

DATA SHEET

SURFACE MOUNT MULTILAYER CERAMIC CAPACITORS

General purpose & High capacitance

Class 2, X5R

4 V TO 50 V

100 pF to 100 μ F

RoHS compliant & Halogen free



SCOPE

This specification describes X5R series chip capacitors with lead-free terminations.

APPLICATIONS

- PCs, Hard disk, Game PCs
- Power supplies
- DVD players
- Mobile phones
- Data processing

FEATURES

- Supplied in tape on reel
- Nickel-barrier end termination
- RoHS compliant
- Halogen free compliant

ORDERING INFORMATION - GLOBAL PART NUMBER, PHYCOMP

CTC & I2NC

All part numbers are identified by the series, size, tolerance, TC material, packing style, voltage, process code, termination and capacitance value.

YAGEO BRAND ordering code

GLOBAL PART NUMBER (PREFERRED)

CC XXXX X X **X5R** X **BB** XXX
 (1) (2) (3) (4) (5)

(1) SIZE – INCH BASED (METRIC)

0201 (0603)
 0402 (1005)
 0603 (1608)
 0805 (2012)
 1206 (3216)
 1210 (3225)
 1812 (4532)

(2) TOLERANCE

K = $\pm 10\%$
 M = $\pm 20\%$

(3) PACKING STYLE

R = Paper/PE taping reel; Reel 7 inch
 K = Blister taping reel; Reel 7 inch
 P = Paper/PE taping reel; Reel 13 inch
 F = Blister taping reel; Reel 13 inch
 C = Bulk case

(4) RATED VOLTAGE

4 = 4 V
 5 = 6.3 V
 6 = 10 V
 7 = 16 V
 8 = 25 V
 9 = 50 V

(5) CAPACITANCE VALUE

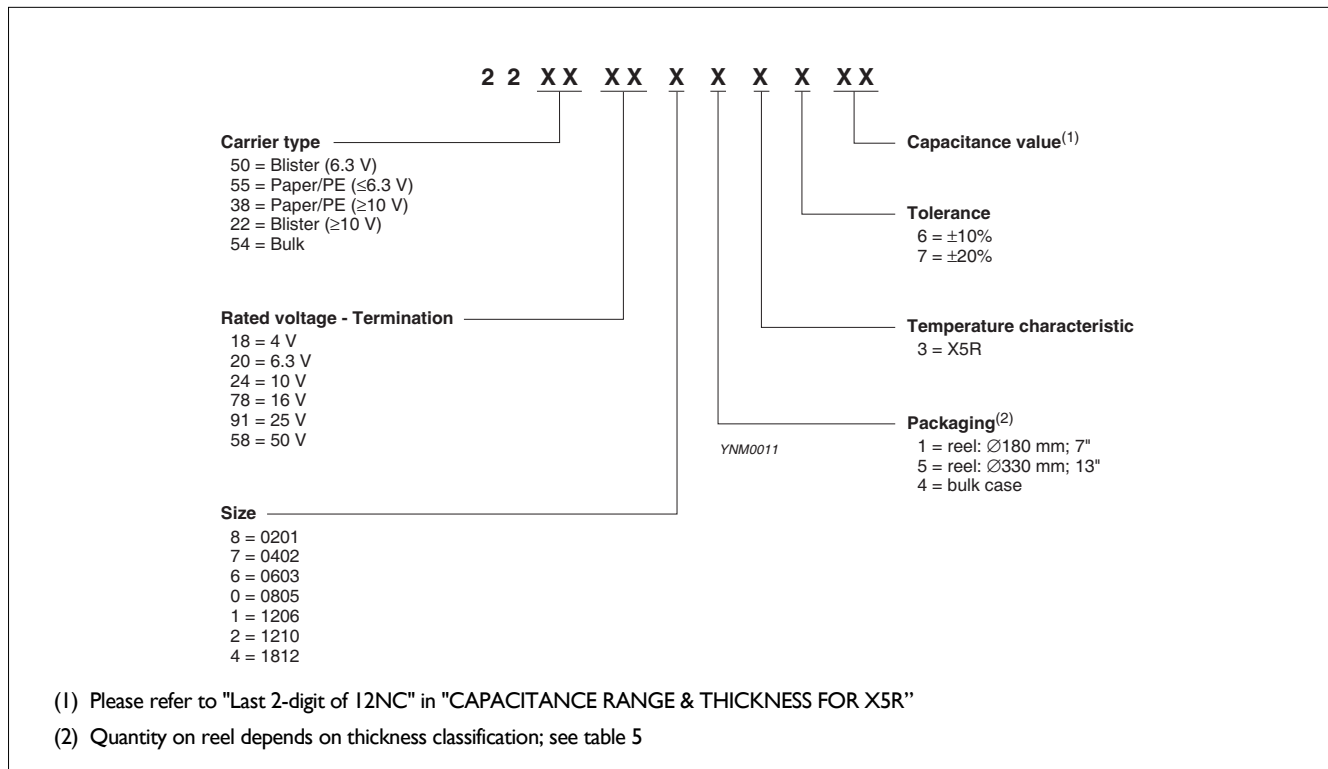
2 significant digits+number of zeros
 The 3rd digit signifies the multiplying factor, and letter R is decimal point
 Example: 103 = $10 \times 10^3 = 10,000 \text{ pF} = 10 \text{ nF}$

PHYCOMP BRAND ordering codes

GLOBAL PART NUMBER (preferred), PHYCOMP CTC (for North America) and I2NC (traditional) codes are acceptable to order Phycomp brand products.

GLOBAL PART NUMBER (PREFERRED)

For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

I2NC CODE**PHYCOMP CTC CODE (FOR NORTH AMERICA)**

Example: 06032B225M5B20D

| 0603 | 2B | 225 | M | 5 | B | 2 | 0 | D |
|-----------|-------------|-------------------------|----------------|-----------|-------------|---------------|----------------|------------------|
| Size code | Temp. Char. | Capacitance in pF | Tolerance | Voltage | Termination | Packing | Marking | Range identifier |
| 0201 | 2B = X5R | 101 = 100 pF; the | K = $\pm 10\%$ | 4 = 4 V | B = NiSn | 2 = 180 mm | 0 = no marking | D = Class 2 MLCC |
| 0402 | | third digit signifies | M = $\pm 20\%$ | 5 = 6.3 V | | 7" Paper/PE | | |
| 0603 | | the multiplying | | 6 = 10 V | | 3 = 330 mm | | |
| 0805 | | factor: | | 7 = 16 V | | 13" Paper/PE | | |
| 1206 | | 0 = $\times 1$ | | 8 = 25 V | | B = 180 mm | | |
| 1210 | | 1 = $\times 10$ | | 9 = 50 V | | 7" Blister | | |
| 1812 | | 2 = $\times 100$ | | | | F = 330 mm | | |
| | | 3 = $\times 1,000$ | | | | 13" Blister | | |
| | | 4 = $\times 10,000$ | | | | P = Bulk case | | |
| | | 5 = $\times 100,000$ | | | | | | |
| | | 6 = $\times 1,000,000$ | | | | | | |
| | | 7 = $\times 10,000,000$ | | | | | | |

CONSTRUCTION

The capacitor consists of a rectangular block of ceramic dielectric in which a number of interleaved metal electrodes are contained. This structure gives rise to a high capacitance per unit volume.

The inner electrodes are connected to the two end terminations and finally covered with a layer of plated tin (NiSn). The terminations are lead-free. A cross section of the structure is shown in Fig.1.

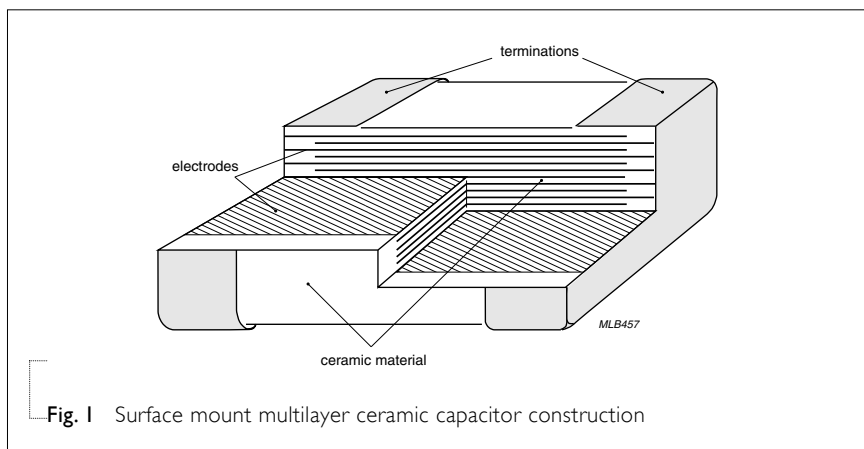


Fig. 1 Surface mount multilayer ceramic capacitor construction

DIMENSION

Table I For outlines see fig. 2

| TYPE | L ₁ (mm) | W (mm) | T (MM) | L ₂ / L ₃ (mm) | | L ₄ (mm) |
|------|--------------------------|---------------------------|--------------------------|--------------------------------------|------|---------------------|
| | | | | min. | max. | min. |
| 0201 | 0.6 ±0.03 ⁽¹⁾ | 0.3 ±0.03 ⁽¹⁾ | Refer to table 2 to 4 | 0.10 | 0.20 | 0.20 |
| | 0.6 ±0.05 ⁽²⁾ | 0.3 ±0.05 ⁽²⁾ | | | | |
| 0402 | 1.0 ±0.05 ⁽¹⁾ | 0.5 ±0.05 ⁽¹⁾ | | 0.20 | 0.30 | 0.40 |
| | 1.0 ±0.15 ⁽²⁾ | 0.5 ±0.15 ⁽²⁾ | | | | |
| | 1.0 ±0.20 ⁽³⁾ | 0.5 ±0.20 ⁽³⁾ | | | | |
| 0603 | 1.6 ±0.10 ⁽¹⁾ | 0.8 ±0.10 ⁽¹⁾ | | 0.20 | 0.60 | 0.40 |
| | 1.6 ±0.15 ⁽²⁾ | 0.8 ±0.15 ⁽²⁾ | | | | |
| | 1.6 ±0.20 ⁽³⁾ | 0.8 ±0.20 ⁽³⁾ | | | | |
| 0805 | 2.0 ±0.10 ⁽¹⁾ | 1.25 ±0.10 ⁽¹⁾ | | 0.25 | 0.75 | 0.55 |
| | 2.0 ±0.20 ⁽²⁾ | 1.25 ±0.20 ⁽²⁾ | | | | |
| 1206 | 3.2 ±0.15 ⁽¹⁾ | 1.6 ±0.15 ⁽¹⁾ | | 0.25 | 0.75 | 1.40 |
| | 3.2 ±0.30 ⁽²⁾ | 1.6 ±0.20 ⁽²⁾ | | | | |
| | 3.2 ±0.30 ⁽³⁾ | 1.6 ±0.30 ⁽²⁾ | | | | |
| 1210 | 3.2 ±0.20 ⁽¹⁾ | 2.5 ±0.20 ⁽¹⁾ | | 0.25 | 0.75 | 1.40 |
| | 3.2 ±0.40 ⁽²⁾ | 2.5 ±0.30 ⁽²⁾ | | | | |
| 1812 | 4.5 ±0.20 ⁽¹⁾ | 3.2 ±0.20 ⁽¹⁾ | | 0.25 | 0.75 | 2.20 |
| | 4.5 ±0.40 ⁽²⁾ | 3.2 ±0.40 ⁽²⁾ | | | | |

NOTE

1. Dimensions for size 0201, C < 1 µF; 0402, C < 4.7 µF; 0603, C < 4.7 µF; 0805 to 1812, C ≤ 100nF
2. Dimensions for size 0201, C ≥ 1 µF; 0402, C ≥ 4.7 µF; 0603, 10 µF > C ≥ 4.7 µF; 0805 to 1812, C > 100 nF
3. Dimensions for size 0402, C ≥ 10 µF; 0603, C ≥ 10 µF; 1206, C ≥ 100 µF

OUTLINES

For dimension see Table I

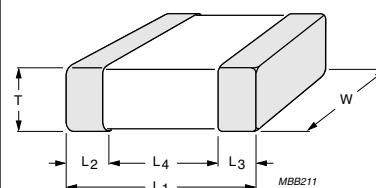


Fig. 2 Surface mount multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR X5R**Table 2** Sizes from 0201 to 0402

| CAP. | Last 2-digit of 12NC | | 0201 4 V | | | | | 0402 4 V | | | | | | | | | |
|--------|----------------------------|----------|-------------|----------|----------|----------|----------|-------------|----------|----------|----------|----------|--|--|--|--|--|
| | | | 6.3 V | 10 V | 16 V | 25 V | 50 V | 6.3 V | 10 V | 16 V | 25 V | 50 V | | | | | |
| 100 pF | 09 | | 0.3±0.03 | 0.3±0.03 | 0.3±0.03 | 0.3±0.03 | 0.3±0.03 | | | | | | | | | | |
| 150 pF | 12 | | | | | | | | | | | | | | | | |
| 220 pF | 14 | | | | | | | | | | | | | | | | |
| 330 pF | 16 | | | | | | | | | | | | | | | | |
| 470 pF | 18 | | | | | | | | | | | | | | | | |
| 680 pF | 21 | | | | | | | | | | | | | | | | |
| 1.0 nF | 23 | | | | | | | | | | | | | | | | |
| 1.5 nF | 25 | | | | | | | | | | | | | | | | |
| 2.2 nF | 27 | | | | | | | | | | | | | | | | |
| 3.3 nF | 29 | | | | | | | 0.3±0.03 | 0.3±0.03 | 0.3±0.03 | | | | | | | |
| 4.7 nF | 32 | | 0.3±0.03 | 0.3±0.03 | 0.3±0.03 | 0.3±0.03 | 0.3±0.03 | | | | | | | | | | |
| 6.8 nF | 34 | | | | | | | | | | | | | | | | |
| 10 nF | 36 | | | | | | | | | | | | | | | | |
| 15 nF | 39 | | | | | | | | | | | | | | | | |
| 22 nF | 41 | | | | | | | | | | | | | | | | |
| 33 nF | 43 | | | | | | | | | | | | | | | | |
| 47 nF | 45 | | | | | | | | | | | | | | | | |
| 68 nF | 47 | | | | | | | | | | | | | | | | |
| 100 nF | 49 | | | | | | | | | | | | | | | | |
| 150 nF | 52 | | | | | | | | | | | | | | | | |
| 220 nF | 54 | 0.3±0.03 | 0.3±0.03 | 0.3±0.03 | | | | 0.5±0.05 | 0.5±0.05 | | | | | | | | |
| 330 nF | 56 | | | | | | | 0.5±0.05 | 0.5±0.05 | | | | | | | | |
| 470 nF | 58 | 0.3±0.03 | 0.3±0.03 | | | | | | | 0.5±0.05 | 0.5±0.05 | 0.5±0.05 | | | | | |
| 680 nF | 61 | | | | | | | | | | | | | | | | |
| 1.0 μF | 63 | 0.3±0.05 | 0.3±0.05 | | | | | | | | 0.5±0.05 | 0.5±0.05 | | | | | |
| 2.2 μF | 67 | | | | | | | | | | | | | | | | |
| 4.7 μF | 72 | | | | | | | 0.5±0.15 | 0.5±0.15 | | | | | | | | |
| 10 μF | 76 | | | | | | | 0.5±0.20 | 0.5±0.20 | | | | | | | | |

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is available on request

CAPACITANCE RANGE & THICKNESS FOR X5R**Table 3** Sizes from 0603 to 0805

| CAP. | Last 2-digit of | 0603 | | | | 0805 | | | |
|--------|-----------------|---------|---------|---------|----------|----------------------|----------------------|----------------------|----------|
| | | 12NC | 6.3 V | 10 V | 16 V | 25 V | 6.3 V | 10 V | 16 V |
| 10 nF | 36 | | | | | | | | |
| 15 nF | 38 | | | | | | | | |
| 22 nF | 41 | | | | | | | | |
| 33 nF | 43 | | | | | | | | |
| 47nF | 45 | | | | | | | | |
| 68 nF | 47 | | | | | | | | |
| 100 nF | 49 | | | | | | | | |
| 150 nF | 52 | | | | | | | | |
| 220 nF | 54 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | 0.8±0.1 | | | | |
| 330 nF | 56 | | | | | | | | |
| 470 nF | 58 | | | | | 0.85±0.1 1.25±0.2 | 0.85±0.1 1.25±0.2 | 0.85±0.1 1.25±0.2 | 1.25±0.2 |
| 680 nF | 61 | | | | | | | | |
| 1.0 μF | 63 | | | | | | | | |
| 2.2 μF | 67 | | | | | | | 0.85±0.1 1.25±0.2 | |
| 4.7 μF | 72 | | | | 0.8±0.15 | | | | |
| 10 μF | 76 | 0.8±0.2 | 0.8±0.2 | | | 1.25±0.2 | 1.25±0.2 | 1.25±0.2 | |
| 22 μF | 81 | | | | | | | | |
| 47 μF | 85 | | | | | 1.25±0.2 | | | |
| 100 μF | 89 | | | | | | | | |

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is available on request

CAPACITANCE RANGE & THICKNESS FOR X5R**Table 4** Sizes from 1206 to 1812

| CAP. | Last 2-digit of | 1206 | | | | 1210 | | | | 1812 | |
|-------------|-----------------|------|----------------|----------------|----------------|----------------|---------------|---------------|---------------|---------------|---------------|
| | | 12NC | 6.3 V | 10 V | 16 V | 25 V | 6.3 V | 10 V | 16 V | 25 V | 6.3 V |
| 10 nF | 36 | | | | | | | | | | |
| 15 nF | 38 | | | | | | | | | | |
| 22 nF | 41 | | | | | | | | | | |
| 33 nF | 43 | | | | | | | | | | |
| 47 nF | 45 | | | | | | | | | | |
| 68 nF | 47 | | | | | | | | | | |
| 100 nF | 49 | | | | | | | | | | |
| 150 nF | 52 | | | | | | | | | | |
| 220 nF | 54 | | | | | | | | | | |
| 330 nF | 56 | | | | | | | | | | |
| 470 nF | 58 | | | | | | | | | | |
| 680 nF | 61 | | | | | | | | | | |
| 1.0 μ F | 63 | | 1.15 \pm 0.1 | 1.15 \pm 0.1 | 1.15 \pm 0.1 | 1.15 \pm 0.1 | | | | | |
| 2.2 μ F | 67 | | | | | | | | | | |
| 4.7 μ F | 72 | | | | | | 1.9 \pm 0.2 | 1.9 \pm 0.2 | 1.9 \pm 0.2 | 1.9 \pm 0.2 | |
| 10 μ F | 76 | | 1.6 \pm 0.2 | 1.6 \pm 0.2 | 1.6 \pm 0.2 | 1.6 \pm 0.2 | | | | | |
| 22 μ F | 81 | | | | | | | 2.5 \pm 0.2 | 2.5 \pm 0.2 | 2.5 \pm 0.3 | |
| 47 μ F | 85 | | | | | | 2.5 \pm 0.2 | | | | 2.5 \pm 0.2 |
| 100 μ F | 89 | | 1.6 \pm 0.3 | | | | | | | | 3.2 \pm 0.3 |

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is available on request

THICKNESS CLASSES AND PACKING QUANTITY

Table 5

| SIZE CODE | THICKNESS CLASSIFICATION | TAPE WIDTH QUANTITY PER REEL | Ø180 MM / 7 INCH | | Ø330 MM / 13 INCH | | QUANTITY PER BULK CASE |
|-----------|--------------------------|---------------------------------|------------------|----------------|-------------------|---------|---------------------------|
| | | | Paper | Blister | Paper | Blister | |
| 0201 | 0.3 ±0.03 mm | 8 mm | 15,000 | --- | 50,000 | --- | --- |
| 0402 | 0.5 ±0.05 mm | 8 mm | 10,000 | --- | 50,000 | --- | 50,000 |
| 0603 | 0.8 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- | 15,000 |
| 0805 | 0.6 ±0.1 mm | 8 mm | 4,000 | --- | 20,000 | --- | 10,000 |
| | 0.85 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- | 8,000 |
| | 1.25 ±0.2 mm | 8 mm | --- | 3,000 | --- | 10,000 | 5,000 |
| 1206 | 0.6 ±0.1 mm | 8 mm | 4,000 | --- | 20,000 | --- | --- |
| | 0.85 ±0.1 mm | 8 mm | 4,000 | --- | 15,000 | --- | --- |
| | 1.00 / 1.15 ±0.1 mm | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.25 ±0.2 mm | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.6 ±0.15 mm | 8 mm | --- | 2,500 | --- | 10,000 | --- |
| | 1.6 ±0.2 mm | 8 mm | --- | 2,000 | --- | 10,000 | --- |
| 1210 | 0.6 / 0.7 ±0.1 mm | 8 mm | --- | 4,000 | --- | 15,000 | --- |
| | 0.85 ±0.1 mm | 8 mm | --- | 4,000 | --- | 10,000 | --- |
| | 1.15 ±0.1 mm | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.15 ±0.15 mm | 8 mm | --- | 3,000 | --- | 10,000 | --- |
| | 1.25 ±0.2 mm | 8 mm | --- | 3,000 | --- | --- | --- |
| | 1.5 ±0.1 mm | 8 mm | --- | 2,000 | --- | --- | --- |
| | 1.6 / 1.9 ±0.2 mm | 8 mm | --- | 2,000 | --- | --- | --- |
| | 2.0 ±0.2 mm | 8 mm | --- | 2,000 1,000 | --- | --- | --- |
| | 2.5 ±0.2 mm | 8 mm | --- | 1,000 500 | --- | --- | --- |
| 1808 | 1.15 ±0.15 mm | 12 mm | --- | 3,000 | --- | --- | --- |
| | 1.25 ±0.2 mm | 12 mm | --- | 3,000 | --- | --- | --- |
| | 1.35 ±0.15 mm | 12 mm | --- | 2,000 | --- | --- | --- |
| | 1.5 ±0.1 mm | 12 mm | --- | 2,000 | --- | --- | --- |
| | 1.6 ±0.2 mm | 12 mm | --- | 2,000 | --- | --- | --- |
| | 2.0 ±0.2 mm | 12 mm | --- | 2,000 | --- | --- | --- |
| 1812 | 0.6 / 0.85 ±0.1 mm | 12 mm | --- | 2,000 | --- | --- | --- |
| | 1.15 ±0.1 mm | 12 mm | --- | 1,000 | --- | --- | --- |
| | 1.25 ±0.2 mm | 12 mm | --- | 1,000 | --- | --- | --- |
| | 1.5 ±0.1 mm | 12 mm | --- | 1,000 | --- | --- | --- |
| | 1.6 ±0.2 mm | 12 mm | --- | 1,000 | --- | --- | --- |
| | 2.0 ±0.2 mm | 12 mm | --- | 1,000 | --- | --- | --- |
| | 2.5 ±0.2 mm | 12 mm | --- | 500 | --- | --- | --- |

ELECTRICAL CHARACTERISTICS**X5R DIELECTRIC CAPACITORS; NISN TERMINATIONS**

Unless otherwise specified, all tests and measurements shall be made under standard atmospheric conditions for testing as given in 5.3 of IEC 60068-1:

- Temperature: 15 °C to 35 °C
- Relative humidity: 25% to 75%
- Air pressure: 86 kPa to 106 kPa

Before the measurements are made, the capacitor shall be stored at the measuring temperature for a time sufficient to allow the entire capacitor to reach this temperature.

The period as prescribed for recovery at the end of a test is normally sufficient for this purpose.

Table 6

| DESCRIPTION | VALUE |
|---|--|
| Capacitance range | 10 nF to 100 µF |
| Capacitance tolerance | ±10% and ±20% |
| Dissipation factor (D.F.) | |
| 6.3 V | ≤ 5% |
| Exception: 0402 ≥ 180 nF; 1210 ≥ 22 µF | ≤ 7% |
| 0201 ≥ 12 nF; 0402 ≥ 330 nF; 0603 ≥ 2.2 µF; | ≤ 10% |
| 0805 ≥ 1 µF; 1206 ≥ 22 µF; 1210 ≥ 100 µF | |
| 1206 ≥ 100 µF | ≤ 15% |
| 10 V | ≤ 5% |
| Exception: 0402 ≥ 180 nF; 0805 ≥ 1 µF; 1206 ≥ 6.8 µF | ≤ 7% |
| 0201 ≥ 100 nF; 0402 ≥ 330 nF; 0603 ≥ 1 µF; | ≤ 10% |
| 0805 ≥ 2.2 µF; 1206 ≥ 10 µF; 1210 ≥ 10 µF | |
| 16 V | ≤ 5% |
| Exception: 0402 ≥ 180 nF; 0603 ≥ 680 nF; 0805 ≥ 1 µF | ≤ 7% |
| 0402 ≥ 330 nF; 0603 ≥ 2.2 µF; 0805 ≥ 10 µF | ≤ 10% |
| 1206 ≥ 10 µF; 1210 ≥ 10 µF | |
| ≥ 25 V | ≤ 3.5% |
| Exception: 0402 ≥ 27 nF; 0603 ≥ 220 nF; 0805 ≥ 2.2 µF; | ≤ 5% |
| 1206 ≥ 4.7 µF; 1210 ≥ 10 µF | |
| 0402 ≥ 180 nF | ≤ 7% |
| 0402 ≥ 470 nF; 1206 ≥ 10 µF 0805 ≥ 4.7 µF | ≤ 10% |
| Insulation resistance after 1 minute at U_r (DC) | $R_{ins} \geq 10 \text{ G}\Omega$ or $R_{ins} \times C_r \geq 500$ seconds whichever is less |
| Maximum capacitance change as a function of temperature (temperature characteristic/coefficient): | ±15% |
| Operating temperature range: | -55 °C to +85 °C |

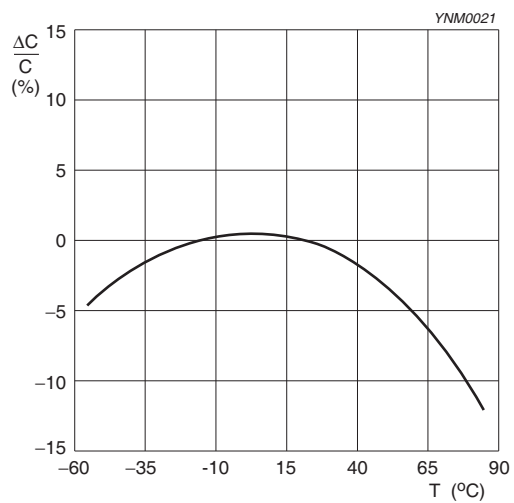


Fig. 3 Typical capacitance change as a function of temperature

Size 0201 10 nF / 16 V
Solid lines: Impedance / Dotted lines: ESR

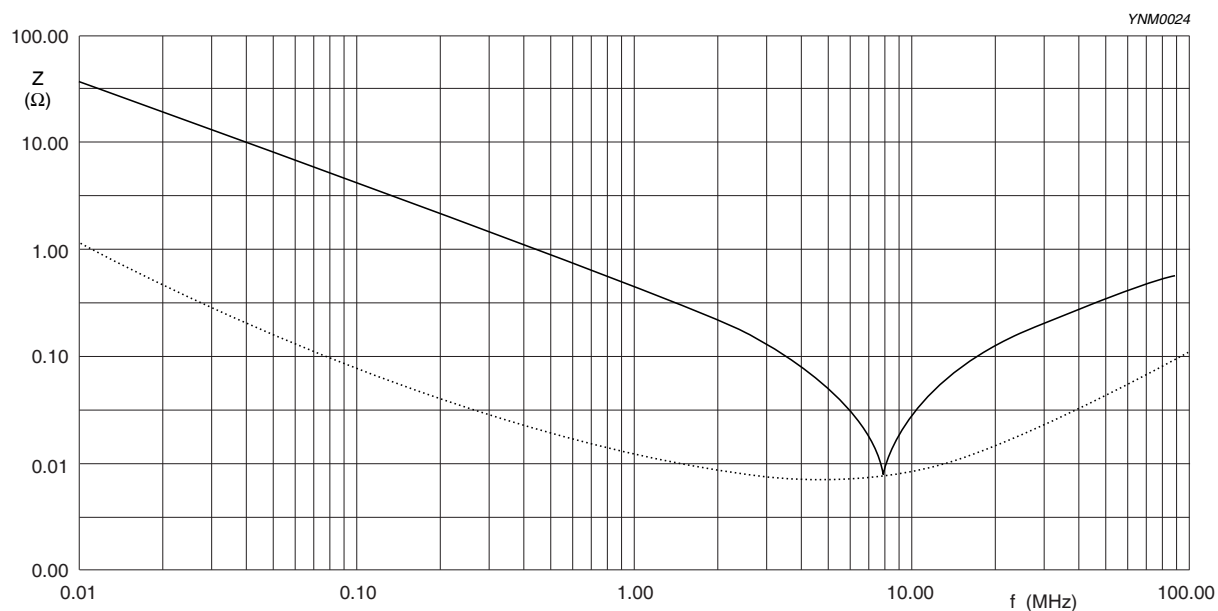


Fig. 4 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 0603 1 μF / 10 V
Solid lines: Impedance / Dotted lines: ESR

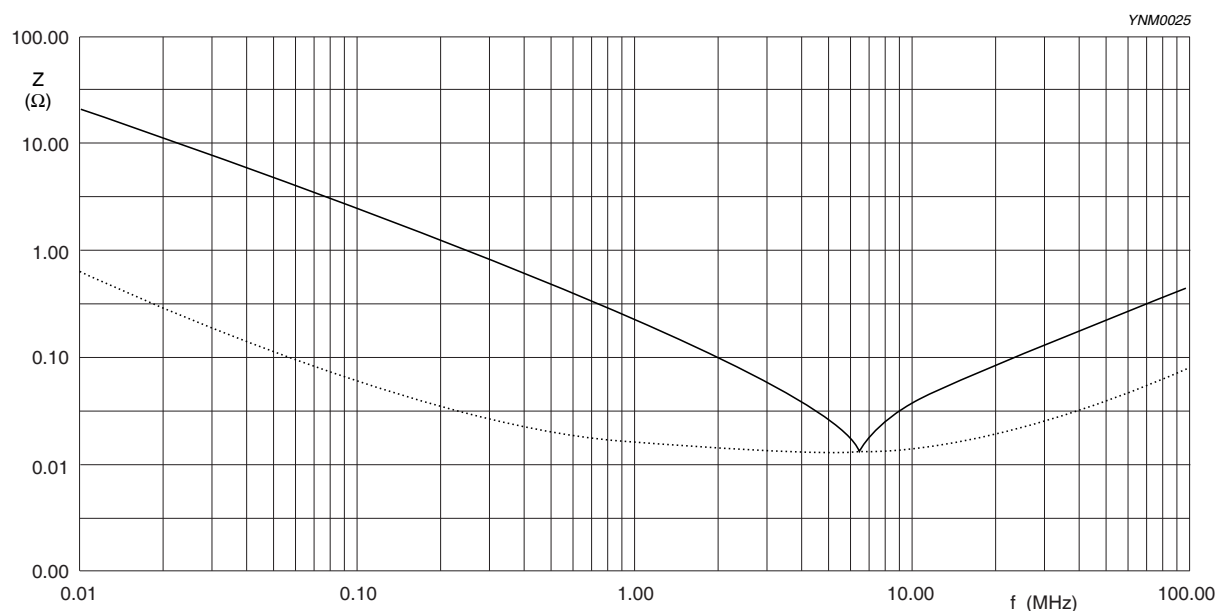


Fig. 5 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 0805 10 μ F / 6.3 V
Solid lines: Impedance / Dotted lines: ESR

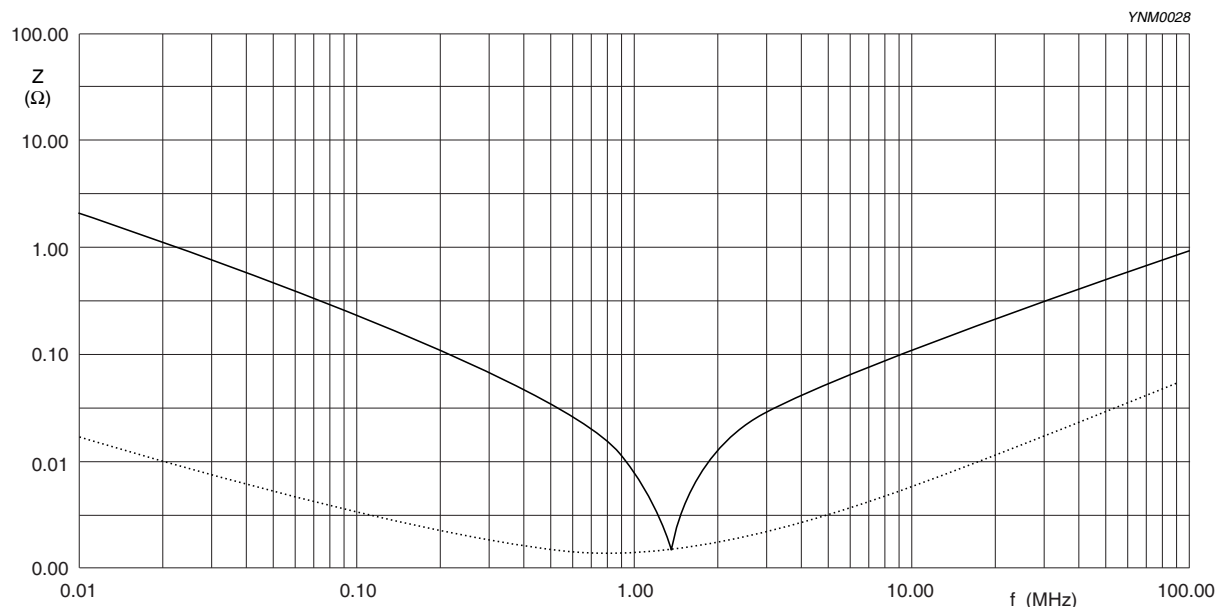


Fig. 6 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 1206 10 μ F / 16 V
Solid lines: Impedance / Dotted lines: ESR

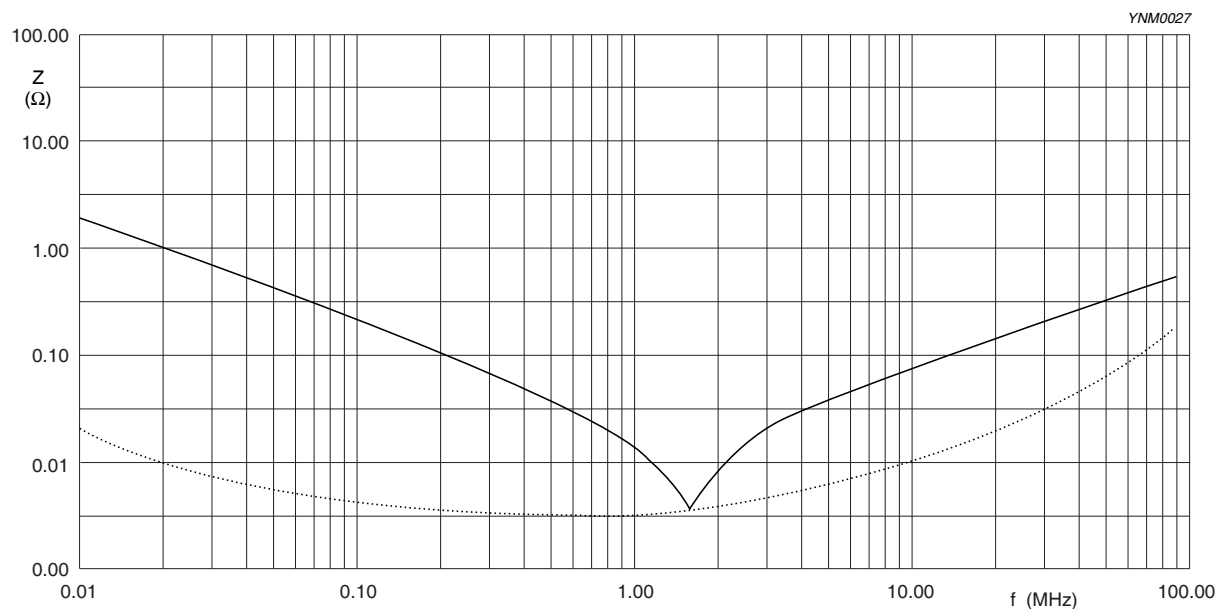


Fig. 7 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

Size 1210 10 μ F / 25 V
Solid lines: Impedance / Dotted lines: ESR

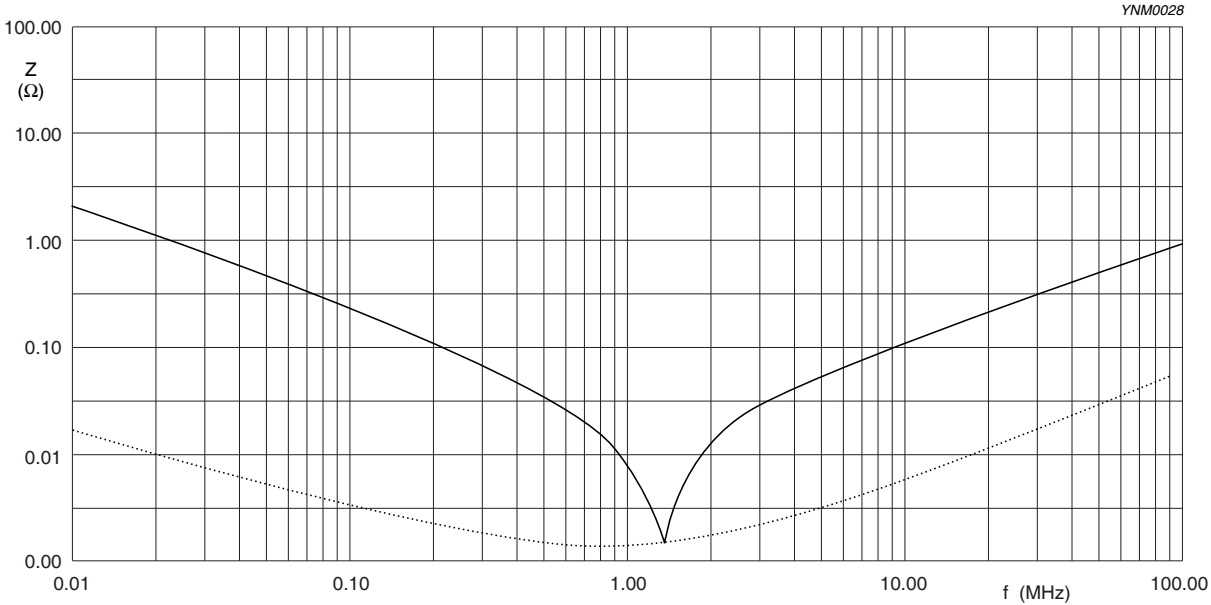


Fig. 8 Impedance ESR vs. frequency characteristics for multilayer chip capacitors

SOLDERING RECOMMENDATION

Table 7

| SOLDERING METHOD | SIZE 0402 | 0603 | 0805 | 1206 | ≥ 1210 |
|------------------|---------------|---------------|---------------|---------------|-------------|
| Reflow | ≥ 0.1 μ F | ≥ 1.0 μ F | ≥ 2.2 μ F | ≥ 4.7 μ F | Reflow only |
| Reflow/Wave | < 0.1 μ F | < 1.0 μ F | < 2.2 μ F | < 4.7 μ F | --- |

TESTS AND REQUIREMENTS**Table 8** Test procedures and requirements

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|--|---------------------|---|---|
| Mounting | IEC 60384-21/22 4.3 | The capacitors may be mounted on printed-circuit boards or ceramic substrates | No visible damage |
| Visual Inspection and Dimension Check | 4.4 | Any applicable method using $\times 10$ magnification | In accordance with specification |
| Capacitance ⁽¹⁾ | 4.5.1 | Class 2: At 20 °C, 24 hrs after annealing $f = 1 \text{ KHz}$ for $C \leq 10 \text{ }\mu\text{F}$, rated voltage $> 6.3 \text{ V}$, measuring at voltage $1 V_{\text{rms}}$ at 20 °C $f = 1 \text{ KHz}$, for $C \leq 10 \text{ }\mu\text{F}$, rated voltage $\leq 6.3 \text{ V}$, measuring at voltage $0.5 V_{\text{rms}}$ at 20 °C $f = 120 \text{ Hz}$ for $C > 10 \text{ }\mu\text{F}$, measuring at voltage $0.5 V_{\text{rms}}$ at 20 °C | Within specified tolerance |
| Dissipation Factor (D.F.) ⁽¹⁾ | 4.5.2 | Class 2: At 20 °C, 24 hrs after annealing $f = 1 \text{ KHz}$ for $C \leq 10 \text{ }\mu\text{F}$, rated voltage $> 6.3 \text{ V}$, measuring at voltage $1 V_{\text{rms}}$ at 20 °C $f = 1 \text{ KHz}$, for $C \leq 10 \text{ }\mu\text{F}$, rated voltage $\leq 6.3 \text{ V}$, measuring at voltage $0.5 V_{\text{rms}}$ at 20 °C $f = 120 \text{ Hz}$ for $C > 10 \text{ }\mu\text{F}$, measuring at voltage $0.5 V_{\text{rms}}$ at 20 °C | In accordance with specification |
| Insulation Resistance | 4.5.3 | At U_r (DC) for 1 minute | In accordance with specification |
| Temperature Characteristic | 4.6 | Class 2: Between minimum and maximum temperature X5R: -55 °C to +85 °C Normal Temperature: 20 °C | <General purpose series> $\Delta C/C$ Class 2: X5R: $\pm 15\%$ <High Capacitance series> $\Delta C/C$ Class 2: X5R: $\pm 15\%$ |
| Adhesion | 4.7 | A force applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate | Force size ≥ 0603 : 5N size = 0402: 2.5N size = 0201: 1N |

NOTE

1. The figure indicates typical inspection. Please refer to individual specifications.

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---|---------------------|--|--|
| Bond Strength of Plating on End Face | IEC 60384- 21/22 | 4.8 Mounting in accordance with IEC 60384-22 paragraph 4.3 Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 340 mm | No visible damage <General purpose series> $\Delta C/C$ Class2: X5R: $\pm 10\%$ <High Capacitance series> $\Delta C/C$ Class2: X5R: $\pm 10\%$ |
| Resistance to Soldering Heat | 4.9 | Precondition: 150 $\pm 0/-10$ °C for 1 hour, then keep for 24 ± 1 hours at room temperature Preheating: for size ≤ 1206 : 120 °C to 150 °C for 1 minute Preheating: for size >1206 : 100 °C to 120 °C for 1 minute and 170 °C to 200 °C for 1 minute Solder bath temperature: 260 ± 5 °C Dipping time: 10 ± 0.5 seconds Recovery time: 24 ± 2 hours | Dissolution of the end face plating shall not exceed 25% of the length of the edge concerned <General purpose series> $\Delta C/C$ Class2: X5R: $\pm 10\%$ <High Capacitance series> $\Delta C/C$ Class2: X5R: $\pm 10\%$ D.F. within initial specified value R_{ins} within initial specified value |
| Solderability | 4.10 | Preheated the temperature of 80 °C to 140 °C and maintained for 30 seconds to 60 seconds. Test conditions for lead-free containing solder alloy Temperature: 235 ± 5 °C Dipping time: 2 ± 0.2 seconds Depth of immersion: 10 mm Alloy Composition: 60/40 Sn/Pb Number of immersions: 1 Test conditions for lead-free containing solder alloy Temperature: 245 ± 5 °C Dipping time: 3 ± 0.3 seconds Depth of immersion: 10 mm Alloy Composition: SAC305 Number of immersions: 1 | The solder should cover over 95% of the critical area of each termination |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|-----------------------------|-----------------|--|---|
| Rapid Change of Temperature | IEC 60384-21/22 | 4.1.1 Preconditioning: 150 +0/-10 °C for 1 hour, then keep for 24 ± 1 hours at room temperature 5 cycles with following detail: 30 minutes at lower category temperature 30 minutes at upper category temperature Recovery time 24 ± 2 hours | No visual damage <hr/> <General purpose series> $\Delta C/C$ Class2: X5R: ± 15% <High Capacitance series> $\Delta C/C$ Class2: X5R: ± 15% <hr/> D.F. meet initial specified value R_{ins} meet initial specified value |
| | | | |
| Damp Heat with U_r Load | 4.13 | 1. Preconditioning, class 2 only: 150 +0/-10 °C / 1 hour, then keep for 24 ± 1 hour at room temp 2. Initial measure: Spec: refer to initial spec C, D, IR 3. Damp heat test: 500 ± 12 hours at 40 ± 2 °C; 90 to 95% R.H. 1.0 U_r applied 4. Recovery: Class 2: 24 ± 2 hours 5. Final measure: C, D, IR P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned according to "IEC 60384 4.1" and then the requirements shall be met. | No visual damage after recovery <hr/> <General purpose series> $\Delta C/C$ Class2: X5R: ± 15% D.F. Class2: X5R: $\leq 16V: \leq 7\%$ $\geq 25V: \leq 5\%$ R_{ins} Class2: X5R: $\geq 500 M\Omega$ or $R_{ins} \times C_r \geq 25s$ whichever is less <High Capacitance series> $\Delta C/C$ Class2: X5R: ± 20% D.F. Class2: X5R: 2 × initial value max R_{ins} Class2: X5R: 500 M Ω or $R_{ins} \times C_r \geq 25s$ whichever is less |
| | | | |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---------------|----------------------|--|--|
| Endurance | IEC 60384-21/22 4.14 | <ol style="list-style-type: none"> Preconditioning, class 2 only: 150 +0/-10 °C / 1 hour, then keep for 24 ±1 hour at room temp Initial measure: Spec: refer to initial spec C, D, IR Endurance test: Temperature: X5R: 85 °C Specified stress voltage applied for 1,000 hours: Applied $2.0 \times U_r$ for general product. Applied $1.5 \times U_r$ for high cap. product. Recovery time: 24 ±2 hours Final measure: C, D, IR <p>P.S. If the capacitance value is less than the minimum value permitted, then after the other measurements have been made the capacitor shall be preconditioned according to "IEC 60384 4.1" and then the requirements shall be met.</p> | <p>No visual damage</p> <hr/> <p><General purpose series></p> <p>$\Delta C/C$</p> <p>Class2:</p> <p>X5R: ±15%</p> <p>D.F.</p> <p>Class2:</p> <p>X5R: $\leq 16V: \leq 7\%$ $\geq 25V: \leq 5\%$</p> <p>R_{ins}</p> <p>Class2:</p> <p>X5R: $\geq 1,000 M\Omega$ or $R_{ins} \times C_r \geq 50s$ whichever is less</p> <p><High Capacitance series></p> <p>$\Delta C/C$</p> <p>Class 2:</p> <p>X5R: ±20%</p> <p>D.F.</p> <p>Class 2:</p> <p>X5R: 2 × initial value max</p> <p>R_{ins}</p> <p>Class 2:</p> <p>X5R: $1,000 M\Omega$ or $R_{ins} \times C_r \geq 50s$ whichever is less</p> |
| Voltage Proof | IEC 60384-1 4.6 | <p>Specified stress voltage applied for 1 minute</p> <p>$U_r \leq 100 V$: series applied $2.5 U_r$</p> <p>$100 V < U_r \leq 200 V$ series applied $(1.5 U_r + 100)$</p> <p>$200 V < U_r \leq 500 V$ series applied $(1.3 U_r + 100)$</p> <p>$U_r > 500 V$: $1.3 U_r$</p> <p>I: 7.5 mA</p> | No breakdown or flashover |

REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|------------|--------------|---------------------|---|
| Version 14 | May 16, 2012 | - | - Product range updated |
| Version 13 | May 02, 2012 | - | - Product range updated |
| Version 12 | Feb 10, 2012 | - | - Product range updated |
| Version 11 | Oct 21, 2011 | - | - Product range updated |
| Version 10 | Jun 21, 2011 | - | - Product range updated |
| Version 9 | Mar 23, 2011 | - | - Product range updated |
| Version 8 | Jan 25, 2011 | - | - Rated voltage of 0201 extend to 50V |
| Version 7 | Jan 05, 2011 | - | - Product range updated |
| Version 6 | Jul 27, 2010 | - | - Dimension on 0603 and 1206 case size updated |
| Version 5 | Apr 21, 2010 | - | - The statement of "Halogen free" on the cover added - Dimension updated |
| Version 4 | Jan 13, 2010 | - | - Thickness updated |
| Version 3 | Aug 17, 2009 | - | - Dimension updated |
| Version 2 | Jun 09, 2009 | - | - Ordering code updated |
| Version 1 | May 15, 2009 | - | - Product range updated |
| Version 0 | Apr 15, 2009 | - | - New datasheet for general purpose and high capacitance X5R series with RoHS compliant - Replace the "6.3V to 50V" part of pdf files: UP-X5R_X7R_HighCaps_6.3-to-25V_11, UY-X5R_X7R_HighCaps_6.3-to-25V_11 - Combine 0201 from pdf files: UP-NP0X5RX7RY5V_0201_6.3-to-50V_2 and UY-NP0X5RX7RY5V_0201_6.3-to-50V_2 - Define global part number - Description of "Halogen free compliant" added - Test method and procedure updated |

Mouser Electronics

Authorized Distributor

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Yageo:

| | | | |
|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| CC0402KRX5R7BB104 | CC0402KRX5R6BB224 | CC0402KRX5R6BB104 | CC0402KRX5R5BB224 |
| CC0603KRX5R8BB474 | CC0603KRX5R8BB334 | CC0603KRX5R7BB474 | CC0603KRX5R6BB474 |
| CC0603KRX5R6BB334 | CC0805KKX5R6BB106 | CC0402KRX5R5BB105 | CC1812KKX5R7BB226 |
| CC1206KKX5R5BB106 | CC1206KKX5R7BB475 | CC1210KKX5R6BB226 | CC0805KKX5R6BB475 |
| CC0805KKX5R6BB225 | CC0603KRX5R6BB105 | CC1210MKX5R6BB226 | CC0603KRX5R5BB225 |
| CC0603KRX5R7BB105 | CC0805MKX5R5BB226 | CC0603KRX5R5BB106 | CC0201KRX5R5BB104 |
| CC0201KRX5R6BB103 | CC0201MRX5R5BB104 | CC0603KRX5R6BB224 | CC1210KKX5R7BB106 |
| CC0805KRX5R5BB106 | CC0603KRX5R5BB475 | CC0603MRX5R5BB106 | CC1206KKX5R8BB105 |
| CC1206MKX5R5BB106 | CC0805KRX5R6BB475 | CC1206KKX5R7BB225 | CC0402KPX5R6BB104 |
| CC0402KRX5R7BB224 | CC0402MRX5R5BB225 | CC0805KFX5R5BB106 | CC0805KKX5R6BB105 |
| CC0805KKX5R7BB106 | CC0805KKX5R8BB475 | CC0805KRX5R6BB225 | CC1206KKX5R6BB106 |
| CC1210KKX5R8BB106 | CC1210MKX5R9BB106 | CC1210MKX5R5BB107 | CC0201KRX5R5BB223 |
| CC0201KRX5R5BB224 | CC0201KRX5R5BB333 | CC0201KRX5R5BB473 | CC0201MRX5R5BB224 |
| CC0805KKX5R7BB475 | CC0201KPX5R5BB104 | CC0201KRX5R7BB103 | CC0201MRX5R5BB105 |
| CC0402KPX5R5BB105 | CC0402KPX5R5BB474 | CC0402KRX5R5BB154 | CC0402KRX5R5BB225 |
| CC0402KRX5R5BB334 | CC0402KRX5R6BB154 | CC0402KRX5R6BB474 | CC0402KRX5R6BB823 |
| CC0402KRX5R7BB105 | CC0402KRX5R7BB683 | CC0402KRX5R9BB681 | CC0402MRX5R5BB104 |
| CC0402MRX5R5BB224 | CC0402MRX5R6BB104 | CC0402MRX5R6BB105 | CC0402MRX5R6BB224 |
| CC0402MRX5R7BB104 | CC0603KPX5R6BB105 | CC0603KPX5R6BB225 | CC0603KPX5R7BB105 |
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| CC0603KRX5R7BB224 | CC0603KRX5R7BB334 | CC0603KRX5R7BB475 | CC0603KRX5R8BB224 |
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| CC0603MRX5R6BB225 | CC0603MRX5R6BB335 | CC0603MRX5R6BB474 | CC0603MRX5R6BB475 |
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| CC0402KRX5R5BB104 | CC0603KRX5R6BB225 | CC0603KRX5R6BB475 | CC0603KRX5R8BB105 |