

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.

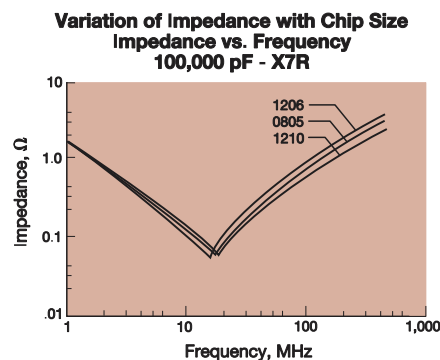
X7R dielectric chip usage covers the broad spectrum of industrial applications where known changes in capacitance due to applied voltages are acceptable.



PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

0805	5	C	103	M	A	T	2	A
Size (L" x W")	Voltage 4V = 4 6.3V = 6 10V = Z 16V = Y 25V = 3 50V = 5 100V = 1 200V = 2 500V = 7	Dielectric X7R = C	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros	Capacitance Tolerance J = $\pm 5\%$ * K = $\pm 10\%$ M = $\pm 20\%$ * $\leq 1\mu\text{F}$ only, contact factory for additional values	Failure Rate A = Not Applicable	Terminations T = Plated Ni and Sn Z = FLEXITERM®** *Optional termination **See FLEXITERM® X7R section	Packaging 2 = 7" Reel 4 = 13" Reel Contact Factory For Multiples	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, 0.5Vrm @ 120Hz	
Dissipation Factor		$\leq$ 10% for $\geq$ 50V DC ratings $\leq$ 12.5% for 25V and 16V DC rating $\leq$ 12.5% for $\leq$ 10V DC rating Contact Factory for DF by PN		
Insulation Resistance		10,000M Ω or 500M Ω - μ F, whichever is less	Charge device with rated voltage for 120 $\pm$ 5 secs @ room temp/humidity	
Dielectric Strength		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.	
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	Pre-treatment: After mounting, perform heat treatment 150+0/-10C for 2 hour, then stabilise for 24+/-2 hour at room temp, then measure.	
	Capacitance Variation	$\leq \pm 12.5\%$		
	Dissipation Factor	$\leq$ Initial Value x 2.0 (See Above)	Charge device with $\geq$ rated voltage in test chamber set at 125°C $\pm$ 2°C for 1000 hours (+48, -0).	
	Insulation Resistance	$\geq$ Initial Value x 0.3 (See Above)	Pre-treatment: After remove from test chamber, perform heat treatment 150+0/-10C for 2 hour, then stabilise for 24+/-2 hour at room temp, then measure.	
	Dielectric Strength	Meets Initial Values (As Above)	Contact KYOCERA AVX for datasheet of specific parts.	
Load Humidity	Appearance	No visual defects	Pre-treatment: After mounting, perform heat treatment 150+0/-10C for 2 hour, then stabilise for 24+/-2 hour at room temp, then measure.	
	Capacitance Variation	$\leq \pm 12.5\%$		
	Dissipation Factor	$\leq$ Initial Value x 2.0 (See Above)	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.	
	Insulation Resistance	$\geq$ Initial Value x 0.3 (See Above)	Pre-treatment: After remove from test chamber, perform heat treatment 150+0/-10C for 2 hour, then stabilise for 24+/-2 hour at room temp, then measure.	
	Dielectric Strength	Meets Initial Values (As Above)		

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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 ± 0.03 (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 ± 0.30 (0.126 ± 0.012)												
(W) Width	mm (in.)	0.20 ± 0.02 (0.008 ± 0.0008)	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 ± 0.30 (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	500	
Cap	100	101	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	J	J													G	G	N	N	N
(pF)	150	151	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	J	J											G	G	G	N	N		
	220	221	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	J	J	E	E	E	E	E	E	E	J	J	J	J	J	J	N	N	P	
	330	331	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P		
	470	471	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P		
	680	681	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P		
	1000	102	B	A	A	A	A	A	C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P		
	1500	152		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P		
	2200	222		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P			
	3300	332		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P			
	3900	392		A	A	A	A																																
	4700	472		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P			
	5600	562		A	A	A	A																																
	6800	682		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P			
Cap	0.01	103		A	A	A	A		C	C	C	C	C	C	G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P				
(μF)	0.012	123																																					
	0.015	153							C	C	C	C	C		G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	N	N	Q					
	0.018	183																																					
	0.022	223		A	A	A			C	C	C	C	C		G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	P	P	Q					
	0.027	273																																					
	0.033	333							C	C	C	C	C		G	G	G	G	J	J			J	J	J	J	P	P	P	J	J	J	J	Q	Q	Q			
	0.039	393																																					
	0.047	473							C	C	C	C	C		G	G	G	G	J	J			J	J	J	J	P	P	P	J	J	J	J	Q	Q	Q			
	0.068	683							C	C	C	C	E		G	G	G	G	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	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	J				P	P	P	P	P			K	K	K	K	N	Q				
	0.47	474							C	C					J	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	K				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								
	47	476																												X	X								
	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	500	

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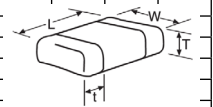
NOTE: Contact factory for non-specified capacitance values
*EIA 01005
**Contact Factory for Specifications

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Capacitance Range

PREFERRED SIZES ARE SHADED

SIZE		1210							1812							1825			2220					2225		
		Reflow Only							Reflow Only							Reflow Only			Reflow Only					Reflow Only		
		Paper/Embossed							All Embossed							All Embossed			All Embossed					All Embossed		
(L) Length	mm (in.)	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	mm (in.)	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	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 50 100 200 500	16 25 50 100 200 500																								
Cap	100 101																									
(pF)	150 151																									
	220 221																									
	330 331																									
	470 471																									
	680 681																									
	1000 102	K K K K K K K M N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	1500 152	K K K K K K K M N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	2200 222	K K K K K K K M N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	3300 332	K K K K K K K P N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	4700 472	K K K K K K K P N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	6800 682	K K K K K K K P N N N N N N N X X X X X X X X X X X X X X X X X X X																								
Cap	0.01 103	K K K K K K K P N N N N N N N X X X X X X X X X X X X X X X X X X X																								
(μF)	0.015 153	K K K K K K K P N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	0.022 223	K K K K K K P Q N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	0.033 333	K K K K K K P X N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	0.047 473	K K K K K K P X N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	0.068 683	K K K K K K P X N N N N N N N X X X X X X X X X X X X X X X X X X X																								
	0.1 104	K K K K K K P X N N N N P X X X X X X X X 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 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 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 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 X X X X X X X																								
	0.68 684	M M P X X Z Q Q Q Q Q Z X X X X X X X X X X X X X X X X X X																								
	1.0 105	P P P X Z Z Q Q Q Q X Z X X X X X X X X X X X X X X X X X X																								
	1.5 155	N N Z Z Z Z Z Z Z Z X X Z X X X Z X X X Z X X X Z X X X Z																								
	2.2 225	X X Z Z Z Z Z Z Z Z X X Z X X X Z X X X Z X X X Z X X X Z																								
	3.3 335	X X Z Z Z Z Z Z Z X X X X X X X X X Z X X Z X X X X X X X																								
	4.7 475	Z Z Z Z Z Z Z X X X X X X X Z Z Z X X Z X X X X X X X																								
	10 106	Z Z Z Z Z Z Z Z Z Z X X X X X X Z Z Z 7 Z Z Z X X X																								
	22 226	Z Z Z Z Z Z Z Z Z Z Z 7 X X X X X X X X X X X X X X X X																								
	47 476	Z Z																								
	100 107	Z Z																								
WVDC	10 16 25 50 100 200 500	16 25 50 100 200 500																								
SIZE		1210							1812							1825			2220					2225		



Letter	A	B	C	E	G	J	K	M	N	P	Q	X	Y	Z	7
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)	3.30 (0.130)
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NOTE: Contact factory for non-specified capacitance values