ISSUE: January 2012

Compound Power Devices Co-Package SiC Schottkys With MOSFETs Or IGBTs

Renesas Electronics has announced the availability of three 600-V silicon carbide (SiC) compound power devices, the RJQ6020DPM, the RJQ6021DPM and the RJQ6022DPM, which incorporate multiple SiC diodes and multiple power transistors in a single package. These represent the second series of power semiconductor products from Renesas to employ SiC and are intended for use in home appliances such as air conditioners, PC servers, and power electronics products such as solar power generation systems.

The new products have a voltage tolerance of 600 V and use a SiC diode based on low-leakage SiC-SBD technology developed jointly by Hitachi and Renesas. They combine low loss and compactness and are available in a fully molded TO-3P package with a 5-pin configuration (see the figure) and pin assignments optimized for specific applications.

The three new devices target PFC and inverter half-bridge circuits. In each case, the SiC-SBD features a reverse recovery time (t_{rr}) of only 15 ns.

The RJQ6020DPM combines a SiC-SBD and two high-voltage power MOSFETs required in switching circuits for critical-conduction-mode PFC in the power supplies of products such as air conditioners or flat-panel TVs. The high-voltage power MOSFETs are highly efficient superjunction (SJ-MOS) transistors employing a deep-trench configuration to achieve a low on-resistance of 100 mΩ. The RJQ6020DPM device can be combined with the R2A20112A/132 critical-conduction-mode PFC IC from Renesas Electronics to implement interleaved control.

The RJQ6021DPM combines a SiC-SBD and two IGBTs required for continuous-conduction-mode PFC applications such as ac-dc rectifiers for communication equipment and PC servers. The ultra-thin-wafer IGBTs deliver a low on-voltage of 1.5 V that is ideal for continuous-conduction-mode PFC applications. The RJQ6021DPM device can be combined with the R2A20114A continuous-conduction-mode PFC-IC to implement interleaved control.

The RJQ6022DPM combines two SiC-SBDs and two IGBTs required for half-bridge circuits in inverters for applications such as motor drives in air conditioners and industrial machinery. The ultra-thin-wafer IGBTs deliver a low on-voltage of 1.5 V and short circuit time (t_{sc}) of 6 µs, which is suitable for motor drive applications.

A single RJQ6022DPM device is sufficient to implement a half-bridge circuit, while two can be used for a full-bridge configuration and three for a three-phase bridge configuration. In addition to simplifying the design of motor drive circuits, the RJQ6022DPM device will be available as part of kit solutions with Renesas MCUs such as the RX600 Series.

Samples of Renesas' SiC compound power devices are scheduled to become available in February 2012, priced at $10 per unit. Mass production is scheduled to start in May 2012 and is expected to reach a combined volume of 300,000 units per month in April 2013.

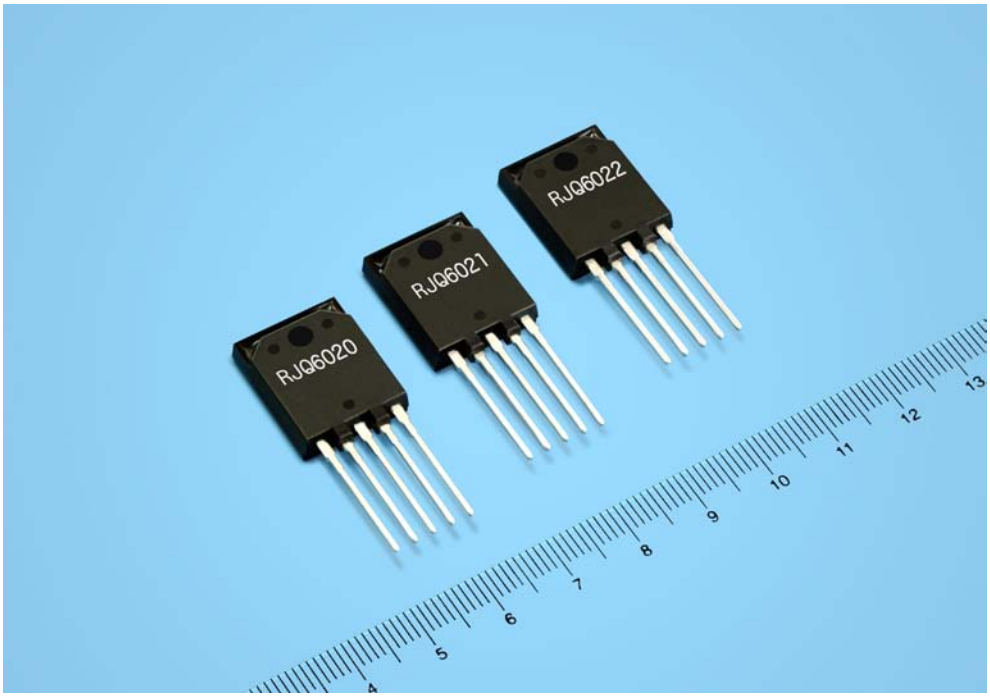

Figure. The RJQ6020DPM, RJQ6021DPM and RJQ6022DPM are application-specific, compound power devices that combine 600-V SiC Schottky barrier diodes with either superjunction MOSFETs or IGBTs in a single TO-3P package. These devices enable more compact power stages in PFC and inverter applications.