

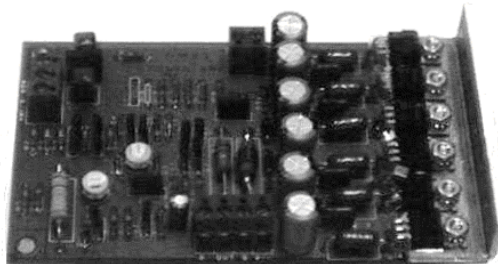
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PM23 Installation Instructions

General

The PM23 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.



terminal block. Use stranded insulated hookup wire of 22 gauge or thicker. The minimum supply voltage is +/- 25V, and the maximum value is +/- 75 V. A higher value than 75V 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.

Input

The input is differential. There is a 3-position terminal block on the circuit board, labeled INV-GND-NON. 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.

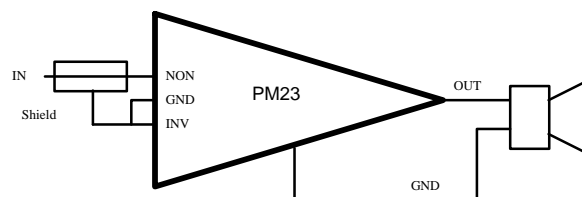
The inputs are AC or DC coupled. For DC coupling, install two shorting blocks on the 4-pin header near the input. For AC coupling remove the shorting blocks.

Output

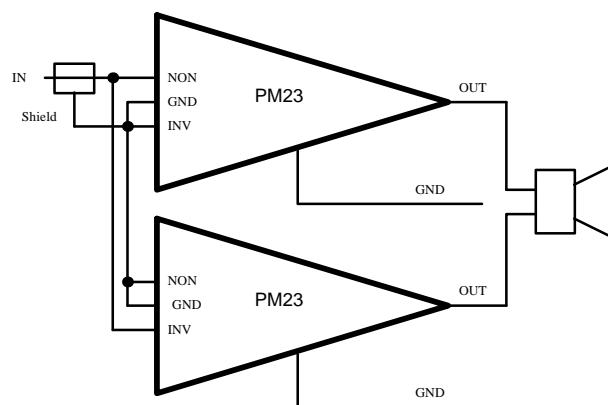
Connect the load to the two terminals labeled OUT-GND on the 4-position terminal block. The PM23 is designed for loads of 4 Ohm or 8 Ohm. Maximum output power depends on the value of the load and the power supply voltage. With a 8 Ohm load and a power supply voltage of +/- 65 Volt, an output power of 200W RMS can be achieved. In a 4 Ohm load the max power will be 200 Watt using a 45 Volt power supply.

Power Supply

A regulated or unregulated dual power supply of nominally +/- 50 Volt should be connected to the terminals V-- GND of the 4-position terminal block and terminals V++ GND of the 3-position



Single Channel Hookup



Bridged Hookup using 2 Amplifiers

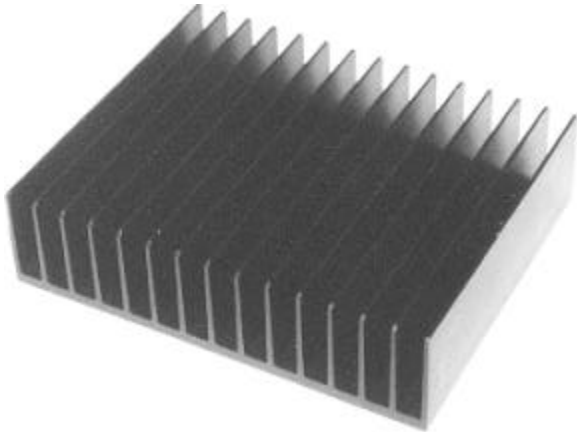
Heat sink

The PM23 should be bolted onto a heat sink of sufficient size to keep the amplifier cool. Use of a thermal cutout switch on the heatsink is recommended. Use a Normally Closed thermal

switch of 5A and 70°C rating. Install this switch in the AC line going to the power transformer.

Bias current

The PM23 operates in class AB. The bias current can be set with potentiometer R22. A bias current of ~ 50 mA, when cold, is normal. The bias current can be observed with an Amp-Meter in the power supply, or by measuring the voltage across R37 with a DMM. See the section "Bias Current Adjustment". The voltage between the two testpoints will be 25 mV for a bias current of 50 mA. The bias current will increase or decrease slightly when the amplifier is warm. This is normal.



PM23-HS custom heatsink.
5.0"x6.1"x1.6"
0.8°C/W

PM23 Parts List

ID	Value	Description
Resistors		
R1	100K	1%, 1/4W, Metal Film
R2	100K	1%, 1/4W, Metal Film
R3	24.9K	1%, 1/4W, Metal Film
R4	24.9K	1%, 1/4W, Metal Film
R5	499K	1%, 1/4W, Metal Film
R6	499K	1%, 1/4W, Metal Film
R7	24.9K	1%, 1/4W, Metal Film
R8	2.00K	1%, 1/4W, Metal Film
R9	10K	2W Power Resistor
R10	100K	1%, 1/4W, Metal Film
R11	100K	1%, 1/4W, Metal Film
R12	1.50K	1%, 1/4W, Metal Film
R13	100 Ohm	1%, 1/4W, Metal Film
R14	1.00M	1%, 1/4W, Metal Film
R15	4.22K	1%, 1/4W, Metal Film
R16	499 Ohm	1%, 1/4W, Metal Film
R17	4.22K	1%, 1/4W, Metal Film
R18	1.00K	1%, 1/4W, Metal Film
R19	1.00K	1%, 1/4W, Metal Film
R20	2.00K	1%, 1/4W, Metal Film
R21	2.00K	1%, 1/4W, Metal Film
R22	10 KOhm	Trimmer Potentiometer
R23	100 Ohm	Trimmer Potentiometer
R24	5.6 Ohm	2W
R25	5.6 Ohm	2W
R26	49.9 Ohm	1%, 1/4W, Metal Film
R27	1.5 Ohm	3W Wirewound
R28	49.9 Ohm	1%, 1/4W, Metal Film
R29	1.5 Ohm	3W Wirewound
R30	49.9 Ohm	1%, 1/4W, Metal Film
R31	1.5 Ohm	3W Wirewound
R32	49.9 Ohm	1%, 1/4W, Metal Film
R33	1.5 Ohm	3W Wirewound
R34	49.9 Ohm	1%, 1/4W, Metal Film
R35	1.5 Ohm	3W Wirewound
R36	49.9 Ohm	1%, 1/4W, Metal Film
R37	1.5 Ohm	3W Wirewound
R38	1.00K	1%, 1/4W, Metal Film
R39	1.00K	1%, 1/4W, Metal Film

Capacitors

C1	1uF	Stacked Film
C2	1uF	Stacked Film
C3	10pF	Silver Mica
C4	10pF	Silver Mica
C5	.22uF, 100V	Stacked Film
C6	10uf, 50v	Aluminum Electrolytic
C8	.22uF, 100V	Stacked Film

C9	47uF, 100V	Aluminum Electrolytic
C10	47uF, 100V	Aluminum Electrolytic
C11	47uF, 100V	Aluminum Electrolytic
C12	47uF, 100V	Aluminum Electrolytic
C13	47uF, 100V	Aluminum Electrolytic
C14	47uF, 100V	Aluminum Electrolytic
C15	.22uF, 100V	Stacked Film
C16	.22uF, 100V	Stacked Film
C17	.22uF, 100V	Stacked Film
C18	.22uF, 100V	Stacked Film

Diodes

D1	1N4740	10 Volt Zener Diode
D2	1N4148	Signal Diode
D3	1N4148	Signal Diode
D4	1N4148	Signal Diode
D5	1N4148	Signal Diode
D6	1N5232B	5.6 Volt Zener Diode
D7	HER102*	High Efficiency Diode
D8	HER102*	High Efficiency Diode
D9	1N4148	Signal Diode
D10	1N4148	Signal Diode

* UFR102 may be substituted for HER102

Transistors

Q1	ZVNL120A*	N-Channel SS MOSFET
Q2	ZVNL120A*	N-Channel SS MOSFET
Q3	ZVNL120A	N-Channel SS MOSFET
Q4	ZVNL120A	N-Channel SS MOSFET
Q5	ZVP2120A	P-Channel SS MOSFET
Q6	ZVP2120A	P-Channel SS MOSFET
Q7	ZVP2120A	P-Channel SS MOSFET
Q8	ZVNL120A	N-Channel SS MOSFET
Q9	ZVNL120A	N-Channel SS MOSFET
Q10	IRF9630	P-Channel Power MOSFET
Q11	IRF9630	P-Channel Power MOSFET
Q12	IRF9630	P-Channel Power MOSFET
Q13	IRF630	N-Channel Power MOSFET
Q14	IRF630	N-Channel Power MOSFET
Q15	IRF630	N-Channel Power MOSFET

*NOTE: Q1 and Q2 are a matched pair

The PM23 kits contains the following parts:

Qu.	Value	Description
Resistors		
6	49.9 Ohm	1%, 1/4W, Metal Film
1	100 Ohm	1%, 1/4W, Metal Film
1	499 Ohm	1%, 1/4W, Metal Film
4	1.00K	1%, 1/4W, Metal Film
1	1.50K	1%, 1/4W, Metal Film
5	2.00K	1%, 1/4W, Metal Film
2	4.22K	1%, 1/4W, Metal Film
3	24.9K	1%, 1/4W, Metal Film
4	100K	1%, 1/4W, Metal Film
2	499K	1%, 1/4W, Metal Film
1	1.00M	1%, 1/4W, Metal Film
1	100 Ohm	Trimmer Potentiometer
1	10 KOhm	Trimmer Potentiometer
6	1.5 Ohm	5W Wirewound
2	5.6 Ohm	2W Power Resistor
1	10K	2W Power Resistor

Capacitors

2	1uF	Stacked Film
2	10pF	Silver Mica
6	.22uF, 100V	Stacked Film
1	10uf, 50v	Aluminum Electrolytic
6	47uF, 100V	Aluminum Electrolytic

Diodes

6	1N4148	Signal Diode
1	1N5232B	5.6 Volt Zener Diode
1	1N4170	10 Volt Zener Diode
2	HER102	High Efficiency Diode

Transistors

1 pair	ZVNL120A	N-Channel SS MOSFET
4	ZVNL120A	N-Channel SS MOSFET
3	ZVP2120A	P-Channel SS MOSFET
3	IRF630	N-Channel Power MOSFET
3	IRF9630	P-Channel Power MOSFET

Mechanical

Quantity	Description
1'	20 gauge magnet wire
3	2 Pos. Terminal block
1	3 Pos. Terminal block
6	TO220 Insulator

6	4/40x3/4" Machine Screw
6	4/40 Nut
6	#4 split lock washer
12	Black shoulder washer
1	Heat Sink Bracket
1	Bag Heat Sink Compound
1	Tube Silicone Glue
1	PM23 circuit board
1	4 pin header
2	shorting blocks

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. **NOTE:** do **NOT** install transistor Q5 till last and follow the special installation instructions below. Do **NOT** install R25 before reading the section on inductor below.

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

49.9 Ohm	Yellow-White-White-Gold--Brown
100 Ohm	Brown-Black-Black-Black--Brown
499 Ohm	Yellow-White-White-Black--Brown
1.00 K	Brown-Black-Black-Brown--Brown
2.00 K	Red-Black-Black-Brown--Brown
1.50 K	Brown-Green-Black-Brown--Brown
4.22 K	Yellow-Red-Red-Brown--Brown
6.49 K	Blue-Yellow-White-Brown-Brown
24.9 K	Red-Yellow-White-Red--Brown
100 K	Brown-Black-Black-Orange--Brown
499 K	Yellow-White-White -Orange-Brown
1.00 M	Brown-Black-Black-Yellow--Brown

When installing the power resistors leave a gap of about 0.1" between the body of the resistor and the circuit board. This will improve the cooling of the resistors. The small resistors can be installed flush with the circuit board.

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.

Inductor: The inductor L1 is made up with 5 turns of 20 gauge magnet wire on resistor R25. Install as usual. Carefully wind the wire tightly around the 2W power resistors. Strip the ends of the magnet wire and solder to the resistor leads.

Diodes: Diodes D1 ... D10 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 Q1,2,3,4,6,7,8 and 9 are the small black parts with the three leads. Note that the black part has a big flat side and a round side. Install the transistors according to the marking on the circuit board. Make **sure** there is no mistake here.

Power transistors Q10 through Q15 are installed onto the heat-sink bracket. Use the insulating wafers between the transistors and the heat-sink 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 4/40 screws and nuts and the two black plastic shoulder washers. Orient the screws so that the head of the screw is on the solder side and the nut is on the component side. Note that the shoulder washers serve to insulate the screws from the circuit board. The narrow part of the shoulder washers are inserted into the circuit board on one side and the tab of the power transistors on the other side. Solder the three transistor pins only after all the mounting screws have been tightened.

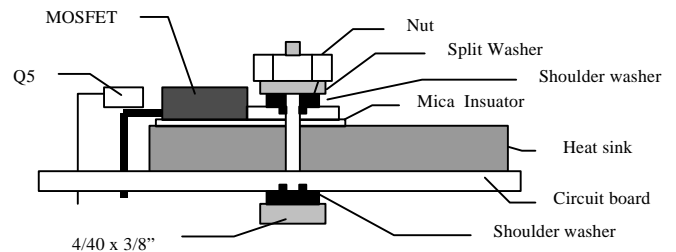
Header: Install the 4-pin header between C1 and C2. The two jumper blocks are installed onto the header. Remove these for AC coupling. Leave for DC coupling.

Terminal Blocks: Install the 2-pin 3-pin and 4-pin terminal blocks at the edge of the circuit board. The 4-pin terminal block is made by joining two 2-pin terminal blocks together.

Q5 (do this last !!): This transistor senses the temperature of the output transistors. It is glued to transistor Q14. Insert transistor Q5 in the designated holes near transistor Q14. Leave the leads long, do **not** cut them at this point. Bend the leads of Q5 90 degrees so that the body of Q5 rests onto the leads of the power transistor Q14. Holding the transistor in place solder the

leads of Q5. Now apply a generous amount of silicone glue between the two transistors.

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



Mounting of power transistors.

Bias current adjustment.

The bias current of the amplifier must be adjusted by setting the potentiometer R22. First turn the potentiometer fully counterclockwise. This will set the bias current to zero. Connect a DVM or suitable voltmeter between the leads of power resistor R37. Hook the PM23 to a bipolar power supply. The supply voltage should be between +/- 30V and +/- 50 V. For doing this step it is best to use a 30V supply. This will reduce chance of damage to the parts if there is an error in the installation of the parts. 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 power supply voltage slowly from zero to about 30V, while observing the DMM. Now slowly adjust R22 clockwise until a reading of 25 mV is indicated on the DMM. Precise adjustment is difficult. But a value between 10 mV and 40 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. The assembly and adjustment of PM23 is now complete.

Offset adjustment.

The offset voltage of the amplifier must be adjusted by setting the potentiometer R23. With no signal applied to the inputs, adjust R23 for

minimum DC voltage at the outputs. A residual output voltage of a few mV is normal.

