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PM22 Installation Instructions

General

The PM22 is a power amplifier module capable of driving an 8 Ohm or 4 Ohm load. It has a differential input, but can also be used with a single ended input. The amplifier needs an external dual DC power supply and must be bolted onto a heatsink.

Input

The input is differential. There is a 3-position terminal block on the circuit board, labeled INV-GND-NON INV. These are the inverting input, the ground terminal and the Non Inverting inputs. These should be hooked to the signal source. For single ended input, choose GND and either INV or NON INV. The unused terminal MUST be grounded to the GND terminal.
The inputs are AC or DC coupled. For DC coupling, install two shorting blocks on the 4-pin header near the input. For AC coupling remove the shorting blocks.

Output

Connect the load to the two terminals labeled OUT-GND on the 5-position terminal block. The PM22 is designed for loads of 4 Ohm or 8 Ohm. Maximum output power depends on the value of the load and the power supply voltage. With a 8 Ohm load and a power supply voltage of +/- 40 Volt, an output power of 65W RMS can be achieved. In a 4 Ohm load the max power will be 130 Watt.

Power Supply

A regulated dual power supply of nominally +/- 40 Volt should be connected to the terminals V-- GND V++ of the 5-position terminal block. The minimum supply voltage is +/- 25V, and the maximum value is +/- 50 V. A higher value than 50V may damage the amplifier. The current capability of the power supply depends on the load and the voltage. For a 40 volt supply and an 8Ohm load, a rating of 2.5 Amp on each side is indicated.

Heat sink

The PM22 should be bolted onto a heat sink of sufficient size to keep the amplifier cool. A thermal protection circuit on the PM22 will shut the amplifier off when the temperature of the output transistors reaches 100 degree Centigrade. The amplifier will automatically resume operation after it cools down to about 90 degree. With insufficient heat sink capacity and continuous operation the amplifier will cycle between hot and cold / on and off.

Bias current

The PM22 can operate in class A or class AB. The mode of operation is determined by the bias current in the output stage. The bias current can be set with potentiometer R8. A bias current of ~ 30 mA, when cold, is good for AB operation. The bias current can be observed with an Amp-Meter in the power supply, or by measuring the voltage R18-R19.See the section "Bias Current Adjustment". The voltage between the two testpoints will be 30 mV for a bias current of 30 mA. Set the bias current to 2 Amp for class A operation. This will read 2 V between the two testpoints. The bias current will increase slightly when the amplifier is warm. This is normal.
The PM22 will normally be shipped for class AB operation. This is the most efficient mode of operation.Class A mode has better distortion figures, but uses more power. The power supply must be able to supply the extra 2 A. of current. The heatsink must be bigger also.

"Hot" Output Terminal

The terminal marked "Hot" can be used to connect an external indicator, like a warning light, to the PM22. When the over-temperature circuit gets activated, the Hot terminal will be shorted to ground with a power-mosfet transistor. For example, a LED with 10 KOhm resistor in series can be connected between the "Hot" terminal and the positive supply. The LED will then turn on when the amplifier shuts down.

Parts List

R1	249 K	1% Metal Film
R2	33.2 K	1% Metal Film
R4	24.9 K	1% Metal Film
R5	249 K	1% Metal Film
R6	100 K	1% Metal Film
R7	100 K	1% Metal Film
R8	10 K	Trimmer Cermet
R9	2.00 K	1% Metal Film
R10	10.0 K	1% Metal Film
R11	10.0 K	1% Metal Film
R12	324 K	1% Metal Film
R13	324 K	1% Metal Film

R14	3.24 K	1% Metal Film
R15	3.24 K	1% Metal Film
R16	6.49 K	1% Metal Film
R17	6.49 K	1% Metal Film
R18	.68 Ohm	3 Watt Wirewound
R19	.68 Ohm	3 Watt Wirewound
R20	5.6 Ohm	1W carbon comp.
R21	10 Ohm	2W carbon comp.
R22	100 K	1% Metal Film
R23	100 K	1% Metal Film
R24	100 K	1% Metal Film
R25	127 K	1% Metal Film
R26	10.0 K	1% Metal Film
R27	10.0 K	1% Metal Film
R28	24.9K	1% Metal Film
R29	249 K	1% Metal Film
R30	100 K	1% Metal Film
R31	100 K	1% Metal Film
R32	100K	1% Metal Film
C2	10 uF, 50V	Radial Electrolytic
C3	47 pF	Mica
C4	47 pF	Mica
C5	.22 uF	Stacked Film
C6	1000 pF	Ceramic Disk
C7	1000 pF	Ceramic Disk
C8	47 uF,50V	Radial Electrolyic
C9	47 uF,50V	Radial Electrolyic
C10	.22 uF	Stacked Film
C11	.22 uF	Stacked Film
C12	.22 uF	Stacked Film
C13	10 pF	Mica
C14	10 pF	Mica
C15	1 uF	Stacked Film
C16	1 uF	Stacked Film
C17	.22 uF	Stacked Film
C18	.22 uF	Stacked Film
D1	1N5260	Zener Diode 43V
D2	1N5260	Zener Diode 43V
D3	1N4932	Diode 1A
D4	1N4932	Diode 1A
D5	Not Used	
D6	Not Used	
D7	LED	
D8	1N5232	Zener Diode 5.6 V
L1	1 uH	10 Turns on R2
Q1	2N6284	NPN Power Darlington
Q2	2N6287	PNP Power Darlington
Q3	2N2222	NPN Transistor TO92
Q4	2N2222	NPN Transistor TO92
Q5	2N2222	NPN Transistor TO92
Q6	2N2222	NPN Transistor TO92
Q7	IRF540	N Channel MOSFET TO220
IC1	LM391	Power Driver
TB1		3 Position Terminal Block
TB2		6 Position Terminal Block
J1	1 ea	2 Position Jumper
J2	1 ea	2 Position Jumper
M1	1 ea	Heat Sink Bracket
M2	2 ea	TO3 insulators
M3	4"	Insulating tubing 0.200" OD
M4		Silicone compound
M5	1 ea	16 pin IC socket
M6	1 ea	Circuit board
M7	4 ea	6-32 * 3/8" Screw
M8	4 ea	6-32 hex nut
M9	4 ea	star washer
M10	1 ea	4-pin header

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.

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

2.00 K	Red-Black-Black-Brown--Brown
3.24 K	Orange-Red-Yellow-Brown--Brown
6.49 K	Blue-Yellow-White-Brown-Brown
10.0 K	Brown-Black-Black-Red--Brown
24.9 K	Red-Yellow-White-Red--Brown
33.2 K	Orange-Orange-Red-Red--Brown
100 K	Brown-Black-Black-Orange--Brown
127 K	Brown-Red-Purple-Orange-Brown
249 K	Red-Yellow-White-Orange--Brown
324 K	Orange-Red-Yellow-Orange-Brown
1.00 M	Brown-Black-Black-Yellow--Brown

The 1W Carbon Composition resistor:

5.6 Ohm Green-Blue-Gold--Gold

Capacitors:The Electrolytic capacitors are all radial type. Be sure to observe polarity markings when installing. The stacked film capacitors are brown and have marking 224 for .22 uF and 105 for the 1 uF part. The ceramic discs show 001 for the 1000 pF capacitors.

Inductor: The inductor L1 is made up with 10 turns of wire on resistor R21. Install as usual.

Integrated Circuits: For IC1, install a 16 pin DIP socket and then plug in the LM391.

Transistors:Power transistors Q1 (NPN 2N6284) and Q2 (PNP 2N6287) are installed onto the heat-sink bracket. Use the insulating wafers between the transistors and the heat-sink bracket. Before using the heatsink, the inside of the 8 transistor mounting holes must be insulated with sections of the insulating tubing. Insert the tubing into each hole and slice off the tubing flush with the bracket, using a sharp utility knife. A short section of the tubing will now extend from one side of the heatsink bracket to the other side. Make sure the tubing does not extend above the surface of the bracket.

Apply a thin uniform layer of the white silicone compound on both sides of the insulating wafers before installing. Install the transistors with the 6-32 screws and nuts. 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 two transistor pins only after the two mounting screws have been tightened. Use a lockwasher between nut and TO3 transistor

package. Q3 and Q4, 2N2222 are installed in the usual way. Observe orientation by matching the flat part of the package with the identification on the board. Q5 and Q6 are supplied mounted on a solder lug. Q5 is installed under the mounting screw of transistor Q2, Remove the mounting screw, insert the leads of Q5 into the circuit board and bend the leads so that the transistor and lug fit on the mounting hole of Q2. Now replace the mounting screw. Q6 gets installed the same way but on transistor Q. Both Q5 and Q6 are installed this way in order that they are at the same temperature as the power transistors.

Header: Install the 4-pin header between C15 and C16. The two jumper blocks are installed onto the header. Remove these for AC coupling. Leave for DC coupling.

Terminal Blocks:Install the 3-pin and 6-pin terminal blocks at the edge of the circuit board.

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).

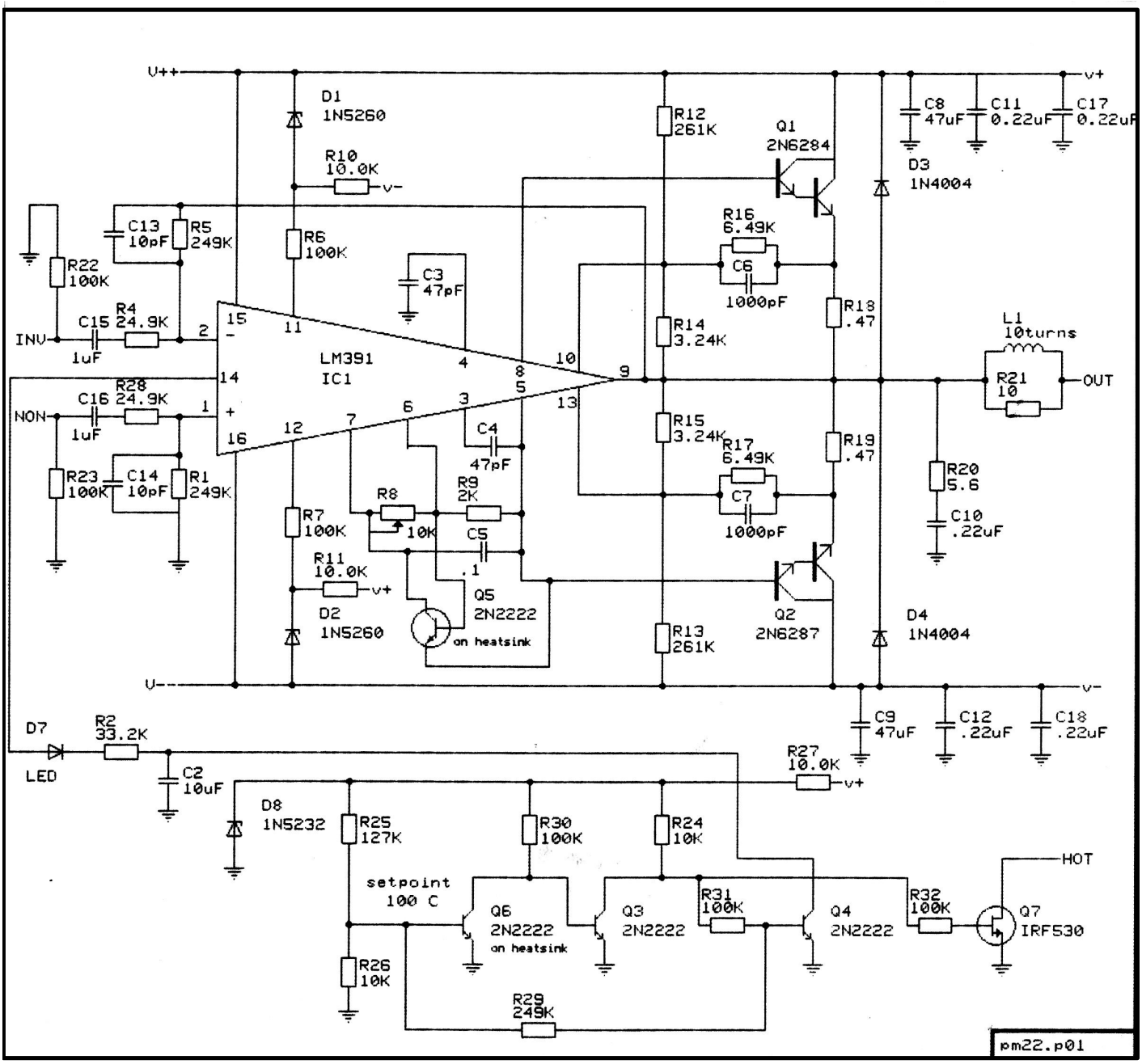
The bias current of the amplifier must be adjusted by setting the potentiometer R8. First turn the potentiometer fully counterclockwise. This will set the bias current to zero. Connect a DVM or suitable voltmeter between R18 and R19. These are the two square resistors. Use the leads closest to the heat-sink. They are the leads just next to the markings "R18" and "R19". Hook the PM22 to a bipolar power supply. The supply voltage should be between +/- 20V and +/- 50 V. Now slowly adjust R8 clockwise until a reading of 30 mV is indicated on the DMM. Precise adjustment is difficult. But a value between 25 mV and 35 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 increase to about 150 mA at heat-sink temperature of 100 degree Celsius. This is normal. The assembly and adjustment of PM22 is now complete.

Bias current adjustment (Class A).

For operation in class A, where power transistors Q and Q2 are always conducting current, The bias current should be adjusted to about 1A. use the same procedure as above, but set the potentiometer for a reading of 1.0V on the DMM. Use a power supply of not more than +/- 20V. The amplifier will get warm. Use a proper heatsink.

Thermal Protection.

The thermal protection will switch the amplifier off at about 100C. It will come back on after it has cooled down a bit. This protection protects the amplifier itself from heat damage. When the amplifier is in the shut-down mode the LED will light up. If this happens the heatsink of the amplifier is not sufficient. It can be corrected by using a bigger heatsink or by installing a cooling fan.


V++
D1
1N5260
R10
10.0K
V-
R12
261K
Q1
2N6284
C8
47uF
C11
0.22uF
C17
0.22uF
V+
D3
1N4004
R16
6.49K
C6
1000pF
R18
.47
C13
10pF
R5
249K
R6
100K
C3
47pF
R22
100K
R4
24.9K
C15
1uF
INV
LM391
IC1
R14
3.24K
L1
10turns
R21
10
OUT
R28
C16
24.9K
1uF
NON
R15
3.24K
R17
6.49K
C7
1000pF
R19
.47
C4
47pF
R20
5.6
C10
.22uF
R23
100K
C14
10pF
R1
249K
R7
100K
R8
10K
R9
2K
C5
.1
R11
10.0K
V+
D2
1N5260
Q5
2N2222
on heatsink
Q2
2N6287
D4
1N4004
R13
261K
V-
C9
47uF
C12
.22uF
C18
.22uF
D7
LED
R2
33.2K
C2
10uF
R27
10.0K
V+
D8
1N5232
R25
127K
R30
100K
R24
10K
HOT
setpoint
100 C
Q6
2N2222
on heatsink
Q3
2N2222
R31
100K
Q4
2N2222
R32
100K
Q7
IRF530
R26
10K
R29
249K
pm22.p01