Innovative Service Around the Globe YAGEO

DATA SHEET

SURFACE MOUNT MULTILAYER CERAMIC CAPACITORS

LOW ACOUSTIC NOISE MLCC

X5R/X7R

6.3 V TO 50 V

100nF to 10 µF

RoHS compliant & Halogen free

YAGEO Phycomp

Product Specification – January 12, 2016 V.2

SCOPE

This specification describes X5R/X7R 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

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)

CN	XXXX	X	X	XXX	X	BB	XXX
	(1)	(2)	(3)	(4)	(5)	(6)	

(1) SIZE – INCH BASED (METRIC)

0402 (1005)
0805 (2012)
1206 (3216)

(2) TOLERANCE

K = ±10%
M = ±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

(4) TC MATERIAL

X5R

(5) RATED VOLTAGE

5 = 6.3 V
6 = 10 V
8 = 25 V

(6) CAPACITANCE VALUE

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

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). Thterminations are lead-free. A cross section of the structure is shown in Fig.1.

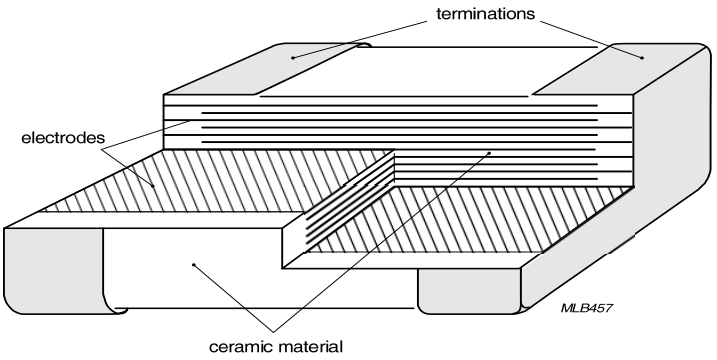

Fig. 1 Surface mount multilayer ceramic capacitor construction

DIMENSION

Table 1 For outlines see fig. 2

TYPE	L_1 (mm)	W (mm)	T (MM)	L_2 / L_3 (mm)		L_4 (mm)
				min.	max.	min.
0402	1.0 ±0.15	0.5 ±0.15	Refer to table 2 to 3	0.20	0.30	0.40
0805	2.0 ±0.20	1.25 ±0.20		0.25	0.75	0.55
1206	3.2 ±0.30	1.6 ±0.30		0.25	0.75	1.40

OUTLINES

For dimension see Table 1

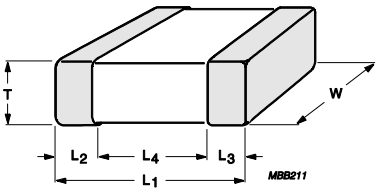

Fig. 2 Surface mount multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR X5R

Table 2 Sizes from 0201 to 1206

CAP.	0402	0805	1206
	6.3 V	10 V	25 V
100 nF			
220 nF			
470 nF			
1 uF		1.25 ±0.2	
2.2 uF	0.5 ±0.15	1.25 ±0.2	
4.7 uF		1.25 ±0.2	
10 uF		1.25 ±0.2	1.60 ±0.3

NOTE

1. Values in shaded cells indicate thickness class in mm
2. Capacitance value of non E-6 series is on request
3. For special ordering code, please contact local sales force before order.

THICKNESS CLASSES AND PACKING QUANTITY

Table 4

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	
0402	0.5 ±0.15 mm	8 mm	10,000	---	50,000	---	50,000
0805	1.25 ±0.2 mm	8 mm	---	3,000	---	10,000	5,000
1206	1.6 ±0.3 mm	8 mm	---	2,000	---	8,000	---

ELECTRICAL CHARACTERISTICS

X5R/X7R 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 5

DESCRIPTION	VALUE
Capacitance range	1uF to 10 μF
Capacitance tolerance	±10% and ±20%
Dissipation factor (D.F.)	≤ 10%
Insulation resistance after 1 minute at U_r (DC)	$R_{ins} \times C_r \geq 100\ \Omega.F$
Maximum capacitance change as a function of temperature (temperature characteristic/coefficient):	±15%
Operating temperature range:	
X5R	–55 °C to +85 °C

SOLDERING RECOMMENDATION

Table 16

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

TESTS AND REQUIREMENTS

Table 17 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 × 10 magnification	In accordance with specification
Capacitance (1)		4.5.1	Class 2: At 20 °C, 24 hrs after annealing f = 1 KHz for C ≤ 10 µF, rated voltage > 6.3 V, measuring at voltage 1 V_{rms} at 20 °C f = 1 KHz, for C ≤ 10 µF, rated voltage ≤ 6.3 V, measuring at voltage 0.5 V_{rms} at 20 °C f = 120 Hz for C > 10 µF, measuring at voltage 0.5 V_{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 KHz for C ≤ 10 µF, rated voltage > 6.3 V, measuring at voltage 1 V_{rms} at 20 °C f = 1 KHz, for C ≤ 10 µF, rated voltage ≤ 6.3 V, measuring at voltage 0.5 V_{rms} at 20 °C f = 120 Hz for C > 10 µF, measuring at voltage 0.5 V_{rms} at 20 °C	In accordance with specification
Insulation Resistance		4.5.3	At U_r (DC) for 1 minute	In accordance with specification

NOTE

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

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Characteristic	4.6	Capacitance shall be measured by the steps shown in the following table. The capacitance change should be measured after 5 min at each specified temperature stage. Step / Temperature(℃) a / 25±2 b / Lower temperature±3℃ c / 25±2 d / Upper Temperature±2℃ e / 25±2 (1) Class I Temperature Coefficient shall be calculated from the formula as below Temp, Coefficient = $\frac{C2 - C1}{C1 \times \Delta T} \times 10^6$ [ppm/℃] C1: Capacitance at step c C2: Capacitance at 125℃ ΔT: 100℃(=125℃-25℃) (2) Class II Capacitance Change shall be calculated from the formula as below $\Delta C = \frac{C2 - C1}{C1} \times 100\%$ C1: Capacitance at step c C2: Capacitance at step b or d	<General purpose series> Class1: Δ C/C: ±30ppm Class2: X7R: Δ C/C: ±15% Y5V: Δ C/C: 22~-82% <High Capacitance series> Class2: X7R/X5R: Δ C/C: ±15% Y5V: Δ C/C: 22~-82%
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
Bending Strength	IEC 60384-21/22 4.8	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	<General purpose series> ΔC/C Class2: X5R: ±10% <High Capacitance series> ΔC/C Class2: X5R: ±10%

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Resistance to Soldering Heat		4.9	Precondition: 150 +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> ΔC/C Class2: X5R: ±10% <High Capacitance series> ΔC/C Class2: X5R: ±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. 1. Temperature: 235±5°C / Dipping time: 2 ±0.5 s 2. Temperature: 245±5°C / Dipping time: 3 ±0.5 s (lead free) Depth of immersion: 10mm	The solder should cover over 95% of the critical area of each termination
Rapid Change of Temperature	IEC 60384-21/22	4.11	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 <General purpose series> ΔC/C Class2: X5R: ±15% <High Capacitance series> ΔC/C Class2: X5R: ±15% D.F. meet initial specified value R_{ins} meet initial specified value

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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 **<General purpose series>** ΔC/C Class2: X5R: ±15% D.F. Class2: X5R: ≤ 16V: ≤ 7% ≥ 25V: ≤ 5% R_{ins} Class2: X5R: ≥ 500 MΩ or $R_{ins} \times C_r \geq 25s$ whichever is less **<High Capacitance series>** ΔC/C Class2: X5R: ±20% D.F. Class2: X5R: 2 x initial value max R_{ins} Class2: Rins x Cr ≥ 5s whichever is less

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Endurance	IEC 60384-21/22 4.14	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. Endurance test: Temperature: X5R: 85 °C Specified stress voltage applied for 1,000 hours: Applied 2.0 x Ur for general product. Applied 1.5 x Ur for high cap. product. Applied 1.0 x Ur for high cap. product. 0201: 100nF/25V, 220nF/10V,/1uF/6.3V; 0402: 4.7uF/10V, 6.3V, 10uF/4V, 6.3V; 0603: 10uF/ 10V, 22uF/6.3V, 10V 1206: 10uF/ 50V 4. Recovery time: 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 <General purpose series> ΔC/C Class2: X5R: ±15% D.F. Class2: X5R: ≤ 16V: ≤ 7% ≥ 25V: ≤ 5% R_{ins} Class2: X5R: ≥ 1,000 MΩ or $R_{ins} \times C_r \geq 50s$ whichever is less <High Capacitance series> ΔC/C Class 2: X5R: ±20% D.F. Class 2: X5R: 2 x initial value max R_{ins} Class 2: Rins x Cr ≥ 10s whichever is less
Voltage Proof		Specified stress voltage applied for 1~5 seconds Ur ≤ 50 V: series applied 2.5 Ur Charge/Discharge current less than 50mA	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 2	Jan. 12, 2016		- Capacitance range & thickness
Version 1	Dec. 28, 2015		- Capacitance range & thickness
Version 0	Aug. 19, 2014	-	- New Datasheet