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Silicon Germanium Rectifiers Enable Higher Efficiency In High-Temperature Applications

Nexperia has introduced a new type of rectifier that combines the low forward voltage (and thus efficiency) of Schottkys with the low leakage current and thermal stability of fast recovery diodes at device ratings up to 200 V. The new silicon germanium (SiGe) rectifiers, which offer reverse voltage ratings of 120 V, 150 V, and 200 V, and current ratings of 1 A to 3 A, target automotive, communications infrastructure and server markets, and are said to be of particular benefit in high-temperature applications like LED lighting, engine control units or fuel injection (Figs. 1 and 2.)

Design engineers using the new, extremely low leakage devices can now rely on an extended safe-operating area with no thermal runaway up to 175°C. At the same time, they can optimize their designs for higher efficiency which is not feasible using fast recovery diodes commonly used in such high-temperature designs. With their low forward voltage (V_f) and low Q_{rr}, the SiGe rectifiers have an advantage of 10% to 20% lower conduction losses, according to the vendor.

The PMEG SiGe devices (PMEGxGxELR/P) are housed in size- and thermally efficient CFP3 and CFP5 packages that have become the industry standard for power diodes. By featuring a solid copper clip the packages' thermal resistance is reduced and transfer of heat into the ambient environment is optimized, allowing small and compact PCB designs. Moreover, simple pin-to-pin replacements of Schottky and fast recovery diodes are possible when switching to SiGe technology. Fig 3 compares the forward voltage and leakage current of the SiGe rectifiers with competing Schottkys and fast recovery rectifiers.

Jan Fischer, Nexperia product manager commented, "Utilizing Nexperia's innovative silicon germanium technology gives engineers unprecedented options to design their power circuitry and finally build market-leading products. SiGe perfectly complements Nexperia's power diodes offering which includes more than 100 Schottky and fast recovery rectifiers in the clip-bonded FlatPower (CFP) package. And, we continue to grow this portfolio to always offer our customers a part which is the ideal fit for their application."

The first four AEC-Q101-qualified 120 V SiGe rectifiers are already in mass production. A further eight 150-V and 200-V devices are sampling now. For more information on Nexperia's SiGe rectifiers, including product specs and datasheets, visit the SiGe rectifiers page. Also see Jan Fischer's blog "SiGe rectifiers: thermally stable efficiency" for further background on this rectifier technology

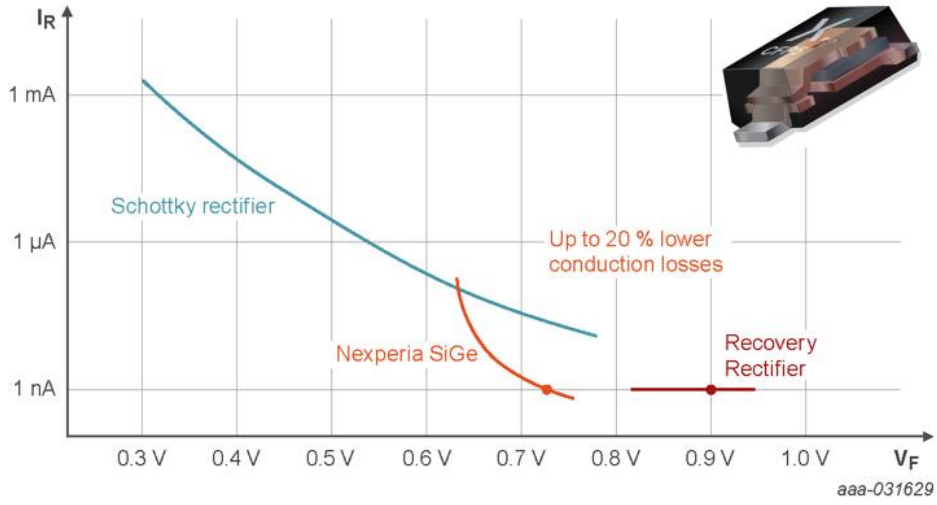

Fig. 1. SiGe rectifiers enable new tradeoffs in forward voltage vs. leakage current for rectifiers used in power designs at 100 to 200 V. the new rectifiers feature reduced reverse current (IR) compared to Schottky diodes, yet also exhibit lower forward voltage (V_F) versus fast recovery rectifiers, leading to low power losses. This enables designers to better optimize their 100-V to 200-V power designs for higher efficiency. Also, see Fig. 3 for further comparisons of V_F and I_R. A cutaway drawing of a packaged SiGe rectifier is shown in the upper right hand corner of this graph.

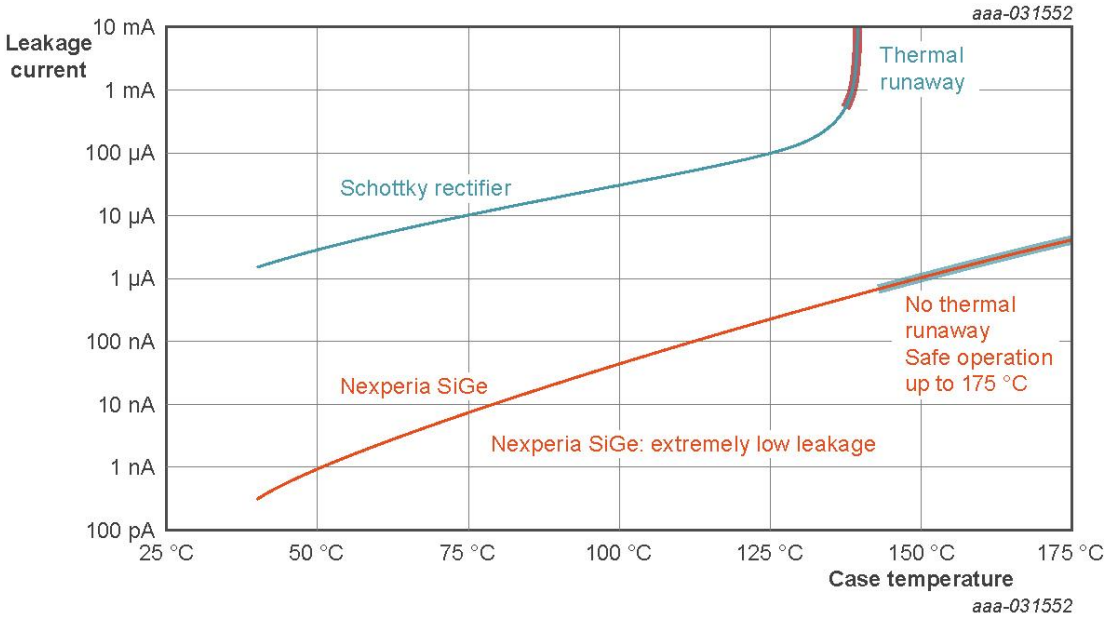

Fig. 2. The high thermal stability of SiGe rectifiers also distinguishes these devices from Schottkys. The new rectifiers have much lower leakage current and an extended safe operating area versus Schottkys. The SiGe rectifiers are stable at up to and beyond 175°C, which is the specified limit of the CFP package.

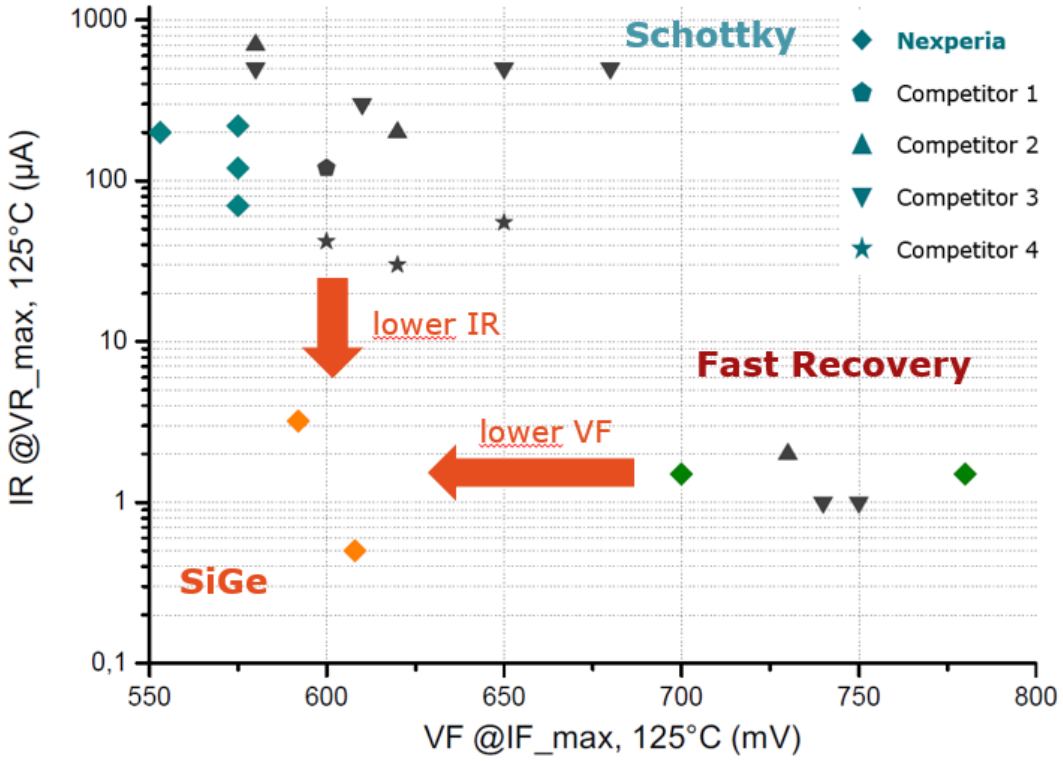

Fig. 3. Benchmarking SiGe vs. existing Schottky and fast recovery rectifiers.