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## Buck Converter With Versatile I<sup>2</sup>C Interface Benefits Automotive Systems

**Diodes'** AP61406Q is a 5.5-V, 4-A automotive-compliant synchronous buck converter with low quiescent current ( $I_Q$ ) and a versatile interface. This I<sup>2</sup>C 3.0-compatible serial interface supports SCL clock rates up to 3.4 MHz and allows the programming of various parameters enabling it to meet the growing demand for compact design and high efficiency in various automotive point-of-load (POL) applications, including infotainment, instrument clusters, telematics, and advanced driver assistance systems (ADASs).

Programmable parameters include PFM/PWM modes, frequencies (1 MHz, 1.5 MHz, 2 MHz, and 2.5 MHz), and output currents (1 A, 2 A, 3 A and 4 A), and  $V_{OUT}$  adjustability (in 20-mV increments). The I<sup>2</sup>C interface can also provide fault status reports.

Optimized for high-power-density automotive POL applications, the AP61406Q is available in a W-QFN1520-8/SWP (Type UX) package (see the figure), enabling it to operate at high ambient temperatures. The device also features a proprietary gate-driver scheme that effectively resists switching node ringing without compromising MOSFET turn-on and turn-off times, thereby reducing high-frequency radiated EMI noise.

The AP61406Q operates over an input voltage range of 2.3 V to 5.5 V. It integrates a 75-m $\Omega$  high-side and a 33-m $\Omega$  low-side power MOSFET to provide high-efficiency stepdown conversion. Its adoption of constant on-time (COT) control minimizes external component count, facilitates loop stabilization, and results in low output voltage ripple

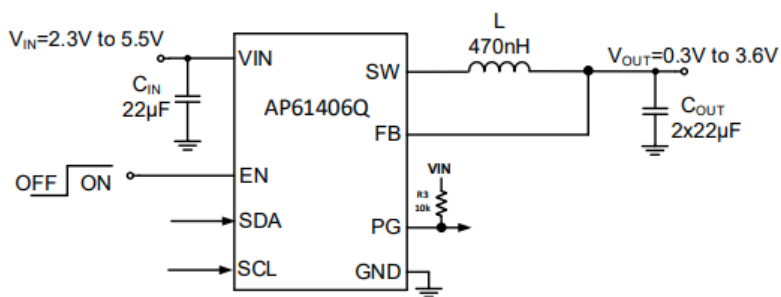
Users can employ the multi-function enable (EN) input to control the mode of operation. This capability enables flexibility for low  $I_Q$  (20- $\mu$ A), high-load efficiency in fixed PFM mode or equal ripple across load conditions in PWM mode. Additional features include an accurate power good (PG) indicator with an internal 5-M $\Omega$  pull-up resistor with a  $\pm 5\%$  window comparator circuit, which reduces bill-of-materials (BOM) costs.

In addition, the AP61406Q has high-side and low-side current-sense protection during output short circuits, increasing its reliability in automotive POL applications. Other protection features include undervoltage lockout (UVLO),  $V_{IN}$  overvoltage protection (OVP), peak and valley current limiting, and thermal shutdown.

The AP61406Q is unit priced at \$0.24 in 1,000-piece quantities. In addition to the automotive-grade part, a standard-compliance version, AP61406, is offered for industrial and consumer applications. For more information, see the [AP61406Q](#) and [AP61406](#) pages.



(a)



(b)

Figure. The AP61406Q is a 2.3-V to 5.5-V input, 4-A synchronous buck converter featuring an I<sup>2</sup>C interface that allows programming of various parameters, enabling it to meet the growing demand for compact design and high efficiency in various automotive point-of-load (POL) applications (a). Its use of constant on-time (COT) control minimizes external component count as shown in (b), facilitates loop stabilization, and results in low output voltage ripple.