

## ***Ultra-Low Inductance Current Shunts Target Fastest-Switching Power Systems***

[Picotest's](#) new family of ultra-low insertion inductance, ultra-high-bandwidth current shunt resistor is designed to enable accurate, real-time transient voltage measurement in today's fastest-switching power systems. The technology—currently under provisional patent as “Ultra-Low Insertion Inductance and Ultra-High-Bandwidth Current Shunt”—addresses one of the most critical and long-standing challenges in power electronics: how to measure current and small power rail voltage changes without disturbing the circuit being measured.

As switching speeds continue to accelerate—particularly in low voltage/ultra-high dynamic current systems—engineers are increasingly limited not by their designs, but by their ability to measure them. Traditional differential voltage/current measurement methods introduce excessive inductance, degrade performance, and fail to capture fast transient behavior. This is especially problematic when validating power distribution networks (PDNs), VRMs, and high-speed load transients. Picotest's current shunt technology directly addresses this limitation.

“In many high-speed systems, the measurement tool is the dominant source of error,” said Steve Sandler, founder and CEO of Picotest. “Our goal was to create a differential voltage/current measurement solution that is effectively invisible to the circuit.”

Unlike conventional resistors which are lumped components, the Picotest current shunt is designed as a distributed electromagnetic structure, optimizing internal coupling, geometry, and current paths to achieve unprecedented performance.

Key innovations include:

- Ultra-low insertion inductance (~2 pH contribution in real systems) minimizing circuit disturbance
- Gigahertz-class bandwidth capability, enabling measurement of sub-nanosecond switching events
- Optimized internal coupling to reduce ESL without degrading resistance accuracy
- Integrated thermal and electromagnetic design, including reference plane and heat-spreading structures
- Production-ready form factor suitable for PCB integration—not just lab setups.

The physical implementation leverages a thin substrate with resistive films, controlled terminations, vias, and a heat-spreading structure that also influences electrical performance (see the figure).

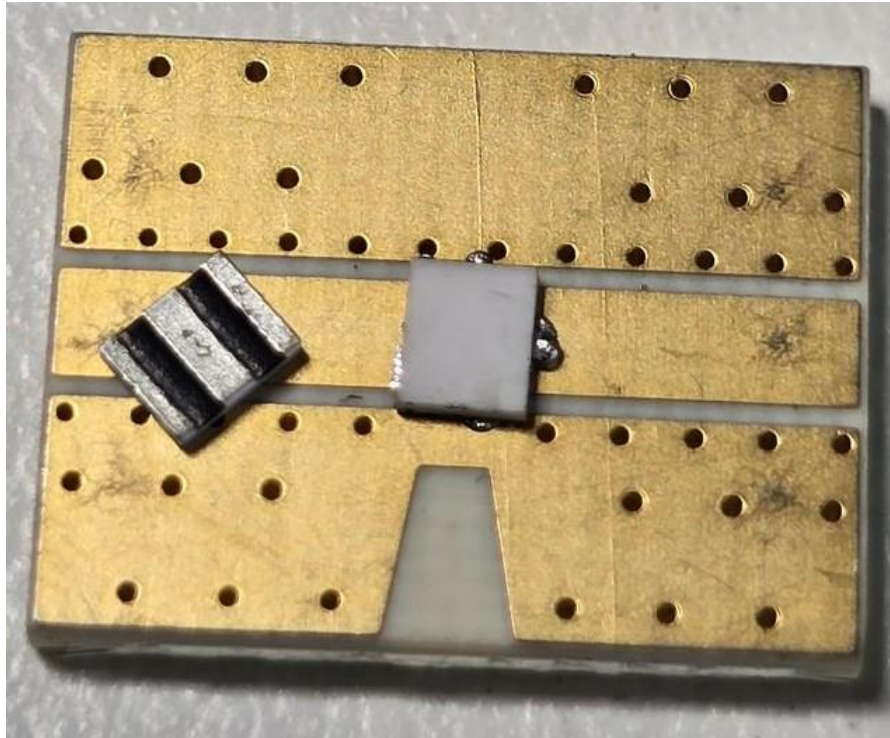
Unlike traditional external shunts that are removed after validation, Picotest's new current shunts are designed to be embedded directly into production PCBs and used for real-time monitoring and control. Additionally these devices are compatible with both hardware and software compensation techniques and work with high-CMRR probes such as the Tektronix's TICP IsoVu isolated current probes. In addition, the shunts are designed for seamless integration with high-bandwidth oscilloscopes and software-based compensation workflows.

The current shunts enable new capabilities such as real-time current visibility in deployed systems, phase current balancing and sharing, efficiency optimization and degradation monitoring, and high-fidelity double-pulse and switching loss analysis.

The new current shunt technology is a natural extension of Picotest's high-speed load stepper portfolio, including the industry-leading S2000 2000-A/ns transient load stepper. In the targeted systems, measurement fidelity is critical: Load steps are applied to ultra-low voltage rails, voltage response is captured using high-bandwidth probes (e.g., P2104A, P2105A) and current is traditionally difficult to measure without introducing error.

With the new shunt technology, engineers can now directly measure current at critical nodes—such as VRM power rail disturbances or MOSFET drains—without significantly altering system behavior. This is particularly important in sensitive locations where even small parasitic inductance can distort results. In validation testing, the Picotest shunt contributes less than 10% of total parasitic inductance in critical nodes, enabling highly accurate characterization.

Picotest is transitioning the technology into production in collaboration with Thin Film Technology. Initial devices and evaluation boards will be available soon. Distribution is expected through major channels including DigiKey. For more information, contact [Charles Hymowitz](#).



*Figure. The Picotest current shunt is designed as a distributed electromagnetic structure, optimizing internal coupling, geometry, and current paths to achieve unprecedented performance. It features ultra-low insertion inductance (~2 pH contribution in real systems) minimizing circuit disturbance and gigahertz-class bandwidth capability, enabling measurement of sub-nanosecond switching events. Unlike traditional external shunts that are removed after validation, Picotest's new current shunts are designed to be embedded directly into production PCBs and used for real-time monitoring and control.*