

# Terminology Glossary of Current Sensing Resistors

## What is a Current Sensing Resistor

Current sensing products are the newest and fastest growing resistive products in the industry today. As with most passive products, the majority of new designs are surface mount. These resistors are used to monitor the current in a circuit and translate the amount of current in that circuit into a voltage that can be easily measured and monitored.

## Current Detecting Resistors

Due to the increase in sales of notebook PCs, the demand for the DC/DC converter has shown rapid growth because of its high-energy conversion efficiency, and its precise current-limiting capability. However, to ensure the performance of the multiple output DC/DC converter, the current limiting voltage must be detected precisely to protect an expensive notebook PC from an overload, which is generally due to shorts within the capacitors used in these devices.

For high-energy conversion efficiency various control ICs have been developed that utilize resistive components. To achieve the perfect cutoff mode of the DC load current at the programmed current-limiting voltage of the control IC, a very stable and accurate sense resistor with the following characteristics is required for precise voltage comparison.

- Very Low Ohmic Value should be below 25mΩ for minimizing power consumption at the current sensing resistor.
- Tight Tolerance must be ±1% or tighter for maximizing the current supply within the limit of acceptable current.
- Low TCR is required for current sensing across the ambient temperature range of 0°C to 60°C.
- Low Thermal EMF for an accurate comparison between the programmed current-limiting voltage of the control IC and the detected voltage.

Furthermore, the self-inductance should be for high frequency applications. Recommended types are general purpose current sensing products or a flame retardant type.

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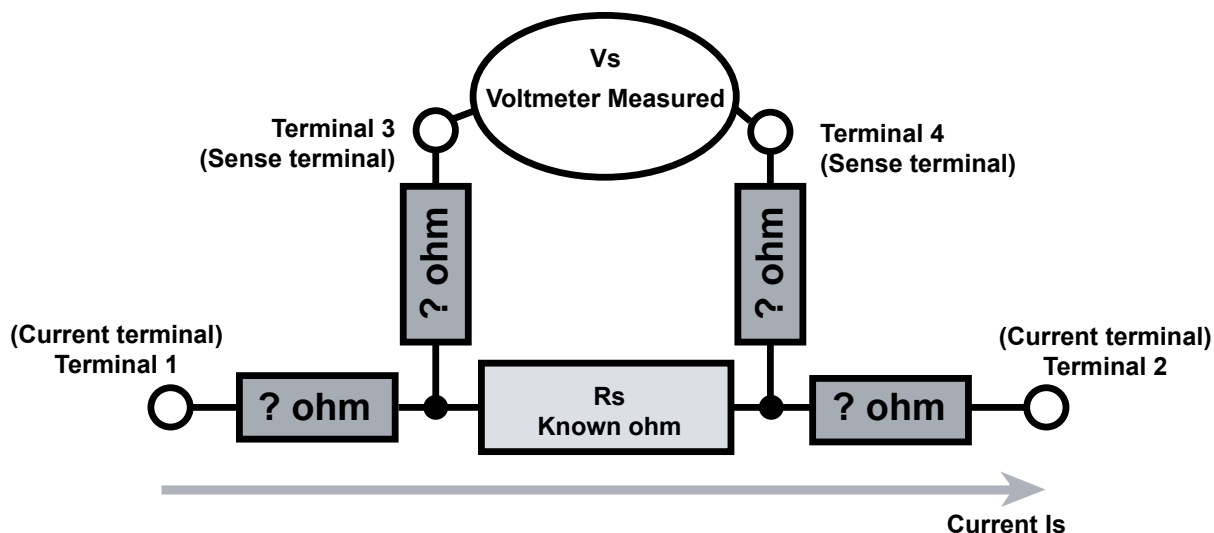
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## How Four Terminal Sense Resistor Work

High precision resistors used for current sensing are usually low ohmic value devices suitable for four terminal connection. To use a 4-terminal resistor, we force a current from Terminal 1 to Terminal 2. It's current, so the unknown resistances attached to Terminal 1 and Terminal 2 don't affect the amount of the current. The same number of electrons per second flow through from T1 to T2, regardless of the resistance.

A voltmeter measures the resulting voltage drop across the ultra-precise resistor, measuring through the unknown resistors attached to Terminal 3 and Terminal 4. The voltmeter's input impedance is very, very high compared to the unknown resistors, so the unknown resistors have essentially zero effect (typically less than 0.1 parts-per-million).

So the current flows through the  $0.100\ \text{ohm}$  resistor, unaffected by the unknown resistors, and we measure the voltage across the  $0.100\ \text{ohm}$  resistor, unaffected by the unknown resistors. And that's how a 4-terminal resistor works!



## **Flip Chip Resistor**

An unencapsulated resistor chip on which bead-type leads terminate on one face to permit “flip” (face down) mounting of the resistor chip by contact of the leads with interconnective circuitry.

## **Hot-Spot Temperature**

The maximum temperature measured on the resistor due to both internal heating and the ambient operating temperature.

## **Low Profile**

Components designed with “lower than standard heights”, to save space and allow clearance when mounted on PCBs.

## **Maximum Working Voltage**

The maximum specified voltage that may be applied across a resistor.

## **PPM**

Parts per million. The terminology used when describing the temperature coefficient.

## **Screen**

The process of printing a network pattern of thick-film ink or paste onto a substrate by means of a squeegee applied to a photo-etched wire-mesh “silk screen” or metal mask.

## **Current Shunt Resistors**

Current shunt resistors are low resistance precision resistors used to measure AC or DC electrical currents by the voltage drop those currents create across the resistance. Sometimes called an ammeter shunt, it is a type of current sensor.

## **SMT/SMD**

Surface-mount technology/surface-mount device.

## **Zero Ohm Resistors**

Products that look like resistors, but actually have no resistance (very very low resistance) and instead perform as jumpers.