

# APPROVAL SHEET

## MULTILAYER CERAMIC CAPACITORS

Microwave Series (RF)

01005 to 1111 Sizes (6.3V to 1500V)

NP0 Dielectric

Halogen Free & RoHS Compliance



\*Contents in this sheet are subject to change without prior notice.

## 1. INTRODUCTION

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

WTC RF series MLCC is used at high frequencies generally have a small temperature coefficient of capacitance, typical within the  $\pm 30\text{ppm}/^\circ\text{C}$  required for NP0 (C0G) classification and have excellent conductivity internal electrode. Thus, WTC RF series MLCC will be with the feature of low ESR and high Q characteristics.

## 2. FEATURES

- High Q and low ESR performance at high frequency.
- Ultra low capacitance to 0.1pF.
- Can offer high precision tolerance to  $\pm 0.05\text{pF}$ .
- Quality improvement of telephone calls for low power loss and better performance.

## 3. APPLICATIONS

- Telecommunication products & equipments: Mobile phone, WLAN, Base station.
- RF module: Power amplifier, VCO.
- Tuners.

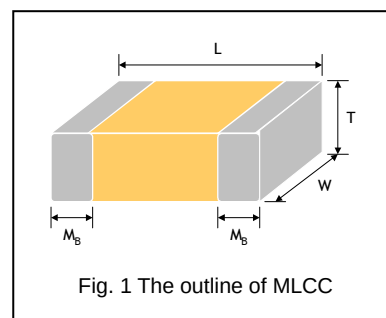
## 4. HOW TO ORDER

| <u>RF</u>                 | <u>15</u>                                                                                                                  | <u>N</u>          | <u>100</u>                                                                                                                                             | <u>J</u>                                                                                                                                           | <u>500</u>                                                                                                                                                                                                                | <u>C</u>           | <u>I</u>                     |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------|
| <u>Series</u>             | <u>Size</u>                                                                                                                | <u>Dielectric</u> | <u>Capacitance</u>                                                                                                                                     | <u>Tolerance</u>                                                                                                                                   | <u>Rated voltage</u>                                                                                                                                                                                                      | <u>Termination</u> | <u>Packaging</u>             |
| RF=Ultra High Q & Low ESR | 02=01005(0402)<br>03=0201 (0603)<br>15=0402 (1005)<br>18=0603 (1608)<br>11=0505 (1414)<br>21=0805 (2012)<br>22=1111 (2828) | N=NP0             | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br>eg.:<br>0R5=0.5pF<br>1R0=1.0pF<br>100=10x10 <sup>0</sup> =10pF | A= $\pm 0.05\text{pF}$<br>B= $\pm 0.1\text{pF}$<br>C= $\pm 0.25\text{pF}$<br>D= $\pm 0.5\text{pF}$<br>F= $\pm 1\%$<br>G= $\pm 2\%$<br>J= $\pm 5\%$ | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br>6R3=6.3 VDC<br>100=10 VDC<br>250=25 VDC<br>500=50 VDC<br>101=100 VDC<br>201=200 VDC<br>251=250 VDC<br>501=500 VDC<br>152=1500 VDC | C=Cu/Ni/Sn         | T=7" reeled<br>G= 13" reeled |

Multilayer Ceramic Capacitors

## 5. EXTERNAL DIMENSIONS

| Size<br>Inch (mm) | L (mm)              | W (mm)              | T (mm)/Symbol | Remark | M <sub>B</sub> (mm) |
|-------------------|---------------------|---------------------|---------------|--------|---------------------|
| 01005 (0402)      | 0.40±0.02           | 0.20±0.02           | 0.20±0.02     | V #    | 0.10±0.03           |
| 0201 (0603)       | 0.60±0.03           | 0.30±0.03           | 0.30±0.03     | L #    | 0.15±0.05           |
| 0402 (1005)       | 1.00±0.05           | 0.50±0.05           | 0.50±0.05     | N #    | 0.25±0.05/-0.10     |
| 0603 (1608)       | 1.60±0.10           | 0.80±0.10           | 0.80±0.07     | S      | 0.40±0.15           |
|                   | 1.60<br>+0.15/-0.10 | 0.80<br>+0.15/-0.10 | 0.50±0.10     | H      |                     |
| 0805 (2012)       | 2.00±0.15           | 1.25±0.10           | 0.60±0.10     | A      | 0.50±0.20           |
|                   | 2.00±0.20           | 1.25±0.20           | 0.85±0.10     | T      |                     |
| 0505 (1414)       | 1.40<br>+0.38/-0.25 | 1.40±0.38           | 1.15±0.15     | J #    | 0.25±0.25/-0.13     |
| 1111 (2828)       | 2.79<br>+0.51/-0.25 | 2.79±0.38           | ≤ 1.78        | G #    | 0.38±0.25           |



# Reflow soldering only is recommended.

## 6. GENERAL ELECTRICAL DATA

|                                         |                                                                                                                                               |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Dielectric                              | NP0                                                                                                                                           |
| Size                                    | 01005, 0201, 0402, 0505, 0603, 0805, 1111                                                                                                     |
| Capacitance*                            | 0.1pF to 1000pF                                                                                                                               |
| Capacitance tolerance                   | Cap≤5pF: A (±0.05pF), B (±0.1pF), C (±0.25pF)<br>5pF<Cap<10pF: B (±0.1pF), C (±0.25pF), D (±0.5pF)<br>Cap≥10pF: F (±1%), G (±2%), J (±5%)     |
| Rated voltage (WVDC)                    | 6.3V, 10V, 25V, 50V, 100V, 200V, 250V, 500V, 1500V                                                                                            |
| Q*                                      | 01005, 0201, 0402/25V~50V: Cap<30pF:Q≥400+20C; Cap≥30pF:Q≥1000<br>0402/100V~200V, 0603, 0805, 0505, 1111: Cap<30pF:Q≥800+20C; Cap≥30pF:Q≥1400 |
| Insulation resistance at U <sub>r</sub> | ≥10GΩ or R <sub>x</sub> C≥100Ω·F whichever is smaller.                                                                                        |
| Operating temperature                   | -55 to +125℃                                                                                                                                  |
| Capacitance change                      | ±30ppm/℃                                                                                                                                      |
| Termination                             | Ni/Sn (lead-free termination)                                                                                                                 |

\* Measured at the conditions of 25℃ ambient temperature and 30~70% relative humidity.

Apply 1.0±0.2V<sub>rms</sub>, 1.0MHz±10% for Cap≤1000pF and 1.0±0.2V<sub>rms</sub>, 1.0kHz±10% for Cap>1000pF.

## 7. PACKAGING DIMENSION AND QUANTITY

| Size         | Thickness (mm)/Symbol |   | Paper tape   |          |
|--------------|-----------------------|---|--------------|----------|
|              |                       |   | 7" reel      | 13" reel |
| 01005 (0402) | 0.20±0.02             | V | 20,000       | -        |
| 0201 (0603)  | 0.30±0.03             | L | 15,000       | 70,000   |
| 0402 (1005)  | 0.50±0.05             | N | 10,000       | 50,000   |
| 0603 (1608)  | 0.80±0.07             | S | 4,000        | 15,000   |
|              | 0.50±0.10             | H | 4,000        | -        |
| 0805 (2012)  | 0.60±0.10             | A | 4,000        | 15,000   |
|              | 0.85±0.10             | T | 4,000        | 15,000   |
| Size         | Thickness (mm)/Symbol |   | Plastic tape |          |
|              |                       |   | 7" reel      | 13" reel |
| 0505 (1414)  | 1.15±0.15             | J | 3,000        | -        |
| 1111 (2828)  | ≤ 1.78                | G | 2,000        | -        |

Unit: pieces

Multilayer Ceramic Capacitors

## 8. CAPACITANCE RANGE

| DIELECTRIC          |              | NP0   |    | Tolerance |
|---------------------|--------------|-------|----|-----------|
| SIZE                |              | 01005 |    |           |
| RATED VOLTAGE (VDC) |              | 16    | 25 |           |
| Capacitance         | 0.2pF (0R2)  | V     | V  | A, B      |
|                     | 0.3pF (0R3)  | V     | V  | A, B      |
|                     | 0.4pF (0R4)  | V     | V  | A, B      |
|                     | 0.5pF (0R5)  | V     | V  | A, B, C   |
|                     | 0.6pF (0R6)  | V     | V  | A, B, C   |
|                     | 0.7pF (0R7)  | V     | V  | A, B, C   |
|                     | 0.75pF (R75) | V     | V  | A, B, C   |
|                     | 0.8pF (0R8)  | V     | V  | A, B, C   |
|                     | 0.9pF (0R9)  | V     | V  | A, B, C   |
|                     | 1.0pF (1R0)  | V     | V  | A, B, C   |
|                     | 1.2pF (1R2)  | V     | V  | A, B, C   |
|                     | 1.5pF (1R5)  | V     | V  | A, B, C   |
|                     | 1.8pF (1R8)  | V     | V  | A, B, C   |
|                     | 2.0pF (2R0)  | V     | V  | A, B, C   |
|                     | 2.2pF (2R2)  | V     | V  | A, B, C   |
|                     | 2.7pF (2R7)  | V     | V  | A, B, C   |
|                     | 3.0pF (3R0)  | V     | V  | A, B, C   |
|                     | 3.3pF (3R3)  | V     | V  | A, B, C   |
|                     | 3.9pF (3R9)  | V     | V  | A, B, C   |
|                     | 4.0pF (4R0)  | V     | V  | A, B, C   |
|                     | 4.7pF (4R7)  | V     | V  | A, B, C   |
|                     | 5.0pF (5R0)  | V     | V  | A, B, C   |
|                     | 5.6pF (5R6)  | V     | V  | B, C, D   |
|                     | 6.0pF (6R0)  | V     | V  | B, C, D   |
|                     | 6.8pF (6R8)  | V     | V  | B, C, D   |
|                     | 7.0pF (7R0)  | V     | V  | B, C, D   |
|                     | 8.0pF (8R0)  | V     | V  | B, C, D   |
|                     | 8.2pF (8R2)  | V     | V  | B, C, D   |
|                     | 9.0pF (9R0)  | V     | V  | B, C, D   |
|                     | 10pF (100)   | V     | V  | C, D, G   |
|                     | 12pF (120)   | V     | V  | J         |
|                     | 15pF (150)   | V     | V  | J         |
|                     | 20pF (200)   | V     | V  | J         |
|                     | 22pF (220)   | V     | V  | J         |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

| DIELECTRIC          |              | NP0  |    |    |    |     |      |    |     |         |           |
|---------------------|--------------|------|----|----|----|-----|------|----|-----|---------|-----------|
| SIZE                |              | 0201 |    |    |    |     | 0402 |    |     |         | Tolerance |
| RATED VOLTAGE (VDC) |              | 6.3  | 10 | 25 | 50 | 100 | 25   | 50 | 100 | 200     |           |
| Capacitance         | 0.1pF (0R1)  | L    | L  | L  | L  | L   | N    | N  | N*  | N*      | A, B      |
|                     | 0.2pF (0R2)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B      |
|                     | 0.3pF (0R3)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B      |
|                     | 0.4pF (0R4)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B      |
|                     | 0.5pF (0R5)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 0.6pF (0R6)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 0.7pF (0R7)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 0.75pF (R75) | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 0.8pF (0R8)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 0.9pF (0R9)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.0pF (1R0)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.1pF (1R1)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.2pF (1R2)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.3pF (1R3)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.4pF (1R4)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.5pF (1R5)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.6pF (1R6)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.7pF (1R7)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.8pF (1R8)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 1.9pF (1R9)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.0pF (2R0)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.1pF (2R1)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.2pF (2R2)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.3pF (2R3)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.4pF (2R4)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.5pF (2R5)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.6pF (2R6)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.7pF (2R7)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.8pF (2R8)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 2.9pF (2R9)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.0pF (3R0)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.1pF (3R1)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.2pF (3R2)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.3pF (3R3)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.4pF (3R4)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.5pF (3R5)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.6pF (3R6)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.7pF (3R7)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.8pF (3R8)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 3.9pF (3R9)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.0pF (4R0)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.1pF (4R1)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.2pF (4R2)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.3pF (4R3)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.4pF (4R4)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.5pF (4R5)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.6pF (4R6)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.7pF (4R7)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.8pF (4R8)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 4.9pF (4R9)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 5.0pF (5R0)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | A, B, C   |
|                     | 5.1pF (5R1)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 5.2pF (5R2)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 5.3pF (5R3)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 5.4pF (5R4)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 5.5pF (5R5)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 5.6pF (5R6)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 5.7pF (5R7)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 5.8pF (5R8)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 5.9pF (5R9)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
| 6.0pF (6R0)         | L            | L    | L  | L  | L  | N   | N    | N  | N   | B, C, D |           |

\*. The letter in cell with “\*” mark is expressed the capacitance tolerance “B tolerance( $\pm 0.1pF$ )” only.

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

| DIELECTRIC          |             | NP0  |    |    |    |     |      |    |     |         |           |
|---------------------|-------------|------|----|----|----|-----|------|----|-----|---------|-----------|
| SIZE                |             | 0201 |    |    |    |     | 0402 |    |     |         | Tolerance |
| RATED VOLTAGE (VDC) |             | 6.3  | 10 | 25 | 50 | 100 | 25   | 50 | 100 | 200     |           |
| Capacitance         | 6.1pF (6R1) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 6.2pF (6R2) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 6.3pF (6R3) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 6.4pF (6R4) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 6.5pF (6R5) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 6.6pF (6R6) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 6.7pF (6R7) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 6.8pF (6R8) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 6.9pF (6R9) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.0pF (7R0) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.1pF (7R1) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.2pF (7R2) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.3pF (7R3) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.4pF (7R4) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.5pF (7R5) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.6pF (7R6) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.7pF (7R7) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.8pF (7R8) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 7.9pF (7R9) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.0pF (8R0) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.1pF (8R1) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.2pF (8R2) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.3pF (8R3) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.4pF (8R4) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.5pF (8R5) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.6pF (8R6) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.7pF (8R7) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.8pF (8R8) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 8.9pF (8R9) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.0pF (9R0) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.1pF (9R1) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.2pF (9R2) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.3pF (9R3) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.4pF (9R4) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.5pF (9R5) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.6pF (9R6) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.7pF (9R7) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.8pF (9R8) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 9.9pF (9R9) | L    | L  | L  | L  | L   | N    | N  | N   | N       | B, C, D   |
|                     | 10pF (100)  | L    | L  | L  | L  | L   | N    | N  | N   | N       | F, G, J   |
| 11pF (110)          | L           | L    | L  | L  |    | N   | N    | N  | N   | F, G, J |           |
| 12pF (120)          | L           | L    | L  | L  |    | N   | N    | N  | N   | F, G, J |           |
| 13pF (130)          | L           | L    | L  | L  |    | N   | N    | N  | N   | F, G, J |           |
| 15pF (150)          | L           | L    | L  | L  |    | N   | N    | N  | N   | F, G, J |           |
| 16pF (160)          | L           | L    | L  | L  |    | N   | N    | N  | N   | F, G, J |           |
| 18pF (180)          | L           | L    | L  | L  |    | N   | N    | N  | N   | F, G, J |           |
| 20pF (200)          | L           | L    | L  | L  |    | N   | N    | N  | N   | F, G, J |           |
| 22pF (220)          | L           | L    | L  |    |    | N   | N    | N  | N   | F, G, J |           |
| 24pF (240)          | L           | L    | L  |    |    | N   | N    | N  | N   | F, G, J |           |
| 27pF (270)          | L           | L    | L  |    |    | N   | N    | N  | N   | F, G, J |           |
| 30pF (300)          | L           | L    | L  |    |    | N   | N    | N  | N   | F, G, J |           |
| 33pF (330)          | L           | L    | L  |    |    | N   | N    | N  | N   | F, G, J |           |
| 36pF (360)          |             |      |    |    |    | N   | N    | N  |     | F, G, J |           |
| 39pF (390)          |             |      |    |    |    | N   | N    | N  |     | F, G, J |           |
| 43pF (430)          |             |      |    |    |    | N   | N    | N  |     | F, G, J |           |
| 47pF (470)          |             |      |    |    |    | N   | N    | N  |     | F, G, J |           |
| 56pF (560)          |             |      |    |    |    | N   | N    | N  |     | F, G, J |           |
| 68pF (680)          |             |      |    |    |    | N   | N    |    |     | F, G, J |           |
| 82pF (820)          |             |      |    |    |    | N   | N    |    |     | F, G, J |           |
| 100pF (101)         |             |      |    |    |    | N   | N    |    |     | F, G, J |           |

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

| DIELECTRIC          |             | NP0 |     |      |     |     |      |     |     |     |   | Tolerance |
|---------------------|-------------|-----|-----|------|-----|-----|------|-----|-----|-----|---|-----------|
| SIZE                | 0505        |     |     | 0603 |     |     | 0805 |     |     |     |   |           |
| RATED VOLTAGE (VDC) | 50          | 100 | 250 | 50   | 100 | 250 | 50   | 100 | 250 | 500 |   |           |
| Capacitance         | 0.1pF (0R1) |     |     |      | H   | H   | H    |     |     |     |   | A, B      |
|                     | 0.2pF (0R2) |     |     |      | H   | H   | H    | A   | A   | A   | A | A, B      |
|                     | 0.3pF (0R3) |     |     |      | S   | S   | S    | T   | T   | T   | T | A, B      |
|                     | 0.4pF (0R4) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B      |
|                     | 0.5pF (0R5) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 0.6pF (0R6) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 0.7pF (0R7) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 0.8pF (0R8) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 0.9pF (0R9) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.0pF (1R0) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.1pF (1R1) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.2pF (1R2) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.3pF (1R3) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.4pF (1R4) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.5pF (1R5) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.6pF (1R6) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.7pF (1R7) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.8pF (1R8) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 1.9pF (1R9) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.0pF (2R0) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.1pF (2R1) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.2pF (2R2) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.3pF (2R3) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.4pF (2R4) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.5pF (2R5) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.6pF (2R6) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.7pF (2R7) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.8pF (2R8) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 2.9pF (2R9) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.0pF (3R0) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.1pF (3R1) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.2pF (3R2) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.3pF (3R3) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.4pF (3R4) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.5pF (3R5) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.6pF (3R6) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.7pF (3R7) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.8pF (3R8) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 3.9pF (3R9) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.0pF (4R0) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.1pF (4R1) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.2pF (4R2) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.3pF (4R3) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.4pF (4R4) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.5pF (4R5) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.6pF (4R6) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.7pF (4R7) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.8pF (4R8) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 4.9pF (4R9) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 5.0pF (5R0) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | A, B, C   |
|                     | 5.1pF (5R1) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 5.2pF (5R2) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 5.3pF (5R3) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 5.4pF (5R4) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 5.5pF (5R5) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 5.6pF (5R6) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 5.7pF (5R7) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 5.8pF (5R8) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 5.9pF (5R9) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |
|                     | 6.0pF (6R0) | J   | J   | J    | S   | S   | S    | T   | T   | T   | T | B, C, D   |

1. The letter in cell is expressed the symbol of product thickness.
2. For more information about products with special capacitance or other data, please contact WTC local representative.

| DIELECTRIC          |             | NP0  |     |     |      |     |     |      |     |     |         |           |
|---------------------|-------------|------|-----|-----|------|-----|-----|------|-----|-----|---------|-----------|
| SIZE                |             | 0505 |     |     | 0603 |     |     | 0805 |     |     |         | Tolerance |
| RATED VOLTAGE (VDC) |             | 50   | 100 | 250 | 50   | 100 | 250 | 50   | 100 | 250 | 500     |           |
| Capacitance         | 6.1pF (6R1) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 6.2pF (6R2) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 6.3pF (6R3) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 6.4pF (6R4) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 6.5pF (6R5) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 6.6pF (6R6) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 6.7pF (6R7) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 6.8pF (6R8) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 6.9pF (6R9) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.0pF (7R0) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.1pF (7R1) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.2pF (7R2) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.3pF (7R3) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.4pF (7R4) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.5pF (7R5) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.6pF (7R6) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.7pF (7R7) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.8pF (7R8) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 7.9pF (7R9) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.0pF (8R0) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.1pF (8R1) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.2pF (8R2) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.3pF (8R3) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.4pF (8R4) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.5pF (8R5) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.6pF (8R6) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.7pF (8R7) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.8pF (8R8) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 8.9pF (8R9) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.0pF (9R0) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.1pF (9R1) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.2pF (9R2) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.3pF (9R3) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.4pF (9R4) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.5pF (9R5) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.6pF (9R6) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.7pF (9R7) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.8pF (9R8) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 9.9pF (9R9) | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | B, C, D   |
|                     | 10pF (100)  | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | F, G, J   |
|                     | 11pF (110)  | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | F, G, J   |
|                     | 12pF (120)  | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | F, G, J   |
|                     | 13pF (130)  | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | F, G, J   |
|                     | 15pF (150)  | J    | J   | J   | S    | S   | S   | T    | T   | T   | T       | F, G, J   |
| 16pF (160)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 18pF (180)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 20pF (200)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 22pF (220)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 24pF (240)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 27pF (270)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 30pF (300)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 33pF (330)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 36pF (360)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 39pF (390)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 43pF (430)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 47pF (470)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 56pF (560)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 68pF (680)          | J           | J    | J   | S   | S    | S   | T   | T    | T   | T   | F, G, J |           |
| 82pF (820)          | J           | J    | J   | S   | S    | S   | T   | T    | T   |     | F, G, J |           |
| 100pF (101)         | J           | J    | J   | S   | S    | S   | T   | T    | T   |     | F, G, J |           |
| 120pF (121)         |             |      |     | S   |      |     | T   | T    | T   |     | F, G, J |           |
| 150pF (151)         |             |      |     | S   |      |     | T   | T    | T   |     | F, G, J |           |
| 180pF (181)         |             |      |     | S   |      |     | T   | T    | T   |     | F, G, J |           |
| 220pF (221)         |             |      |     | S   |      |     | T   | T    | T   |     | F, G, J |           |

1. The letter in cell is expressed the symbol of product thickness.

2. For more information about products with special capacitance or other data, please contact WTC local representative.

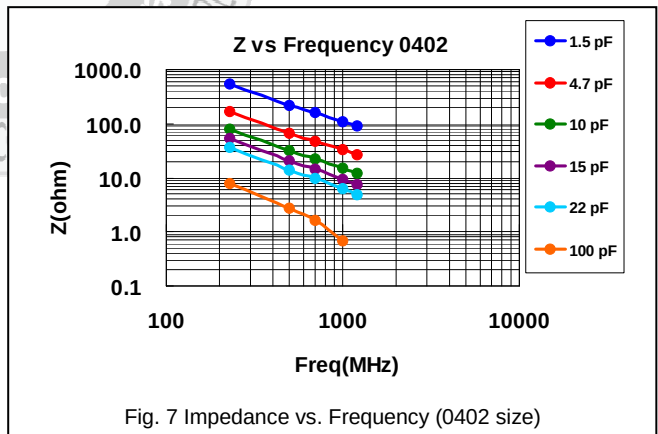
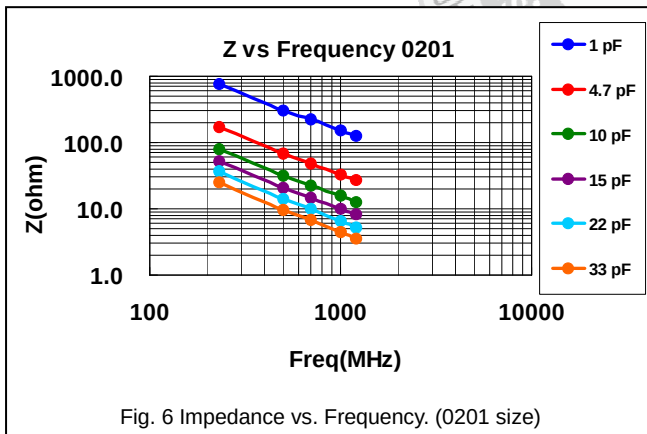
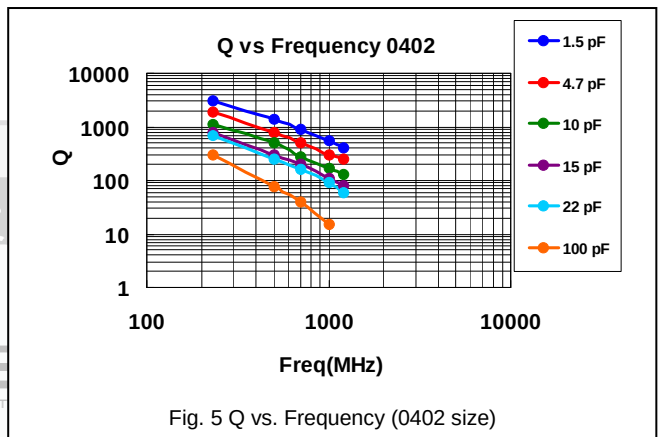
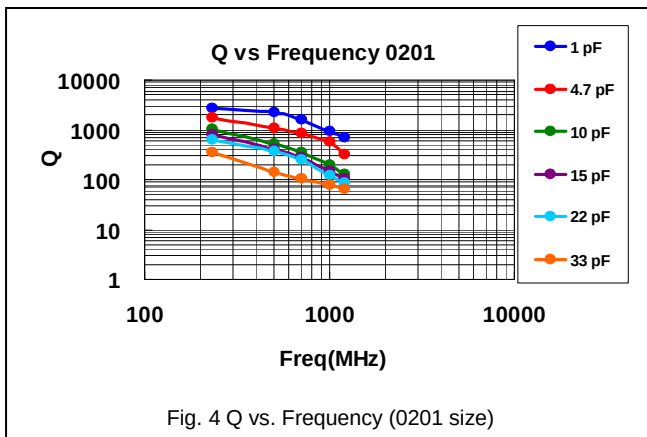
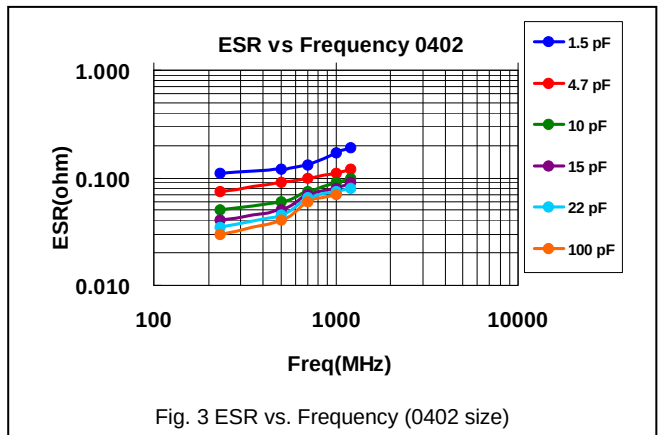
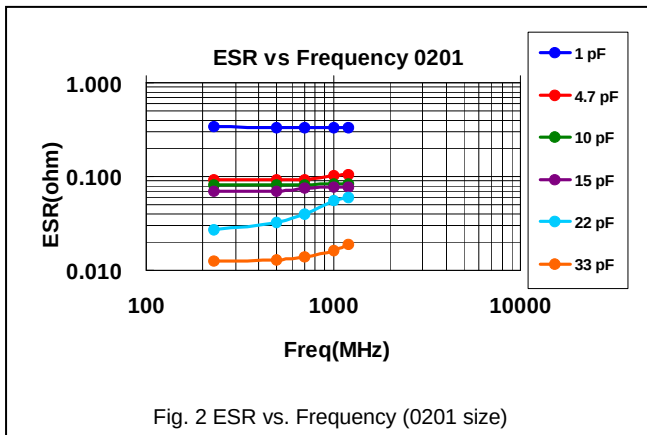
| DIELECTRIC          |             | NP0  |     |     |     |     |         | Tolerance |
|---------------------|-------------|------|-----|-----|-----|-----|---------|-----------|
| SIZE                |             | 1111 |     |     |     |     |         |           |
| RATED VOLTAGE (VDC) |             | 50   | 100 | 200 | 250 | 500 | 1500    |           |
| Capacitance         | 1.0pF (1R0) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 1.1pF (1R1) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 1.2pF (1R2) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 1.3pF (1R3) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 1.5pF (1R5) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 1.6pF (1R6) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 1.8pF (1R8) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 2.0pF (2R0) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 2.2pF (2R2) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 2.4pF (2R4) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 2.7pF (2R7) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 3.0pF (3R0) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 3.3pF (3R3) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 3.6pF (3R6) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 3.9pF (3R9) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 4.0pF (4R0) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 4.3pF (4R3) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 5.0pF (5R0) | G    | G   | G   | G   | G   | G       | A, B, C   |
|                     | 5.1pF (5R1) | G    | G   | G   | G   | G   | G       | B, C, D   |
|                     | 5.6pF (5R6) | G    | G   | G   | G   | G   | G       | B, C, D   |
|                     | 6.0pF (6R0) | G    | G   | G   | G   | G   | G       | B, C, D   |
|                     | 6.8pF (6R8) | G    | G   | G   | G   | G   | G       | B, C, D   |
|                     | 7.0pF (7R0) | G    | G   | G   | G   | G   | G       | B, C, D   |
|                     | 8.0pF (8R0) | G    | G   | G   | G   | G   | G       | B, C, D   |
|                     | 8.2pF (8R2) | G    | G   | G   | G   | G   | G       | B, C, D   |
|                     | 10pF (100)  | G    | G   | G   | G   | G   | G       | F, G, J   |
|                     | 12pF (120)  | G    | G   | G   | G   | G   | G       | F, G, J   |
|                     | 15pF (150)  | G    | G   | G   | G   | G   | G       | F, G, J   |
|                     | 18pF (180)  | G    | G   | G   | G   | G   | G       | F, G, J   |
|                     | 22pF (220)  | G    | G   | G   | G   | G   | G       | F, G, J   |
|                     | 27pF (270)  | G    | G   | G   | G   | G   | G       | F, G, J   |
|                     | 33pF (330)  | G    | G   | G   | G   | G   | G       | F, G, J   |
|                     | 39pF (390)  | G    | G   | G   | G   | G   |         | F, G, J   |
|                     | 47pF (470)  | G    | G   | G   | G   | G   |         | F, G, J   |
|                     | 56pF (560)  | G    | G   | G   | G   | G   |         | F, G, J   |
|                     | 68pF (680)  | G    | G   | G   | G   | G   |         | F, G, J   |
|                     | 82pF (820)  | G    | G   | G   | G   | G   |         | F, G, J   |
|                     | 100pF (101) | G    | G   | G   | G   | G   |         | F, G, J   |
|                     | 120pF (121) | G    | G   | G   | G   | G   |         | F, G, J   |
|                     | 150pF (151) | G    | G   | G   | G   | G   |         | F, G, J   |
| 180pF (181)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 220pF (221)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 270pF (271)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 330pF (331)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 390pF (391)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 470pF (471)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 560pF (561)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 680pF (681)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 820pF (821)         | G           | G    | G   | G   | G   |     | F, G, J |           |
| 1000pF (102)        | G           | G    | G   | G   | G   |     | F, G, J |           |

1. The letter in cell is expressed the symbol of product thickness.

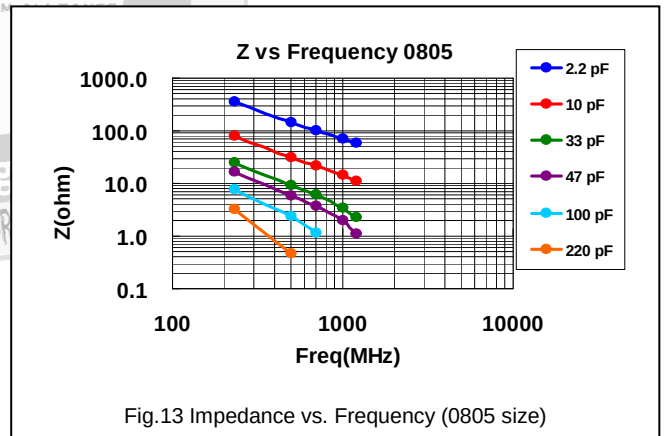
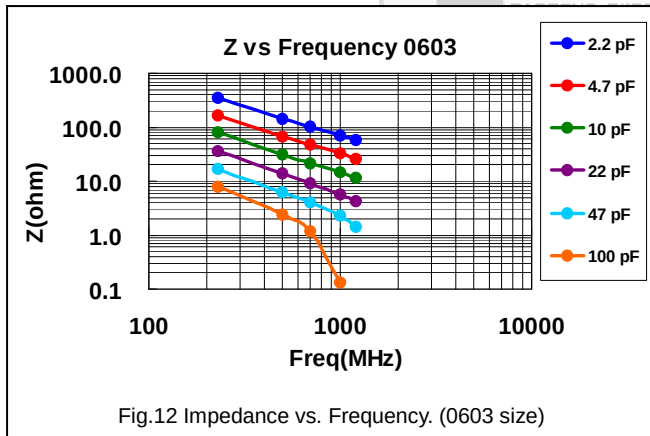
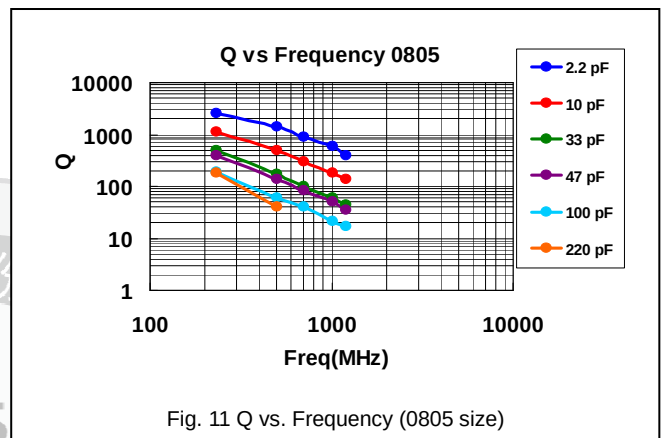
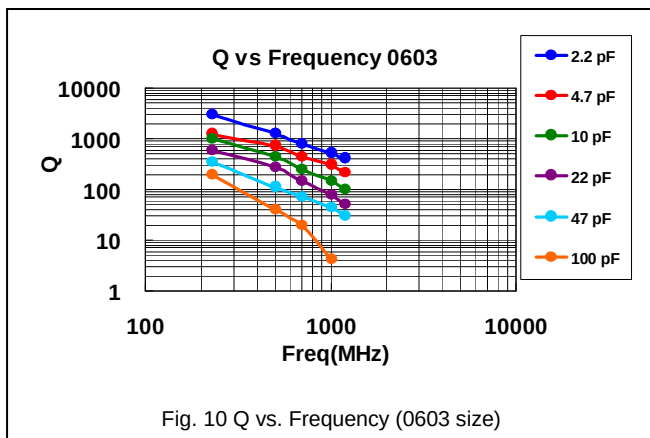
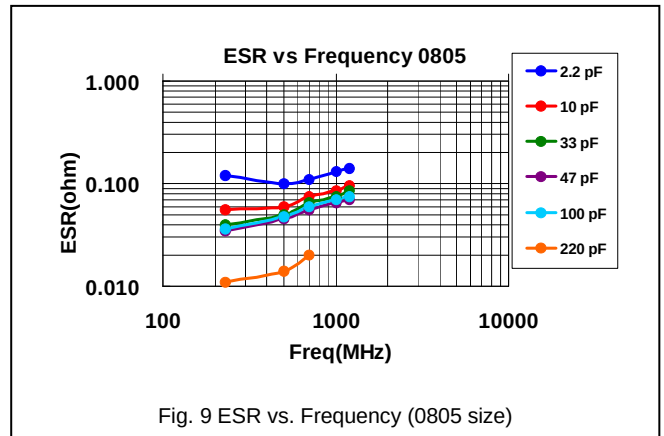
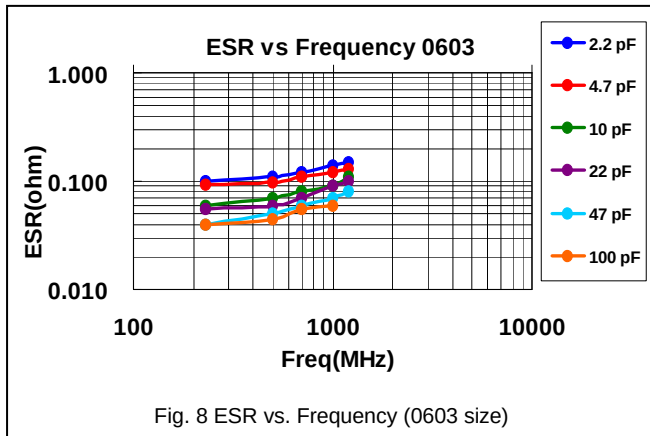
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Multilayer Ceramic Capacitors

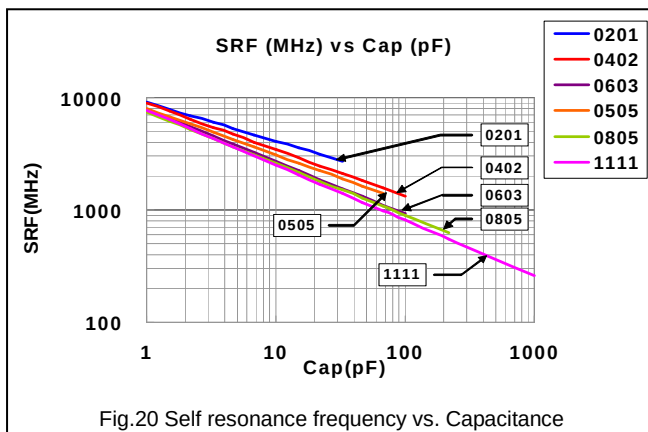
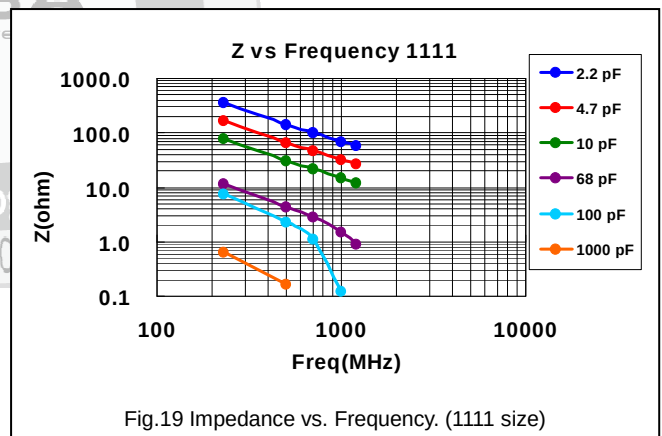
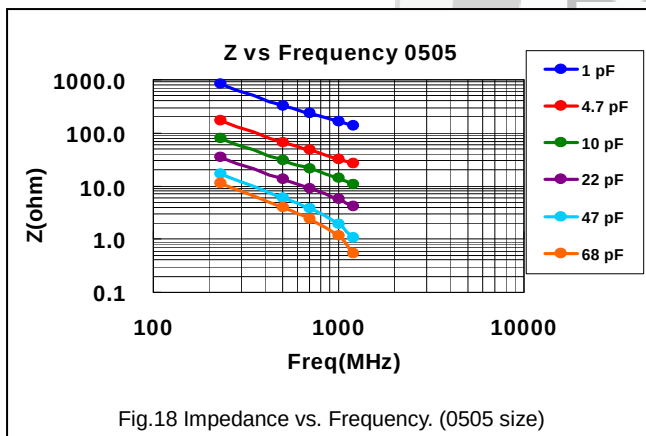
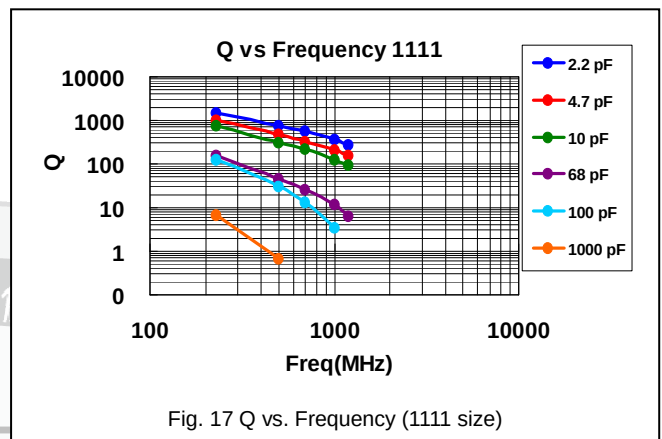
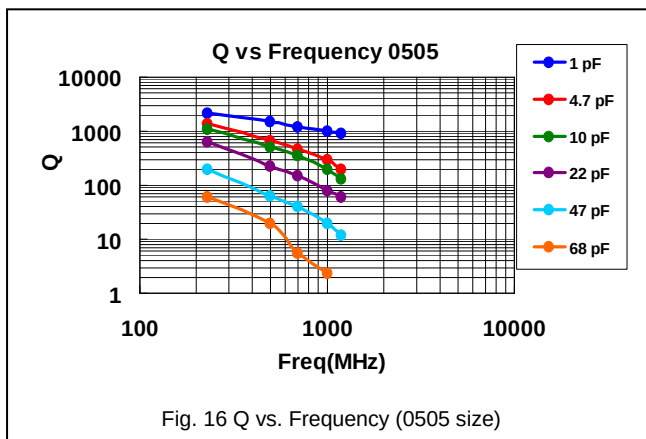
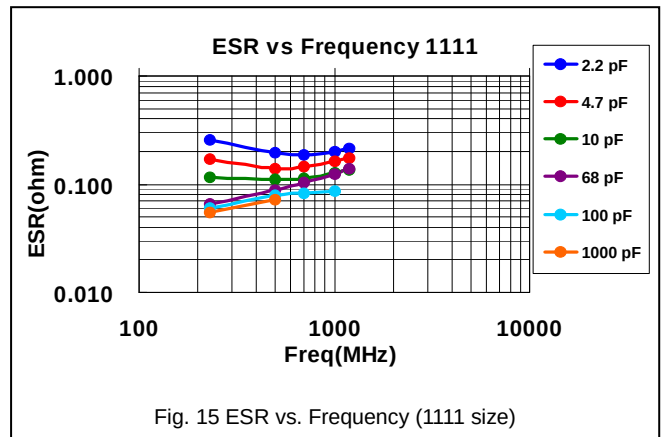
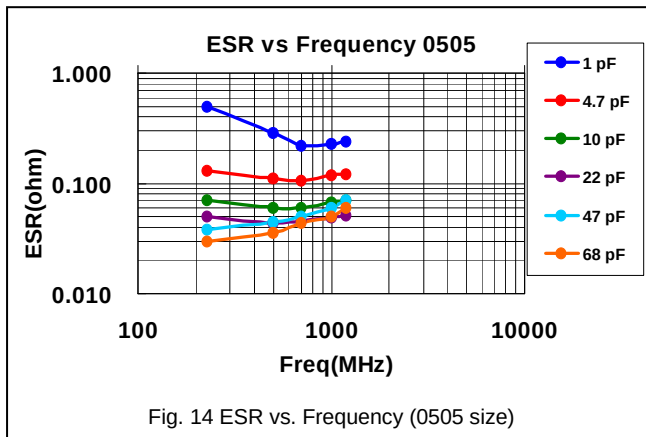
## 9. ELECTRICAL CHARACTERISTICS



Multilayer Ceramic Capacitors



Multilayer Ceramic Capacitors



Multilayer Ceramic Capacitors

## 10. RELIABILITY TEST CONDITIONS AND REQUIREMENTS

| No. | Item                             | Test Conditions                                                                                                                                                                                                                                                                                                                                                                                                                             | Requirements                                                                                                                                                                                                                                                                                   |
|-----|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | Visual and Mechanical            |                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>* No remarkable defect.</li> <li>* Dimensions to conform to individual specification sheet.</li> </ul>                                                                                                                                                  |
| 2.  | Capacitance                      | 1.0±0.2Vrms, 1MHz±10%                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>* Shall not exceed the limits given in the detailed spec.</li> </ul>                                                                                                                                                                                    |
| 3.  | Q/ D.F.<br>(Dissipation Factor)  | At 25°C ambient temperature.                                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>* 01005, 0201, 0402/25V~50V:<br/>Cap&lt;30pF, Q≥400+20C; Cap≥30pF, Q≥1000</li> <li>* 0402/100V~200V, 0603, 0805, 0505, 1111:<br/>Cap&lt;30pF: Q≥800+20C; Cap≥30pF: Q≥1400</li> </ul>                                                                    |
| 4.  | Dielectric Strength              | <ul style="list-style-type: none"> <li>* To apply voltage:<br/> <ul style="list-style-type: none"> <li>≤100V : 250% of rated voltage.</li> <li>200V ~ 300V : 200% of rated voltage.</li> <li>500V ~ 999V : 150% of rated voltage.</li> <li>1000V ~ 3000V : 120% of rated voltage.</li> <li>4000V : 110% of rated voltage.</li> </ul> </li> <li>* Duration: 1 to 5 sec.</li> <li>* Charge &amp; discharge current less than 50mA.</li> </ul> | <ul style="list-style-type: none"> <li>* No evidence of damage or flash over during test.</li> </ul>                                                                                                                                                                                           |
| 5.  | Insulation Resistance            | <ul style="list-style-type: none"> <li>≤100V : To apply rated voltage for max. 120 sec.</li> <li>≥200V : To apply rated voltage (500V max.) for 60 sec.</li> </ul>                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>* ≥10GΩ or Rx C≥100Ω·F whichever is smaller</li> </ul>                                                                                                                                                                                                  |
| 6.  | Temperature Coefficient          | <ul style="list-style-type: none"> <li>* With no electrical load.</li> <li>* Operating temperature: -55~125°C at 25°C</li> </ul>                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>* Capacitance change: within ±30ppm/°C;</li> </ul>                                                                                                                                                                                                      |
| 7.  | Adhesive Strength of Termination | <ul style="list-style-type: none"> <li>* Pressurizing force :<br/> <ul style="list-style-type: none"> <li>01005: 1N</li> <li>0201: 2N</li> <li>0402 to 0603: 5N</li> <li>&gt;0603: 10N</li> </ul> </li> <li>* Test time: 10±1 sec.</li> </ul>                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>* No remarkable damage or removal of the terminations.</li> </ul>                                                                                                                                                                                       |
| 8.  | Vibration Resistance             | <ul style="list-style-type: none"> <li>* Vibration frequency: 10~55 Hz/min.</li> <li>* Total amplitude: 1.5mm</li> <li>* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)</li> <li>* Cap./DF(Q) Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</li> </ul>                                                                                                           | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap change and Q/D.F.: To meet initial spec.</li> </ul>                                                                                                                                                              |
| 9.  | Solderability                    | <ul style="list-style-type: none"> <li>* Solder temperature: 235±5°C</li> <li>* Dipping time: 2±0.5 sec.</li> </ul>                                                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>* 95% min. coverage of all metalized area.</li> </ul>                                                                                                                                                                                                   |
| 10. | Bending Test                     | <ul style="list-style-type: none"> <li>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec.</li> <li>* Measurement to be made after keeping at room temp. for 24±2 hrs.</li> </ul>                                                                                              | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap change: within ±5.0% or ±0.5pF whichever is larger.<br/>(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</li> </ul> |
| 11. | Resistance to Soldering Heat     | <ul style="list-style-type: none"> <li>* Solder temperature: 260±5°C</li> <li>* Dipping time: 10±1 sec</li> <li>* Preheating: 120 to 150°C for 1 minute before immerse the capacitor in a eutectic solder.</li> <li>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</li> </ul>                                                                                             | <ul style="list-style-type: none"> <li>* No remarkable damage.</li> <li>* Cap change: within ±2.5% or ±0.25pF whichever is larger.</li> <li>* Q/D.F., I.R. and dielectric strength: To meet initial requirements.</li> <li>* 25% max. leaching on each edge.</li> </ul>                        |

| No.                      | Item                              | Test Condition                                                                                                                                                                                                                                                                                                         | Requirements                                                                                                                                                                                                                                                                                                                                                                                                       |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|--------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------------|--------------------------|----------------------------|-----------------------|-------------------------|-----------------------|-------------------------|----------------------|----------------------------|-----------------------|---|------------|
| 12.                      | Temperature Cycle                 | * Conduct the five cycles according to the temperatures and time.                                                                                                                                                                                                                                                      | * No remarkable damage.                                                                                                                                                                                                                                                                                                                                                                                            |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | <table><tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30±3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30±3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table> | Step                                                                                                                                                                                                                                                                                                                                                                                                               | Temp. (°C) | Time (min.)              | 1                        | Min. operating temp. +0/-3 | 30±3                  | 2                       | Room temp.            | 2~3                     | 3                    | Max. operating temp. +3/-0 | 30±3                  | 4 | Room temp. |
| Step                     | Temp. (°C)                        | Time (min.)                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 1                        | Min. operating temp. +0/-3        | 30±3                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 2                        | Room temp.                        | 2~3                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 3                        | Max. operating temp. +3/-0        | 30±3                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 4                        | Room temp.                        | 2~3                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Q/D.F., I.R. and dielectric strength: To meet initial requirements.                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 13.                      | Humidity (Damp Heat) Steady State | * Test temp.: 40±2°C                                                                                                                                                                                                                                                                                                   | * No remarkable damage.                                                                                                                                                                                                                                                                                                                                                                                            |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Humidity: 90~95% RH                                                                                                                                                                                                                                                                                                  | * Cap change: within ±5.0% or ±0.5pF whichever is larger.                                                                                                                                                                                                                                                                                                                                                          |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Test time: 500+24/-0hrs.                                                                                                                                                                                                                                                                                             | * Q/D.F. value: Cap≥30pF, Q≥350;                                                                                                                                                                                                                                                                                                                                                                                   |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.                                                                                                                                                                                                       | 10pF≤Cap<30pF, Q≥275+2.5C                                                                                                                                                                                                                                                                                                                                                                                          |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   |                                                                                                                                                                                                                                                                                                                        | Cap<10pF; Q≥200+10C                                                                                                                                                                                                                                                                                                                                                                                                |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   |                                                                                                                                                                                                                                                                                                                        | * I.R.: ≥1GΩ.                                                                                                                                                                                                                                                                                                                                                                                                      |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 14.                      | Humidity (Damp Heat) Load         | * Test temp.: 40±2°C                                                                                                                                                                                                                                                                                                   | * No remarkable damage.                                                                                                                                                                                                                                                                                                                                                                                            |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Humidity: 90~95%RH                                                                                                                                                                                                                                                                                                   | * Cap change: within ±7.5% or ±0.75pF whichever is larger.                                                                                                                                                                                                                                                                                                                                                         |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Test time: 500+24/-0 hrs.                                                                                                                                                                                                                                                                                            | * Q/D.F. value: Cap≥30pF, Q≥200;                                                                                                                                                                                                                                                                                                                                                                                   |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * To apply voltage : rated voltage (MAX. 500V)                                                                                                                                                                                                                                                                         | Cap<30pF, Q≥100+10/3C                                                                                                                                                                                                                                                                                                                                                                                              |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.                                                                                                                                                                                                       | * I.R.: ≥500MΩ.                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 15.                      | High Temperature Load (Endurance) | * Test temp.: 125±3°C                                                                                                                                                                                                                                                                                                  | * No remarkable damage.                                                                                                                                                                                                                                                                                                                                                                                            |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * To apply voltage:<br>(1) 10V ≤ Ur<500V: 200% of rated voltage.<br>(2) ≤ 6.3V or 500V: 150% of rated voltage.<br>(3) Ur ≥ 630V: 120% of rated voltage.                                                                                                                                                                | * Cap change: within ±3.0% or ±0.3pF whichever is larger.                                                                                                                                                                                                                                                                                                                                                          |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Test time: 1000+24/-0 hrs.                                                                                                                                                                                                                                                                                           | * Q/D.F. value: Cap≥30pF, Q≥350                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24±2 hrs at room temp                                                                                                                                                                                                        | 10pF≤Cap<30pF, Q≥275+2.5C                                                                                                                                                                                                                                                                                                                                                                                          |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   |                                                                                                                                                                                                                                                                                                                        | Cap<10pF, Q≥200+10C                                                                                                                                                                                                                                                                                                                                                                                                |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   |                                                                                                                                                                                                                                                                                                                        | * I.R.: ≥1GΩ.                                                                                                                                                                                                                                                                                                                                                                                                      |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 16.                      | ESR                               | The ESR should be measured at room temperature and tested at frequency 1±0.1 GHz.                                                                                                                                                                                                                                      | <table><tr><th>01005</th><th>0505</th></tr><tr><td>0.2pF≤Cap≤1pF:&lt; 700mΩ/pF</td><td>0.4pF≤Cap&lt;1.0pF: &lt; 1500mΩ</td></tr><tr><td>1pF&lt;Cap≤2pF:&lt; 600mΩ</td><td>1.0pF≤Cap&lt;10pF: &lt; 250mΩ</td></tr><tr><td>2pF&lt;Cap≤5pF:&lt; 500mΩ</td><td>10pF≤Cap≤100pF: &lt; 200mΩ</td></tr><tr><td>5pF&lt;Cap≤10pF:&lt; 300mΩ</td><td></td></tr><tr><td>10pF&lt;Cap≤22pF:&lt; 350mΩ</td><td></td></tr></table> | 01005      | 0505                     | 0.2pF≤Cap≤1pF:< 700mΩ/pF | 0.4pF≤Cap<1.0pF: < 1500mΩ  | 1pF<Cap≤2pF:< 600mΩ   | 1.0pF≤Cap<10pF: < 250mΩ | 2pF<Cap≤5pF:< 500mΩ   | 10pF≤Cap≤100pF: < 200mΩ | 5pF<Cap≤10pF:< 300mΩ |                            | 10pF<Cap≤22pF:< 350mΩ |   |            |
|                          |                                   |                                                                                                                                                                                                                                                                                                                        | 01005                                                                                                                                                                                                                                                                                                                                                                                                              | 0505       |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 0.2pF≤Cap≤1pF:< 700mΩ/pF | 0.4pF≤Cap<1.0pF: < 1500mΩ         |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 1pF<Cap≤2pF:< 600mΩ      | 1.0pF≤Cap<10pF: < 250mΩ           |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 2pF<Cap≤5pF:< 500mΩ      | 10pF≤Cap≤100pF: < 200mΩ           |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 5pF<Cap≤10pF:< 300mΩ     |                                   |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 10pF<Cap≤22pF:< 350mΩ    |                                   |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | <table><tr><th>0201</th><th>0402</th></tr><tr><td>0.1pF≤Cap≤1pF:&lt; 350mΩ/pF</td><td>0.1pF≤Cap≤1pF:&lt; 350mΩ/pF</td></tr><tr><td>1pF&lt;Cap≤5pF:&lt; 300mΩ</td><td>1pF&lt;Cap≤5pF:&lt; 300mΩ</td></tr><tr><td>5pF&lt;Cap≤22pF:&lt; 250mΩ</td><td>5pF&lt;Cap≤100pF:&lt; 250mΩ</td></tr></table>                       | 0201                                                                                                                                                                                                                                                                                                                                                                                                               | 0402       | 0.1pF≤Cap≤1pF:< 350mΩ/pF | 0.1pF≤Cap≤1pF:< 350mΩ/pF | 1pF<Cap≤5pF:< 300mΩ        | 1pF<Cap≤5pF:< 300mΩ   | 5pF<Cap≤22pF:< 250mΩ    | 5pF<Cap≤100pF:< 250mΩ |                         |                      |                            |                       |   |            |
| 0201                     | 0402                              |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 0.1pF≤Cap≤1pF:< 350mΩ/pF | 0.1pF≤Cap≤1pF:< 350mΩ/pF          |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 1pF<Cap≤5pF:< 300mΩ      | 1pF<Cap≤5pF:< 300mΩ               |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 5pF<Cap≤22pF:< 250mΩ     | 5pF<Cap≤100pF:< 250mΩ             |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | <table><tr><th>0603</th><th>0805</th></tr><tr><td>0.3pF≤Cap≤1pF:&lt; 1500mΩ</td><td>0.3pF≤Cap≤1pF: &lt; 1500mΩ</td></tr><tr><td>1pF&lt;Cap≤10pF:&lt; 250mΩ</td><td>1pF&lt;Cap≤10pF: &lt; 250mΩ</td></tr><tr><td>10pF&lt;Cap≤220pF:&lt; 200mΩ</td><td>Cap&gt;10pF: &lt; 200mΩ</td></tr></table>                         | 0603                                                                                                                                                                                                                                                                                                                                                                                                               | 0805       | 0.3pF≤Cap≤1pF:< 1500mΩ   | 0.3pF≤Cap≤1pF: < 1500mΩ  | 1pF<Cap≤10pF:< 250mΩ       | 1pF<Cap≤10pF: < 250mΩ | 10pF<Cap≤220pF:< 200mΩ  | Cap>10pF: < 200mΩ     |                         |                      |                            |                       |   |            |
| 0603                     | 0805                              |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 0.3pF≤Cap≤1pF:< 1500mΩ   | 0.3pF≤Cap≤1pF: < 1500mΩ           |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 1pF<Cap≤10pF:< 250mΩ     | 1pF<Cap≤10pF: < 250mΩ             |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
| 10pF<Cap≤220pF:< 200mΩ   | Cap>10pF: < 200mΩ                 |                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | The ESR should be measured at room temperature and tested at frequency 500±50 MHz.                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |
|                          |                                   | 0201, 22pF≤Cap≤33pF: < 300mΩ                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                          |                          |                            |                       |                         |                       |                         |                      |                            |                       |   |            |

Multilayer Ceramic Capacitors

## APPENDIXES

### ■ Tape & reel dimensions

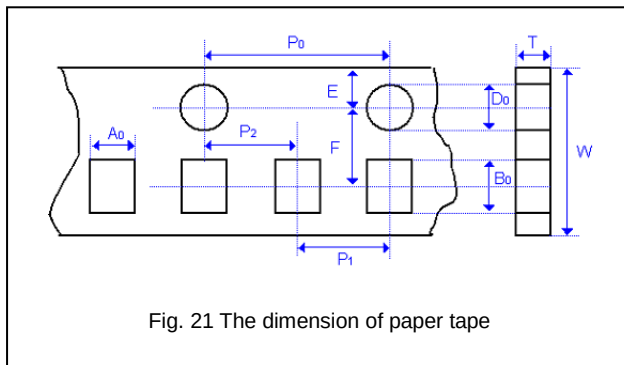


Fig. 21 The dimension of paper tape

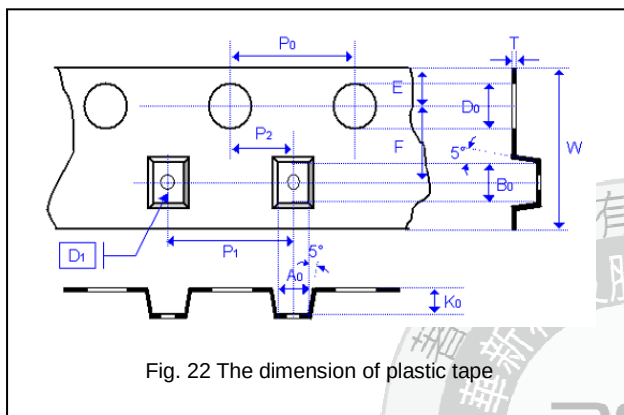


Fig. 22 The dimension of plastic tape

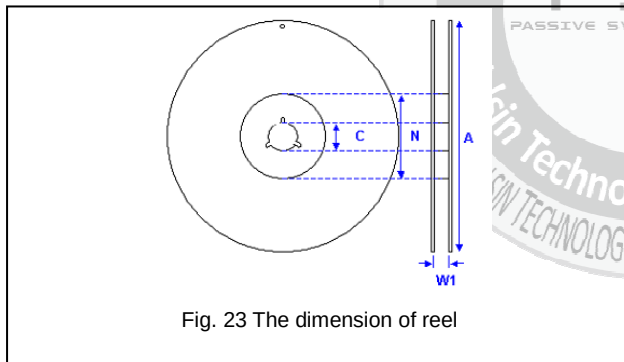
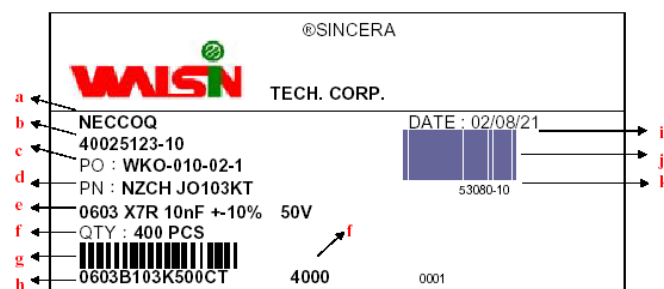


Fig. 23 The dimension of reel

| Size              | 01005            | 0201             | 0402             | 0505             | 0603             | 0805             | 1111             |
|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Thickness         | V                | L                | N                | J                | S                | T                | G                |
| A <sub>0</sub>    | 0.25<br>+/-0.05  | 0.40<br>+/-0.10  | 0.70<br>+/-0.20  | < 1.90           | 1.05<br>+/-0.30  | 1.50<br>+/-0.20  | < 3.05           |
| B <sub>0</sub>    | 0.45<br>+/-0.05  | 0.70<br>+/-0.10  | 1.20<br>+/-0.20  | < 1.90           | 1.80<br>+/-0.30  | 2.30<br>+/-0.20  | < 3.80           |
| T                 | ≤ 0.50           | ≤ 0.55           | ≤ 0.80           | 0.23<br>+/-0.1   | ≤ 1.20           | ≤ 1.20           | 0.23<br>+/-0.1   |
| K <sub>0</sub>    | -                | -                | -                | < 1.50           | -                | -                | < 2.50           |
| W                 | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  | 8.00<br>+/-0.30  |
| P <sub>0</sub>    | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  |
| 10xP <sub>0</sub> | 40.00<br>+/-0.10 | 40.00<br>+/-0.10 | 40.00<br>+/-0.10 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 | 40.00<br>+/-0.20 |
| P <sub>1</sub>    | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  | 4.00<br>+/-0.10  |
| P <sub>2</sub>    | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  | 2.00<br>+/-0.05  |
| D <sub>0</sub>    | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  | 1.50<br>+0.1/-0  |
| D <sub>1</sub>    | -                | -                | -                | 1.00<br>+/-0.10  | -                | -                | 1.00<br>+/-0.10  |
| E                 | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  | 1.75<br>+/-0.10  |
| F                 | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  | 3.50<br>+/-0.05  |

| Size           | 01005, 0201, 0402, 0505, 0603, 0805, 1111 |               |
|----------------|-------------------------------------------|---------------|
| Reel size      | 7"                                        | 13"           |
| C              | 13.0+0.5/-0.2                             | 13.0+0.5/-0.2 |
| W <sub>1</sub> | 8.4+1.5/-0                                | 8.4+1.5/-0    |
| A              | 178.0±1.0                                 | 330.0±1.0     |
| N              | 60.0+1.0/-0                               | 100±1.0       |

### ■ Example of customer label



\*Customized label is available upon request

- a. Customer name
- b. WTC order series and item number
- c. Customer P/O
- d. Customer P/N
- e. Description of product
- f. Quantity
- g. Bar code including quantity & WTC P/N or customer
- h. WTC P/N
- i. Shipping date
- j. Order bar code including series and item numbers
- k. Serial number of label

## Multilayer Ceramic Capacitors

### ■ Constructions

| No. | Name             | NP0                     |
|-----|------------------|-------------------------|
| ①   | Ceramic material | Hi-Q dielectric ceramic |
| ②   | Inner electrode  | Cu                      |
| ③   | Termination      | Inner layer             |
| ④   |                  | Middle layer            |
| ⑤   |                  | Outer layer             |
|     |                  | Sn (Matt)               |

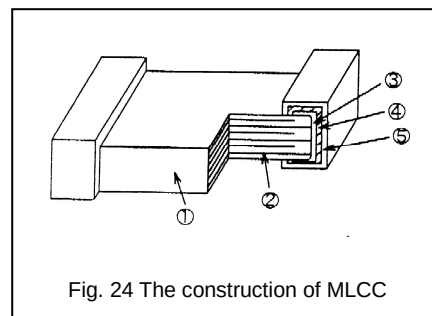


Fig. 24 The construction of MLCC

### ■ Storage and handling conditions

- (1) To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions.
- (2) The product is recommended to be used within one year after shipment. Check solderability in case of shelf life extension is needed.

Cautions:

- a. The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solderability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- b. In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- c. Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sunlight, the solderability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

### ■ Recommended soldering conditions

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste. If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N<sub>2</sub> within oven are recommended.

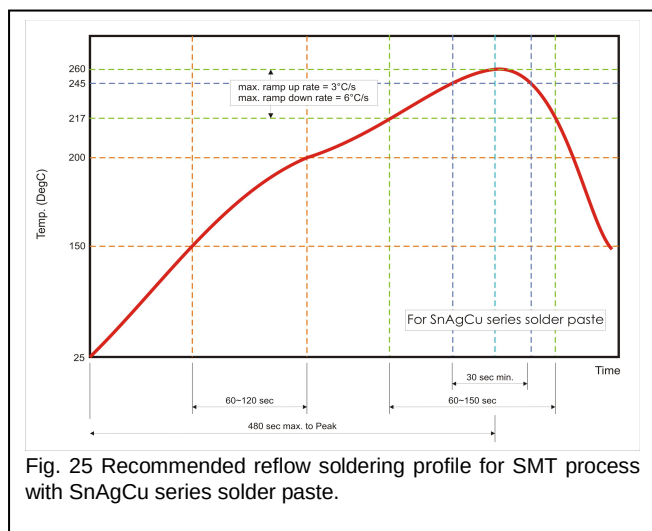


Fig. 25 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

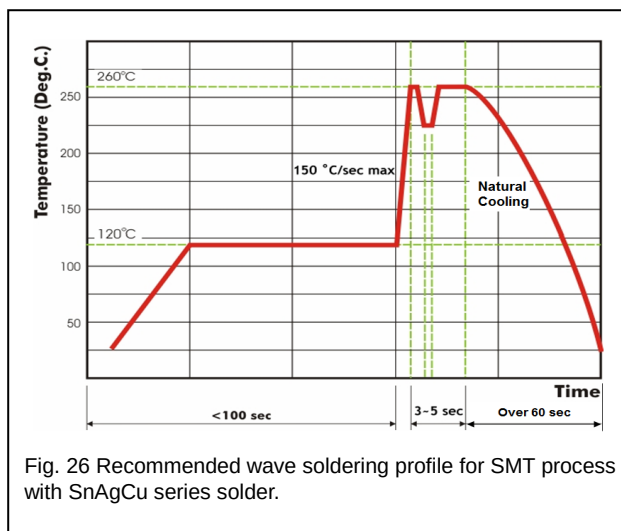


Fig. 26 Recommended wave soldering profile for SMT process with SnAgCu series solder.



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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