

**150-174 MHz, 110 WATT POWER AMPLIFIER 19D901865G1****136-174 MHz, 40 WATT POWER AMPLIFIER 19D901865G2,3****TABLE OF CONTENTS**

	PAGE
DESCRIPTION	1
CIRCUIT ANALYSIS	1
OUTLINE DIAGRAMS	3
SCHEMATIC DIAGRAM	4
PARTS LIST AND PRODUCTION CHANGES	5

DESCRIPTION

The PA assembly uses five RF power transistors to provide 110 watts of output power, or 3 RF transistors to provide 40 watts of output power. The output power is adjustable over a range of 55 to 110 watts in the high power PA, and 20 to 40 watts in the medium power PA. Five transistors are used in the power control circuit.

Supply voltage for the PA is connected from power leads on the Transmit-Receive-System (TRS) board through feedthrough capacitors A2-C1 and C2 to hole 11 (A-) and hole 12 (A+) on the PA board. C52, C53, and L23, and L24 prevent RF from getting on the power leads. Diode D5 will cause the main fuse in the fuse assembly to blow if the polarity of the power leads is reversed.

The PA assembly is insulated from vehicle ground by C33 through C44 to permit operation in positive or negative ground vehicles.

NOTE

In positive ground vehicles, A- is "hot" with respect to vehicle ground. Shorting the transmitter PA printed wiring board ground pattern to the radio case may cause one of the in-line fuses to blow.

PA metering Jack J1 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12 with a cable adaptor. The Test Set meters the RF drive (exciter output), control voltage driver current, PA current and PA voltage.

CIRCUIT ANALYSIS**RF AMPLIFIERS**

The exciter output is coupled through P101 on the TRS board to PA input jack J3. The RF is coupled through a 50 ohm stripline (Z5) and then through T1, stripline Z6, L1 and Z7 to the base of 1st RF Driver Q1.

Part of the RF is rectified by D1 and applied to RF Switch Q13 to activate the power control circuitry. Part of the DC voltage is applied to voltage dividers R1 and R2 for metering the exciter output at J1.

The RF amplifiers consist of three Class C, common-emitter amplifiers. In 40 watt transmitters, Q3 is the PA stage. R17, L12 and L42 are a stabilizing network in the base of Q3. The output of Q3 is coupled through 50 ohm coaxial cable W6 to the low pass filter and then to the antenna relay.

Driver current is metered at J1 (Driver Current). The reading is taken on the one-volt scale with the High Sensitivity button pressed, and with the meter polarity switch in the minus (-) position. The meter is read as 15 amperes full scale.

Jumpers W3, W5 and W7 act as shunt resistors for the metering circuit.

In 110 watt transmitters, the 40 watt output is coupled through jumper W1 to a Wilkinson power splitter consisting of C57, C59, L26, L27 and Z1.

The power amplifier stages consist of two identical paralleled Class C power amplifiers (Q5 and Q6).

L30, L32, R24 and C63 make up a stabilizing network in the base of Q5, while L31, L33, R25 and C68 make up the stabilizing network in the base of Q6. Supply voltage (A+) for Q5 and Q6 is coupled through collector feed networks Z3 and Z4.

Collector current for Q5 and Q6 is measured at J1 (PA Current). The reading is taken on the one-volt scale with the high sensitivity button pressed and the polarity switch in the minus (-) position. The current is read as 30 amperes full scale.

The output of Q5 and Q6 is applied to a Wilkinson power combiner consisting of C78, L40, Z2, L41 and C79. The output of the combiner is coupled through T2 and two 50 ohm striplines (Z16 and Z17) to the low pass filter. The filter output is coupled through 50 ohm stripline to Z18 to the antenna relay (K1).

WARNING

The RF Power Transistors used in the transmitter contain Beryllium Oxide, A TOXIC substance. If the ceramic, or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

POWER CONTROL CIRCUIT

The power control circuit provides power leveling as well as thermal protection for the PA.

When the transmitter is keyed, RF is rectified by D1. The resulting DC turns on RF switch Q13. This allows Q11, Q12 and pass transistor Q4 to turn on. Turning on Q4 applies collector voltage to 1st RF driver Q1.

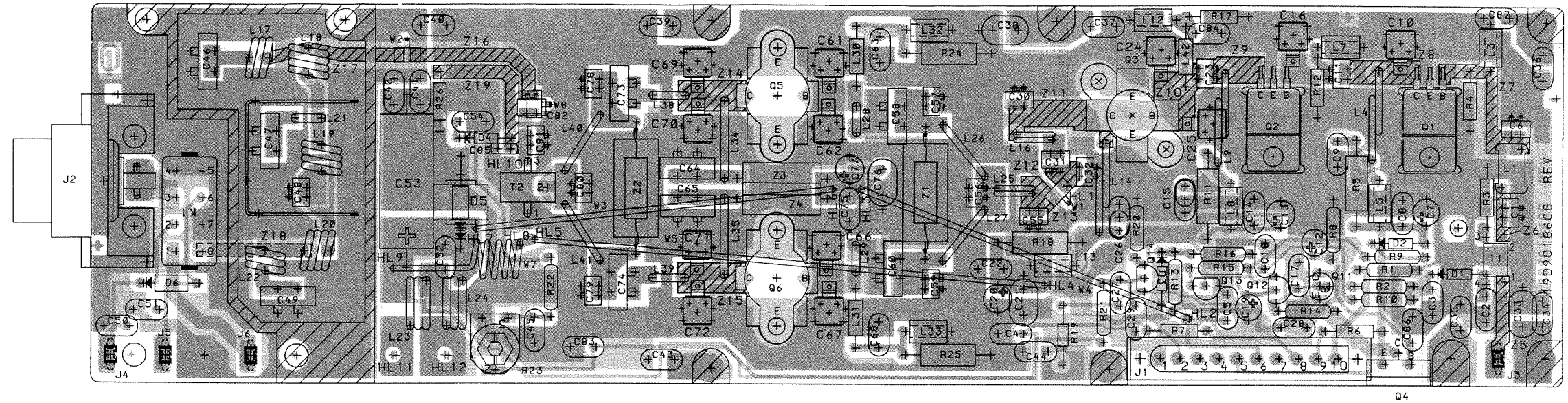
If the power output should start to increase above the level set by R23, Q14 will start to conduct. This causes Q12, Q11 and Q13 to conduct less, reducing the collector voltage to the 1st RF driver.

Thermal protection is provided by temperature compensating resistor R19. As the heat sink temperature rises above 70°C, the resistance of R19 decreases. This causes Q3, Q11, and Q12 to conduct less, reducing the power output.

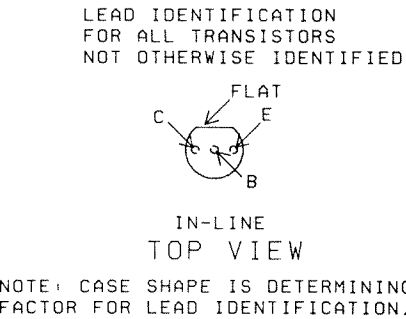
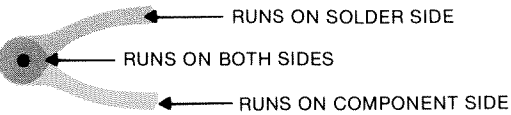
CAUTION

Do not operate the transmitter at levels higher than rated output. Operating at higher than rated output will shorten the life of the RF power transistor.



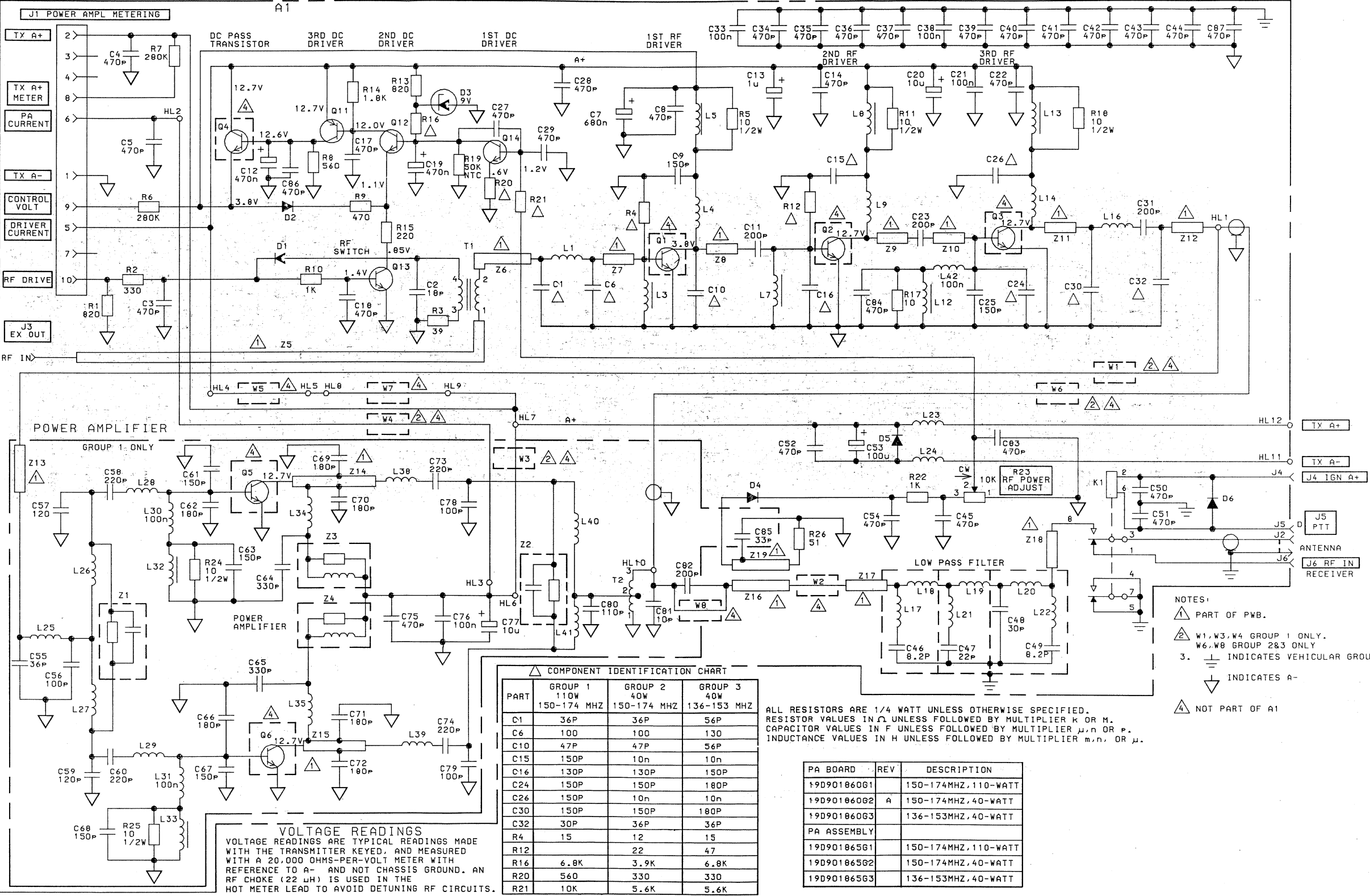


(19D901860, Sh. 1, Rev. 0)
(19A705110, Sh. 1 & 2, Rev. 1)
(19A705110, Sh. 3 & 4, Rev. 0)



OUTLINE DIAGRAM

POWER AMPLIFIER ASSEMBLY



SCHEMATIC DIAGRAM

POWER AMPLIFIER ASSEMBLY

GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION
	----- NETWORKS -----			
19A702003G1	NETWORK LOAD 19A702003G1 (G1 ONLY)		19A701093P4	Strap. (Used with Q1 & Q2).
	----- CAPACITORS -----		19A701706P1	Heat sink. (Used with Q1 & Q2).
19A700105P19	Mica: 27 pF + or -5%, 500 VDCW.		19A701983P1	Shield washer. (Secures Q1 & Q2).
	----- RESISTORS -----		19A700068P1	Insulator, bushing. (Used with Q4).
19A700111P24	Composition: 24 ohms + or - 5%, 750 VDCW.		19A701312P3	Flatwasher, metric: No. 2.5MM. (Secures Q4).
	FILTER ASSEMBLY 19A701092G4 (G1 ONLY)		19A700033P3	Lockwasher, external tooth: M2.5. (Secures Q4).
	----- INDUCTORS -----		19A700034P3	Hex nut, metric: M2.5 x 0.45. (Secures Q4).
19A701091G2	Coil.			
	----- RESISTORS -----			
19A700112P15	Composition: 10 ohms + or - 5%, 1 w.			
	Part of PWB 19D901859P1.			
19A703218G1	Capacitor assembly: ceramic, feed-thru, 1000 pF +100% -0%, 500 VDCW.			
	----- TRANSISTORS -----			
19A701891P1	Silicon, NPN, VHF Amplifier, 5 watt, 12.5 v.			
19A701891P4	Silicon, NPN, VHF Amplifier, 14.5 watt, 12.5 v.			
19A704867P1	Silicon, NPN, 12.5 v, 50 watt, VHF Amplifier.			
19A700054P1	Silicon, NPN, 60 w; sim to BD-201.			
19A134387P1	Silicon, NPN.			
	----- CABLES -----			
19A701093P1	Strap. (G1 only).			
19A701093P1	Strap.			
19A701851P2	Coil. (G1 only).			
19A701851P3	Coil. (G1 only).			
19A701851P4	Coil.			
19A702075G1	Semi rigid cable. (G2 & G3).			
19A701871P2	Coil.			
19A701093P1	Strap. (G2 & G3).			
	HANDLE LOCK ASSEMBLY 19D900349G3 LOW POWER 19D900349G4 HIGH POWER			
19B800004P5	Lock.			
19C850699P1	Lock support.			
19C850627P1	Handle.			
19A700132P818	Dowel pin. (Secures handle).			
19A701347P1	Lock pin. (Locks handle).			
19A700140P2	Compression spring. (Used with lock pin).			
19C850941P1	Slide lock. (Secures compression spring).			
19A702362P408	Machine screw: M3.5-.6 x 8. (Quantity 2).			
	----- MISCELLANEOUS -----			
19D900262P1	Low pass filter housing.			
19A700115P3	Insulator, plate. (Used with Q4).			

PARTS LIST			SYMBOL	GE PART NO.	DESCRIPTION	SYMBOL	GE PART NO.	DESCRIPTION
POWER AMPLIFIER ASSEMBLY 19D901865G1 150-174 MHZ, 110 W 19D901865G2 150-174 MHZ, 40 W 19D901865G3 136-153 MHZ, 40 W ISSUE 1								
A1		POWER AMPLIFIER BOARD 19D901860G1 150-174 MHZ, 110 W 19D901860G2 150-174 MHZ, 40 W 19D901860G3 136-153 MHZ, 40 W						
		----- CAPACITORS -----						----- DIODES -----
C1	19A701413P22	Mica: 36 pF + or -5%, 100 VDCW. (Used in G1 & G2).	C30	19A701413P38	Mica: 150 pF + or -5%, 100 VDCW. (Used in G1 & G2).	D1	19A700047P2	Silicon, 100 mW, continuous dissipation; sim to DO-15.
C1	19A701413P28	Mica: 56 pF + or -5%, 100 VDCW. (Used in G3).	C30	19A701413P41	Mica: 180 pF + or -5%, 100 VDCW. (Used in G3).	D2	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148.
C2	19A701624P314	Ceramic, disc: 18 pF + or -5%, 500 VDCW, temp coef N220 PPM + or -30.	C31	19A701413P43	Mica: 200 pF + or -5%, 100 VDCW.	D3	19A700025P16	Silicon, zener: 400 mA max; sim to BZX55-C9V1.
C3 thru C5	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	C32	19A701413P20	Mica: 30 pF + or -5%, 100 VDCW. (Used in G1).	D4	19A700028P1	Silicon, fast recovery: fwd current 75 mA, 75 PIV; sim to Type 1N4148. (Used in G1).
C6	19A701413P34	Mica: 100 pF + or -5%, 100 VDCW. (Used in G1 & G2).	C32	19A701413P22	Mica: 36 pF + or -5%, 100 VDCW. (Used in G2 & G3).	D4	19A700047P2	Silicon, 100 mW, continuous dissipation; sim to DO-15. (Used in G2 & G3).
C6	19A701413P37	Mica: 130 pF + or -5%, 100 VDCW. (Used in G3).	C33	19A702250P113	Polyester: 0.1 uF + or -10%, 50 VDCW.	D5	19A700082P1	Rectifier, silicon; sim to MR751. (Used in G1).
C7	19A701534P13	Tantalum: .68 uF + or -20%, 35 VDCW.	C34 thru C37	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	D5	T324ADP1041	Rectifier, silicon; general purpose. (Used in G2 & G3).
C8	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	C38	19A702250P113	Polyester: 0.1 uF + or -10%, 50 VDCW.	D6	T324ADP1041	Rectifier, silicon; general purpose.
C9	19A701602P8	Ceramic: 150 pF + or -10%, 1000 VDCW.	C39 thru C45	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.			----- JACKS -----
C10	19A700006P26	Mica: 47 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020. (Used in G1 & G2).	C46	19A700015P3	Teflon/Mica: 8.2 pF + or -5%, 250 VDCW.	J1	19B800555G3	Connector: metering, block. Includes: (10) 19A700237P1 contacts.
C10	19A700006P28	Mica: 56 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020. (Used in G3).	C47	19A700015P12	Teflon/Mica: 22 pF + or -5%, 250 VDCW.	J2	19A701854G1	Coax; sim to Amphenol 83-87601002.
C11	19A701413P43	Mica: 200 pF + or -5%, 100 VDCW.	C48	19A701413P20	Mica: 30 pF + or -5%, 100 VDCW.	J3 thru J6	19A701883P4	Contact, electrical; sim to AMP 86444-1.
C12	19A701534P3	Tantalum: 0.47 uF + or - 20%, 35 VDCW.	C49	19A700015P3	Teflon/Mica: 8.2 pF + or -5%, 250 VDCW.			----- RELAYS -----
C13	19A703314P6	Electrolytic: 1 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.	C50 thru C52	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	K1	19A700061P1	Hermetic sealed: 180 to 341 ohms coil res, 8-16.3 VDC; sim to GE 35AV1760A2, CP Clare HFW-1201558, or Potter-Brumfield HCM6160.
C14	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	C53	19A700064P4	Electrolytic: 100 uF, -10+150%, 250 VDCW.			----- INDUCTORS -----
C15	19A701602P8	Ceramic: 150 pF + or -10%, 1000 VDCW. (Used in G1).	C54	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	L1	19J706085P1	Coil, choke: 0.822 uH + or -30%; sim to Paul Smith LM-2.
C15	19A700121P2	Ceramic: 0.01 uF + or - 20%, 50 VDCW. (Used in G2 & G3).	C55	19A701413P22	Mica: 36 pF + or -5%, 100 VDCW.	L3	19A701091G1	Coil.
C16	19A700006P37	Mica: 130 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020. (Used in G1 & G2).	C56	19A701413P34	Mica: 100 pF + or -5%, 100 VDCW.	L4	19A701848P1	Coil.
C16	19A700006P38	Mica: 150 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020. (Used in G3).	C57	19A701413P36	Mica: 120 pF + or -5%, 100 VDCW.	L5	19A701091G1	Coil.
C17 and C18	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	C58	19A700015P37	Teflon/Mica: 220 pF + or -5%, 250 VDCW.	L7 and L8	19A701091G1	Coil.
C19	19A701534P3	Tantalum: 0.47 uF + or - 20%, 35 VDCW.	C59	19A701413P36	Mica: 120 pF + or -5%, 100 VDCW.	L9	19A701848P1	Coil.
C20	19A703314P10	Electrolytic: 10 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.	C60	19A700015P37	Teflon/Mica: 220 pF + or -5%, 250 VDCW.	L12 and L13	19A701091G1	Coil.
C21	19A702250P113	Polyester: 0.1 uF + or -10%, 50 VDCW.	C61	19A700006P38	Mica: 150 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020.	L14	19A701848P1	Coil.
C22	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	C62	19A700006P41	Mica: 180 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020.	L16	19A702201P1	Coil.
C23	19A701413P43	Mica: 200 pF + or -5%, 100 VDCW.	C63	19A701602P8	Ceramic: 150 pF + or -10%, 1000 VDCW.	L17	19A701418P3	Coil.
C24	19A700006P38	Mica: 150 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020. (Used in G1 & G2).	C64 and C65	19A700015P41	Teflon/Mica: 330 pF + or -5%, 250 VDCW.	L18 thru L20	19A701419P3	Coil.
C24	19A700006P41	Mica: 180 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020. (Used in G3).	C66	19A700006P41	Mica: 180 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020.	L21	19A701420P5	Coil.
C25	19A700006P38	Mica: 150 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020.	C67	19A700006P38	Mica: 150 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020.	L22	19A701418P3	Coil.
C26	19A701602P8	Ceramic: 150 pF + or -10%, 1000 VDCW. (Used in G1).	C68	19A701602P8	Ceramic: 150 pF + or -10%, 1000 VDCW.	L23 and L24	19A701849P1	Coil.
C26	19A700121P2	Ceramic: 0.01 uF + or - 20%, 50 VDCW. (Used in G2 & G3).	C69 thru C72	19A700006P41	Mica: 180 pF + or -5%, 100 VDCW; sim to Underwood 3HS0020.	L25	19A702201P1	Coil.
C27 thru C29	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	C73 and C74	19A700015P37	Teflon/Mica: 220 pF + or -5%, 250 VDCW.	L26 and L27	19A701851P1	Coil.
			C75	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.	L28 and L29	19A701420P3	Coil.
			C76	19A702250P113	Polyester: 0.1 uF + or -10%, 50 VDCW.	L30 and L31	19A700024P1	Coil, RF: 100 nH + or -10%, 0.08 ohms DC res max, 100 v.
			C77	19A703314P10	Electrolytic: 10 uF -10+50% tol, 50 VDCW; sim to Panasonic LS Series.	L32 and L33	19A701091G1	Coil.
			C78 and C79	19A701413P34	Mica: 100 pF + or -5%, 100 VDCW.	L34 and L35	19A701852P1	Coil.
			C80	19A701413P35	Mica: 110 pF + or -5%, 100 VDCW.	L38 and L39	19A701420P4	Coil.
			C81	19A701413P6	Mica: 10 pF + or -5%, 100 VDCW.	L40 and L41	19A701851P1	Coil.
			C82	19A701413P43	Mica: 200 pF + or -5%, 100 VDCW.			
			C83 and C84	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.			
			C85	19A700219P46	Ceramic: 33 pF + or -10%, 100 VDCW, temp coef 0 PPM.			
			C86 and C87	19A701602P13	Ceramic: 470 pF + or - 20%, 1000 VDCW; sim to Type JF Discap.			

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES