Inductor DC Bias Testing Using an LCR Meter and DC Power Source

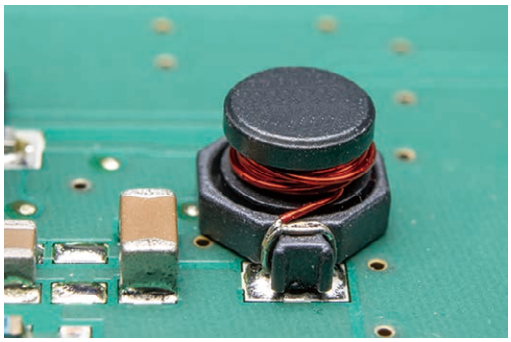
Until now, DC bias testing has required an external bias circuit with a protective capacitor and coil. Used in conjunction with a DC bias power source from Voltech, the LCR Meter IM3536 makes it easy to perform inductor DC bias testing (DC superposition testing) without a protective capacitor or coil.

Target

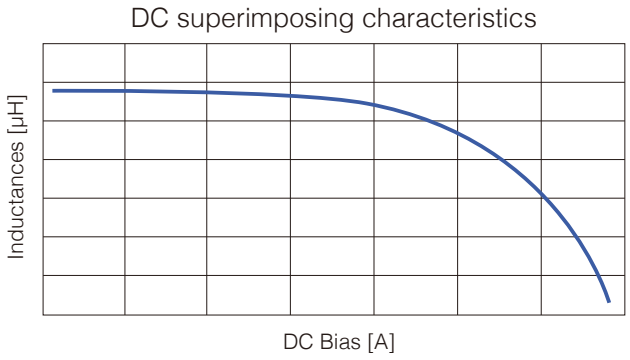
Inductors

Market Movements

Widespread adoption of electric vehicles (EVs) and expansion of datacenters have led to growth in demand for power supply circuits. Power inductors, a key component used in such circuits, play two roles. First, they smooth current flow and eliminate high frequencies in power circuits by allowing DC current to pass while blocking AC current, a property of inductors. Second, they store electrical energy as magnetic energy. However, if too much DC current flows through an inductor, the magnetic material that makes up its core will exhibit magnetic saturation, causing its inductance value to decrease. This phenomenon can cause the power supply circuit to behave in an unintended manner. The purpose of DC bias testing is to evaluate DC current value and inductance value characteristics.

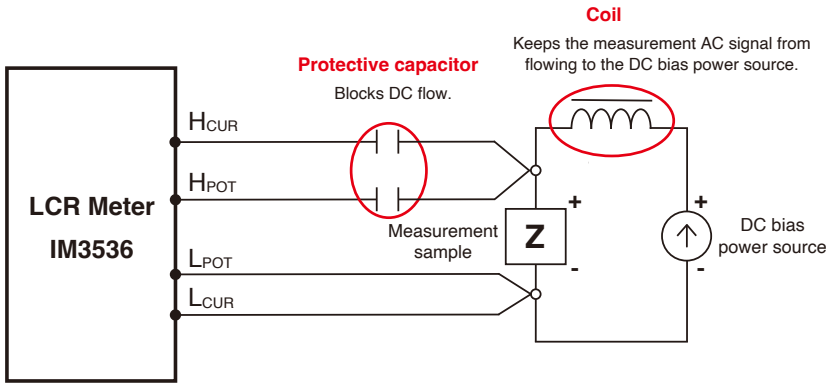


A power inductor mounted on a printed circuit board



Problem

To measure inductance while applying a DC current to a coil, a capacitor is necessary to protect the LCR meter from the DC current. In addition, a coil is necessary to keep the LCR meter's measurement AC signal from flowing to the DC bias power source. The coil must have an inductance value that is sufficiently large compared to the inductor being measured, and it must be able to withstand the DC bias current being tested; as a result, it's necessary to prepare multiple coils to accommodate various test current values and inductor inductance values.



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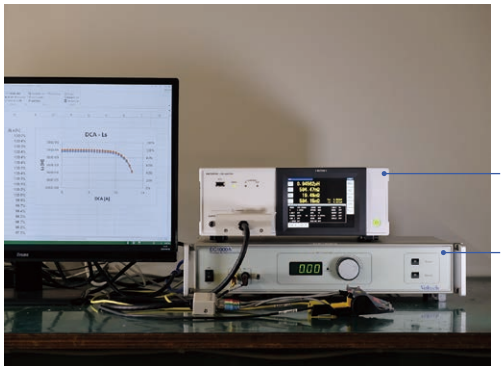
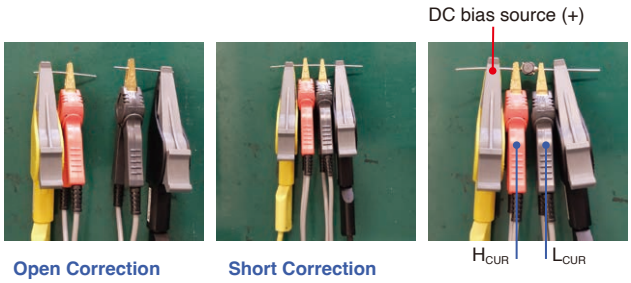
Application Note

Solutions

Voltech's DC1000A DC bias current source eliminates the need for a protective capacitor and incorporates a built-in coil to keep the LCR meter's measurement AC signal from flowing to the source. With voltage and frequency settings of 1 V and 100 kHz, respectively, the LCR meter can be used to test inductors of up to 790 µH. Hioki performed DC bias testing of a 1 µH chip inductor with this combination of equipment and settings.





Open Correction
DC bias power source output: 0 A

Short Correction
DC bias power source output: 0 A

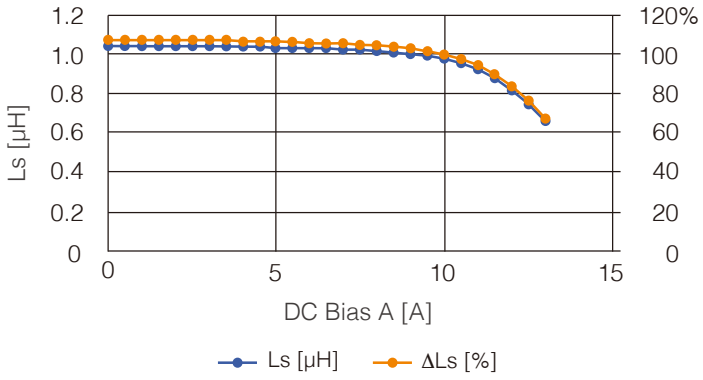
LCR Meter measurement cable

Equipment used

LCR Meter	IM3536	HIOKI
DC Bias Current Source	DC1000A	Voltech
DUT: Power Inductor	CLF7045T-1R0N-D	TDK

Measured data

Hioki performed DC bias testing of an inductor under the following conditions:
·LCR meter measurement signal: V = 1.0 V, 100 kHz
·DC bias current: 0 to 13 A



The results closely tracked the catalog specifications of the power inductor CLF7045T-1R0N-D.

To automate testing by controlling the IM3536 and DC1000A, Hioki used Sequence Maker, an Excel® add-on that provides integrated control of instruments.

Website
https://sequencemaker.hioki.com/

HIOKI

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