electronic design

Power-Meter ICs Reflect Different Nations' Needs On A Common Platform

DON TUITE
Analog/Power Editor
dtuite@penton.com

Designers who target the global market must account for the differences in submarkets and accommodate them within the confines of their basic designs. Two variations on an electrical power-meter IC from Cirrus Logic vividly demonstrate this principle.

In China, electricity once was unmetered and had limited reach. Today, the Chinese power grid is expanding rapidly, and citizens are expected to pay for what they use. The latter requirement presents a challenge to some end users' ingenuity. In contrast, Japan's electrical grid reaches everywhere, and metered power is the accepted norm. What's new is a greater concern about power quality and a desire to meter total power consumption.

To meet the differing needs of these countries, Cirrus developed two ICs with a high degree of commonality and some interesting differences. For China, the CS5464 compares current on the return wire with current on the hot wire. It also allows the electric bill to be calculated on the basis of the higher current. Additionally, it tattles on any scheme that works "around the meter." The CS5467, however, reports active and reactive power on separate outputs.

Both of the chips contain four delta-sigma analog-to-digital converter channels followed by a computation engine that performs power calculations and energy-to-pulse conversion. Instantaneous voltage and current samples are multiplied to obtain the instantaneous power, which then is averaged over multiple conversions to compute active power. Active low-pulse-output frequencies on the chips' output pins are directly proportional to power being consumed. The difference is in how the outputs are used.

For single-phase measurements, the current channels on the CS5464 are independent while the voltage channels are multiplexed. This enables a tamper input that monitors the current through the neutral wire. The chip calculates active power using both current channel inputs, and the values for both channels are matched to a programmable threshold as an indicator of a connection fault that might be caused by tampering. The current channel that produces the larger active power appears on the pulse output pins.

In contrast, the CS5467's voltage and current input channels are independent for simultaneous two-phase measurements. The outputs represent active and reactive power according to an interesting encoding scheme in which pin E1 registers average active energy, E3 registers average reactive energy, and E2 indicates the sign of both active and reactive energy. A falling voltage on E1 or E3 while the E2 is high represents positive energy. Meanwhile, a falling voltage on E1 or E3 while E2 is low represents negative energy.

The chips can interface to shunt resistors or current transformers for current measurement, as well as to resistive dividers or potential transformers for voltage measurement. An on-chip 2.5-V reference provides a typical 25-ppm/°C temperature coefficient. Energy data linearity is ±0.1% of reading over a 1000:1 dynamic range.

Other features include system-level calibration, voltage sag detection, phase compensation, and temperature sensing. The on-chip temperature sensor enables characterization over a desired temperature range. In normal operation, it can be used to compensate for temperature drift. For communication to a microprocessor, the CS5464 and CS5467 provide an SPI-compatible and Microwire-compatible three-wire serial interface.

Both chips come in a 28-lead shrink small-outline package (SSOP). The CS5464 costs $4.06 and the CS5467 is priced at $4.45, both in quantities of 1000 units.

Cirrus Logic
www.cirrus.com