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Solder Die Attach Precautions for SiC MOSFET Chips

MITSUBISHI ELECTRIC CORPORATION

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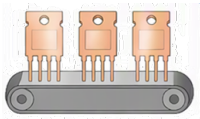
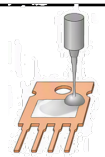
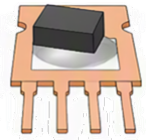
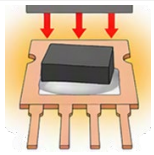
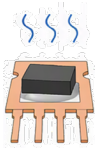
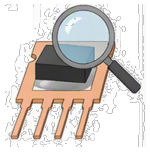
The figure below illustrates a typical solder die attach process flow and the key precautions at each process step.

Process	Overview	Precautions
Frame (Substrate) Supply 	Frames or substrates onto which the chips will be mounted are supplied.	To prevent poor solder wettability caused by foreign matter, scratches, or contamination on the frame/substrate surface, cleaning and/or reduction treatment is recommended.
Solder Application 	An appropriate amount of solder is applied to the designated locations.	The amount of solder should be optimized to achieve the appropriate solder thickness according to the chip size and thickness.
Chip Placement 	The chips are accurately positioned and placed using solder.	Process conditions, such as die bonding force and placement speed, should be optimized to prevent pickup failures, chip cracking, and chipping during die attach. In addition, chip misalignment, rotation, or tilt during die attach may lead to defects in subsequent processes and increased thermal resistance.
Bonding 	The solder is melted by heating and/or pressure to bond the chip to the frame or substrate.	Rapid heating may introduce thermal stress to the chip, resulting in solder cracking or insufficient solder wetting. Therefore, an appropriate temperature profile should be established and carefully controled.
Cooling 	The solder is solidified to stabilize the bond.	Rapid cooling may increase warpage and residual stress due to the difference in the coefficients of thermal expansion between the chip and the frame/substrate. Therefore, an appropriate temperature profile should be established and carefully controled.
Inspection 	The appearance and bond quality are inspected to verify product quality.	Voids within the solder layer that cannot be detected by visual inspection can increase thermal resistance. Therefore, they should be strictly controlled using X-ray inspection or equivalent methods. In addition, the bonding strength between the chip and the frame/substrate affects the temperature cycling lifetime of the module and should be verified through bond strength testing.

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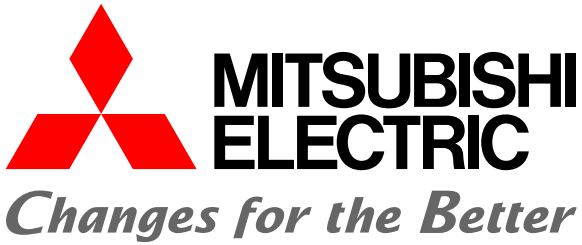
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