PME CAPACITORS
Extended Range For SPACE APPLICATIONS
NASA SPEC S311-P-829

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WHY A NEW SPEC.?  

**NEED FOR:**

A. LIGHTER/SMALLER CAPS  
(0402 min. versus 0805 min. Planning 0201 for 2014)

B. LOWER VOLTAGE  
(5 V min. versus 50 V min.)

C. LOW INDUCTANCE  
(reverse geometry)

D. MORE CAPACITANCE per case size
<table>
<thead>
<tr>
<th>Voltage</th>
<th>0402</th>
<th>0403</th>
<th>0504</th>
<th>0603</th>
<th>0805</th>
<th>1206</th>
<th>1209</th>
<th>1712</th>
<th>1725</th>
<th>2225</th>
<th>DT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Volt</td>
<td>0.01</td>
<td></td>
<td></td>
<td>0.22</td>
<td>1</td>
<td>1.8</td>
<td>2.7</td>
<td>4.7</td>
<td></td>
<td></td>
<td>0.3</td>
</tr>
<tr>
<td>16 Volt</td>
<td>0.0068</td>
<td>0.022</td>
<td>0.082</td>
<td>0.1</td>
<td>0.22</td>
<td>0.39</td>
<td>0.68</td>
<td>1.2</td>
<td>3.3</td>
<td>3.9</td>
<td>0.4</td>
</tr>
<tr>
<td>25 Volt</td>
<td>0.0047</td>
<td>0.015</td>
<td>0.047</td>
<td>0.027</td>
<td>0.1</td>
<td>0.27</td>
<td>0.47</td>
<td>1</td>
<td>2.2</td>
<td>3.3</td>
<td>0.8</td>
</tr>
<tr>
<td>50 Volt</td>
<td>0.0039</td>
<td>0.012</td>
<td>0.039</td>
<td>0.022</td>
<td>0.1</td>
<td>0.22</td>
<td>0.39</td>
<td>0.68</td>
<td>1.8</td>
<td>2.2</td>
<td>0.8</td>
</tr>
<tr>
<td>100 Volt</td>
<td>0.0012</td>
<td>0.0022</td>
<td>0.0068</td>
<td>0.0033</td>
<td>0.022</td>
<td>0.1</td>
<td>0.15</td>
<td>0.27</td>
<td>0.68</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

S-311-P-829 OFFERS MUCH WIDER RANGE OF PARTS THAN MIL-PRF-123
SMALLER CASE SIZES EVOLUTION OF 0.1 µF for SPACE

1980
1209
MIL-123

2003
0805
Presidio SCD

2006
0603
NASA SCD

2014
0402
NASA S-311
SMALLER CASE SIZES

(REDUCTION IN AREA)
(Capacitor + Mounting pads) for 0.1 µF

55681 50V (1209)  M123  50V (1209)  S311  50V (0805)  S311  10V (0603)  S311  10V (0402)
SPACE QUALIFIED PARTS

1) R&D on PME is active
2) We can go thin with PME
   Space: 7.5 µm – Commercial: 2 µm
3) We can test small parts (0201)
4) No compromise on the screening
   (Tougher than MIL-PRF-123)
   TOR COMPLIANT
R & D on PME is ACTIVE

- We are working with our suppliers which in many cases also supply the BME capacitor industry to improve dielectrics, grain size, metal powders, purity.

- Internally we are continuously optimizing our processes, design, tape casting, terminations, reduction of defects
I. DIFFERENT DIELECTRIC

*HIGHER K - X7R versus BX*

II. THINNER LAYERS

*7.5 µm AVAILABLE FOR SPACE APPS*
**Dielectrics: Characteristics**

<table>
<thead>
<tr>
<th></th>
<th>X7R</th>
<th>BX</th>
<th>NPO/BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>K (typical)</td>
<td>4000</td>
<td>2200</td>
<td>90</td>
</tr>
<tr>
<td>Q (typical)</td>
<td>60</td>
<td>100</td>
<td>1000</td>
</tr>
<tr>
<td>TC (-55/+125°C)</td>
<td>±15% max.</td>
<td>±15% max.</td>
<td>±30 ppm/°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LAYERS</th>
<th>DT (inches)</th>
<th>Grains per Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>G311P829BRX475L5N1</td>
<td>100</td>
<td>.0005</td>
</tr>
</tbody>
</table>
LOWER VOLTAGES

- MOST CIRCUITS WORK AT VERY LOW VOLTAGES
- NO NEED FOR THE 50 V min. OF M123
- 5, 6.3, 10, 16 and 25 V AVAILABLE WITH S311
LOW INDUCTANCE CASE SIZES for HIGH FREQUENCY APPLICATIONS

- NO REVERSE GEOMETRY AVAILABLE WITH M123

- 0306, 0508, 0612 AND 0912 HAVE BEEN ADDED TO S311.
We can go thin with PME (0.3 mil or 7.5 μm)

- M123 specifies 0.8 mil minimum but in practice the layers are much thicker (1.2 mils min)

- Started 10 years ago with a true 0.8 mil (0805 - 0.1 μF – 25 V)

- Currently – 0.3 mil (0805 - 1 μF – 10V)
NO SILVER MIGRATION ISSUE WITH LOW VOLTAGE LIFE TEST

TEST PERFORMED: 0603, X7R, 0.1 uF, 5V, Tin-Lead

- 1.5 V
- 4000 H
- 1300 pcs
- 125°C
- 0 failure

NO EVIDENCE OF SILVER MIGRATION WITH THIN LAYER PME
WE CAN TEST SMALL CASE SIZE DOWN TO 0201

THE FOLLOWING SCREENING IS ROUTINELY PERFORMED ON 0201:

- ULTRASONIC SCANNING
- VOLTAGE CONDITIONING
- LIFE TEST

We are working on adding 0201 0.01µF 10V to the S311 drawing
NO COMPROMISE ON SCREENING
TOUGHER TESTING than MIL-PRF-123

QUALIFICATION: more stringent than M123
(125 PC/4000 hr life test/0 Failures)

LOT TESTS:

**Group A:** (same as M123) PDA final 48 h Presidio counts all hard electrical failures towards final 48 hour & overall PDA

**Group B** Life Test Sample Size Based on Dielectric Thickness

ZERO FAILURES ALLOWED IN LIFE TEST
TOR COMPLIANT
For ALL our G311 parts from 2010 to 2013

<table>
<thead>
<tr>
<th>OPERATING TEMPERATURE</th>
<th>50 °C</th>
<th>85 °C</th>
<th>105 °C</th>
<th>125 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATING VOLTAGE</td>
<td>50% OF RATED</td>
<td>50% OF RATED</td>
<td>50% OF RATED</td>
<td>RATED</td>
</tr>
<tr>
<td>ACCELERATED HOURS</td>
<td>2.5 TRILLION</td>
<td>100.98 BILLION</td>
<td>15.98 BILLION</td>
<td>317 MILLION</td>
</tr>
<tr>
<td>FIT/FAILURE RATE</td>
<td>&lt;.0004</td>
<td>&lt;.01</td>
<td>&lt;.06</td>
<td>S LEVEL</td>
</tr>
</tbody>
</table>