

### High-Q Capacitors (Microwave Chip Capacitors) [High-accuracy Types of High-frequency Multilayer Chip Capacitors]

Series: **ECD**



#### ■ Features

- Low Capacitance with tight tolerance.  
(0.1 to 15.0 pF,  $\pm 0.05$  pF to  $\pm 5$  %)
- High Q value / Low ESR at High Frequencies
- Ultra-Stable COG Performance ( $0 \pm 30$  ppm/°C)
- 0402/0201 Miniature Size  
(0.10 to 15.0 pF/0.10 to 2.0 pF,  $\pm 0.05$  pF,  $\pm 0.075$  pF etc)

#### ■ Applications

- At Microwave Frequencies
  - Impedance Matching Circuit
  - Resonant Circuit
  - Coupling Circuit
- Application Examples
  - RF modules, VCO, BPF, DUP, PA, etc.
  - Cellular Phone, Bluetooth, Wireless LAN etc.

#### ■ Product Code

ECD:High-Q Capacitors

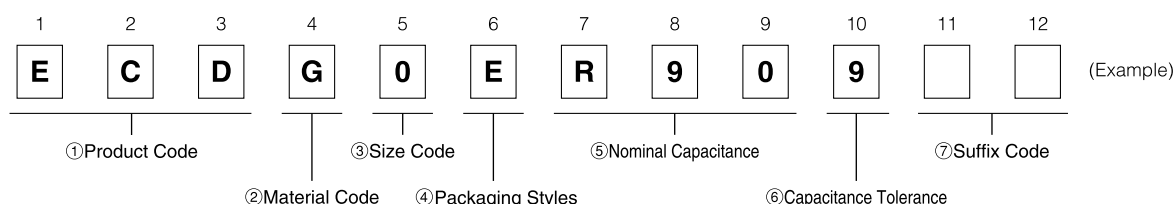
#### ■ Precaution for Handling

See Page 51 to 57

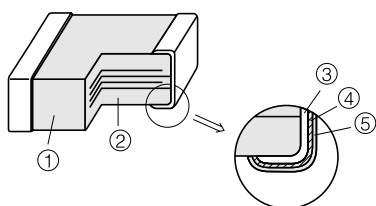
#### ■ Packaging method

See Page 96

#### ■ Explanation of Part Numbers

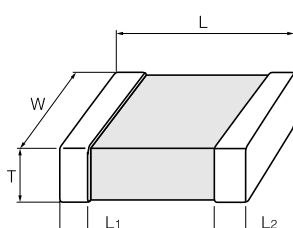


#### ■ Construction



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

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



| Unit : mm (inch) |                  |                 |                 |                 |                                 |
|------------------|------------------|-----------------|-----------------|-----------------|---------------------------------|
| Code             | Size Code (EIA)  | L               | W               | T               | L <sub>1</sub> , L <sub>2</sub> |
| Z                | Type "06" (0201) | 0.60 $\pm$ 0.03 | 0.30 $\pm$ 0.03 | 0.30 $\pm$ 0.03 | 0.15 $\pm$ 0.05                 |
| 0                | Type "10" (0402) | 1.00 $\pm$ 0.05 | 0.50 $\pm$ 0.05 | 0.50 $\pm$ 0.05 | 0.2 $\pm$ 0.1                   |

■ Packaging Styles

| Code | Packaing Styles |                                | Quantity  | Type "06" (0201)   | Type "10" (0402)   |
|------|-----------------|--------------------------------|-----------|--------------------|--------------------|
|      |                 |                                |           | T=0.3              | T=0.5              |
| E    | φ 180<br>reel   | Paper taping<br>(Pitch : 2 mm) | pcs./reel | 15,000 pcs. / reel | 10,000 pcs. / reel |

■ Temperature Coefficient

| Characteristics | Temperature. Coefficient. |
|-----------------|---------------------------|
| C0G             | 0 ± 30 ppm/°C             |

These temperature coefficient are calculated between 20°C and 85°C

■ Rated Voltage

| Rated Voltage | DC25V |
|---------------|-------|
|---------------|-------|

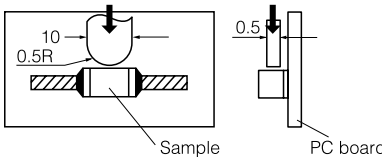
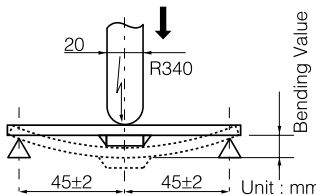
■ Nominal Capacitance

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

■ Capacitance Tolerance

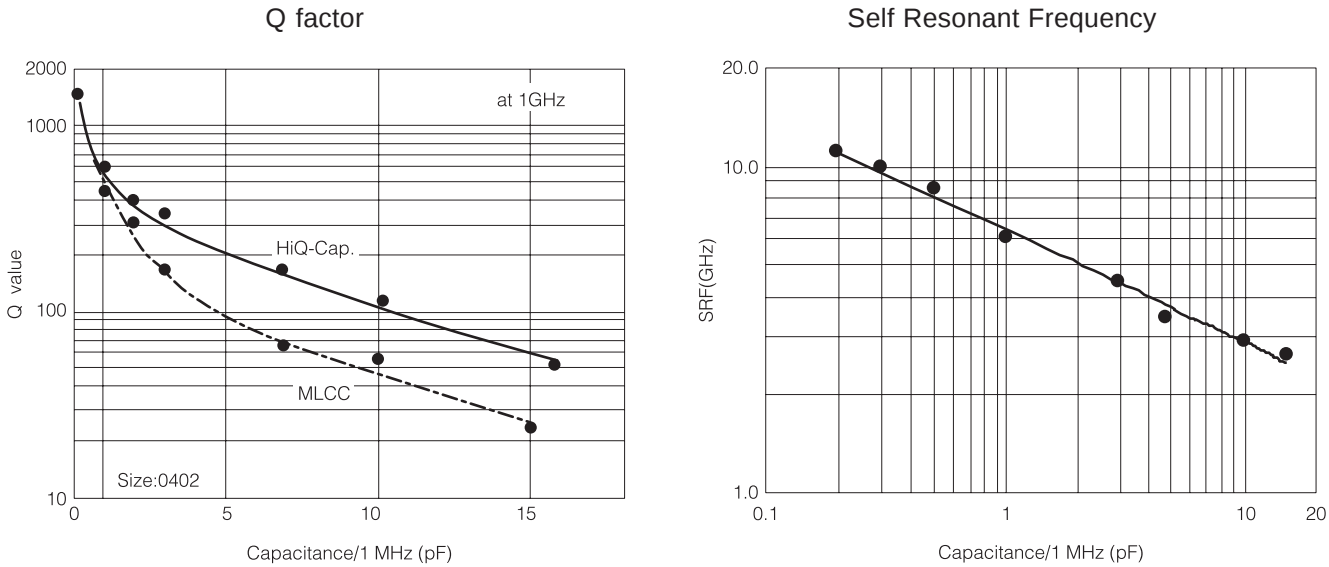
| Size Code<br>(EIA)  | Tol. Code | Capacitance Range | Capacitance Tolerabce |
|---------------------|-----------|-------------------|-----------------------|
| Type "06"<br>(0201) | 8         | 0.10 to 0.50 pF   | ±0.05 pF              |
|                     | 9         | 0.60 to 0.90 pF   | ±0.075 pF             |
|                     | B         | 1.0 to 3.0 pF     | ±0.1 pF               |
| Type "10"<br>(0402) | 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     | ±0.1 pF               |
|                     | C         | 3.3 to 10.0 pF    | ±0.25 pF              |
|                     | J         | 12 to 15 pF       | ±5 %                  |

### ■ Specification

| Characteristics                 | Specification                                                                                       | Test Method                                                                                                                                                                                                                                                                                              |             |             |              |             |               |             |                                    |          |         |          |         |          |
|---------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|--------------|-------------|---------------|-------------|------------------------------------|----------|---------|----------|---------|----------|
| Operating Temperature Range     | −55 to 125 °C                                                                                       |                                                                                                                                                                                                                                                                                                          |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Rated Voltage                   | 25 VDC                                                                                              |                                                                                                                                                                                                                                                                                                          |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Dielectric Withstanding Voltage | No break down                                                                                       | Test voltage:Rated voltage ×300 %<br>Duration:1 to 5s<br>Limit suge current:50 mA max.                                                                                                                                                                                                                   |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Insulation Resistance (I R)     | More than 10000 MΩ                                                                                  | Measuring voltage:Rated voltage<br>Duration:60±5s<br>Limit surge current:50 mA max.                                                                                                                                                                                                                      |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Cpacitance                      | Within the specified tolerance                                                                      | Temperature:20 °C<br>Measuring frequency :1 MHz±10 %<br>Measuring voltage:0.5 to 5 Vrms                                                                                                                                                                                                                  |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Dissipation Factor (tan δ)      | $\tan \delta \leq 0.005$                                                                            |                                                                                                                                                                                                                                                                                                          |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Temperature Characteristics     | C0G:0±30 ppm/ °C                                                                                    | Maximum capacitance change at stage 1 to 5                                                                                                                                                                                                                                                               |             |             |              |             |               |             |                                    |          |         |          |         |          |
|                                 |                                                                                                     | <table><tr><td>Stage</td><td>Temperature</td></tr><tr><td>Stage 1</td><td>+20±2 °C</td></tr><tr><td>Stage 2</td><td>−25±2 °C</td></tr><tr><td>Stage 3<br/>(Reference Temperature)</td><td>+20±2 °C</td></tr><tr><td>Stage 4</td><td>+85±2 °C</td></tr><tr><td>Stage 5</td><td>+20±2 °C</td></tr></table> | Stage       | Temperature | Stage 1      | +20±2 °C    | Stage 2       | −25±2 °C    | Stage 3<br>(Reference Temperature) | +20±2 °C | Stage 4 | +85±2 °C | Stage 5 | +20±2 °C |
|                                 |                                                                                                     | Stage                                                                                                                                                                                                                                                                                                    | Temperature |             |              |             |               |             |                                    |          |         |          |         |          |
|                                 |                                                                                                     | Stage 1                                                                                                                                                                                                                                                                                                  | +20±2 °C    |             |              |             |               |             |                                    |          |         |          |         |          |
|                                 |                                                                                                     | Stage 2                                                                                                                                                                                                                                                                                                  | −25±2 °C    |             |              |             |               |             |                                    |          |         |          |         |          |
|                                 |                                                                                                     | Stage 3<br>(Reference Temperature)                                                                                                                                                                                                                                                                       | +20±2 °C    |             |              |             |               |             |                                    |          |         |          |         |          |
|                                 |                                                                                                     | Stage 4                                                                                                                                                                                                                                                                                                  | +85±2 °C    |             |              |             |               |             |                                    |          |         |          |         |          |
| Stage 5                         | +20±2 °C                                                                                            |                                                                                                                                                                                                                                                                                                          |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Adhesion                        | The terminal electrode shall be free from peeling or signs of peeling.                              | Soldering the specimen to the testing jig shown in the figure, and apply at 5 N force to the arrow direction for 10 seconds.<br>                                                                                    |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Bending Strength                | Appearance:no mechanical damage                                                                     | Bending value:1 mm<br>Bending speed:1 mm/s<br>                                                                                                                                                                      |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Solderability                   | More than 75 % of the soldered area of both terminal electrodes shall be covered with fresh solder. | Solder temperature:230±5 °C<br>Dipping period:4±1 s<br>Solder:H63A(JIS-Z-3283)                                                                                                                                                                                                                           |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Resistance to Solder Heat       | Appearance:no mechanical damage<br>Capacitance change:<br>IR:more than 10000 MΩ                     | Solder temperature:270±5 °C<br>Dipping period:3.0±0.5 s                                                                                                                                                                                                                                                  |             |             |              |             |               |             |                                    |          |         |          |         |          |
|                                 |                                                                                                     | Preheat condition:                                                                                                                                                                                                                                                                                       |             |             |              |             |               |             |                                    |          |         |          |         |          |
|                                 |                                                                                                     | <table><tr><td>Temp.</td><td>Period</td></tr><tr><td>80 to 100 °C</td><td>120 to 180s</td></tr><tr><td>150 to 200 °C</td><td>120 to 180s</td></tr></table>                                                                                                                                               | Temp.       | Period      | 80 to 100 °C | 120 to 180s | 150 to 200 °C | 120 to 180s |                                    |          |         |          |         |          |
|                                 |                                                                                                     | Temp.                                                                                                                                                                                                                                                                                                    | Period      |             |              |             |               |             |                                    |          |         |          |         |          |
| 80 to 100 °C                    | 120 to 180s                                                                                         |                                                                                                                                                                                                                                                                                                          |             |             |              |             |               |             |                                    |          |         |          |         |          |
| 150 to 200 °C                   | 120 to 180s                                                                                         |                                                                                                                                                                                                                                                                                                          |             |             |              |             |               |             |                                    |          |         |          |         |          |
| Recovery:24±2 h                 |                                                                                                     |                                                                                                                                                                                                                                                                                                          |             |             |              |             |               |             |                                    |          |         |          |         |          |

| Characteristics             | Specification                                                                                                                                   | Test Method                                                                                                                                                                                                                                |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature cycle           | Appearance:no mechanical damage<br>IR:more than 1000 MΩ<br>Capacitance change:<br>Within ±7.5 % or ±0.02 pF whichever is lager.                 | Condition of one cycle<br>Step1:-55±3 °C                   30±3 min.<br>Step2:Room temp.               3 min.<br>Step3:+125±3 °C               30±3 min.<br>Step4:Room temp.               3 min.<br>Number of cycles:5<br>Recovery:24±2 h |
| Moisture Resistance         | Appearance:no mechanical damage<br>IR:more than 1000 MΩ<br>Capacitance change:<br>Within ±7.5 % or ±0.02 pF whichever is lager.<br>tanδ ≤ 0.005 | Temperature:40±2 °C<br>Relative humidity:90 to 95 %<br>Test period:500+24/0 h<br>Recovery:24±2 h                                                                                                                                           |
| Moisture Resistant Loading  | Appearance:no mechanical damage<br>IR:more than 1000 MΩ                                                                                         | Temperature:40±2 °C<br>Relative humidity:90 to 95 %<br>Applied voltage:25 VDC<br>Limit surge current:50 mA max.<br>Test period:500+24/0 h<br>Recovery:24±2 h                                                                               |
| Loading at high temperature | Appearance:no mechanical damage<br>IR:more than 10000 MΩ                                                                                        | Temperature:+125 °C ±3 °C<br>Applied voltage:50 VDC<br>(Rated voltage ×200 %)<br>Limit surge current:50 mA max.<br>Test period:1000+48/0 h<br>Recovery:24±2 h                                                                              |

■ Typical Performance Data



■ Standard Products for Type “06” (EIA “0201”),  
Taped Version

| Capacitance | Code          |           | C          |                  |
|-------------|---------------|-----------|------------|------------------|
|             | Rated voltage |           | DC 25V     |                  |
|             | Capacitance   | Tolerance | Part No.   | Dim<br>T<br>(mm) |
|             |               |           |            |                  |
| 0.1         | ±0.05 pF      |           | ECDGZER108 | 0.3              |
| 0.2         |               |           | ECDGZER208 | 0.3              |
| 0.3         |               |           | ECDGZER308 | 0.3              |
| 0.4         |               |           | ECDGZER408 | 0.3              |
| 0.5         |               |           | ECDGZER508 | 0.3              |
| 0.6         | ±0.075 pF     |           | ECDGZER609 | 0.3              |
| 0.7         |               |           | ECDGZER709 | 0.3              |
| 0.8         |               |           | ECDGZER809 | 0.3              |
| 0.9         |               |           | ECDGZER909 | 0.3              |
| 1           | ±0.1 pF       |           | 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           |               |           | ECDGZE2R0B | 0.3              |
| 2.2         |               |           | ECDGZE2R2B | 0.3              |
| 2.4         |               |           | ECDGZE2R4B | 0.3              |
| 2.7         |               |           | ECDGZE2R7B | 0.3              |
| 3           |               |           | ECDGZE3R0B | 0.3              |

Packaging Style Code : “E” for Taped Version (ø180 reel, Taping pitch : 2 mm)

■ Standard Products for Type “10” (EIA “0402”),  
Taped Version

| Capacitance | Code          |           | C          |                  |
|-------------|---------------|-----------|------------|------------------|
|             | Rated voltage |           | DC 25V     |                  |
|             | Capacitance   | Tolerance | Part No.   | Dim<br>T<br>(mm) |
|             |               |           |            |                  |
| 0.1         | ±0.05 pF      |           | ECDG0ER108 | 0.5              |
| 0.2         |               |           | ECDG0ER208 | 0.5              |
| 0.3         |               |           | ECDG0ER308 | 0.5              |
| 0.4         |               |           | ECDG0ER408 | 0.5              |
| 0.5         |               |           | ECDG0ER508 | 0.5              |
| 0.6         | ±0.075 pF     |           | ECDG0ER609 | 0.5              |
| 0.7         |               |           | ECDG0ER709 | 0.5              |
| 0.8         |               |           | ECDG0ER809 | 0.5              |
| 0.9         |               |           | ECDG0ER909 | 0.5              |
| 1           | ±0.1 pF       |           | 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           |               |           | ECDG0E2R0B | 0.5              |
| 2.2         |               |           | ECDG0E2R2B | 0.5              |
| 2.4         |               |           | ECDG0E2R4B | 0.5              |
| 2.7         |               |           | ECDG0E2R7B | 0.5              |
| 3           |               |           | ECDG0E3R0B | 0.5              |
| 3.3         | ±0.25 pF      |           | ECDG0E3R3C | 0.5              |
| 3.9         |               |           | ECDG0E3R9C | 0.5              |
| 4.7         |               |           | ECDG0E4R7C | 0.5              |
| 5.6         |               |           | ECDG0E5R6C | 0.5              |
| 6.8         |               |           | ECDG0E6R8C | 0.5              |
| 8.2         |               |           | ECDG0E8R2C | 0.5              |
| 10          |               |           | ECDG0E100C | 0.5              |
| 12          | ±5 %          |           | ECDG0E120J | 0.5              |
| 15          |               |           | ECDG0E150J | 0.5              |

Packaging Style Code : “E” for Taped Version (ø180 reel, Taping pitch : 2 mm)