

A COMPARISON OF SiC POWER SWITCHES FOR HI-REL APPLICATIONS

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Three principal switch types based on silicon carbide have achieved a reasonable level of maturity for Hi-Rel applications. They are the vertical junction field effect transistor (VJFET), the metal-oxide-semiconductor FET (MOSFET), and the bipolar junction transistor (BJT). The VJFET is principally valued for having demonstrated the highest current and voltage combinations, positive temperature coefficient over the entire applications range of -40 C to 300 C; and other features that are either inherent to the simplicity of the VJFET or to their somewhat greater technology readiness level, such as the lowest reported specific on-resistance, rugged radiation tolerance, and good reliability at operating temperatures well above 175 C. In principal, this makes the VJFET the preferred solution for Hi-Rel applications in the defense, aerospace, and commercial sectors, but the perception remains that the VJFET is a normally on device that is not compatible with typical circuits and methods in power electronics. However, the large built-in potential of the SiC pn-junction gate, a liability in power diodes, is an asset for VJFET power switches for expanding the design options for threshold voltage to include positive threshold voltage (meaning normally off devices).