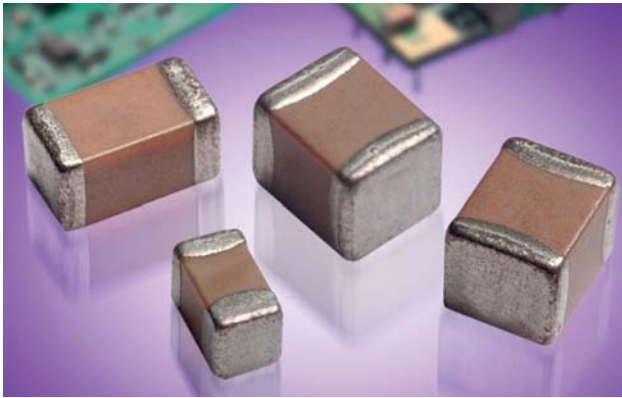# X7R Dielectric

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.

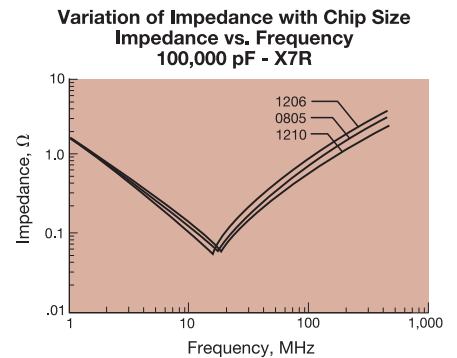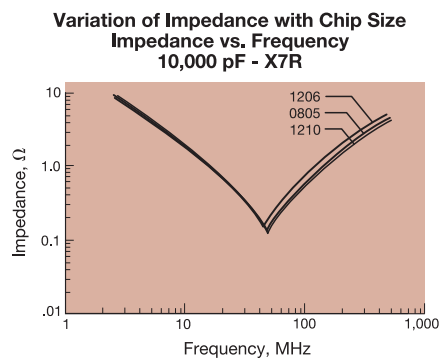Capacitance for X7R varies under the influence of electrical operating conditions such as voltage and frequency.

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

RoHS COMPLIANT

PART NUMBER (see page 2 for complete part number explanation)
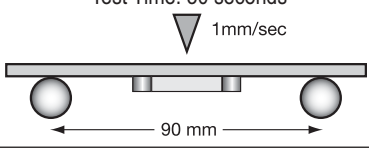
0805	5	C	103	M	A	T	2	A

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.

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
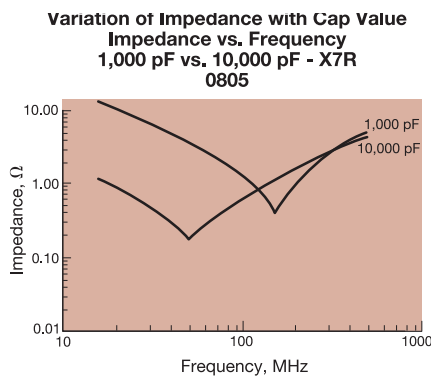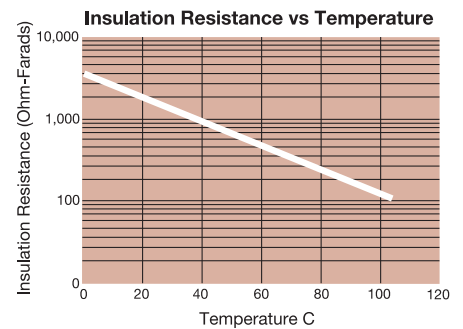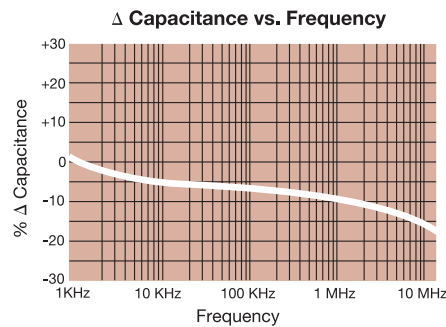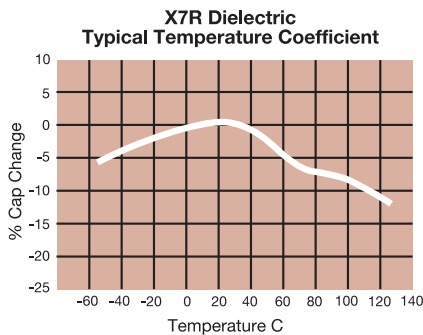
X7R Dielectric

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 > 10µF, 05Vrm @ 120Hz	
Dissipation Factor		≤ 10% for ≥ 50V DC rating ≤ 12.5% for 25V DC rating ≤ 12.5% for 25V and 16V DC rating ≤ 12.5% for ≤ 10V DC rating		
Insulation Resistance		100,000MΩ or 1000MΩ - µF, whichever is less	Charge device with rated voltage for 120 ± 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 1mm/sec 90 mm	
	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 1.5 rated voltage (≤ 10V) 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)		

AVAX

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 ± 0.20 (0.126 ± 0.008)
(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 ± 0.20 (0.063 ± 0.008)
(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)

Cap	Code	0101 16	0201 6.3	10	16	25	50	0402 6.3	10	16	25	50	0603 6.3	10	16	25	50	100	200	0805 6.3	10	16	25	50	100	200	1206 6.3	10	16	25	50	100	200	500
100 (pF)	101	B	A	A	A	A	A			C	C	C					G	G	G															K
150	151	B	A	A	A	A	A			C	C	C					G	G	G															K
220	221	B	A	A	A	A	A			C	C	C					G	G	G															K
330	331	B	A	A	A	A	A			C	C	C					G	G	G		J	J	J	J	J	J								K
470	471	B	A	A	A	A	A	A		C	C	C					G	G	G		J	J	J	J	J	J								K
680	681	B	A	A	A	A				C	C	C					G	G	G		J	J	J	J	J	J								K
1000	102	B	A	A	A	A		C	C	C	C						G	G	G		J	J	J	J	J	J								K
1500	152	B	A	A	A	A		C	C	C	C						G	G			J	J	J	J	J	J		J	J	J	J	J	J	M
2200	222	B	A	A	A	A		C	C	C	C						G	G			J	J	J	J	J	J		J	J	J	J	J	J	M
3300	332		A	A	A	A		C	C	C	C						G	G			J	J	J	J	J	J		J	J	J	J	J	J	M
4700	472		A	A	A	A		C	C	C	C						G	G			J	J	J	J	J	J		J	J	J	J	J	J	M
6800	682		A	A	A	A		C	C	C	C						G	G			J	J	J	J	J	J		J	J	J	J	J	J	P
0.01 (µF)	103		A	A	A	A		C	C	C	C				G	G	G	J			J	J	J	J	J	J		J	J	J	J	J	J	P
0.015	153		A					C	C	C	C				G	G	G	J			J	J	J	J	J		N	J	J	J	J	J	M	Q
0.022	223		A					C	C	C	C					G	G	J			J	J	J	J	J		N	J	J	J	J	J	M	Q
0.033	333							C	C	C	C			G	G	G	J			J	J	J	J	J		N	N	J	J	J	J	J	M	
0.047	473		A					C	C	C	C			G	G	G	J			J	J	J	J	J		N	N	J	J	J	J	J	M	
0.068	683							C	C	C	C			G	G	G	J			J	J	J	J	J		N	N	J	J	J	J	J	P	
0.1	104		A					C	C	C	C	G	G	G	G	G	J			J	J	J	J	J		N	N	J	J	J	J	J	P	P
0.15	154											G	G	G	G	G				J	J	J	J	J		N	N	J	J	J	J	J		Q
0.22	224							C	C	C		G	G	J	J	J				J	J	J	J	N		N	N	J	J	J	J	J		Q
0.33	334											J	J	J	J	J				N	N	N	N	N		N	J	J	M	P	Q		
0.47	474							C	C			J	J	J	J	J				N	N	N	N	N		N	M	M	M	P	Q		
0.68	684											J	J	J	J					N	N	N				M	M	Q	Q	Q			
1.0	105							C				J	J	J	J	J				N	N	N	N			M	M	Q	Q	Q	Q		
2.2	225											J	J	J						P	P	P	P	P**			Q	Q	Q	Q	Q	Q**	
4.7	475											J								P	P	P					Q	Q	Q	Q			
10	106																			P	P	P					Q	Q	X	X			
22	226																										Q	Q	Q				
47	476																										Q	Q	X				
100	107																																

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)	1.80 (0.071)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
	PAPER						EMBOSSED							

PAPER and EMBOSSED available for 01005

NOTE: Contact factory for non-specified capacitance values

*EIA 01005

**Contact Factory for Specifications

X7R Dielectric

Capacitance Range

PREFERRED SIZES ARE SHADED

		1210	1812	1825	2220	2225
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	mm (in.)	3.30 ± 0.4 (0.130± 0.016)	4.50 ± 0.30 (0.177 ± 0.012)	4.50 ± 0.30 (0.177 ± 0.012)	5.70 ± 0.40 (0.225 ± 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)	5.00 ± 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)

Cap	Code	10	16	25	50	100	200	500	16	25	50	100	200	500	50	100	200	25	50	100	200	500	50	100	200
100 (pF)	101																								
150	151																								
220	221																								
330	331																								
470	471																								
680	681																								
1000	102																								
1500	152	J	J	J	J	J	J	M																	
2200	222	J	J	J	J	J	J	M																	
3300	332	J	J	J	J	J	J	M																	
4700	472	J	J	J	J	J	J	M																	
6800	682	J	J	J	J	J	J	M																	
0.01 (µF)	103	J	J	J	J	J	J	M	K	K	K	K	K		M	M	M	X	X	X	X		M	P	P
0.015	153	J	J	J	J	J	J	P	K	K	K	K	P		M	M	M	X	X	X	X		M	P	P
0.022	223	J	J	J	J	J	J	Q	K	K	K	K	P		M	M	M	X	X	X	X		M	P	P
0.033	333	J	J	J	J	J	J	Q	K	K	K	K	X		M	M	M	X	X	X	X		M	P	P
0.047	473	J	J	J	J	J	J	Q	K	K	K	K	Z		M	M	M	X	X	X	X		M	P	P
0.068	683	J	J	J	J	J	M	Q	K	K	K	K	Z		M	M	M	X	X	X	X		M	P	P
0.1	104	J	J	J	J	J	M	X	K	K	K	K	Z		M	M	M	X	X	X	X		M	P	P
0.15	154	J	J	J	J	M	Z	Z	K	K	K	P	Z		M	M	M	X	X	X	X		M	P	X
0.22	224	J	J	J	J	P	Z		K	K	K	P	Z		M	M	M	X	X	X	X		M	P	X
0.33	334	J	J	J	J	Q			K	K	M	X	Z		M	M		X	X	X	X		M	P	X
0.47	474	M	M	M	M	Q			K	K	P	X	Z		M	M		X	X	X	X		M	P	X
0.68	684	M	M	P	X	X	Z		M	M	Q				M	P		X	X				M	P	X
1.0	105	N	N	P	X	Z			M	M	X	Z			M	P			X	X	X	Z	M	P	X
1.5	155	N	N	Z	Z	Z			Z	Z	Z				Q	X			X	X			M	X	Z
2.2	225	X	X	Z	Z	Z			Z	Z	Z				X	X	Z		X	X			M	X	Z
3.3	335	X	X	Z	Z	Z			Z	Z	Z								X	Z			Z	X	Z
4.7	475	Z	Z	Z	Z	Z			Z	Z	Z								X	Z					
10	106	Z	Z	Z	Z				Z						Z	Z			Z	Z			Z	Z	
22	226	Z	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)	1.80 (0.071)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
	PAPER						EMBOSSED							

NOTE: Contact factory for non-specified capacitance values

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

AVX:

  08055C393KAT2A   08055C393KAT4A   08055C393MAT2A   08055C471JAT2A   08055C471KAT2A

08055C471KAT4A   08055C471MAT2A   08055C472JAT2A   08055C472KAT2A   08055C472KAT4A   08055C472MAT2A

  08055C473JAT2A   08055C473KAT2A   08055C473KAT4A   08055C473MAT2A   08055C473MAT4A

08055C561KAT2A   08055C561KAT4A   08055C561MAT2A   08055C562JAT2A   08055C562KAT2A   08055C562KAT4A

  08055C562MAT2A   08055C563JAT2A   08055C563KAT2A   08055C563KAT4A   08055C563MAT2A

08055C681KAT2A   08055C681KAT4A   08055C681MAT2A   08055C682JAT2A   08055C682KAT2A   08055C682KAT4A

  08055C682MAT2A   08055C682MAT4A   08055C683KAT2A   08055C683KAT4A   08055C683MAT2A

08055C683MAT4A   08055C821KAT2A   08055C821KAT4A   08055C821MAT2A   08055C822JAT2A   08055C822KAT2A

  08055C822KAT4A   08055C823JAT2A   08055C823KAT2A   08055C823MAT2A   08055C101JAT2A   08055C101KAT2A

  08055C102JAT2A   08055C102KAT2A   08055C102KAT4A   08055C102MAT2A   08055C102MAT4A

08055C103JAT2A   08055C103JAT4A   08055C103KAT4A   08055C103MAT2A   08055C103MAT4A   08055C104KA72A

08055C104MAT2A   08055C104MAT4A   08055C105KAT2A   08055C122KAT2A   08055C123KAT2A   08055C123MAT2A

  08055C124KAT2A   08055C151KAT2   08055C151KAT2A   08055C152KAT4A   08055C152MAT2A   0805YC474MA72A

  0805YC474MAT2A   0805YC474MAT4A   0805YC561KAT2A   0805YC562KAT2A   0805YC562MAT2A

0805YC563KAT2A   0805YC563KAT4A   0805YC682KAT2A   0805YC683KAT2A   0805YC821KAT2A

0805YC821MAT2A   0805YC822KAT2A   0805YC822KAT4A   0805YC823KAT2A   0805ZC102KAT2A

0805ZC102MAT2A   0805ZC103KAT2A   0805ZC103MAT2A   0805ZC103MAT4A   0805ZC104KAT2A

0805ZC104MAT2A   0805ZC105JAT2A   0805ZC105JAT4A   0805ZC105KA72A   0805ZC105KAT2A   0805ZC105KAT4A

  0805ZC105MAT2A