Laser Driver IC Could Spur Burst Of Activity In Lidar Applications

From Efficient Power Conversion (EPC), the EPC21601 laser driver IC integrates a 40-V, 10-A FET with integrated gate driver and 3.3-logic level input in a single chip for time-of-flight (ToF) lidar systems used in robotics, surveillance systems, drones, autonomous cars, and vacuum cleaners (Fig. 1). The EPC21601 is the first member in a new gallium nitride (GaN) IC family offering higher performance and smaller solution size for ToF lidar applications when compared with existing two-chip (silicon driver+ eGaN FET) and single-chip (all silicon) laser driver solutions.

This laser driver is controlled using 3.3-V logic and is capable of very high frequencies exceeding 100 MHz and super short pulses <2 ns to modulate laser driving currents up to 10 A. Turn-on and turn-off times are 410 ps and 320 ps, respectively.

According to EPC's Alex Lidow, CEO, and co-founder of EPC, these switching speeds represent much faster performance than what's achievable with existing two-chip laser driver solutions employing a silicon gate driver and eGaN FET, co-packaged in a hybrid device. Mainly that improvement's due to the lower parasitic inductance in the gate loop—it's only a few picohenries with the monolithic integration of the driver and eGaN FET and chipscale packaging of EPC21601 versus 10 to 20 pH for the two-chip hybrid solution. The speed advantage of the EPC21601 translates to better sensing resolution in ToF lidar systems.

Lidow adds that, when compared with the lower-power all-silicon, monolithic laser driver ICs, the 10-A output capability of the EPC21601 extends the vision capability and sensing distance of lidar applications. Moreover, the EPC21601 costs less than either of these two existing laser-driver options.

As noted above, the EPC21601 monolithically integrates a single-chip driver and eGaN FET. It does this using EPC's proprietary GaN IC technology. Unlike in silicon, there's no cost penalty for integrating the driver in a higher-voltage IC process, says Lidow, "So there's no reason not to have the driver" on the same chip as the power switch.

This GaN IC is housed in a chip-scale BGA that measures only 1.5 mm x 1.0 mm. With this small form factor and the integration of several functions, the overall solution is said to be 36% smaller on the printed circuit board (PCB) compared to an equivalent multi-chip discrete implementation (Fig 2).

The EPC21601 is the first offering in what will be a wide-ranging family of integrated laser drive ICs available in chip-scale packages (CSPs). Integrated devices in a single chip are easier to design, easier to layout, easier to assemble, save space on the PCB, increase efficiency, and reduce cost. This family of products will enable faster adoption and increased ubiquity of ToF solutions across a wider array of end-user applications. Lidow cites a few examples.

For instance, some tablets have implemented lidar sensing using weaker drivers, but the low cost and high performance of the EPC21601 will support more widespread adoption of lidar in tablets and smart phones where it can be used to implement augmented reality. The new laser driver IC is also expected to be applied to lidar in drones (see Fig. 3) and automated guided vehicles. Eventually, it can used to implement lidar-based backup systems in vehicles where it would replace ultrasonic sensing. Eventually this part will be AEC qualified, says Lidow.

"Recent advances in our GaN IC technology are poised to change the way time-of-flight lidar systems are designed," says Alex Lidow. "Integrating an eGaN FET plus driver on one chip generates an extremely powerful, blazingly-fast IC and reduces size and cost enabling wider adoption in consumer applications. This new family of GaN integrated circuits will dramatically improve the performance while reducing size and cost for time-of-flight lidar systems."

EPC already has much experience supporting customers with lidar applications. In terms of dedicated laser driver ICs, the company has previously developed driver plus eGaN FET chips for long-range lidar systems. However, those have been custom ICs. The EPC21601 is an off-the-shelf, general-purpose laser driver IC.

The company offers a development board, the EPC9154, to support evaluation of and design-in of the EPC21601 and is primarily intended to drive laser diodes with short, high current pulses. Capabilities include minimum pulse widths of <2 ns, 10-A peak currents, and a bus voltage rating of 30 V.

As a follow-up to the introduction of the EPC21601, which has the 3.3-V logic input, EPC will soon be announcing a version of the laser driver IC with low-voltage differential (LVDS) input from 1.8 V up to 5 V.

The EPC21601 is priced at less than $1.00 at 500,000-piece quantities. The EPC9154 development board is priced at $465.23 each. The EPC21601 and EPC9154 are available for immediate delivery from Digi-Key. For more information, see the preliminary datasheet.

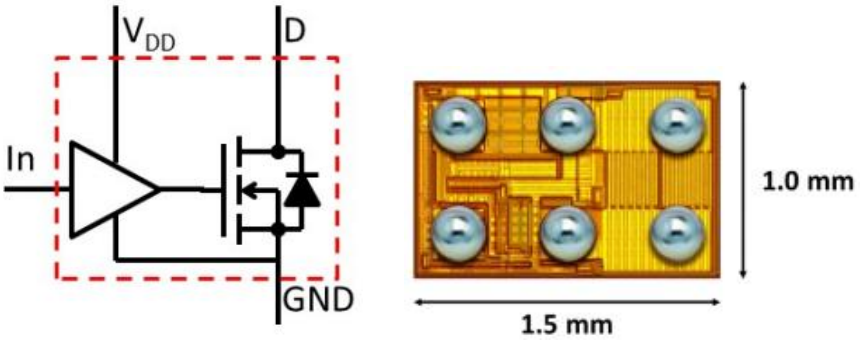

Fig. 1. The EPC21601 laser driver IC monolithically integrates a 40-V, 10-A eGaN FET with a GaN-based gate driver in an all-GaN chipscale packaged part that measures just 1.0 mm x 1.5 mm. Functional block diagram and bump-side view of the part are shown here.

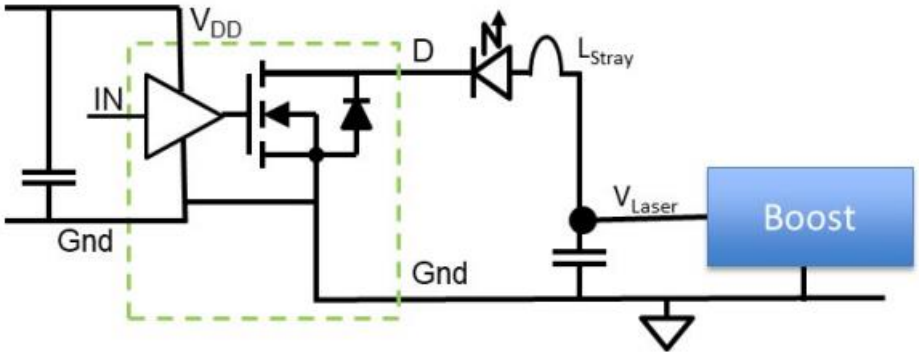

Fig.2. Typical connection diagram for the EPC21601 in a laser driver application. This laser driver IC is controlled using 3.3-V logic and is capable of very high frequencies exceeding 100 MHz and super short pulses <2 ns to modulate laser driving currents up to 10 A. Turn-on and turn-off times are 410 ps and 320 ps, respectively.

Fig. 3. The EPC21601 is the first member of a new GaN IC product family offering higher performance and smaller solution size for time-of-flight lidar applications including robotics, drones, 3D sensing, and autonomous cars. According to the vendor, this laser driver IC will extend the use of lidar into many new applications.