VISHAY PRECISION GROUP

CASE STUDY

Product Group: Vishay Foil Resistors

Precision Current Sensing for µCurrent Multimeter Current Adapter

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With its four-terminal Kelvin configuration, low thermal EMF, and tight tolerance, Vishay Foil Resistors' CSM2512 Bulk Metal® Foil current sensing resistor helps the µCurrent GOLD multimeter current adapter provide superb accuracy.

Industry/Application Area: Precision instruments

Product Used: CSM2512 Bulk Metal® Foil high-precision current sensing resistor with resistance of 0.01 Ω and tolerance of 0.1%

The Challenge

The µCurrent GOLD professional current adapter turns a multimeter (or oscilloscope) into a powerful and precise current measurement tool. The device measures the standby and sleeping current of the latest generation of microcontroller-based digital electronics down to the nanoamp and picoamp levels with superb accuracy. In addition, the µCurrent serves as a precision x100 voltage amplifier. To achieve its high level of accuracy, a precision current sensing resistor was required that offered tight tolerances, low thermal EMF, and high reliability.

The Solution

Current sense resistors are core passive components in analog circuits for demanding power applications. The devices measure the voltage drop across a resistive element created by the current through that element. In doing this, there are five issues commonly associated with inaccurate measurement: connection errors, external and internal temperature errors, frequency, load-life stability, and thermal EMF. For the µCurrent GOLD, Vishay Foil Resistors' (VFR) CSM2512 is designed to address all of these issues, while meeting the need for increased reliability.

Figure 1: µCurrent GOLD PCB

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The device features a four-terminal Kelvin configuration and an all-welded construction composed of a Bulk Metal resistive element with copper-plated terminations. This design combination reduces solder joint stress and the stress due to temperature coefficient of expansion (TCE) differences between the PCB and element. The resistor element is designed to uniformly dissipate power in order to minimize hot spots and is compatible with the lead material, resulting in a lower thermal EMF of 3 µV/°C.

The User Explains

With the CSM2512, the µCurrent GOLD provides improved accuracy of ±0.05% in the µA and nA ranges, and ±0.1% in the mA range. The GOLD version also offers improved maximum current and mA range burden voltage. The device features increased bandwidth to 300 KHz, which allows users to measure fast-changing "sleep" modes in microcontrollers. An added "shorting mode" ensures uninterrupted power to the device under test while changing ranges.

For more information on the µCurrent, please visit https://www.kickstarter.com/projects/eevblog/current-gold-precision-multimeter-current-adapter?ref=live or http://www.eevblog.com/files/uCurrentArticle.pdf.

“With the help of VFR's CSM2512 current sense resistor, the µCurrent GOLD is a truly precision instrument that can rival 5.5-digit multimeters in accuracy.”

Acknowledgements:

David L. Jones is an electronics design engineer based in Sydney, Australia. In his popular blog — EEVBlog — he shares some of his 20+ years of industry experience in a unique, non-scripted style. Jones is the inventor of the µCurrent precision multimeter current adapter, which started as a Kickstarter project and has quickly become the industry-standard low-cost tool for low-power current measurement in microcontroller-based digital electronics. Most recently, he introduced the µCurrent GOLD with improved specifications.
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