

élantec

It is quite typical to monitor the current through a component or a voltage on a node to regulate an input. Some applications may find it more useful, however, to monitor the power through a transistor. One such occasion would be in charging a battery. When the voltage is low, the designer may want more current charging, but as the voltage increases, the current could decrease, ultimately saving charging time and power.

Circuit Description

The circuit in Figure 1 utilizes an EL4452, a wideband variable gain amplifier compensated for a gain of 10. Circuit operation is very straightforward. Add a small resistor (R_e) in shunt with the emitter and apply the differential voltage across it to the differential input of the EL4452. The voltage at this input will be:

$$V_{IN1} = I_e * R_e$$

Secondly, attach a simple voltage divider between the collector and emitter and apply this voltage to the gain input of the EL4452. The voltage at the gain input will be:

$$V_{IN2} = V_C * R_{C2} / (R_{C1} + R_{C2})$$

The voltage divider, R_1 and R_2 , is necessary to ensure linearity if the collector will swing beyond $\pm 2V$.

Simply choosing R_{fb} and R_{gain} to give a gain of ten ($R_{fb} = 9 * R_{gain}$), the output will be a real-time, scaled measurement of power

$$V_{OUT} = k * I_e * V_C$$

$$\text{where } k = [R_e * R_{C2} * 10 / (R_{C1} + R_{C2})]$$

The EL4452 is internally compensated for a feedback gain of 10. It is not guaranteed stable for smaller values of gain. Also, since it is a high frequency part, the feedback resistors should be on the order of hundreds of ohms so that the pole created by the feedback resistors and the parasitic capacitances does not limit the performance. If there are instability problems with parasitics, small capacitors can be placed across R_{fb} and R_{gain} to dominate these parasitics, increase the compensation, and allow for higher divider resistances.

Conclusion

A circuit capable of providing real time power measurements has been presented. This circuit has a functional bandwidth of 50MHz (with R_{fb} and R_{gain} chosen for a gain of 10.) The gain bandwidth product holds, so if more gain is needed, it is a proportional trade-off with bandwidth.

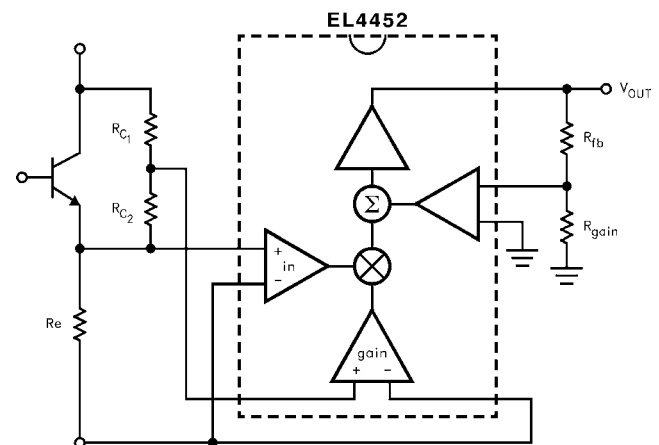


FIGURE 1.

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