Intelligent SiC Power Modules For E-Mobility And Aerospace Applications

CISSOID is expanding its platform of three-phase SiC MOSFET Intelligent Power Modules (IPMs) by introducing two liquid-cooled modules for E-mobility tailored for lower switching losses or for higher power (CXT-PLA3SA12340AA and CXT-PLA3SA12550AA). The company is also introducing a module based on a lightweight AlSiC flat baseplate that meets the demand for natural convection or forced-air cooling in aerospace and in dedicated industrial applications (CMT-PLA3SB12340AA) (see Fig. 1).

The IPMs, which integrate a three-phase SiC MOSFET module with a powerful gate driver, leverage a technology platform that can be rapidly adapted to new voltage, power and cooling requirements. They accelerate the design of SiC-based power converters enabling high efficiency and high power density.

The embedded gate driver solves multiple challenges related to fast-switching SiC transistors: negative drive and active Miller clamping (AMC) prevent parasitic turn-on; desaturation detection and soft-shutdown (SSD) react rapidly but safely to short-circuit events; undervoltage lockout (UVLO) functions on gate driver and dc bus voltages monitor the proper operation of the system (Fig. 2).

The CXT-PLA3SA12340AA and CXT-PLA3SA12550AA are liquid-cooled power modules based on a pin fin baseplate and are rated for 1200-V blocking voltages and maximum continuous currents of 340-A or 550-A, respectively. They have corresponding on-resistance values of 4.19 mΩ and 2.53 mΩ. The total switching energies are as low as 7.48 mJ (Eon) and 7.39 mJ (Eoff) at 600 V and 300 A.

The co-design of the power module and the gate driver enables optimizing the IPMs for lowest switching energies by carefully tuning dV/dt and controlling voltage overshoots inherent to fast switching. The reverse bias safe operating area (RBSOA) allows peak currents up to 600 A with dc bus voltages up to 880 V, making the power modules safe for 800-V battery applications.

The CMT-PLA3SB12340AA air-cooled module is designed for applications where liquid cooling is not an option, as with aerospace electromechanical actuators and power converters, for example. This module is rated for a blocking voltage of 1200 V and a maximum continuous current of 340 A with an on-resistance of 3.25 mΩ. Turn-on and turn-off switching energies are respectively 8.42 mJ and 7.05 mJ at 600 V and 300 A.

The air cooled power module is cooled through an AlSiC flat baseplate. The module is rated for a 175°C junction temperature and the gate driver for a 125°C ambient temperature.

"We initially developed this IPM platform to accelerate SiC-based motor drives development for E-Mobility and we are also very pleased to see demand from aerospace customers," said Dave Hutton, CEO at CISSOID. For more information, see the SIC Intelligent Power Modules page.

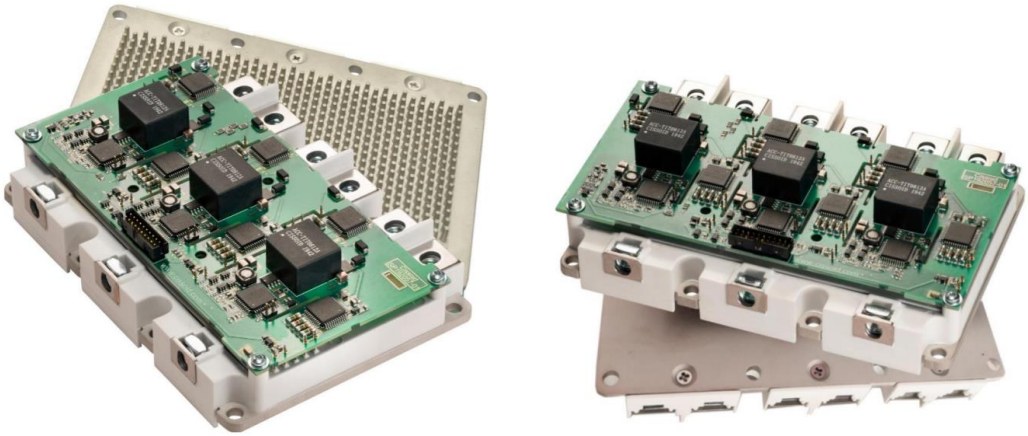

Fig. 1. The CXT-PLA3SA12340A (shown on left) is a three-phase 1200-V, 340-A SiC MOSFET-based intelligent power module which employs a pin-fin heatsink for liquid cooling. A 550-A rated version (the CXT-PLA3SA12550AA) is also offered. The CMT-PLA3SB12340AA (shown on the right) is an air-cooled version of the 1200-V, 340-A IPM.

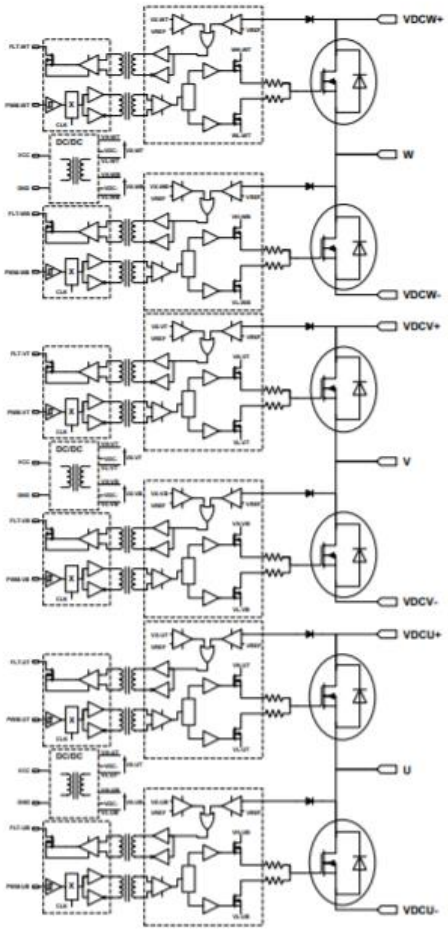

Fig. 2. Internal block diagram of the CXT-PLA3SA12340A IPM. The integration of the gate driver together with the power module gives direct access to a fully validated and optimized solution in terms of switching speed and losses, robustness againt dI/dt and dV/dt and protection of the power stages (desat, UVLO, active Miller clamping, and soft shutdown turn-off).