

# DATA SHEET

## SURFACE-MOUNT CERAMIC EMI FILTER CAPACITORS

X2Y® Series  
6.3 V TO 100 V



## Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### DESCRIPTION

X2Y® series is a breakthrough in the design of ceramic multilayer products for decoupling and filtering in an IPD (integrated passive device).

X2Y® products comprise two identical Y-capacitors and one X-capacitor, integrated into a 4 terminal device, which is available in standard MLCC sizes. Thanks to the unique multilayer construction the device provides noise cancellation within the device, reducing ESL from nanohenry to picohenry levels.

Using the unique balance between the Y-capacitors and the shielded multilayer structure the X2Y® products offer superior decoupling and filtering.

The X2Y® device performs as a broadband filter enabling better EMC compliance for electrical equipment in a wide range of applications.

### FEATURES

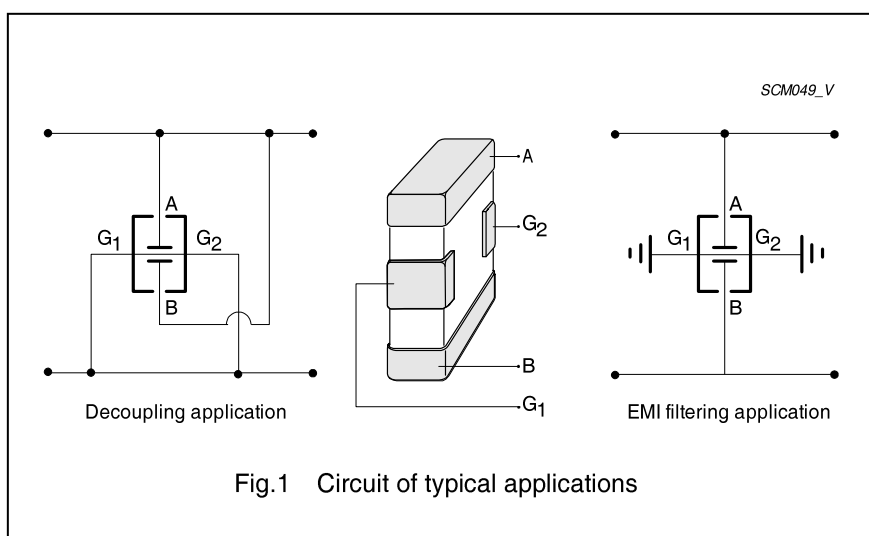
- **Broadband Filtering and Decoupling:** X2Y® is effective up to 10 GHz and frequencies beyond
- **Ultra Low ESL:** Noise cancellation within X2Y® makes ESL reducing from nanohenry to picohenry levels
- **Bypass:** Unlike feedthrough capacitors, X2Y® is in bypass, so no DC current limitations
- **Matched Y-caps:** Two tightly matched line to ground capacitors in one device
- **Superior Balance:** Temperature and voltage variations balanced of two Y-caps
- **Aging Reliability:** Aging effects are equal on two Y-caps

### BENEFITS

- **Fewer Component in Filtering:** One X2Y® can replace multiple inductors and/or capacitors
- **Superior Performance in Filtering:** One X2Y® can eliminate both differential and common mode noises
- **Fewer Component in Decoupling:** Up to 1:7 replacement of MLCC in power delivering system bypass networks
- **Superior Performance in Decoupling:** Large or small, X2Y® components exhibit ultra low ESL
- **Total Cost Savings:** Assembly cost savings through reduced component count and placement costs
- **Board Level Design Advantages:** Dramatically reduces via drills, which blocks routing

### APPLICATIONS

- EMI filtering on DC motors
- Filtered connectors (airbag connectors, RJ-45 connectors)
- High speed data-line filtering
- Decoupling of supply-lines in high speed digital circuits
- Broadband filtering.
- Amplifier decoupling and EMI suppression.
- IC Decoupling, on-package, on-PCB.
- DC power line filtering.
- Data line filtering.
- EMI suppression for DC motors.
- Sensors
- Audio



**Surface-mount ceramic  
EMI filter capacitors****X2Y® Series****QUICK REFERENCE DATA**

| DESCRIPTION                     | VALUE                                      |
|---------------------------------|--------------------------------------------|
| Materials                       | X7R / X5R                                  |
| Rated voltage                   |                                            |
| X7R                             | 10 V, 16 V, 25 V, 50 V / 63 V, 100 V (IEC) |
| X5R                             | 10 V                                       |
| Capacitance range (Y-capacitor) |                                            |
| X7R 0603 series                 | 1 nF to 330 nF                             |
| 0805 series                     | 1 nF to 180 nF                             |
| 1206 series                     | 10 nF to 470 nF                            |
| 1210 series                     | 100 nF to 1 $\mu$ F                        |
| X5R 0603 series                 | 180 nF to 470 nF                           |
| Tolerance on capacitance        | $\pm 20\%$ (M)                             |
| Test voltage (DC) for 1 minute  | $2.5 \times U_R$                           |
| Sectional specifications        | IEC 60384-10, second edition 1989-04       |
| Detailed specification          | based on IEC 60384-10-1                    |
| Climatic category (IEC 60068)   | X7R: 55 / 125 / 56                         |

# Surface-mount ceramic EMI filter capacitors

## X2Y® Series

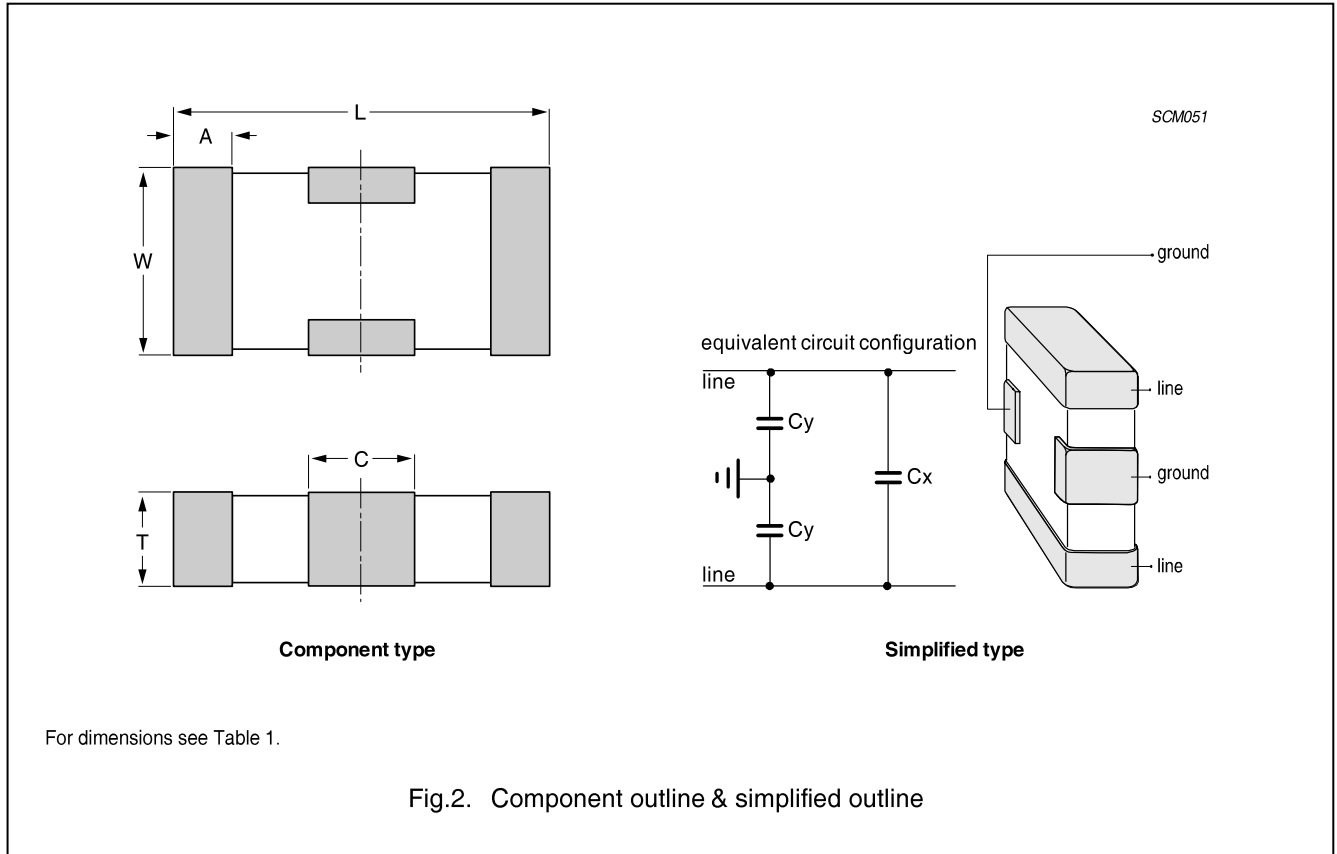
### GENERAL SELECTION CHART

| C         | X7R  |       |       |      | X5R  |
|-----------|------|-------|-------|------|------|
| (pF)      | 0603 | 0805  | 1206  | 1210 | 0603 |
| 1,000     | 100V | 100 V |       |      |      |
| 1,500     |      |       |       |      |      |
| 2,200     |      |       |       |      |      |
| 4,700     |      |       |       |      |      |
| 5,600     |      |       |       |      |      |
| 10,000    | 50 V | 50 V  | 100 V |      |      |
| 15,000    | 25 V |       |       |      |      |
| 18,000    |      |       |       |      |      |
| 22,000    |      |       |       |      |      |
| 39,000    | 16 V | 25 V  | 50 V  |      |      |
| 47,000    |      | 16 V  |       |      |      |
| 56,000    |      |       |       |      |      |
| 100,000   | 10 V | 10 V  | 50V   |      | 10 V |
| 180,000   |      |       |       |      |      |
| 220,000   |      |       |       |      |      |
| 270,000   |      | 16 V  |       |      |      |
| 330,000   |      |       |       |      |      |
| 390,000   |      |       | 10 V  |      |      |
| 470,000   |      | 10 V  |       |      |      |
| 560,000   |      |       |       |      |      |
| 820,000   |      |       | 16 V  |      |      |
| 1,000,000 |      |       |       |      |      |

# Surface-mount ceramic EMI filter capacitors

X2Y® Series

## MECHANICAL DATA



## Physical dimensions

**Table 1** Capacitor dimensions

| CASE SIZE                 | L            | W            | T     |       | A     |       | C            |
|---------------------------|--------------|--------------|-------|-------|-------|-------|--------------|
|                           |              |              | MIN.  | MAX.  | MIN.  | MAX.  |              |
| Dimensions in millimetres |              |              |       |       |       |       |              |
| 0603                      | 1.6 ±0.15    | 0.85 ±0.15   | 0.55  | 0.75  | 0.25  | 0.55  | 0.40 ±0.20   |
| 0805                      | 2.0 ±0.15    | 1.25 ±0.15   | 0.75  | 0.95  | 0.25  | 0.55  | 0.70 ±0.20   |
| 1206                      | 3.2 ±0.20    | 1.65 ±0.20   | 1.10  | 1.40  | 0.25  | 0.65  | 1.20 ±0.30   |
| 1210                      | 3.2 ±0.20    | 2.5 ±0.20    | 1.10  | 1.70  | 0.25  | 0.65  | 1.20 ±0.30   |
| Dimensions in inches      |              |              |       |       |       |       |              |
| 0603                      | 0.063 ±0.006 | 0.033 ±0.006 | 0.022 | 0.030 | 0.010 | 0.022 | 0.016 ±0.008 |
| 0805                      | 0.079 ±0.006 | 0.049 ±0.006 | 0.030 | 0.037 | 0.010 | 0.022 | 0.028 ±0.008 |
| 1206                      | 0.126 ±0.008 | 0.065 ±0.008 | 0.043 | 0.055 | 0.010 | 0.026 | 0.047 ±0.012 |
| 1210                      | 0.126 ±0.008 | 0.098 ±0.008 | 0.043 | 0.067 | 0.010 | 0.026 | 0.047 ±0.012 |

## Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### Electrical characteristics CHARACTERISTICS FOR X7R

#### Class 2 capacitors; X7R dielectric; Ni/Sn terminations

| DESCRIPTION                                                               | VALUE                                                                         |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Rated voltage $U_R$ (DC)                                                  | 10 V, 16 V, 25 V, 50 V/63 V, 100 V                                            |
| Capacitance range                                                         | 1 nF to 1 $\mu$ F                                                             |
| Capacitance tolerance                                                     | $\pm 20\%$                                                                    |
| Dissipation factor (D.F.); note 1<br>6.3 V<br>10 V<br>16 V<br>$\geq 25$ V | 6%<br>5%<br>3.5%<br>2.5%                                                      |
| Insulation resistance after 1 minute at $U_R$ (DC)                        | $R_{ins} \times C > 500$ seconds or $R_{ins} > 10G\Omega$ , whichever is less |
| Maximum capacitance change as a function of temperature                   | $\pm 15\%$                                                                    |
| Operating temperature range:<br>X7R                                       | $-55\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$               |
| Aging                                                                     | Typical 1% per time decade                                                    |

#### Note

1. Measured at  $20\text{ }^{\circ}\text{C}$ , 1 V and 1 KHz, using a four-gauge method.

### CHARACTERISTICS FOR X5R

#### Class 2 capacitors; X5R dielectric; Ni/Sn terminations

| DESCRIPTION                                             | VALUE                                                                         |
|---------------------------------------------------------|-------------------------------------------------------------------------------|
| Rated voltage $U_R$ (DC)                                | 6.3V, 10 V                                                                    |
| Capacitance range                                       | 180 nF to 470 nF                                                              |
| Capacitance tolerance                                   | $\pm 20\%$                                                                    |
| Dissipation factor (D.F.); note 1<br>6.3 V<br>10 V      | 10%<br>10%                                                                    |
| Insulation resistance after 1 minute at $U_R$ (DC)      | $R_{ins} \times C > 500$ seconds or $R_{ins} > 10G\Omega$ , whichever is less |
| Maximum capacitance change as a function of temperature | $\pm 15\%$                                                                    |
| Operating temperature range:<br>X5R                     | $-55\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$                |
| Aging                                                   | Typical 1% per time decade                                                    |

#### Note

1. Measured at  $20\text{ }^{\circ}\text{C}$ , 1 V and 1 KHz, using a four-gauge method.

# Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### SELECTION CHART FOR X7R SIZES 0603, 0805, 1206, 1210 AND ORDERING INFORMATION

| SIZE | Y-CAPACITOR  |                    | VOLTAGE<br>RATING<br>(V) | THICKNESS<br>(mm) | CTC ORDERING CODE | QUANTITY<br>PER REEL |
|------|--------------|--------------------|--------------------------|-------------------|-------------------|----------------------|
|      | CAP.<br>(nF) | TOLERANCE<br>( % ) |                          |                   |                   |                      |
| 0603 | 1            | 20%                | 100                      | 0.65              | CX0603MRX7R0BB102 | 4,000                |
|      | 1            | 20%                | 50                       | 0.65              | CX0603MRX7R9BB102 | 4,000                |
|      | 1            | 20%                | 16                       | 0.65              | CX0603MRX7R7BB102 | 4,000                |
|      | 1.5          | 20%                | 100                      | 0.65              | CX0603MRX7R0BB152 | 4,000                |
|      | 1.5          | 20%                | 50                       | 0.65              | CX0603MRX7R9BB152 | 4,000                |
|      | 2.2          | 20%                | 100                      | 0.65              | CX0603MRX7R0BB222 | 4,000                |
|      | 4.7          | 20%                | 100                      | 0.65              | CX0603MRX7R0BB472 | 4,000                |
|      | 5.6          | 20%                | 100                      | 0.65              | CX0603MRX7R0BB562 | 4,000                |
|      | 5.6          | 20%                | 50 / 63                  | 0.65              | CX0603MRX7R9BB562 | 4,000                |
|      | 10           | 20%                | 50 / 63                  | 0.65              | CX0603MRX7R9BB103 | 4,000                |
|      | 15           | 20%                | 25                       | 0.65              | CX0603MRX7R8BB153 | 4,000                |
|      | 18           | 20%                | 25                       | 0.65              | CX0603MRX7R8BB183 | 4,000                |
|      | 22           | 20%                | 25                       | 0.65              | CX0603MRX7R8BB223 | 4,000                |
|      | 39           | 20%                | 16                       | 0.65              | CX0603MRX7R7BB393 | 4,000                |
|      | 47           | 20%                | 16                       | 0.65              | CX0603MRX7R7BB473 | 4,000                |
|      | 56           | 20%                | 16                       | 0.65              | CX0603MRX7R7BB563 | 4,000                |
|      | 100          | 20%                | 10                       | 0.65              | CX0603MRX7R6BB104 | 4,000                |
|      | 180          | 20%                | 10                       | 0.65              | CX0603MRX7R6BB184 | 4,000                |
|      | 220          | 20%                | 10                       | 0.65              | CX0603MRX7R6BB224 | 4,000                |
|      | 270          | 20%                | 10                       | 0.65              | CX0603MRX7R6BB274 | 4,000                |
|      | 330          | 20%                | 10                       | 0.65              | CX0603MRX7R6BB334 | 4,000                |
| 0805 | 1            | 20%                | 100                      | 0.85              | CX0805MRX7R0BB102 | 4,000                |
|      | 1            | 20%                | 50                       | 0.85              | CX0805MRX7R9BB102 | 4,000                |
|      | 1.5          | 20%                | 100                      | 0.85              | CX0805MRX7R0BB152 | 4,000                |
|      | 2.2          | 20%                | 100                      | 0.85              | CX0805MRX7R0BB222 | 4,000                |
|      | 4.7          | 20%                | 100                      | 0.85              | CX0805MRX7R0BB472 | 4,000                |
|      | 10           | 20%                | 100                      | 0.85              | CX0805MRX7R0BB103 | 4,000                |
|      | 15           | 20%                | 50                       | 0.85              | CX0805MRX7R9BB153 | 4,000                |
|      | 18           | 20%                | 50                       | 0.85              | CX0805MRX7R9BB183 | 4,000                |
|      | 22           | 20%                | 50                       | 0.85              | CX0805MRX7R9BB223 | 4,000                |
|      | 22           | 20%                | 50                       | 0.85              | CX0805MRX7R8BB223 | 4,000                |
|      | 47           | 20%                | 16                       | 0.85              | CX0805MRX7R7BB473 | 4,000                |
|      | 56           | 20%                | 16                       | 0.85              | CX0805MRX7R7BB563 | 4,000                |
|      | 100          | 20%                | 16                       | 0.85              | CX0805MRX7R7BB104 | 4,000                |
|      | 180          | 20%                | 10                       | 0.85              | CX0805MRX7R6BB184 | 4,000                |

**Surface-mount ceramic  
EMI filter capacitors**
**X2Y® Series**

| SIZE | Y-CAPACITOR  |                  | VOLTAGE<br>RATING<br>(V) | THICKNESS<br>(mm) | CTC ORDERING CODE | QUANTITY<br>PER REEL |
|------|--------------|------------------|--------------------------|-------------------|-------------------|----------------------|
|      | CAP.<br>(nF) | TOLERANCE<br>(%) |                          |                   |                   |                      |
| 1206 | 10           | 20%              | 100                      | 1.2               | CX1206MKX7R0BB103 | 3,000                |
|      | 15           | 20%              | 100                      | 1.2               | CX1206MKX7R0BB153 | 3,000                |
|      | 15           | 20%              | 50                       | 1.2               | CX1206MKX7R9BB153 | 3,000                |
|      | 18           | 20%              | 100                      | 1.2               | CX1206MKX7R0BB183 | 3,000                |
|      | 22           | 20%              | 100                      | 1.2               | CX1206MKX7R0BB223 | 3,000                |
|      | 33           | 20%              | 100                      | 1.2               | CX1206MKX7R0BB333 | 3,000                |
|      | 39           | 20%              | 50                       | 1.2               | CX1206MKX7R9BB393 | 3,000                |
|      | 47           | 20%              | 50                       | 1.2               | CX1206MKX7R9BB473 | 3,000                |
|      | 56           | 20%              | 50                       | 1.2               | CX1206MKX7R9BB563 | 3,000                |
|      | 100          | 20%              | 50                       | 1.2               | CX1206MKX7R9BB104 | 3,000                |
|      | 180          | 20%              | 16                       | 1.2               | CX1206MKX7R7BB184 | 3,000                |
|      | 220          | 20%              | 16                       | 1.2               | CX1206MKX7R7BB224 | 3,000                |
|      | 270          | 20%              | 16                       | 1.2               | CX1206MKX7R7BB274 | 3,000                |
|      | 330          | 20%              | 16                       | 1.2               | CX1206MKX7R7BB334 | 3,000                |
|      | 390          | 20%              | 16                       | 1.2               | CX1206MKX7R7BB394 | 3,000                |
|      | 470          | 20%              | 10                       | 1.2               | CX1206MKX7R6BB474 | 3,000                |
| 1210 | 100          | 20%              | 50                       | 1.6               | CX1210MKX7R9BB104 | 2,000                |
|      | 180          | 20%              | 50                       | 1.6               | CX1210MKX7R9BB184 | 2,000                |
|      | 220          | 20%              | 50                       | 1.6               | CX1210MKX7R9BB224 | 2,000                |
|      | 270          | 20%              | 50                       | 1.6               | CX1210MKX7R9BB274 | 2,000                |
|      | 330          | 20%              | 50                       | 1.6               | CX1210MKX7R9BB334 | 2,000                |
|      | 390          | 20%              | 50                       | 1.6               | CX1210MKX7R9BB394 | 2,000                |
|      | 470          | 20%              | 50                       | 1.6               | CX1210MKX7R9BB474 | 2,000                |
|      | 470          | 20%              | 25                       | 1.6               | CX1210MKX7R8BB474 | 2,000                |
|      | 560          | 20%              | 50                       | 1.6               | CX1210MKX7R9BB564 | 2,000                |
|      | 560          | 20%              | 25                       | 1.6               | CX1210MKX7R8BB564 | 2,000                |
|      | 820          | 20%              | 16                       | 1.6               | CX1210MKX7R7BB824 | 2,000                |
|      | 1000         | 20%              | 16                       | 1.6               | CX1210MKX7R7BB105 | 2,000                |



# Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### SELECTION CHART FOR X5R SIZES 0603 <sup>(1)</sup>

| SIZE | Y-CAPACITOR  |                    | VOLTAGE<br>RATING<br>(V) | THICKNESS<br>(mm) | CTC ORDERING CODE | QUANTITY<br>PER REEL |
|------|--------------|--------------------|--------------------------|-------------------|-------------------|----------------------|
|      | CAP.<br>(nF) | TOLERANCE<br>( % ) |                          |                   |                   |                      |
| 0603 | 180          | 20%                | 10                       | 0.65              | CX0603MRX5R6BB184 | 4,000                |
|      | 220          | 20%                | 10                       | 0.65              | CX0603MRX5R6BB224 | 4,000                |
|      | 270          | 20%                | 10                       | 0.65              | CX0603MRX5R6BB274 | 4,000                |
|      | 330          | 20%                | 10                       | 0.65              | CX0603MRX5R6BB334 | 4,000                |
|      | 390          | 20%                | 10                       | 0.65              | CX0603MRX5R6BB394 | 4,000                |
|      | 470          | 20%                | 10                       | 0.65              | CX0603MRX5R6BB474 | 4,000                |
|      | 470          | 20%                | 10                       | 0.65              | CX0603MRX5R5BB474 | 4,000                |

#### Notes

- Other values are available on request.

### THICKNESS CLASSIFICATION AND PACKING QUANTITIES FOR X7R

| THICKNESS<br>CLASSIFICATION<br>(mm) | QUANTITY PER REEL |         |               |         |
|-------------------------------------|-------------------|---------|---------------|---------|
|                                     | 8 mm TAPE WIDTH   |         |               |         |
|                                     | Ø 180 mm; 7"      |         | Ø 330 mm; 13" |         |
|                                     | 0603 - 1210       |         |               |         |
|                                     | PAPER             | BLISTER | PAPER         | BLISTER |
| 0.65 ±0.1                           | 4,000             |         |               |         |
| 0.85 ±0.1                           | 4,000             |         |               |         |
| 1.2 ±0.15                           | —                 | 3,000   |               |         |
| 1.6 ±0.15                           | —                 | 2,000   |               |         |

# Surface-mount ceramic EMI filter capacitors

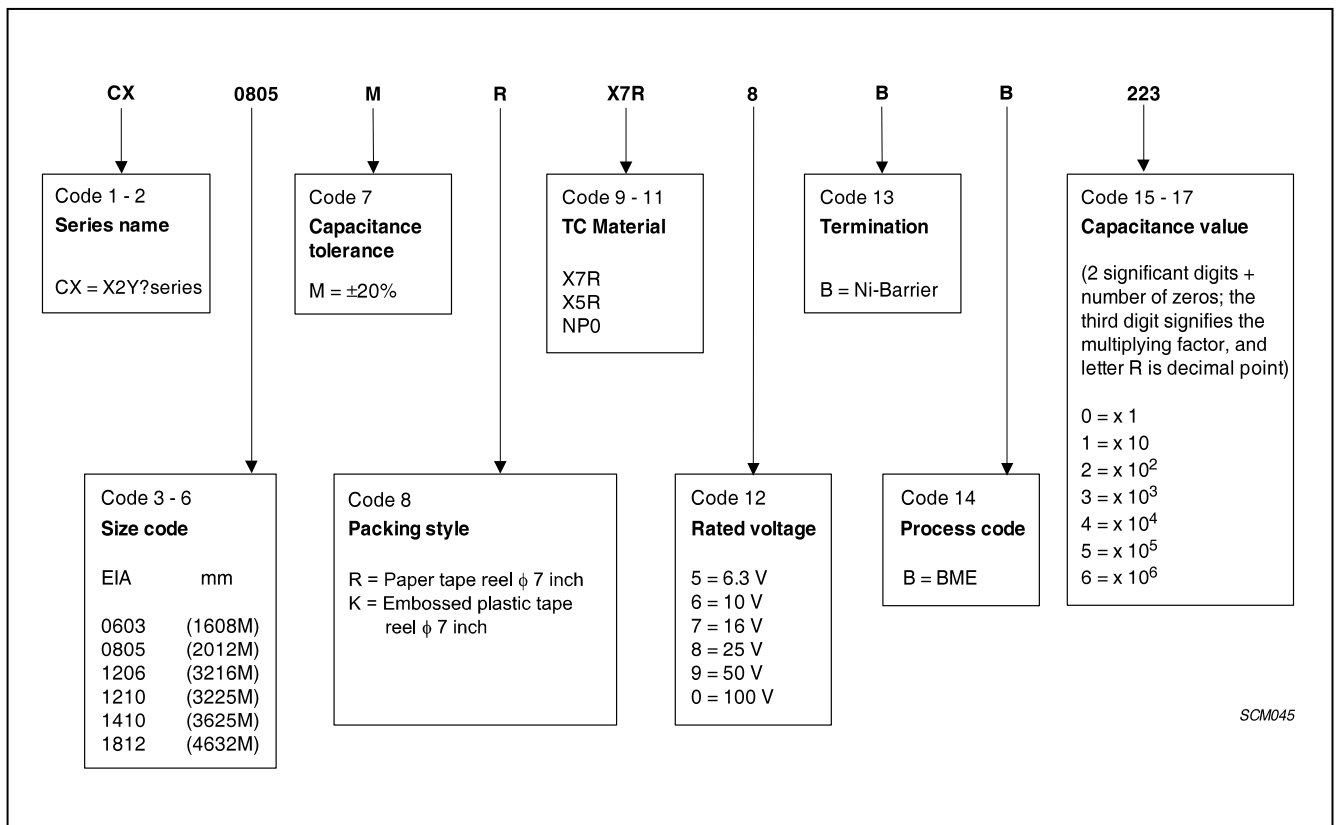
## X2Y® Series

### ORDERING INFORMATION

Components may be ordered by using either a Yageo part number or Phycomp's unique 12NC.

**Ordering code: Yageo part number**

**Example: CX0805MRX7R8BB223**



# Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### RECOMMENDED DIMENSIONS OF SOLDER LANDS

**Table 3** Reflow soldering

| CASE SIZE<br>(EIA) | Footprint dimensions<br>(mm) |      |      |      |      | Placement<br>Accuracy<br>(mm) |
|--------------------|------------------------------|------|------|------|------|-------------------------------|
|                    | A                            | B    | C    | D    | E    |                               |
| 0603               | 2.30                         | 0.76 | 0.64 | 0.51 | 1.52 | ±0.20                         |
| 0805               | 3.05                         | 1.27 | 0.89 | 0.56 | 2.03 | ±0.20                         |
| 1206               | 4.06                         | 1.65 | 1.00 | 1.02 | 3.05 | ±0.25                         |
| 1210               | 4.57                         | 2.55 | 1.00 | 1.14 | 4.06 | ±0.25                         |

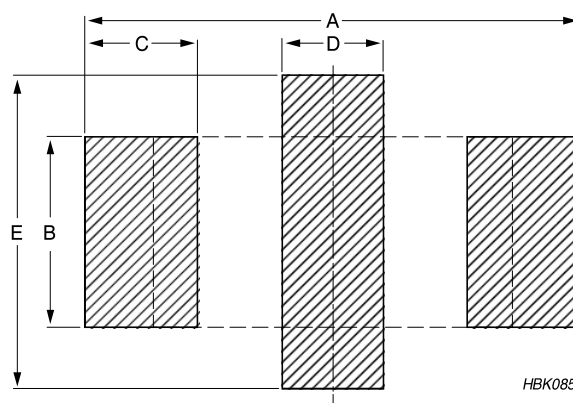


Fig.3 Recommended dimensions of solder lands

# Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### MEASUREMENT SETUP

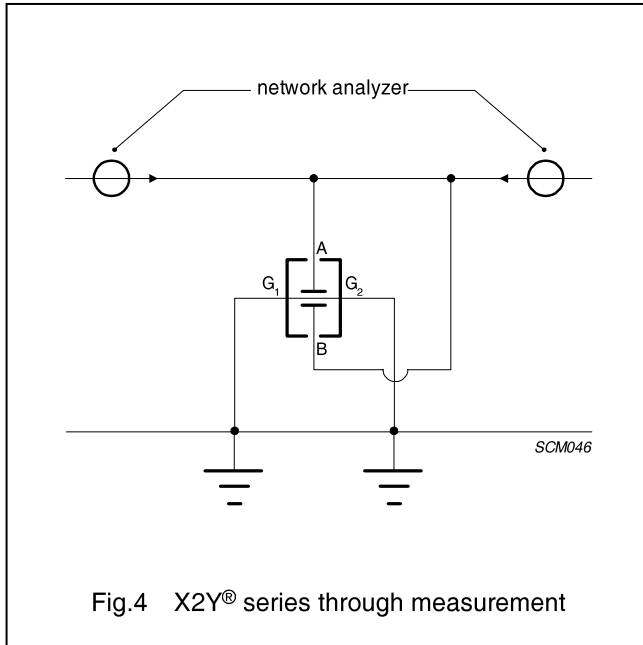


Fig.4 X2Y® series through measurement

- X2Y® are soldered on a printed circuit board
- PCB: FR-4 substrate, with 50  $\Omega$  microstrip line
- Network Analyzer: Agilent E5071b
- Calibration: full 2-port calibration with 85033E kit

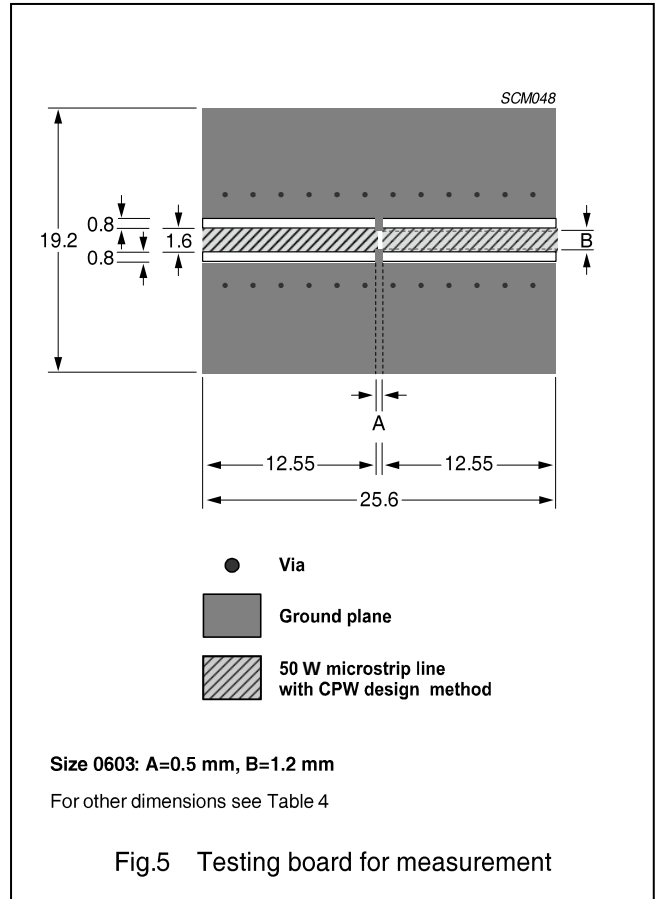


Fig.5 Testing board for measurement

**Table 4** Recommended dimensions of measurement

| CASE SIZE | A (mm)         | B (mm)         |
|-----------|----------------|----------------|
| 0603      | 0.5 $\pm$ 0.10 | 1.2 $\pm$ 0.10 |
| 0805      | 0.8 $\pm$ 0.10 | 1.6 $\pm$ 0.10 |
| 1206      | 1.2 $\pm$ 0.10 | 2.8 $\pm$ 0.15 |
| 1210      | 2.1 $\pm$ 0.15 | 2.8 $\pm$ 0.15 |

# Surface-mount ceramic EMI filter capacitors

X2Y® Series

## TESTS AND REQUIREMENTS

Table 5 Test procedures and requirements

| IEC 60384-10/<br>CECC 32 100<br>CLAUSE | IEC<br>60068-2 | TEST                                  | PROCEDURE                                                                                                                                                                                                              | REQUIREMENTS                      |
|----------------------------------------|----------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
|                                        | TEST<br>METHOD |                                       |                                                                                                                                                                                                                        |                                   |
| 4.4                                    |                | mounting                              | the capacitors may be mounted on printed-circuit boards or ceramic substrates by applying reflow soldering (including vapor phase soldering) or conductive adhesive                                                    | no visible damage                 |
| 4.5                                    |                | visual inspection and dimension check | any applicable method using $\times 10$ magnification                                                                                                                                                                  | in accordance with specification  |
| 4.6.1                                  |                | capacitance                           | Class 1: $\leq 1000$ pF; $f = 1$ MHz<br>$>1000$ pF; $f = 1$ kHz NP0: measuring voltage 1 V at 20 °C<br>Class 2: For all capacitors $f = 1$ kHz X7R: measuring voltage 1 V at 20 °C Y5V: measuring voltage 1 V at 25 °C | within specified tolerance        |
| 4.6.2                                  |                | $\tan \delta$                         | Class 1: $\leq 1000$ pF; $f = 1$ MHz<br>$>1000$ pF; $f = 1$ kHz NP0: measuring voltage 1 V at 20 °C<br>Class 2: For all capacitors $f = 1$ kHz X7R: measuring voltage 1 V at 20 °C Y5V: measuring voltage 1 V at 25 °C | in accordance with specifications |
| 4.6.3                                  |                | insulation resistance                 | at UR (DC) for 1 minute                                                                                                                                                                                                | in accordance with specification  |
| 4.6.4                                  |                | voltage proof                         | $2.5 \times UR$ for 1 minute                                                                                                                                                                                           | no breakdown or flashover         |
| 4.7.1                                  |                | temperature characteristic            | Between minimum and maximum temperature                                                                                                                                                                                | in accordance with specification  |
| 4.8                                    |                | adhesion                              | a force of 5 N applied for 10 s to the line joining the terminations and in a plane parallel to the substrate                                                                                                          | no visible damage                 |

# Surface-mount ceramic EMI filter capacitors

## X2Y® Series

Table 5 Test procedures and requirements (continued)

| IEC 60384-10/<br>CECC 32 100<br>CLAUSE | IEC<br>60068-2 | TEST                                       | PROCEDURE                                                                                                                                                                                                     | REQUIREMENTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------|----------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        | TEST<br>METHOD |                                            |                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 4.9                                    |                | bond strength<br>of plating on<br>end face | mounted in accordance with<br>CECC 32 100, paragraph 4.4                                                                                                                                                      | no visible damage                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                        |                |                                            | conditions: bending 1 mm at a<br>rate of 1 mm/s, radius jig 340<br>mm                                                                                                                                         | $\Delta C/C$ : class 1: within $\pm 10\%$<br>class 2, X7R: within $\pm 10\%$<br>class 2, Y5V: within $\pm 30\%$                                                                                                                                                                                                                                                                                                                                                                             |
| 4.10                                   | Tb             | resistance to<br>soldering heat            | Precondition: 120 to 150 °C<br>for 1 minute; 260 $\pm 5$ °C for 10<br>$\pm 0.5$ s in a static solder bath                                                                                                     | the terminations shall be well<br>tinned after recovery $\Delta C/C$ :<br>class 1: within $\pm 0.5\%$ or 0.5<br>pF whichever is greater class<br>2, X7R: $> -5\%$ and $\leq 10\%$<br>class 2, Y5V: $> -10\%$ and<br>$\leq 20\%$                                                                                                                                                                                                                                                             |
|                                        |                | resistance to<br>leaching                  | 260 $\pm 5$ °C for 30 $\pm 1$ s in a<br>static solder bath                                                                                                                                                    | using visual enlargement of<br>$\times 10$ , dissolution of the<br>terminations shall not exceed<br>10%                                                                                                                                                                                                                                                                                                                                                                                     |
| 4.11                                   | Ta             | solderability                              | zero hour test, and test after<br>storage (20 to 24 months) in<br>original packing in normal<br>atmosphere; unmounted<br>chips completely immersed<br>for 2 $\pm 0.5$ s in a solder bath at<br>235 $\pm 5$ °C | the terminations shall be well<br>tinned                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 4.12                                   | Na             | rapid change of<br>temperature             | Preconditioning, class 2 only;<br>NP0 / X7R: $-55$ to $+125$ °C; 5<br>cycles Y5V: $-25$ to $+85$ °C; 5<br>cycles                                                                                              | no visual damage after 48<br>hours recovery; $\Delta C/C$ : class<br>1: within $\pm 1\%$ or 1 pF class 2,<br>X7R: within $\pm 15\%$ class 2,<br>Y5V: within $\pm 20\%$                                                                                                                                                                                                                                                                                                                      |
| 4.15                                   |                | Endurance                                  | Pre-conditioning, class 2 only:<br>1000 hours at upper category<br>temperature at: $1.5 \times UR$                                                                                                            | no visual damage after 24<br>hours recovery: $\Delta C/C$ : class<br>1: within $\pm 2\%$ or 1 pF,<br>whichever is greater class 2,<br>X7R: within $\pm 20\%$ class 2,<br>Y5V: within $+30/-40\%$ $\tan \delta$ :<br>class 1: $\leq 2 \times$ specified value<br>class 2: X7R: $\leq 7\%$ class 2:<br>Y5V: $\leq 15\%$ Rins: class 1:<br>4000 M $\Omega$ or Rins $\times CR \geq 40$<br>s, whichever is less class 2:<br>2000 M $\Omega$ or Rins $\times CR \geq 50$<br>s, whichever is less |

**Surface-mount ceramic  
EMI filter capacitors****X2Y® Series****REVISION HISTORY**

| Revision | Date         | Change Notification | Description                                                                                                                                   |
|----------|--------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Rev.5    | 2001 Sep 25  | -                   | - Published on web                                                                                                                            |
| Rev.6    | 2002 Jul 10  | -                   | - Product range extended in all materials and sizes;<br>- Insertion loss measurements added.                                                  |
| Rev.7    | 2003 Apr 02  | -                   | - Updated company logo                                                                                                                        |
| Rev.8    | 2003 Jul 23  | -                   | - Cover page revised                                                                                                                          |
| Rev.9    | 2003 Sep 09  | -                   | - Cover page corrected                                                                                                                        |
| Rev.10   | 2004 Apr 21  | -                   | - Product range updated<br>- NP0, Y5V and size 1812 removed.                                                                                  |
| Rev.11   | 2006 Nov 21  | -                   | - Size 1410 extended<br>- Product applications, features and benefits update<br>- Measurement setup added<br>- Updated tests and requirements |
| Rev.12   | 2006 Dec 22  | -                   | - 12 NC revised                                                                                                                               |
| Rev.13   | 2008 Nov 10  | -                   | - Product range extended in materials of NP0 and X5R                                                                                          |
| Rev. 14  | 2013 June 27 |                     | - Rev.14 : Product range extended on NPO 0606 and 0805                                                                                        |
| Rev. 15  | 2016 July 25 |                     | - Product range extended on X7R                                                                                                               |