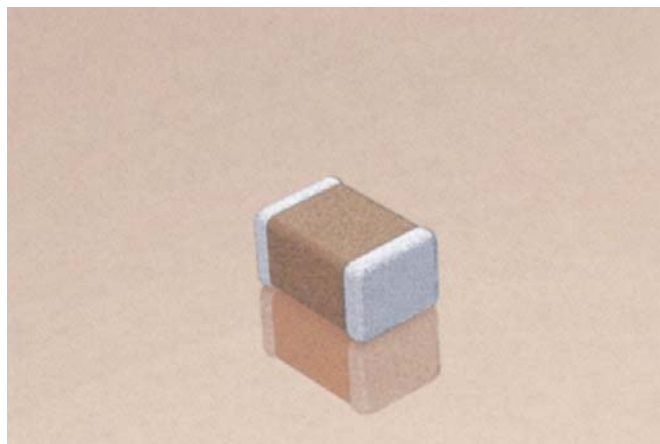


X7R Dielectric

General Specifications



X7R formulations are called "temperature stable" ceramics and fall into EIA Class II materials. X7R is the most popular of these intermediate dielectric constant materials. Its temperature variation of capacitance is within $\pm 15\%$ from -55°C to $+125^{\circ}\text{C}$. This capacitance change is non-linear.

Capacitance for X7R varies under the influence of electrical operating conditions such as voltage and frequency.

X7R dielectric chip usage covers the broad spectrum of industrial applications where known changes in capacitance due to applied voltages are acceptable.

PART NUMBER (see page 2 for complete part number explanation)

0805

Size
(L" x W")

5

Voltage
4V = 4
6.3V = 6
10V = Z
16V = Y
25V = 3
50V = 5
100V = 1
200V = 2
500V = 7

C

Dielectric
X7R = C

103

Capacitance Code (In pF)
2 Sig. Digits +
Number of Zeros

M

Capacitance Tolerance
J = $\pm 5\%$ *
K = $\pm 10\%$
M = $\pm 20\%$

* $\leq 1\mu\text{F}$ only

A

Failure Rate
A = Not
Applicable

T

Terminations
T = Plated Ni
and Sn
7 = Gold Plated*
Z = FLEXITERM®**

*Optional termination

**See FLEXITERM®
X7R section

2

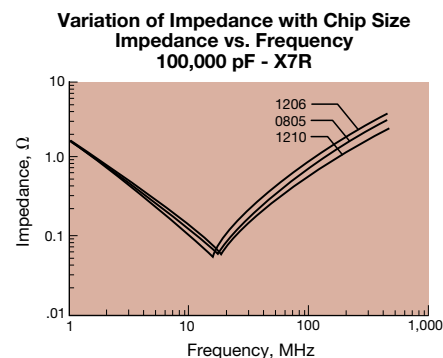
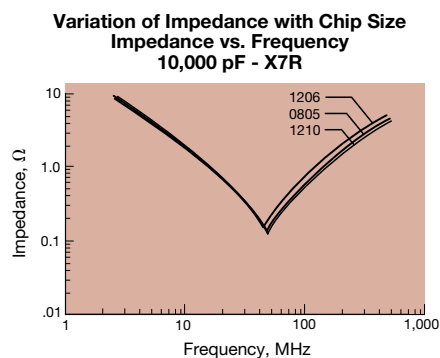
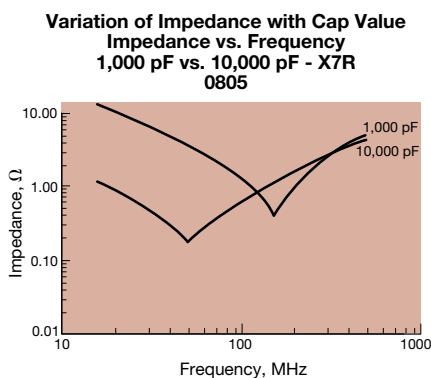
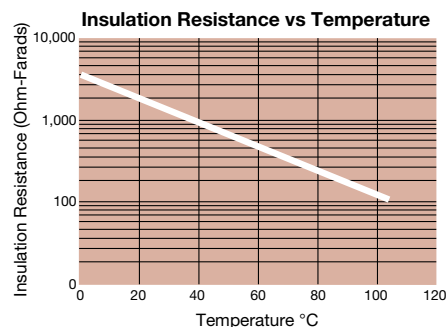
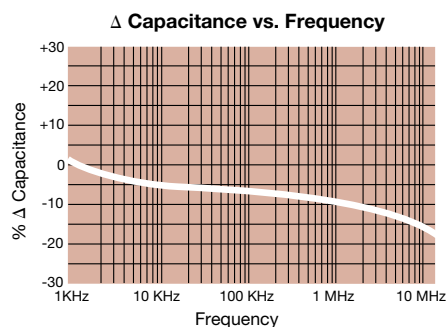
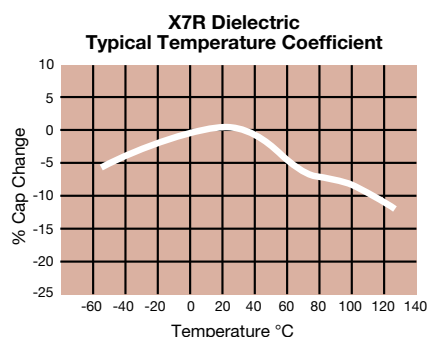
Packaging
2 = 7" Reel
4 = 13" Reel
7 = Bulk Cass.
9 = Bulk

**Contact
Factory For
Multiples**

A

Special Code
A = Std. Product

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.
Contact factory for non-specified capacitance values.



X7R Dielectric



Specifications and Test Methods

Parameter/Test		X7R Specification Limits	Measuring Conditions	
Operating Temperature Range		-55°C to +125°C	Temperature Cycle Chamber	
Capacitance		Within specified tolerance	Freq.: 1.0 kHz $\pm$ 10% Voltage: 1.0Vrms $\pm$.2V For Cap > 10 μ F, 0.5Vrms @ 120Hz	
Dissipation Factor		$\leq$ 2.5% for $\geq$ 50V DC rating $\leq$ 3.0% for 25V DC rating $\leq$ 3.5% for 16V DC rating $\leq$ 5.0% for $\leq$ 10V DC rating		
Insulation Resistance		100,000M Ω or 1000M Ω - μ F, whichever is less		
Dielectric Strength		No breakdown or visual defects	Charge device with rated voltage for 120 $\pm$ 5 secs @ room temp/humidity Charge device with 300% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max) Note: Charge device with 150% of rated voltage for 500V devices.	
Resistance to Flexure Stresses	Appearance	No defects	Deflection: 2mm Test Time: 30 seconds 	
	Capacitance Variation	$\leq \pm 12\%$		
	Dissipation Factor	Meets Initial Values (As Above)		
	Insulation Resistance	$\geq$ Initial Value x 0.3		
Solderability		$\geq$ 95% of each terminal should be covered with fresh solder	Dip device in eutectic solder at 230 $\pm$ 5°C for 5.0 $\pm$ 0.5 seconds	
Resistance to Solder Heat	Appearance	No defects, <25% leaching of either end terminal	Dip device in eutectic solder at 260°C for 60 seconds. Store at room temperature for 24 $\pm$ 2 hours before measuring electrical properties.	
	Capacitance Variation	$\leq \pm 7.5\%$		
	Dissipation Factor	Meets Initial Values (As Above)		
	Insulation Resistance	Meets Initial Values (As Above)		
	Dielectric Strength	Meets Initial Values (As Above)		
Thermal Shock	Appearance	No visual defects	Step 1: -55°C $\pm$ 2°	30 $\pm$ 3 minutes
	Capacitance Variation	$\leq \pm 7.5\%$	Step 2: Room Temp	$\leq$ 3 minutes
	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C $\pm$ 2°	30 $\pm$ 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	$\leq$ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles and measure after 24 $\pm$ 2 hours at room temperature	
Load Life	Appearance	No visual defects	Charge device with 1.5 rated voltage ($\leq$ 10V) in test chamber set at 125°C $\pm$ 2°C for 1000 hours (+48, -0) Remove from test chamber and stabilize at room temperature for 24 $\pm$ 2 hours before measuring.	
	Capacitance Variation	$\leq \pm 12.5\%$		
	Dissipation Factor	$\leq$ Initial Value x 2.0 (See Above)		
	Insulation Resistance	$\geq$ Initial Value x 0.3 (See Above)		
	Dielectric Strength	Meets Initial Values (As Above)		
Load Humidity	Appearance	No visual defects	Store in a test chamber set at 85°C $\pm$ 2°C/ 85% $\pm$ 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied. Remove from chamber and stabilize at room temperature and humidity for 24 $\pm$ 2 hours before measuring.	
	Capacitance Variation	$\leq \pm 12.5\%$		
	Dissipation Factor	$\leq$ Initial Value x 2.0 (See Above)		
	Insulation Resistance	$\geq$ Initial Value x 0.3 (See Above)		
	Dielectric Strength	Meets Initial Values (As Above)		

X7R Dielectric

Capacitance Range



PREFERRED SIZES ARE SHADED

SIZE		0201			0402			0603							0805							1206							
Soldering		Reflow Only			Reflow/Wave			Reflow/Wave							Reflow/Wave							Reflow/Wave							
Packaging		All Paper			All Paper			All Paper							Paper/Embossed							Paper/Embossed							
(L) Length	mm (in.)	0.60 ± 0.03 (0.024 ± 0.001)			1.00 ± 0.10 (0.040 ± 0.004)			1.60 ± 0.15 (0.063 ± 0.006)							2.01 ± 0.20 (0.079 ± 0.008)							3.20 ± 0.20 (0.126 ± 0.008)							
(W) Width	mm (in.)	0.30 ± 0.03 (0.011 ± 0.001)			0.50 ± 0.10 (0.020 ± 0.004)			0.81 ± 0.15 (0.032 ± 0.006)							1.25 ± 0.20 (0.049 ± 0.008)							1.60 ± 0.20 (0.063 ± 0.008)							
(t) Terminal	mm (in.)	0.15 ± 0.05 (0.006 ± 0.002)			0.25 ± 0.15 (0.010 ± 0.006)			0.35 ± 0.15 (0.014 ± 0.006)							0.50 ± 0.25 (0.020 ± 0.010)							0.50 ± 0.25 (0.020 ± 0.010)							
WVDC		10	16	25	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	500
Cap (pF)	100	A	A	A																									
	150	A	A	A																									
	220	A	A	A			C																						
	330	A	A	A			C					G	G	G		J	J	J	J	J	J								K
Cap (pF)	470	A	A				C					G	G	G		J	J	J	J	J	J								K
	680	A	A				C					G	G	G		J	J	J	J	J	J								K
	1000	A	A				C					G	G	G		J	J	J	J	J	J								K
	1500	A					C					G	G	G		J	J	J	J	J	J			J	J	J	J	J	M
Cap (pF)	2200	A					C					G	G	G		J	J	J	J	J	J			J	J	J	J	J	M
	3300	A					C					G	G	G		J	J	J	J	J	J			J	J	J	J	J	M
	4700	A					C					G	G	G		J	J	J	J	J	J			J	J	J	J	J	M
	6800	A					C					G	G	G		J	J	J	J	J	J			J	J	J	J	J	P
Cap (μF)	0.010	A					C					G	G	G		J	J	J	J	J	J			J	J	J	J	J	P
	0.015						C					G	G	G		J	J	J	J	J	J			J	J	J	J	J	M
	0.022						C					G	G	G		J	J	J	J	J	J			J	J	J	J	J	M
	0.033											G	G	G		J	J	J	J	J	N			J	J	J	J	J	M
Cap (μF)	0.047											G	G	G		J	J	J	J	J	N			J	J	J	J	J	M
	0.068											G	G	G		J	J	J	J	J	N			J	J	J	J	J	P
	0.10						C					G	G	G		J	J	J	J	J	N			J	J	J	J	J	P
	0.15											G	G	G		J	J	J	J	J	N			J	J	J	J	J	
Cap (μF)	0.22											J*				J	J	J	J	J	N			J	J	J	J	J	
	0.33											J*				N	N	N	N	N	N			J	J	M	P	Q	
	0.47											J*				N	N	N	N	N	N			M	M	M	P	Q	
	0.68															N	N	N	N	N	N			M	M	Q	Q	Q	
Cap (μF)	1.0											J*				N	N	N	N	N	N			M	M	Q	Q	Q	
	1.5																							M	Q	Q	Q		
	2.2											J*												Q	Q	Q			
	3.3																							Q*	Q*	Q*			
Cap (μF)	4.7															P*	P*	P*						Q*	Q*	Q*			
	10															P*								Q*	Q*	Q*			
	22																							Q*					
	47																												
Cap (μF)	100																												
	WVDC	10	16	25	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	500
	SIZE		0201			0402			0603							0805							1206						
	Letter Max. Thickness		A 0.33 (0.013)	C 0.56 (0.022)	E 0.71 (0.028)	G 0.90 (0.035)	J 0.94 (0.037)	K 1.02 (0.040)							M 1.27 (0.050)	N 1.40 (0.055)	P 1.52 (0.060)	Q 1.78 (0.070)	X 2.29 (0.090)	Y 2.54 (0.100)	Z 2.79 (0.110)								
		PAPER							EMBOSSED																				

*Optional Specifications – Contact factory

Capacitance Range



Figure 1. The effect of the number of nodes on the number of iterations required for convergence. The number of iterations required for convergence increases with the number of nodes. The number of iterations required for convergence is approximately 100 for 10 nodes, 200 for 20 nodes, 300 for 30 nodes, 400 for 40 nodes, 500 for 50 nodes, 600 for 60 nodes, 700 for 70 nodes, 800 for 80 nodes, 900 for 90 nodes, and 1000 for 100 nodes.

*Optional Specifications – Contact factory

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