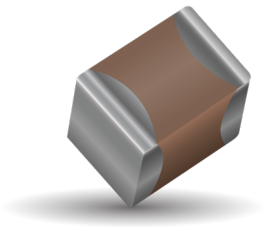
X7R Dielectric

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 con-ditions such as voltage and frequency.

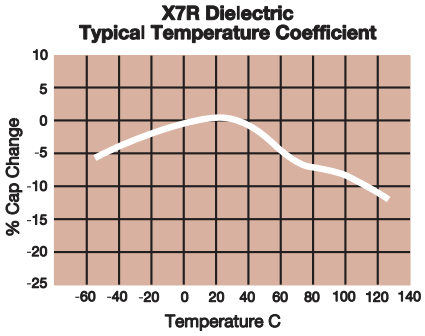
X7R dielectric chip usage covers the broad spectrum of industrial applications where known changes in capacitance due to applied voltages are acceptable.

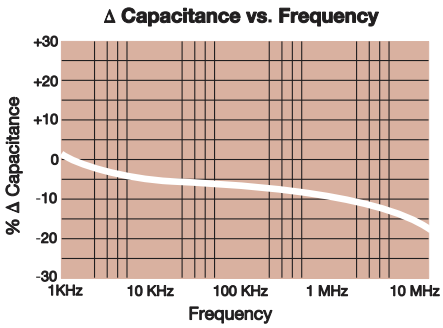
RoHS COMPLIANT

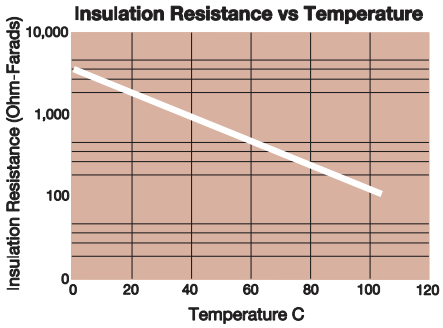
PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

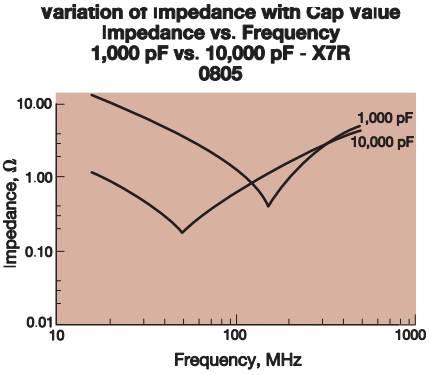
0805	5	C	103	M	A	T	2	A
Size (L” x W”)	**Voltage** 4V = 4 6.3V = 6 10V = Z 16V = Y 25V = 3 50V = 5 100V = 1 200V = 2 500V = 7	**Dielectric** X7R = C	**Capacitance** Code (In pF) 2 Sig. Digits + Number of Zeros	**Capacitance Tolerance** J = ± 5%* K = ±10% M = ± 20% *≤1µF only, contact factory for additional 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

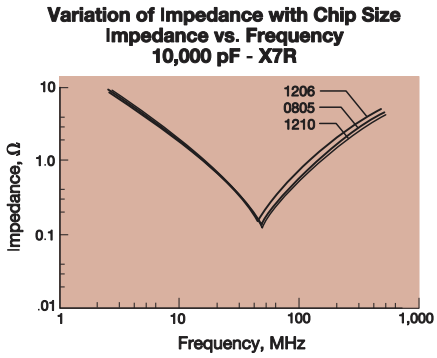
NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.
Contact factory for non-specified capacitance values.

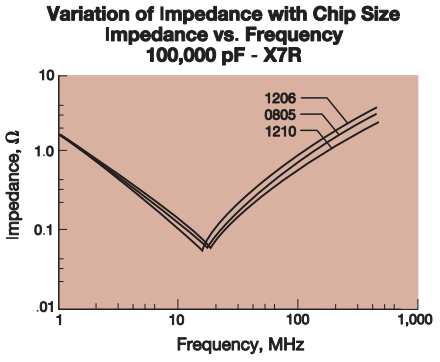












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X7R Dielectric

Specifications and Test Methods

Parameter/Test		X7R Specification Limits	Measuring Conditions (Complies with JIS C5101 / IEC60384)
Operating Temperature Range		-55ºC to +125ºC	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 C>10µF Frequency : 120Hz±10% Volt : 0.5±0.2Vrms The charge and discharge current of the capacitor must not exceed 50mA.
Dissipation Factor / Tanδ		Refer to https://spicat.kyocera-avx.com for individual part number specification	
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 temperature 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±5ºC 3±0.5 sec.
Resistance to Solder Heat	Appearance	No problem observed	Take the initial value after heat treatment. Soak the sample in 260ºC±5ºC solder for 10±0.5 seconds and place in normal temperature and humidity, and measure after heat treatment. (Pre-heating conditions) Order Temperature Time 1 80 to 100ºC 2 minutes 2 150 to 200ºC 2 minutes The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.
	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 40ºC ± 2ºC 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/ −10ºC 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)

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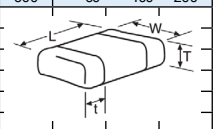
NOTE: Contact factory for non-specified capacitance values
*EIA 01005
**Contact Factory for Specifications

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	M	P	Z	Z	N	N	N	P	P	Z	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
	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
	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	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)
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NOTE: Contact factory for non-specified capacitance values

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