A Note on Hybrid Enclosure Materials of Construction and their Finishes

MDI's product lines encompass both solder sealed and parallel seam welded hermetic enclosures for DC-DC converters, Inrush Limiters, Active OR-ing and Bus Master modules and Solid State Relays. Hermetic construction means glass or ceramic to metal seals are used exclusively at the pin interfaces and the enclosures are permanently closed by intermetallic soldering or welding to seal them from environmental influences. No elastomers, adhesives, o-rings or gaskets are used. Leak rates attained are less than 5e-8 He and the construction is robust enough to maintain hermetic integrity through qualification life, vibration, shock, acceleration and thermal cycling endurance testing (QCI) provided the seals remain undamaged.

Headers are manufactured from cold rolled steel for its comparative advantage in thermal conductivity (Kovar, Alloy 42 case style 1), and electro plated in nickel followed by gold. The mounting surface is flat to .005-inch total indicator reading and its surface roughness (Ra) is 63 or better. These specifications demonstrate the need for very little (thin- section amount) of gap filler when the host heat sink is constructed to similar specifications.

Pins are generally made from Alloy 52. Those used in larger case styles (4, 7, 9, 11) are copper cored. Pins are .040 inch diameter straight types (.018 dia. case styles 1, 14, 15). Pins are finished in electrolytic gold (50 µ in.) over nickel. The use of gold plating ensures excellent solderability even under extended storage in humid environmental conditions.

Solder Sealed Devices

Solder sealed converters are constructed on platform headers with a sealing ring of solder flowed continuously about the perimeter of a drawn cover. Platform headers are exclusive to the PC mounting orientation, where pins exit the bottom of the enclosure for insertion into a through-hole PWB design. MDI case styles 1-4, 10 and 11 refer. Mounting flanges and non-flanged versions to save PWB surface area are available. In either case, compression should be maintained to the manufacture's specification for the gap filler material selected. Non-flanged versions may be mounted using thermally conductive adhesives or captured using mechanical compression assembly mounting techniques. Flanged parts should be assembled with locking hardware that compensates for pressure variation during applications of extreme or repetitive thermal cycling. Stud mounted case styles combine PWB area savings and easily implemented thermal management in rugged, vibratory environments; use locking fasteners and torque them to 8 ±1 in lb. Covers for solder sealed devices are drawn from steel (Kovar, Alloy 42 case style 1) and finished in tin/lead electroplating. A 5 percent minimum lead (Pb) content is specified to preclude the formation of whiskers or dendrites. Periodic lot testing using EDX /EDS techniques

monitors Pb content compliance. Solders used in sealing are lead bearing SN63 types; fluxes are not added during the process.

Parallel Seam Welded Devices

Seam welded converters offer the ultimate in sealing technique and cleanliness and are preferred for aerospace and space applications. In this construction, a flat lid is resistance welded to a deep walled header itself constructed from a machined billet of cold rolled steel. PC (flanged and non-flanged case styles 5-7, 13, 14) and stud mounting (style 12) and chassis mounting versions (styles 8, 9, 15) are available. The same flatness, smoothness, finish and plating schedules are followed as discussed above so similar mounting notes apply. Chassis mounting offers the advantage that the converter's dissipation may be conducted directly into the host equipment frame without additional heat sink interfaces. Coordinated flatness and smoothness schedules for the host heat sink area should be applied. Chassis mount devices feature very rugged ceramic pin seals for crack-free, fracture-free, leak-free performance even as the pins may be stressed during lead forming/cutting or soldering/connecting operations.

Soldering and Wiring MDI DC-DC Converters

Devices pass Soldering Heat requirements of MIL-STD-750, Method 2031, Test Condition A - Solder Iron 350 ±10°C tip temp. for 4-5 seconds. This is the identical test to MIL-STD-883, Method 2036, Condition A.

Soldering and wiring converters is discretionary among users; following industry proven best practices help insure longevity and reliability in mission life.

While it is common to use wave or flow soldering in PWA fabrication, it is best to avoid these techniques when mounting and wiring MDI DC-DC converters. Temperatures reached at the pins in such processes may exceed those of the materials of construction inside the converter. Circuits internal to the hybrids are brought to the pins using 221°C eutectic solder and flexible stress relieved wired connections. Selection of 221°C eutectic offers a degree of margin against reflow during soldering operations outside the hybrid; hand soldering techniques with controlled heat application and 183°C eutectic is the preferred method.

Direct hand soldering the converter pins to pads in PC mount applications is common, especially among users of case styles 1 and 14 (.018 pins), where the relatively small diameter pins heat quickly and solder easily. When soldering larger converters with .040 pins, however, the advantage is not as clear-cut. Better heat control is needed due to longer dwell times necessary to heat the thicker pin, there is more solder volume and a larger PC pad involved as well. The resultant joint is more massive and has a larger bearing

in coefficients of thermal expansion effects of the various materials involved in reliability life performance during thermal cycling applications.

The optimum connection scheme in MDI's view is to replicate similar connection architecture outside the converter as is used inside the converter: flexible, stress- relieved wiring. For connecting pins on chassis mount hybrids, we recommend following guidelines of IPC J-STD-001, Para. 5.4.2 wiring to terminals including stress relief of Para. 5.4.1.3 and orientation of wire lead/wrap of Para. 5.4.1.4. When connecting PC mount hybrid pins to PC pads, follow the same guidelines, wrapping the pin and continuing the wire onto the pad with stress relief making two independent solder connections with flexible, stress relieved wiring in between.

Pins may be trimmed (cut) after installation. Use sharp, high quality flush cutters and make two cuts using gentle, even pressure; the first a partial cut though, the second with a 90 degree rotation to finish. This mitigates vibration and shock effects of a single brute- force stroke on the seals. It also helps prevent the spent lead from flying wild after the cut and becoming lost FOD in the assembly. If your requirements dictate special lead lengths or lead forms, ask the factory; we can tailor to suit.