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Pulse A YAGEO Company | LARSEN Antennas

TECHNICAL DATA SHEET

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 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

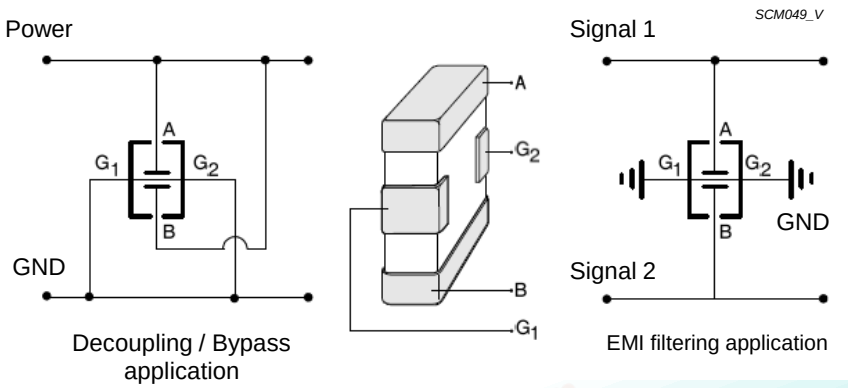


Fig.1 Circuit of typical applications

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Surface-mount ceramic EMI filter capacitors X2Y® Series

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Materials	X7R / X5R
Rated voltage X7R X5R	 10V, 16V, 25V, 50V, 63V, 100V (IEC) 10V, 6.3V
Capacitance range (Y-capacitor) X7R 0603 series X7R 0805 series X7R 1206 series X7R 1210 series X5R 0603 series	 1 nF to 330 nF 1 nF to 180 nF 10 nF to 470 nF 100 nF to 1 µF 180 nF to 470 nF
Tolerance on capacitance	± 20% (M)
Test voltage (DC) for 1 minute	2.5 × 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

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Surface-mount ceramic EMI filter capacitors

X2Y® Series

GENERAL SELECTION CHART

C	X7R				X5R
(pF)	0603	0805	1206	1210	0603
1,000	16 / 50 / 100 V	50 / 100 V			
1,500	50 / 100 V	100 V			
2,200	100 V				
4,700					
5,600	50 / 63 / 100 V				
10,000	50 / 63V		100 V		
15,000	25 V	50 V	50 / 100 V		
18,000			100 V		
22,000					
33,000					
39,000	16 V	25 V	50 V		
47,000		16 V			
56,000					
100,000	10 V			50V	
180,000		10 V	16 V		10 V
220,000					
270,000					
330,000					
390,000					
470,000			10 V	25 / 50 V	10 / 6.3 V
560,000					
820,000				16 V	
1,000,000					

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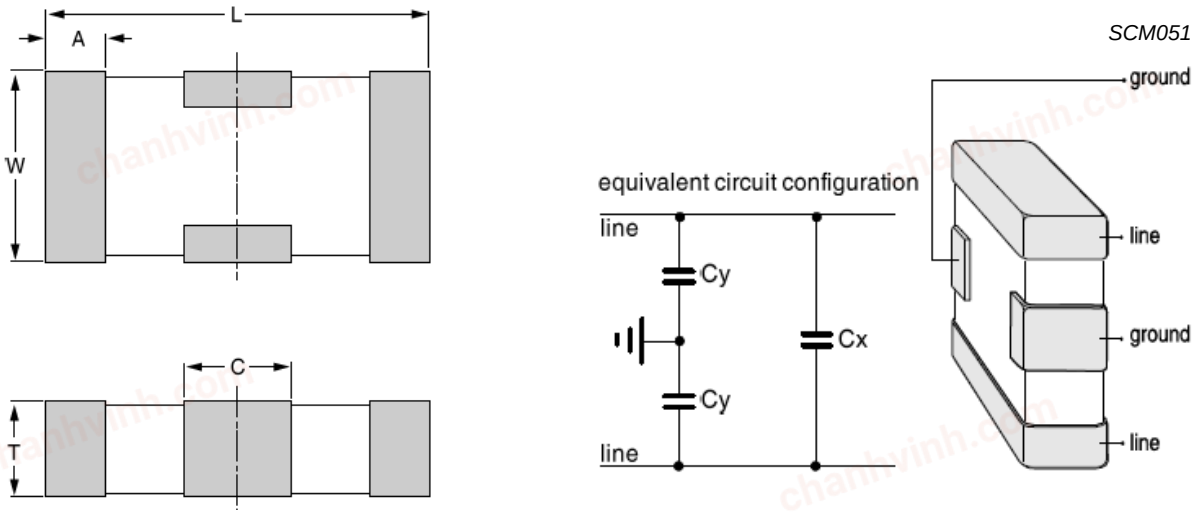
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Surface-mount ceramic EMI filter capacitors

X2Y® Series

MECHANICAL DATA



Component **Simplified type**

Fig.2 Component outline & simplified outline

For dimensions see **Table1.**

Table1 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

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ELECTRICAL 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 uF
Capacitance tolerance	±20%
Dissipation factor (D.F.); note 1 6.3 V 10 V 16 V ≧25 V	 6% 5% 3.5% 2.5%
Insulation resistance after 1 minute at UR (DC)	R_{ins} x C > 500 seconds or R_{ins} > 10GΩ, whichever is less
Maximum capacitance change as a function of temperature	±15%
Operating temperature range: X7R	 –55 ˚C to +125 ˚C
Aging	Typical 1% per time decade

Note: Measured at 20 °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 UR (DC)	6.3V,10 V
Capacitance range	180 nF to 470 nF
Capacitance tolerance	±20%
Dissipation factor (D.F.); note 1 6.3 V 10 V	 10% 10%
Insulation resistance after 1 minute at UR (DC)	R_{ins} x C > 500 seconds or R_{ins} s > 10GΩ, whichever is less
Maximum capacitance change as a function of temperature	±15%
Operating temperature range: X5R	 –55 ˚C to +85 ˚C
Aging	Typical 1% per time decade

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

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Surface-mount ceramic EMI filter capacitors

X2Y® Series

SELECTION CHART FOR X7R SIZES 0603, 0805, AND ORDERING INFORMATION

SIZE	Y-CAPACITOR		VOLTAGE RATING (V)	THICKNESS (mm)	CTC ORDERING CODE	QUANTITY PER REEL
	CAP. (nF)	TOLERANCE (%)				
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%	25	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

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Surface-mount ceramic EMI filter capacitors

X2Y® Series

SELECTION CHART FOR X7R SIZES 1206,1210 AND ORDERING INFORMATION

SIZE	Y-CAPACITOR		VOLTAGE RATING (V)	THICKNESS (mm)	CTC ORDERING CODE	QUANTITY PER REEL
	CAP. (nF)	TOLERANCE (%)				
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

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Surface-mount ceramic EMI filter capacitors

X2Y® Series

SELECTION CHART FOR X5R SIZES 0603 (1) AND ORDERING INFORMATION

SIZE	Y-CAPACITOR		VOLTAGE RATING (V)	THICKNESS (mm)	CTC ORDERING CODE	QUANTITY PER REEL
	CAP. (nF)	TOLERANCE (%)				
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%	6.3	0.65	CX0603MRX5R5BB474	4,000

Note: 1. Other values are available on request.

THICKNESS CLASSIFICATION AND PACKING QUANTITIES FOR X7R

THICKNESS CLASSIFICATION (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		

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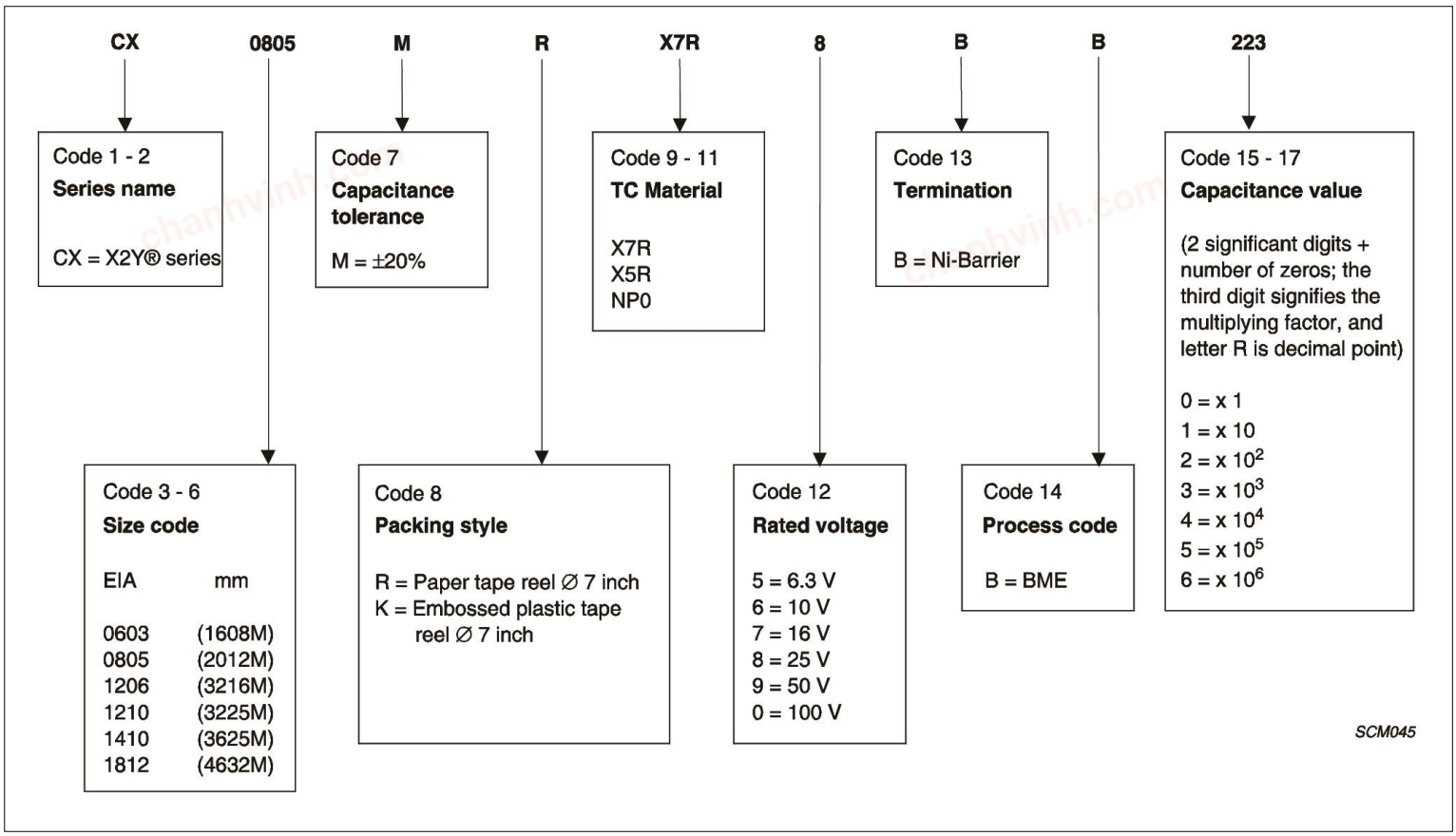
Surface-mount ceramic EMI filter capacitors

X2Y® Series

ORDERING INFORMATION

Components may be ordered by using either a Pulse part number or Phycomp's unique 12NC.
Ordering code: Pulse part number

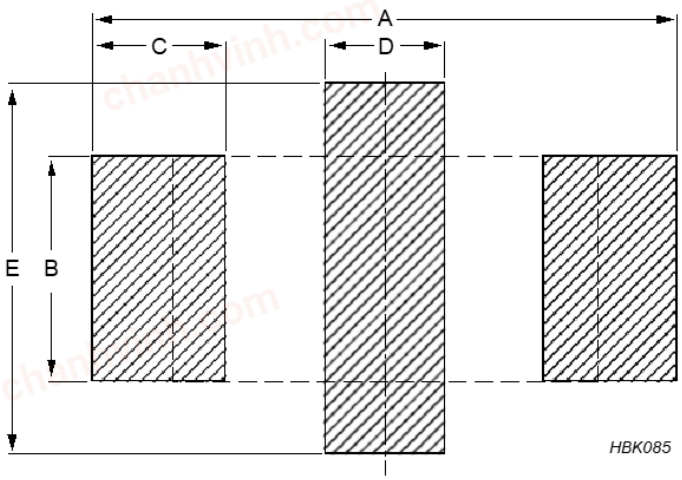
Example: CX0805MRX7R8BB223



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RECOMMENDED DIMENSIONS OF SOLDER LANDS



For dimensions see **Table2.**

Fig.3 Recommended dimensions of solder lands

Table 2 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

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X2Y® Series

MEASUREMENT SETUP

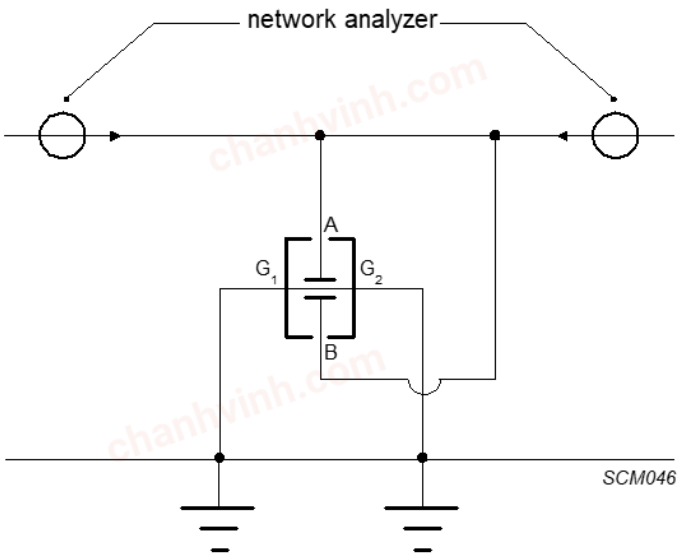
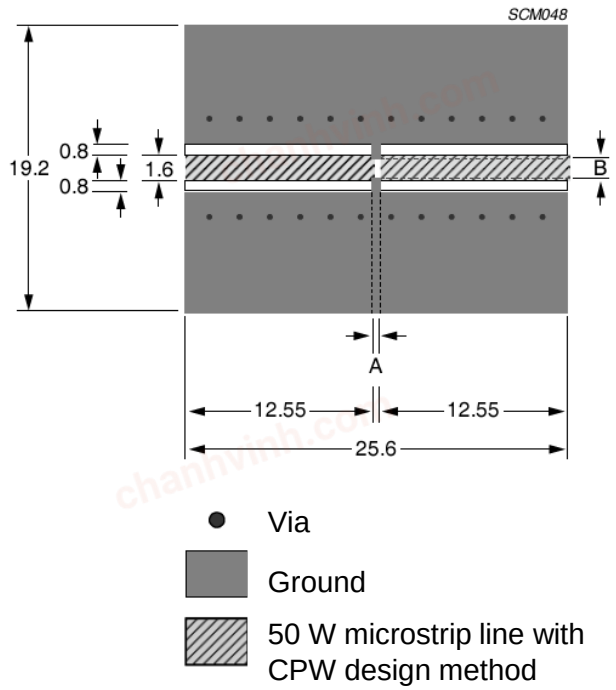


Fig.4 X2Y® series through measurement

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



Size 0603: A=0.5 mm, B=1.2 mm

For other dimensions see **Table 3.**

Fig.5 Testing board for measurement

Table 3 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

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TESTS AND REQUIREMENTS

Table 4 Test procedures and requirements

IEC 60384-10/ CECC 32 100 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
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 ×10 magnification	in accordance with specification
4.6.1		capacitance	Class 1: ≤1000 pF; f = 1 MHz >1000 pF; f = 1 kHz NP0: measuring voltage 1 V at 20 °C 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 δ	Class 1: ≤1000 pF; f = 1 MHz >1000 pF; f = 1 kHz NP0: measuring voltage 1 V at 20 °C 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 × 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

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Table4 Test procedures and requirements (continued)

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

In the effort to improve our products, we reserve the right to make changes judged to be necessary.
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REVISION HISTORY

Revision	Date	Description
01	Jan. 21, 2021	- New issue
02	Dec. 30, 2022	- Fixed voltage rating for CX0603MRX5R5BB474

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