

Power Supply Current Limiting

Application Notes

Kyle L. Coveart

ECE 480

Design Team 1

Executive Summary

In applications in which high current devices are used in conjunction with sensitive control circuitry, it is necessary to protect such circuitry from over currents from the power supplies. Over current can severely damage circuits and integrated circuits rendering the device inoperable. Current limiting circuitry is a simple way of protecting circuits from high currents, while allowing high current devices to draw high current from the same power supply.

Keywords: Over Current, Current Limiting, Power Transistor

Objective

The purpose of this application note is to introduce the concepts of current limiting and basic current limiting circuits.

Introduction

Current limiting is the protecting of sensitive device from large currents that can occur during either normal operation or due to faults. The simplest form of a current limiting device is a fuse. If the current through the fuse rises above the rated amount, the metal element inside will rapidly melt, resulting in an open circuit. This is a very effective way of protecting devices from over current while at the same time, reducing cost and complexity to the circuit.

Fuses however, must be replaced when they blow, this can often times be a very inconvenient process. Also, not all over current situations are the result of a device failure or a short circuit. Devices will often times try and draw more current than what they can handle under normal operation. Simple current limiting circuits can be constructed to provide active current limiting without interrupting current flow altogether. Most power

supplies already have current limiting circuits in them as it is. However it may be necessary to implement additional circuitry if high current devices share the same power supply as the sensitive circuitry.

Computers are a good example of the application of current limiting circuitry. In a computer, multiple voltages and amperages are needed. Peripherals such as hard drives and CD/DVD drives run off of 12 volts, and can draw several amps. This amount of current would destroy the motherboard which typically runs off of 2.5 – 5 volts and at only a couple of hundred milliamps. Inside the power supply, there are various current limiting circuits to allow the hard drive and such to draw larger amounts of current, while at the same time preventing the motherboard from drawing current that could cause catastrophic damage to it.

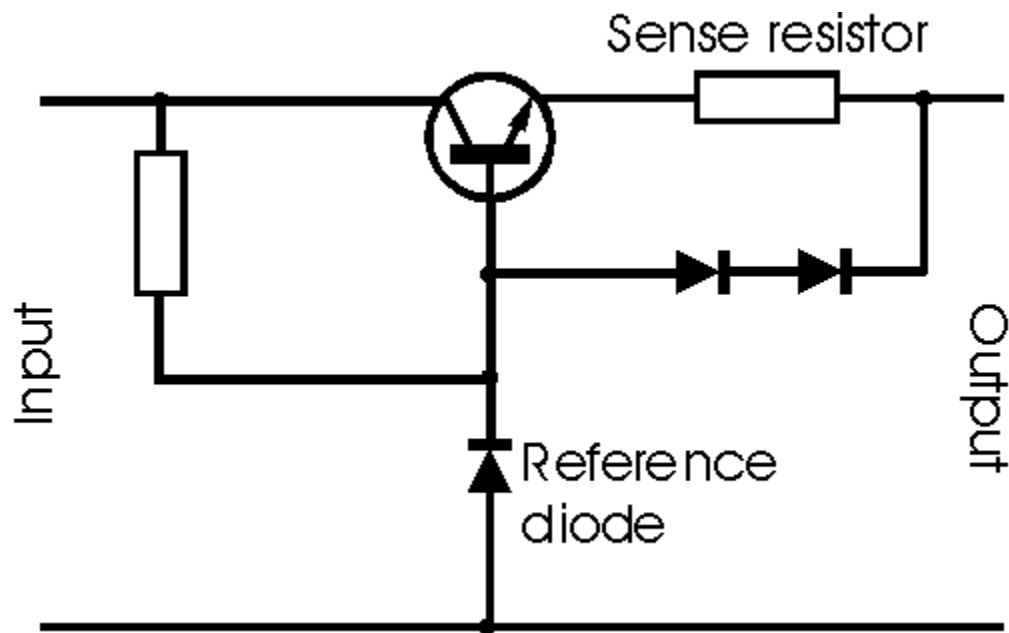


Figure 1.

Figure 1 shows a simple current limiting circuit. As the current through the two diodes in series begins to rise, they begin to conduct. This lowers the voltage at the base of the transistor and thus reduces the amount of current passing through the collector – emitter junction and subsequently to the output.

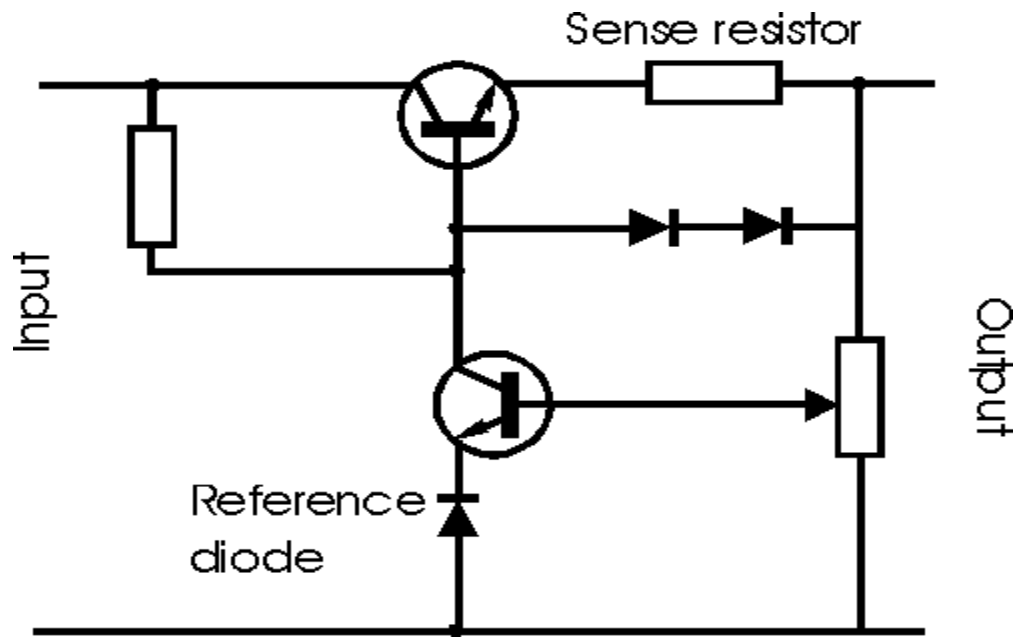


Figure 2.

Figure 2 is similar to the circuit in figure 1, although now a feedback loop has been introduced to allow variable control over the output voltage.

Conclusion

There are many more of types of current limiting circuits available to use. They range from simple circuits as shown above, to very complex designs with precision control. The type of current limiting circuit used, and the ranges of allowable current depend on the application in which it is being used.

References

1. Wikipedia - Current Limiting

http://en.wikipedia.org/wiki/Current_limiting

2. Power supply current limiter circuit

http://www.radioelectronics.com/info/circuits/diode_current_limiter/power_supply_current_limiter.php