All products in this catalog comply with the RoHS Directive.

Safety Precautions (Common precautions for EMC Components and ESD Suppressor)

- When using our products, no matter what sort of equipment they might be used for, be sure to make a written agreement on the specifications with us in advance. The design and specifications in this catalog are subject to change without prior notice.
- Do not use the products beyond the specifications described in this catalog.
- This catalog explains the quality and performance of the products as individual components. Before use, check and evaluate their operations when installed in your products.
- Install the following systems for a failsafe design to ensure safety if these products are to be used in equipment where a defect in these products may cause the loss of human life or other significant damage, such as damage to vehicles (automobile, train, vessel), traffic lights, medical equipment, aerospace equipment, electric heating appliances, combustion/gas equipment, rotating equipment, and disaster/crime prevention equipment.
- Systems equipped with a protection circuit and a protection device
- Systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault

(1) Precautions for use
- These products are designed and manufactured for general and standard use in general electronic equipment (e.g. AV equipment, home electric appliances, office equipment, information and communication equipment)
- These products are not intended for use in the following special conditions. Before using the products, carefully check the effects on their quality and performance, and determine whether or not they can be used.
  1. In liquid, such as water, oil, chemicals, or organic solvent
  2. In direct sunlight, outdoors, or in dust
  3. In salty air or air with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO₂
  4. Electric Static Discharge (ESD) Environment (except ESD Suppressors)
     - These components are sensitive to static electricity and can be damaged under static shock (ESD).
     - Please take measures to avoid any of these environments.
     - Smaller components are more sensitive to ESD environment.
  5. Electromagnetic Environment
     - Avoid any environment where strong electromagnetic waves exist.
  6. In an environment where these products cause dew condensation
  7. Sealing or coating of these products or a printed circuit board on which these products are mounted, with resin or other materials
- These products generate Joule heat when energized. Carefully position these products so that their heat will not affect the other components.
- Carefully position these products so that their temperatures will not exceed the category temperature range due to the effects of neighboring heat-generating components. Do not mount or place heat-generating components or inflammables, such as vinyl-coated wires, near these products.
- Note that non-cleaning solder, halogen-based highly active flux, or water-soluble flux may deteriorate the performance or reliability of the products.
- Carefully select a flux cleaning agent for use after soldering. An unsuitable agent may deteriorate the performance or reliability. In particular, when using water or a water-soluble cleaning agent, be careful not to leave water residues. Otherwise, the insulation performance may be deteriorated.

(2) Precautions for storage
- Do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.
  1. In salty air or in air with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO₂
  2. In direct sunlight

<Package markings>
Package markings include the product number, quantity, and country of origin.
In principle, the country of origin should be indicated in English.
Common mode Noise Filters

Type: **EXCX4CZ**

**Features**

- Small and thin (L 0.65 mm x W 0.50 mm x H 0.30 mm)
- High-common mode attenuation at 2.4GHz, suitable for noise suppression at Wi-Fi band
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

**Recommended Applications**

- Smartphones, Tablet PCs and DSC
- Suppresses noise radiation to Wi-Fi Equipment

**Explanation of Part Numbers**

<table>
<thead>
<tr>
<th>Code</th>
<th>Product Code</th>
<th>Size</th>
<th>Number of Terminals</th>
<th>Type</th>
<th>Characteristics</th>
<th>Nominal Impedance</th>
<th>Form</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>EXC4CZ</td>
<td>X</td>
<td>4</td>
<td>C</td>
<td>2</td>
<td>Z</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

- Noise Filter Code
- Dimensions (mm): 0.65 x 0.50 x 0.30 (L x W x H)
- The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.

**Construction**

- Outer Conductor
- Electrode
- Inner Conductor

**Dimensions in mm (not to scale)**

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>F (mm)</th>
<th>Mass (Weight) [mg/pc]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCX4CZ</td>
<td>0.52±0.15</td>
<td>0.65±0.15</td>
<td>0.30±0.05</td>
<td>0.12±0.10</td>
<td>0.4±0.10</td>
<td>0.16±0.10</td>
<td>0.28</td>
</tr>
</tbody>
</table>

**Circuit Configuration (No Polarity)**

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCX4CZ200X</td>
<td>20 ±30 %</td>
<td>10</td>
<td>100</td>
<td>3.0 ±30 %</td>
</tr>
</tbody>
</table>

- Category Temperature Range −40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXCX4CZ200X**

![Impedance Graph]

- Measurement Circuit

![Measurement Circuit Diagram]

### Attenuation Characteristics (Typical)

- **EXCX4CZ200X**

![Attenuation Graph]

### As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,
Please see Data Files
Common mode Noise Filters

Type: EXCX4CH

Features
- Small and thin (L 0.65 mm×W 0.50 mm×H 0.30 mm)
- High common mode attenuation in high-speed differential transmission lines, Cut-off frequency is more than 8.5 GHz, and an influence to differential transmission signal quality is little
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications
- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as USB, LVDS and HDMI

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions(mm)</th>
<th>L Terminals</th>
<th>Characteristic</th>
<th>Nominal Impedance</th>
<th>Form</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC</td>
<td>0.65×0.50×0.30</td>
<td>(L) × (W) × (H)</td>
<td>Coupled type</td>
<td>High speed Differential transmission</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.

Construction

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pc.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCX4CH (0202)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A 0.50±0.05</td>
<td>0.45±0.05</td>
<td>0.12×0.10 0.43</td>
</tr>
<tr>
<td>B 0.50±0.05</td>
<td>0.30±0.05</td>
<td>0.15±0.10 0.43</td>
</tr>
<tr>
<td>C 0.30±0.05</td>
<td>0.20±0.10</td>
<td></td>
</tr>
<tr>
<td>D 0.20±0.10</td>
<td>0.10±0.10</td>
<td></td>
</tr>
<tr>
<td>E 0.10±0.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F 0.10±0.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCX4CH120X</td>
<td>12 ±5 Ω</td>
<td>5</td>
<td>100</td>
<td>2.0</td>
</tr>
<tr>
<td>EXCX4CH350X</td>
<td>35 Ω±30 %</td>
<td>5</td>
<td>100</td>
<td>2.7</td>
</tr>
</tbody>
</table>

- Category Temperature Range: –40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXCX4CH120X**
  - Common Mode
  - Differential Mode

- **EXCX4CH350X**
  - Common Mode
  - Differential Mode

### Measurement Circuit

- (A) Common Mode
- (B) Differential Mode

### Insertion Loss (Typical)

- **Common mode Attenuation Characteristics (Typical)**

- **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
  Please see Data Files

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-- 6 --
Common mode Noise Filters

Type: EXCX4CE

Features

● Small and thin (L 0.65 mm x W 0.50 mm x H 0.30 mm)
● Noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
● Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
● Lead, halogen and antimony-free
● RoHS compliant

Recommended Applications

● Smartphones, Tablet PCs and DSC
● Noise suppression of high-speed differential data lines such as MIPI, USB and LVDS

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions(mm)</th>
<th>X Terminals</th>
<th>Type</th>
<th>Characteristics</th>
<th>Nominal Impedance</th>
<th>Form</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>0.65 x 0.50 x 0.30 (L x W x H)</td>
<td>X</td>
<td>C</td>
<td>Coupled type</td>
<td>E High speed</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.

Code | Packing
U | Pressed Carrier Taping 2 mm pitch, 10,000 pcs.

Construction

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pc]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCX4CE (0202)</td>
<td>0.5±0.05 0.5±0.05 0.3±0.05 0.3±0.10 0.4±0.10 0.1±0.10</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters

Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)max.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Common Mode</td>
<td>Differential Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXCX4CE600U</td>
<td>60 Ω±20 %</td>
<td>18 Ω max.</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>EXCX4CE900U</td>
<td>90 Ω±20 %</td>
<td>20 Ω max.</td>
<td>5</td>
<td>100</td>
</tr>
</tbody>
</table>

- Category Temperature Range −40 °C to +85 °C

Impedance Characteristics (Typical)

- EXCX4CE600U

- EXCX4CE900U

- Measurement Circuit

As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files
Common mode Noise Filters

Type: EXCX4CT

Features
- Small and thin (L 0.65 mm x W 0.50 mm x H 0.30 mm)
- High attenuation at common-mode for noise suppression of harmonic signal components and cellular frequency
- Cut-off frequency is more than 3 GHz, the insertion loss is low in differential transmission line
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications
- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as MIPI, USB and LVDS

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions(mm)</th>
<th>Type</th>
<th>Characteristics</th>
<th>Nominal Impedance</th>
<th>Form</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>0.65 x 0.50 x 0.30</td>
<td>C</td>
<td>Coupled type</td>
<td>High attenuation type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>(L) x (W) x (H)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td></td>
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<tr>
<td>T</td>
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<td>11</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Packing
- Pressed Carrier Taping, 2 mm pitch, 10,000 pcs.

Construction
- Ceramics
- Ferrite
- Inner Conductor
- Electrode

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCX4CT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pc]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>0.52±0.05</td>
<td>0.55±0.05</td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)
- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCX4CT650X</td>
<td>65 Ω±20 %</td>
<td>10</td>
<td>100</td>
<td>2.7 Ω±30 %</td>
</tr>
<tr>
<td>EXCX4CT900X</td>
<td>90 Ω±20 %</td>
<td>10</td>
<td>100</td>
<td>3.0 Ω±30 %</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXCX4CT650X**

![Impedance characteristic graph for EXCX4CT650X](image)

- **EXCX4CT900X**

![Impedance characteristic graph for EXCX4CT900X](image)

#### Measurement Circuit

![Measurement circuit diagram](image)

### Insertion Loss (Typical)

![Insertion loss graph for EXCX4CT650X](image)

![Insertion loss graph for EXCX4CT900X](image)

### Common mode Attenuation Characteristics (Typical)

![Common mode attenuation graph for EXCX4CT650X](image)

![Common mode attenuation graph for EXCX4CT900X](image)

- **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
  Please see Data Files

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00 Sep. 2015
Common mode Noise Filters

Type: **EXC14CH**

### Features

- Small and thin (L 0.85 mm × W 0.65 mm × H 0.45 mm)
- High common mode attenuation in high-speed differential transmission lines, Cut-off frequency is more than 8.5 GHz, and an influence to differential transmission signal quality is little
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

### Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as USB, LVDS and HDMI

### Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>C</td>
<td>1</td>
<td>4</td>
<td>C</td>
<td>H</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

- **Product Code:** E
- **Size:** X
- **Number of Terminals:** C
- **Type:** 1
- **Characteristics:** 4
- **Nominal Impedance:** C
- **Form:** H
- **Suffix:**

### Construction

- Ceramics
- Ferrite
- Inner Conductor
- Electrode

### Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) (mg/pc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CH (0302)</td>
<td>0.65±0.05</td>
<td>0.10 min. 0.9±0.10</td>
</tr>
</tbody>
</table>

### Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CH120U</td>
<td>12 Ω ± 25 % 10 Ω max.</td>
<td>5</td>
<td>100</td>
<td>1.0</td>
</tr>
<tr>
<td>EXC14CH350U</td>
<td>35 Ω ± 30 % 15 Ω max.</td>
<td>5</td>
<td>100</td>
<td>1.5</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

### Impedance Characteristics (Typical)

#### EXC14CH120U

- **Common Mode**
- **Differential Mode**

#### EXC14CH350U

- **Common Mode**
- **Differential Mode**

#### Measurement Circuit

- **A** Common Mode
- **B** Differential Mode

### Insertion Loss (Typical)

- **EXC14CH120U**
- **EXC14CH350U**

### Common mode Attenuation Characteristics (Typical)

- **EXC14CH120U**
- **EXC14CH350U**

- **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files**
Common mode Noise Filters

Type: EXC14CG  EXC14CE

Features
- Small and thin (L 0.85 mm x W 0.65 mm x H 0.45 mm)
- Noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- Low DC resistance and low insertion loss
- High-Q value and high impedance of GHz zone: EXC14CG type
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications
- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as USB, LVDS and MHL

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>C</td>
<td>1</td>
<td>4</td>
<td>C</td>
<td>E</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

- **Product Code**
- **Dimensions (mm)**
  - 0.85 x 0.65 x 0.45 (L x W x H)
- **Number of Terminals**: 4 Terminals
- **Type**: Coupled type
- **Characteristics**: High speed, Differential transmission
- **Nominal Impedance**: The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following
- **Form**
- **Suffix**

Construction

- Ferrite
- Inner Conductor
- Electrode

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight per pcs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CG/CE (0302)</td>
<td>A 0.65±0.05 B 0.85±0.05 C 0.45±0.05 D 0.10 mm E 0.5±0.1 F 0.27±0.10</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CG120U</td>
<td>12 Ω±30 % 10 Ω max.</td>
<td>5</td>
<td>130</td>
<td>2.0</td>
</tr>
<tr>
<td>EXC14CG350U</td>
<td>35 Ω±30 % 15 Ω max.</td>
<td>5</td>
<td>100</td>
<td>2.0</td>
</tr>
<tr>
<td>EXC14CG430U</td>
<td>43 Ω±25 % 15 Ω max.</td>
<td>5</td>
<td>100</td>
<td>2.7</td>
</tr>
<tr>
<td>EXC14CE650U</td>
<td>65 Ω±20 % 20 Ω max.</td>
<td>5</td>
<td>130</td>
<td>2.5</td>
</tr>
<tr>
<td>EXC14CE900U</td>
<td>90 Ω±20 % 20 Ω max.</td>
<td>5</td>
<td>130</td>
<td>2.5</td>
</tr>
<tr>
<td>EXC14CE121U</td>
<td>120 Ω±20 % 20 Ω max.</td>
<td>5</td>
<td>100</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Category Temperature Range –40 °C to +85 °C

Impedance Characteristics (Typical)

- EXC14CG120U
- EXC14CG350U
- EXC14CG430U
- EXC14CE650U
- EXC14CE900U
- EXC14CE121U

Measurement Circuit
As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files
Common mode Noise Filters

Type: EXC14CT

Features

- Small and thin (L 0.85 mm x W 0.65 mm x H 0.45 mm)
- High attenuation at common-mode for noise suppression of harmonic signal components and cellular frequency
- High cut-off frequency and capability of coping with high-speed signals (USB and HDMI)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications

- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as MIPI, USB and LVDS

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions (mm)</th>
<th>Number of Terminals</th>
<th>Type</th>
<th>Characteristics</th>
<th>Nominal Impedance</th>
<th>Form</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>0.85 x 0.65 x 0.45 (L) x (W) x (H)</td>
<td>4 Terminals</td>
<td>Coupled type</td>
<td>High attenuation type</td>
<td>The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Construction

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pc.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CT (0302)</td>
<td>0.65 ± 0.05</td>
<td>0.45 ± 0.05 0.10 mm 0.9 ± 0.10 0.27 ± 0.10 1.0</td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
## Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Common Mode</td>
<td>Differential Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC14CT500U</td>
<td>50 Ω±25 %</td>
<td>17 Ω max.</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>EXC14CT900U</td>
<td>90 Ω±20 %</td>
<td>20 Ω max.</td>
<td>5</td>
<td>100</td>
</tr>
</tbody>
</table>

* Category Temperature Range –40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXC14CT500U**

![Impedance Characteristics Graph](image)

- **EXC14CT900U**

![Impedance Characteristics Graph](image)

**Measurement Circuit**

(A) Common Mode

(B) Differential Mode

### Attenuation Characteristics (Typical)

- **EXC14CT500U**

![Attenuation Characteristics Graph](image)

- **EXC14CT900U**

![Attenuation Characteristics Graph](image)

### As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files
Common mode Noise Filters

Type: **EXC14CX**

### Features
- Small and thin (L 0.85 mm\(\times\)W 0.65 mm\(\times\)H 0.45 mm)
- Effective noise suppression of smartphones by eliminating common mode noises and removing differential signal components
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

### Recommended Applications
- Smartphones, Tablet PCs and DSC
- Noise suppression of high-speed differential data lines such as MIPI, USB and LVDS

### Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>C</td>
<td>1</td>
<td>4</td>
<td>C</td>
<td>X</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

- **Product Code**
- **Size**
- **Number of Terminals**
- **Type**
- **Characteristics**
- **Nominal Impedance**
- **Form**
- **Suffix**

- **Noise Filter**
- **Code**
- **Dimensions(mm)**
- **Impedance**

<table>
<thead>
<tr>
<th>E</th>
<th>X</th>
<th>C</th>
<th>1</th>
<th>4</th>
<th>C</th>
<th>X</th>
<th>9</th>
<th>0</th>
<th>0</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise Filter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions(mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impedance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXC14CX**

- The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.

### Construction

- Ferrite
- Inner Conductor
- Electrode

### Dimensions in mm (not to scale)

| Part No. (inch size) | Dimensions (mm) | Mass (Weight) [mg/pc.]
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CX (0302)</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>0.85±0.05</td>
<td>0.45±0.05</td>
<td>0.10 mm</td>
</tr>
</tbody>
</table>

### Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CX280U</td>
<td>28 Ω±25 % 25 Ω max.</td>
<td>5</td>
<td>100</td>
<td>3.0</td>
</tr>
<tr>
<td>EXC14CX400U</td>
<td>40 Ω±25 % 30 Ω max.</td>
<td>5</td>
<td>100</td>
<td>4.0</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXC14CX280U**

  ![Impedance Characteristics Graph](image)

- **EXC14CX400U**

  ![Impedance Characteristics Graph](image)

- Measurement Circuit

  ![Measurement Circuit Diagram](image)

### Attenuation Characteristics (Typical)

- **EXC14CX280U**

  ![Attenuation Characteristics Graph](image)

- **EXC14CX400U**

  ![Attenuation Characteristics Graph](image)

- As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files
Common mode Noise Filters

Type: EXC16CT

Features

● Corresponding to new high-speed differential interface (MIPI C-PHY)
  Corresponding to 3-line transmission, transmission rate up to 2.5 Gsps
● Unique plating fine coil process and ceramic multilayer process enable compact size
  (L 0.90 mm x W 0.68 mm x H 0.40 mm)
  around 40% reduction of mounting area (comparing with MIPI D-PHY)
● Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
● Lead, halogen and antimony-free
● RoHS compliant

Recommended Applications

● High resolution camera and display equipped mobile devices (Smartphones, Tablet PCs and wearable)
● Noise suppression of high-speed differential data lines such as MIPI C-PHY

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>E</th>
<th>X</th>
<th>C</th>
<th>1</th>
<th>6</th>
<th>C</th>
<th>T</th>
<th>3</th>
<th>5</th>
<th>0</th>
<th>U</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise Filter Code</td>
<td>Product Code</td>
<td>Size</td>
<td>Number of Terminals</td>
<td>Type</td>
<td>Characteristics</td>
<td>Nominal Impedance</td>
<td>Form</td>
<td>Suffix</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions(mm)</td>
<td>9.0 x 0.68 x 0.40 L x W x H</td>
<td>6 Terminals</td>
<td>Coupled type</td>
<td>High attenuation type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.

Code | Packing
---|---
U | Embossed Carrier Taping
2 mm pitch, 10,000 pcs.

Construction

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass [Weight] [mg/pcs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC16CT (0403)</td>
<td>0.68x0.05 x 0.40x0.05</td>
<td>0.45x0.05 x 0.35x0.05</td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC16CT250U</td>
<td>25 ±25 %</td>
<td>5</td>
<td>100</td>
<td>3.0</td>
</tr>
<tr>
<td>EXC16CT350U</td>
<td>35 ±25 %</td>
<td>5</td>
<td>100</td>
<td>4.0</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files
Common mode Noise Filters

Type: EXC24CH

Features
- Small and thin type, built-in filter circuit (L 1.25 mm x W 1.00 mm x H 0.50 mm)
- Suppression of high frequency noise with little influence of waveform rounding on signal transmission, achieved by setting high cut-off frequency between 6 and 10 GHz
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications
- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD), Communications equipment (Mobile phones, Smartphones)
- Noise suppression of high-speed differential data lines such as USB 3.0, HDMI and Display Port

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>C</td>
<td>2</td>
<td>4</td>
<td>C</td>
<td>H</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

- **Product Code**: E
- **Size**: X
- **Number of Terminals**: C
- **Type**: 2
- **Characteristics**: 4
- **Nominal Impedance**: C
- **Form**: H
- **Nominal Impedance**: 9
- **Suffix**: 0

**Noise Filter**
- **Code**: EXC24CH
- **Dimensions(mm)**: 2.0 (L) x 1.0 (W) x 0.5 (H)
- **Terminals**: 4

**Dimensions in mm (not to scale)**

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pcs.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CH (0504)</td>
<td>1.25 ± 0.15 x 1.00 ± 0.15 x 0.50 ± 0.10</td>
<td>3</td>
</tr>
</tbody>
</table>

**Construction**

- Ferrite
- Inner Conductor
- Electrode

**Circuit Configuration (No Polarity)**

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
## Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100MHz</th>
<th>Cutoff Frequency (GHz)</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CH500U</td>
<td>50 ±25 %</td>
<td>13 Ω max.</td>
<td>10 Typ.</td>
<td>5</td>
<td>160</td>
</tr>
<tr>
<td>EXC24CH900U</td>
<td>90 ±20 %</td>
<td>15 Ω max.</td>
<td>6 Typ.</td>
<td>5</td>
<td>130</td>
</tr>
</tbody>
</table>

- Category Temperature Range −40 °C to +85 °C

### Impedance Characteristics (Typical)

![Impedance Characteristics](image)

- Measurement Circuit
  
  (A) Common Mode
  
  ![Common Mode Circuit](image)
  
  (B) Differential Mode
  
  ![Differential Mode Circuit](image)

### Insertion Loss (Typical)

![Insertion Loss](image)

- As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
Common mode Noise Filters

Type: EXC24CG

Features

- Elimination of radiation noises from high-speed differential transmissions
- Prevention of reflection of transmission signals and noise radiation by controlling TDR characteristic impedance as 100 Ω
- Satisfaction of eye pattern standards of HDMI waveforms with capability to improve waveform fluctuations of skew and overshoot
- Simple multilayer structure, excellent mass productivity and high reliability
- Small and thin (L 1.25 mm × W 1.00 mm × H 0.50 mm)
- RoHS compliant

Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD), Communications equipment (Mobile phones, Smartphones)
- Noise suppression of high-speed differential data lines such as HDMI, SATA and LAN

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>E</th>
<th>X</th>
<th>C</th>
<th>2</th>
<th>4</th>
<th>C</th>
<th>G</th>
<th>9</th>
<th>0</th>
<th>0</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise Filter Code</td>
<td>Dimensions(mm)</td>
<td>Type Number of Terminals</td>
<td>Characteristics</td>
<td>Nominal Impedance</td>
<td>Form Suffix</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC24CG</td>
<td>(0504)</td>
<td>1.25±0.15 1.00±0.15 0.50±0.10 0.20±0.15 0.55±0.10 0.30±0.10</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Construction

Dimensions in mm (not to scale)

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CG240U</td>
<td>24 Ω ±25 %</td>
<td>5</td>
<td>160</td>
<td>1.5</td>
</tr>
<tr>
<td>EXC24CG360U</td>
<td>36 Ω ±25 %</td>
<td>5</td>
<td>130</td>
<td>1.7</td>
</tr>
<tr>
<td>EXC24CG900U</td>
<td>90 Ω ±25 %</td>
<td>5</td>
<td>100</td>
<td>3.0</td>
</tr>
</tbody>
</table>

- **Category** Temperature Range: –40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXC24CG240U**

- **EXC24CG360U**

- **EXC24CG900U**

- **Measurement Circuit**

- **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files**
Common mode Noise Filters

Type: EXC24CE
EXC24CF

Features
- Elimination of radiation noises from high-speed differential transmissions
- Strong multilayer structure, excellent reflow resistance and high mounting reliability
- Magnetic shield type with no leakage
- High-Q impedance: EXC24CF
- Small and thin (L 1.25 mm × W 1.00 mm × H 0.50 mm)
- RoHS compliant

Recommended Applications
- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers), Communications equipment (Mobile phones, Smartphones)
- Noise suppression of high-speed differential data lines such as USB2.0 and LVDS

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>C</td>
<td>2</td>
<td>4</td>
<td>C</td>
<td>E</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

- **Product Code**
- **Size**
- **Number of Terminals**
- **Type**
- **Characteristics**
- **Nominal Impedance**
- **Form**
- **Suffix**

The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following.

Construction

- Ferrite
- Inner Conductor
- Electrode

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pcs.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CE/CF (0504)</td>
<td>25 ± 0.15 1.00 ± 0.15 0.55 ± 0.10</td>
<td>3</td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters

## Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Common Mode</td>
<td>Differential Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC24CE360UP</td>
<td>36 Ω±25 %</td>
<td>20 Ω max.</td>
<td>5</td>
<td>200</td>
</tr>
<tr>
<td>EXC24CE900U</td>
<td>90 Ω±25 %</td>
<td>15 Ω max.</td>
<td>5</td>
<td>160</td>
</tr>
<tr>
<td>EXC24CE121U</td>
<td>120 Ω±25 %</td>
<td>18 Ω max.</td>
<td>5</td>
<td>140</td>
</tr>
<tr>
<td>EXC24CE201U</td>
<td>200 Ω±25 %</td>
<td>20 Ω max.</td>
<td>5</td>
<td>130</td>
</tr>
<tr>
<td>EXC24CF900U</td>
<td>90 Ω±25 %</td>
<td>20 Ω max.</td>
<td>5</td>
<td>130</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXC24CE360UP**
- **EXC24CE900U**
- **EXC24CE121U**
- **EXC24CE201U**
- **EXC24CF900U**

- **Measurement Circuit**

- **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
  Please see Data Files

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Common mode Noise Filters

Type: EXC34CG/CE

Features

- Thin type, built-in filter circuit (L 2.0 mm x W 1.25 mm x H 0.50 mm)
- Noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers)
- Noise suppression of high-speed differential data lines such as USB2.0, LVDS, HDMI and LAN

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions (mm)</th>
<th>Number of Terminals</th>
<th>Type</th>
<th>Characteristics</th>
<th>Nominal Impedance</th>
<th>Form</th>
<th>Suffix</th>
<th>Packing</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX</td>
<td>2.00 x 1.25 x 0.50 (L) x (W) x (H)</td>
<td>4</td>
<td>C</td>
<td>High-speed Differential transmission (for Mbps)</td>
<td>Coupled type</td>
<td>G</td>
<td>U</td>
<td>Embossed Carrier Taping 4 mm pitch, 5,000 pcs.</td>
</tr>
</tbody>
</table>

Construction

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pc.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC34C (0805)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Current (mA DC)</th>
<th>Rated Voltage (V DC)</th>
<th>Insulation Resistance (MΩ min.)</th>
<th>Withstand Voltage (V DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC34CE670U</td>
<td>67 Ω±25 %</td>
<td>250</td>
<td>5</td>
<td>10 MΩ</td>
<td>125</td>
<td>0.8</td>
</tr>
<tr>
<td>EXC34CE900U</td>
<td>90 Ω±25 %</td>
<td>250</td>
<td>5</td>
<td>10 MΩ</td>
<td>125</td>
<td>0.8</td>
</tr>
<tr>
<td>EXC34CE121U</td>
<td>120 Ω±25 %</td>
<td>200</td>
<td>5</td>
<td>10 MΩ</td>
<td>125</td>
<td>1.0</td>
</tr>
<tr>
<td>EXC34CE201U</td>
<td>200 Ω±25 %</td>
<td>200</td>
<td>5</td>
<td>10 MΩ</td>
<td>125</td>
<td>1.0</td>
</tr>
<tr>
<td>EXC34CG900U</td>
<td>90 Ω±25 %</td>
<td>100</td>
<td>5</td>
<td>10 MΩ</td>
<td>125</td>
<td>3.0</td>
</tr>
</tbody>
</table>

- **Category Temperature Range** –40 °C to +85 °C

### Impedance Characteristics (Typical)

- EXC34CE670U
- EXC34CE900U
- EXC34CE121U
- EXC34CE201U
- EXC34CG900U

- **Measurement Circuit**

- **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
  Please see Data Files

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02 Mar. 2015

- 29 -
Common mode Noise Filters Array

Type: EXC18CG
EXC18CE

Features

- Small and thin type, two built-in filter circuit (L 1.6 mm×W 0.8 mm×H 0.4 mm)
- Noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- Low DC resistance and low insertion loss
- High-Q value and high impedance of GHz zone : EXC18CG type
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers)
- Noise suppression of high-speed differential data lines such as USB2.0, LVDS, HDMI and LAN

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions(mm)</th>
<th>Number of Terminals</th>
<th>Type</th>
<th>Characteristics</th>
<th>Nominal Impedance</th>
<th>Form</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>1.6 × 0.8 × 0.4 (L) × (W) × (H)</td>
<td>8 Terminals</td>
<td>C</td>
<td>Coupled type</td>
<td>High speed Differential transmission</td>
<td>0.4±0.1</td>
<td>U</td>
</tr>
</tbody>
</table>

Construction

- Ferrite
- Inner Conductor Electrode

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight [mg/pc.])</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC18CG/CE (0603)</td>
<td>0.8±0.1 1.6±0.1 0.4±0.1 0.2±0.1 0.4±0.1 0.2±0.1 2.6</td>
<td></td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters Array

Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Ω)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC18CG430U</td>
<td>43 ±25 %</td>
<td>5</td>
<td>100</td>
<td>2.7</td>
</tr>
<tr>
<td>EXC18CE650U</td>
<td>65 ±20 %</td>
<td>5</td>
<td>140</td>
<td>1.8</td>
</tr>
<tr>
<td>EXC18CE900U</td>
<td>90 ±20 %</td>
<td>5</td>
<td>130</td>
<td>2.0</td>
</tr>
<tr>
<td>EXC18CE201U</td>
<td>200 ±20 %</td>
<td>5</td>
<td>100</td>
<td>3.5</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

Impedance Characteristics (Typical)

- EXC18CG430U

- EXC18CE650U

- EXC18CE900U

- EXC18CE201U

- Measurement Circuit

(A) Common Mode

(B) Differential Mode

As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files
Common mode Noise Filter Array

Type: EXC28CH

Features

- Small and thin type, two built-in filter circuit (L 2.0 mm x W 1.0 mm x H 0.5 mm)
- Suppression of high frequency noise with little influence of waveform rounding on signal transmission, achieved by setting high cut-off frequency between 6 and 10 GHz
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications

- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers)
- Noise suppression of high-speed differential data lines such as USB3.0, LVDS, HDMI and LAN

Explanation of Part Numbers

```
<table>
<thead>
<tr>
<th>E</th>
<th>X</th>
<th>C</th>
<th>2</th>
<th>8</th>
<th>H</th>
<th>9</th>
<th>0</th>
<th>0</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Noise Filter</td>
<td>Product Code</td>
<td>Size</td>
<td>Number of Terminals</td>
<td>Type</td>
<td>Characteristics</td>
<td>Nominal Impedance</td>
</tr>
</tbody>
</table>

- C: Number of Terminals
- H: High speed Differential transmission (for Gbps)
- The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following

Packing

- U: Embossed Carrier Taping 4 mm pitch, 5,000 pcs.

Construction

- Ferrite
- Inner Conductor
- Electrode

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) (mg/pcs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC28CH (0804)</td>
<td>A: 1.00±0.15</td>
<td>B: 2.0±0.2</td>
</tr>
<tr>
<td></td>
<td>C: 0.5±0.1</td>
<td>D: 1.2±0.15</td>
</tr>
<tr>
<td></td>
<td>E: 0.5±0.1</td>
<td>F: 0.25±0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

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Common mode Noise Filter Array

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Cutoff Frequency (GHz)</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC28CH500U</td>
<td>50 ±25 % 13 Ω max.</td>
<td>10 Typ.</td>
<td>5</td>
<td>160</td>
<td>1.5</td>
</tr>
<tr>
<td>EXC28CH900U</td>
<td>90 ±20 % 15 Ω max.</td>
<td>6 Typ.</td>
<td>5</td>
<td>130</td>
<td>2.5</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

### Impedance Characteristics (Typical)

![Impedance Characteristics Graph]

- Measurement Circuit
  - (A) Common Mode
  - (B) Differential Mode

### Insertion Loss (Typical)

![Insertion Loss Graph]

- As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files

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03 Mar. 2015
Common mode Noise Filter Array

Type: EXC28CG

Features

• Small and thin type, two built-in filter circuit (L 2.0 mm×W 1.0 mm×H 0.5 mm)
• Prevention of weakening of transmission signals by controlling signal pass band as 3 GHz or above
• Prevention of reflection of transmission signals and noise radiation by controlling TDR characteristic impedance as 100 Ω
• Satisfaction of eye pattern standards of HDMI waveforms with capability to improve waveform fluctuations of Jitter and phase shift etc
• Elimination of radiation noises from high-speed differential transmissions
• Magnetic shield type with no leakage
• RoHS compliant

Recommended Applications

• AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD), Communications equipment (Mobile phones, Smartphones)
• Noise suppression of high-speed differential data lines such as HDMI, SATA and LAN

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>C</td>
<td>2</td>
<td>8</td>
<td>C</td>
<td>G</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>U</td>
<td></td>
</tr>
</tbody>
</table>

Construction

Dimensions in mm (not to scale)

Circuit Configuration (No Polarity)
Common mode Noise Filter Array

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC28CG240U</td>
<td>24 Ω ±25 %</td>
<td>5</td>
<td>160</td>
<td>1.5</td>
</tr>
<tr>
<td>EXC28CG900U</td>
<td>90 Ω ±25 %</td>
<td>5</td>
<td>130</td>
<td>3.0</td>
</tr>
</tbody>
</table>

- Category Temperature Range −40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXC28CG240U**

- **EXC28CG900U**

- **Measurement Circuit**

- **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files**
Common mode Noise Filter Array

Type: EXC28CE

Features
● Small and thin type, two built-in filter circuit (L 2.0 mm × W 1.0 mm × H 0.5 mm)
● Elimination of radiation noises from high-speed differential transmissions
● Magnetic shield type with no leakage
● Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
● Lead, halogen and antimony-free
● RoHS compliant

Recommended Applications
● AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD, Printers), Communications equipment (Mobile phones, Smartphones)
● Noise suppression of high-speed differential data lines such as USB2.0 and LVDS

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>C</td>
<td>8</td>
<td>C</td>
<td>E</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>U</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Product Code
- Size
- Number of Terminals
- Type
- Characteristics
- Nominal Impedance
- Form
- Suffix

Noise Filter Code Dimensions (mm) Mass (Weight)[mg/pc.]
2 2.0 × 1.0 × 0.5 (L) × (W) × (H) 5

Construction

Dimensions in mm (not to scale)

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filter Array

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Common Mode</td>
<td>Differential Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC28CE900U</td>
<td>90 Ω±25 %</td>
<td>15 Ω max.</td>
<td>5</td>
<td>160</td>
</tr>
<tr>
<td>EXC28CE121U</td>
<td>120 Ω±25 %</td>
<td>18 Ω max.</td>
<td>5</td>
<td>140</td>
</tr>
<tr>
<td>EXC28CE201U</td>
<td>200 Ω±25 %</td>
<td>20 Ω max.</td>
<td>5</td>
<td>130</td>
</tr>
</tbody>
</table>

- Category Temperature Range -40 °C to +85 °C

### Impedance Characteristics (Typical)

![Impedance Characteristics Graphs](image)

- **EXC28CE900U**
  - Impedance (Ω) vs. Frequency (MHz)
  - Common Mode and Differential Mode

- **EXC28CE121U**
  - Impedance (Ω) vs. Frequency (MHz)
  - Common Mode and Differential Mode

- **EXC28CE201U**
  - Impedance (Ω) vs. Frequency (MHz)
  - Common Mode and Differential Mode

### Measurement Circuit

![Measurement Circuit Diagram](image)

- **(A) Common Mode**
  - Diagram showing the common mode connection

- **(B) Differential Mode**
  - Diagram showing the differential mode connection

- As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files
Packaging Methods (Taping)

- **Standard Quantity**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Size (inch)</th>
<th>Type</th>
<th>Kind of Taping</th>
<th>Pitch (P₁)</th>
<th>Quantity</th>
<th>Size (inch)</th>
<th>Type</th>
<th>Kind of Taping</th>
<th>Pitch (P₁)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC4C</td>
<td>0202</td>
<td>Single</td>
<td>Pressed Carrier Taping</td>
<td>2 mm</td>
<td>10,000 pcs./reel</td>
<td>EXC14C</td>
<td>0302</td>
<td>Embossed Carrier Taping</td>
<td>2 mm</td>
<td>10,000 pcs./reel</td>
</tr>
<tr>
<td>EXC14C</td>
<td>0302</td>
<td>Single</td>
<td>Embossed Carrier Taping</td>
<td>4 mm</td>
<td>5,000 pcs./reel</td>
<td>EXC16C</td>
<td>0403</td>
<td>Single</td>
<td>Pressed Carrier Taping</td>
<td>2 mm</td>
</tr>
<tr>
<td>EXC24C</td>
<td>0504</td>
<td>Single</td>
<td>Embossed Carrier Taping</td>
<td>4 mm</td>
<td>5,000 pcs./reel</td>
<td>EXC34C</td>
<td>0805</td>
<td>Single</td>
<td>Pressed Carrier Taping</td>
<td>2 mm</td>
</tr>
<tr>
<td>EXC18C</td>
<td>0603</td>
<td>Array</td>
<td>Embossed Carrier Taping</td>
<td>4 mm</td>
<td>5,000 pcs./reel</td>
<td>EXC28C</td>
<td>0802</td>
<td>Single</td>
<td>Pressed Carrier Taping</td>
<td>2 mm</td>
</tr>
<tr>
<td>EXC28C</td>
<td>0802</td>
<td>Array</td>
<td>Embossed Carrier Taping</td>
<td>4 mm</td>
<td>5,000 pcs./reel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Pressed Carrier Taping**

<table>
<thead>
<tr>
<th>EXC4C</th>
</tr>
</thead>
<tbody>
<tr>
<td>chap component</td>
</tr>
<tr>
<td>compart</td>
</tr>
<tr>
<td>tape running direction</td>
</tr>
</tbody>
</table>

- **Embossed Carrier Taping**

<table>
<thead>
<tr>
<th>EXC14C, 16C</th>
</tr>
</thead>
<tbody>
<tr>
<td>chap component</td>
</tr>
<tr>
<td>compart</td>
</tr>
<tr>
<td>tape running direction</td>
</tr>
</tbody>
</table>

- **Taping Reel**

- **Pressed Carrier Taping**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>A</th>
<th>B</th>
<th>W</th>
<th>F</th>
<th>E</th>
<th>P₁</th>
<th>P₂</th>
<th>P₀</th>
<th>φD₀</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC4C</td>
<td>0.60±0.10</td>
<td>0.80±0.10</td>
<td>8.0±0.2</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
<td>2.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.35 typ</td>
</tr>
</tbody>
</table>

- **Embossed Carrier Taping**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>A</th>
<th>B</th>
<th>W</th>
<th>F</th>
<th>E</th>
<th>P₁</th>
<th>P₂</th>
<th>P₀</th>
<th>φD₀</th>
<th>t₁</th>
<th>t₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14C</td>
<td>0.75±0.10</td>
<td>0.95±0.10</td>
<td>8.0±0.2</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
<td>2.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.25±0.05</td>
<td>0.85±0.15</td>
</tr>
<tr>
<td>EXC16C</td>
<td>0.77±0.10</td>
<td>0.99±0.10</td>
<td>8.0±0.2</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
<td>2.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.25±0.05</td>
<td>0.80±0.15</td>
</tr>
<tr>
<td>EXC18C</td>
<td>1.00±0.10</td>
<td>1.80±0.10</td>
<td>8.0±0.2</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
<td>2.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.25±0.05</td>
<td>0.80±0.15</td>
</tr>
<tr>
<td>EXC24C</td>
<td>1.20±0.15</td>
<td>1.45±0.15</td>
<td>8.0±0.2</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
<td>2.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.25±0.05</td>
<td>0.90±0.15</td>
</tr>
<tr>
<td>EXC28C</td>
<td>1.50±0.20</td>
<td>2.30±0.20</td>
<td>8.0±0.2</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
<td>2.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.25±0.05</td>
<td>0.90±0.15</td>
</tr>
</tbody>
</table>

- **Taping Reel**

**Standard Reel Dimensions**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>φA</th>
<th>φB</th>
<th>φC</th>
<th>φD</th>
<th>E</th>
<th>W</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC4C</td>
<td>180.0±3.0</td>
<td>60.0±1.0</td>
<td>13.0±0.2</td>
<td>21.0±0.8</td>
<td>2.0±0.5</td>
<td>9.0±0.3</td>
<td>11.4±1.5</td>
</tr>
<tr>
<td>EXC14C</td>
<td>180.0±3.0</td>
<td>60.0±1.0</td>
<td>13.0±0.2</td>
<td>21.0±0.8</td>
<td>2.0±0.5</td>
<td>9.0±0.3</td>
<td>11.4±1.5</td>
</tr>
<tr>
<td>EXC16C</td>
<td>180.0±3.0</td>
<td>60.0±1.0</td>
<td>13.0±0.2</td>
<td>21.0±0.8</td>
<td>2.0±0.5</td>
<td>9.0±0.3</td>
<td>11.4±1.5</td>
</tr>
<tr>
<td>EXC24C</td>
<td>180.0±3.0</td>
<td>60.0±1.0</td>
<td>13.0±0.2</td>
<td>21.0±0.8</td>
<td>2.0±0.5</td>
<td>9.0±0.3</td>
<td>11.4±1.5</td>
</tr>
<tr>
<td>EXC28C</td>
<td>180.0±3.0</td>
<td>60.0±1.0</td>
<td>13.0±0.2</td>
<td>21.0±0.8</td>
<td>2.0±0.5</td>
<td>9.0±0.3</td>
<td>11.4±1.5</td>
</tr>
</tbody>
</table>

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Should a safety concern arise regarding this product, please be sure to contact us immediately.

07 Dec. 2018
Recommended Land Pattern Design

- **Single**
  - EXCX4C, 14C, 24C, 34C
  - EXC16C

- **Array**

### Common Mode Noise Filters / Array

#### Preheating

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>EXC4C</td>
<td>0.80 to 0.90</td>
</tr>
<tr>
<td>EXC14C</td>
<td>0.80 to 1.00</td>
</tr>
<tr>
<td>EXC24C</td>
<td>1.60 to 2.00</td>
</tr>
<tr>
<td>EXC34C</td>
<td>2.60</td>
</tr>
<tr>
<td>EXC16C</td>
<td>0.99</td>
</tr>
</tbody>
</table>

#### Recommended Soldering Conditions

**Recommendations and precautions are described below**

- **Recommended soldering conditions for reflow**
  - Reflow soldering shall be performed a maximum of two times.
  - Please contact us for additional information when used in conditions other than those specified.
  - Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.

- **Flow soldering**
  - We do not recommend flow soldering, because flow soldering may cause bridges between the electrodes.

**Repair with hand soldering**

- Preheat with a blast of hot air or similar method. Use a soldering iron with a tip temperature of 350 °C or less. Solder each electrode for 3 seconds or less.
- Never touch this product with the tip of a soldering iron.

### Temperature vs. Time

#### Temperature vs. Time

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>140 °C to 160 °C</td>
<td>60 s to 120 s</td>
</tr>
<tr>
<td>Above 200 °C</td>
<td>30 s to 40 s</td>
</tr>
<tr>
<td>235 ± 10 °C</td>
<td>max. 10 s</td>
</tr>
</tbody>
</table>

#### Temperature vs. Time

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 °C to 170 °C</td>
<td>60 s to 120 s</td>
</tr>
<tr>
<td>Above 230 °C</td>
<td>30 s to 40 s</td>
</tr>
<tr>
<td>max. 260 °C</td>
<td>max. 10 s</td>
</tr>
</tbody>
</table>
Common mode Noise Filters with ESD Suppressor

Type: **EXC14CS**

### Features
- Provides EMI Filtering and ESD Protection (L 0.85 mm × W 0.65 mm × H 0.45 mm)
- ESD and noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- High Common mode attenuation in the range between 700 MHz and 1 GHz (RF band)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

### Recommended Applications
- Smartphones, Tablet PCs and DSC
- ESD and noise suppression of high-speed differential data lines such as MIPI and USB

### Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>X</td>
<td>C</td>
<td>1</td>
<td>4</td>
<td>C</td>
<td>S</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>H</td>
<td></td>
</tr>
</tbody>
</table>

- **E**: Product Code
- **X**: Size
- **C**: Number of Terminals
- **1**: Type
- **4**: Characteristics
- **C**: Nominal Impedance
- **S**: Form
- **0**: Suffix

- **Code**: Embossed Carrier Taping
- **Packing**: 2 mm pitch, 10,000 pcs.

### Construction

- **Ceramics**
- **Ferrite**
- **Inner Conductor**
- **Electrode**

### Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pc.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CS (0302)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.

Should a safety concern arise regarding this product, please be sure to contact us immediately.

Common mode Noise Filters with ESD Suppressor

### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Common Mode</td>
<td>Differential Mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC14CS350H</td>
<td>35 Ω±30 %</td>
<td>15 Ω max.</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>EXC14CS900H</td>
<td>90 Ω±20 %</td>
<td>20 Ω max.</td>
<td>5</td>
<td>100</td>
</tr>
</tbody>
</table>

*Category Temperature Range –40 °C to +85 °C

### Impedance Characteristics (Typical)

- **EXC14CS350H**

![Impedance Characteristics (Typical) - EXC14CS350H](image)

- **EXC14CS900H**

![Impedance Characteristics (Typical) - EXC14CS900H](image)

**Measurement Circuit**

- (A) Common Mode
- (B) Differential Mode

### ESD Suppression Characteristics (Typical: IEC61000-4-2, 8 kV contact discharge)

![ESD Suppression Characteristics](image)

### Recommended Land Pattern Design in mm (not to scale)

![Recommended Land Pattern Design in mm](image)

- **As for Packaging Methods, Soldering Conditions and Safety Precautions,**
  Please see Data Files

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02 Dec. 2018
Common mode Noise Filters with ESD Suppressor

Type: EXC24CS

Features
- Provides EMI Filtering and ESD Protection (L 1.25 mm x W 1.00 mm x H 0.50 mm)
- ESD and noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- High Common mode attenuation in the range between 700 MHz and 1 GHz (RF band)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications
- Smartphones, Tablet PCs and DSC
- ESD and noise suppression of high-speed differential data lines such as MIPI and USB

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Dimensions (inch)</th>
<th>Mass (Weight)</th>
<th>Packing</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CS</td>
<td>0.25±0.15 x 0.47±0.15</td>
<td>2.4 mg/pc.</td>
<td>4 mm pitch, 5,000 pcs.</td>
</tr>
</tbody>
</table>

Construction

Dimensions in mm (not to scale)

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filters with ESD Suppressor

Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CS350U</td>
<td>35 Ω±30 %</td>
<td>5</td>
<td>100</td>
<td>2.0</td>
</tr>
<tr>
<td>EXC24CS900U</td>
<td>90 Ω±20 %</td>
<td>5</td>
<td>100</td>
<td>3.0</td>
</tr>
</tbody>
</table>

● Category Temperature Range –40 °C to +85 °C

Impedance Characteristics (Typical)

- EXC24CS350U

- EXC24CS900U

● Measurement Circuit

ESD Suppression Characteristics (Typical): IEC61000-4-2, 8 kV contact discharge

Recommended Land Pattern Design in mm (not to scale)

■ As for Packaging Methods, Soldering Conditions and Safety Precautions,
Please see Data Files
Common mode Noise Filter Array with ESD Suppressor

Type: EXC18CS

Features
- Provides EMI Filtering and ESD Protection (L 1.6 mm × W 0.8 mm × H 0.4 mm)
- ESD and noise suppression of high-speed differential transmission lines with little influence of waveform rounding on signal transmission
- High Common mode attenuation in the range between 700 MHz and 1 GHz (RF band)
- Strong multilayer/sintered structure, excellent reflow resistance and high mounting reliability
- Lead, halogen and antimony-free
- RoHS compliant

Recommended Applications
- Smartphones, Tablet PCs and DSC
- ESD and noise suppression of high-speed differential data lines such as MIPI and USB

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC18CS</td>
<td>1.6±0.1 0.8±0.1 0.4±0.1 0.4±0.1 0.2±0.1 0.2±0.1</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Dimensions in mm (not to scale)

Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
Common mode Noise Filter Array with ESD Suppressor

Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC18CS350U</td>
<td>35 Ω±30 % Common Mode</td>
<td>5</td>
<td>100</td>
<td>1.8±30 %</td>
</tr>
<tr>
<td></td>
<td>15 Ω max. Differential Mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC18CS900U</td>
<td>90 Ω±20 % Common Mode</td>
<td>5</td>
<td>100</td>
<td>3.0±30 %</td>
</tr>
<tr>
<td></td>
<td>20 Ω max. Differential Mode</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

Impedance Characteristics (Typical)

- **EXC18CS350U**

- **EXC18CS900U**

- Measurement Circuit

- ESD Suppression Characteristics (Typical: IEC61000-4-2, 8 kV contact discharge)

- Recommended Land Pattern Design in mm (not to scale)

- As for Packaging Methods, Soldering Conditions and Safety Precautions, Please see Data Files

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**Packaging Methods (Taping)**

- **Standard Quantity**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Size (inch)</th>
<th>Type</th>
<th>Kind of Taping</th>
<th>Pitch (P₁)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CS</td>
<td>0302</td>
<td>Single</td>
<td>Embossed Carrier Taping</td>
<td>2 mm</td>
<td>10,000 pcs./reel</td>
</tr>
<tr>
<td>EXC24CS</td>
<td>0504</td>
<td></td>
<td></td>
<td>4 mm</td>
<td>5,000 pcs./reel</td>
</tr>
<tr>
<td>EXC18CS</td>
<td>0603</td>
<td>Array</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Embossed Carrier Taping**

**EXC14CS**

- **Taping Reel**

**EXC18CS, EXC24CS**

- **Embossed Carrier Taping**

**EXC14CS**

- **Embossed Carrier Taping**

**EXC18CS, EXC24CS**

**Taping Reel**

**Embossed Carrier Taping**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>A</th>
<th>B</th>
<th>W</th>
<th>F</th>
<th>E</th>
<th>P₁</th>
<th>P₂</th>
<th>P₃</th>
<th>φD₀</th>
<th>t₁</th>
<th>t₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CS</td>
<td>0.75±0.10</td>
<td>0.95±0.10</td>
<td>8.0±0.2</td>
<td>3.5±0.05</td>
<td>1.75±0.10</td>
<td>2.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.25±0.05</td>
<td>0.85±0.15</td>
</tr>
<tr>
<td>EXC18CS</td>
<td>1.00±0.10</td>
<td>1.80±0.10</td>
<td>8.0±0.2</td>
<td>3.5±0.1</td>
<td>1.75±0.10</td>
<td>4.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.25±0.05</td>
<td>0.50±0.05</td>
</tr>
<tr>
<td>EXC24CS</td>
<td>1.20±0.15</td>
<td>1.45±0.15</td>
<td>8.0±0.2</td>
<td>3.5±0.1</td>
<td>1.75±0.10</td>
<td>4.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>1.5±0.1</td>
<td>0.25±0.05</td>
<td>0.90±0.15</td>
</tr>
</tbody>
</table>

**Taping Reel**

**Standard Reel Dimensions**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>φA</th>
<th>φB</th>
<th>φC</th>
<th>φD</th>
<th>E</th>
<th>W</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CS</td>
<td>180.0±3.0</td>
<td>60.0±1.0</td>
<td>13.0±0.5</td>
<td>21.0±0.8</td>
<td>2.0±0.5</td>
<td>9.0±0.3</td>
<td>11.4±1.5</td>
</tr>
<tr>
<td>EXC18CS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC24CS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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01 Dec. 2018
# Recommended Soldering Conditions

Recommendations and precautions are described below.

- **Recommended soldering conditions for reflow**
  - Reflow soldering shall be performed a maximum of two times.
  - Please contact us for additional information when used in conditions other than those specified.
  - Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.

  ![Soldering Temperature Diagram]

- **Flow soldering**
  - We do not recommend flow soldering, because flow soldering may cause bridges between the electrodes.

<table>
<thead>
<tr>
<th>For soldering (Example : Sn-37Pb)</th>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preheating</td>
<td>140 °C to 160 °C</td>
<td>60 s to 120 s</td>
</tr>
<tr>
<td>Main heating</td>
<td>Above 200 °C</td>
<td>30 s to 40 s</td>
</tr>
<tr>
<td>Peak</td>
<td>235 ± 10 °C</td>
<td>max. 10 s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>For lead-free soldering (Example : Sn/3Ag/0.5Cu)</th>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preheating</td>
<td>150 °C to 170 °C</td>
<td>60 s to 120 s</td>
</tr>
<tr>
<td>Main heating</td>
<td>Above 230 °C</td>
<td>30 s to 40 s</td>
</tr>
<tr>
<td>Peak</td>
<td>max. 260 °C</td>
<td>max. 10 s</td>
</tr>
</tbody>
</table>

**<Repair with hand soldering>**
- Preheat with a blast of hot air or similar method. Use a soldering iron with a tip temperature of 350 °C or less. Solder each electrode for 3 seconds or less.
- Never touch this product with the tip of a soldering iron.
2 mode Noise Filters

Type: EXC14CP

### Features
- Small size and low-profile: 0302 inch size (L 0.85 mm × W 0.65 mm × H 0.45 mm)
- Burst/radiation noise filtering for audio circuits
- The optimally magnetic-coupled ferrite beads allow for the filtering of both common and normal mode noises
- The strong multi-layer structure provides high resistance to reflow soldering heat and a high mounting reliability
- Lead, halogen, and antimony free
- RoHS compliant

### Recommended Applications
- Smart phones, Tablet PCs, DSC and Portable Music Player
- Noise suppression of burst noise of Receiver/Microphone and D-class power amplifier

### Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions(mm)</th>
<th>Nominal Impedance Low DCR Type</th>
<th>Form</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>0.85 × 0.65 × 0.45 (L × W × H)</td>
<td>The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>4 Terminals</td>
<td></td>
<td>Embossed Carrier Taping</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Coupled type</td>
<td></td>
<td>2 mm pitch, 10,000 pcs.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Construction

- Ferrite
- Inner Conductor
- Electrode

### Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [mg/pc.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CP (0302)</td>
<td>A 0.65 ± 0.15, B 0.65 ± 0.15, C 0.45 ± 0.05, D 0.10 ± 0.10, E 0.50 ± 0.10, F 0.27 ± 0.10</td>
<td>1.2</td>
</tr>
</tbody>
</table>

### Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.
### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Ω) at 100 MHz</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CP121U</td>
<td>Open mode: 120 ±30 %</td>
<td>140 ±25 %</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Common mode: 75</td>
<td>300</td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>EXC14CP221U</td>
<td>Open mode: 220 ±30 %</td>
<td>140 ±25 %</td>
<td>200</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>Common mode: 100</td>
<td>300</td>
<td></td>
<td>0.7</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

### Impedance Characteristics (Typical)

#### EXC14CP121U

- **Open Mode**
- **Common Mode**

#### EXC14CP221U

- **Open Mode**
- **Common Mode**

#### Measurement Circuit

- (A) Open Mode
- (B) Common Mode

#### As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,
Please see Data Files
2 mode Noise Filters

**Type:** EXC24CB/CP
EXC24CN

---

### Features
- Burst/radiation noise filtering for audio circuits
- The optimally magnetic-coupled ferrite beads allow for the filtering of both common and normal mode noises
- The strong multi-layer structure provides high resistance to reflow soldering heat and a high mounting reliability
- Magnetic shield type
- High Impedance : 220 to 1 kΩ (EXC24CB type)
- Low Resistance Value : 0.4 Ω max. (EXC24CP type)
- High Impedance : 600 Ω, Low Resistance Value : 0.9 Ω max. (EXC24CN type)
- RoHS compliant

---

### Recommended Applications
- Smart phones, Tablet PCs, DSC and Portable Music Player
- Noise suppression of burst noise of Receiver/Microphone and D-class power amplifier

---

### Explanation of Part Numbers

#### EXC24CB/CP Type

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions(mm)</th>
<th>1 Terminals</th>
<th>C Coupled type</th>
<th>B High Impedance Type</th>
<th>P Low DCR Type</th>
<th>The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.25 x 1.00 x 0.50 (L) x (W) x (H)</td>
<td>C</td>
<td>B</td>
<td></td>
<td>P</td>
<td></td>
</tr>
</tbody>
</table>

#### EXC24CN Type

<table>
<thead>
<tr>
<th>Code</th>
<th>Dimensions(mm)</th>
<th>1 Terminals</th>
<th>C Coupled type</th>
<th>N High Impedance Type and Low DCR Type</th>
<th>The first two digits are significant figure of impedance value, and the third one denotes the number of zeros following</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.25 x 1.00 x 0.50 (L) x (W) x (H)</td>
<td>C</td>
<td>N</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

### 2 mode Noise Filters

#### Construction

[Diagram of construction showing Ferrite, Inner Conductor, and Electrode]

#### Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) (mg/pc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24C (0504)</td>
<td>1.00±0.15 1.25±0.15 0.50±0.10 0.20±0.15 0.65±0.10 0.35±0.10</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Circuit Configuration (No Polarity)

- The pin numbers shown here are for reference purposes only. Confirm the actual pin number arrangement with the exchanged specification documents.

![Circuit Configuration Diagram]

#### Ratings

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Open mode) (Ω) at 100 MHz</th>
<th>Tolerance(%)</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CP121U</td>
<td>120</td>
<td>±25</td>
<td>5</td>
<td>500</td>
<td>0.3</td>
</tr>
<tr>
<td>EXC24CP221U</td>
<td>220</td>
<td>350</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC24CB221U</td>
<td>220</td>
<td>100</td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EXC24CB102U</td>
<td>1000</td>
<td>50</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Impedance (Common mode) (Ω) at 100 MHz</th>
<th>Tolerance(%)</th>
<th>Rated Voltage (V DC)</th>
<th>Rated Current (mA DC)</th>
<th>DC Resistance (Ω) max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CN601X</td>
<td>600</td>
<td>±25</td>
<td>5</td>
<td>200</td>
<td>0.9</td>
</tr>
</tbody>
</table>

- Category Temperature Range –40 °C to +85 °C

Dec. 2018
Impedance Characteristics (Typical)

- **EXC24CP121U**
- **EXC24CP221U**
- **EXC24CB221U**
- **EXC24CB102U**

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Normal Mode</th>
<th>Open Mode</th>
<th>Common Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 10 100 1000 10000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Attenuation Characteristics (Typical)

- **EXC24CN601X**

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Differential Mode</th>
<th>Common Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 10 100 1000 10000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Measurement Circuit**
  - (A) Open Mode
  - (B) Common Mode
  - (C) Normal Mode
  - (D) Differential Mode

**As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions, Please see Data Files**
Packaging Methods (Taping)

- Standard Quantity

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Size (inch)</th>
<th>Kind of Taping</th>
<th>Pitch ($P_1$)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CP U</td>
<td>0302</td>
<td>Embossed Carrier Taping</td>
<td>2 mm</td>
<td>10,000 pcs./reel</td>
</tr>
<tr>
<td>EXC24CP/CBU</td>
<td>0504</td>
<td>Embossed Carrier Taping</td>
<td>4 mm</td>
<td>5,000 pcs./reel</td>
</tr>
<tr>
<td>EXC24CNX</td>
<td>0504</td>
<td>Pressed Carrier Taping</td>
<td>2 mm</td>
<td>10,000 pcs./reel</td>
</tr>
</tbody>
</table>

- Embossed Carrier Taping

- Pressed Carrier Taping

- Taping Reel

- Embossed Carrier Dimensions

<table>
<thead>
<tr>
<th>Part Number</th>
<th>A</th>
<th>B</th>
<th>W</th>
<th>F</th>
<th>E</th>
<th>$P_1$</th>
<th>$P_2$</th>
<th>$P_0$</th>
<th>$\phi D_0$</th>
<th>$t_1$</th>
<th>$t_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14CP</td>
<td>0.75</td>
<td>0.95</td>
<td>8.0</td>
<td>3.50</td>
<td>1.75</td>
<td>2.0</td>
<td>2.0</td>
<td>1.5</td>
<td>0.25</td>
<td>0.85</td>
<td>±0.15</td>
</tr>
<tr>
<td>EXC24CP/CB</td>
<td>1.20</td>
<td>1.45</td>
<td>8.0</td>
<td>3.5</td>
<td>1.75</td>
<td>4.0</td>
<td>2.0</td>
<td>1.5</td>
<td>0.25</td>
<td>0.90</td>
<td>±0.15</td>
</tr>
</tbody>
</table>

- Pressed Carrier Dimensions

<table>
<thead>
<tr>
<th>Part Number</th>
<th>A</th>
<th>B</th>
<th>W</th>
<th>F</th>
<th>E</th>
<th>$P_1$</th>
<th>$P_2$</th>
<th>$P_0$</th>
<th>$\phi D_0$</th>
<th>$t_1$</th>
<th>$t_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC24CN</td>
<td>1.14</td>
<td>1.38</td>
<td>8.0</td>
<td>3.5</td>
<td>1.75</td>
<td>2.0</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5±0.1</td>
<td>0.68</td>
<td>±0.10</td>
</tr>
</tbody>
</table>

- Standard Reel Dimensions

<table>
<thead>
<tr>
<th>Part Number</th>
<th>A</th>
<th>B</th>
<th>W</th>
<th>E</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXC14C/EXC24C</td>
<td>180.0</td>
<td>60.0</td>
<td>13.0</td>
<td>21.0</td>
<td>11.4</td>
</tr>
</tbody>
</table>

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
**Recommended Land Pattern Design**

![Recommended Land Pattern Diagram]

**Recommended Soldering Conditions**

Recommendations and precautions are described below.

- **Recommended soldering conditions for reflow**
  - Reflow soldering shall be performed a maximum of two times.
  - Please contact us for additional information when used in conditions other than those specified.
  - Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Dimension (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>EXC14CP</td>
<td>0.80 to 1.00</td>
</tr>
<tr>
<td>EXC24CP</td>
<td>1.50 to 1.90</td>
</tr>
<tr>
<td>EXC24CB</td>
<td></td>
</tr>
<tr>
<td>EXC24CN</td>
<td></td>
</tr>
</tbody>
</table>

- **Flow soldering**
  - We do not recommend flow soldering, because flow soldering may cause bridges between the electrodes.

  - **For soldering (Example : Sn-37Pb)**
    - **Preheating**
      - Temperature: 140 °C to 160 °C
      - Time: 60 s to 120 s
    - **Main heating**
      - Temperature: Above 200 °C
      - Time: 30 s to 40 s
    - **Peak**
      - Temperature: 235 ± 10 °C
      - Time: max. 10 s

  - **For lead-free soldering (Example : Sn/3Ag/0.5Cu)**
    - **Preheating**
      - Temperature: 150 °C to 170 °C
      - Time: 60 s to 120 s
    - **Main heating**
      - Temperature: Above 230 °C
      - Time: 30 s to 40 s
    - **Peak**
      - Temperature: max. 260 °C
      - Time: max. 10 s

- **Repair with hand soldering**
  - Preheat with a blast of hot air or similar method. Use a soldering iron with a tip temperature of 350 °C or less. Solder each electrode for 3 seconds or less.
  - Never touch this product with the tip of a soldering iron.
### Performance

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Performance Requirements</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance</td>
<td>Within Specified Tolerance</td>
<td>25 °C</td>
</tr>
<tr>
<td>Overload</td>
<td></td>
<td>Rated Voltage</td>
</tr>
<tr>
<td>Resistance to Soldering Heat</td>
<td>±30 % (Impedance Change)</td>
<td>260 °C, 10 s</td>
</tr>
<tr>
<td>Rapid Change of Temperature</td>
<td>±30 % (Impedance Change)</td>
<td>−40 °C (30 min.) / +85 °C (30 min.), 200 cycles</td>
</tr>
<tr>
<td>High Temperature Exposure</td>
<td>±30 % (Impedance Change)</td>
<td>85 °C, 500 h</td>
</tr>
<tr>
<td>Damp Heat, Steady State</td>
<td>±30 % (Impedance Change)</td>
<td>60 °C, 95 %RH, 500 h</td>
</tr>
<tr>
<td>Load Life in Humidity</td>
<td>±30 % (Impedance Change)</td>
<td>60 °C, 95 %RH, Rated Current, 500 h</td>
</tr>
</tbody>
</table>


⚠️ Safety Precautions
(Common mode Noise Filters/Array, Common mode Noise Filters/Array with ESD Suppressor, 2 mode Noise Filters)

The following are precautions for individual products. Please also refer to the common precautions for EMC Components in this catalog.

1. Use rosin-based flux or halogen-free flux.
2. For cleaning, use an alcohol-based cleaning agent. Before using any other type, consult with our sales person in advance.
3. Do not apply shock to Common mode Noise Filters and 2 mode Noise Filters (hereafter called the filters) or pinch them with a hard tool (e.g. pliers and tweezers). Otherwise, their bodies may be chipped, affecting their performance. Excessive mechanical stress may damage the filters. Handle with care.
4. Store the filters in a location with a temperature ranging from –5 °C to +40 °C and a relative humidity of 40 % to 60 %, where there are no rapid changes in temperature or humidity.
5. Use the filters within a year from the date of arrival at your company, provided that they remain packed as they were when delivered.
ESD Suppressor

Type: EZAEG
EZAEG2A, 3A

Features

- ESD protection of high-speed data lines
- Low capacitance 0.05 pF: 1005 (0402) size
  0.10 pF: 1608 (0603) size
- Good ESD suppression characteristics
- Good ESD withstanding
- RoHS compliant

Recommended Applications

- Smart phones, Mobile phones, RF Modules, NFC and GPS
- ESD suppression of high-speed differential data lines such as Antena circuit, HDMI, SATA, USB, Display Port

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>Code</th>
<th>Size Code</th>
<th>Design Specification</th>
<th>Peak Voltage</th>
<th>Special Feature</th>
<th>Packaging Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>2</td>
<td>EZAEG2A 1005 (0402)</td>
<td>50 500 V</td>
<td>A Standard</td>
<td>Pressed Carrier Taping 2 mm Pitch, 10,000 pcs.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>EZAEG3A 1608 (0603)</td>
<td></td>
<td>A Standard</td>
<td>Punched Carrier Taping 4 mm Pitch, 5,000 pcs.</td>
</tr>
</tbody>
</table>

Construction

- Protective coating
- Alumina substrate
- Gap electrode
- Electrode (Between)
- ESD absorbent material
- Electrode (Outer)

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight g/1000 pcs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEG2A (0402)</td>
<td>L: 1.00 ±0.50, W: 0.50 ±0.25, a: 0.20 ±0.15, b: 0.25 ±0.15, t: 0.38 ±0.25</td>
<td>0.6</td>
</tr>
<tr>
<td>EZAEG3A (0603)</td>
<td>L: 1.60 ±0.30, W: 0.80 ±0.25, a: 0.30 ±0.20, b: 0.50 ±0.15</td>
<td>2.2</td>
</tr>
</tbody>
</table>

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Should a safety concern arise regarding this product, please be sure to contact us immediately.
EZAEG2A50AX (0402)  0.05 +0.05 pF
EZAEG2A50AV (0603)  0.10 +0.10 pF

(1) Capacitance = The capacitance value shall be measured under the conditions specified below:
Frequency : 1 MHz±10 %, Voltage : 1 Vrms±0.2 Vrms, Temperature : 25 °C±2 °C

Performance

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Performance Requirements</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Voltage</td>
<td>500 V max.</td>
<td>IEC61000-4-2, contact discharge 8 kV, Peak voltage value</td>
</tr>
<tr>
<td>Clamping Voltage</td>
<td>100 V max.</td>
<td>IEC61000-4-2, contact discharge 8 kV, voltage at 30 ns after initiation of pulse</td>
</tr>
<tr>
<td>Leakage Current</td>
<td>1 μA max.</td>
<td>Current at Rated voltage (DC 30 V)</td>
</tr>
<tr>
<td>ESD withstanding</td>
<td>Leakage current 10 μA max.</td>
<td>IEC61000-4-2, contact discharge 8 kV, +/- 10 times</td>
</tr>
<tr>
<td>Rapid Change of Temperature</td>
<td>Leakage current 10 μA max. -55 °C (30 min.) /+125 °C (30 min.), 100 cycles</td>
<td></td>
</tr>
<tr>
<td>Load Life in Humidity</td>
<td>Leakage current 10 μA max. 60 °C, 90% to 95%RH, Rated voltage, 1000 h</td>
<td></td>
</tr>
<tr>
<td>Endurance at 85 °C</td>
<td>Leakage current 10 μA max. 85 °C, Rated voltage, 1000 h</td>
<td></td>
</tr>
<tr>
<td>Resistance to Soldering Heat</td>
<td>Leakage current 10 μA max. 270 °C, 10 s</td>
<td></td>
</tr>
</tbody>
</table>

Frequency Characteristics

ESD Suppression Voltage Waveform

Typical Circuits Requiring Protection

- HDMI circuit
- Antenna circuit

Recommended Land Pattern

Recommended land pattern design for ESD Suppressor is shown below.

Part Number (inch size) | Dimensions (mm) |
------------------------|-----------------|
EZAEG2A (0402)          | a: 0.5 to 0.6   |
                        | b: 1.4 to 1.6   |
                        | c: 0.4 to 0.6   |
EZAEG3A (0603)          | a: 0.7 to 0.9   |
                        | b: 2.0 to 2.2   |
                        | c: 0.8 to 1.0   |

As for Packaging Methods, Soldering Conditions and Safety Precautions,
Please see Data Files

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
ESD Suppressor

Type: EZAEG
EZAEG1N, 2N

Features
- Good ESD withstanding (IEC61000-4-2 15 kV contact/air Discharge)
- ESD protection of high-speed data lines
- Low capacitance 0.04 pF: 0603(0201) size
  0.05 pF: 1005(0402) size
- Good ESD suppression characteristics
- RoHS compliant

Recommended Applications
- Smart phones, Mobile phones, RF Modules, NFC and GPS
- ESD supression of high-speed differential data line such as Antena circuit, HDMI, SATA, USB, Display Port

Explanation of Part Numbers

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEG1N</td>
<td>ESD withstanding 15 kV</td>
<td>30 V</td>
<td>Standard</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>EZAEG2N</td>
<td>50 V</td>
<td>A</td>
<td>EZAEG2N</td>
</tr>
</tbody>
</table>

Construction

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No. (inch size)</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight) [g/1000 pcs.]</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEG1N (0201)</td>
<td>0.60±0.03 x 0.38±0.03 x 0.15±0.10 x 0.15±0.10 x 0.23±0.03</td>
<td>0.12</td>
</tr>
<tr>
<td>EZAEG2N (0402)</td>
<td>0.50±0.05 x 0.20±0.10 x 0.27±0.10 x 0.38±0.05</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
ESD Suppressor

Ratings

<table>
<thead>
<tr>
<th>Part Number (inch size)</th>
<th>Capacitance(1)</th>
<th>Rated Voltage</th>
<th>Category Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEG1N50AC (0201)</td>
<td>0.04±0.02 pF</td>
<td>30 V max.</td>
<td>-55 to +125 °C</td>
</tr>
<tr>
<td>EZAEG2N50AX (0402)</td>
<td>0.05±0.02 pF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Capacitance = The capacitance value shall be measured under the conditions specified below.  
Frequency : 1 MHz±10 %, Voltage : 1 Vrms±0.2 Vrms, Temperature : 25 °C±2 °C

Performance

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Performance Requirements</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Voltage</td>
<td>500 V max.</td>
<td>IEC61000-4-2, contact discharge 8 kV, Peak voltage value</td>
</tr>
<tr>
<td>Clamping Voltage</td>
<td>100 V max.</td>
<td>IEC61000-4-2, contact discharge 8 kV, voltage at 30 ns after initiation of pulse</td>
</tr>
<tr>
<td>Leakage Current</td>
<td>1 μA max.</td>
<td>Current at Rated voltage (DC 30 V)</td>
</tr>
<tr>
<td>ESD withstanding voltage</td>
<td>10 μA max.</td>
<td>IEC61000-4-2, contact discharge 15 kV or air discharge 15 kV, +/- 50 times</td>
</tr>
<tr>
<td>Load Life in Humidity</td>
<td>10 μA max.</td>
<td>60 °C, 90% to 95%RH, Rated voltage, 1000 h</td>
</tr>
<tr>
<td>Endurance at 85 °C</td>
<td>10 μA max.</td>
<td>85 °C, Rated voltage, 1000 h</td>
</tr>
<tr>
<td>Resistance to Soldering</td>
<td>10 μA max.</td>
<td>270 °C, 10 s</td>
</tr>
</tbody>
</table>

Frequency Characteristics

<table>
<thead>
<tr>
<th>Frequency (MHz)</th>
<th>Attenuation (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-300</td>
</tr>
<tr>
<td>10</td>
<td>-270</td>
</tr>
<tr>
<td>100</td>
<td>-240</td>
</tr>
<tr>
<td>1000</td>
<td>-210</td>
</tr>
<tr>
<td>10000</td>
<td>-180</td>
</tr>
</tbody>
</table>

ESD Suppression Voltage Waveform

<table>
<thead>
<tr>
<th>Times (nSecs)</th>
<th>Volts (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>40</td>
<td>150</td>
</tr>
<tr>
<td>60</td>
<td>200</td>
</tr>
<tr>
<td>80</td>
<td>250</td>
</tr>
<tr>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>120</td>
<td>350</td>
</tr>
<tr>
<td>140</td>
<td>400</td>
</tr>
</tbody>
</table>

Typical Circuits Requiring Protection

- HDMI circuit
- Antenna circuit

Recommended Land Pattern

Recommended land pattern design for ESD Suppressor is shown below.

<table>
<thead>
<tr>
<th>Part Number (inch size)</th>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
</tr>
<tr>
<td>EZAEG1N (0201)</td>
<td>0.3</td>
</tr>
<tr>
<td>EZAEG2N (0402)</td>
<td>0.5</td>
</tr>
</tbody>
</table>

As for Packaging Methods, Soldering Conditions and Safety Precautions,
Please see Data Files

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

03 Dec. 2018
Features
- 4 ESD suppressors in one package
- ESD protection of high-speed data lines
- Low capacitance (0.25 pF)
- Good ESD suppression characteristics
- Good ESD withstanding
- RoHS compliant

Recommended Applications
- AV equipment (LCD-TV, DVD/Blu-ray drives), Information equipment (PCs, HDD.)
- ESD suppression of high-speed differential data line such as USB3.0, HDMI, Display Port

ESD Suppressor Array
Type: EZAEGCA

Explanation of Part Numbers
- **Product Code**
  - E: ESD Suppressor
- **Size Code**
  - C: Size mm (inch)
  - 2012 (0805) for 4 Line use
- **Design Specification**
  - Code: Design Specification
  - A: Rated Voltage 15 V
- **Peak Voltage**
  - Code: Peak Voltage
  - 5: 500 V
- **Special Feature**
  - Code: Special Feature
  - A: Standard
- **Packaging Methods**
  - Code: Packaging Method
  - V: Punched Carrier Taping
  - 4 mm Pitch, 5,000 pcs.

Construction
- Protective coating
- Alumina substrate
- GND terminal: 1, 6
- I/O terminal: 2 to 5, 7 to 10

Dimensions in mm (not to scale)
- Mass (Weight) [1000 pcs.]: 4 g

Circuit Configuration
- 4 ESD suppressors arranged in a 2x2 grid
- GND terminal: 1, 6
- I/O terminal: 2 to 5, 7 to 10

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
### Ratings

<table>
<thead>
<tr>
<th>Part Number (inch size)</th>
<th>Capacitance(1)</th>
<th>Rated Voltage(2)</th>
<th>Rated Current(3)</th>
<th>Category Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEGCA50AV (0805)</td>
<td>0.25±10% pF</td>
<td>15 V max.</td>
<td>100 mA max.</td>
<td>-55 to +125 °C</td>
</tr>
</tbody>
</table>

(1) Capacitance = The capacitance value shall be measured under the conditions specified below. Frequency: 1 MHz±10 %, Voltage: 1 Vrms±0.2 Vrms, Temperature: 25 °C±2 °C

(2) Rated voltage between I/O terminal and GND.

(3) Rated current between input terminal and output terminal.

### Performance

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Performance Requirements</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Voltage</td>
<td>500 V max.</td>
<td>IEC61000-4-2, contact discharge 8 kV, Peak voltage value</td>
</tr>
<tr>
<td>Clamping Voltage</td>
<td>100 V max.</td>
<td>IEC61000-4-2, contact discharge 8 kV, voltage at 30 ns after initiation of pulse</td>
</tr>
<tr>
<td>Leakage Current</td>
<td>1 μA max.</td>
<td>Current at Rated voltage (DC 15 V)</td>
</tr>
<tr>
<td>ESD withstanding</td>
<td>Leakage current 10 μA max.</td>
<td>IEC61000-4-2, contact discharge 8 kV, +/- 10 times</td>
</tr>
<tr>
<td>Rapid Change of Temperature</td>
<td>Leakage current 10 μA max.</td>
<td>-55 °C (30 min.) +/-125 °C (30 min.), 100 cycles</td>
</tr>
<tr>
<td>Load Life in Humidity</td>
<td>Leakage current 10 μA max.</td>
<td>60 °C, 90% to 95%RH, Rated voltage, 1000 h</td>
</tr>
<tr>
<td>Endurance at 85 °C</td>
<td>Leakage current 10 μA max.</td>
<td>85 °C, Rated voltage, 1000 h</td>
</tr>
<tr>
<td>Resistance to Soldering Heat</td>
<td>Leakage current 10 μA max.</td>
<td>270 °C, 10 s</td>
</tr>
</tbody>
</table>

### Typical Circuits Requiring Protection

- HDMI circuit

**HDMI Controller**

**HDMI Rx/Tx**

### Recommended Land Pattern

Recommended land pattern design for ESD Suppressor Array is shown below.

**Land pattern**

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.75</td>
<td>0.25</td>
<td>1.70</td>
<td>0.35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>e</th>
<th>h</th>
<th>g</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.85</td>
<td>2.60</td>
<td>0.25</td>
<td>0.50</td>
</tr>
</tbody>
</table>

**As for Packaging Methods, Soldering Conditions and Safety Precautions,**

Please see Data Files

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03 Dec. 2018
ESD Suppressor, High Withstanding Type

Type: EZAEG

EZAEG3W

Features

● Excellent ESD withstanding (Conforms with automotive ESD standards (ISO10605, air discharge 25 kV))
● Low capacitance 0.10 pF : 1608 (0603) size
● High rated voltage (DC 50 V) contributes to reduce the risk of communication error
● AEC-Q200 qualified
● RoHS compliant

Recommended Applications

● High speed data line for automotive (CAN, Ethernet, USB, LVDS)
● Automotive Antenna
● Amusement equipment

Explanation of Part Numbers

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>Z</td>
<td>A</td>
<td>E</td>
<td>G</td>
<td>3</td>
<td>W</td>
<td>1</td>
<td>1</td>
<td>A</td>
<td>V</td>
</tr>
</tbody>
</table>

Product Code: ESD Suppressor
Code: 3
Size: 1608 (0603)

Design Specification
Code: W
Design Specification: High with standing type Rated voltage 50 V

Peak Voltage
Code: 11
Peak Voltage: 1000 V

Special Feature
Code: A
Special Feature: Standard

Packaging Methods
Code: V
Packaging: Punched Carrier Taping 4 mm Pitch, 4000 pcs.

Part No.: EZAEG3W

Construction

Insulating ceramic
Terminal electrode

Inner electrode
Discharge area (Hollow inside)

Dimensions in mm (not to scale)

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Dimensions (mm)</th>
<th>Mass (Weight [g/1000 pcs.])</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEG3W  (0603)</td>
<td>L: 1.60±0.15 W: 0.80±0.15 T: 0.80±0.15 a: 0.30±0.20</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Circuit Configuration

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

01 Dec. 2018
ESD Suppressor, High Withstanding Type

**Ratings**

<table>
<thead>
<tr>
<th>Part Number (inch size)</th>
<th>Capacitance(1)</th>
<th>Rated Voltage</th>
<th>Category Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEG3W11AV (0603)</td>
<td>0.10±0.01 pF</td>
<td>50 V max.</td>
<td>-55 to +125 °C</td>
</tr>
</tbody>
</table>

(1) Capacitance = The capacitance value shall be measured under the conditions specified below. Frequency : 1 MHz±10 %, Voltage : 1 Vrms±0.2 Vrms, Temperature : 25 °C±2 °C

**Performance**

**Test Item** | **Performance Requirements** | **Test Conditions**
---|---|---
Peak Voltage | 1000 V max. | ISO10605, air discharge 15 kV, Peak voltage value
Leakage Current | 1 μA max. | Current at Rated voltage (DC 50 V)
ESD withstanding | Leakage current 10 μA max. | ISO10605, air discharge 25 kV, +/- 50 times
Rapid Change of Temperature | Leakage current 10 μA max. | -55 °C (30 min.)/+125 °C (30 min.), 100 cycles
Load Life in Humidity | Leakage current 10 μA max. | 85 °C, 85%RH, Rated voltage, 1000 h
Endurance at 125 °C | Leakage current 10 μA max. | 125 °C, Rated voltage, 1000 h
Resistance to Soldering Heat | Leakage current 10 μA max. | 270 °C, 10 s

**Frequency Characteristics**

**ESD Suppression Voltage Waveform**

**Typical Circuits Requiring Protection**

- Automotive network (CAN, Ethernet)
- Automotive antenna

**Recommended Land Pattern**

Recommended land pattern design for ESD Suppressor is shown below.

**Part Number (inch size)**

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
</tr>
<tr>
<td>EZAEG3W (0603)</td>
</tr>
</tbody>
</table>

As for Packaging Methods, Soldering Conditions and Safety Precautions, Please see Data Files

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

01 Dec. 2018
### Packaging Methods (Taping)

#### Standard Quantity

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Size (inch)</th>
<th>Kind of Taping</th>
<th>Pitch (P1)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEG1N</td>
<td>0201</td>
<td>Pressed Carrier Taping</td>
<td>2 mm</td>
<td>15,000 pcs./reel</td>
</tr>
<tr>
<td>EZAEG2A,2N</td>
<td>0402</td>
<td>Pressed Carrier Taping</td>
<td>2 mm</td>
<td>10,000 pcs./reel</td>
</tr>
<tr>
<td>EZAEG3A</td>
<td>0603</td>
<td>Pressed Carrier Taping</td>
<td>2 mm</td>
<td>5,000 pcs./reel</td>
</tr>
<tr>
<td>EZAEG3W</td>
<td>0603</td>
<td>Pressed Carrier Taping</td>
<td>4 mm</td>
<td>4,000 pcs./reel</td>
</tr>
<tr>
<td>EZAEGCA</td>
<td>0805</td>
<td>Pressed Carrier Taping</td>
<td>4 mm</td>
<td>5,000 pcs./reel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Punched Carrier Taping</td>
<td>4 mm</td>
<td>5,000 pcs./reel</td>
</tr>
</tbody>
</table>

**Taping Reel**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>A (Unit : mm)</th>
<th>B (Unit : mm)</th>
<th>W (Unit : mm)</th>
<th>F (Unit : mm)</th>
<th>E (Unit : mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZAEG1N</td>
<td>0.38±0.05</td>
<td>0.68±0.05</td>
<td>8.00±0.20</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
</tr>
<tr>
<td>EZAEG2A,2N</td>
<td>0.70±0.05</td>
<td>1.20±0.05</td>
<td>8.00±0.20</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
</tr>
<tr>
<td>EZAEG3A</td>
<td>1.10±0.10</td>
<td>1.90±0.10</td>
<td>8.00±0.20</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
</tr>
<tr>
<td>EZAEG3W</td>
<td>0.91±0.10</td>
<td>1.82±0.10</td>
<td>8.00±0.20</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
</tr>
<tr>
<td>EZAEGCA</td>
<td>1.55±0.15</td>
<td>2.30±0.20</td>
<td>8.00±0.20</td>
<td>3.50±0.05</td>
<td>1.75±0.10</td>
</tr>
</tbody>
</table>

### Recommended Soldering Conditions

- **Recommended soldering conditions for reflow**
  - Reflow soldering shall be performed a maximum of two times.
  - Please contact us for additional information when used in conditions other than those specified.
  - Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.

**For soldering (Example : Sn/Pb)**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preheating</td>
<td>140 °C to 160 °C</td>
</tr>
<tr>
<td>Main heating</td>
<td>Above 200 °C</td>
</tr>
<tr>
<td>Peak</td>
<td>235 ± 5 °C</td>
</tr>
</tbody>
</table>

**For lead-free soldering (Example : Sn/Ag/Cu)**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preheating</td>
<td>150 °C to 180 °C</td>
</tr>
<tr>
<td>Main heating</td>
<td>Above 230 °C</td>
</tr>
<tr>
<td>Peak</td>
<td>max. 260 °C</td>
</tr>
</tbody>
</table>

### Safety Precautions

The following are precautions for individual products. Please also refer to the common precautions for ESD Suppressor in this catalog.

1. If a large electric surge (especially, one which is larger than an ESD) is expected to be applied, be sure to test and confirm proper ESD Suppressor (hereafter called the suppressors) functionality when mounted on your board. When the applied load is more than the allowable rated power under normal load conditions, it may impair performance and/or the reliability of the suppressors. Never exceed the rated power. If the product will be used under these special conditions, be sure to contact a Panasonic representative first.
2. Do not use halogen-based or other high-activity flux. Otherwise, the residue may impair the suppressors’ performance and/or reliability.
3. When soldering with a soldering iron, never touch the suppressors’ bodies with the tip of the soldering iron. When using a soldering iron with a high temperature tip, finish soldering as quickly as possible (within three seconds at 350 °C max.).
4. Avoid excessive bending of printed circuit boards in order to protect the suppressors from abnormal stress.
5. Do not immerse the suppressors in solvent for a long time. Before using solvent, carefully check the effects of immersion.
6. The suppressors, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of 5 °C to 35 °C and a relative humidity of 45 % to 85 %.

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05 Apr. 2017

– 65 –
**Multilayer Varistors (Automotive Grade)**

**Series:** EZJZ-M, EZJP-M

---

### Features

- Excellent ESD suppression due to original advanced material technology
- Having large electrostatic resistance meeting IEC61000-4-2, ISO10605
- Having no polarity (bipolar) facilitated replacing Zener Diodes. Capable of replacing 2 Zener Diodes and 1 Capacitor.
- Lead-free plating terminal electrodes enabling great solderability
- Wide range of products is available by adopting multilayer structure, meeting various needs.
- AEC-Q200 qualified
- RoHS compliant

---

**As for Packaging Methods, Handling Precautions**

Please see Data Files

---

**Explanation of Part Numbers**

<table>
<thead>
<tr>
<th>E</th>
<th>Z</th>
<th>J</th>
<th>P</th>
<th>0</th>
<th>V</th>
<th>2</th>
<th>7</th>
<th>0</th>
<th>E</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>EZJ series</td>
<td>0</td>
<td>0402/EIA</td>
<td>0402,0603 Paper Taping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Example)</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>EZJP series</td>
<td>T</td>
<td>0603/EIA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Nominal Varistor Voltage:** The first and second digits denote the first 2 numbers of the varistor voltage and the third digit indicates the number of zeros following. The decimal point denotes in R.

- **Capacitance Code:**
  - B: 10 pF
  - C: 20 pF
  - D: 27 pF
  - E: 47 pF
  - F: 56 pF
  - G: 100 pF
  - H: 150 pF
  - J: 220 pF
  - K: 330 pF

---

**Construction**

- **Zinc oxide-based ceramics**
- **Internal electrode**
- **Terminal electrode**
- **Substrate electrode**
- **Intermediate electrode**
- **External electrode**

---

**Dimensions in mm (not to scale)**

<table>
<thead>
<tr>
<th>Size Code</th>
<th>Size(inch)</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>L1, L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0902/EIA</td>
<td>0.62±0.05</td>
<td>0.50±0.05</td>
<td>0.2±0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0603/EIA</td>
<td>0.62±0.05</td>
<td>0.8±0.1</td>
<td>0.3±0.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.

Should a safety concern arise regarding this product, please be sure to contact us immediately.
Multilayer Varistors (Automotive Grade)

Features
Wide variety of products is available by adopting multilayer construction, which achieved wide range of usage, such as application to DC voltage lines and signal lines.

- Circuit voltage

Recommended Applications
- Engine ECU
- Various body ECU
- Communication line, such as CAN, LIN
- Audio, Navigation
- LED Light
- Control SW

Varistor voltage : 18 to 100 V [at 1mA]
Capacitance : 10 to 220 pF max. [at 1MHz]

Ratings and Characteristics

<table>
<thead>
<tr>
<th>Size</th>
<th>Part No.</th>
<th>Maximum allowable voltage DC (V)</th>
<th>Nominal varistor voltage at 1mA (V)</th>
<th>Capacitance (pF) at 1MHz</th>
<th>Maximum peak current at 8/20μs, 2 times (A)</th>
<th>Maximum ESD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0402 /EIA</td>
<td>EZJ0V180JM</td>
<td>11</td>
<td>18</td>
<td>150 max. [120 typ.]</td>
<td>140 typ.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>EZJ0V220JM</td>
<td>13</td>
<td>22</td>
<td>150 max. [100 typ.]</td>
<td>116 typ.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>EZJ0V270GM</td>
<td>18</td>
<td>27</td>
<td>100 max. [85 typ.]</td>
<td>100 typ.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>EZJ0V270EM</td>
<td>18</td>
<td>27</td>
<td>47 max. [33 typ.]</td>
<td>37 typ.</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>EZJ0V270RM</td>
<td>18</td>
<td>27</td>
<td>20 max. [15 typ.]</td>
<td>16.5 typ.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EZJ0V270BM</td>
<td>18</td>
<td>27</td>
<td>10 max. [8 typ.]</td>
<td>10 typ.</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>EZJ0V330GM</td>
<td>25</td>
<td>33</td>
<td>100 max. [85 typ.]</td>
<td>100 typ.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>EZJ0V420WM</td>
<td>30</td>
<td>42</td>
<td>56 max. [40 typ.]</td>
<td>45 typ.</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>EZJ0V650DM</td>
<td>40</td>
<td>65</td>
<td>27 max. [22 typ.]</td>
<td>33 typ.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EZJ0V101BM</td>
<td>30</td>
<td>100</td>
<td>10 max. [8 typ.]</td>
<td>10 typ.</td>
<td>–</td>
</tr>
<tr>
<td>0603 /EIA</td>
<td>EZJ1V180JM</td>
<td>11</td>
<td>18</td>
<td>220 max. [180 typ.]</td>
<td>210 typ.</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>EZJ1V220JM</td>
<td>13</td>
<td>22</td>
<td>220 max. [160 typ.]</td>
<td>185 typ.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>EZJ1V270GM</td>
<td>18</td>
<td>27</td>
<td>100 max. [85 typ.]</td>
<td>100 typ.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>EZJ1V270EM</td>
<td>18</td>
<td>27</td>
<td>47 max. [33 typ.]</td>
<td>37 typ.</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>EZJ1V270RM</td>
<td>18</td>
<td>27</td>
<td>20 max. [15 typ.]</td>
<td>16.5 typ.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EZJ1V330GM</td>
<td>25</td>
<td>33</td>
<td>100 max. [85 typ.]</td>
<td>100 typ.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>EZJ1V420FM</td>
<td>30</td>
<td>42</td>
<td>68 max. [55 typ.]</td>
<td>63 typ.</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>EZJ1V650DM</td>
<td>40</td>
<td>65</td>
<td>27 max. [22 typ.]</td>
<td>33 typ.</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EZJ1V650DM</td>
<td>40</td>
<td>65</td>
<td>27 max. [22 typ.]</td>
<td>33 typ.</td>
<td>2</td>
</tr>
</tbody>
</table>

- Operating Temperature Range : EZJP serie –55 to 150 °C  
- Recommend soldering method : Reflow soldering 
- EZJZ serie –55 to 125 °C

Maximum Allowable Voltage
Maximum DC Voltage that can be applied continuously within the operating temperature range

Varistor Voltage
Varistor starting voltage between terminals at DC 1mA, also known as Breakdown voltage

Maximum Peak Current
Maximum current that can be withstood under the standard pulse 8/20 μs, 2 times based

Maximum ESD
Maximum voltage that can be withstood under ESD

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

06 Oct. 2018
**Varistor Characteristics and Equivalent Circuit**

A Multilayer Varistor does not have an electrical polarity like zener diodes and is equivalent to total 3 pcs. of 2 zener diodes and 1 capacitor.

![Equivalent Circuit]

**ESD Suppressive Effects**

Typical effects of ESD suppression

Test conditions: IEC61000-4-2* Level 4 Contact discharge, 8k V

![ESD suppressed waveform]

*IEC61000-4-2* --- International Standard of the ESD testing method (HBM) for electronic equipment ability to withstand ESD generated from a human body. It sets 4 levels of severity

<table>
<thead>
<tr>
<th>Severity</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact discharge</td>
<td>2k V</td>
<td>4k V</td>
<td>6k V</td>
<td>8k V</td>
</tr>
<tr>
<td>Air discharge</td>
<td>2k V</td>
<td>4k V</td>
<td>8k V</td>
<td>15k V</td>
</tr>
</tbody>
</table>

**Replacement of Zener diode**

Replacing “Zener diode and Capacitor” with Multilayer Varistor saves both the mounting area and number of components used.
### Performance and Testing Methods

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specifications</th>
<th>Testing Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard test conditions</td>
<td>Electrical characteristics shall be measured under the following conditions. Temp. : 5 to 35 °C, Relative humidity : 85 % or less</td>
<td></td>
</tr>
<tr>
<td>Varistor voltage</td>
<td>To meet the specified value.</td>
<td>The Varistor voltage is the voltage (Vc or VcmA) between both end terminals of a Varistor when specified current (ICmA) is applied to it. The measurement shall be made as quickly as possible to avoid heating effects.</td>
</tr>
<tr>
<td>Maximum allowable voltage</td>
<td>To meet the specified value.</td>
<td>The maximum DC voltage that can be applied continuously to a varistor.</td>
</tr>
<tr>
<td>Capacitance</td>
<td>To meet the specified value.</td>
<td>Capacitance shall be measured at the specified frequency, bias voltage 0 V, and measuring voltage 0.2 to 2 Vrms.</td>
</tr>
<tr>
<td>Maximum peak current</td>
<td>To meet the specified value.</td>
<td>The maximum current measured (Varistor voltage tolerance is within ±10 %) when a standard impulse current of 8/20 μ seconds is applied twice with an interval of 5 minutes.</td>
</tr>
<tr>
<td>Maximum ESD</td>
<td>To meet the specified value.</td>
<td>The part shall be immersed into a soldering bath under the conditions below. Solder : Sn-Ag-Cu, Soldering flux : Ethanol solution of rosin (Concentration approx. 25 wt%), Soldering temp. : 230±5 °C, Period : ±1 s, Soldering position : Immerse both terminal electrodes until they are completely into the soldering bath.</td>
</tr>
<tr>
<td>Solder ability</td>
<td>To meet the specified value.</td>
<td>The part shall be immersed into a soldering bath under the conditions below. Solder : Sn-Ag-Cu, Soldering flux : Ethanol solution of rosin (Concentration approx. 25 wt%), Soldering temp. : 230±5 °C, Period : ±1 s, Soldering position : Immerse both terminal electrodes until they are completely into the soldering bath.</td>
</tr>
<tr>
<td>Resistance to soldering heat</td>
<td>∆Vc / Vc : within ±10 %</td>
<td>The varistor shall be soldered on the testing board shown in Fig.3. G force : 5 G, Vibration frequency range : 10 to 2000 Hz, Sweet time : 20 min, Sweet direction : 12 cycles for 3 courses perpendicular each other</td>
</tr>
<tr>
<td>Temperature cycling</td>
<td>∆Vc / Vc : within ±10 %</td>
<td>The varistor shall be soldered on the testing board shown in Fig.3. Shock-wave formation : Half sine, G force : 50 G, Shock direction : 6 directions of X, Y, Z, for each three times</td>
</tr>
<tr>
<td>Vibration</td>
<td>∆Vc / Vc : within ±10 %</td>
<td>After conducting the test under the conditions specified below, leave the part 24±2 hours, then evaluate its characteristics.</td>
</tr>
<tr>
<td>Mechanical Shock</td>
<td>∆Vc / Vc : within ±10 %</td>
<td>The varistor shall be soldered on the testing board shown in Fig.3. G force : 50 G, Shock direction : 6 directions of X, Y, Z, for each three times</td>
</tr>
<tr>
<td>Biased Humidity</td>
<td>∆Vc / Vc : within ±10 %</td>
<td>After conducting the test under the conditions specified below, leave the part 24±2 hours, then evaluate its characteristics.</td>
</tr>
<tr>
<td>High temperature exposure (dry heat)</td>
<td>∆Vc / Vc : within ±10 %</td>
<td>After conducting the test under the conditions specified below, leave the part 24±2 hours, then evaluate its characteristics.</td>
</tr>
</tbody>
</table>
Multilayer Varistors (Automotive Grade)

Packaging Methods

- Standard Packing Quantity

<table>
<thead>
<tr>
<th>Series</th>
<th>Size Code</th>
<th>Thickness (mm)</th>
<th>Kind of Taping</th>
<th>Pitch (mm)</th>
<th>Q’ty (pcs./reel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZJZ, EZJP</td>
<td>0 (0402)</td>
<td>0.5</td>
<td>Punched Carrier Taping</td>
<td>2</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td>1 (0603)</td>
<td>0.8</td>
<td></td>
<td>4</td>
<td>4,000</td>
</tr>
</tbody>
</table>

- Pitch 2mm (Punched Carrier Taping) : Size 0402

- Pitch 4mm (Punched Carrier Taping) : Size 0603

- Reel for Taping

- Leader Part and Taped End

Dimensions in mm

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06 Oct. 2018
Multilayer Varistors, Chip Type (Automotive Grade)
Series: EZJZ-M, EZJP-M

Handling Precautions

⚠️ Safety Precautions
Multilayer Varistors for Automotive (hereafter referred to as “Varistors”) should be used for general purpose applications as countermeasures against ESD and noise found in vehicle electronics (Engine ECU and various body ECU, accessory equipment, etc.) equipment. When subjected to severe electrical, environmental, and/or mechanical stress beyond the specifications, as noted in the Ratings and Specified Conditions section, the Varistors’ performance may be degraded, or become failure mode, such as short circuit mode and open-circuit mode. If you use under the condition of short-circuit, heat generation of Varistors will occur by running large current due to application of voltage. There are possibilities of smoke emission, substrate burn-out, and, in the worst case, fire. For products which require high safety levels, please carefully consider how a single malfunction can affect your product. In order to ensure the safety in the case of a single malfunction, please design products with fail-safe, such as setting up protecting circuits, etc.

● For the following applications and conditions, please contact us for additional specifications, which is not found in this document.
   · When your application may have difficulty complying with the safety or handling precautions specified below.
   · High-quality and high-reliability required devices that have possibility of causing hazardous conditions, such as death or injury (regardless of directly or indirectly), due to failure or malfunction of the product.
     ① Aircraft and Aerospace Equipment (artificial satellite, rocket, etc.)
     ② Submarine Equipment (submarine repeating equipment, etc.)
     ③ Transportation Equipment (airplanes, trains, ship, traffic signal controllers, etc.)
     ④ Power Generation Control Equipment (atomic power, hydroelectric power, thermal power plant control system, etc.)
     ⑤ Medical Equipment (life-support equipment, pacemakers, dialysis controllers, etc.)
     ⑥ Information Processing Equipment (large scale computer systems, etc.)
     ⑦ Electric Heating Appliances, Combustion devices (gas fan heaters, oil fan heaters, etc.)
     ⑧ Rotary Motion Equipment
     ⑨ Security Systems
     ⑩ And any similar types of equipment

⚠️ Strict Observance
1. Confirmation of Rated Performance
The Varistors shall be operated within the specified rating/performance. Applications exceeding the specifications may cause deteriorated performance and/or breakdown, resulting in degradation and/or smoking or ignition of products. The following are strictly observed.
(1) The Varistors shall not be operated beyond the specified operating temperature range.
(2) The Varistors shall not be operated in excess of the specified maximum allowable voltage.
(3) The Varistors shall not be operated in the circuits to which surge current and ESD that exceeds the specified maximum peak current and maximum ESD.
(4) Never use for AC power supply circuits.

2. The Varistors shall not be mounted near flammables.

Operating Conditions and Circuit Design

1. Circuit Design
1.1 Operating Temperature and Storage Temperature
When operating a components-mounted circuit, please be sure to observe the “Operating Temperature Range”, written in delivery specifications. Storage temperature of PCB after mounting Varistors, which is not operated, should be within the specified “Storage Temperature Range” in the delivery specifications. Please remember not to use the product under the condition that exceeds the specified maximum temperature.

1.2 Operating Voltage
The Varistors shall not be operated in excess of the “Maximum allowable voltage”. If the Varistors are operated beyond the specified Maximum allowable voltage, it may cause short and/or damage due to thermal run away. The circuit that continuously applies high frequency and/or steep pulse voltage please examines the reliability of the Varistor even if it is used within a “Maximum allowable voltage”. Also, it would be safer to check also the safety and reliability of your circuit.
1.3 Self-heating
The surface temperature of the Varistors shall be under the specified Maximum Operating Temperature in the Specifications including the temperature rise caused by self-heating. Check the temperature rise of the Varistor in your circuit.

1.4 Environmental Restrictions
The Varistors shall not be operated and/or stored under the following conditions.
(1) Environmental conditions
   - (a) Under direct exposure to water or salt water
   - (b) Under conditions where water can condense and/or dew can form
   - (c) Under conditions containing corrosive gases such as hydrogen sulfide, sulfuric acid, chlorine and ammonia
(2) Mechanical conditions
   The place where vibration or impact that exceeds specified conditions written in delivery specification is loaded.

2. Design of Printed Circuit Board
2.1 Selection of Printed Circuit Boards
There is a possibility of performance deterioration by heat shock (temperature cycles), which causes cracks, from alumina substrate. Please confirm that the substrate you use does not deteriorate the Varistors’ quality.

2.2 Design of Land Pattern
(1) Recommended land dimensions are shown below. Use the proper amount of solder in order to prevent cracking. Using too much solder places excessive stress on the Varistors.

![Recommended Land Dimensions Diagram]

<table>
<thead>
<tr>
<th>Component dimensions</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>L W T</td>
<td>a</td>
<td>b</td>
<td>c</td>
</tr>
<tr>
<td>0402</td>
<td>1.0</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>0603</td>
<td>1.6</td>
<td>0.8</td>
<td>0.8</td>
</tr>
</tbody>
</table>

(2) The land size shall be designed to have equal space, on both right and left side. If the amount of solder on the right land is different from that of the left land, the component may be cracked by stress since the side with a larger amount of solder solidifies later during cooling.

2.3 Utilization of Solder Resist
(1) Solder resist shall be utilized to equalize the amounts of solder on both sides.
(2) Solder resist shall be used to divide the pattern for the following cases:
   - Components are arranged closely.
   - The Varistor is mounted near a component with lead wires.
   - The Varistor is placed near a chassis.

Prohibited Applications and Recommended Applications

<table>
<thead>
<tr>
<th>Item</th>
<th>Prohibited applications</th>
<th>Improved applications by pattern division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed mounting with a component with lead wires</td>
<td>The lead wire of a Component With lead wires</td>
<td>Solder resist</td>
</tr>
<tr>
<td>Arrangement near chassis</td>
<td>Chassis Solder (ground solder)</td>
<td>Solder resist</td>
</tr>
<tr>
<td>Retro-fitting of component with lead wires</td>
<td>Soldering iron A lead wire of Retrofit fitted component</td>
<td>Solder resist</td>
</tr>
<tr>
<td>Lateral arrangement</td>
<td>Portion to be Excessively soldered Land</td>
<td>Solder resist</td>
</tr>
</tbody>
</table>

2.4 Component Layout
To prevent the crack of Varistors, place it on the position that could not easily be affected by the bending stress of substrate while going through procedures after mounting or handling.
(1) To minimize mechanical stress caused by the warp or bending of a PC board, please follow the recommended Varistors’ layout below.

![Layout of Varistors Diagram]

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

03 May, 2019
2.5 Mounting Density and Spaces

Intervals between components should not be too narrow to prevent the influence from solder bridges and solder balls. The space between components should be carefully determined.

Precautions for Assembly

1. Storage
(1) The Varistors shall be stored between 5 to 40 °C and 20 to 70 % RH, not under severe conditions of high temperature and humidity.
(2) If stored in a place where humidity, dust, or corrosive gasses (hydrogen sulfide, sulfuric acid, hydrogen chloride and ammonia, etc.) are contained, the solderability of terminals electrodes will be deteriorated.
In addition, storage in a place where the heat or direct sunlight exposure occurs will causes mounting problems due to deformation of tapes and reels and components and taping/reels sticking together.

(3) Do not store components longer than 6 months. Check the solderability of products that have been stored for more than 6 months before use.

2. Adhesives for Mounting
(1) The amount and viscosity of an adhesive for mounting shall be such that the adhesive will not flow off on the land during its curing.
(2) If the amount of adhesive is insufficient for mounting, the Varistors may fall off after or during soldering.
(3) Low-viscosity of the adhesive causes displacement of Varistors.

(4) The heat-curing methods for adhesive are ultraviolet radiation, far-infrared radiation, and so on. In order to prevent the terminal electrodes of the Varistors from oxidizing, the curing shall be under the following conditions: 160 °C max., for 2 minutes max.
(5) Insufficient curing may cause the Varistors to fall off after or during soldering. In addition, insulation resistance between terminal electrodes may deteriorate due to moisture absorption. In order to prevent these problems, please observe proper curing conditions.

3. Chip Mounting Consideration
(1) When mounting the Varistors components on a PC board, the Varistor bodies shall be free from excessive impact loads such as mechanical impact or stress due to the positioning, pushing force and displacement of vacuum nozzles during mounting.
(2) Maintenance and inspection of the Chip Mounter must be performed regularly.
(3) If the bottom dead center of the vacuum nozzle is too low, the Varistor will crack from excessive force during mounting.
Please refer to the following precautions and recommendations.

(a) Set and adjust the bottom dead center of the vacuum nozzles to the upper surface of the PC board after correcting the warp of the PC board.
(b) Set the pushing force of the vacuum nozzle during mounting to 1 to 3 N in static load.
(c) For double surface mounting, apply a supporting pin on the rear surface of the PC board to suppress the bending of the PC board in order to minimize the impact of the vacuum nozzles. Typical examples are shown in the table below.
(d) Adjust the vacuum nozzles so that their bottom dead center during mounting is not too low.

<table>
<thead>
<tr>
<th>Item</th>
<th>Prohibited mounting</th>
<th>Recommended mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single surface mounting</td>
<td><img src="crack.png" alt="Crack" /></td>
<td>The supporting pin does not necessarily have to be positioned beneath the Varistor.</td>
</tr>
<tr>
<td>Double surface mounting</td>
<td><img src="separation.png" alt="Separation of solder" /></td>
<td><img src="supporting_pin.png" alt="Supporting pin" /></td>
</tr>
</tbody>
</table>

(2) The following layout is for your reference since mechanical stress near the dividing/breaking position of a PC board varies depending on the mounting position of the Varistors.

(3) The magnitude of mechanical stress applied to the Varistors when dividing the circuit board in descending order is as follows: push back < slit < V-groove < perforation. Also take into account the layout of the Varistors and the dividing/breaking method.

Panasonic Multilayer Varistors (Automotive Grade)
4. Selection of Soldering Flux
Soldering flux may seriously affect the performance of the Varistors. Please confirm enough whether the soldering flux have an influence on performance of the Varistors or not, before using.

5. Soldering
5.1 Flow Soldering
When conducting flow soldering, stress from abrupt temperature change is applied to the Varistors, so the temperature, especially temperature of solder should be controlled very carefully. Varistors should not be subjected to abrupt temperature change because it causes occurrence of thermal cracks as a result of excessive thermal stress inside of the Varistors from flow soldering. You should be careful to temperature difference. Therefore it is essential that soldering process follow these recommended conditions.

(1) Application of Soldering flux :
The soldering flux shall be applied to the mounted Varistors thinly and uniformly by foaming method.

(2) Preheating :
Conduct sufficient pre-heating, and make sure that the temperature difference between solder and Varistors' surface is 150 °C or less.

(3) Immersion into Soldering bath :
The Varistors shall be immersed into a soldering bath of 240 to 260 °C for 3 to 5 seconds.

(4) Gradual Cooling :
After soldering, avoid rapid cooling (forced cooling) and conduct gradual cooling, so that thermal cracks do not occur.

(5) Flux Cleaning :
When the Varistors are immersed into a cleaning solvent, be sure that the surface temperatures of devices do not exceed 100 °C.

(6) Performing flow soldering once under the conditions shown in the figure on the right “Recommended profile of Flow soldering (Ex.)” will not cause any problems. However, pay attention to the possible warp and bending of the PC board.

5.2 Reflow Soldering
The reflow soldering temperature conditions are composed of temperature curves of Preheating, Temp. rise, Heating, Peak and Gradual cooling. Large temperature difference inside the Varistors caused by rapid heat application to the Varistors may lead to excessive thermal stresses, contributing to the thermal cracks. The Preheating temperature requires controlling with great care so that tombstone phenomenon may be prevented.

<table>
<thead>
<tr>
<th>Item</th>
<th>Temperature</th>
<th>Period or Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Preheating</td>
<td>140 to 180 °C</td>
<td>60 to 120 s</td>
</tr>
<tr>
<td>② Temp. rise</td>
<td>Preheating temp to Peak temp</td>
<td>2 to 5 °C/s</td>
</tr>
<tr>
<td>③ Heating</td>
<td>220 °C min.</td>
<td>60 s max.</td>
</tr>
<tr>
<td>④ Peak</td>
<td>260 °C max.</td>
<td>10 s max.</td>
</tr>
<tr>
<td>⑤ Gradual cooling</td>
<td>Peak temp. to 140 °C</td>
<td>1 to 4 °C/s</td>
</tr>
</tbody>
</table>

The rapid cooling (forced cooling) during Gradual cooling part should be avoided, because this may cause defects such as the thermal cracks, etc. When the Varistors are immersed into a cleaning solvent, make sure that the surface temperatures of the devices do not exceed 100 °C. Performing reflow soldering twice under the conditions shown in the figure above “Recommended profile of Reflow soldering (Ex.)” will not cause any problems. However, pay attention to the possible warp and bending of the PC board.
5.3 Hand Soldering
Hand soldering typically causes significant temperature change, which may induce excessive thermal stresses inside the Varistors, resulting in the thermal cracks, etc.

In order to prevent any defects, the following should be observed.
- Control the temperature of the soldering tips with special care.
- Avoid the direct contact of soldering tips with the Varistors and/or terminal electrodes.
- Do not reuse dismounted Varistors.

(1) Condition 1 (with preheating)
(a) Soldering:
   Use thread solder (Φ1 mm or below) which contains flux with low chlorine, developed for precision electronic equipment.
(b) Preheating:
   Conduct sufficient Preheating, and make sure that the temperature difference between solder and Varistors' surface is 150 °C or less.
(c) Temperature of Iron tip: 350 °C max.
   (The required amount of solder shall be melted in advance on the soldering tip.)
(d) Gradual cooling:
   After soldering, the Varistors shall be cooled gradually at room temperature.

6. Post Soldering Cleaning
6.1 Cleaning solvent
Soldering flux residue may remain on the PC board if cleaned with an inappropriate solvent. This may deteriorate the performance of Varistors, especially insulation resistance.

6.2 Cleaning conditions
Inappropriate cleaning conditions such as insufficient cleaning or excessive cleaning may impair the electrical characteristics and reliability of the Varistors.

(1) Insufficient cleaning can lead to:
   (a) The halogen substance found in the residue of the soldering flux may cause the metal of terminal electrodes to corrode.
   (b) The halogen substance found in the residue of the soldering flux on the surface of the Varistors may change resistance values.
   (c) Water-soluble soldering flux may have more remarkable tendencies of (a) and (b) above compared to those of rosin soldering flux.

(2) Excessive cleaning can lead to:
   (a) When using ultrasonic cleaner, make sure that the output is not too large, so that the substrate will not resonate. The resonance causes the cracks in Varistors and/or solders, and deteriorates the strength of the terminal electrodes.

Please follow these conditions for Ultrasonic cleaning:
- Ultrasonic wave output: 20 W/L max.
- Ultrasonic wave frequency: 40 kHz max.
- Ultrasonic wave cleaning time: 5 min. max.

6.3 Contamination of Cleaning solvent
Cleaning with contaminated cleaning solvent may cause the same results as that of insufficient cleaning due to the high density of liberated halogen.

7. Inspection Process
The pressure from measuring terminal pins might bend the PCB when implementing circuit inspection after mounting Varistors on PCB, and as a result, cracking may occur.

(1) Mounted PC boards shall be supported by an adequate number of supporting pins on the back with bend settings of 90 mm span 0.5 mm max.
(2) Confirm that the measuring pins have the right tip shape, are equal in height, have the right pressure and are set in the correct positions. The following figures are for your reference to avoid bending the PC board.
8. Protective Coating
When the surface of a PC board on which the Varistors have been mounted is coated with resin to protect against moisture and dust, it shall be confirmed that the protective coating does not affect the performance of Varistors.
(1) Choose the material that does not emit the decomposition and/or reaction gas. The gas may affect the composing members of the Varistors.
(2) Shrinkage and expansion of resin coating when curing may apply stress to the Varistors and may lead to occurrence of cracks.

9. Dividing/Breaking of PC Boards
(1) Please be careful not to stress the substrate with bending/twisting when dividing, after mounting components including Varistors. Abnormal and excessive mechanical stress such as bending or torsion shown below can cause cracking in the Varistors.
(2) Dividing/Breaking of the PC boards shall be done carefully at moderate speed by using a jig or apparatus to prevent the Varistors on the boards from mechanical damage.
(3) Examples of PCB dividing/breaking jigs:
The outline of PC board breaking jig is shown below. When PC boards are broken or divided, loading points should be close to the jig to minimize the extent of the bending. Also, planes with no parts mounted on should be used as plane of loading, in order to prevent tensile stress induced by the bending, which may cause cracks of the Varistors or other parts mounted on the PC boards.

10. Mechanical Impact
(1) The Varistors shall be free from any excessive mechanical impact. The Varistor body is made of ceramics and may be damaged or cracked if dropped. Never use a Varistor which has been dropped; their quality may already be impaired, and in that case, failure rate will increase.
(2) When handling PC boards with Varistors mounted on them, do not allow the Varistors to collide with another PC board. When mounted PC boards are handled or stored in a stacked state, the corner of a PC board might strike Varistors, and the impact of the strike may cause damage or cracking and can deteriorate the withstand voltage and insulation resistance of the Varistor.

Other
The various precautions described above are typical. For special mounting conditions, please contact us.
Multilayer Varistor for ESD pulse
[DC voltage lines/High speed signal lines]
Series: EZJZ, EZJP

Features

- Excellent ESD suppression due to original advanced material technology
- Having large electrostatic resistance meeting IEC61000-4-2, Level 4 standard
- Having no polarity (bipolar) facilitated replacing Zener Diodes. Capable of replacing 2 Zener Diodes and 1 Capacitor.
- Lead-free plating terminal electrodes enabling great solderability
- Wide range of products is available by adopting multilayer structure, meeting various needs.
- Low capacitance versions for DC voltage lines of high speed busses
- Ultra low capacitance for high speed signal line
- Applicable to high-speed signal lines, such as interfaces (e.g. USB 2.0, IEEE1394, HDMI, and so on), due to our original ultra-low capacitance technology.
- RoHS compliant

As for Packaging Methods, Handling Precautions
Please see Data Files

Explanation of Part Numbers

- **Product Code**
  - E: Series Code
  - Z: Size Code
  - J: Design Code

- **Packaging Style Code**
  - V: 0402, 0603 Paper Taping

- **Nominal Varistor Voltage**
  - The first and second digits denote the first 2 numbers of the varistor voltage and the third digit indicates the number of zeros following. The decimal point denotes in R.

- **Capacitance Code**
  - A: Below 3 pF, the 10 or 11th position of the P/N indicates the capacitance value as follows:
    - 2.0 pF···20
    - 1.5 p···F15
  - B: Cap. Tolerance : ±0.1 pF
  - C: Cap. Tolerance : ±0.25 pF
  - D: Cap. Tolerance : ±0.50 pF
  - E: Cap. Tolerance : ±0.1 pF
  - F: Cap. Tolerance : ±10 %
  - G: Cap. Tolerance : ±20 %

- **Design Code**
  - B: Cap. Tolerance : ±0.1 pF
  - C: Cap. Tolerance : ±0.25 pF
  - D: Cap. Tolerance : ±0.50 pF
  - E: Cap. Tolerance : ±10 %
  - F: Cap. Tolerance : ±20 %

Construction

- **No.**
  - 1: Semiconductive Ceramics
  - 2: Internal electrode
  - 3: Terminal electrode
  - 4: Intermediate electrode
  - 5: External electrode

Dimensions in mm (not to scale)

<table>
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<tr>
<th>Size Code</th>
<th>Size(inch)</th>
<th>L</th>
<th>W</th>
<th>T</th>
<th>L1, L2</th>
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<td>1</td>
<td>0603</td>
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<td>0.8±0.1</td>
<td>0.3±0.2</td>
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</tbody>
</table>

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

06 May, 2019
Multilayer Varistor, Low Capacitance Type
[High speed signal lines]

Features

- Multilayer monolithic ceramic construction for high speed signal lines
- Ideal for USB 2.0, IEEE1394, and HDMI high speed data busses
- Applicable to high-speed signal lines, such as interfaces (e.g. USB 2.0, IEEE1394, HDMI, and so on), due to our original material technology and multilayer technology.
- Capacitance: 0.8 to 2.1 pF typ.

Recommended Applications

| Mobile phone | Antenna circuit, External IF |
| DSC, DVC | USB2.0, IEEE1394 |
| PC, PDA | USB2.0, IEEE1394, LAN1000BASE |
| TV, DVD | USB2.0, IEEE1394, HDMI |
| Game console | Controller, External IF |

Ratings and Characteristics

<table>
<thead>
<tr>
<th>Size</th>
<th>Part No.</th>
<th>Maximum allowable voltage DC (V)</th>
<th>Nominal varistor voltage at 1mA (V)</th>
<th>Capacitance (pF) at 1MHz</th>
<th>Maximum ESD IEC61000-4-2</th>
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<td>EZJZ0V80015D</td>
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<td>1.5±0.5</td>
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<td>50</td>
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<td></td>
<td>EZJZ0V171AA</td>
<td>18</td>
<td>170</td>
<td>3 max. [2.1 typ.]</td>
<td></td>
</tr>
</tbody>
</table>

| 0603 | EZJZ1V80010 | 10 | 80 | 1 max. [0.8 typ.] |
|      | EZJZ1V500AA | 5 | 50 | 3 max. [2.1 typ.] |
|      | EZJZ1V800AA | 18 | 80 | 3 max. [2.1 typ.] |
|      | EZJZ1V171AA | 18 | 170 | 3 max. [2.1 typ.] |

- Operating Temperature Range: –40 to 85 °C
- Recommend soldering method: Reflow soldering

Voltage vs. Current

[Graph showing voltage vs. current with typical curves for EZJZ0V80010, EZJZ0V500AA, EZJZ1V800AA, and EZJZ1V171AA]
**Multilayer Varistors**

### Capacitance vs. Frequency

- Capacitance (pF) vs. Frequency (MHz)

### Impedance vs. Frequency

- Impedance (Ω) vs. Frequency (MHz)

### Attenuation vs. Frequency

- Attenuation (dB) vs. Frequency (MHz)

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.
Multilayer Varistors

**Multilayer Varistor, Low Voltage Type (Standard Type)**

**[DC voltage lines/Low speed signal lines]**

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### Features

Wide variety of products is available by adopting multilayer construction, which achieved wide range of usage, such as application to DC voltage lines and signal lines.

- **Circuit voltage**
  
  ![Circuit voltage DC (V)](chart)

- **Varistor voltage**: 6.8 to 65 V [at 1 mA]
- **Capacitance**: 8.5 to 420 pF typ. [at 1 MHz]

### Ratings and Characteristics

<table>
<thead>
<tr>
<th>Size</th>
<th>Part No.</th>
<th>Maximum allowable voltage DC (V)</th>
<th>Nominal varistor voltage at 1mA (V)</th>
<th>Capacitance (pF)</th>
<th>Maximum peak current at 8/20μs, 2times (A)</th>
<th>Maximum ESD IEC61000-4-2</th>
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<tr>
<td>0201</td>
<td>EZJPV6R8JA</td>
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<td>6.8</td>
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<td>175 typ. 5</td>
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<td>6.8</td>
<td>100 max. 85 typ.</td>
<td>100 typ. 5</td>
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<td>EZJPV120GA</td>
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<td>12</td>
<td>100 max. 85 typ.</td>
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<td>27 max. 22 typ.</td>
<td>33 typ. 1</td>
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<td>EZJPV120RA</td>
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<td>18 typ. 1</td>
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<td>EZJPV150RA</td>
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<td>15</td>
<td>20 max. 15 typ.</td>
<td>18 typ. 1</td>
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<td>1</td>
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<tr>
<td>0402</td>
<td>EZJP0V6R8MA</td>
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<td>6.8</td>
<td>680 max. 420 typ.</td>
<td>650 typ. 20</td>
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<td>100 typ. 3</td>
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<tr>
<td></td>
<td>EZJP0V080MA</td>
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<td>8</td>
<td>680 max. 420 typ.</td>
<td>650 typ. 20</td>
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<tr>
<td></td>
<td>EZJP0V080GA</td>
<td>5.6</td>
<td>8</td>
<td>330 max. 290 typ.</td>
<td>480 typ. 15</td>
<td>15</td>
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<tr>
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<td>EZJP0V080DA</td>
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<td>8</td>
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<td>100 typ. 3</td>
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<td>EZJP0V120MA</td>
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<td>37 typ. 4</td>
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<td>EZJP0V240WA</td>
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<td>27 max. 22 typ.</td>
<td>33 typ. 5</td>
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<td>65</td>
<td>27 max. 22 typ.</td>
<td>33 typ. 5</td>
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</tbody>
</table>

- **Operating Temperature Range**: –40 to 85 °C  *Recommend soldering method*: Reflow soldering

### Recommended Applications

- **Mobile phone**: SW, LCD, LED, Audio terminal, Battery pack, Memory card, External IF
- **DSC, DVC**: SW, LCD, LED, USB
- **PC, PDA**: SW, LCD, LED, USB
- **TV, DVD**: Audio, Video terminal
- **Audio**: Audio terminal, Microphone, Receiver
- **Game console**: Controller, External IF

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Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use.

Should a safety concern arise regarding this product, please be sure to contact us immediately.

06 May, 2019
Multilayer Varistors

Voltage vs. Current

- **EZJP Series**
  - Graph showing voltage vs. current with typical curve labels:
    - EZJPZV270RA
    - EZJPZV120GA
    - EZJPZV6R8
    - EZJPZV150RA
  - Capacitance vs. frequency with typical curve labels:
    - 680 pF max.
    - 330 pF max.
    - 100 pF max.
    - 27 pF max.
    - 20 pF max.
  - Attenuation vs. frequency with typical curve labels:
    - 10 pF max.

- **EZJZ Series**
  - Graph showing voltage vs. current with typical curve labels:
    - EZJZV420RA
    - EZJZV330RA
    - EZJZV270RA
    - EZJZV220RA
    - EZJZV180RA
    - EZJZV120RA
    - EZJZV650RA

Capacitance vs. Frequency

- **EZJP Series**
  - Graph showing capacitance vs. frequency with typical curve labels:
    - 680 pF max.
    - 330 pF max.
    - 100 pF max.
    - 27 pF max.
    - 20 pF max.

- **EZJZ Series**
  - Graph showing capacitance vs. frequency with typical curve labels:
    - 10000 pF max.
    - 680 pF max.
    - 330 pF max.
    - 27 pF max.
    - 20 pF max.

Attenuation vs. Frequency

- **EZJP Series**
  - Graph showing attenuation vs. frequency with typical curve labels:
    - 10 pF max.
    - 330 pF max.
    - 110 pF max.
    - 680 pF max.

- **EZJZ Series**
  - Graph showing attenuation vs. frequency with typical curve labels:
    - 20 pF max.
    - 110 pF max.
    - 220 pF max.
    - 330 pF max.
Multilayer Varistor for ESD pulse
[DC voltage lines]
Series: EZJS

Features

- Excellent ESD suppression due to original advanced material technology
- Having large electrostatic resistance meeting IEC61000-4-2, Special Level 30 kV standard
- Having no polarity (bipolar) facilitated replacing Zener Diodes. Capable of replacing 2 Zener Diodes and 1 Capacitor.
- Lead-free terminal electrodes enabling great solderability
- RoHS compliant

As for Packaging Methods, Handling Precautions

Please see Data Files

Explanation of Part Numbers

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<th></th>
<th></th>
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<tr>
<td>1</td>
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<td>0603</td>
<td>V</td>
<td>B DC 6 V</td>
<td>f180 reel, Paper Taping</td>
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<td>Internal electrode</td>
<td>J</td>
<td>S</td>
<td>0805</td>
<td>Y</td>
<td>C DC 18 V</td>
<td>f180 reel, Embossed Taping</td>
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Construction

Dimensions in mm (not to scale)

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<th>Size Code</th>
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<th>L</th>
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</tr>
<tr>
<td>2</td>
<td>0805</td>
<td>2.0±0.2</td>
<td>1.25±0.20</td>
<td>0.8±0.2</td>
<td>1.25±0.20</td>
</tr>
</tbody>
</table>
Multilayer Varistors

Ratings and Characteristics

<table>
<thead>
<tr>
<th>Size</th>
<th>Part No.</th>
<th>Maximum Allowable Voltage DC (V)</th>
<th>Nominal Varistor Voltage at 0.1 mA (V)</th>
<th>Capacitance at 1 kHz (pF)</th>
<th>Maximum ESD IEC61000-4-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0603</td>
<td>EZJS1VB822</td>
<td>6</td>
<td>12</td>
<td>8200 typ.</td>
<td>Contact discharge: 30 kV</td>
</tr>
<tr>
<td></td>
<td>EZJS1VC92</td>
<td>18</td>
<td>30</td>
<td>3900 typ.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EZJS1VD182</td>
<td>30</td>
<td>50</td>
<td>1800 typ.</td>
<td></td>
</tr>
<tr>
<td>0805</td>
<td>EZJS2VB223</td>
<td>6</td>
<td>12</td>
<td>22000 typ.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EZJS2YC822</td>
<td>18</td>
<td>30</td>
<td>8200 typ.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EZJS2YD472</td>
<td>30</td>
<td>50</td>
<td>4700 typ.</td>
<td></td>
</tr>
</tbody>
</table>

● Operating Temperature Range: –40 to 85 °C
※ Avoid flow soldering

Voltage vs. Current

Capacitance vs. Frequency

Attenuation vs. Frequency
**Varistor Characteristics and Equivalent Circuit**

A Multilayer Varistor does not have an electrical polarity like zener diodes and is equivalent to total 3 pcs. of 2 zener diodes and 1 capacitor.

[Equivalent Circuit]

**ESD Suppressive Effects**

Typical effects of ESD suppression

Test conditions: IEC61000-4-2* Level 4 Contact discharge, 8 kV

[ESD suppressed waveform]

* IEC61000-4-2 : International Standard of the ESD testing method (HBM) for electronic equipment ability to withstand ESD generated from a human body. It sets 4 levels of severity

<table>
<thead>
<tr>
<th>Severity</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact discharge</td>
<td>2 kV</td>
<td>4 kV</td>
<td>6 kV</td>
<td>8 kV</td>
</tr>
<tr>
<td>Air discharge</td>
<td>2 kV</td>
<td>4 kV</td>
<td>8 kV</td>
<td>15 kV</td>
</tr>
</tbody>
</table>

**Replacement of Zener diode**

Replacing “Zener diode and Capacitor” with Multilayer Varistor saves both the mounting area and number of components used.

[Diagram: Mounting area Approx. 83% space saving]
### Recommended Applications

<table>
<thead>
<tr>
<th>Applications</th>
<th>Series</th>
<th>DC</th>
<th>1k</th>
<th>1M</th>
<th>1G</th>
<th>Circuit (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile phones, DSC, PC, PDA, HDD TV (PDP, LC etc.), DVD, DVC, Game consoles, Audio equipment</td>
<td>Series EZJZ, P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ultra low capacitance (Cap.: 3 pF or less)</td>
</tr>
<tr>
<td>PWR, Photoelectronic sensors, SSR, Motors, Pressure sensors, Proximity switches</td>
<td>Series EZJS</td>
<td>Ultra low capacitance (Cap.: 3 pF or less)</td>
<td></td>
<td></td>
<td></td>
<td>DC to GHz Antenna, RF circuit, LVDS USB, IEEE1394, HDMI etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low capacitance (Cap.: 20 to 680 pF)</td>
<td></td>
<td></td>
<td></td>
<td>DC to tens of Hz PWR, SW, Audio terminals LCD, RS232C, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High capacitance (Cap.: 1800 to 22000 pF)</td>
<td></td>
<td></td>
<td></td>
<td>DC to several kHz PWR, SW, Audio terminals etc.</td>
</tr>
</tbody>
</table>

### Applications

- **Mobile Phone**
  - Audio lines
  - LCD/Camera lines
  - I/O data lines
  - LED
  - SW/Keyboard

- **USB1.1/2.0 lines**
  - USB controller

- **HDMI lines**
  - HDMI IC

- **IEEE1394 lines**
  - Power IC
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Specifications</th>
<th>Testing Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard test conditions</td>
<td>Electrical characteristics shall be measured under the following conditions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Temp. : 5 to 35 °C, Relative humidity : 85 % or less</td>
<td></td>
</tr>
<tr>
<td>Varistor voltage</td>
<td>To meet the specified value.</td>
<td>The Varistor voltage is the voltage ( (V_c, \text{or} \ V_{cmA}) ) between both</td>
</tr>
<tr>
<td></td>
<td></td>
<td>end terminals of a Varistor when specified current ( (CmA) ) is applied to it.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The measurement shall be made as quickly as possible to avoid heating effects.</td>
</tr>
<tr>
<td>Maximum allowable voltage</td>
<td>To meet the specified value.</td>
<td>The maximum DC voltage that can be applied continuously to a varistor.</td>
</tr>
<tr>
<td>Capacitance</td>
<td>To meet the specified value.</td>
<td>Capacitance shall be measured at the specified frequency, bias voltage 0 V,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and measuring voltage 0.2 to 2 Vrms.</td>
</tr>
<tr>
<td>Maximum peak current</td>
<td>To meet the specified value.</td>
<td>The maximum current measured (Varistor voltage tolerance is within ±10 %)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>when a standard impulse current of 8/20 μ seconds is applied twice with an</td>
</tr>
<tr>
<td></td>
<td></td>
<td>interval of 5 minutes.</td>
</tr>
<tr>
<td>Maximum ESD</td>
<td>To meet the specified value.</td>
<td>The maximum ESD measured (while the varistor voltage is within ±30 % of its</td>
</tr>
<tr>
<td></td>
<td></td>
<td>nominal value) when exposed to ESD 10 times (five times for each positive-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>negative polarity) based on IEC61000-4-2.</td>
</tr>
<tr>
<td>Solder ability</td>
<td>To meet the specified value.</td>
<td>The part shall be immersed into a soldering bath under the conditions below.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Solder: H63A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soldering flux : Ethanol solution of rosin (Concentration approx. 25 wt%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soldering temp. : 230±5 °C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Period : 4±1 s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Soldering position : Immerse both terminal electrodes until they are completely</td>
</tr>
<tr>
<td></td>
<td></td>
<td>into the soldering bath.</td>
</tr>
<tr>
<td>Resistance to soldering</td>
<td>( \Delta V_c / V_c : \text{within} \pm 10 % )</td>
<td>After the immersion, leave the part for 24 ±2 hours under the standard condition,</td>
</tr>
<tr>
<td>heat</td>
<td></td>
<td>then evaluate its characteristics.</td>
</tr>
<tr>
<td>Temperature cycling</td>
<td>( \Delta V_c / V_c : \text{within} \pm 10 % )</td>
<td>After repeating the cycles stated below for specified number of times, leave</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the part for 24±2 hours, then evaluate its characteristics.</td>
</tr>
<tr>
<td>Biased Humidity</td>
<td>( \Delta V_c / V_c : \text{within} \pm 10 % )</td>
<td>After conducting the test under the conditions specified below, leave the part</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24±2 hours, then evaluate its characteristics.</td>
</tr>
<tr>
<td>High temperature exposure</td>
<td>( \Delta V_c / V_c : \text{within} \pm 10 % )</td>
<td>After conducting the test under the conditions specified below, leave the part</td>
</tr>
<tr>
<td>(dry heat)</td>
<td></td>
<td>24±2 hours, then evaluate its characteristics.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step</th>
<th>Temperature</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Max. Operating Temp.</td>
<td>30±3 min</td>
</tr>
<tr>
<td>2</td>
<td>Ordinary temp.</td>
<td>3 min max.</td>
</tr>
<tr>
<td>3</td>
<td>Min. Operating Temp.</td>
<td>30±3 min</td>
</tr>
<tr>
<td>4</td>
<td>Ordinary temp.</td>
<td>3 min max.</td>
</tr>
</tbody>
</table>

Design and specifications are each subject to change without notice. Ask factory for the current technical specifications before purchase and/or use. Should a safety concern arise regarding this product, please be sure to contact us immediately.

06 May, 2019
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Packaging Methods

- **Standard Packing Quantity**

<table>
<thead>
<tr>
<th>Series</th>
<th>Size Code (EIA)</th>
<th>Kind of Taping</th>
<th>Pitch (mm)</th>
<th>Quantity (pcs/reel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EZJZ</td>
<td>Z (0201)</td>
<td>Pressed Carrier Taping</td>
<td>2</td>
<td>15,000</td>
</tr>
<tr>
<td>EZJP</td>
<td>0 (0402)</td>
<td>Pressed Carrier Taping</td>
<td>2</td>
<td>10,000</td>
</tr>
<tr>
<td>EZJS</td>
<td>1 (0603)</td>
<td>Punched Carrier Taping</td>
<td>4</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td>2 (0805)</td>
<td>Embossed Carrier Taping</td>
<td>4</td>
<td>2,000</td>
</tr>
</tbody>
</table>

- **Pitch 2mm (Pressed Carrier Taping): Size 0201/EIA**

- **Pitch 2mm (Punched Carrier Taping): Size 0402/EIA**

- **Embossed Carrier Taping: Size 0805/EIA**

- **Reel for Taping**

- **Leader Part and Taped End**

Dimensions in mm
Multilayer Varistors, Chip Type
Series: \textbf{EZJZ, EZJP} (For DC voltage lines, high speed signal lines)
Series: \textbf{EZJS} (For DC voltage lines)

Handling Precautions

⚠️ Safety Precautions
Multilayer Varistors (hereafter referred to as “Varistors”) should be used for general purpose applications as countermeasures against ESD and noise found in consumer electronics (audio/visual, home, office, information & communication) equipment. When subjected to severe electrical, environmental, and/or mechanical stress beyond the specifications, as noted in the Ratings and Specified Conditions section, the Varistors’ performance may be degraded, or become failure mode, such as short circuit mode and open-circuit mode.

If you use under the condition of short-circuit, heat generation of Varistors will occur by running large current due to application of voltage. There are possibilities of smoke emission, substrate burn-out, and, in the worst case, fire.

For products which require high safety levels, please carefully consider how a single malfunction can affect your product. In order to ensure the safety in the case of a single malfunction, please design products with fail-safe, such as setting up protecting circuits, etc.

- For the following applications and conditions, please contact us for additional specifications, which is not found in this document.
  - When your application may have difficulty complying with the safety or handling precautions specified below.
  - When your application may have difficulty complying with the safety or handling precautions specified below.
  - High-quality and high-reliability required devices that have possibility of causing hazardous conditions, such as death or injury (regardless of directly or indirectly), due to failure or malfunction of the product.
    1. Aircraft and Aerospace Equipment (artificial satellite, rocket, etc.)
    2. Submarine Equipment (submarine repeating equipment, etc.)
    3. Transportation Equipment (motor vehicles, airplanes, trains, ship, traffic signal controllers, etc.)
    4. Power Generation Control Equipment (atomic power, hydroelectric power, thermal power plant control system, etc.)
    5. Medical Equipment (life-support equipment, pacemakers, dialysis controllers, etc.)
    6. Information Processing Equipment (large scale computer systems, etc.)
    7. Electric Heating Appliances, Combustion devices (gas fan heaters, oil fan heaters, etc.)
    8. Rotary Motion Equipment
    9. Security Systems
    10. And any similar types of equipment

⚠️ Strict Observance
1. Confirmation of Rated Performance
The Varistors shall be operated within the specified rating/performance. Applications exceeding the specifications may cause deteriorated performance and/or breakdown, resulting in degradation and/or smoking or ignition of products. The following are strictly observed.
(1) The Varistors shall not be operated beyond the specified operating temperature range.
(2) The Varistors shall not be operated in excess of the specified maximum allowable voltage.
(3) The Varistors shall not be operated in the circuits to which surge current and ESD that exceeds the specified maximum peak current and maximum ESD.
(4) Never use for AC power supply circuits.

2. The Varistors shall not be mounted near flammables.

Operating Conditions and Circuit Design

1. Circuit Design
1.1 Operating Temperature and Storage Temperature
When operating a components-mounted circuit, please be sure to observe the “Operating Temperature Range”, written in delivery specifications. Storage temperature of PCB after mounting Varistors, which is not operated, should be within the specified “Storage Temperature Range” in the delivery specifications. Please remember not to use the product under the condition that exceeds the specified maximum temperature.

1.2 Operating Voltage
The Varistors shall not be operated in excess of the “Maximum allowable voltage”. If the Varistors are operated beyond the specified Maximum allowable voltage, it may cause short and/or damage due to thermal run away.
The circuit that continuously applies high frequency and/or steep pulse voltage please examines the reliability of the Varistor even if it is used within a “Maximum allowable voltage”. Also, it would be safer to check also the safety and reliability of your circuit.
1.3 Self-heating
The surface temperature of the Varistors shall be under the specified Maximum Operating Temperature in the Specifications including the temperature rise caused by self-heating. Check the temperature rise of the Varistor in your circuit.

1.4 Environmental Restrictions
The Varistors shall not be operated and/or stored under the following conditions:

(1) Environmental conditions
(a) Under direct exposure to water or salt water
(b) Under conditions where water can condense and/or dew can form
(c) Under conditions containing corrosive gases such as hydrogen sulfide, sulfurous acid, chlorine and ammonia

(2) Mechanical conditions
The place where vibration or impact that exceeds specified conditions written in delivery specification is loaded.

2. Design of Printed Circuit Board
2.1 Selection of Printed Circuit Boards
There is a possibility of performance deterioration by heat shock (temperature cycles), which causes cracks, from alumina substrate.
Please confirm that the substrate you use does not deteriorate the Varistors’ quality.

2.2 Design of Land Pattern
(1) Recommended land dimensions are shown below. Use the proper amount of solder in order to prevent cracking. Using too much solder places excessive stress on the Varistors.

**Recommended Land Dimensions**

<table>
<thead>
<tr>
<th>Size Code (EIA)</th>
<th>Component dimensions</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z(0201)</td>
<td>0.6 0.3 0.3</td>
<td>0.2 to 0.3</td>
<td>0.25 to 0.3</td>
<td>0.2 to 0.3</td>
</tr>
<tr>
<td>0(0402)</td>
<td>1.0 0.5 0.5</td>
<td>0.4 to 0.5</td>
<td>0.4 to 0.5</td>
<td>0.4 to 0.5</td>
</tr>
<tr>
<td>1(0603)</td>
<td>1.6 0.8 0.8</td>
<td>0.8 to 1.0</td>
<td>0.8 to 1.0</td>
<td>0.8 to 1.0</td>
</tr>
<tr>
<td>2(0805)</td>
<td>2.0 1.25 0.8 to 1.25</td>
<td>0.8 to 1.2</td>
<td>0.8 to 1.0</td>
<td>0.8 to 1.0</td>
</tr>
</tbody>
</table>

(2) The land size shall be designed to have equal space, on both right and left side. If the amount of solder on the right land is different from that of the left land, the component may be cracked by stress since the side with a larger amount of solder solidifies later during cooling.

**Recommended Amount of Solder**

(a) Excessive amount (b) Proper amount (c) Insufficient amount

2.3 Utilization of Solder Resist
(1) Solder resist shall be utilized to equalize the amounts of solder on both sides.
(2) Solder resist shall be used to divide the pattern for the following cases:
- Components are arranged closely.
- The Varistor is mounted near a component with lead wires.
- The Varistor is placed near a chassis.

See the table below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Prohibited applications</th>
<th>Improved applications by pattern division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed mounting with a component with lead wires</td>
<td>The lead wire of a Component With lead wires</td>
<td>Solder resist</td>
</tr>
<tr>
<td>Arrangement near chassis</td>
<td>Chassis Solder (ground solder)</td>
<td>Solder resist</td>
</tr>
<tr>
<td>Retro-fitting of component with lead wires</td>
<td>Soldering iron A lead wire of Retrofitted component</td>
<td>Solder resist</td>
</tr>
<tr>
<td>Lateral arrangement</td>
<td>Portion to be Excessively soldered Land</td>
<td>Solder resist</td>
</tr>
</tbody>
</table>

2.4 Component Layout
To prevent the crack of Varistors, place it on the position that could not easily be affected by the bending stress of substrate while going through procedures after mounting or handling.

(1) To minimize mechanical stress caused by the warp or bending of a PC board, please follow the recommended Varistors’ layout below.

**Prohibited layout**

**Recommended layout**

Layout the Varistors sideways against the stressing direction.
(2) The following layout is for your reference since mechanical stress near the dividing/breaking position of a PC board varies depending on the mounting position of the Varistors.

Magnitude of stress A>B=C>D>E

(3) The magnitude of mechanical stress applied to the Varistors when dividing the circuit board in descending order is as follows: push back < slit < V-groove < perforation. Also take into account the layout of the Varistors and the dividing/breaking method.

2.5 Mounting Density and Spaces
Intervals between components should not be too narrow to prevent the influence from solder bridges and solder balls. The space between components should be carefully determined.

Precautions for Assembly

1. Storage
(1) The Varistors shall be stored between 5 to 40 °C and 20 to 70 % RH, not under severe conditions of high temperature and humidity.
(2) If stored in a place where humidity, dust, or corrosive gasses (hydrogen sulfide, sulfuric acid, hydrogen chloride and ammonia, etc.) are contained, the solderability of terminals electrodes will be deteriorated.
In addition, storage in a place where the heat or direct sunlight exposure occurs will causes mounting problems due to deformation of tapes and reels and components and taping/reels sticking together.
(3) Do not store components longer than 6 months. Check the solderability of products that have been stored for more than 6 months before use.

2. Adhesives for Mounting
(1) The amount and viscosity of an adhesive for mounting shall be such that the adhesive will not flow off on the land during its curing.
(2) If the amount of adhesive is insufficient for mounting, the Varistors may fall off after or during soldering.
(3) Low-viscosity of the adhesive causes displacement of Varistors.

(4) The heat-curing methods for adhesive are ultraviolet radiation, far-infrared radiation, and so on. In order to prevent the terminal electrodes of the Varistors from oxidizing, the curing shall be under the following conditions: 160 °C max., for 2 minutes max.
(5) Insufficient curing may cause the Varistors to fall off after or during soldering. In addition, insulation resistance between terminal electrodes may deteriorate due to moisture absorption. In order to prevent these problems, please observe proper curing conditions.

3. Chip Mounting Consideration
(1) When mounting the Varistors components on a PC board, the Varistor bodies shall be free from excessive impact loads such as mechanical impact or stress due to the positioning, pushing force and displacement of vacuum nozzles during mounting.
(2) Maintenance and inspection of the Chip Mounter must be performed regularly.
(3) If the bottom dead center of the vacuum nozzle is too low, the Varistor will crack from excessive force during mounting.
Please refer to the following precautions and recommendations.
(a) Set and adjust the bottom dead center of the vacuum nozzles to the upper surface of the PC board after correcting the warp of the PC board.
(b) Set the pushing force of the vacuum nozzle during mounting to 1 to 3 N in static load.
(c) For double surface mounting, apply a supporting pin on the rear surface of the PC board to suppress the bending of the PC board in order to minimize the impact of the vacuum nozzles. Typical examples are shown in the table below.
d) Adjust the vacuum nozzles so that their bottom dead center during mounting is not too low.

<table>
<thead>
<tr>
<th>Item</th>
<th>Prohibited mounting</th>
<th>Recommended mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single surface</td>
<td><img src="#" alt="Crack" /></td>
<td><img src="#" alt="The supporting pin does not necessarily have to be positioned beneath the Varistor." /></td>
</tr>
<tr>
<td>mounting</td>
<td><img src="#" alt="Supporting pin" /></td>
<td></td>
</tr>
<tr>
<td>Double surface</td>
<td><img src="#" alt="Separation of solder" /></td>
<td><img src="#" alt="Supporting pin" /></td>
</tr>
<tr>
<td>mounting</td>
<td><img src="#" alt="Crack" /></td>
<td></td>
</tr>
</tbody>
</table>
4. Selection of Soldering Flux
Soldering flux may seriously affect the performance of the Varistors. Please confirm enough whether the soldering flux have an influence on performance of the Varistors or not, before using.

5. Soldering

5.1 Flow Soldering
When conducting flow soldering, stress from abrupt temperature change is applied to the Varistors, so the temperature, especially temperature of solder should be controlled very carefully. Varistors should not be subjected to abrupt temperature change because it causes occurrence of thermal cracks as a result of excessive thermal stress inside of the Varistors from flow soldering. You should be careful to temperature difference. Therefore it is essential that soldering process follow these recommended conditions.

(1) Application of Soldering flux : The soldering flux shall be applied to the mounted Varistors thinly and uniformly by foaming method.

(2) Preheating : Conduct sufficient pre-heating, and make sure that the temperature difference between solder and Varistors’ surface is 150 °C or less.

(3) Immersion into Soldering bath : The Varistors shall be immersed into a soldering bath of 240 to 260 °C for 3 to 5 seconds.

(4) Gradual Cooling : After soldering, avoid rapid cooling (forced cooling) and conduct gradual cooling, so that thermal cracks do not occur.

(5) Flux Cleaning : When the Varistors are immersed into a cleaning solvent, be sure that the surface temperatures of devices do not exceed 100 °C.

(6) Performing flow soldering once under the conditions shown in the figure on the right “Recommended profile of Flow soldering (Ex.)” will not cause any problems. However, pay attention to the possible warp and bending of the PC board.

5.2 Reflow Soldering
The reflow soldering temperature conditions are composed of temperature curves of Preheating, Temp. rise, Heating, Peak and Gradual cooling. Large temperature difference inside the Varistors caused by rapid heat application to the Varistors may lead to excessive thermal stresses, contributing to the thermal cracks. The Preheating temperature requires controlling with great care so that tombstone phenomenon may be prevented.

Recommended profile of Reflow soldering (EX.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Temperature</th>
<th>Period or Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preheating</td>
<td>140 to 180 °C</td>
<td>60 to 120 s</td>
</tr>
<tr>
<td>2. Temp. rise</td>
<td>Preheating temp</td>
<td>2 to 5 °C /s</td>
</tr>
<tr>
<td>3. Heating</td>
<td>220 °C min.</td>
<td>60 s max.</td>
</tr>
<tr>
<td>4. Peak</td>
<td>260 °C max.</td>
<td>10 s max.</td>
</tr>
<tr>
<td>5. Gradual cooling</td>
<td>Peak temp.</td>
<td>1 to 4 °C /s</td>
</tr>
</tbody>
</table>

ΔT : Allowable temperature difference ΔT ≤ 150 °C

The rapid cooling (forced cooling) during Gradual cooling part should be avoided, because this may cause defects such as the thermal cracks, etc. When the Varistors are immersed into a cleaning solvent, make sure that the surface temperatures of the devices do not exceed 100 °C. Performing reflow soldering twice under the conditions shown in the figure above “Recommended profile of Reflow soldering (Ex.)” will not cause any problems. However, pay attention to the possible warp and bending of the PC board.
5.3 Hand Soldering

Hand soldering typically causes significant temperature change, which may induce excessive thermal stresses inside the Varistors, resulting in the thermal cracks, etc.

In order to prevent any defects, the following should be observed.

- Control the temperature of the soldering tips with special care.
- Avoid the direct contact of soldering tips with the Varistors and/or terminal electrodes.
- Do not reuse dismounted Varistors.

(1) Condition 1 (with preheating)

(a) Soldering:
   Use thread solder (Ø1 mm or below) which contains flux with low chlorine, developed for precision electronic equipment.

(b) Preheating:
   Conduct sufficient Preheating, and make sure that the temperature difference between solder and Varistors’ surface is 150 °C or less.

(c) Temperature of Iron tip: 300 °C max.
   (The required amount of solder shall be melted in advance on the soldering tip.)

(d) Gradual cooling:
   After soldering, the Varistors shall be cooled gradually at room temperature.

6. Post Soldering Cleaning

6.1 Cleaning solvent

Soldering flux residue may remain on the PC board if cleaned with an inappropriate solvent. This may deteriorate the performance of Varistors, especially insulation resistance.

6.2 Cleaning conditions

Inappropriate cleaning conditions such as insufficient cleaning or excessive cleaning may impair the electrical characteristics and reliability of the Varistors.

(1) Insufficient cleaning can lead to:

(a) The halogen substance found in the residue of the soldering flux may cause the metal of terminal electrodes to corrode.

(b) The halogen substance found in the residue of the soldering flux on the surface of the Varistors may change resistance values.

(c) Water-soluble soldering flux may have more remarkable tendencies of (a) and (b) above compared to those of rosin soldering flux.

(2) Excessive cleaning can lead to:

(a) When using ultrasonic cleaner, make sure that the output is not too large, so that the substrate will not resonate. The resonance causes the cracks in Varistors and/or solders, and deteriorates the strength of the terminal electrodes.

Please follow these conditions for Ultrasonic cleaning:

- Ultrasonic wave output: 20 W/L max.
- Ultrasonic wave frequency: 40 kHz max.
- Ultrasonic wave cleaning time: 5 min. max.

6.3 Contamination of Cleaning solvent

Cleaning with contaminated cleaning solvent may cause the same results as that of insufficient cleaning due to the high density of liberated halogen.

7. Inspection Process

The pressure from measuring terminal pins might bend the PCB when implementing circuit inspection after mounting Varistors on PCB, and as a result, cracking may occur.

(1) Mounted PC boards shall be supported by an adequate number of supporting pins on the back with bend settings of 90 mm span 0.5 mm max.

(2) Confirm that the measuring pins have the right tip shape, are equal in height, have the right pressure and are set in the correct positions.

The following figures are for your reference to avoid bending the PC board.
8. Protective Coating
When the surface of a PC board on which the Varistors have been mounted is coated with resin to protect against moisture and dust, it shall be confirmed that the protective coating does not affect the performance of Varistors.

(1) Choose the material that does not emit the decomposition and/or reaction gas. The gas may affect the composing members of the Varistors.

(2) Shrinkage and expansion of resin coating when curing may apply stress to the Varistors and may lead to occurrence of cracks.

9. Dividing/Breaking of PC Boards
(1) Please be careful not to stress the substrate with bending/twisting when dividing, after mounting components including Varistors. Abnormal and excessive mechanical stress such as bending or torsion shown below can cause cracking in the Varistors.

(2) Dividing/Breaking of the PC boards shall be done carefully at moderate speed by using a jig or apparatus to prevent the Varistors on the boards from mechanical damage.

(3) Examples of PCB dividing/breaking jigs:
The outline of PC board breaking jig is shown below. When PC board are broken or divided, loading points should be close to the jig to minimize the extent of the bending. Also, planes with no parts mounted on should be used as plane of loading, in order to prevent tensile stress induced by the bending, which may cause cracks of the Varistors or other parts mounted on the PC boards.

10. Mechanical Impact
(1) The Varistors shall be free from any excessive mechanical impact. The Varistor body is made of ceramics and may be damaged or cracked if dropped. Never use a Varistor which has been dropped; their quality may already be impaired, and in that case, failure rate will increase.

(2) When handling PC boards with Varistors mounted on them, do not allow the Varistors to collide with another PC board. When mounted PC boards are handled or stored in a stacked state, the corner of a PC board might strike Varistors, and the impact of the strike may cause damage or cracking and can deteriorate the withstand voltage and insulation resistance of the Varistor.

Other
The various precautions described above are typical. For special mounting conditions, please contact us.
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