

AN-38

Fine Tuning Current Limit Power Amp Design

Synopsis: By necessity only a few values of current limiting sense resistors can be supplied with evaluation kits. This application note shows how to achieve intermediate values of current limit with the resistors supplied in our evaluation kits.

Power Amp Design's evaluation kits include a limited number of current limit sense resistor values. Typical values are 10m Ω , 15m Ω , 50m Ω and 100m Ω . Whether the PAD125 Current Limit Accessory Module is used or the built-in current limit circuit is used the typical values of sense resistor provide only a limited range of current limit set points. It is often desirable to achieve some intermediate value.

Fortunately, the evaluation kits are designed with locations where additional resistors can be added to the circuit to modify the current limit set point using a simple voltage divider network.

In the schematic in Figure 1, the circuit of the EVAL117 is shown. Although each evaluation kit model has a somewhat different circuit, the components around the R_s resistor are the same and this same technique can be used with other evaluation kits or, indeed, your production circuit.

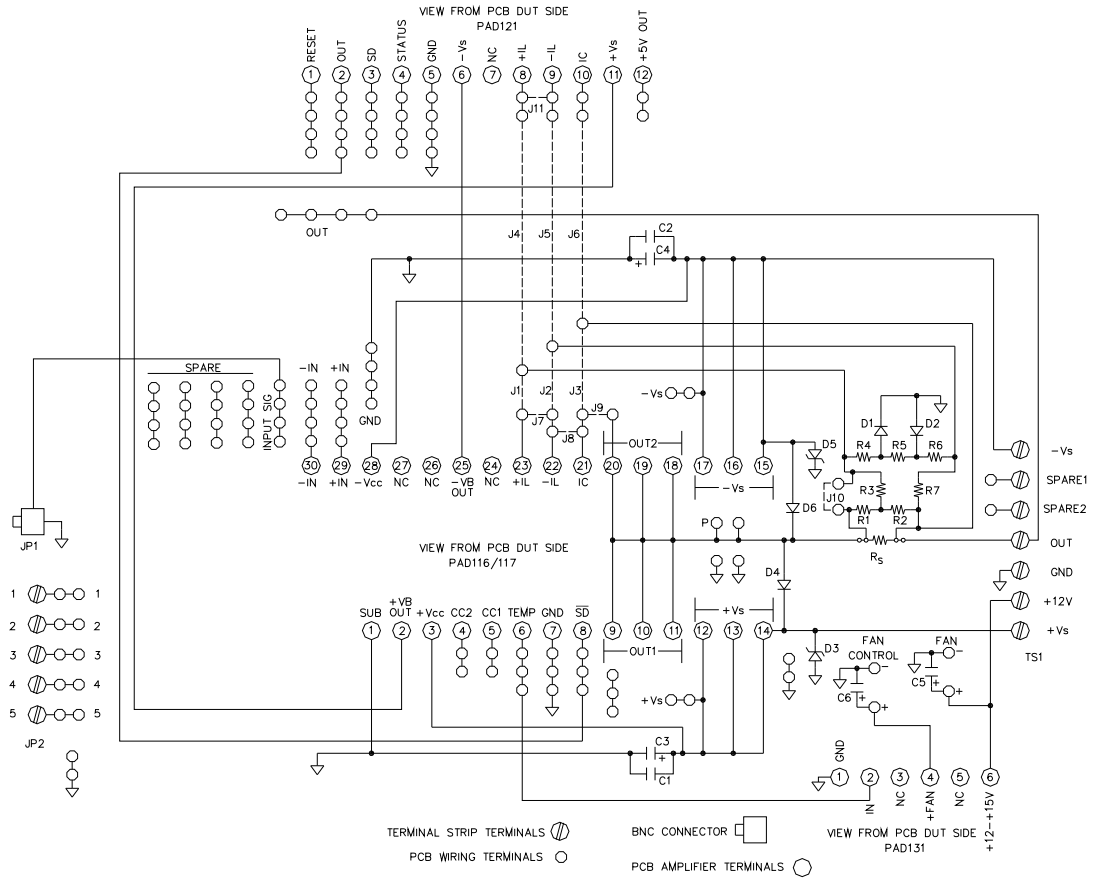


Figure 1
Circuit Diagram of the EVAL117 Evaluation kit

In the EVAL117 none of the components R1-R7 or D1, D2 are supplied. These components are used to implement a fold-over current limit scheme. But R1, R2 can also be used to modify the current limit set point that would otherwise be determined by Rs alone.

For example, let's assume that the PAD125 Current Limit Accessory Module is being used in your circuit and you want to current limit at 6 amps. Since the current limit sense voltage of the PAD125 is 150mV, Rs would normally be determined by

$$\frac{150mV}{6amps} = 25m\Omega$$

A 25mΩ resistor value is not included in the EVAL117 evaluation kit. So, first select the next higher value that is included in the kit, a 50mΩ. Now the job is to select a ratio of R1 to R2 that gives 150mV across R1 when 6 amps flows in Rs:

$$\frac{R1}{R1 + R2} = \frac{150mV}{300mV} = \frac{1}{2}$$

To simplify the arithmetic it is best to make R1 and R2 on the order of 1000 times greater than Rs to minimize loading of the circuit. So choose R2=50Ω. In this example R1 and R2 can both be 50Ω and we are simply dividing down the voltage across Rs by 2.

To complete the circuit remove jumper J10 and install a wire to jumper R3. Now, when 6 amps flows through Rs 150 mV will appear across R1 and the PAD125 will shut down the PAD117 at 6 amps output. It is the voltage across R1 that now provides the input voltage to the PAD125. Other ratios of R1 and R2 will, of course, give different current limit trip points. Since the values of Rs are so small, even small values of R1 and R2 will not much affect the accuracy of current limit set point and can probably be ignored since even the small values in this example are on the order of 1000 times greater than the sense resistor. The input impedance to the PAD125 is high and so this can also be neglected.

The final check you should make is for the power dissipation in Rs. In our example up to 6 amps could flow in Rs. The maximum power dissipation in Rs is then

$$P = I^2 R = 6^2 \text{ amps} \bullet 0.05\Omega = 1.8\text{Watts}$$

Up to 8 watts dissipation in the heat sink for Rs is permissible so this total solution works.

This same technique also works when the internal current limit circuit is used in place of the PAD125 (for those models with an internal current limit option). The difference is that the internal current limit has a different sense voltage (approximately 0.65 volts) and is temperature dependent and not as precise as that of the PAD125.

The exact desired value of Rs is often hard to find and this technique can be used to fine tune the current limit set point to most any value desired.