FEATURES:
- Ultra High-Q and low ESR
- Extended working range for wireless products
- Extended battery life of portable devices

PART NUMBER DESCRIPTION

<table>
<thead>
<tr>
<th>Size</th>
<th>M</th>
<th>Series</th>
<th>Rated Voltage (VDC)</th>
<th>Dielectric</th>
<th>Capacitance</th>
<th>Tolerance</th>
<th>Termination</th>
<th>Packaging</th>
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<tbody>
<tr>
<td>0201</td>
<td>0402</td>
<td>0505</td>
<td>0603 (1608)</td>
<td>0805</td>
<td>1111 (2828)</td>
<td>M: Ultra High Q, Low ESR</td>
<td>N: NP0</td>
<td>0R1=0.10pF</td>
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<tr>
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<td>N: NP0</td>
<td>0R1=0.10pF</td>
<td>C=Cu/Ni/Sn</td>
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General Electrical Data

<table>
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<tr>
<th>Dielectric</th>
<th>NP0</th>
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<tbody>
<tr>
<td>Size</td>
<td>0201, 0402, 0505, 0603, 0805, 1111</td>
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<tr>
<td>Capacitance Range</td>
<td>0.1pF to 1.000pF</td>
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<tr>
<td>Capacitance tolerance</td>
<td>Cap≤5pF: A (±0.05pF), B (±0.1pF), C (±0.25pF)</td>
</tr>
<tr>
<td></td>
<td>5pF&lt;Cap&lt;10pF: B (±0.1pF), C (±0.25pF), D (±0.5pF)</td>
</tr>
<tr>
<td></td>
<td>Cap≥10pF: F (±1%), G (±2%), J (±5%)</td>
</tr>
<tr>
<td>Rated voltage (WVDC)</td>
<td>6.3V, 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V</td>
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<tr>
<td>Q</td>
<td>Cap≥30pF, Q≥1000</td>
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<tr>
<td></td>
<td>Cap&lt;30pF, Q≥400+20C</td>
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<tr>
<td>Insulation resistance (25°C)</td>
<td>≥10GΩ</td>
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<tr>
<td>Operating temperature</td>
<td>-55°C to +125°C</td>
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<tr>
<td>Temperature coefficient of capacitance</td>
<td>±30ppm/°C (±60ppm/°C for 0201 with values ≥22pF)</td>
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<tr>
<td>Termination</td>
<td>Ni/Sn (lead-free termination)</td>
</tr>
</tbody>
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### External Dimensions

<table>
<thead>
<tr>
<th>Outline</th>
<th>Case Size EIA (mm)</th>
<th>L (mm)</th>
<th>W (mm)</th>
<th>T (mm)</th>
<th>Soldering Method</th>
<th>M_B (mm)</th>
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<td>0201 (0603)</td>
<td>0.60 ±0.03</td>
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<td>0.30 ±0.03</td>
<td>R</td>
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<td>R</td>
<td>0.25 ±0.05/-0.1</td>
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<td></td>
<td>0505 (1414)</td>
<td>1.40 ±0.33/-0.25</td>
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<td>1.15 ±0.15</td>
<td>R/W</td>
<td>0.25 +0.25/-0.13</td>
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<tr>
<td></td>
<td>0603 (1608)</td>
<td>1.60 ±0.10</td>
<td>0.80 ±0.10</td>
<td>0.80 ±0.07</td>
<td>R/W</td>
<td>0.40 ±0.15</td>
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<tr>
<td></td>
<td>0805 (2012)</td>
<td>2.0 ±0.15</td>
<td>1.25 ±0.10</td>
<td>0.50 ±0.10</td>
<td>R/W</td>
<td>0.50 ±0.20</td>
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<tr>
<td></td>
<td>1111 (2828)</td>
<td>2.79 ±0.51/-0.25</td>
<td>2.79 ±0.38</td>
<td>1.78 max</td>
<td>R</td>
<td>0.38 ±0.25</td>
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</table>

### Thickness Codes/Packaging Quantity

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<thead>
<tr>
<th>Case Size</th>
<th>Size Code</th>
<th>Max Thickness (mm)</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Thickness (mm)</th>
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<th>Embossed Plastic Tape</th>
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<tbody>
<tr>
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<td>7&quot; Reel</td>
<td>13&quot; Reel</td>
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<tr>
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<tr>
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<td>1.30</td>
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<td>1.40 ±0.38</td>
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<td>15,000</td>
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<tr>
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<td>CD</td>
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<td>1.6 ±0.2</td>
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<td>0.8 ±0.2</td>
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<td>15,000</td>
</tr>
<tr>
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<td>DB</td>
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<td>0.6 ±0.1</td>
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<td>DE</td>
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<td>1.78</td>
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<td>2,000</td>
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### M SERIES ULTRA HIGH Q CAPACITOR SPEC

#### Rev. F

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<thead>
<tr>
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<th>0402</th>
<th>0505</th>
<th>0603</th>
<th>0805</th>
<th>1105</th>
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<tr>
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DC Volts

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<th>0805</th>
<th>1105</th>
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<tr>
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<td>25V</td>
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<td>BA</td>
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</table>

### Notes:

- 0201: 10, 25, 50, 100, 200, 500 VDC
- 0402: 10, 25, 50, 100, 200, 500 VDC
- 0505: 10, 25, 50, 100, 200, 500 VDC
- 0603: 10, 25, 50, 100, 200, 500 VDC
- 0805: 10, 25, 50, 100, 200, 500 VDC
- 1105: 10, 25, 50, 100, 200, 500 VDC

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**Frontier Electronics Corp.**

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667 E. Cochran St. Simi Valley, CA 93065

Phone: 1-805-522-9998, Fax: 1-805-522-9989
## M SERIES ULTRA HIGH Q CAPACITOR SPEC

### Rev. F

**Frontier Electronics Corp.**  
© 667 E. Cochran St. Simi valley, CA 93065  
Phone: 1-805-522-9998, Fax: 1-805-522-9989

### Item 1: Visual and Mechanical
- **Test Condition:** ---
- **Requirements:** *No remarkable defect*

### Item 2: Capacitance
- **Rated Voltage (DCV):**
  - ≤50V: ≤2.5%
  - ≤5V: ≤7%
  - ≤10V: ≤5%
  - 35V: ≤10%
  - ≤10%
  - ≤7%
  - ≤5%
  - ≤15%
  - ≤10%
  - ≤7%
  - ≤5%
  - ≤15%
  - ≤10%
  - ≤7%
  - ≤5%

### Item 3: Q, DF (Dissipation Factor)
- **Class I: NP0**
  - Cap1,000pf: 1.0±0.2%rms, 1kHz±10%
  - Cap1,000pf: 1.0±0.2%rms, 1kHz±10%
- **Class II: X7R, X5R, Y5V**
  - Cap10uf: 1.0±0.2%rms, 1kHz±10%
  - Cap10uf: 0.5±0.2%rms, 120Hz±20%

### Item 4: Dielectric Strength
- **Rated Voltage:**
  - ≤50V: ≤5%
  - ≤5V: ≤7%
  - ≤10V: ≤5%
  - 35V: ≤10%
  - ≤10%
  - ≤5%
  - ≤7%
  - ≤15%
  - ≤10%
  - ≤7%
  - ≤5%
  - ≤15%
  - ≤10%
  - ≤7%

### Item 5: Insulation Resistance
- **Class II (X7R, X5R, Y5V):**
  - Cap≤1,000pf: 1.0±0.2Vrms, 1MHz±10%
  - Cap>1,000pf: 0.5±0.2Vrms, 120Hz±20%

### Item 6: Temperature Coefficient
- **Rated Voltage:**
  - 600V: ≤3%
  - 400V: ≤5%
  - 100V: ≤10%

### Item 7: Adhesive Strength of Termination
- **Pressurizing force:** 0.021N
- **Test time:** 10 ±1 sec

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**M SERIES ULTRA HIGH Q CAPACITOR SPEC**

**Frontier Electronics Corp.**

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<table>
<thead>
<tr>
<th>Item</th>
<th>Test Condition</th>
<th>Requirements</th>
</tr>
</thead>
</table>
| **8 Vibration Resistance** | * Vibration frequency: 10~55 Hz/min.  
* Total amplitude: 1.5mm  
* Test time: 6 hours (Two hrs each in three mutually perpendicular directions)  
* Measurement to be made after keeping at room temp. for 24±2 hours | * No remarkable damage.  
* Cap change and Q/D/F.: To meet initial spec. |
| **9 Solderability** | * Solder temperature: 235±5°C  
* Dipping time: 2±0.5 sec. | 95% min. coverage of all metalized area. |
| **10 Bending Test** | * The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of approximate 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec.  
* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.  
* Capacitance change:  
**NP0:** within ±5% or 0.5pF whichever is larger  
**X7R, X7E, X5R:** within ±12.5%  
**Y5V:** within ±30%  
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) |
| **11 Resistance to Soldering Heat** | * Solder temperature: 260±5°C  
* Dipping time: 10±1 sec  
* Preheating: 120 to 150°C for 1 minute before immersing the capacitor in an eutectic solder.  
* Before initial measurement (Class II only):  
  Perform 150±0/10°C for 1 hr and then set for 24±2 hrs at room temp.  
* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.  
* Capacitance change:  
**NP0:** within ±2.5% or 0.25pF whichever is larger  
**X7R, X7E, X5R:** within ±7.5%  
**Y5V:** within ±20%  
* Q/D/F., I.R. and dielectric strength: To meet initial requirements.  
* 25% max. leaning on each edge. |
| **12 Temperature Cycle** | * Conduct the five cycles according to the temperatures and time.  
| | | |
| | Temp. | Time (min.) |
| 1 | Mn. operating temp.  
| x±3 | 30±3 |
| 2 | Room temp.  
| 2±3 | 30±3 |
| 3 | Max. operating temp.  
| x±3 | 30±3 |
| 4 | Room temp.  
| 2±3 | 30±3 |
| * Before initial measurement (Class II only):  
* Perform 150±0/10°C for 1 hr and then set for 24±2 hrs at room temp.  
* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.  
* Cap change and Q/D/F.: To meet initial spec. |
| **13 Humidity (Damp Heat) Steady State** | * Test temp.: 40±2°C  
* Humidity: 90~95% RH  
* Test time: 500±240hrs.  
* Before initial measurement (Class II only):  
  Perform 150±0/10°C for 1 hr and then set for 24±2 hrs at room temp.  
* Measurement to be made after keeping at room temp. for 24±2 hrs. | * No remarkable damage.  
* Cap change: NP0: within ±5% or 0.5pF whichever is larger  
**X7R, X7E, X5R:** within ±12.5%  
**Y5V:** within ±25%  
* TT series, within ±25%  
* Q/D/F., I.R. and dielectric strength: To meet initial requirements. |
<table>
<thead>
<tr>
<th><strong>Rated Voltage</strong></th>
<th><strong>D.F.</strong></th>
<th><strong>Exception of D.F.s</strong></th>
</tr>
</thead>
</table>
| ≤50V | ±3% | ≥5%  
| | | ≤50%  
| | | ≤100μF  
| | C50 C50  
| | 0805  
| | 1206  
| | 206  
| ≤35V | ±5% | ≤5%  
| | | ≤35%  
| | | ≤120μF  
| | C50  
| | 0805  
| | 1206  
| | 206  
| ≤25V | ±5% | ≤5%  
| | | ≤25%  
| | | ≤120μF  
| | C50  
| | 0805  
| | 1206  
| | 206  
| ≤16V | ±5% | ≤5%  
| | | ≤16%  
| | | ≤120μF  
| | C50  
| | 0805  
| | 1206  
| | 206  
| ≤10V | ±5% | ≤5%  
| | | ≤10%  
| | | ≤120μF  
| | C50  
| | 0805  
| | 1206  
| | 206  
| ≤8.3V | ±15% | ≤15%  
| | | ≤30%  
| | | ≤120μF  
| | C50  
| | 0805  
| | 1206  
| | 206  
| ≤6.3V | ±20% | ≤20%  
| | | ≤30%  
| | | ≤120μF  
| | C50  
| | 0805  
| | 1206  
| | 206  
| **VYS:** | | **120±22μF**  
| | | **0603  
| | | **0402  
| | | **0201  
| | | **Y5V:** | | **120±22μF**  
| | | **0603  
| | | **0402  
| | | **0201  
| | | **Y5V:** | | **120±22μF**  
| | | **0603  
| | | **0402  
| | | **0201  
| **IR:** | | **≥10V:**  
| | | **1GΩ or RxC≥10 Ω-F whichever is lower.** |

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667 E. Cochran St. Simi valley, CA 93065  
Phone: 1-805-522-9998, Fax: 1-805-522-9989
<table>
<thead>
<tr>
<th>Item</th>
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<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**High Temperature Load (Endurance)**

- **Test temp.:** 40°C ±3°C
- **Humidity:** 95% RH
- **Test time:** 500 ±20 hrs.

Before initial measurement (Class II only): To apply test voltage for 1 hr at 45°C and then set for 24 ±2 hrs at room temp. *Measurement to be made after keeping at room temp. for 24 ±2 hrs.

<table>
<thead>
<tr>
<th>Size</th>
<th>D.F.</th>
<th>Rated voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0201</td>
<td>X5R/X7R</td>
<td>3.3V, 10V</td>
</tr>
<tr>
<td>0402</td>
<td>X5R/X7R</td>
<td>3.3V, 10V</td>
</tr>
<tr>
<td>0603</td>
<td>X5R/X7R</td>
<td>3.3V, 10V</td>
</tr>
<tr>
<td>0805</td>
<td>X5R/X7R</td>
<td>3.3V, 10V</td>
</tr>
<tr>
<td>1206</td>
<td>X5R/X7R</td>
<td>3.3V, 10V</td>
</tr>
<tr>
<td>0201</td>
<td>X7R, X5R</td>
<td>6.3V, 10V</td>
</tr>
<tr>
<td>0402</td>
<td>X7R, X5R</td>
<td>6.3V, 10V</td>
</tr>
<tr>
<td>0603</td>
<td>X7R, X5R</td>
<td>6.3V, 10V</td>
</tr>
<tr>
<td>0805</td>
<td>X7R, X5R</td>
<td>6.3V, 10V</td>
</tr>
</tbody>
</table>

Before initial measurement (Class II only): To apply test voltage for 1 hr at test temp. and then set for 24 ±2 hrs at room temp. *Measurement to be made after keeping at room temp. for 24 ±2 hrs.

**Insulation Resistance**

- **100V, X5R, X7R:** 1 GΩ or 500 MΩ whichever is lower
- **16V (C≥1.0μF):** 1 GΩ or 500 MΩ whichever is lower
- **16V (C<1.0μF):** 100 MΩ or 50 MΩ-F whichever is lower
- **25V:** 100 MΩ or 50 MΩ-F whichever is lower
- **50V:** 10 MΩ or 5 MΩ-F whichever is lower
- **100V:** 1 MΩ or 500 KΩ-F whichever is lower
- **1 GHz:** 100 KΩ or 50 KΩ-F whichever is lower

**Test voltage:** D.F. ≤

- ≤6%
- ≤10%
- ≤20%
- ≤5%
- ≤7.5%
- ≤12.5%
- ≤15%
- ≤14%
- ≤15%
- ≤10%
- ≤15%
- ≤15%
- ≤6%
- ≤7.5%
- ≤30%

**Rated voltage:**

- 6.3V ≤10%
- 35V ≤30%
- 6.3V, 10V ≤20%
- 16V ≤5%
- 10V ≤15%
- 10V ≤30%
- 6.3V ≤15%
- 10V ≤14%
- 10V ≤15%
- 10V ≤6%
- 10V ≤7.5%
- 10V ≤10%
- 10V ≤30%
- 10V ≤12.5%
- 35V ≤30%
- 6.3V ≤15%
- 10V ≤14%
- 10V ≤15%
- 10V ≤10%
- 10V ≤6%
- 10V ≤7.5%
- 10V ≤30%
- 10V ≤12.5%
- 35V ≤30%

**Capacitance**

- D.F. ≤
- ≤30%
- ≤10%
- ≤6%
- ≤7.5%

**Data Sheet**

- D.F. ≤
- ≤30%
- ≤10%
- ≤6%
- ≤7.5%

**Quality**

- D.F. ≤
- ≤30%
- ≤10%
- ≤6%
- ≤7.5%

**Test temp.:** 40°C ±3°C

**Humidity:** 95% RH

**Test time:** 500 ±20 hrs.

Before initial measurement (Class II only): To apply test voltage for 1 hr at 45°C and then set for 24 ±2 hrs at room temp. *Measurement to be made after keeping at room temp. for 24 ±2 hrs.

**Insulation Resistance**

- **100V, X5R, X7R:** 1 GΩ or 500 MΩ whichever is lower
- **16V (C≥1.0μF):** 1 GΩ or 500 MΩ whichever is lower
- **16V (C<1.0μF):** 100 MΩ or 50 MΩ-F whichever is lower
- **25V:** 100 MΩ or 50 MΩ-F whichever is lower
- **50V:** 10 MΩ or 5 MΩ-F whichever is lower
- **100V:** 1 MΩ or 500 KΩ-F whichever is lower
- **1 GHz:** 100 KΩ or 50 KΩ-F whichever is lower

**Test voltage:** D.F. ≤

- ≤6%
- ≤10%
- ≤20%
- ≤5%
- ≤7.5%
- ≤12.5%
- ≤15%
- ≤14%
- ≤15%
- ≤10%
- ≤15%
- ≤15%
- ≤6%
- ≤7.5%
- ≤30%

**Rated voltage:**

- 6.3V ≤10%
- 35V ≤30%
- 6.3V, 10V ≤20%
- 16V ≤5%
- 10V ≤15%
- 10V ≤30%
- 6.3V ≤15%
- 10V ≤14%
- 10V ≤15%
- 10V ≤6%
- 10V ≤7.5%
- 10V ≤30%
- 10V ≤12.5%
- 35V ≤30%
- 6.3V ≤15%
- 10V ≤14%
- 10V ≤15%
- 10V ≤10%
- 10V ≤6%
- 10V ≤7.5%
- 10V ≤30%
- 10V ≤12.5%
- 35V ≤30%

**Capacitance**

- D.F. ≤
- ≤30%
- ≤10%
- ≤6%
- ≤7.5%

**Quality**

- D.F. ≤
- ≤30%
- ≤10%
- ≤6%
- ≤7.5%
### Storage and handling

1. Products should be stored at 5 to 40°C ambient temperature and 20 to 70% relative humidity.
2. It is recommended that the product be used within one year from shipment. After one year from shipment, solderability should be checked.

### Cautions

a. Corrosive gas reacts with the terminal electrodes of capacitors. Do not store capacitors in the proximity of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.) otherwise there can be solderability issues.

b. In a corrosive atmosphere, solderability might be degraded, and/or silver migration may occur which can cause lower reliability.

c. Dewing caused by rapid humidity changes and/or photochemical changes of the terminal electrode (caused by direct sunlight contact) can affect the solderability and electrical performance. Do not store capacitors under direct sunlight or in dewing conditions.

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**Recommended reflow profile for SnAgCu solder paste:**

**Recommended wave profile for SnAgCu solder paste:**