

APPROVAL SHEET

MULTILAYER CERAMIC CAPACITOR

X7R/0612/50V

Low Inductance Capacitor

Customer : _____

Approval No : _____

Issue Date : _____

Customer Approval :

APPLICATION

The total inductance of a chip capacitor is determined both by its length to width ratio and by the mutual inductance coupling between its electrodes. Thus a 0612 chip size has lower inductance than a 1206 chip's.

As switching speeds increase and Pulse rise times decrease the need to reduce inductance become a serious limitation for improved system performance. Even the decoupling capacitors, that act as a local energy source, can generate unacceptable voltage spikes: $V = L (di/dt)$. Thus, in high speed circuits, where di/dt can be quite large, the size of the voltage spike can be improved by reducing L. Therefore, low inductance are designed for high speed IC package, processor package decoupling and reducing AC noise in multi-chip modules etc..

The aspect ratio and size have been optimised to reduce inductance from 1nH range found in normal chip capacitors to less than 0.4nH.

The capacitors are supplied in blister tape on reel; this makes them suitable for use with automatic placement equipment. It is also supplied in bulk in boxes.

DESCRIPTION of MLCC

The raw materials are finely milled and carefully mixed. Thereafter the powders are calcined at temperatures between 1100 and 1300 °C to achieve the required chemical composition. The resultant mass is reground and dopes and/or sintering means are added. The finely ground material is mixed with a solvent and binding matter. Thin sheets are obtained by casting or rolling.

For multilayer capacitors electrode material is printed on the sheets and after stacking and pressing of the sheets cofired with the ceramic compact at temperatures between 1000 and 1400 °C. The totally enclosed electrodes of a multilayer capacitor guarantee good life test behaviour as well.

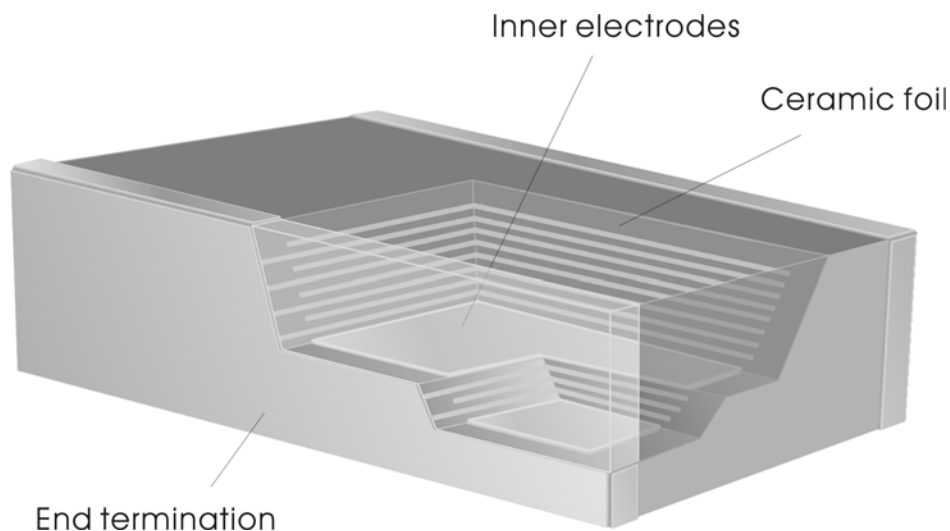


Fig. 1 Construction of a Low inductance MLCC

ELECTRICAL DATA

all electrical values apply at an ambient temperature of $23 \pm 3^\circ\text{C}$ and a relative humidity of 30 to 70%.

Description	Specification
Material	Class 2, X7R dielectric
Capacitance range	10 nF~ 150 nF, E12 series (*Note 1)
Tolerance of capacitance	$\pm 10\%$ (*Note 2)
Rated voltage U_R (DC)	50V
Test voltage (DC) for 1~5 seconds	$2.5 \times U_R$
Equivalent Series Inductance (ESL)	Max. 500pH
Tan δ	$\leq 2.5\%$ (*Note 3)
Insulation resistance after 1 min. at U_R (DC)	$RC > 1000$ sec
Temperature coefficient	$\pm 15\%$
Terminations	NiSn / Pb, metallized (*Note 4)

Note:

1. Other values on request.
2. Special tolerance upon request.
3. Measured at 1V, 1 MHz for $C \leq 1000$ pF, and 1 V, 1 kHz for $C > 1000$ pF, 25°C using a four-gauge method
4. Pb-Free product upon customer requested.

DIMENSION DATA

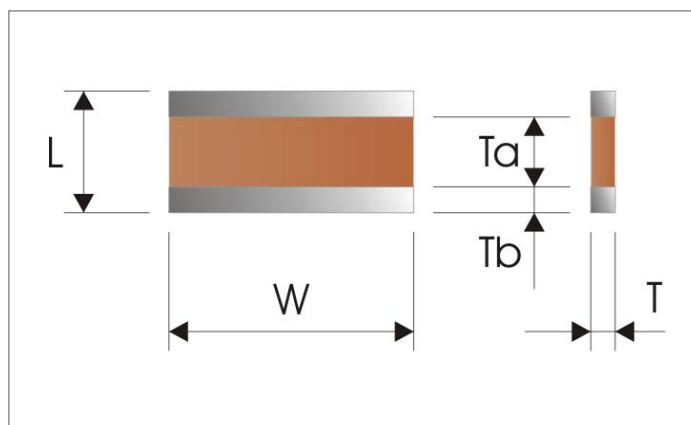


Figure 1. MLCC Dimensions

Chip dimensions (Units: mm)

CASE SIZE	L	W	T	Ta	Tb
0612	1.60 ± 0.15	3.20 ± 0.15	$0.85^{+0.05}_{-0.15}$	Min. 0.50	Min. 0.13

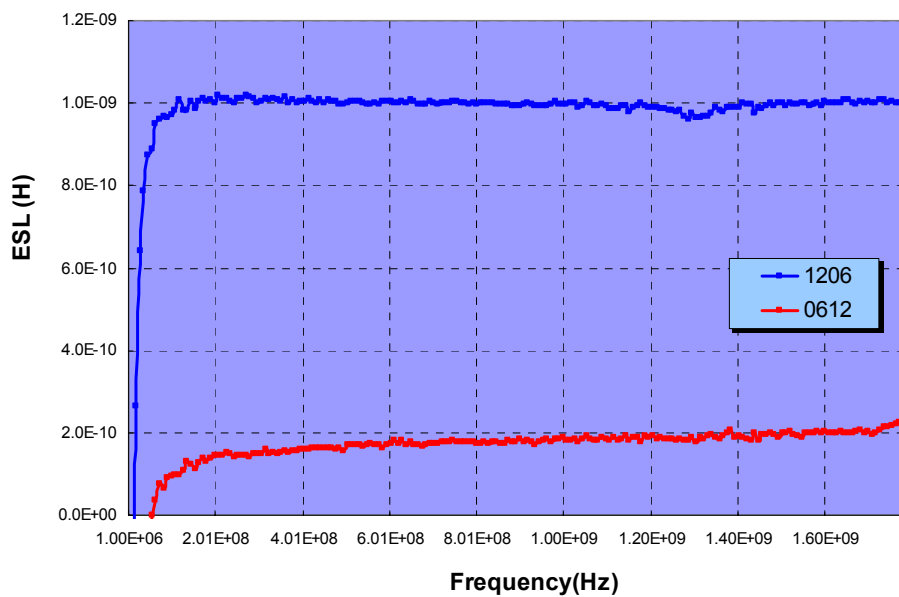
TEST and REQUIREMENTS (X7R)

Test Items	Test Condition	Requirements
Visual inspection and check of dimensions	By visual inspection	1. No remarkable defect 2. within dimension specification.
Temperature Coefficient	With no electrical load:-55 ~ 125°C at 25°C	Within $\pm 15\%$
Capacitance	Freq. = 1KHz $\pm 10\%$, measuring voltage: 1 ± 0.2 Vrms	shall not exceed the limits given in the detail spec.
Dissipation factor	1kHz $\pm 10\%$, 1.0 ± 0.2 Vrms	X7R : 50V, DF $\leq 2.5\%$ max.
Dielectric strength	Apply 250%of rated Voltage for1 to 5 sec, Charge & discharge current less than 50mA	No evidence of damage or flash-over during test
Insulation Resistance	Apply rated voltage for max. 120sec.	>10G or >500 Ω -F whichever is smaller
Solderability	Solder temperature : 230 $\pm 5^\circ\text{C}$ Dipping time : 2 ± 0.5 sec Solder : SN63A	90% min .Coverage of entire metalized area .
Resistance to soldering heat	Solder temperature : 260 $\pm 5^\circ\text{C}$ Dipping time : 10 ± 1 sec Solder : SN63A Measurement taken after keeping at room temp . for 48 ± 4 hours	1. Appearance: No damage 2. CAP Change : $\pm 7.5\%$ max. 3. DF, IR and Dielectric strength : to meet initial requirements
Adhesion strength of Termination	Apply 10N(1kg) force, Test time: 10 ± 1 sec	no remarkable damage or removal of terminations
Vibration Resistance	The range of Vibration frequency : 10~55~10 Hz/min. <ul style="list-style-type: none"> ▪ Total amplitude : 1.5mm ▪ Test time : 6 hrs.(Two hours each in three mutually perpendicular directions.) 	1. No remarkable damage. 2. Cap change & DF : To meet initial requirements.
Bending test	<ul style="list-style-type: none"> ▪ The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 sec. ▪ Measurement to be made after keeping at room temp. for 24 ± 2hours 	no visible damage $\Delta C/C: \leq \pm 12.5\%$ This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.
Resistance to leaching	Solder temperature : 260 $\pm 5^\circ\text{C}$ Dipping time :30 ± 0.5 sec Solder : SN63A	Using visual enlargement, dissolution of the terminations shall not exceed 25% total termination area.
Humidity test (steady state)	Test temp. : 40 $\pm 2^\circ\text{C}$ Humidity : 90~95%RH Test time : 1000+24/-0 hrs. Measurement to be made after keeping at room temp. for 48 ± 4 hours.	1. No remarkable damage. 2. Cap change : $\leq \pm 12.5\%$ 3. DF : $\leq 3\%$ for rated voltage $\geq 50\text{V}$ 4. I.R. : 1G Ω min. or 50 Ω -F min. whichever is less.



Test Items	Test Condition	Requirements
Humidity Load (Damp Heat)	Test temp. : 40±2°C Humidity : 90~95%RH Test time : 1000+24/-0 hrs. To apply voltage : rated voltage Measurement to be made after keeping at room temp. for 48±4hours.	1. No remarkable damage. 2. Cap change : ≤±12.5% 3. DF : ≤3% for rated voltage ≥50V 4. I.R. : 500MΩ- MIN. or 25 Ω-F MIN., whichever is smaller .
Life test (Endurance)	Test temp. : at max. rated temp. Apply Voltage : 200% of rated Voltage Test time : 1000 + 24/-0 hours Measurement taken after keeping at room temp. for 48±4 hours	1. No remarkable damage 2. Cap change : ≤±12.5% 3. DF : ≤3% for rated voltage ≥50V 4. I.R. : 1GΩ- MIN. or 50Ω-F MIN., whichever is smaller .
Temperature cycle (Thermal Shock)	1. Test step : 1) -55±3°C for 30±3min. 2) room temp. for 2~5min. 3) 125 ±3°C for 30 ±2min. 4) room temp. for 2~5min. 2. Conduct the five cycles according to the temperatures and time . 3. Measurement to be made after keeping at room temp. for 48±4 hours.	1. No remarkable damage. 2. Cap change : ≤±7.5% MAX. 3. DF & I.R : To meet initial requirements.

ESL Performance Comparison



ORDERING CODE

0612	B	104	K	500	B	T
<u>Size code</u>	<u>Dielectric</u>	<u>Capacitance</u> (PicoFarads)	<u>Capacitance</u> <u>Tolerance</u> (EIA code)	<u>Voltage</u> <u>(VDCW)</u>	<u>Termination</u>	<u>Packaging</u> <u>code</u>
0612 (1632)	B = X7R	2 significant digits followed by nr. Of zeros. E.g. : 100 = 10pF 560 = 56pF 101 = 100pF 102 = 1000pF	K : +/- 10%	2 significant digits followed by nr. Of zeros. E.g. : 500 = 50V 101 = 100V	B = BME Nickel barrier	T : 7" reel/Paper tape G : 13" reel/Paper tape

Dielectric	X7R/0612	
EIA Cap. Code	Capacitance (nF)	Thickness Range
103	10	$0.85^{+0.05}_{-0.15}$
123	12	
153	15	
183	18	
223	22	
273	27	
333	33	
393	39	
473	47	
563	56	
683	68	
823	82	
104	100	
124	120	
154	150	

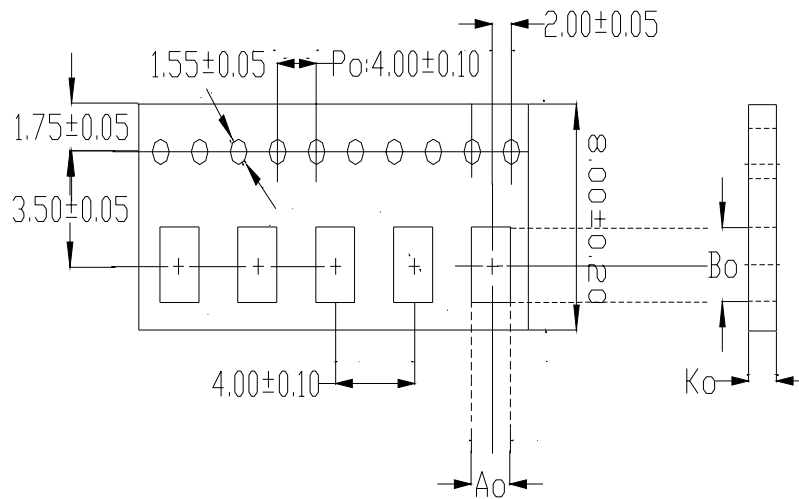


PACKAGING ON TAPE AND REEL

SIZE	T(mm)	TAPE TYPE	QUANTITY
0612	0.85 ^{+0.05} _{-0.15}	Paper tape	4Kps/reel

*Reel Size: standard 7" diameter reel (13" reel available, upon requested)

PLASTIC TAPE



Symbol	Ao	Bo	Co	Ko	Po x 10
Dimension (mm)	2.00±0.20	3.50±0.20	4.00± 0.10	<1.00	40.00±0.20

REEL

