

TDK INNOVETA Inc., - APPLICATION NOTE
Soldering and Cleaning Guidelines for TDK Innoveta Power Modules
Date Issued: March 12, 2010

Handling

TDK Innoveta power modules should be stored in their shipping boxes as they are received until time of assembly. This will protect them from mechanical and ESD damage. Full ESD procedures should be followed when handling TDK Innoveta products.

TDK Innoveta products are susceptible to physical damage from rough or careless handling, as are all open frame modules. The modules should not be subjected to mechanical shock, twisting or bending. This can result in damaged or broken components, and/or bent pins.

TDK Innoveta power modules should not be stacked on top of one another. TDK Innoveta modules should be handled by the sides or edges; do not touch the active components on the underside of the modules.

Soldering – Through-Hole Modules

TDK Innoveta through-hole power modules may be either hand soldered or wave soldered.

Wave Soldering

Standard Pb-Eutectic Wave Soldering (Sn63Pb37)

TDK Innoveta recommends that the solder wave temperature be, at most, 250°C, with maximum dwell time of 6 to 7 seconds. Wave side PWB surface preheat temperature is recommended to be 135°C +/- 10°C, with a maximum ramp rate of 4°C/sec. The PWB top side preheat temperature should be kept below the wave side temperature to prevent reflow.

Pb-Free Wave Soldering (SAC305 Alloy)

TDK Innoveta recommends that the solder wave temperature be, at most, 290°C, with maximum dwell time of 6 to 7 seconds. Wave side PWB surface preheat temperature is recommended to be 140°C +/- 10°C, with a maximum ramp rate of 4°C/sec. The PWB top side preheat temperature should be kept below the wave side temperature to prevent reflow.

Hand Soldering

Hand Soldering - Standard Pb-Eutectic Solder (Sn63Pb37)

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For single board modules, pre-heat the power module with hot air to a temperature of approximately 120°C, \pm 5°C as measured by a thermocouple mounted on the module itself. This additional heating is necessary for good soldering results. TDK Innoveta power modules are designed to spread heat uniformly. Without adequate pre-heating, the sections of the pins to be wetted may not reach the reflow temperature of the solder, resulting in weak, brittle joints.

For dual board power modules built with an IMS *{Integrated Metal Substrate}* baseplate, such as the iHA series, the iFA series, and the iQM/N/P series, a hot plate may also be used to pre-heat the power modules during soldering. Place the power module assembly on the heat plate with the back of the metal substrate on the hot surface. If a heat sink or heat spreader is to be attached to the dual-board modules as part of the final assembly, TDK Innoveta STRONGLY recommends that the heat sink be attached **before** soldering the units into the PWB. Once the heat sink has been attached, the hot plate can no longer be used as the pre-heating tool.

CAUTION #1: Do not pre-heat the units above this recommended temperature. Our studies have shown that the pin temperature may increase an average of 40°C in the first 4 seconds of soldering, depending on the diameter of the pin, and the soldering iron tip used. Some of the smaller signal pins may increase their temperatures even faster. Once this initial jump has occurred, however, the rate of temperature rise decreases dramatically. If the pre-heating temperature is too high, it is possible to exceed the melting point of the pin base joint on the TDK Innoveta module, causing the solder joint to reflow, and the pin to move. For single-board modules, this is not of great concern, since the pins are anchored mechanically in the holes on the FR4 PWB. For the dual-board units, however, the power pins are surface mounted to the metal board. Melting this base joint, and allowing the pins to move, may result in disturbed solder in the joints, or, in the worst case, cause the pins to lift off the metal board altogether, causing an open.

Apply no-clean flux to the pins before soldering. This will help the solder to flow down the pins, and their receiving holes.

Touch the soldering iron to the pin, and feed the no-clean solder wire onto the pin (and the iron tip) until the solder flows into the receiving hole, and onto the sidewall of the hole.

CAUTION #2: We have seen instances where resting the soldering iron tip on the annular ring of the receiving hole instead of on the pin itself may cause the PWB to blister around the hole. We have produced good solder joints with soldering iron temperatures set from 370°C (~700°F) to 430°C (~800°F). We recommend an average setting of 400°C, or 750°F, but this can depend on the type of equipment used, and the tip size. Soldering times should range from 6 seconds to 10 seconds per joint for the power pins. Some of the larger pins may even take longer to solder, as they do not heat up as fast. The signal pins can be soldered in less time, since they tend to heat up faster than the power pins.

Hand Soldering - Pb-Free Solder Alloys (SAC 387 and SAC305 Alloys)

For soldering with the Pb-free alloys, the pre-heat temperature should be increased to 145°C \pm 5°C, and the soldering time per joint can be increased for the power pins to 12 seconds to 15

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seconds. All other procedures are the same, and all of the CAUTIONS mentioned above apply as well.

Reflow Soldering – Surface Mount Modules

TDK Innoveta recommends reflow soldering surface mountable power modules to the receiving board using standard reflow mounting techniques. Refer to the datasheet for each product for the recommended land pattern and solder paste coverage.

TDK Innoveta recommends the following solder paste alloys.

Standard Pb-Eutectic	63% Sn/37% Pb or 62% Sn/36% Pb/2% Ag
Pb-Free	95.5% Sn/3.8% Ag/0.7% Cu or 96.5% Sn/3% Ag/0.5% Cu

Reflow Profile

In order to reflow TDK Innoveta surface mountable power modules onto a main panel, it is completely acceptable to use the solder paste manufacturer's recommended reflow profile, whether the solder paste being used is the standard 63Sn/37Pb eutectic solder, or one of the Pb-free alloys. TDK Innoveta power modules are designed to withstand a peak reflow temperature of 260°C. However, we recommend that the peak surface temperature of the surface mount module should not exceed 240°C, as measured by thermocouple attached to one of the pins. Be aware, however, that TDK Innoveta modules tend to be densely populated, and therefore contain a fair amount of thermal mass. The customer's normal oven profile may need to be slightly adjusted to make sure that the TDK Innoveta power module does in fact reflow onto the receiving board. TDK Innoveta recommends that the oven profile be set up with at least one thermocouple monitoring the temperature of the module connector solder joint and one thermocouple monitoring the top board surface of the power module.

TDK Innoveta power modules have been assigned MSL ratings based on component sets and in-house testing. Please follow the applicable handling procedures associated with the indicated MSL rating for the module being used. Up to date MSL handling procedures and environmental exposure times can be found in IPC-9592, Section 6.

Cleaning

TDK Innoveta power modules are fabricated with a no-clean process, and, as such, do not require any cleaning themselves. TDK Innoveta recommends the use of either no-clean flux or water-soluble flux for wave soldering applications, and no-clean solder paste for surface mount applications. If cleaning is required, TDK Innoveta power modules are compatible with the following cleaning process:

DI water wash	140°F – 160°F, 50psi – 60psi <i>(If DI water is not sufficient, an alkaline saponifier may be added to the wash, in a concentration not to exceed 6% by volume.)</i>
Rinse	120°F to 140°F, 50psi – 60psi <i>(As in all cleaning operations, good rinsing is critical. This is especially true when the wash solution contains dissolved or solvated cleaning agents, such as saponifiers, detergents, or</i>

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emulsifiers. Inadequate rinsing may leave ionic residues on the board or power module surfaces, providing current leakage paths between adjacent conductors. To confirm sufficient rinsing, a conductivity meter can be used to monitor the rinse effluent. Resistivities of 1 to 2 M Ω -cm are usually enough to guarantee good rinsing.)

Oven Dry 30 minutes to 1 hr @ 105°C, 750cfm minimum airflow
(Shorter drying times may be acceptable for the smaller modules.)

TDK Innoveta does not recommend solvent cleaning of the power modules.