MULTILAYER CERAMIC CAPACITORS

MULTILAYER CERAMIC CAPACITORS are made from extremely pure, fine and uniform synthesized materials. These multilayer ceramic capacitors have several significant attributes, such as high capacitance values in small sizes and excellent high frequency characteristics. In addition, they can be mounted with standard surface mount equipment.

Our fully integrated manufacturing and total quality control systems ensure unprecedented high standards of various characteristics.

STACKED TYPE CERAMIC CAPACITORS

STACKED TYPE CERAMIC CAPACITORS consist of a stack of our KC or VC series capacitors. This stacked capacitor takes up the same board space as one standard chip capacitor, making it an ideal replacement for Aluminum electrolytic capacitors in applications such as compact, high frequency switching power supply.

Part Number System

<table>
<thead>
<tr>
<th>KC</th>
<th>Series</th>
<th>30</th>
<th>E</th>
<th>1H</th>
<th>105</th>
<th>M</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
</table>

Temperature Characteristics

<table>
<thead>
<tr>
<th>Class</th>
<th>Temperature characteristics</th>
<th>EIA symbol</th>
<th>Capacitance change</th>
<th>Temperature range</th>
<th>Related series</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CG</td>
<td>COG</td>
<td>0±30ppm/°C</td>
<td>–55~+125°C</td>
<td>XR series</td>
</tr>
<tr>
<td>2</td>
<td>R</td>
<td>X7R</td>
<td>±15%</td>
<td>–25~+85°C</td>
<td>VC, HC and VH,XC series</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Y5U(Z5U)</td>
<td>+20~55%</td>
<td></td>
<td>KC and VC series</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Y5V</td>
<td>+30~80%</td>
<td></td>
<td>CC series</td>
</tr>
</tbody>
</table>

Rated Voltage

<table>
<thead>
<tr>
<th>Symbol</th>
<th>IA</th>
<th>IC</th>
<th>IE</th>
<th>IH</th>
<th>2A</th>
<th>2E</th>
<th>2V</th>
<th>2H</th>
<th>2J</th>
<th>3A</th>
<th>3C</th>
<th>3D</th>
<th>3F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Voltage</td>
<td>10</td>
<td>16</td>
<td>25</td>
<td>50</td>
<td>100</td>
<td>250</td>
<td>350</td>
<td>500</td>
<td>630</td>
<td>1000</td>
<td>1600</td>
<td>2000</td>
<td>3000</td>
</tr>
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</table>

Capacitance

<table>
<thead>
<tr>
<th>Capacity constant</th>
<th>0R1</th>
<th>0</th>
<th>100</th>
<th>101</th>
<th>102</th>
<th>103</th>
<th>104</th>
<th>105</th>
<th>106</th>
<th>107</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacitance</td>
<td>0.1 (pF)</td>
<td>1 (pF)</td>
<td>10 (pF)</td>
<td>100 (pF)</td>
<td>1000 (pF)</td>
<td>0.01 (μF)</td>
<td>0.1 (μF)</td>
<td>1 (μF)</td>
<td>10 (μF)</td>
<td>100 (μF)</td>
</tr>
</tbody>
</table>

Packing Form

<table>
<thead>
<tr>
<th>Symbol</th>
<th>T</th>
<th>C</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing form</td>
<td>CC, KC, VC</td>
<td>KS, VS</td>
<td>Bulk case</td>
</tr>
<tr>
<td>(Ø178mm) (Ø330mm)</td>
<td>(Ø178mm)</td>
<td>(Sample)</td>
<td></td>
</tr>
</tbody>
</table>

Bulk case available for CC11 type, and CC21 type with T=0.60 only.
MULTILAYER CERAMIC CAPACITORS

■Terminations

<table>
<thead>
<tr>
<th>Symbol</th>
<th>P</th>
<th>R</th>
<th>E</th>
<th>S</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminations</td>
<td>Ni-bARRIER</td>
<td>Ag/Pd</td>
<td>Ag/Pd</td>
<td>High reliability Ni-bARRIER</td>
<td>Solder Cu Ni-bARRIER</td>
</tr>
<tr>
<td>Soldering</td>
<td>Flow/Reflow</td>
<td>Reflow</td>
<td>Reflow (High temperature)</td>
<td>Flow/Reflow</td>
<td>Flow/Reflow</td>
</tr>
</tbody>
</table>

* Highly reliable Ni-barrier Terminations show excellent [Flexion] and [Temperature cycling].
* Please consult us when Sn soldering is used.
* KC40, 70, 80 types are available for reflow soldering only.

■Map of multilayer ceramic capacitors
### List of multilayer ceramic capacitors

<table>
<thead>
<tr>
<th>SERIES (Pages)</th>
<th>Features</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>KC SERIES (high capacitance) (P20)</td>
<td>Using our unique materials that offer the following exceptional properties, the KC series capacitors make excellent replacements for tantalum electrolytic capacitors. 1) Larger capacitance values in smaller sizes compared to conventional materials. 2) Very little drop in capacitance value when a DC voltage bias is applied. 3) Highly reliable termination with excellent flexion and temperature cycling is available.</td>
<td>DC brushless motor driving circuit. DC/DC converter smoothing circuit. Modern coupling circuit. Consumer electronics and industrial electronic equipment, including LCD control circuit.</td>
</tr>
<tr>
<td>VC SERIES (High voltage capacitor, high bias type) (P21)</td>
<td>Exhibiting the following exceptional properties, the VC series capacitors make excellent replacements for film capacitors. 1) The piezo-electric characteristics are small. 2) Very little drop in capacitance value when a DC voltage bias is applied. 3) Can reduce design size by replacing larger film type capacitors.</td>
<td>Stroboscope circuit. Power supply, SSR snubber circuit. Modern ring detector circuit. High voltage circuits for PDP, CRTs and in ultrasonic medical equipment.</td>
</tr>
<tr>
<td>XC SERIES (High voltage capacitor) (P22)</td>
<td>1) High voltage (rated voltage~3kV) 2) Small dielectric loss.</td>
<td>LCD back light, snubber circuit.</td>
</tr>
<tr>
<td>HC SERIES (Medium/high voltage capacitor) (P22)</td>
<td>1) High capacitance in small size. 2) High withstanding voltage.</td>
<td>Power supply snubber circuit.</td>
</tr>
<tr>
<td>VH SERIES (Medium/high voltage capacitor, high bias type) (P23)</td>
<td>1) Low tan δ 2) Very little drop in capacitance value when a DC bias is applied.</td>
<td>Trigger for strobe circuit. Snubber of switching power supply.</td>
</tr>
<tr>
<td>KS SERIES (High capacitance stacked type capacitor) (P24)</td>
<td>Offering the following exceptional properties, KS • VS stacked capacitors make excellent replacements for aluminum electrolytic capacitors. 1) Low impedance 2) Allowable ripple current is large 3) Long life 4) Non-polar 5) Surface mountable 6) Excellent temperature cycling</td>
<td>Smoothing circuit, snubber circuit of compact switching power supply.</td>
</tr>
<tr>
<td>VS SERIES (High voltage stacked type capacitor) (P25)</td>
<td>The monolithic structure with ceramic materials and internals electrodes ensures high reliability.</td>
<td>Consumer and industrial electronic equipment.</td>
</tr>
<tr>
<td>CC SERIES (standard) (P26)</td>
<td>The monolithic structure with ceramic materials and internals electrodes ensures high reliability.</td>
<td>Consumer and industrial electronic equipment.</td>
</tr>
</tbody>
</table>

### Features of high reliability “S” terminations

**Features**
- Products with highly reliable terminations have the excellent features shown below.
- They are suitable for circuits that require high reliability.
  1) Excellent temperature cycle
  2) Large critical flexion

**Applications**
- Suitable for circuits that need high temperature-resistant cycles and circuits in which Aluminum substrates are used.
FEATURES OF MULTILAYER CERAMIC CAPACITORS

- Features of KC (E) Series
  - Frequency change of impedance
  - Chart showing impedance (\( |Z| \)) vs frequency (kHz) for Al electrolytic Cap., Ta electrolytic Cap., and KC series.

- Features of VC(R) Series
  - DC bias property of capacitance
  - Chart showing capacitance change (%) vs electric field (V/\( \mu \)m) for VC Series R, Conventional R (Barium Titanate).

- Features of HC Series
  - Temperature characteristics
  - Chart showing rate of change in capacitance (%) vs temperature (°C) for R characteristic temperature range.

- Features of VH Series (rating: R630V, DC0.033\( \mu \)F)
  - Trigger voltage characteristics (Standard product)
    - Chart showing trigger voltage (Vp) vs time (\( \mu \)S).
  - Trigger voltage characteristics (Low ESR product)
    - Chart showing trigger voltage (Vp) vs time (\( \mu \)S).
Using our unique materials that offer the following exceptional properties, the KC series capacitors make excellent replacements for tantalum capacitors.

### Features
- Very little drop in capacitance value when a DC voltage bias is applied.
- Larger capacitance values in smaller sizes compared to conventional materials.

### Applications
- Smoothing circuit of switching power supply and DC/DC converter, motor control circuit.

![Dimensions Diagram]

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Capacitance (F)</th>
<th>Product height (T/mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KC11</td>
<td>0.15</td>
<td>0.75±0.0 / -0.2</td>
</tr>
<tr>
<td>KC20</td>
<td>0.22</td>
<td>1.00±0.0 / -0.25</td>
</tr>
<tr>
<td>KC30</td>
<td>0.47</td>
<td>1.25±0.0 / -0.3</td>
</tr>
<tr>
<td>KC40</td>
<td>0.68</td>
<td>1.50±0.0 / -0.3</td>
</tr>
<tr>
<td>KC50</td>
<td>1.00±0.0 / -0.25</td>
<td></td>
</tr>
<tr>
<td>KC60</td>
<td>1.25±0.0 / -0.25</td>
<td></td>
</tr>
<tr>
<td>KC70</td>
<td>1.50±0.0 / -0.25</td>
<td></td>
</tr>
<tr>
<td>KC80</td>
<td>2.00±0.0 / -0.25</td>
<td></td>
</tr>
</tbody>
</table>

### List of products in KC Series

**Temperature characteristics:** E (-25°C → 85°C, +20% → -55%)

**Capacitance tolerance:** M (+20%)

<table>
<thead>
<tr>
<th>Rated Voltage : 50VDC</th>
<th>Part Number</th>
<th>Capacitance (μF)</th>
<th>Product height (T/mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KC11</td>
<td>0.15</td>
<td>0.75±0.0 / -0.2</td>
<td></td>
</tr>
<tr>
<td>KC20</td>
<td>0.22</td>
<td>1.00±0.0 / -0.25</td>
<td></td>
</tr>
<tr>
<td>KC30</td>
<td>0.47</td>
<td>1.25±0.0 / -0.3</td>
<td></td>
</tr>
<tr>
<td>KC40</td>
<td>0.68</td>
<td>1.50±0.0 / -0.3</td>
<td></td>
</tr>
<tr>
<td>KC50</td>
<td>1.00±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC60</td>
<td>1.25±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC70</td>
<td>1.50±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC80</td>
<td>2.00±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated Voltage : 25VDC</th>
<th>Part Number</th>
<th>Capacitance (μF)</th>
<th>Product height (T/mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KC11</td>
<td>0.15</td>
<td>0.75±0.0 / -0.2</td>
<td></td>
</tr>
<tr>
<td>KC20</td>
<td>0.22</td>
<td>1.00±0.0 / -0.25</td>
<td></td>
</tr>
<tr>
<td>KC30</td>
<td>0.47</td>
<td>1.25±0.0 / -0.3</td>
<td></td>
</tr>
<tr>
<td>KC40</td>
<td>0.68</td>
<td>1.50±0.0 / -0.3</td>
<td></td>
</tr>
<tr>
<td>KC50</td>
<td>1.00±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC60</td>
<td>1.25±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC70</td>
<td>1.50±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC80</td>
<td>2.00±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated Voltage : 16VDC</th>
<th>Part Number</th>
<th>Capacitance (μF)</th>
<th>Product height (T/mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KC11</td>
<td>0.15</td>
<td>0.75±0.0 / -0.2</td>
<td></td>
</tr>
<tr>
<td>KC20</td>
<td>0.22</td>
<td>1.00±0.0 / -0.25</td>
<td></td>
</tr>
<tr>
<td>KC30</td>
<td>0.47</td>
<td>1.25±0.0 / -0.3</td>
<td></td>
</tr>
<tr>
<td>KC40</td>
<td>0.68</td>
<td>1.50±0.0 / -0.3</td>
<td></td>
</tr>
<tr>
<td>KC50</td>
<td>1.00±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC60</td>
<td>1.25±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC70</td>
<td>1.50±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC80</td>
<td>2.00±0.0 / -0.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Specify the taped product (T) or bulk product (B) for □.
- Highly reliable Ni-barrier terminations show excellent flexion and temperature cycling.
- KC40, KC70, KC80 types are available for reflow soldering in principle. Please consult us when flow soldering is used.
<table>
<thead>
<tr>
<th>Type</th>
<th>T Dimensions (mm)</th>
<th>Q’ty/Standard package (No. of units)</th>
<th>Carrier tape material</th>
</tr>
</thead>
<tbody>
<tr>
<td>KC20</td>
<td>0.75 ±0.2 / -0.2</td>
<td>4000</td>
<td>Paper</td>
</tr>
<tr>
<td></td>
<td>1.00 ±0.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.25 ±0.3</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>KC30</td>
<td>1.00 ±0.25</td>
<td>4000/2000</td>
<td>Paper or Plastic</td>
</tr>
<tr>
<td>VC30</td>
<td>1.25 ±0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.80 ±0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC40</td>
<td>1.00 ±0.25</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>VC40</td>
<td>1.25 ±0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.70 ±0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.20 ±0.5</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.50 ±0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC70</td>
<td>1.00 ±0.25</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>VC70</td>
<td>1.25 ±0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.70 ±0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.20 ±0.5</td>
<td>800 (CC70/500)</td>
<td>Plastic</td>
</tr>
<tr>
<td></td>
<td>2.50 ±0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC80</td>
<td>1.25 ±0.3</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>VC80</td>
<td>1.70 ±0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.20 ±0.5</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.50 ±0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KS70</td>
<td>5.8 max.</td>
<td>1500</td>
<td></td>
</tr>
<tr>
<td>VS70</td>
<td>6.5 max.</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>HS25</td>
<td>1.8 max.</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>VH35</td>
<td>2.2 max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HC47</td>
<td>2.8 max.</td>
<td>T: ±2.2 / 1000</td>
<td></td>
</tr>
<tr>
<td>VH47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HC89</td>
<td>2.8 max.</td>
<td>T: ±2.2 / 700</td>
<td></td>
</tr>
<tr>
<td>HC79</td>
<td>3.0 max.</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>XC44</td>
<td>2.3 max.</td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>XC47</td>
<td>3.0 max.</td>
<td>T: ±2.2 / 1000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>T Dimensions (mm)</th>
<th>Q’ty/Standard package (No. of units)</th>
<th>Carrier tape material</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC11/KC11</td>
<td>0.80 ±0.10</td>
<td>4000</td>
<td>Paper</td>
</tr>
<tr>
<td>CC21</td>
<td>0.60 ±0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.85 ±0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.25 ±0.10</td>
<td>2000</td>
<td>Plastic</td>
</tr>
<tr>
<td>CC31</td>
<td>0.85 ±0.10</td>
<td>4000</td>
<td>Paper</td>
</tr>
<tr>
<td></td>
<td>1.15 ±0.10</td>
<td>2000</td>
<td>Plastic</td>
</tr>
</tbody>
</table>
### Performance and Test Method

<table>
<thead>
<tr>
<th>Item</th>
<th>Performance</th>
<th>Test method and conditions (In accordance with JIS 5101-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CC series (Class 1)</td>
<td>KC series</td>
</tr>
<tr>
<td>Dissipation Factor (or Q)</td>
<td>$C^\ast \leq 30pF \Rightarrow Q \geq 1,000, C^\ast \leq 10pF \Rightarrow Q \geq 400-20^\circ C$</td>
<td>2.5% or less (+1)</td>
</tr>
<tr>
<td>Withstanding voltage</td>
<td>No insulation breakdown and no failure.</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>No less than 10,000MΩ or 500MΩ + μF, whichever is smaller.</td>
<td>Rated voltage is applied for 1 minute.</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Capacitance</td>
<td>Within the specified tolerance</td>
<td>Full amplitude: 1.6mm, 10–55–100Hz 1min.</td>
</tr>
<tr>
<td>Dissipation factor (or Q)</td>
<td>$C^\ast \leq 30pF \Rightarrow Q \geq 1,000, C^\ast \leq 10pF \Rightarrow Q \geq 400-20^\circ C$</td>
<td>2.5% or less (+1)</td>
</tr>
<tr>
<td>Resistance to soldering heat</td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Rate change in capacitance</td>
<td>No more than ±2.5% or ±5.25pF, whichever is larger.</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>No less than 10,000MΩ or 500MΩ + μF, whichever is smaller.</td>
<td></td>
</tr>
<tr>
<td>Solderability</td>
<td>Termination surface should be covered with new solder to over 75%.</td>
<td></td>
</tr>
<tr>
<td>Temperature cycle</td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Capacitance change</td>
<td>No more than ±2.5% or ±5.25pF, whichever is larger.</td>
<td>Within ±7.5%</td>
</tr>
<tr>
<td>Dissipation factor (or Q)</td>
<td>$C^\ast \leq 30pF \Rightarrow Q \geq 1,000, C^\ast \leq 10pF \Rightarrow Q \geq 400-20^\circ C$</td>
<td>2.5% or less (+1)</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>No less than 10,000MΩ or 500MΩ + μF, whichever is smaller.</td>
<td></td>
</tr>
<tr>
<td>Humidity load test</td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Capacitance change</td>
<td>No more than ±3% or ±5pF, whichever is larger.</td>
<td>Within ±12.5%</td>
</tr>
<tr>
<td>Dissipation factor (or Q)</td>
<td>$C^\ast \leq 30pF \Rightarrow Q \geq 1,000, C^\ast \leq 10pF \Rightarrow Q \geq 275+(5/2)C^\ast \leq 400+20\times C^\ast \leq 10pF \Rightarrow Q \geq 200-10C^\ast$</td>
<td>5% or less (+3)</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>No less than 10,000MΩ or 500MΩ + μF, whichever is smaller.</td>
<td></td>
</tr>
<tr>
<td>Life test (at elevated ambient temperature)</td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Capacitance change</td>
<td>No more than ±3% or ±3pF, whichever is larger.</td>
<td>Within ±12.5%</td>
</tr>
<tr>
<td>Dissipation factor (or Q)</td>
<td>$C^\ast \leq 30pF \Rightarrow Q \geq 1,000, C^\ast \leq 10pF \Rightarrow Q \geq 275+(5/2)C^\ast \leq 400+20\times C^\ast \leq 10pF \Rightarrow Q \geq 200-10C^\ast$</td>
<td>4% or less (+3)</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>No less than 10,000MΩ or 500MΩ + μF, whichever is smaller.</td>
<td></td>
</tr>
<tr>
<td>Flexion</td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Capacitance change</td>
<td>No more than ±5% or ±5pF, whichever is larger.</td>
<td>Within ±12.5%</td>
</tr>
</tbody>
</table>

Note: $C^\ast$ represents capacitance values (pF).  
+ Please consult us regarding [S] termination.  
Lower limit temp. and upper limit temp. are shown as below.

#### Temperature characteristics

<table>
<thead>
<tr>
<th>Condition</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower limit temp.</td>
<td>°C</td>
<td>-55°C</td>
</tr>
<tr>
<td>Upper limit temp.</td>
<td>°C</td>
<td>+125°C</td>
</tr>
</tbody>
</table>

#### Test temp.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower limit temp.</td>
<td>°C</td>
<td>+125°C</td>
</tr>
<tr>
<td>Upper limit temp.</td>
<td>°C</td>
<td>+85°C</td>
</tr>
</tbody>
</table>
## PERFORMANCE AND TEST METHOD

<table>
<thead>
<tr>
<th>Item</th>
<th>Performance</th>
<th>Testing method and conditions (In accordance with JIS 5101-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Withstanding voltage</strong></td>
<td>VS Series</td>
<td>KS + VS Series</td>
</tr>
<tr>
<td>R</td>
<td>No insulation breakdown and no failure.</td>
<td>Applications time is 1–5 seconds.</td>
</tr>
<tr>
<td>E</td>
<td>Applications time is 1–5 seconds.</td>
<td>WV=630V. applied in silicon oil.</td>
</tr>
<tr>
<td></td>
<td>KS series</td>
<td>VS series</td>
</tr>
<tr>
<td></td>
<td>Applied 250% of the rated voltage</td>
<td>Applied 150% (WV=630V), 200% (WV=250V), 250% (WV=100V) of the rated voltage</td>
</tr>
<tr>
<td><strong>Insulation resistance</strong></td>
<td>No less than 10,000MΩ or 500MΩ × μF, whichever is smaller.</td>
<td>Rated voltage is applied for 1 minute.</td>
</tr>
<tr>
<td><strong>Adhesion strength of termination</strong></td>
<td>Chip</td>
<td>Solder a specimen on the testing jig shown on the left and apply a force of 5N (0.5kgf) in the direction indicated by an arrow.</td>
</tr>
<tr>
<td></td>
<td>Substrate</td>
<td>No peeling-off or exfoliation shall be manifest or recognizable in its incipient stages.</td>
</tr>
<tr>
<td><strong>Vibration resistance</strong></td>
<td>Visual</td>
<td>Vibration frequency : 10<del>55Hz. Full amplitude : 1.5mm, 10</del>55~10Hz. 1min. XY2 direction 2hrs for each, total 6hrs.</td>
</tr>
<tr>
<td>Capacitance</td>
<td>No serious mechanical damage</td>
<td>Type of solder : JIS Z2302 H60A (Ag included)</td>
</tr>
<tr>
<td>Dissipation factor</td>
<td>2.5% or less</td>
<td>Soldering temperature : 230±5°C</td>
</tr>
<tr>
<td></td>
<td>5% or less</td>
<td>Immersion time : 4±1 seconds</td>
</tr>
<tr>
<td><strong>Resistance to soldering heat</strong></td>
<td>Visual</td>
<td>Preheating prior to immersion : 80~100°C (1-2min.)</td>
</tr>
<tr>
<td>Capacitance change</td>
<td>No serious mechanical damage</td>
<td>Continuous immersion after preheating</td>
</tr>
<tr>
<td>Dissipation factor</td>
<td>Within ±7.5%</td>
<td>Type of solder : JIS Z2302 H60A (Ag included)</td>
</tr>
<tr>
<td></td>
<td>Within ±20%</td>
<td>Soldering temperature : 230±5°C</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>2.5% or less</td>
<td>Immersion time : 2±1 seconds</td>
</tr>
<tr>
<td>Withstanding voltage</td>
<td>No less than 10,000MΩ or 500MΩ × μF, whichever is smaller.</td>
<td></td>
</tr>
<tr>
<td><strong>Solderability</strong></td>
<td>Termination surface should be covered with new solder to over 90%.</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature cycle</strong></td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Capacitance change</td>
<td>Within ±7.5%</td>
<td>Test temperature : 65±2°C</td>
</tr>
<tr>
<td>Dissipation factor</td>
<td>2.5% or less</td>
<td>Relative humidity : 90~95%</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>Within ±20%</td>
<td>Testing time : 1000~10000hours</td>
</tr>
<tr>
<td>Withstanding voltage</td>
<td>No less than 10,000MΩ or 500MΩ × μF, whichever is smaller.</td>
<td></td>
</tr>
<tr>
<td><strong>Humidity load test (at elevated ambient temperature)</strong></td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Capacitance change</td>
<td>Within ±12.5%</td>
<td>Test temp. : #</td>
</tr>
<tr>
<td>Dissipation factor</td>
<td>5% or less</td>
<td>Testing time : 1000~10000hours</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>Within ±30%</td>
<td>200% of rated voltage (DC voltage) is applied for KS series, in case of VS series, 100% or 200% of rated voltage (DC voltage) is applied.</td>
</tr>
<tr>
<td><strong>Life test</strong></td>
<td>Visual</td>
<td>No serious mechanical damage</td>
</tr>
<tr>
<td>Capacitance change</td>
<td>Within ±12.5%</td>
<td></td>
</tr>
<tr>
<td>Dissipation factor</td>
<td>4% or less</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>Within ±30%</td>
<td></td>
</tr>
<tr>
<td>Withstanding voltage</td>
<td>No less than 10,000MΩ or 500MΩ × μF, whichever is smaller.</td>
<td></td>
</tr>
</tbody>
</table>

### Table 1: Temperature Cycle

<table>
<thead>
<tr>
<th>Step</th>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower limit temp.</td>
<td>3min.</td>
</tr>
<tr>
<td>2</td>
<td>Room temp.</td>
<td>3min.</td>
</tr>
<tr>
<td>3</td>
<td>Upper limit temp.</td>
<td>3min.</td>
</tr>
<tr>
<td>4</td>
<td>Room temp.</td>
<td>3min.</td>
</tr>
</tbody>
</table>

Leaving a specimen under the temperature of step 1–4 above in order completes 1 cycle. The cycle is repeated 5 times.

### Table 2: Humidity Load Test

<table>
<thead>
<tr>
<th>Step</th>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower limit temp.</td>
<td>48hours</td>
</tr>
<tr>
<td>2</td>
<td>Room temp.</td>
<td>3min.</td>
</tr>
<tr>
<td>3</td>
<td>Upper limit temp.</td>
<td>3min.</td>
</tr>
<tr>
<td>4</td>
<td>Room temp.</td>
<td>3min.</td>
</tr>
</tbody>
</table>

Testing method and conditions:
- Test temp. : #
- Test temp. : 100% of rated voltage (DC voltage) is applied
- Test temp. : 200% of rated voltage (DC voltage) is applied for KS series, in case of VS series, 100% or 200% of rated voltage (DC voltage) is applied.

### Table 3: Life Test

<table>
<thead>
<tr>
<th>Step</th>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower limit temp.</td>
<td>48hours</td>
</tr>
<tr>
<td>2</td>
<td>Room temp.</td>
<td>3min.</td>
</tr>
<tr>
<td>3</td>
<td>Upper limit temp.</td>
<td>3min.</td>
</tr>
<tr>
<td>4</td>
<td>Room temp.</td>
<td>3min.</td>
</tr>
</tbody>
</table>

Testing method and conditions:
- Test temp. : #
- Test temp. : 100% of rated voltage (DC voltage) is applied
- Test temp. : 200% of rated voltage (DC voltage) is applied for KS series, in case of VS series, 100% or 200% of rated voltage (DC voltage) is applied.

**Lower limit temp.** and upper limit temp. are shown as below.

<table>
<thead>
<tr>
<th>Temp. characteristics</th>
<th>R</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower limit temp.</td>
<td>-55°C</td>
<td>-25°C</td>
</tr>
<tr>
<td>Upper limit temp.</td>
<td>+125°C</td>
<td>+85°C</td>
</tr>
</tbody>
</table>
**HANDLING PRECAUTIONS**

**Mounting**

1. Chip mounting

   (1) While mounting, if the bottom dead point of the suction nozzle is too low, the force on the chip may be great enough to cause breaking or cracking. Adjust the distance of the bottom dead point of the nozzle from the top surface of the chip, after resetting the substrate straight, to prevent overload on the chip.

   ![Diagram showing proper and improper chip mounting](image)

   (2) To prevent cracking or breaking, set the static load force between 100~300gf when mounting.

   (3) A worn clamp fixture of the mounter can cause an uneven distribution of the clamping force, leading to cracking or breaking of the capacitor. Check the dimensions of the clamping fixture in the closed position, perform routine maintenance on the suction nozzle and clamping fixture, and inspect or change worn parts on a periodic basis.

2. Board breaking

   When large multi-circuit boards are broken into individual boards after soldering, flexure stress may be placed on the parts causing them to cracking or breaking. For designing patterns please refer to below.

   ![Diagram showing proper and improper board breaking](image)

**Soldering**

1. Basic design

   Recommended land pattern for reflow soldering.

   ![Diagram showing recommended land pattern](image)

<table>
<thead>
<tr>
<th>Type</th>
<th>CC11 KC11</th>
<th>CC21 KC20</th>
<th>CC31 KC30 VC30</th>
<th>KC40 VC40</th>
<th>KS70 KC70 VS70 VC70</th>
<th>KC80 VC80 KS80/VS80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chip length (L) x Width (W)</td>
<td>1.6 x 0.8</td>
<td>2.0 x 1.25</td>
<td>3.2 x 1.6</td>
<td>3.2 x 2.5</td>
<td>4.5 x 3.2</td>
<td>5.7 x 5.0</td>
</tr>
<tr>
<td>Land dimension</td>
<td>a</td>
<td>0.6~0.7</td>
<td>0.6~0.7</td>
<td>0.8~0.9</td>
<td>1.0~1.2</td>
<td>1.1~1.3</td>
</tr>
<tr>
<td>b</td>
<td>0.6~0.8</td>
<td>0.8~1.1</td>
<td>1.0~1.4</td>
<td>1.8~2.5</td>
<td>2.3~3.2</td>
<td>3.5~5.0</td>
</tr>
<tr>
<td>c</td>
<td>0.6~0.8</td>
<td>1.0~1.2</td>
<td>2.2~2.4</td>
<td>2.0~2.4</td>
<td>2.6~3.4</td>
<td>3.6~4.6</td>
</tr>
</tbody>
</table>

2. General cautions for soldering

   (1) Excessively high soldering temperatures or long soldering times can cause leaching of terminations, and consequently decrease adherence strength, and capacitance value, etc.
**HANDLING PRECAUTIONS**

(2) For soldering, please refer to the soldering curves below. (CC, KC, VC, KS, VS series)

(3) For parts with Ag/Pd terminations, be aware that silver has a tendency to diffuse into the solder bath. To prevent leaching, please use a Sn : Pb = 6 : 4 solder, with 2~5% Ag added.

(4) When using a soldering iron for repair work, make sure to apply the tip of the iron and the solder to the edge of the chip at the same time, being careful not to touch the chip directly with the iron.

---

### Flow soldering (air preheating) recommended conditions

![Flow soldering (air preheating) recommended conditions](image1)

### Flow soldering (hot plate preheating) recommended conditions

![Flow soldering (hot plate preheating) recommended conditions](image2)

### Reflow soldering recommended conditions

![Reflow soldering recommended conditions](image3)

---

(4) As to the soldering recommended conditions to the Sn-barrier, please consult us.

Note 1: Below are listed recommended conditions for the temperature profile of Ag/Pd terminated parts.

1. Keep the peak temperature as low as possible.
2. Do not keep the parts above 200°C for more than 20 seconds.

Note 2: Reflow soldering on Ag/Pd terminated parts should be done only once.

(5) Please use a mild flux (containing less than 0.2wt% Cl). Also, if the flux is water soluble, be sure to wash thoroughly to remove any residue from the underside of components that could affect resistance.

3. Cleaning

When using ultrasonic cleaning, the board may resonate if the output power is too high. Because this vibration can cause cracking or decrease in the adhesion of the termination, we recommend the conditions below.

- Frequency: 28kHz
- Output power: 20W/liter
- Cleaning time: 5 minutes max.

---

**Storage/keeping**

1. Deterioration of solderability can be caused by oxidization/sulfurization because of high temperature, high humidity or chlorine/sulfur gas. Parts should be used within 6 months if possible and stored below 40°C and 70%RH in a atmosphere free of sulfur, chlorine or toxic gasses.

2. These capacitors are made of ceramics. Avoid dropping or other mechanical shock that could damage the parts.

3. The capacitors kept in your storage for over 6 months should be used only after checking solderability.
MARUWA GENERAL CATALOG

PACKAGE FORM DETAILS

Taping Specifications

- Paper carrier tape for 4,000 pcs. (11,20,21,30,31 size)
- Plastic carrier tape for 800, 1000 and 1500 pcs. (70, 80 size)

Features

- Plastic carrier tape for 800, 1000 and 1500 pcs. (70, 80 size)
- Standard packaging volume (pc./reel)

Taping Specifications

- Plastic carrier tape for 2,000 pcs. (Partially 20,21,30,31 size and 40 size)

Reel Type Size