MicroNotes

# CARE, HANDLING AND SOLDER PROFILE OF DIODES

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1. Microsemi zeners, zero TC reference diodes, transient voltage suppressors, and most rectifiers are all ESD nonsensitive up to 15,999 volts per the Human Body Model test as defined in MIL-STD 750 Method 1020 and other similar specifications. Therefore special handling or packaging conditions are not required. Schottky rectifiers of 1 Amp minimum ratings and many low power signal or switching diodes using very small die elements can be ESD sensitive in the range of 4000 to 15,999 volts when referencing the Human Body Model Test thus making them a class 3 device. These also do not require special handling or packaging per MIL-PRF-19500, Appendix E. Smaller lower current rated Schottky rectifiers may require special handling.

2. Incoming test screening (if performed) should avoid other longer duration transients that may be potentially damaging. For example the smallest DO-35 zeners made by Microsemi can still typically absorb or withstand peak pulse power ($P_{PP}$) transients up to 3 or 4 watts for 8.3 ms of a ½ sine wave. Higher or lower $P_{PP}$ at 25 °C will be further dictated by shorter or longer $t_W$ pulse widths respectively as typically determined by the classic Wunsch-Bell curve of $P_{PP}=K/\sqrt{t_W}$ where K is a constant dictated by effective size of pn junction semiconductor devices. **CAUTION:** Transients can be generated by poor contact to the DUT by some test equipment designs when uncontrolled high compliance voltages may be briefly generated while trying to force a desired programmed level of test current. Therefore precautions are also necessary in test equipment selection or maintenance of electromechanical features (test clip contacts as one example) where poor electrical continuity may occur. If the DUT have tarnished leads from other prior high temperature testing such as HTRB or burn-in operations, then leads should be cleaned prior to testing.

3. Lead bending of axial leaded devices prior to insertion into PC boards should not be in such close proximity to the body to force a bend up to and into the body itself. This excessive "tight bend" may stress glass body devices or transmit undesired forces internally into the active die element for plastic body devices as well. This is less critical on double slug glass diodes where the lead is welded or brazed to a larger diameter slug before entering a glass to metal seal region. In most examples, a 90 degree bend should be *at least* 1/8 inch or three lead diameters from the body which ever is greater. It is also recommended that leads be supported adjacent to the body before the bend is made.

4. Maximum soldering temperatures and times for Microsemi diodes are typically 260 °C for 10 seconds maximum. Solder profiles will generally be much lower and shorter in time than these maximums when using commonly used solders such as 63/37% Sn/Pb, 60/40% Sn/Pb, or 62/36/2% Sn/Pb/Ag. Actual time and temperature is determined by overall thermal mass of PC boards and components along with considerations of other component sensitivity. For most through-hole axial lead devices, the body does not directly see these temperature-time extremes, however surface mount (SM) do. Common surface mounting processes used in the industry are accomplished by using convection or infrared belt furnace, vapor phase reflow, or wave soldering equipment. Microsemi surface mount devices may be mounted with any of these methods except for the Powermite. Due to its design geometry, it may not be mounted with the wave solder technique unless the wave is under the board and the Powermite is on top of the board. All other SM packages may be affixed temporarily to the circuit board with a fast curing adhesive system between package body and board (separate from the defined solderable footprint) to accommodate soldering. Examples include the DO-214 and DO-215 variants as well as the double-slug surface mount MELFs such as the DO-213AA or DO-213AB round-end-cap or the tungsten slug hard glass square-end-cap MELF products. In these examples where the body is suddenly exposed to soldering temperatures (such as in wave soldering), it is recommended that a preheat step be included that is within 100 C of the final soldering temperature to minimize thermal shock effects on the body of the device. For frequently used convection or infrared belt furnaces, a temperature versus time profile is also shown in Figure 1 for the higher temperatures now used for RoHS Compliant components using solders at the PC board level that are Lead (Pb) free. This also includes considerations for the previously described component ratings of 260C for 10 seconds maximum with product terminals typically having a matte-Tin plating finish.

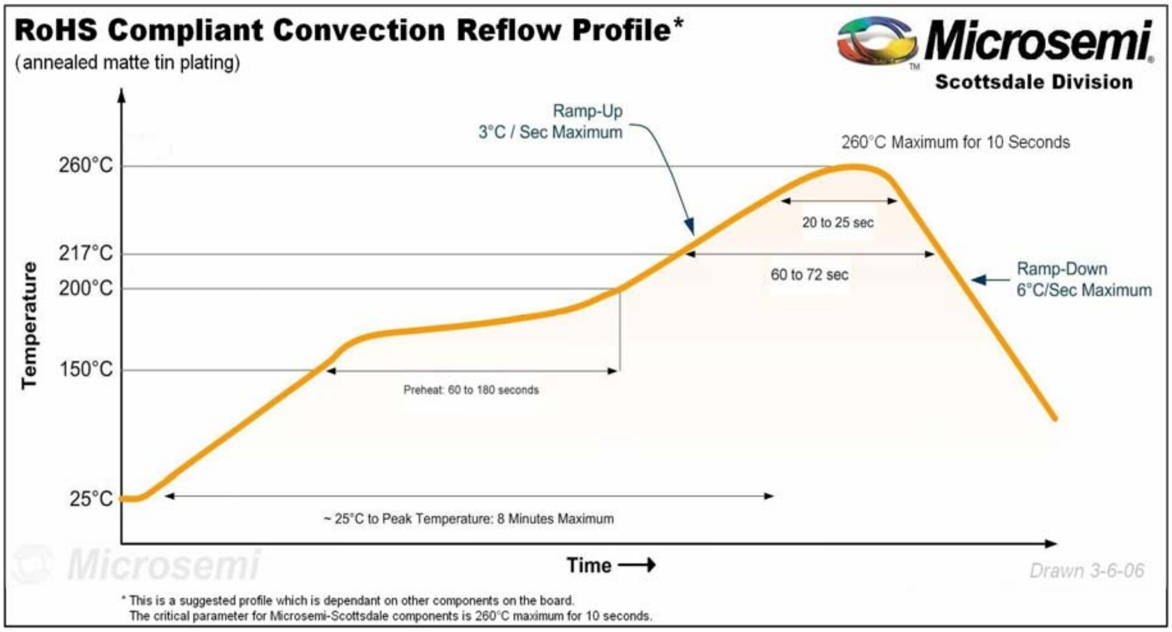


**FIGURE 1.**

5. If PC Board level coatings are used after solder mounting, they should be carefully selected to avoid stressing components particularly glass body designs. When used they should be silastic or pliable to minimize stresses that may be induced by differences in coefficient of expansion or other transmitted forces imparted from PC Board flexure. Rigid epoxy coatings have for example been known to crack glass body devices including those board coatings applied in a relatively thin layer. This may be partly stimulated by stresses imparted on a device when rigid coatings are placed in the narrow standoff relief space between the PC Board and a glass body diode.