

Multiaxial Coreless Hall-Effect Current Sensor Improves Accuracy In EVs

[Texas Instruments'](#) TMCS2100-Q1 is being introduced as the industry's first multiaxial coreless Hall-effect current sensor designed for all hybrid electric vehicle and electric vehicle (HEV/EV) traction inverter applications. In these applications it enables more efficient, longer-range and more enjoyable driving experiences, according to the vendor. The company adds that this product offers a first-of-its-kind approach to current sensing through the combination of multiaxial measurement and a proprietary algorithm, eliminating the tradeoff between precision and system size in traction inverter designs (see the figure).

While existing coreless solutions are limited to single-axis measurements, the TMCS2100-Q1 sensor is said to be the first to measure magnetic fields in both horizontal and vertical directions. This multiaxial measurement is 20 times more accurate than single-axis alternatives, says TI, achieving displacement error of less than 1% at 0.4-mm movement and as low as 0.25% at 0.1 mm. This level of precision improves the EV powertrain torque control loop, maximizing efficiency and power delivery across varying load and thermal conditions.

"For the first time, engineers have a Hall-effect current sensor that breaks through the limitations of existing solutions, which is especially critical as 800-V architectures raise the bar for traction inverter accuracy," said Jason Cole, vice president and general manager, Sensing Products at TI. "Leveraging advanced research from TI's Kilby Labs—our advanced R&D engine—the TMCS2100-Q1 was developed to give automakers a tool to build HEVs and EVs where tighter current measurement translates directly into longer range, smoother ride quality and more efficient motor control."

Automakers are continuously looking to make traction inverters lighter and more efficient to extend driving range and enhance vehicle performance. Traditional measurement approaches present designers with a fundamental tradeoff. Solutions with a magnetic core—or C-core implementations—deliver accuracy but add size and weight. Meanwhile, coreless alternatives are smaller but compromise precision due to displacement error and magnetic crosstalk.

TI's current sensing technology addresses this tradeoff by measuring both axes simultaneously: vibration during vehicle operation creates movement between the sensor and conductor, causing single-axis, differential coreless sensors to lose accuracy. The TMCS2100-Q1 sensor significantly reduces vibration-induced error by measuring magnetic fields in both horizontal and vertical axes at once.

It also addresses the tradeoff by maintaining accuracy: reducing error and maintaining accurate current measurement minimizes magnetic crosstalk influence and torque ripple, a cause of jerky acceleration, motor noise and inefficient operation that reduces range.

Production quantities of the TMCS2100-Q1 Hall-effect current sensor are now available upon request at TI.com. For more information see the TMCS2100-Q1 page .For more on the technology, read the article, "[Smooth operators: How multiaxial Hall-effect current sensors deliver precise torque control.](#)" Also look online for information on the related [evaluation module](#), [characterization module](#) and [reference design](#).

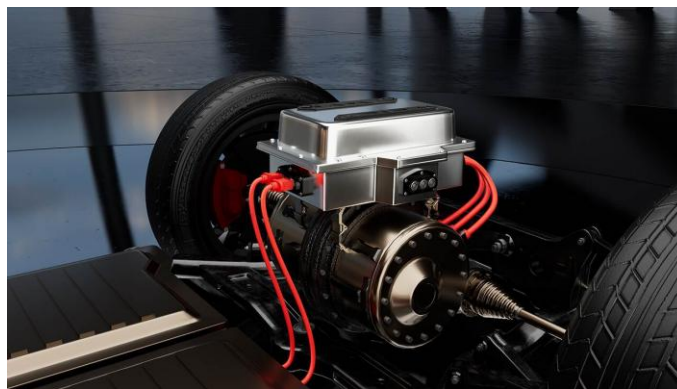


Figure. By eliminating the magnetic core without sacrificing precision, the TMCS2100-Q1 current sensor enables smaller, more power-dense traction inverter designs, helping automakers build EVs that are more efficient, longer-range and more enjoyable to drive, says the vendor.