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Gate Drivers For Automotive Applications Feature Fast Propagation Delays

From Texas Instruments, the UCC275xx-Q1 family of single- and dual-channel gate drivers are AECQ-100 qualified devices featuring propagation delays of less than 15 ns—the industry's fastest according to the company. The six new gate drivers are also said to provide the highest power efficiency, reliability, and flexibility for automotive applications.

According to Nagarajan Sridhar, product marketing manager for industrial, automotive and renewable energy markets at Texas instruments, the closest competitive part is at least 5 ns higher in propagation delay, although TI does have some existing products with 15-ns propagation delay. Sridhar adds that the faster performance in the new parts is achieved through increased drive currents.

The ultra-low propagation delays of these products allow automotive power converters to switch at high frequencies while maintaining a small footprint. Targeted applications include powertrain, bi-directional converters (12-V to 48-V and 12-V to 400-V input), onboard charging, traction inverters, advanced driver assistance systems (ADAS), safety functions, headlamps and instrumentation clusters. Among these applications, the powertrain uses provided the key motivation for developing the UCC275xx-Q1 drivers, because as Sridhar explains, "this sub-system in the vehicle has a lot of high power ac-dc, dc-dc and dc-ac converters–isolated and non-isolated topologies—all of which need gate drivers for improved efficiency and reliability."

The UCC275xx-Q1 offer integrated gate-drive solutions that save space (see the figure) and enable high efficiency: With peak currents ranging from 2.5 A to 5 A and propagation delays of less than 15 ns, TI's automotive output-stage drivers can replace discrete totem-pole solutions and in the process provide several benefits versus discrete totem-pole solutions.

One major benefit of the gate driver ICs is that they reduce the number of devices required on the board versus the discrete totem-pole designs. Along with that comes a reduction in the required PCB real estate as well as lower cost for the overall solution. Other benefits of the ICs include built in-level shifting; flexibility, in terms of having the gate drivers available in either inverting (UCC27518A-Q1 and UCC27519A-Q1) or non-inverting (UCC27531-Q1, UCC27517A-Q1, UCC27519A-Q1 and UCC27524A-Q1) configurations; and matched parasitics and improved layout leading to improved efficiency.

As would be expected with automotive-targeted devices, these new gate drivers have been designed for both reliability and robustness. The wide temperature range of -40°C to 140°C and negative input voltage of -5 V enables handling of ground bounce experienced in harsh environments.

In addition, these devices provide design flexibility in terms of their support for a wide, 4.5-V to 35-V input voltage range. This capability enables driving of wide bandgap switches, such as SiC MOSFETs and IGBTs, which are capable of withstanding high temperatures without compromising efficiency.

Samples and production quantities are available now. The UCC27531-Q1 and UCC27532-Q1 single-channel gate drivers are available in a 6-pin SOT-23 package priced at $0.88 each in 1,000-unit quantities. The UCC27517A-Q1, UCC27518A-Q1 and UCC27519A-Q1 single-channel gate drivers are available in a 5-pin SOT-23 package priced at $0.61 each and the UCC27524A-Q1 dual-channel gate driver is available in an 8-pin MSOP-PowerPAD package for $1.00 each, also in 1,000-unit quantities.

In addition, two evaluation modules, the UCC27531EVM-184 and the UCC27532EVM-538 are available for $49.00 each. There is also a PSpice model plus two TINA-TI SPICE simulation models for the UCC27531-Q1. In addition, the UCC27532-Q1 has a POWERSTAGE-DESIGNER development tool. For more information and samples, visit TI's gate drivers' page.

Figure. The ultra-low propagation delays of the UCC275xx-Q1 family of single- and dual-channel gate drivers allow automotive power converters to switch at high frequencies while maintaining a small footprint. Targeted applications include powertrain, bi-directional converters, onboard charging, traction inverters, advanced driver assistance systems, safety functions, headlamps and instrumentation clusters.