

Bias Arrangement for Initial Series Power Amplifiers

The driver board (LME498xx board) of Initial Power Amplifier Kits has been designed to accommodate various biasing circuits for different output devices. This app note shows some examples.

Using ThermalTrak Power Transistors (e.g. NJL3281D/1302D)

ON Semi ThermalTrak transistors are hosted in 5-Lead TO-264 package. The extra two leads are for the embedded diode. Compared to conventional V_{BE} bias generator, it simplifies biasing circuit and offers better thermal tracking [1]. Power board for these transistors is shown in Fig 1. The power board has a driver stage for the output transistors as illustrated in Fig. 2.

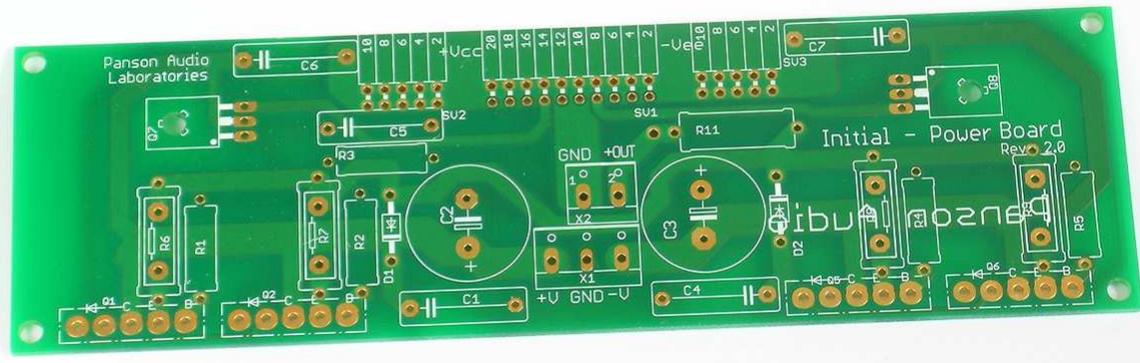


Figure 1 Power board for 5-Lead TO-264 packaged output transistors.

The driver transistors (MJE15030/15031) require V_{BE} bias voltage as the output transistors. Together with the output emitter follower stage, we need at least four V_{BE} forward bias voltages. Hence, we should use two pairs of ThermalTrak to provide these voltages. If one pair is employed, we need a bias pot at R6 on the drive board to generate sufficient bias for driver and output transistors.

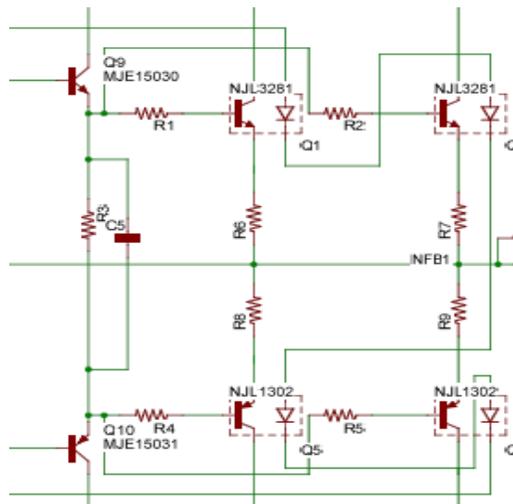


Figure 2 Power board driver and output devices.

offset the thermal attenuation and latency between output device and sensor as mentioned in [2].

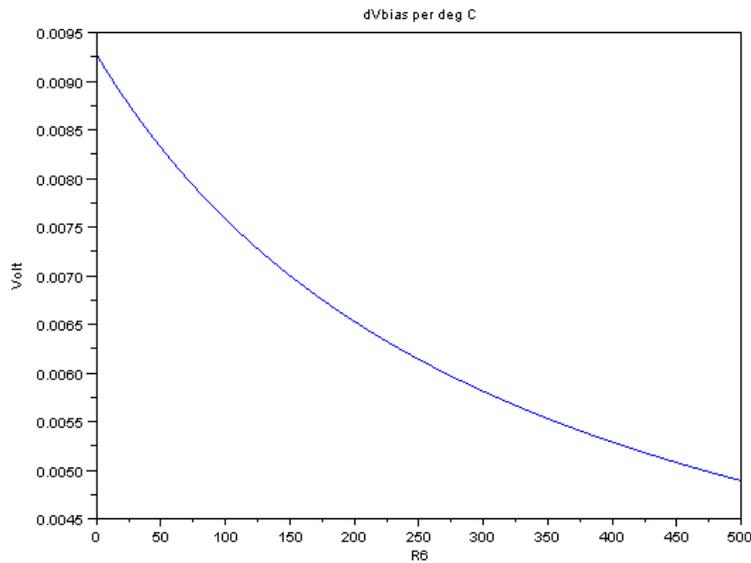


Figure 4 Bias voltage temperature coefficient versus R6.

Using MJL21194/21193 Power Transistors

The power board for standard 3-Lead TO-264 packaged transistors is shown in Fig. 5. To use traditional V_{BE} bias generator, you simply short B+ and B- together, select appropriate R9, R10 and R6, and mount Q1 (e.g. MJE340) on the heat sink. We have used R9 = 1.2 k Ω , R10 = 330 Ω and R6 = 500 Ω with good bias control and thermal compensation.



Figure 5 Power board for 3-Lead TO-264 packaged output transistors.

You can use the bias circuit of Leach amp where D5 - D8 are in series between B+ and B- as shown in Fig. 6. In addition, you can also emulate ThermalTrak with D5-D8. In these cases, D5 - D8 must be tightly touching the surface of the corresponding output

transistors to have good thermal coupling, Fig. 7. R9 and R10 are again shorted, and Q1 omitted. We have tested it with a pot (R6) of 500 Ω for bias adjustment.

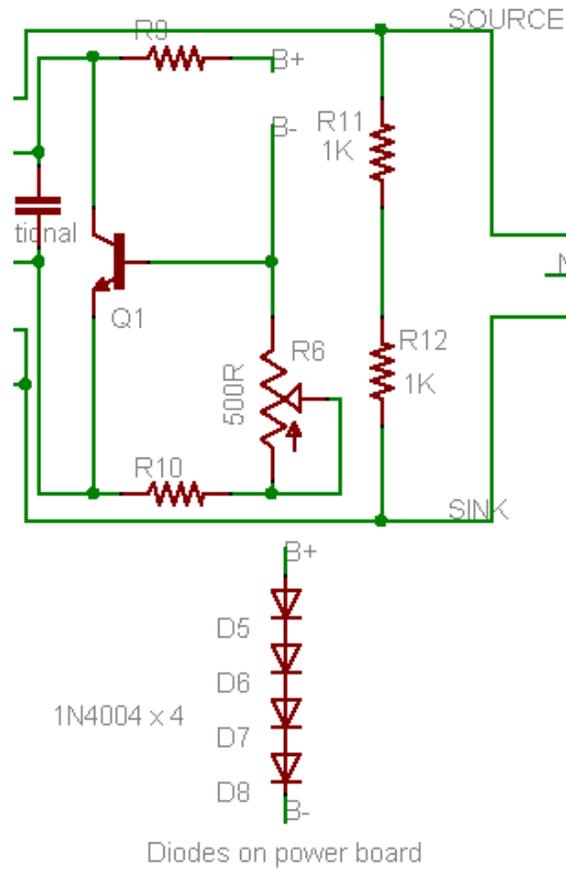


Figure 6 Bias generator as that of Leach amp.

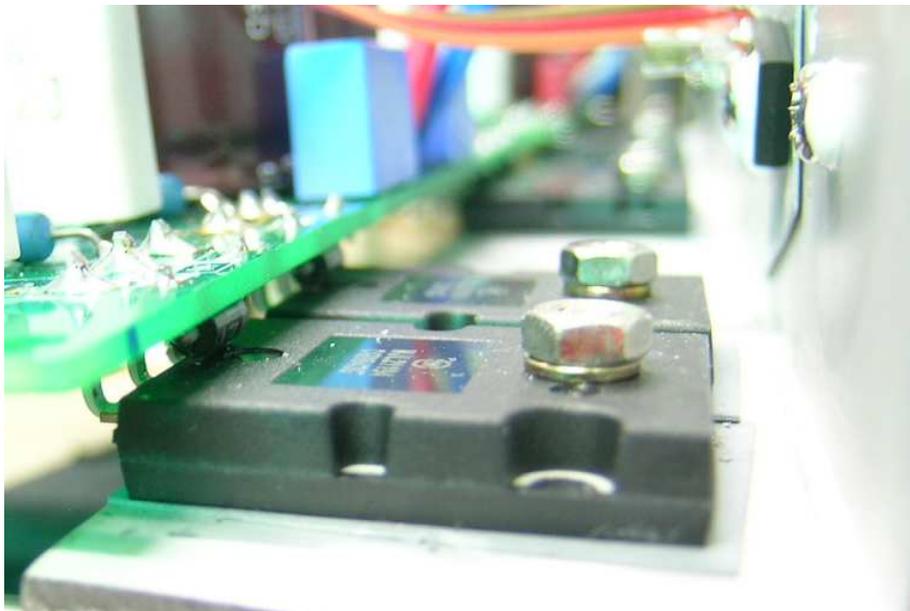


Figure 7 Biasing diode installation.

Using IRF240/P9240 MOSFET Power Transistors

The bias circuit for MOSFET transistor is essentially identical to that of the above MJL21194/93 example. You only need to select proper R6, R9 and R10 values. For IRFP240/9240, we have used R6 = 500 Ω , R9 = 5.6 k Ω and R10 = 330 Ω . The power board for 3-Lead TO-264 fits for many power MOSFET's.

Using BJT as diodes for thermal tracking

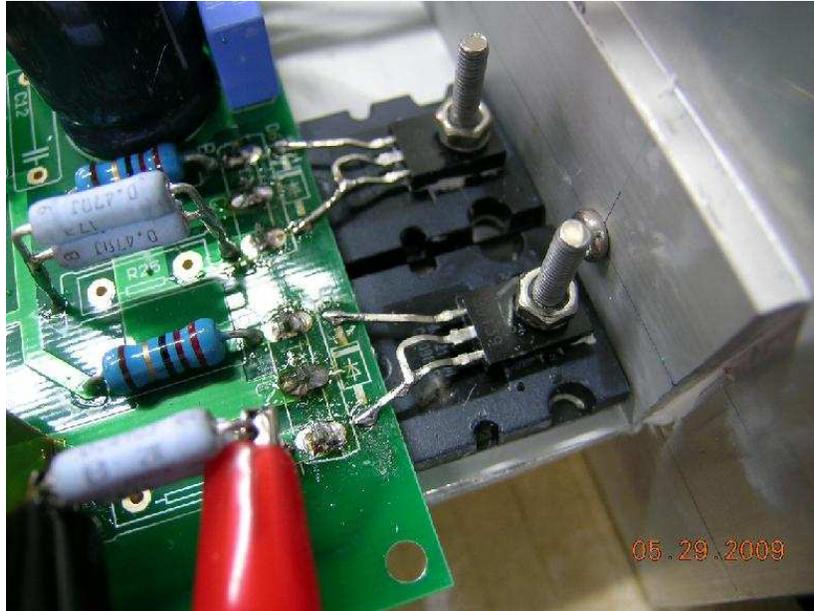


Figure 8 BJT as diodes for thermal tracking.

We can use medium-power NPN transistors (such as BD139) connected as diodes (CB connected together) for bias thermal tracking as shown in Fig. 8. These diodes can be tightly connected to the surface of each output device. It should provide tracking performance than mounting Q1 of V_{BE} multiplier on the heat sink.

References

- [1] Mark Busier, "ThermalTrak Audio Output Transistors", AND8196/D, ON Semiconductor.
- [2] D. Self, "Audio Power Amplifier Design Handbook", 4-th Ed., Newnes, 2006.

History

Revision	Description	Date
1.0	Initial Release	May 2009
1.1	Using BJT as diodes for thermal tracking	May 2009
1.2	V_{BE} multiplier resistor values are given for IRFP240/9240 example.	July 2009

ThermalTrak is a trade mark of ON Semiconductor.