



# Unlocking the Door to More Compact Designs with Vincotech's New Highly Integrated 1200 V *flow*IPM

*Michele Portico, Product Marketing Manager, Vincotech GmbH, Unterhaching*

## 1 Abstract

*A new family of intelligent power devices has been developed to fulfill industry requirements for highly reliable, low-cost motor controls that deliver higher performance in a smaller footprint.*

## 2 Trend for Intelligent Power Modules

The trend in power electronics is moving towards greater integration and more complex subsystems. On a related note, intelligent power modules (IPMs) have made major inroads into the market for motor control applications. These advanced modules combine high-performance IGBTs, diode power devices with integrated gate drives, and protection circuits in single housing. Demand for these IPMs is growing primarily because of the many benefits this power electronics technology brings to motor control applications.

## 3 Vincotech's IPM family

The *flow*IPM product family extends Vincotech's portfolio of power modules for mechanical environments that demand high performance in a small footprint, for example, in embedded motor drives for fans, pumps, washing machines, air conditioners and small industrial motor drives that provide more than 4 kW electrical power at 80°C heat sink temperature.

One of these new additions to the portfolio is the 1200 V *flow*IPM, an advanced power module that combines (see Fig. 1):

- A three-phase input rectifier
- A three-phase motor inverter
- Current sensing with shunts in all low-side emitters
- Gate drives including all bootstrap power supply circuits, under-voltage lockout and over-current protection
- A temperature sensor



The three-phase inverter features an open emitter configuration and integrated shunt resistors for sensing the current in each leg, which results in vastly improved motor control.

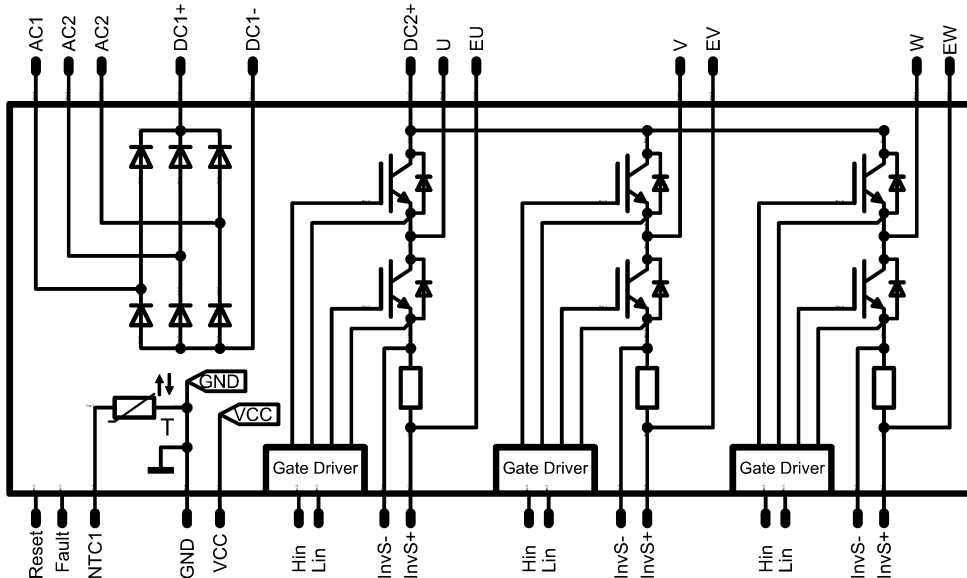


Fig. 1: A streamlined schematic of the 1200V flowIPM

Thick-film technology takes integration to a whole new level (see Fig. 2). To this end, different layers of conduction and isolating materials are printed on a ceramic sheet. These layers serve to build tracks, pads and resistors that may be laser-trimmed to achieve high levels of accuracy.

This technology achieves high thermal conductivity and accommodates PCB-like layouts. Thick-film is a very mature technology. It has already been used for several years, especially for critical applications, for example, in the automotive industry.

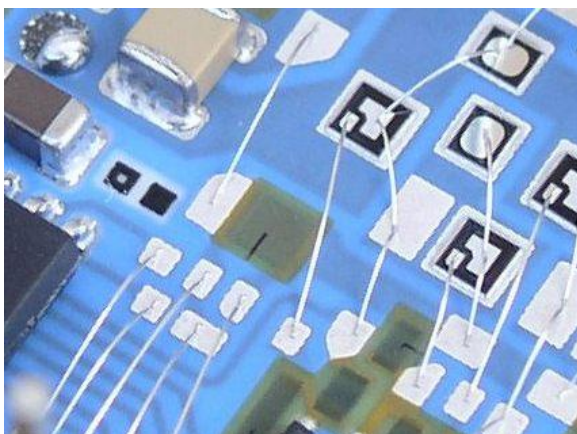


Fig. 2: IPMs in thick-film technology



Vincotech's 1200V *flowIPM* comes in a compact *flowIPM* 1B housing equipped with Press-fit pins (see Fig.3). Press-fit technology reduces PCB assembly time and effort considerably by eliminating the need for soldering. This cuts process time and costs and boosts production output.



*Fig. 3: Press-fit pins for solder-less mounting*

The module's creepage and clearance distances fulfill the applicable industrial standards. There are no special requirements regarding the shape of the heat sink. The thermal interconnection between *flowIPM* and the heat sink is vastly improved by pre-applying phase-change material. Vincotech's in-house screen-printing process deposits the material with great precision, achieving the proper thickness. The material can be optimized for maximum heat transfer capability.

## **4 Vincotech's 1200V *flowIPM* for greater integration**

Space is tight in embedded drive systems and their compact, hermetical design makes it difficult to dissipate the heat generated by so many electronic components.

Vincotech's 1200V *flowIPM* features the highest level of integration of any power module available on the market today and it is the best solution for such mechanical environments. The benefits of using this highly integrated module are considerable:



- The overall system's size, cost, and time to market can be slashed by integrating all of a motor drive's functional blocks, apart from the input filter, DC capacitor and microcontroller.
- Protection circuitry is tuned to match the power device's capability and factory-tested to improve the system's reliability.
- A lot of space is saved with highly integrated components and bare power chips to achieve a much smaller footprint than that of discrete designs.
- Motor drive assembly is streamlined and simplified with fewer external components and smart isolation techniques.
- The ceramic sheet used in thick-film technology improves the module's thermal performance by providing the best possible direct cooling for power components.

## 5 Conclusion

IPMs provide the functional integration and power density that engineers need to design embedded drive systems. The outstanding level of integration achieved by Vincotech's 1200V *flowIPM* enables system engineers to come up with more compact designs and to take advantage of a proven combination of power components and gate drive circuits, which happen to be the most critical elements in the inverter's design. This mitigates the risk associated with circuit design, speeds up development, and dramatically reduces time to market. Power semiconductors, integrated circuits, SMDs and resistors integrated into the substrate can all be combined with the benefit of thick-film technology, thereby maximizing the new *flowIPM* power module's functional integration.