KEMET is the undisputed global leader in delivering high-performance ceramic and tantalum capacitors. Our Space, Avionics & Defense Grade products comply with the most stringent reliability requirements in the industry.
# High Reliability Ceramic Capacitors

**COTS MLCCs**

<table>
<thead>
<tr>
<th>Test Level A</th>
<th>Test Level B</th>
<th>Test Level C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Conditioning</td>
<td>Voltage Conditioning</td>
<td>Voltage Conditioning</td>
</tr>
<tr>
<td>DW</td>
<td>IR @ 25°C</td>
<td>IR @ 25°C</td>
</tr>
<tr>
<td>PDA</td>
<td>PDA</td>
<td>PDA</td>
</tr>
<tr>
<td>C of C</td>
<td>DPA</td>
<td>DPA</td>
</tr>
</tbody>
</table>

**Space Grade MLCCs**

- **MIL-PRF-123**
  - Intensive screening and testing protocols with numerous termination options.
  - **GR-900**
    - KEMET's non-QPL high-reliability capacitors for aerospace applications.

- **MIL-PRF-323535**
  - X7R, C0G, and BP surface mount capacitors are designed, tested, and screened to meet demanding high-reliability, defense, and aerospace application requirements. These series are qualified under specification MIL-PRF-323535 and are QPL listed. They also meet or exceed the requirements outlined by DLA and are currently available in M (standard reliability) and T (high reliability) product levels.

**KPS MIL Stacked Capacitors**

- **MIL-PRF-49470**
  - T-Level Reliability available Higher capacitance in the same footprint Robust termination system.

**High Reliability Alternative (HRA)**

- High Reliability Alternative (HRA) - Designed, tested, and screened to meet the demands of higher reliability applications that require capacitance values not available in traditional MIL-SPEC products.

# High Reliability Tantalum Capacitors

**MIL-PRF-32700**

- **MIL & Space Grade**
  - KEMET’s T560 and T581 series polymer electrolytic capacitors are in support of the newly released MIL-PRF-32700. Preliminary datasheets are available upon request.

**T560 & T541 Polymer HRA**

- **DLA Drawing 04051/2**
  - This series is currently the only polymer electrolytic capacitors available today with Reliability Assessment testing criteria, which allows for a Failure Rate grading. F-Tech and SBDS are also available upon request using a customer source control drawing (SCD).

**F-Tech Advantage**

KEMET's optional F-Tech eliminates hidden defects in the tantalum dielectric. This unique manufacturing process minimizes oxygen and carbon content in the anode, provides a stronger mechanical connection between anode and lead wire and significantly enhances capacitor robustness.

F-Tech is available on select KEMET tantalum capacitor families and can be combined with SBDS.

**Simulated Breakdown Screening (SBDS)**

Breakdown voltage (BDV) is the ultimate test of a capacitor’s robustness but is a destructive test. To simulate the results of a breakdown screening, KEMET developed a patented Simulated Breakdown Screening (SBDS). This nondestructive testing technique simulates the BDV of a capacitor without damage to its dielectric. This 100% population screening identifies hidden defects in the dielectric, providing the highest level of dielectric testing.

SBDS is available on select KEMET tantalum capacitor families and can be combined with F-Tech.

**Tantalum Stacked**

- **Polymer (TSP) / MnO₂ (TSM)**
  - KEMET’s Tantalum Stack Polymer [TSP] Electrolytic Capacitor is designed to provide the highest CV (capacitance/voltage) ratings in a surface mount configuration.

**Polymer Hermetic Seal T550/1**

- **DLA Drawing 13030, T-Level Reliability**
  - High capacitance, low ESR, lightweight alternative to wet tantalum axial capacitors.
  - Based on polymer cathode technology.

**MIL-PRF-55365 MnO₂**

- **MIL & Space Grade**
  - Numerous custom testing/screening options and termination finishes available.
## Tantalum Space, Avionics & Defense Capacitors

### QPL (Qualified Product Listing)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td></td>
<td>GR500</td>
<td>T210/T220/T240</td>
<td>★ ● ● ● ■</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 39003</td>
<td>CSS11/33</td>
<td>MIL-PRF-39003/10</td>
<td>T216/T226</td>
<td>★ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 39003</td>
<td>CSS12/33</td>
<td>MIL-PRF-39003/12</td>
<td>T212/T215</td>
<td>★ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 39003</td>
<td>CSS13</td>
<td>MIL-PRF-39003/13</td>
<td>T222/T225</td>
<td>★ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 39003</td>
<td>CSS14</td>
<td>MIL-PRF-39003/14</td>
<td>T242/T245</td>
<td>★ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 39003</td>
<td>CSS15</td>
<td>MIL-PRF-39003/15</td>
<td>T213</td>
<td>★ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 39003</td>
<td>CSS16</td>
<td>MIL-PRF-39003/16</td>
<td>T252/T255</td>
<td>★ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 39003</td>
<td>CSS17</td>
<td>MIL-PRF-39003/17</td>
<td>T262</td>
<td>★ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 69137</td>
<td>CX01</td>
<td>MIL-PRF-69137/1.5</td>
<td>T323</td>
<td>★</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 69137</td>
<td>CX02</td>
<td>MIL-PRF-69137/2</td>
<td>T363/T369</td>
<td>★</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
<tr>
<td>QPL 69137</td>
<td>CX06</td>
<td>MIL-PRF-69137/6</td>
<td>T376</td>
<td>★</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>○ ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
<td>● ● ● ● ●</td>
</tr>
</tbody>
</table>

### Terminology Guide

- **C-SAM**: C-Mode Scanning Acoustic Microscopy (ceramic only)
- **DPA**: Destructive Physical Analysis
- **DWV**: Dielectric Withstanding Voltage (ceramic only)
- **ESR**: Equivalent Series Resistance (ESR) is the preferred high-frequency statement of the resistance unavoidably appearing in these capacitors. ESR is not a pure resistance, and it decreases with increasing frequency.
- **F-Tech**: KEMET’s optional manufacturing process to eliminate hidden defects in the tantalum dielectric (tantalum only). For more information, please see page 7.
- **PDA**: Percent Defective Allowed
- **Polymer Reliability Assessment Method**: Sample test under accelerated conditions to demonstrate long-term device reliability (polymer only). Please contact KEMET for details.
- **SBDS**: KEMET’s patented nondestructive testing technique which simulates the breakdown voltage of a capacitor without damage to its dielectric (tantalum only). For more information, please see page 7.
- **Thermal Shock**: Parts are temperature cycled.
- **Voltage Conditioning**: Parts receive a voltage conditioning at X rated voltage and X°C for a minimum and maximum amount of hours (ceramic only).
# Ceramic Space, Avionics & Defense Capacitors

QPL (Qualified Product Listing) | Style | MIL-PRF/DLA/KEMET Specification | KEMET Series |
---|---|---|---|
QPL M123/1, 2, 3 | CK05, CK06, CK07 | MIL-PRF-123/1, 2, 3 T Level | C052, C062, C072 |
QPL M123/10, 11, 12, 13, 21, 22, 23 | CK055, CK056, CK057 | MIL-PRF-123/10, 11, 12, 13 T Level | C0552, C102, C1052, C122T |
QPL M123/21, 22, 23 | CK055, CK056, CK057 | MIL-PRF-123/21, 22, 23 T Level | C1206, C1212, C12152 |
M32535/02/03/04/05/06/07/08 | N/A | MIL-PRF-32535 T Level | K Spec - T Failure Rate |
M32535/02/03/04/05/06/07/08 | N/A | MIL-PRF-32535 M Level | K Spec - M Failure Rate |
N/A | BGR050 | B Spec Through-Hole |
N/A | GMR050 | A Spec SMD |
N/A | GMR050 | A Spec Through-Hole |
N/A | PS01 | MIL-PRF-49470/1 T Level | L1XN, L1RN, L1QN |
N/A | PS01 | MIL-PRF-49470/1 B Level | L1XN, L1RN, L1QN |
QPL 55681/1 | CDR01, 02, 03, 04 | MIL-PRF-55681/1 M, P, R, S Level | C0805P, C1805P, C1808P, C1812P |
QPL 55681/2 | CDR05 | MIL-PRF-55681/2 M, P, R, S Level | C2205P |
QPL 55681/3 | CDR06 | MIL-PRF-55681/3 M, P, R, S Level | C2205P |
QPL 55681/7, 8, 9, 10, 11 | C0103, 32, 33, 34, 35 | MIL-PRF-55681/7, 8, 9, 10, 11 M, P, R, S Level | C0855N, C1206N, C1210N, C1212N, C1215N |
QPL 20/35 | CCR05 | MIL-PRF-20/35 | C052G, C065G |
QPL 20/36 | CCR06 | MIL-PRF-20/36 | C062G, C065G, C066G |
QPL 20/36 | CCR06 | MIL-PRF-20/36 | C062G, C065G, C066G (no FR) |
QPL 20/36 | CCR06 | MIL-PRF-20/36 | C062G, C065G, C066G (no FR) |
QPL 20/37, 38 | CCR/07, 08 | MIL-PRF-20/37, 38 | C220G, C222G |
QPL 20/37, 38 | CCR/07, 08 | MIL-PRF-20/37, 38 | C220G, C222G (no FR) |
QPL 39014/1 | CDR05 | MIL-PRF-39014/1 | C052T, C065T |
QPL 39014/5 | CDR06 | MIL-PRF-39014/5 | C062T, C065T |
N/A | CDA05, CDA06, CDA07 | MIL-PRF-10105/18, 76/20 | C052K, C062K, C142K, C142K, C162K, C222K |
N/A | HRA X Level*** | CHA07, CHA08, CHA09, CHA20, CHA31, CHA41 |

Note: All series are tested for capacitance, dielectric withstanding voltage, insulation resistance at room temperature, and dissipation factor.

**KEY**
- **Standard**
- **Optional**
- **JAN Branding will be affected**
- **S Failure Rate**

Optional tests performed on military specification parts will affect JAN branding.

* Non-stocking item

** MIL-PRF-55681 Group A Tested. BME Dielectric, PME also available on select part numbers.

*** Pending Release