Mounting for Through-hole Components

General

All through-hole or leaded styles fall into two general classes. The first is provided with leads extending from opposite ends of the body, generally along the principle axis of the body (“axial leads”). The second is provided with parallel leads extending from one side or face of the body (“radial leads”). With both type, mounting points are normally provided by the leads themselves.

Axial leads may be used for point-to-point wiring, but usually, the wires are bent at 90° from the capacitor axis for insertion through printed circuit (PC) boards. Axial capacitors supplied on reels for machine insertion will withstand the mechanical stresses of bending and inserting. The Vishay axial series may be supplied on reels to feed such machines. Radial leads are intended to plug directly into holes of PC boards. Auto-insertion machines will insert compatible radial capacitor designs, and most Vishay capacitors may be supplied in appropriate reeled forms.

With either axial or radial types, attention should be paid to treatment of the capacitors during mounting and afterward under service conditions. Difficulty during mounting usually arises from lead damage or from overheating. The hand soldering technique or more often, wave-soldering machines can cause overheating. The internal cathode connection on most solid tantalum through-hole series is made between solder and a silver-pigmented paint. If too much heat is applied, this solder may reflow and degrade the silver-solder interface or cause a direct short circuit.

Vishay’s hermetically-sealed series has an internal space into which molten cathode solder may run, depriving the cathode connection and possibly flowing across the terminals to short circuit the capacitor from the inside. It is also possible to remelt or reflow the solder which bonds the rim of the glass-metal seal, causing loss of hermeticity and possibly a short circuit. Finally, solder at the exit point of the positive wire may be re-melted with-similar effect. This solder however, is a high-temperature alloy, and it is much less likely to be melted. Redipping of leadwires is practiced by some users, introducing another hazard of re-melting this solder. Vishay recommends that redipping or hot solder dipping of any tantalum capacitor be performed by our factories under controlled conditions.

Molded series have only one site of solder, the internal cathode connection. The rate of heat transfer through the plastic is lower than through the metal can of our hermetic styles. However the opportunity for temperature transfer or conduction along the negative lead-wire to re-melt this solder is very similar. There is little internal void within molded cased capacitors, so re-melted solder tends to remain in its original location and solidify when heat is removed. Short circuiting is very unlikely, but reliability of the internal connection may be compromised by leaching of silver from the paint into the molten solder. The latter effect degrades the cathode connection in hermetic parts as well.

Lead Forming

While we will provide some general guidelines for bending leads, more specific details are outlined in J-STD-001. The positive or anode lead bend must be a minimum of 0.050" from the case or from the external weld connection. If the part has a hermetic (glass-to-metal) seal, do not bend, cut, or disturb the tube between the weld and the glass seal. The cathode lead bend must be a minimum of 0.050" from the case.

Solder Heat Test

All through-hole capacitors will pass the Resistance to Soldering Heat Test of MIL-STD-202, Method 210, Condition B. This test dips each lead-wire into molten solder at + 260 °C for 10 s while the capacitor body is held vertically above the solder. Vishay capacitors will pass this test when the depth of immersion brings the capacitor body (or closest external solder joint, if it is closer as in some hermetic styles) to a minimum distance of 0.100" from the solder surface. This demonstration of resistance to solder heat is in accordance with what is believed to be the industry standard. More severe treatment must be considered reflective of an improper soldering process.

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Solder Profile

Shown below is a recommended solder wave profile for both axial and radial through-hole solid tantalum capacitors.