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### High-Q Capacitors (Microwave Chip Capacitors)

Series: **ECD**



#### ■ Features

- Low Capacitance with tight tolerance  
(0.1 to 15.0 pF, +/-0.05 pF to +/-5 %)
- High Q value / Low ESR at High Frequencies
- Ultra-Stable COG Performance (0±30 ppm/°C)
- 0402 & 0201 Case sizes  
(0.1 to 15.0 pF & 0.1 to 5.6 pF, +/-0.05 pF, +/-0.075 pF etc)
- Pb Free
- RoHS compliant

#### ■ Recommended Applications

- Microwave Circuitry
  - Impedance Matching Circuitry
  - Resonant Circuitry
  - Coupling Circuitry
- RF modules, VCO, BPF, DUP, PA
- Cellular Phone, Bluetooth, Wireless LAN

#### ■ Product Code

ECD: High-Q Capacitors

#### ■ Handling Precautions

See Page 48 to 53

#### ■ Packaging Specifications

See Page 45, 46, 56

#### ■ Explanation of Part Numbers



#### ■ Construction



| No | Name               |                        |
|----|--------------------|------------------------|
| ①  | Ceramic dielectric |                        |
| ②  | Internal electrode |                        |
| ③  | Terminal electrode | Substrate electrode    |
| ④  |                    | Intermediate electrode |
| ⑤  |                    | External electrode     |

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



| Size Code | Size (EIA) | L         | W         | T         | L <sub>1</sub> , L <sub>2</sub> |
|-----------|------------|-----------|-----------|-----------|---------------------------------|
| Z         | 0201       | 0.60±0.03 | 0.30±0.03 | 0.30±0.03 | 0.15±0.05                       |
| 0         | 0402       | 1.00±0.05 | 0.5±0.05  | 0.5±0.05  | 0.2±0.1                         |

### ■ Packaging Styles and Standard Packaging Quantities

Quantity : pcs./reel

| Packaging Style Code | Packaging Styles |                               | Size   |        |
|----------------------|------------------|-------------------------------|--------|--------|
|                      |                  | Thickness (mm)                |        |        |
| E                    | φ180 reel        | Paper taping<br>(Pitch: 2 mm) | 0201   | 0402   |
|                      |                  |                               | T=0.3  | T=0.5  |
|                      |                  |                               | 15,000 | 10,000 |

### ■ Temperature Characteristics

| Temperature Characteristic Code | Temperature Coefficient |
|---------------------------------|-------------------------|
| C0G                             | 0±30 ppm/°C             |

These temperature coefficients are calculated between 25 °C and 85 °C

### ■ Rated Voltage

|               |
|---------------|
| Rated Voltage |
| DC 25 V       |

### ■ Nominal Capacitance

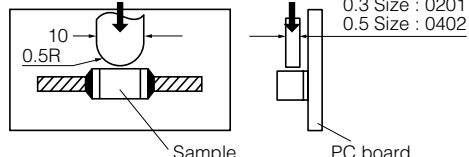
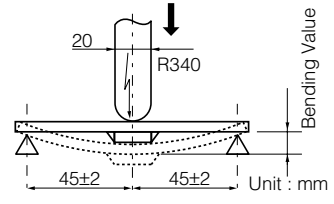
| Ex.                 | R10     | 1R0    | 2R7    | 120   |
|---------------------|---------|--------|--------|-------|
| Nominal Capacitance | 0.10 pF | 1.0 pF | 2.7 pF | 12 pF |

The first two digits are significant figures of capacitance. Small number of people display the point by R.

### ■ Capacitance tolerance

| Size (EIA) | Tolerance Code | Capacitance Range | Capacitance Tolerance |
|------------|----------------|-------------------|-----------------------|
| 0201       | 8              | 0.10 to 0.50 pF   | ±0.05 pF              |
|            | 9              | 0.60 to 0.90 pF   | ±0.075 pF             |
|            | B              | 1.0 to 3.0 pF     | ±0.10 pF              |
|            | C              | 3.3 to 5.6 pF     | ±0.25 pF              |
| 0402       | 8              | 0.10 to 0.90 pF   | ±0.05 pF              |
|            | 9              | 0.60 to 0.90 pF   | ±0.075 pF             |
|            | B              | 1.0 to 8.2 pF     | ±0.10 pF              |
|            | C              | 3.3 to 10.0 pF    | ±0.25 pF              |
|            | J              | 12 to 15 pF       | ±5 %                  |

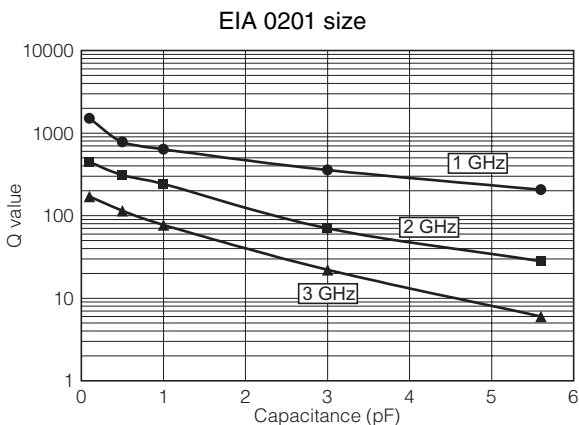
### ■ Specifications and Testing Methods

| Characteristics                   | Specifications   | Test Method  |       |             |          |         |           |            |                                   |            |            |         |        |         |
|-----------------------------------|--|--|-------|-------------|----------|---------|-----------|------------|-----------------------------------|------------|------------|---------|--------|---------|
| Operating Temperature Range       | -55 to 125 °C  | —  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Dielectric Withstanding Voltage   | No dielectric breakdown and/or damage  | Test voltage: Rated voltage × 300 %<br>Duration: 1 to 5 s<br>Charge/discharge current: 50 mA max.  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Insulation Resistance (IR)        | 10000 MΩ min.  | Measuring voltage: Rated voltage<br>Duration: 60±5 s<br>Charge / Discharge current: 50 mA max.   |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Capacitance                       | Within the specified tolerance   | Temperature: 20 +/-2 °C  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Dissipation Factor (tan δ)        | tan δ ≤ 0.005 max.   | Measuring Frequency: 1 MHz +/-10 %<br>Measuring Voltage: 0.5 to 5 Vrms   |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Temperature Characteristics       | COG : 0 +/-30 ppm/°C   | Maximum capacitance change at stage 1 to 5 <table border="1"> <thead> <tr> <th>Stage</th> <th>Temperature</th> </tr> </thead> <tbody> <tr> <td>Stage1</td> <td>25±2 °C</td> </tr> <tr> <td>Stage2</td> <td>-25±2 °C</td> </tr> <tr> <td>Stage3<br/>(Reference Temperature)</td> <td>25±2 °C</td> </tr> <tr> <td>Stage4</td> <td>85±2 °C</td> </tr> <tr> <td>Stage5</td> <td>25±2 °C</td> </tr> </tbody> </table> | Stage | Temperature | Stage1   | 25±2 °C | Stage2    | -25±2 °C   | Stage3<br>(Reference Temperature) | 25±2 °C    | Stage4     | 85±2 °C | Stage5 | 25±2 °C |
| Stage                             | Temperature  |  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Stage1                            | 25±2 °C  |  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Stage2                            | -25±2 °C   |  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Stage3<br>(Reference Temperature) | 25±2 °C  |  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Stage4                            | 85±2 °C  |  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Stage5                            | 25±2 °C  |  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Adhesion                          | The terminal electrode shall be free from peeling or signs of peeling.                               | Applied force :<br>Size : 0201 : 2N<br>Size : 0402 : 5N<br>Arrow direction for 10 seconds.<br>   |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Bending Strength                  | Appearance : no mechanical damage  | Bending value : 1 mm<br>Bending speed : 1 mm/s<br>  |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Resistance to Solder Heat         | Appearance : no mechanical damage<br>I.R. : initial value  | Solder temperature : 270±5 °C<br>Dipping period : 3.0±0.5 s<br>Preheat condition : <table border="1"> <thead> <tr> <th>Order</th> <th>Temp. (°C)</th> <th>Time (s)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>80 to 100</td> <td>120 to 180</td> </tr> <tr> <td>2</td> <td>150 to 200</td> <td>120 to 180</td> </tr> </tbody> </table> Recovery (Standard condition)<br>: 24 ±2 h                           | Order | Temp. (°C)  | Time (s) | 1       | 80 to 100 | 120 to 180 | 2                                 | 150 to 200 | 120 to 180 |         |        |         |
| Order                             | Temp. (°C)   | Time (s)   |       |             |          |         |           |            |                                   |            |            |         |        |         |
| 1                                 | 80 to 100  | 120 to 180   |       |             |          |         |           |            |                                   |            |            |         |        |         |
| 2                                 | 150 to 200   | 120 to 180   |       |             |          |         |           |            |                                   |            |            |         |        |         |
| Solderability                     | More than 75 % of the soldered area of both terminal electrodes shall be covered with fresh solder . | Solder bath method<br>Solder temperature : 230±5 °C<br>Dipping period : 4±1 s<br>Solder : H63A (JIS Z 3283)  |       |             |          |         |           |            |                                   |            |            |         |        |         |

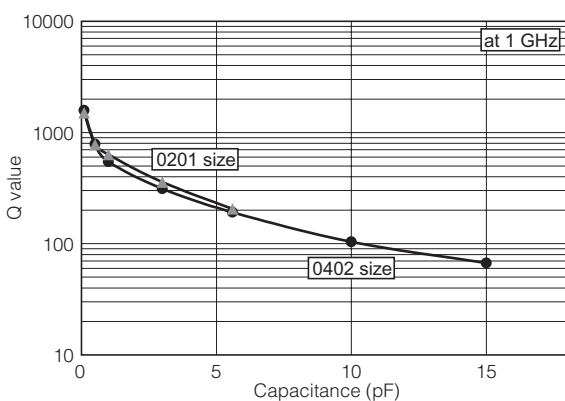
\* Standard condition: Temperature 15 to 35 °C, Relative humidity 45 to 75 %.

| Characteristics             | Specifications   | Test Method  |
|-----------------------------|--|--|
| Temperature cycle           | Appearance : no mechanical damage<br>I.R. : 1000M $\Omega$ min.  | Condition of one cycle<br>Step1 : -55 $\pm$ 3 $^{\circ}$ C 30 $\pm$ 3 min.<br>Step2 : Room temp 3 min.<br>Step3 : 125 $\pm$ 3 $^{\circ}$ C 30 $\pm$ 3 min.<br>Step4 : Room temp 3 min.<br>Number of cycles : 5 cycles<br>Recovery (Standard condition)<br>: 24 $\pm$ 2 h |
| Moisture Resistance         | Appearance : no mechanical damage<br>I.R. : 1000M $\Omega$ min.<br>Capacitance Change:<br>Within $\pm$ 7.5 % or $\pm$ 0.02 pF whichever is larger<br>tan $\delta$ : 0.005 max. | Temperature : 40 $\pm$ 2 $^{\circ}$ C<br>Relative Humidity : 90 to 95 %<br>Test period : 500 +24/0 h<br>Recovery (Standard condition)<br>: 24 $\pm$ 2 h  |
| Moisture Resistant Loading  | Appearance : no mechanical damage<br>I.R. : 1000M $\Omega$ min.  | Temperature : 40 $\pm$ 2 $^{\circ}$ C<br>Relative Humidity : 90 to 95 %<br>Applied voltage : Rated voltage<br>Limit surge current : 50 mA max.<br>Test period : 500 +24/0 h<br>Recovery (Standard condition)<br>: 24 $\pm$ 2 h   |
| Loading at high temperature | Appearance : no mechanical damage<br>I.R. : 1000M $\Omega$ min.  | Temperature: 125 $^{\circ}$ C $\pm$ 3 $^{\circ}$ C<br>Applied voltage : Rated voltage $\times$ 200 %<br>Limit surge current : 50 mA max.<br>Test period : 1000 +48/0 h<br>Recovery (Standard condition)<br>: 24 $\pm$ 2 h  |

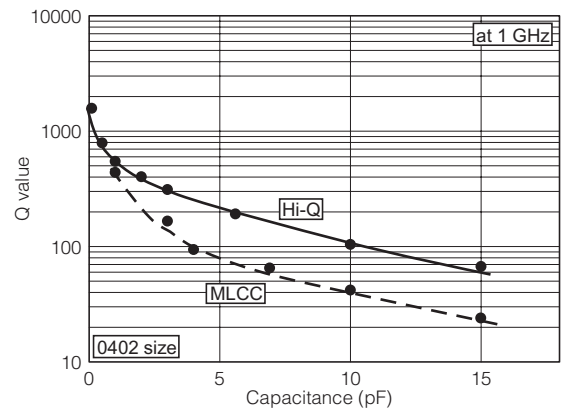
### ■ Q value vs. Capacitance



### ■ Comparison data of Q value



### ■ Comparison data of Q value



Measurements performed Boonton34A Resonant Coaxial-Line and represent typical capacitor performance.

■ Standard Products for EIA Size "0201", Taped Version  
● Temperature Characteristics C0G

| Rated voltage    |                       | DC 25 V    |             |
|------------------|-----------------------|------------|-------------|
| Capacitance (pF) | Capacitance Tolerance | Part No.   | Dim. T (mm) |
| 0.10             | ±0.05 pF (8)          | ECDGZER108 | 0.3         |
| 0.20             |                       | ECDGZER208 | 0.3         |
| 0.30             |                       | ECDGZER308 | 0.3         |
| 0.40             |                       | ECDGZER408 | 0.3         |
| 0.50             |                       | ECDGZER508 | 0.3         |
| 0.60             | ±0.075 pF (9)         | ECDGZER609 | 0.3         |
| 0.70             |                       | ECDGZER709 | 0.3         |
| 0.80             |                       | ECDGZER809 | 0.3         |
| 0.90             |                       | ECDGZER909 | 0.3         |
| 1.0              | ±0.1 pF (B)           | ECDGZE1R0B | 0.3         |
| 1.1              |                       | ECDGZE1R1B | 0.3         |
| 1.2              |                       | ECDGZE1R2B | 0.3         |
| 1.3              |                       | ECDGZE1R3B | 0.3         |
| 1.5              |                       | ECDGZE1R5B | 0.3         |
| 1.6              |                       | ECDGZE1R6B | 0.3         |
| 1.8              |                       | ECDGZE1R8B | 0.3         |
| 2.0              |                       | ECDGZE2R0B | 0.3         |
| 2.2              |                       | ECDGZE2R2B | 0.3         |
| 2.4              |                       | ECDGZE2R4B | 0.3         |
| 2.7              | ECDGZE2R7B            | 0.3        |             |
| 3.0              | ±0.25 pF (C)          | ECDGZE3R0B | 0.3         |
| 3.3              |                       | ECDGZE3R3C | 0.3         |
| 3.9              |                       | ECDGZE3R9C | 0.3         |
| 4.7              |                       | ECDGZE4R7C | 0.3         |
| 5.6              | ECDGZE5R6C            | 0.3        |             |

Packaging Style Code : "E" (T=0.3 mm) for Standard Packaging Quantity (15,000 pcs./reel)

■ Standard Products for EIA Size "0402", Taped Version  
● Temperature Characteristics C0G

| Rated voltage    |                                   | DC 25 V    |             |
|------------------|-----------------------------------|------------|-------------|
| Capacitance (pF) | Capacitance Tolerance             | Part No.   | Dim. T (mm) |
| 0.10             | ±0.05 pF (8)                      | ECDG0ER108 | 0.5         |
| 0.20             |                                   | ECDG0ER208 | 0.5         |
| 0.30             |                                   | ECDG0ER308 | 0.5         |
| 0.40             |                                   | ECDG0ER408 | 0.5         |
| 0.50             |                                   | ECDG0ER508 | 0.5         |
| 0.60             | ±0.05 pF(8)<br>or<br>±0.075 pF(9) | ECDG0ER60□ | 0.5         |
| 0.70             |                                   | ECDG0ER70□ | 0.5         |
| 0.80             |                                   | ECDG0ER80□ | 0.5         |
| 0.90             |                                   | ECDG0ER90□ | 0.5         |
| 1.0              | ±0.1 pF (B)                       | ECDG0E1R0B | 0.5         |
| 1.1              |                                   | ECDG0E1R1B | 0.5         |
| 1.2              |                                   | ECDG0E1R2B | 0.5         |
| 1.3              |                                   | ECDG0E1R3B | 0.5         |
| 1.5              |                                   | ECDG0E1R5B | 0.5         |
| 1.6              |                                   | ECDG0E1R6B | 0.5         |
| 1.8              |                                   | ECDG0E1R8B | 0.5         |
| 2.0              |                                   | ECDG0E2R0B | 0.5         |
| 2.2              |                                   | ECDG0E2R2B | 0.5         |
| 2.4              |                                   | ECDG0E2R4B | 0.5         |
| 2.7              | ECDG0E2R7B                        | 0.5        |             |
| 3.0              | ±0.1 pF(B)<br>or<br>±0.25 pF(C)   | ECDG0E3R0B | 0.5         |
| 3.3              |                                   | ECDG0E3R3□ | 0.5         |
| 3.9              |                                   | ECDG0E3R9□ | 0.5         |
| 4.7              |                                   | ECDG0E4R7□ | 0.5         |
| 5.6              | ECDG0E5R6□                        | 0.5        |             |
| 6.8              | ECDG0E6R8□                        | 0.5        |             |
| 8.2              | ECDG0E8R2□                        | 0.5        |             |
| 10.0             | ±0.25 pF                          | ECDG0E100C | 0.5         |
| 12               | ±5 %                              | ECDG0E120J | 0.5         |
| 15               | (J)                               | ECDG0E150J | 0.5         |

□ : Capacitance tolerance code.  
Packaging Style Code : "E" (T=0.5 mm) for Standard Packaging Quantity (10,000 pcs./reel)

### Application Examples

#### RF Circuit

