Innovative Service Around the Globe YAGEO

DATA SHEET

SURFACE MOUNT MULTILAYER CERAMIC CAPACITORS

General purpose class II

X6S

4 V TO 50 V

100 pF to 47µF

RoHS compliant & Halogen free



YAGEO

Product Specification – February 07, 2023 V.7



SCOPE

This specification describes X6S 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

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	X6S	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)

(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
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 x 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.

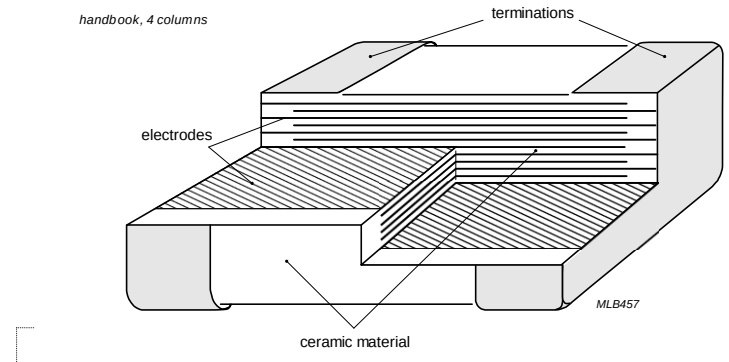


Fig. 1 Surface mount multilayer ceramic capacitor construction

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.
0201	0.6 ±0.03	0.3 ±0.03	0.3 ±0.03	0.10	0.20	0.20
	0.6±0.09	0.3 ±0.09	0.3±0.09			
0402	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	0.15	0.35	0.30
	1.0 ±0.1	0.5 ±0.1	0.5 ±0.1			
	1.0 ±0.15	0.5 ±0.15	0.5 ±0.15			
	1.0 ±0.20	0.5 ±0.20	0.5 ±0.20			
0603	1.6±0.10	0.8 ±0.10	0.8 ±0.10	0.20	0.60	0.40
	1.6 ±0.15	0.8 ±0.15	0.8 ±0.15			
	1.6 ±0.20	0.8 ±0.20	0.8 ±0.20			
0805	2.0±0.20	1.25 ±0.20	1.25 ±0.20	0.25	0.75	0.70
1206	3.2 ±0.30	1.6 ±0.20	1.6 ±0.20	0.25	0.75	1.40
1210	3.2 ±0.40	2.5 ±0.30	2.5 ±0.20	0.25	0.75	1.40
	3.2 ±0.40	2.5 ±0.30	2.5 ±0.30			

OUTLINES

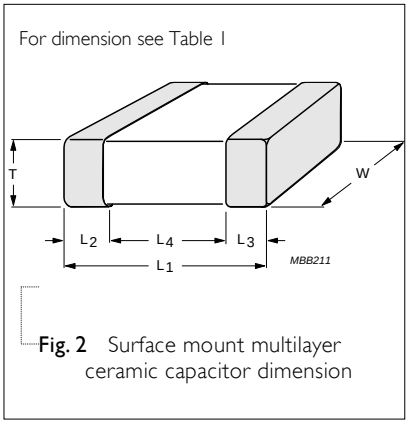


Fig. 2 Surface mount multilayer ceramic capacitor dimension

CAPACITANCE RANGE & THICKNESS FOR X6S

Table 2 Sizes from 0201 to 0603

CAP.	0201				0402				0603					
	6.3V	10V	16V	25V	6.3 V	10 V	16 V	25 V	4 V	6.3 V	10 V	16 V	25 V	50 V
100 nF	0.3±0.03	0.3±0.03	0.3±0.03	0.3±0.03										
220 nF	0.3±0.03	0.3±0.03			0.5±0.05	0.5±0.05	0.5±0.05	0.5±0.05						
470 nF	0.3±0.09	0.3±0.09			0.5±0.05	0.5±0.05	0.5±0.1							
1 uF	0.3±0.09	0.3±0.09			0.5±0.05	0.5±0.05	0.5±0.1		0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.1	
2.2 uF					0.5±0.20	0.5±0.20			0.8±0.1	0.8±0.1	0.8±0.1	0.8±0.2		
4.7 uF					0.5±0.15				0.8±0.2	0.8±0.2				
10 uF									0.8±0.2	0.8±0.2				
22 uF									0.8±0.2	0.8±0.2				
47 uF														

Table 3 Sizes from 0805 to 1210

CAP.	0805					1206				1210		
	6.3 V	10 V	16 V	25 V	50 V	6.3 V	10 V	16 V	25 V	6.3 V	10 V	16V
100 nF												
220 nF												
470 nF												
1 uF												
2.2 uF	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2							
4.7 uF	1.25±0.2	1.25±0.2	1.25±0.2	1.25±0.2								
10 uF	1.25±0.2	1.25±0.2	1.25±0.2			1.6±0.2	1.6±0.2	1.6±0.2	1.6±0.2			
22 uF	1.25±0.2					1.6±0.2	1.6±0.2					
47 uF										2.5±0.2	2.5±0.2	
100 uF												

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	
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	1.25 ±0.2 mm	8 mm	---	3,000	---	10,000	5,000
1206	1.6 ±0.2 mm	8 mm	---	2,000	---	8,000	---
1210	2.5±0.2/0.3 mm	8 mm	---	500	---	---	---

ELECTRICAL CHARACTERISTICS

X6S 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	100 nF to 100 µF
Capacitance tolerance	±10% and ±20%
Dissipation factor (D.F.)	≤10%
Insulation resistance after 1 minute at U_r (DC)	Rins × Cr ≥ 100 / 50 Ω.F *
Maximum capacitance change as a function of temperature (temperature characteristic/coefficient):	±22%
Operating temperature range:	–55 °C to +105 °C

Note:

Rins × Cr ≥ 100 Ω.F

0201: 100nF to 470nF

0603: 1uF, 2.2uF/ 6.3V to 16V, 4.7uF/ 6.3V to 16V

0805: 2.2uF, 4.7uF to 10uF/ 6.3V to 16V

1206: 10uF/ 6.3V to 16V, 22uF/ 6.3V to 10V

Rins × Cr ≥ 50 Ω.F

0201: 100nF / 16V to 25V, 1uF

0402: 220nF/ 6.3V to 25V, 470nF/ 6.3V to 16V, 1uF to 2.2uF/ 6.3V to 16V, 4.7uF/ 6.3V

0603: 2.2uF/ 25V, 4.7uF/ 25V, 10uF to 22uF

0805: 4.7uF/ 50V, 10uF/ 25V, 22uF to 47uF

1206: 10uF/ 25V, 22uF/ 16V, 47uF to 100uF

1210: 47uF to 100uF

SOLDERING RECOMMENDATION

Table 6

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

TESTS AND REQUIREMENTS

Table 7 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	IEC 60384-21/22 4.4	Any applicable method using × 10 magnification	In accordance with specification
Capacitance (1)	IEC 60384-21/22 4.5.1	Class 2: At 20 °C, 24 hrs after annealing Cap ≤ 1 µF, f = 1 KHz, measuring at voltage 1 Vrms at 20 °C Cap > 1 µF, f = 1 KHz for C ≤ 10 µF, rated voltage > 6.3 V, measuring at voltage 1 Vrms at 20 °C f = 1 KHz, for C ≤ 10 µF, rated voltage ≤ 6.3 V, measuring at voltage 0.5 to 1 Vrms at 20 °C f = 120 Hz for C > 10 µF, measuring at voltage 0.5 Vrms at 20 °C	Within specified tolerance
Dissipation Factor (D.F.) (1)	IEC 60384-21/22 4.5.2	Class 2: At 20 °C, 24 hrs after annealing Cap ≤ 1 µF, f = 1 KHz, measuring at voltage 1 Vrms at 20 °C Cap > 1 µF, f = 1 KHz for C ≤ 10 µF, rated voltage > 6.3 V, measuring at voltage 1 Vrms at 20 °C f = 1 KHz, for C ≤ 10 µF, rated voltage ≤ 6.3 V, measuring at voltage 0.5 Vrms at 20 °C f = 120 Hz for C > 10 µF, measuring at voltage 0.5 Vrms at 20 °C	In accordance with specification
Insulation Resistance	IEC 60384-21/22 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	IEC 60384-21/22 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(°C): a 25±2; b Lower temperature±3°C; c 25±2; d Upper Temperature±2°C; e 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	X6S: Δ C/C: ±22%
Adhesion	IEC 60384-21/22 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 5 mm	ΔC/C X6S: ±10%

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Resistance to Soldering Heat	IEC 60384-21/22	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 ΔC/C X6S: ±10% D.F. within initial specified value R_{ins} within initial specified value
Solderability	IEC 60384-21/22	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 ΔC/C X6S: ±15% D.F. meet initial specified value R_{ins} meet initial specified value

TEST	TEST METHOD		PROCEDURE	REQUIREMENTS
Damp Heat with U_r Load	IEC 60384-21/22	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 ΔC/C ±20% D.F. 2 x initial value max R_{ins} Rins x Cr ≥ 5s
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: X6S: 105 °C Specified stress voltage applied for 1,000 hours: Applied 1.5 x Ur. Applied 1 Ur: 0201: 1uF 0402: 4.7uF, 10uF 0603: 10uF, 22uF 0805: 10uF/ 25V, 22uF/ 10V to 16V Recovery time: 24 ±2 hours 4. 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 ΔC/C ±20% D.F. 2 x initial value max R_{ins} Rins x Cr ≥ 10s
Voltage Proof	IEC 60384-1	4.6	Specified stress voltage applied for 1~5 seconds Ur ≤ 100 V: series applied 2.5 Ur Charge/Discharge current is less than 50 mA	No breakdown or flashover

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 7	Feb. 07, 2023	-	- Product range updated
Version 6	Jan. 20, 2021	-	- Product range updated
Version 5	Jun. 2, 2020	-	- Product range updated
Version 4	Aug 7, 2017	-	- 0402 Dimension update
Version 3	Jul 19, 2017	-	- Product range updated
Version 2	Feb. 20, 2017	-	- Dimension & capacitance update
Version 1	Sep. 16, 2015	-	- Dimension & capacitance update
Version 0	Nov. 18, 2014	-	- New datasheet for general purpose High Cap X6S

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