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## Polymer Termination for Y5V and Z5U Ceramic Multilayer Capacitors

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### 1. What is Mechanical Cracking?

Due to its brittle nature, multilayer ceramic capacitors are more prone to excesses of mechanical stress than other components used in surface mounting. One of the most common causes of capacitor failures is directly attributable to bending of the printed circuit (PCB) after solder attachment. Excessive bending will create mechanical crack(s) within the ceramic capacitor. Mechanical cracks, depending upon severity, may not cause capacitor failure during the final assembly test. Over time moisture penetration into the crack can cause a reduction in insulation resistance and eventual dielectric breakdown leading to capacitor failure in service.

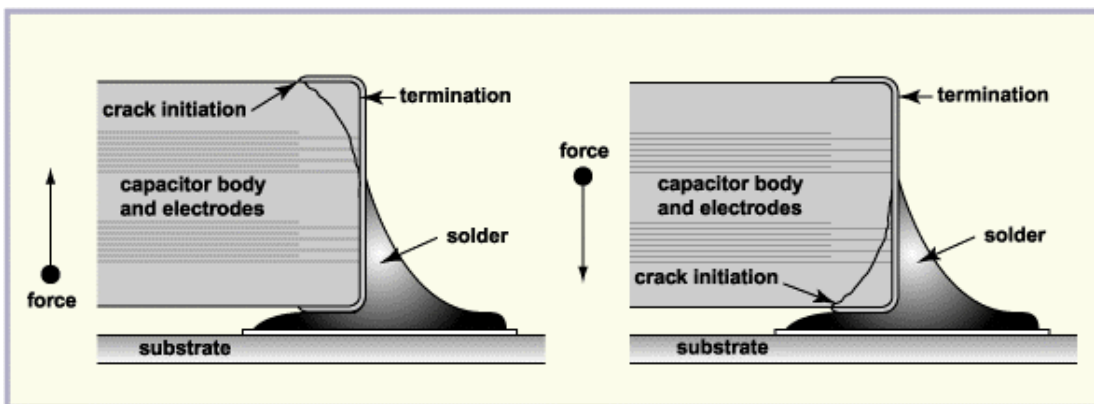


Figure 1. Mechanical Crack

2. Polymer Termination helps to Prevent Mechanical Cracking.

In order to reduce the possibility of mechanically cracking multilayer ceramic capacitors, Novacap has qualified polymer termination on all of its dielectric offerings for surface mount applications, and it is the termination of choice for high capacitance value Class III Y5V and Z5U multilayer chip capacitors as well as all high board stress applications. This termination is a silver loaded epoxy polymer that is flexible and absorbs some of the strain between the substrate and the ceramic capacitor. The termination is applied using conventional termination techniques, but instead of being sintered at approximately 800°C, the polymer is cured at 180°C. The polymer material has very good adhesive and conductive properties that are obtained after curing. After the termination process stage, the capacitors are plated with Nickel and overcoated with Tin or Tin / Lead using the same methods as the industry standard sintered Silver terminated capacitors.

3. Standard versus Polymer Termination Comparative Data for Surface Mount Applications.

Polymer Termination has been qualified for use in Y5V and Z5U and is the preferred termination of choice for new and existing applications due to the added robustness and reliability that the polymer affords. Below are key comparative test results demonstrating differences between standard Silver terminated and Polymer terminated multilayer chip capacitors.

a) Mechanical Bend Test

| <b><i>TERMINATION TYPE</i></b> | <b><i>MEAN BEND DEFLECTION (mm)</i></b> |
|--------------------------------|---|
| Standard Silver                | 3.4                                     |
| Polymer                        | 6.5                                     |

The bend tests conducted have demonstrated that Polymer termination withstands almost twice the level of mechanical stress before mechanical cracking has begun.

b) Operation Life Test

Typical operation life data at 90% confidence are listed below for a typical component at 10 VDC rating and 50°C temperature.

| <b><i>Termination type</i></b> | <b><i>%FR @ 90% CL</i></b> | <b><i>fit</i></b> | <b><i>mtbf</i></b> |
|--------------------------------|----------------------------|-------------------|--------------------|
| Standard Silver                | 0.000275                   | 2.75              | 3.63E+08           |
| Polymer                        | 0.000127                   | 1.27              | 7.87E+08           |

c) Solderability of Termination

*Condition:* Immerse the capacitor into Kester 135 flux and then into solder at a speed of 1 inches per second at 245°C, +/- 5°C, and hold submerged for five seconds. Retrieve unit and allow cooling in air. Rinse in Isopropyl alcohol and dry.

*Specification:* Solder covers more than >95% of the external termination area, evenly and continuously.

| <i>NO</i> | <i>RESULTS</i> |
|-----------|----------------|
| 1         | Pass           |
| 2         | Pass           |
| 3         | Pass           |
| 4         | Pass           |
| 5         | Pass           |
| 6         | Pass           |
| 7         | Pass           |
| 8         | Pass           |
| 9         | Pass           |
| 10        | Pass           |

d) Resistance to Soldering Heat

*Condition:* Preheat the capacitor between 100 and 120°C for 1 minute, and then, between 170 and 200°C for 1 minute. Immerse the capacitor in SN60 solder solution at 260°C for 10 seconds.

*Pre-treatment:* Store at 150°C for 1 hour, and then, place at room condition for 24 hours.

*Post-treatment:* Place at room condition for 24 hours.

| <i>No</i> | <i>Capacitance</i> | <i>Dissipation Factor</i> |
|-----------|--------------------|---------------------------|
| 1         | Pass               | Pass                      |
| 2         | Pass               | Pass                      |
| 3         | Pass               | Pass                      |
| 4         | Pass               | Pass                      |
| 5         | Pass               | Pass                      |
| 6         | Pass               | Pass                      |
| 7         | Pass               | Pass                      |
| 8         | Pass               | Pass                      |
| 9         | Pass               | Pass                      |
| 10        | Pass               | Pass                      |

4. Ordering Information.

| 1206        | Y                                       | 104   | M  | 250                                    | N   | X   | T                              | M                            |
|-------------|---|---|--|--|---|---|--------------------------------|------------------------------|
| <u>Size</u> | <u>Dielectric</u><br>Z = Z5U<br>Y = Y5V | <u>Capacitance</u><br>Value in<br>picofarads:<br>104 =<br>100,000pF | <u>Tolerance</u><br>M = $\pm 20\%$<br>Z = +80%,-20%<br>P = +100%,-0% | <u>Voltage</u><br>VDCW<br>250 =<br>25V | <u>Termination</u><br>C = polymer<br>with nickel<br>barrier (100%<br>tin)<br>D = polymer<br>with nickel<br>barrier (90%tin<br>/10%lead) | <u>Special</u><br><u>Thickness</u><br><u>Option</u> | <u>Packaging</u><br>T = reeled | <u>Marking</u><br>M = marked |

For questions or quotation please contact Novacap Sales department.