



# CT41 CHIP MULTILAYER CERAMIC CAPACITORS

## General Purpose Series (4V to 4000V)

### HOW TO ORDER

| <u>1206</u>   | <u>B</u>                         | <u>104</u>  | <u>K</u>   | <u>500</u>   | <u>C</u>           | <u>R</u>               |
|---|----------------------------------|---|--|--|--------------------|------------------------|
| <b>Size</b>   | <b>Dielectric</b>                | <b>Capacitance</b>  | <b>Tolerance</b>   | <b>Rated voltage</b>   | <b>Termination</b> | <b>Packaging style</b> |
| Inch (mm)<br>0201 (0603)<br>0402 (1005)<br>0603 (1608)<br>0805 (2012)<br>1206 (3216)<br>1210 (3225)<br>1808 (4520)<br>1812 (4532)<br>1825 (4563)<br>2211 (5728)<br>2220 (5750)<br>2225 (5763) | N=NP0<br>B=X7R<br>F=Y5V<br>X=X5R | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>eg.:<br>0R5=0.5pF<br>1R0=1.0pF<br>104=10x10 <sup>4</sup> =100nF | B=±0.1pF<br>C=±0.25pF<br>D=±0.5pF<br>F=±1%<br>G=±2%<br>J=±5%<br>K=±10%<br>M=±20%<br>Z=-20/+80% | Two significant digits followed by no. of zeros. And R is in place of decimal point.<br><br>4R0=4 VDC<br>6R3=6.3 VDC<br>100=10 VDC<br>160=16 VDC<br>250=25 VDC<br>500=50 VDC<br>101=100 VDC<br>102=1000 VDC<br>202= 2000 VDC | C=Cu/Ni/Sn         | R = T&R                |

### The Outlines and External Dimensions of Capacitors

| Outline     | Size Inch (mm)                            | L (mm)                 | W (mm)                  | T (mm)/Symbol          | Soldering Method * | M <sub>B</sub> (mm)                    |  |
|-------------|---|------------------------|-------------------------|------------------------|--------------------|--|--|
|             | 01R5 (0402)                               | 0.4±0.02               | 0.2±0.02                | 0.2±0.02               | V                  | R                                      | 0.10±0.03                              |
|             | 0201 (0603)                               | 0.6±0.03               | 0.3±0.03                | 0.3±0.03               | L                  | R                                      | 0.15±0.05                              |
|             |   | 0.6±0.05 <sup>#2</sup> | 0.3±0.05 <sup>#2</sup>  | 0.3±0.05 <sup>#2</sup> |                    |  | 0.15±0.1/-0.05                         |
|             |   | 0.6±0.09 <sup>#3</sup> | 0.3±0.09 <sup>#3</sup>  | 0.3±0.09 <sup>#3</sup> |                    |  |  |
|             | 0402 (1005)                               | 1.00±0.05              | 0.50±0.05               | 0.50±0.05              | N                  | R                                      | 0.25<br>+0.05/-0.10                    |
|             |   | 1.00±0.20              | 0.50±0.20               | 0.50+0.02/-0.05        | Q                  | R                                      |  |
|             |   | 1.60±0.10              | 0.80±0.10               | 0.5±0.20               | E                  | R                                      |  |
|             | 0603 (1608)                               | 1.60+0.15/-0.10        | 0.80+0.15/-0.10         | 0.80±0.07              | S                  | R / W                                  | 0.40±0.15                              |
|             |   |                        |                         | 0.50±0.10              | H                  | R / W                                  |  |
|             |   |                        |                         | 0.80+0.15/-0.10        | X                  | R / W                                  |  |
|             | 0805 (2012)                               | 2.00±0.15              | 1.25±0.10               | 0.50±0.10              | H                  | R / W                                  | 0.50±0.20                              |
|             |   |                        |                         | 0.60±0.10              | A                  | R / W                                  |  |
|             |   |                        |                         | 0.80±0.10              | B                  | R / W                                  |  |
|             |   |                        |                         | 1.25±0.10              | D                  | R                                      |  |
|             |   |                        |                         | 0.85±0.10              | T                  | R / W                                  |  |
|             | 1206 (3216)                               | 3.20±0.20              | 1.60±0.20               | 1.25±0.20              | I                  | R                                      | 0.60±0.20<br>(0.5±0.25) <sup>***</sup> |
|             |   |                        |                         | 0.80±0.10              | B                  | R / W                                  |  |
|             |   |                        |                         | 0.95±0.10              | C                  | R                                      |  |
|             |   |                        |                         | 1.25±0.10              | D                  | R                                      |  |
|             |   |                        |                         | 1.15±0.15              | J                  | R                                      |  |
| 1.60±0.20   |   |                        |                         | G                      | R                  |  |  |
| 1210 (3225) | 3.20±0.30                                 | 2.50±0.20              | 0.85±0.10               | T                      | R                  | 0.75±0.25                              |  |
|             |   |                        | 1.25±0.10               | D                      | R                  |  |  |
|             |   |                        | 1.60±0.20               | G                      | R                  |  |  |
|             |   |                        | 2.00±0.20               | K                      | R                  |  |  |
|             |   |                        | 2.50±0.30               | M                      | R                  |  |  |
| 1808 (4520) | 4.50±0.40<br>(4.5+0.5/-0.3) <sup>**</sup> | 2.03±0.25              | 2.50±0.50 <sup>#4</sup> | P                      | R                  | 0.75±0.25<br>(0.5±0.25) <sup>***</sup> |  |
|             |   |                        | 1.25±0.10               | D                      | R                  |  |  |
|             |   |                        | 1.40±0.15               | F                      | R                  |  |  |
|             |   |                        | 1.60±0.20               | G                      | R                  |  |  |
| 1812 (4532) | 4.50±0.40<br>(4.5+0.5/-0.3) <sup>**</sup> | 3.20±0.30              | 2.00±0.20               | K                      | R                  | 0.75±0.25<br>(0.5±0.25) <sup>***</sup> |  |
|             |   |                        | 2.50±0.30               | M                      | R                  |  |  |
|             |   |                        | 2.80±0.30               | U                      | R                  |  |  |
|             |   |                        | 1.60±0.20               | G                      | R                  |  |  |
|             |   |                        | 2.00±0.20               | K                      | R                  |  |  |
| 1825 (4563) | 4.60±0.50                                 | 6.30±0.40              | 1.60±0.20 (G)           | 2.00±0.20              | R                  | ≥ 0.26                                 |  |
| 2211 (5728) | 5.70±0.50                                 | 2.80±0.30              | (K)                     |                        | R                  | ≥ 0.30                                 |  |
| 2220 (5750) | 5.70±0.50                                 | 5.00±0.40              | 2.50±0.30 (M)           |                        | R                  | ≥ 0.30                                 |  |
| 2225 (5763) | 5.70±0.50                                 | 6.30±0.40              | 2.80±0.30 (U)           |                        | R                  | ≥ 0.30                                 |  |

\* R = Reflow soldering process ; W = Wave soldering process.

\*\* For 1808\_200V ~3kV, 1812\_200V~3kV

\*\*\* For 1206\_1000V ~3kV,1808\_200V ~3kV, 1812\_200V~3kV

#1 : For0603/Cap ≥ 10µF or 0603(≤ 6.3V)/Cap ≥ 4.7µF For 0603(>10V)/Cap>1µF products.

#2 : For 0201/Cap ≥ 0.68µF products.

#3 : For 0201/Cap ≥ 1µF products.

#4 : For 1210(100V)/Cap>1µF or 1210(250V)/Cap>0.47µF or 1210(400V~630V)/Cap>0.22µF.

## DESCRIPTION

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.

MLCC is made by NP0, X7R, X5R and Y5V dielectric material and which provides product with high electrical precision, stability and reliability.

## FEATURES

- \* A wide selection of sizes is available (0201 to 2225).
- \* High capacitance in given case size.
- \* RoHS REACH Compliance

## APPLICATIONS

- For general digital circuit.
- For power supply bypass capacitors.
- For consumer electronics.
- For telecommunication.

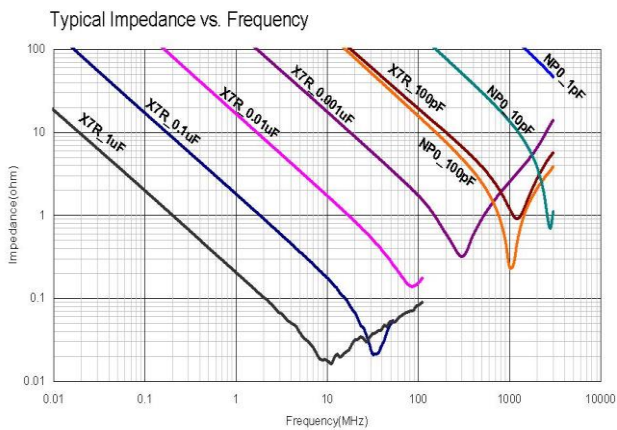
## ■ GENERAL ELECTRICAL DATA

| Dielectric                 | NP0   | X7R                                | X5R                   | Y5V                       |
|----------------------------|---|------------------------------------|-----------------------|---------------------------|
| Size                       | 0201, 0402, 0603, 0805, 1206, 1210, 1812, 1825, 2220, 2225  |                                    |                       |                           |
| Capacitance range          | 0.1pF to 0.27μF   | 100pF to 47μF                      | 100pF to 220μF        | 0.01μF to 100μF           |
| Capacitance tolerance      | Cap ≤ 5pF <sup>#1</sup> :<br>A (±0.05pF), B (±0.1pF),<br>C (±0.25pF)<br>5pF < Cap < 10pF:<br>C (±0.25pF), D (±0.5pF)<br>Cap ≥ 10pF:<br>F (±1%), G (±2%), J (±5%),<br>K (±10%) | J (±5%),<br>K (±10%),<br>M (±20%)  | K (±10%),<br>M (±20%) | M (±20%),<br>Z (-20/+80%) |
| Rated voltage (WVDC)       | 10V, 16V, 25V, 50V, 100V  | 4V, 6.3V, 10V, 16V, 25V, 50V, 100V |                       |                           |
| Operating temperature      | -55 to +125°C   |                                    | -55 to +85°C          | -25 to +85°C              |
| Capacitance characteristic | ±30ppm  | ±15%                               | ±15%                  | +30/-80%                  |
| Termination                | Ni/Sn (lead-free termination)   |                                    |                       |                           |

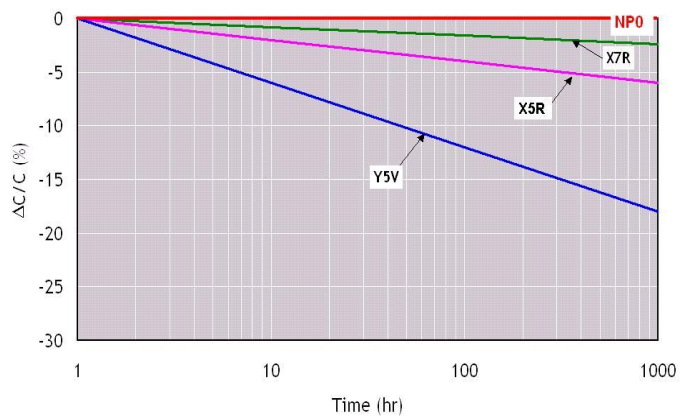
#1: NP0, 0.1pF product only provide B tolerance

## ■ ELECTRICAL CHARACTERISTICS

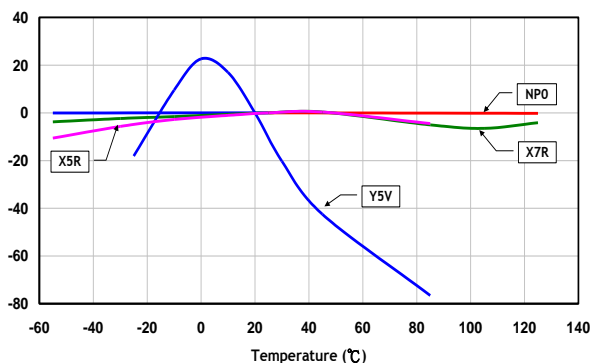
### 1) Frequency characteristics



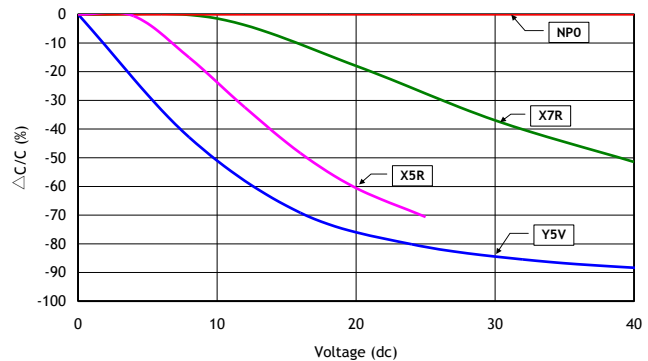
### 2) Capacitance Change - Typical aging rate



### 3) Temperature characteristics of capacitance (TCC)



### 4) DC Bias characteristics



All above typical electronic characteristics are for reference only.

■ CAPACITANCE RANGE

NP0 Dielectric

| Dielectric          |          | NP0 |                      |     |                      |     |          |          |     |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
|---------------------|----------|-----|----------------------|-----|----------------------|-----|----------|----------|-----|----------|----------|-----|----------|----------|-----|----------------------|-----|------|-----|------|-----|------|-----|---|---|
| Size                | 0201     |     | 0402                 |     | 0603                 |     | 0805     |          |     | 1206     |          |     | 1210     |          |     | 1812                 |     | 1825 |     | 2220 |     | 2225 |     |   |   |
| Rated Voltage (VDC) | 16<br>25 | 50  | 10<br>16<br>25<br>50 | 100 | 10<br>16<br>25<br>50 | 100 | 10<br>16 | 25<br>50 | 100 | 10<br>16 | 25<br>50 | 100 | 10<br>16 | 25<br>50 | 100 | 10<br>16<br>25<br>50 | 100 | 50   | 100 | 50   | 100 | 50   | 100 |   |   |
| 0.3pF (0R3)         | L        | L   | N                    |     | S                    |     |          |          |     |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 0.4pF (0R4)         | L        | L   | N                    |     | S                    |     |          |          |     |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 0.5pF (0R5)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 0.6pF (0R6)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 0.7pF (0R7)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 0.8pF (0R8)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 0.9pF (0R9)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 1.0pF (1R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 1.2pF (1R2)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 1.5pF (1R5)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 1.8pF (1R8)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 2.0pF (2R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 2.2pF (2R2)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 2.7pF (2R7)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 3.0pF (3R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 3.3pF (3R3)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 3.9pF (3R9)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 4.0pF (4R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 4.7pF (4R7)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 5.0pF (5R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 5.6pF (5R6)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 6.0pF (6R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 6.8pF (6R8)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 7.0pF (7R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 8.0pF (8R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 8.2pF (8R2)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 9.0pF (9R0)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   |          |          |     |                      |     |      |     |      |     |      |     |   |   |
| 10pF (100)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 12pF (120)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 15pF (150)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 18pF (180)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 22pF (220)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 27pF (270)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 33pF (330)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 39pF (390)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 47pF (470)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 56pF (560)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 68pF (680)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 82pF (820)          | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 100pF (101)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 120pF (121)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 150pF (151)         | L        | L   | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 180pF (181)         |          |     | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 220pF (221)         |          |     | N                    | N   | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 270pF (271)         | L        |     | N                    |     | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 330pF (331)         | L        |     | N                    |     | S                    | S   | A        | A        | A   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 390pF (391)         | L        |     | N                    |     | S                    | S   | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 470pF (471)         | L        |     | N                    |     | S                    | S   | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 560pF (561)         | L        |     | N                    |     | S                    | S   | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 680pF (681)         |          |     | N                    |     | S                    | S   | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 820pF (821)         |          |     | N                    |     | S                    | S   | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 1,000pF (102)       |          |     | N                    |     | S                    | S   | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 1,200pF (122)       |          |     |                      |     | X                    | X   | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 1,500pF (152)       |          |     |                      |     | X                    | X   | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 1,800pF (182)       |          |     |                      |     | X                    |     | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 2,200pF (222)       |          |     |                      |     | X                    |     | B        | B        | B   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 2,700pF (272)       |          |     |                      |     | X                    |     | D        | D        | D   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 3,300pF (332)       |          |     |                      |     | X                    |     | D        | D        | D   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 3,900pF (392)       |          |     |                      |     | X                    |     | D        | D        | D   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 4,700pF (472)       |          |     |                      |     | X                    |     | D        | D        | D   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 5,600pF (562)       |          |     |                      |     | X                    |     | D        | D        | D   | B        | B        | B   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 6,800pF (682)       |          |     |                      |     | X                    |     | D        | D        | D   | C        | C        | C   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 8,200pF (822)       |          |     |                      |     | X                    |     | D        | D        | D   | D        | D        | D   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 0.010uF (103)       |          |     |                      |     | X                    |     | D        | D        | D   | D        | D        | D   | C        | C        | C   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 0.012uF (123)       |          |     |                      |     |                      |     | T        | T        |     | P        | P        | P   | D        | D        | D   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 0.015uF (153)       |          |     |                      |     |                      |     | T        | T        |     | P        | P        | P   | D        | D        | D   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 0.018uF (183)       |          |     |                      |     |                      |     | D        | D        |     | P        | P        | P   | K        | K        | K   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 0.022uF (223)       |          |     |                      |     |                      |     | D        | D        |     | P        | P        | P   | K        | K        | K   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 0.027uF (273)       |          |     |                      |     |                      |     |          |          |     | P        | P        | P   | K        | K        | K   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 0.033uF (333)       |          |     |                      |     |                      |     |          |          |     | P        | P        | T   | K        | K        | K   | D                    | D   | G    | G   | G    | G   | G    | G   | G | G |
| 0.039uF (393)       |          |     |                      |     |                      |     |          |          |     | P        | P        |     | K        | K        | K   | M                    | M   | G    | G   | G    | G   | G    | G   | G | G |
| 0.047uF (473)       |          |     |                      |     |                      |     |          |          |     | J        | J        |     | K        | K        | K   | M                    | M   | G    | G   | G    | G   | G    | G   | G | G |
| 0.056uF (563)       |          |     |                      |     |                      |     |          |          |     | J        | J        |     |          |          |     | M                    | M   | G    | K   | G    | K   | G    | G   | G | G |
| 0.068uF (683)       |          |     |                      |     |                      |     |          |          |     | G        | G        |     |          |          |     | M                    | M   | G    | K   | K    | K   | K    | G   | K | K |
| 0.082uF (823)       |          |     |                      |     |                      |     |          |          |     | G        | G        |     |          |          |     | M                    | M   | K    | M   | M    | M   | M    | K   | K | K |
| 0.10uF (104)        |          |     |                      |     |                      |     |          |          |     | G        | G        |     |          |          |     | M                    | M   | M    | M   | M    | M   | M    | K   | M | M |
| 0.12uF (124)        |          |     |                      |     |                      |     |          |          |     |          |          |     |          |          |     |                      |     | M    | M   |      |     | M    | M   | M | M |
| 0.15uF (154)        |          |     |                      |     |                      |     |          |          |     |          |          |     |          |          |     |                      |     |      | M   |      |     | M    | M   | M | M |
| 0.18uF (184)        |          |     |                      |     |                      |     |          |          |     |          |          |     |          |          |     |                      |     |      |     |      |     | M    | M   | M | M |
| 0.22uF (224)        |          |     |                      |     |                      |     |          |          |     |          |          |     |          |          |     |                      |     |      |     |      |     |      |     | M | M |
| 0.27uF (274)        |          |     |                      |     |                      |     |          |          |     |          |          |     |          |          |     |                      |     |      |     |      |     |      |     |   | M |

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

# X7R Dielectric

| Dielectric          |                 | X7R  |    |           |          |      |     |                 |    |      |     |                 |    |      |     |                 |    |      |     |    |    |      |    |     |                |           |           |          |     |          |     |      |   |   |   |   |  |
|---------------------|-----------------|------|----|-----------|----------|------|-----|-----------------|----|------|-----|-----------------|----|------|-----|-----------------|----|------|-----|----|----|------|----|-----|----------------|-----------|-----------|----------|-----|----------|-----|------|---|---|---|---|--|
| Size                |                 | 0201 |    |           |          | 0402 |     |                 |    | 0603 |     |                 |    | 0805 |     |                 |    | 1206 |     |    |    | 1210 |    |     |                | 1812      |           | 1825     |     | 2220     |     | 2225 |   |   |   |   |  |
| Rated Voltage (VDC) | 6.3<br>10<br>16 | 25   | 50 | 6.3<br>10 | 16<br>25 | 50   | 100 | 6.3<br>10<br>16 | 25 | 50   | 100 | 6.3<br>10<br>16 | 25 | 50   | 100 | 6.3<br>10<br>16 | 25 | 50   | 100 | 10 | 16 | 25   | 50 | 100 | 10<br>16<br>25 | 50<br>100 | 50<br>100 | 25<br>50 | 100 | 25<br>50 | 100 |      |   |   |   |   |  |
|                     |                 |      |    |           |          |      |     |                 |    |      |     |                 |    |      |     |                 |    |      |     |    |    |      |    |     |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 100pF (101)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   |                 |    |      |     |    |    |      |    |     |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 120pF (121)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   |                 |    |      |     |    |    |      |    |     |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 150pF (151)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  |    |      |    |     |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 180pF (181)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 220pF (221)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 270pF (271)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 330pF (331)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 390pF (391)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 470pF (471)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 560pF (561)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 680pF (681)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 820pF (821)         | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | B   |                |           |           |          |     |          |     |      |   |   |   |   |  |
| 1,000pF (102)       | L               | L    | L  | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 1,200pF (122)       | L               | L    |    | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 1,500pF (152)       | L               | L    |    | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 1,800pF (182)       | L               | L    |    | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 2,200pF (222)       | L               | L    |    | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 2,700pF (272)       | L               | L    |    | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 3,300pF (332)       | L               | L    |    | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 3,900pF (392)       | L               | L    |    | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 4,700pF (472)       | L               | L    |    | N         | N        | N    | N   | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 5,600pF (562)       | L               | L    |    | N         | N        | N    |     | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 6,800pF (682)       | L               |      |    | N         | N        | N    |     | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 8,200pF (822)       | L               |      |    | N         | N        | N    |     | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 0.010uF (103)       | L               | L    |    | N         | N        | N    |     | S               | S  | S    | S   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | B  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 0.012uF (123)       |                 |      |    | N         | N        | E    |     | S               | S  | S    | X   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.015uF (153)       |                 |      |    | N         | N        | E    |     | S               | S  | S    | X   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.018uF (183)       |                 |      |    | N         | N        | E    |     | S               | S  | S    | X   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.022uF (223)       | L               |      |    | N         | N        | E    |     | S               | S  | S    | X   | B               | B  | B    | B   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.027uF (273)       |                 |      |    | N         | N        | E    |     | S               | S  | S    | X   | B               | B  | B    | D   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.033uF (333)       |                 |      |    | N         | N        | E    |     | S               | S  | X    | X   | B               | B  | B    | D   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.039uF (393)       |                 |      |    | N         | N        | E    |     | S               | S  | X    | X   | B               | B  | B    | D   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.047uF (473)       |                 |      |    | N         | N        | E    |     | S               | S  | X    | X   | B               | B  | B    | D   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.056uF (563)       |                 |      |    | N         | N        | E    |     | S               | S  | X    | X   | B               | B  | B    | D   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.068uF (683)       |                 |      |    | N         | N        | E    |     | S               | S  | X    | X   | B               | B  | B    | D   | B               | B  | B    | B   | B  | B  | B    | C  | C   | C              | C         | C         | D        | D   | K        | K   | K    | K | K | K |   |  |
| 0.082uF (823)       |                 |      |    | N         | N        | E    |     | S               | S  | X    | X   | B               | B  | B    | D   | B               | B  | B    | D   | B  | B  | B    | D  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 0.10uF (104)        |                 |      |    | N         | N        | E    |     | S               | S  | X    | X   | B               | B  | B    | D   | B               | B  | B    | D   | B  | B  | B    | D  | C   | C              | C         | C         | C        | D   | D        | K   | K    | K | K | K | K |  |
| 0.12uF (124)        |                 |      |    |           |          |      |     | S               | X  |      |     | B               | B  | D    | I   | B               | B  | B    | D   | C  | C  | C    | C  | C   | C              | D         | D         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.15uF (154)        |                 |      |    |           |          |      |     | S               | X  |      |     | D               | D  | D    | I   | C               | C  | C    | G   | C  | C  | C    | C  | C   | D              | D         | D         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.18uF (184)        |                 |      |    |           |          |      |     | S               | X  |      |     | D               | D  | D    | I   | C               | C  | C    | G   | C  | C  | C    | C  | C   | D              | D         | D         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.22uF (224)        |                 |      |    | N         | N        |      |     | S               | X  | X    |     | D               | D  | D    | I   | C               | C  | C    | G   | C  | C  | C    | C  | D   | D              | D         | D         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.27uF (274)        |                 |      |    |           |          |      |     | X               | X  |      |     | D               | D  | I    |     | C               | C  | D    | G   | C  | C  | C    | C  | G   | D              | D         | K         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.33uF (334)        |                 |      |    |           |          |      |     | X               | X  | X    |     | D               | D  | I    |     | C               | C  | D    | G   | C  | C  | C    | D  | G   | D              | D         | K         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.39uF (394)        |                 |      |    |           |          |      |     | X               | X  |      |     | D               | D  | I    |     | C               | J  | P    | G   | C  | C  | C    | D  | M   | D              | D         | K         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.47uF (474)        |                 |      |    | N         |          |      |     | X               | X  | X    |     | D               | D  | I    | I   | J               | J  | P    | G   | C  | C  | C    | D  | M   | D              | D         | K         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.56uF (564)        |                 |      |    |           |          |      |     | X               |    |      |     | D               | D  |      |     | J               | J  | P    | P   | D  | D  | D    | D  | M   | D              | D         | K         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.68uF (684)        |                 |      |    |           |          |      |     | X               |    |      |     | D               | D  |      |     | J               | J  | P    | P   | D  | D  | D    | D  | K   | D              | K         | K         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 0.82uF (824)        |                 |      |    |           |          |      |     | X               |    |      |     | D               | D  |      |     | J               | J  | P    | P   | D  | D  | D    | D  | K   | D              | K         | K         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 1.0uF (105)         |                 |      |    | N         |          |      |     | X               | X  | X    |     | D               | D  | I    |     | J               | J  | P    | P   | D  | D  | D    | D  | K   | D              | K         | K         | K        | K   | K        | K   | K    | K | K | K |   |  |
| 1.5uF (155)         |                 |      |    |           |          |      |     |                 |    |      |     | I               | I  |      |     | J               | P  |      |     |    |    |      | G  | G   | M              | M         |           | K        | K   | K        | K   | K    | K | K | K |   |  |
| 2.2uF (225)         |                 |      |    |           |          |      |     | X               |    |      |     | I               | I  | I    |     | J               | P  | P    | P   |    |    |      | G  | G   | M              | M         |           | M        | K   | K        | K   | K    | K | K | K |   |  |
| 3.3uF (335)         |                 |      |    |           |          |      |     |                 |    |      |     |                 |    |      |     | P               | P  |      |     |    |    |      | G  | G   | M              |           |           |          | K   | K        | K   | K    | K | K | K |   |  |
| 4.7uF (475)         |                 |      |    |           |          |      |     | X               |    |      |     | I               | I  |      |     | P               | P  | P    |     |    |    |      | K  | K   | K              | M         | M         |          |     | K        | K   | M    | K | K | K |   |  |
| 6.8uF (685)         |                 |      |    |           |          |      |     |                 |    |      |     |                 |    |      |     |                 |    |      |     |    |    |      |    |     |                |           |           |          |     |          |     |      |   | M | U | M |  |
| 10uF (106)          |                 |      |    |           |          |      |     |                 |    |      |     | I               |    |      |     | P               | P  |      |     |    |    |      | K  | K   | K              | M         |           |          |     |          |     |      | U | U | U |   |  |
| 22uF (226)          |                 |      |    |           |          |      |     |                 |    |      |     |                 |    |      |     | P               |    |      |     |    |    |      | M  | M   | M              |           |           |          |     |          |     |      |   |   |   |   |  |
| 47uF (476)          |                 |      |    |           |          |      |     |                 |    |      |     |                 |    |      |     |                 |    |      |     |    |    |      | M  |     |                |           |           |          |     |          |     |      |   |   |   |   |  |

1. The letter in cell is expressed the symbol of product thickness.  
 2. 0402 size, Cap.1.0uF\_6.3V only; 0603 size, Cap.4.7uF\_6.3V only.



X5R Dielectric

| Dielectric          |               | X5R |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|---------------------|---------------|-----|----|----|----|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|------|----|----|----|----|------|-----|----|----|----|----|---|--|--|
| Size                | 0201          |     |    |    |    | 0402 |    |    |    |    | 0603 |    |    |    |    | 0805 |    |    |    |    | 1206 |    |    |    |    | 1210 |     |    |    |    |    |   |  |  |
| Rated Voltage (VDC) | 6.3           | 10  | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 6.3  | 10 | 16 | 25 | 50 | 4    | 6.3 | 10 | 16 | 25 | 50 |   |  |  |
| Capacitance         | 100pF (101)   | L   | L  | L  | L  | L    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 220pF (221)   | L   | L  | L  | L  | L    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 470pF (471)   | L   | L  | L  | L  | L    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 1000pF (102)  | L   | L  | L  | L  | L    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 2200pF (222)  | L   | L  | L  | L  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 4700pF (472)  | L   | L  | L  | L  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.010µF (103) | L   | L  | L  | L  | L    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.027µF (273) | L   | L  |    |    |      |    |    |    | N  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.033µF (333) | L   | L  |    |    |      |    |    |    | N  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.039µF (393) | L   | L  |    |    |      |    |    |    | N  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.047µF (473) | L   | L  |    |    |      |    |    |    | N  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.056µF (563) | L   | L  |    |    |      |    |    |    | N  | N    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.068µF (683) | L   | L  |    |    |      |    |    |    | N  | N    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.082µF (823) | L   | L  |    |    |      |    | N  | N  | N  |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.10µF (104)  | L   | L  | L  | L  |      |    | N  | N  | N  | N    | E  |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.15µF (154)  |     |    |    |    |      |    | N  | N  | N  | N    |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.22µF (224)  | L   | L  | L  |    |      |    | N  | N  | N  | N    | N  |    |    | X  | X    | X  |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.27µF (274)  |     |    |    |    |      |    |    |    |    |      |    |    | X  | X  | X    |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.33µF (334)  | L   | L  |    |    |      |    | N  | N  |    |      |    | X  | X  | X  | X    |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
|                     | 0.39µF (394)  |     |    |    |    |      |    |    |    |    |      |    | X  | X  | X  | X    |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
| 0.47µF (474)        | L             |     |    |    |    |      | N  | N  | E  | E  | E    |    | X  | X  | X  | X    | X  |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
| 0.68µF (684)        |               |     |    |    |    |      | N  | N  |    |    |      | X  | X  | X  | X  |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
| 0.82µF (824)        |               |     |    |    |    |      |    |    |    |    |      | X  | X  | X  | X  |      |    |    |    |    |      |    |    |    |    |      |     |    |    |    |    |   |  |  |
| 1.0µF (105)         | L             | L   | L  |    |    |      | N  | N  | N  | N  |      | X  | X  | X  | X  | X    |    | D  | D  | D  | I    |    |    |    |    |      |     |    |    |    |    |   |  |  |
| 1.5µF (155)         |               |     |    |    |    |      |    |    |    |    |      | X  |    |    |    |      | I  | I  | I  | I  |      |    |    |    |    |      |     | J  | J  |    | K  |   |  |  |
| 2.2µF (225)         | L             | L   |    |    |    |      | N  | N  | E  | E  |      | X  | X  | X  | X  | X    |    | I  | I  | I  | I    | I  |    | J  | J  | P    | P   |    |    |    |    | K |  |  |
| 3.3µF (335)         |               |     |    |    |    |      |    |    |    |    |      | X  | X  |    |    |      | I  | I  | I  | I  | I    |    | P  | P  | P  | P    |     |    |    |    |    |   |  |  |
| 4.7µF (475)         |               |     |    |    |    |      | E  | E  | E  |    |      | X  | X  | X  | X  |      | I  | I  | I  | I  | I    |    | P  | P  | P  | P    | P   |    |    | K  | K  |   |  |  |
| 6.8µF (685)         |               |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    | P  | P  |    |      |     |    |    |    |    |   |  |  |
| 10µF (106)          |               |     |    |    |    |      | E  | E  |    |    |      | X  | X  | X  | X  |      | I  | I  | I  | I  | I    |    | P  | P  | P  | P    | P   |    | K  | K  | K  | M |  |  |
| 22µF (226)          |               |     |    |    |    |      |    |    |    |    |      | X  | X  |    |    |      | I  | I  | I  | I  |      | P  | P  | P  | P  |      | M   | M  | M  |    |    |   |  |  |
| 47µF (476)          |               |     |    |    |    |      |    |    |    |    |      | X  |    |    |    |      | I  | I  |    |    |      | P  | P  | P  |    |      | M   | M  | M  |    |    |   |  |  |
| 100µF (107)         |               |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      | I  |    |    |    |      | P  |    |    |    |      | M   | M  |    |    |    |   |  |  |
| 220µF (227)         |               |     |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      |    |    |    |    |      | M   | M  |    |    |    |   |  |  |

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

# Middle & High Voltage Capacitors 200V~4000V

## ■ FEATURES

- \* High voltage in a given case size.
- \* High stability and reliability.

## ■ GENERAL ELECTRICAL DATA

| Dielectric                  | NP0  | X7R                | Y5V                    |
|-----------------------------|--|--------------------|------------------------|
| Size                        | 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225   |                    | 0805, 1206, 1210, 1812 |
| Capacitance                 | 0.5pF to 0.12μF  | 100pF to 2.2μF     | 0.01μF to 0.68μF       |
| Capacitance tolerance       | Cap≤5pF: C (±0.25pF)<br>5pF<Cap<10pF: D (±0.5pF)<br>Cap≥10pF: J (±5%), K (±10%)  | K (±10%), M (±20%) | Z (-20/+80%)           |
| Rated voltage (WVDC)        | 200V to 4000V  |                    | 200V, 250V             |
| DF/ Q                       | Cap<30pF: Q≥400+20C<br>Cap≥30pF: Q≥1000  | ≤2.5%              | ≤5%                    |
| Insulation resistance at Ur | Ur=200~630V: ≥10GΩ or RxC≥100Ω·F whichever is smaller<br>Ur=1000~3000V: ≥10GΩ  |                    |                        |
| Dielectric strength         | 200~300V: ≥2 x WVDC<br>400V~450V: ≥1.2 x WVDC<br>500~999V: ≥1.5 x WVDC<br>1000~3000V: ≥1.2 x WVDC<br>4000: ≥1.1 x WVDC |                    |                        |
| Operating temperature       | -55 to +125°C  |                    | -25 to +85°C           |
| Capacitance characteristic  | ±30ppm   | ±15%               | +30/-80%               |
| Termination                 | Ni/Sn (lead-free termination)  |                    |                        |

## ■ CAPACITANCE RANGE

### Y5V Dielectric 200V to 250V

| DIELECTRIC          |               | Y5V  |     |      |     |      |     |      |     |
|---------------------|---------------|------|-----|------|-----|------|-----|------|-----|
| SIZE                |               | 0805 |     | 1206 |     | 1210 |     | 1812 |     |
| RATED VOLTAGE (VDC) |               | 200  | 250 | 200  | 250 | 200  | 250 | 200  | 250 |
| Capacitance         | 0.010μF (103) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.015μF (153) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.022μF (223) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.033μF (333) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.047μF (473) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.068μF (683) | B    | B   | B    | B   | C    | C   | D    | D   |
|                     | 0.10μF (104)  |      |     | B    | B   | C    | C   | D    | D   |
|                     | 0.15μF (154)  |      |     | C    | C   | C    | C   | D    | D   |
|                     | 0.22μF (224)  |      |     |      |     |      |     | D    | D   |
|                     | 0.33μF (334)  |      |     |      |     |      |     | D    | D   |
| 0.47μF (474)        |               |      |     |      |     |      | D   | D    |     |
| 0.68μF (684)        |               |      |     |      |     |      | D   | D    |     |

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







# General Information

## ■ Constructions

| No. | Name             | NP0                      | NPO/X7R/X5R/Y5V |
|-----|------------------|--------------------------|-----------------|
| ①   | Ceramic material | BaTiO <sub>3</sub> based |                 |
| ②   | Inner electrode  | AgPd alloy               | Ni              |
| ③   | Termination      | Inner layer              | Ag              |
| ④   |                  | Middle layer             | Ni              |
| ⑤   |                  | Outer layer              | Sn              |

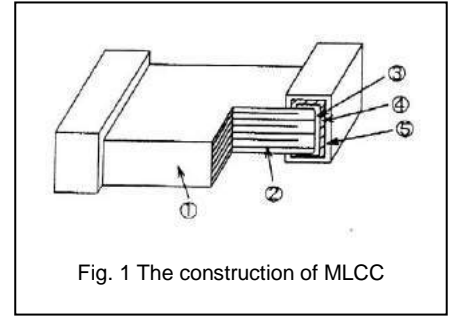


Fig. 1 The construction of MLCC

## ■ 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:

- 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.)
- In corrosive atmosphere, solderability might be degraded, and silver migration might occur to cause low reliability.
- 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.

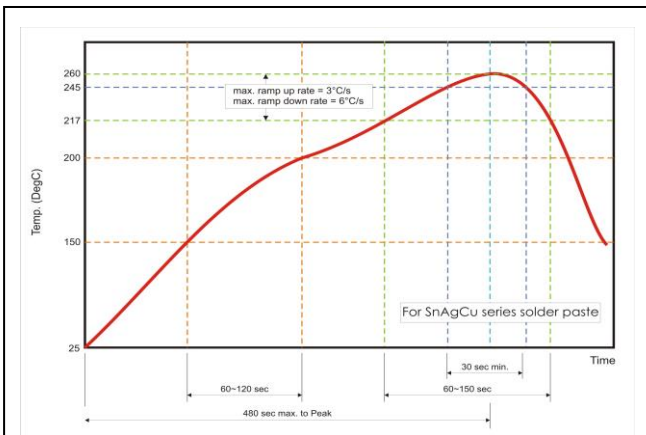


Fig. 2 Recommended reflow soldering profile for SMT process with SnAgCu series solder paste.

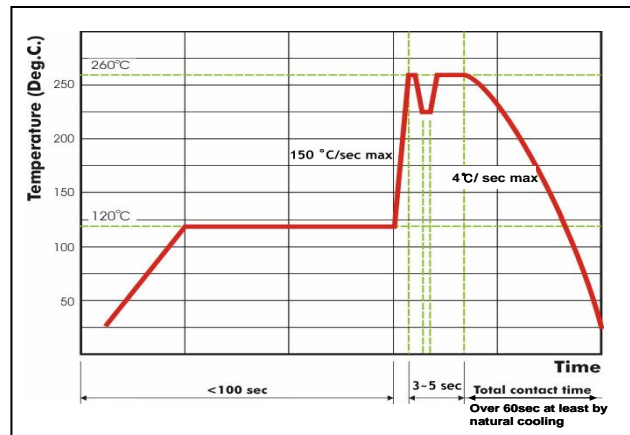


Fig. 3 Recommended wave soldering profile for SMT process with SnAgCu series solder.