

flow90 – The power module of choice for 90-degree mounting

Patrick Baginski, Field Application Engineer, Vincotech GmbH

Abstract:

Vincotech offers a wide range of power modules, one line of which is the perfect match for book-sized inverters and 19-inch rack-mounted power supplies with a 90-degree angle between the heat-sink and PCB. Called *flow90* and featuring pins arrayed at a 90-degree angle, these modules are available as standard products with CON, PIM, and PACK configurations. Furthermore customized topologies like for switching mode power supplies and battery chargers are also commonly used in this package. This concept gets rid of flexible PCBs. The use of *flow90* modules utilize the PCB to its maximum and achieve small applications.

Introduction:

Most power modules come with a copper layer or base plate at the bottom to transfer heat to the cooler. Spring contacts, screw terminals, solder pins, or Press-fit pins on the opposite side provide an electrical connection to the printed circuit board. The pins of the *flow90* module, however, are arrayed at a 90-degree angle to the module's DBC substrate. This brings considerable benefits to book-sized inverters and 19-inch rack-mounted applications. Standard topologies such as CIB / PIM and PACK configurations are available with 600 V and 1200 V components. Vincotech also offers rectifier modules, including half-controlled versions and with an optional brake transistor. The internal layout is symmetrical so a six-pack module's power rating may be increased by connecting the three legs together to form a half-bridge.

In most conventional modules, the electrical connection sits on the opposite side; that is, where the cooling area is located. The module is soldered to a PCB and mounted to a heat-sink or vice versa. This can be done on the PCB side with through-hole and other components sited on the solder side.

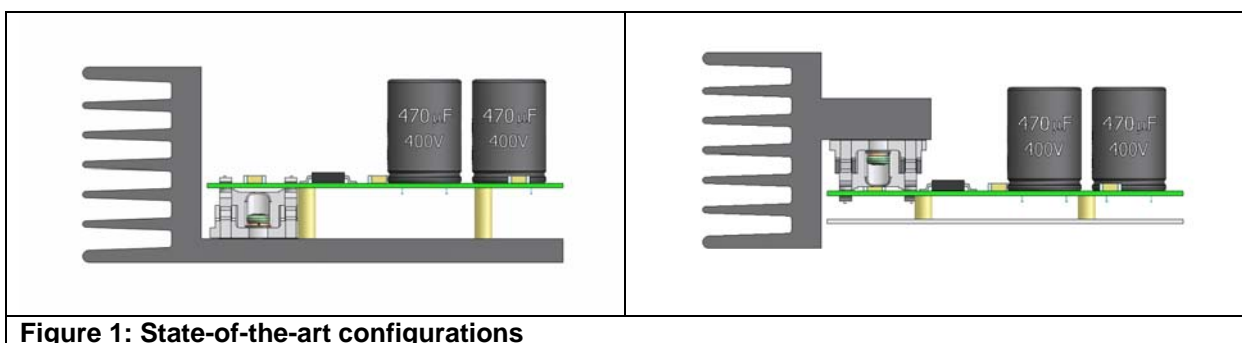


Figure 1: State-of-the-art configurations

Both options have their advantages and drawbacks. The module is usually mounted on a flat heat-sink for higher power applications, which simplifies production. Of course, this option is also viable for lower power ratings.

However, the drawbacks of switching mode power supplies designed for use in a 19-inch rack or book-size inverters in flat modules often outweigh any potential advantages. In such cases, heat-sinks frequently sit on the back of the inverter or on the left or right of a 19-inch device.

The concept behind *flow90*

This module affords engineers the opportunity to make a mechanical connection between the heat sink and PCB at a 90-degree angle within the device. It requires no additional mechanical components or special heat-sinks. The power module is installed vertically, on the same side as all other components, rather than horizontally as is the case with conventional designs. What's more, there is no longer a need for specially designed heat-sinks. This simplifies manufacturing and reduces operating costs. Beyond that, *flow90* allows end devices such as frequency inverters to be built in a more compact format. This method of mounting modules is perfect for power components housed in narrow control cabinets where cooling is performed at the back of the cabinet, as well as for all other applications requiring the heat-sink and PCB to be arrayed at a 90-degree angle.

The electrical connection to the PCB is easily made. The module's internal structure, particularly the DBC layout, is mapped to optimize the power flow from the input rectifiers to the output inverter IGBTs. This streamlines printed circuit board routing and leaves a much smaller footprint. The housing may be handled like any standard THT component. And with the 90-degree mount, there is no need for a flexible PCB, which makes the system even more reliable.

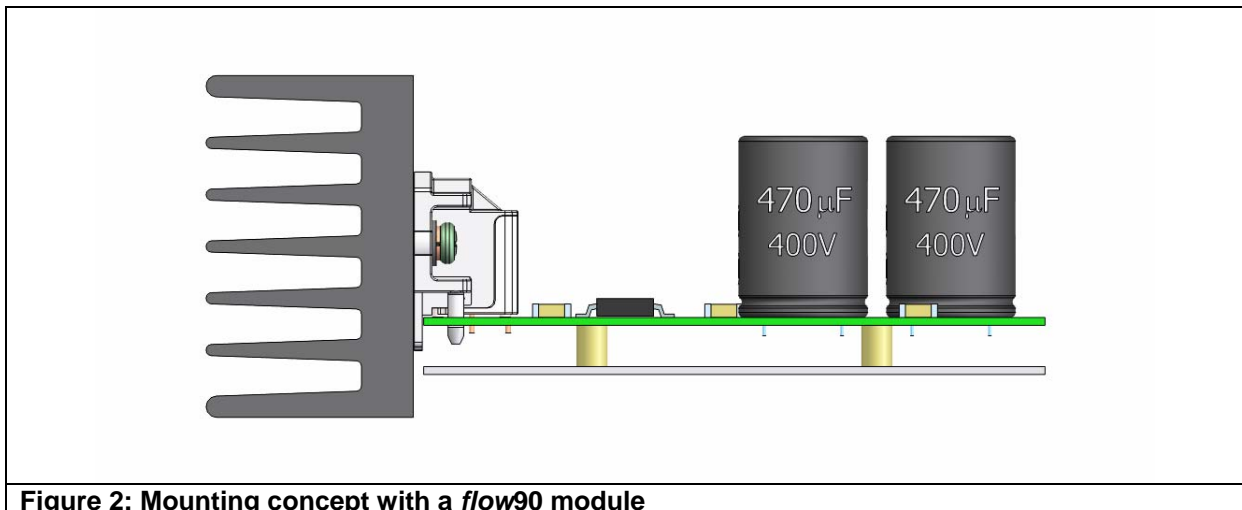


Figure 2: Mounting concept with a *flow90* module

Two plastic clips that engage in the PCB attach the module to the board. The heat-sink may be affixed conventionally using screws or with the aid of two clips. The clips screw onto the heat-sink or wedge into a groove. Clip fastening can prove very useful in instances where it is difficult or impossible to screw the module on because of obstructions posed by larger components such as capacitors. The *flow90* housing is designed to preclude the need for additional mounting brackets near the module between the PCB and heat-sink. This also cuts the costs of assembly material and mounting. In addition, it prevents potential tolerance differences when additional spacers or brackets are employed. The plastic housing consists of a small pin in the center, which bends the DBC to a convex shape. This ensures low thermal resistance and improved operating performance.

The figure below shows how the module is fixed in place in the PCB and heat-sink.

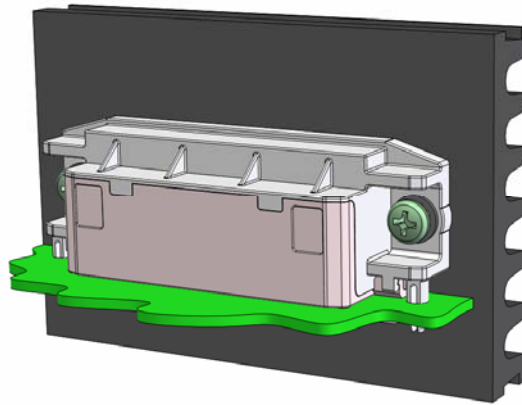


Figure 3: Detailed view of the flow90 module

In contrast to discrete components, the *flow90* module ships with electrical isolation on board, so additional pads or foils are unnecessary. Vincotech can furnish these modules with a pre-applied phase-change material. This material has high thermal conductivity, melts at temperatures above 45 degrees centigrade, and has beneficial EMI properties. Components are arrayed closely together with shorter connecting paths to create a low-inductance design with better dynamic response.

Conclusion:

Featuring an integrated input rectifier, brake, and motor inverter, *flow90PIM* combines the benefits of a power module - isolation, good thermal coupling with the heatsink, and enhanced reliability - with the advantages of the 90-degree mounting option customarily used for discrete components. *flow90CON* and *flow90PACK* modules are available to extend the power rating. A sixpack configuration can be easily connected to a half-bridge due to a symmetrical layout inside the module. Topologies are easily customized. The *flow90* module is the perfect fit for book-sized frequency inverters and 19-inch rack applications such as switching mode power supplies and battery chargers. When mounted vertically on the board, the module can be installed on the same side as other through-hole components, and wave-soldered along with these other components in one pass. Modules with a pre-applied phase-change material are available on demand which shifts the complicated process of applying thermal interface material to Vincotech. With all its features the *flow90* is the module of choice for many applications that can benefit of the 90-degree concept.