GaN Power ICs Integrate Fast Overcurrent And Overtemperature Protection

Navitas Semiconductor's third generation of GaNFast power ICs includes the company's new GaNSense technology, which integrates critical, real-time, autonomous sensing and protection for both current and temperature. These features enhance the devices' reliability and robustness, while increasing the energy savings and fast-charging benefits of Navitas' GaN IC technology.

GaNSense technology integrates real-time, accurate and fast sensing of system parameters including current and temperature. This technology enables a patent-pending lossless current-sensing capability—a form of $R_{DS(ON)}$ sensing—which improves energy savings by up to an additional 10% compared to prior generations, as well as further reducing external component count and shrinking system footprints (Fig. 1)

In addition, if the GaN IC identifies a potentially dangerous system condition, the IC is designed to transition rapidly to a cycle-by-cycle sleep-state, protecting both the device and the surrounding system. GaNSense also integrates an autonomous standby-power feature which automatically reduces standby power consumption when the GaN IC is in idle-mode, helping to further reduce power consumption, which is especially important to the growing list of customers aggressively pursuing their own environmental initiatives (Fig. 2).

With the industry's tightest current-measurement accuracy, according to the vendor, and GaNFast response time, GaNSense technology means reducing dangerous overcurrent spikes by 50% and reducing time in the "danger zone" by 50% compared to previous best-in-class solutions, says Navitas. GaNFast monolithic integration delivers dependable, glitch-free operation with no ringing, for improved system reliability.

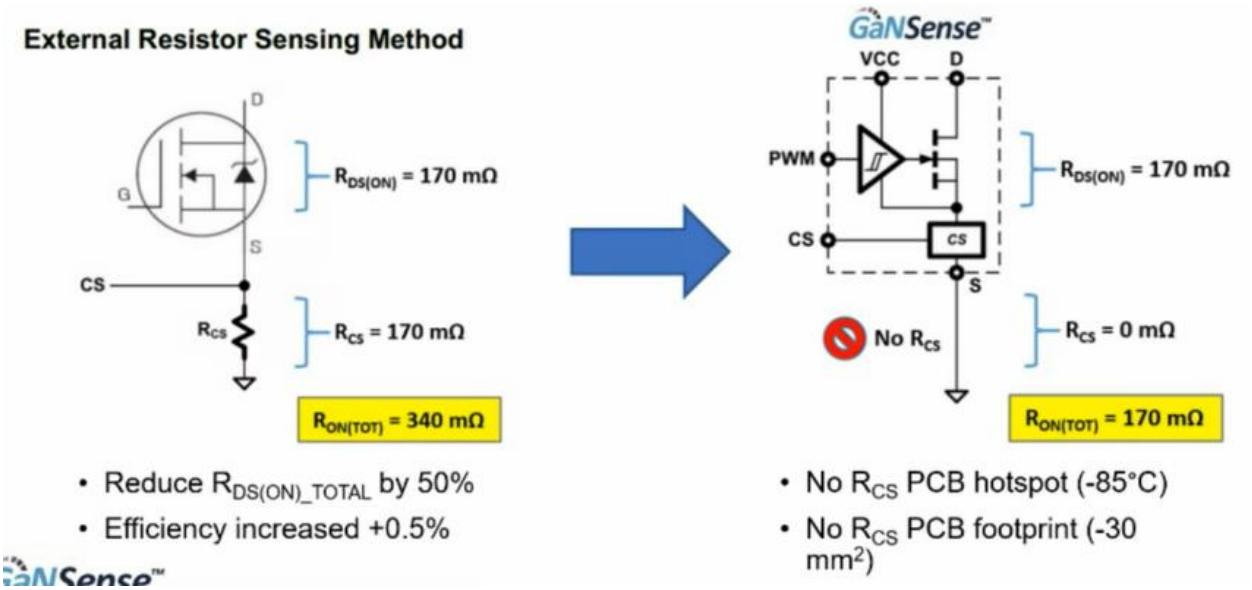
"From detection to protection in only 30 ns, GaNSense technology is 600% faster than discrete GaN implementations," said Dan Kinzer, COO, CTO and co-founder of Navitas (see Fig. 3). "This next generation from Navitas provides a highly-accurate and effective defence against potential system failure modes. Couple that with immunity to transient voltages up to 800 V and tight gate waveform control and voltage regulation, only possible with our proprietary process design kit, and you have a new standard in reliability, robustness and performance for power semiconductors."

The new family of GaN power ICs with GaNSense technology spans 10 products, which all have the core, critical GaNFast integration of GaN power, GaN drive, control and protection. All are rated at 650 V/800 V with 2-kV ESD protection, and $R_{DS(ON)}$ ranging from 120 to 450 mΩ in 5-mm x 6-mm and 6-mm x 8-mm PQFN packaging with the GaNSense protection circuits and lossless current-sensing.

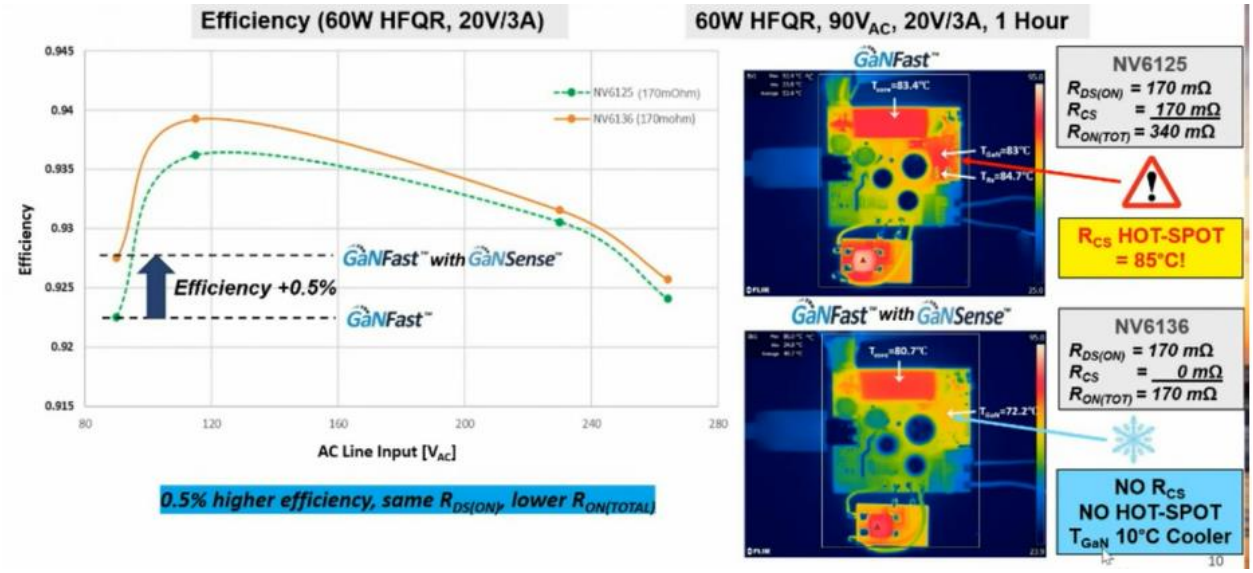
This family of third-generation GaN ICs is optimized for modern power conversion topologies including high-frequency quasi-resonant (HFQR) flyback, active-clamp flyback (ACF) and PFC boost, which are popular to deliver the fastest, most efficient and smallest chargers and adapters within the mobile and consumer markets.

Target markets include fast chargers for smartphones and laptops, as well as all-in-one PCs, TVs and home networking and automation. GaNSense technology is already used in Lenovo's YOGA 65-W laptop charger.

GaNFast power ICs with GaNSense technology are in mass production with immediate availability. Full technical details of the new GaNSense technology, including datasheets, qualification data, application notes and samples are available to customer partners under NDA.



(a)



(b)

Fig. 1. Lossless current sensing in third-generation GaNFast ICs can effectively cut total $R_{DS(ON)}$ in half. This provides an efficiency boost and eliminates the hot spot associated with the current sense resistor (b). (Images in this article are from Dan Kinzer's keynote presentation at WiPDA 2021.)

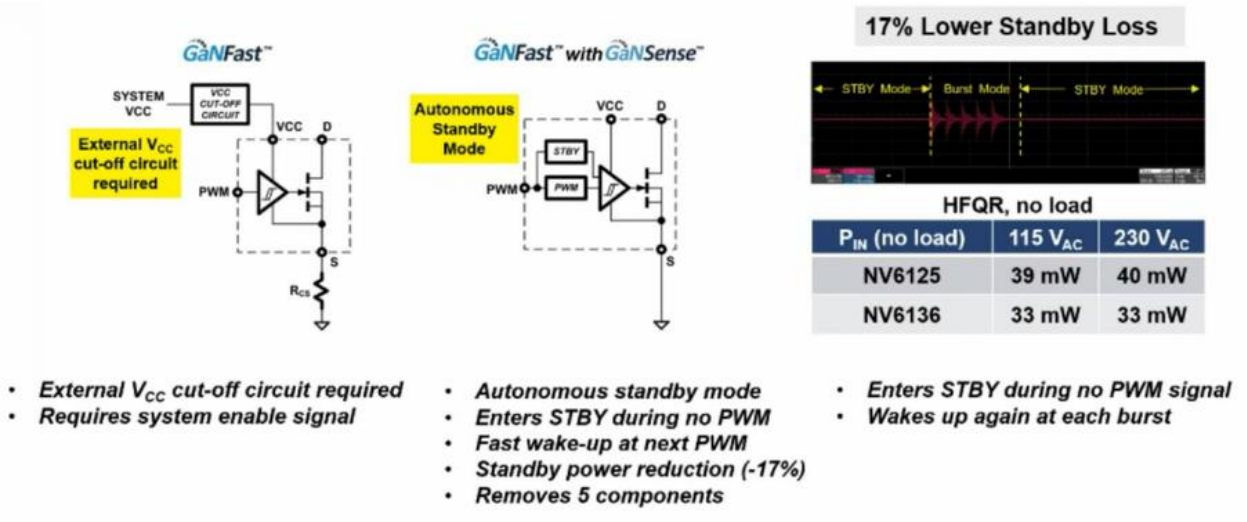


Fig. 2. An autonomous standby mode reduces standby power consumption while eliminating external components normally required to implement this function.

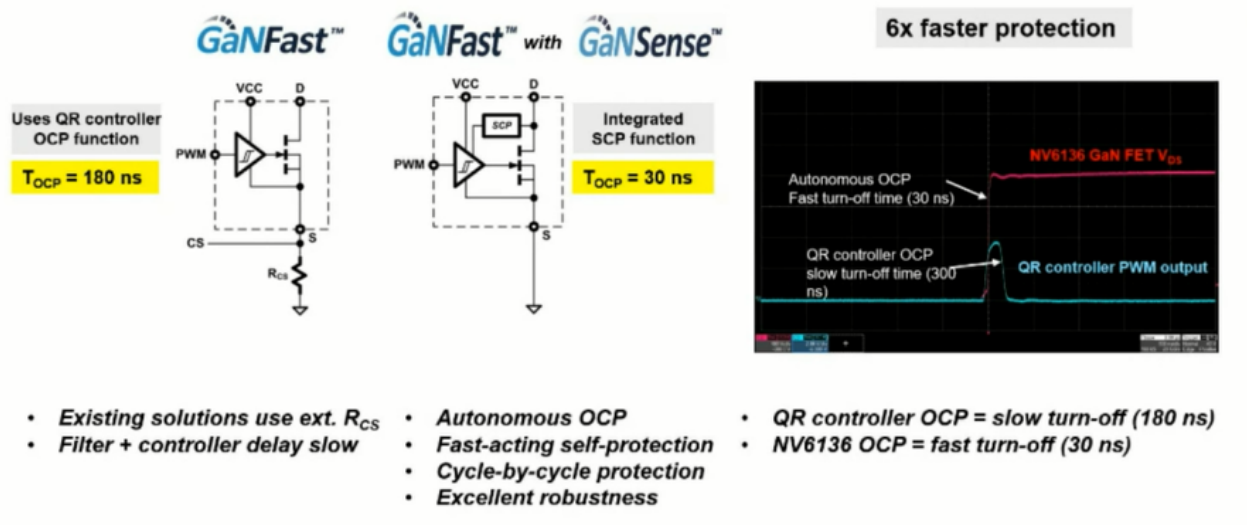


Fig. 3. Autonomous overcurrent protection reduces the time required to turn off the power stage by a factor of 6 versus that when turn-off is managed by an external QR controller.