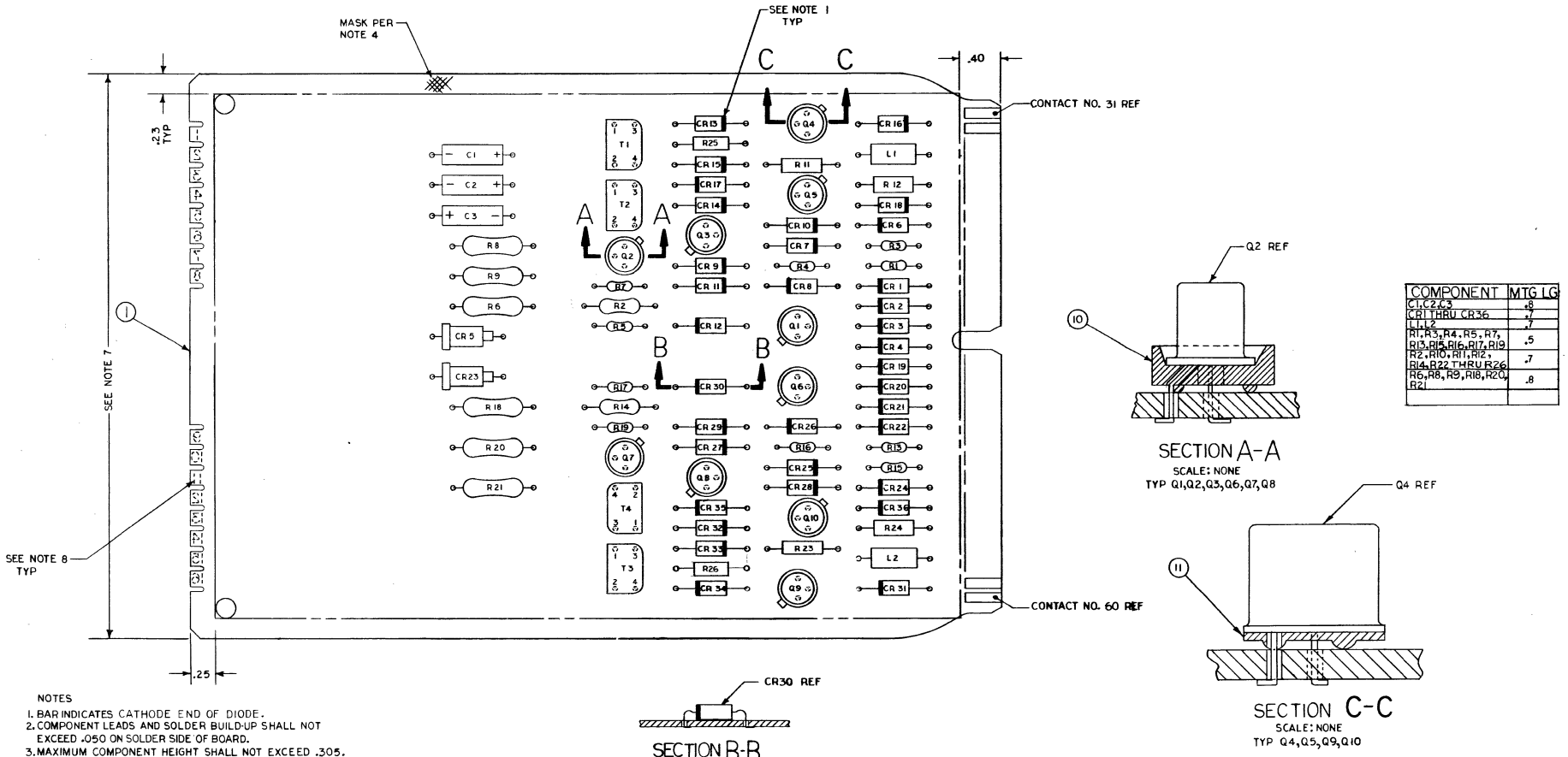
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR6	8935924-1	Semiconductor device, diode
1	CR7	8935924-1	Semiconductor device, diode
1	CR8	8935924-1	Semiconductor device, diode
1	CR9	8935924-1	Semiconductor device, diode
1	CR10	2180816-4	Semiconductor device, diode
1	CR11	2180816-4	Semiconductor device, diode
1	CR12	8935924-1	Semiconductor device, diode
1	CR13	2180816-4	Semiconductor device, diode
1	CR14	2180816-4	Semiconductor device, diode
1	CR15	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR16	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR17	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR18	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR19	8935924-1	Semiconductor device, diode
1	CR20	8935924-1	Semiconductor device, diode
1	CR21	8935924-1	Semiconductor device, diode
1	CR22	8935924-1	Semiconductor device, diode
1	CR23	2182181-1	Semiconductor device, diode
1	CR24	8935924-1	Semiconductor device, diode
1	CR25	8935924-1	Semiconductor device, diode
1	CR26	8935924-1	Semiconductor device, diode
1	CR27	8935924-1	Semiconductor device, diode
1	CR28	2180816-4	Semiconductor device, diode
1	CR29	2180816-4	Semiconductor device, diode
1	CR30	8935924-1	Semiconductor device, diode
1	CR31	2180816-4	Semiconductor device, diode
1	CR32	2180816-4	Semiconductor device, diode

Table 7. Selector Pair (Module 416) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR33	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR34	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR35	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR36	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	L1	8701588-249	Coil, molded, rf choke, 10 uh, ±10%
1	L2	8701588-249	Coil, molded, rf choke, 10 uh, ±10%
1	Q1	2180801-2	Semiconductor device, transistor
1	Q2	2180801-2	Semiconductor device, transistor
1	Q3	2180801-2	Semiconductor device, transistor
1	Q4	2180804-1	Semiconductor device, transistor
1	Q5	2180804-1	Semiconductor device, transistor
1	Q6	2180801-2	Semiconductor device, transistor
1	Q7	2180801-2	Semiconductor device, transistor
1	Q8	2180801-2	Semiconductor device, transistor
1	Q9	2180804-1	Semiconductor device, transistor
1	Q10	2180804-1	Semiconductor device, transistor
1	R1	2182165-248	Resistor, fixed, film, 4700 ohms, $\frac{1}{4}$ w, 2%
1	R2	2182165-32	Resistor, fixed, film, 1000 ohms, $\frac{1}{2}$ w, 2%
1	R3	2182165-246	Resistor, fixed, film, 3900 ohms, $\frac{1}{4}$ w, 2%
1	R4	2182165-246	Resistor, fixed, film, 3900 ohms, $\frac{1}{4}$ w, 2%
1	R5	2182165-266	Resistor, fixed, film, 27 k ohms, $\frac{1}{4}$ w, 2%
1	R6	2182165-121	Resistor, fixed, film, 360 ohms, 1 w, 2%
1	R7	2182165-266	Resistor, fixed, film, 27 k ohms, $\frac{1}{4}$ w, 2%
1	R8	2182165-126	Resistor, fixed, film, 560 ohms, 1 w, 2%
1	R9	2182165-126	Resistor, fixed, film, 560 ohms, 1 w, 2%
1	R11	RC20GF471K	Resistor, fixed, composition, 470 ohms, $\frac{1}{2}$ w, 10% (MIL-R-11D)

Table 7. Selector Pair (Module 416) Parts List (cont)

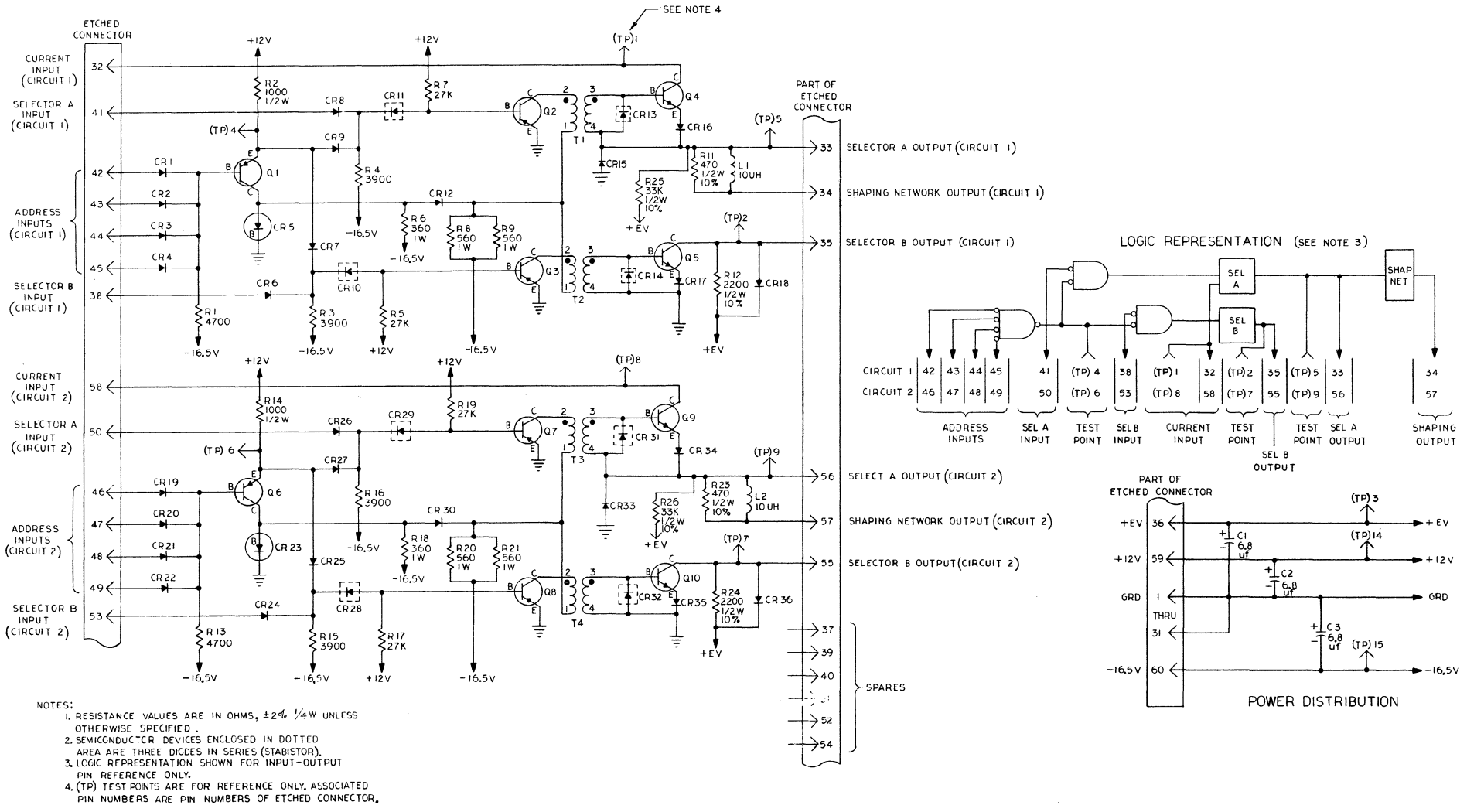
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R12	RC20GF222K	Resistor, fixed, composition, 2200 ohms, ½ w, 10% (MIL-R-11D)
1	R13	2182165-248	Resistor, fixed, film, 4700 ohms, ¼w, 2%
1	R14	2182165-32	Resistor, fixed, film, 1000 ohms, ½ w, 2%
1	R15	2182165-246	Resistor, fixed, film, 3900 ohms, ¼ w, 2%
1	R16	2182165-246	Resistor, fixed, film, 3900 ohms, ¼ w, 2%
1	R17	2182165-266	Resistor, fixed, film, 27 k ohms, ¼ w, 2%
1	R18	2182165-121	Resistor, fixed, film, 360 ohms, 1 w, 2%
1	R19	2182165-266	Resistor, fixed, film, 27 k ohms, ¼ w, 2%
1	R20	2182165-126	Resistor, fixed, film, 560 ohms, 1 w, 2%
1	R21	2182165-126	Resistor, fixed, film, 560 ohms, 1 w, 2%
1	R23	RC20GF471K	Resistor, fixed, composition, 470 ohms, ½ w, 10% (MIL-R-11D)
1	R24	RC20GF222K	Resistor, fixed, composition, 2200 ohms, ½ w, 10% (MIL-R-11D)
1	R25	RC20GF333K	Resistor, fixed, composition, 33 k ohms, ½ w, 10% (MIL-R-11D)
1	R26	RC20GF333K	Resistor, fixed, composition, 33 k ohms, ½ w, 10% (MIL-R-11D)
1	T1	2183230-1	Transformer, pulse
1	T2	2183230-1	Transformer, pulse
1	T3	2183230-1	Transformer, pulse
1	T4	2183230-1	Transformer, pulse
1	1	2161394-16	Board, printed circuit
6	10	2180896-2	Pad, transistor mounting
4	11	2180896-9	Pad, transistor mounting



NOTES

1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665, USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
9. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PAD.
10. FOR LIST OF MATERIALS SEE LM 2162416.
11. ~~DRILL MOUNTING HOLE BESIDE SOLDER SIDE PRINTED CIRCUIT. BEND COMPONENT LEAD ACROSS PRINTED CIRCUIT FOR SOLDERING.~~
12. ~~INSULATE FULL LENGTH WITH TEFLON TUBING.~~

Figure 2. Selector Pair (Module 416), Assembly Drawing



NOTES:
1. RESISTANCE VALUES ARE IN OHMS, ±2% 1/4W UNLESS OTHERWISE SPECIFIED.
2. SEMICONDUCTOR DEVICES ENCLOSED IN DOTTED AREA ARE THREE DIODES IN SERIES (STABISTOR).
3. LOGIC REPRESENTATION SHOWN FOR INPUT-OUTPUT PIN REFERENCE ONLY.
4. (TP) TEST POINTS ARE FOR REFERENCE ONLY. ASSOCIATED PIN NUMBERS ARE PIN NUMBERS OF ETCHED CONNECTOR.

Figure 3. Selector Pair (Module 416), Schematic Diagram

CONSTANT-CURRENT POWER SUPPLY (MODULE 417)

RCA 2110308-501

DESCRIPTION

The 417 module contains two identical constant-current power supplies, a voltage regulating circuit, and two line filter capacitors. These circuits supply the magnetic core memory with current, under control of the 416 module selector pair circuits.

CIRCUIT ANALYSIS

Resistor R1 and Zener diode CR1 form a +22 v regulated power supply. Capacitors C1 and C2 are line filter capacitors for the +50 v input voltage and the +22 v output voltage, respectively. Diodes CR5 and CR6 clamp the output voltage of each constant-current power supply to a maximum of +22 v.

The two constant-current power supplies are identical, therefore only one is described in detail. The main current path when no current is supplied to the load is from the +22 v source through diode CR5, inductor L1 series-parallel resistors R10, R11, and R14, transistor Q5, and resistor R6. When current is provided to the load, the load resistance falls to nearly zero, and diode CR3 is bypassed. The current through inductor L1 is held constant. Diode CR2, and transistor Q3 and Q2 are a feedback circuit which controls variation in current by increasing current flow through transistor Q3 or restricting current flow through transistor Q1. The value of the line current is controlled by the setting of variable resistor R11.

CIRCUIT CHARACTERISTICS

The input to the constant-current power supply is from the +50 v power supply. The maximum current output is 300 ma.

LOADING

Each constant-current power supply circuit supplies a current pulse of 170 ma to 240 ma, with a resolution less than 2 percent. Variation in current during the current pulse is less than 5 ma. The current transient at the leading edge of the pulse is less than 20 ma. The +22 v output is regulated ±10 percent, at 30 ma maximum.

POWER REQUIREMENTS

The power input to the constant-current power supply is 1 ampere maximum at +50 v ±5%.

WIRING

Wiring from the constant current power supply to the selector pair circuit must be twisted pair with maximum length 96 inches. One wire of the twisted pair must be grounded at each end.

PARTS LIST

Table 1 lists parts for the 417 module. The 417 module assembly is illustrated in Figure 1, and the schematic diagram is illustrated in Figure 2.

Table 1. Constant-Current Power Supply (Module 417) Parts List

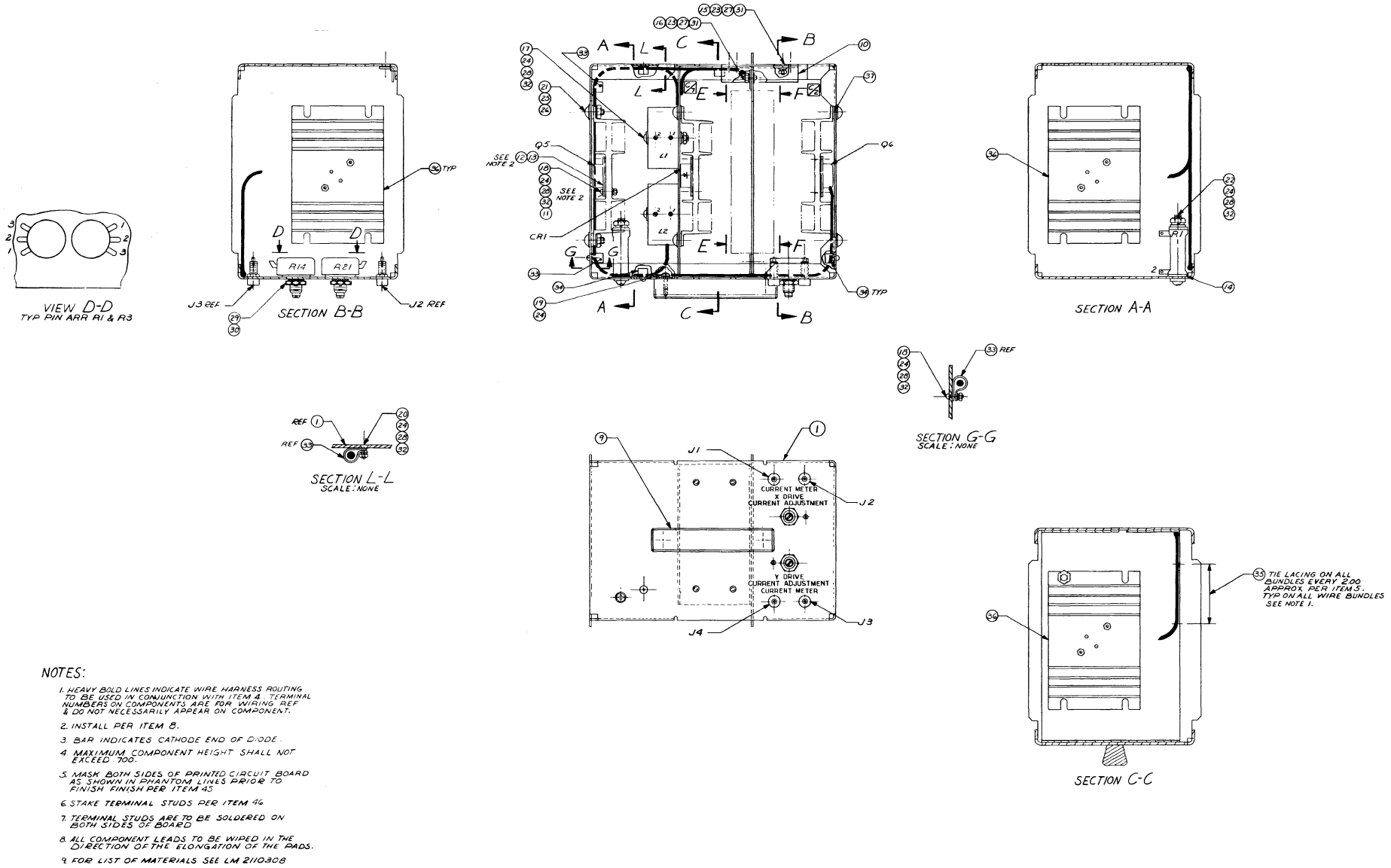
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, ±10%, 100 v (MIL-C-25)
1	C2	CL35BJ060MP1	Capacitor, fixed, tantalum electrolytic, 6 uf, ±20%, 50 v (MIL-C-3965B)
1	CR1	USN 1N2819B	Semiconductor device, diode (Zener), 22 v, 50 w (MIL-S-19500/114)
1	CR2	2180823-1	Semiconductor device, diode (Zener), 6.8 v, 400 mw
1	CR3	2180823-1	Semiconductor device, diode (Zener), 6.8 v, 400 mw
1	CR5	2182124-1	Semiconductor device, diode
1	CR6	2182124-1	Semiconductor device, diode
1	J1	8825493-2	Jack, tip (red)
1	J2	8825493-3	Jack, tip (black)
1	J3	8825493-2	Jack, tip (red)
1	J4	8825493-3	Jack, tip (black)
1	L1	2181779-1	Rf choke, 10 mh
1	L2	2181779-1	Rf choke, 10 mh
1	Q1	2182004-1	Semiconductor device, transistor, type 2N1480
1	Q2	2182004-1	Semiconductor device, transistor, type 2N1480
1	Q3	2182004-1	Semiconductor device, transistor, type 2N1480
1	Q4	2182004-1	Semiconductor device, transistor, type 2N1480
1	Q5	2181788-1	Semiconductor device, transistor, type 2N1906
1	Q6	2181788-1	Semiconductor device, transistor, type 2N1906
1	R1	RW31G201J	Resistor, power, fixed, wirewound, 200 ohms, ±5%, 10 w (MIL-R-26)
1	R2	RC20GF332K	Resistor, fixed, composition, 3300 ohms, ±10%, 1/2 w (MIL-R-11)
1	R3	8977940-313	Resistor, fixed, film, 17.8 k ohms, ±1%, 1/2 w
1	R4	8977940-313	Resistor, fixed, film, 17.8 k ohms, ±1%, 1/2 w
1	R5	RC20GF332K	Resistor, fixed, composition, 3300 ohms, ±10%, 1/2 w (MIL-R-11)

Table 1. Constant-Current Power Supply (Module 417) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R6	RW55G310J	Resistor, power, fixed, wirewound, 31 ohms, ±5%, 5 w (MIL-R-26)
1	R7	RC42GF472K	Resistor, fixed, composition, 4700 ohms, ±10%, 2 w (MIL-R-11)
1	R8	RC42GF472K	Resistor, fixed, composition, 4700 ohms, ±10%, 2 w (MIL-R-11)
1	R9	RW55G310J	Resistor, power, fixed, wirewound, 31 ohms, ±5%, 5 w (MIL-R-26)
1	R10	RW55G200J	Resistor, power, fixed, wirewound, 20 ohms, ±5%, 5 w (MIL-R-26)
1	R11	8977940-81	Resistor, fixed, film, 68.1 ohms, ±1%, 1/2 w
1	R12	8977940-81	Resistor, fixed, film, 68.1 ohms, ±1%, 1/2 w
1	R13	RW55G200J	Resistor, power, fixed, wirewound, 20 ohms, ±5%, 5 w (MIL-R-26)
1	R14	RA20LASB500A	Resistor, variable, wirewound, 0-50 ohms, ±10%, 2 w (MIL-R-19)
1	R21	RA20LASB500A	Resistor, variable, wirewound, 0-50 ohms, ±10%, 2 w (MIL-R-19)
1	1	2132060-501	Chassis, constant-current power supply
1	9	2140784-1	Handle, constant-current power supply
1	10	2182746-1	Bracket support, printed circuit board
3	11	99061-5	Terminal lug
3	12	8265323-1	Insulator
6	13	8265376-1	Insulator
2	14	8954849-4	Bushing, insulating
4	15	8924490-1	Screw, machine, flat head, no. 4 (0.112) 32 x 0.250 lg
4	16	8914385-7	Screw, machine, no. 4 (0.112) 32 x 0.312 lg
2	17	8914387-25	Screw, machine, no. 6 (0.138) 32 x 1.25 lg
10	18	8914387-11	Screw, machine, no. 6 (0.138) 32 x 0.437 lg
2	19	8914387-13	Screw, machine, no. 6 (0.138) 32 x 0.500 lg

Table 1. Constant-Current Power Supply (Module 417) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
2	20	8924492-705	Screw, machine, flat head, no. 6 (0.138) - 32 x 0.250 lg
12	21	8977993-13	Screw, machine, no. 10 (0.190) - 32 x 0.500 lg
1	22	8954974-1	Stud, resistor
8	23	8924401-3	Washer, flat (for 0.112 dia)
17	24	8924401-4	Washer, flat (for 0.138 dia)
12	25	8924401-6	Washer, flat (for 0.375 dia)
2	26	93610-22	Washer, lock external tooth (for 0.375 dia)
8	27	93621-5	Washer, lock, spring (for 0.112 dia)
11	28	93621-7	Washer, lock, spring (for 0.138 dia)
6	29	93621-22	Washer, lock, spring (for 0.375 dia)
2	30	8924492-705	Screw, machine, flat head no. 6 (0.138) - 32 x 0.250 lg
8	31	57435-703	Nut, plain, hexagon (for 0.112 dia)
9	32	57435-704	Nut, plain, hexagon (for 0.138 dia)
4	33	8811154-2	Clamp, loop
2	34	8811154-31	Clamp, loop
AR	35	2010811-1	Cord, nylon (waxed, flat)
3	36	2181792-1	Heat sink, semiconductor device
12	37	8910544-26	Washer, flat, nylon (for 0.375 dia)
4	44	2180894-1	Pad, transistor mounting
17	47	8902763-1	Terminal, stud



NOTES:

1. HEAVY BOLD LINES INDICATE WIRE HARNESS ROUTING TO BE USED IN CONJUNCTION WITH ITEM 4. TERMINAL NUMBERS ON COMPONENTS ARE FOR WIRING REF & DO NOT NECESSARILY APPEAR ON COMPONENT.
2. INSTALL PER ITEM 8.
3. BAR INDICATES CATHODE END OF DIODE.
4. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .700.
5. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH FINISH PER ITEM 45
6. STAKE TERMINAL STUDS PER ITEM 46
7. TERMINAL STUDS ARE TO BE SOLDERED ON BOTH SIDES OF BOARD
8. ALL COMPONENT LEADS TO BE WIPED IN THE DIRECTION OF THE ELONGATION OF THE PADS.
9. FOR LIST OF MATERIALS SEE LM 2110308

Figure 1. Constant-Current Power Supply (Module 417), Assembly Drawing (Sheet 1 of 2)

COMPONENT	MTG. LG.
C1, C2	1.8
C3, C4	.4
R2, R5	.7
R4, R3, R12, R11	1.1
R10, R6, R9, R13	2.3
R8, R7, R19, R20	1.0
R15, R16, R17, R18	
CR2THRU CR7	.7

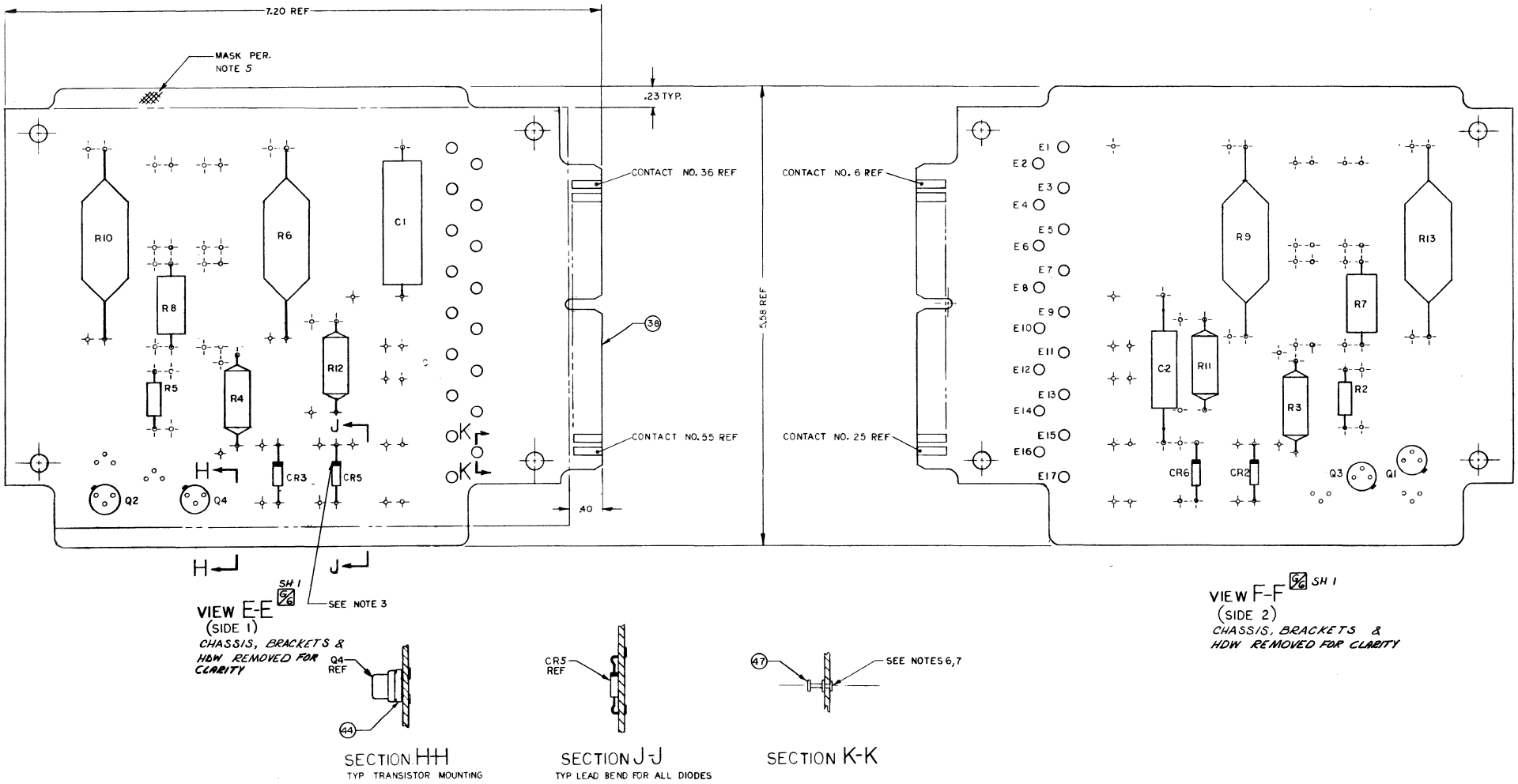
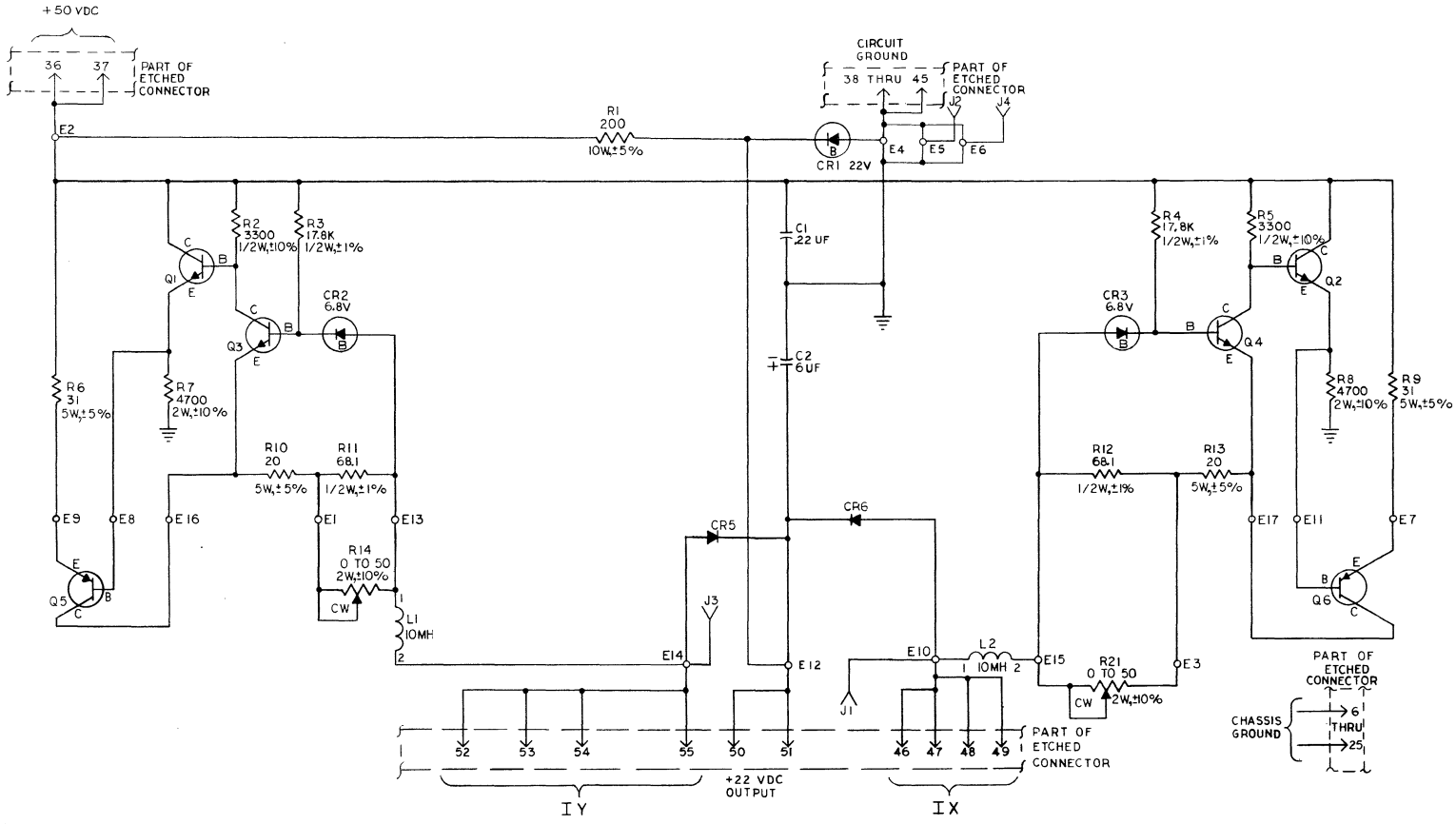


Figure 1. Constant-Current Power Supply (Module 417), Assembly Drawing (Sheet 2 of 2)



NOTES:
1. RESISTANCE VALUES ARE IN OHMS

Figure 2. Constant-Current Power Supply (Module 417), Schematic Diagram

SENSE AMPLIFIER (MODULE 418)

RCA 2162418-501

DESCRIPTION

The 418 module contains four identical sense amplifier circuits, a common level set circuit, two line filter capacitors, and a voltage regulating circuit. The sense amplifiers are used as the load for circuits in the IBM 7330 Magnetic Tape Unit, and provide output logic levels compatible with the requirements of the RCA 4102S computer.

CIRCUIT ANALYSIS

The input to the level set input circuit is either a write signal (0 v), or a read signal (-4. 5 v). When the input is 0 v, transistor Q9 is cut off; when the input is -4. 5 v, transistor Q9 is saturated. The loads on the level set input circuits are four identical resistor networks which determine the sensing levels of the amplifier circuits. When transistor Q9 is saturated, its collector voltage is near 0 v, and diodes CR1, CR7, CR15, and CR21 are forward biased. When transistor Q9 is cutoff, its collector voltage falls to a negative value, and diodes CR1, CR7, CR15, and CR21 are back-biased. Thus, the input to the level set circuit determines the bias voltage applied by each resistor network to the sense amplifier circuit.

The four sense amplifier circuits are identical, therefore only one is described in detail. Resistors R6 and R7 are a voltage divider bias circuit. The input, which may be positive or negative pulses, is amplified by transistor Q4. Diode CR2, resistor R4 and half of the secondary of transformer T1 form one input to transistor Q1; diode CR5, resistor R8, and the other half of the secondary of transformer T1 form another input to transistor Q1. Voltage induced in the secondary of transformer T1, being of opposite polarity for each of these two circuits, causes current flow in either diode CR2 or diode CR5 after the voltage exceeds the bias voltage applied from the resistor network controlled by the level set circuit.

Transistor Q1 is driven from saturation to cutoff. Transistor Q2 is driven from cutoff to saturation. Transistor Q3 is driven from saturation to cutoff. As transistor Q3 is driven from saturation to cutoff, its collector voltage falls from near 0 v and is clamped near -6. 2 v by current flow through resistor R14 and diode CR6. These conditions hold for a period determined by transient characteristics of the circuit, then transistor Q1 becomes saturated, transistor Q2 is cut off, transistor Q3 is saturated, the output rises to near 0 v, and diode CR6 is back-biased.

Resistor R60 and Zener diode CR27, form a voltage regulator for the -6. 8 v source. Capacitors C13 and C14 are line filter capacitors for the +12 v supply and the -16. 5 v supply respectively.

CIRCUIT CHARACTERISTICS

The level set circuit inputs are described in Table 1. The inputs to each sense amplifier circuit are positive or negative pulses from the IBM 7330 Magnetic Tape Unit. Output levels are described in Table 2. The waveforms and timing are illustrated in Figure 1.

Table 1. Level Set Inputs

MODE	VOLTAGE	CURRENT
Write	0. 0 v (+0. 0 v, -0. 5 v)	8. 3 ma IN maximum
Read	-4. 5 v (+0. 5 v, -2. 5 v)	0. 1 ma OUT maximum

Table 2. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-6. 2 v (+0. 5 v, -0. 8 v)	2. 0 ma OUT maximum 3. 5 ma IN maximum
1	0. 0 v (+0. 0 v, -0. 5 v)	34. 5 ma OUT maximum 4. 0 ma IN maximum

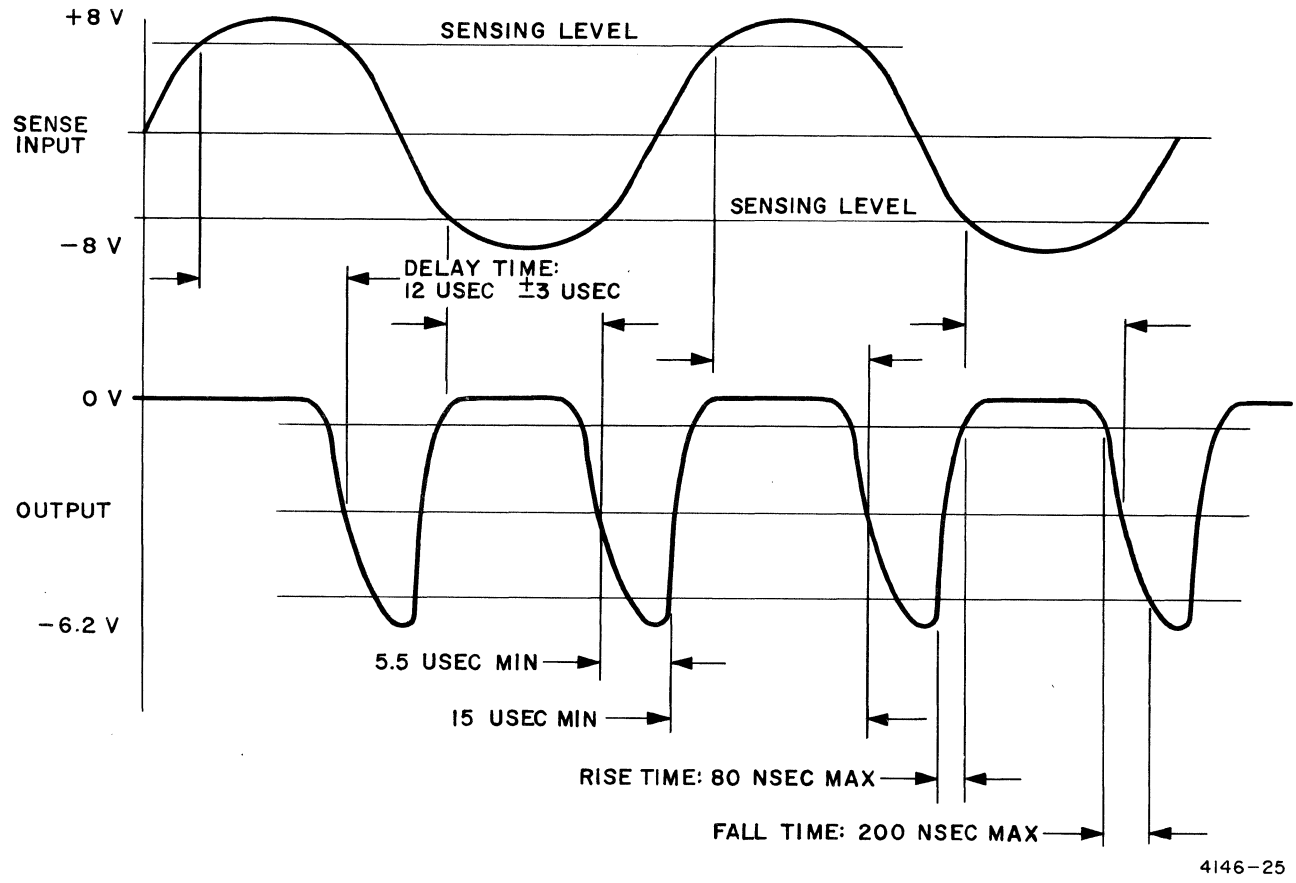


Figure 1. 418 Module, Waveforms and Timing

LOADING

The level set input is approximately 2. 4 unit loads. The sense inputs interface with the IBM 7330 Magnetic Tape Unit. The outputs can drive a maximum of eight unit loads.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	4. 5 ma maximum
-16. 5 v ± 5%	195 ma maximum

WIRING

Table 4 lists maximum lengths of wire which may be used.

Table 4. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	96 Inches
Single Load	120 Inches

PARTS LIST

Table 5 lists parts for the 418 module. The 418 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 5. Sense Amplifier (Module 418) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-70	Capacitor, fixed, tantalum, 1.0 μf, ± 20%, 35 vdc
1	C2	8924416-310	Capacitor, fixed, mica, 1000 μμf, ± 5%
1	C3	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C4	8412778-70	Capacitor, fixed, tantalum, 1.0 μf, ± 20%, 35 vdc
1	C5	8924416-310	Capacitor, fixed, mica, 1000 μμf, ± 5%
1	C6	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C7	8412778-70	Capacitor, fixed, tantalum, 1.0 μf, ± 20%, 35 vdc
1	C8	8924416-310	Capacitor, fixed, mica, 1000 μμf, ± 5%
1	C9	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C10	8412778-70	Capacitor, fixed, tantalum, 1.0 μf, ± 20%, 35 vdc
1	C11	8924416-310	Capacitor, fixed, mica, 1000 μμf, ± 5%
1	C12	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C13	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	C14	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 vdc
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2182140-1	Semiconductor device, diode
1	CR3	2180816-3	Semiconductor device, diode
1	CR4	2180816-3	Semiconductor device, diode
1	CR5	2182140-1	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2182140-1	Semiconductor device, diode
1	CR9	2180816-3	Semiconductor device, diode
1	CR10	2180816-3	Semiconductor device, diode
1	CR11	2182140-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180820-1	Semiconductor device, diode

Table 5. Sense Amplifier (Module 418) Parts List (cont)

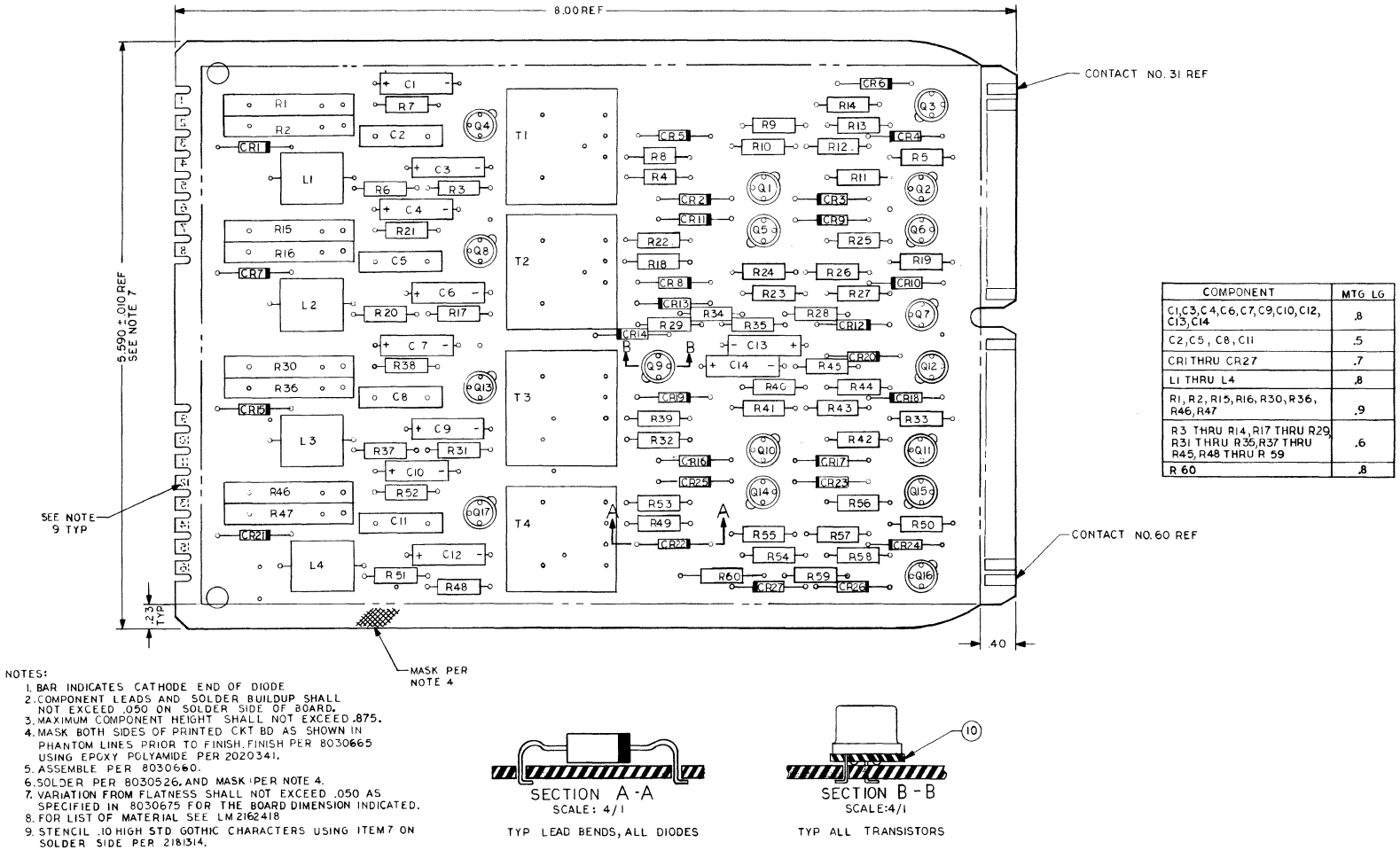
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR14	2180816-3	Semiconductor device, diode
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2182140-1	Semiconductor device, diode
1	CR17	2180816-3	Semiconductor device, diode
1	CR18	2180816-3	Semiconductor device, diode
1	CR19	2182140-1	Semiconductor device, diode
1	CR20	2180820-1	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2182140-1	Semiconductor device, diode
1	CR23	2180816-3	Semiconductor device, diode
1	CR24	2180816-3	Semiconductor device, diode
1	CR25	2182140-1	Semiconductor device, diode
1	CR26	2180820-1	Semiconductor device, diode
1	CR27	1N753A	Semiconductor device, diode (Zener) (MIL-S-19500/117)
1	R1	2182836-206	Resistor, variable, 500 ohms, ±5%, 1 w
1	R2	2182836-207	Resistor, variable, 1 k ohm, ±5%, 1 w
1	R3	2182165-39	Resistor, fixed, film, 2 k ohms, ±2%, 1/2 w
1	R4	2182165-67	Resistor, fixed, film, 30 k ohms, ±2%, 1/2 w
1	R5	2182165-8	Resistor, fixed, film, 100 ohms, ±2%, 1/2 w
1	R6	2182165-45	Resistor, fixed, film, 3600 ohms, ±2%, 1/2 w
1	R7	2182165-45	Resistor, fixed, film, 3600 ohms, ±2%, 1/2 w
1	R8	2182165-67	Resistor, fixed, film, 30 k ohms, ±2%, 1/2 w
1	R9	2182165-69	Resistor, fixed, film, 36 k ohms, ±2%, 1/2 w
1	R10	2182165-49	Resistor, fixed, film, 5100 ohms, ±2%, 1/2 w
1	R11	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R12	2182165-49	Resistor, fixed, film, 5100 ohms, ±2%, 1/2 w
1	R13	2182165-73	Resistor, fixed, film, 51 k ohms, ±2%, 1/2 w
1	R14	2182165-40	Resistor, fixed, film, 2200 ohms, ±2%, 1/2 w
1	R15	2182836-206	Resistor, variable, 500 ohms, ±5%, 1 w

Table 5. Sense Amplifier (Module 418) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R16	2182636-207	Resistor, variable, 1 k ohm, ± 5%, 1 w
1	R17	2182165-39	Resistor, fixed, film, 2 k ohms, ± 2%, 1/2 w
1	R18	2182165-67	Resistor, fixed, film, 30 k ohms, ± 2%, 1/2 w
1	R19	2182165-8	Resistor, fixed, film, 100 ohms, ± 2%, 1/2 w
1	R20	2182165-45	Resistor, fixed, film, 3600 ohms, ± 2%, 1/2 w
1	R21	2182165-45	Resistor, fixed, film, 3600 ohms, ± 2%, 1/2 w
1	R22	2182165-67	Resistor, fixed, film, 30 k ohms, ± 2%, 1/2 w
1	R23	2182165-69	Resistor, fixed, film, 36 k ohms, 2%, 1/2 w
1	R24	2182165-49	Resistor, fixed, film, 5100 ohms, 2%, 1/2 w
1	R25	2182165-73	Resistor, fixed, film, 51 k ohms, 2%, 1/2 w
1	R26	2182165-49	Resistor, fixed, film, 5100 ohms, 2%, 1/2 w
1	R27	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R28	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R29	2182165-67	Resistor, fixed, film, 30 k ohms, ± 2%, 1/2 w
1	R30	2182836-206	Resistor, variable, 500 ohms, ± 5%, 1 w
1	R31	2182165-39	Resistor, fixed, film, 2 k ohms, ± 2%, 1/2 w
1	R32	2182165-67	Resistor, fixed, film, 30 k ohms, ± 2%, 1/2 w
1	R33	2182165-8	Resistor, fixed, film, 100 ohms, ± 2%, 1/2 w
1	R34	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R35	2182165-58	Resistor, fixed, film, 12 k ohms, ± 2%, 1/2 w
1	R36	2182836-207	Resistor, variable, 1 k ohm, ± 5%, 1 w
1	R37	2182165-45	Resistor, fixed, film, 3600 ohms, ± 2%, 1/2 w
1	R38	2182165-45	Resistor, fixed, film, 3600 ohms, ± 2%, 1/2 w
1	R39	2182165-67	Resistor, fixed, film, 30 k ohms, ± 2%, 1/2 w
1	R40	2182165-69	Resistor, fixed, film, 36 k ohms, ± 2%, 1/2 w
1	R41	2182165-49	Resistor, fixed, film, 5100 ohms, ± 2%, 1/2 w
1	R42	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w

Table 5. Sense Amplifier (Module 418) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R43	2182165-49	Resistor, fixed, film, 5100 ohms, ± 2%, 1/2 w
1	R44	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R45	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R46	2182836-206	Resistor, variable, 500 ohms, ± 5%, 1 w
1	R47	2182836-207	Resistor, variable, 1 k ohm, ± 5%, 1 w
1	R48	2182165-39	Resistor, fixed, film, 2 k ohms, ± 2%, 1/2 w
1	R49	2182165-67	Resistor, fixed, film, 30 k ohms, ± 2%, 1/2 w
1	R50	2182165-8	Resistor, fixed, film, 100 ohms, ± 2%, 1/2 w
1	R51	2182165-45	Resistor, fixed, film, 3600 ohms, ± 2%, 1/2 w
1	R52	2182165-45	Resistor, fixed, film, 3600 ohms, ± 2%, 1/2 w
1	R53	2182165-67	Resistor, fixed, film, 30 k ohms, ± 2%, 1/2 w
1	R54	2182165-69	Resistor, fixed, film, 36 k ohms, ± 2%, 1/2 w
1	R55	2182165-49	Resistor, fixed, film, 5100 ohms, ± 2%, 1/2 w
1	R56	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R57	2182165-49	Resistor, fixed, film, 5100 ohms, ± 2%, 1/2 w
1	R58	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R59	2182165-40	Resistor, fixed film, 2200 ohms, ± 2%, 1/2 w
1	R60	2182165-117	Resistor, fixed, film, 2200 ohms, ± 2%, 1 w
1	1	2161394-18	Board, printed circuit
17	10	2180896-1	Pad, transistor mounting



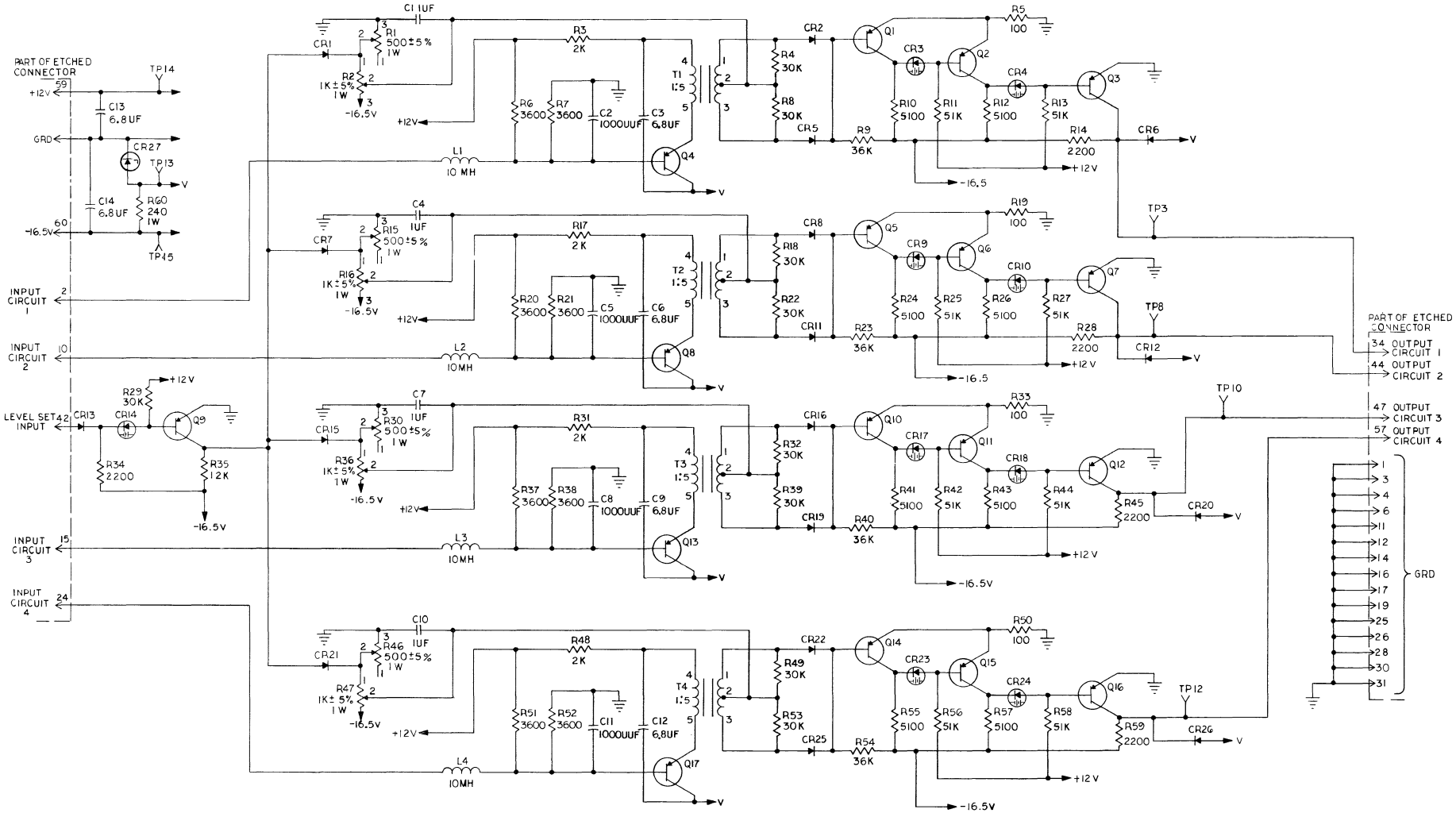
COMPONENT	MTG LG
C1,C3,C4,C6,C7,C9,C10,C12, C13,C14	.8
C2,C5, C8, C11	.5
CR1 THRU CR27	.7
L1 THRU L4	.8
R1, R2, R15, R16, R30, R36, R46, R47	.9
R3 THRU R14, R17 THRU R29, R31 THRU R35, R37 THRU R45, R48 THRU R 59	.6
R 60	.8

NOTES:
1. BAR INDICATES CATHODE END OF DIODE
2. COMPONENT LEADS AND SOLDER BUILDUP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .875.
4. MASK BOTH SIDES OF PRINTED CKT BD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526. AND MASK PER NOTE 4.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. FOR LIST OF MATERIAL SEE LM 2162418
9. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.

SECTION A-A
SCALE: 4/1
TYP LEAD BENDS, ALL DIODES

SECTION B-B
SCALE: 4/1
TYP ALL TRANSISTORS

Figure 2. Sense Amplifier (Module 418), Assembly Drawing



NOTES:

1. ALL RESISTANCE VALUES ARE IN OHMS, ±2%, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. LIKE CALLOUTS OF V ARE COMMON.

Figure 3. Sense Amplifier (Module 418), Schematic Diagram

LINE DRIVER (MODULE 419)

RCA 2162419-501

DESCRIPTION

The 419 module contains eight identical line driver circuits, four voltage regulator circuits, and two line filter capacitors. The line driver circuit is a three-input NOR gate with output logic levels compatible with input requirements of the IBM 7330 Magnetic Tape Unit.

CIRCUIT ANALYSIS

Each line driver circuit is identical, therefore only line driver 1 is described in detail. The nominal level of a logical 0 input is -5.5 v; the nominal level of a logical 1 input is 0 v. If any input to line driver 1 is at a logical 1 level, the junction of diodes CR1, CR2, CR3, CR4, CR5, and resistor R1, is held near 0 v. Current flow through diode CR5 and resistor R2 biases transistor Q1 at cut off. Under these conditions transistor Q2 conducts, and its collector voltage is near -1.5 v. When all inputs to line driver 1 are at the logical 0 level, the junction of diodes CR1, CR2, CR3, CR4, CR5, and resistor R1 is held near -5.5 v. Current flow through diode CR5 and resistor R2 biases transistor Q1 in saturation. The emitter voltage of transistor Q2 is held near ground, and its base-to-emitter junction is reverse biased. Thus, transistor Q2 collector rises to +1 v through the termination network in the IBM 7330 Magnetic Tape Unit.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Output logic levels are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-5.5 v (+2.05 v, -2.5 v)	25 ua maximum OUT
1	0.0 v (+0.0 v, -0.8 v)	4.0 ma maximum IN

Table 2. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-1.5 v (+1.1 v, -2.1 v)	+23.21 ma minimum +39.19 ma maximum
1	1.0 v (+1.5 v, -0.6 v)	+0.0 ua minimum +0.2 ua maximum

LOADING

Each input to the line driver is one unit load. Each line driver circuit is capable of driving eight circuits of the type illustrated in Figure 2. This circuit is described in detail in the IBM 7330 Magnetic Tape Unit Reference Manual.

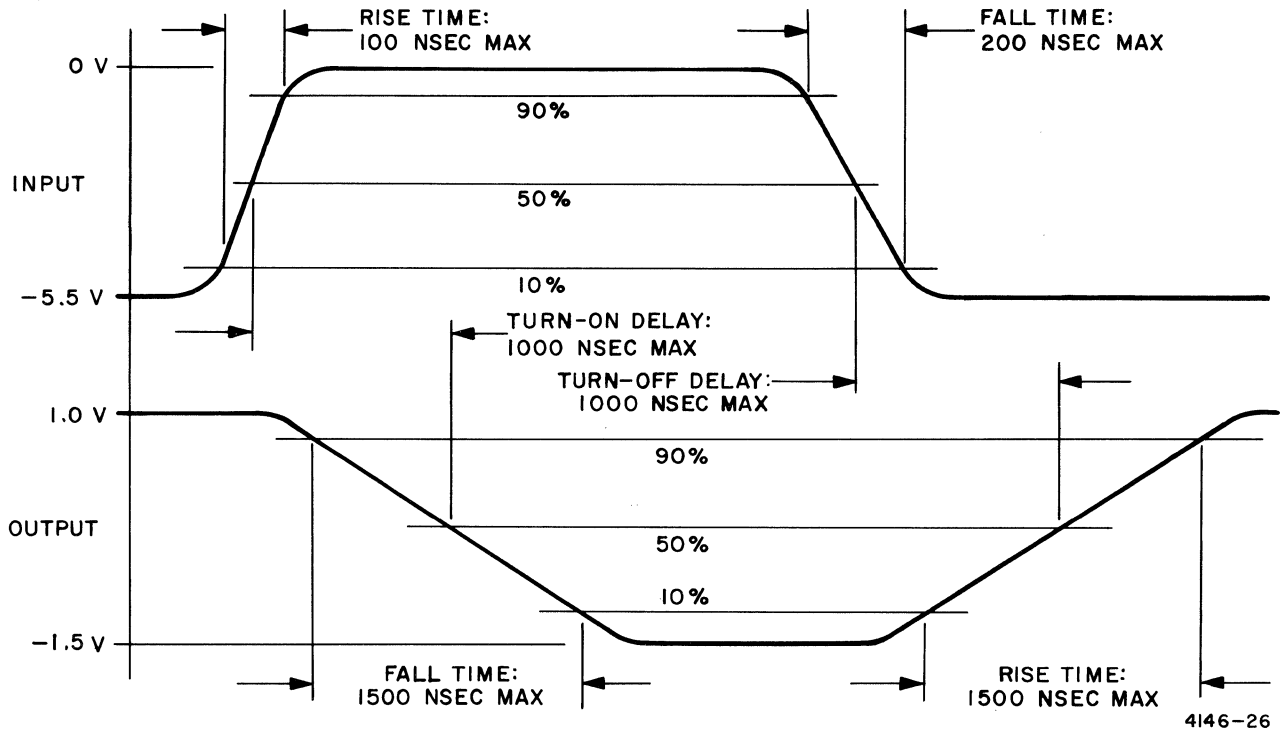


Figure 1. 419 Module, Waveforms and Timing

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT	POWER
+12 v ± 5% -16. 5 v ± 5%	2. 26 ma maximum 502. 2 ma maximum	8. 74 watts maximum

WIRING

Table 4 lists maximum lengths of wire which may be used for input wiring. For output wiring, four feet of twisted pair may be used between the line driver and the coaxial cable.

Table 4. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	96 Inches
Single Load	120 Inches

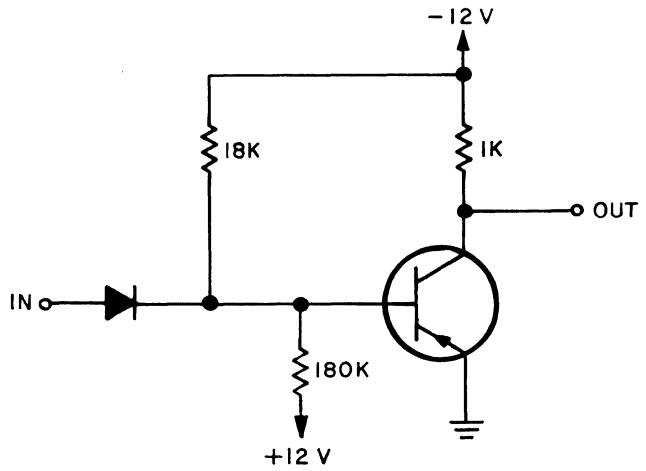


Figure 2. 419 Module, Line Driver Load

PARTS LIST

Table 5 lists parts for the 419 module. The 419 module assembly is illustrated in Figure 3, and the schematic diagram is illustrated in Figure 4.

Table 5. Line Driver (Module 419) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	2182821-6	Capacitor, fixed, mica dielectric, 2700 pf, ±5%, 500 v
1	C2	2182821-6	Capacitor, fixed, mica dielectric, 2700 pf, ±5%, 500 v
1	C3	2182821-6	Capacitor, fixed, mica dielectric, 2700 pf, ±5%, 500 v
1	C4	2182821-6	Capacitor, fixed, mica dielectric, 2700 pf, ±5%, 500 v
1	C5	2182821-6	Capacitor, fixed, mica dielectric, 2700 pf, ±5%, 500 v
1	C6	2182821-6	Capacitor, fixed, mica dielectric, 2700 pf, ±5%, 500 v
1	C7	2182821-6	Capacitor, fixed, mica dielectric, 2700 pf, ±5%, 500 v
1	C8	2182821-6	Capacitor, fixed, mica dielectric, 2700 pf, ±5%, 500 v
1	C9	8412778-25	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 10 v
1	C10	8412778-25	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 10 v
1	C11	8412778-25	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 10 v
1	C12	8412778-25	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 10 v
1	C13	8412778-95	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ±20%, 35 v

Table 5. Line Driver (Module 419) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C14	8412778-95	Capacitor, fixed, tantalum electrolytic, 6.8 μf, ± 20%, 35 v
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180816-3	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	2180820-1	Semiconductor device, diode
1	CR10	2180816-3	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180820-1	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180816-3	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	CR17	2180820-1	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2180820-1	Semiconductor device, diode
1	CR20	2180816-3	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2180820-1	Semiconductor device, diode
1	CR23	2180820-1	Semiconductor device, diode
1	CR24	2180820-1	Semiconductor device, diode
1	CR25	2180816-3	Semiconductor device, diode

Table 5. Line Driver (Module 419) Parts List (cont)

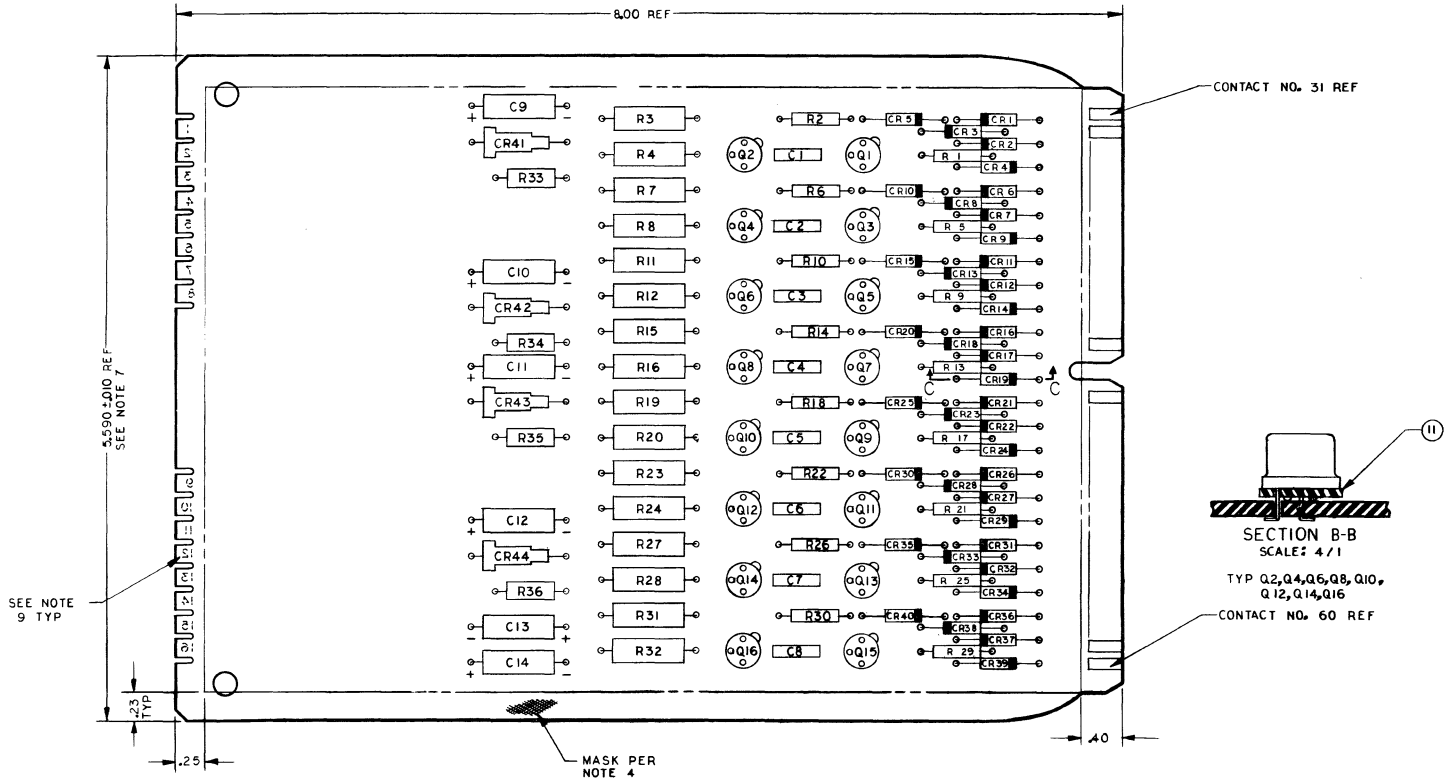
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR26	2180820-1	Semiconductor device, diode
1	CR27	2180820-1	Semiconductor device, diode
1	CR28	2180820-1	Semiconductor device, diode
1	CR29	2180820-1	Semiconductor device, diode
1	CR30	2180816-3	Semiconductor device, diode
1	CR31	2180820-1	Semiconductor device, diode
1	CR32	2180820-1	Semiconductor device, diode
1	CR33	2180820-1	Semiconductor device, diode
1	CR34	2180820-1	Semiconductor device, diode
1	CR35	2180816-3	Semiconductor device, diode
1	CR36	2180820-1	Semiconductor device, diode
1	CR37	2180820-1	Semiconductor device, diode
1	CR38	2180820-1	Semiconductor device, diode
1	CR39	2180820-1	Semiconductor device, diode
1	CR40	2180816-3	Semiconductor device, diode
1	CR41	2182181-1	Semiconductor device, diode
1	CR42	2182181-1	Semiconductor device, diode
1	CR43	2182181-1	Semiconductor device, diode
1	CR44	2182181-1	Semiconductor device, diode
1	Q1	2180811-1	Semiconductor device, transistor
1	Q2	2182184-2	Semiconductor device, transistor
1	Q3	2180811-1	Semiconductor device, transistor
1	Q4	2182184-2	Semiconductor device, transistor
1	Q5	2180811-1	Semiconductor device, transistor
1	Q6	2182184-2	Semiconductor device, transistor
1	Q7	2180811-1	Semiconductor device, transistor

Table 5. Line Driver (Module 419) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q8	2182184-2	Semiconductor device, transistor
1	Q9	2180811-1	Semiconductor device, transistor
1	Q10	2182184-2	Semiconductor device, transistor
1	Q11	2180811-1	Semiconductor device, transistor
1	Q12	2182184-2	Semiconductor device, transistor
1	Q13	2180811-1	Semiconductor device, transistor
1	Q14	2182184-2	Semiconductor device, transistor
1	Q15	2180811-1	Semiconductor device, transistor
1	Q16	2182184-2	Semiconductor device, transistor
1	R1	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R2	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R3	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R4	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R5	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R6	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R7	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R8	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R9	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R10	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R11	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R12	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R13	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R14	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R15	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R16	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R17	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w

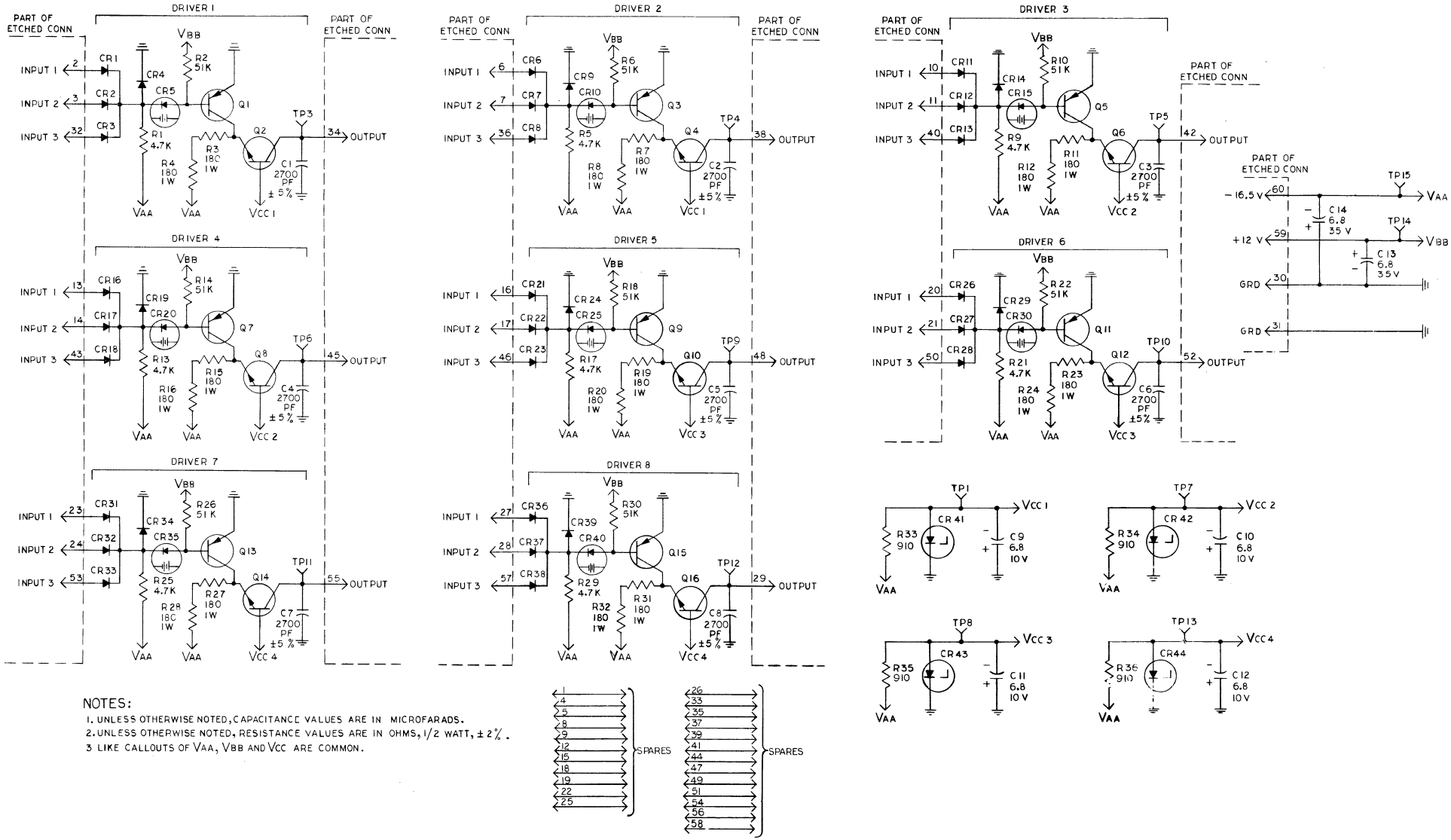
Table 5. Line Driver (Module 419) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R18	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R19	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R20	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R21	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R22	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R23	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R24	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R25	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R26	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R27	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R28	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R29	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R30	2182165-73	Resistor, fixed, film, 51 k ohms, ± 2%, 1/2 w
1	R31	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R32	2182165-114	Resistor, fixed, film, 180 ohms, ± 2%, 1 w
1	R33	2182165-31	Resistor, fixed, film, 910 ohms, ± 2%, 1/2 w
1	R34	2182165-31	Resistor, fixed, film, 910 ohms, ± 2%, 1/2 w
1	R35	2182165-31	Resistor, fixed, film, 910 ohms, ± 2%, 1/2 w
1	R36	2182165-31	Resistor, fixed, film, 910 ohms, ± 2%, 1/2 w
1	1	2161394-19	Board, printed
8	10	2180896-2	Pad, transistor mounting
8	11	2180896-9	Pad, transistor mounting



NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILDUP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CKT BD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. FOR LIST OF MATERIALS SEE LM2162419.
9. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.

Figure 3. Line Driver (Module 419), Assembly Drawing



NOTES:

1. UNLESS OTHERWISE NOTED, CAPACITANCE VALUES ARE IN MICROFARADS.
2. UNLESS OTHERWISE NOTED, RESISTANCE VALUES ARE IN OHMS, 1/2 WATT, ± 2%.
3. LIKE CALLOUTS OF VAA, VBB AND VCC ARE COMMON.

Figure 4. Line Driver (Module 419), Schematic Diagram

LINE RECEIVER (MODULE 420)

RCA 2162420-501

DESCRIPTION

The 420 module contains ten identical line receiver circuits and three line filter capacitors. This module converts logic levels of the IBM 7330 Magnetic Tape Unit to logic levels of the RCA 4102S Computer, and is used in interface circuits between the two units.

CIRCUIT ANALYSIS

The ten line receiver circuits are identical, therefore only one is described in detail. When a logical 0 input is applied to line receiver 1, the junction of resistors R1, R2, and R3 is held between -1.0 v and and -2.2 v. Transistor Q1 is saturated and its emitter voltage is near 0 v. Current flow through diode CR1 and resistor R5 biases transistor Q2 at cut off. The collector voltage of transistor Q2 is clamped near -5.5 v by current flow through resistor R6 and diode CR2. When a logical 1 input is applied to line receiver 1, the junction of resistors R1, R2, and R3 is held between +0.4 v and +0.8v. The base-to-emitter junction of transistor Q1 is reverse biased, and transistor Q1 is cut off. Under these conditions, current flow through resistor R4, diode CR1 and resistor R5 holds the base-to-emitter voltage of transistor Q2 positive. Transistor Q2 is saturated, its emitter voltage is near 0 v, and diode CR2 is back-biased.

Capacitors C1, C2, and C3 are line filter capacitors for the +12 v, -5.5 v, and -16.5 v sources, respectively.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Output logic levels are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-1.0 v to -2.2 v	30 ma maximum OUT
1	+0.4 v to +0.8 v	7 ma maximum OUT

Table 2. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-5.23 v to -6.27 v	5.5 ma maximum IN 6.0 ma maximum OUT
1	0.0 v to -0.5 v	4.0 ma maximum IN 34.5 ma maximum OUT

LOADING

Each line receiver is the load of a circuit in the IBM 7330 Magnetic Tape Unit. Each line receiver can drive 8 unit loads or one steering input of a 403 module flip-flop.

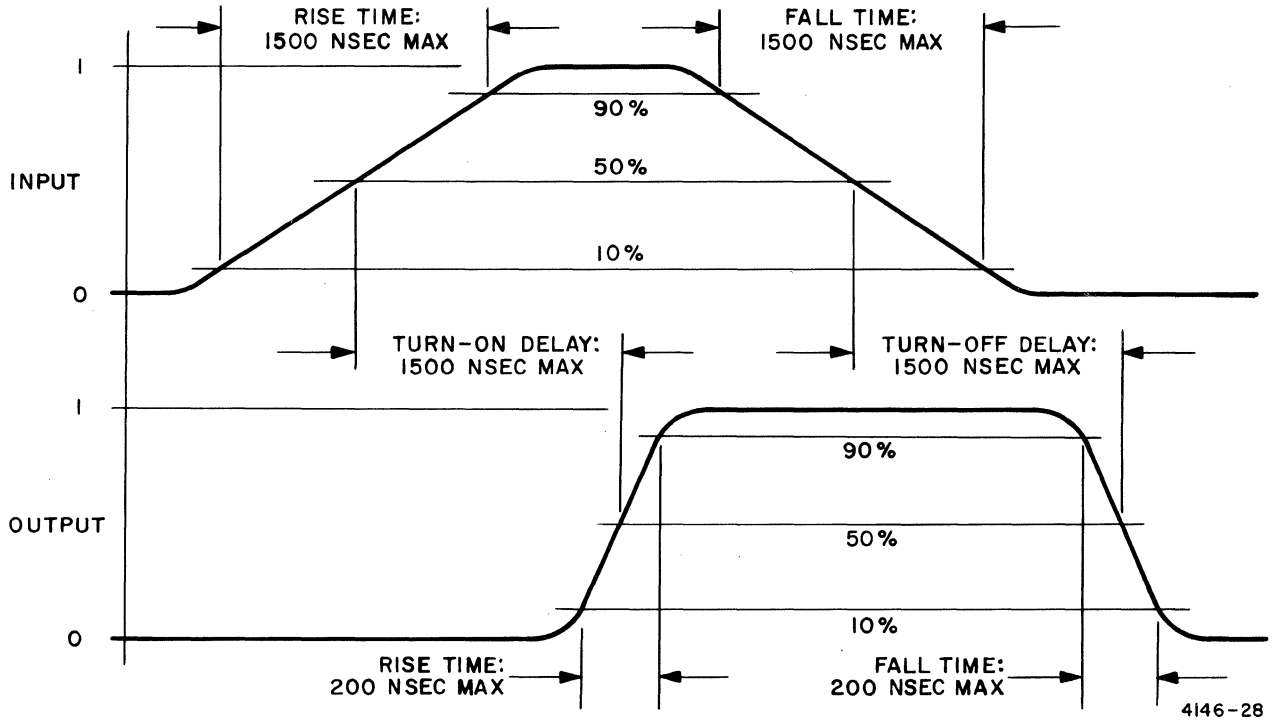


Figure 1. 420 Module, Waveforms and Timing

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ±5%	114 ma maximum
-16.5 v ±5%	119 ma maximum
-5.5 v ±10%	57 ma maximum

WIRING

Table 3 lists maximum lengths of wire which may be used for output wiring. For input wiring four feet of twisted pair may be used between the line receiver and the coaxial cable.

Table 3. Wiring

OPEN WIRE	
Maximum Length	36 Inches
Fan-Out Length	132 Inches

PARTS LIST

Table 4 lists parts for the 420 module. The 420 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 4. Line Receiver (Module 420) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 15 v
1	C2	8412778-25	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 10 v
1	C3	8412778-95	Capacitor, fixed, tantalum, 6.8 μf, ± 20%, 35 v
1	CR1	2180816-3	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180816-3	Semiconductor device, diode
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180816-3	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180816-3	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	2180816-3	Semiconductor device, diode
1	CR10	2180820-1	Semiconductor device, diode
1	CR11	2180816-3	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180816-3	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180816-3	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	CR17	2180816-3	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2180816-3	Semiconductor device, diode
1	CR20	2180820-1	Semiconductor device, diode
1	Q1	2182800-1	Semiconductor device, transistor
1	Q2	2182800-1	Semiconductor device, transistor
1	Q3	2182800-1	Semiconductor device, transistor
1	Q4	2182800-1	Semiconductor device, transistor

Table 4. Line Receiver (Module 420) Parts List (cont)

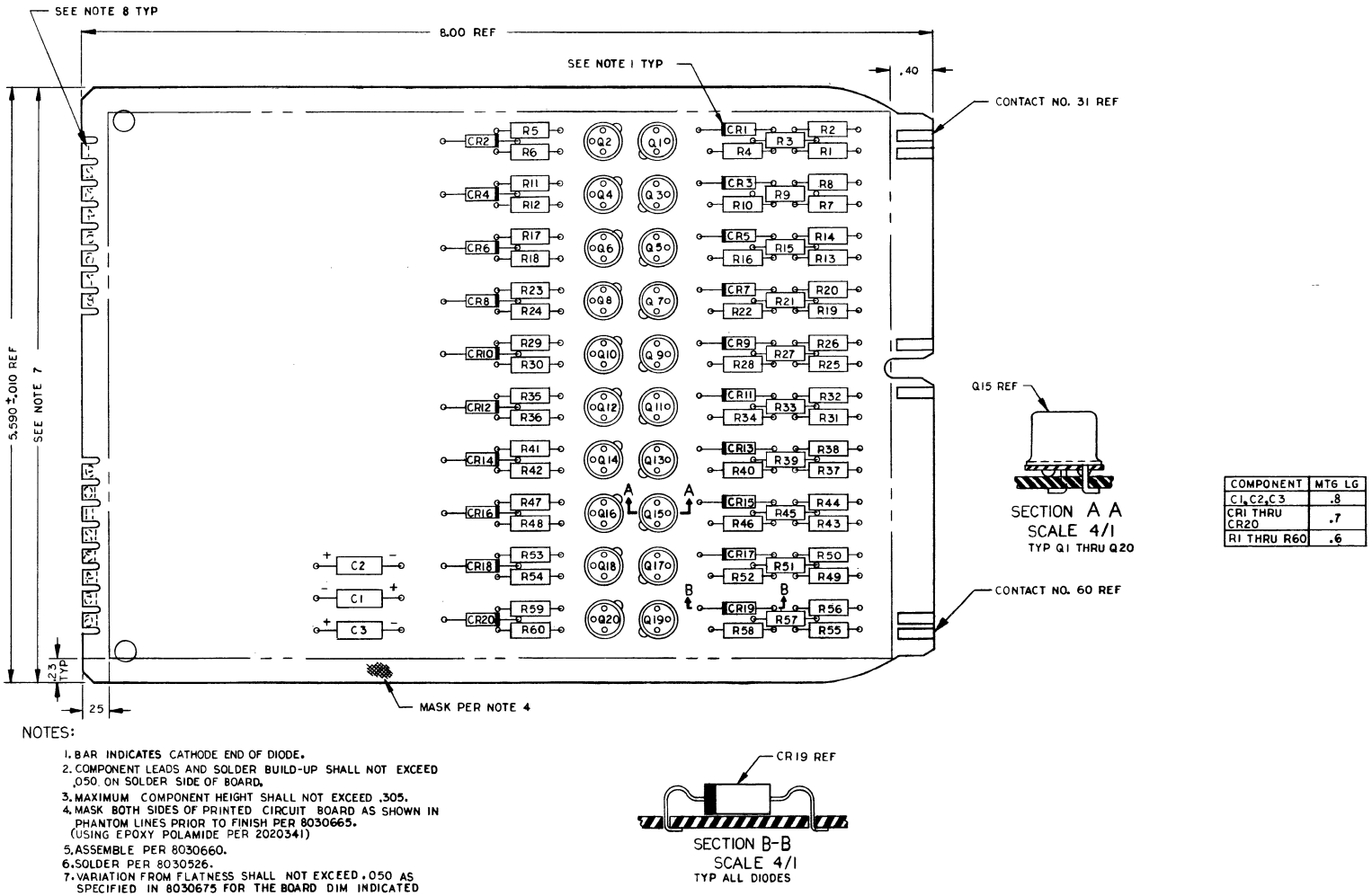
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q5	2182800-1	Semiconductor device, transistor
1	Q6	2182800-1	Semiconductor device, transistor
1	Q7	2182800-1	Semiconductor device, transistor
1	Q8	2182800-1	Semiconductor device, transistor
1	Q9	2182800-1	Semiconductor device, transistor
1	Q10	2182800-1	Semiconductor device, transistor
1	Q11	2182800-1	Semiconductor device, transistor
1	Q12	2182800-1	Semiconductor device, transistor
1	Q13	2182800-1	Semiconductor device, transistor
1	Q14	2182800-1	Semiconductor device, transistor
1	Q15	2182800-1	Semiconductor device, transistor
1	Q16	2182800-1	Semiconductor device, transistor
1	Q17	2182800-1	Semiconductor device, transistor
1	Q18	2182800-1	Semiconductor device, transistor
1	Q19	2182800-1	Semiconductor device, transistor
1	Q20	2182800-1	Semiconductor device, transistor
1	R1	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R2	2182165-36	Resistor, fixed, film, 1500 ohms, ±2%, 1/2 w
1	R3	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R4	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R5	2182165-60	Resistor, fixed, film, 15 k ohms, ±2%, 1/2 w
1	R6	2182165-40	Resistor, fixed, film, 2200 ohms, ±2%, 1/2 w
1	R7	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R8	2182165-36	Resistor, fixed, film, 1500 ohms, ±2%, 1/2 w
1	R9	2182165-15	Resistor, fixed, film, 200 ohms, ±2%, 1/2 w
1	R10	2182165-48	Resistor, fixed, film, 4700 ohms, ±2%, 1/2 w
1	R11	2182165-60	Resistor, fixed, film, 15 k ohms, ±2%, 1/2 w

Table 4. Line Receiver (Module 420) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R12	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R13	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R14	2182165-36	Resistor, fixed, film, 1500 ohms, ± 2%, 1/2 w
1	R15	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R16	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R17	2182165-60	Resistor, fixed, film, 15 k ohms, ± 2%, 1/2 w
1	R18	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R19	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R20	2182165-36	Resistor, fixed, film, 1500 ohms, ± 2%, 1/2 w
1	R21	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R22	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R23	2182165-60	Resistor, fixed, film, 15 k ohms, ± 2%, 1/2 w
1	R24	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R25	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R26	2182165-36	Resistor, fixed, film, 1500 ohms, ± 2%, 1/2 w
1	R27	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R28	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R29	2182165-60	Resistor, fixed, film, 15 k ohms, ± 2%, 1/2 w
1	R30	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R31	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R32	2182165-36	Resistor, fixed, film, 1500 ohms, ± 2%, 1/2 w
1	R33	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R34	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R35	2182165-60	Resistor, fixed, film, 15 k ohms, ± 2%, 1/2 w
1	R36	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R37	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R38	2182165-36	Resistor, fixed, film, 1500 ohms, ± 2%, 1/2 w

Table 4. Line Receiver (Module 420) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R39	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R40	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R41	2182165-60	Resistor, fixed, film, 15 k ohms, ± 2%, 1/2 w
1	R42	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R43	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R44	2182165-36	Resistor, fixed, film, 1500 ohms, ± 2%, 1/2 w
1	R45	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R46	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R47	2182165-60	Resistor, fixed, film, 15 k ohms, ± 2%, 1/2 w
1	R48	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R49	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R50	2182165-36	Resistor, fixed, film, 1500 ohms, ± 2%, 1/2 w
1	R51	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R52	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R53	2182165-60	Resistor, fixed, film, 15 k ohms, ± 2%, 1/2 w
1	R54	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	R55	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R56	2182165-36	Resistor, fixed, film, 1500 ohms, ± 2%, 1/2 w
1	R57	2182165-15	Resistor, fixed, film, 200 ohms, ± 2%, 1/2 w
1	R58	2182165-48	Resistor, fixed, film, 4700 ohms, ± 2%, 1/2 w
1	R59	2182165-60	Resistor, fixed, film, 15 k ohms, ± 2%, 1/2 w
1	R60	2182165-40	Resistor, fixed, film, 2200 ohms, ± 2%, 1/2 w
1	1	2161394-20	Board, printed
20	10	2180896-9	Pad, transistor mounting



COMPONENT	MTG LG
C1, C2, C3	.8
CR1 THRU CR20	.7
R1 THRU R60	.6

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILD-UP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CIRCUIT BOARD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH PER 8030665. (USING EPOXY POLAMIDE PER 2020341)
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIM INDICATED
8. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.
9. ALL COMPONENT LEADS TO BE WIPED IN DIRECTION OF THE THE ELONGATION OF THE PAD.
10. FOR LIST OF MATERIALS SEE LM 2162420

Figure 2. Line Receiver (Module 420), Assembly Drawing

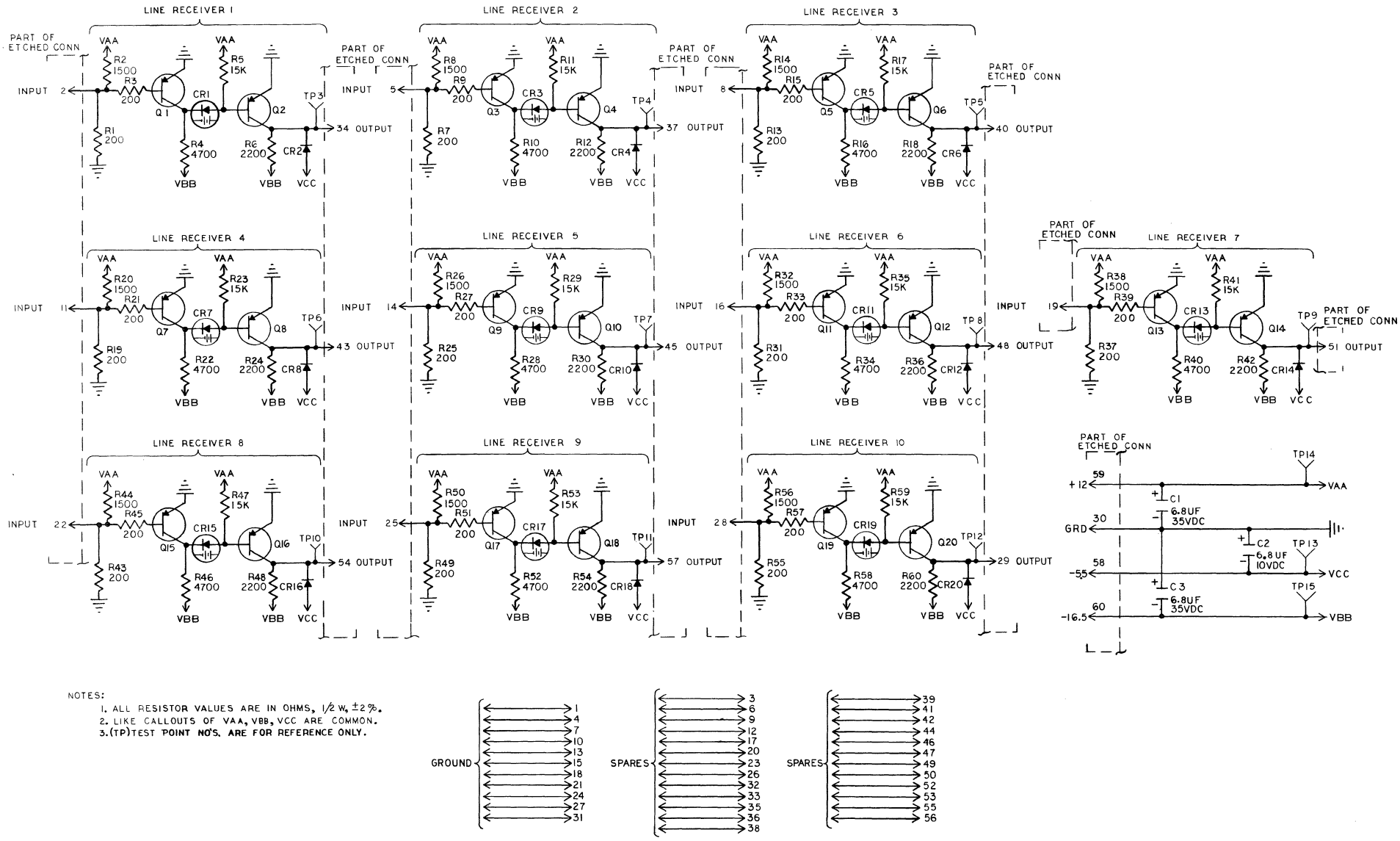


Figure 3. Line Receiver (Module 420), Schematic Diagram

CURRENT DISTRIBUTION NETWORK (MODULE 421)

RCA 2162421-501

DESCRIPTION

The 421 module contains two identical current distribution networks. A 421 module distributes the current from a 417 module constant current power supply to a 416 module selector pair circuit.

CIRCUIT ANALYSIS

The two current distribution circuits are identical, therefore only the X-input circuit is described in detail. The output of a constant-current power supply is applied at INPUT 1 or INPUT 2. The +22 v voltage output of the constant-current power source is connected to one +E input; the remaining +E input is connected to the selector pair circuits. Each X output is connected to a current source input on a selector pair circuit of a 416 module.

CIRCUIT CHARACTERISTICS

Each 421 module current distribution network receives as its input the output of a constant current power supply circuit.

LOADING

Each branch of a 421 module current distribution network feeds current from the constant-current power supply through a 416 module selector pair circuit to a 412 module diode matrix.

POWER REQUIREMENTS

The 421 module consists entirely of passive circuit elements driven by other circuits. No separate power input is required.

WIRING

Table 1 lists maximum lenth of wire which may be used.

Table 1. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	96 Inches
Single Load	120 Inches

PARTS LIST

Table 2 lists parts for the 421 module. The 421 module assembly is illustrated in Figure 1, and the schematic diagram is illustrated in Figure 2.

Table 2. Current Distribution Network (Module 421) Parts List

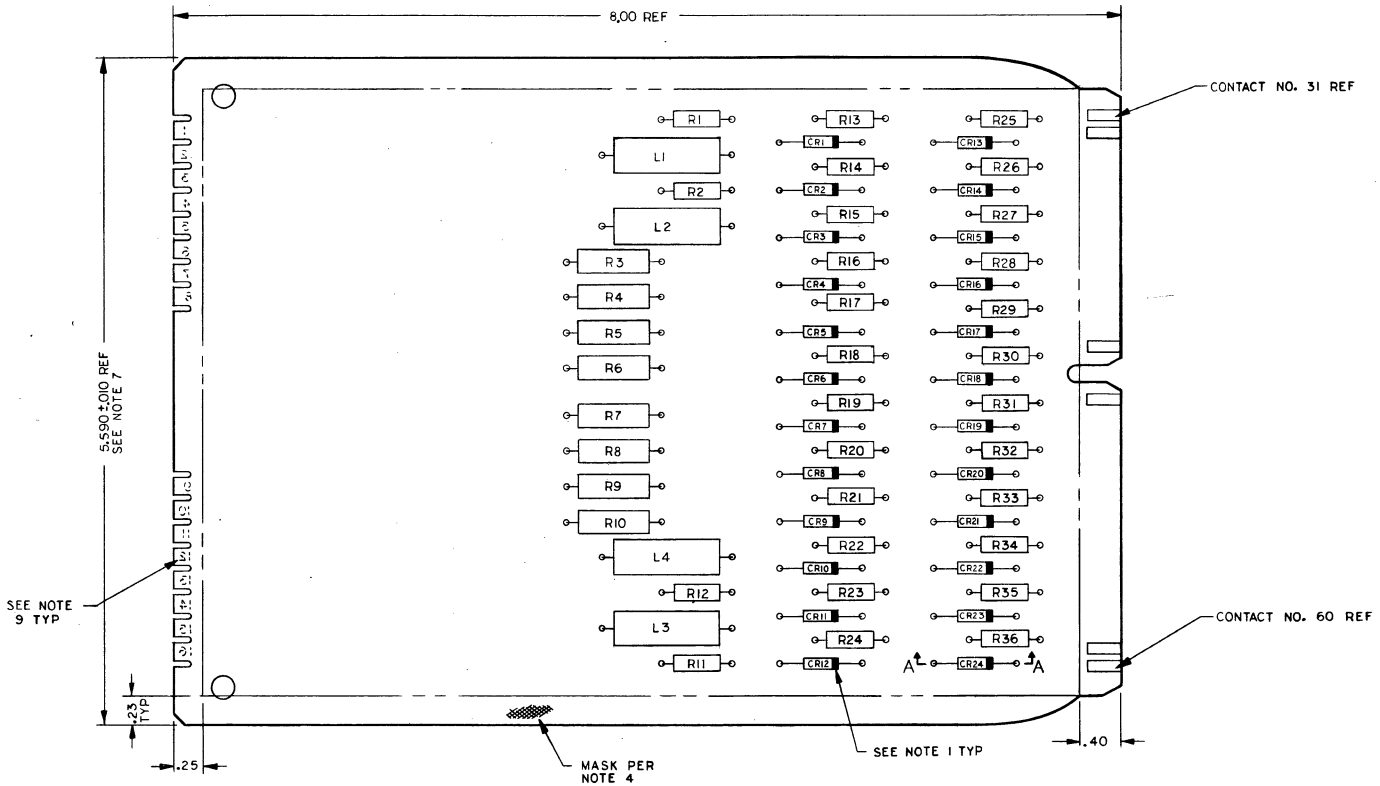
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR1	2182124-1	Semiconductor device, diode
1	CR2	2182124-1	Semiconductor device, diode
1	CR3	2182124-1	Semiconductor device, diode
1	CR4	2182124-1	Semiconductor device, diode
1	CR5	2182124-1	Semiconductor device, diode
1	CR6	2182124-1	Semiconductor device, diode
1	CR7	2182124-1	Semiconductor device, diode
1	CR8	2182124-1	Semiconductor device, diode
1	CR9	2182124-1	Semiconductor device, diode
1	CR10	2182124-1	Semiconductor device, diode
1	CR11	2182124-1	Semiconductor device, diode
1	CR12	2182124-1	Semiconductor device, diode
1	CR13	2182124-1	Semiconductor device, diode
1	CR14	2182124-1	Semiconductor device, diode
1	CR15	2182124-1	Semiconductor device, diode
1	CR16	2182124-1	Semiconductor device, diode
1	CR17	2128124-1	Semiconductor device, diode
1	CR18	2182124-1	Semiconductor device, diode
1	CR19	2182124-1	Semiconductor device, diode
1	CR20	2182124-1	Semiconductor device, diode
1	CR21	2182124-1	Semiconductor device, diode
1	CR22	2182124-1	Semiconductor device, diode
1	CR23	2182124-1	Semiconductor device, diode
1	CR24	2182124-1	Semiconductor device, diode
1	L1	8701590-259	Choke, rf, molded, 27 uh
1	L2	8701590-263	Choke, rf, molded, 39 uh
1	L3	8701590-259	Choke, rf, molded, 27 uh

Table 2. Current Distribution Network (Module 421) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	L4	8701590-263	Choke, rf, molded, 39 uh
1	R1	RC20GF221K	Resistor, fixed,composition, 220 ohms, ½ w, 10%
1	R2	RC20GF221K	Resistor, fixed,composition, 220 ohms, ½ w, 10%
1	R3	RC32GF122K	Resistor, fixed, composition, 1.2 k, 1 w, ±10%
1	R4	RC32GF152K	Resistor, fixed, composition, 1.5k, 1 w, ±10%
1	R5	RC32GF152K	Resistor, fixed, composition, 1.5k,1 w, ±10%
1	R6	RC32GF122K	Resistor, fixed, composition, 1.2k, 1 w, ±10%
1	R7	RC32GF122K	Resistor, fixed, composition, 1.2k, 1 w, ±10%
1	R8	RC32GF152K	Resistor, fixed, composition, 1.5k, 1 w, ±10%
1	R9	RC32GF152K	Resistor, fixed, composition, 1.5k, 1 w, ±10%
1	R10	RC32GF122K	Resistor, fixed, composition, 1.2 k, 1 w, ±10%
1	R11	RC20GF221K	Resistor, fixed, composition, 220 ohms, ½ w, ±10%
1	R12	RC20GF221K	Resistor, fixed, composition, 220 ohms, ½ w, ±10%
1	R13	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R14	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R15	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R16	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R17	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R18	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R19	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R20	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R21	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R22	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ± 10%
1	R23	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R24	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R25	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%
1	R26	RC20GF103K	Resistor, fixed, composition, 10 k ohms, ½ w, ±10%

Table 2. Current Distribution Network (Module 421) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R27	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ±10%
1	R28	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ±10%
1	R29	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ±10%
1	R30	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ± 10%
1	R31	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ±10%
1	R32	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ±10%
1	R33	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ±10%
1	R34	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{4}$ w, ±10%
1	R35	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ±10%
1	R36	RC20GF103K	Resistor, fixed, composition, 10 k ohms, $\frac{1}{2}$ w, ±10%
1	1	2161394-21	Board printed



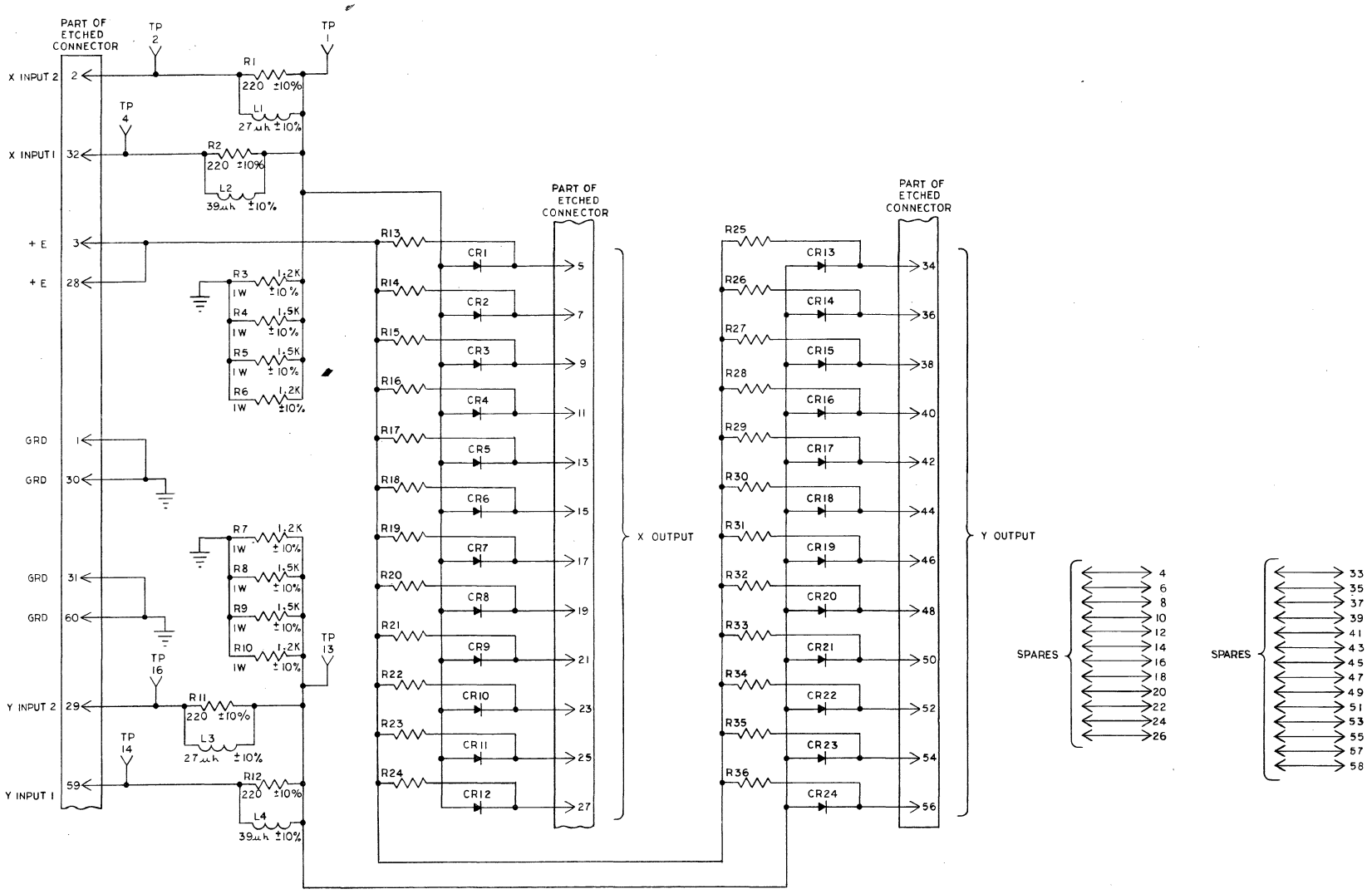
COMPONENT	MTG LG
CR1 THRU CR24	.7
L1 THRU L4	L1
R1, R2, R11, & THRU R36	.6
R3 THRU R10	.8

NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. COMPONENT LEADS AND SOLDER BUILDUP SHALL NOT EXCEED .050 ON SOLDER SIDE OF BOARD.
3. MAXIMUM COMPONENT HEIGHT SHALL NOT EXCEED .305.
4. MASK BOTH SIDES OF PRINTED CKT BD AS SHOWN IN PHANTOM LINES PRIOR TO FINISH. FINISH PER 8030665 USING EPOXY POLYAMIDE PER 2020341.
5. ASSEMBLE PER 8030660.
6. SOLDER PER 8030526.
7. VARIATION FROM FLATNESS SHALL NOT EXCEED .050 AS SPECIFIED IN 8030675 FOR THE BOARD DIMENSION INDICATED.
8. FOR LIST OF MATERIALS SEE LM 2162421.
9. STENCIL .10 HIGH STD GOTHIC CHARACTERS USING ITEM 7 ON SOLDER SIDE PER 2181314.

SECTION A-A
SCALE: 4/1

TYP LEAD BENDS, ALL DIODES

Figure 1. Current Distribution Network (Module 421), Assembly Drawing



1. ALL RESISTANCE VALUES ARE IN OHMS.
2. ALL RESISTANCE VALUES ARE 10K, ±10%, 1/2 WATT UNLESS OTHERWISE SPECIFIED.

Figure 2. Current Distribution Network (Module 421), Schematic Diagram

LINE DRIVER (MODULE MD15)

RCA 8631196-501

DESCRIPTION

The MD15 module contains five identical line driver circuits, five independent diodes, five ground return lines, and two filter networks. Each MD15 module line driver provides inputs to one or more MD16 module line receivers. An MD15 module line driver and an MD16 module line receiver together make a NOR gate.

CIRCUIT ANALYSIS

All line driver circuits are identical, therefore only line driver 1 is described in detail. The nominal level of a logical 0 is -6.0 v; the nominal level of a logical 1 is 0 v. When the input to either diode CR1 or diode CR2 is a logical 1, the junction of diodes CR1 and CR2 and resistors R1 and R2 is held near 0 v. Current flow through resistors R1, R2, and R3 biases transistor Q1 at cutoff.

With transistor Q1 cutoff, current flow in the resistor network of R4 through R7 causes the base of transistor Q2 to be forward biased. Transistor Q2 saturates and its collector output is near 0 v. This output of transistor Q2 is directly coupled to the base of transistor Q3 causing enough current flow to hold the output near 0 v.

When the input to both diode CR1 and CR2 are at the logical 0 level, transistor Q1 becomes saturated, and transistor Q2 is cut off. When transistor Q2 is cut off, its collector voltage rises to +8 v determined by voltage divider resistors R8 and R9. The emitter of transistor Q3 is clamped to the + 8 v level by diode CR3.

Resistor R62 and capacitor C11 are a filter network for the +12 v supply. Resistor R64 and capacitor C12 are a filter network for the -16.5 v supply. Resistors R61 and R63 are current-limiting resistors for test points. Diodes CR16 through CR20 may be used to increase the number of inputs to a gate.

CIRCUIT CHARACTERISTICS

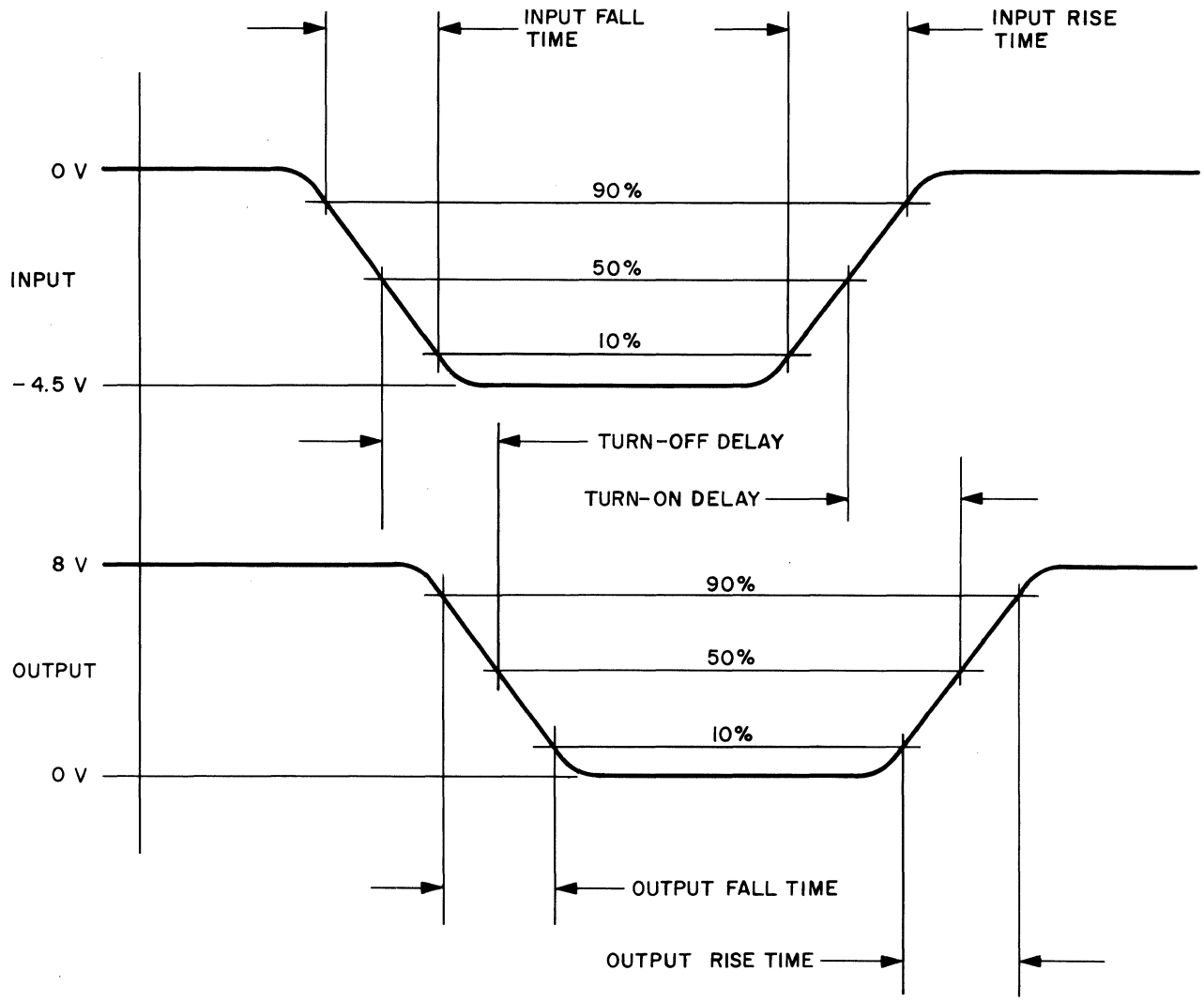
Input logic levels are described in Table 1. Output logic levels are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-6.0 v (+1.6 v, -2.5 v)	1 ma IN at -4.4 v 0 ma at -8.5 v
1	0.0 v (+0.5 v, -0.5 v)	3.2 ma maximum IN

Table 2. Output Logic

LOGIC LEVEL	VOLTAGE	CURRENT
0	0 v (+0.5 v, -0.5 v)	2 ma maximum
1	+8 v (+2.0 v, -0.6 v)	10 ma maximum



PARAMETER	LOW-SPEED	MEDIUM-SPEED
INPUT FALL TIME	1000 NSEC MAX	560 NSEC MAX
TURN-OFF DELAY	1000 NSEC MAX	450 NSEC MAX
OUTPUT FALL TIME	1000 NSEC MAX	300 NSEC MAX
INPUT RISE TIME	1000 NSEC MAX	220 NSEC MAX
TURN-ON DELAY	1000 NSEC MAX	450 NSEC MAX
OUTPUT RISE TIME	1000 NSEC MAX	500 NSEC MAX

4146-29

Figure 1. MD15 Module, Waveforms and Timing

LOADING

Each input to an MD15 line driver is approximately one unit load. The output of an MD15 line driver must be an MD16 line receiver or a 406 line receiver.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT ALL OUTPUTS AT 0 V	CURRENT ALL OUTPUTS AT + 8 V
+12 v ±5%	31.0 ma maximum	66.5 ma maximum
	32.4 ma minimum	46.4 ma minimum
-16.5 v ±5%	23.1 ma maximum	16.0 ma maximum
	17.9 ma minimum	8.1 ma minimum

WIRING

When a large number of MD15 modules are to be interconnected a ground system must be constructed of 3/4-in x 3/8-in copper bars interconnected at both ends by braided cables of 1/4-in diameter. Interconnections between MD15 module ground pins must be made to the ground system with AWG No. 16 gauge wire of a length no greater than three inches. Twisted pair AWG No. 22 wire, with one wire grounded at each end; must be used for input signal connections. The MD15 line driver must be connected to the line receiver through a 73-ohm coaxial cable. However, a maximum of 12 feet of AWG No. 22 gauge twisted pair wire may be used to connect the MD15 module to the coaxial cable.

PARTS LIST

Table 4 lists the parts for the MD15 module. The MD15 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 4. Line Driver (Module MD15) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc
1	C2	8936059-8	Capacitor, fixed, mica, 1800 μμf, 100 vdc
1	C3	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc
1	C4	8936059-8	Capacitor, fixed, mica, 1800 μμf, 100 vdc
1	C5	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc
1	C6	8936059-8	Capacitor, fixed, mica, 1800 μμf, 100 vdc

Table 4. Line Driver (Module MD15) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C7	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc
1	C8	8936059-8	Capacitor, fixed, mica, 1800 μμf, 100 vdc
1	C9	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc
1	C10	8936059-8	Capacitor, fixed, mica, 1800 μμf, 100 vdc
1	C11	CL35BE180MP1	Capacitor, fixed, tantalum electrolytic, 18 μf, 15 vdc (MIL-C-3965)
1	C12	CL35BH2R5MP1	Capacitor, fixed, tantalum electrolytic, 2.5 μf, 30 vdc (MIL-C-3965)
1	CR1	8935924-1	Semiconductor device, diode, type 24
1	CR2	8935924-1	Semiconductor device, diode, type 24
1	CR3	8935924-1	Semiconductor device, diode, type 24
1	CR4	8935924-1	Semiconductor device, diode, type 24
1	CR5	8935924-1	Semiconductor device, diode, type 24
1	CR6	8935924-1	Semiconductor device, diode, type 24
1	CR7	8935924-1	Semiconductor device, diode, type 24
1	CR8	8935924-1	Semiconductor device, diode, type 24
1	CR9	8935924-1	Semiconductor device, diode, type 24
1	CR10	8935924-1	Semiconductor device, diode, type 24
1	CR11	8935924-1	Semiconductor device, diode, type 24
1	CR12	8935924-1	Semiconductor device, diode, type 24
1	CR13	8935924-1	Semiconductor device, diode, type 24
1	CR14	8935924-1	Semiconductor device, diode, type 24
1	CR15	8935924-1	Semiconductor device, diode, type 24
1	CR16	8935924-1	Semiconductor device, diode, type 24
1	CR17	8935924-1	Semiconductor device, diode, type 24
1	CR18	8935924-1	Semiconductor device, diode, type 24
1	CR19	8935924-1	Semiconductor device, diode, type 24
1	CR20	8935924-1	Semiconductor device, diode, type 24

Table 4. Line Driver (Module MD15) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	J1	8934595-3	Jack, tip, printed circuit
1	J3	8934595-7	Jack, tip, printed circuit
1	J4	8934595-2	Jack, tip, printed circuit
1	J9	8934595-5	Jack, tip, printed circuit
1	J11	8934595-5	Jack, tip, printed circuit
1	J13	8934595-5	Jack, tip, printed circuit
1	J15	8934595-5	Jack, tip, printed circuit
1	J17	8934595-5	Jack, tip, printed circuit
1	J23	8716037-1	Connector, receptacle, electrical
1	Q1	8935910-1	Semiconductor device, transistor, type DEP10
1	Q2	8935904-1	Semiconductor device, transistor, type DEP04
1	Q3	8935904-1	Semiconductor device, transistor, type DEP04
1	Q4	8935910-1	Semiconductor device, transistor, type DEP10
1	Q5	8935904-1	Semiconductor device, transistor, type DEP04
1	Q6	8935904-1	Semiconductor device, transistor, type DEP04
1	Q7	8935910-1	Semiconductor device, transistor, type DEP10
1	Q8	8935904-1	Semiconductor device, transistor, type DEP04
1	Q9	8935904-1	Semiconductor device, transistor, type DEP04
1	Q10	8935910-1	Semiconductor device, transistor, type DEP10
1	Q11	8935904-1	Semiconductor device, transistor, type DEP04
1	Q12	8935904-1	Semiconductor device, transistor, type DEP04
1	Q13	8935910-1	Semiconductor device, transistor, type DEP10
1	Q14	8935904-1	Semiconductor device, transistor, type DEP04
1	Q15	8935904-1	Semiconductor device, transistor, type DEP04
1	R1	RN60B4641F	Resistor, fixed, film, 4640 ohms, 1/8 w (MIL-R-10509)
1	R2	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R3	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)

Table 4. Line Driver (Module MD15) Parts List (cont)

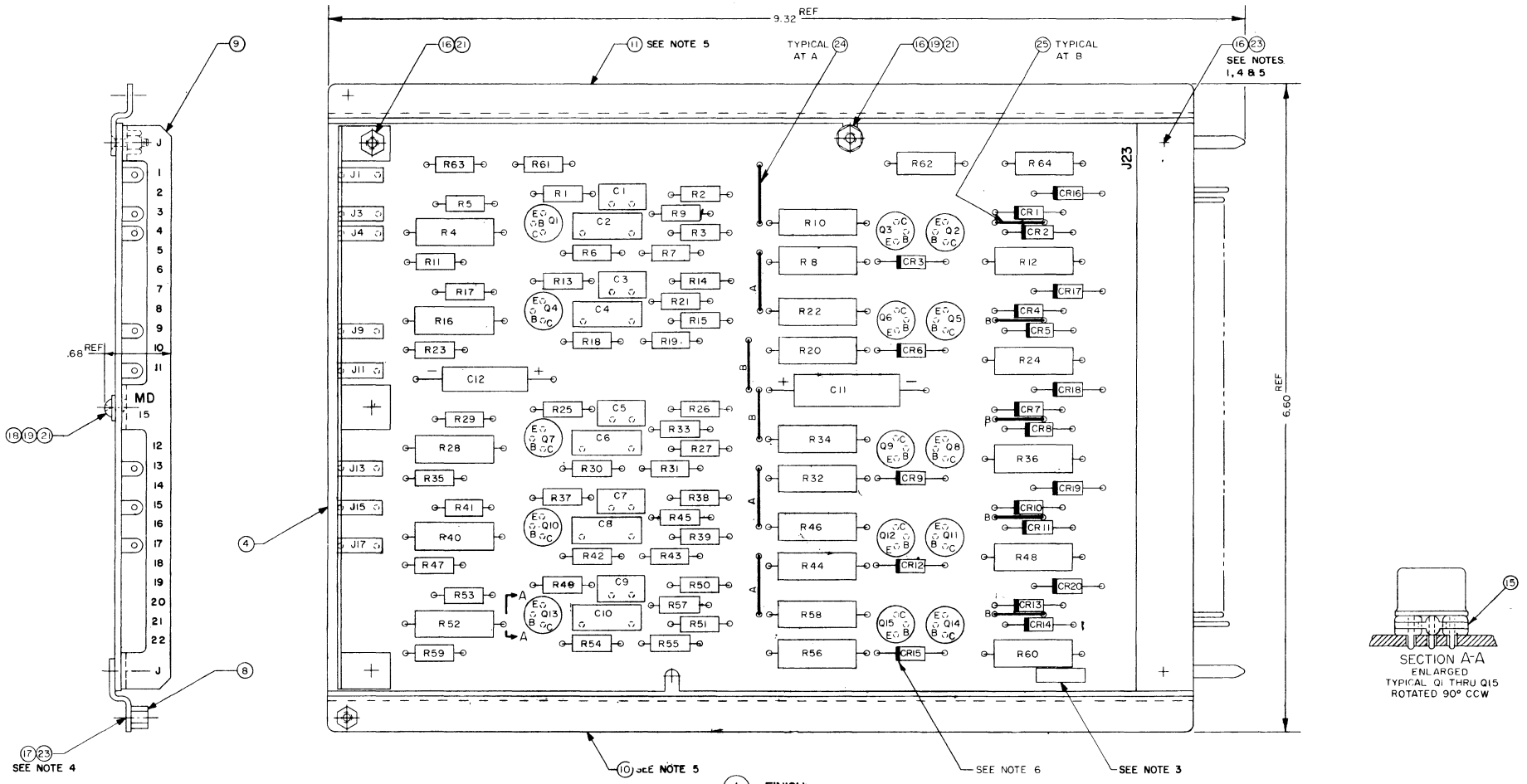
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R4	RN70B9090F	Resistor, fixed, film, 909 ohms, 1/2 w (MIL-R-10509)
1	R5	RN60B1101F	Resistor, fixed, film, 1100 ohms, 1/8 w (MIL-R-10509)
1	R6	RN60B4221F	Resistor, fixed, film, 4220 ohms, 1/8 w (MIL-R-10509)
1	R7	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)
1	R8	RN70B4640F	Resistor, fixed, film, 464 ohms, 1/2 w (MIL-R-10509)
1	R9	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R10	RN70B51R1F	Resistor, fixed, film, 51.1 ohms, 1/2 w (MIL-R-10509)
1	R11	RC20GF221K	Resistor, fixed, composition, 220 ohms, 1/2 w (MIL-R-11)
1	R12	RN70B75R0F	Resistor, fixed, film, 75 ohms 1/2 w (MIL-R-10509)
1	R13	RN60B4641F	Resistor, fixed, film, 4640 ohms, 1/8 w (MIL-R-10509)
1	R14	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R15	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)
1	R16	RN70B9090F	Resistor, fixed, film, 909 ohms, 1/2 w (MIL-R-10509)
1	R17	RN60B1101F	Resistor, fixed, film, 1100 ohms, 1/8 w (MIL-R-10509)
1	R18	RN60B4221F	Resistor, fixed, film, 4220 ohms, 1/8 w (MIL-R-10509)
1	R19	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)
1	R20	RN70B4640F	Resistor, fixed, film, 464 ohms, 1/2 w (MIL-R-10509)
1	R21	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R22	RN70B51R1F	Resistor, fixed, film, 51.1 ohms, 1/2 w (MIL-R-10509)
1	R23	RC20GF221K	Resistor, fixed, composition, 220 ohms, 1/2 w (MIL-R-11)
1	R24	RN70B75R0F	Resistor, fixed, film, 75 ohms, 1/2 w (MIL-R-10509)
1	R25	RN60B4641F	Resistor, fixed, film, 4640 ohms, 1/8 w (MIL-R-10509)
1	R26	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R27	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)
1	R28	RN70B9090F	Resistor, fixed, film, 909 ohms, 1/2 w (MIL-R-10509)
1	R29	RN60B1101F	Resistor, fixed, film, 1100 ohms, 1/8 w (MIL-R-10509)

Table 4. Line Driver (Module MD15) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R30	RN60B4221F	Resistor, fixed, film, 4220 ohms, 1/8 w (MIL-R-10509)
1	R31	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)
1	R32	RN70B4640F	Resistor, fixed, film, 464 ohms, 1/2 w (MIL-R-10509)
1	R33	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R34	RN70B51R1F	Resistor, fixed, film, 51.1 ohms, 1/2 w (MIL-R-10509)
1	R35	RC20GF221K	Resistor, fixed, composition, 220 ohms, 1/2 w (MIL-R-11)
1	R36	RN70B75R0F	Resistor, fixed, film, 75 ohms, 1/2 w (MIL-R-10509)
1	R37	RN60B4641F	Resistor, fixed, film, 4640 ohms, 1/8 w (MIL-R-10509)
1	R38	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R39	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)
1	R40	RN70B9090F	Resistor, fixed, film, 909 ohms, 1/2 w (MIL-R-10509)
1	R41	RN60B1101F	Resistor, fixed, film, 1100 ohms, 1/8 w (MIL-R-10509)
1	R42	RN60B4221F	Resistor, fixed, film, 4220 ohms, 1/8 w (MIL-R-10509)
1	R43	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)
1	R44	RN70B4640F	Resistor, fixed, film, 464 ohms, 1/2 w (MIL-R-10509)
1	R45	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R46	RN70B51R1F	Resistor, fixed, film, 51.1 ohms, 1/2 w (MIL-R-10509)
1	R47	RC20GF221K	Resistor, fixed, composition, 220 ohms, 1/2 w (MIL-R-11)
1	R48	RN70B75R0F	Resistor, fixed, film, 75 ohms, 1/2 w (MIL-R-10509)
1	R49	RN60B4641F	Resistor, fixed, film, 4640 ohms, 1/8 w (MIL-R-10509)
1	R50	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R51	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)
1	R52	RN70B9090F	Resistor, fixed, film, 909 ohms, 1/2 w (MIL-R-10509)
1	R53	RN60B1101F	Resistor, fixed, film, 1100 ohms, 1/8 w (MIL-R-10509)
1	R54	RN60B4221F	Resistor, fixed, film, 4220 ohms, 1/8 w (MIL-R-10509)
1	R55	RN60B9091F	Resistor, fixed, film, 9090 ohms, 1/8 w (MIL-R-10509)

Table 4. Line Driver (Module MD15) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R56	RN70B4640F	Resistor, fixed, film, 460 ohms, 1/2 w (MIL-R-10509)
1	R57	RN60B1781F	Resistor, fixed, film, 1780 ohms, 1/8 w (MIL-R-10509)
1	R58	RN70B51R1F	Resistor, fixed, film, 51.1 ohms, 1/2 w (MIL-R-10509)
1	R59	RC20GF221F	Resistor, fixed, composition, 220 ohms, 1/2 w (MIL-R-11)
1	R60	RN70B75R0F	Resistor, fixed, film, 75 ohms, 1/2 w (MIL-R-10509)
1	R61	RC20GF681K	Resistor, fixed, composition, 680 ohms, 1/2 w (MIL-R-11)
1	R62	RC32GF3R3K	Resistor, fixed, composition, 3.3 ohms, 1 w (MIL-R-11)
1	R63	RC20GF681K	Resistor, fixed, composition, 680 ohms, 1/2 w (MIL-R-11)
1	R64	RC32GF4R7K	Resistor, fixed, composition, 4.7 ohms, 1 w (MIL-R-11)
1	4	8631199-1	Board, printed circuit, MD15
2	8	8936316-1	Pin, extractor
1	9	8470963-8	Stiffener
1	10	8717245-1	Guide, module (lower)
1	11	8717245-2	Guide, module (upper)
15	15	8977887-1	Insulator, washer
6	16	8954980-9	Screw, machine, flat head, cross recessed, no. 4 (0.112) 40 x 0.38 lg
2	17	8954980-5	Screw, machine, flat head, cross recessed, no. 4 (0.112) 40 x 0.25 lg
1	18	8914385-9	Screw, machine, pan head, cross recessed, no. 4 (0.112) 40 x 0.38 lg
3	19	AN960-C4	Washer, flat, no. 4
5	21	8811181-109	Nut, hex, lock, no. 4
4	24	8701551-210	Lead, electrical, printed wiring
7	25	8701551-208	Lead, electrical, printed wiring



NOTES:

1. J23 LEADS TO BE INSERTED INTO ITEM 4 AND CLINCHED PRIOR TO SOLDERING. DIRECTION OF CLINCH TO BE CONSISTENT WITHIN EACH ROW BUT OPPOSITE TO OTHER ROW. BENT LEAD AND SOLDER BUILDUP NOT TO EXCEED .080 ON WIRING SIDE OF BOARD.
2. ASSEMBLE AND DIP SOLDER PER MANUFACTURING SPECIFICATION 2020319.
3. MARK SERIAL NUMBERS (.09 HIGH CONDENSED CHARACTERS) IN BLOCK PROVIDED WITH 78712-39 (BLACK).
4. APPLY 2016075-1 (STAKING COMPOUND) PER MANUFACTURING SPECIFICATION 2020342.
5. MASK FOLLOWING AREAS PRIOR TO APPLYING FINISH:
   A. CONTACTS AND GUIDE PINS OF J23.
   B. SLIDING SURFACES (OUTSIDE OF BEND) OF ITEMS 10 AND 11.
   C. TEST JACK CONTACTS.
6. BAR OR DOT INDICATES CATHODE END OF DIODE.
7. THIS ASSEMBLY WAS FORMERLY KNOWN AS GATE, ELECTRONIC, DIGITAL MD15 (LINE DRIVER)

Figure 2. Line Driver (Module MD15), Assembly Drawing

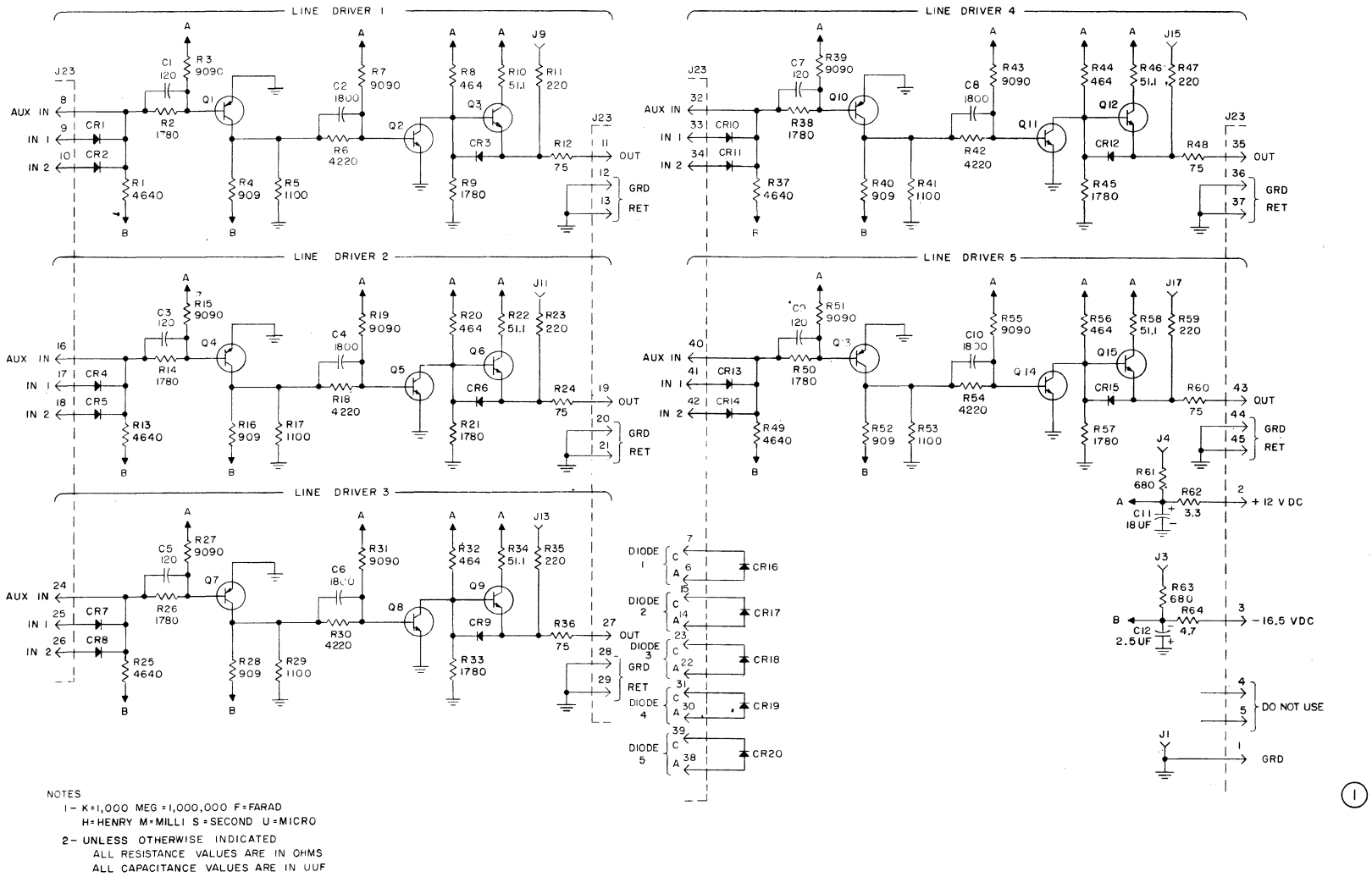


Figure 3. Line Driver (Module MD15), Schematic Diagram

LINE RECEIVER (MODULE MD16)

RCA 8633620-501

DESCRIPTION

The MD16 module contains eight identical line receiver circuits, two independent ground connections, a voltage regulator circuit, and a line filter circuit. Each line receiver circuit includes resistor networks which may be connected to the input when a terminating resistance is required. An MD16 module line receiver circuit may be the receiver for an MD15 line driver circuit or for a 405 module line driver circuit.

CIRCUIT ANALYSIS

The eight line receiver circuits are identical, therefore only line receiver 1 is described in detail. When the input level is 0 v, diode CR1 is back-biased by the voltage divider formed by resistors R4 and R5. Diode CR2 is back-biased. Transistor Q1 is forward-biased and saturated, holding the output at 0 v. When the input level is +8 v, diodes CR1 and CR2 are forward biased, transistor Q1 is reverse-biased and cut off, and the output near the -4.5 v level. Resistors R1, R2, and R3 form a terminating network used for inputs provided from sources other than an MD15 or 405 line driver.

A line receiver performs a level changing function for a line driver circuit of an MD15 or a 405 module. When used in this manner, a line driver of an MD15 module and a line receiver of an MD16 module perform a NOR function, as indicated in Table 1.

Table 1. MD15 and MD16 as NOR Gate

MD15			MD16	
IN 1	IN 2	OUT	IN	OUT
-6.0 v	-6.0 v	0 v	0 v	0 v
-6.0 v	0 v	+8 v	+8v	-4.5 v
0 v	-6.0 v	+8 v	+8 v	-4.5 v
0 v	0 v	+8 v	+8 v	-4.5 v

Resistor R67, Zener diode CR17, and capacitor C10 form a voltage regulator for the -4.5 v source. Resistor R66 and capacitor C9 are a filter for the -16.5 v supply. Resistor R65 is a current-limiting resistor for the test point.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 2. Output logic levels are described in Table 3. Waveforms and timing are illustrated in Figure 1.

Table 2. Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-8.0 v (+0.8 v, -1.0 v)	0 ma
1	0.0 v (+0.0 v, -0.3 v)	28 ma maximum

Table 3. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-8.0 v (+0.8 v, -1.0 v)	0 ma
1	0.0 v (+0.0 v, -0.3 v)	28 ma maximum

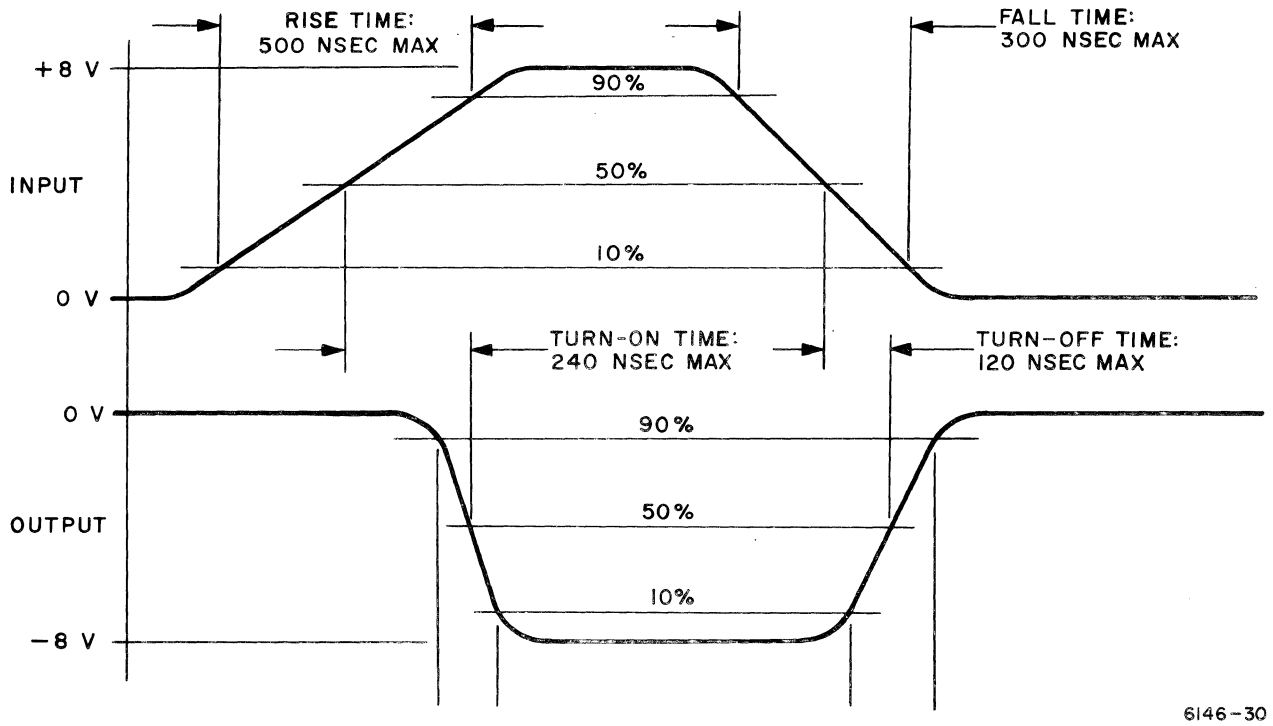


Figure 1. MD16 Module, Waveforms and Timing

LOADING

The input to an MD16 line receiver is from an MD15 or a 405 line driver. The output of an MD16 line receiver may drive a maximum of seven medium-speed G loads. Up to five MD16 line receivers may have their outputs connected to a common point. The relation between the number of line receivers connected in parallel and the loading is listed in Table 4.

Table 4. MD16 Parallel Output Loads

NUMBER IN PARALLEL	G LOADS AT OUTPUT
2	5
3	4
4	2
5	1

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 5.

Table 5. Power Supply Requirements

VOLTAGE	CURRENT
-16.5 v ±5%	42.1 ma maximum 86.9 ma minimum

WIRING

Table 6 lists maximum lengths of wire which may be used for output wiring. The MD16 line receiver must be connected to the MD15 line driver through a 73-ohm coaxial cable. However, a maximum of 12 feet of AWG No. 22 twisted pair may be used to connect the module to the coaxial cable.

Table 6. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	96 Inches
Single Load	120 Inches

PARTS LIST

Table 7 lists parts for the MD16 module. The MD16 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 7. Line Receiver (Module MD16) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc (MIL-C-5)
1	C2	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc (MIL-C-5)
1	C3	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc (MIL-C-5)
1	C4	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc (MIL-C-5)
1	C5	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc (MIL-C-5)
1	C6	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc (MIL-C-5)

Table 7. Line Receiver (Module MD16) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C7	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc (MIL-C-5)
1	C8	8936033-110	Capacitor, fixed, mica, 120 μμf, 500 vdc, (MIL-C-5)
1	C9	CP09A1KB224K1	Capacitor, fixed, paper, 0.22 μf, 100 vdc (MIL-C-25C)
1	C10	CP09A1KB104K1	Capacitor, fixed, paper, 0.10 μf, 100 vdc (MIL-C-25C)
1	CR1	8935924-1	Semiconductor device, diode, type 24
1	CR2	8935924-1	Semiconductor device, diode, type 24
1	CR3	8935924-1	Semiconductor device, diode, type 24
1	CR4	8935924-1	Semiconductor device, diode, type 24
1	CR5	8935924-1	Semiconductor device, diode, type 24
1	CR6	8935924-1	Semiconductor device, diode, type 24
1	CR7	8935924-1	Semiconductor device, diode, type 24
1	CR8	8935924-1	Semiconductor device, diode, type 24
1	CR9	8935924-1	Semiconductor device, diode, type 24
1	CR10	8935924-1	Semiconductor device, diode, type 24
1	CR11	8935924-1	Semiconductor device, diode, type 24
1	CR12	8935924-1	Semiconductor device, diode, type 24
1	CR13	8935924-1	Semiconductor device, diode, type 24
1	CR14	8935924-1	Semiconductor device, diode, type 24
1	CR15	8935924-1	Semiconductor device, diode, type 24
1	CR16	8935924-1	Semiconductor device, diode, type 24
1	CR17	8264051-1	Semiconductor device, diode, type D-01
1	J1	8934595-3	Jack, tip, printed circuit
1	J3	8934595-7	Jack, tip, printed circuit
1	J6	8934595-5	Jack, tip, printed circuit
1	J8	8934595-5	Jack, tip, printed circuit
1	J10	8934595-5	Jack, tip, printed circuit
1	J13	8934595-5	Jack, tip, printed circuit

Table 7. Line Receiver (Module MD16) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	J15	8934595-5	Jack, tip, printed circuit
1	J17	8934595-5	Jack, tip, printed circuit
1	J19	8934595-5	Jack, tip, printed circuit
1	J21	8934595-5	Jack, tip, printed circuit
1	J23	8716037-1	Connector, receptacle, electrical (male)
1	Q1	8935910-2	Transistor, type DEP10A
1	Q2	8935910-2	Transistor, type DEP10A
1	Q3	8935910-2	Transistor, type DEP10A
1	Q4	8935910-2	Transistor, type DEP10A
1	Q5	8935910-2	Transistor, type DEP10A
1	Q6	8935910-2	Transistor, type DEP10A
1	Q7	8935910-2	Transistor, type DEP10A
1	Q8	8935910-2	Transistor, type DEP10A
1	R1	RD65P61R9J	Resistor, fixed, film, 61.9 ohms, 2 w (MIL-R-11804B)
1	R2	RD60P42R2J	Resistor, fixed, film, 42.2 ohms, 1 w (MIL-R-11804B)
1	R3	RD60P31R6J	Resistor, fixed, film, 31.6 ohms, 1 w (MIL-R-11804B)
1	R4	RN70B8250F	Resistor, fixed, film, 825 ohms, 1/2 w (MIL-R-10509)
1	R5	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R6	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R7	RC20GF101K	Resistor, fixed, composition, 100 ohms, 1/2 w (MIL-R-11)
1	R8	RN60B1621F	Resistor, fixed, film, 1620 ohms, 1/8 w (MIL-R-10509)
1	R9	RD65P61R9J	Resistor, fixed, film, 61.9 ohms, 2 w (MIL-R-11804B)
1	R10	RD60P42R2J	Resistor, fixed, film, 42.2 ohms, 1 w (MIL-R-11804B)
1	R11	RD60P31R6J	Resistor, fixed, film, 31.6 ohms, 1 w (MIL-R-11804B)
1	R12	RN70B8250F	Resistor, fixed, film, 825 ohms, 1/2 w (MIL-R-10509)
1	R13	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R14	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)

Table 7. Line Receiver (Module MD16) Parts List (cont)

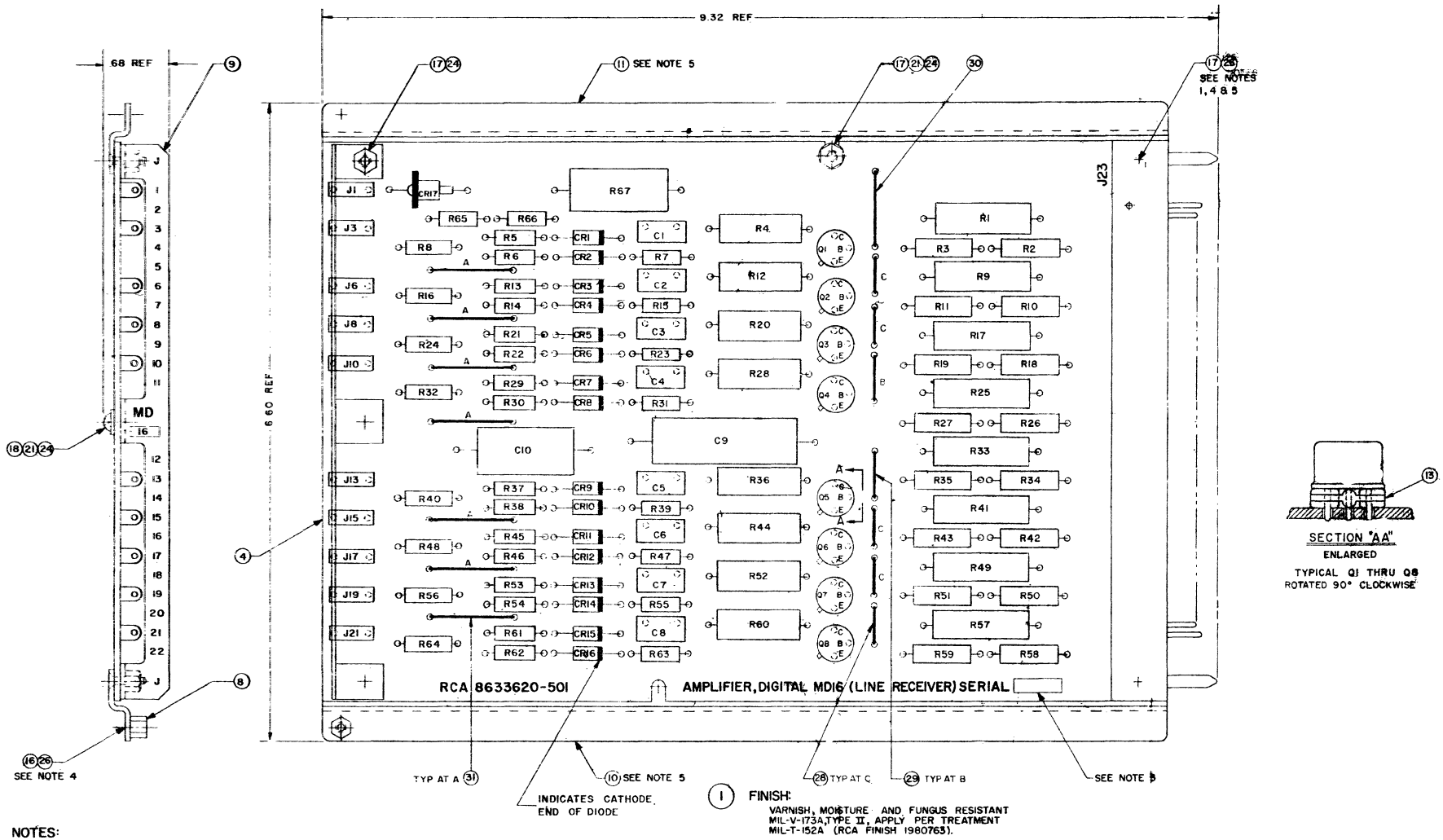
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R15	RC20GF101K	Resistor, fixed, composition, 100 ohms, 1/2 w (MIL-R-11)
1	R16	RN60B1621F	Resistor, fixed, film, 1620 ohms, 1/8 w (MIL-R-10509)
1	R17	RD65P61R9J	Resistor, fixed, film, 61.9 ohms, 2 w (MIL-R-11804B)
1	R18	RD60P42R2J	Resistor, fixed, film, 42.2 ohms, 1 w (MIL-R-11804B)
1	R19	RD60P31R6J	Resistor, fixed, film, 31.6 ohms, 1 w (MIL-R-11804B)
1	R20	RN70B8250F	Resistor, fixed, film, 825 ohms, 1/2 w (MIL-R-10509)
1	R21	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R22	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R23	RC20GF101K	Resistor, fixed, composition, 100 ohms, 1/2 w (MIL-R-11)
1	R24	RN60B1621F	Resistor, fixed, film, 1620 ohms, 1/8 w (MIL-R-10509)
1	R25	RD65P61R9J	Resistor, fixed, film, 61.9 ohms, 2 w (MIL-R-11804B)
1	R26	RD60P42R2J	Resistor, fixed, film, 42.2 ohms, 1 w (MIL-R-11804B)
1	R27	RD60P31R6J	Resistor, fixed, film, 31.6 ohms, 1 w (MIL-R-11804B)
1	R28	RN70B8250F	Resistor, fixed, film, 825 ohms, 1/2 w (MIL-R-10509)
1	R29	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R30	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R31	RC20GF101K	Resistor, fixed, composition, 100 ohms, 1/2 w (MIL-R-11)
1	R32	RN60B1621F	Resistor, fixed, film, 1620 ohms, 1/8 w (MIL-R-10509)
1	R33	RD65P61R9J	Resistor, fixed, film, 61.9 ohms, 2 w (MIL-R-11804B)
1	R34	RD60P42R2J	Resistor, fixed, film, 42.2 ohms, 1 w (MIL-R-11804B)
1	R35	RD60P31R6J	Resistor, fixed, film, 31.6 ohms, 1 w (MIL-R-11804B)
1	R36	RN70B8250F	Resistor, fixed, film, 825 ohms, 1/2 w (MIL-R-10509)
1	R37	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R38	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R39	RC20GF101K	Resistor, fixed, composition, 100 ohms, 1/2 w (MIL-R-11)
1	R40	RN60B1621F	Resistor, fixed, film, 1620 ohms, 1/8 w (MIL-R-10509)
1	R41	RD65P61R9J	Resistor, fixed, film, 61.9 ohms, 2 w (MIL-R-11804B)

Table 7. Line Receiver (Module MD16) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R42	RD60P42R2J	Resistor, fixed, film, 42.2 ohms, 1 w (MIL-R-11804B)
1	R43	RD60P31R6J	Resistor, fixed, film, 31.6 ohms, 1 w (MIL-R-11804B)
1	R44	RN70B8250F	Resistor, fixed, film, 825 ohms, 1/2 w (MIL-R-10509)
1	R45	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R46	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R47	RC20GF101K	Resistor, fixed, composition, 100 ohms, 1/2 w (MIL-R-11)
1	R48	RN60B1621F	Resistor, fixed, film, 1620 ohms, 1/8 w (MIL-R-10509)
1	R49	RD65P61R9J	Resistor, fixed, film, 61.9 ohms, 2 w (MIL-R-11804B)
1	R50	RD60P42R2J	Resistor, fixed, film, 42.2 ohms, 1 w (MIL-R-11804B)
1	R51	RD60P31R6J	Resistor, fixed, film, 31.6 ohms, 1 w (MIL-R-11804B)
1	R52	RN70B8250F	Resistor, fixed, film, 825 ohms, 1/2 w (MIL-R-10509)
1	R53	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R54	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R55	RC20GF101K	Resistor, fixed, composition, 100 ohms, 1/2 w (MIL-R-11)
1	R56	RN60B1621F	Resistor, fixed, film, 1620 ohms, 1/8 w (MIL-R-10509)
1	R57	RD65P61R9J	Resistor, fixed, film, 61.9 ohms, 2 w (MIL-R-11804B)
1	R58	RD60P42R2J	Resistor, fixed, film, 42.2 ohms, 1 w (MIL-R-11804B)
1	R59	RD60P31R6J	Resistor, fixed, film, 31.6 ohms, 1 w (MIL-R-11804B)
1	R60	RN70B8250F	Resistor, fixed, film, 825 ohms, 1/2 w (MIL-R-10509)
1	R61	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R62	RN60B8251F	Resistor, fixed, film, 8250 ohms, 1/8 w (MIL-R-10509)
1	R63	RC20GF101K	Resistor, fixed, composition, 100 ohms, 1/2 w (MIL-R-11)
1	R64	RN60B1621F	Resistor, fixed, film, 1620 ohms, 1/8 w (MIL-R-10509)
1	R65	RC20GF681K	Resistor, fixed, composition, 680 ohms, 1/2 w (MIL-R-11)
1	R66	RC20GF150K	Resistor, fixed, composition, 15 ohms, 1/2 w (MIL-R-11)
1	R67	RN75B2150F	Resistor, fixed, film, 215 ohms, 1 w (MIL-R-10509)

Table 7. Line Receiver (Module MD16) Parts List (cont)

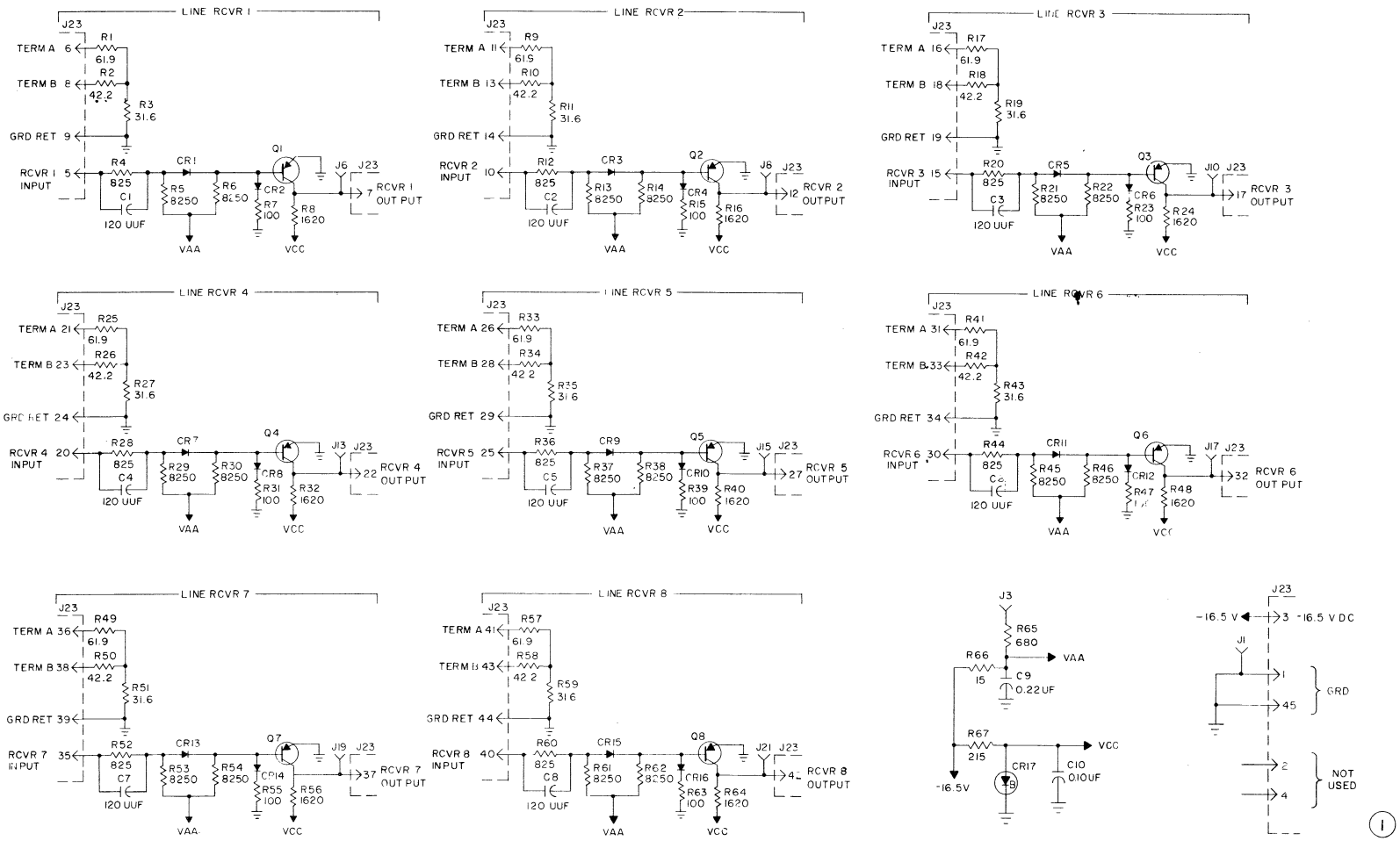
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	4	8633188-1	Board, printed circuit
2	8	8936316-1	Pin extractor
1	9	8266908-16	Stiffener
1	10	8717245-1	Guide, printed circuit, board
1	11	8717245-2	Guide, printed circuit, board
8	13	8977887-1	Insulator, washer
2	16	8954980-5	Screw, machine, flat head, cross recessed, no. 4 (0.112) 40 x 0.250 lg
6	17	8954980-9	Screw, machine, flat head, cross recessed, no. 4 (0.112) 40 x 0.375 lg
1	18	8914385-9	Screw, machine, pan head, cross recessed, no. 4 (0.112) 40 x 0.375 lg
3	21	AN960C4L	Washer, flat, no. 4
5	24	8811181-109	Nut, hex, lock 4-40
5	28	8701551-206	Lead, electrical, printed wiring
2	29	8701551-208	Lead, electrical, printed wiring
1	30	8701551-214	Lead, electrical, printed wiring
7	31	8701551-216	Lead, electrical, printed wiring



NOTES:

1. J23 LEADS TO BE INSERTED INTO ITEM 4 AND CLINCHED PRIOR TO SOLDERING. DIRECTION OF CLINCH TO BE CONSISTENT WITHIN EACH ROW BUT OPPOSITE TO OTHER ROW. BENT LEAD AND SOLDER BUILDUP NOT TO EXCEED .080 ON WIRING SIDE OF BOARD.
2. ASSEMBLE AND DIP SOLDER PER MANUFACTURING SPECIFICATION 2020319.
3. MARK SERIAL NUMBERS (.09 HIGH CONDENSED CHARACTERS) IN BLOCK PROVIDED WITH 78712-39 (BLACK).
4. APPLY 2016075-1 (STAKING COMPOUND) PER MANUFACTURING SPECIFICATION 2020342.
5. MASK FOLLOWING AREAS PRIOR TO APPLYING FINISH:
   A. CONTACTS AND GUIDE PINS AT J23.
   B. SLIDING SURFACES (OUTSIDE OF BEND) OF ITEMS 10 AND 11.
   C. TEST JACK CONTACTS.

Figure 2. Line Receiver (Module MD16), Assembly Drawing



NOTES

1 - K = 1,000 MEG = 1,000,000 F = FARAD H = HENRY
M = MILLI S = SECOND U = MICRO W = WATT
2 - UNLESS OTHERWISE INDICATED :
ALL RESISTANCE VALUES ARE IN OHMS.
ALL CAPACITANCE VALUES ARE IN ___.
ALL INDUCTANCE VALUES ARE IN ___.

Figure 3. Line Receiver (Module MD16), Schematic Diagram

HIGH SPEED GATE (MODULE MD659)

RCA 2160173-501

DESCRIPTION

The MD659 module contains eight multiple-input high-speed gates, two independent collector resistors, one three-diode group having common cathodes, one two-diode group having common cathodes, a power supply regulating network, and power supply filtering networks. Any gate used must have a collector resistor. The diode groups may be used to modify the input to any gate. Gates may be cross-coupled to form flip-flops.

CIRCUIT ANALYSIS

Operation of each gate is identical. The number of possible inputs, and the possibilities for joining outputs to a common collector resistor is the major difference between any two gates. Detailed operation is described for gate 2.

The nominal level of a logical 0 input is -4.5 v; the nominal level of a logical 1 input is 0 v. When the input to diode CR5, CR6, or CR7 is a logical 1, the junction of all diodes and resistor R4 is held near 0 v. When this condition exists, resistor R5 and diode CR9 hold transistor Q2 cut off by maintaining the base voltage at a positive potential. With transistor Q2 cut off, the output at the collector is clamped at -4.5 v through diode CR10 to the -4.5 v power source. When the inputs to diodes CR5, CR6, and CR7 are all at the logical 0 level, the junction of all diodes and resistor R4 is held near 4.5 v. When this condition exists, resistor R5 and diode CR9 hold transistor Q2 in saturation by maintaining the base voltage at a negative potential. With transistor Q2 in saturation, the output at the collector is near 0 v, and diode CR10 is back-biased.

A diode group may be connected to auxiliary inputs of gates 1, 7, or 8 to increase the number of inputs. The outputs of gates 3, 7, and 8 may be connected to each other and to one of the independent collector resistors to form a multiple gate. The outputs of these gates may be similarly connected to a gate having a collector resistor, provided that any multiple gate formed in this manner has only one collector resistor. Gates or diode groups on one MD659 module may be connected with gates on another MD659 module.

If the output of gate 6 is connected to input 1 of gate 5, and the output of gate 5 connected to input 1 of gate 6, the gates form a flip-flop controlled by the remaining two inputs. This flip-flop can be used to drive other gates.

Resistor R24 and capacitor C2 form a filter network for the -16.5 v supply. Resistor R22 and capacitor C3 form a filter network for the +12 v supply. Resistor R23, capacitor C1, and Zener diode CR47 form a voltage regulator and filter for the -4.5 v supply.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Output logic levels are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+1.25, -4.5)	0 ma nominal
1	0 v (+0.0, -0.8)	3.8 ma maximum

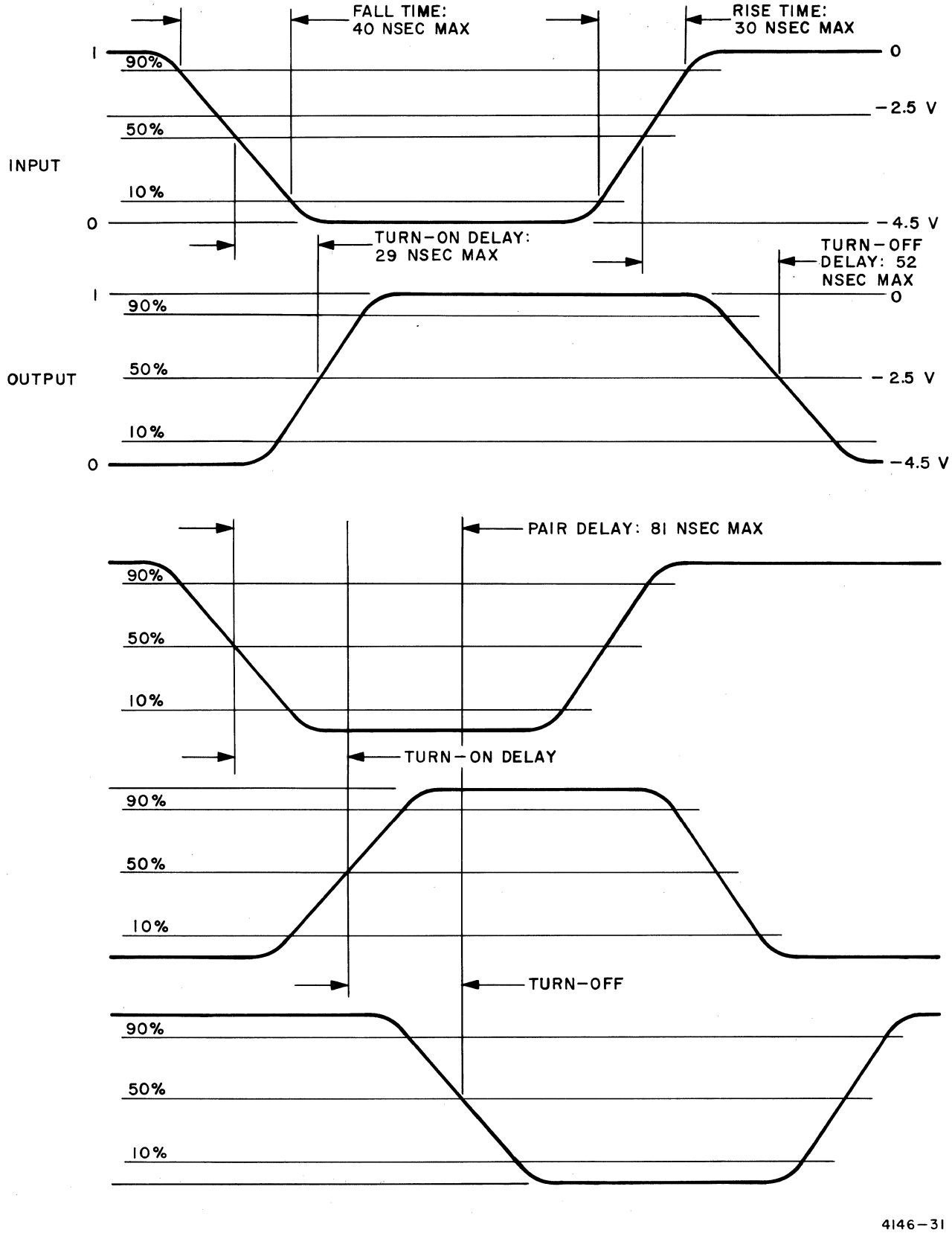


Figure 1. MD659 Module, Waveforms and Timing

Table 2. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT	
		WITH COLLECTOR RESISTOR	WITHOUT COLLECTOR RESISTOR
0	-4.5 v (+0.2, -1.2)	5 ma maximum OUT 12 ma maximum OUT	20 ma maximum OUT 0 ma nominal IN
1	0 v (+0.0, -0.5)	31.3 ma maximum OUT 15 ma maximum IN	52.9 ma maximum OUT 0 ma nominal IN

LOADING

Each input of an MD659 gate is the standard unit load of one MD659 gate. Each gate is capable of driving a maximum of eight other MD659 module gates (eight unit loads).

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT	POWER
+12 v ± 5%	1.83 ma maximum	3.42 watts maximum
-165 v ± 5%	205.3 ma maximum	

WIRING

Table 4 lists maximum lengths of wire which may be used.

Table 4. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	72 Inches
Single Load	96 Inches

PARTS LIST

Table 5 lists parts for the MD659 module. The MD659 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 5. High Speed Gate (Module MD659) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CP09A1KB224K1	Capacitor, paper, dielectrical, 0.22 μf, 100 v (MIL-C-25)
1	C2	CP09A1KB224K1	Capacitor, paper, capacitor, 0.22 μf, 100 v (MIL-C-25)
1	C3	CP09A1KB104K1	Capacitor, paper, capacitor, 0.10 μf, 100 v (MIL-C-25)
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180821-1	Semiconductor device, diode
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180820-1	Semiconductor device, diode
1	CR6	2180820-1	Semiconductor device, diode
1	CR7	2180820-1	Semiconductor device, diode
1	CR8	2180820-1	Semiconductor device, diode
1	CR9	2180821-1	Semiconductor device, diode
1	CR10	2180820-1	Semiconductor device, diode
1	CR11	2180820-1	Semiconductor device, diode
1	CR12	2180820-1	Semiconductor device, diode
1	CR13	2180820-1	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180820-1	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	CR17	2180821-1	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2180820-1	Semiconductor device, diode
1	CR20	2180820-1	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2180820-1	Semiconductor device, diode
1	CR23	2180821-1	Semiconductor device, diode
1	CR24	2180820-1	Semiconductor device, diode

Table 5. High Speed Gate (Module MD659) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR25	2180820-1	Semiconductor device, diode
1	CR26	2180820-1	Semiconductor device, diode
1	CR27	2180820-1	Semiconductor device, diode
1	CR28	2180821-1	Semiconductor device, diode
1	CR29	2180820-1	Semiconductor device, diode
1	CR30	2180820-1	Semiconductor device, diode
1	CR31	2180820-1	Semiconductor device, diode
1	CR32	2180820-1	Semiconductor device, diode
1	CR33	2180821-1	Semiconductor device, diode
1	CR34	2180820-1	Semiconductor device, diode
1	CR35	2180820-1	Semiconductor device, diode
1	CR36	2180820-1	Semiconductor device, diode
1	CR37	2180820-1	Semiconductor device, diode
1	CR38	2180821-1	Semiconductor device, diode
1	CR39	2180820-1	Semiconductor device, diode
1	CR40	2180820-1	Semiconductor device, diode
1	CR41	2180820-1	Semiconductor device, diode
1	CR42	2180820-1	Semiconductor device, diode
1	CR43	2180820-1	Semiconductor device, diode
1	CR44	2180820-1	Semiconductor device, diode
1	CR45	2180821-1	Semiconductor device, diode
1	CR46	2180820-1	Semiconductor device, diode
1	CR47	2180822-1	Semiconductor device, diode
1	CR48	2180820-1	Semiconductor device, diode
1	CR49	2180820-1	Semiconductor device, diode
1	CR50	2180820-1	Semiconductor device, diode
1	CR51	2180820-1	Semiconductor device, diode

Table 5. High Speed Gate (Module MD659) Parts List (cont)

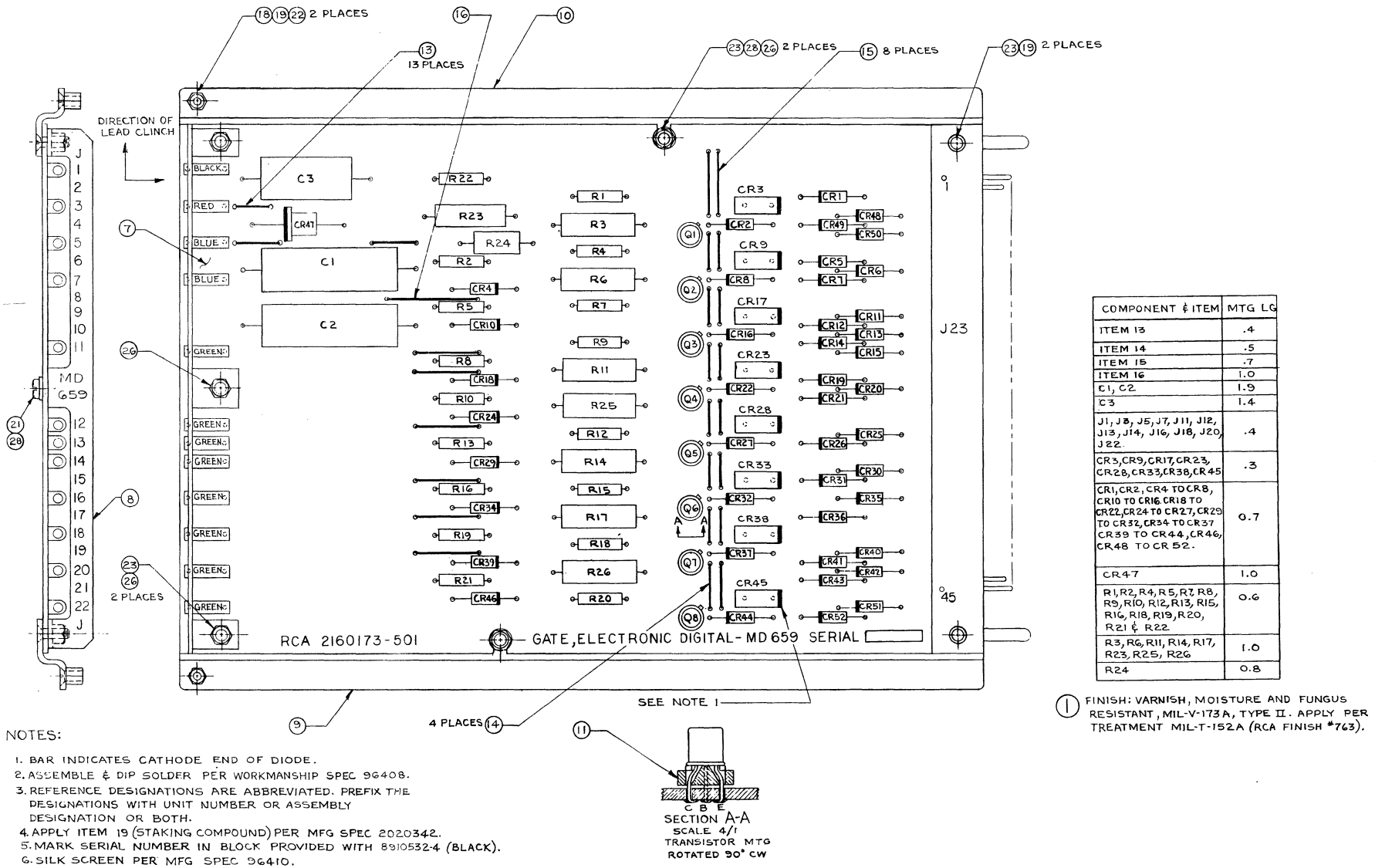
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR52	2180820-1	Semiconductor device, diode
1	J1	8934595-3	Jack, tip, printed circuit (black)
1	J3	8934595-2	Jack, tip, printed circuit (red)
1	J5	8934595-7	Jack, tip, printed circuit (blue)
1	J7	8934595-7	Jack, tip, printed circuit (blue)
1	J11	8934595-5	Jack, tip, printed circuit (green)
1	J12	8934595-5	Jack, tip, printed circuit (green)
1	J13	8934595-5	Jack, tip, printed circuit (green)
1	J14	8934595-5	Jack, tip, printed circuit (green)
1	J16	8934595-5	Jack, tip, printed circuit (green)
1	J18	8934595-5	Jack, tip, printed circuit (green)
1	J20	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-5	Jack, tip, printed circuit (green)
1	J23	8716037-1	Connector, receptacle, electrical (male)
1	Q1	2180801-1	Semiconductor device, transistor
1	Q2	2180801-1	Semiconductor device, transistor
1	Q3	2180801-1	Semiconductor device, transistor
1	Q4	2180801-1	Semiconductor device, transistor
1	Q5	2180801-1	Semiconductor device, transistor
1	Q6	2180801-1	Semiconductor device, transistor
1	Q7	2180801-1	Semiconductor device, transistor
1	Q8	2180801-1	Semiconductor device, transistor
1	R1	8977933-257	Resistor, fixed, film, 4640 ohms, $\frac{1}{8}$w, ±1%
1	R2	8977933-365	Resistor, fixed, film, 61.9 k ohms, $\frac{1}{8}$w, ±1%
1	R3	8977940-185	Resistor, fixed, film, 825 ohms, $\frac{1}{2}$w, ±1%
1	R4	8977933-257	Resistor, fixed, film, 4640 ohms $\frac{1}{8}$w, ±1%
1	R5	8977933-365	Resistor, fixed, film, 61.9 k ohms, $\frac{1}{8}$w, ±1%

Table 5. High Speed Gate (Module MD659) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R6	8977940-185	Resistor, fixed, film, 825 ohms, $\frac{1}{2}$ w, ±1%
1	R7	8977933-257	Resistor, fixed, film, 4640 ohms, $\frac{1}{8}$ w, ±1%
1	R8	8977933-365	Resistor, fixed, film, 61.9 k ohms, $\frac{1}{8}$ w, ±1%
1	R9	8977933-257	Resistor, fixed, film, 4640 ohms, $\frac{1}{8}$ w, ±1%
1	R10	8977933-365	Resistor, fixed, film, 61.9 k ohms, $\frac{1}{8}$ w, ±1%
1	R11	8977940-185	Resistor, fixed, film, 825 ohms, $\frac{1}{2}$ w, ±1%
1	R12	8977933-257	Resistor, fixed, film, 4640 ohms, $\frac{1}{8}$ w, ±1%
1	R13	8977933-365	Resistor, fixed, film, 61.9 k ohms, $\frac{1}{8}$ w, ±1%
1	R14	8977940-185	Resistor, fixed, film, 825 ohms, $\frac{1}{2}$ w, ±1%
1	R15	8977933-257	Resistor, fixed, film, 4640 ohms, $\frac{1}{8}$ w, ±1%
1	R16	8977933-365	Resistor, fixed, film, 61.9 k ohms, $\frac{1}{8}$ w, ±1%
1	R17	8977940-185	Resistor, fixed, film, 825 ohms, $\frac{1}{2}$ w, ±1%
1	R18	8977933-257	Resistor, fixed, film, 4640 ohms, $\frac{1}{8}$ w, ±1%
1	R19	8977933-365	Resistor, fixed, film, 61.9 k ohms, $\frac{1}{8}$ w, ±1%
1	R20	8977933-257	Resistor, fixed, film, 4640 ohms, $\frac{1}{8}$ w, ±1%
1	R21	8977933-365	Resistor, fixed, film, 61.9 k ohms, $\frac{1}{8}$ w, ±1%
1	R22	8977933-1	Resistor, fixed, film, 10 ohms, $\frac{1}{8}$ w, ±1%
1	R23	8977940-165	Resistor, fixed, film, 511 ohms, $\frac{1}{2}$ w, ±1%
1	R24	RC32GF3R3K	Resistor, fixed, composition, 3.3 ohms, $\frac{1}{2}$ w, ±10% (MIL-R-11)
1	R25	8977940-185	Resistor, fixed, film, 825 ohms, $\frac{1}{2}$ w, ±1%
1	R26	8977940-185	Resistor, fixed, film, 825 ohms, $\frac{1}{2}$ w, ±1%
1	7	2160180-2	Board, printed circuit
1	8	8266908-659	Stiffener
1	9	8717245-1	Guide module (lower)
1	10	8717245-2	Guide module (upper)
8	11	2180896-1	Mounting pad, transistor
13	13	8983171-207	Lead, electrical, printed wiring

Table 5. High Speed Gate (Module MD659) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
4	14	8983171-209	Lead, electrical, printed wiring
8	15	8983171-213	Lead, electrical, printed wiring
1	16	8983171-219	Lead, electrical, printed wiring
2	18	8936316-1	Pin extractor
1	21	8914385-9	Screw, machine, pan head, cross recessed, no. 4 (0.112) 40 x 0.38 lg
2	22	8954980-5	Screw, machine,flat head, cross recessed, no.4 (0.112) 40 x 0.25 lg
6	23	8954980-9	Screw, machine, flat head, cross recessed, no. 4 (0.112) 40 x 0.38 lg
5	26	8811181-109	Nut, hex lock, no. 4 (0.112) 40 thread
3	28	AN960-C4	Washer,flat, no. 4, 0.032 thick



COMPONENT & ITEM	MTG LG
ITEM 13	.4
ITEM 14	.5
ITEM 15	.7
ITEM 16	1.0
C1, C2	1.9
C3	1.4
J1, J3, J5, J7, J11, J12, J13, J14, J16, J18, J20, J22.	.4
CR3, CR9, CR17, CR23, CR28, CR33, CR38, CR45	.3
CR1, CR2, CR4 TO CR8, CR10 TO CR16, CR18 TO CR22, CR24 TO CR27, CR29 TO CR32, CR34 TO CR37, CR39 TO CR44, CR46, CR48 TO CR52.	0.7
CR47	1.0
R1, R2, R4, R5, R7, R8, R9, R10, R12, R13, R15, R16, R18, R19, R20, R21 & R22.	0.6
R3, R6, R11, R14, R17, R23, R25, R26	1.0
R24	0.8

(1) FINISH: VARNISH, MOISTURE AND FUNGUS RESISTANT, MIL-V-173A, TYPE II. APPLY PER TREATMENT MIL-T-152A (RCA FINISH #763).

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. ASSEMBLE & DIP SOLDER PER WORKMANSHIP SPEC 96408.
3. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
4. APPLY ITEM 19 (STAKING COMPOUND) PER MFG SPEC 2020342.
5. MARK SERIAL NUMBER IN BLOCK PROVIDED WITH 8910532-4 (BLACK).
6. SILK SCREEN PER MFG SPEC 96410.

Figure 2. High Speed Gate (Module MD659), Assembly Drawing

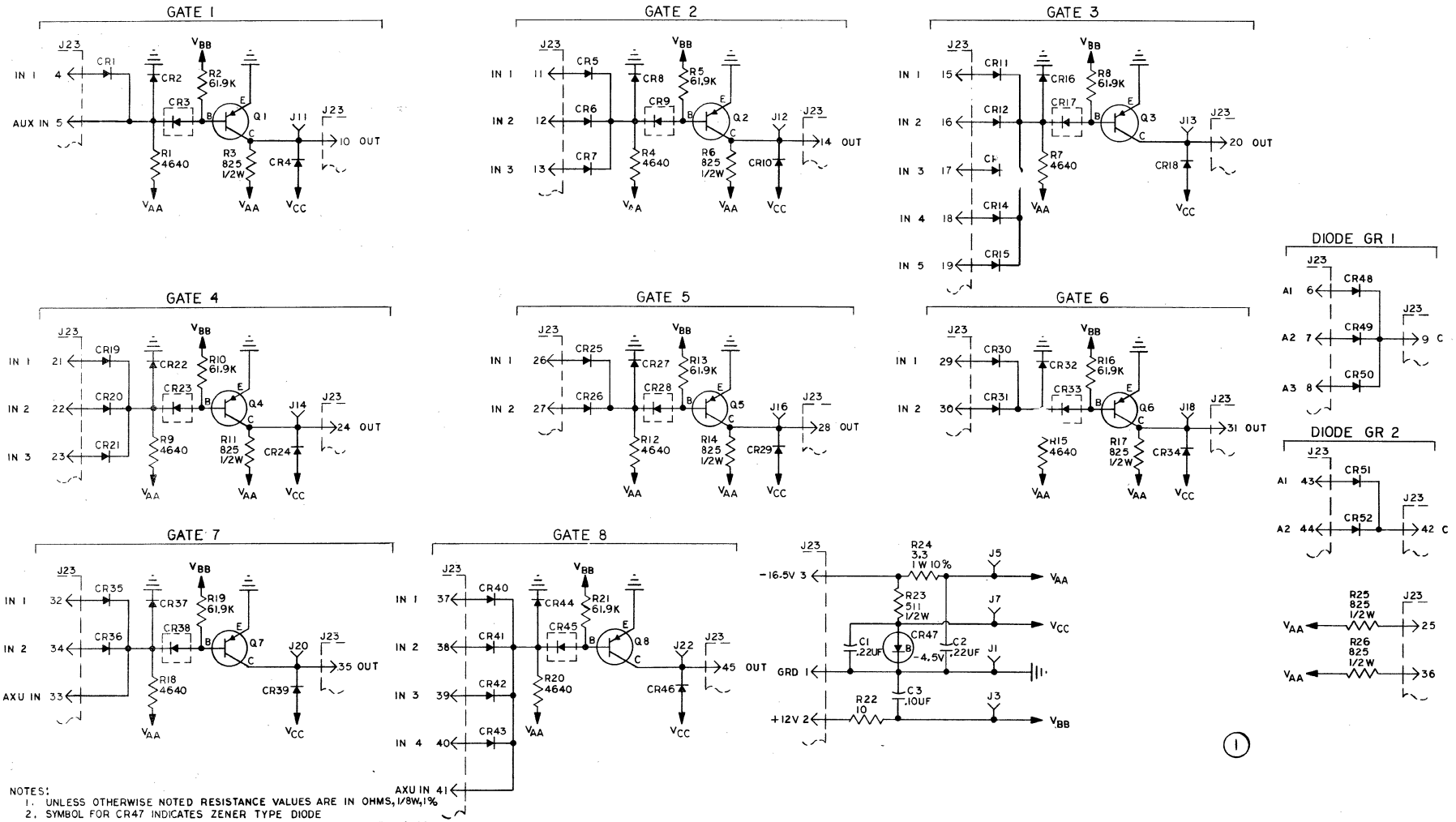


Figure 3. High Speed Gate (Module MD659), Schematic Diagram

RELAY (MODULE MD753)

RCA 2160725-501

DESCRIPTION

The MD753 module contains six identical relay circuits, each controlled by a two-input driver gate. Each relay has one set of SPDT Form D (make-before-break) mercury-wetted contacts, and is provided with two contact protection networks. A resistor-capacitor filter network and a three-diode voltage stabilizing network are provided at the power supply input line.

CIRCUIT ANALYSIS

All of the six circuits are identical and independent, therefore, only one is described in detail. The nominal voltage of the logical 0 level is -4.5 v; the nominal voltage of the logical 1 level is 0 v. If the input to either diode CR1 or diode CR2 is at the logical 1 level, the junction of diodes CR1, CR2 and resistors R1, R20 is held near 0 v. Under these conditions, transistor Q1 is cut off, and relay K1 is not energized. If the inputs to both diodes are at the logical 0 level, the junction is held near -4.5 v. Under these conditions, transistor Q1 is conducting to saturation, and relay K1 is energized. An open-circuit condition at either input is equivalent to a logical 0.

Diode CR3 protects transistor Q1 from the self-induced voltage developed when relay K1 is deenergized. Resistor R2 and capacitor C1, when externally connected to the common contact form a contact protection network for the normally-closed contacts; resistor R3 and capacitor C2 form a similar network for the normally-open contacts. Resistor R19 and capacitor C13 form a filter network for the -16.5 v power source. Diodes CR13, CR14 and CR15 form a voltage stabilizer which holds the emitters of all transistor slightly below ground potential.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Relay characteristics are described in Table 2.

Table 1. Input Logic Level

LOGIC LEVEL	VOLTAGE	CURRENT
1	0 v (+0.0 v, -0.8 v)	3.1 ma maximum
0	-5.5 v (+0.55 v, -0.55 v)	0 ma

Table 2. Relay Characteristics

Pull-in Time	Not more than 3.5 milliseconds after application of controlling input.
Drop-out Time	Not more than 3.5 milliseconds after application of controlling input.
Current	For voltages less than 160 v, the current shall not exceed 0.6 amperes.
	For voltages greater than 160 v but less than 500 v, the contacts shall not carry more than 100 volt-amperes.

LOADING

Each input of an MD753 gate is approximately equivalent to one MD659 gate. The output load is limited by the relay contact characteristics listed in Table 2.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT	POWER
-16.5 v ±5%	247 ma maximum	5 watts maximum

WIRING

No wiring restrictions unless used to switch circuit outputs; then rules for that circuit apply.

PARTS LIST

Table 4 lists parts for the MD753 module. The MD753 module assembly is illustrated in Figure 1, and the schematic diagram is illustrated in Figure 2.

Table 4. Relay (Module MD753) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C2	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C3	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C4	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C5	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C6	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C7	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C8	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C9	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C10	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C11	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v

Table 4. Relay (Module MD753) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C12	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	C13	8954838-61	Capacitor, fixed, tantalum, electrolytic, 0.4 μf, ± 20%, 100 v
1	CR1	8935924-1	Semiconductor device, diode, type 24
1	CR2	8935924-1	Semiconductor device, diode, type 24
1	CR4	8935924-1	Semiconductor device, diode, type 24
1	CR5	8935924-1	Semiconductor device, diode, type 24
1	CR6	8935924-1	Semiconductor device, diode, type 24
1	CR8	8935924-1	Semiconductor device, diode, type 24
1	CR9	8935924-1	Semiconductor device, diode, type 24
1	CR10	8935924-1	Semiconductor device, diode, type 24
1	CR12	8935924-1	Semiconductor device, diode, type 24
1	CR13	1N645	Semiconductor device, diode (MIL-E-1143)
1	CR14	1N645	Semiconductor device, diode (MIL-E-1143)
1	CR15	1N645	Semiconductor device, diode (MIL-E-1143)
1	CR16	8935924-1	Semiconductor device, diode, type 24
1	CR17	8935924-1	Semiconductor device, diode, type 24
1	CR19	8935924-1	Semiconductor device, diode, type 24
1	CR20	8935924-1	Semiconductor device, diode, type 24
1	CR21	8935924-1	Semiconductor device, diode, type 24
1	CR23	8935924-1	Semiconductor device, diode, type 24
1	CR24	8935924-1	Semiconductor device, diode, type 24
1	CR25	8935924-1	Semiconductor device, diode, type 24
1	CR27	8935924-1	Semiconductor device, diode, type 24
1	J1	8934595-3	Jack, tip, printed circuit (black)
1	J3	8934595-7	Jack, tip, printed circuit (blue)
1	J11	8934595-5	Jack, tip, printed circuit (green)

Table 4. Relay (Module MD753) Parts List (cont)

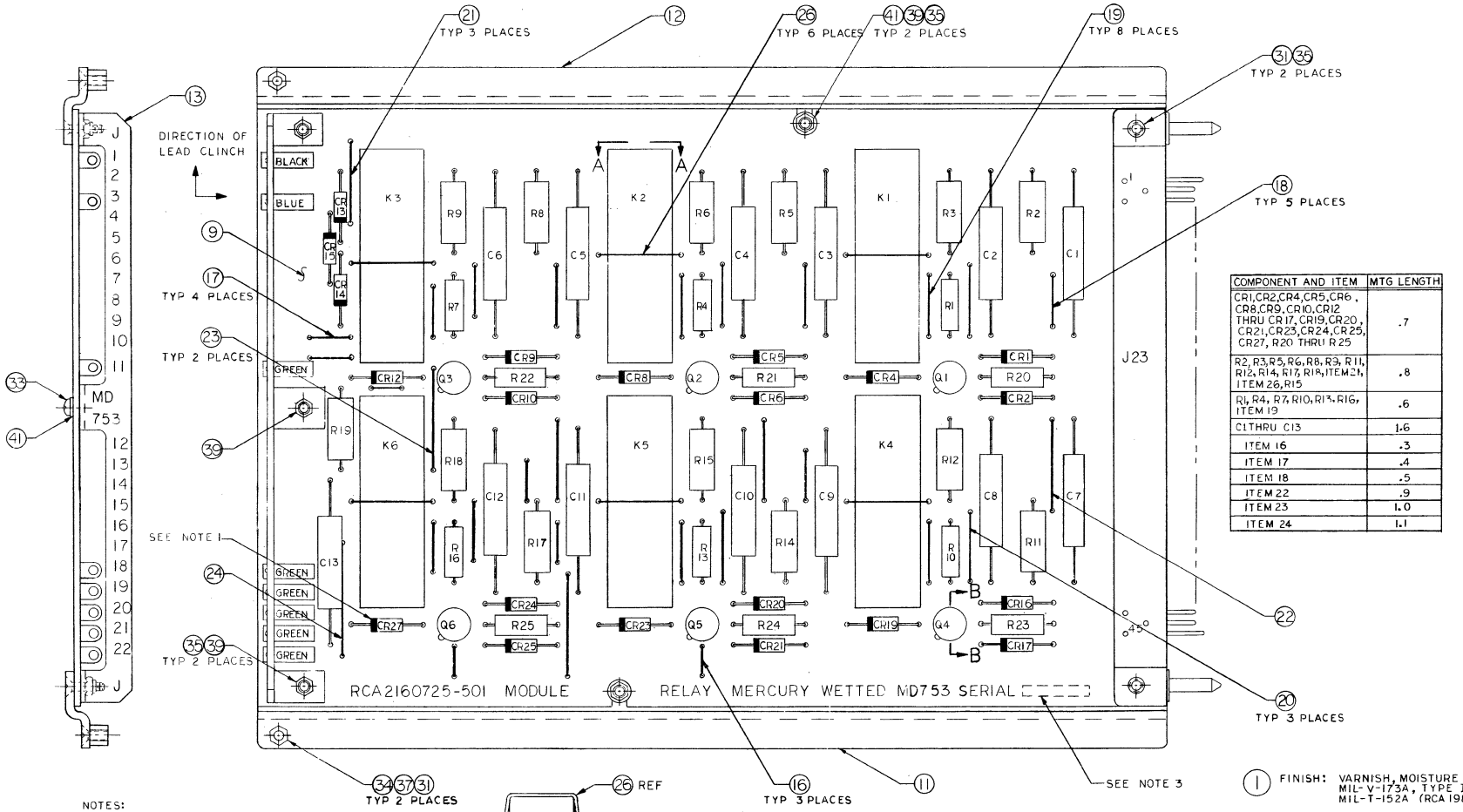
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	J18	8934595-5	Jack, tip, printed circuit (green)
1	J19	8934595-5	Jack, tip, printed circuit (green)
1	J20	8934595-5	Jack, tip, printed circuit (green)
1	J21	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-5	Jack, tip, printed circuit (green)
1	J23	8716037-1	Connector, receptacle, electrical
1	K1	2180987-1	Relay, mercury wetted
1	K2	2180987-1	Relay, mercury wetted
1	K3	2180987-1	Relay, mercury wetted
1	K4	2180987-1	Relay, mercury wetted
1	K5	2180987-1	Relay, mercury wetted
1	K6	2180987-1	Relay, mercury wetted
1	Q1	8935914-1	Semiconductor device, transistor, type DEP14
1	Q2	8935914-1	Semiconductor device, transistor, type DEP14
1	Q3	8935914-1	Semiconductor device, transistor, type DEP14
1	Q4	8935914-1	Semiconductor device, transistor, type DEP14
1	Q5	8935914-1	Semiconductor device, transistor, type DEP14
1	Q6	8935914-1	Semiconductor device, transistor, type DEP14
1	R1	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R2	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R3	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R4	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R5	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R6	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R7	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R8	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)

Table 4. Relay (Module MD753) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R9	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R10	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R11	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w (MIL-R-11)
1	R12	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w
1	R13	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R14	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w
1	R15	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w
1	R16	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R17	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w
1	R18	RC32GF220K	Resistor, fixed, composition, 22 ohms, ±10%, 1 w
1	R19	RC32GF3R3K	Resistor, fixed, composition, 3.3 ohms, ±10%, 1 w
1	R20	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R21	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R22	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R23	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R24	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, 1/8 w (MIL-R-10509)
1	R25	8977933-125	Resistor, fixed, film, 196 ohms, ±1%, 1/8 w (MIL-R-10509)
1	9	2160180-9	Board, printed circuit
1	11	8717245-1	Guide, module (lower)
1	12	8717245-2	Guide, module (upper)
1	13	8266908-753	Stiffener
6	14	2180896-1	Pad, transistor mounting
3	16	8983171-205	Lead, electrical
4	17	8983171-207	Lead, electrical
5	18	8983171-209	Lead, electrical
8	19	8983171-211	Lead, electrical

Table 4. Relay (Module MD753) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
3	20	8983171-213	Lead, electrical
3	21	8983171-215	Lead, electrical
1	22	8983171-217	Lead, electrical
2	23	8983171-219	Lead, electrical
1	24	8983171-221	Lead, electrical
AR	31	2016075-1	Staking compound
1	33	8914385-9	Screw, machine, pan head, recessed, no. 4 (0.112) 40 x 0.38 lg
2	34	8954980-5	Screw, machine, flat head, recessed, no. 4 (0.112) 40 x 0.25 lg
6	35	8954980-9	Screw, machine, flat head, recessed, no. 4 (0.112) 40 x 0.38 lg
2	37	8936316-1	Pin extractor
5	39	8811181-109	Nut, hex, lock, no. 4 (0.112) 40
3	41	AN960-C4	Washer, flat, no. 4, 0.032 thk



COMPONENT AND ITEM	MTG LENGTH
CR1,CR2,CR4,CR5,CR6, CR8,CR9,CR10,CR12 THRU CR17,CR19,CR20, CR21,CR23,CR24,CR25, CR27, R20 THRU R25	.7
R2,R3,R5,R6,R8,R9, R11, R12, R14, R17, R18, ITEM 21, ITEM 26, R15	.8
R1, R4, R7, R10, R13, R16, ITEM 19	.6
C1 THRU C13	1.6
ITEM 16	.3
ITEM 17	.4
ITEM 18	.5
ITEM 22	.9
ITEM 23	1.0
ITEM 24	1.1

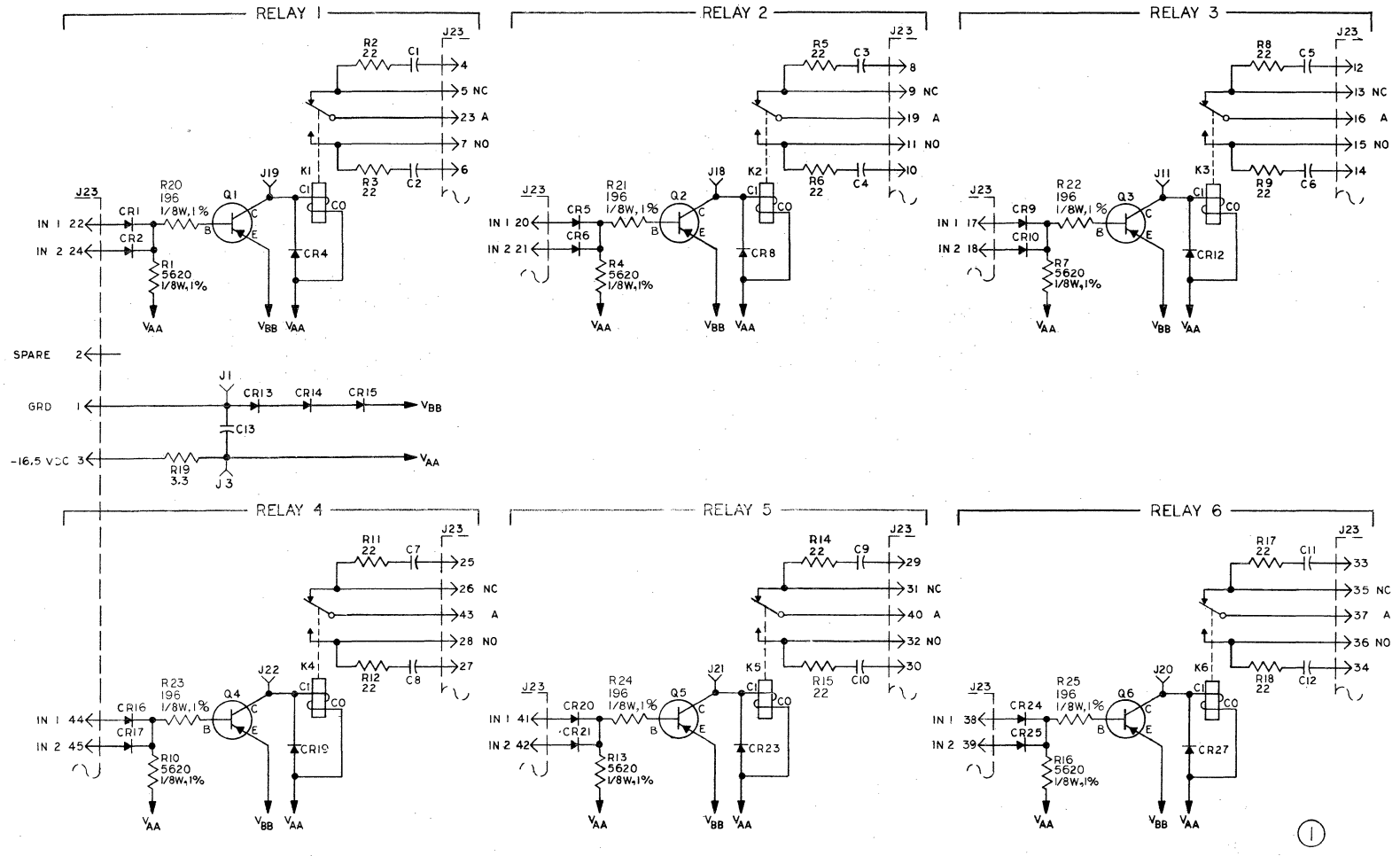
NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. APPLY ITEM 31 (STAKING COMPOUND) PER MFG SPEC 2020342
3. MARK SERIAL NUMBER IN BLOCK PROVIDED WITH 8910532-4 (BLACK)
5. ASSEMBLE AND DIP SOLDER PER WORKMANSHIP SPECIFICATION 96408
6. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NO. OR ASSEMBLY DESIGNATION OR BOTH.
7. ASSEMBLE AND DIP SOLDER PER ITEM 7 AND 2020319.

SECTION A-A
RELAY MTG
ROTATED 180°

SECTION B-B
SCALE 4/1
TRANSISTOR MTG
ROTATED 90° CCW

(1) FINISH: VARNISH, MOISTURE AND FUNGUS RESISTANT, MIL-V-173A, TYPE II, APPLY TREATMENT PER MIL-T-152A (RCA 1980763-1)

Figure 1. Relay (Module MD753), Assembly Drawing



NOTES:

1. RESISTOR VALUES ARE IN OHMS, 10%, 1W, UNLESS OTHERWISE NOTED.
2. CAPACITORS ARE .4UF, 100V, 20%, UNLESS OTHERWISE NOTED.
3. PINS 4,6,8,10,12,14, 25,27,29, 30, 33, AND 34 ON J23, MAY BE USED FOR CONTACT PROTECTION
4. ALL CALLOUTS MARKED V_{AA} INTERCONNECT WITH EACH OTHER. ALL CALLOUTS MARKED V_{BB} ALSO INTERCONNECT WITH EACH OTHER.

SYMBOL NO.S NOT USED: CR 3, CR 7, CR11, CR18, CR22, CR26

SYMBOL NO.S OUT OF SERIES: R19, R20, R21, R22, R23, R24, R25

Figure 2. Relay (Module MD753), Schematic Diagram

DIODE MATRIX (MODULE MD754)

RCA 2160186-501

DESCRIPTION

The MD754 module contains 12 passive networks consisting of resistors and diodes. Each network is connected between a selector pair circuit in a MD757 module and a set of cores in the memory. The functions of each passive network are to route the read pulse or the write pulse in the proper direction through the cores and to isolate the read and write sources.

CIRCUIT ANALYSIS

All of the 12 networks are identical, therefore only one is described in detail. Diodes CR1 through CR4, and resistors R1 and R2 form a matrix controlled by input 1. The read and write current sources are connected to the inputs; the set of cores is connected to the output, in parallel with resistor R1. Read pulses and write pulses cannot occur at the same time. When a read pulse is generated for this network, the current flows from the READ SELECTOR B for input 1, through diode CR3, resistor R1 and the core load, and diode CR2 to READ SELECTOR A for input 1. No current flows through diode CR4 to WRITE SELECTOR A for input 1 because no path exists through the associated write circuit. When a write pulse occurs current flows from the WRITE SELECTOR B for input 1 through diode CR1, resistor R1 and the SELECTOR core load, and diode CR4, to WRITE SELECTOR A for input 1. In this case, no external path exists through diode CR2 and READ SELECTOR A for input 1. Resistor R1 is connected in parallel with the inductive core load to provide a low impedance path during transient conditions. At steady-state conditions, the core load has nearly zero impedance. Resistor R2 is a high-resistance connection to the common bias input. Capacitor C1 is a line filter for the common bias input.

CIRCUIT CHARACTERISTICS

Each MD754 module diode matrix receives as its input the output of a selector pair circuit on an MD757 module.

LOADING

Each MD754 module diode matrix, together with a set of cores in the magnetic core memory, forms the load for an MD757 module.

POWER REQUIREMENTS

The MD754 module consists entirely of passive circuit elements driven by other circuits. No separate power input is required.

PARTS LIST

Table 1 lists parts for the MD754 module. The MD754 module assembly is illustrated in Figure 1, and the schematic diagram is illustrated in Figure 2.

Table 1. Diode Matrix (Module MD754) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CP09A1KB104K1	Capacitor, fixed, paper dielectric, 0.10 μf, 100 v, ±10% (MIL-C-25A)
1	CR1	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR2	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR3	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR4	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR5	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR6	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR7	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR8	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR9	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR10	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR11	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR12	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR13	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR14	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR15	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR16	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR17	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR18	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR19	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR20	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR21	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR22	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR23	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR24	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR25	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)

Table 1. Diode Matrix (Module MD754) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR26	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR27	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR28	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR29	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR30	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR31	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR32	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR33	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR34	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR35	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR36	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR37	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR38	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR39	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR40	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR41	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR42	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR43	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR44	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR45	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR46	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR47	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR48	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	J2	8934595-5	Jack, tip, printed circuit (green)
1	J5	8934595-5	Jack, tip, printed circuit (green)
1	J6	8934595-5	Jack, tip, printed circuit (green)
1	J7	8934595-5	Jack, tip, printed circuit (green)

Table 1. Diode Matrix (Module MD754) Parts List (cont)

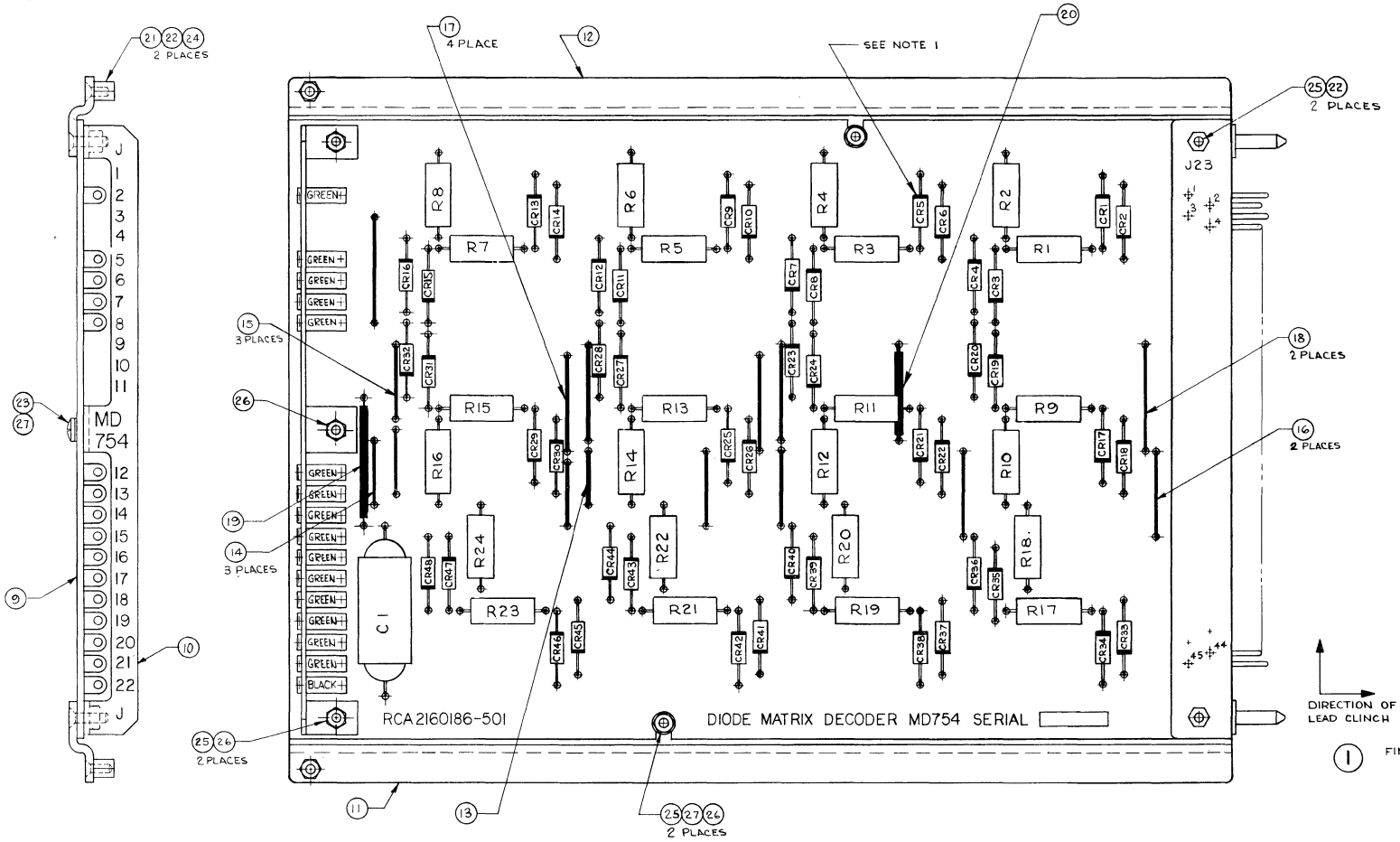
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	J8	8934595-5	Jack, tip, printed circuit (green)
1	J12	8934595-5	Jack, tip, printed circuit (green)
1	J13	8934595-5	Jack, tip, printed circuit (green)
1	J14	8934595-5	Jack, tip, printed circuit (green)
1	J15	8934595-5	Jack, tip, printed circuit (green)
1	J16	8934595-5	Jack, tip, printed circuit (green)
1	J17	8934595-5	Jack, tip, printed circuit (green)
1	J18	8934595-5	Jack, tip, printed circuit (green)
1	J19	8934595-5	Jack, tip, printed circuit (green)
1	J20	8934595-5	Jack, tip, printed circuit (green)
1	J21	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-3	Jack, tip, printed circuit (black)
1	J23	8716037-1	Connector, receptacle, electrical
1	R1	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ± 10% (MIL-R-11)
1	R2	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ± 10% (MIL-R-11)
1	R3	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ± 10% (MIL-R-11)
1	R4	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ± 10% (MIL-R-11)
1	R5	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ± 10% (MIL-R-11)
1	R6	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ± 10% (MIL-R-11)
1	R7	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ± 10% (MIL-R-11)
1	R8	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ± 10% (MIL-R-11)
1	R9	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ± 10% (MIL-R-11)
1	R10	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ± 10% (MIL-R-11)
1	R11	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ± 10% (MIL-R-11)
1	R12	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ± 10% (MIL-R-11)
1	R13	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ± 10% (MIL-R-11)
1	R14	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ± 10% (MIL-R-11)

Table 1. Diode Matrix (Module MD754) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R15	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11)
1	R16	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ±10% (MIL-R-11)
1	R17	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11)
1	R18	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ±10% (MIL-R-11)
1	R19	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11)
1	R20	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ±10% (MIL-R-11)
1	R21	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11)
1	R22	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ±10% (MIL-R-11)
1	R23	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11)
1	R24	RC32GF103K	Resistor, fixed, composition, 10 k ohms, 1 w, ±10% (MIL-R-11)
1	9	2160180-4	Board, printed circuit
1	10	8266908-754	Stiffener
1	11	8717245-1	Guide, module (lower)
1	12	8717245-2	Guide, module (upper)
1	13	8983171-209	Lead, electrical, printed wiring (uninsulated)
3	14	8983171-211	Lead, electrical, printed wiring (uninsulated)
3	15	8983171-213	Lead, electrical, printed wiring (uninsulated)
2	16	8983171-215	Lead, electrical, printed wiring (uninsulated)
4	17	8983171-217	Lead, electrical, printed wiring (uninsulated)
2	18	8983171-219	Lead, electrical, printed wiring (uninsulated)
1	19	8983171-823	Lead, electrical, printed wiring (insulated)
1	20	8983171-817	Lead, electrical, printed wiring (insulated)
2	21	8936316-1	Pin extractor
AR	22	2016075-1	Staking compound
1	23	8914385-9	Screw, machine, 4 (0.112) 40, pan head, cross recessed, (0.38 lg)
2	24	8954980-5	Screw, machine, 4 (0.112) 40, 100°, flat head, cross recessed, (0.250 lg)

Table 1. Diode Matrix (Module MD754) Parts List (cont)

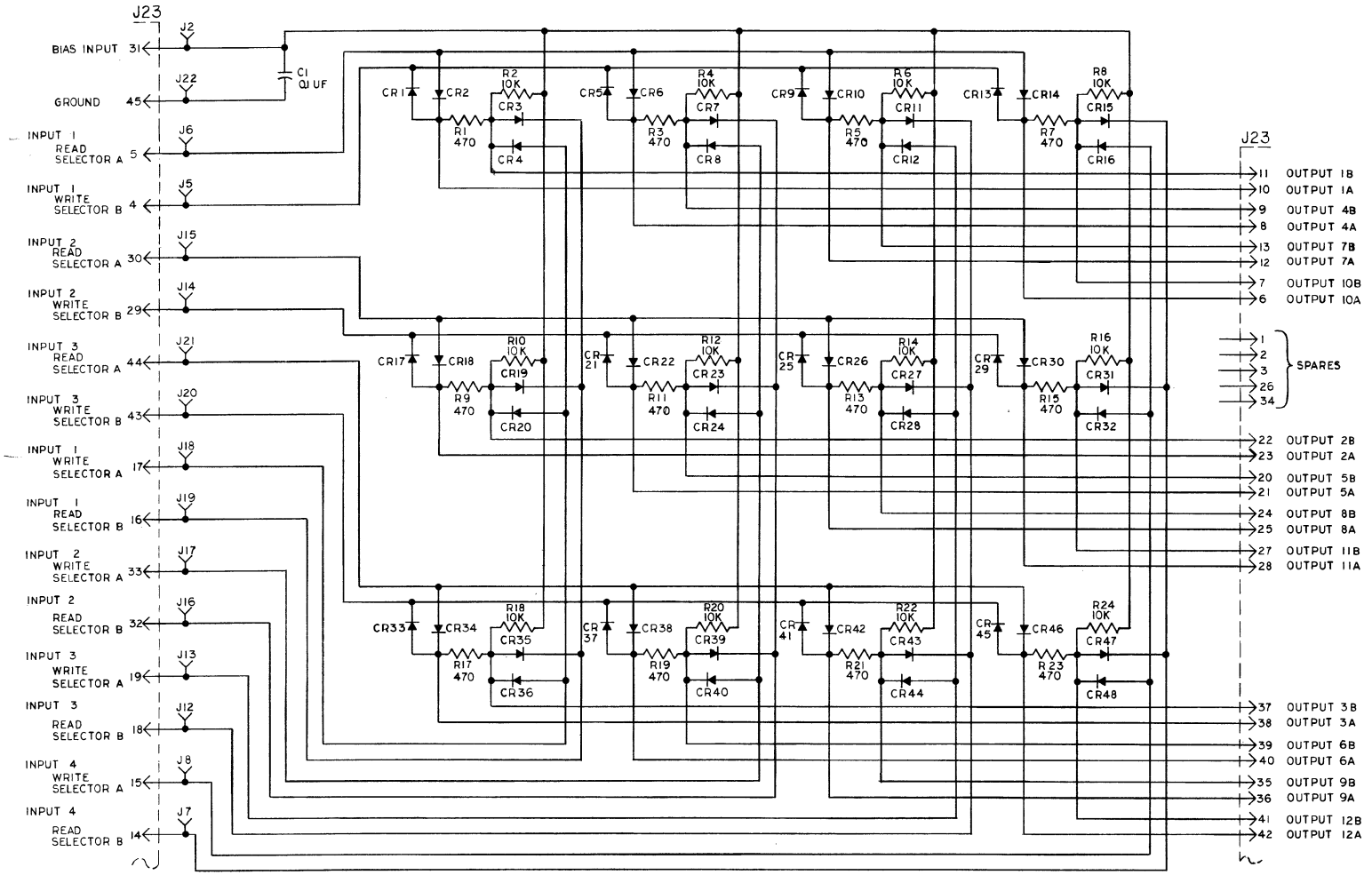
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
6	25	8954980-9	Screw, machine, 4 (0.112) 40, 100°, flat head, cross recessed, (0.38 lg)
5	26	8811181-109	Nut, hex, self-lock, no. 4 (0.112) 40
3	27	AN 960-C4	Washer, flat, no. 4, 0.032 thk



COMPONET AND ITEM	MTG LG
CR1 THRU CR48	.7
R1 THRU R24	.8
C1	1.6
ITEM 13	.5
ITEM 14	.6
ITEM 15	.7
ITEM 16	.8
ITEM 17	.9
ITEM 18	1.0
ITEM 19	1.2
ITEM 20	.9

NOTES:
1. BAR INDICATES CATHODE END OF DIODE
2. ASSEMBLE AND DIP SOLDER PER ITEMS 5 AND 31
3. MARK SERIAL NO. IN BLOCK PROVIDED WITH RCA 8910532-4 (BLACK)
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH
5. APPLY ITEM 22 (STAKING COMPOUND) PER ITEM 32
6. SILK SCREEN ITEM 9 PER ITEMS 4 AND 6

Figure 1. Diode Matrix (Module MD754), Assembly Drawing



NOTES
1 RESISTOR VALUES ARE IN OHMS, 1WATT, ±10%.
2 REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NO. OR ASSY DESIGNATION OR BOTH

Figure 2. Diode Matrix (Module MD754), Schematic Diagram

DIGIT DRIVER (MODULE MD755)

RCA 2160178-501

DESCRIPTION

The MD755 module contains two identical digit driver circuits, two line filter capacitors and a resistor-capacitor filter circuit. The input and output stages of each digit driver are separated on the module, and must be connected by external jumpers.

CIRCUIT ANALYSIS

The two digit driver circuits are identical, therefore only one is described in detail. The nominal level of a logical 0 is -4. 5 v; the nominal level of a logical 1 is 0v. When the input at either diode CR1 or diode CR2 is a logical 1, the junction of diodes CR1, CR2, and CR3, resistor R1, and Zener diode CR5 is held near 0v. The regulating network formed by resistor R2 and Zener diode CR5 holds transistor Q1 cut off. Diode CR6 prevents the base voltage from exceeding the +4. 5 v maintained by Zener diode CR4 and resistor R3. The collector of transistor Q1 is clamped near 0 v by current flow through resistor R4 and diode CR7. The collector of transistor Q1 is connected to the base of transistor Q2 by a jumper between pins 17 and 23, or connected to the base of transistor Q3 by a jumper between pins 19 and 21, or to the bases of both transistors. If both are connected, they each have identical loads and respond in an identical manner, therefore only the circuit associated with the transistor Q2 is described in detail. With transistor Q1 cut off, the 0 v emitter voltage reverse-biases Q2 which is cut off. If the inputs to both diode CR1 and diode CR2 are at the logical 0 level, the voltage at the anode of Zener diode CR5 goes to -4. 5 v. A negative-going voltage is generated at the base of transistor Q1. Transistor Q1 becomes saturated. The collector voltage rises from 0 v to the emitter voltage of +4. 5 v, which is maintained by current flow through Zener diode CR4 and resistor R3. As the collector voltage increases, transistor Q2 is driven to saturation. The load on transistor Q2 is a set of magnetic cores in the memory, which are connected between pins 6 and 7, in series with the resistor-capacitor network formed by resistors R7 and R8, and capacitor C3, all in parallel with diode CR8. When transistor Q2 changes from saturation to cut off, the resistor-capacitor network and diode CR8 provide a path for dissipating the back emf of the inductive load.

Capacitors C1 and C2 are line filter capacitors for the -16. 5 v supply and the +12 v supply, respectively. Resistor R17 and capacitor C5 are a filter network for the +18 v to +26 v supply.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. Output logic levels are described in Table 2. A typical input waveform is illustrated in Figure 1.

Table 1. Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4. 5 v (+0. 2 v, -4. 5 v)	8. 0 ma maximum
1	0. 0 v (+0. 2 v, -0. 5 v)	0 ma maximum

Table 2. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
ON	0 v to +1. 5 v	250 ma maximum
OFF	+16 v to +22 v	0 ma

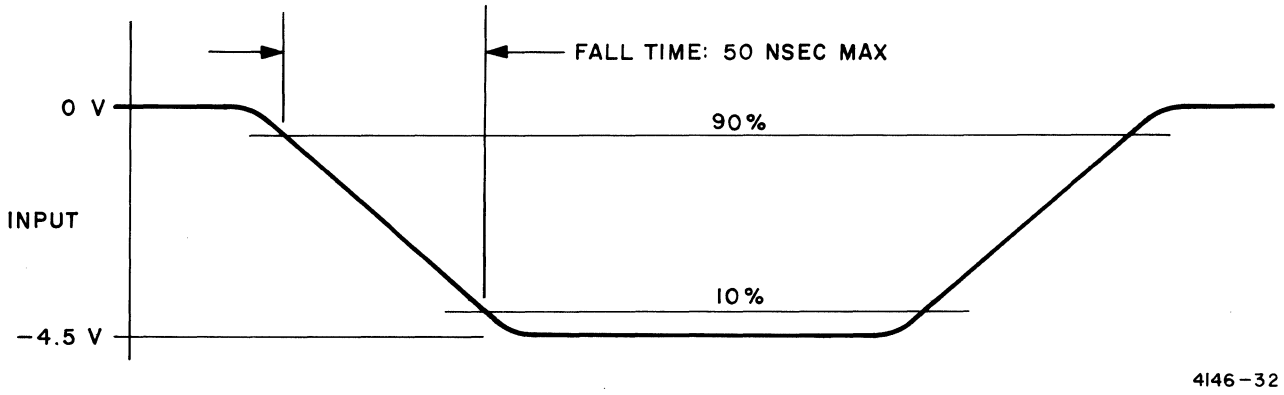


Figure 1. MD755 Module, Input Waveform

LOADING

Each input to an MD755 module digit driver circuit is equivalent to two MD659 gates. The load on the output is either 4, 096 or 8, 192 cores in the magnetic core memory.

POWER REQUIREMENTS

No power supply sequencing is required, unless retention of information is necessary. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	200 ma nominal 220 ma maximum
-16. 5 v ± 5%	36 ma nominal 40 ma maximum

PARTS LIST

Table 4 lists parts for the MD755 module. The MD755 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 4. Digit Driver (Module 755) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0. 22 μf, 100 v (MIL-C-25)
1	C2	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0. 22 μf, 100 v (MIL-C-25
1	C3	8936033-219	Capacitor, fixed, mica, 680 μμf, 300 v
1	C4	8936033-219	Capacitor, fixed, mica, 680 μμf, 300 v
1	C5	CL35BJ200MP1	Capacitor, fixed, electrolytic (tantalum), 20 μ, 50 v (MIL-C-3965)
1	C6	8936033-219	Capacitor, fixed, mica dielectric, 680 μμf, 300 v
1	C7	8936033-219	Capacitor, fixed, mica dielectric, 680 μμf, 300 v
1	CR1	8935924-1	Semiconductor device, diode, type 24
1	CR2	8935924-1	Semiconductor device, diode, type 24
1	CR3	8935924-1	Semiconductor device, diode, type 24
1	CR4	2180822-1	Semiconductor device, diode, Zener
1	CR5	2180823-1	Semiconductor device, diode, Zener
1	CR6	USN 1N914	Semiconductor device, diode, type 1N914 (MIL-S-19500/116)
1	CR7	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR8	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR9	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR10	8935924-1	Semiconductor device, diode, type 24
1	CR11	8935924-1	Semiconductor device, diode, type 24
1	CR12	8935924-1	Semiconductor device, diode, type 24
1	CR13	2180822-1	Semiconductor device, diode, Zener
1	CR14	2180823-1	Semiconductor device, diode, Zener
1	CR15	USN 1N914	Semiconductor device, diode, type 1N914 (MIL-S-19500/116)
1	CR16	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR17	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	CR18	USN 1N691	Semiconductor device, diode (MIL-S-19500/132)
1	J1	8934595-3	Jack, tip, printed circuit (black)

Table 4. Digit Driver (Module 755) Parts List (cont)

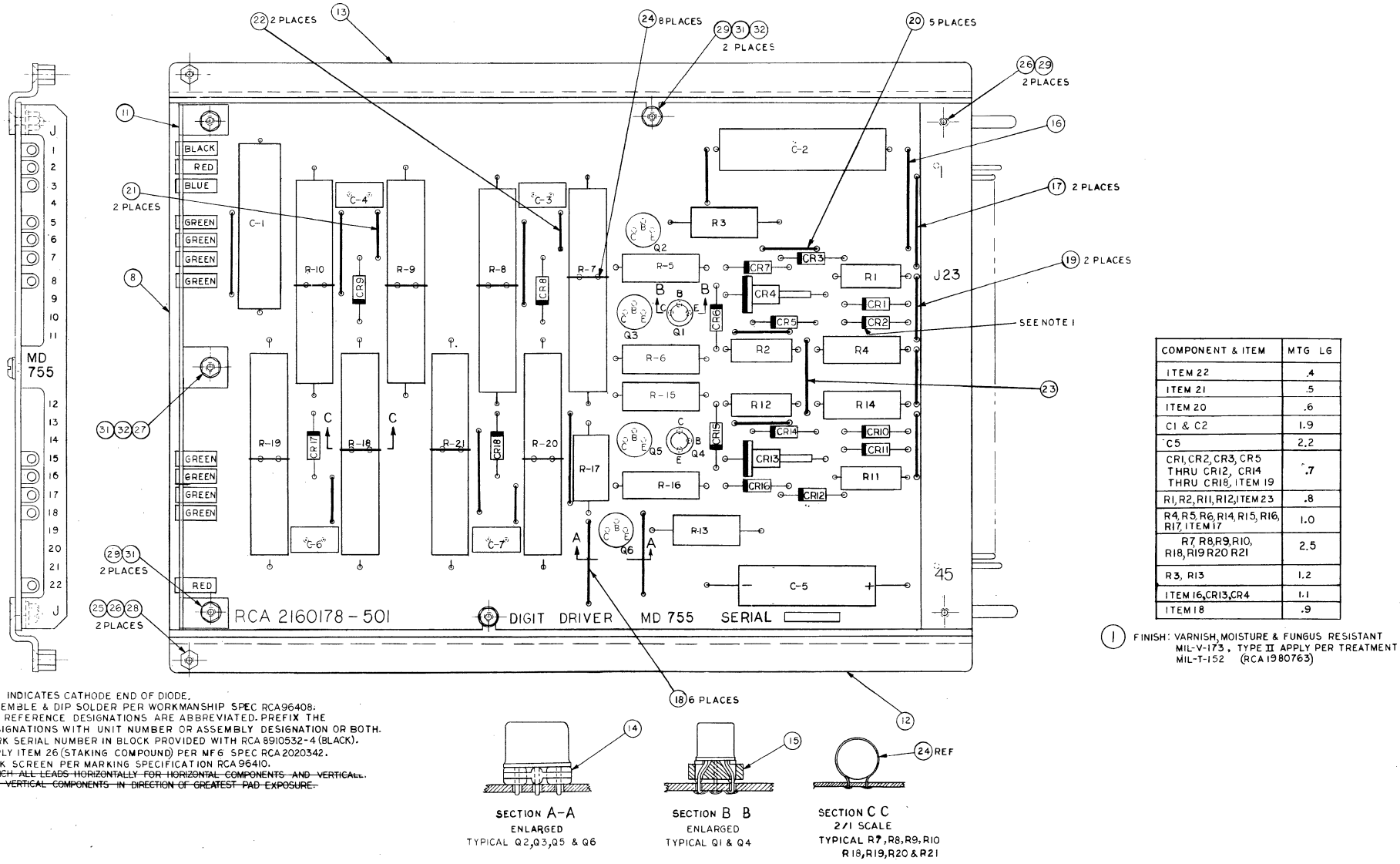
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	J2	8934595-2	Jack, tip, printed circuit (red)
1	J3	8934595-7	Jack, tip, printed circuit (blue)
1	J5	8934595-5	Jack, tip, printed circuit (green)
1	J6	8934595-5	Jack, tip, printed circuit (green)
1	J7	8934595-5	Jack, tip, printed circuit (green)
1	J8	8934595-5	Jack, tip, printed circuit (green)
1	J15	8934595-5	Jack, tip, printed circuit (green)
1	J16	8934595-5	Jack, tip, printed circuit (green)
1	J17	8934595-5	Jack, tip, printed circuit (green)
1	J18	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-2	Jack, tip, printed circuit (red)
1	J23	8716037-1	Connector, receptacle, electrical
1	Q1	2180801-2	Semiconductor device, transistor
1	Q2	2180804-1	Semiconductor device, transistor
1	Q3	2180804-1	Semiconductor device, transistor
1	Q4	2180801-2	Semiconductor device, transistor
1	Q5	2180804-1	Semiconductor device, transistor
1	Q6	2180804-1	Semiconductor device, transistor
1	R1	8977939-229	Resistor, fixed, film, 2370 ohms, $\frac{1}{4}$w, 1%
1	R2	8977939-277	Resistor, fixed, film, 7500 ohms, $\frac{1}{4}$w, 1%
1	R3	RL42AD680J	Resistor, fixed, film, 68 ohms, 2 w, 5% (MIL-R-22684)
1	R4	8977940-213	Resistor, fixed, film, 1620 ohms, $\frac{1}{2}$ w, 1%
1	R5	8977940-97	Resistor, fixed, film, 100 ohms, $\frac{1}{2}$ w, 1%
1	R6	8977940-97	Resistor, fixed, film, 100 ohms, $\frac{1}{2}$ w, 1%
1	R7	2180932-1	Resistor, fixed, film, 178 ohms, 2 w, 0. 5%
1	R8	2180932-1	Resistor, fixed, film, 178 ohms, 2 w, 0. 5%
1	R9	2180932-1	Resistor, fixed, film, 178 ohms, 2 w, 0. 5%

Table 4. Digit Driver (Module 755) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R10	2180932-1	Resistor, fixed, film, 178 ohms, 2 w, 0. 5%
1	R11	8977939-229	Resistor, fixed, film, 2370 ohms, $\frac{1}{4}$ w, 1%
1	R12	8977939-277	Resistor, fixed, film, 7500 ohms, $\frac{1}{4}$ w, 1%
1	R13	RL42AD680J	Resistor, fixed, film, 68 ohms, 2 w, 5% (MIL-R-22684)
1	R14	8977940-213	Resistor, fixed, film, 1620 ohms, $\frac{1}{2}$ w, 1%
1	R15	8977940-97	Resistor, fixed, film, 100 ohms, $\frac{1}{2}$ w, 1%
1	R16	8977940-97	Resistor, fixed, film, 100 ohms, $\frac{1}{2}$ w, 1%
1	R17	RC42GF561K	Resistor, fixed, composition, 560 ohms, 2 w, 10% (MIL-R-11)
1	R18	2180932-1	Resistor, fixed, film, 178 ohms, 2 w, 0. 5%
1	R19	2180932-1	Resistor, fixed, film, 178 ohms, 2 w, 0. 5%
1	R20	2180932-1	Resistor, fixed, film, 178 ohms, 2 w, 0. 5%
1	R21	2180932-1	Resistor, fixed, film, 178 ohms, 2 w, 0. 5%
1	8	2160180-1	Board, printed circuit
1	11	826690B-755	Stiffener
1	12	8717245-1	Guide, lower
1	13	8717245-2	Guide, upper
4	14	8977887-1	Insulator, washer
2	15	2180896-1	Mounting pad, transistor
1	16	8983171-221	Lead, electrical, printed wiring
2	17	8983171-219	Lead, electrical, printed wiring
6	18	8983171-217	Lead, electrical, printed wiring
2	19	8983171-213	Lead, electrical, printed wiring
5	20	8983171-211	Lead, electrical, printed wiring
2	21	8983171-209	Lead, electrical, printed wiring
2	22	8983171-207	Lead, electrical, printed wiring
1	23	8983171-215	Lead, electrical, printed wiring
8	24	2010105-20	Wire, copper, tinned, 0. 032 dia (16 in. lg)

Table 4. Digit Driver (Module 755) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
2	25	8936316-1	Pin extractor
1 set	26	2016075-1	Staking compound
1	27	8914385-9	Screw, machine, pan head, no.4, 40 x 0. 375 lg
2	28	8954980-5	Screw, machine, flat head, 100°, no. 40 x 0. 25 lg
6	29	8954980-9	Screw, machine, flat head, 100°, no. 40 x 0. 375 lg
5	31	8811181-109	Nut, hex, lock, no. 4
3	32	AN 960-C4	Washer, flat, no. 4



COMPONENT & ITEM	MTG LG
ITEM 22	.4
ITEM 21	.5
ITEM 20	.6
C1 & C2	1.9
C5	2.2
CR1, CR2, CR3, CR5 THRU CR12, CR14 THRU CR18, ITEM 19	.7
R1, R2, R11, R12, ITEM 23	.8
R4, R5, R6, R14, R15, R16, R17, ITEM 17	1.0
R7, R8, R9, R10, R18, R19 R20 R21	2.5
R3, R13	1.2
ITEM 16, CR13, CR4	1.1
ITEM 18	.9

(1) FINISH: VARNISH, MOISTURE & FUNGUS RESISTANT MIL-V-173, TYPE II APPLY PER TREATMENT MIL-T-152 (RCA 1980763)

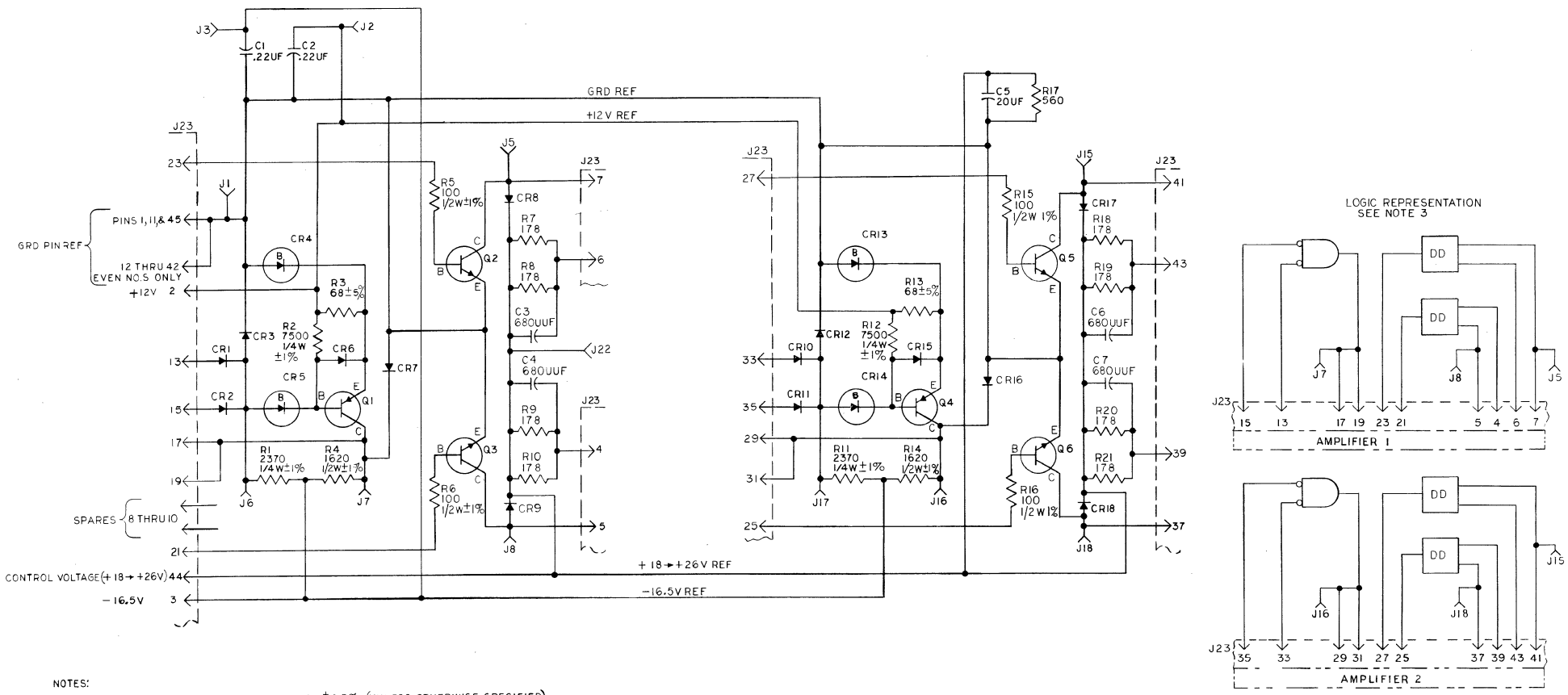
NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. ASSEMBLE & DIP SOLDER PER WORKMANSHIP SPEC RCA96408.
3. ALL REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
4. MARK SERIAL NUMBER IN BLOCK PROVIDED WITH RCA 8910532-4 (BLACK).
5. APPLY ITEM 26 (STAKING COMPOUND) PER MF6 SPEC RCA 2020342.
6. SILK SCREEN PER MARKING SPECIFICATION RCA 96410.
~~7. CLINCH ALL LEADS HORIZONTALLY FOR HORIZONTAL COMPONENTS AND VERTICAL FOR VERTICAL COMPONENTS IN DIRECTION OF GREATEST PAD EXPOSURE.~~

SECTION A-A
ENLARGED
TYPICAL Q2, Q3, Q5 & Q6

SECTION B B
ENLARGED
TYPICAL Q1 & Q4

SECTION C C
2/1 SCALE
TYPICAL R7, R8, R9, R10 R18, R19, R20 & R21

Figure 2. Digit Driver (Module MD755), Assembly Drawing



NOTES:

1. RESISTANCE VALUES ARE IN OHMS 2W ±0.5% (UNLESS OTHERWISE SPECIFIED)
2. SYMBOL FOR ZENER DIODE
   EXAMPLE
3. LOGIC REPRESENTATION OF INPUT-OUTPUT CONNECTIONS ARE FOR REFERENCE. "DD" MEANS DIGIT DRIVER.
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE REFERENCE DESIGNATION WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

Figure 3. Digit Driver (Module MD755), Schematic Diagram

ONE-SHOT (MODULE MD756)

RCA 2160189-501

DESCRIPTION

The MD756 module contains two identical one-shots, two regulated power supplies, and two line filter capacitors. The MD756 module produces a positive-going output pulse for a negative-going input trigger. The pulse width can be varied by selecting combinations of eight fixed capacitance values.

CIRCUIT ANALYSIS

The two one-shots are identical and independent, therefore only one circuit is described.

ONE-SHOT STABLE STATE

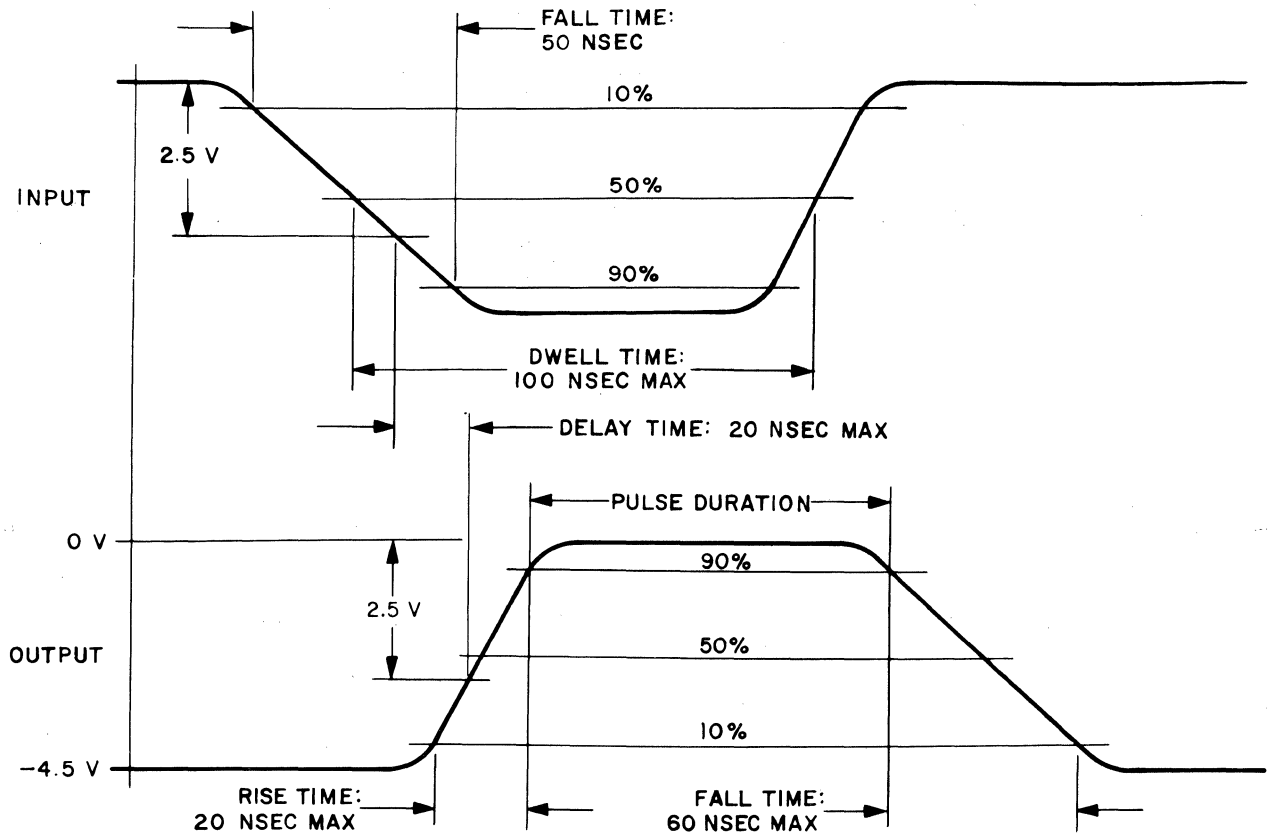
In the stable state transistors Q3 and Q5 are cut off, and transistor Q1 is in saturation. The base voltage of transistor Q3 is maintained at a slight positive voltage by current flow through resistors R4 and R12. The collector of transistor Q3 is clamped to -6.8 v by current flow through resistor R11 and diode CR9. The collector of transistor Q3 is coupled to the junction of diode CR3 and resistor R5 through one or more of capacitors C1 through C9, which form the timing capacitor for the one-shot. The base voltage of transistor Q1 is controlled by current flow through variable resistor R6, thermistor RT1, resistor R5, diode CR3, and resistor R1. In the stable state, the base voltage is near -4 v and diode CR1 is back-biased. The collector of saturated transistor Q1 is near 0 v, and diode CR13 is reverse biased. The base voltage of transistor Q5 is maintained at a slight positive potential by current flow through resistors R13 and R14. The collector of transistor Q5 is clamped to -4.7 v by current flow through resistor R20 and diode CR14.

ONE-SHOT UNSTABLE STATE

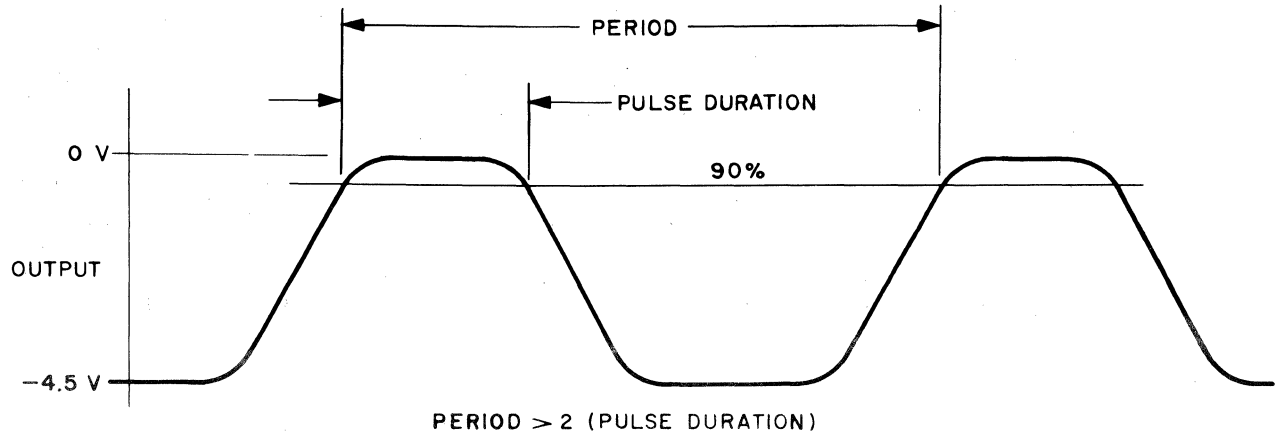
A negative-going level change applied to the input is differentiated by capacitor C20 and resistor R3, and causes current to flow from the base of transistor Q3 through diode CR7 and resistor R3. The base current starts transistor Q3 transition from cutoff to saturation. Transistor Q3 collector voltage rises from the -6.8 v clamped level toward 0 v. This positive-going change is coupled through the timing capacitors to the junction of resistor R5 and diode CR3, driving the junction to a more positive potential back-biasing diode CR3. The base voltage of transistor Q1 is pulled positive by resistor R1 until diode CR1 conducts, clamping the base voltage to 0 v. Transistor Q1 is driven from saturation to cutoff. The collector voltage of transistor Q1 goes negative until it is clamped at -4.7 v by current flow through resistor R19 and diode CR13. This negative-going pulse is coupled through resistor R13 and capacitor C25 to the base of transistor Q5, which becomes forward-biased, causing transistor Q5 to be saturated. The output voltage rises from the clamped -4.7 v level to near 0 v. The negative-going pulse output of transistor Q1 is also coupled to the base of transistor Q3 through resistor R12 and capacitor C21, holding transistor Q3 in saturation. As the timing capacitor discharges through resistor R5, thermistor RT1, and variable resistor R6, transistor Q1 once again becomes forward-biased and saturated. The collector voltage rises from the -4.7 v level to near 0 v, and drives transistor Q3 and Q5 to cutoff. The discharge period is primarily determined by the size of the capacitor and the discharge circuit.

VOLTAGE REGULATORS AND FILTERS

Resistor R23 and Zener diode CR11 form a voltage-regulated power source for -6.8 v. Resistor R24 and Zener diode CR14, form a voltage-regulated power source for -4.7 v. Capacitors C24 and C19 are line filter capacitors for the -16.5 v source and +12 v source, respectively.



A. WAVEFORMS



B. DUTY CYCLE

4146-20

Figure 1. MD756 Module, Waveforms and Timing

CIRCUIT CHARACTERISTICS

The one-shot is triggered by a negative-going voltage change greater than 3.25 v and less than 9.0 v.

Output logic levels are described in Table 1. Pulse duration for various combinations of timing capacitors are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2 v, -0.6 v)	0 ma
1	0.0 v (+0.0 v, -0.5 v)	32 ma maximum OUT

LOADING

Each one-shot is capable of driving a maximum of eight MD659 module gates. The input to each one-shot is approximately equivalent to one MD659 module gate.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 2.

Table 2. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	5.7 ma minimum
	6.4 ma nominal
	7.0 ma maximum
-16.5 v ± 5%	144 ma minimum
	160 ma nominal
	175 ma maximum

WIRING

Table 3 lists maximum length of wire which may be used.

Table 3. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	96 Inches
Single Load	120 Inches

PARTS LIST

Table 4 lists parts for the MD756 module. The MD756 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 4. One-Shot (Module MD756) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	8412778-59	Capacitor, fixed, tantalum electrolytic, 33 μf, ±10%, 35 vdc
1	C2	CY10C390G	Capacitor, fixed, glass dielectric, 39 pf, ±2%, 500 vdc (MIL-C-11272)
1	C3	CY10C820G	Capacitor, fixed, glass dielectric, 82 pf, ±2%, 500 vdc (MIL-C-11272)
1	C4	CY10C151G	Capacitor, fixed, glass dielectric, 150 pf, ±2%, 500 vdc (MIL-C-11272)
1	C5	CY15C331G	Capacitor, fixed, glass dielectric, 330 pf, ±2%, 500 vdc (MIL-C-11272)
1	C6	CY15C681G	Capacitor, fixed, glass dielectric, 680 pf, ±2%, 300 vdc (MIL-C-11272)
1	C7	CY20C152G	Capacitor, fixed, glass dielectric, 1500 pf, ±2%, 500 vdc (MIL-C-11272)
1	C8	CY30C103G	Capacitor, fixed, glass dielectric, 0.01 μf, ±2%, 300 vdc (MIL-C-11272)
1	C9	CY20C392G	Capacitor, fixed, glass dielectric, 3900 pf, ±2%, 300 vdc (MIL-C-11272)
1	C10	8412778-59	Capacitor, fixed, tantalum electrolytic, 33 μf, ±10%, 35 vdc
1	C11	CY10C390G	Capacitor, fixed, glass dielectric, 39 pf, ±2%, 500 vdc (MIL-C-11272)
1	C12	CY10C820G	Capacitor, fixed, glass dielectric, 82 pf, ±2%, 500 vdc (MIL-C-11272)
1	C13	CY10C151G	Capacitor, fixed, glass dielectric, 150 pf, ±2%, 500 vdc (MIL-C-11272)
1	C14	CY15C331G	Capacitor, fixed, glass dielectric, 330 pf, ±2%, 500 vdc (MIL-C-11272)
1	C15	CY15C681G	Capacitor, fixed, glass dielectric, 680 pf, ±2%, 300 vdc (MIL-C-11272)
1	C16	CY20C152G	Capacitor, fixed, glass dielectric, 1500 pf, ±2%, 500 vdc (MIL-C-11272)
1	C17	CY20C392G	Capacitor, fixed, glass dielectric, 3900 pf, ±2%, 300 vdc (MIL-C-11272)
1	C18	CY30C103G	Capacitor, fixed, glass dielectric, 0.01 μf, ±2%, 300 vdc (MIL-C-11272)

Table 4. One-Shot (Module MD756) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C19	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, ±10%, 100 vdc (MIL-C-25)
1	C20	8936033-205	Capacitor, fixed, mica dielectric, 47 pf, ±5%, 500 vdc
1	C21	8936033-201	Capacitor, fixed, mica dielectric, 22 pf, ±5%, 500 vdc
1	C22	8936033-205	Capacitor, fixed, mica dielectric, 47 pf, ±5%, 500 vdc
1	C23	8936033-201	Capacitor, fixed, mica dielectric, 22 pf, ±5%, 500 vdc
1	C24	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, ±10%, 100 vdc (MIL-C-25)
1	C25	8936033-203	Capacitor, fixed, mica dielectric, 33 pf, ±5%, 500 vdc
1	C26	8936033-203	Capacitor, fixed, mica dielectric, 33 pf, ±5%, 500 vdc
1	CR1	8935924-1	Semiconductor device, diode, type 24
1	CR2	8935924-1	Semiconductor device, diode, type 24
1	CR3	USN 1N914	Semiconductor device, diode, type 1N914 (MIL-S-19500/116)
1	CR5	USN 1N914	Semiconductor device, diode, type 1N914 (MIL-S-19500/116)
1	CR7	8935924-1	Semiconductor device, diode, type 24
1	CR8	8935924-1	Semiconductor device, diode, type 24
1	CR9	8935924-1	Semiconductor device, diode, type 24
1	CR10	8935924-1	Semiconductor device, diode, type 24
1	CR11	2180823-1	Semiconductor device, diode, type 1N754
1	CR12	2180822-1	Semiconductor device, diode
1	CR13	8935924-1	Semiconductor device, diode, type 24
1	CR14	8935924-1	Semiconductor device, diode, type 24
1	CR15	8935924-1	Semiconductor device, diode, type 24
1	CR16	8935924-1	Semiconductor device, diode, type 24
1	J1	8934595-3	Jack, tip, printed circuit (black)
1	J2	8934595-2	Jack, tip, printed circuit (red)
1	J3	8934595-7	Jack, tip, printed circuit (blue)
1	J4	8934595-5	Jack, tip, printed circuit (green)

Table 4. One-Shot (Module MD756) Parts List (cont)

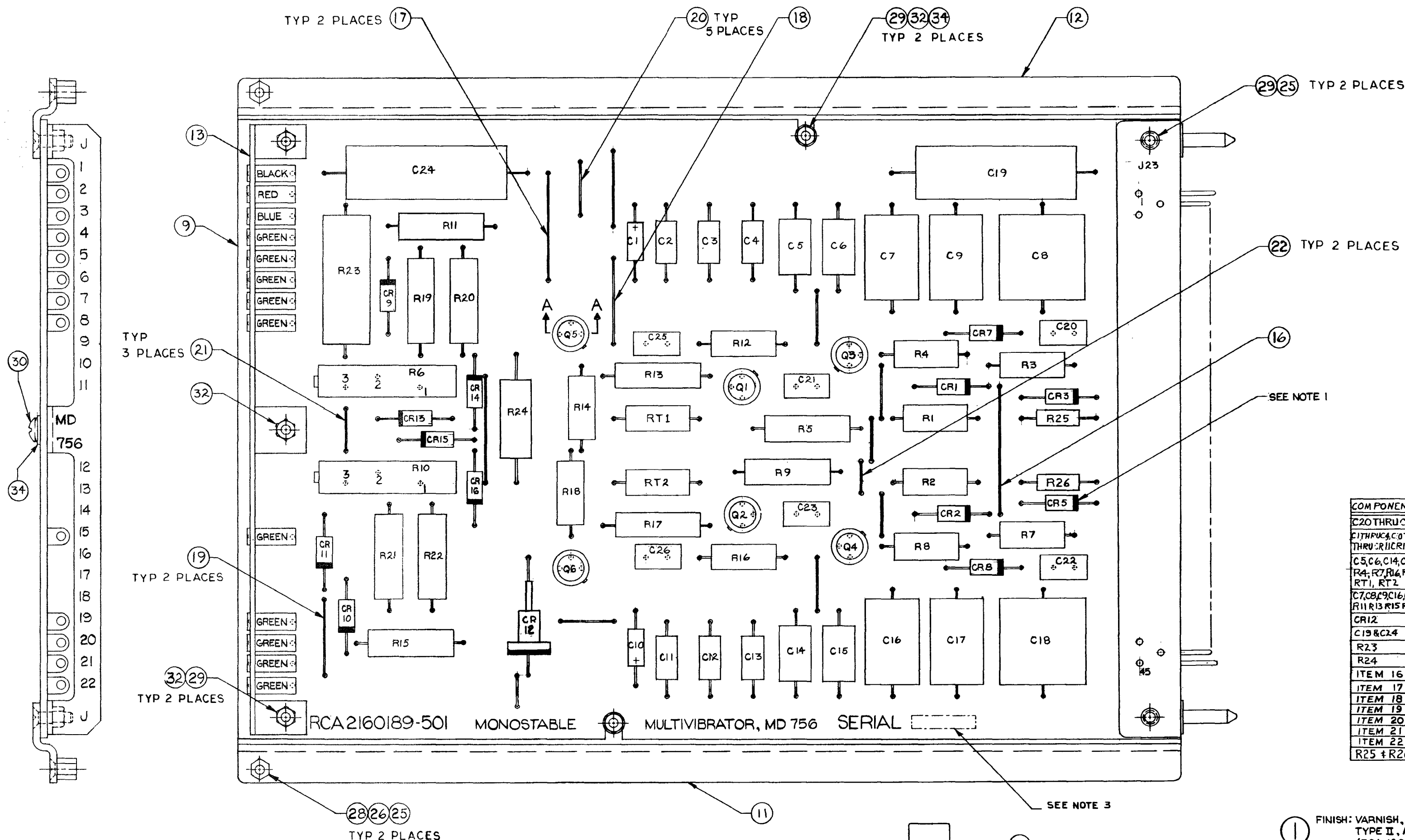
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	J5	8934595-5	Jack, tip, printed circuit (green)
1	J6	8934595-5	Jack, tip, printed circuit (green)
1	J7	8934595-5	Jack, tip, printed circuit (green)
1	J8	8934595-5	Jack, tip, printed circuit (green)
1	J15	8934595-5	Jack, tip, printed circuit (green)
1	J19	8934595-5	Jack, tip, printed circuit (green)
1	J20	8934595-5	Jack, tip, printed circuit (green)
1	J21	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-5	Jack, tip, printed circuit (green)
1	J23	8716037-1	Connector, receptacle, electrical (male)
1	Q1	2180801-1	Semiconductor device, transistor
1	Q2	2180801-1	Semiconductor device, transistor
1	Q3	2180801-1	Semiconductor device, transistor
1	Q4	2180801-1	Semiconductor device, transistor
1	Q5	2180801-1	Semiconductor device, transistor
1	Q6	2180801-1	Semiconductor device, transistor
1	R1	8977939-317	Resistor, fixed, film, 19.6 k ohms, 1/4 w, ±1%
1	R2	8977939-317	Resistor, fixed, film, 19.6 k ohms, 1/4 w, ±1%
1	R3	8977939-209	Resistor, fixed, film, 1470 ohms, 1/4 w, ±1%
1	R4	8977939-301	Resistor, fixed, film, 13.3 k ohms, 1/4 w, ±1%
1	R5	RN65C1101F	Resistor, fixed, film, 1100 ohms, 1/4 w, ±1% (MIL-R-10509)
1	R6	8954937-57	Resistor, variable, subminiature, wirewound, 0.8 w, ±10%, 10 to 1000 ohms
1	R7	8977939-209	Resistor, fixed, film, 1470 ohms, 1/4 w, ±1%
1	R8	8977939-301	Resistor, fixed, film, 13.3 k ohms, 1/4 w, ±1%
1	R9	RN65C1101F	Resistor, fixed, film, 1100 ohms, 1/4 w, ±1% (MIL-R-10509)
1	R10	8954937-57	Resistor, variable, subminiature, wirewound, 0.8 w, ±10%, 10 to 1000 ohms

Table 4. One-Shot (Module MD756) Parts List (cont)

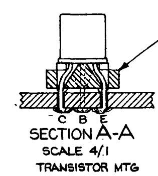
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R11	8977940-205	Resistor, fixed, film, 1330 ohms, 1/2 w, ±1%
1	R12	8977939-221	Resistor, fixed, film, 1960 ohms, 1/4 w, ±1%
1	R13	8977940-193	Resistor, fixed, film, 1 k ohms, 1/2 w, ±1%
1	R14	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R15	8977940-205	Resistor, fixed, film, 1330 ohms, 1/2 w, ±1%
1	R16	8977939-221	Resistor, fixed, film, 1960 ohms, 1/4 w, ±1%
1	R17	8977940-193	Resistor, fixed, film, 1 k ohms, 1/2 w, ±1%
1	R18	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R19	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R20	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R21	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R22	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R23	RN75B3480F	Resistor, fixed, film, 348 ohms, 1 w, ±1% (MIL-R-10509)
1	R24	RL42AD201J	Resistor, fixed, film, 200 ohms, 2 w, ±5% (MIL-R-22684)
1	R25	RC20GF105K	Resistor, fixed, composition, 1.0 megohm, 1/2 w, ±10% (MIL-R-11)
1	R26	RC20GF105K	Resistor, fixed, composition, 1.0 megohm, 1/2 w, ±10% (MIL-R-11)
1	RT1	2180888-27	Resistor, thermal, 150 ohms, 1/4 w, ±5%
1	RT2	2180888-27	Resistor, thermal, 150 ohms, 1/4 w, ±5%
1	9	2160180-3	Board, printed circuit
1	11	8717245-1	Guide, module (lower)
1	12	8717245-2	Guide, module (upper)
1	13	8266908-756	Stiffener
6	14	2180896-1	Pad, transistor mounting
1	16	8983171-223	Lead, electrical, printed wiring
2	17	8983171-219	Lead, electrical, printed wiring

Table 4. One-Shot (Module MD756) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	18	8983171-215	Lead, electrical, printed wiring
2	19	8983171-213	Lead, electrical, printed wiring
5	20	8983171-209	Lead, electrical, printed wiring
3	21	8983171-207	Lead, electrical, printed wiring
2	22	8983171-205	Lead, electrical, printed wiring
1 set	25	2016075-1	Staking compound
2	26	8936316-1	Pin extractor
2	28	8954980-5	Screw, machine, flat head, 100°, no. 4 (0.112) 40 x 0.25 lg
6	29	8954980-9	Screw, machine, flat head, 100°, no. 4 (0.112) 40 x 0.375 lg
1	30	8914385-9	Screw, machine, pan head, no. 4 (0.112) 40 x 0.375 lg
5	32	8811181-109	Nut, hex, lock, no. 4
3	34	AN960-C4	Washer, flat, no. 4



COMPONENT & ITEMS	MTG LG
C20 THRU C23, C25, C26	0.2
C1 THRU C4, C10 THRU C13 CR1 THRU CR11 CR13 TO CR16 R6, R10	0.7
C5, C6, C14, C15, R1 THRU R4, R7, R16, R8 R18 R12 R14 RT1, RT2	0.8
C7, C8, C9, C16, C17, C18, R5, R9 R11 R13 R15 R17 R19 THRU R22	1.0
CR12	1.1
C19 & C24	1.9
R23	1.4
R24	1.2
ITEM 16	1.2
ITEM 17	1.0
ITEM 18	.8
ITEM 19	.7
ITEM 20	.5
ITEM 21	.4
ITEM 22	.3
R25 + R26	0.7

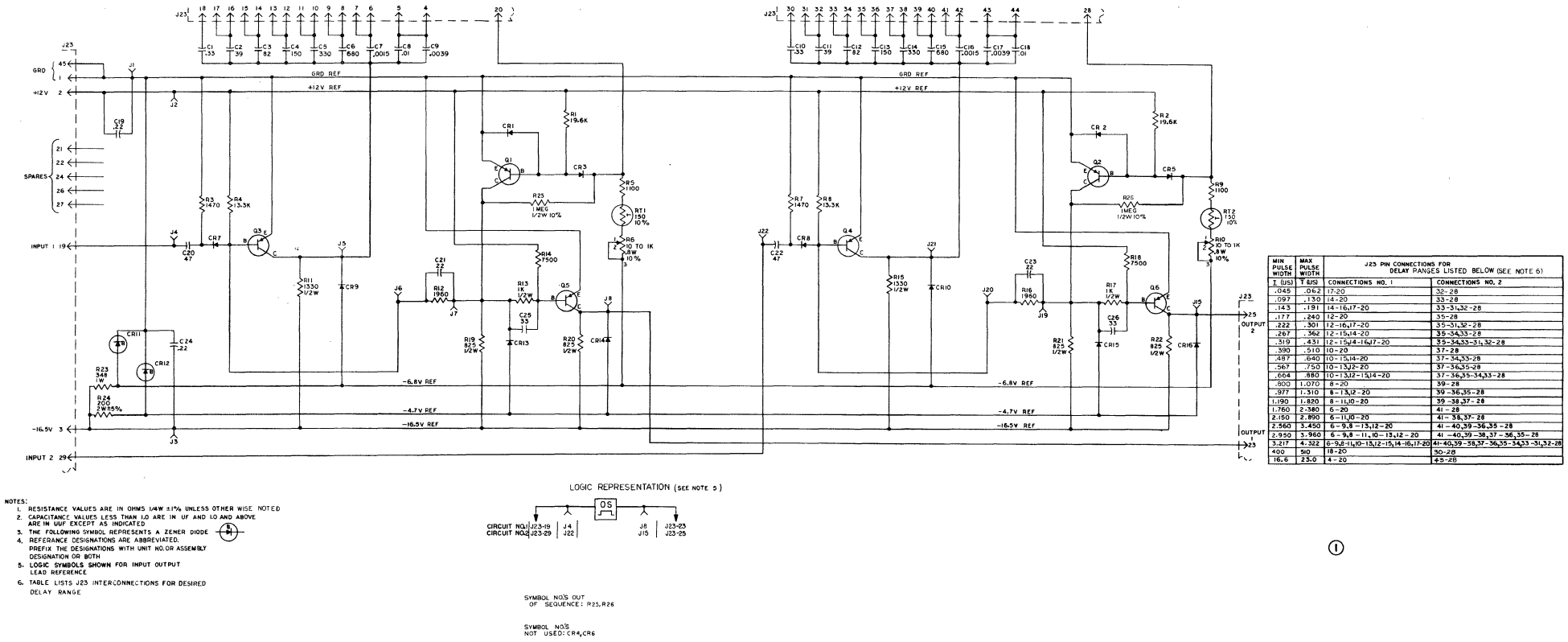


(1) FINISH: VARNISH, MOISTURE & FUNGUS RESISTANT, MIL-V-173, TYPE II, APPLY PER TREATMENT MIL-T-152 (RCA 1980763)

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. APPLY ITEM 25 (STAKING COMPOUND) PER RCA MFG SPEC 202342.
3. MARK SERIAL NUMBER IN BLOCK PROVIDED WITH RCA 8910532-4 (BLACK).
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NO. OR ASSEMBLY DESIGNATION OR BOTH.
5. + INDICATES ANODE OF CAPACITOR (C1, C10).
6. ASSEMBLE & DIP SOLDER PER RCA WORKMANSHIP SPEC 96408.
7. SILK SCREEN PER RCA MARKING SPEC. 96410.
8. ~~CLINCH ALL LEADS HORIZONTALLY FOR HORIZONTALLY COMPONENTS AND VERTICALLY FOR VERTICAL COMPONENTS IN DIRECTION OF GREATEST PAD EXPOSURE.~~

Figure 2. One-Shot (Module MD756), Assembly Drawing



MIN PULSE WIDTH	MAX PULSE WIDTH	J23 PIN CONNECTIONS FOR DELAY RANGES LISTED BELOW (SEE NOTE 6)	
T (US)	T (US)	CONNECTIONS NO. 1	CONNECTIONS NO. 2
.045	.062	17-20	32-28
.097	.130	14-20	33-28
.143	.191	14-16,17-20	33-31,32-28
.177	.240	12-20	35-28
.222	.301	12-16,17-20	35-31,32-28
.267	.362	12-15,14-20	35-34,33-28
.319	.431	12-15,14-16,17-20	35-34,33-31,32-28
.390	.510	10-20	37-28
.487	.640	10-15,14-20	37-34,33-28
.567	.750	10-13,12-20	37-36,35-28
.664	.880	10-13,12-15,14-20	37-36,35-34,33-28
.800	1.070	8-20	39-28
.977	1.310	8-13,12-20	39-36,35-28
1.190	1.820	8-11,10-20	39-38,37-28
1.760	2.380	6-20	41-28
2.150	2.890	6-11,10-20	41-38,37-28
2.560	3.450	6-9,8-13,12-20	41-40,39-36,35-28
2.950	3.960	6-9,8-11,10-13,12-20	41-40,39-38,37-36,35-28
3.217	4.322	6-9,8-11,10-13,12-15,14-16,17-20	41-40,39-38,37-36,35-34,33-31,32-28
400	540	18-20	30-28
16.6	25.0	4-20	45-28

NOTES:
1. RESISTANCE VALUES ARE IN OHMS 1/4W ±1% UNLESS OTHER WISE NOTED
2. CAPACITANCE VALUES LESS THAN 1.0 ARE IN UF AND 1.0 AND ABOVE ARE IN UUF EXCEPT AS INDICATED
3. THE FOLLOWING SYMBOL REPRESENTS A ZENER DIODE
4. REFERANCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NO. OR ASSEMBLY DESIGNATION OR BOTH
5. LOGIC SYMBOLS SHOWN FOR INPUT OUTPUT LEAD REFERENCE
6. TABLE LISTS J23 INTERCONNECTIONS FOR DESIRED DELAY RANGE

Figure 3. One-Shot (Module MD756), Schematic Diagram

SELECTOR PAIR (MODULE MD757)

RCA 2160195-501

DESCRIPTION

The MD757 module contains two identical selector pair circuits. These circuits control direction of current flow through the constant current power supply, the diode matrix on module MD754, and the cores of the magnetic core memory. For one set of input conditions, current flows through the associated memory cores in one direction; for another set of input conditions current flows through the associated memory cores in the opposite direction; for other sets of input conditions, no current flows through the associated memory cores.

CIRCUIT ANALYSIS

The two selector pair circuits are identical, therefore only one is described in detail. Diodes CR16, CR22, CR26 and CR30, and transistor Q5 form a four-input AND gate for negative inputs. When all inputs are at the logical 0 level (-4. 5 v), transistor Q1 is saturated, and its collector voltage is clamped at -4. 5 v by current flow through resistor R18 and Zener diode CR18. Diode CR12 clamps the junction of transformer T1 and resistor R10 near -4. 7 v, to limit current flow through transistor Q1. The emitter voltage, which is near the -4. 7 v level, is applied to diodes CR4 and CR17. These diodes are inputs to two-input gates for transistors Q1 and Q7.

If transistor Q5 is saturated and the input to diode CR2 is at the logical 1 level (0 v), transistor Q1 is cut off. If the input to diode CR8 is driven to the logical 0 level (-4. 5 v), transistor Q1 is driven to saturation, and a pulse of current flows through resistor R10, the primary of transformer T1, and transistor Q2. The current induced in the secondary of transformer T1 drives transistor Q2 to saturation, and current flows from the load through transistor Q2 to the current source.

If transistor Q1 is saturated and the input to diode CR32 is at the logical 1 level (0 v), transistor Q7 is cut off. If the input to diode CR32 is driven to the logical 0 level (-4. 5 v), transistor Q7 is driven to saturation. The collector of transistor Q7 is coupled to the base of transistor Q9 through resistor R25. Transistor Q9 is driven to saturation, and current flows through transistor Q9, the load, and the current source.

Two selector pair circuits are connected through a diode matrix on module MD754. To send a current pulse through a load, the address gates of both circuits are enabled. The SELECTOR A INPUT of one circuit and the SELECTOR B INPUT of the other circuit are enabled, providing one complete path. When the other SELECTOR A INPUT and SELECTOR B INPUT are enabled, a path through the load is provided for current flow in the opposite direction.

Pin 32 is a direct output to the load. When pin 31 is used, resistors R11 and R15 limit current flow. When pin 30 is used, inductor L1 limits transient current flow and resistors R11 and R15 limit steady-state current flow. When a full core memory load is driven, the load is connected to pin 32 and resistor R11 and inductor L1 are not in the circuit. Resistor R4 is a high-resistance bias for the output. Capacitors C3, C1, and C2 are line filter capacitors for the +E voltage in the constant current power supply, the +12 v power supply, and the -16. 5 v power supply, respectively.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Tables 1, 2, and 3. Output logic levels are described in Table 4 and Table 5. Input waveforms are illustrated in Figure 1.

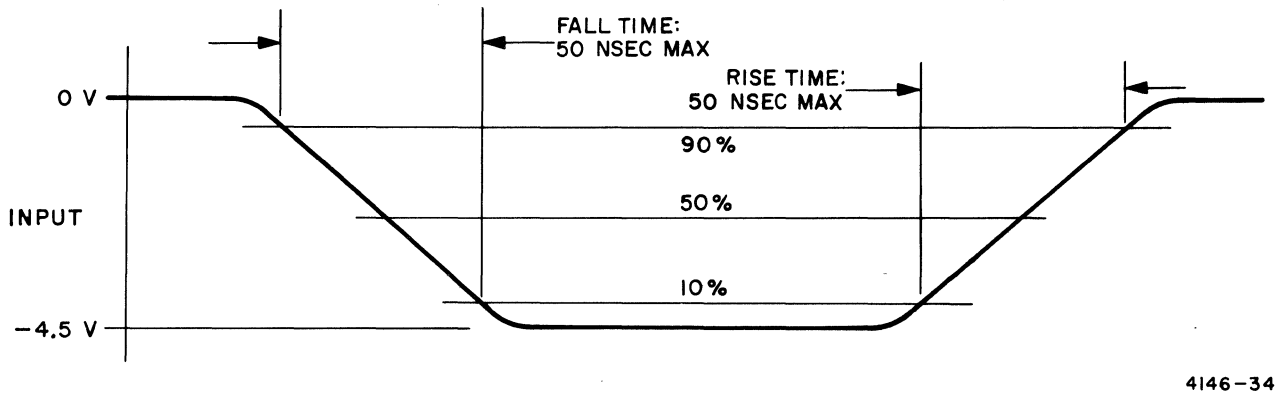


Figure 1. MD757 Module, Input Waveform

Table 1. Address Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2 v, -1.2 v)	0 ma
1	0.0 v (+0.2 v, -0.5 v)	1.8 ma maximum

Table 2. Selector A Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2 v, -1.2 v)	0 ma
1	0.0 v (+0.2 v, -0.5 v)	5.6 ma maximum

Table 3. Selector B Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2 v, -1.2 v)	0 ma
1	0.0 v (+0.2 v, -1.2 v)	5.3 ma maximum

Table 4. Selector A Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
ON	0 to +24 v	0 to 250 ma
OFF	0 to +24 v	0 ma

Table 5. Selector B Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
ON	0 to +1.5 v	0 to 300 ma
OFF	0 to +24 v	0 ma

LOADING

Each address input is equivalent to one-half the load of an MD659 gate. Each selector input is equivalent to 1.5 times the load of an MD659 gate.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 6.

Table 6. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	187 ma maximum
-16.5 v ± 5%	318 ma maximum

PARTS LIST

Table 7 lists parts for the MD757 module. The MD757 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 7. Selector Pair (Module MD757) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CP09A1KB224K	Capacitor, fixed, paper dielectric, 0.22 μf, 100 vdc (MIL-C-25)
1	C2	CP09A1KB224K	Capacitor, fixed, paper dielectric, 0.22 μf, 100 vdc (MIL-C-25)
1	C3	CP09A1KB224K	Capacitor, fixed, paper dielectric, 0.22 μf, 100 vdc (MIL-C-25)
1	CR1	2180822-1	Semiconductor device, diode
1	CR2	8935924-1	Semiconductor device, diode, type 24
1	CR3	8935924-1	Semiconductor device, diode, type 24
1	CR4	8935924-1	Semiconductor device, diode, type 24
1	CR5	2180821-1	Semiconductor device, diode, stabistor
1	CR6	8935924-1	Semiconductor device, diode, type 24

Table 7. Selector Pair (Module MD757) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR7	2180821-1	Semiconductor device, diode, stabistor
1	CR8	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR9	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR10	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR11	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR12	8935924-1	Semiconductor device, diode, type 24
1	CR13	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR14	8935924-1	Semiconductor device, diode, type 24
1	CR15	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR16	8935924-1	Semiconductor device, diode, type 24
1	CR17	8935924-1	Semiconductor device, diode, type 24
1	CR18	2180822-1	Semiconductor device, diode, type 1N691
1	CR19	8935924-1	Semiconductor device, diode, type 24
1	CR20	8935924-1	Semiconductor device, diode, type 24
1	CR21	2180822-1	Semiconductor device, diode
1	CR22	8935924-1	Semiconductor device, diode, type 24
1	CR23	USN 1N914	Semiconductor device, diode, type 1N914 (MIL-S-19500/116)
1	CR24	8935924-1	Semiconductor device, diode, type 24
1	CR25	USN 1N914	Semiconductor device, diode, type 1N914 (MIL-S-19500/116)
1	CR26	8935924-1	Semiconductor device, diode, type 24
1	CR27	8935924-1	Semiconductor device, diode, type 24
1	CR28	2180823-1	Semiconductor device, diode
1	CR29	2180823-1	Semiconductor device, diode
1	CR30	8935924-1	Semiconductor device, diode, type 24
1	CR31	8935924-1	Semiconductor device, diode, type 24
1	CR32	8935924-1	Semiconductor device, diode, type 24

Table 7. Selector Pair (Module MD757) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR33	8935924-1	Semiconductor device, diode, type 24
1	CR34	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	CR35	USN 1N691	Semiconductor device, diode, type 1N691 (MIL-S-19500/132)
1	J1	8934595-3	Jack, tip, printed circuit (black)
1	J2	8934595-2	Jack, tip, printed circuit (red)
1	J3	8934595-7	Jack, tip, printed circuit (blue)
1	J4	8934595-5	Jack, tip, printed circuit (green)
1	J5	8934595-5	Jack, tip, printed circuit (green)
1	J10	8934595-5	Jack, tip, printed circuit (green)
1	J11	8934595-5	Jack, tip, printed circuit (green)
1	J19	8934595-5	Jack, tip, printed circuit (green)
1	J20	8934595-5	Jack, tip, printed circuit (green)
1	J21	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-5	Jack, tip, printed circuit (green)
1	J23	8716037-1	Connector, receptacle, electrical (male)
1	L1	8701588-249	Coil, molded, rf choke, 10 μh,$\pm$10%
1	L2	8701588-249	Coil, molded, rf choke, 10 μh,$\pm$10%
1	Q1	2180801-2	Semiconductor device, transistor
1	Q2	2180804-1	Semiconductor device, transistor
1	Q3	2180801-2	Semiconductor device, transistor
1	Q4	2180804-1	Semiconductor device, transistor
1	Q5	2180801-2	Semiconductor device, transistor
1	Q6	2180801-2	Semiconductor device, transistor
1	Q7	2180801-2	Semiconductor device, transistor
1	Q8	2180801-2	Semiconductor device, transistor
1	Q9	2180804-1	Semiconductor device, transistor
1	Q10	2180804-1	Semiconductor device, transistor

Table 7. Selector Pair (Module MD757) Parts List (cont)

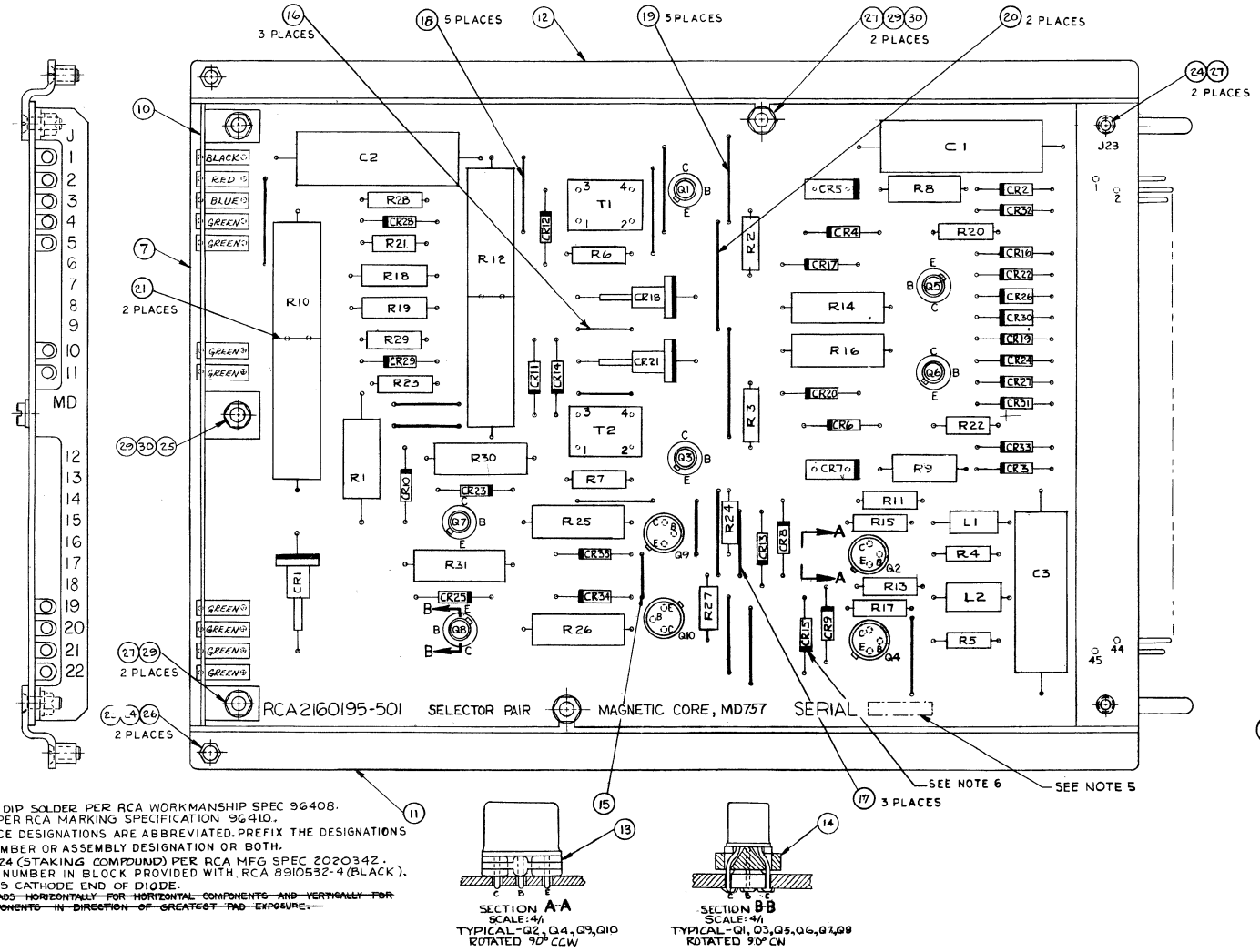
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R1	RL42AD680J	Resistor, fixed, film, 68 ohms, 2 w, ±5% (MIL-R-22684)
1	R2	8977933-329	Resistor, fixed, film, 26.1 k ohms, 1/8 w, ±1%
1	R3	8977933-329	Resistor, fixed, film, 26.1 k ohms, 1/8 w, ±1%
1	R4	RC20GF103K	Resistor, fixed, composition, 10 k ohms, 1/2 w, ±10% (MIL-R-11)
1	R5	RC20GF103K	Resistor, fixed, composition, 10 k ohms, 1/2 w, ±10% (MIL-R-11)
1	R6	8977933-97	Resistor, fixed, film, 100 ohms, 1/8 w, ±1%
1	R7	8977933-97	Resistor, fixed, film, 100 ohms, 1/8 w, ±1%
1	R8	8977939-241	Resistor, fixed, film, 3160 ohms, 1/4 w, ±1%
1	R9	8977939-241	Resistor, fixed, film, 3160 ohms, 1/4 w, ±1%
1	R10	RN80B1780F	Resistor, fixed, film, 78 ohms, 2 w, ±1% (MIL-R-10509)
1	R11	8977933-1	Resistor, fixed, film, 10 ohms, 1/8 w, ±1%
1	R12	RN80B1780F	Resistor, fixed, film, 178 ohms, 2 w, ±1% (MIL-R-10509)
1	R13	8977933-1	Resistor, fixed, film, 10 ohms, 1/8 w, ± 1%
1	R14	8977940-193	Resistor, fixed, film, 1 k ohms, 1/2 w, ±1%
1	R15	8977933-1	Resistor, fixed, film, 10 ohms, 1/8 w, ±1%
1	R16	8977940-193	Resistor, fixed, film, 1 k ohms, 1/2 w, ±1%
1	R17	8977933-1	Resistor, fixed, film, 10 ohms, 1/8 w, ±1%
1	R18	RL32AD241J	Resistor, fixed, film, 240 ohms, 1 w, ±5% (MIL-R-22684)
1	R19	RL32AD241J	Resistor, fixed, film, 240 ohms, 1 w, ±5% (MIL-R-22684)
1	R20	8977933-289	Resistor, fixed, film, 10 k ohms, 1/8 w, ±1%
1	R21	8977933-277	Resistor, fixed, film, 7.5 k ohms, 1/8 w, ±1%
1	R22	8977933-289	Resistor, fixed, film, 10 k ohms, 1/8 w, ±1%
1	R23	8977933-277	Resistor, fixed, film, 7.5 k ohms, 1/8 w, ±1%
1	R24	RC20GF222K	Resistor, fixed, composition, 2200 ohms, 1/2 w, ±10% (MIL-R-11)
1	R25	8977940-93	Resistor, fixed, film, 90.9 ohms, 1/2 w, ±1%

Table 7. Selector Pair (Module MD757) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R26	8977940-93	Resistor, fixed, film, 90.9 ohms, 1/2 w, ±1%
1	R27	RC20GF222K	Resistor, fixed, composition, 2200 ohms, 1/2 w, ±10% (MIL-R-11)
1	R28	8977933-245	Resistor, fixed, film, 3480 ohms, 1/8 w, ±1%
1	R29	8977933-245	Resistor, fixed, film, 3480 ohms, 1/8 w, ±1%
1	R30	8977940-213	Resistor, fixed, film, 1620 ohms, 1/2 w, ±1%
1	R31	8977940-213	Resistor, fixed, film, 1620 ohms, 1/2 w, ±1%
1	T1	2180865-1	Transformer, pulse
1	T2	2180865-1	Transformer, pulse
1	7	2160180-5	Board, printed circuit
1	10	8266908-757	Stiffener
1	11	8717245-1	Guide, lower
1	12	8717245-2	Guide, upper
4	13	8977887-1	Insulator, washer
6	14	2180896-1	Mounting pad, transistor
1	15	8983171-207	Lead, electrical, printed wiring
3	16	8983171-209	Lead, electrical, printed wiring
3	17	8983171-211	Lead, electrical, printed wiring
5	18	8983171-213	Lead, electrical, printed wiring
5	19	8983171-215	Lead, electrical, printed wiring
2	20	8983171-219	Lead, electrical, printed wiring
2	21	2010105-20	Wire, copper, tinned 0.032 dia (1.6 in. lg)
2	23	8936316-1	Pin extractor
1 set	24	2016075-1	Staking compound
1	25	8914385-9	Screw, machine, pan head, no. 4 (0.112) 40 x 0.375 lg
2	26	8954980-5	Screw, machine, flat head, 100°, no. 4 (0.112) 40 x 0.25 lg

Table 7. Selector Pair (Module MD757) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
6	27	8954980-9	Screw, machine, flat head, 100°, no. 4 (0.112) 40 x 0.375 lg
5	29	8811181-109	Nut, hex, self locking, no. 4
3	30	AN960-C4	Washer, flat, no. 4



COMPONENT & ITEM	MTG LG
C1, C2, C3	1.9
CR1, CR18, CR21	1.1
CR2, CR3, CR4, CR6, CR8 THRU CR17, CR19, CR20, CR22 THRU CR35, ITEM 18	.7
L1, L2	.7
R10, R12	2.6
R2 THRU R7, R11, R13, R15, R17, R20 THRU R24, R27, R28, R29 ITEM 17	.6
R8, R9, R18, R19, ITEM 19	.8
R14, R16, R25, R26, R30, R31, ITEM 20	1.0
R1	1.2
ITEM 16	.5
ITEM 15	.4

(1) FINISH: VARNISH, MOISTURE & FUNGUS RESISTANT MIL-V-173, TYPE II APPLY PER TREATMENT MIL-T-152 (RCA 1980763)

NOTES:
1. ASSEMBLE & DIP SOLDER PER RCA WORKMANSHIP SPEC 96408.
2. SILK SCREEN PER RCA MARKING SPECIFICATION 9640.
3. ALL REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
4. APPLY ITEM 24 (STAKING COMPOUND) PER RCA MFG SPEC 2020342.
5. MARK SERIAL NUMBER IN BLOCK PROVIDED WITH RCA 8910532-4 (BLACK).
6. BAR INDICATES CATHODE END OF DIODE.
7. ~~CLINCH ALL LEADS HORIZONTALLY FOR HORIZONTAL COMPONENTS AND VERTICALLY FOR VERTICAL COMPONENTS IN DIRECTION OF GREATEST PAD EXPOSURE.~~

Figure 2. Selector Pair (Module MD757), Assembly Drawing

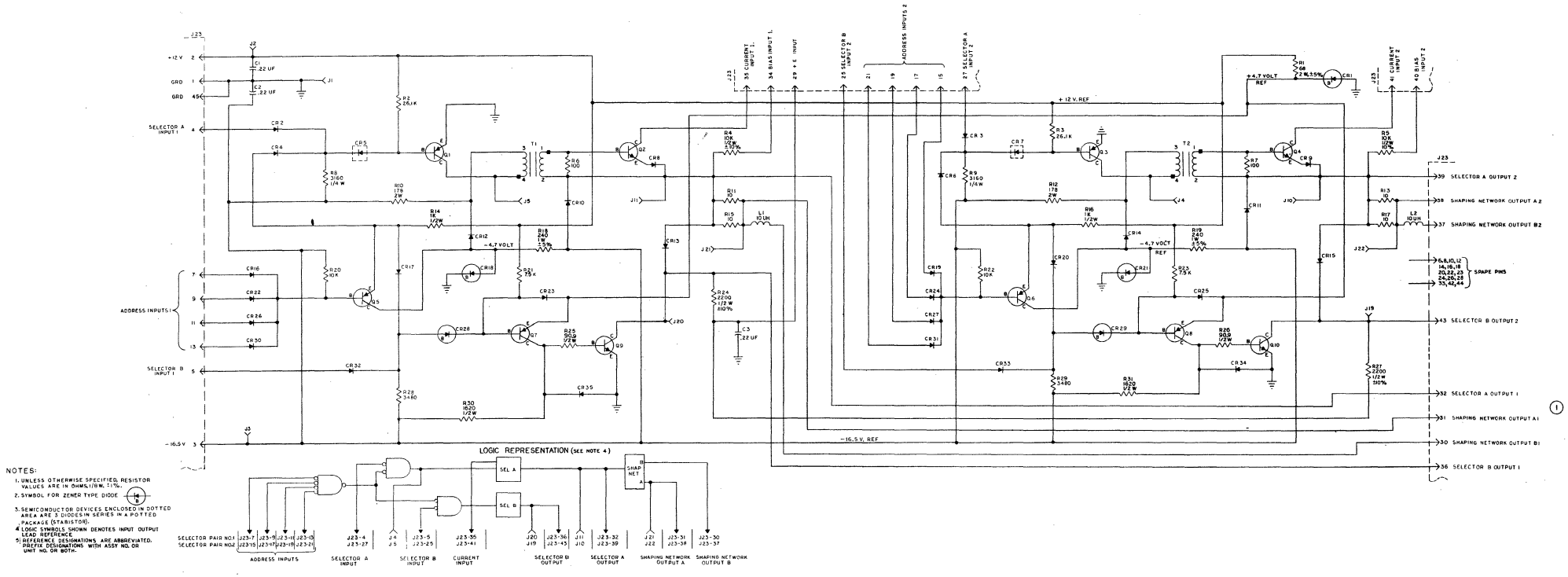


Figure 3. Selector Pair (Module MD757), Schematic Diagram

DIFFERENTIAL PREAMPLIFIER (MODULE MD758)

RCA 2160721-501

DESCRIPTION

The MD758 module contains two identical differential preamplifier circuits, a regulated power supply, and three line filter capacitors. A differential preamplifier circuit receives a pulse output from the Magnetic Core Memory, and provides amplified pulses to the sense amplifiers of module MD759.

CIRCUIT ANALYSIS

The two differential preamplifier circuits are identical, therefore only one circuit is described in detail. The input voltage applied between pins 9 and 11 varies from 0 v to a maximum of +50 millivolts or -50 millivolts. A logical 1 may be of either polarity and reaches a value near the maximum voltage; a logical 0 may be of either polarity, reaches a value near 15 mv and is of shorter duration than a logical 1. The output voltage at pin 21 will reach a peak near -5.0 v for a logical 1 of either polarity, and will reach a peak near -1.5 v for a logical 0 of either polarity. Resistor R10 and R9 are bias resistors for transistors Q1 and Q7, respectively. Resistor R8 and capacitor C4 are a terminating network for the input signal. The input signal is amplified by the differential amplifier consisting of transistors Q1 and Q7. The output of transistor Q1 is directly coupled to the base of transistor Q2. The output of transistor Q7 is directly coupled to the base of transistor Q8. Input signals of opposite polarity generate differential outputs of opposite polarity. Transistors Q2 and Q8 form a second differential amplifier with an output coupled to transistors Q3 and Q9 through capacitors C2 and C10. A +1.5 v bias voltage is applied to the base of transistor Q3 through resistor R17, and to the base of transistor Q9 through resistor R18. Transistor Q3 or Q9 conducts if the output voltage from transistors Q2 and Q8 is outside the range ±1.5 v. Whichever transistor conducts, the output is a negative-going pulse. Resistor R36 and Zener diode CR7 form a -6.8 v regulated power supply. Diodes CR1, CR2, and resistor R1 form a source for the +1.5 v bias supply. Capacitors C1, C12, and C13 are line filter capacitors for the +12 v, -28.5 v, and -16.5 v sources, respectively.

CIRCUIT CHARACTERISTICS

The input to the differential preamplifier must be from the Magnetic Core Memory. The load for the differential preamplifier must be the sense amplifier of the MD759 module. Waveforms are illustrated in Figure 1.

LOADING

The input to an MD758 differential preamplifier circuits is from a set of cores in the Magnetic Core Memory. An MD758 differential preamplifier circuit is capable of driving not more than one MD759 sense amplifier circuit.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 1.

Table 1. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	63.2 ma maximum
-16.5 v ± 5%	52.3 ma maximum
-28.5 v ± 5%	17.4 ma maximum

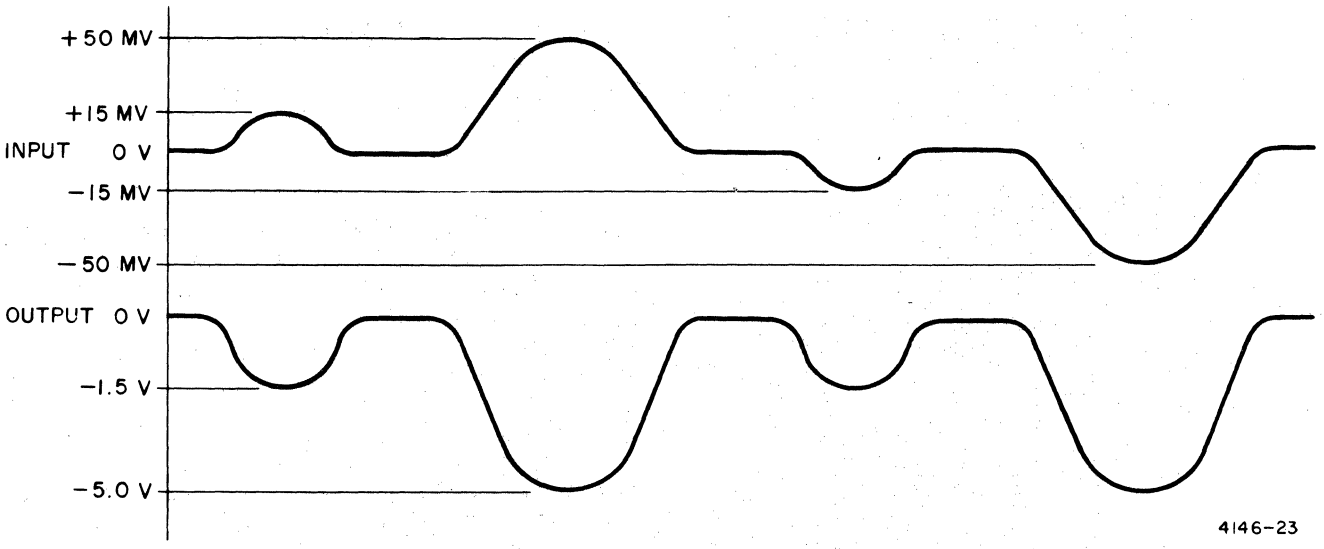


Figure 1. MD758 Module, Waveforms

PARTS LIST

Table 2 lists parts for the MD758 module. The MD758 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 2. Differential Preamplifier (Module MD758) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, ±10%, 100 v (MIL-C-25)
1	C2	8954838-26	Capacitor, fixed, tantalum, electrolytic, 6 μf, ±20%, 25 v
1	C3	8954838-26	Capacitor, fixed, tantalum, electrolytic, 6 μf, ±20%, 25 v
1	C4	8936059-104	Capacitor, fixed, mica dielectric, 820 μμf, ±5%, 300 v
1	C5	8954838-7	Capacitor, fixed, tantalum, electrolytic, 85 μf, ±20%, 6 v
1	C6	8954838-9	Capacitor, fixed, tantalum, electrolytic, 250 μf, ±20%, 6 v
1	C7	8936059-104	Capacitor, fixed, mica dielectric, 820 μμf, ±5%, 300 v
1	C8	8954838-7	Capacitor, fixed, tantalum, electrolytic, 85 μf, ±20%, 6 v
1	C9	8954838-9	Capacitor, fixed, tantalum, electrolytic, 250 μf, ±20%, 6 v
1	C10	8954838-26	Capacitor, fixed, tantalum, electrolytic, 6 μf, ±20%, 25 v
1	C11	8954838-26	Capacitor, fixed, tantalum, electrolytic, 6 μf, ±20%, 25 v
1	C12	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, ±10%, 100 v (MIL-C-25)

Table 2. Differential Preamplifier (Module MD758) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C13	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, ±10%, 100 v (MIL-C-25)
1	CR1	99250-152	Semiconductor device, diode
1	CR2	99250-152	Semiconductor device, diode
1	CR3	8935924-1	Semiconductor device, diode
1	CR4	8935924-1	Semiconductor device, diode
1	CR5	8935924-1	Semiconductor device, diode
1	CR6	8935924-1	Semiconductor device, diode
1	CR7	2180823-1	Semiconductor device, diode (Zener)
1	J1	8934595-3	Jack, tip, printed circuit (black)
1	J2	8934595-2	Jack, tip, printed circuit (red)
1	J3	8934595-7	Jack, tip, printed circuit (blue)
1	J4	8934595-5	Jack, tip, printed circuit (green)
1	J5	8934595-5	Jack, tip, printed circuit (green)
1	J6	8934595-5	Jack, tip, printed circuit (green)
1	J7	8934595-5	Jack, tip, printed circuit (green)
1	J8	8934595-7	Jack, tip, printed circuit (blue)
1	J19	8934595-5	Jack, tip, printed circuit (green)
1	J20	8934595-5	Jack, tip, printed circuit (green)
1	J21	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-5	Jack, tip, printed circuit (green)
1	J23	8716037-1	Connector, receptacle, electrical
1	Q1	8935917-1	Semiconductor device, transistor, type DEP17
1	Q2	8935917-1	Semiconductor device, transistor, type DEP17
1	Q3	8935910-1	Semiconductor device, transistor, type DEP10
1	Q4	8935917-1	Semiconductor device, transistor, type DEP17
1	Q5	8935917-1	Semiconductor device, transistor, type DEP17

Table 2. Differential Preamplifier (Module MD758) Parts List (cont)

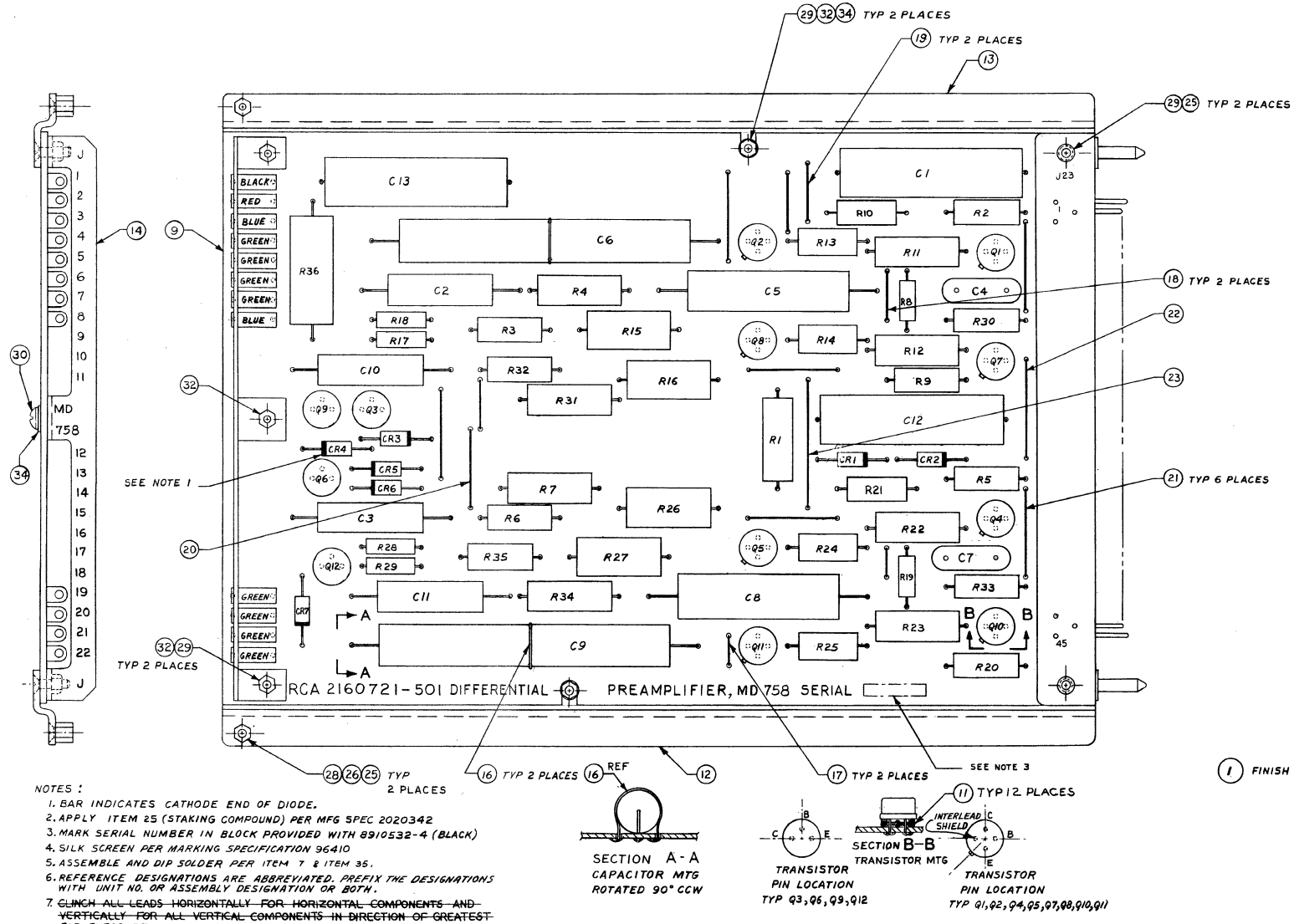
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q6	8935910-1	Semiconductor device, transistor, type DEP10
1	Q7	8935917-1	Semiconductor device, transistor, type DEP17
1	Q8	8935917-1	Semiconductor device, transistor, type DEP17
1	Q9	8935910-1	Semiconductor device, transistor, type DEP10
1	Q10	8935917-1	Semiconductor device, transistor, type DEP17
1	Q11	8935917-1	Semiconductor device, transistor, type DEP17
1	Q12	8935910-1	Semiconductor device, transistor, type DEP10
1	R1	8977940-153	Resistor, fixed, film, 383 ohms, ±1%, 1/2 w
1	R2	8977939-245	Resistor, fixed, film, 3480 ohms, ±1%, 1/4 w
1	R3	8977939-237	Resistor, fixed, film, 2870 ohms, ±1%, 1/4 w
1	R4	8945608-189	Resistor, fixed, film, 28.7 k ohms, ±1%, 1/2 w
1	R5	8977939-245	Resistor, fixed, film, 3480 ohms, ±1%, 1/4 w
1	R6	8977939-237	Resistor, fixed, film, 2870 ohms, ±1%, 1/4 w
1	R7	8945608-189	Resistor, fixed, film, 28.7 k ohms, ±1%, 1/2 w
1	R8	RC20GF151K	Resistor, fixed, composition, 150 ohms, ±10%, 1/2 w (MIL-R-11)
1	R9	8977939-165	Resistor, fixed, film, 511 ohms, ±1%, 1/4 w
1	R10	8977939-165	Resistor, fixed, film, 511 ohms, ±1%, 1/4 w
1	R11	2180948-1	Resistor, fixed, film, 100 ohms, ±1%, 1/2 w
1	R12	2180948-1	Resistor, fixed, film, 100 ohms, ±1%, 1/2 w
1	R13	RB55AE34800F	Resistor, fixed, wirewound, 3480 ohms, ±1%, 0.15 w (MIL-R-93)
1	R14	RB55AE34800F	Resistor, fixed, wirewound, 3480 ohms, ±1%, 0.15 w (MIL-R-93)
1	R15	RB53AE46400F	Resistor, fixed, wirewound, 4640 ohms, ±1%, 1/3 w (MIL-R-93)
1	R16	RB53AE46400F	Resistor, fixed, wirewound, 4640 ohms, ±1%, 1/3 w (MIL-R-93)
1	R17	8977933-265	Resistor, fixed, film, 3620 ohms, ±1%, 1/8 w
1	R18	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w

Table 2. Differential Preamplifier (Module MD758) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R19	RC20GF151K	Resistor, fixed, composition, 150 ohms, ±10%, 1/2 w
1	R20	8977939-165	Resistor, fixed, film, 511 ohms, ±1%, 1/4 w
1	R21	8977939-165	Resistor, fixed, film, 511 ohms, ±1%, 1/4 w
1	R22	2180948-1	Resistor, fixed, film, 100 ohms, ±1%, 1/2 w
1	R23	2180948-1	Resistor, fixed, film, 100 ohms, ±1%, 1/2 w
1	R24	RB55AE34800F	Resistor, fixed, wirewound, 3480 ohms, ±1%, 0.15 w (MIL-R-93)
1	R25	RB55AE34800F	Resistor, fixed, wirewound, 3480 ohms, ±1%, 0.15 w (MIL-R-93)
1	R26	RB53AE46400F	Resistor, fixed, wirewound, 4640 ohms, ±1%, 1/3 w (MIL-R-93)
1	R27	RB53AE46400F	Resistor, fixed, wirewound, 4640 ohms, ±1%, 1/3 w (MIL-R-93)
1	R28	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w
1	R29	8977933-265	Resistor, fixed, film, 5620 ohms, ±1%, 1/8 w
1	R30	8977939-245	Resistor, fixed, film, 3480 ohms, ±1%, 1/4 w
1	R31	8945608-189	Resistor, fixed, film, 28.7 k ohms, ±1%, 1/2 w
1	R32	8977939-237	Resistor, fixed, film, 2870 ohms, ±1%, 1/4 w
1	R33	8977939-245	Resistor, fixed, film, 3480 ohms, ±1%, 1/4 w
1	R34	8945608-189	Resistor, fixed, film, 28.7 k ohms, ±1%, 1/2 w
1	R35	8977939-237	Resistor, fixed, film, 2870 ohms, ±1%, 1/4 w
1	R36	RN75B3160F	Resistor, fixed, film, 316 ohms, ±1%, 1 w (MIL-R-10509)
1	9	2160180-7	Board, printed circuit
12	11	8977887-1	Insulator, washer
1	12	8717245-1	Guide, module (lower)
1	13	8717245-2	Guide, module (upper)
1	14	8266908-758	Stiffener
1 set	16	2010105-20	Wire, copper, tinned, 0.032 dia (2 in. lg)
2	17	8983171-205	Lead, electrical, printed circuit

Table 2. Differential Preamplifier (Module MD758) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
2	18	8983171-209	Lead, electrical, printed circuit
2	19	8983171-211	Lead, electrical, printed circuit
1	20	8983171-215	Lead, electrical, printed circuit
6	21	8983171-217	Lead, electrical, printed circuit
1	22	8983171-219	Lead, electrical, printed circuit
1	23	8983171-225	Lead, electrical, printed circuit
1 set	25	2016075-1	Staking, compound
2	26	8936316-1	Pin, extractor
2	28	8954980-5	Screw, machine, flat head 100° no. 4, 40 x 0.25 lg
6	29	8954980-9	Screw, machine, flat head 100° no. 4, 40 x 0.375 lg
1	30	8914385-9	Screw, machine, pan head no. 4, 40 x 0.375 lg
5	32	8811181-109	Nut, hex, lock no. 4
3	34	AN 960-C4	Washer, flat no. 4



COMPONENT AND ITEM	MTG. LG.
R10, R17, R18, R21, R28, R29	.6
CR1, CR2, CR3, CR4 CR5, CR6, CR7	.7
R2, R3, R5, R6, R8, R9 R13, R14, R19, R20, R24 R25, R30, R32, R33, R35	.8
R1, R4, R7, R11, R12, R15, R16, R22 R23, R26, R27, R31, R34	1.0
R36	1.4
C2, C3, C10, C11	1.6
C1, C12, C13	1.9
C5, C8	2.2
C6, C9	3.5
ITEM 17	.3
ITEM 18	.5
ITEM 19	.6
ITEM 20	.8
ITEM 21	.9
ITEM 22	1.0
ITEM 23	1.3
C4, C7	.5

(1) FINISH: VARNISH, MOISTURE & FUNGUS RESISTANT, MIL-V-173, TYPE II, APPLY PER TREATMENT MIL-T-152 (RCA 1980763)

NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. APPLY ITEM 25 (STAKING COMPOUND) PER MFG SPEC 2020342
3. MARK SERIAL NUMBER IN BLOCK PROVIDED WITH 8910532-4 (BLACK)
4. SILK SCREEN PER MARKING SPECIFICATION 96410
5. ASSEMBLE AND DIP SOLDER PER ITEM 7 & ITEM 35.
6. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NO. OR ASSEMBLY DESIGNATION OR BOTH.
7. ~~CLINCH ALL LEADS HORIZONTALLY FOR HORIZONTAL COMPONENTS AND VERTICALLY FOR ALL VERTICAL COMPONENTS IN DIRECTION OF GREATEST PAD EXPOSURE.~~

SECTION A-A
CAPACITOR MTG
ROTATED 90° CCW

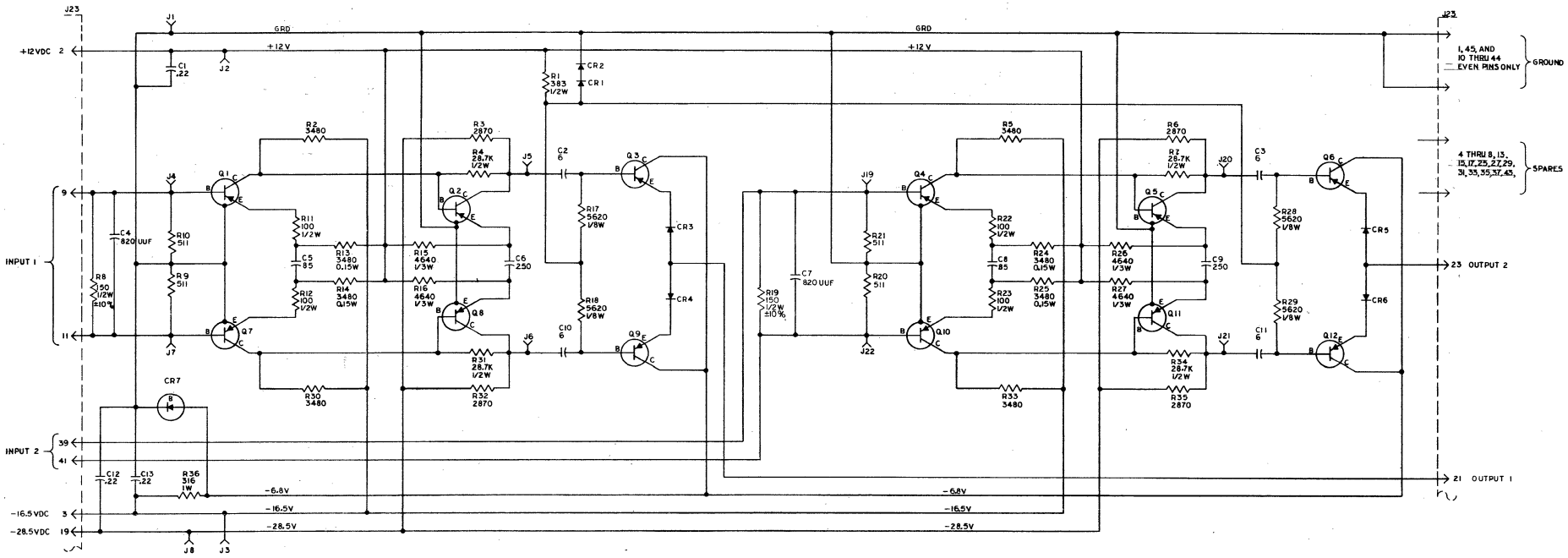
SECTION B-B
TRANSISTOR MTG

TRANSISTOR PIN LOCATION
TYP Q3, Q6, Q9, Q12

TRANSISTOR PIN LOCATION
TYP Q1, Q2, Q4, Q5, Q7, Q8, Q10, Q11

INTERLEAD SHIELD

Figure 2. Differential Preamplifier (Module MD758), Assembly Drawing



NOTES:

1. RESISTANCE VALUES ARE IN OHMS, 1/4 WATT, ±1%, UNLESS OTHERWISE NOTED.
2. CAPACITANCE VALUES ARE IN MICROFARADS, UNLESS OTHERWISE NOTED. (UF)
3. SYMBOL FOR CR7 IS A ZENER TYPE DIODE.
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
5. THE FOURTH LEAD ON Q1, Q2, Q4, Q5, Q7, Q8, Q10, Q11, AS SHOWN TIES TO GROUND AND IS INTERNALLY GROUND TO CASE.
6. LOGIC REPRESENTATION SHOWN FOR INPUT-OUTPUT LEAD REFERENCE.

LOGIC REPRESENTATION
(SEE NOTE 6)

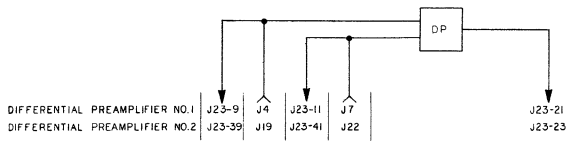


Figure 3. Differential Preamplifier (Module MD758), Schematic Diagram

SENSE AMPLIFIER (MODULE MD759)

RCA 2160714-501

DESCRIPTION

The MD759 module contains four identical sense amplifier circuits, a voltage regulator circuit, and two line filter capacitors. Each sense amplifier receives a signal from a differential preamplifier on an MD758 module, and a strobe input. If the signal from the differential preamplifier becomes negative while the strobe input is at the logical 0 level, the sense amplifier generates a positive-going output pulse.

CIRCUIT ANALYSIS

Each sense amplifier operates in the same manner, therefore only one circuit is described in detail. If the voltage at INPUT 1 is positive (no pulse), transistor Q1 conducts, and its collector voltage is near 0 v. Diode CR2 is back-biased, and the junction of diodes CR3, CR4, and CR5, and resistor R3 is held near 0 v. The base of transistor Q2 is held at a slight positive potential by current flow through diode CR5 and resistor R4. Transistor Q2 is cut off, and its collector voltage is clamped at -4.7 v by current flow through resistor R5 and diode CR6. When STROBE INPUT 1 goes to the -4.5 v level, current flow through resistor R3, diode CR3, transistor Q1, diode CR1 and resistor R1 holds the cathode of diode CR4 near 0 v, so that diode CR4 is back-biased. Therefore, the output does not change. If INPUT 1 becomes negative, transistor Q1 is cut off, and its collector voltage is clamped at -4.7 v by current flow through resistor R2 and diode CR2. When STROBE INPUT 1 goes to the -4.5 v level, the junction of diodes CR3, CR4, and CR5, and resistor R3, is pulled to a negative potential. Under these conditions, transistor Q2 conducts, and the collector voltage is near 0 v. Resistor R11 and Zener diode CR13 form a voltage-regulating circuit for the -4.7 v supply. Capacitors C1 and C2 are line filters for the +12 v supply and the -16.5 v supply, respectively.

CIRCUIT CHARACTERISTICS

Input logic levels are described in Table 1. The data input must be from the output of an MD758 module differential preamplifier. Output logic levels are described in Table 2. Waveforms and timing are illustrated in Figure 1.

Table 1. Strobe Input Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+1.25 v, -4.5 v)	0 ma
1	0.0 v (+0.0 v, -0.8 v)	3.8 ma maximum

Table 2. Output Logic Levels

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2 v, -1.2 v)	5 ma maximum OUT 12 ma maximum IN
1	0.0 v (+0.0 v, -0.5 v)	31.3 ma maximum OUT 15 ma maximum IN

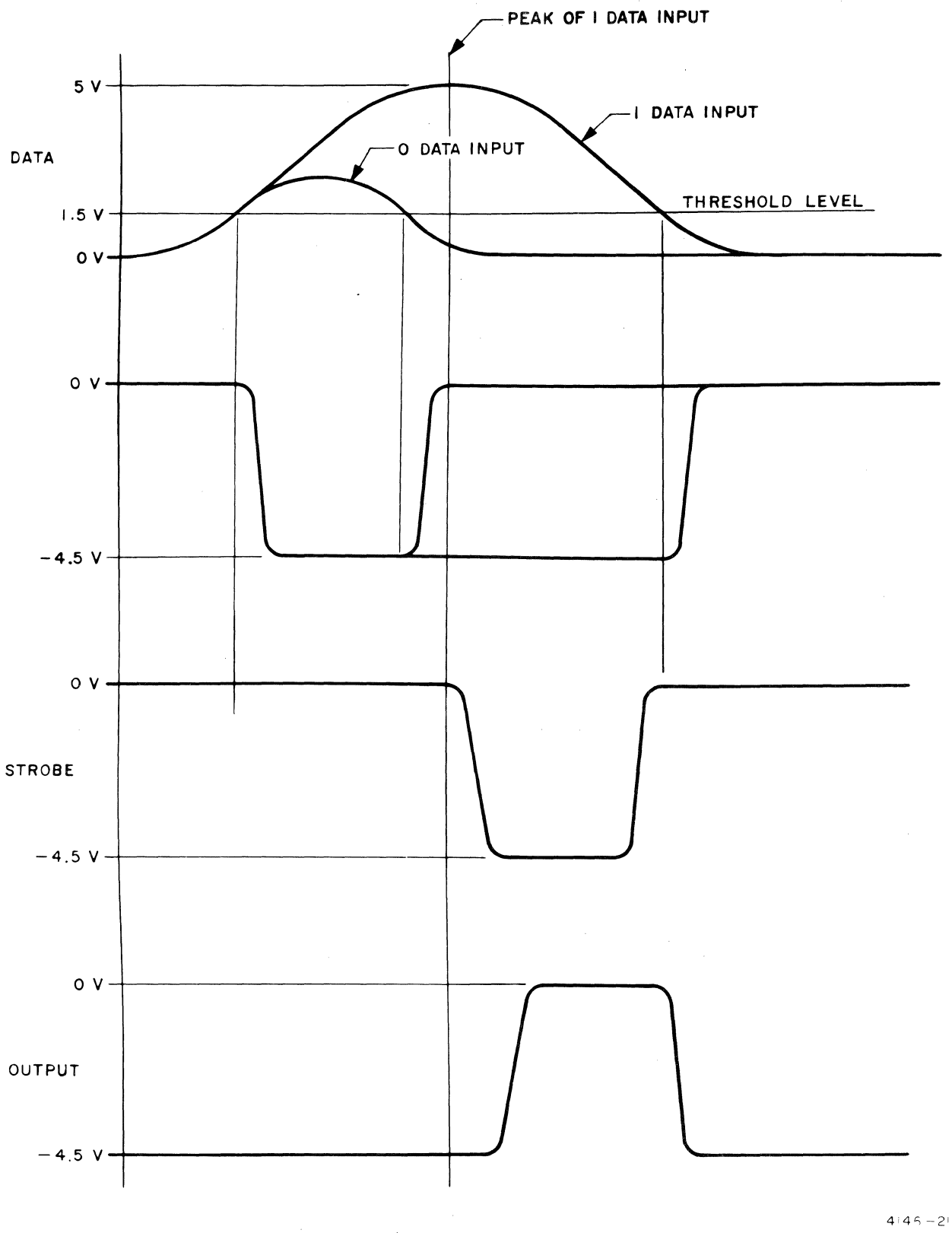


Figure 1. MD759 Module, Waveforms and Timing

LOADING

The input to the sense amplifier is from not more than two differential preamplifier circuits. Each sense amplifier is capable of driving a maximum of eight MD659 gates.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ± 5%	50 ma maximum
-16.5 v ± 5%	110 ma maximum

WIRING

Table 4 lists maximum lengths of wire which may be used.

Table 4. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	96 Inches
Single Load	120 Inches

PARTS LIST

Table 5 lists parts for the MD759 module. The MD759 module assembly is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 5. Sense Amplifier (Module MD759) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, 100 v (MIL-C-25)
1	C2	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, 100 v (MIL-C-25)
1	CR1	8935924-1	Semiconductor device, diode
1	CR2	8935924-1	Semiconductor device, diode
1	CR3	8935924-1	Semiconductor device, diode
1	CR4	8935924-1	Semiconductor device, diode
1	CR5	2180821-1	Semiconductor device, diode
1	CR6	8935924-1	Semiconductor device, diode
1	CR7	8935924-1	Semiconductor device, diode
1	CR8	8935924-1	Semiconductor device, diode
1	CR9	8935924-1	Semiconductor device, diode
1	CR10	8935924-1	Semiconductor device, diode
1	CR11	2180821-1	Semiconductor device, diode
1	CR12	8935924-1	Semiconductor device, diode
1	CR13	2180822-1	Semiconductor device, diode
1	CR14	8935924-1	Semiconductor device, diode
1	CR15	8935924-1	Semiconductor device, diode
1	CR16	8935924-1	Semiconductor device, diode
1	CR17	8935924-1	Semiconductor device, diode
1	CR18	2180821-1	Semiconductor device, diode
1	CR19	8935924-1	Semiconductor device, diode
1	CR20	8935924-1	Semiconductor device, diode
1	CR21	8935924-1	Semiconductor device, diode
1	CR22	8935924-1	Semiconductor device, diode
1	CR23	8935924-1	Semiconductor device, diode
1	CR24	2180821-1	Semiconductor device, diode
1	CR25	8935924-1	Semiconductor device, diode

Table 5. Sense Amplifier (Module MD759) Parts List (cont)

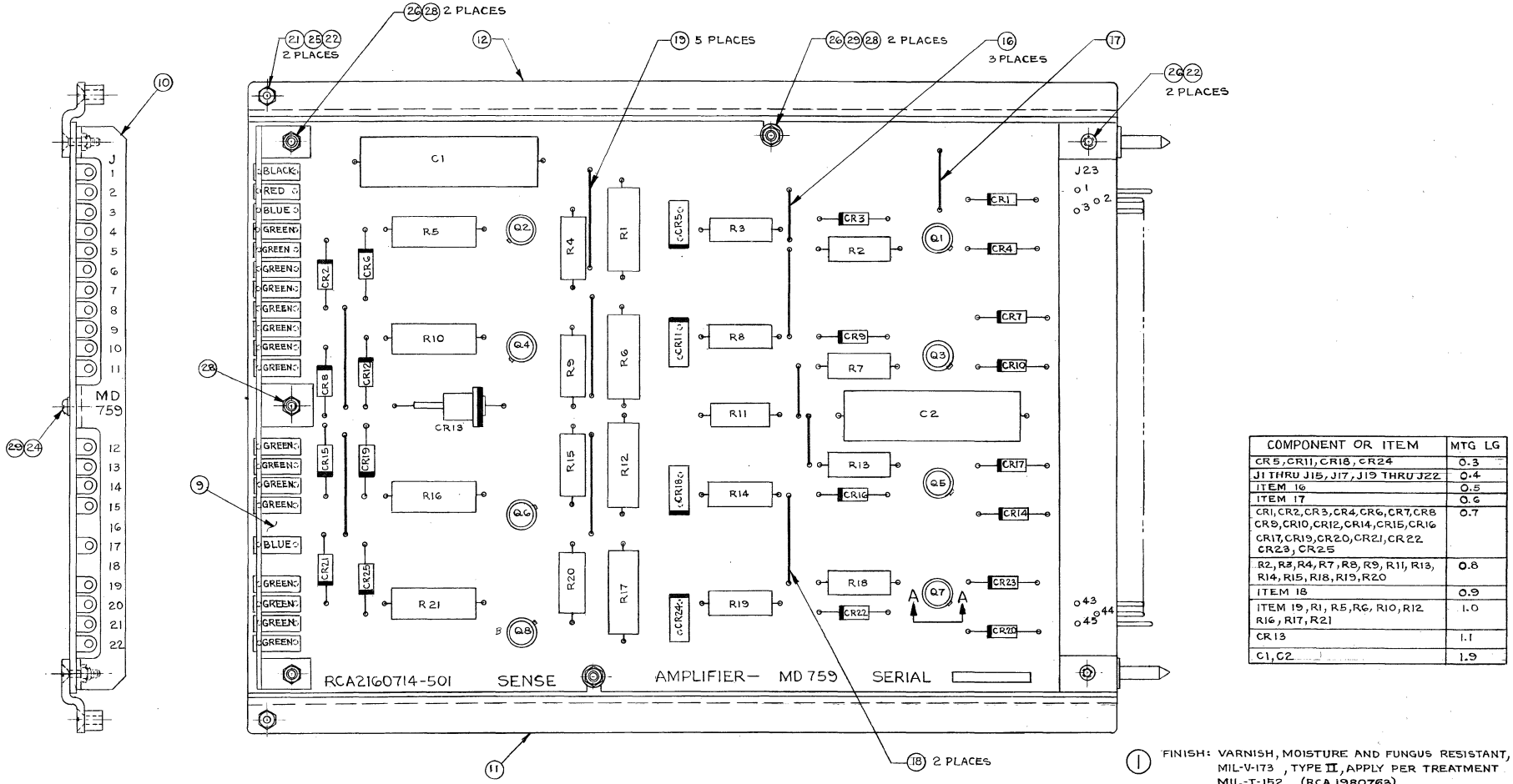
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	J1	8934595-3	Jack, tip, printed circuit (black)
1	J2	8934595-2	Jack, tip, printed circuit (red)
1	J3	8934595-7	Jack, tip, printed circuit (blue)
1	J4	8934595-5	Jack, tip, printed circuit (green)
1	J5	8934595-5	Jack, tip, printed circuit (green)
1	J6	8934595-5	Jack, tip, printed circuit (green)
1	J7	8934595-5	Jack, tip, printed circuit (green)
1	J8	8934595-5	Jack, tip, printed circuit (green)
1	J9	8934595-5	Jack, tip, printed circuit (green)
1	J10	8934595-5	Jack, tip, printed circuit (green)
1	J11	8934595-5	Jack, tip, printed circuit (green)
1	J12	8934595-5	Jack, tip, printed circuit (green)
1	J13	8934595-5	Jack, tip, printed circuit (green)
1	J14	8934595-5	Jack, tip, printed circuit (green)
1	J15	8934505-5	Jack, tip, printed circuit (green)
1	J17	8934595-7	Jack, tip, printed circuit (blue)
1	J19	8934595-5	Jack, tip, printed circuit (green)
1	J20	8934595-5	Jack, tip, printed circuit (green)
1	J21	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-5	Jack, tip, printed circuit (green)
1	J23	8716037-1	Connector, receptacle, electrical
1	Q1	2180801-1	Semiconductor device, transistor
1	Q2	2180801-1	Semiconductor device, transistor
1	Q3	2180801-1	Semiconductor device, transistor
1	Q4	2180801-1	Semiconductor device, transistor
1	Q5	2180801-1	Semiconductor device, transistor

Table 5. Sense Amplifier (Module MD759) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q6	2180801-1	Semiconductor device, transistor
1	Q7	2180801-1	Semiconductor device, transistor
1	Q8	2180801-1	Semiconductor device, transistor
1	R1	8977940-201	Resistor, fixed, film, 1210 ohms, 1/2 w, ±1%
1	R2	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R3	8977939-257	Resistor, fixed, film, 4640 ohms, 1/4 w, ±1%
1	R4	8977939-365	Resistor, fixed, film, 61.9 k ohms, 1/4 w, ±1%
1	R5	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R6	8977940-201	Resistor, fixed, film, 1210 ohms, 1/2 w, ±1%
1	R7	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R8	8977939-257	Resistor, fixed, film, 4640 ohms, 1/4 w, ±1%
1	R9	8977939-365	Resistor, fixed, film, 61.9 k ohms, 1/4 w, ±1%
1	R10	8977940-186	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R11	RC32GF471K	Resistor, fixed, composition, 470 ohms, 1 w, ±10% (MIL-R-11)
1	R12	8977940-201	Resistor, fixed, film, 1210 ohms, 1/2 w, ±1%
1	R13	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R14	8977939-257	Resistor, fixed, film, 4640 ohms, 1/4 w, ±1%
1	R15	8977939-365	Resistor, fixed, film, 61.9 k ohms, 1/4 w, ±1%
1	R16	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R17	8977940-201	Resistor, fixed, film, 1210 ohms, 1/2 w, ±1%
1	R18	8977939-277	Resistor, fixed, film, 7500 ohms, 1/4 w, ±1%
1	R19	8977939-257	Resistor, fixed, film, 4640 ohms, 1/4 w, ±1%
1	R20	8977939-365	Resistor, fixed, film, 61.9 k ohms, 1/4 w, ±1%
1	R21	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	9	2160180-8	Board, printed circuit
1	10	8266908-759	Stiffener

Table 5. Sense Amplifier (Module MD759) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	11	8717245-1	Guide, module (lower)
1	12	8717245-2	Guide, module (upper)
8	13	2180896-1	Pad, transistor mounting
3	16	8983171-209	Lead, electrical, printed wiring
1	17	8983171-211	Lead, electrical, printed wiring
2	18	8983171-217	Lead, electrical, printed wiring
5	19	8983171-219	Lead, electrical, printed wiring
2	21	8936316-1	Pin extractor
1 set	22	2016075-1	Staking compound
1	24	8914385-9	Screw, machine, pan head, recessed, no. 4 (0.112) 40 x 0.38 lg
2	25	8954980-5	Screw, machine, flat head, recessed, no. 4 (0.112) 40 x 0.25 lg
6	26	8954980-9	Screw, machine, flat head, recessed, no. 4 (0.112) 40 x 0.38 lg
5	28	8811181-109	Nut, hex, lock, no. 4 (0.112) 40 thk
3	29	AN960-C4	Washer, flat, no. 4, 0.032 thk



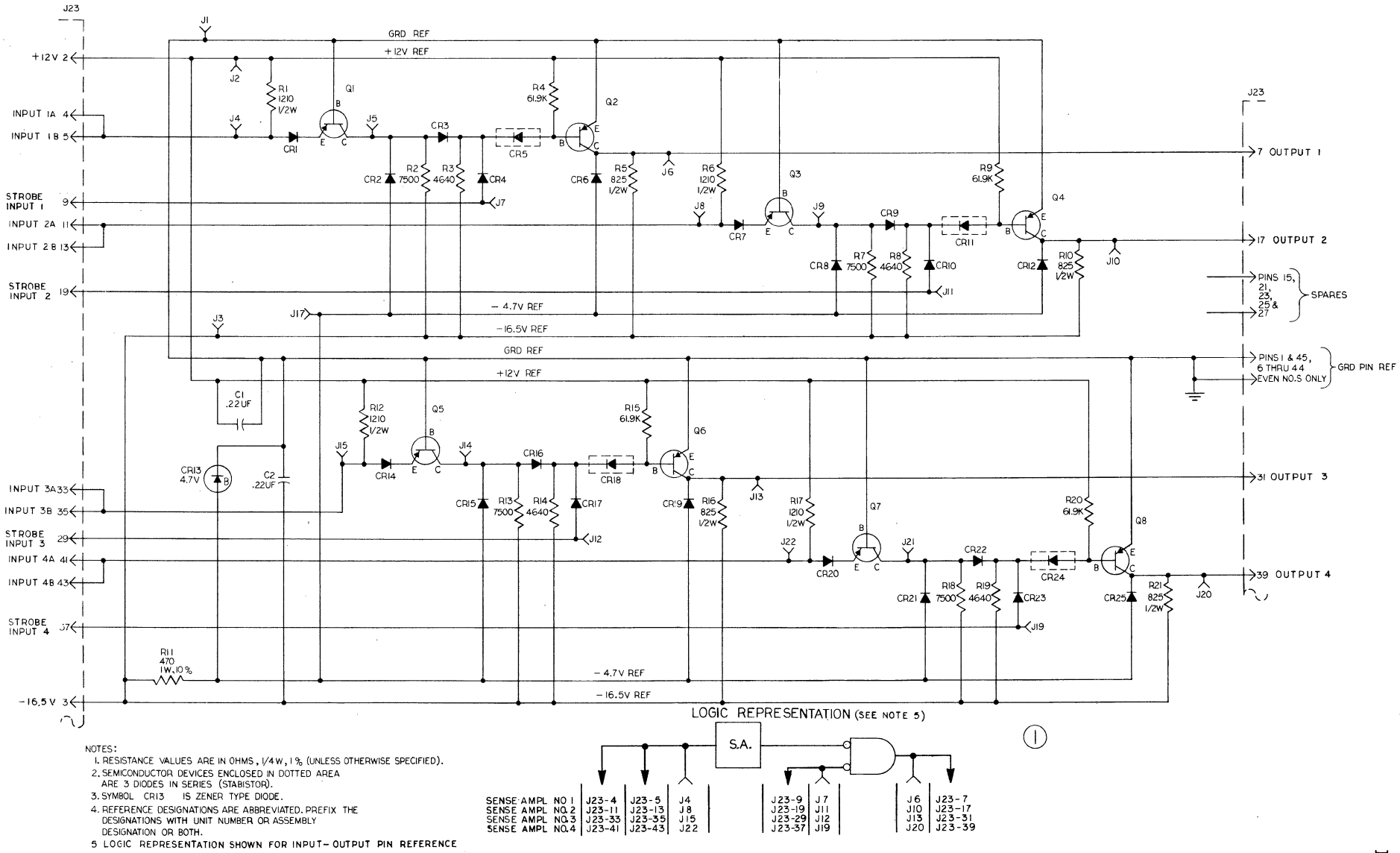
COMPONENT OR ITEM	MTG LG
CR5, CR11, CR18, CR24	0.3
J1 THRU J15, J17, J19 THRU J22	0.4
ITEM 16	0.5
ITEM 17	0.6
CR1, CR2, CR3, CR4, CR6, CR7, CR8 CR9, CR10, CR12, CR14, CR15, CR16 CR17, CR19, CR20, CR21, CR22 CR23, CR25	0.7
R2, R3, R4, R7, R8, R9, R11, R13, R14, R15, R18, R19, R20	0.8
ITEM 18	0.9
ITEM 19, R1, R5, R6, R10, R12 R16, R17, R21	1.0
CR13	1.1
C1, C2	1.9

(1) FINISH: VARNISH, MOISTURE AND FUNGUS RESISTANT, MIL-V-173, TYPE II, APPLY PER TREATMENT MIL-T-152 (RCA 1980763).

NOTES:

1. BAR INDICATES CATHODE END OF DIODE.
2. ASSEMBLE AND DIP SOLDER PER ITEM 5 & ITEM 30.
3. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATION WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
4. MARK SERIAL NUMBER IN BLOCK PROVIDED WITH 8910532-4 (BLACK).
5. APPLY ITEM 22 (STAKING COMPOUND) PER MFG SPEC 2020342.
6. SILK SCREEN PER MARKING SPECIFICATION 96410.
7. ~~CLINCH ALL LEADS HORIZONTALLY FOR HORIZONTAL COMPONENTS AND VERTICALLY FOR VERTICAL COMPONENTS IN DIRECTION OF GREATEST PAD EXPOSURE.~~

Figure 2. Sense Amplifier (Module MD759), Assembly Drawing



NOTES:

1. RESISTANCE VALUES ARE IN OHMS, 1/4W, 1% (UNLESS OTHERWISE SPECIFIED).
2. SEMICONDUCTOR DEVICES ENCLOSED IN DOTTED AREA ARE 3 DIODES IN SERIES (STABISTOR).
3. SYMBOL CR13 IS ZENER TYPE DIODE.
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
5. LOGIC REPRESENTATION SHOWN FOR INPUT- OUTPUT PIN REFERENCE

Figure 3. Sense Amplifier (Module MD759), Schematic Diagram

4-PHASE CLOCK (MODULE MD792)

RCA 2161871-501

DESCRIPTION

The MD792 module contains a 4-phase clock pulse generator, two power supply filter circuits, and a regulated power supply circuit. The 4-phase clock pulse generator provides four separate sets of 2 MC clock pulses controlled by a single input.

CIRCUIT DESCRIPTION

The 4-phase clock pulse generator consists of a timing loop which generates three timing signals and five logic circuits which combine the three timing signals to generate the clock pulses.

TIMING LOOP

The timing loop includes an input gate (CR1, CR2, CR3), transistors Q1, Q3, and Q5, and delay lines DL1 and DL2. When the timing loop is not generating timing signals, the outputs of transistors Q1, Q3, and Q5 are at the logical 0 level (nominal -4.5 volts) and the control input is at the logical 1 level (nominal 0 volts), inhibiting the input gate. When the control input goes to a logical 0 level, the output of transistor Q1 goes to a logical 1 level. This level is applied to diodes CR4 and CR10, and is also propagated through delay line DL1. After a delay of 200 nanoseconds this level causes the output of transistor Q3 to go to a logical 1 level.

The output of transistor Q3 is applied to diodes CR14 and CR17, and to diode CR3 of the input gate. The input gate is inhibited, and the output of transistor Q1 falls to the logical 0 level. This level is also propagated through delay line DL1, so that after a delay of 200 nanoseconds, the output of transistor Q3 again goes to a logical 0 level.

The output of delay line DL1 is propagated through delay line DL2, and after a delay of 100 nanoseconds causes the output of transistor Q5 to go to a logical 1 level. The output of transistor Q5 is applied to diodes CR16 and CR20, and to diode CR1 of the input gate. The input gate is inhibited and the output of transistor Q1 remains at the logical 0 level until both Q3 and Q5 return to a logical 0 level.

In summary, the timing loop provides three outputs, and uses two of these outputs to control the input circuit. A typical cycle of the timing loop is shown in figure 1. The input gate is inhibited while the outputs of transistors Q3 and Q5 are at the logical 1 level. This action determines the width of pulses propagated through the timing loop. In order to stop operation of the timing loop at the completion of a full cycle, the control input must be raised to the logical 1 level while the input gate is inhibited.

Resistor R7 and diodes CR7 and CR8 are the input network which shift the signal level up for delay line DL1. Resistor R8 and diode CR11 form a voltage regulator circuit for the collectors of transistors Q3 and Q5. Resistors R13 and R31 form part of the loads of delay lines DL2 and DL1, respectively.

LOGIC CIRCUITS

When the voltage at the junction of diode CR6 and resistor R2 is near -4.5 v, the base of transistor Q2 is held at a negative potential by current flow through diode CR6 and resistor R4. Transistor Q2 is saturated, and its collector voltage is near 0 v. Diode CR9 is back-biased. When the voltage at the junction of diode CR6 and resistor R2 is near 0 v, the base of transistor Q2 is held at a positive potential. Transistor Q2 is cut off, and its collector voltage is clamped at -4.5 v by current flow through resistor R6 and diode CR9. Transistors Q4, Q6, Q7, Q8, and Q9, with their associated components, form circuits identical to that of transistor Q2; transistor Q1 and its associated components form a circuit differing from that of transistor Q2 only in the value of collector resistor R5. All these circuits operate in an identical manner. Logic outputs are illustrated in figure 1.

The output of transistor Q1 is applied to diodes CR4 and CR10, which are inputs to transistors Q2 and Q4. When the output of transistor Q1 rises to the logical 1 level, the outputs of transistors Q2 and Q4 fall to the logical 0 level. The outputs of these two stages are CCBN No. 1 and CCBN No. 2.

The output of transistor Q3 is applied to diode CR17, which is one part of a gate driving transistor Q7, and to diode CR14. When the output of transistor Q3 rises to the logical 1 level, the output of transistor Q6 falls to the logical 0 level. The output of transistor Q6 is applied to diode CR21, which is one part of a gate driving transistor Q8, and to diode CR26. When the output of transistor Q6 falls to the logical 0 level, the output of transistor Q9 rises to the logical 1 level. Thus the CCSP output is at the logical 1 level when the output of transistor Q3 is at the logical 1 level.

The output of transistor Q5 is applied to diode CR16, which is one part of a gate driving transistor Q7; and is applied to diode CR20, which is one part of a gate driving transistor Q8. The other inputs to these gates are from the outputs of transistors Q3 and Q6.

When the inputs to diodes CR20 and CR21 are both at the logical 0 level, the junction of diodes CR20, CR21, CR23, and resistor R20 is held near -4.5 v. The output of transistor Q8 is near 0 v. When either input, or both, are at the logical 1 level, the junction is held near 0 v, and the output is clamped at -4.5 v. Because transistor Q6 inverts the signal from transistor Q3, the CCRP output of transistor Q8 is at the logical 1 level only when the output of transistor Q5 is at the logical 0 level and the output of transistor Q3 is at the logical 1 level.

When the inputs to diodes CR16 and CR17 are at the logical 1 level the junction of diodes CR16, CR17, CR18, and resistor R18 is held near 0 v, providing a logical 1 input to transistor Q7. The output of Q7 is then at the logical 0 level. When either input, or both, are at the logical 0 level, the junction is held near -4.5 v. The input to transistor Q7 is at the logical 0 level, and the output is at the logical 1 level. Therefore the CCAN output of transistor Q7 is at the logical 0 level only if the outputs of both transistor Q3 and transistor Q5 are at the logical 1 level.

Resistor R28 and diode C1 form a filter network for the +12 v supply. Resistor R29 and diode C2 form a filter network for the -16.5 v supply. Resistor R30, Zener diode CR29, and capacitor C3 form a voltage regulator for the -4.5 v power supply.

CIRCUIT CHARACTERISTICS

Control input voltage levels are described in Table 1. Output voltage levels are the same for all outputs and are described in Table 2. Waveforms are shown in Figure 1.

Table 1. Control Input Voltage Level

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+1.25 v, -4.5 v)	0 ma maximum
1	0.0 v (+0.0 v, -0.8 v)	3.8 ma maximum

Table 2. Output Voltage Level

LOGIC LEVEL	VOLTAGE	CURRENT
0	-4.5 v (+0.2, -1.2 v)	5 ma OUT maximum 12 ma IN maximum
1	0.0 v (+0.0 v, -0.5 v)	31.3 ma OUT maximum 15 ma IN maximum

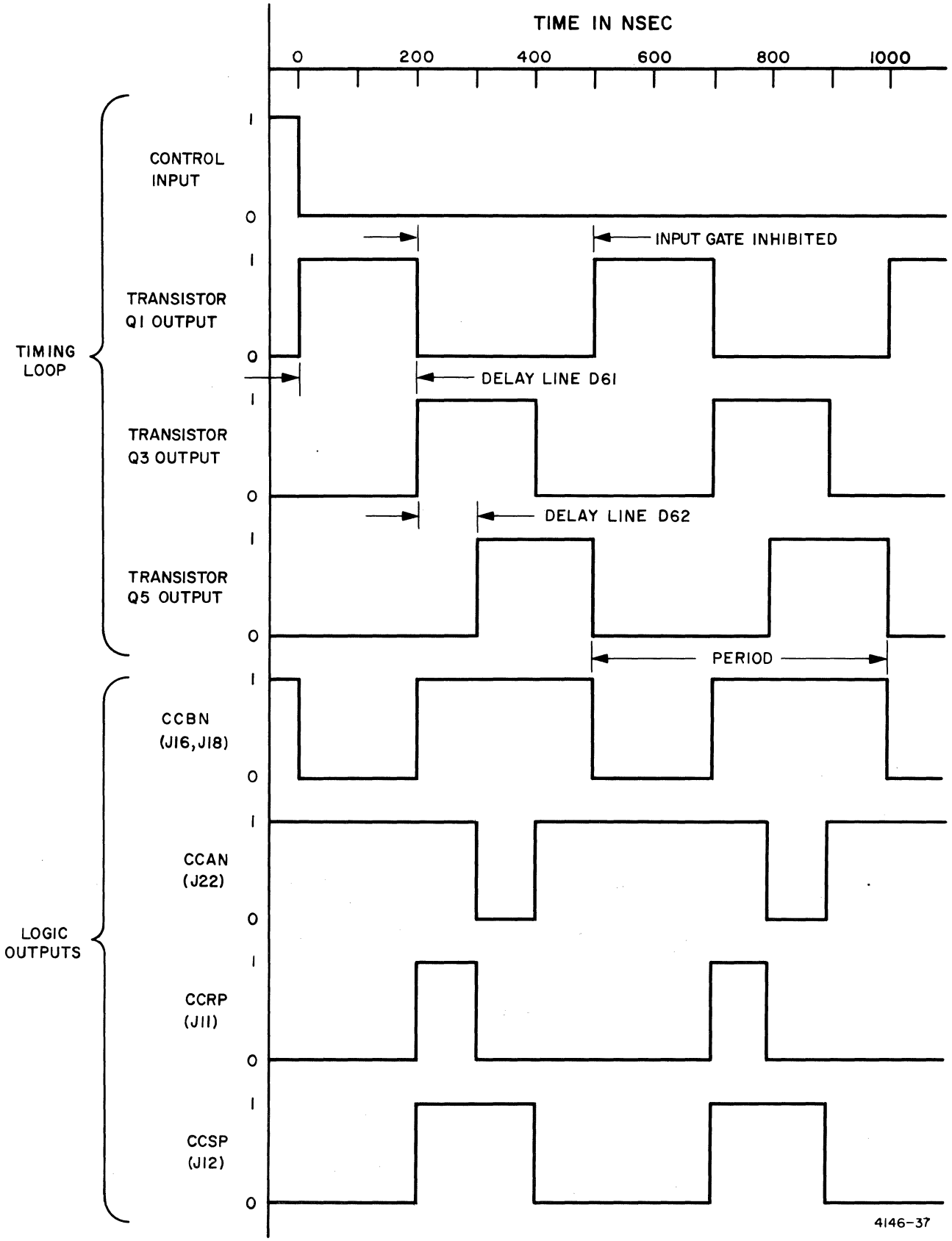


Figure 1. MD792 Module, Waveforms

LOADING

Each gated output of the MD792 module is capable of driving eight MD659 logic gates.

The control input is equivalent to one MD659 gate.

POWER REQUIREMENTS

No power supply sequencing is required. Power supply requirements are listed in Table 3.

Table 3. Power Supply Requirements

VOLTAGE	CURRENT
+12 v ±5%	20 ma maximum
-16.5 v ±5%	240 ma maximum

WIRING

Table 4 lists maximum lengths of wire which may be used.

Table 4. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	72 Inches
Single Load	96 Inches

ALIGNMENT PROCEDURE

Align the MD792 delay lines as follows:

a. Insert module in correct position in machine.

b. Adjust both variable delay lines to maximum counterclockwise position. Then turn DL1 adjustment 4 1/2 turns clockwise and DL2 adjustment 2 turns clockwise.

c. Using a Tektronix dual-trace oscilloscope, connect A probe and external sync lead to J12, and connect B probe to J11. Place oscilloscope TRIGGER switch to EXTERNAL and TRACE MODE switch to ALTERNATE.

d. Observe oscilloscope traces and readjust DL1 and DL2 until patterns match those shown in Figure 1.

e. Move probe B to J16, J18, and J22 to verify that CCBN and CCAN patterns match those shown in Figure 1.

PARTS LIST

Table 5 lists parts for the MD792 module. The MD792 module is illustrated in Figure 2, and the schematic diagram is illustrated in Figure 3.

Table 5. 4-Phase Clock (Module MD792) Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CP09A1KB104K1	Capacitor, fixed, paper dielectric, 0.1 μf, 100 v (MIL-C-25)
1	C2	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, 100 v (MIL-C-25)
1	C3	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, 100 v (MIL-C-25)
1	CR1	2180820-1	Semiconductor device, diode
1	CR2	2180820-1	Semiconductor device, diode
1	CR3	2180820-1	Semiconductor device, diode
1	CR4	2180820-1	Semiconductor device, diode
1	CR5	2180821-1	Semiconductor device, diode
1	CR6	2180821-1	Semiconductor device, diode
1	CR7	99250-152	Semiconductor device, diode
1	CR8	99250-152	Semiconductor device, diode
1	CR9	2180820-1	Semiconductor device, diode
1	CR10	2180820-1	Semiconductor device, diode
1	CR11	2180821-1	Semiconductor device, diode
1	CR12	2180821-1	Semiconductor device, diode
1	CR13	2180820-1	Semiconductor device, diode
1	CR14	2180820-1	Semiconductor device, diode
1	CR15	2180821-1	Semiconductor device, diode
1	CR16	2180820-1	Semiconductor device, diode
1	CR17	2180820-1	Semiconductor device, diode
1	CR18	2180820-1	Semiconductor device, diode
1	CR19	2180820-1	Semiconductor device, diode
1	CR20	2180820-1	Semiconductor device, diode
1	CR21	2180820-1	Semiconductor device, diode
1	CR22	2180821-1	Semiconductor device, diode
1	CR23	2180821-1	Semiconductor device, diode

Table 5. 4-Phase Clock (Module MD792) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	CR24	2180820-1	Semiconductor device, diode
1	CR25	2180820-1	Semiconductor device, diode
1	CR26	2180820-1	Semiconductor device, diode
1	CR27	2180821-1	Semiconductor device, diode
1	CR28	2180820-1	Semiconductor device, diode
1	CR29	2180822-1	Semiconductor device, diode
1	DL1	2184037-1	Delay line, variable
1	DL2	2184037-1	Delay line, variable
1	E1	486039-4	Standoff, insulated
1	E2	486039-4	Standoff, insulated
1	E3	486039-4	Standoff, insulated
1	E4	486039-4	Standoff, insulated
1	J1	8934595-3	Jack, tip, printed circuit (black)
1	J3	8934595-2	Jack, tip, printed circuit (red)
1	J5	8934595-7	Jack, tip, printed circuit (blue)
1	J7	8934595-7	Jack, tip, printed circuit (blue)
1	J11	8934595-5	Jack, tip, printed circuit (green)
1	J12	8934595-5	Jack, tip, printed circuit (green)
1	J16	8934595-5	Jack, tip, printed circuit (green)
1	J18	8934595-5	Jack, tip, printed circuit (green)
1	J22	8934595-5	Jack, tip, printed circuit (green)
1	J23	8716037-1	Connector, receptacle, electrical (male)
1	Q1	2180801-1	Semiconductor device, transistor
1	Q2	2180801-1	Semiconductor device, transistor
1	Q3	1021280-1	Semiconductor device, transistor
1	Q4	2180801-1	Semiconductor device, transistor

Table 5. 4-Phase Clock (Module 792) Parts List (cont)

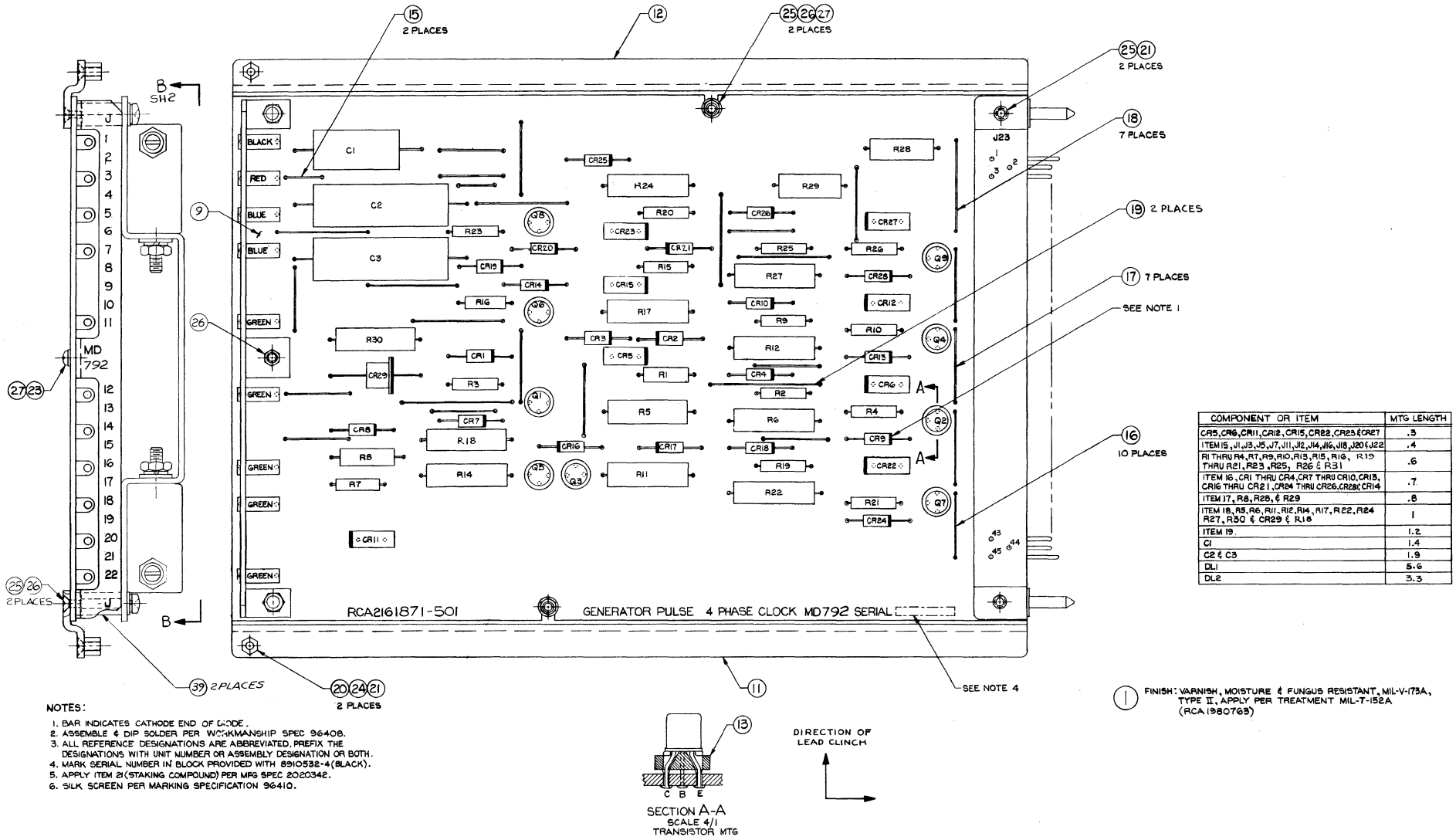
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	Q5	1021280-1	Semiconductor device, transistor
1	Q6	2180801-1	Semiconductor device, transistor
1	Q7	2180801-1	Semiconductor device, transistor
1	Q8	2180801-1	Semiconductor device, transistor
1	Q9	2180801-1	Semiconductor device, transistor
1	R1	8977933-257	Resistor, fixed, film, 4640 ohms, 1/8 w, ±1%
1	R2	8977933-257	Resistor, fixed, film, 4640 ohms, 1/8 w, ±1%
1	R3	8977933-365	Resistor, fixed, film, 61.9 k ohms, 1/8 w, ±1%
1	R4	8977933-365	Resistor, fixed, film, 61.9 k ohms, 1/8 w, ±1%
1	R5	8977940-193	Resistor, fixed, film, 1 k ohms, 1/2 w, ±1%
1	R6	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R7	8977933-257	Resistor, fixed, film, 4640 ohms, 1/8 w, ±1%
1	R8	RD60P2370J	Resistor, fixed, film, 237 ohms, 1 w, ±1% (MIL-R-11804)
1	R9	8977933-257	Resistor, fixed, film, 4640 ohms, 1/8 w, ±1%
1	R10	8977933-365	Resistor, fixed, film, 61.9 k ohms, 1/8 w, ±1%
1	R11	8977940-193	Resistor, fixed, film, 1 k ohms, 1/2 w, ±1%
1	R12	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R13	8977933-193	Resistor, fixed, film, 1 k ohms, 1/8 w, ±1%
1	R14	8977940-193	Resistor, fixed, film, 1 k ohms, 1/2 w, ±1%
1	R15	8977933-257	Resistor, fixed, film, 4640 ohms, 1/8 w, ±1%
1	R16	8977933-365	Resistor, fixed, film, 61.9 k ohms, 1/8 w, ±1%
1	R17	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R18	8977940-217	Resistor, fixed, film, 1780 ohms, 1/2 w, ±1%
1	R19	8977933-257	Resistor, fixed, film, 4640 ohms, 1/8 w, ±1%
1	R20	8977933-257	Resistor, fixed, film, 4640 ohms, 1/8 w, ±1%
1	R21	8977933-365	Resistor, fixed, film, 61.9 k ohms, 1/8 w, ±1%
1	R22	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%

Table 5. 4-Phase Clock (Module 792) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R23	8977933-365	Resistor, fixed, film, 61.9 k ohms, 1/8 w, ±1%
1	R24	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R25	8977933-257	Resistor, fixed, film, 4640 ohms, 1/8 w, ±1%
1	R26	8977933-365	Resistor, fixed, film, 61.9 k ohms, 1/8 w, ±1%
1	R27	8977940-185	Resistor, fixed, film, 825 ohms, 1/2 w, ±1%
1	R28	RC32GF3R3K	Resistor, fixed, composition, 3.3 ohms, 1 w, ±10% (MIL-R-11)
1	R29	RC32GF3R3K	Resistor, fixed, composition, 3.3 ohms, 1 w, ±10% (MIL-R-11)
1	R30	8977940-165	Resistor, fixed, film, 511 ohms, 1/2 w, ±1%
1	R31	8977933-193	Resistor, fixed, film, 1 k ohms, 1/8 w, ±1%
1	9	2160180-11	Board, printed circuit
1	10	8266908-792	Stiffener
1	11	8717245-1	Guide, module (lower)
1	12	8717245-2	Guide, module (upper)
9	13	2180896-1	Pad, transistor mounting
AR	14	2010105-20	Wire, copper, tinned, 0.032 dia (2 in. lg)
2	15	8983171-207	Lead, electrical, printed wiring
10	16	8983171-213	Lead, electrical, printed wiring
7	17	8983171-215	Lead, electrical, printed wiring
7	18	8983171-219	Lead, electrical, printed wiring
2	19	8983171-223	Lead, electrical, printed wiring
2	20	8936316-1	Pin, extractor
AR	21	2016075-1	Staking compound
1	23	8914385-9	Screw, machine, pan head, cross recessed, no. 4 (0.112) 40 x 0.38 lg
2	24	8954980-5	Screw, machine, flat head, cross recessed, no. 4 (0.112) 40 x 0.25 lg
6	25	8954980-9	Screw, machine, flat head, cross recessed, no. 4 (0.112) 40 x 0.38 lg

Table 5. 4-Phase Clock (Module 792) Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
3	26	8811181-109	Nut, hex, lock, no. 4 (0.112), 40
3	27	AN960-C4	Washer, flat, no. 4, 0.032 thick
4	28	MS24584-12	Screw, machine, pan head, cross recessed, no. 4 (0.112) 40 x 0.25 lg
4	29	NAS671-8	Nut, hex, plain, no. 8 (1.64), 32
4	30	MS15795-207	Washer, flat, no. 8
4	31	MS35337-42	Washer, lock, split, no. 8
4	32	MS15795-203	Washer, flat, no. 4
4	33	MS35337-40	Washer, lock, split, no. 4
4	34	MS35649-22	Nut, hex, plain, no. 2 (0.086), 56
4	35	MS15795-202	Washer, flat, no. 2
4	36	MS35337-39	Washer, lock, split, no. 2
1	38	2172154-1	Bracket
2	39	2183416-1	Spacer, 0.45 lg



COMPONENT OR ITEM	MTG LENGTH
CR5,CR6,CR11,CR12,CR15,CR22,CR25 & CR27	.3
ITEM 15, J1, J3, J5, J7, J11, J12, J14, J16, J18, J20 & J22	.4
R1 THRU R4, R7, R9, R10, R13, R15, R16, R19 THRU R21, R23, R25, R26 & R31	.6
ITEM 16, CR1 THRU CR4, CR7 THRU CR10, CR13, CR16 THRU CR21, CR24 THRU CR26, CR28 & CR14	.7
ITEM 17, R8, R28, & R29	.8
ITEM 18, R5, R6, R11, R12, R14, R17, R22, R24 R27, R30 & CR29 & R18	1
ITEM 19	1.2
C1	1.4
C2 & C3	1.9
DL1	5.6
DL2	3.3

NOTES:
1. BAR INDICATES CATHODE END OF DIODE.
2. ASSEMBLE & DIP SOLDER PER WORKMANSHIP SPEC 96408.
3. ALL REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.
4. MARK SERIAL NUMBER IN BLOCK PROVIDED WITH 89IC532-4 (BLACK).
5. APPLY ITEM 21 (STAKING COMPOUND) PER MFG SPEC 2020342.
6. SILK SCREEN PER MARKING SPECIFICATION 96410.

Figure 2. 4-Phase Clock (Module MD792), Assembly Drawing (Sheet 1 of 2)

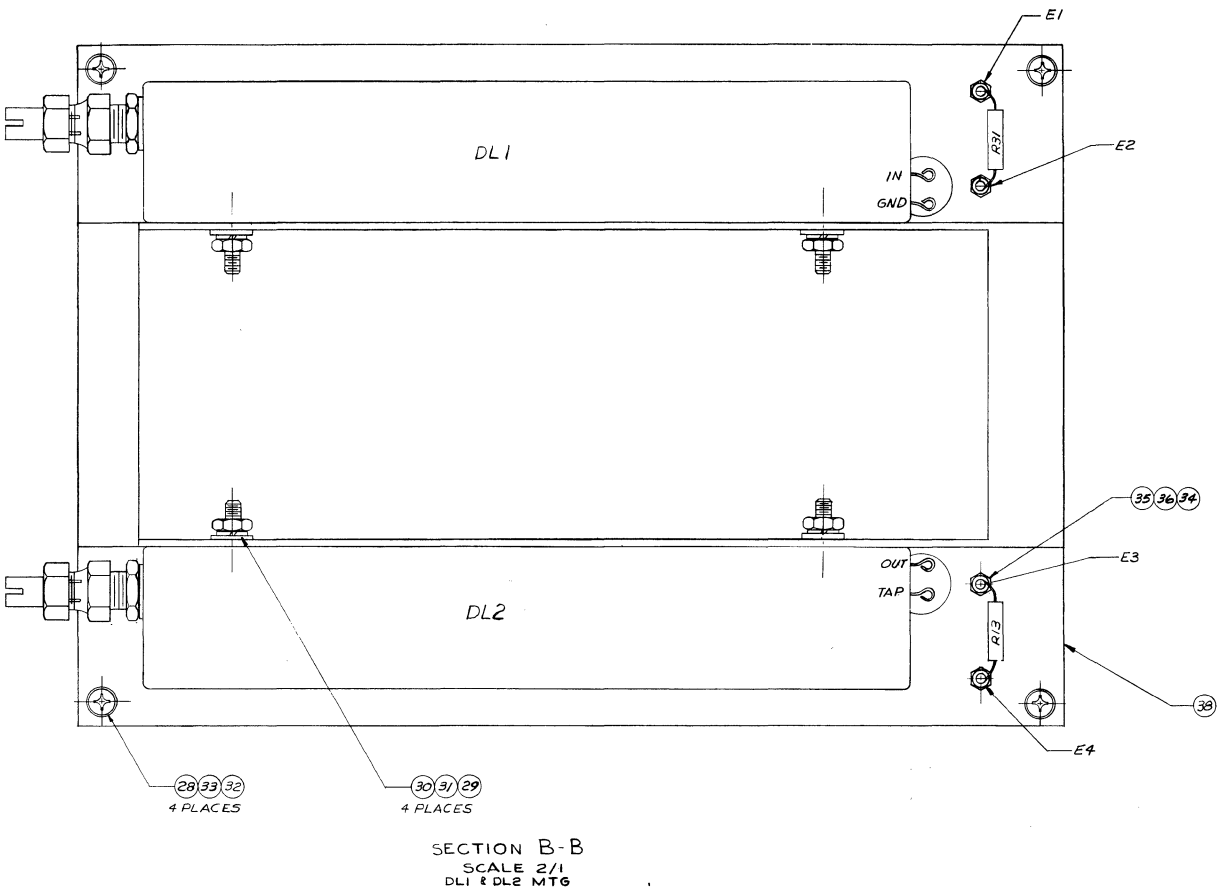
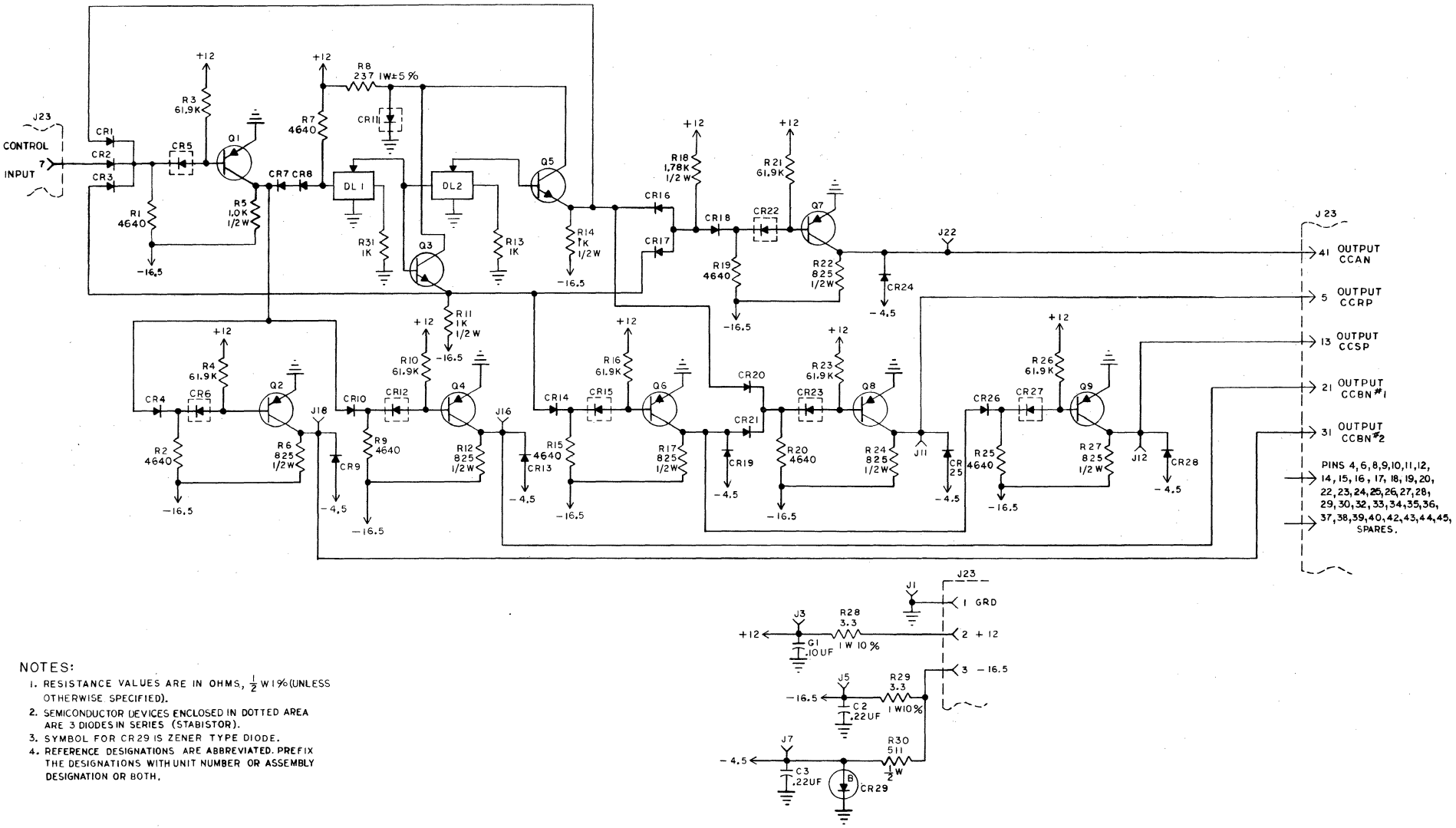


Figure 2. 4-Phase Clock (Module MD792), Assembly Drawing (Sheet 2 of 2)



NOTES:

1. RESISTANCE VALUES ARE IN OHMS, $\frac{1}{2}$ W 1% (UNLESS OTHERWISE SPECIFIED).
2. SEMICONDUCTOR DEVICES ENCLOSED IN DOTTED AREA ARE 3 DIODES IN SERIES (STABISTOR).
3. SYMBOL FOR CR29 IS ZENER TYPE DIODE.
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH UNIT NUMBER OR ASSEMBLY DESIGNATION OR BOTH.

Figure 3. 4-Phase Clock (Module MD792), Schematic Diagram

CONSTANT-CURRENT POWER SUPPLY

RCA 2160900

DESCRIPTION

The 2160900 assembly contains two identical constant-current power supplies, a voltage regulating circuit, and two line filter capacitors. These circuits supply the magnetic core memory with current under control of MD757 module selector pair circuits.

CIRCUIT ANALYSIS

Resistor R1 and Zener diode CR1 form a +22 v regulated power supply. Capacitors C1 and C2 are line filter capacitors for the +50 v input voltage and the +22 v output voltage, respectively. Diodes CR5 and CR6 clamp the output voltage of each constant-current power supply to a maximum of +22 v.

The two constant-current power supplies are identical, therefore only one is described in detail. The main current path when no current is supplied to the load is from the +22 v source through diode CR5, inductor L1 series-parallel resistors R10, R11, and R14, transistor Q5, and resistor R6. When current is provided to the load, the load resistance falls to nearly zero, and diode CR3 is bypassed. The current through inductor L1 is held constant. Diode CR2, and transistor Q3 and Q2 are a feedback circuit which controls variation in current by increasing current flow through transistor Q3 or restricting current flow through transistor Q1. The value of the line current is controlled by the setting of variable resistor R11.

CIRCUIT CHARACTERISTICS

The input to the constant-current power supply is from the +50 v power supply. The maximum current output is 300 ma.

LOADING

Each constant-current power supply circuit supplies a current pulse of 170 ma to 240 ma, with a resolution less than 2 percent. Variation in current during the current pulse is less than 5 ma. The current transient at the leading edge of the pulse is less than 20 ma. The +22 v output is regulated ± 10 percent at 30 ma maximum.

POWER REQUIREMENTS

The power input to the constant-current power supply is 1 ampere maximum at +50 v ± 5%.

WIRING

Wiring from the constant current power supply to the selector pair circuit must be twisted pair with a maximum length of 96 inches. One wire of the twisted pair must be grounded at each end.

PARTS LIST

Table 1 lists parts for the 2160900 constant-current power supply. The 2160900 constant-current power supply is illustrated in Figure 1. The schematic diagram of the constant-current power supply is shown in Figure 2.

Table 1. Constant-Current Power Supply Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	C1	CL35BJ060MP1	Capacitor, fixed, tantalum electrolytic, 6 μf, ±20%, 50 v (MIL-C-3965B)
1	C2	CP09A1KB224K1	Capacitor, fixed, paper dielectric, 0.22 μf, ±10%, 100 v (MIL-C-25)
1	C3	DM20F821JN3	Capacitor, fixed, mica dielectric, 0.82 μf, ±5%, 500 v (MIL-C-5B)
1	C4	DM20F821JN3	Capacitor, fixed, mica dielectric, 0.82 μf, ±5%, 500 v (MIL-C-5B)
1	CR1	1N2819B	Semiconductor device, diode (Zener), 22 v, 50 w (MIL-S-19500/114)
1	CR2	2180823-1	Semiconductor device, diode (Zener), 6.8 v, 400 mw
1	CR3	2182124-1	Semiconductor device, diode
1	CR4	2182124-1	Semiconductor device, diode
1	CR5	2180823-1	Semiconductor device, diode (Zener), 6.8 v, 400 mw
1	CR6	8935924-1	Semiconductor device, diode
1	CR7	8935924-1	Semiconductor device, diode
1	E1	8954874-2	Terminal stud, grounding
1	J1	8825493-3	Jack, tip (black)
1	J2	8825493-2	Jack, tip (red)
1	J3	8825493-3	Jack, tip (black)
1	J4	8825493-2	Jack, tip (red)
1	L1	2181779-1	Rf choke, 10 mh
1	L2	2181779-1	Rf choke, 10 mh
1	Q1	2181788-1	Semiconductor device, transistor, type 2N1906
1	Q2	2182004-1	Semiconductor device, transistor, type 2N1480
1	Q3	2182004-1	Semiconductor device, transistor, type 2N1480
1	Q4	2182004-1	Semiconductor device, transistor, type 2N1480
1	Q5	2182004-1	Semiconductor device, transistor, type 2N1480
1	Q6	2181788-1	Semiconductor device, transistor, type 2N1906

Table 1. Constant-Current Power Supply Parts List (cont)

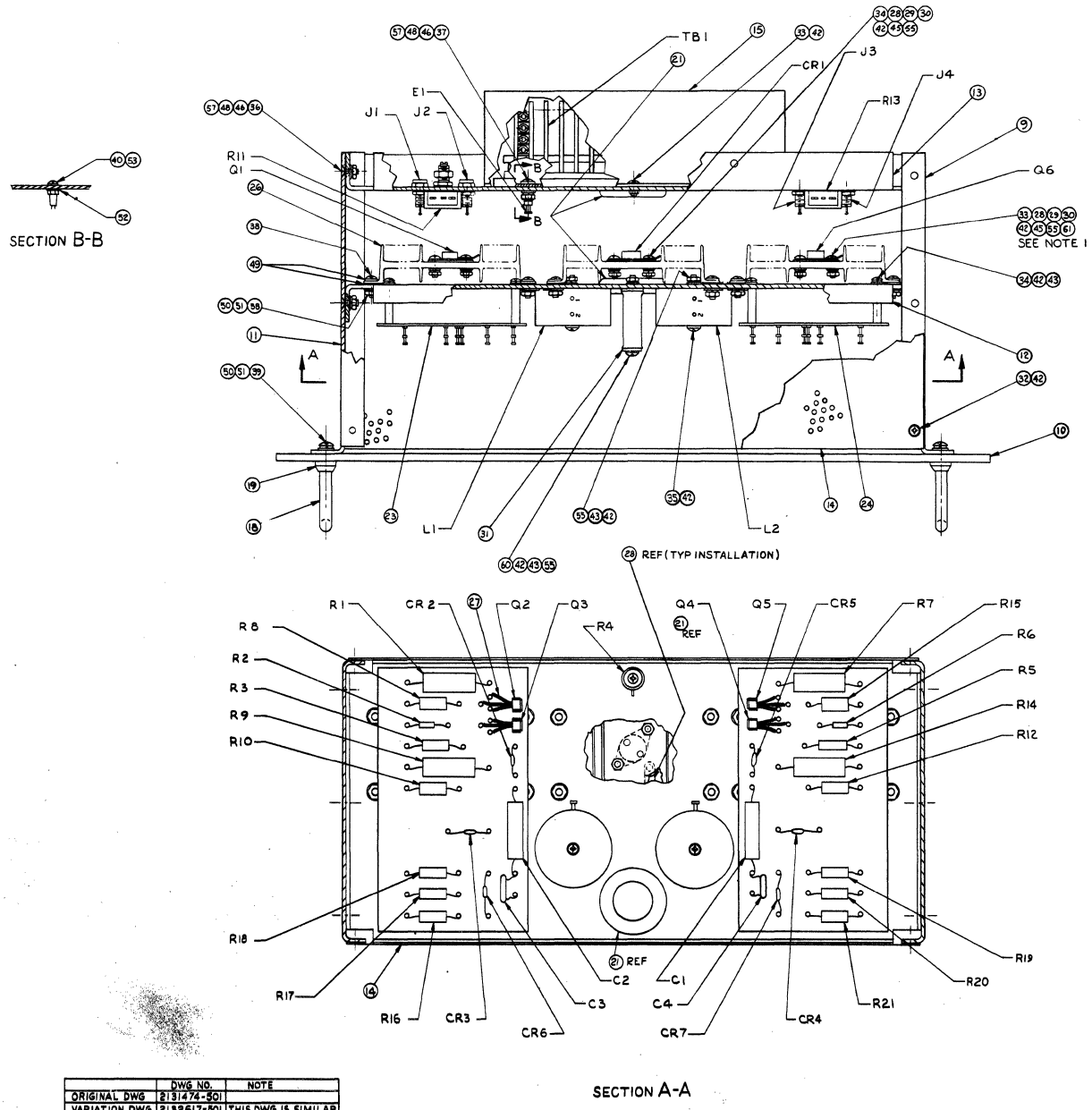
NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	R1	RW55G310J	Resistor, power, fixed, wirewound, 31 ohms, ±5%, 5 w (MIL-R-26C)
1	R2	RC20GF332K	Resistor, fixed, composition, 3300 ohms, ±10%, 1/2 w (MIL-R-11)
1	R3	8977940-313	Resistor, fixed, film, 17.8 k ohms, ±1%, 1/2 w (MIL-R-10509C)
1	R4	RW31G201J	Resistor, power, fixed, wirewound, 200 ohms, ±5%, 10 w (MIL-R-26C)
1	R5	8977940-313	Resistor, fixed, film, 17.8 k ohms, ±1%, 1/2 w (MIL-R-10509C)
1	R6	RC20GF332K	Resistor, fixed, composition, 3300 ohms, ±10%, 1/2 w (MIL-R-11)
1	R7	RW55G310J	Resistor, power, fixed, wirewound, 31 ohms, ±5%, 5 w (MIL-R-26C)
1	R8	RC42GF472K	Resistor, fixed, composition, 4700 ohms, ±10%, 2 w (MIL-R-11)
1	R9	RW55G200J	Resistor, power, fixed, wirewound, 20 ohms, ±5%, 5 w (MIL-R-26C)
1	R10	8977940-81	Resistor, fixed, film, 68.1 ohms, ±1%, 1/2 w (MIL-R-10509C)
1	R11	RA20LASB500A	Resistor, variable, wirewound, 0-50 ohms, ±10%, 2 w (MIL-R-19A)
1	R12	8977940-81	Resistor, fixed, film, 68.1 ohms, ±1%, 1/2 w (MIL-R-10509C)
1	R13	RA20LASB500A	Resistor, variable, wirewound, 0-50 ohms, ±10%, 2 w (MIL-R-19A)
1	R14	RW55G200J	Resistor, power, fixed, wirewound, 20 ohms, ±5%, 5 w (MIL-R-26C)
1	R15	RC42GF472K	Resistor, fixed, composition, 4700 ohms, ±10%, 2 w (MIL-R-11)
1	R16	RC42GF561K	Resistor, fixed, composition, 560 ohms, ±10%, 2 w (MIL-R-11)
1	R17	RC42GF681K	Resistor, fixed, composition, 680 ohms, ±10%, 2 w (MIL-R-11)
1	R18	RC42GF681K	Resistor, fixed, composition, 680 ohms, ±10%, 2 w (MIL-R-11)
1	R19	RC42GF681K	Resistor, fixed, composition, 680 ohms, ±10%, 2 w (MIL-R-11)
1	R20	RC42GF681K	Resistor, fixed, composition, 680 ohms, ±10%, 2 w (MIL-R-11)
1	R21	RC42GF561K	Resistor, fixed, composition, 560 ohms, ±10%, 2 w (MIL-R-11)

Table 1. Constant-Current Power Supply Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	TB1	2170965-501	Terminal board
1	9	2170945-502	Plate, side, chassis
1	10	2171558-1	Panel, front, memory power
1	11	2170945-503	Plate, side, chassis
1	12	2160901-1	Tray, mounting, constant current
1	13	2160902-501	Tray, rear mounting, constant current
2	14	2170957-1	Cover, perforated
1	15	2170955-1	Cover, terminal board
2	18	MS39087-1	Handle, bow
4	19	1008076-2	Ferrule, handle
2	21	MS35489-52	Grommet, rubber, synthetic
1	23	2170948-501	Terminal board, constant current, lh
1	24	2170946-501	Terminal board, constant current, rh
3	26	2181792-1	Heat sink, semiconductor device
AR	27	2010823	Sleeving, transistor leads
3	28	99061-5	Terminal lug
3	29	8265323-1	Insulator
6	30	8265376-1	Insulator
2	31	8954849-4	Bushing, insulating, ceramic
6	32	8914387-7	Screw, machine, pan head, no. 6 (0.138) 32 x 0.312 lg
4	33	8914387-13	Screw, machine, pan head, no. 6 (0.138) 32 x 0.500 lg
9	34	8914387-17	Screw, machine, pan head, no. 6 (0.138) 32 x 0.750 lg
2	35	8914387-25	Screw, machine, pan head, no. 6 (0.138) 32 x 1.25 lg
12	36	MS24693-PC50	Screw, machine, 100°, flat head, no. 8 (0.164) 32 x 0.500 lg
2	37	8844148-13	Screw, machine, pan head, no. 8 (0.164) 32 x 0.500 lg
12	38	8977993-13	Screw, machine, round head, no. 10 (0.190) 32 x 0.500 lg

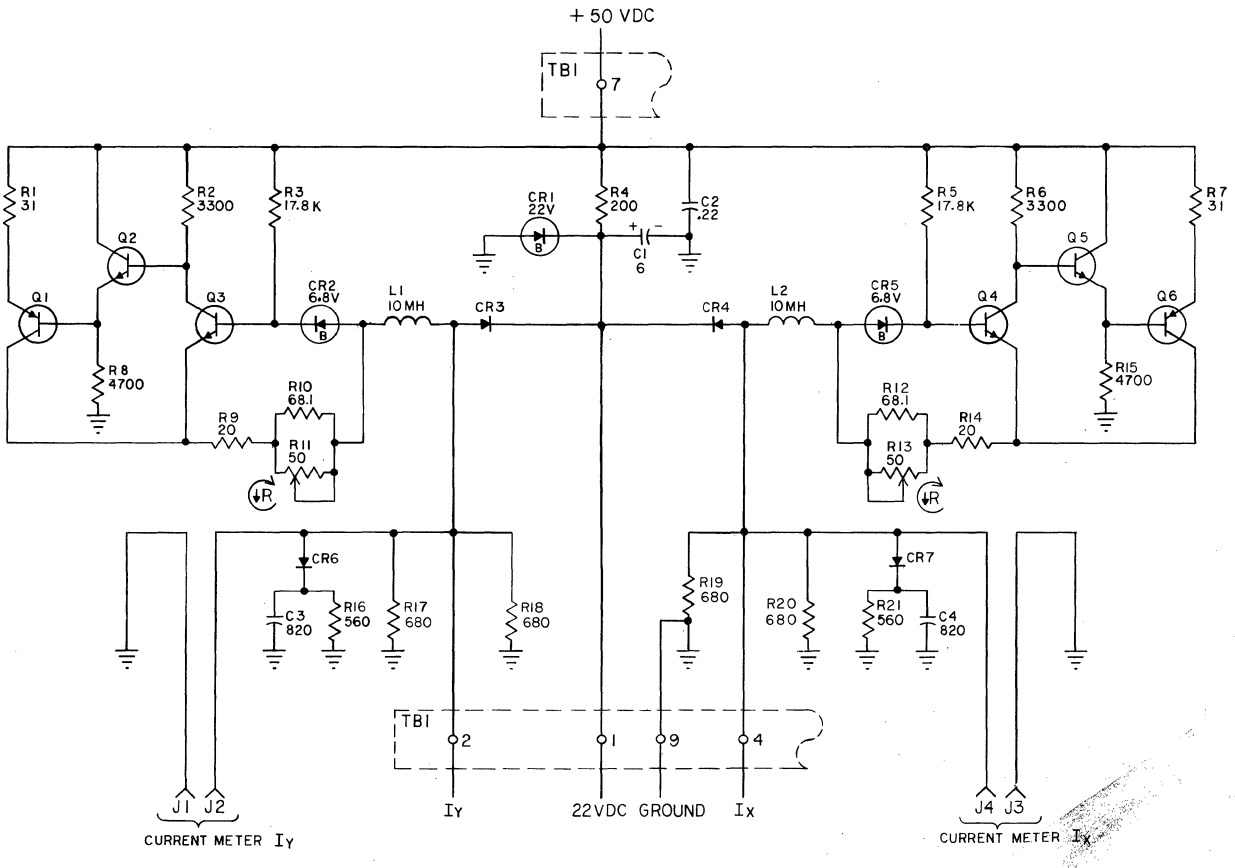
Table 1. Constant-Current Power Supply Parts List (cont)

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
4	39	8914375-17	Screw, machine, pan head, no. 10 (0.190) 32 x 0.750 lg
1	40	8914385-5	Screw, machine, pan head, no. 4 (0.112) 40 x 0.250 lg
33	42	AN960-C6	Washer, flat, no. 6
11	43	93620-57	Washer, spring lock, no. 6
6	45	MS35338-117	Washer, spring lock, no. 6, Ni copper
14	46	AN960-C8	Washer, flat, no. 8
14	48	MS35338-118	Washer, spring lock, no. 8, Ni copper
24	49	8910544-15	Washer, flat, no. 10, nylon
16	50	AN960-C10L	Washer, flat, no. 10
16	51	MS35338-119	Wahser, spring lock, no. 10, Ni copper
1	52	MS35335-71	Washer, lock, external tooth, no. 4
1	53	AN960-C4L	Washer, flat, no. 4
7	55	NAS671-6	Nut, plain, hex, no. 6 (0.138), 32
14	57	NAS671-8	Nut, plain, hex, no. 8 (0.164), 32
12	58	AN315-CL	Nut, plain, hex, no. 10 (0.190), 32
1	60	8954975-1	Stud, resistor mounting, no. 6 (0.138), 32
AR	61	90481-18	Grease, silicone



	DWG NO.	NOTE
ORIGINAL DWG	2131474-501	
VARIATION DWG	2132617-501	THIS DWG IS SIMILAR TO 2131474-501.

Figure 1. Constant-Current Power Supply, Assembly Drawing



NOTES:
1. RESISTANCE VALUES ARE IN OHMS
2. CAPACITANCE VALUES LESS THAN 10 ARE IN UF AND 10 AND ABOVE ARE IN UUF

Figure 2. Constant-Current Power Supply, Schematic Diagram

DIODE MATRIX

RCA 2161447

DESCRIPTION

The diode matrix assembly has three different production configurations, each of which provides a special-purpose program for controlling a paper tape reader (Flexowriter) or a card reader.

CIRCUIT ANALYSIS

The diode matrix contains 24 sets of diodes in which each output line is connected to one or more input lines by a set of diodes, as illustrated in Figure 1. The specific connections for each of the three configurations are shown on the assembly illustration (Figure 2).

CIRCUIT CHARACTERISTICS

Each input line is connected to the output of an MD659 gate. Each output line is connected to the auxiliary input of an MD659 gate. Each set of diodes, therefore, has the same function as the multiple-diode groups on MD659 modules.

LOADING

Each production diode matrix board is designed for a specific use. The number of loads on a driving gate is determined by the number of diodes connected to the input line from that gate. Where more than 8 diodes are connected to an input line, the driving gate for that line consists of two MD659 gates with identical inputs, common output and one collector resistor (capable of driving up to 21 loads).

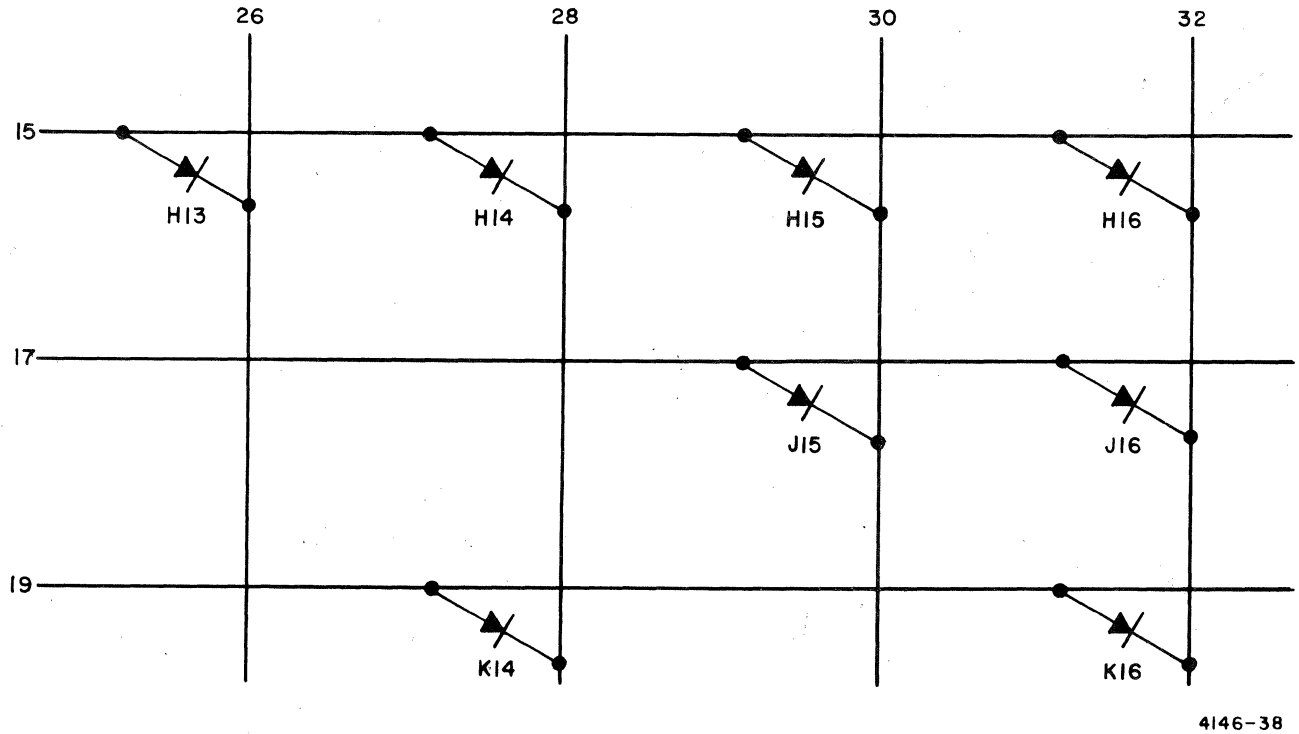


Figure 1. Portion of 2161447-501 Diode Matrix

POWER REQUIREMENTS

The diode matrix consists entirely of passive circuit elements driven by other circuits. No separate power input is required.

WIRING

Table 1 lists maximum lengths of wire which may be used.

Table 1. Wiring

OPEN WIRE	
Maximum Length	21 Inches
Fan-Out Length	72 Inches
TWISTED PAIR	
Maximum Length	72 Inches
Single Load	96 Inches

PARTS LIST

Table 2 lists parts for each production model of the 2161447 diode matrix. The 2161447 diode matrix assembly is illustrated in Figure 2.

Table 2. Diode Matrix Parts List

NO. REQD	ITEM NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
1	1	2162215-1	Board, printed circuit, diode matrix
1	6	8717245-1	Guide, module (lower)
1	7	8717245-2	Guide, module (upper)
158	8-501	2180820-1	Semiconductor device, diode
84	8-502	2180820-1	Semiconductor device, diode
155	8-503	2180820-1	Semiconductor device, diode
1	9	8716037-1	Connector, receptacle, electrical (male)
1	10	8936316-1	Pin, extractor
2	11	8954980-5	Screw, machine, flat head, no. 4 (0.112) - 40 x 0.250
6	12	8954980-9	Screw, machine, flat head, no. 4 (0.112) - 40 x 0.375 lg
4	13	8811181-109	Nut, hex, self-locking no. 4 (0.112) - 40
4	14	AN960 C4	Washer, flat
AR	19	2016075	Staking compound
1	29	8427115-3	Handle

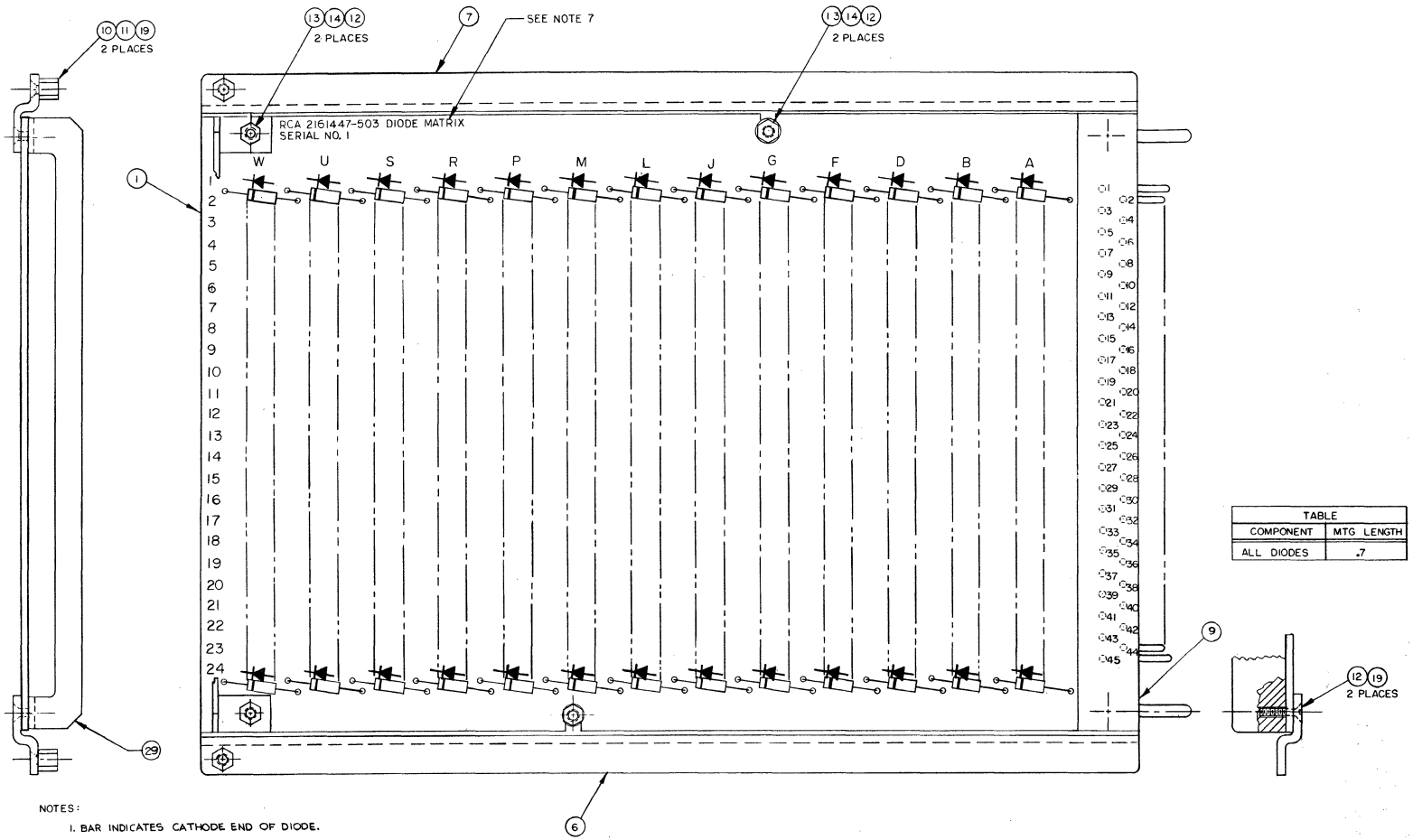


Figure 2. Diode Matrix Module, Assembly Drawing (Sheet 1 of 2)

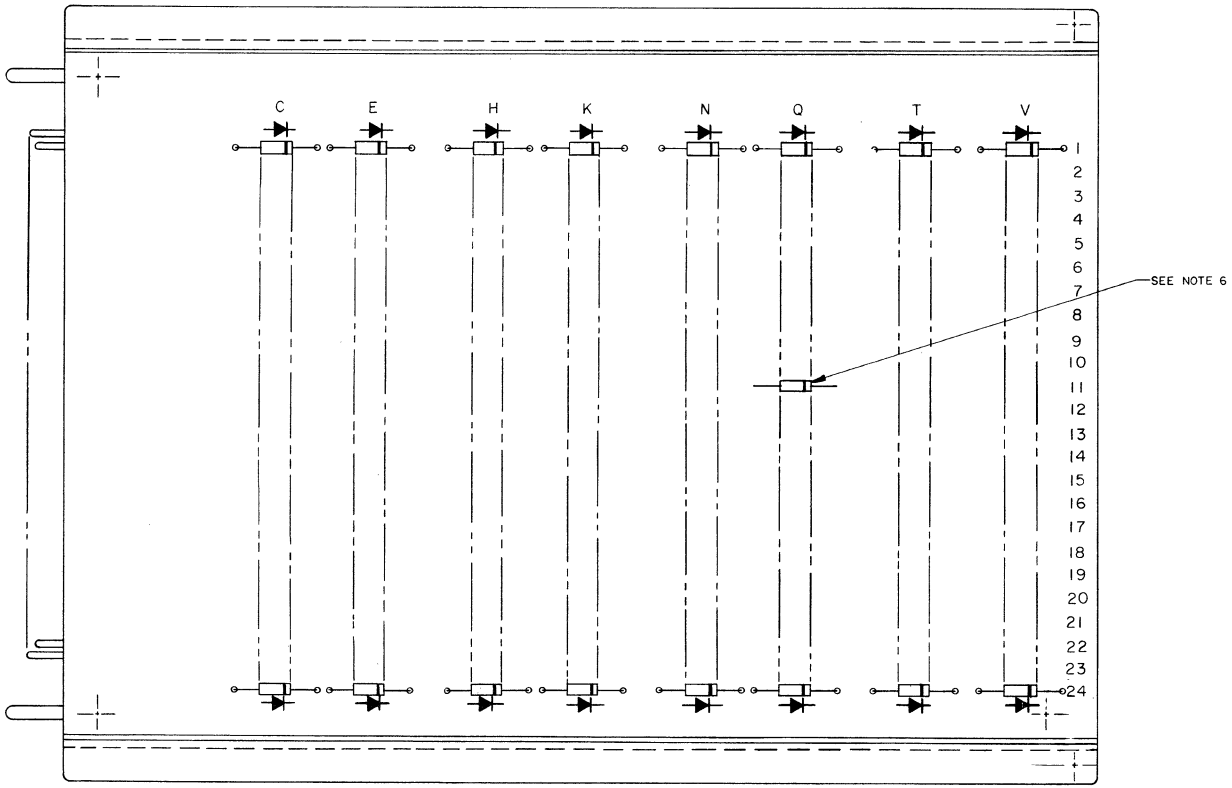


TABLE 1 (501 ASSY)

LTR FIELD \ NO. FIELD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A	X									X													X	
B			X	X	X									X										
C	X	X																	X	X				
D	X								X															
E				X	X		X							X										
F							X			X	X	X		X										X
G	X																				X			
H	X		X	X	X	X		X					X	X	X	X								
J	X						X	X		X	X								X	X	X	X	X	
K				X		X						X	X		X		X							
L		X					X							X		X	X	X	X	X	X	X	X	X
M										X														
N		X	X	X							X	X	X			X				X	X	X	X	
P			X		X		X	X							X	X	X	X	X	X				
Q										X		X				X	X					X	X	
R				X				X	X	X						X	X					X	X	
S					X			X	X	X			X		X		X					X	X	X
T		X						X	X					X			X							
U	X	X	X						X												X	X	X	
V		X	X	X	X									X		X	X	X	X	X	X	X	X	X
W				X		X				X					X		X	X	X	X	X	X		

TABLE 2 (502 ASSY)

LTR FIELD \ NO. FIELD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A	X				X																		X	
B			X	X	X									X										
C	X	X																	X		X		X	
D	X								X												X			
E	X	X				X				X	X	X										X	X	
F						X				X		X												
G	X																			X			X	
H			X	X						X	X	X												
J			X	X		X				X	X	X	X									X		
K							X			X	X	X											X	
L	X	X	X	X	X		X											X	X		X	X	X	X
M						X																		
N																								
P		X			X		X	X	X	X	X		X	X										X
Q																								
R			X												X	X							X	
S		X	X	X						X	X	X			X					X			X	X
T																								
U																								
V																								
W																								

TABLE 3 (503 ASSY)

LTR FIELD \ NO. FIELD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A	X									X													X	
B			X	X	X									X										
C	X	X																	X	X				
D	X								X															
E				X	X		X		X	X				X										
F							X			X	X	X		X										X
G	X																			X			X	
H	X	X	X	X	X	X		X					X	X	X							X		
J	X						X	X		X	X			X					X	X	X	X	X	X
K				X		X				X	X		X											
L		X					X						X		X	X	X	X	X	X	X	X	X	X
M									X	X														
N		X	X	X							X	X		X					X	X	X	X	X	X
P			X		X		X	X				X		X	X	X	X	X	X	X				X
Q							X			X				X								X	X	
R			X				X	X	X	X				X								X	X	
S				X		X	X	X	X	X		X		X								X	X		X
T		X				X	X						X											
U	X	X	X					X											X	X	X			
V		X	X	X	X							X			X	X	X	X	X	X	X	X	X	X
W			X		X		X				X			X	X	X	X	X	X	X	X			

Figure 2. Diode Matrix Module, Assembly Drawing (Sheet 2 of 2)

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