POWER AMPLIFIER INTERMITTENT DUTY

MODEL TLD2532A

1. GENERAL

The TLD2532A Power Amplifier consists of the power amplifier chassis and associated hardware, and contains two circuit boards, the power control board and the power amplifier board. The following sections detail the theory of operation and troubleshooting information for the power amplifier circuitry. Because the setting of power levels is affected by the alignment of the exciter, the power set procedure is part of the overall transmitter alignment procedure given in the Transmitter section of this manual.

Table 1. Power Amplifier Kits

TLD2532A Power Amplifier
TFD6452A Harmonic Filter
TKN8313A Power Amplifier Cable
TLD9252A Power Amplifier Board
TLD9272A Power Control Board
TRN5141A Power Amplifier Hardware Kit
TRN5378A PA Transistor and Hardware Kit

2. THEORY OF OPERATION

2.1 POWER AMPLIFIER BOARD

2.1.1 The output from the exciter is applied to the power amplifier board via J802. This 1.5 watt (nominal) signal is attenuated approximately 2.8 dB by the resistive network comprised of R807-R810. Predriver Q801 amplifies the exciter signal to a level of approximately 11 watts.

2.1.2 The predriver output is applied to driver Q802, which develops up to 25 watts of rf power. The final amplifier stage of Q803/Q804 provides the power output of 110 watts (nominal). The power output signal is routed through the harmonic filter and through the directional coupler to the station antenna circuitry.

2.2 POWER CONTROL CIRCUITRY

2.2.1 General

2.2.1.1 The power control board provides power amplifier protection and power regulation. Output impedance match, final amplifier current and temperature, control voltage level, and power output are monitored by the power control circuit. In turn, the power control circuit sets the exciter power output to the proper level for optimum power amplifier operation.

2.2.1.2 The resistive voltage divider comprised of R926, R927, and R928 provides dc biasing voltages to improve directivity of the directional coupler, and set the operating point of the directional coupler inputs to the forward power and protection comparators. The reference voltage for forward power detector U901A is developed across Power Set control R911. The reference voltage for protection comparator U901B is developed at the junction of R914 and R913.

2.2.2 Thermal Protection

As the temperature of the power amplifier board increases, the resistance of RT801 decreases, causing the voltage on the TEMP SENSE HI line to decrease. When this voltage reaches approximately 5 volts, CR904 conducts, dropping both the forward power detector and protection comparator reference voltages. This causes the comparators to reduce the voltage on the CONTROL VOLTAGE line, which reduces exciter drive to the power amplifier. The net effect of this is to lower power amplifier output and heat, keeping operating temperature within safe operating limits.

2.2.3 Forward Power Level Control

Forward output power, sampled by the directional coupler, is rectified and filtered by the circuitry associated with CR901. The detected voltage is applied to the inverting input of forward power detector U901A, where it is compared to the set level at the noninverting input. If the two levels are not the same, the output level of U901A changes in a direction that raises or lowers the voltage on the CONTROL VOLTAGE line, until the inputs to U901A are matched. This provides a constant rf power output from the PA.

2.2.4 Reverse Power Protection

Reverse (reflected) power sampled by the directional coupler is rectified and filtered by the circuitry associated with CR902. The output voltage across R908 is applied to the inverting input of U901B, and compared to the reference voltage. Under normal operating conditions with the transmitter feeding a 50-ohm load, the reference voltage is higher than the directional coupler voltage. This keeps the output of U901B at maximum, keeping Q905 turned off. If the reflected power increases to the point that the voltage across R908 exceeds the reference voltage, the output of U901B drops, turning on Q905. Increased collector voltage on Q905 causes an increase in the voltage applied to the inverting input of U901A, to force the control voltage and the power output to drop until the inputs to U901A equalize.

2.2.5 Over-Current Protection

Final amplifier current in the power amplifier is sensed through R801. The voltage drop across R801 is applied to the base at Q907. As the voltage at Q907 decreases, Q907 turns on, increasing the voltage across R908. The power cutback occurs in the same manner as described in the Reverse Power Protection paragraph.

2.2.6 Control Voltage Limit

The circuit of Q905 compares the voltage on the CONTROL VOLTAGE line to the voltage set by the position of the wiper on R931. When the control voltage exceeds the set limit, Q905 conducts, raising the voltage at the inverting input of U901A. U901A, in turn, reduces the control voltage until both inputs are balanced.

3. POWER AMPLIFIER SERVICING

3.1 GENERAL

Troubleshooting information for the *MSR 2000* station power amplifier is presented in several levels. It is best to begin by following the power amplifier troubleshooting procedure given in Table 4. If the specific cause of the transmitter failure is not covered in Table 4, the service person is directed to Table 5 (for power control board problems) or to paragraph 3.2 (for power amplifier board problems).

3.2 POWER AMPLIFIER BOARD TROUBLESHOOTING PROCEDURE

Checks and tests in the following paragraphs may be used to locate defects isolated to the power amplifier board. The following checks assume 13.8 volts dc is applied to the PA and that the amplifier is operating closed-loop with the exciter. Set all power control potentiometers (R911, R931, R939) fully clockwise.

3.2.1 No Power Output or Power Output Less Than 20% of Rated Power

3.2.1.1 Voltage Checks

With the radio unkeyed and the receiver audio at a minimum, check for +13.3 V dc on the power amplifier collectors. If one or more stages has zero voltage, check associated dc feed circuits for an open circuit.

3.2.1.2 Individual Stage Current Checks

Check the collector currents drawn by all stages to determine if the normal value shown in Table 2 is drawn.

Table 2. Minimum Normal Current Reading (all power control potentiometers set fully clockwise)

	Ic	146-155 MHz	155-165 MHz	165-174 MHz
Q801	Direct	1.7A	1.2A	0.75A
Q802	Direct	3.0A	2.4A	2.1A
	Drop across R822	300 mV	240 mV	210 mV
Q803-4	Direct	20A	17A	18A
	Drop across R801	20 mV	170 mV	180 mV
	MTR 5	20 uA	17 uA	18 uA

Step 1. If a stage is found with less than minimum Ic (see Table 2), check for shorts or defective components in that stage, then in the preceding and following stages.

Step 2. Where more than one stage indicates low current, check the earliest defective stage (toward the PA input) first.

Step 3. If all stages give a low current indication, check the exciter output. The exciter is defective if the output is less than 1.5 W.

3.2.2 Power Output Does Not Exceed the Rated Radio Power by 20% at Maximum Power Settings

3.2.2.1 Check A+ and A− voltages at the collectors with the power amplifier operating. Use ***only*** a passive voltmeter or a VOM with 1.2 uH series chokes at the probe tips. With the power supply accurately set for 13.8 V dc, voltages on the transistor collectors should exceed the Table 3 values (all voltages measured with respect to the A− plating on the power amplifier board).

Step 1. If all voltages are low, recheck the power supply. If the power supply is satisfactory, check the feedthrough capacitors for poor solder connections and the A+ and A− connections for good contact.

Step 2. If only one or two stages have low voltages, trace back through the dc-feeds of that stage, checking

for bad connections or defective components. The maximum normal voltage drops are 0.3 V dc for R801, 0.5 V dc for R822, and less than 0.1 V dc for all other components in the dc feed circuits.

Table 3. PA Collector Voltages (@13.8 V A + /A − Supply)

Q801	13.0 V dc
Q802	12.6 V dc
Q803, 804	12.8 V dc

3.2.2.2 Check the stage currents as outlined in paragraph 3.2.1.2.

3.2.2.3 If trouble in the final amplifier transistor stage (Q803, 804) is indicated, or other approaches have failed, check the balance in the final amplifier by soldering a 2.7 V lamp (type 338, Motorola Part No. 65-82671G01) between the collectors of Q803 and Q804 using #14 wire or a 0.1 inch wide copper strap or braid. If the lamp lights up to greater than half its normal brilliance, or flashes and burns out, there is a defect in one side of the parallel final amplifier circuitry. If such imbalance is indicated, the defective section can usually be isolated by shorting the base to emitter of one transistor (at the transistor body) with a screwdriver blade. The section that shows the least drop in power output (when shorted) is the one to be checked for defective components. If no obviously defective passive components, misconnections, or shorts can be located, make the following tests prior to considering the replacement of Q803 or Q804.

NOTE

Remove all power from the PA for the following tests.

Step 1. Check in-circuit base-emitter resistance on the suspect transistor(s). If *greater* than 1 ohm, coil L809 or L810 is bad.

NOTE

Place the negative potential lead from the ohmmeter on the transistor base for this test.

Step 2. If the resistance check shows that L809 and L810 are not defective, remove the base capacitors, C825 and C827 (for Q803) or C826 and C828 (for Q804), and check for shorts, both internal (with an ohmmeter), and external (visual check for solder shorts on the capacitor or printed circuit board). If a capacitor or its connection is suspect, replace it and recheck the power output and balance before proceeding.

Step 3. If the capacitor is not defective, replace transistor (Q803 or Q804) and reassemble the power amplifier.

NOTE

In any case where gross imbalance is found and suspected faulty components are replaced, ***always*** recheck balance after replacing components. Continue the investigation if imbalance has not been fully corrected.

3.2.2.4 With all power removed from the radio set, check for open base return on Q801 and Q802 by measuring in-circuit base-emitter resistance. The resistance should be less than 1 ohm on Q801 and less than 2.5 ohms on Q802.

NOTE

Place negative potential lead of ohmmeter on transistor base(s) for this test.

3.3 POWER AMPLIFIER TRANSISTOR REPLACEMENT

3.3.1 To remove the power transistors, remove two transistor mounting screws, or one stud nut (accessible from the chassis bottom). Unsolder and remove the clamped mica capacitors, unsolder and remove the transistors. (Special soldering iron tips ST1160 and ST1161 are available from the Motorola National Parts Department to aid in the capacitor and transistor removal.)

3.3.2 When replacing rf power transistors several precautions ***must*** be observed. First remove all thermal compound and residue from *both the chassis and the transistor* using a soft cloth or paper towel. Apply a thin film of silicone thermal compound to the bottom of the transistor mounting flange. Place the transistor in the center of the printed circuit board cutout and tighten the mounting hardware to 6-7 inch pounds ***maximum.*** Solder leads using a low power (40-60 W) iron using enough solder to completely cover the lead and solder pad. ***Make sure*** that the solder is flowing freely both *over* and *under* the lead before removing the heat. If a lead tends to spring away from the printed circuit board, hold down the far end of the lead against the board (using the tip of pliers) until the solder hardens. *Be sure* to replace the clamped mica capacitors in the *exact* original position with respect to the transistor body after replacing the transistors.

3.3.3 When removing components from the power amplifier printed circuit board it is ***essential*** that the solder be *completely molten* around the lead(s) to be removed ***before*** attempting to remove any component(s). Failure to exercise this precaution *could result* in removal of through-plating in component holes and/or top side metal on the printed circuit board which may necessitate removal of the printed circuit board for repair. To ensure proper performance of the rf power amplifier, it is ***essential*** (when replacing board-mounted parts) that the parts be mounted vertically and with the bottom of the component(s) flush against the printed circuit board.

3.4 POWER AMPLIFIER BOARD REMOVAL

3.4.1 Under normal maintenance conditions, there should be no need to remove the PA board. If, however, it should become necessary, the following procedure should be used. Unsolder and remove the input and output coaxial cables, unsolder feedthrough capacitors, remove hex head screws, transistor mou ing screws, and stud nut(s) (accessible from the bottor Lift the board out of the chassis.

3.4.2 To replace the PA board, reverse the removal procedure. PA power transistors should be installed after the circuit board installation has been completed. Refer to paragraph 3.3.

Table 4. Power Amplifier Troubleshooting Procedure

Step	Symptom	Procedure	Normal Indication	If Normal	If Abnormal
1	Suspected Transmitter Failure	Measure rf output power at antenna connector.	Rated power	Transmitter OK.	High Power — perform Power Amplifier Control and Protection Troubleshooting Procedure. Low Power — go to 3. No Power — go to 2.
2	No Output Power	a. Set all controls fully clockwise and observe meters 1 and 5.	Both greater than 10 uA	Go to b.	No indication — Perform Transmitter Control and Protection Troubleshooting Procedure. Meter 1 indication, no Meter 5 indication — Go to e.
		b. Measure dc voltage across antenna relay coil during transmit.	5 V	Go to c.	Check coil continuity (dc resistance approximately 160 ohms).
		c. Check reed switch continuity.	Continuous during transmit	Go to d.	Replace.
		d. Check harmonic filter and output cable for shorts and discontinuities.	See schematic diagram	Perform Power Amplifier Board Troubleshooting Procedure.	Repair defect.
		e. Measure rf power at the exciter output.	1.5 W minimum	Perform Power Amplifier Board Troubleshooting Procedure.	Refer to Exciter section of manual.
3	Low Output Power	a. Set all controls fully clockwise and observe Meter 1.	Greater than 20 uA	Go to b.	Perform Power Amplifier Control and Protection Troubleshooting Procedure.
		b. Measure rf power at exciter output.	1.5 W minimum	Perform Power Amplifier Board Troubleshooting Procedure.	Refer to Exciter section of manual

Table 5. Power Amplifier Control and Protection Troubleshooting Procedure

Step	Symptom	Procedure	Normal Indication	If Normal	If Abnormal
1	No meter 1 or 5 with all controls clockwise	a. Disconnect PA from exciter J802. Check for keyed 9.3 V at U901-8.	9.3 V	Go to b.	Check Q554 (in exciter) keyed 9.3 V switch.
		b. Measure output voltage of U901A, pin 1.	Greater than 3.3 V	Repair fault in control voltage amplifiers Q903 & Q904.	Go to c.
		c. Measure voltages to input of U901A, pins 2 & 3.	Pin 3 greater than Pin 2	U901 defective.	Check for shorts or opens in resistive feed circuits to pins 2 & 3.
2	Meter 1 reads max of about 10 uA with all controls fully clockwise. Little or no output power	a. Disconnect PA from exciter at J802. Measure voltage of protection comparator output, at U901B-7.	Greater than 7 V	Troubleshoot Q905 circuit.	Go to b.
		b. Measure voltages to input of U901B, pins 5 & 6.	Pin 5 greater than Pin 6	U901 defective.	Analyze and repair current limiter circuitry Q906, Q907 & Q908.
3	All controls inoperative and meter 1 approx. 25 uA	a. Disconnect PA from exciter at J802. Observe meter 1 in RX mode.	0 uA	Go to b.	Repair fault in control voltage amplifiers Q903 & Q904.
		b. Set all controls counterclockwise. Measure pins 2 & 3, U901A in TX mode.	Pin 2 greater than Pin 3	U901 defective	Look for defect in voltage reference network R926, U927, R928, R912, R911.
4	Control voltage limit (R931), current limit (R939) and reflected power (VSWR) protection inoperative	Q905 and associated resistors probably defective. Analyze and repair.			
5	Current limit (R939) inoperative	Disconnect PA from exciter at J802. Pull current sense line (green) from C897. Observe meter 1.	15 uA	Check for short to A + of current sense line.	Analyze fault in current limit circuit Q906, Q907 & Q908 and repair.
6	Reflected power (VSWR) protection inoperative	Check and repair defect in reflected power detector components R902, CR902, etc.			
7	Thermal protection inoperative	Check and repair defect in thermal protection components RT801, R915, R930 and CR904.			
8	Power set (R911) inoperative	Check and repair defect in forward power detector components R901, CR901, etc.			

3.5 POWER AMPLIFIER FUNCTIONAL TESTS

3.5.1 General

The tests in this section should be performed *after* servicing but *before* alignment, to verify that the power amplifier and control circuitry are operating correctly.

3.5.2 Set-up

Step 1. Connect radio to proper dummy load through a wattmeter.

Step 2. Plug metering connector of DC Metering Chassis, TEK 5 Metering Panel (set to position E) or S1056-59 Portable Test Set, into J1 on power control board.

CAUTION
Key transmitter only while making test or adjustment.

3.5.3 Control and Protection Tests

3.5.3.1 Control Voltage Limiting

Step 1. Set Current Limit (R939) and Power Set (R911) fully clockwise.

Step 2. Set Control Voltage Limit (R931) fully counterclockwise. Key transmitter and observe meter 1. Meter 1 should read approximately 4 uA.

Step 3. Rotate Control Voltage Limit Set (R931) clockwise. Near mid-rotation the reading of M1 should begin increasing to a maximum of approximately 25 uA at maximum clockwise rotation.

3.5.3.2 Current Limiting

Step 1. Set Power Set (R911) and Control Voltage Limit (R931) fully clockwise.

Step 2. Set Current Limit (R939) fully counterclockwise. Key transmitter and observe M5. Meter 5 should indicate less than 8 uA. Rotate Current Limit clockwise. Meter 5 should increase to a maximum indication of no more than 28 uA before maximum clockwise rotation is reached.

3.5.3.3 Power Set

Step 1. Set Control Voltage Limit (R931) and Current Limit (R939) fully clockwise.

Step 2. Set Power Set (R911) fully counterclockwise.

Step 3. Key transmitter and observe wattmeter. Power output should be zero. Power output should increase as Power Set is rotated clockwise.

3.5.3.4 Thermal Protection

Step 1. Set Control Voltage Limit (R931) and Current Limit (R934) fully clockwise.

Step 2. Adjust Power Set (R911) to 120 watts output. Using a short length, (6 inches) of 22 AWG solid wire, short Temp Sense Hi, pin 6 of P901, to Temp Sense Lo, pin 7 of P901, with P901 connected to J901 on the power control board. Power output should drop to less than 50% of set power.

3.5.3.5 Reflected Power Protection

Step 1. Set Control Voltage Limit (R931) and Current Limit (R939) fully clockwise.

Step 2. Adjust Power Set (R911) for 120 watts output. Remove cable from the output of the station.

CAUTION

As the following step requires transmitting without a dummy load, key transmitter long enough to verify operation only.

Step 3. Key transmitter and observe meter 5. Meter 5 should indicate less than 10 uA.

3.5.4 Power Amplifier Board Test

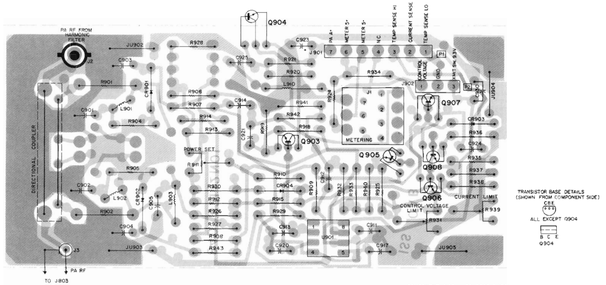
Step 1. Disconnect PA from antenna switch/duplexer at J803.

Step 2. Connect the PA directly to a wattmeter and dummy load via J803.

Step 3. Set Power Set (R911), Control Voltage Limit (R931), and Current Limit (R939) fully clockwise.

Step 4. Key transmitter and observe the wattmeter. Power output should exceed 145 watts.

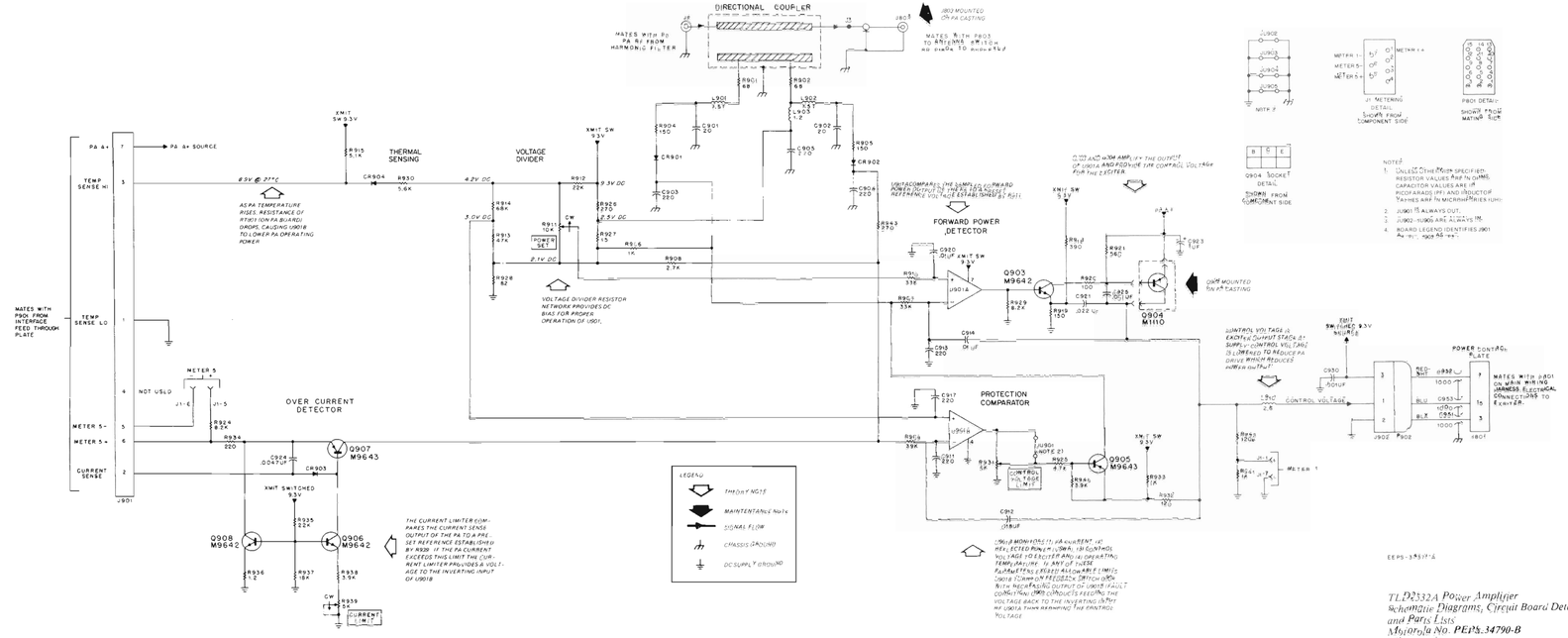
POWER CONTROL BOARD



SHOWN FROM COMPONENT SIDE

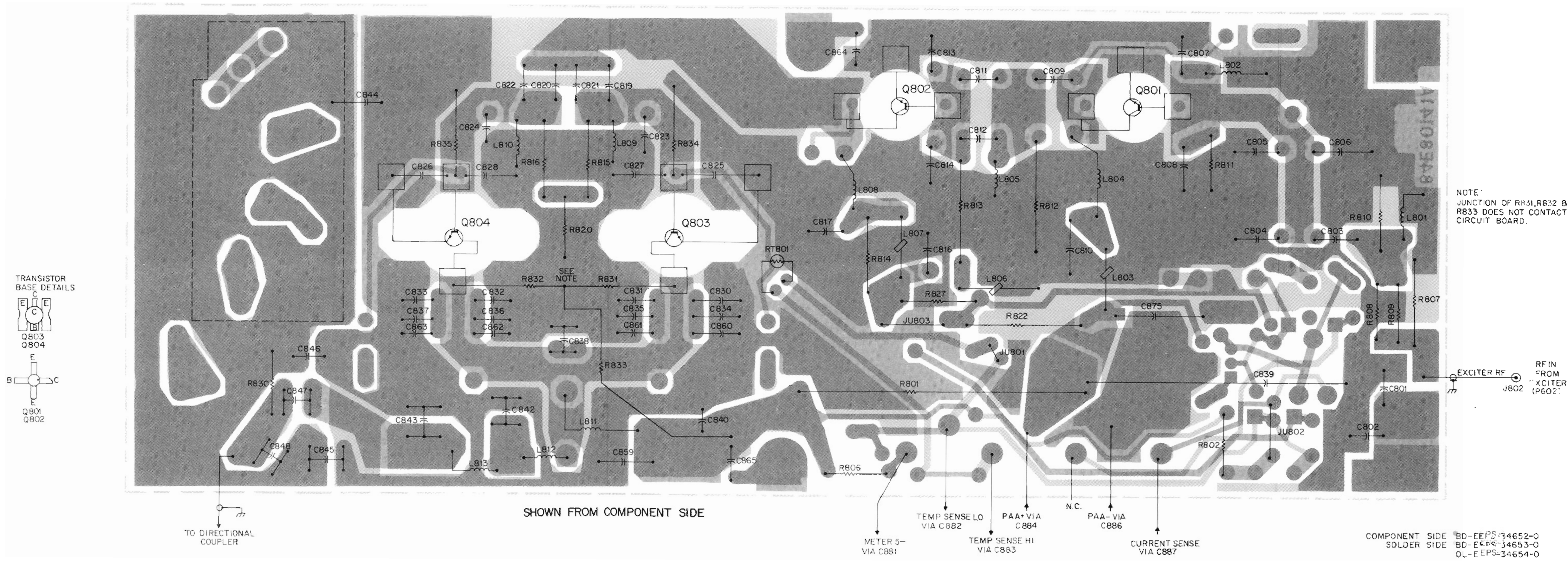
COMPONENT SIDE 80 DEPS-346611-1
SOLDER SIDE 80 DEPS-346612-0
GL DEPS-346613-4

POWER CONTROL BOARD



TLD2532A Power Amplifier Schematic Diagrams, Circuit Board Details, and Parts Lists
Motorola No. PEPS-34790-B
(Sheet 1 of 3)
1/14/82 V&G

POWER AMPLIFIER BOARD



parts list

TLD9252A Power Amplifier Board — PL-7938-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ± 5%; 500 V: unless otherwise stated
C801	21-863629	330 ± 10%; 600 V
C802	21-82372C10	.05 uF ± 20%; 25 V
C803	21-83406D77	30
C804	21-84493B59	39
C805, 806	21-83406D77	30
C807, 808	21-84493B65	100
C809	21-84493B66	150
C810	21-83596E10	220 ± 20%
C811, 812	21-84715F26	56
C813, 814	21-84493B64	91
C816	8-84637L14	0.1 uF ± 10%; 100 V
C817	21-83596E10	220 ± 20%
C819	21-83406D56	24
C820, 821	21-84493B35	19
C822	21-83406D56	24
C823, 824	21-84715F26	56
C830 thru 837	21-84715F26	56
C838	21-83366K16	150
C839	23-83210A22	660 uF + 150-10%; 25 V
C840	21-863629	330 ± 10%; 600 V
C842	21-84395B18	44; 250 V
C843	21-84395B16	15 ± 10%; 250 V
C844	21-84493B59	39
C845	21-84395B35	240 ± 10%; 350 V
C846	21-863629	330 ± 10%; 600 V
C847	21-84395B35	240 ± 10%; 350 V
C848	21-84395B45	12 ± 10%; 250 V
C859	8-83293B02	0.22 uF ± 10%; 50 V
C860 thru 863	21-83406D97	15
C864	21-82187B07	470 + 10%
C865	21-83596E10	220 ± 20%
C875	8-82905G02	.022 uF ± 10%; 50 V
		coil, rf:
L801	24-83884G01	3-1/2 turns; coded (PINK)
L802	24-82723H27	choke; 1.2 uH
L803	24-80036A02	choke; 1/2 turn
L804	24-80277A01	12-1/2 turns
L805	7-80062B02	bracket, large 1/2 turn
L806, 807	24-80036A02	choke; 1/2 turn
L808	24-80277A05	1-1/2 turns
L809, 810	24-82723H27	choke; 1.2 uH
L811	24-80277A04	7-1/2 turns
L812, 813	7-80062B04	bracket, small; 1/2 turn
		resistor, fixed: ± 5%; 1/2 W: unless otherwise stated
R801	17-80165C01	.01 ± 20% bracket type
R802	6-11009C49	1k; 1/4 W
R806	6-11009C33	220; 1/4 W
R807	6-125A37	330
R808, 809	6-11009C13	33; 1/4 W
R810	6-125A37	330
R811	6-125C01	10 ± 10%
R812	6-127C17	47 ± 10%; 2 W
R813	17-82036G07	1.5 ± 10%; 2 W
R814	6-125B61	4.7
R815, 816	6-125A09	22
R820	6-125A15	39
R822	17-82291B24	0.1 ± 5%; 3 W
R830	6-11009C97	100k; 1/4 W
R834, 835	6-125A21	68
		thermistor:
RT801	6-83600K09	100k @ 25 °C
		mechanical part
	29-80014A01	CLIP, coax terminal

TFD6452A PA Harmonic Filter — PL-7935-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C1	21-83366K33	15 pF ± 5%; 850 V
C3, 5	21-82785H52	30 pF ± 1 pF; 850 V
C7	21-83366K33	15 pF ± 5%; 850 V
		coil, rf:
L2	24-80066A04	5-1/2 turns
L4	24-80066A03	6-1/2 turns
L6	24-80066A04	5-1/2 turns
		connector, plug:
P2	28-82231G01	male; single contact
		mechanical parts
	1-80748D72	ASSEMBLY, cable input includes:
	29-5379	LUG, solder
	30-83794C01	CABLE, coaxial (WHT); 8" used
	1-80748D73	ASSEMBLY, cable output includes:
	5-136977	EYELET
	30-83794C01	CABLE, coaxial (WHT); 8-1/2 used
	7-83373N01	FRAME

TLD9272A Power Control Board — PL-7940-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ± 10%; 50 V: unless otherwise stated
C901	21-11022G37	20 ± 5%
C902	21-11022G37	20 ± 5%
C903, 904, 905	21-11015B05	220
C911	21-11015B05	220
C912	8-11017B10	.018 uF
C913	21-11015B05	220
C914	8-11017B08	.01 uF
C917	21-11015B05	220
C920	21-11021F04	.01 uF
C921	8-11017B11	.022 uF
C923	23-11019A09	1 uF ± 20%; 50 V
C924	21-11021E21	4700
C925	21-11015B13	.001 uF ± 10%; 100 V
C930	21-11015B13	.001 uF ± 10%; 100 V
		diode: (see note)
CR901, 902	48-84616A01	hot carrier
CR903, 904	48-83654H01	silicon
		connector, receptacle:
J1	9-84207B01	female: 7-contact (metering)
J2	9-84931B03	female: phono
J3	42-80259A01	clip, coax terminal
		connector, plug:
J901	28-83441F08	male: 7-contact (WHT)
J902	28-83441F18	male: 3-contact (WHT)
		jumper:
JU902 thru 905	6-11009B23	0 ohms
		coil, rf:
L901, 902	24-84393B04	7-1/2 turns
L903	24-82723H01	choke; 1.2 uH
L910	24-82835G08	choke; 2.6 uH
		transistor: (see note)
Q903	48-869642	NPN; type M9642
Q905	48-869643	PNP; type M9643
Q906	48-869642	NPN; type M9642
Q907	48-869643	PNP; type M9643
Q908	48-869642	NPN; type M9642
		resistor, fixed ± 5%; 1/4 W: unless otherwise stated
R901, 902	6-125A21	68 ± 5%; 1/2 W
R904, 905	6-11009A29	150
R906	6-11009A49	1k
R907	6-11009A85	33k
R908	6-11009A59	2.7k
R909	6-11009A87	39k
R910	6-11009A85	33k
R911	18-80268B03	variable: 10k
R912	6-11009A81	22k
R913	6-11009A89	47k
R914	6-11009A93	68k
R915	6-11009A66	5.1k
R918	6-11009A39	390
R919	6-11009A29	150
R920	6-11009A25	100
R921	6-11009A43	560
R924	6-11009A71	8.2k
R925	6-11009A65	4.7k
R926	6-11009A35	270
R927	6-11009A05	15
R928	6-11009A23	82
R929	6-11009A71	8.2k
R930	6-11009A67	5.6k
R931	18-80268B02	variable: 5k
R932	6-11009A27	120
R933	6-11009A49	1k
R934	6-11009A33	220
R935	6-11009A81	22k
R936	6-11009A51	1.2k
R937	6-11009A79	18k
R938	6-11009A63	3.9k
R939	18-80268B02	variable; 5k
R940	6-11009A63	3.9k
R941	6-11009A49	1k
R942	6-11009A97	100k
R943	6-11009A35	270
		integrated circuit: (see note)
U901	51-80067C03	dual operational amplifier
		mechanical parts
	14-80278B01	INSULATOR, coupler; 2 used
	26-80279B01	SHIELD, coupler
	9-80028A01	SOCKET, transistor (Q901)
	30-80280B01	THROUGH LOOP, coupler
	30-80280B02	PICK-UP LOOP, coupler

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN5378A PA Transistor and Hardware Kit — PL-7937-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C825 thru 828	21-84366F12	200 pF ± 5%; 250 V
		transistor: (see note)
Q801	48-84411L90	NPN; type M1190
Q802	48-84411L91	NPN; type M1191
Q803, 804	48-84411L04	NPN; type M1104
Q904	48-84411L10	PNP; type M1110
		resistor, fixed:
R831, 832	6-126C01	10 ± 10%; 1 W
R833	6-127C05	15 ± 10%; 2 W
		mechanical parts
	2-7003	NUT, 8-32 x 5/16"; 2 used
	3-3375	SCREW, tapping; 6-20 x 5/16"; 9 used
	3-3398	SCREW, tapping; 6-20 x 3/8"
	3-129841	SCREW, machine; 4-40 x 1/4"
	3-134186	SCREW, tapping; 6-32 x 5/16"; 4 used
	3-138813	SCREW, machine; 4-40 x 3/8"; 4 used
	3-488006	SCREW, machine; 6-32 x 1/2"; 4 used
	4-858060	WASHER, insulator; 4 used
	4-84180C01	WASHER, shoulder; 1 used
	14-84391F01	INSULATOR, transistor
	15-80066B01	COVER; harmonic filter
	15-82400N01	COVER; PA
	26-83374N04	SHIELD, harmonic filter
	5-129977	EYELET

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN5141A Power Amplifier Hardware — PL-7939-A

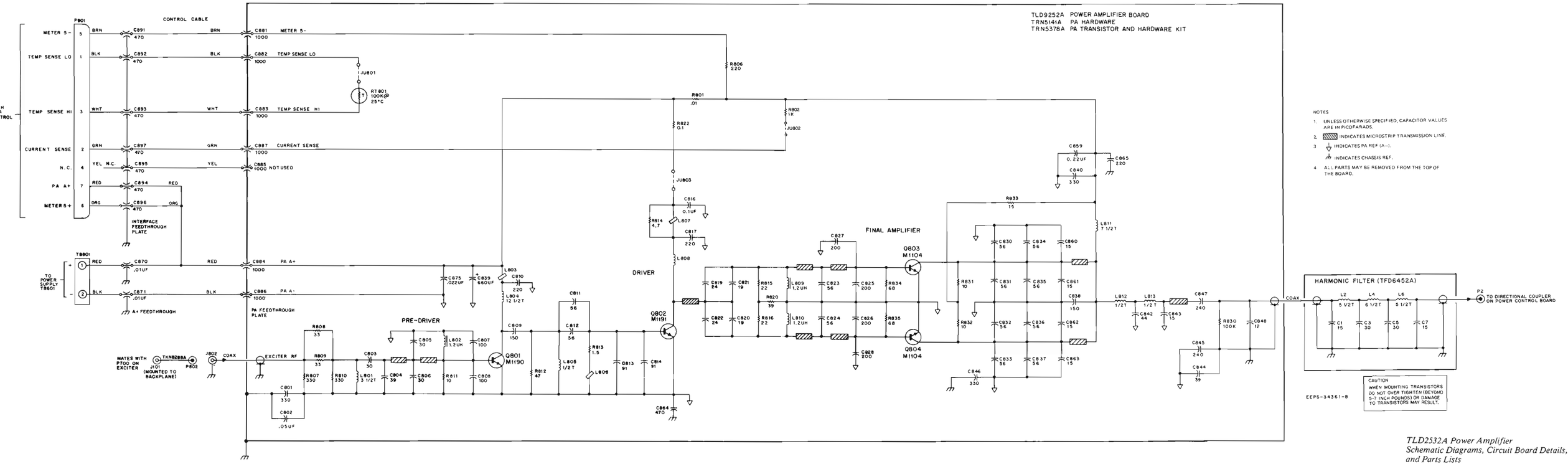
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C870, 871	21-84211B01	.01 uF; GMV; 250 V (feed-thru)
		connector, receptacle:
J802	9-82442E01	RECEPTACLE, PA rf in
		strip, terminal:
TB801	31-50378	barrier type; 2 terminal
		mechanical parts
	2-131435	NUT, 4-40 x 1/4 x 3/32"; 2 used
	3-3375	SCREW, tapping; 6-20 x 5/16"; 4 used
	3-115213	SCREW, machine; 3-48 x 1/4"; 4 used
	3-129890	SCREW, machine; 10-32 x 3/8"; 6 used
	3-131195	SCREW, machine; 6-32 x 3/8"; 3 used
	3-138294	SCREW, tapping; 8-32 x 5/8"; 2 used
	3-138810	SCREW, machine; 4-40 x 5/8"; 2 used
	4-7681	LOCKWASHER, #3 internal; 4 used
	14-80143A04	INSULATOR, HB, LB
	14-82406N01	INSULATOR, control
	14-82407N01	INSULATOR
	26-82323N01	HEAT SINK, PA
	29-5347	LUG, soldering; 2 used
	29-129883	LUG, soldering
	30-83794C01	CABLE, coaxial (WHT); 4" used
	43-82275C01	SPACER
	43-82416N01	SPACER, feed-thru
	64-82986N01	PANEL, PA

TKN8313A Internal Cable Kit — PL-8318-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed:
C881 thru 887	21-82812H03	1000 pF + 100-0%; 500 V (feed-thru)
C891 thru 897	21-821474	470 pF ± 20%; 500 V (feed-thru)
C951, 952, 953	21-82812H03	1000 pF + 100-0%; 500 V (feed-thru)
		connector, feed-through:
J801	1-80748D81	ASSEMBLY, POWER control plate; includes: C951, 952, 953
	64-82405N01	PLATE, plug
		connector, receptacle:
J803	9-82442E01	RECEPTACLE, PA rf out
P901	15-83498F15	HOUSING, 7-contact
P902	15-83498F28	HOUSING, 3-contact
		mechanical parts
	1-80748D80	ASSEMBLY, control cable; includes: P902
	29-83499F01	TERMINAL; 3 used
	42-10217A02	STRAP, tie; 2 used
	1-80748D82	ASSEMBLY, power control feed-thru; includes:
	30-83678K01	CABLE, 7-conductor shield; 12" used
	1-80748D83	ASSEMBLY, PA feed-thru plate; includes: C881 thru 887
	64-80005A01	PLATE, feed-thru
	1-80748D92	ASSEMBLY, cable power out; includes J803:
	15-483599	HOOD, receptacle
	30-83794C01	CABLE, coaxial WHT; 4-1/2"
	1-80748D84	ASSEMBLY, cable interface; includes: P901
	29-83499F01	TERMINAL; 6 used
	30-83678K01	CABLE, 2-conductor shielded; 8-1/2"
	1-80753D16	ASSEMBLY, interface plate; includes: C891 thru 897
	64-82404N01	PLATE, RF

TLD2532A Power Amplifier
Schematic Diagrams, Circuit Board Details,
and Parts Lists
Motorola No. PEPS-34790-B
(Sheet 2 of 3)
1/14/83- V&G

POWER AMPLIFIER BOARD



TLD2532A Power Amplifier
Schematic Diagrams, Circuit Board Details, and Parts Lists
Motorola No. PEPS-34790-B
(Sheet 3 of 3)
1/14/83- V&G