MAINTENANCE MANUAL FOR POWER MODULE 19D902589G1

TABLE OF CONTENTS

	Page
DESCRIPTION	Front Cover
CIRCUIT ANALYSIS	Front Cover
ASSEMBLY DIAGRAM	1
OUTLINE DIAGRAM	2
PARTS LIST	3
PRODUCTION CHANGES	3
SCHEMATIC DIAGRAM	4
IC DATA	5

DESCRIPTION

The Power Module 19D902589G1 contains switching power supplies for the +12 and -12 volt supplies, and a switching power supply for the +5 volt digital supply. The outputs of the +12 volt and -12 volt supplies are regulated to provide +5 volt and -5 volt outputs. A filtered A+ output is also provided.

The Power Module is powered from the 13.8 volt Station Power Supply output. Power is distributed to the Control Shelf modules through the Backplane Board.

Due to the high current switching components, both EMI and RFI shielding are provided by a zinc diecast cover.

CIRCUIT ANALYSIS

The Power Module connects to 96-pin DIN connector J9 on the Backplane Board. The Power Module provides all operating voltages for the Control Shelf, and operates from the station power supply A+. The Power Module is designed to operate over an input voltage range of 10.8 to 16.2 volts, and provides the following outputs:

FILTERED A+	at	1550 mA
REGULATED +12V	at	100 mA
REGULATED -12V	at	100 mA
REGULATED -5V	at	40 mA
ANALOG +5V	at	40 mA
DIGITAL +5V	at	1000 mA

FILTERED A+

Filtered A+ is generated by coupling the input voltage (A+) through an LC filter network consisting of L1, C11 and C18. The filter network filters out any low frequency hum and isolates the audio circuits from the noise on A+.

±12V AND ANALOG ±5V SUPPLY

The 12 volt supplies require a dc-to-dc converter as the 12 Volts is generated from an input below 13 volts. The converter consists of a push-pull chopper, voltage doublers, and linear regulators.

The clock for the chopper is a standard 555 oscillator, U4. The clock frequency is set by C9, R9 and R14 to approximately 27 kHz. Resistor R9 is selected to obtain an approximate fifty percent duty cycle. When pin 3 of U4 is high, the NPN side of the chopper is enabled. When U4-pin 3 is low, the PNP side of the chopper is enabled. This assures that the high current transistors Q2 and Q3 are never on at the same time. A filter consisting of L5, C19, C25 and C29 prevents the chopper's spikes from contaminating A+. Inductor L5 also provides some current limiting.

ERICSSON

Ericsson Inc.
Private Radio Systems
Mountain View Road
Lynchburg, Virginia 24502
1-800-528-7711 (Outside USA, 804-528-7711)

Printed in U.S.A.

The rising edge of the clock pulse turns Q5 on, turning on Q1. Q1 provides two functions; it turns high current transistor Q2 rapidly, and also provides the pull-up to Q4 so that high current transistor Q3 can be turned on. The rising edge of the clock also turns on Q6, which in turn, turns off Q4. However, the voltage at the collector of Q4 is delayed by the charge time of C22 and the turn on time of Q1. This is done to make sure Q2 is turned off before Q3 can turn on.

The falling edge of clock pulse Q6 turns off, turning on Q4. This rapidly discharges C22, causing a negative pulse that rapidly turns off high current transistor Q3. Diode D2 helps to protect the base of Q3 by clipping the negative excursion of the spike. Q4 also pulls R12 low to turn on high current transistor Q2. But Q2 can not turn on until Q1 turns off. The falling edge of clock turns off Q5 which turns off Q1. Q1 does not have any help from a capacitor so it remains on slightly longer than Q4. This assures that Q3 is turned off before Q2 turns on.

The collector outputs of Q2 and Q3 provide a high current square wave. This is fed into the doubler circuits. The doublers are required because the negative source will always be below the threshold of the linear regulator, and the positive supply will come perilously close to threshold at low voltage.

Part of this square wave is added to the supply voltage provided through D3, and rectified by D1 to provide about 26 volts from 13.6-volt supply. This voltage is regulated down to the 12-volt supply by linear T0220 7812 regulator IC U3.

The analog 5V, +5VA, is generated by further regulating the twelve volt supply to 5 volts with T092 98L05 regulator IC U7.

Another portion of the square wave is rectified by D4 and D9 to provide an -11 volt supply. This supply is coupled through D8 and added to the remaining part of the square wave. The sum of the outputs is rectified by D6 to provide about -20 volts from the 13.6-Volt supply. The -20 volts is coupled to the regulated -12 volt supply through linear T0220 7912 regulator U1.

The -5 volt supply is generated by further regulating the -12 volt supply to -5 volts with T09279L05 IC U2. Diode D5 is a one ampere Shottky diode whose function is to clamp the -5V line below +.4 volts during power-on transients. This is required to protect the codec IC on the DSP board.

Digital +5V Supply

The digital 5 volt supply is generated by step-down switching regulator. The heart of the system is a MC34063 switching regulator control IC, U6. U6 has an internal temperature compensated reference, a voltage comparator that controls a variable duty cycle oscillator, and a transistor switch. C10 controls the maximum ON time, and the value is selected to reduce ripple.

The current requirements of the +5-volt supply exceeds the internal switch in U6. Therefore, U6 is used to switch the external power fet Q7. R15 provides a pullup on the open collector nature of the internal switch. The emitter of the internal switch is tied to ground.

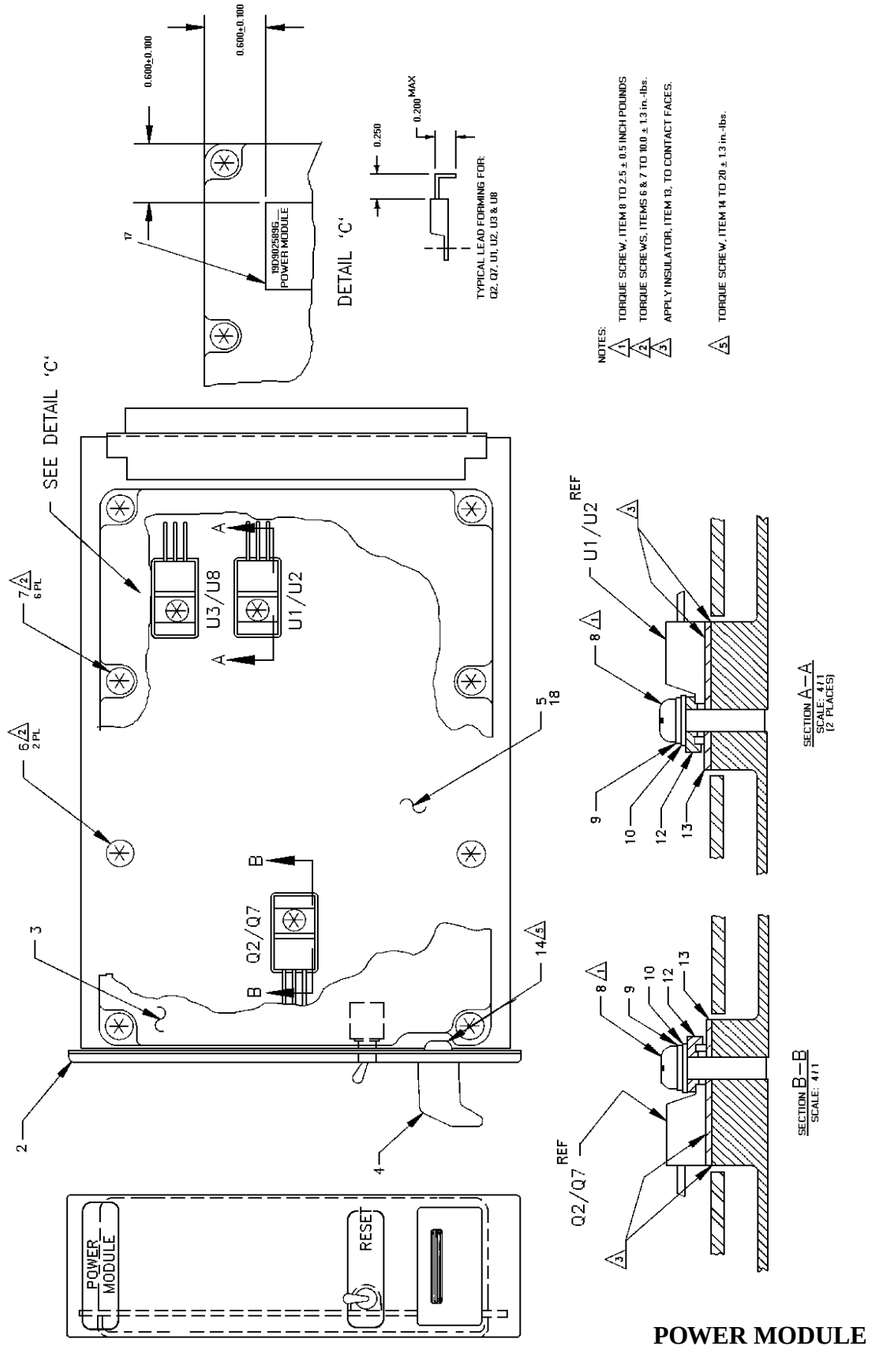
U6 also contains a current limiting feature. The voltage across R17 is monitored, and it rises as the supply draws current. There is a point where it starts limiting the switch on time. This causes the voltage to fold back. Components R17, C14 and L4 combine to provide a filter to prevent switching transients from corrupting A+ supply.

Components L2, L3, C4, C6, C8 and C12 form the output filter. D7 is a high current shottky diode that acts as the supply's catch diode. The regulator output voltage is set by R4 and R5. These resistors are selected to apply 1.25 volts to the sense pin (U6-5) of the regulator IC when the voltage is 5 volts. Additional filtering after the regulator sensing is provided by L3, C8 and C12 to further reduce ripple.

IC U5 provides overvoltage protection. It will trip SCR Q8 whenever the voltage on pin 3 exceeds 1.25 volts. The overvoltage limit is set for 6.25 volts by R6 and R7. Capacitor C7 prevents the circuit from tripping when power is turned on, or from short spikes. When U5 trips, it fires SCR Q8. Q8 is a crowbar on the A+ line, and should short out and blow the fuse in the main power supply.

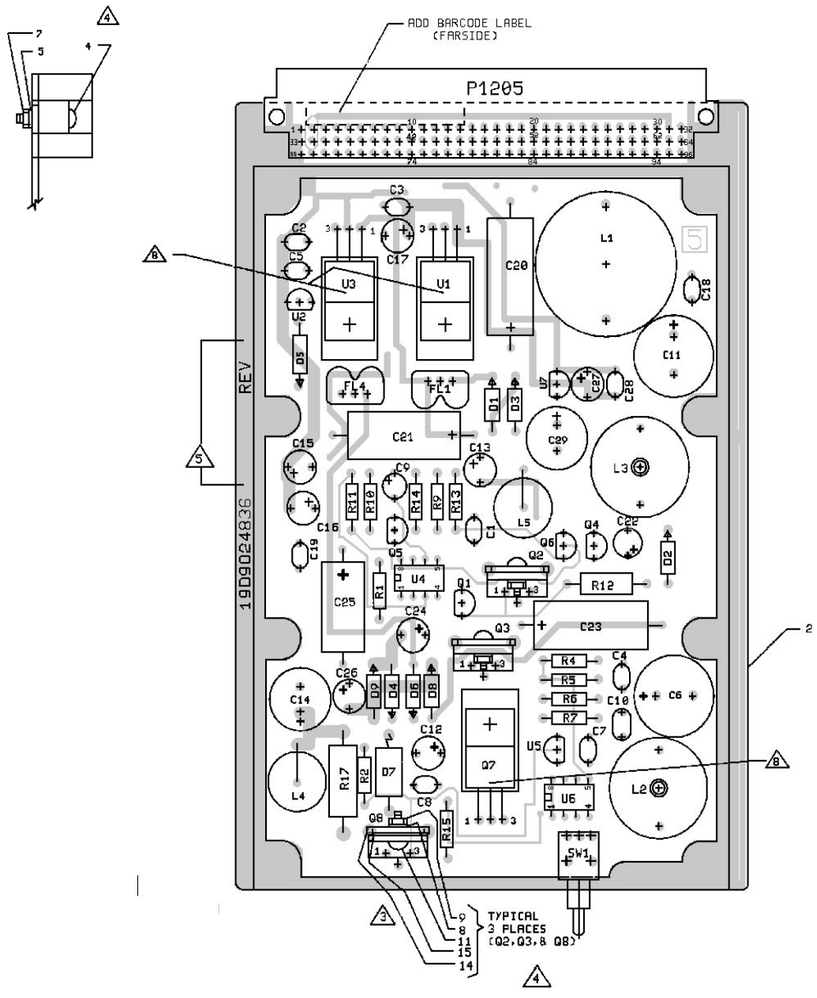
System Reset Switch

System's Reset Switch SW1 is located on the Power Module front panel. The pull-up resistor for the switch is located on the System Module.



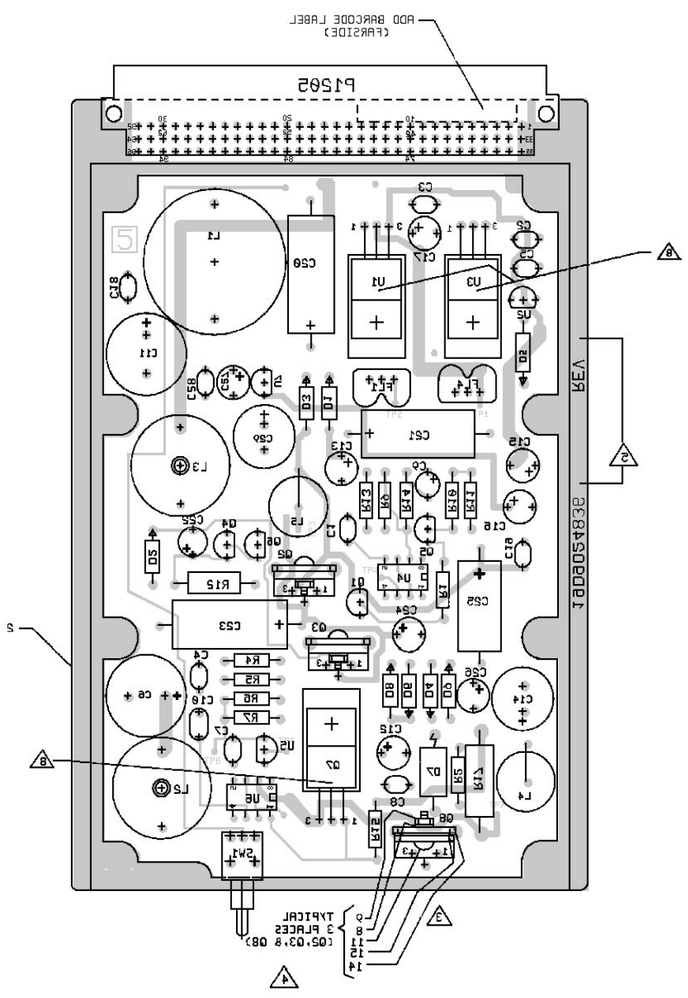
POWER MODULE
19D902589G1
(19D902589, Rev.6)

COMPONENT SIDE

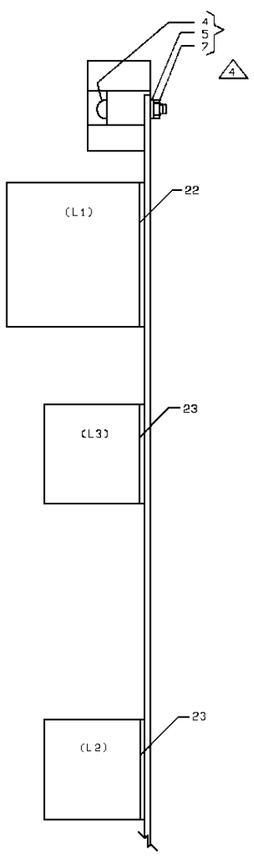


(19D902483, Sh. 1, Rev. 6)
(19D902482, Component Side, Rev 5.)

SOLDER SIDE



(19D902483, Sh. 1, Rev. 6)
(19D902482, Solder Side, Rev 5.)



NOTES:

4 TORQUE HARDWARE TO 4 in-lb.

CAUTION

OBSERVE PRECAUTIONS FOR HANDLING

ELECTROSTATIC SENSITIVE DEVICES

POWER MODULE BOARD
19D902962G1

POWER MODULE
19D902589G1

SYMBOL	PART NUMBER	DESCRIPTION
		— — — — TRANSISTORS — — — —
Q7	19A705325P1	MOSFET, P-Channel: sim to Seimens BUZ171.
		— — INTEGRATED CIRCUITS —
U1	19A134718P2	Linear: -12 Volt Regulator; sim to uA7912U.
U3	19A134717P2	Linear: 12 Volt Regulator: sim to MC7812CT.
		— — — MISCELLANEOUS — —
2	19D902485P2	Chassis.
3	19D902486P2	Cover.
4	19D902555P1	Handle.
5	19D902483G1	Power Module Board (see below).
6	19A702381P506	Screw, thread forming: TORX, No. M3.5-.6 x 6.
7	19A702381P513	Screw, thread forming: TORX, No. M3.5 - 0.6 X 13.
8	19A702364P208	Machine screw: TORX Drive, M2.5 - 0.45 x 8.
9	19A700032P3	Lockwasher, tooth, steel, metric: 2.5.
10	19A701312P3	Flatwasher, metric: No. 2.5MM.
12	19A700068P1	Insulator, bushing.
13	19A705469P1	Insulator Plate, TO-220.
14	19A702381P508	Screw, thd. form: No. 3.5-0.6 x 8.
17	19B235310P1	Nameplate (blank).
		POWER MODULE BOARD 19D902483G1
		— — — — CAPACITORS — — —
C1	T644ACP310K	Polyester: .010 µF ±10%, 50 VDCW.
C2 thru C5	19A700121P106	Ceramic: 0.1 µF ±20%, 50 VDCW.
C6	19A701225P5	Electrolytic: 680 µF, -10+50%, 35 VDCW.
C7 and C8	19A700121P106	Ceramic: 0.1 µF ±20%, 50 VDCW.
C9	T644ACP322K	Polyester: .022 µF ±10%, 50 VDCW.
C10	19A700233P3	Ceramic: 220 pF ±20%, 50 VDCW.
C11	19A701225P5	Electrolytic: 680 µF, -10+50%, 35 VDCW.
C12	19A701534P9	Tantalum: 47 µF ±20%, 6.3 VDCW.
C13	19A701534P8	Tantalum: 22 µF ±20%, 16 VDCW.
C14	19A701225P4	Electrolytic: 330 µF ±10%, 25 VDCW.
C15 and C16	19A701534P8	Tantalum: 22 µF ±20%, 16 VDCW.
C17	19A701534P9	Tantalum: 47 µF ±20%, 6.3 VDCW.
C18 and C19	19A700121P106	Ceramic: 0.1 µF ±20%, 50 VDCW.
C20 and C21	5496267P19	Tantalum: 22 µF ±20%, 35 VDCW; sim to Sprague Type 150D.
C22	19A701534P6	Tantalum: 4.7 µF ±20%, 35 VDCW.
C23	5496267P19	Tantalum: 22 µF ±20%, 35 VDCW; sim to Sprague Type 150D.
C24	19A701534P8	Tantalum: 22 µF ±20%, 16 VDCW.
C25	5496267P16	Tantalum: 100 µF ±20%, 20 VDCW; sim to Sprague Type 150D.
C26	19A701534P8	Tantalum: 22 µF ±20%, 16 VDCW.
C27	19A701534P9	Tantalum: 47 µF ±20%, 6.3 VDCW.
C28	19A700121P106	Ceramic: 0.1 µF ±20%, 50 VDCW.
C29	19A701225P4	Electrolytic: 330 µF ±10%, 25 VDCW.
		— — — — DIODES — — — — —
D1 thru D4	T324ADP1041	Silicon: Rectifier; sim to 1N4004.
D5	19A134134P2	Rectifier, silicon; sim to Motorola 1N5818.
D6	T324ADP1041	Silicon: Rectifier; sim to 1N4004.
D7	19A702977P1	Diode, silicon, SCHOTTKY: sim to IN5822.
D8 and D9	T324ADP1041	Silicon: Rectifier; sim to 1N4004.
		— — — — FILTERS— — — — —
FL1	19A705217P1	Filter, EMI Suppression.
FL4	19A705217P1	Filter, EMI Suppression.
		— — — INDUCTORS — — — —
L1	19A703475P1	Reactor: 1 µH ±10% @ 3 amps DC, 18 VDCW.
L2 and L3	19A149806P1	Reactor: 100 µH ±10% @ 4 amps DC.
L4 and L5	19A149806P2	Reactor: 100 µH ±10% @ 2 amps DC.
		— — — — — PLUGS — — — — —
P1205	19B801587P4	Connector, DIN: 96 male contacts, right angle mounting; sim to AMP 532505-1.
		— — — TRANSISTORS — — —
Q1	19A700022P2	Silicon, PNP: sim to 2N3906.
Q2	19A116375P1	Silicon, PNP.
Q3	19A700054P1	Silicon, NPN, 60 w; sim to BD-201.
Q4 thru Q6	19A700023P2	Silicon, NPN: sim to 2N3904.
Q8	19A116451P1	Thyristor, silicon controlled; sim to C122BX3.
		— — — — RESISTORS — — — —
R1	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R2	H212CRP110C	Deposited carbon: 100 ohms ±5%, 1/4 w.
R4	19A701250P257	Metal film: 3.83K ohms ±1%, 1/4 w.
R5	19A701250P209	Metal film: 1.21K ohms ±1%, 1/4 w.
R6	19A701250P226	Metal film: 1.82K ohms ±1%, 1/4 w.
R7	19A701250P242	Metal film: 2.67K ohms ±1%, 1/4 w.
R9 thru R11	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R12	19A700113P55	Composition: 470 ohms ±5%, 1/2 w.
R13	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R14	H212CRP247C	Deposited carbon: 4.7K ohms ±5%, 1/4 w.
R15	H212CRP210C	Deposited carbon: 1K ohms ±5%, 1/4 w.
R17	19A700050P1	Wirewound: 0.1 ohms ±10%, 2W
		— — — — SWITCHES — — — —
SW1	19A705959P4	Toggle switch: SPDT, 0.4 VA @ 20V, sim to E & K T101-M-149-4-B-E.
		— — INTEGRATED CIRCUITS —
U2	19A704971P5	Linear: -5 Volt Regulator; sim to MC79L05ACP.
U3	19A134717P2	Linear: +12 Volt Regulator; sim to MC78L12.
U4	19A701865P1	Linear: Timer; sim to Signetics NE555N.
U5	19A705957P1	Linear, Voltage Detector; sim to MC34061.
U6	19A705941P1	Linear, DC to DC Converter; sim to MC33063P1.
U7	19A704971P1	Linear: +5 Volt Regulator; sim to MC78L05ACP.
		— — — MISCELLANEOUS — —
4	19A702364P210	Machine screw, metric: M2.5-.45 x 10.
5	19A700032P3	Lockwasher, tooth, steel, metric: 2.5.
7	19A700034P3	Hex nut, metric: M2.5 x 0.45.
8	19A700032P5	Lockwasher, internal tooth: No. 3MM.
9	19A700034P4	Nut, hex: No. M3 x 0.5MM.
11	19A702364P308	Machine screw, TORZ Drive: No. M3-0.5 x 8.
14	19B232901P2	Support.
15	19A705469P1	Insulator Plate, TO-220.
22	19C337679P1	Foam pad.
23	19C337679P2	Foam pad.

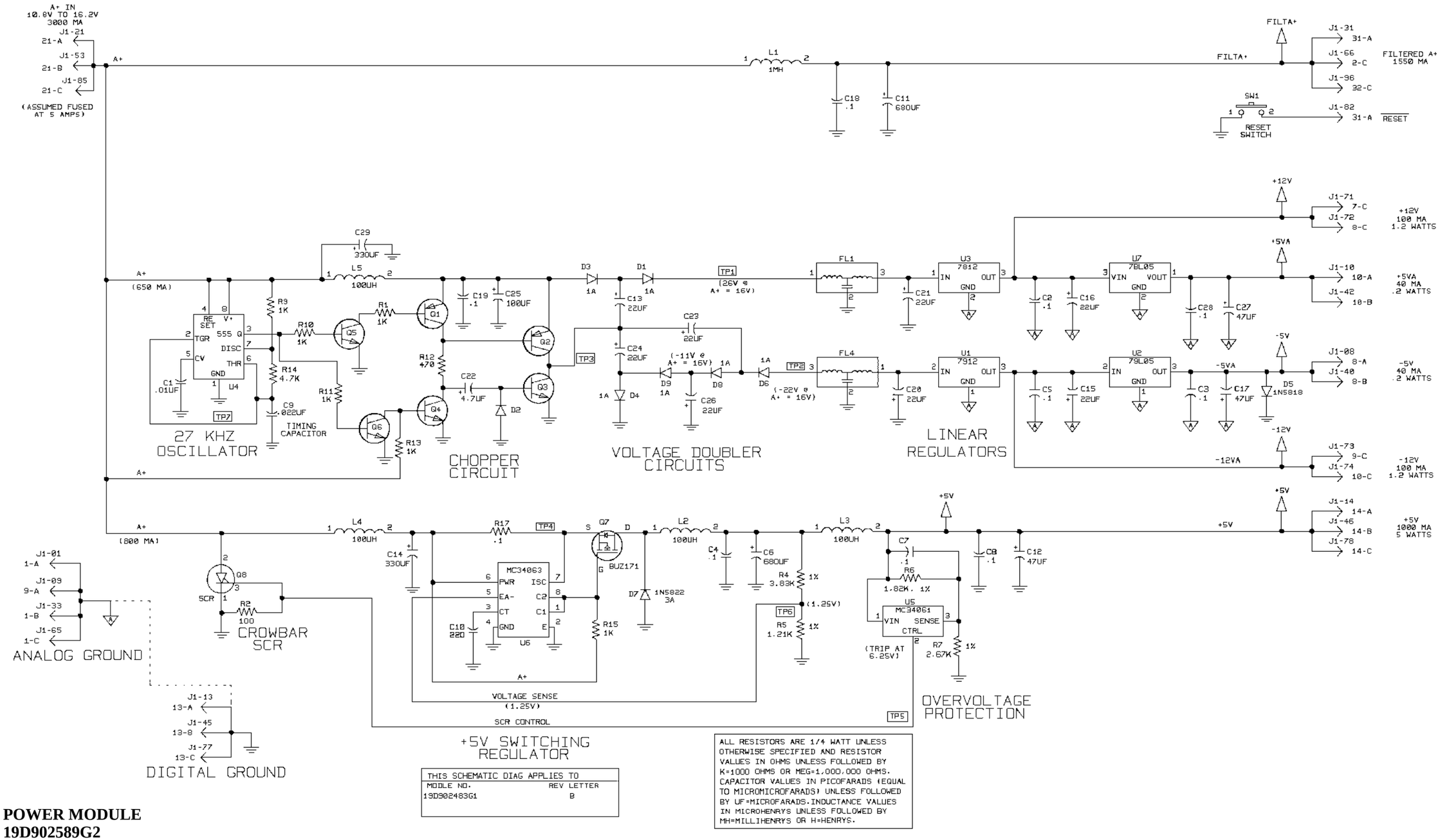
* COMPONENTS, ADDED, DELETED OR CHANGED BY PRODUCTION

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter" which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for the descriptions of parts affected by these revisions.

Rev. A - Power Module Board, 19D902483G1.
Incorporated into initial shipment

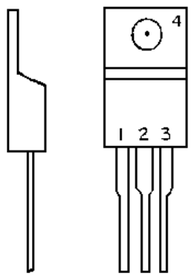
Rev. B - Power Module Board, 19D902483G1.
Incorporated into initial shipment

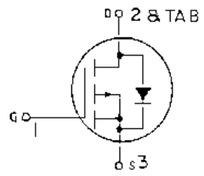


POWER MODULE
19D902589G2

(19D902909, Rev. 3)

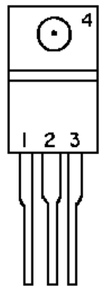
Q7
MOSFET TRANSISTOR
19A705325P1





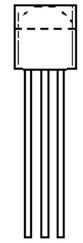
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

U3
(+12 VOLT)
VOLTAGE REGULATOR
19A134717P2



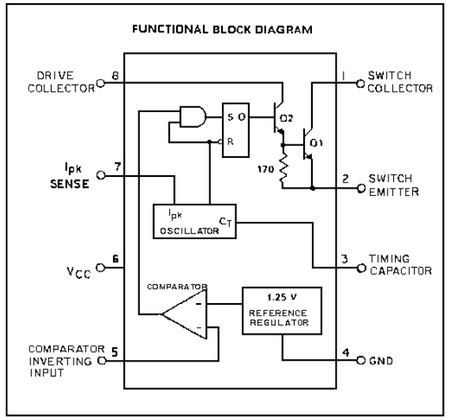
1. INPUT
2. COMMON
3. OUTPUT
4. TAB COMMON

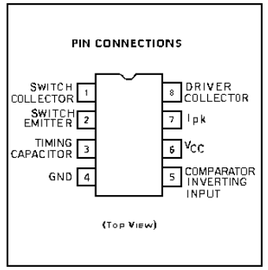
U5
OVER-VOLTAGE SENSING
19A705957P1

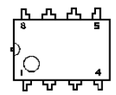


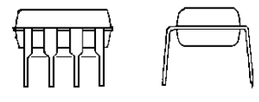
PIN 1. Vcc
2. DRIVE OUTPUT
3. SENSE

U6
DC TO DC CONVERTER
19A705941P1

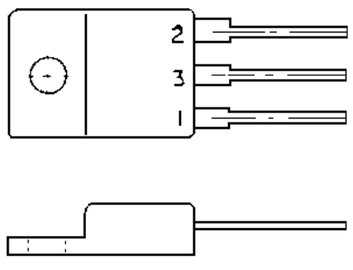






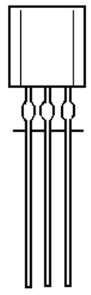


U1
(-12 VOLT)
VOLTAGE REGULATOR
19A134718P1 & P2



1. COMMON
2. OUTPUT
3. INPUT

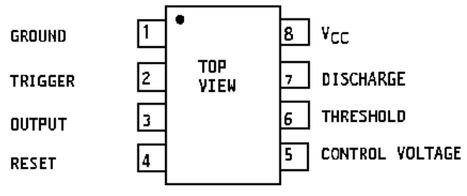
U2
(-5 VOLT)
VOLTAGE REGULATOR
19A704013P1



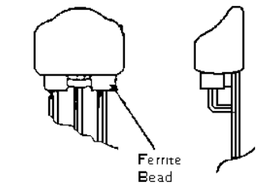
BOTTOM VIEW

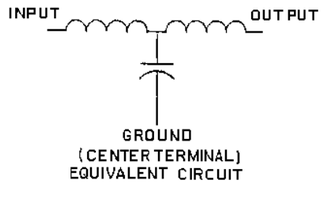
PIN 1 - GROUND
PIN 2 - INPUT
PIN 3 - OUTPUT

U4
LINEAR 555 TIMER (27 kHz)
19A701865P1

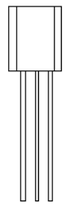


FL1,FL3,FL4
"DOLLY" FILTER
19A705217P1





U7
(+5 VOLT)
VOLTAGE REGULATOR
19J706031P1



BOTTOM VIEW

PIN IDENTIFICATION

PIN 1 - OUTPUT
PIN 2 - GROUND (COMMON)
PIN 3 - INPUT