

## V.I Chip Soldering Recommendations

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### Introduction

V.I Chips™ are intended for reflow soldering assembly. The information contained in this document defines the processing conditions required for successful attachment to a PCB. Failure to follow the recommendations provided can result in aesthetic and functional failure of the module.

### Storage

Devices rated at JEDEC MSL-6 should remain in the dry vacuum bag during storage prior to assembly. Exposure to ambient conditions for more than 4 hours requires a bake at 125°C for 24 hours to remove moisture from the package.

Devices rated at JEDEC MSL-5 should remain in the dry vacuum bag during storage prior to assembly. Exposure to ambient conditions for more than 48 hours requires a bake at 125°C for 24 hours to remove moisture from the package.

### Solder Paste Stencil Design

Solder paste is recommended for a number of reasons, including overcoming minor co-planarity issues as well as simpler integration into overall SMD process.

For product rated for 225°C reflow:

63/37 SnPb, either no-clean or water-washable, solder paste should be used. Other types of SnPb solder pastes may be used if the module can be safely reflowed without exceeding its maximum case temperature.

For product rated for 245°C reflow:

SAC 305, either no-clean or water-washable, solder paste should be used. Other types of lead free solder pastes may be used if the module can be safely reflowed without exceeding its maximum case temperature.

The minimum solder paste thickness is 6 mils. The stencil apertures should be 0.9:1.

### Pick & Place

The V.I Chips should be placed within  $\pm 5$  mils. To maintain placement position, the modules should not be subjected to acceleration greater than 500 in/sec<sup>2</sup> between pick & place and reflow. All people or equipment handling V.I Chips should have proper ESD protection to avoid damaging the units during the mounting process.

### Solder Reflow

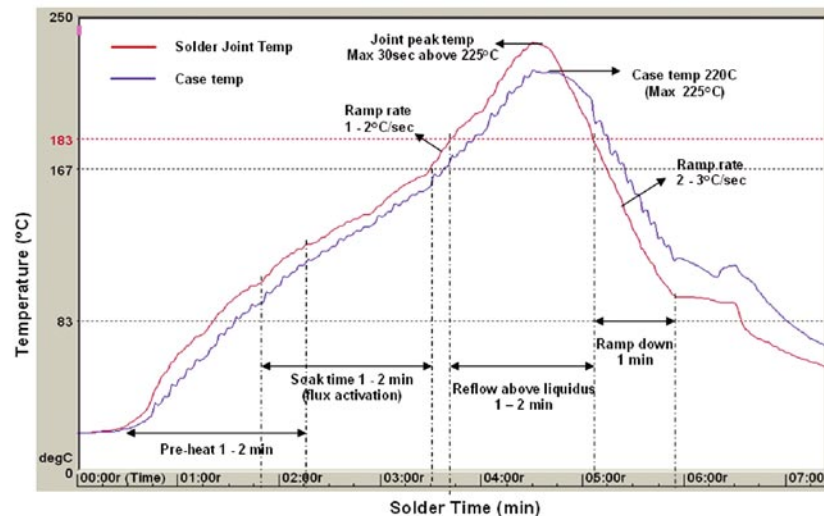
MSL and reflow temperatures vary by product. Please refer to the specific product data sheet for the appropriate MSL and reflow rating for the product being handled.

## 225°C Reflow Procedure

If noted in the data sheet as 225°C reflow capable, the V•I Chip is qualified per J-STD-020 for 3 reflows at a peak temperature of 225°C in the MSL-5 conditions. Information provided here is based on experiments executed on V•I Chip modules. They do not represent exact conditions present at a customer site. Hence, information herein should be used as guidance only and process optimizations are recommended to develop an application-specific reflow solution. There are two temperatures critical to the reflow process: the solder joint temperature and the module case temperature. The solder joint temperature is allowed to reach 225°C for up to 30 sec. The module case temperature must not exceed 225°C at anytime during reflow. Because of the  $\Delta T$  needed between the J-lead pins and the case, a forced-air convection oven is recommended for reflow soldering. This reflow method generally transfers heat from the PCB to the solder joint. The module's large mass also reduces its temperature rise. Other types of reflow methods (Vapor Phase, IR, etc.) have not been qualified for use with V•I Chips and should be studied to insure that the unit's maximum case temperature is not exceeded during reflow.

In the reflow step, the assembly is preheated to 100 to 150°C and held for a minimum of one minute to evaporate solvents from solder paste. The next stage is soak zone where the flux activation occurs and the flux reacts with the oxide and contaminants on the surfaces to be joined. The assembly is then brought to above the 183°C liquidus temperature to produce reflow of the solder. The typical time above liquidus (183°C) is preferably 60-90 seconds. In order to achieve the appropriate temperature profile, the peak temperature and belt speed of the reflow furnace are determined based on the total mass of the assembly going through soldering.

Figure 1  
Typical 225°C PbSn solder reflow profile for V•I Chip to board assembly.



The final stage is cooling. Slower cool down produces a finer grain structure in the solder joint. Fig. 1 shows a typical reflow profile used in the reflow of SnPb eutectic or similar solder. Following reflow, flux residue must be removed from between the V•I Chip J-leads or over time this residue could become electrically conductive and cause V•I Chip failures.

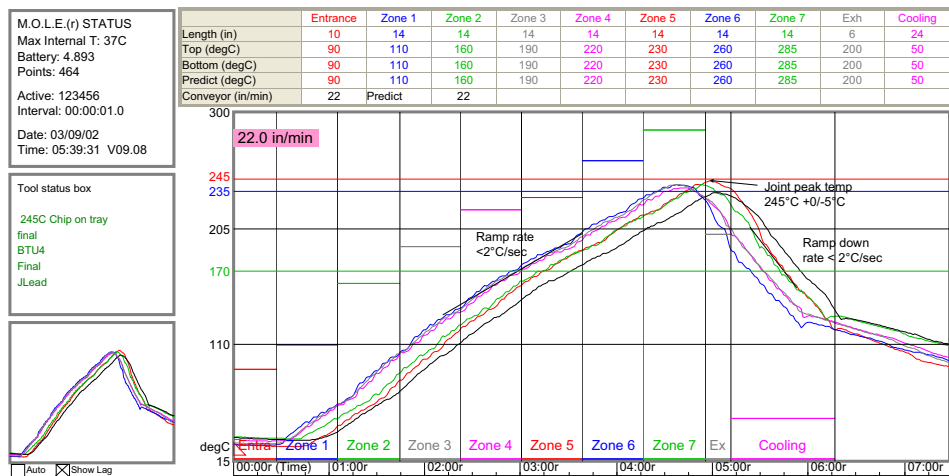
The modules can be subjected to the maximum case temperature of 225°C up to 3 times. Between each reflow, the same MSL-5 handling procedure should be applied. Exposure to ambient conditions for more than 48 hours requires a re-bake at 125°C for 24 hours prior to reflow to remove moisture.

## 245°C Reflow Procedure

If noted in the data sheet as 245°C reflow capable, the V-I Chips are qualified per J-STD-020D for 3 reflows at a peak temperature of 245°C in the MSL-6 conditions. Time out of bag (TOB) is 4 hours for V-I Chip MSL 6 product. The solder reflow information provided here is based on experiments executed on V-I Chip modules. They do not represent exact conditions present at a customer site. Hence, information herein should be used as guidance only and process optimizations are recommended to develop an application-specific reflow solution.

There are two temperatures critical to the reflow process: the solder joint temperature and the module case temperature. The solder joint temperature should reach at least 240°C while the module case temperature must not exceed 245°C at anytime during reflow. Because of the  $\Delta T$  between the J-lead pins and the case, a forced-air convection oven is recommended for reflow soldering. This reflow method generally transfers heat from the PCB to the solder joint. The module's large mass also reduces its temperature rise.

Figure 2  
Typical 245°C solder  
reflow profile for V-I Chip  
to board assembly.



In the reflow step, the assembly should be heated at a rate no faster than 2°C/sec. Once the assembly is above the liquidus temperature to produce reflow of the solder, the typical time above liquidus should be between 60-90 seconds. In order to achieve the appropriate temperature profile, the peak temperature and belt speed of the reflow furnace are determined based on the total mass of the assembly going through soldering. The final stage is cooling. Cool down rate should be no faster than 3°C/sec. Figure 2 shows a typical reflow profile used in the reflow of SAC 305 or similar solder.

Following reflow, flux residue must be removed from between the V-I Chip J-leads or over time this residue could become electrically conductive and cause V-I Chip failures. The modules can be subjected to the maximum case temperature of 245°C up to 3 times. Between each reflow, the same MSL-6 handling procedure should be applied. Exposure to ambient conditions for more than 4 hours requires a re-bake at 125°C for 24 hours prior to reflow to remove moisture.

## Inspection

Both a package and a solder-joint inspection should be performed following a reflow operation. A package inspection should show no evidence of:

- Solder extrusion from the V•I Chip package
- J-lead separation from the module body
- J-lead damage or delamination

Any evidence of the above would indicate that the maximum temperature was exceeded during the reflow process.

The J-lead solder joints should conform to IPC 12.2

- Properly wetted fillet must be evident as shown in Fig. 3.
- Heel fillet height must exceed lead thickness plus solder thickness.

Note that the J-leads do not sit flat on the PCB. For this reason, the solder fillet forms underneath the lead and the heel does not necessarily extend up the side of the J-lead once the unit has been properly reflowed.

## Removal & Rework

V•I Chips can be removed from PCBs using special tools such as those made by Air-Vac [air-vac-eng.com/index.html](http://air-vac-eng.com/index.html). These tools heat a very localized region of the board with a hot gas while applying a tensile force to the component (using vacuum). Prior to component heating and removal, the entire board should be heated to 80-100 °C to decrease the component heating time as well as local PCB warping. If there are adjacent moisture-sensitive components, a 125°C bake should be used prior to component removal to prevent popcorning. A removal process using heat will likely damage the unit, and the V•I Chip should not be expected to function following a removal process.

Reflow of modules onto a PCB using Air-Vac-type equipment is not recommended due to the high temperature the module will experience.

*Figure 3  
Example of reflowed  
V•I Chip J-lead shown  
wetted solder fillet.*

