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SiC-Based IPMs Enable High Efficiency, Small Size For Motor Drives

onsemi's EliteSiC SPM 31 IPMs are the company's first generation of 1200-V SiC MOSFET-based intelligent power modules. According to the company, these IPMs deliver the highest energy efficiency and power density in the smallest form factor compared to using Field Stop 7 IGBT technology, resulting in lower total system cost than any other leading solution on the market (see the figure).

Their improved thermal performance, reduced power losses and ability to support fast switching speeds makes these IPMs well suited for three-phase inverter drive applications such as electronically commutated (EC) fans in AI data centers, heat pumps, commercial HVAC systems, servo motors, robotics, variable frequency drives (VFDs), and industrial pumps and fans. The EliteSiC SPM 31 IPMs offer several current ratings from 40 A to 70 A.

With the number and size of data centers growing, the demand for EC fans is expected to rise. These cooling fans maintain the ideal operating environment for all equipment in a data center and are essential for accurate, error-free data transmission. The SiC IPM ensures the EC fan operates reliably and at its highest efficiency, says the vendor.

Like many other industrial applications such as compressor drives and pumps, EC fans require higher power density and efficiency than existing larger IGBT solutions. By switching to EliteSiC SPM 31 IPMs, customers can benefit from a smaller footprint, higher performance, and a simplified design due to high integration, resulting in shortened development time and lower total system cost in addition to reduced GHG emissions.

For example, compared to a system solution that uses a current IGBT power integrated module (PIM) with power losses of 500 W at 70% load, implementing highly efficient EliteSiC SPM 31 IPMs could reduce the annual energy consumption and cost per EC fan by 52%, according to onsemi.

The fully integrated EliteSiC SPM 31 IPM consists of an independent high-side gate driver, low-voltage integrated circuit (LVIC), six EliteSiC MOSFETs and a temperature sensor (voltage temperature sensor (VTS) or thermistor). The module is based on the M3 SiC technology that shrinks die size and is optimized for hard-switching applications with improved short-circuit withstand time (SCWT) performance when used in the SPM 31 package, making them suitable for inverter motor drives for industrial use. The MOSFETs are configured in a three-phase bridge with separate source connections for the lower legs for maximum flexibility in the choice of control algorithm.

In addition, the EliteSiC SPM 31 IPMs include the following benefits:

- Low loss, short-circuit-rated M3 EliteSiC MOSFETs to prevent catastrophic equipment and component failures such as electric shock or fire.
- Built-in under-voltage protection (UVP) to protect against damage to the device when voltage is low.
- As the peer-to-peer product of FS7 IGBT SPM 31, customers can choose between various current ratings while using the same PCB board.
- UL certified to meet national and international safety standards
- Single-grounded power supply offering better safety, equipment protection and noise reduction.
- Simplified design and reduced size of customer boards due to included controls for gate drivers and protections; built-in bootstrap diodes and resistors; internal boost diodes for high-side gate boost drive; integrated temperature sensor and built-in high-speed high-voltage integrated circuit.

For more information, see the EliteSiC SPM 31 IPMs and FS7 IGBT SPM 31 IPMs pages. Also see the EliteSiC SPM 31 IPMs and FS7 IGBT SPM 31 IPMs application note pages.

Figure. With their improved thermal performance, reduced power losses and ability to support fast switching speeds, the EliteSiC SPM 31 IPMs are well suited for three-phase inverter drive applications such as electronically commutated fans in AI data centers, heat pumps, commercial HVAC systems, servo motors, robotics, variable frequency drives (VFDs), and industrial pumps and fans. The EliteSiC SPM 31 IPMs offer several current ratings from 40 A to 70 A. The IPM consists of an independent high-side gate driver, low voltage integrated circuit (LVIC), six EliteSiC MOSFETs and a temperature sensor.