

Fast Prototyping of Power Converters by Plug-and-Play Capability of SCALE-2 Driver Cores

The new 2BB0108T and 2BB0435T Basic Boards offer an easy, low-cost way to evaluate the 2SC0108T and 2SC0435T gate driver cores with different IGBT modules and technologies by providing plug-and-play capability. The standardized DIC-20 interface used with all SCALE-2 plug-and-play drivers, with its wide adaptability, options for customized volume production and open access to schematics, layout data and support, makes such an approach into a fast, inexpensive and consequently very attractive solution.

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Make or buy? This becomes an increasingly important question for customers who need power stacks in their applications - such as solar or wind power systems - for cost reasons. Once it has been decided to go for an in-house solution, the task of designing a new power converter leaves the design engineer with the question of where to start the design. One reasonable approach is to place the focus on the most expensive parts of the system, namely the IGBT modules, which account for

approximately 30% of the overall component cost. A proper evaluation of the cost and performance of the IGBT module would then yield a sound solution.

A flexible, adaptable and state-of-the-art IGBT driver solution is required to enable efficient verification of the cost/performance ratio of possible IGBT modules. The newly designed CONCEPT Basic Boards in combination with the appropriate SCALE-2 driver core provide the necessary flexibility throughout the design. They help the engineer to achieve

a well-balanced design which satisfies the need for cost optimization without sacrificing reliability.

Basic board as starting point

The 2SC0108T and 2SC0435T driver cores comprise complete and extremely compact 2-channel IGBT drivers equipped with DC/DC converters, short-circuit protection, supply-voltage monitoring, optional half-bridge control and support of Active Clamping. However, some effort - such as designing an adaptor board - must initially be made to set up the drivers to work in the initial power-stack prototypes.

Up to now, the fastest way to evaluate the advantages of SCALE-2 technology in an application was to take the ready-to-use plug-and-play drivers suited for immediate operation after mounting on the IGBT module. But this sometimes has the drawback that the mechanics, or even the power module itself, may not yet be fixed at this early design stage.

The use of basic boards overcomes this hurdle by enabling the user to select the IGBT driver first on the basis of the overall power needed in the inverter system. Once the gate resistors are assembled, the basic boards equipped with the driver core offer full plug-and-play functionality.

Different IGBT modules could then be evaluated in this way without changing the driver, leading to fast optimization of the power stack configuration.

Driver cores easily become plug-and-play

SCALE-2 has a significantly higher degree

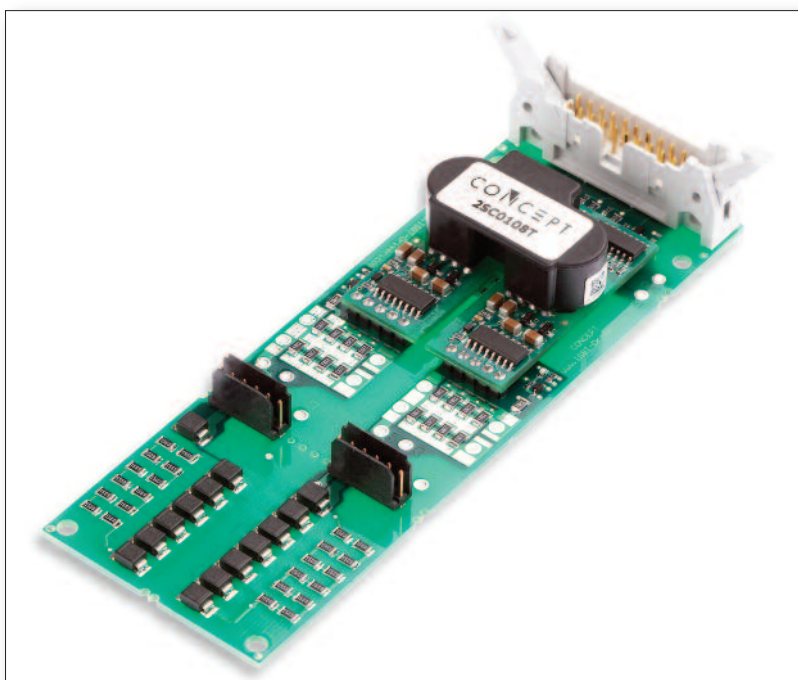


Figure 1: 2BB0108T Basic Board with 2SC0108T driver

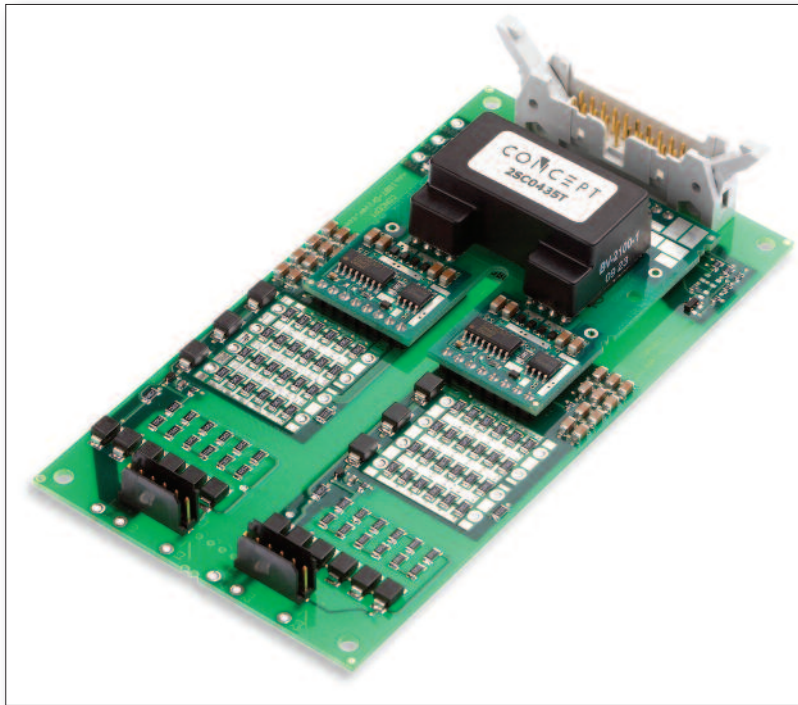


Figure 2: 2BB0435T Basic Board with 2SC0435T driver

of integration, thus dramatically reducing the number of components on the driver boards. This results in maximum reliability, a smaller space requirement and much lower costs.

The compact basic boards have been designed to facilitate the set-up and evaluation of the SCALE-2 driver cores together with different IGBT packages and technologies.

The resulting plug-and-play solutions based on 2SC0108T or 2SC0435T drivers using the new 2BB0108T and 2BB0435T Basic Boards are shown in Figures 1 and 2 respectively. The topology of 2BB0435T is shown in Figure 4.

An important fact in this respect is the standardized DIC-20 interface, which is compatible with all other SCALE-2 plug-and-play drivers. Thus it allows a single control solution to be used for different power stacks. The turn-on and turn-off gate resistors of the two channels are generally not assembled in order to assure maximum flexibility. The boards support both SMD and wired-gate resistors.

The basic boards are available in three voltage classes to drive 600V to 1700V IGBT modules.

The 2BB0108T solution is primarily optimized to drive 34mm, 62mm and 17mm dual-housing and other IGBT

modules up to a current of about 600A.

The high-performance 2BB0435T is designed to drive 62mm, 130mm x 140mm single and dual IGBT modules, 190mm x 140mm single IGBT modules, 17mm dual IGBT modules, as well as PrimePACK™ and EconoPACK™ IGBT modules.

Main features

Its plug-and-play capability means that it is ready to operate immediately after assembling the gate resistors.

The complete driver solutions provide both direct-driving and half-bridge modes with combined input and fault processing and an internally generated half-bridge dead time which is set at the factory to 3μs.

The V_{ce} -monitoring threshold is set at the factory to 10.2V to achieve universal short-circuit protection. The response time is set to 4.4μs for 600V IGBT modules and to 6.5μs for 1200V and 1700V IGBTs. A command blocking time of 90ms is also set after a fault event to ensure proper reset and thermal stability of the system. These functionalities can be deactivated by connecting the corresponding pins to signal ground at the primary-side interface.

The basic boards have been developed with a clear focus on full current and power utilization of the IGBTs. The Advanced Active Clamping function (see Figure 3) supports DC-link voltages up to 400V, 800V and 1200V for the IGBT voltage classes of 600V, 1200V and 1700V respectively. The 2BB0108T fully utilizes the gate output power of the 2SC0108T driver core, which is 1.2W per channel at ambient temperatures below 70°C and drops linearly to 1.0W at 85°C.

The 2BB0435T achieves a gate output

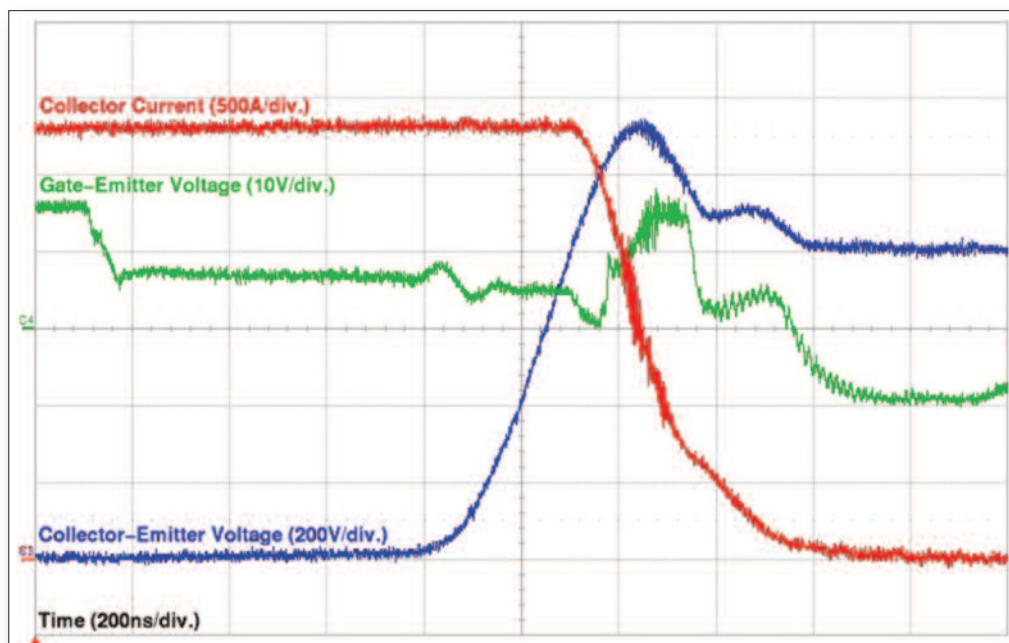


Figure 3: Turn-off transition with Advanced Active Clamping of an FF1400R12IP4 IGBT by 2BB0435T

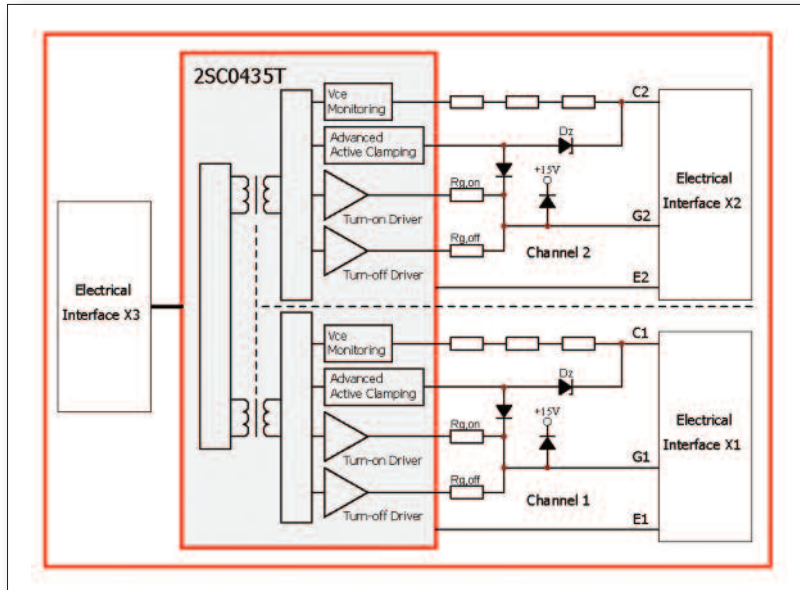


Figure 4: Topology of a plug-and-play driver using a 2BB0435T Basic Board

topologies as well as parallel-connected IGBTs equipped with separate gate drivers.

Open Design and availability

Wide adaptability, full support, several options for factory-set configuration or user customization, combined with open access to schematics and production layout data (Gerber files, BOM) make this a fast, inexpensive and therefore very attractive approach for different solutions. The basic board may be used for prototype or small-volume series. Alternatively, users may prefer to use the core and layout data just to adapt the driver to their own environment. Even the use of plug-and-play drivers represents a simple transition as the technology is exactly the same.

Small volumes are available from stock. The basic boards are delivered without driver cores or gate resistors. At minimum order quantities of 1000, the basic boards can also be assembled with their respective gate drivers and required gate resistors. Other adaptations will be provided upon request. For further information, please contact Sales@IGBT-Driver.com.

power of 3W per channel at ambient temperatures below 70°C which drops linearly to 2W at 85°C.

The complete driver solutions feature safe isolation to EN 50178, protection class II and UL compliance.

Scalability of converter power through direct paralleling

These drivers have an extremely short

transit time of typically less than 80ns and a jitter of less than ±2ns. Parameter variations over the production process, temperature and supply voltage are widely compensated. Fault states are transmitted to the primary side within a microsecond. These gate drivers are consequently suitable for all known applications - the SCALE-2 drivers inherently support not only 2-level but also 3-level and multi-level

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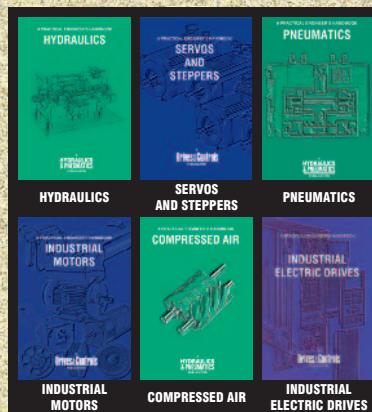
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