

C0G (NP0) Dielectric



General Specifications



C0G (NP0) is the most popular formulation of the “temperature-compensating,” EIA Class I ceramic materials. Modern C0G (NP0) formulations contain neodymium, samarium and other rare earth oxides.

C0G (NP0) ceramics offer one of the most stable capacitor dielectrics available. Capacitance change with temperature is $0 \pm 30 \text{ ppm}/^\circ\text{C}$ which is less than $\pm 0.3\% \Delta C$ from -55°C to $+125^\circ\text{C}$. Capacitance drift or hysteresis for C0G (NP0) ceramics is negligible at less than $\pm 0.05\%$ versus up to $\pm 2\%$ for films. Typical capacitance change with life is less than $\pm 0.1\%$ for C0G (NP0), one-fifth that shown by most other dielectrics. C0G (NP0) formulations show no aging characteristics.

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

0805

Size
(L" x W")

5

Voltage
6.3V = 6
10V = Z
16V = Y
25V = 3
50V = 5
100V = 1
200V = 2
500V = 7

A

Dielectric
C0G (NP0) = A

101

Capacitance Code (In pF)
2 Sig. Digits +
Number of
Zeros

J

Capacitance Tolerance
B = $\pm 10 \text{ pF}$ ($< 10 \text{ pF}$)
C = $\pm 25 \text{ pF}$ ($< 10 \text{ pF}$)
D = $\pm 50 \text{ pF}$ ($< 10 \text{ pF}$)
F = $\pm 1\%$ ($\geq 10 \text{ pF}$)
G = $\pm 2\%$ ($\geq 10 \text{ pF}$)
J = $\pm 5\%$
K = $\pm 10\%$

A

Failure Rate
A = Not
Applicable

T

Terminations
T = Plated Ni
and Sn
7 = Gold Plated

2

Packaging
2 = 7" Reel
4 = 13" Reel
7 = Bulk Cass.
9 = Bulk

A

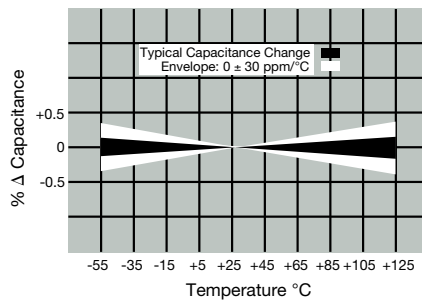
Special Code
A = Std.
Product

Contact Factory For
1 = Pd/Ag Term

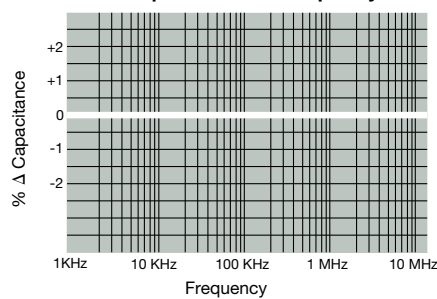
Contact Factory For
Multiples

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

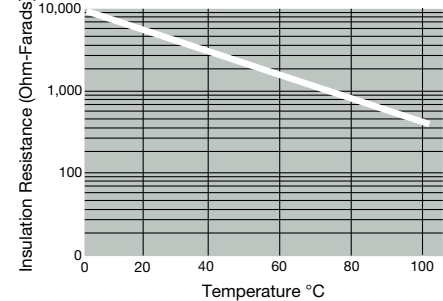
Temperature Coefficient



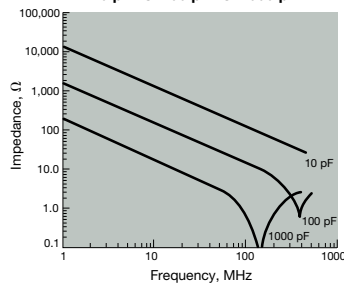
Δ Capacitance vs. Frequency



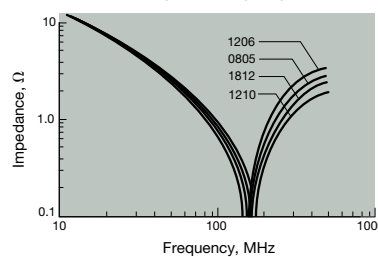
Insulation Resistance vs Temperature



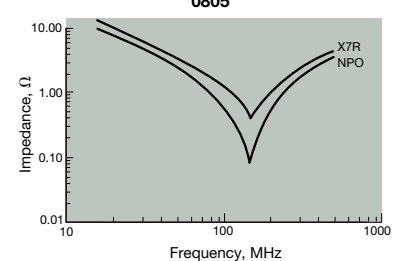
Variation of Impedance with Cap Value
Impedance vs. Frequency
0805 - C0G (NP0)
10 pF vs. 100 pF vs. 1000 pF



Variation of Impedance with Chip Size
Impedance vs. Frequency
1000 pF - C0G (NP0)



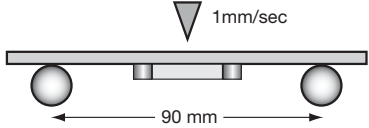
Variation of Impedance with Ceramic Formulation
Impedance vs. Frequency
1000 pF - C0G (NP0) vs X7R
0805



COG (NP0) Dielectric



Specifications and Test Methods

Parameter/Test		NP0 Specification Limits	Measuring Conditions	
Operating Temperature Range		-55°C to +125°C	Temperature Cycle Chamber	
Capacitance		Within specified tolerance	Freq.: 1.0 MHz ± 10% for cap ≤ 1000 pF 1.0 kHz ± 10% for cap > 1000 pF Voltage: 1.0Vrms ± .2V	
Q		<30 pF: Q ≥ 400+20 x Cap Value ≥30 pF: Q ≥ 1000		
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) 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	±5% or ±.5 pF, whichever is greater		
	Q	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 ± 5°C 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 260°C for 60 seconds. Store at room temperature for 24 ± 2 hours before measuring electrical properties.	
	Capacitance Variation	≤ ±2.5% or ±.25 pF, whichever is greater		
	Q	Meets Initial Values (As Above)		
	Insulation Resistance	Meets Initial Values (As Above)		
Thermal Shock	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±2.5% or ±.25 pF, whichever is greater	Step 2: Room Temp	≤ 3 minutes
	Q	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	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 hours at room temperature	
Load Life	Appearance	No visual defects	Charge device with twice rated voltage in test chamber set at 125°C ± 2°C for 1000 hours (+48, -0). Remove from test chamber and stabilize at room temperature for 24 hours before measuring.	
	Capacitance Variation	≤ ±3.0% or ± .3 pF, whichever is greater		
	Q (C=Nominal Cap)	≥ 30 pF: Q ≥ 350 ≥10 pF, <30 pF: Q ≥ 275 +5C/2 <10 pF: Q ≥ 200 +10C		
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)		
Load Humidity	Appearance	No visual defects	Store in a test chamber set at 85°C ± 2°C/ 85% ± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied. Remove from chamber and stabilize at room temperature for 24 ± 2 hours before measuring.	
	Capacitance Variation	≤ ±5.0% or ± .5 pF, whichever is greater		
	Q	≥ 30 pF: Q ≥ 350 ≥10 pF, <30 pF: Q ≥ 275 +5C/2 <10 pF: Q ≥ 200 +10C		
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)		
		Dielectric Strength	Meets Initial Values (As Above)	

COG (NP0) Dielectric



Capacitance Range

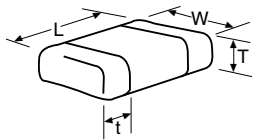
PREFERRED SIZES ARE SHADED

SIZE	0201		0402			0603				0805					1206					
	Reflow Only		Reflow/Wave			Reflow/Wave				Reflow/Wave					Reflow/Wave					
Soldering	All Paper		All Paper			All Paper				Paper/Embossed					Paper/Embossed					
Packaging	All Paper		All Paper			All Paper				Paper/Embossed					Paper/Embossed					
(L) Length	mm	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	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	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		25 50	16 25 50	16 25 50 100	16 25 50 100 200	16 25 50 100 200 500														
Cap (pF)	0.5	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	1.0	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	1.2	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	1.5	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	1.8	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	2.2	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	2.7	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	3.3	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	3.9	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	4.7	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	5.6	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	6.8	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	8.2	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	10	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	12	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	15	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	18	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	22	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	27	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	33	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	39	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	47	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	56	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	68	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	82	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	100	A	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	120		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	150		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	180		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	220		C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	M
	270		C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
	330		C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
	390		C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
	470		C	C	C	G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
	560					G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
	680					G	G	G	G	J	J	J	J		J	J	J	J	J	P
	820					G	G	G	G	J	J	J	J		J	J	J	J	J	P
	1000					G	G	G	G	J	J	J	J		J	J	J	J	J	Q
	1200									J	J	J	J		J	J	J	J	J	Q
	1500									J	J	J	J		J	J	J	M	J	Q
	1800									J	J	J	J		J	J	M	M		
	2200									J	J	J	N		J	J	M	P		
	2700									J	J	J	N		J	J	M	P		
	3300									J	J				J	J	M	P		
	3900									J	J				J	J	M	P		
	4700									J	J				J	J	M	P		
	5600														J	J	M			
	6800														J	J	M			
	8200														M	M				
Cap (µF)	0.010														M	M				
	0.012														M	M				
	0.015																			
	0.018																			
	0.022																			
	0.027																			
	0.033																			
	0.039																			
	0.047																			
	0.068																			
	0.082																			
	0.1																			
WVDC		25 50	16 25 50	16 25 50 100	16 25 50 100 200	16 25 50 100 200 500														

Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	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)

SIZE	0201			0402			0603				0805					1206				
Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z							

	PAPER					EMBOSSSED														
Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z							



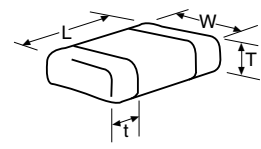
COG (NP0) Dielectric



Capacitance Range

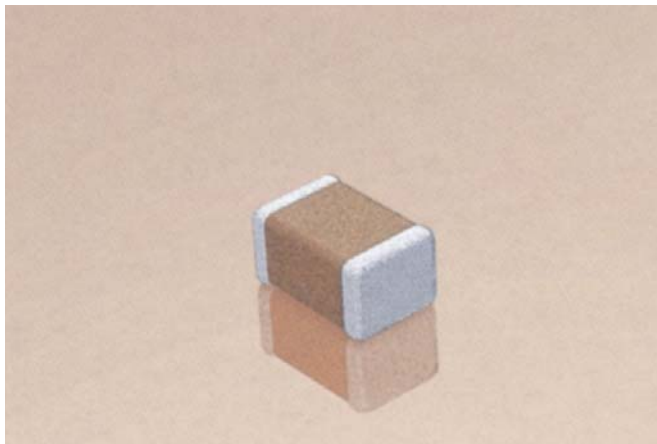
PREFERRED SIZES ARE SHADED

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.)	3.20 ± 0.20 (0.126 ± 0.008)					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)				
WVDC		25	50	100	200	500	25	50	100	200	500	50	100	200	50	100	200	50	100	200	50	100	200			
Cap (pF)	0.5																									
	1.0																									
	1.2																									
	1.5																									
	1.8																									
	2.2																									
	2.7																									
	3.3																									
	3.9																									
	4.7																									
	5.6																									
	6.8																									
	8.2																									
	10					J																				
	12					J																				
	15					J																				
	18					J																				
	22					J																				
	27					J																				
	33					J																				
	39					J																				
	47					J																				
	56					J																				
	68					J																				
	82					J																				
	100					J																				
	120					J																				
	150					J																				
	180					J																				
	220					J																				
	270					J																				
	330					J																				
	390					M																				
	470					M																				
	560	J	J	J	J	M																				
	680	J	J	J	J	M																				
	820	J	J	J	J	M																				
	1000	J	J	J	J	M	K	K	K	K	M	M	M	M							M	M	P			
	1200	J	J	J	M	M	K	K	K	K	M	M	M	M							M	M	P			
	1500	J	J	J	M	M	K	K	K	K	M	M	M	M							M	M	P			
	1800	J	J	J	M		K	K	K	K	M	M	M	M							M	M	P			
	2200	J	J	J	Q		K	K	K	K	P	M	M	M							M	M	P			
	2700	J	J	J	Q		K	K	K	P	Q	M	M	M							M	M	P			
	3300	J	J	J			K	K	K	P	Q	M	M	M				X			M	M	P			
	3900	J	J	M			K	K	K	P	Q	M	M	M				X			M	M	P			
	4700	J	J	M			K	K	K	P	Q	M	M	M				X	X	X	M	M	P			
	5600	J	J				K	K	M	P	X	M	M	M	X	X	X	X	X	X	M	M	P			
	6800	J	J				K	K	M	X		M	M	M	X	X	X	X	X	X	M	M	P			
	8200	J	J				K	M	M		M	M	M	X	X	X	X	X	X	M	M	P				
Cap (µF)	0.010	J	J				K	M	M		M	M	M	X	X	X	X	X	X	M	M	P				
	0.012	J	J				K	M			M	M	M	X	X	X	X	X	X	M	M	P				
	0.015						M	M			M	M	M	X	X	X	X	X	X	M	M	Y				
	0.018						M	M			P	M		X	X	X				M	M	Y				
	0.022						M	M			P			X	X					M	Y	Y				
	0.027						M	M			P			X	X					P	Y	Y				
	0.033						M	M			P			X	X					P						
	0.039						M	M			P			Y						P						
	0.047						M	M			P			Y						P						
	0.068						M	M												P						
	0.082						M	M												Q						
	0.1																			Q						
WVDC		25	50	100	200	500	25	50	100	200	500	50	100	200	50	100	200	50	100	200	50	100	200			
SIZE		1210					1812					1825					2220					2225				
Letter		A	C	E	G	J	K	M	N	P	Q	X	Y	Z												
Max. Thickness		0.33 (0.013)	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					EMBOSS																			



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.

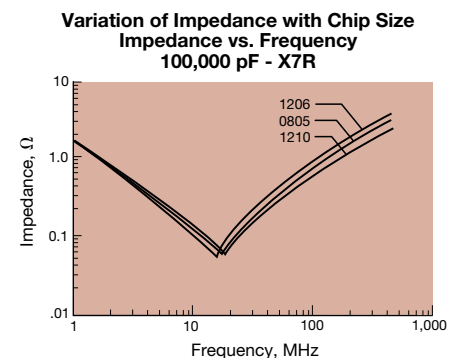
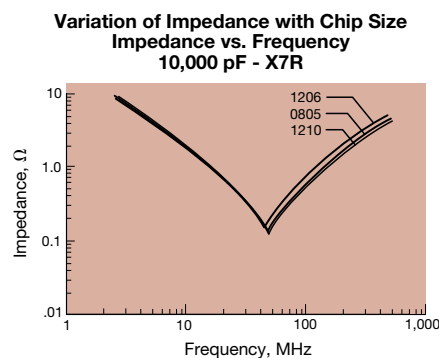
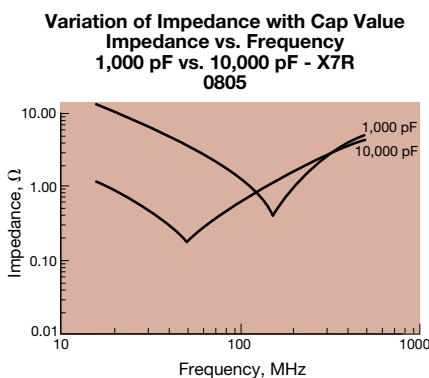
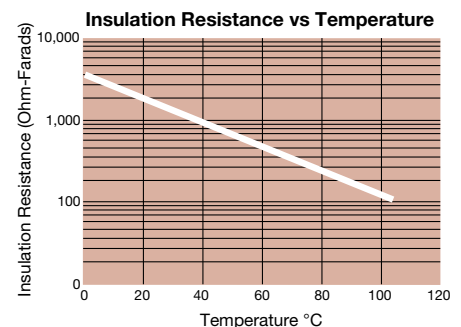
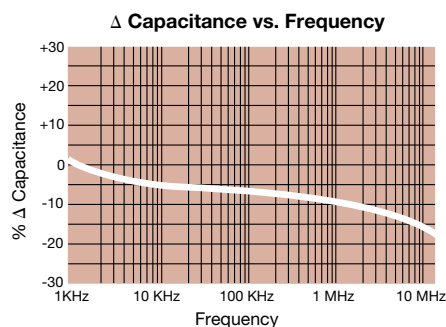
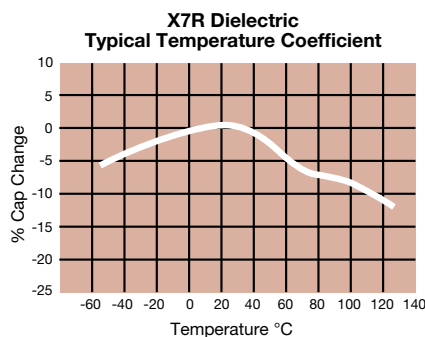
Capacitance for X7R varies under the influence of electrical operating conditions such as voltage and frequency.

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 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 = $\pm 5\%*$ K = $\pm 10\%$ M = $\pm 20\%$ * $\leq 1\mu\text{F}$ only	Failure Rate A = Not Applicable	Terminations T = Plated Ni and Sn 7 = Gold Plated* Z = FLEXITERM [®] **	Packaging 2 = 7" Reel 4 = 13" Reel 7 = Bulk Cass. 9 = Bulk	Special Code A = Std. Product
						*Optional termination **See FLEXITERM [®] X7R section	Contact Factory For Multiples	

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



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 ± 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 120 ± 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) 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	≤ ±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 ± 5°C 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 260°C 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: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	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 125°C ± 2°C 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 85°C ± 2°C/ 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																
	Reflow Only			Reflow/Wave			Reflow/Wave						Reflow/Wave						Reflow/Wave																
Packaging	All Paper			All Paper			All Paper						Paper/Embossed						Paper/Embossed																
(L) Length (mm)	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)	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)	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	10	16	25	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	500
Cap (pF)	100	A	A	A																															
	150	A	A	A																															
	220	A	A	A			C																												
	330	A	A	A			C				G	G	G	J	J	J	J	J	J	J	J												K		
	470	A	A	A			C				G	G	G	J	J	J	J	J	J	J	J												K		
	680	A	A	A			C				G	G	G	J	J	J	J	J	J	J	J												K		
	1000	A	A	A			C				G	G	G	J	J	J	J	J	J	J	J												K		
	1500	A	A	A			C				G	G	G	J	J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	2200	A	A	A			C				G	G	G	J	J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	3300	A	A	A			C	C			G	G	G	J	J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	4700	A	A	A			C	C			G	G	G	J	J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	6800	A	A	A			C	C			G	G	G	J	J	J	J	J	J	J	J					J	J	J	J	J	J	J	P		
Cap (µF)	0.010	A					C	C						J	J	J	J	J	J	J	J					J	J	J	J	J	J	J	P		
	0.015						C	C			G	G	G	J	J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	0.022						C	C			G	G	G	J	J	J	J	J	J	J	J					J	J	J	J	J	J	J	M		
	0.033										G	G	G	J	J	J	J	J	N							J	J	J	J	J	J	J	M		
	0.047										G	G	G	J	J	J	J	J	N							J	J	J	J	J	J	J	M		
	0.068										G	G	G	J	J	J	J	J	N							J	J	J	J	J	J	J	P		
	0.10						C				G	G	G	J	J	J	J	J	N*							J	J	J	J	J	J	J	P		
	0.15										G	G	G	J	J	J	J	J	N	N*						J	J	J	J	J	J	J			
	0.22										G	G	G	J	J	J	J	J	N	N*						J	J	J	J	J	J	J			
	0.33													N	N	N	N	N	N*							J	J	M	P	Q	Q	Q			
	0.47										J*			N	N	N	N	N	N*							M	M	M	P	Q	Q	Q			
	0.68										J*			N	N	N	N	N	N*							M	M	Q	Q	Q	Q	Q			
	1.0										J*	J*		N	N	N	N	N	N*							M	M	Q	Q	Q	Q	Q			
	1.5													N	N	N	N	N	N*							P	Q	Q	Q	Q	Q	Q			
	2.2										J*															Q	Q	Q	Q	Q	Q	Q			
	3.3																																		
	4.7																																		
	10																																		
	22																																		
	47																																		
	100																																		
WVDC	10	16	25	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	500
SIZE	0201			0402			0603						0805						1206																

Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	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					EMBOSSSED							

= Under Development

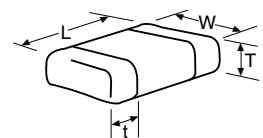
X7R Dielectric



Capacitance Range

PREFERRED SIZES ARE SHADED

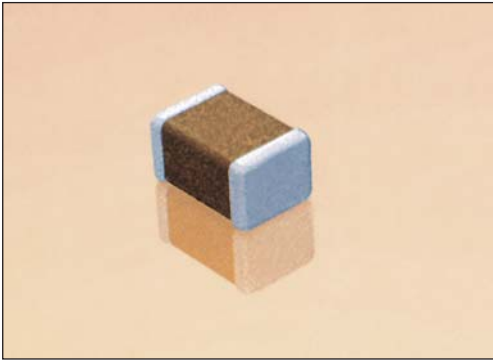
SIZE	1210								1812				1825		2220				2225		
	Reflow Only								Reflow Only				Reflow Only		Reflow Only				Reflow Only		
Soldering	Paper/Embossed								All Embossed				All Embossed		All Embossed				All Embossed		
Packaging	Paper/Embossed								All Embossed				All Embossed		All Embossed				All Embossed		
(L) Length	3.20 ± 0.20 (0.126 ± 0.008)								4.50 ± 0.30 (0.177 ± 0.012)				4.50 ± 0.30 (0.177 ± 0.012)		5.70 ± 0.40 (0.225 ± 0.016)				5.72 ± 0.25 (0.225 ± 0.010)		
(W) Width	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	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	50	100	200	500	50	100	25	50	100	200	50	100		
Cap (pF)	100																				
	150																				
	220																				
	330																				
	470																				
	680																				
	1000																				
	1500	J	J	J	J	J	J	M													
	2200	J	J	J	J	J	J	M													
	3300	J	J	J	J	J	J	M													
	4700	J	J	J	J	J	J	M													
	6800	J	J	J	J	J	J	M													
Cap (µF)	0.010	J	J	J	J	J	J	M	K	K	K	K	M	M			X	X	X	M	P
	0.015	J	J	J	J	J	J	M	K	K	K	P	M	M			X	X	X	M	P
	0.022	J	J	J	J	J	J	M	K	K	K	P	M	M			X	X	X	M	P
	0.033	J	J	J	J	J	J	Q	K	K	K	X	M	M			X	X	X	M	P
	0.047	J	J	J	J	J	J		K	K	K	Z	M	M			X	X	X	M	P
	0.068	J	J	J	J	J	M		K	K	K	Z	M	M			X	X	X	M	P
	0.10	J	J	J	J	J	M		K	K	K	Z	M	M			X	X	X	M	P
	0.15	J	J	J	J	M	Z		K	K	P		M	M			X	X	X	M	P
	0.22	J	J	J	J	P	Z		K	K	P		M	M			X	X	X	M	P
	0.33	J	J	J	J	Q			K	M	X		M	M			X	X	X	M	P
	0.47	M	M	M	M	Q			K	P			M	M			X	X	X	M	P
	0.68	M	M	P	X	X			M	Q			M	P			X	X		M	P
	1.0	N	N	P	X	Z			M	X			M	P			X	X		M	P
	1.5	N	N	Z	Z	Z			Z	Z			M				X	X		M	X
	2.2	X	X	Z	Z	Z			Z	Z							X	X		M	
	3.3	X	X	Z	Z				Z								X	Z			
	4.7	X	X	Z	Z				Z								X	Z			
	10	Z	Z	Z*													Z				
	22	Z*	Z*																		
	47																				
	100																				



Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	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					EMBOSS							

X5R Dielectric

General Specifications



GENERAL DESCRIPTION

- General Purpose Dielectric for Ceramic Capacitors
- EIA Class II Dielectric
- Temperature variation of capacitance is within $\pm 15\%$ from -55°C to $+85^{\circ}\text{C}$
- Well suited for decoupling and filtering applications
- Available in High Capacitance values (up to $100\mu\text{F}$)

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

1210

Size
(L" x W")

4

Voltage
4 = 4V
6 = 6.3V
Z = 10V
Y = 16V
3 = 25V
D = 35V
5 = 50V

D

Dielectric
D = X5R

107

Capacitance Code (In pF)
2 Sig. Digits +
Number of
Zeros

M

Capacitance Tolerance
K = $\pm 10\%$
M = $\pm 20\%$

A

Failure Rate
A = N/A

T

Terminations
T = Plated Ni
and Sn

2

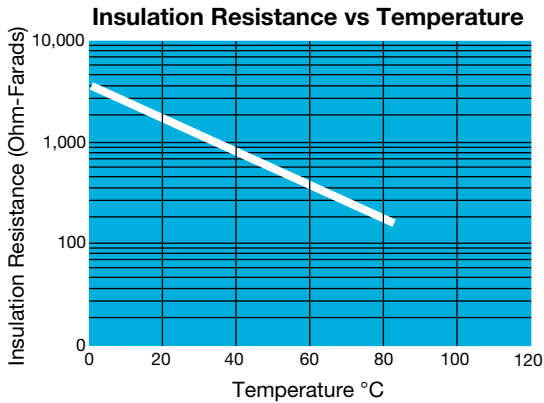
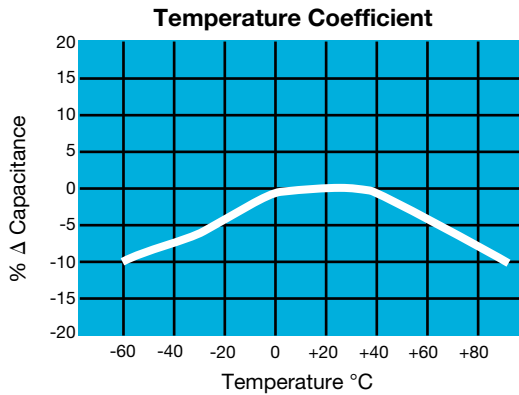
Packaging
2 = 7" Reel
4 = 13" Reel
7 = Bulk Cass.
9 = Bulk

A

Special Code
A = Std.

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

TYPICAL ELECTRICAL CHARACTERISTICS

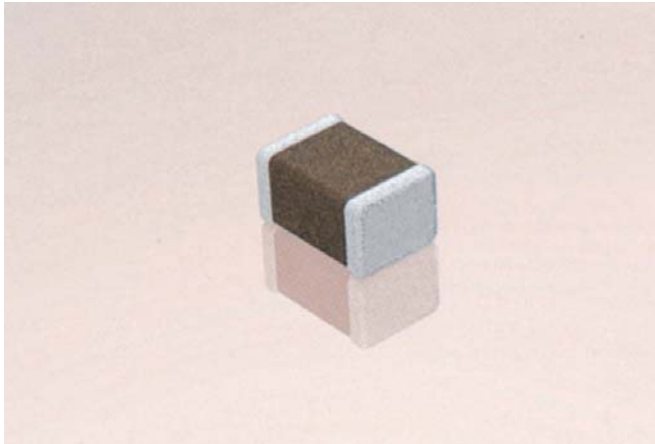


Specifications and Test Methods

Parameter/Test		X5R Specification Limits	Measuring Conditions	
Operating Temperature Range		-55°C to +85°C	Temperature Cycle Chamber	
Capacitance		Within specified tolerance	Freq.: 1.0 kHz \pm 10% Voltage: 1.0Vrms \pm .2V For Cap > 10 μ F, 0.5Vrms @ 120Hz	
Dissipation Factor		\leq 2.5% for \geq 50V DC rating \leq 3.0% for 25V DC rating \leq 12.5% Max. for 16V DC rating and lower 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 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	\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: +85°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	Charge device with 1.5X rated voltage in test chamber set at 85°C \pm 2°C for 1000 hours (+48, -0). Note: Contact factory for *optional specification part numbers that are tested at < 1.5X rated voltage. Remove from test chamber and stabilize at room temperature for 24 \pm 2 hours before measuring.	
	Capacitance Variation	\leq \pm 12.5%		
	Dissipation Factor	\leq Initial Value x 2.0 (See Above)		
	Insulation Resistance	\geq 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 85°C \pm 2°C/ 85% \pm 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied. Remove from chamber and stabilize at room temperature and humidity for 24 \pm 2 hours before measuring.	
	Capacitance Variation	\leq \pm 12.5%		
	Dissipation Factor	\leq Initial Value x 2.0 (See Above)		
	Insulation Resistance	\geq Initial Value x 0.3 (See Above)		
	Dielectric Strength	Meets Initial Values (As Above)		

Y5V Dielectric

General Specifications



Y5V formulations are for general-purpose use in a limited temperature range. They have a wide temperature characteristic of +22% -82% capacitance change over the operating temperature range of -30°C to +85°C.

These characteristics make Y5V ideal for decoupling applications within limited temperature range.

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

0805

Size
(L" x W")

3

Voltage
6.3V = 6
10V = Z
16V = Y
25V = 3
50V = 5

G

Dielectric
Y5V = G

104

Capacitance Code (In pF)
2 Sig. Digits + Number of Zeros

Z

Capacitance Tolerance
Z = +80 -20%

A

Failure Rate
A = Not Applicable

T

Terminations
T = Plated Ni and Sn

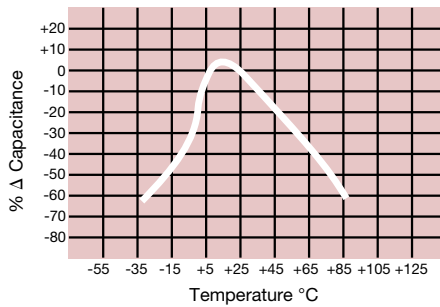
2

Packaging
2 = 7" Reel
4 = 13" Reel

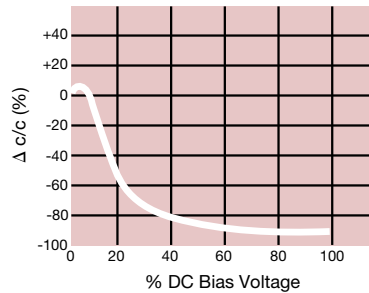
A

Special Code
A = Std. Product

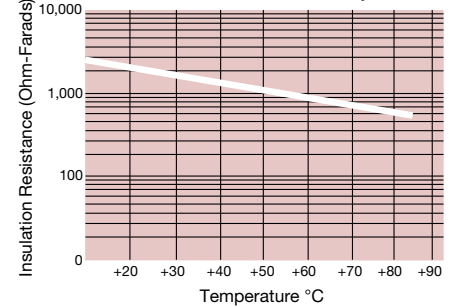
Temperature Coefficient



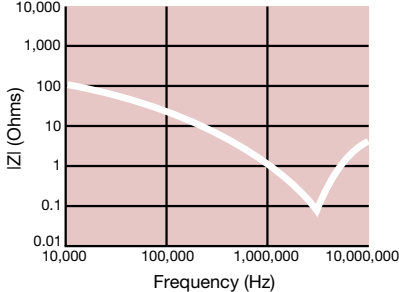
Capacitance Change vs. DC Bias Voltage



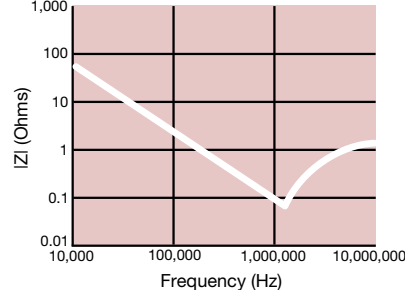
Insulation Resistance vs. Temperature



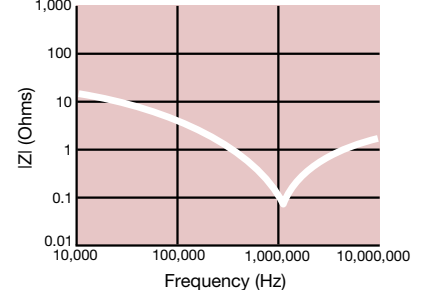
0.1 μF - 0603 Impedance vs. Frequency



0.22 μF - 0805 Impedance vs. Frequency



1 μF - 1206 Impedance vs. Frequency



Specifications and Test Methods

Parameter/Test		Y5V Specification Limits	Measuring Conditions	
Operating Temperature Range		-30°C to +85°C	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		≤ 5.0% for ≥ 50V DC rating ≤ 7.0% for 25V DC rating ≤ 9.0% for 16V DC rating ≤ 12.5% for ≤ 10V DC rating		
Insulation Resistance		10,000MΩ or 500MΩ - 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 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 1mm/sec 90 mm	
	Capacitance Variation	≤ ±30%		
	Dissipation Factor	Meets Initial Values (As Above)		
	Insulation Resistance	≥ Initial Value x 0.1		
Solderability		≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic solder at 230 ± 5°C 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 260°C for 60 seconds. Store at room temperature for 24 ± 2 hours before measuring electrical properties.	
	Capacitance Variation	≤ ±20%		
	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: -30°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±20%	Step 2: Room Temp	≤ 3 minutes
	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +85°C ± 2°	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 85°C ± 2°C for 1000 hours (+48, -0) Remove from test chamber and stabilize at room temperature for 24 ± 2 hours before measuring.	
	Capacitance Variation	≤ ±30%		
	Dissipation Factor	≤ Initial Value x 1.5 (See Above)		
	Insulation Resistance	≥ Initial Value x 0.1 (See Above)		
	Dielectric Strength	Meets Initial Values (As Above)		
Load Humidity	Appearance	No visual defects	Store in a test chamber set at 85°C ± 2°C/ 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	≤ ±30%		
	Dissipation Factor	≤ Initial Value x 1.5 (See above)		
	Insulation Resistance	≥ Initial Value x 0.1 (See Above)		
	Dielectric Strength	Meets Initial Values (As Above)		

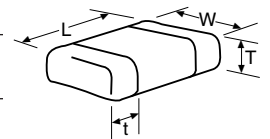
Y5V Dielectric



Capacitance Range

PREFERRED SIZES ARE SHADED

		0201		0402				0603				0805				1206				1210					
SIZE		0201		0402				0603				0805				1206				1210					
Soldering		Reflow Only		Reflow/Wave				Reflow/Wave				Reflow/Wave				Reflow/Wave				Reflow Only					
Packaging		All Paper		All Paper				All Paper				Paper/Embossed				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				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)				(0.126 ± 0.008)					
(W) Width	mm	0.30 ± 0.03		0.50 ± 0.10				.81 ± 0.15				1.25 ± 0.20				1.60 ± 0.20				2.50 ± 0.20					
	(in.)	(0.011 ± 0.001)		(0.020 ± 0.004)				(0.032 ± 0.006)				(0.049 ± 0.008)				(0.063 ± 0.008)				(0.098 ± 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				.50 ± 0.25					
	(in.)	(0.006 ± 0.002)		(0.010 ± 0.006)				(0.014 ± 0.006)				(0.020 ± 0.010)				(0.020 ± 0.010)				(0.020 ± 0.010)					
WVDC		6.3	10	6	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50	
Cap (pF)	820																								
	1000		A																						
	2200		A																						
Cap (µF)	4700		A																						
	0.010	A	A																						
	0.022	A	A																						
	0.047	A																							
	0.10			C		C						G	G												
	0.22																								
	0.33																								
	0.47																								
	1.0			C		C																			
	2.2																								
	4.7																								
	10.0																								
	22.0																								
	47.0																								
WVDC		6.3	10	6	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50	



Letter	A	C	E	G	J	K	M	N	P	Q	X	Y	Z
Max. Thickness	0.33 (0.013)	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					EMBOSSED							