

TECHNICAL PAPER

Aluminum Electrolytic Capacitor Holder for Ruggedized Automotive Applications

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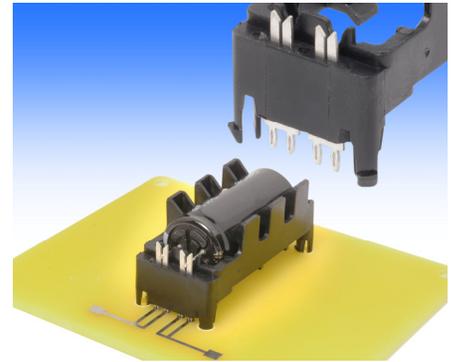


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By: Tom Anderson, KYOCERA AVX Components Corporation

Harsh environments such as automotive and industrial applications can be very demanding on larger electronic components, which are exposed to severe shock and vibration requirements. In order to protect these components, extra attention and most often times cost needs to be devoted to the processing and mechanical attachment within the device to the Printed Circuit Board (PCB).

In this specific case, the challenge was to develop a reliable and cost effective solution to terminate an 18mm diameter aluminum electrolytic capacitor to the PCB which would meet critical automotive testing and environments. The goals in this application included;



1. Develop a mechanical holder that would securely hold and electrically connect the capacitor to the PCB while providing mechanical attachment of the completed module to the PCB which will meet specified drop, impact and vibration testing
2. Develop a contact system for both the capacitor and PCB terminations which will meet specified electrical and environmental testing
3. Provide a simplified assembly process for the completed module, which can be applied after the reflow process. As a note, the capacitor cannot be exposed to the elevated temperatures of the RoHS soldering process.

The solution was to identify the contact system, as this would become the heart of the entire module. To do this, AVX Interconnect combined two contact technologies with over twenty years of industry experience. This marriage of a press-fit compliant pin for the PCB and Insulation Displacement for the capacitor leads would be able to meet all of the goals outlined above. Both of these contact systems have been qualified and used in multiple automotive connectors over recent years. Here is a quick overview of each technology;

Press-Fit

The eye-of-the-needle compliant pin has been in production since the mid-1970's. The updated hourglass shaped compliant section was specifically developed for the automotive industry to better distribute the stress over the entire length of the press-fit section. This resulted in lower PCB stress, enlarged contact area and increased tolerance accommodation in the plated through hole. During optimization of the hourglass cross section, special care was taken to produce minimum insertion force with maximum retention force across the entire spectrum of plated through hole diameters. Specific advantages include;

- a. 100% elastic press-fit cross section
- b. Automotive shock and vibration performance
- c. Selective plating
- d. Low transition voltage

Insulation Displacement

Insulation Displacement Connectors (IDC) have been around since the early 1980's. As the name implies, a phosphor bronze contact would pierce the insulation of a wire, wedging the core conductor(s) into the "V" slot of the contact to create a gas-tight connection. The only difference with the capacitor holder is that there is no insulation on the leads of the capacitor. The primary purpose of the insulation in a traditional IDC wire termination is to provide a strain relief to protect the contact integrity when there is pulling or bending forces applied to the wire. When used within the holder, the capacitor is held firmly within a retention cradle that immobilizes the capacitor and thus protecting the integrity of the gas-tight termination. The use of IDC style connectors today span a broad range of sizes and requirements for automotive and harsh environments, these include;

1. 14AWG to 28AWG
2. 1 AMP to 15 AMPS
3. Solid Wire
4. Stranded Wires

The next step was to develop the robust plastic housing that would retain the contacts and capacitor in a single module that could be cost effectively pressed into the PCB. A 30% glass-fiber reinforced polybutylene terephthalate (PBT) thermoplastic polymer was selected because of its mechanical strength and heat resistance characteristics. Integrated into the molded housing are very special features that are critical to meeting the final mechanical performance criteria of 1.2m drop test, 50g's impact test and temperature based vibration testing. These include;

1. Third generation retention cradle that holds and supports the electrolytic capacitor
2. Enhanced PCB location pegs that provide instant mechanical attachment to the PCB while absorbing normal PCB fabrication tolerances.
3. Stand-offs which allows component placement underneath the module
4. Open ended back end to accept up to a 60mm long capacitor
5. Support/location rib adds strength during impact tests in the capacitors cylinder axis

The final product was then tested and passed a battery of automotive level mechanical and environmental testing to confirm compliance to the goals set by our customers. This final qualified product will now become a standard offering from AVX Interconnect.



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