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CARE, HANDLING AND SOLDER PROFILE OF DIODES

1. Microsemi zeners, temperature compensated reference diodes, transient voltage suppressors, and most rectifiers are typically ESD nonsensitive up to 15,999 volts per the Human Body Model (HBM) test as defined in MIL-STD-750 Method 1020 and other similar specifications. Therefore special handling or packaging conditions are not required in those examples. Schottky rectifiers of 1 Amp minimum ratings and many lower power signal or switching diodes using very small die elements can be sensitive in the range of 4000 to 15,999 volts when referencing the HBM test. As described in the MIL-PRF-19500 specification Appendix E, this makes them class 3A or 3B devices. Lower current rated Schottky rectifiers of smaller size will have correspondingly lower classifications and greater ESD sensitivity where special handling is very important particularly for class 1A. These diode ESD classifications are also now shown for qualified military devices in QPDSIS-19500. Any products that are classified as sensitive (0, 1A, 1B, 1C, 2, 3A, or 3B) require special handling per JESD-625.

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}) transient 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 the active p-n junction size for semiconductor devices. For other general handling including automated test equipment, it should be noted that transients can also be generated by poor contact to the for the device under test (DUT) with 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 and cleaning) where poor electrical continuity may occur. If the DUT have tarnished leads from other prior high temperatures 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 to the active die element for plastic 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 before the bend is made.

4. The maximum soldering temperature and times for Microsemi diodes are typically 260°C for 10 seconds maximum. 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. Many of the Microsemi surface mount devices may be mounted with any of these methods except as follows: For Powermite, PLAD, and Thinkey packages, they may not be mounted with the wave solder technique unless the wave is under the board and the package is on top of the board. Also for UB, UA, and U packages, the 260°C temperature maximum restrictions are particularly important since the lid seal uses Au20Sn that reflows at 280°C. Also never touch a soldering iron tip to the top (lid) of these type packages or use a solder wave that may also damage the lids. 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 including wave soldering. Examples include the DO-214 and DO-215 variants as well as double slug surface mount MELFs such as the DO-213AA or DO-213AB round-end-cap or tungsten slug hard glass

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.

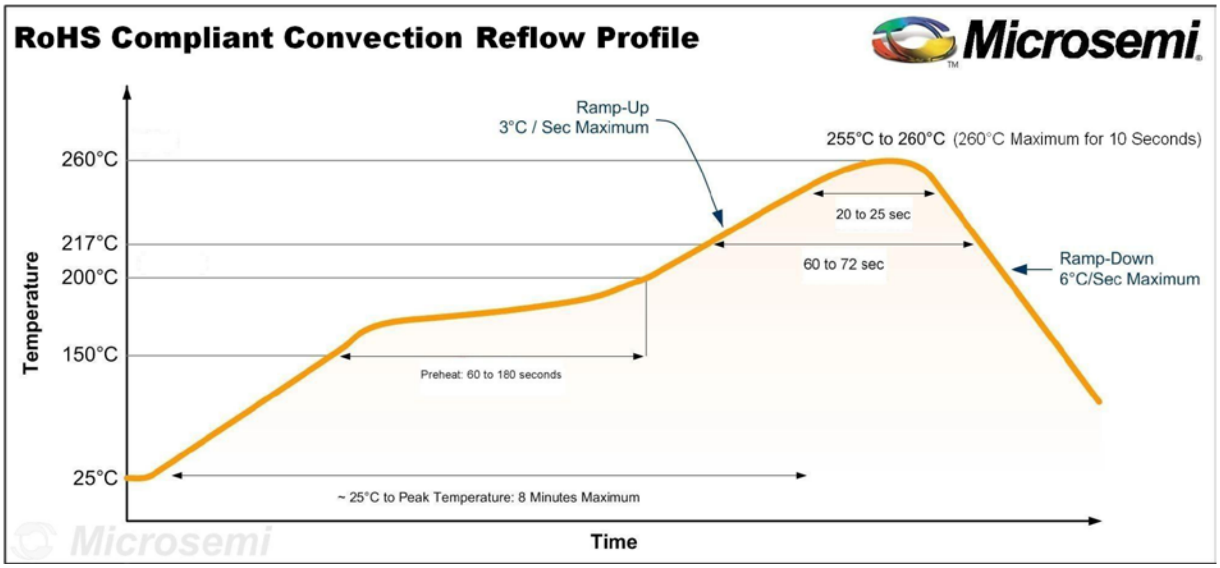

FIGURE 1

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 260°C for 10 seconds maximum with products terminals typically having a matte-tin plating finish.

5. If PC board protective (conformal) coatings are used after solder mounting, they should be carefully selected to avoid stressing components particularly glass body designs. When used, the material 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 in a device when rigid coatings are placed in the narrow standoff relief space between the PC Board and a glass body diode. This subject is also further covered in MicroNote 006 particularly for glass surface mount products.

6. Soldering guidelines for glass MELF diodes is further described in MicroNote 006.