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MB301 300 Watt MOSFET Power Amplifier

500W into 4 Ohm

300W into 8 Ohm



Features

The MB301 is a mono MOSFET power amplifier for high quality audio reproduction. The construction is all heavy-duty. The amplifier is housed in an aluminum chassis. Heatsinks on the side of the unit provide the cooling. Inside is a toroidal power transformer and power supply with large storage capacitors. The amplifier is designed for use with a 4 or 8 Ohm load, but it is stable with any output load.

XLR Balanced inputs	Balanced inputs for high noise immunity
RCA	Standard line level inputs
Selector switch	Switch between balanced and standard inputs
Phase switch	Inverts the phase
Gain Switch	Selects between 4 different gain settings
Binding Posts	Connection for the loudspeakers
Circuit breaker	Protects the amplifier in case of overload
Thermal cutout	Protects the amplifier in case it gets too hot
Power entry connector	Standard line cord for 120V AC 1-phase operation.

Specifications.

Frequency response:	20Hz - 20KHz +/- 1 dB
Harmonic Distortion @ 1KHz, 10W	0.02% or better
Sensitivity (4 pos switch)	0.775VRMS, 1.28VRMS, 1.83VRMS, 2.44VRMS
Voltage gain	36dB (66X), 32dB(40X), 29dB(28X), 26dB(20X)
Input impedance (RCA)	500 KOhm
Short circuit output current	50A peak, 16A Continuous
Output load	8 or 4 Ohm, stable with any load
Max power output	500W into 4 Ohm, 300W into 8 Ohm
Power requirement	120VAC, 6A breaker; 240 VAC available
Construction	All metal cabinet, black with white legend
Dimensions:	7.75" x 5" x 12.5" (WxHxD)
Weight:	19 lbs

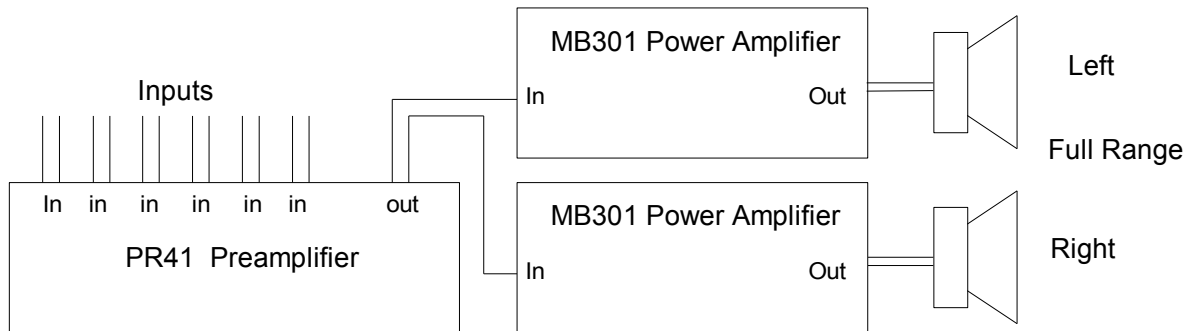


Figure 1 Typical Sound System

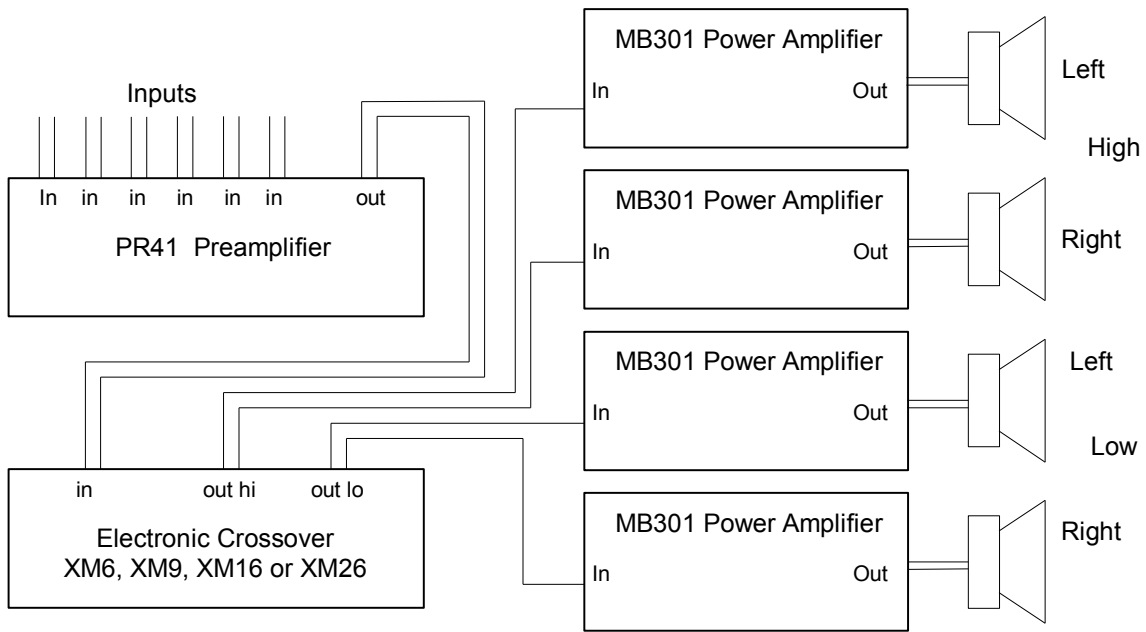


Figure 2 Sound System with 2-way Electronic Crossover Network



Figure 3: Inside view. Note the placement of the MB301 power amplifier board (mounted on heatsink on the side of the unit) and the PS11 power supply board; (mounted onto the bottom of the chassis) . The toroidal power transformer is mounted near the front of the unit on the baseplate.

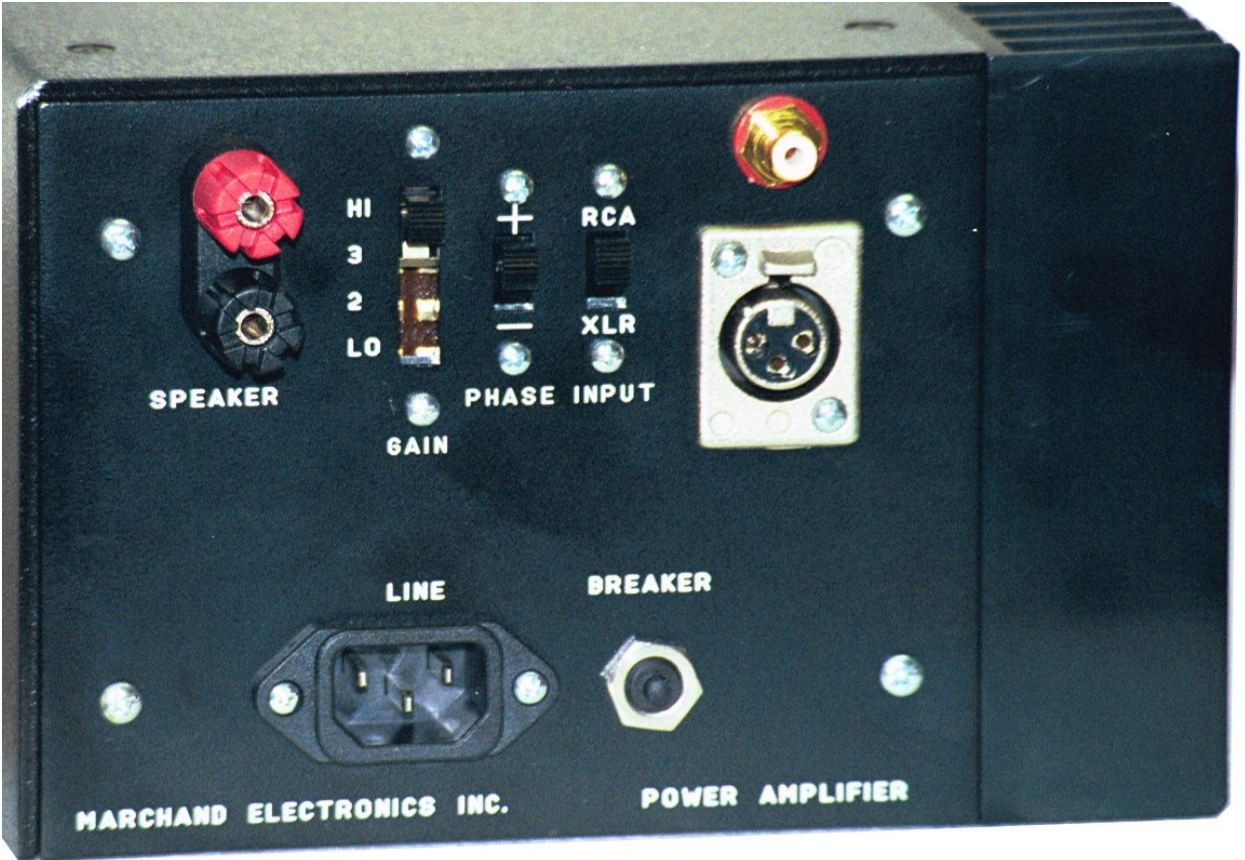


Figure 4 Rear view of the amplifier.

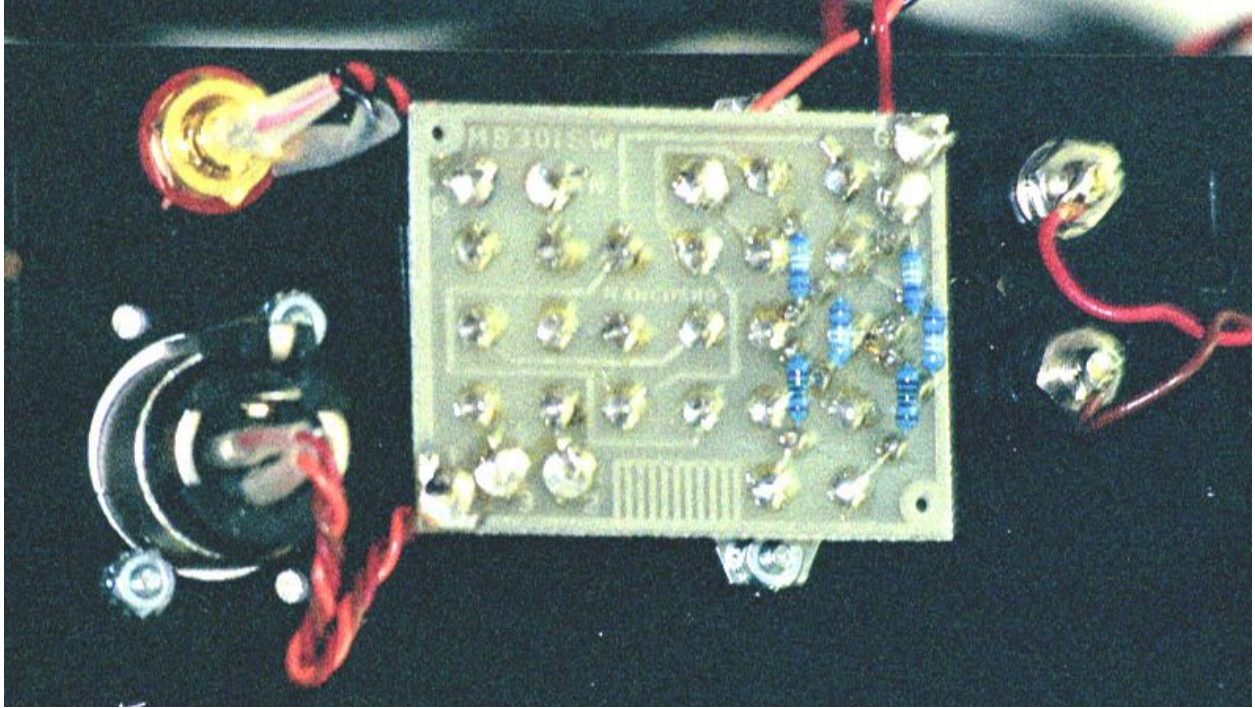


Figure 5 Inside view of the rear panel.

Assembly Instructions for the MB301 Kit.

Parts list.

Qu.	Description
1	MB301 board Kit, Power Amplifier
1	PS11 Kit, power supply
1	circuit board kit MB301SW
1	1 board MB301SW
4	4.99K 1% MF
2	7.50K 1% MF
1	MB301 Cabinet
1	500VA power transformer
	55V+55V secondary for class AB
	35V+35V secondary for class A
1	Transformer dish & hardware
1	DPDT AC Power switch
1	XLR connector, female
1	RCA connector, red & black
2	DPDT slide switch
1	DP4T slide switch
1	Dual binding post w. spacer
1	6 A circuit breaker
1	Power entry connector
1	Thermal cutout
5'	AWG22 hookup wire, red
5'	AWG22 hookup wire, orange
5'	AWG22 hookup wire, black
1'	AWG22 hookup wire, green
5'	AWG18 hookup wire, red
5'	AWG18 hookup wire, orange
5'	AWG18 hookup wire, black
1	100 Ohm, 1W resistor
14	solder lug
4	quick disconnect lug
6	8/32 Hex head bolt
6	#8 split lock washer
6	4/40 x 1/2" Machine Screw
6	4/40 lock nut
10	6/32 x 1/4" Machine Screw
4	6/32 x 1/2" Hex Standoff
2	6/32 lock nut
1	heatsink compound
1	line cord

Assembly instructions.

Before assembling the MB301 amplifier complete the assembly of the MB301 power amplifier board and the PS11 power supply board.

Rear panel: Remove the rear panel from the cabinet before starting this assembly. Mount the following parts to the rear panel:

2 DPDT switches using 4/40 hardware.

1 DP4T switches using 4/40 hardware.

1 XLR connectors using 4/40 hardware.

1 RCA connectors, .

1 Pair of binding posts

Circuit breaker using 4/40 hardware.

Power entry module. using 4/40 hardware.

Use Figure 5 as a guide when wiring up above parts according to the wiring diagrams. Place the MB301SW board over the switch terminals. The switch terminals should stick out about 0.1". Do not push in all the way. Solder. The wires going to the binding posts should be twisted. The wires going to the inputs of the MB301 board should be twisted together also. Leave plenty of wire length for those wires going from the rear panel to internal components. They will be trimmed to length later.

Refer to Figure 7 for installing resistors R101 to R106. Note that these resistors are best mounted on the solder side of the circuit board MB301SW. Leave about 0.1" of space between the resistors and the circuit board.

R101	4.99K	1% ,1/4W, Metal Film
R102	4.99K	1% ,1/4W, Metal Film
R103	4.99K	1% ,1/4W, Metal Film
R104	4.99K	1% ,1/4W, Metal Film
R105	7.50K	1% ,1/4W, Metal Film
R106	7.50K	1% ,1/4W, Metal Film

After the assembly is completed the rear panel can be bolted to the rear of the chassis using 6/32 machine screws and locknuts.

Thermal cutout: Mount the thermal cutout onto the base plate of the cabinet using 6/32 hardware.

Power Switch: Install the power switch to the front panel. Leave the front panel off for now.

Important: The connections to the power switch must not be soldered. Use the quick disconnect lugs provided.

Transformer: Install the toroidal power transformer onto the baseplate of the cabinet near

the front. Use the mounting dish and the two rubber washers. See Figure 6

Wiring note: Use the heavy gauge wire for the AC wiring to and from the power transformer and for the DC power supply wiring from the PS11. Use the smaller gauge wire for all other interconnect.

AC Wiring: Complete the AC wiring according to the wiring diagram. Note the different wiring options for the primary of the power transformer. Run the wires near the edge of the chassis closest to the thermal cutout. Use a length of green wire and a solder lug to install the chassis grounding wire. The solder lug should be placed under one of the 6/32 nuts that hold the rear panel.

PS11 Power supply: Install the power supply next to the power transformer using 4 hex standoffs, as shown in Figure 3.

MB301 power amplifier: Install the board onto the heatsink as shown in Figure 3. Use heat sink compound between the MB301 mounting bracket and the heatsink (this is important!). Use the 8/32 bolts with hex head for this. Use a lock washer with each bolt. Access to the mounting bolts is difficult. Use a long hex-wrench for this.

Chassis grounding. Solder the 100Ohm, 2W resistor to the remaining solder lug. Solder a length of black wire to the other end of the resistor. Install solder lug under one of the 6/32 nuts of the rear panel. Connect the wire the GROUND connection (terminal marked G of the three position terminal block) of the PS11 power supply board. This will connect the chassis of the amplifier to the DC ground of the power supply.

!!!! Assembly is now complete. !!!!

Initial power up.

Refer to the bias adjustment procedure in the section for assembly of the MB301 board for instructions.

The first time power is applied observe any unusual events, like smoke, etc. Turn the power off immediately if this happens and check for correct construction. It is best to power up initially using a variable power transformer (variac) and observe operation at about half line voltage.

The heatsinks will become warm during normal operation. When the amplifier is powered up but no power is delivered the heatsink should become just slightly warm to the touch. If the become hot in this mode check the bias current of the Mb301 amplifier module.

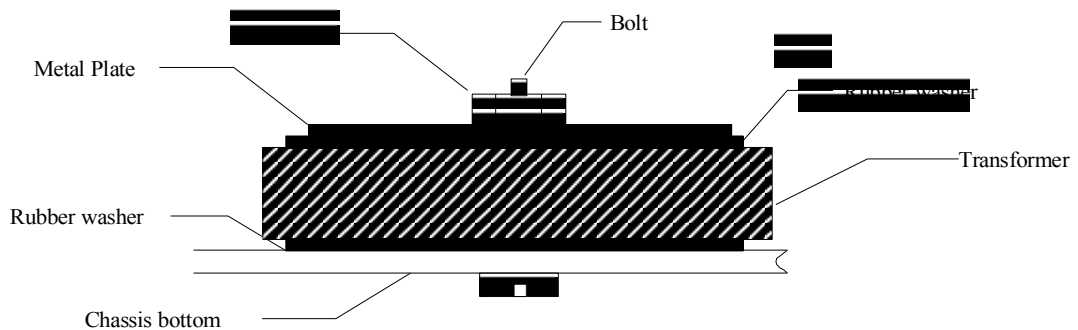
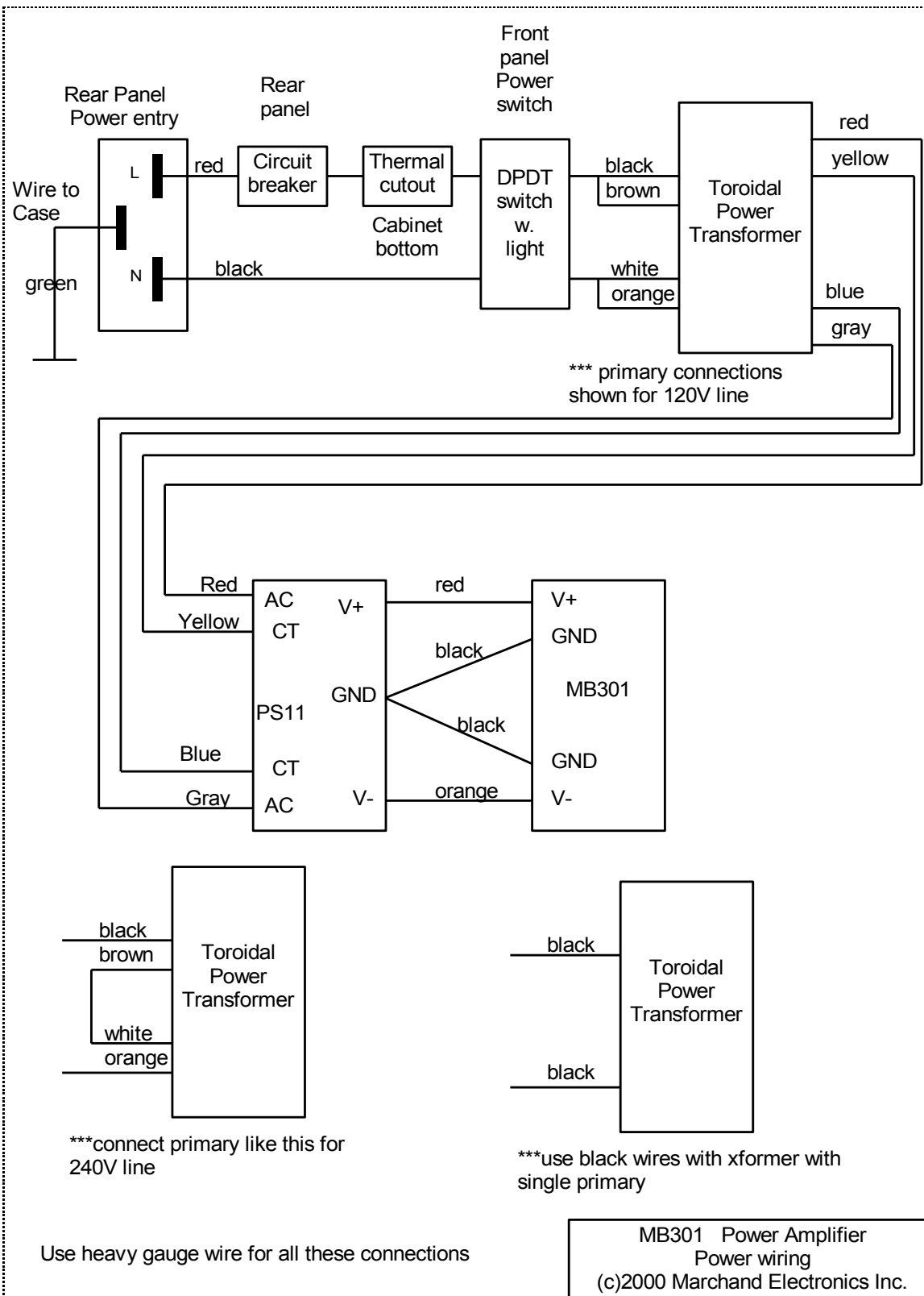


Figure 6 : Mounting of power transformer



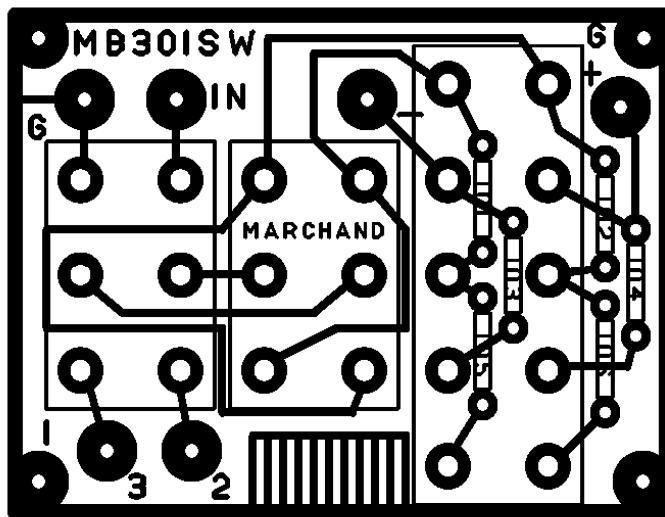
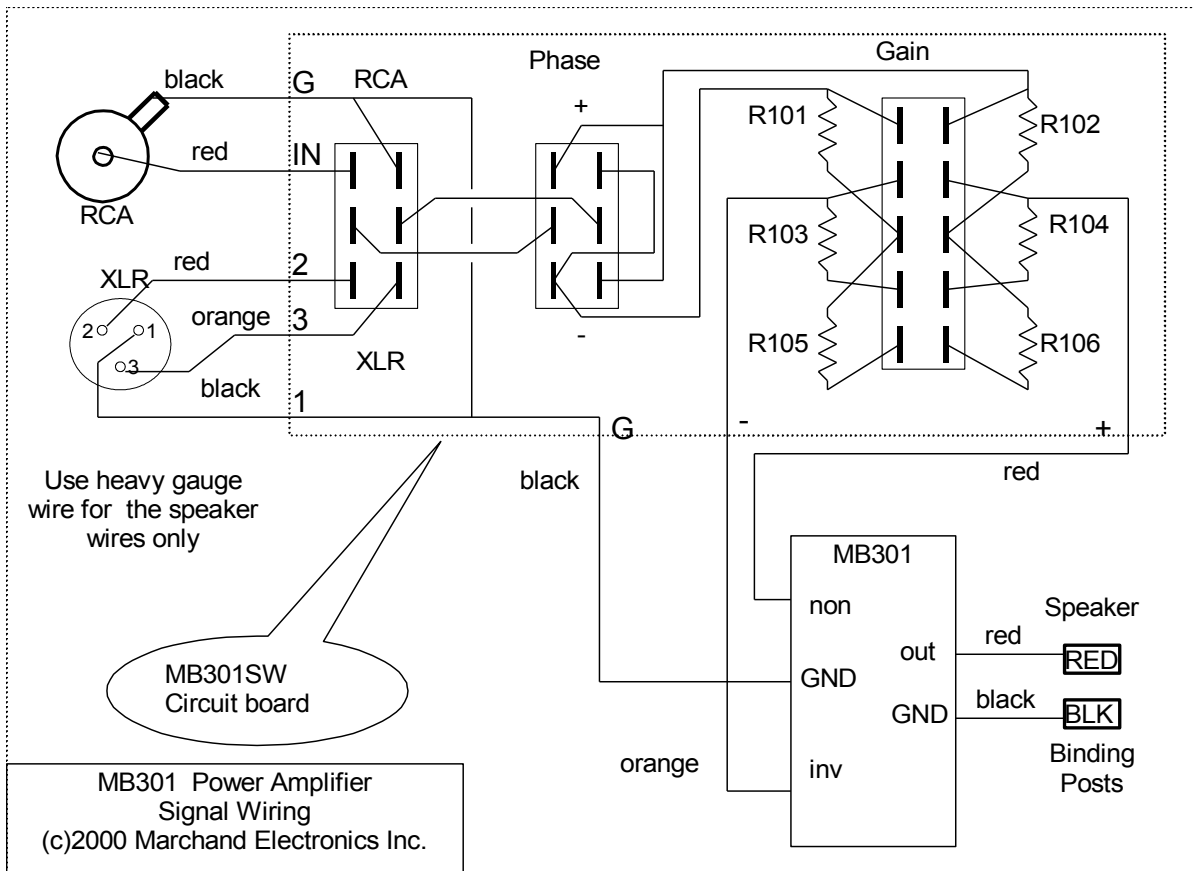


Figure 7 Circuit board layout of MB301SW shows location of resistors R101 ...R106. Resistors are mounted on solder side of the circuit board. The switches are mounted on the component side of the circuit board.

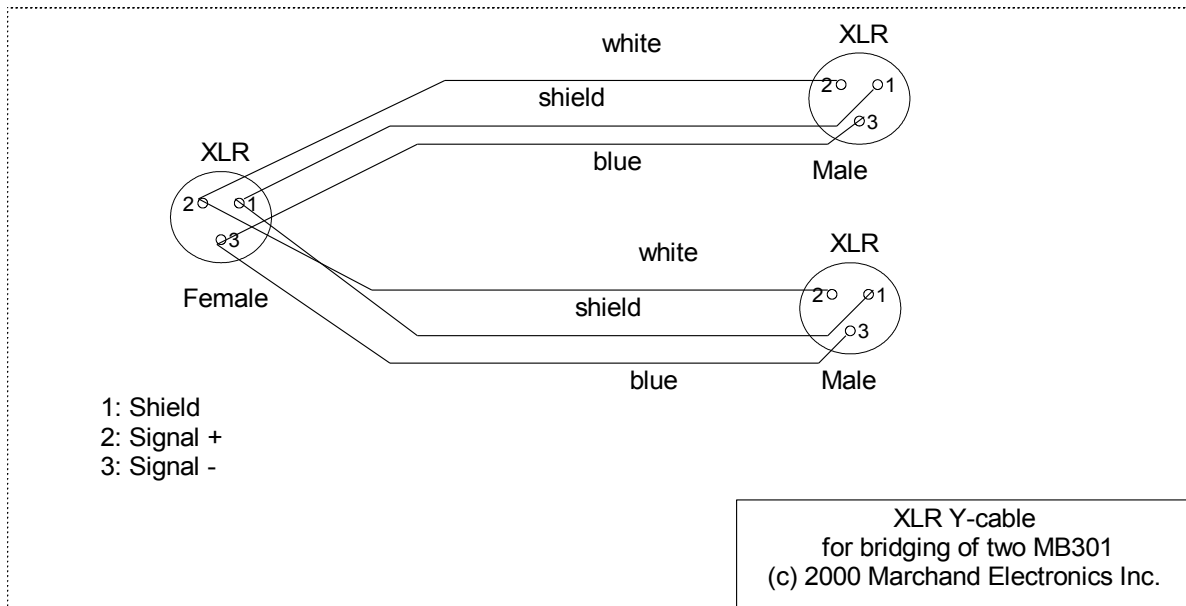


Figure 8 : Y cable is used for bridging of amplifiers with balanced input connection. Set one amplifier to + phase and the other amplifier to – phase. Connect the speaker to the red speaker terminals on each amplifier.

Assembly instructions for the MB301 main amplifier board.

Parts List			Capacitors		
ID	Value	Description			
Resistors			C1	1.5uF	Polypropylene
R1	100K	1% ,1/4W, Metal Film	C2	1.5uF	Polypropylene
R2	100K	1% ,1/4W, Metal Film	C3	1pF	Ceramic NPO
R3	7.50K	1% ,1/4W, Metal Film	C4	1pF	Ceramic NPO
R4	7.50K	1% ,1/4W, Metal Film	C5	0.22uF	Stacked Film
R5	not used		C6	330uf, 25v	Aluminum Electrolytic
R6	not used		C7	330uf, 25v	Aluminum Electrolytic
R7	499K	1% ,1/4W, Metal Film	C8*	2200uf, 80v	Aluminum Electrolytic
R8	499K	1% ,1/4W, Metal Film	C9*	2200uf, 80v	Aluminum Electrolytic
R9	100K	1% ,1/4W, Metal Film	C10	not used	
R10	100 Ohm	1% ,1/4W, Metal Film	C11	not used	
R11	100 Ohm	Trimmer Potentiometer	* 9 places		
R12	100 Ohm	Trimmer Potentiometer	Diodes		
R13	10.0 Ohm	1% ,1/4W, Metal Film	D1	1N4735	6.2 Volt Zener Diode
R14	499 Ohm	1% ,1/4W, Metal Film	D2	1N4148	Signal Diode
R15	499 Ohm	1% ,1/4W, Metal Film	D3	1N4148	Signal Diode
R16	1.00M	1% ,1/4W, Metal Film	D4	1N4148	Signal Diode
R17	49.9 Ohm	1% ,1/4W, Metal Film	D5	1N4148	Signal Diode
R18	49.9 Ohm	1% ,1/4W, Metal Film	D6	1N4735	6.2 Volt Zener Diode
R19	49.9 Ohm	1% ,1/4W, Metal Film	D7	not used	
R20	not used		D8	not used	
R21	10 KOhm	Trim Pot, 10 turn	D9	1N4735	6.2 Volt Zener Diode
R22	not used		D10	1N4735	6.2 Volt Zener Diode
R23*	49.9 Ohm	1% ,1/4W, Metal Film	D11	HER102	High Efficiency Diode
R24*	49.9 Ohm	1% ,1/4W, Metal Film	D12	HER102	High Efficiency Diode
R25*	0.47 Ohm	5W Wirewound	D13	not used	
R26*	0.47 Ohm	5W Wirewound	D14	not used	
R27*	2.00K	1% ,1/4W, Metal Film	D15	not used	
R28*	2.00K	1% ,1/4W, Metal Film	D16	not used	
R29	10.0 Ohm	1% ,1/4W, Metal Film	* UFR102 may be substituted for HER102		
R30	10.0 Ohm	1% ,1/4W, Metal Film	Transistors		
R31	not used		Q1*	IRF710	N-Channel MOSFET
R32	not used		Q2*	IRF710	N-Channel MOSFET
R33	10.0 Ohm	1% ,1/4W, Metal Film	Q3	IRF710	N-Channel MOSFET
R34	10.0 Ohm	1% ,1/4W, Metal Film	Q4	IRF710	N-Channel MOSFET
R35	not used		Q5	IRF710	N-Channel MOSFET
R36	not used		Q6	MTP2P50E	P-Channel MOSFET
R37	not used		Q7	MTP2P50E	P-Channel MOSFET
R38	not used		Q8*	IRFI640	N-Channel Power MOSFET
R39	not used		Q9*	IRFI9640	P-Channel Power MOSFET
R40	not used		Q10	IRFI640	N-Channel Power MOSFET
R41	59.0K	1% ,1/4W, Metal Film	Q11	2N2222	NPN transistor
R42	59.0K	1% ,1/4W, Metal Film	Q12	2N5087	PNP transistor
* 8 places			Q13	not used	
			Q14	not used	NPN transistor

Q15 not used
 Q16 not used
 Q17 not used
 *Q1,Q2 come as a matched pair
 *Q8 & Q9 8 places each

The MB301 main board kit contains the following parts:

Qu.	Value	Description
Resistors		
5	10.0 Ohm	1%, 1/4W, Metal Film
19	49.9 Ohm	1%, 1/4W, Metal Film
1	100 Ohm	1%, 1/4W, Metal Film
2	499 Ohm	1%, 1/4W, Metal Film
16	2.00K	1%, 1/4W, Metal Film
2	7.50K	1%, 1/4W, Metal Film
2	59.0K	1%, 1/4W, Metal Film
3	100K	1%, 1/4W, Metal Film
2	499K	1%, 1/4W, Metal Film
1	1.00M	1%, 1/4W, Metal Film
2	100 Ohm	Trimmer Potentiometer
1	10 KOhm	Trim Pot, 10 turn
16	0.47 Ohm	5W Wirewound

Capacitors

2	1.5uF	Polypropylene
2	1pF	NPO Ceramic
1	0.22uf.	Stacked Film
18	2200uf, 80v	Aluminum Electrolytic
2	330uF,25V	Aluminum Electrolytic

Diodes

4	1N4735	6.2 Volt Zener Diode
4	1N4148	Signal Diode
2	HER102	High Efficiency Diode

Transistors

1 pair	IRF710	N-Channel MOSFET
3	IRF710	N-Channel MOSFET
2	MTP2P50E	P-Channel MOSFET
9	IRF1640	N-Channel Power MOSFET
8	IRF19640	P-Channel Power MOSFET
1	2N2222	NPN transistor
1	2N5087	PNP transistor

Mechanical

Quantity	Description
1	3 Pos. Terminal block Blue
1	2 Pos. Terminal block Black
1	3 Pos. Terminal block Black
17	4/40x1/2" Machine Screw
17	4/40 Nut
34	#4 split lockwasher
17	#4 flat washer
1	Heat Sink Bracket
7	TO220 heatsink
1	Bag Heat Sink Compound
1	MB301 circuit board
4	testpoint

Assembly Instructions

Most parts are installed in the usual way. Insert the part at the location on the circuit board as indicated by the silk screen identification and solder on the solder side of the board. Start with installing smaller parts and install large parts last. This makes installation easiest. The circuit board has plated through holes, so parts need only be soldered on the solder side of the board.

Resistors: The 1% metal film resistors are identified with colored bands in the usual way. The 1% Metal film resistors have the following markings:

10.0 Ohm	Brown- Black-Black-Gold--Brown
49.9 Ohm	Yellow-White-White-Gold--Brown
100 Ohm	Brown- Black-Black-Black--Brown
499 Ohm	Yellow-White-White-Black--Brown
2.00 K	Red-Black-Black-Brown--Brown
7.5 K	Violet-Green-Red-Brown--Brown
100 K	Brown-Black-Black-Orange--Brown
499 K	Yellow-White-White -Orange-Brown
1.00 M	Brown-Black-Black-Yellow--Brown

When placing resistors it is recommended to double-check each value with a DMM before installing.

Note that not some resistors are not used even though they are shown on the circuit board. Just leave the location empty.

Warning
 Resistor R30 is incorrectly labeled as R28.
 It is located next to resistor R32

The multiturn trimmer resistor R21 should be installed as shown in Figure 9.

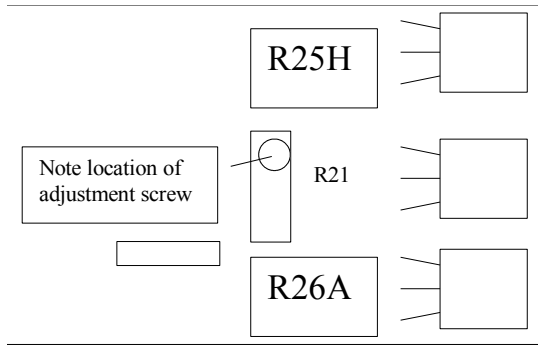


Figure 9 Orientation of R21. This is important.

Note: Resistors R41 and R42. These two resistors are not labeled on the circuit board. They are installed in holes left vacant by unused R20, R31, R22, R32. See Figure 12 for placement.

Capacitors: The Electrolytic capacitors are all radial type or snapfit type. Be **sure** to observe polarity markings when installing.

Diodes: Diodes D1 ... D13 are installed in the usual way. Make sure to observe polarity: the band indicated on the circuit board must coincide with the band on the device.

Transistors: Transistors Q1..7 are installed using a small heatsink each. Slip the transistor into the heatsink and mount on the board. Be careful not to push the transistor into the heatsink too far. The tab should be flush with the heatsink and not ride on top of the stop.

Note that Q1 and Q2 come as a matched pair in a separate bag. Make sure to use these in the locations Q1 and Q2. Install the transistors according to the marking on the circuit board. Make **sure** there is no mistake here.

The 17 power transistors Q8a..h, Q9a..h, and Q10 are installed onto the heat-sink bracket. These TO220 transistors are come in an insulated package, so no additional insulation is required. Apply a thin uniform layer of the white silicone compound on the bottom of the transistor before installing. Install the transistors with the 4/40 screws, split lockwasher and nut. See Figure 10. Orient the screws so that the head of the screw is on the solder side and the nut is on the component side. Solder the three transistor pins only after all the mounting screws have been tightened.

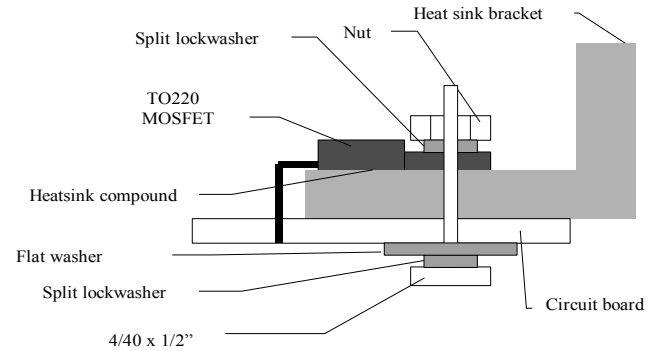


Figure 10 Mounting of power transistors.

Terminal Blocks: Install the 2-pin and 3-pin terminal blocks at the edge of the circuit board.

Testpoints: Install the 4 testpoints at locations TP1, TP2, TP3 and TP4. (Figure 11)

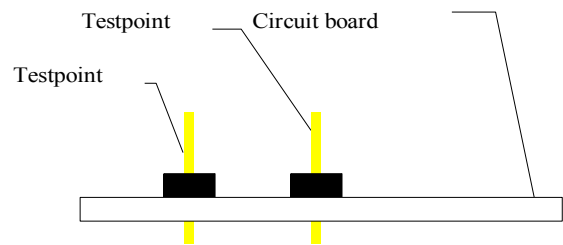


Figure 11 Testpoints

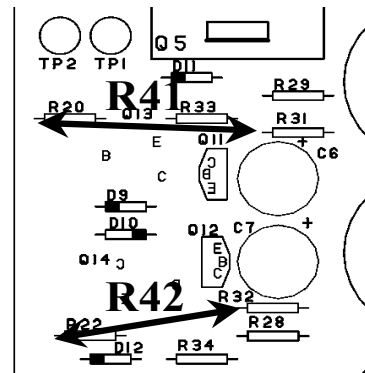


Figure 12 Placement of R41 and R42

Assembly is now complete. Take a few minutes to check all components and orientations. Also make sure there are no solder bridges.

Bias current adjustment (Class AB) .

This section should be completed after the MB301 board has been installed and is connected to the power supply and heatsink.

The bias current of the amplifier must be adjusted by setting the potentiometers R11 and R21. First turn the potentiometers fully counterclockwise. This will set the bias current to zero.

Connect a DVM or suitable voltmeter between testpoints TP3 and TP4. Turn the power on. If the DMM indicates a voltage of more than a few mV turn the power off **immediately** and check all parts placements. A very safe way to do this step is to use a variac to increase the AC line voltage slowly from zero to full, while observing the DMM. Turn the voltage down as soon as something abnormal is observed.

Connect the DVM or suitable voltmeter between testpoints TP1 and TP2. Adjust R11 for a reading of 0.5 volts.

Connect a DVM or suitable voltmeter between testpoints TP3 and TP4.

Now slowly adjust R21 clockwise until a reading of 15 mV is shown on the DMM. Precise adjustment is difficult. But a value between 10 mV and 20 mV is acceptable. Note that the unit will start heating up a little. The adjustment should be made when cold. When the amplifier is hot, the bias current will change a little. This is normal.

Bias adjustments	
TP1 .. TP2	0.5 Volt
TP3 .. TP4 (class AB)	15 mV
TP3 .. TP4 (class A)	75 mV

Table 1

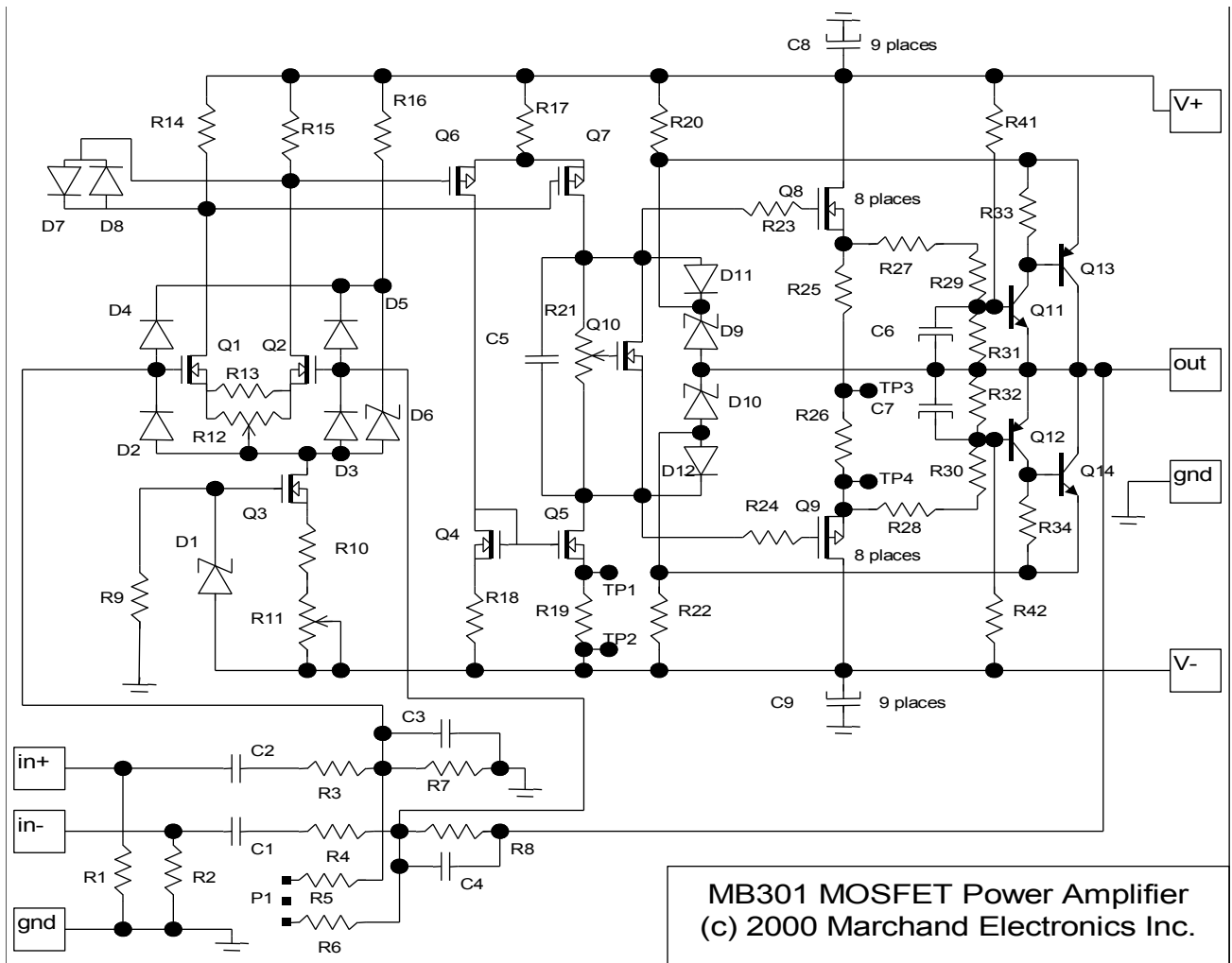
Bias current adjustment (Class A) .

For operation in class A the bias current should be set to a higher value. Proceed as outlined above for the class AB bias and confirm that the amplifier is working properly. After this adjust the bias current to the class A operating point of 75 mV. The amplifier will become quite warm when operating in this mode. This is normal. The heatsinks should still be "touchable". If they become too hot to touch reduce the bias current somewhat.

Offset adjustment.

The offset voltage of the amplifier must be adjusted by setting the potentiometer R12. With no signal applied to the inputs, adjust R12 for minimum DC voltage at the outputs. A residual output voltage of a few mV is normal.

The assembly and adjustment of MB301 is now complete.



MB301 circuit board Packing Labels

3	10.0 Ohm	1%, 1/4W, Metal Film	2	1.5uF	Polypropylene, 250V
19	49.9 Ohm	1%, 1/4W, Metal Film	2	1pF	NPO Ceramic
1	100 Ohm	1%, 1/4W, Metal Film	1	0.22uf.	Stacked Film
2	499 Ohm	1%, 1/4W, Metal Film	18	2200uf, 80v	Aluminum Electrolytic
16	2.00K	1%, 1/4W, Metal Film	2	330uF,25V	Aluminum Electrolytic
2	7.50K	1%, 1/4W, Metal Film	4	1N4735	6.2 Volt Zener Diode
2	59.0K	1%, 1/4W, Metal Film	4	1N4148	Signal Diode
3	100K	1%, 1/4W, Metal Film	2	HER102	High Efficiency Diode
2	499K	1%, 1/4W, Metal Film	1 pair	IRF710	N-Channel MOSFET
2	100 Ohm	Trimmer Potentiometer	3	IRF710	N-Channel MOSFET
1	10 KOhm	Trim Pot, 10 turn	2	MTP2P50E	P-Channel MOSFET
			9	IRF1640	N-Channel Power MOSFET
			8	IRF19640	P-Channel Power MOSFET
16	0.47 Ohm	5W Wirewound			

1	2N2222	NPN transistor
1	2N5087	PNP transistor

1	3 Pos. Terminal block Blue
1	2 Pos. Terminal block Black
2	3 Pos. Terminal block Black

4	testpoint
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17	4/40x1/2" Machine Screw
17	4/40 Nut
17	#4 split lockwasher
1	Bag Heat Sink Compound

1	Heat Sink Bracket
7	TO220 heatsink
1	MB301 circuit board