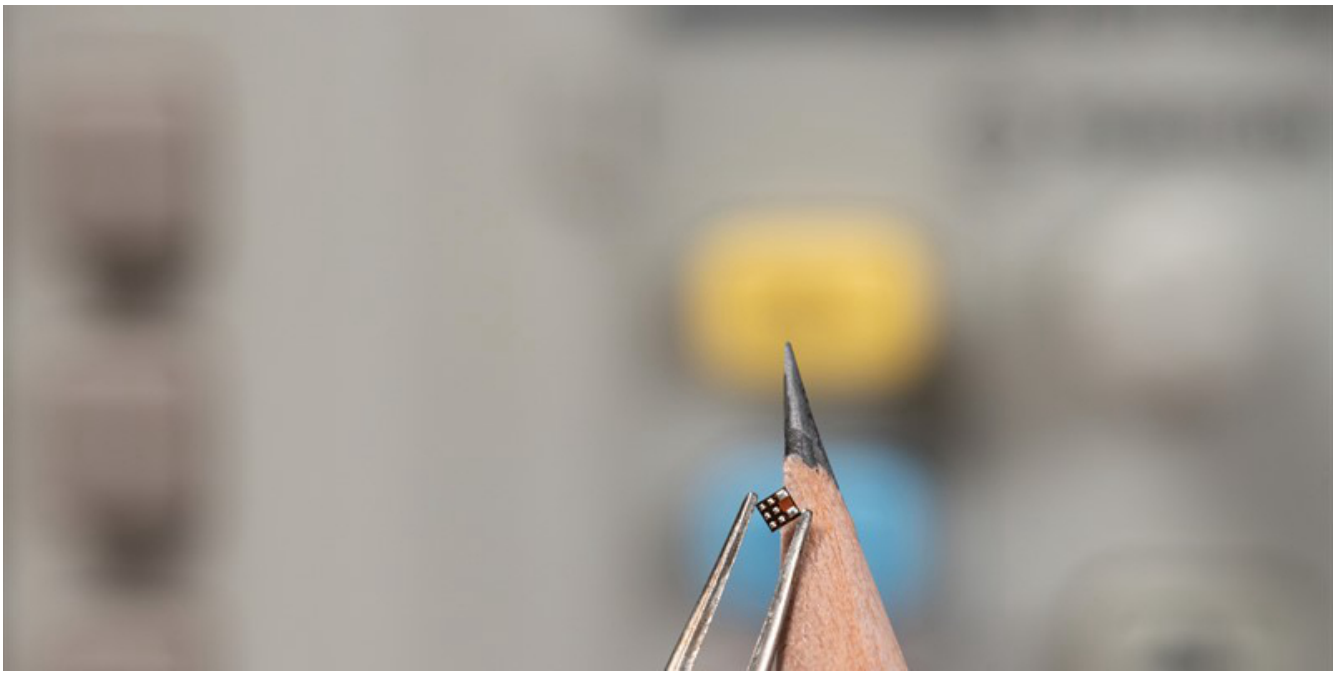
Technical Article

Bringing design simplicity, low drift, and small size to integrated-shunt solutions

Mubina Toa



Fueled by the demand for automation, convenience and sustainability, advancements in electrification are requiring more sensors, power electronics and processors to reliably and accurately sense and react the surrounding environment. It's a challenge to continuously find ways to shrink solution size and optimize and monitor power consumption.

For 20 years, my colleagues have been developing current-sense amplifiers and digital power monitors to help you find ways to measure power for system health monitoring, protect systems against overcurrent circumstances, and perform dynamic measurements to adjust control loops for better efficiency.

While integrated shunt products are not new, what is new is bringing the benefits of simplicity, low drift, small size and cost together. TI's EZShunt™ technology removes the need for an external shunt resistor by using the leadframe in the package itself to behave as the shunt (see Figure 1). EZShunt products compensate for the drift of traditional copper leadframes, which can be as high as 3,600 ppm/°C, using a temperature compensation algorithm. Standard shunt resistors can vary from 50 ppm/°C to 175 ppm/°C. In contrast, EZShunt products can achieve a total solution drift as low as 25 ppm/°C.

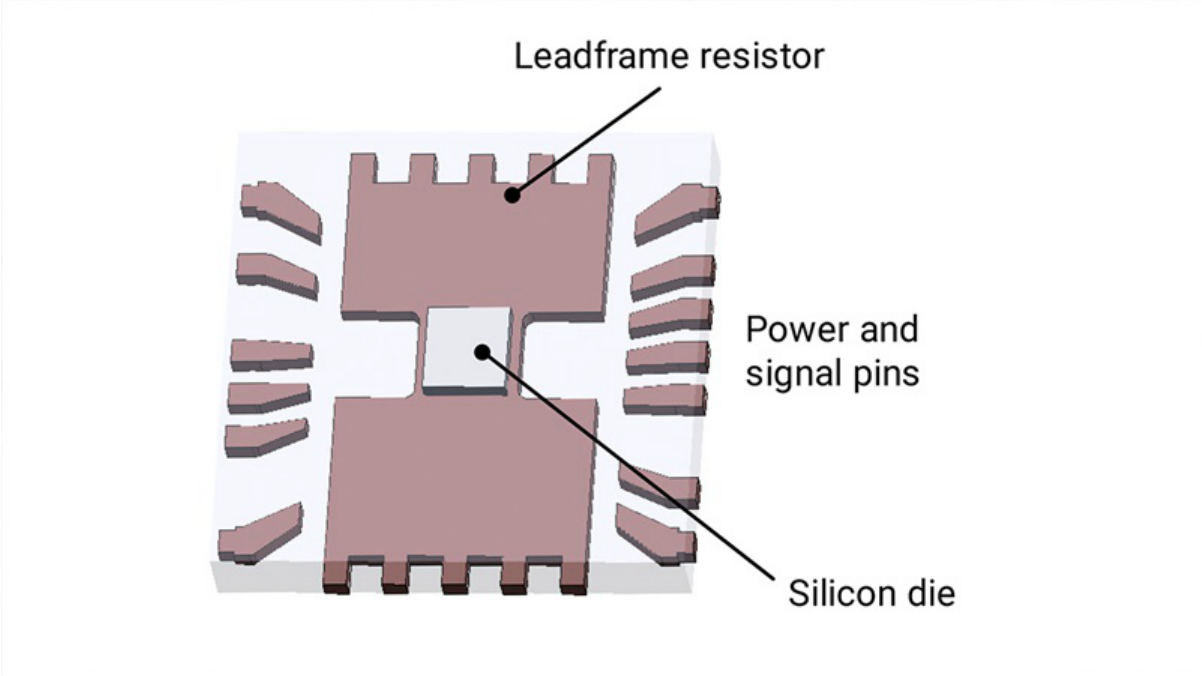


Figure 1-1. Chip rendering demonstrating how the packaging leadframe serves as the shunt

Digital EZShunt products greatly reduce design size. For example, the INA700 digital power monitor reduces component area size as much as 84% when compared to a similar wafer chip-scale package digital power monitor plus a 1206 shunt.

Additionally, digital EZShunt products offer multimodal sensing such as current, power, energy, charge, bus voltage and temperature to reduce the burden on the microcontroller (MCU); performing these calculations in-chip prevents the MCU from spending unnecessary clock cycles on those tasks. There's also an alert pin to report diagnostics or indicate when an analog-to-digital conversion is complete, reducing the need for the MCU to continuously poll the product to extract results.

For high-voltage and current-carrying capability, the 6-mm-by-6-mm quad flat no-lead package (DEK package designator) is able to carry 75 A_{DC} at 25°C (see Figure 2). The INA780A, INA780B and INA781 digital power monitors have a common-mode voltage capability of up to 85 V.

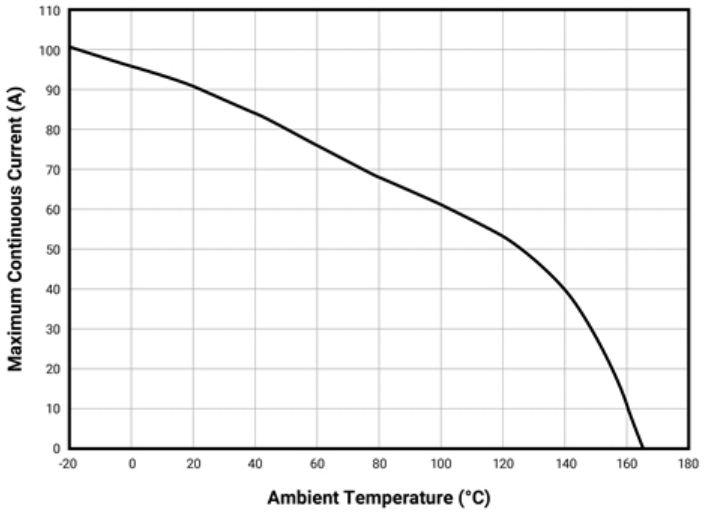


Figure 1-2. The continuous current capability of the DEK package (the INA780A, INA780B, INA781)

EZShunt products also remove the layout complexity of Kelvin connections (see Figure 3), as they either internally connect the shunt to the inputs or illustrate the Kelvin connections of the shunt on external pins.

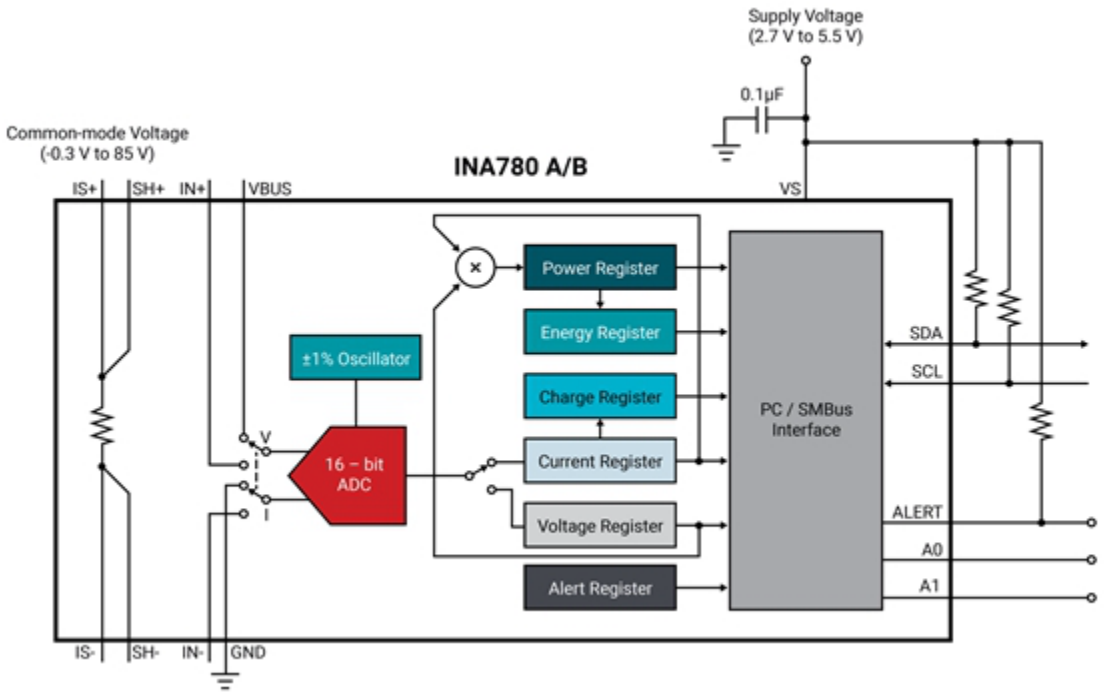


Figure 1-3. This block diagram of the INA780 illustrates the Kelvin-connected pins, SH+ and SH–

TI's new EZShunt technology brings the benefits of simplicity, cost, low drift and small size to a current-sensing space that is proliferating with advancements across many market segments. The portfolio spans a range of voltages, currents, output types (analog and digital), and accuracy to help meet your design needs – whether you are optimizing the full-scale range or reducing power dissipation – with analog and automotive versions coming in the second quarter of 2024.

Additional resources

- Explore what's behind TI's shunt technology.
- Learn about the new TCMS1123 Hall-effect sensor.

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265