Chapter 6

Mounting Guideline and Thermal Design

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1. Soldering to PCB

**Soldering**

(1) The device temperature during soldering might exceed the maximum storage temperature. To prevent damage to the device and to ensure reliability, please use the following soldering temperature.

<table>
<thead>
<tr>
<th>Methods</th>
<th>Soldering Temp. &amp; Time</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Solder dipping / Soldering iron</td>
<td>260±5°C, 10±1sec</td>
<td></td>
</tr>
<tr>
<td>b Solder dipping / Soldering iron</td>
<td>350±10°C, 3.5±0.5sec</td>
<td></td>
</tr>
</tbody>
</table>

(2) The immersion depth of the lead terminal should be more than 1.5mm apart from the device. When using flow-soldering, be careful to avoid immersing the package in the solder bath.

(3) It is not recommended to reuse the device after it is removed from the circuit board. There is a possibility that the removed device was subjected to thermal or mechanical damage during the removal process.
2. Mounting to heat sink

Mounting procedure and precautions

When mounting the IPM to a heat sink, please refer to the following recommended fastening order. Uneven fastening due to excessive torque might lead to destruction or degradation of the chip.

![Recommended screw fastening procedure](image)

**Note:** the pre-screwing torque is set to 30% of the maximum torque rating.

Fig.6-1 Recommended screw fastening procedure

Fig.6-2 shows the measurement position of heat sink flatness.

The heat sink flatness should be from 0µm/100mm to +100µm/100mm, and the surface roughness (Rz) should be less than 10 µm.

- If the heat sink surface is concave, a gap occurs between the heat sink and the IPM, leading to deterioration of cooling efficiency.
- If the flatness is +100 µm or more, the aluminum base of the IPM is deformed and cracks could occur in the internal isolating substrates.

![The measurement point of heat sink flatness](image)

Fig.6-2 The measurement point of heat sink flatness

In order to obtain effective heat dissipation, thermal compound with good thermal conductivity should be applied uniformly with +50µm thickness on the contacting surface between the IPM and heat sink. Refer to the following information for an application position and application quantity.

![Recommended application position and application quantity](image)

**Recommended:**

- **Product name:** G-747 (Shin-Etsu Silicones)
- **Application position:** 7.5mm apart from the edge of aluminum base
- **Application quantity:** 0.03g

Fig.6-3 Recommended an application position and application quantity.
3. Cooler (Heat Sink) Selection Method

• Please make sure that the junction temperature $T_j$ should not exceed the maximum junction temperature $T_{j(max)}$ for safe operation. Cooling device (heat sink) should be designed to ensure that $T_j$ is always below $T_{j(max)}$ even during abnormal conditions such as overload operation as well as during rated load.

• If the IGBT junction temperature is higher than $T_{j(max)}$, it might cause damage to the chips. The over-heating (OH) protection function works when the IGBT junction temperature exceeds $T_{j(max)}$. However, if the temperature rises too quickly, the OH protection might not work.

• Please note that the junction temperature of FWD should not exceed $T_{j(max)}$ also.

• When selecting a cooling device (heat sink), please verify the chip temperature by measuring at the position shown in Figure 2-2.

For more detail about thermal design, please refer Chapter 6 Section 2 of this note and “IGBT MODULE APPLICATION MANUAL (REH984c)”

Contents:
• Power dissipation loss calculation
• Selecting heat sinks
• Heat sink mounting precautions
• Troubleshooting