

# 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 4 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,  
contact factory for additional values

**A**

**Failure Rate**  
A = Not Applicable

**T**

**Terminations**  
T = Plated Ni and Sn  
Z = FLEXITERM<sup>®</sup>\*\*

\*Optional termination

\*\*See FLEXITERM<sup>®</sup> X7R section

**2**

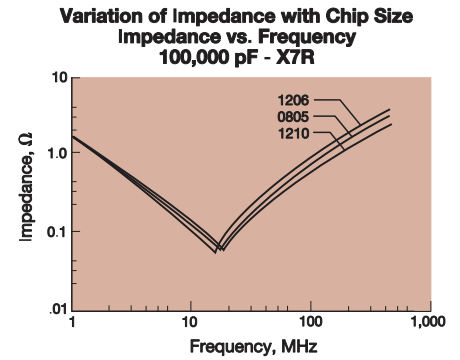
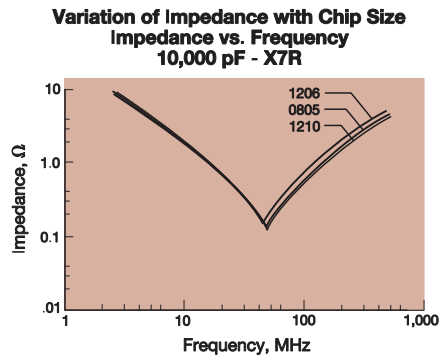
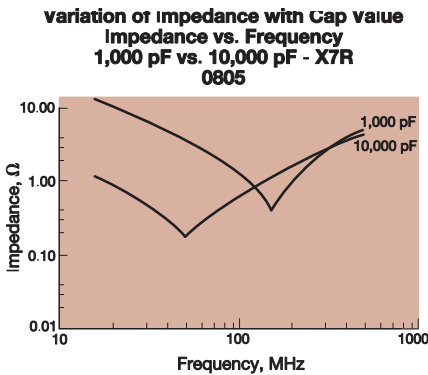
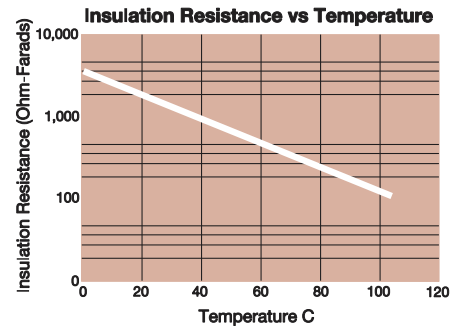
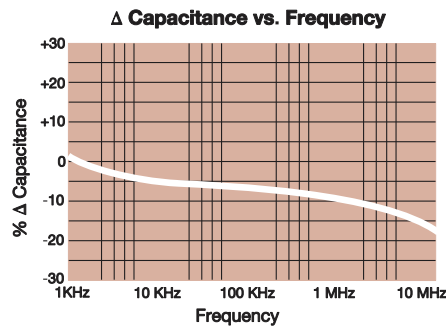
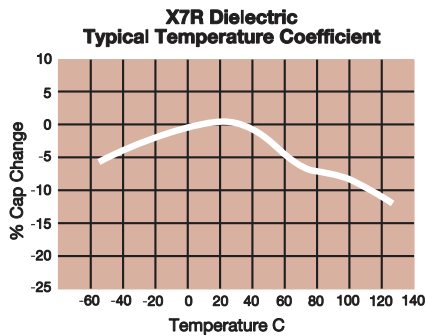
**Packaging**  
2 = 7" Reel  
4 = 13" Reel

**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	
<b>Operating Temperature Range</b>		-55°C to +125°C	Temperature Cycle Chamber	
<b>Capacitance</b>		Within specified tolerance		
<b>Dissipation Factor</b>		$\leq 10\%$ for $\geq 50V$ DC rating $\leq 12.5\%$ for 25V DC rating $\leq 12.5\%$ for $\leq 10V$ DC rating Contact Factory for DF by PN	Freq.: 1.0 kHz $\pm 10\%$ Voltage: 1.0Vrms $\pm .2V$ For Cap > 10 $\mu$ F, 0.5Vrm @ 120Hz	
<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 250% 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)  If RV > 10V then Life Test voltage will be 2xRV but there are exceptions (please contact AVX for further details on exceptions)  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	0101*	0201				0402				0603					0805					1206																											
Soldering	Reflow Only	Reflow Only				Reflow/Wave				Reflow/Wave					Reflow/Wave					Reflow/Wave																											
Packaging	Paper/ Embossed	All Paper				All Paper				All Paper					Paper/Embossed					Paper/Embossed																											
(L) Length	mm (in.)	0.40 ± 0.02 (0.016 ± 0.0008)				0.60 ± 0.09 (0.024 ± 0.004)				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 ± 0.30 (0.126 ± 0.012)																							
(W) Width	mm (in.)	0.20 ± 0.02 (0.008 ± 0.0008)				0.30 ± 0.09 (0.011 ± 0.004)				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 ± 0.30 (0.063 ± 0.012)																							
(t) Terminal	mm (in.)	0.10 ± 0.04 (0.004 ± 0.0016)				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	16	6.3	10	16	25	50	6.3	10	16	25	50	100	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250			
Cap 100 101	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	G	J	J																	G	G	N	N	N	N	N	N		
(pF) 150 151	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	G	J	J																	G	G	G	G	G	G	N	N	N	N
220 221	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	G	J	J	E	E	E	E	E	E	E	E	J	J	J	J	J	J	J	J	G	G	J	J	J	J	N	N	N	N
330 331	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
470 471	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
680 681	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
1000 102	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
1500 152		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
2200 222		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
3300 332		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
3900 392		A	A	A	A																																										
4700 472		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
5600 562		A	A	A	A																																										
6800 682		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
Cap 0.01 103		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	G	J	J									J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	N	N
(µF) 0.012 123																																															
0.015 153							C	C	C	C	E			G	G	G	G	G	J	J	J									J	J	J	J	J	P	P	J	J	J	J	N	N	Q				
0.018 183																																															
0.022 223		A	A	A			C	C	C	C	E			G	G	G	G	G	J	J	J									J	J	J	J	J	P	P	J	J	J	J	J	P	Q				
0.027 273																																															
0.033 333							C	C	C	C	E			G	G	G	G	G	J	J	J									J	J	J	J	P	P	P	J	J	J	J	J	Q	Q				
0.039 393																																															
0.047 473							C	C	C	C	E			G	G	G	G	J	J	J									J	J	J	J	P	P	P	J	J	J	J	J	Q	Q					
0.068 683							C	C	C	C	E			G	G	G	G	J	J	J									J	J	J	J	P	P		J	J	J	J	P	Q	Q					
0.082 823																																															
0.1 104		A					C	C	C	C	E			G	G	G	G	J	J	J									J	J	J	J	P	P		J	J	J	J	P	Q	Q					
0.12 124																																															
0.15 154													G	G	G	J	J														N	N	N	N	P			K	K	K	K	Q	Q	Q			
0.22 224							C	C	C	C			G	G	J	J	J														N	N	N	N	P			K	K	K	K	Q	Q	Q			
0.33 334													J	J	J	J														P	P	P	P	P			K	K	K	N	Q						
0.47 474							C	C					J	J	J	J														P	P	P	P	P			M	M	M	M	X	X					
0.68 684													J	J	J														P	P	P					M	M	M	M	X	X						
1.0 105							C						J	J	J	J														P	P	P	P				M	M	M	M	X	X					
2.2 225													J	J	K														P	P	P	P				M	M	M	X	X	X						
4.7 475													K														P	P	P					X	X	X	X	Z									
10 106																											P	P	P					X	X	X	X										
22 226																																		X	X	X											
47 476																																															
100 107																																															
WVDC	16	6.3	10	16	25	50	6.3	10	16	25	50	100	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250	6.3	10	16	25	50	100	200	250			

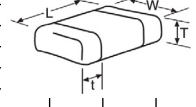
Letter	A	B	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	0.22 (0.009)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
	PAPER						EMBOSSSED							

NOTE: Contact factory for non-specified capacitance values  
 \*EIA 01005  
 \*\*Contact Factory for Specifications

# X7R Dielectric Capacitance Range

## PREFERRED SIZES ARE SHADED

SIZE	1210								1812					1825			2220					2225				
Soldering	Reflow Only								Reflow Only					Reflow Only			Reflow Only					Reflow Only				
Packaging	Paper/Embossed								All Embossed					All Embossed			All Embossed					All Embossed				
(L) Length	3.30 ± 0.4 (0.130 ± 0.016)								4.50 ± 0.40 (0.177 ± 0.016)					4.50 ± 0.40 (0.177 ± 0.016)			5.70 ± 0.50 (0.224 ± 0.020)					5.70 ± 0.40 (0.224 ± 0.016)				
(W) Width	2.50 ± 0.30 (0.098 ± 0.012)								3.20 ± 0.40 (0.126 ± 0.016)					6.40 ± 0.40 (0.252 ± 0.016)			5.00 ± 0.40 (0.197 ± 0.016)					6.30 ± 0.40 (0.248 ± 0.016)				
(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	16	25	50	100	200	500	50	100	200	25	50	100	200	500	50	100	200		
Cap 100 101																										
(pF) 150 151																										
220 221				K	K	K	M																			
330 331				K	K	K	M			N	N	N	N													
470 471				K	K	K	M			N	N	N	N													
680 681				K	K	K	M			N	N	N	N													
1000 102	K	K	K	K	K	K	M	N	N	N	N	N	N	X	X	X	X	X	X	X	X	X	X	X		
1500 152	K	K	K	K	K	K	M	N	N	N	N	N	N	X	X	X	X	X	X	X	X	X	X	X		
2200 222	K	K	K	K	K	K	M	N	N	N	N	N	N	X	X	X	X	X	X	X	X	X	X	X		
3300 332	K	K	K	K	K	K	P	N	N	N	N	N	N	X	X	X	X	X	X	X	X	X	X	X		
4700 472	K	K	K	K	K	K	P	N	N	N	N	N	P	X	X	X	X	X	X	X	X	X	X	X		
6800 682	K	K	K	K	K	K	P	N	N	N	N	N	P	X	X	X	X	X	X	X	X	X	X	X		
Cap 0.01 103	K	K	K	K	K	K	P	N	N	N	N	N	P	X	X	X	X	X	X	X	X	X	X	X		
(µF) 0.015 153	K	K	K	K	K	K	P	N	N	N	N	N	P	X	X	X	X	X	X	X	X	X	X	X		
0.022 223	K	K	K	K	K	P	Q	N	N	N	N	N	P	X	X	X	X	X	X	X	X	X	X	X		
0.033 333	K	K	K	K	K	P	X	N	N	N	N	N	X	X	X	X	X	X	X	X	X	X	X	X		
0.047 473	K	K	K	K	K	P	X	N	N	N	N	P	X	X	X	X	X	X	X	X	X	X	X			
0.068 683	K	K	K	K	K	P	X	N	N	N	N	P	X	X	X	X	X	X	X	X	X	X	X			
0.1 104	K	K	K	K	K	P	X	N	N	N	N	P	X	X	X	X	X	X	X	X	X	X	X			
0.15 154	K	K	K	M	P	Z	Z	N	N	N	P	P	Z	X	X	X	X	X	X	X	X	X	X	X		
0.22 224	K	K	K	M	P	Z		N	N	N	P	Q	Z	X	X	X	X	X	X	X	X	X	X	X		
0.33 334	K	K	K	M	Q	Z		N	N	N	P	X	Z	X	X	X	X	X	X	X	X	X	X	X		
0.47 474	M	M	M	P	Q	Z		N	N	N	Q	X	Z	X	X	X	X	X	X	X	X	X	X	X		
0.68 684	M	M	P	X	X	Z		Q	Q	Q	Q	Z		X	X	X	X	X	X		X	X	X	X		
1.0 105	P	P	P	X	Z			Q	Q	Q	X	Z		X	X	X	X	X	X		X	X	X	X		
1.5 155	N	N	Z	Z	Z				Z	Z	Z		X	X	Z	X	X	Z		X	X	Z	X	X	Z	
2.2 225	X	X	Z	Z	Z				Z	Z	Z		X	X	Z	X	X	Z		X	X	Z	X	X	Z	
3.3 335	X	X	Z	Z	Z				Z	Z	Z		X	X		X	Z			X	Z		X	X		
4.7 475	Z	Z	Z	Z	Z				Z	Z	Z		X	X		Z	Z			Z	Z		X	X		
10 106	Z	Z	Z	Z				Z	Z	Z			Z	Z			Z	Z			Z	Z		Z	Z	
22 226	Z	Z	Z														Z									
47 476	Z																									
100 107																										
WVDC	10	16	25	50	100	200	500	16	25	50	100	200	500	50	100	200	25	50	100	200	500	50	100	200		
SIZE	1210								1812					1825			2220					2225				



Letter	A	B	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	0.22 (0.009)	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							

NOTE: Contact factory for non-specified capacitance values