

December 2020

## Breakthrough Performance of UnitedSiC 750V Gen 4 SiC FETs

Complementing its already strong portfolio of industry-leading SiC FETs, UnitedSiC has released its (Gen 4) SiC FETs, offering breakthrough performance levels designed to accelerate WBG adoption in automotive and industrial charging, telecom rectifiers, datacenter PFC DC-DC conversion as well as renewable energy and energy storage applications.

The new series has expanded UnitedSiC FET offerings to include a 750V rating allowing additional design margin for 400V or 500V battery/bus voltage applications. Despite the increased voltage rating, Gen 4 devices employ advanced cell density to reduce the  $R_{DS(on)}$  per unit area, delivering the industry's lowest resistance products in all packages. In addition, high current ratings are achieved by the devices' advanced sintered die attach technology offering improved thermal performance. Figure 1 shows the new 750V specific on-resistance versus 650V rated SiC competitors, offering substantially lower conduction losses across the full temperature range.

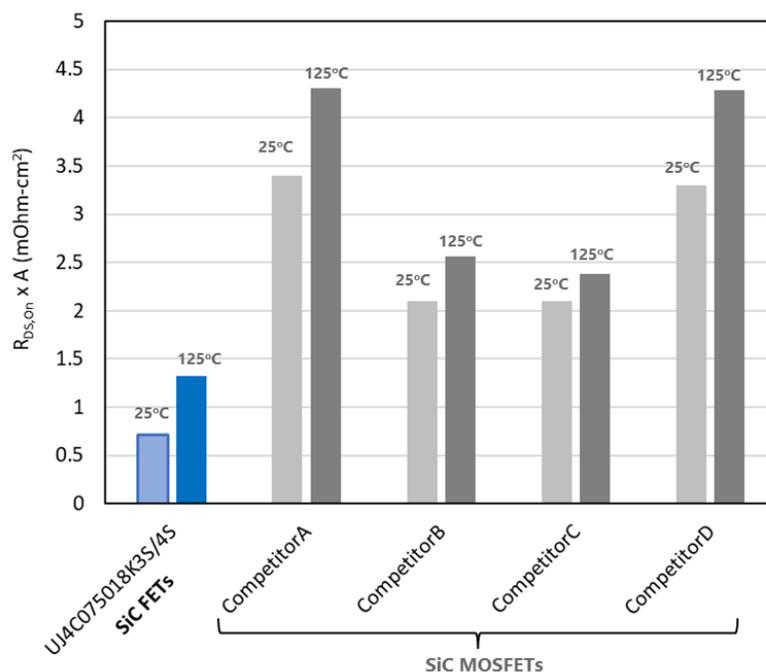


Figure 1. 750V Gen 4 UnitedSiC FET On-resistance per unit area compared to 650V rated SiC competitors

Design ease-of-use will again be featured with UnitedSiC Gen 4 switches. All devices can be safely driven with standard 0V to 12V or 15V gate drive voltage. Good threshold noise margin is maintained with a true 5V threshold voltage. Like previous generations, these new SiC FETs can be

operated from all the typical Si IGBT, Si MOSFET and SiC MOSFET drive voltages and includes a built-in ESD gate protection clamp.

Along with low on-resistance, these new SiC FETs offer improved efficiency in both hard and soft-switched circuits. In hard-switched circuits such as Totem-Pole PFC or standard 2-level inverters, the low on-resistance per unit-area and low output capacitance along with the near-zero stored charge in the low-voltage Si MOSFET combine to offer superior reverse recovery charge ( $Q_{rr}$ ) and low  $E_{oss}/Q_{oss}$ . The devices exhibit a superior and robust integral diode with low voltage drop  $V_F$  ( $<1.75V$ ).

Figure 2 illustrates the advantage of the 750V UnitedSiC FETs versus their 650V rated SiC competitors when represented as a hard-switching Figure-of-Merit (FoM) of  $R_{DS(on)} \times E_{oss}$ . The UJ4C075018K3S (in TO247-3L package) and UJ4C075018K4S (in TO247-4L package) features a low on-resistance of 18mohm, which is 50% less at 25°C and almost 40% less at 125°C compared to its closest competitor.

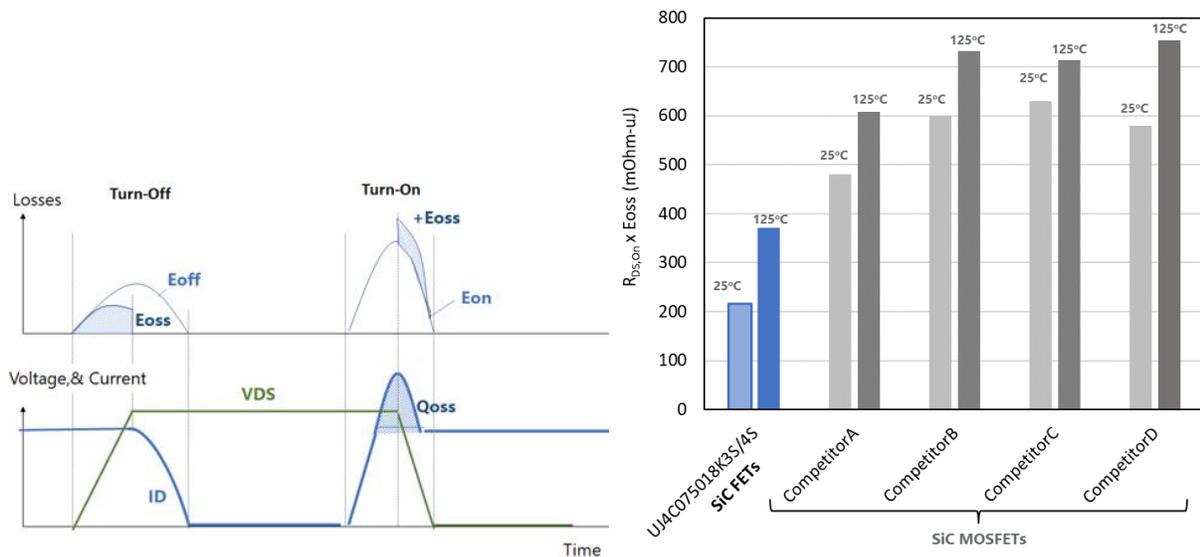


Figure 2. Hard-Switching Figure of Merit advantage of UnitedSiC 750V FETs compared to 650V rated SiC competitors

These new devices also offer improved performance in high-frequency, soft-switched resonant converter topologies such as LLC or PSFB. The breakthrough performance of the 750V UnitedSiC FETs comes as the on-resistance has been substantially reduced, while at the same time, offering lower output capacitance,  $C_{oss(tr)}$ . In Figure 3, the benefit is illustrated with the proposed resonant or soft-switching FoM,  $R_{DS(on)} \times C_{oss(tr)}$ .

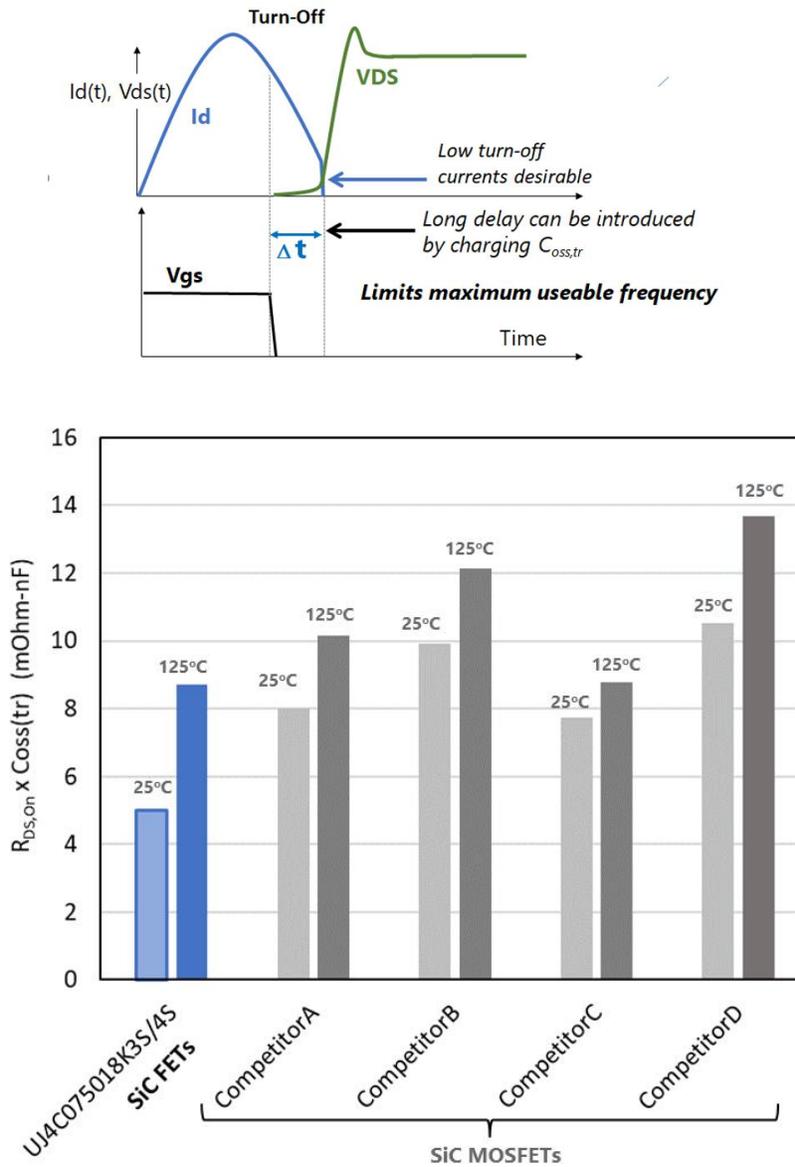


Figure 3. Soft-Switching Figure of Merit advantage of 750V SiC FET compared to 650V rated SiC competitors.

The figure also depicts an example LLC turn-off waveform wherein the delay introduced by  $C_{oss(tr)}$  can limit the maximum useable frequency. In this case, the Gen 4 UnitedSiC FETs offer substantially lower  $C_{oss(tr)}$  and higher voltage rating for fast turn-off. The soft-switching Figure-of-Merit advantage is best in class across the full range of useful operating temperature.

The radar plot shown in Figure 4 summarizes the comparative advantage of Gen 4 750V FETs. The SiC FETs are unmatched when key hard switching and soft-switching parameters are considered.

The ultra-low on-resistance per unit area allow standard discrete packages with performances not achievable with incumbent Si or emerging WBG competing technologies.

**FoMs Normalized to UnitedSiC G4 750V SiC FETs:**

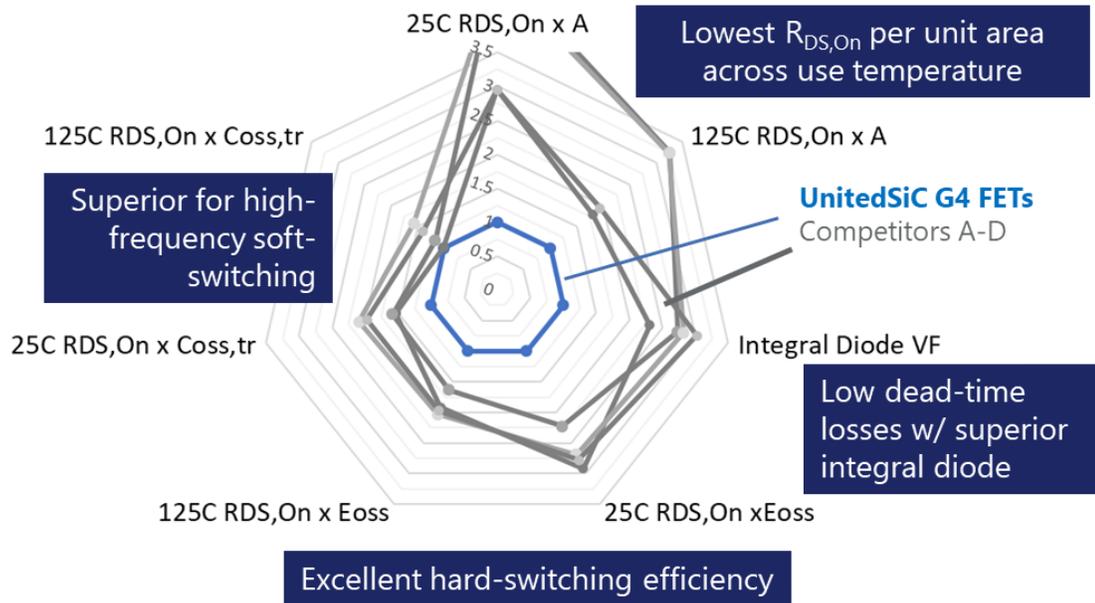


Figure 4. Radar plot of UnitedSiC 750V FETs comparative advantage with key parameters normalized (note: lower values are superior)

These SiC FETs from UnitedSiC deliver an entirely new level of performance enabled by the advanced Gen 4 technology. By adding a 750V option, designers now have additional bus voltage headroom. Important performance “Figures of Merit” deliver an overall better performing SiC FET product that power designers can now benefit from in their next-generation system designs.

To learn more about these new devices, visit [www.unitedsic.com](http://www.unitedsic.com).