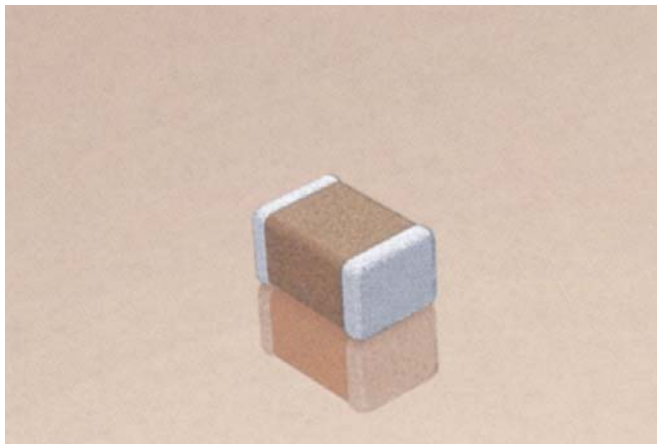


# X7R Dielectric

## 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  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ . This capacitance change is non-linear.

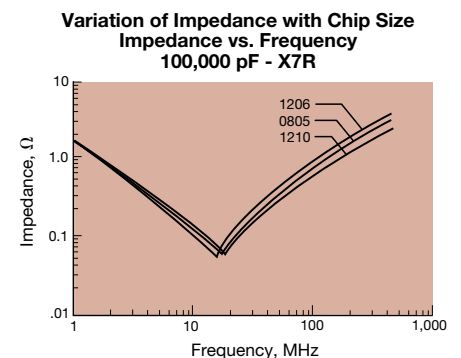
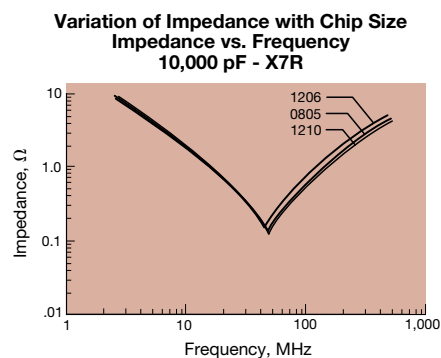
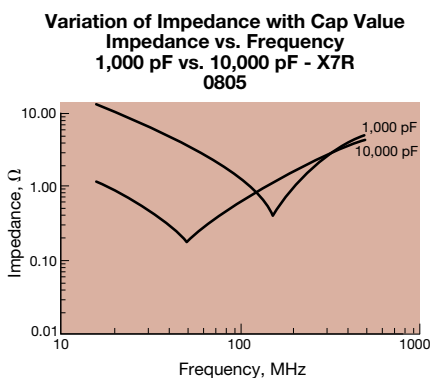
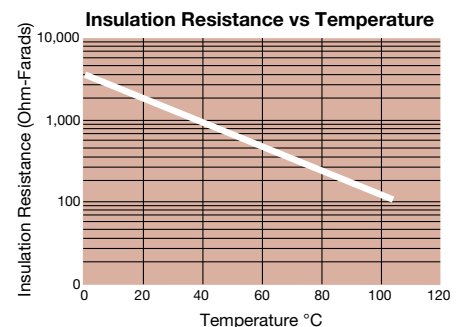
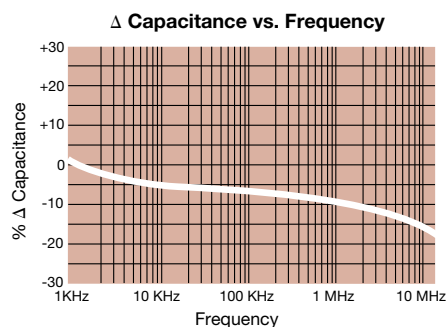
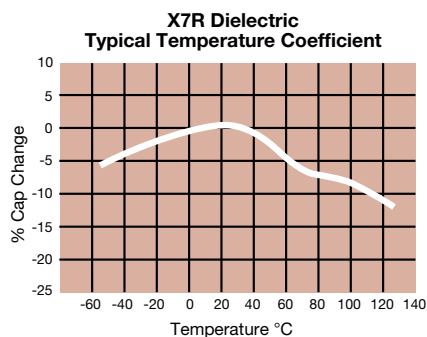
Capacitance for X7R varies under the influence of electrical operating conditions such as voltage and frequency.

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	5	C	103	M	A	T	2	A
<b>Size</b> (L" x W")	<b>Voltage</b> 4V = 4 6.3V = 6 10V = Z 16V = Y 25V = 3 50V = 5 100V = 1 200V = 2 500V = 7	<b>Dielectric</b> X7R = C	<b>Capacitance Code (In pF)</b> 2 Sig. Digits + Number of Zeros	<b>Capacitance Tolerance</b> J = $\pm 5\%*$ K = $\pm 10\%$ M = $\pm 20\%$  * $\leq 1\mu\text{F}$ only	<b>Failure Rate</b> A = Not Applicable	<b>Terminations</b> T = Plated Ni and Sn 7 = Gold Plated* Z = FLEXITERM <sup>®</sup> **	<b>Packaging</b> 2 = 7" Reel 4 = 13" Reel 7 = Bulk Cass. 9 = Bulk	<b>Special Code</b> A = Std. Product
						*Optional termination **See FLEXITERM <sup>®</sup> X7R section	<b>Contact Factory For Multiples</b>	

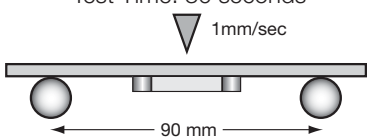
NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.  
Contact factory for non-specified capacitance values.



# X7R Dielectric



## Specifications and Test Methods

Parameter/Test		X7R Specification Limits	Measuring Conditions	
<b>Operating Temperature Range</b>		-55°C to +125°C	Temperature Cycle Chamber	
<b>Capacitance</b>		Within specified tolerance	Freq.: 1.0 kHz $\pm$ 10% Voltage: 1.0Vrms $\pm$ .2V For Cap > 10 $\mu$ F, 0.5Vrms @ 120Hz	
<b>Dissipation Factor</b>		$\leq$ 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		
<b>Insulation Resistance</b>		100,000M $\Omega$ or 1000M $\Omega$ - $\mu$ F, whichever is less	Charge device with rated voltage for 120 $\pm$ 5 secs @ room temp/humidity	
<b>Dielectric Strength</b>		No breakdown or visual defects	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.	
<b>Resistance to Flexure Stresses</b>	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		
<b>Solderability</b>		$\geq$ 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	
<b>Resistance to Solder Heat</b>	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)		
<b>Thermal Shock</b>	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	
<b>Load Life</b>	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)		
<b>Load Humidity</b>	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																
	Reflow Only			Reflow/Wave			Reflow/Wave						Reflow/Wave						Reflow/Wave																
Packaging	All Paper			All Paper			All Paper						Paper/Embossed						Paper/Embossed																
(L) Length (mm)	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)	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)	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	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	J												K		
	470	A	A	A			C				G	G	G		J	J	J	J	J	J	J												K		
	680	A	A	A			C				G	G	G		J	J	J	J	J	J	J												K		
	1000	A	A				C				G	G	G		J	J	J	J	J	J	J												M		
	1500	A	A				C				G	G	G		J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	2200	A	A				C				G	G	G		J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	3300	A	A				C	C			G	G	G		J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	4700	A	A				C	C			G	G	G		J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	6800	A	A				C	C			G	G	G		J	J	J	J	J	J	J					J	J	J	J	J	J	J	P		
Cap (µF)	0.010	A					C	C							J	J	J	J	J	J	J					J	J	J	J	J	J	J	P		
	0.015						C	C			G	G			J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	0.022						C	C			G	G			J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	0.033										G	G			J	J	J	J	J	N						J	J	J	J	J	J	J	M		
	0.047										G	G			J	J	J	J	J	N						J	J	J	J	J	J	J	M		
	0.068										G	G			J	J	J	J	J	N						J	J	J	J	J	J	J	P		
	0.10						C				G	G			J	J	J	J	J	N						J	J	J	J	J	J	J	P		
	0.15										G	G			J	J	J	J	J	N						J	J	J	J	J	J	J			
	0.22										G	G			J	J	J	J	J	N						J	J	J	J	J	J	J	Q		
	0.33														N	N	N	N	N	N						J	J	M	P	Q	Q	Q			
	0.47										J*				N	N	N	N	N	N						M	M	M	P	Q	Q	Q			
	0.68										J*				N	N	N	N	N	N						M	M	Q	Q	Q	Q	Q			
	1.0										J*	J*			N	N	N									M	M	Q	Q	Q	Q	Q			
	1.5																									P	Q	Q	Q						
	2.2										J*															Q	Q	Q							
	3.3																																		
	4.7																																		
	10																																		
	22																																		
	47																																		
	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	6.3	10	16	25	50	100	200	500
SIZE	0201			0402			0603						0805						1206																

Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
	PAPER					EMBOSSSED							

\*Optional Specifications – Contact factory



# X7R Dielectric



## Capacitance Range

PREFERRED SIZES ARE SHADED

SIZE	1210								1812				1825		2220				2225	
	Reflow Only								Reflow Only				Reflow Only		Reflow Only				Reflow Only	
Soldering	Paper/Embossed								All Embossed				All Embossed		All Embossed				All Embossed	
Packaging	Paper/Embossed								All Embossed				All Embossed		All Embossed				All Embossed	
(L) Length	3.20 ± 0.20 (0.126 ± 0.008)								4.50 ± 0.30 (0.177 ± 0.012)				4.50 ± 0.30 (0.177 ± 0.012)		5.70 ± 0.40 (0.225 ± 0.016)				5.72 ± 0.25 (0.225 ± 0.010)	
(W) Width	2.50 ± 0.20 (0.098 ± 0.008)								3.20 ± 0.20 (0.126 ± 0.008)				6.40 ± 0.40 (0.252 ± 0.016)		5.00 ± 0.40 (0.197 ± 0.016)				6.35 ± 0.25 (0.250 ± 0.010)	
(t) Terminal	0.50 ± 0.25 (0.020 ± 0.010)								0.61 ± 0.36 (0.024 ± 0.014)				0.61 ± 0.36 (0.024 ± 0.014)		0.64 ± 0.39 (0.025 ± 0.015)				0.64 ± 0.39 (0.025 ± 0.015)	
WVDC	10	16	25	50	100	200	500	50	100	200	500	50	100	25	50	100	200	50	100	
Cap (pF)	100																			
150																				
220																				
330																				
470																				
680																				
1000																				
1500	J	J	J	J	J	J	M													
2200	J	J	J	J	J	J	M													
3300	J	J	J	J	J	J	M													
4700	J	J	J	J	J	J	M													
6800	J	J	J	J	J	J	M													
Cap (µF)	0.010	J	J	J	J	J	M	K	K	K	K	M	M		X	X	X	M	P	
0.015	J	J	J	J	J	J	P	K	K	K	P	M	M		X	X	X	M	P	
0.022	J	J	J	J	J	J	Q	K	K	K	P	M	M		X	X	X	M	P	
0.033	J	J	J	J	J	J	Q	K	K	K	X	M	M		X	X	X	M	P	
0.047	J	J	J	J	J	J		K	K	K	Z	M	M		X	X	X	M	P	
0.068	J	J	J	J	J	M		K	K	K	Z	M	M		X	X	X	M	P	
0.10	J	J	J	J	J	M		K	K	K	Z	M	M		X	X	X	M	P	
0.15	J	J	J	J	M	Z		K	K	P		M	M		X	X	X	M	P	
0.22	J	J	J	J	P	Z		K	K	P		M	M		X	X	X	M	P	
0.33	J	J	J	J	Q			K	M	X		M	M		X	X	X	M	P	
0.47	M	M	M	M	Q			K	P			M	M		X	X	X	M	P	
0.68	M	M	P	X	X			M	Q			M	P		X	X		M	P	
1.0	N	N	P	X	Z			M	X			M	P		X	X		M	P	
1.5	N	N	Z	Z	Z			Z	Z			M			X	X		M	X	
2.2	X	X	Z	Z	Z			Z	Z						X	X		M		
3.3	X	X	Z	Z				Z							X	Z				
4.7	X	X	Z	Z				Z							X	Z				
10	Z	Z	Z*												Z					
22	Z*	Z*																		
47																				
100																				
WVDC	10	16	25	50	100	200	500	50	100	200	500	50	100	25	50	100	200	50	100	
SIZE	1210								1812				1825		2220				2225	
Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z							
Max. Thickness	0.33 (0.013)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)							
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\*Optional Specifications – Contact factory