

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.

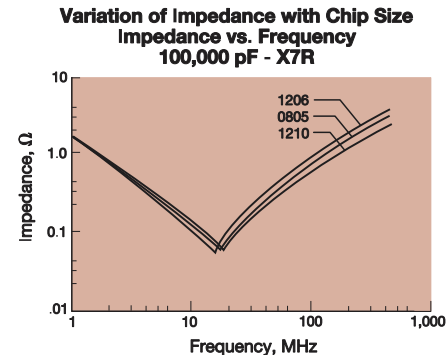
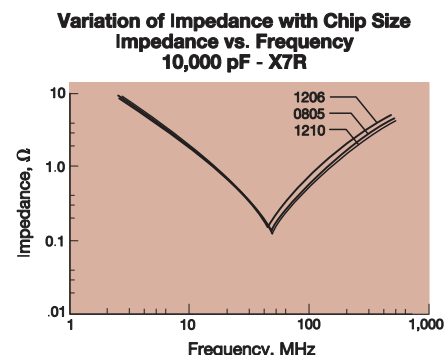
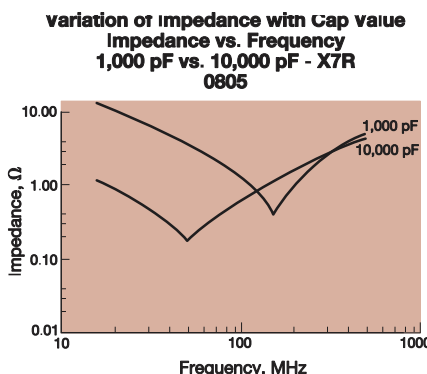
X7R dielectric chip usage covers the broad spectrum of industrial applications where known changes in capacitance due to applied voltages are acceptable.



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 (Complies with JIS C5101 / IEC60384)									
Operating Temperature Range		-55°C to +125°C	Temperature Cycle Chamber									
Capacitance		Within specified tolerance	Measure after heat treatment Capacitance Frequency Volt C≤10μF Frequency : 1kHz±10% Volt : 1.0±0.2Vrms *0.5±0.2Vrms									
Dissipation Factor / Tanδ		Refer to https://spicat.kyocera-avx.com for individual part number specification	C>10μF Frequency : 120Hz±10% Volt : 0.5±0.2Vrms The charge and discharge current of the capacitor must not exceed 50mA.									
Insulation Resistance		Refer to https://spicat.kyocera-avx.com for individual part number specifiction	Apply the rated voltage for 1 minute, and measure it in normal tempera- ture and humidity. The charge and discharge current of the capacitor must not exceed 50mA.									
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.									
Bending Strength		No significant damage with 1mm bending	Glass epoxy PCB: Fulcrum spacing: 90mm, duration time 10 seconds.									
Solderability		Solder coverage : 95% min.	Soaking condition Sn-3Ag-0.5Cu 245±5°C 3±0.5 sec.									
Resistance to Solder Heat	Appearance	No problem observed	Take the initial value after heat treatment. Soak the sample in 260°C±5°C solder for 10±0.5 seconds and place in nor- mal temperature and humidity, and measure after heat treatment. (Pre-heating conditions) <table><tr><td>Order</td><td>Temperature</td><td>Time</td></tr><tr><td>1</td><td>80 to 100°C</td><td>2 minutes</td></tr><tr><td>2</td><td>150 to 200°C</td><td>2 minutes</td></tr></table> The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.	Order	Temperature	Time	1	80 to 100°C	2 minutes	2	150 to 200°C	2 minutes
	Order	Temperature		Time								
	1	80 to 100°C		2 minutes								
	2	150 to 200°C		2 minutes								
	Capacitance Variation	≤ ±7.5%										
Dissipation Factor / Tanδ	Within specification											
Insulation Resistance	Within specification											
Withstanding Voltage / Dielectric Strength	Resist without problem											
Thermal Shock	Appearance	No visual defects	Take the initial value after heat treatment. (Cycle) Room temperature (3 min.)→ Lowest operation temperature (30 min.)→ Room temperature (3 min.)→ Highest operation temperature(30 min.) After 5 cycles, measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.									
	Capacitance Variation	≤ ±7.5%										
	Dissipation Factor	Within specification										
	Insulation Resistance	Within specification										
	Withstanding Voltage / Dielectric Strength	Resist without problem										
Load Life	Appearance	No visual defects	Take the initial value after heat treatment. After applying *1.5 the rated voltage at the highest operation temperature for 1000+12/- 0 hours, and measure the sample after heat treatment in normal temperature and humidity. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement. *Apply 1.0 times when the rated voltage is 4V or less. Applied voltages for respective products are indicated in the chart below.									
	Capacitance Variation	≤ ±12.5%										
	Dissipation Factor / Tanδ	≤ Initial Value x 2.0 (See Above)										
	Insulation Resistance	Over 1000MΩ or 50MΩ · μF, whichever is less. *Exceptions Listed Below										
Load Humidity	Appearance	No visual defects	Take the initial value after heat treatment. After applying rated voltage for 500+12/- 0 hours in the condition of 40°C ± 2°C and 90 to 95%RH, and place in normal temperature and humid- ity, then measure the sample after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.									
	Capacitance Variation	≤ ±12.5%										
	Dissipation Factor / Tanδ	Within specification										
	Insulation Resistance	Over 1000MΩ or 50MΩ · μF, whichever is less. *Exceptions Listed Below										
Appearance		No problem observed	Microscope									
Termination Strength		No problem observed	Apply a sideward force of 500g (5N) to a PCB-mounted sample. note : 2N for 0201 size, and 1N for 01005 size.									
Vibration	Appearance	No problem observed	Take the initial value after heat treatment. Vibration frequency: 10 to 55 (Hz) Amplitude: 1.5mm Sweeping condition: 10 → 55 → 10Hz/ 1 minute in X, Y and Z directions: 2 hours each, 6 hours in total, and place in normal temperature and humidity, then measure the sample after heat treatment.									
	Capacitance	Within tolerance										
	Tanδ	Within tolerance										
Heat Treatment		Expose sample in the temperature of 150+0/- 10°C for 1 hour and leave the sample in normal temperature and humidity for 24±2 hours.										

Voltage to be applied in the High Temperature Load (Applied voltage is the multiple of the rated voltage)

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 ± 0.03 (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	G	N	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	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	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	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	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	J	N	N	P		
	1500	152		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	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	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	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	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	P	P	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	P	P	J	J	J	J	J	J	N	N	P		
(µF)	0.012	123							C	C	C	C	C		G	G	G	G	G	J	J	J		J	J	J	J	J	P	P	J	J	J	J	J	J	N	N	Q		
	0.015	153							C	C	C	C	C		G	G	G	G	G	J	J	J		J	J	J	J	J	P	P	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	P	P	J	J	J	J	J	J	P	P	Q		
	0.027	273																																							
	0.033	333							C	C	C	C	C		G	G	G	G	G	J	J			J	J	J	J	P	P	P	J	J	J	J	J	J	Q	Q	Q		
	0.039	393																																							
	0.047	473							C	C	C	C	C		G	G	G	G	G	J	J			J	J	J	J	P	P	P	J	J	J	J	J	J	Q	Q	Q		
	0.068	683							C	C	C	C	E		G	G	G	G	G	J	J			J	J	J	J	P	P		J	J	J	J	J	P	Q	Q			
	0.082	823																																							
	0.1	104		A					C	C	C	C	E		G	G	G	G	G	J	J			J	J	J	J	P	P		J	J	J	J	J	P	Q	Q			
	0.12	124																																							
	0.15	154													G	G	G	G	J	J				N	N	N	N	P				K	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	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	Z								
	10	106																					P	P	P					X	X	X	X	X							
	22	226																												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	500			
SIZE	0101*		0201					0402					0603								0805								1206												

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						EMBOSSD							

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				
		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	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
	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
	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
	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
	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
	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
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
(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
	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
	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
	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	P	P	X	X	X	X		X	X	X	X	X	X	X
	0.15 154	K	K	K	K	M	P	Z	N	N	N	P	P	Z	X	X	X		X	X	X	X	X	X	X
	0.22 224	K	K	K	K	M	P	Z	N	N	N	P	Q	Z	X	X	X		X	X	X	X	X	X	X
	0.33 334	K	K	K	K	M	Q	Z	N	N	N	P	X	Z	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
	0.68 684	M	M	P	X	X	Z		Q	Q	Q	Q	Z		X	X	X		X	X	X	Z	X	X	X
	1.0 105	P	P	P	X	Z			Q	Q	Q	X	Z		X	X	X		X	X	X	7	X	X	X
	1.5 155	N	N	N	Z	Z	Z			Z	Z	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
	3.3 335	X	X	Z	Z	Z				Z	Z	Z			X	X			X	Z			X	X	
	4.7 475	Z	Z	Z	Z	Z				Z	Z	Z			X	X			Z	Z			X	X	
	10 106	Z	Z	Z	Z				Z	Z	Z				Z	Z			Z	7			Z	Z	
	22 226	Z	Z	Z														Z		7					
	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	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)
PAPER							EMBOSSED								

NOTE: Contact factory for non-specified capacitance values