



# APPLICATION NOTE

CRL2512

## Current Regulation and Circuit Protection using Low Ohmic Chip Resistors



### BACKGROUND

Power supplies for industrial, automotive, medical and telecommunications applications require the capability to maintain a constant supply current irrespective of input supply conditions. This requires the use of feedback to allow the power supply to measure the supply current and adapt accordingly. AC Electric Motor Controllers consisting of an Insulated Gate Bipolar Transistor (IGBT) inverter circuit also require feedback to allow the protection of the IGBT devices from a sudden surge in current caused by a short circuit.

### THE SOLUTION

One approach is to measure the voltage drop across a chip resistor placed in series with the high or low voltage path. Power supplies and inverter drives usually have A/D converters integrated into their micro-controllers that can sample and measure the voltage drop. By measuring the load current, one can calculate the load regulation in the case of the power supply. (Figure 1.)

For the inverter drive the value of the resistance should be chosen on the basis of the threshold voltage which would cause the inverter drive to shut down before its IGBTs are damaged. (Figure 2.)

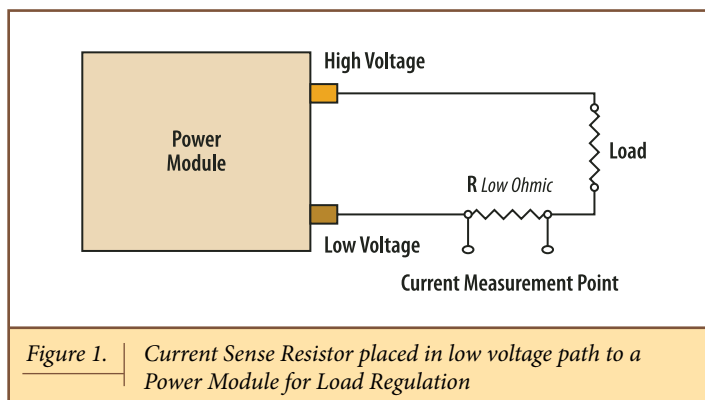


Figure 1. Current Sense Resistor placed in low voltage path to a Power Module for Load Regulation

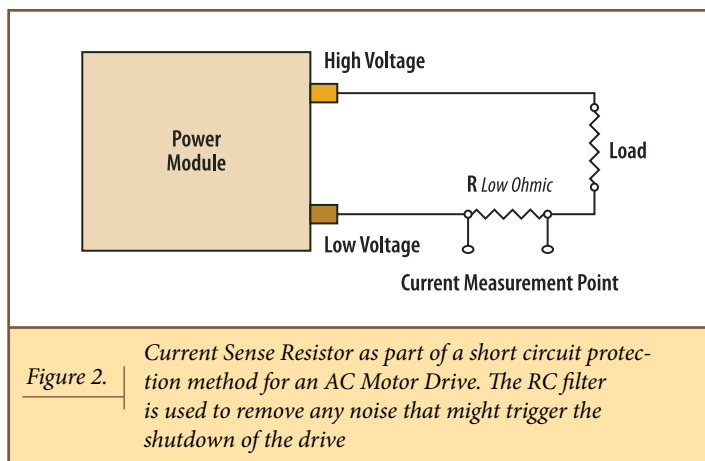


Figure 2. Current Sense Resistor as part of a short circuit protection method for an AC Motor Drive. The RC filter is used to remove any noise that might trigger the shutdown of the drive



### THE SOLUTION (*Continued*)

For accurate and efficient measurements the chip resistors used would have stable resistance values and good current carrying capability. For power applications the chip resistor must be able to dissipate heat without the temperature on the chip's surface exceeding its specification (usually 70 °C). By placing large pads, plated vias and copper cladding underneath the chip on the PCB, the designer can get around this problem. Often a PCB-based solution can be more convenient for size constraints as opposed to leaded parts.

For greater accuracy the temperature coefficient of resistance (TCR, measured in PPM/ °C) should be as low as possible. There is a trade off, however, between stability of resistance and resistance value using thick film technology.

The CRL series from Bourns are thick film chip resistors ranging from 0603 to 2512 in standard EIA sizes and from 0.01  $\Omega$  to 9.10  $\Omega$  at 1 % and 5 % tolerances. The maximum power rating is 1 watt at 70 °C in the 2512-size package. The TCR for resistance values greater than 0.05  $\Omega$  is  $\pm 200$  PPM/ °C.

For more information on the CRL2512 and other resistive products from Bourns, please visit

[www.bourns.com](http://www.bourns.com)