Power Modules | Application Note

Mounting Instructions for ECONO2 Modules

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ECONO2 power modules combine excellent thermal performance (enabled by a direct bonded copper Al_2O_3 substrate), superior mechanical ruggedness, and an environmentally friendly manufacturing process that eliminates the use of hard molds, thus reducing direct stresses on the leads. To prevent axial pull-out, the electrical terminals are co-molded to the module housing.

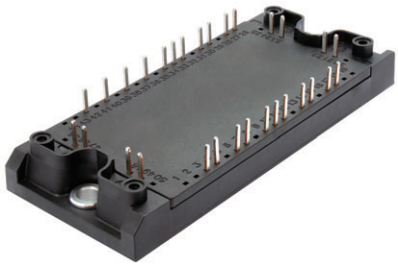

Fig. 1 - Example of ECONO2

INTRODUCTION

ECONO2 products are highly integrated power modules, so it is necessary to follow some basic assembly rules. As with all semiconductor based products, the ECONO2 module should be mounted in a way that avoids heating by adjacent components.

Modules should also be mounted such tension, pressure, or mechanical vibrations cannot cause mechanical stress to the connection between leads, package, and baseplate. The relationship of these factors and the requirements for assembly of ECONO2 modules are discussed over the following pages.

ESD PROTECTION

IGBT and MOSFET modules are sensitive to electrostatic discharges. All ECONO2 modules are shipped from Vishay in an ESD-protected packaging. During the handling and assembly of the modules it's necessary use a conductive grounded wristlet at the working place.

HEATSINK REQUIREMENTS

The heat generated by the module has to be dissipated with a heatsink. Typically natural or forced air cooling is used.

The heatsink design greatly influences the thermal dissipation of the system. Therefore the flatness of the heatsink across the module mounting area should be less than 0.03 mm (1.18 mils) with a levelling depth of less than 0.02 mm (≤ 0.79 mils), according to DIN/ISO 1302.

When natural convection cooling is used, the heatsink fins must be arranged so that the air can flow freely from the bottom to the top. For forced convection by air or liquid, the module can be mounted in any position as long as the cooling medium amount is sufficient for the load.

A milled or machined surface is generally satisfactory if prepared with tools in good working condition. The heatsink mounting surface must be clean, with no dirt, corrosion, or surface oxide. It is very important to keep the mounting surface free from particles exceeding 0.05 mm (2 mils) in thickness, provided a thermal compound is used.

MOUNTING TO HEATSINK

The module baseplate planarity can vary in convexity, typically from 0.02 mm to 0.30 mm (0.79 mils to 11.81 mils) when measured between the 93 mm (3.6 in.) distance between the two fixing holes. This provides for an optimal contact area with the heatsink.

The use of thermal grease is recommended to ensure low case-to-sink thermal resistance. The thermal conductivity of the compound should be not less than 0.5 W/mK. We suggest using either DC340 (Dow Corning) or silicone-free HTCP (Electrolube) or equivalent thermal grease.

It should be applied with a thickness of about 80 µm to 100 µm (3.1 mils to 3.9 mils) by using a roller or spatula. Thermal grease contact and distribution will improve during the first hours and after heating up the system for the first time.

Mounting Instructions for ECONO2 Modules

Bolt the module to the heatsink using the fixing holes. An even amount of torque should be applied for each individual mounting screw.

For proper mounting it is recommended to use M5 screws secured by a lock washer and flat washer torqued to between 2.7 Nm and 3.3 Nm (24 lb-in. to 29 lb-in.). A torque wrench, which is accurate in the specified range, must be used in mounting the module to achieve optimum results.

The minimum required thread depth is 12 mm (0.48 in.) for aluminum heatsinks and 10 mm (0.40 in.) for copper heat sinks. All mounting holes should be free of burrs.

The first mounting screw should be tightened to one third of the recommended torque; the second screw should then be tightened to the same torque. Full tightening of both the screws can then be completed by applying the recommended torque (see data in bulletins). Over-tightening the mounting screw may lead to deformation of the package, which would hence increase the thermal resistance and damage the semiconductors. After a period of three hours, check the torque with a final tightening in opposite sequence to allow the spread of the compound.

PCB MOUNTING

The PCB holes for the module pins have to be designed for a maximum tolerance of 0.4 mm (15.74 mils) in diameter according to the nominal position (see datasheet drawing).

It is essential to design the copper traces on the PCB in a way to prevent damage to the PCB and/or the module by excessive heating. A copper thickness of 105 µm (4.13 mils) usually is used. The maximum RMS current determines the width of the copper pattern.

Forced air-cooling for the PCB can improve the temperature situation.

The mounting height from the heatsink to the lower side of the PCB is 17 mm ± 0.5 mm.

Some configurations are provided with a stand-off embedded in the plastic housing. The transmission of tension and mechanical stress from PCB to the module pins must be avoided by screwing the PCB down to the module stand-offs. Insert the pin straight into the PCB hole without jamming it. Self-tapping screws (for example, EJOT PTÒ self-tapping screws of the dimension K25 with 2.5 mm diameter) are suggested for the mechanical connection between module and PCB. The maximum thread depth into the module mounting studs is 9 mm. This dimension plus the PCB board thickness determines the length of the self-tapping screw. The recommended screw torque is 1.5 Nm (13 lb-in.).

Depending on the design of the power stage, additional support from the heatsink to the PCB might be necessary. A good solder contact is required for proper conduction between terminal pins and PCB and ensures good heat dissipation. Wave soldering or manual soldering is suitable for soldering the pins to the PCB, but soldering conditions must not be exceeded to prevent overheating of the device. Specifically the soldering time must not exceed 3 s at a temperature of 260 °C.

Washing is not recommended due to holes in the module cover.

DISASSEMBLY

For disassembly the solder connection must be undone properly by an appropriate technique. Then any screw connections to the PCB and to the heatsink need to be removed. The modules should be either slid off the heat sink or rotated on the heatsink surface to overcome adhesion of the thermal grease. Pulling directly on the module housing may cause separation of module baseplate and package.

END OF LIFE MODULE WASTE DISPOSAL RECOMMENDATION

Corporate social responsibility is more and more important for the environment protection, Vishay is certified by ISO 140001 and Vishay modules are always compliant with the Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive.

We recommend that the end of life modules (include components of the modules) shall be segregated by hazardous and collected in a labeled container (refer to CER code # 16.02.16) which should be put in a designated place.