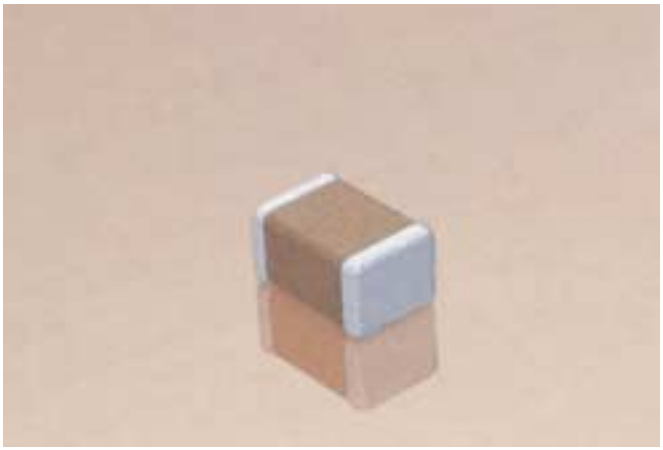
X7R Dielectric

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 ±15% from -55°C to +125°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.

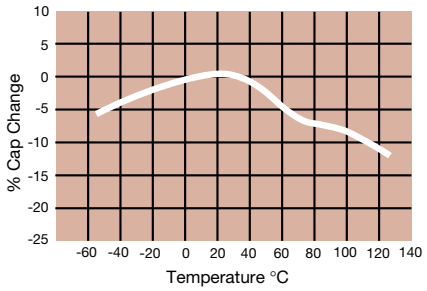
PART NUMBER (see page 2 for complete part number explanation)

0805	5	C	103	M	A	T	2	A
Size (L" x W")	**Voltage** 6.3V = 6, 10V = Z, 16V = Y, 25V = 3, 50V = 5, 100V = 1, 200V = 2	**Dielectric** X7R = C	**Capacitance Code (In pF)** 2 Sig. Digits + Number of Zeros	**Capacitance Tolerance** Preferred J = ± 5%, K = ±10%, M = ± 20%	**Failure Rate** A = Not Applicable	**Terminations** T = Plated Ni and Sn, 7 = Gold Plated	**Packaging** 2 = 7" Reel, 4 = 13" Reel, 7 = Bulk Cass., 9 = Bulk	**Special Code** A = Std. Product

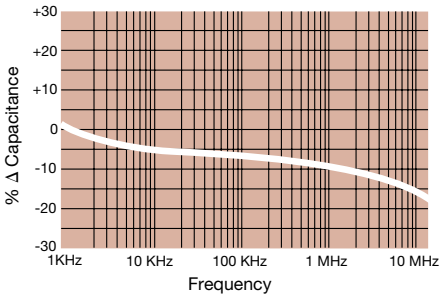
Contact Factory For Multiples

Datasheet.Line

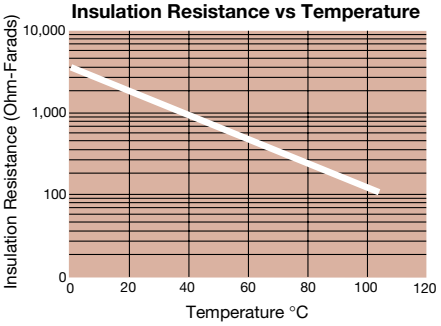
X7R Dielectric
Typical Temperature Coefficient



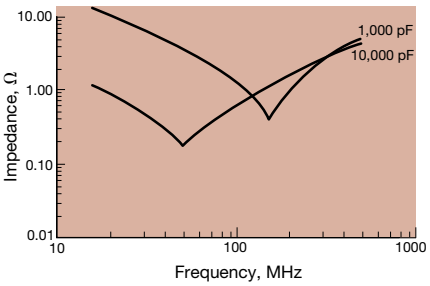
Δ Capacitance vs. Frequency



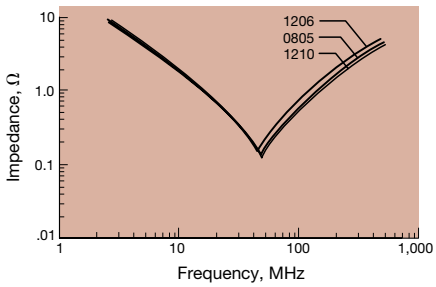
Insulation Resistance vs Temperature



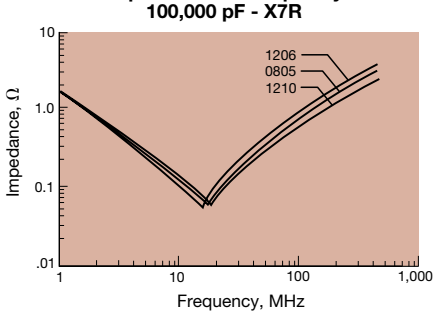
Variation of Impedance with Cap Value
Impedance vs. Frequency
1,000 pF vs. 10,000 pF - X7R
0805



Variation of Impedance with Chip Size
Impedance vs. Frequency
10,000 pF - X7R

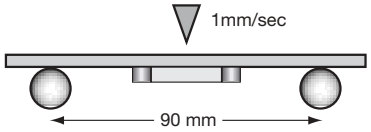


Variation of Impedance with Chip Size
Impedance vs. Frequency
100,000 pF - X7R



X7R Dielectric

Specifications and Test Methods

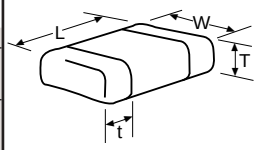
Parameter/Test		X7R Specification Limits	Measuring Conditions	
Operating Temperature Range		-55ºC to +125ºC	Temperature Cycle Chamber	
Capacitance		Within specified tolerance	Freq.: 1.0 kHz ± 10% Voltage: 1.0Vrms ± .2V For Cap > 10 µF, 0.5Vrms @ 120Hz	
Dissipation Factor		≤ 2.5% for ≥ 50V DC rating ≤ 3.0% for 25V DC rating ≤ 3.5% for 16V DC rating ≤ 5.0% for ≤ 10V DC rating		
Insulation Resistance		100,000MΩ or 1000MΩ - µF, whichever is less	Charge device with rated voltage for 60 ± 5 secs @ room temp/humidity	
Dielectric Strength		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)	
Resistance to Flexure Stresses	Appearance	No defects	Deflection: 2mm Test Time: 30 seconds 	
	Capacitance Variation	≤ ±12%		
	Dissipation Factor	Meets Initial Values (As Above)		
	Insulation Resistance	≥ Initial Value x 0.3		
Solderability		≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic solder at 230 ± 5ºC for 5.0 ± 0.5 seconds	
Resistance to Solder Heat	Appearance	No defects, <25% leaching of either end terminal	Dip device in eutectic solder at 260ºC for 60 seconds. Store at room temperature for 24 ± 2 hours before measuring electrical properties.	
	Capacitance Variation	≤ ±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: -55ºC ± 2º	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125ºC ± 2º	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles and measure after 24 ± 2 hours at room temperature	
Load Life	Appearance	No visual defects	Charge device with twice rated voltage in test chamber set at 125ºC ± 2ºC for 1000 hours (+48, -0) Remove from test chamber and stabilize at room temperature for 24 ± 2 hours before measuring.	
	Capacitance Variation	≤ ±12.5%		
	Dissipation Factor	≤ Initial Value x 2.0 (See Above)		
	Insulation Resistance	≥ 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 85ºC ± 2ºC/ 85% ± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied. Remove from chamber and stabilize at room temperature and humidity for 24 ± 2 hours before measuring.	
	Capacitance Variation	≤ ±12.5%		
	Dissipation Factor	≤ Initial Value x 2.0 (See Above)		
	Insulation Resistance	≥ 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 Only					Reflow/Wave							Reflow/Wave						Reflow/Wave					
Packaging		All Paper		All Paper					All Paper							Paper/Embossed						Paper/Embossed					
(L) Length	MM	0.60 ± 0.03		1.00 ± 0.10					1.60 ± 0.15							2.01 ± 0.20						3.20 ± 0.20					
	(in.)	(0.024 ± 0.001)		(0.040 ± 0.004)					(0.063 ± 0.006)							(0.079 ± 0.008)						(0.126 ± 0.008)					
(W) Width	MM	0.30 ± 0.03		0.50 ± 0.10					0.81 ± 0.15							1.25 ± 0.20						1.60 ± 0.20					
	(in.)	(0.011 ± 0.001)		(0.020 ± 0.004)					(0.032 ± 0.006)							(0.049 ± 0.008)						(0.063 ± 0.008)					
(t) Terminal	MM	0.15 ± 0.05		0.25 ± 0.15					0.35 ± 0.15							0.50 ± 0.25						0.50 ± 0.25					
	(in.)	(0.006 ± 0.002)		(0.010 ± 0.006)					(0.014 ± 0.006)							(0.020 ± 0.010)						(0.020 ± 0.010)					
WVDC		10	16	6.3	10	16	25	50	6.3	10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200
Cap (pF)	100	A	A	C	C	C	C	C																			
	120	A	A	C	C	C	C	C																			
	150	A	A	C	C	C	C	C																			
	180	A	A	C	C	C	C	C	G	G	G	G	G	G	G												
	220	A	A	C	C	C	C	C	G	G	G	G	G	G	G												
	270	A	A	C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E						
	330	A	A	C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E						
	390	A	A	C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E						
	470	A	A	C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E						
	560	A	A	C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E						
	680	A	A	C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E						
	820	A	A	C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E						
	1000	A	A	C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E	J	J	J	J	J	J
	1200			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E	J	J	J	J	J	J
	1500			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E	J	J	J	J	J	J
	1800			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E	J	J	J	J	J	J
	2200			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E	J	J	J	J	J	J
	2700			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	E	J	J	J	J	J	J
	3300			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	J	J	J	J	J	J	J
	3900			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	J	J	J	J	J	J	J
	4700			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	E	J	J	J	J	J	J	J
	5600			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	J	J	J	J	J	J	J	J
	6800			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	J	J	J	J	J	J	J	J
	8200			C	C	C	C	C	G	G	G	G	G	G	G	E	E	E	E	J	J	J	J	J	J	J	J
Cap. (µF)	0.010			C	C	C			G	G	G	G	G	G	G	E	E	E	E	J	J	J	J	J	J	J	J
	0.012			C	C	C			G	G	G	G	G	G	G	E	E	E	E	J	J	J	J	J	J	J	J
	0.015			C	C	C			G	G	G	G	G	G	G	E	E	E	E	J	J	J	J	J	J	J	J
	0.018			C	C	C			G	G	G	G	G	G		J	J	J	J	J	M	J	J	J	J	J	M
	0.022			C	C	C			G	G	G	G	G	G		J	J	J	J	J	M	J	J	J	J	J	M
	0.027			C	C	C			G	G	G	G	G	G		J	J	J	J	J	M	J	J	J	J	J	M
	0.033			C	C				G	G	G	G	G			J	J	J	J	M		J	J	J	J	J	M
	0.039			C	C				G	G	G	G	G			J	J	J	J	M		J	J	J	J	J	M
	0.047								G	G	G	G				J	J	J	J	M		J	J	J	J	J	M
	0.056								G	G	G	G				J	J	J	J			J	J	J	J	J	P
	0.068								G	G	G	G				J	J	J	J			J	J	J	J	M	P
	0.082								G	G	G	G				J	J	J	J			J	J	J	J	M	
	0.10								G	G	G					J	J	J	J	J		J	J	J	J	M	
	0.12								G	G	G					J	J	J	J	M		J	J	J	J		
	0.15								G	G	G					J	J	J	J	M		J	J	J	J		
	0.18								G	G						J	J	M	M			J	J	J	J		
	0.22								G	G						J	J	M	M			J	J	J	J		
	0.27															M	M					J	J	J	M		
	0.33															M	M					J	J	M	M		
	0.47															N	M					M	M	M	M		
	0.56															N	M					M	M	Q			
	0.68															N						M	M	Q			
	0.82															N						M	M	Q			
	1.0															N						M	M	Q			
	1.2																					P					
	1.5																					P					
	1.8																					P					
	2.2																					Q					
	3.3																										
	4.7																										
	10																										
	22																										
	47																										
	100																										
WVDC		10	16	6.3	10	16	25	50	6.3	10	16	25	50	100	200	10	16	25	50	100	200	10	16	25	50	100	200
SIZE		0201		0402					0603							0805						1206					



Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z	BB	CC
Max. Thickness	0.33 (0.013)	0.56 (0.022)	0.71 (0.028)	0.86 (0.034)	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)	3.05 (0.120)	3.175 (0.125)
	PAPER					EMBOSSED									

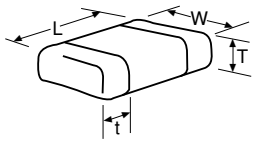
Contact Factory for Multiples

X7R Dielectric

Capacitance Range

PREFERRED SIZES ARE SHADED

SIZE		1210					1812				1825		2220			2225	
Soldering		Reflow/Wave					Reflow Only				Reflow Only		Reflow Only			Reflow Only	
Packaging		Paper/Embossed					All Embossed				All Embossed		All Embossed			All Embossed	
(L) Length	MM (in.)	3.20 ± 0.20 (0.126 ± 0.008)					4.50 ± 0.30 (0.177 ± 0.012)				4.50 ± 0.30 (0.177 ± 0.012)		5.7 ± 0.40 (0.224 ± 0.016)			5.72 ± 0.25 (0.225 ± 0.010)	
(W) Width	MM (in.)	2.50 ± 0.20 (0.098 ± 0.008)					3.20 ± 0.20 (0.126 ± 0.008)				6.40 ± 0.40 (0.252 ± 0.016)		5.0 ± 0.40 (0.197 ± 0.016)			6.35 ± 0.25 (0.250 ± 0.010)	
(t) Terminal	MM (in.)	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	16	25	50	100	50	100	50	100	200	50	100
Cap (pF)	100																
	120																
	150																
	180																
	220																
	270																
	330																
	390																
	470																
	560																
	680																
	820																
	1000	J	J	J	J	J											
	1200	J	J	J	J	J											
	1500	J	J	J	J	J											
	1800	J	J	J	J	J											
	2200	J	J	J	J	J											
	2700	J	J	J	J	J											
	3300	J	J	J	J	J											
	3900	J	J	J	J	J											
	4700	J	J	J	J	J											
	5600	J	J	J	J	J											
	6800	J	J	J	J	J											
	8200	J	J	J	J	J											
Cap. (µF)	0.010	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.012	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.015	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.018	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.022	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.027	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.033	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.039	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.047	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.056	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.068	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.082	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.10	J	J	J	J	J			K	K	M	M	X	X	X	M	M
	0.12	J	J	J	J	M			K	K	M	M	X	X	X	M	M
	0.15	J	J	J	J	M			K	K	M	M	X	X	X	M	M
	0.18	J	J	J	J	P			K	K	M	M	X	X	X	M	M
	0.22	J	J	J	J	P			K	K	M	M	X	X	X	M	M
	0.27	J	J	J	J	Z			K	M	M	M	X	X		M	M
	0.33	J	J	J	J	Z			K	M	M	M	X	X		M	M
	0.47	M	M	M	M	Z			K	P	M	M	X	X		M	M
	0.56	M	M	M		Z			M	Q	M	M	X	X		M	M
	0.68	M	M	P		Z			M	X	M	Q	X	X		M	M
	0.82	M	M	P					M	X	M	Q	X			M	M
	1.0	N	N	P	X	Z			M	X	M	Q	X			M	M
	1.2	N	N					M			M		X			M	P
	1.5	N	N								M					M	P
	1.8	N	P													M	
	2.2			X										Z		M	
	3.3																
	4.7	Q	Z														
	10						Z										
	22																
	47																
	100																
WVDC		10	16	25	50	100	16	25	50	100	50	100	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	BB	CC
Max. Thickness	0.33 (0.013)	0.56 (0.022)	0.71 (0.028)	0.86 (0.034)	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)	3.05 (0.120)	3.175 (0.125)
	PAPER					EMBOSSED									

Contact Factory for Multiples