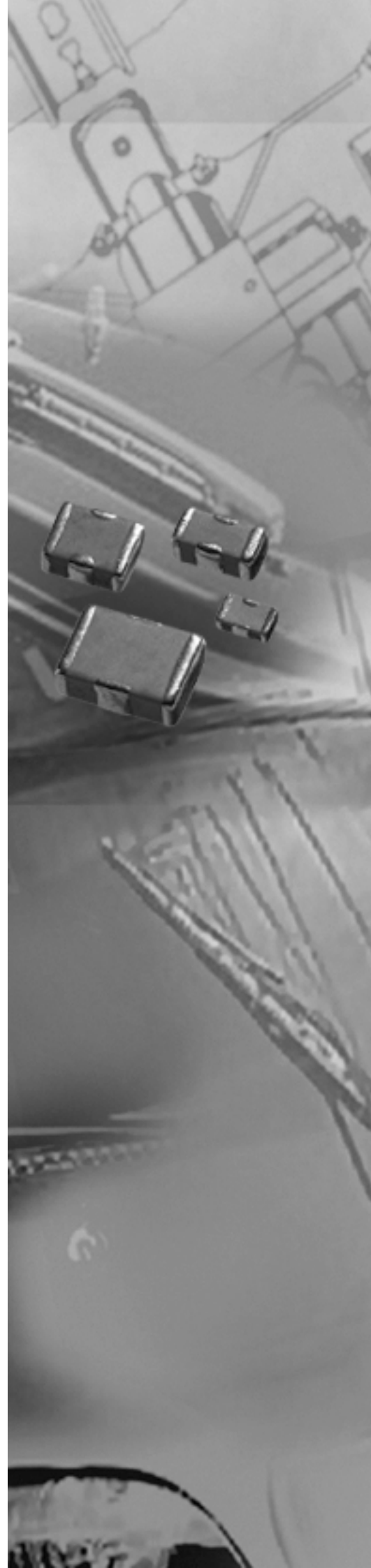


# DATA SHEET

## SURFACE-MOUNT CERAMIC EMI FILTER CAPACITORS

X2Y® Series  
10 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

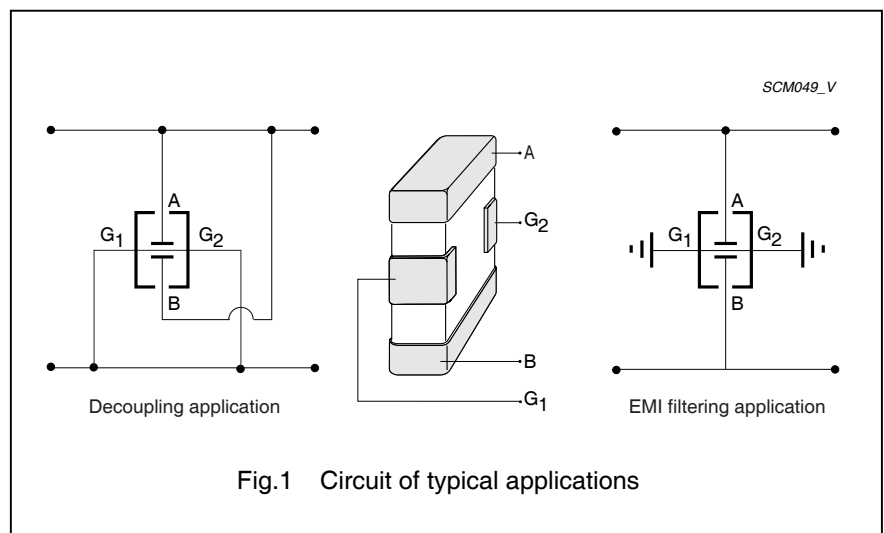
- **Broadband Filtering and Decoupling:** X2Y® is effective up to 10 GHz and frequencies beyond
- **Ultra Low ESL:** Noise cancellation within X2Y® makes ESL reducing from nanohenry to picohenry levels
- **Bypass:** Unlike feedthrough capacitors, X2Y® is in bypass, so no DC current limitations
- **Matched 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<sup>®</sup> Series

### QUICK REFERENCE DATA

DESCRIPTION	VALUE
Materials	X7R
Rated voltage	10 V, 16 V, 25 V, 50/63 V, 100 V (IEC)
Capacitance range (Y-capacitor):	
0603 series	1.5 nF to 100 nF
0805 series	4.7 nF to 180 nF
1206 series	22 nF to 820 nF
1210 series	47 nF to 1 $\mu$ F
1410 series	390 nF
Tolerance on capacitance	$\pm 20\%$
Test voltage (DC) for 1 minute	$2.5 \times U_r$
Sectional specifications	IEC 60384-10, second edition 1989-04; also based on CECC 32 100
Detailed specification	based on CECC 32 101-801
Climatic category (IEC 60068)	X7R: 55/125/56

# Surface-mount ceramic EMI filter capacitors

## X2Y® Series

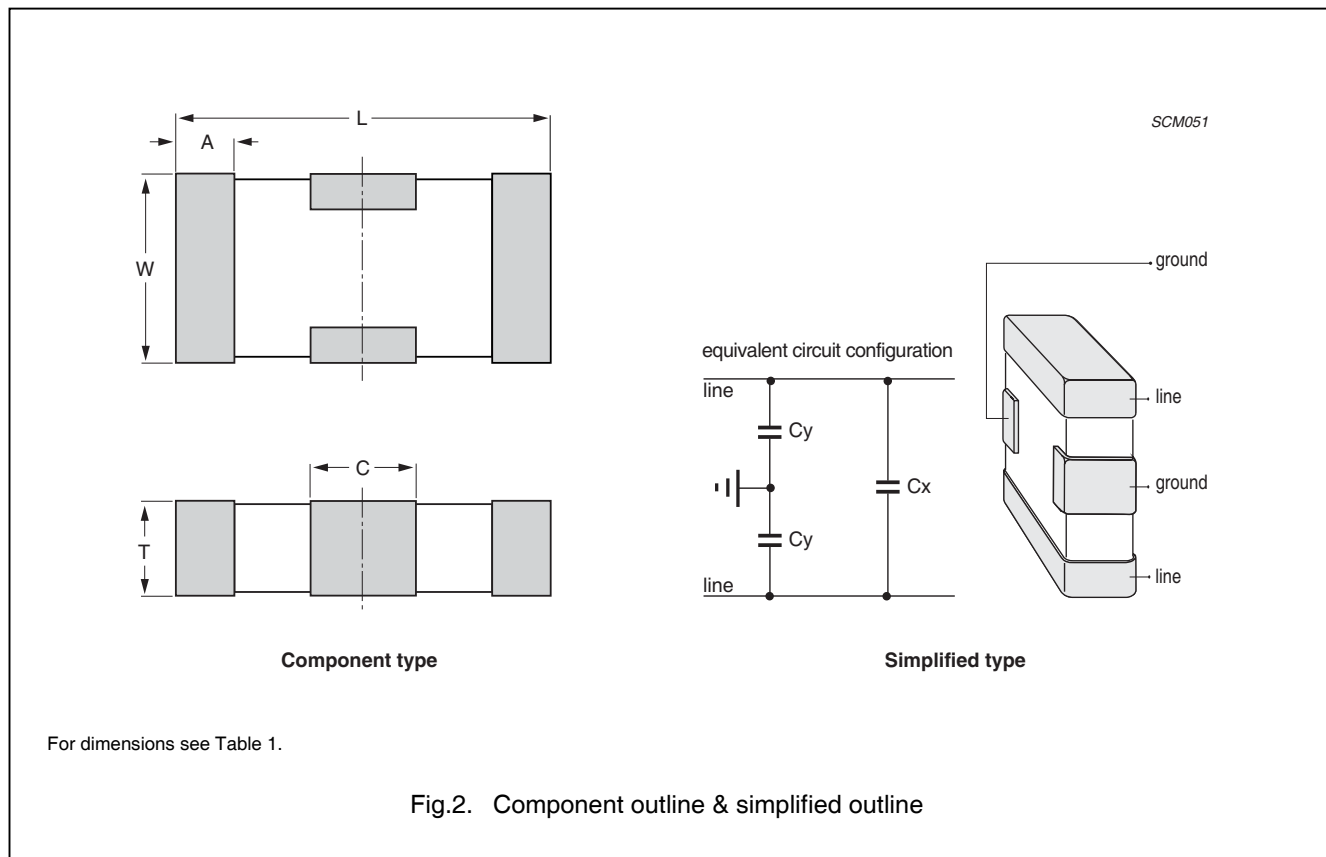
### GENERAL SELECTION CHART

C (pF)	X7R					
	0603	0805	1206	1210	1410	
10						
22						
47						
100						
220						
330						
1,500	100 V					
2,200						
4,700						
5,600		100 V				
10,000	50 V/63 V					
15,000	25 V	50 V/63 V	100 V			
18,000						
22,000			25 V			
39,000	16 V		50 V/63 V			
47,000					100 V	
56,000				16 V		
100,000	10 V			50 V/63 V		
180,000		10 V	25 V			
220,000			16 V			
270,000						
330,000					25 V	
390,000						50 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.	
<b>Dimensions in millimetres</b>							
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
1410	3.56 ±0.20	2.5 ±0.20	1.10	1.50	0.25	0.65	1.20 ±0.30
<b>Dimensions in inches</b>							
0603	0.063 ±0.006	0.032 ±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
1410	0.140 ±0.008	0.098 ±0.008	0.043	0.059	0.010	0.026	0.047 ±0.012

## Surface-mount ceramic EMI filter capacitors

## X2Y<sup>®</sup> Series

### ELECTRICAL CHARACTERISTICS FOR X7R

#### Class 2 capacitors; X7R dielectric; NiSn terminations

Unless otherwise stated all electrical values apply at an ambient temperature of  $20 \pm 1$  °C, an atmospheric pressure of 86 to 106 kPa, and a relative humidity of 63 to 67%.

DESCRIPTION	VALUE
Rated voltage $U_r$ (DC)	10 V, 16 V, 25 V, 50 V/63 V and 100 V
Capacitance range	1.5 nF to 1 $\mu$ F
Tolerance on capacitance after 1,000 hours	$\pm 20\%$
Dissipation factor (D.F.); note 1	
10 V	5%
16 V	3.5%
$\geq 25$ V	2.5%
Insulation resistance after 1 minute at $U_r$ (DC)	$R_{ins} \times C > 500$ seconds
Maximum capacitance change as a function of temperature	$\pm 15\%$
Aging	Typical 1% per time decade

#### Note

1. Measured at 20 °C, 1 V and 1 MHz, using a four-gauge method.

## Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### SELECTION CHART FOR X7R SIZES 0603, 0805, 1206 <sup>(1)</sup>

SIZE	Y-CAPACITOR		X-CAPACITOR		THICKNESS (mm)	CTC ORDERING CODE <sup>(2) (3)</sup>
	CAP. (nF)	VOLTAGE RATING (V)	CAP. (nF)	VOLTAGE RATING (V)		
0603	1.5	100	0.75	200	0.60	CX 0603 MR X7R 0BB 152
	2.2	100	1.1	200	0.60	CX 0603 MR X7R 0BB 222
	4.7	100	2.4	200	0.60	CX 0603 MR X7R 0BB 472
	5.6	100	2.8	200	0.60	CX 0603 MR X7R 0BB 562
	10	50 / 63	5	100	0.60	CX 0603 MR X7R 9BB 103
	22	25	11	50	0.60	CX 0603 MR X7R 8BB 223
	47	16	24	32	0.60	CX 0603 MR X7R 7BB 473
	56	16	28	32	0.60	CX 0603 MR X7R 7BB 563
	100	10	50	20	0.60	CX 0603 MR X7R 6BB 104
0805	4.7	100	24	200	0.85	CX 0805 MR X7R 0BB 472
	10	100	5	200	0.85	CX 0805 MR X7R 0BB 103
	15	50 / 63	8	100	0.85	CX 0805 MR X7R 9BB 153
	18	50 / 63	9	100	0.85	CX 0805 MR X7R 9BB 183
	22	25	11	50	0.85	CX 0805 MR X7R 8BB 223
	39	25	20	50	0.85	CX 0805 MR X7R 8BB 393
	47	16	24	32	0.85	CX 0805 MR X7R 7BB 473
	100	16	50	32	0.85	CX 0805 MR X7R 7BB 104
	180	10	90	20	0.85	CX 0805 MR X7R 7BB 184
1206	22	100	11	200	1.20	CX 1206 MK X7R 0BB 223
	47	50 / 63	24	100	1.20	CX 1206 MK X7R 9BB 473
	100	50 / 63	50	100	1.20	CX 1206 MK X7R 9BB 104
	180	25	90	50	1.20	CX 1206 MK X7R 8BB 184
	220	16	110	32	1.20	CX 1206 MK X7R 7BB 224
	390	16	195	32	1.20	CX 1206 MK X7R 7BB 394
	470	10	235	20	1.20	CX 1206 MK X7R 6BB 474
	820	10	410	20	1.20	CX 1206 MK X7R 6BB 824

#### Notes

1. Other values available on request.
2. Ordering codes for preferred versions ( $\pm 20\%$  tolerance, 180 mm reel). For other packing and tolerance see section "Ordering Code Information".
3. For 12NC ordering codes see Table 2.

## Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### SELECTION CHART FOR X7R SIZES 1210, 1410 <sup>(1)</sup>

SIZE	Y-CAPACITOR		X-CAPACITOR		THICKNESS (mm)	CTC ORDERING CODE <sup>(2) (3)</sup>
	CAP. (nF)	VOLTAGE RATING (V)	CAP. (nF)	VOLTAGE RATING (V)		
1210	47	100	24	200	1.20	CX 1210 MK X7R 0BB 473
	100	50 / 63	50	100	1.20	CX 1210 MK X7R 9BB 104
	220	50 / 63	110	100	1.60	CX 1210 MK X7R 9BB 224
	470	25	235	50	1.60	CX 1210 MK X7R 8BB 474
	560	25	280	50	1.90	CX 1210 MK X7R 8BB 564
	820	16	410	32	1.60	CX 1210 MK X7R 7BB 824
	1.000	16	500	32	1.60	CX 1210 MK X7R 7BB 105
1410	390	50	195	100	1.30	CX 1410 MK X7R 9BB 394

#### Notes

- Other values available on request.
- Ordering codes for preferred versions ( $\pm 20\%$  tolerance, 180 mm reel). For other packing and tolerance see section "Ordering Code Information".
- For 12NC ordering codes see Table 2.

#### Thickness classification and packing quantities for X7R

THICKNESS CLASSIFICATION (mm)	QUANTITY PER REEL	
	8 mm TAPE WIDTH	
	Ø180 mm; 7"	
	PAPER	BLISTER
0.6 $\pm$ 0.1	4,000	–
0.85 $\pm$ 0.1	4,000	–
1.2 $\pm$ 0.15	–	2,500
1.6 $\pm$ 0.15	–	2,500
1.9 $\pm$ 0.2	–	2,500



## 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.

**Table 2** Conversion table for Yageo part number and 12NC code

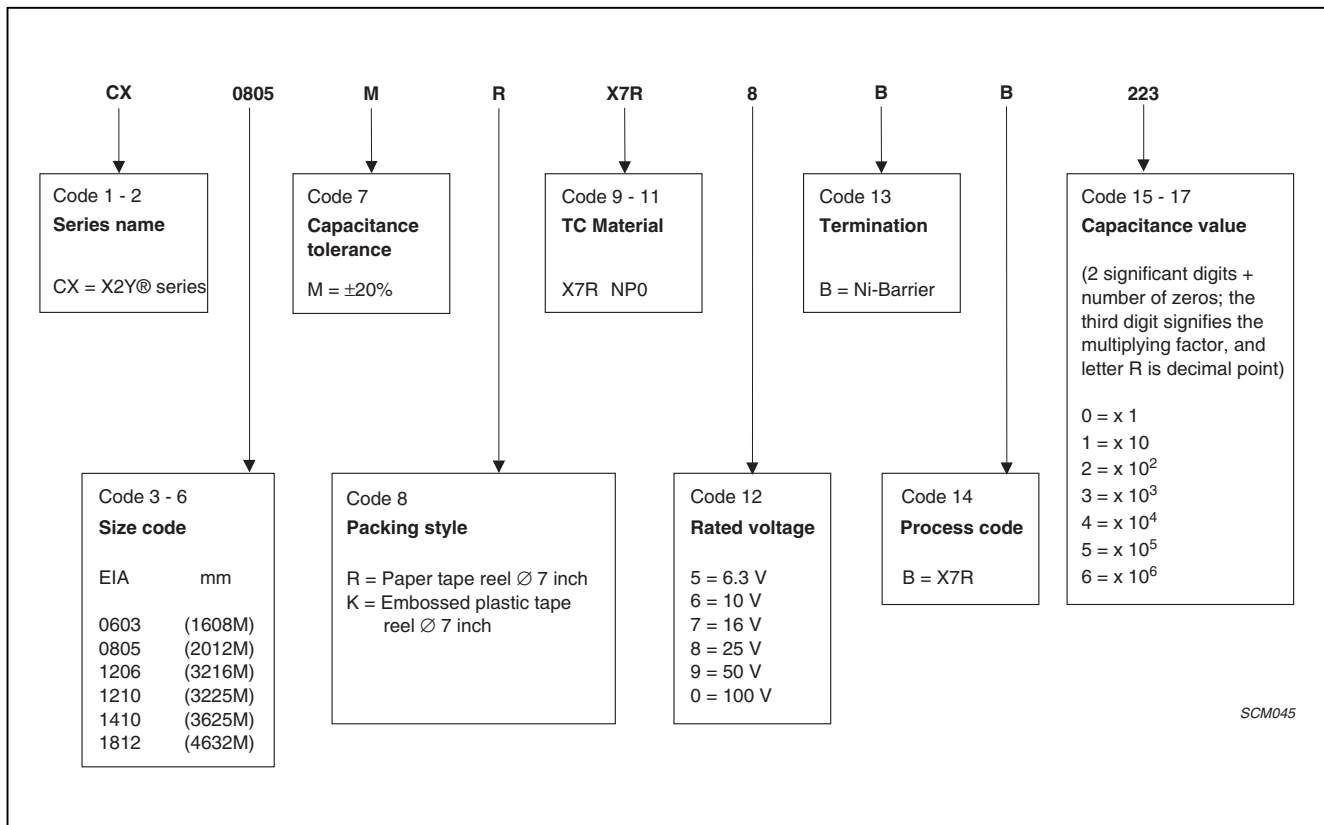
TC	SIZE	CAP. VALUE	CAP. TOLERANCE	RATED VOLTAGE (V)	CTC ORDERING CODE	12NC ORDERING CODE	QUANTITY PER REEL
		Y-CAP	Y-CAP	Y-CAP			
X7R	0603	1.5 nF	±20%	100	CX 0603 MR X7R 0BB 152	2259 096 15725	4,000
X7R	0603	2.2 nF	±20%	100	CX 0603 MR X7R 0BB 222	2259 096 15727	4,000
X7R	0603	4.7 nF	±20%	100	CX 0603 MR X7R 0BB 472	2259 096 15732	4,000
X7R	0603	5.6 nF	±20%	100	CX 0603 MR X7R 0BB 562	2259 096 15733	4,000
X7R	0603	10 nF	±20%	50 / 63	CX 0603 MR X7R 9BB 103	2259 086 15736	4,000
X7R	0603	22 nF	±20%	25	CX 0603 MR X7R 8BB 223	2259 076 15741	4,000
X7R	0603	47 nF	±20%	16	CX 0603 MR X7R 7BB 473	2259 066 15745	4,000
X7R	0603	56 nF	±20%	16	CX 0603 MR X7R 7BB 563	2259 066 15746	4,000
X7R	0603	100 nF	±20%	10	CX 0603 MR X7R 6BB 104	2259 056 15749	4,000
X7R	0805	4.7 nF	±20%	100	CX 0805 MR X7R 0BB 472	2259 090 15732	4,000
X7R	0805	10 nF	±20%	100	CX 0805 MR X7R 0BB 103	2259 090 15736	4,000
X7R	0805	15 nF	±20%	50 / 63	CX 0805 MR X7R 9BB 153	2259 080 15738	4,000
X7R	0805	18 nF	±20%	50 / 63	CX 0805 MR X7R 9BB 183	2259 080 15739	4,000
X7R	0805	22 nF	±20%	25	CX 0805 MR X7R 8BB 223	2259 070 15741	4,000
X7R	0805	39 nF	±20%	25	CX 0805 MR X7R 8BB 393	2259 070 15744	4,000
X7R	0805	47 nF	±20%	16	CX 0805 MR X7R 7BB 473	2259 060 15745	4,000
X7R	0805	100 nF	±20%	16	CX 0805 MR X7R 7BB 104	2259 060 15749	4,000
X7R	0805	180 nF	±20%	10	CX 0805 MR X7R 6BB 184	2259 050 15753	4,000
X7R	1206	22 nF	±20%	100	CX 1206 MK X7R 0BB 223	2259 091 25741	2,500
X7R	1206	47 nF	±20%	50 / 63	CX 1206 MK X7R 9BB 473	2259 081 25745	2,500
X7R	1206	100 nF	±20%	50 / 63	CX 1206 MK X7R 9BB 104	2259 081 25749	2,500
X7R	1206	180 nF	±20%	25	CX 1206 MK X7R 8BB 184	2259 071 25753	2,500
X7R	1206	220 nF	±20%	16	CX 1206 MK X7R 7BB 224	2259 061 25754	2,500
X7R	1206	390 nF	±20%	16	CX 1206 MK X7R 7BB 394	2259 061 25757	2,500
X7R	1206	470 nF	±20%	10	CX 1206 MK X7R 6BB 474	2259 051 25758	2,500
X7R	1206	820 nF	±20%	10	CX 1206 MK X7R 6BB 824	2259 051 25762	2,500
X7R	1210	47 nF	±20%	100	CX 1210 MK X7R 0BB 473	2259 092 25745	2,500
X7R	1210	100 nF	±20%	50 / 63	CX 1210 MK X7R 9BB 104	2259 082 25749	2,500
X7R	1210	220 nF	±20%	50 / 63	CX 1210 MK X7R 9BB 224	2259 082 25754	2,500
X7R	1210	470 nF	±20%	25	CX 1210 MK X7R 8BB 474	2259 072 25758	2,500
X7R	1210	560 nF	±20%	25	CX 1210 MK X7R 8BB 564	2259 072 25759	2,500
X7R	1210	820 nF	±20%	16	CX 1210 MK X7R 7BB 824	2259 062 25762	2,500
X7R	1210	1 µF	±20%	16	CX 1210 MK X7R 7BB 105	2259 062 25763	2,500
X7R	1410	390 nF	±20%	50	CX 1410 MK X7R 9BB 394	2259 089 25757	2,500

# Surface-mount ceramic EMI filter capacitors

## X2Y® Series

Ordering code: Yageo part number

Example: CX0805MRX7R8BB223



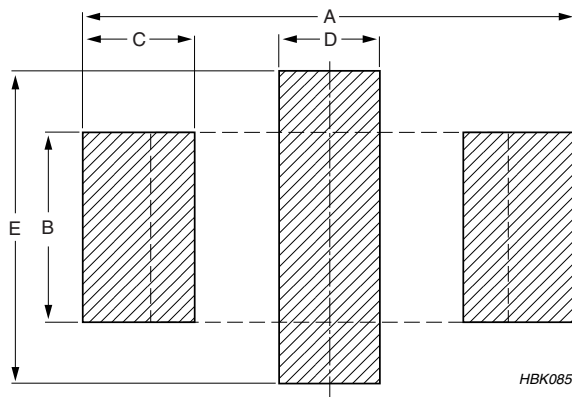
## Surface-mount ceramic EMI filter capacitors

## X2Y<sup>®</sup> Series

### RECOMMENDED DIMENSIONS OF SOLDER LANDS

**Table 3** Reflow soldering

CASE SIZE (EIA)	Footprint dimensions (mm)					Placement Accuracy (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
1410	4.57	2.55	1.00	1.14	4.06	±0.25

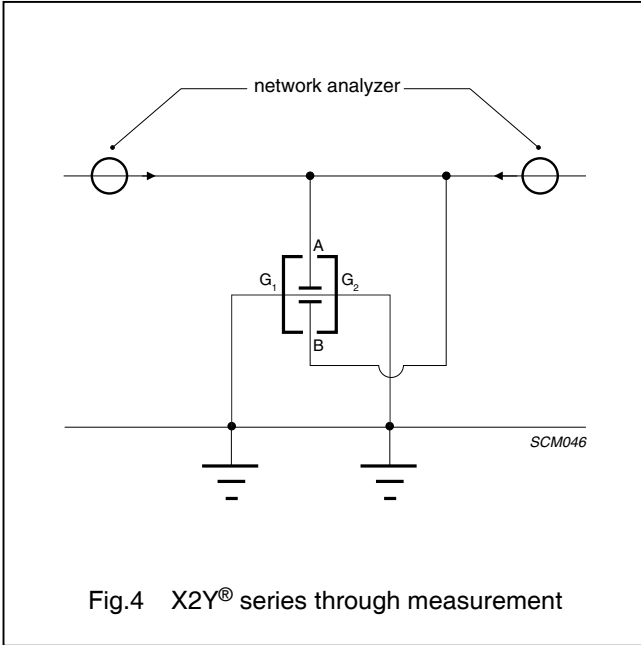


**Fig.3** Recommended dimensions of solder lands

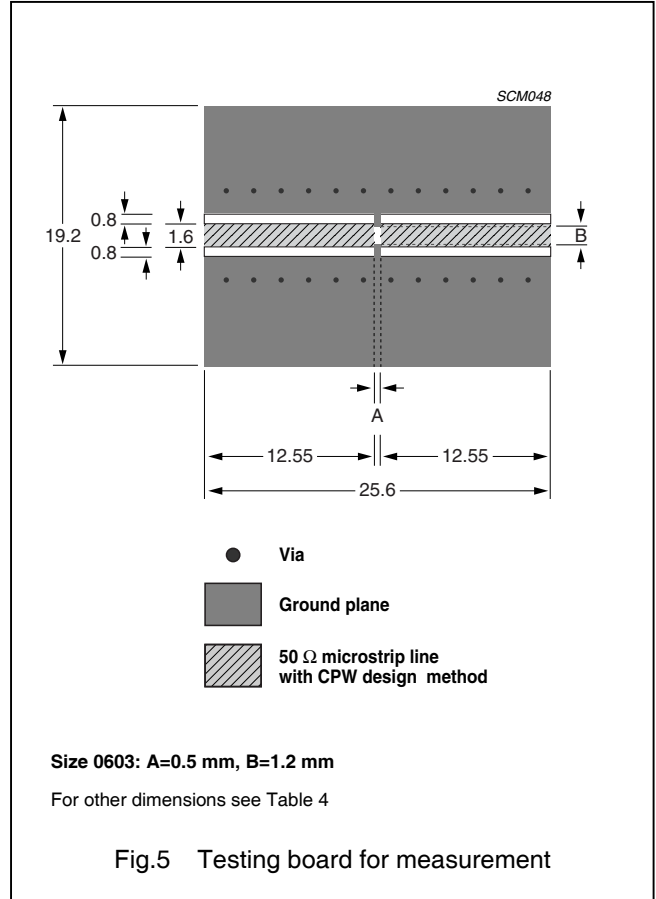
**Surface-mount ceramic  
EMI filter capacitors**

**X2Y® Series**

**MEASUREMENT SETUP**



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



**Table 4** Recommended dimensions of measurement

CASE SIZE	A (mm)	B (mm)
0603	0.5 ±0.10	1.2 ±0.10
0805	0.8 ±0.10	1.6 ±0.10
1206	1.2 ±0.10	2.8 ±0.15
1210	2.1 ±0.15	2.8 ±0.15
1410	2.1 ±0.15	3.1 ±0.15

## Surface-mount ceramic EMI filter capacitors

## X2Y® Series

### TESTS AND REQUIREMENTS

Table 5 Test procedures and requirements

TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
IEC60384-21/22			
4.3	mounting	The capacitors may be mounted on printed-circuit boards or ceramic substrates	no visible damage
4.4	visual inspection and dimension check	any applicable method using $\times 10$ magnification	in accordance with specification
4.5.1	capacitance	NP0: $f = 1 \text{ MHz}$ for $C \leq 1 \text{ nF}$ , measuring at voltage $1 V_{\text{rms}}$ at $20 \text{ }^\circ\text{C}$ ; $f = 1 \text{ KHz}$ for $C > 1 \text{ nF}$ , measuring at voltage $1 V_{\text{rms}}$ at $20 \text{ }^\circ\text{C}$ X5R/X7R/Y5V: $f = 1 \text{ KHz}$ for $C \leq 10 \text{ } \mu\text{F}$ , measuring at voltage $1 V_{\text{rms}}$ at $20 \text{ }^\circ\text{C}$	within specified tolerance
4.5.2	Dissipation factor (D.F.)	NP0: $f = 1 \text{ MHz}$ for $C \leq 1 \text{ nF}$ , measuring at voltage $1 V_{\text{rms}}$ at $20 \text{ }^\circ\text{C}$ ; $f = 1 \text{ KHz}$ for $C > 1 \text{ nF}$ , measuring at voltage $1 V_{\text{rms}}$ at $20 \text{ }^\circ\text{C}$ X5R/X7R/Y5V: $f = 1 \text{ KHz}$ for $C \leq 10 \text{ } \mu\text{F}$ , measuring at voltage $1 V_{\text{rms}}$ at $20 \text{ }^\circ\text{C}$	in accordance with specifications
4.5.3	insulation resistance	at $U_r$ (DC) for 1 minute	in accordance with specification
4.5.4.2	voltage proof	Test voltage (DC) applied for 1 minute $U_r \leq 100 \text{ V}$ : $2.5 \times U_r$ applied to NP0/X5R/X7R/Y5V series $100 \text{ V} < U_r \leq 200 \text{ V}$ : $1.5 \times U_r + 100 \text{ V}$ applied to NP0/X7R series $200 \text{ V} < U_r \leq 500 \text{ V}$ : $1.3 \times U_r + 100 \text{ V}$ applied to NP0/X7R series $U_r > 500 \text{ V}$ : $1.3 \times U_r$ applied to NP0/X7R series $I$ : 7.5 mA	no breakdown or flashover

## Surface-mount ceramic EMI filter capacitors

## X2Y® Series

Table 5 Test procedures and requirements (continued)

TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
IEC 60384-21/22			
4.6	temperature characteristic	Between minimum and maximum temperature	NP0: $\Delta C/C: \pm 30 \text{ ppm}/^\circ\text{C}$ X5R/X7R: $\Delta C/C: \pm 15\%$ Y5V: $\Delta C/C: +22\% \sim -82\%$
4.15	adhesion	A force applied for 10 seconds to the line joining the terminations and in a plane parallel to the substrate for size $\geq 0603$ : a force of 5 N applied for size 0402: a force of 2.5 N applied for size 0201: a force of 1 N applied	no visible damage
4.8	bond strength of plating on end face	Mounting in accordance with IEC 60384-22 paragraph 4.3	no visible damage
		Conditions: bending 1 mm at a rate of 1 mm/s, radius jig 340 mm	NP0: $ \Delta C/C : \leq 1\%$ or 0.5 pF whichever is greater X5R/X7R/Y5V: $ \Delta C/C : \leq 10\%$
4.9	Resistance to soldering heat	Precondition: $150 \pm 0/-10^\circ\text{C}$ for 1 hour, then keep for $24 \pm 1$ hours at room temperature Preheating: for size $\leq 1206$ : $120$ to $150^\circ\text{C}$ for 1 minute Preheating: for size $>1206$ : $100$ to $120^\circ\text{C}$ for 1 minute and $170$ to $200^\circ\text{C}$ for 1 minute Solder bath temperature: $260 \pm 5^\circ\text{C}$ Dipping time: $10 \pm 0.5$ seconds Recovery time: $24 \pm 2$ hours	The termination shall be well tinned NP0: $ \Delta C/C : \leq 0.5\%$ or 0.5 pF whichever is greater X5R/X7R: $ \Delta C/C : \leq 10\%$ Y5V: $ \Delta C/C : \leq 20\%$ D.F.: within initial specified value $R_{\text{ins}}$ : within initial specified value
4.10	Solderability	Unmounted chips completely immersed in a solder bath at $235 \pm 5^\circ\text{C}$ Dipping time: $2 \pm 0.5$ seconds Depth of immersion: 10 mm	The termination shall be well tinned

## Surface-mount ceramic EMI filter capacitors

## X2Y® Series

Table 5 Test procedures and requirements (continued)

TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
IEC 60384-21/22			
4.11	Rapid change of temperature	<p>Preconditioning; 150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature</p> <p>5 cycles with following detail: 30 minutes at lower category temperature; 30 minutes at upper category temperature</p> <p>Recovery time 24 ±2 hours</p>	<p>No visual damage</p> <p>NP0: <math>\Delta C/C_i \leq 1\%</math> or 1 pF whichever is greater</p> <p>X5R/X7R: <math>\Delta C/C_i \leq 15\%</math></p> <p>Y5V: <math>\Delta C/C_i \leq 20\%</math></p> <p>D.F.: within initial specified value</p> <p><math>R_{ins}</math>: within initial specified value</p>
4.13	Damp heat, with $U_r$ load	<p>Initial measurements; after 150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature</p> <p>Duration and conditions: 500 ±12 hours at 40 ±2 °C; 90 to 95% RH; <math>U_r</math> applied</p> <p>Final measurement: perform a heat treatment at 150 +0/-10 °C for 1 hour, final measurements shall be carried out 24 ±1 hours after recovery at room temperature without load</p>	<p>NP0: <math>\Delta C/C_i \leq 2\%</math> or 1 pF whichever is greater</p> <p>X5R/X7R: <math>\Delta C/C_i \leq 20\%</math></p> <p>Y5V: <math>\Delta C/C_i \leq 30\%</math></p> <p>NP0/X5R/X7R/Y5V: D.F.: 2 × initial value max.</p> <p>NP0: <math>R_{ins} \geq 2,500 \text{ M}\Omega</math> or <math>R_{ins} \times C_r \geq 25</math> seconds, whichever is less</p> <p>X5R/X7R/Y5V: <math>R_{ins} \geq 500 \text{ M}\Omega</math> or <math>R_{ins} \times C_r \geq 25</math> seconds, whichever is less</p>
4.14	Endurance	<p>Preconditioning;</p> <p>Initial measurements; after 150 +0/-10 °C for 1 hour, then keep for 24 ±1 hours at room temperature</p> <p>Duration and conditions: 1,000 ±12 hours at upper category temperature with <math>1.5 \times U_r</math> voltage applied</p> <p>Final measurement: perform a heat treatment at 150 +0/-10 °C for 1 hour, final measurements shall be carried out 24 ±1 hours after recovery at room temperature without load</p>	<p>NP0: <math>\Delta C/C_i \leq 2\%</math> or 1 pF whichever is greater</p> <p>X5R/X7R: <math>\Delta C/C_i \leq 20\%</math></p> <p>Y5V: <math>\Delta C/C_i \leq 30\%</math></p> <p>NP0/X5R/X7R/Y5V: D.F.: 2 × initial value max.</p> <p>NP0: <math>R_{ins} \geq 4,000 \text{ M}\Omega</math> or <math>R_{ins} \times C_r \geq 40</math> seconds, whichever is less</p> <p>X5R/X7R/Y5V: <math>R_{ins} \geq 1,000 \text{ M}\Omega</math> or <math>R_{ins} \times C_r \geq 50</math> seconds, whichever is less</p>

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

<b>Revision</b>	<b>Date</b>	<b>Change Notification</b>	<b>Description</b>
Rev.5	2001 Sep 25	-	- Published on web
Rev.6	2002 Jul 10	-	- Product range extended in all materials and sizes; - 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 - NP0, Y5V and size 1812 removed.
Rev.11	2006 Nov 21	-	- Size 1410 extended - Product applications, features and benefits update - Measurement setup added - Updated tests and requirements
Rev.12	2006 Dec 22	-	- 12 NC revised