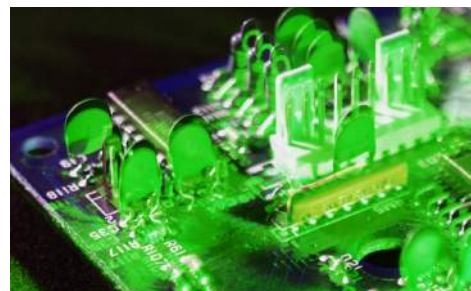
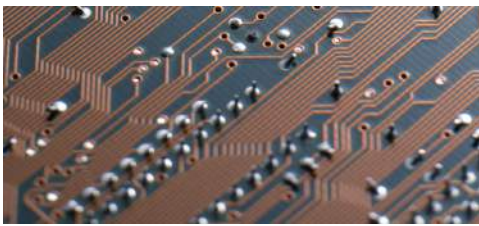




MULTI LAYER CERAMIC CAPACITORS



Ultra High Q, Low ESR Capacitors
High Q, Low ESR Capacitors
General Purpose Capacitors
0201 to 2220 case sizes
6.3 VDC to 3000 VDC
RoHS Compliant
HALOGEN Free

DESIGNING THE CUTTING EDGE

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* Frontier Electronics, Corp. reserves the right to make product design changes without notice.
Frontier Electronics' standard terms and conditions are applicable to all listed products unless otherwise specified.

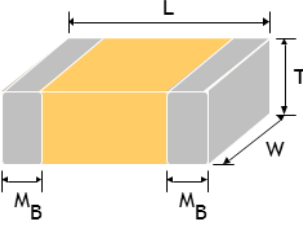
QUICK REFERENCE/PRODUCT SUMMARY

Series	Dielectric	Size	Capacitance	Voltage	Page
General Purpose (G Series)	NP0	0201, 0402, 0603, 0805 1206, 1210, 1808, 1812 1825, 2220, 2225	0.1pF ~ 100,000pF	6.3 ~ 3,000	5
	X7R	0201, 0402, 0603, 0805 1206, 1210, 1808, 1812 1825, 2220, 2225	100pF ~ 47μF	6.3 ~ 3,000	6
	Y5V	0402, 0603, 0805, 1206, 1210, 1812	10,000pF ~ 100μF	6.3 ~ 250	8
	X5R	0201, 0402, 0603, 0805, 1206, 1210	100pF ~ 100μF	6.3 ~ 50	8
Ultra High-Q, Low ESR (M Series)	NP0	0201, 0402, 0505 0603, 0805, 1111	0.1pF ~ 180pF	6.3 ~ 500	10
High-Q, Low ESR (H Series)	NP0	0201, 0402, 0603, 0805	0.1pF ~ 3,300pF	6.3 ~ 630	13

HOW TO ORDER

0402	H	250	N	4R7	B	C	T
Size	Series	Rated Voltage	Dielectric	Capacitance	Tolerance	Termination	Packaging
0201 (0603) 0402 (1005) 0505 (1414) 0603 (1608) 0805 (2012) 1111 (2828) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532) 1825 (4563) 2220 (5750) 2225 (5763)	G: General Purp./High Volt H: High-Q, Low ESR M: Ultra High-Q, Low ESR	6R3: 6.3V 100: 10V 160: 16V 250: 25V 500: 50V 101: 100V 201: 200V 251: 250V 501: 500V 631: 630V 102: 1,000V 202: 2,000V 302: 3,000V	N: NP0 X: X7R W: X5R Y: Y5V	R47: 0.47pF 0R5: 0.5pF 1R0: 1.0pF 100: 10pF 101: 100pF	A: ±0.05pF B: ±0.1pF C: ±0.25pF D: ±0.5pF F: ±1% G: ±2% J: ±5% K: ±10% M: ±20% Z: -20%/+80%	C: Cu/Ni/Sn	T: 7" Paper Tape U: 13" Paper Tape E: 7" Plastic Tape Q: 13" Plastic Tape Z or blank: Bulk

EXTERNAL DIMENSIONS

Outline	Case Size EIA (mm)	L (mm)	W (mm)	T (mm)	Soldering Method	M _B (mm)
	0201 (0603)	0.60 ±0.03	0.30 ±0.03	0.30 ±0.03	R	0.15 ±0.05
	0402 (1005)	1.00 ±0.05	0.50 ±0.05	0.50 ±0.05	R	0.25 +0.05/-0.1
		1.00 ±0.20	0.50 ±0.20	0.50 ±0.20		
	0505 (1414)	1.40 +0.33/-0.25	1.40 ±0.38	1.15 ±0.15	R/W	0.25 +0.25/-0.13
	0603 (1608)	1.60±0.10	0.80±0.10	0.80±0.07	R / W	0.40 ±0.15
		1.60 +0.15/-0.10	0.80+0.15/-0.10	0.50±0.10		
		1.60 ±0.20	0.80±0.20	0.80+0.15/-0.10		
	0805 (2012)	2.0 ±0.15	1.25 ±0.10	0.50±0.10	R / W	0.50 ±0.20
				0.60±0.10	R / W	
				0.80±0.10	R / W	
				1.25±0.10	R	
		2.0 ±0.20	1.25 ±0.20	0.85±0.10	R / W	
				1.25±0.20	R	
	1111 (2828)	2.79 +0.51/-0.25	2.79 ±0.38	1.78 max	R	0.38 ±0.25
	1206 (3216)	3.2 ±0.15	1.6 ±0.15	0.8 ±0.10	R/W	0.6 ±0.20
				0.95 ±0.10	R	
				1.15 ±0.15	R	
		3.2 ±0.20	1.6 ±0.20	1.25 ±0.10	R	
				0.85 ±0.10	R	
	3.2 +0.3/-0.1	1.6 +0.3/-0.1	1.6 +0.3/-0.10	1.6 ±0.20	R/W	
	1210 (3225)	3.2 ±0.30	2.5 ±0.20	0.85 ±0.10	R	0.75 ±0.25
				1.25 ±0.10	R	
		3.2 ±0.40	2.5 ±0.30	1.6 ±0.20	R	
2.0 ±0.20				R		
2.5 ±0.30	R					
1808 (4520)	4.5 ±0.40	2.03 ±0.25	1.4 ±0.15	R	0.75 ±0.25	
			1.6 ±0.20	R		
			2.0 ±0.20	R		
1812 (4532)	4.5 ±0.40	3.2 ±0.30	1.25 ±0.10	R	0.75 ±0.25	
			1.6 ±0.20	R		
		3.2 ±0.40	2.0 ±0.20	R		
			2.5 ±0.30	R		
2.8 ±0.30	R					
1825 (4563)	4.6 ±0.30	6.3 ±0.40	2.0 ±0.20	R	>0.26	
			2.5 ±0.30			
			2.8 ±0.30			
2220 (5750)	5.7 ±0.40	5.0 ±0.40	2.0 ±0.20	R	>0.30	
			2.5 ±0.30			
			2.8 ±0.30			
2225 (5763)	5.7 ±0.40	6.3 ±0.40	2.0 ±0.20	R	>0.30	
			2.5 ±0.30			
			2.8 ±0.30			

* R = Reflow soldering process; W = Wave soldering process

SIZE CODES/PACKAGING STYLE & QUANTITY

Case Size	Size Code	Max. Thickness (mm)	Length (mm)	Width (mm)	Thickness (mm)	Reel Quantity			
						Paper Tape		Embossed Plastic Tape	
						7" Reel	13" Reel	7" Reel	13" Reel
0201	AA	0.33	0.60 ±0.03	0.30 ±0.03	0.30 ±0.03	15,000	70,000	-	-
0402	BA	0.55	1.00 ±0.05	0.50 ±0.05	0.50 ±0.05	10,000	50,000	-	-
0402	BC	0.52	1.0 ±0.20	0.50 ±0.20	0.50 ±0.2	10,000	-	-	-
0505	LA	1.3	1.4 +0.33/-0.25	1.4 ±0.38	1.15 ±0.15	-	-	-	-
0603	CA	0.87	1.6 ±0.1	0.8 ±0.1	0.8±0.07	4,000	15,000	-	-
0603	CC	0.95	1.6 +0.15/-0.01	0.8 +0.15/-0.1	0.8 +0.15/-0.1	4,000	15,000	-	-
0805	DB	0.7	2.0 ±0.15	1.25 ±0.1	0.6 ±0.1	4,000	15,000	-	-
0805	DC	0.9	2.0 ±0.15	1.25 ±0.1	0.8 ±0.1	4,000	15,000	-	-
0805	DD	1.35	2.0 ±0.15	1.25 ±0.1	1.25 ±0.1	-	-	3,000	10,000
0805	DE	0.95	2.0 ±0.2	1.25 ±0.2	0.85 ±0.1	4,000	15,000	-	-
0805	DF	1.45	2.0 ±0.2	1.25 ±0.2	1.25 ±0.2	-	-	3,000	10,000
1111	MA	1.78	2.79 +0.51/-0.25	2.79 ±0.38	1.78 max	-	-	2,000	-
1206	EA	0.9	3.2 ±0.15	1.6 ±0.15	0.8 ±0.1	4,000	15,000	-	-
1206	EB	1.05	3.2 ±0.15	1.6 ±0.15	0.95 ±0.1	-	-	3,000	10,000
1206	EC	1.35	3.2 ±0.15	1.6 ±0.15	1.25 ±0.1	-	-	3,000	10,000
1206	ED	1.3	3.2 ±0.2	1.6 ±0.15	1.15 ±0.15	-	-	3,000	10,000
1206	EE	1.8	3.2 ±0.2	1.6 ±0.2	1.6 ±0.2	-	-	2,000	10,000
1206	EG	1.9	3.2 +0.3/-0.1	1.6 +0.3/-0.1	1.6 +0.3/-0.1	-	-	2,000	9,000
1210	FA	1.05	3.2 ±0.3	2.5 ±0.2	0.95 ±0.1	-	-	3,000	10,000
1210	FC	1.35	3.2 ±0.3	2.5 ±0.2	1.25 ±0.1	-	-	3,000	10,000
1210	FD	1.8	3.2 ±0.4	2.5 ±0.3	1.6 ±0.2	-	-	2,000	-
1210	FE	2.2	3.2 ±0.4	2.5 ±0.3	2.0 ±0.2	-	-	1,000	6,000
1210	FF	2.8	3.2 ±0.4	2.5 ±0.3	2.5 ±0.3	-	-	1,000	6,000
1808	GE	1.35	4.5 +0.5/-0.3	2.03 ±0.25	1.25 ±0.1	-	-	2,000	10,000
1808	GH	2.2	4.5 +0.5/-0.3	2.03 ±0.25	2.0 ±0.2	-	-	1,000	6,000
1812	HA	1.35	4.5 ±0.4	3.2 ±0.3	1.25 ±0.1	-	-	1,000	5,000
1812	HC	2.2	4.5 ±0.4	3.2 ±0.3	2.0 ±0.2	-	-	1,000	-
1825	IA	2.2	4.6 ±0.3	6.3 ±0.4	2.0 ±0.2	-	-	1,000	-
1825	IB	2.8	4.6 ±0.3	5.0 ±0.4	2.5 ±0.3	-	-	500	-
2220	JA	2.2	5.7 ±0.4	5.0 ±0.4	2.0 ±0.2	-	-	1,000	-
2220	JB	2.8	5.7 ±0.4	5.0 ±0.4	2.5 ±0.3	-	-	500	-
2220	JC	3.1	5.7 ±0.4	5.0 ±0.4	2.8 ±0.3	-	-	500	-
2225	KA	2.2	5.7 ±0.4	6.3 ±0.4	2.0 ±0.2	-	-	1,000	-
2225	KB	2.8	5.7 ±0.4	6.3 ±0.4	2.5 ±0.3	-	-	500	-
2225	KC	3.1	5.7 ±0.4	6.3 ±0.4	2.8 ±0.3	-	-	500	-



MLCC, High Q Multi-Layer Capacitor Standard Kits

P/N	EIA (Metric)	50 pieces of each value (pF)																		
0402H-KIT	0402 (1005)	0.2	0.3	0.5	0.7	0.9	1.0	1.2	1.5	2.0	2.2	2.7	3.0	3.6	4.7	5.6	6.8	8.2	10	
50 volts	Tolerance	±0.1pF	±0.05pF	±0.1pF														±5%		
0603H-KIT	0603 (1608)	0.5	0.6	0.8	1.0	1.2	1.5	1.8	2.2	2.4	3.3	3.9	4.7	5.6	6.8	10	22	33	68	
100 volts	Tolerance	±0.1pF													±0.25pF	±5%				
0805H-KIT	0805 (2012)	1.0	1.8	2.7	4.7	5.0	6.0	6.8	8.0	9.0	13	18	24	33	68	120	150	180	220	
250 volts	Tolerance	±0.25pF	±0.1pF				±0.25pF	±0.1pF	±5%											

MLCC, ULTRA High Q Multi-Layer Capacitor Standard Kits

P/N	EIA (Metric)	50 pieces of each value (pF)																		
0201M-KIT	0201 (0603)	0.3	0.7	1.0	1.2	1.5	2.2	2.7	3.3	3.6	3.9	4.3	4.7	5.6	6.8	8.2	10	22	33	
25 volts	Tolerance	±0.1pF																±5%		
0402M-KIT	0402 (1005)	0.2	0.3	0.5	0.7	0.9	1.0	1.2	1.5	2.0	2.2	2.7	3	3.9	4.7	5.6	6.8	8.2	10	
100 volts	Tolerance	±0.1pF	±0.05pF	±0.1pF														±0.25pF	±5%	
0603M-KIT	0603 (1608)	0.5	0.6	0.8	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	10	22	33	47	
250 volts	Tolerance	±0.1pF													±0.25pF	±5%				
0805M-KIT	0805 (2012)	0.3	0.9	1.8	2.7	4.7	5.6	6.8	9.0	10	18	22	27	33	39	47	68	82	100	
250 volts	Tolerance	±0.1pF					±0.25pF					±5%								

Our standard kits are listed above, however, different capacitance values/case sizes/and voltages are available.

Please contact Frontier Electronics or one of our franchised distributors for additional information.

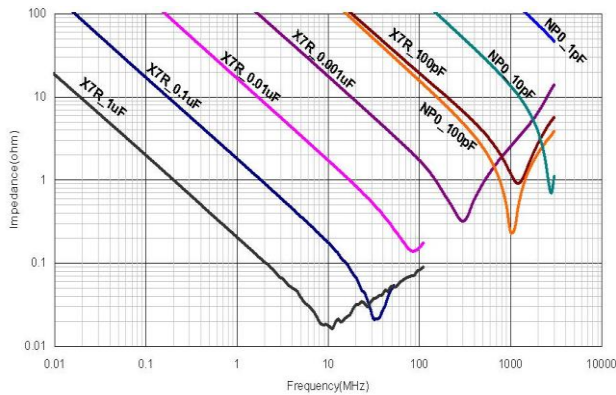
Part Number Description

0201	G	250	N	0R3	A	C	T
Size	Series	Voltage	Dielectric	Capacitance	Tolerance	Termination	Packaging
0201 (0603)	G (General Purpose)	250=25 VDC	N=NP0	0R3=0.3pF	A=±0.05pF	C=Cu/Ni/Sn	T=7" Paper Tape

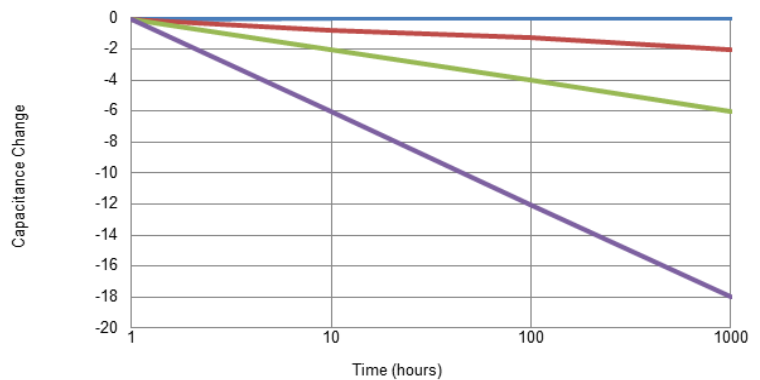
General Electrical Data

Dielectric	NP0	X7R	X5R	Y5V
Size	0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0201, 0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0402, 0603, 0805, 1206, 1210, 1808, 1812
Capacitance range	0.1pF to 0.1µF	100pF to 47µF	100pF to 100µF	0.01µF to 100µF
Capacitance tolerance	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%), K (±10%)	J (±5%) K (±10%) M (±20%)	K (±10%) M (±20%)	M (±20%) Z (-20/+80%)
Rated voltage (VDC)	6.3, 10, 16, 25, 50, 100, 200, 250, 500, 630, 1,000, 2,000, 3,000		6.3, 10, 16, 25, 50	6.3, 10, 16, 25, 50, 100, 200, 250
Operating temperature	-55 to +125°C		-55 to +85°C	-25 to +85°C
Capacitance characteristic	±30ppm	±15%	±15%	-0.375
Insulation resistance at Ur	Ur=200~630V: ≥10GΩ or RxC≥100Ω·F (whichever is lower) Ur=1000~3000V: ≥10GΩ			
Dielectric Strength	<200V: ≥2.5 x VDC 200~300V: ≥2 x VDC 500~999V: ≥1.5 x VDC 1000~3000V: ≥1.2 x VDC *Duration: 1 to 5 seconds *Charge and discharge current less than 50mA			
Termination	Ni/Sn (lead-free termination)			

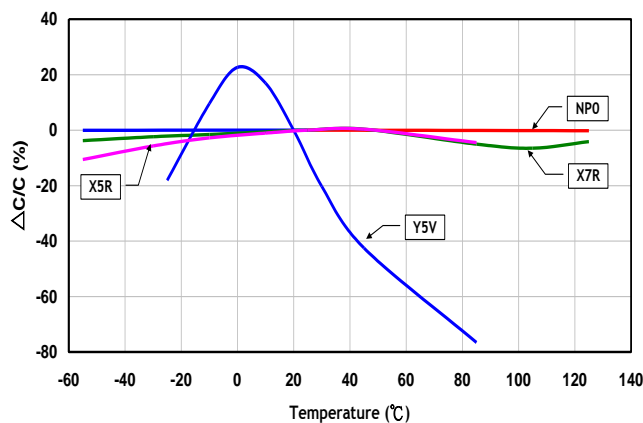
Electrical Characteristics



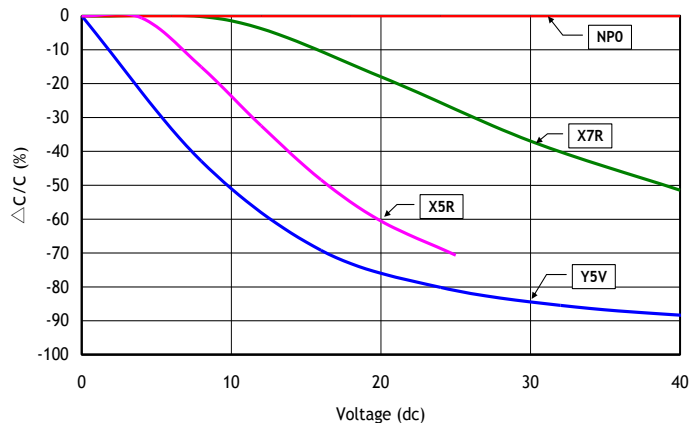
Impedance vs. Frequency (typical)



Capacitance Change – Typical Aging Rate



Temperature Coefficient of Capacitance



DC Bias Characteristics

GENERAL PURPOSE & HIGH VOLTAGE (G SERIES) NP0 DIELECTRIC



		Tolerance		0201	0402	0603	0805	1206	1210	1808	1812	1825	2220	2225
		6.3 10 16 25	3 10 16 25	6.3 10 16 25	6.3 10 16 25	10 16 25 50	10 16 25 50	10 16 25 50	10 16 25 50	10 16 25 50	10 16 25 50	10 16 25 50	10 16 25 50	10 16 25 50
DC Volts														
0R2	0.2 pF	AA	AA											
0R3	0.3 pF	AA	AA											
0R4	0.4 pF	AA	AA											
0R5	0.5 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB			
0R6	0.6 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB			
0R7	0.7 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB			
0R8	0.8 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB			
0R9	0.9 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB			
1R0	1.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB			
1R2	1.2 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
1R5	1.5 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
1R8	1.8 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
2R0	2.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
2R2	2.2 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
2R7	2.7 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
3R0	3.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
3R3	3.3 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
3R9	3.9 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
4R0	4.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
4R7	4.7 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
5R0	5.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
5R6	5.6 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
6R0	6.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
6R8	6.8 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
7R0	7.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
8R0	8.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
8R2	8.2 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
9R0	9.0 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
100	10 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
120	12 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
150	15 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
180	18 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
220	22 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
270	27 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
330	33 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
390	39 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
470	47 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
560	56 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
680	68 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
820	82 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
101	100 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
121	120 pF	AA	AA	BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
151	150 pF			BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
181	180 pF			BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
221	220 pF			BA	BA	CA	CA	CA	DB	DB	DB	EA	EA	EA
271	270 pF			BA		CA	CA	CC	DB	DD	DD	EA	EB	EB
331	330 pF			BA		CA	CA	CC	DB	DD	DD	EA	EB	EB
391	390 pF			BA		CA	CA	CC	DC	DD	DD	EA	EB	EB
471	470 pF			BA		CA	CA	CC	DC	DD	DF	EA	EB	EB
561	560 pF			BA		CA	CA		DC	DD	DF	EA	EC	EC
681	680 pF			BA		CA	CA		DC	DD	DF	EA	EC	EC
821	820 pF			BA		CA	CA		DC	DD	DF	EA	EE	EE
102	1,000 pF			BA		CA	CA		DC	DD	DF	EA	EE	EE
122	1,200 pF					CC	CC		DC	DD		EA	EE	EE
152	1,500 pF					CC	CC		DC	DD		EA	EE	EE
182	1,800 pF					CC			DC	DD		EA	EE	EE
222	2,200 pF					CC			DC	DD	DD	EA	EE	EE
272	2,700 pF					CC			DC	DD		EA	EE	EE
332	3,300 pF					CC			DC	DD		EA	EE	EE
392	3,900 pF					CC			DC	DD		EA	EE	EE
472	4,700 pF					CC			DC	DD		EA	EE	EE
562	5,600 pF					CC			DC	DD		EA	EE	EE
682	6,800 pF					CC			DC	DD		EA	EE	EE
822	8,200 pF					CC			DC	DD		EA	EE	EE
103	10,000 pF					CC			DC	DD	DF	EA	EE	EE
123	12,000 pF								DC	DD		EA	EE	EE
153	15,000 pF								DC	DD		EA	EE	EE
183	18,000 pF								DC	DD		EA	EE	EE
223	22,000 pF								DC	DD		EA	EE	EE
273	27,000 pF								DC	DD		EA	EE	EE
333	33,000 pF								DC	DD		EA	EE	EE
393	39,000 pF								DC	DD		EA	EE	EE
563	56,000 pF								DC	DD		EA	EE	EE
683	68,000 pF								DC	DD		EA	EE	EE
823	82,000 pF								DC	DD		EA	EE	EE
104	100,000 pF								DC	DD		EA	EE	EE

* Tolerance available only for 100V and lower

The letter code in the cell indicates the dimensions and package quantity. The reference table is on page 4 of the catalog.

GENERAL PURPOSE & HIGH VOLTAGE (G SERIES) X7R DIELECTRIC



	Tolerance	1808					1812					1825					2220					2225														
		6.3	100				6.3					10					6.3					6.3					10									
		16	250				16	50	200	500		25	200	500			25		200	500	2K	25		200			25		200							
		50	630	1K	2K	3K	25	100	250	630	1K	2K	3K	100	250	630	1K	2K	3K	50	100	250	630	1K	3K	50	100	250	500	630	1K	2K				
		DC Volts																																		
101	100 pF																																			
121	120 pF																																			
151	150 pF	GE	GE	GE	GE	GE																														
181	180 pF	GE	GE	GE	GE	GE																														
221	220 pF	GE	GE	GE	GE	GE																														
271	270 pF	GE	GE	GE	GE	GE	HA	HA	HA	HA	HA																									
331	330 pF	GE	GE	GE	GE	GH	HA	HA	HA	HA	HA																									
391	390 pF	GE	GE	GE	GE	GH	HA	HA	HA	HA	HA																									
471	470 pF	GE	GE	GE	GE	GH	HA	HA	HA	HA	HA																									
561	560 pF	GE	GE	GE	GE	GH	HA	HA	HA	HA	HA																									
681	680 pF	GE	GE	GE	GE	GH	HA	HA	HA	HA	HA	HC	HC																							
821	820 pF	GE	GE	GE	GE	GH	HA	HA	HA	HA	HA	HC	HC																							
102	1,000 pF	GE	GE	GE	GE	GH	HA	HA	HA	HA	HA	HC		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA		
122	1,200 pF	GE	GE	GE	GH	GH	HA	HA	HA	HA	HA	HC		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA		
152	1,500 pF	GE	GE	GE	GH	GH	HA	HA	HA	HA	HA	HC		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA		
182	1,800 pF	GE	GE	GE	GH		HA	HA	HA	HA	HA	HD		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA		
222	2,200 pF	GE	GE	GE	GH		HA	HA	HA	HA	HA	HD		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
272	2,700 pF	GE	GE	GE	GH		HA	HA	HA	HA	HA	HD		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
332	3,300 pF	GE	GE	GE	GH		HA	HA	HA	HA	HA	HC		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
392	3,900 pF	GE	GE	GE	GH		HA	HA	HA	HA	HA	HC		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
472	4,700 pF	GE	GE	GE	GH		HA	HA	HA	HA	HA	HC		IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
562	5,600 pF	GH	GH	GH	GH		HA	HA	HA	HA	HA			IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
682	6,800 pF	GH	GH	GH			HA	HA	HA	HA	HA			IA	IA	IA	IA	IA	IA	JA	JA	JA	JA	JA	JA	KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
822	8,200 pF	GH	GH	GH			HA	HA	HA	HA	HA			IA	IA	IA	IA	IA	IB	JA	JA	JA	JA	JA	JB	KA	KA	KA	KA	KA	KA	KA	KA	KA		
103	10,000 pF	GH	GH	GH			HA	HA	HA	HA	HA			IA	IA	IA	IA	IA	IB	JA	JA	JA	JA	JA	JB	KA	KA	KA	KA	KA	KA	KA	KA	KA		
123	12,000 pF	GH	GH	GH			HA	HA	HA	HA	HA			IA	IA	IA	IA	IB		JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA		
153	15,000 pF	GH	GH	GH			HA	HA	HA	HA	HC			IA	IA	IA	IA	IB		JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
183	18,000 pF	GH	GH	GH			HA	HA	HA	HA				IA	IA	IA	IA			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
223	22,000 pF	GH	GH	GH			HA	HA	HA	HA				IA	IA	IA	IA			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
273	27,000 pF	GH	GH	GH			HA	HA	HA	HA				IA	IA	IA	IA			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
333	33,000 pF	GH	GH	GH			HA	HA	HA	HA				IA	IA	IA	IA			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
393	39,000 pF	GH	GH	GH			HA	HA	HA	HA				IA	IA	IA	IA			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
473	47,000 pF	GH	GH				HA	HA	HA	HA				IA	IA	IA	IA			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
563	56,000 pF	GH	GH				HA	HA	HA	HC				IA	IA	IA	IA			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
683	68,000 pF	GH	GH				HA	HA	HA	HC				IA	IA	IA	IA			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
823	82,000 pF						HA	HA	HA	HC				IA	IA	IA	IB			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
104	0.1 µF						HA	HA	HA	HC				IA	IA	IA	IB			JA	JA	JA	JA	JA		KA	KA	KA	KA	KA	KA	KA	KA	KA		
124	0.12 µF						HA	HA	HA	HD				IA	IA	IA				JA	JA	JA	JA	JB		KA	KA	KA	KA	KA	KA	KA	KA	KA		
154	0.15 µF						HA	HA	HC	HD				IA	IA	IA				JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
184	0.18 µF						HA	HA	HC					IA	IA	IA				JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
224	0.22 µF						HA	HA	HC					IA	IA	IA				JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
274	0.27 µF						HA	HA	HC					IA	IA					JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
334	0.33 µF						HA	HA	HC					IA	IA					JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
394	0.39 µF						HA	HA	HC					IA	IA					JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
474	0.47 µF						HA	HC	HC					IA	IA					JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
564	0.56 µF						HA	HC	HD					IA	IA					JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
684	0.68 µF						HA	HC	HD					IA	IA					JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
824	0.82 µF						HA	HC	HD					IA	IA					JA	JA	JA	JA			KA	KA	KA	KA	KA	KA	KA	KA	KA	KA	
105	1 µF						HA	HC	HD					IA	IA					JA	JA	JA	JA			KA	KA	KA	KB							
155	1.5 µF						HC	HC	HD					IA						JA	JA	JB	JB			KA	KA	KB								
225	2.2 µF						HD	HD						IA						JA	JA	JB	JB			KA	KA	KB								
335	3.3 µF													IA						JA	JA	JA	JA			KA	KA									
475	4.7 µF													IA						JA	JB					KA										
685	6.8 µF																			JB	JC					KB										
106	10 µF																			JC	JC					KC										
226	22 µF																																			
476	47 µF																																			

*J
K
M

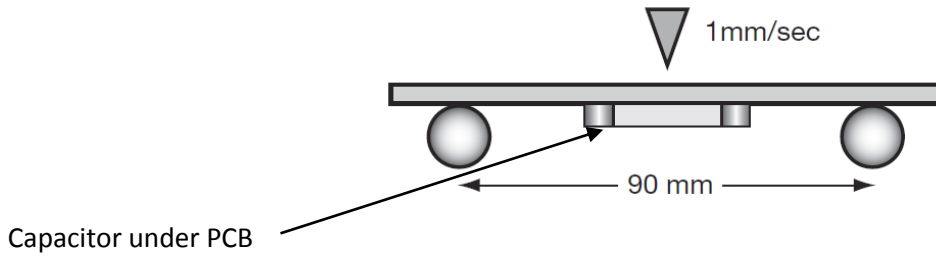
*J Tolerance available only for 100V and lower

SOFT (FLEXIBLE) TERMINATION



Soft Termination is available on most of our G Series Capacitors, 0805 case and larger. With up to 5mm of PCB flex, Soft Termination protects the MLCC from stress fractures with zero failures.

Measuring Method

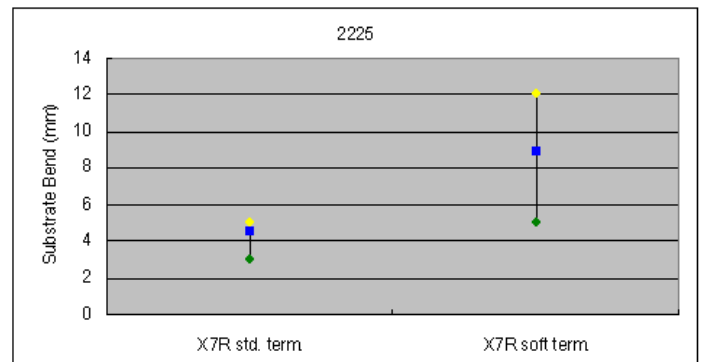
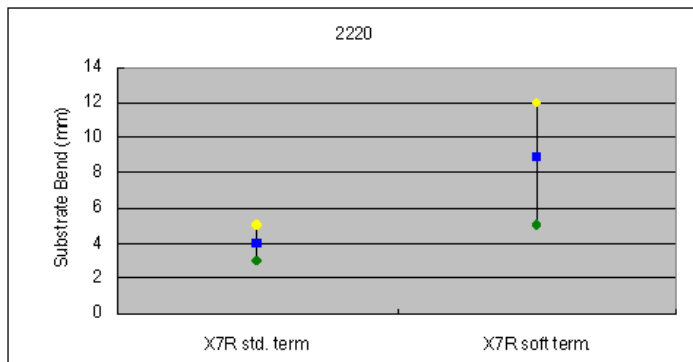
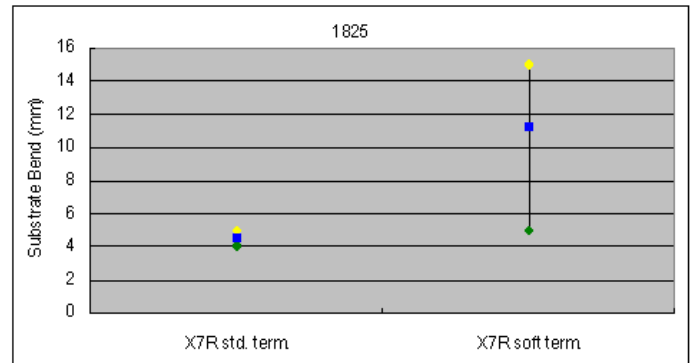
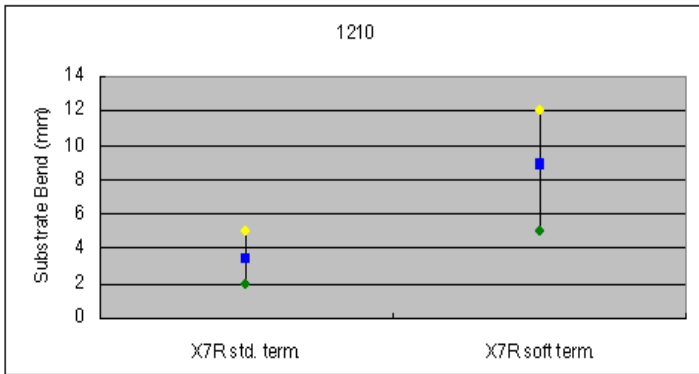


The test sample is soldered onto a PCB and the PCB is deflected, with deflection rate of 1mm/s until the capacitance change exceeds $\pm 12.5\%$, which is considered a failing point.

The table below summarizes the deflection results:

	Size: 1210		Size: 1812		Size: 1825		Size: 2220		Size: 2225	
	Std. Term	Soft Term	Std. Term	Soft Term	Std. Term	Soft Term	Std. Term	Soft Term	Std. Term	Soft Term
Max.	5	12	5	15	5	15	5	12	5	12
Min.	2	5	2	5	4	5	3	5	3	5
Avg.	3.5	9.9	3.5	9.9	4.5	11.2	4	8.9	4.5	8.9

Units in mm



- Please contact Frontier Electronics for additional information and product availability.

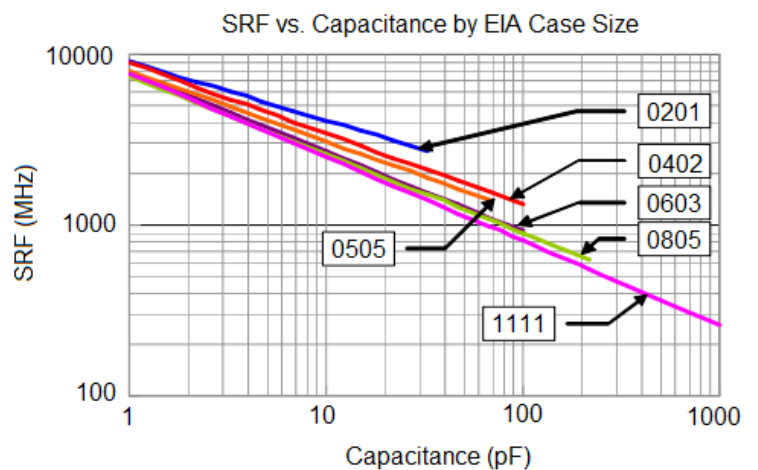
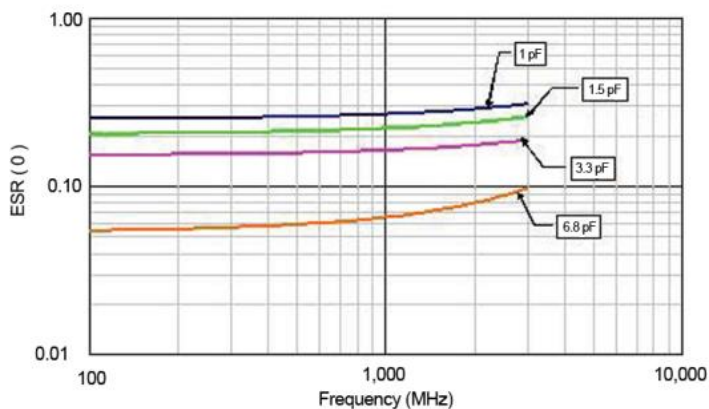
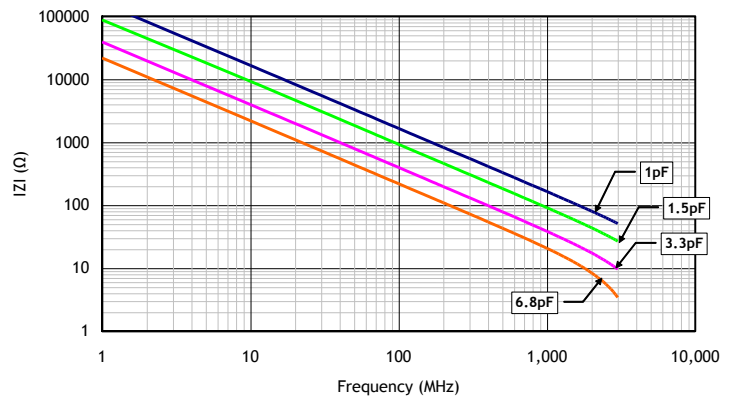
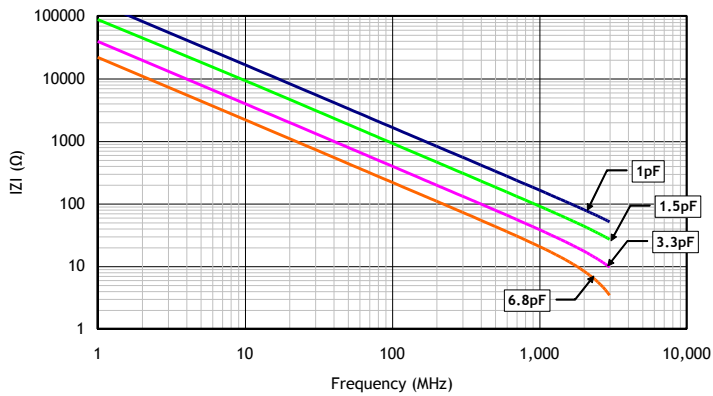
Part Number Description

0201	M	250	N	0R3	A	C	T
Size	Series	Voltage	Dielectric	Capacitance	Tolerance	Termination	Packaging
0201 (0603)	M (Ultra High Q, Low ESR)	250=25 VDC	N=NP0	0R3=0.3pF	A=±0.05pF	C=Cu/Ni/Sn	T=7" Paper Tape

General Electrical Data

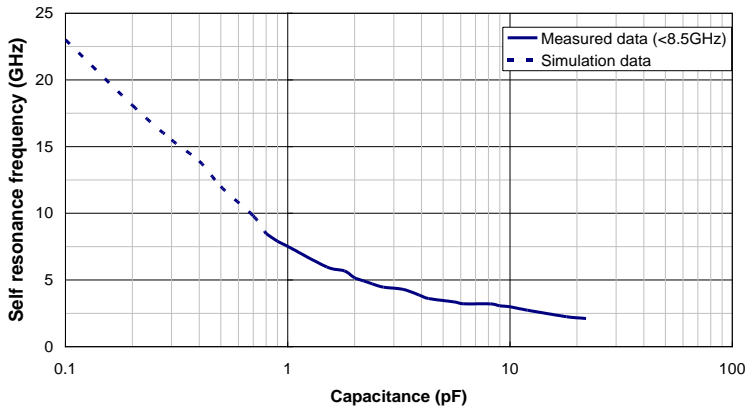
Dielectric	NP0
Size	0201, 0402, 0505, 0603, 0805, 1111
Capacitance	0.1pF to 1,000pF
Capacitance tolerance	Cap≤5pF: A (±0.05pF), B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: B (±0.1pF), C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%)
Rated voltage (WVDC)	6.3V, 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V
Q	Cap≥30pF, Q≥1000 Cap<30pF, Q≥400+20C
Insulation resistance at Ur	≥10GΩ
Operating temperature	-55 to +125°C
Capacitance change	±30ppm/°C; 0201Cap≥22pF, ±60ppm/°C
Termination	Ni/Sn (lead-free termination)

Electrical Characteristics

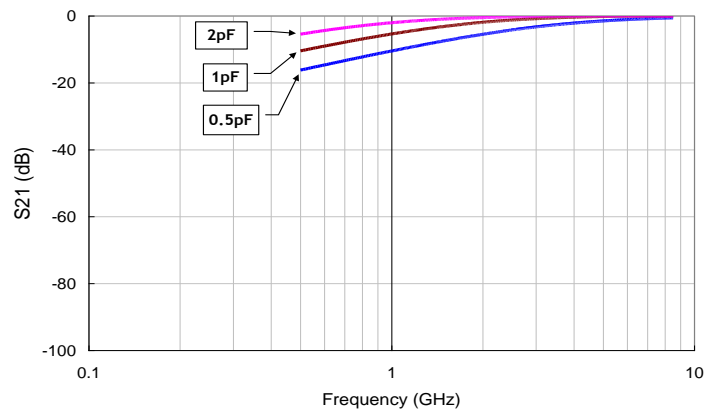


Electrical Characteristics

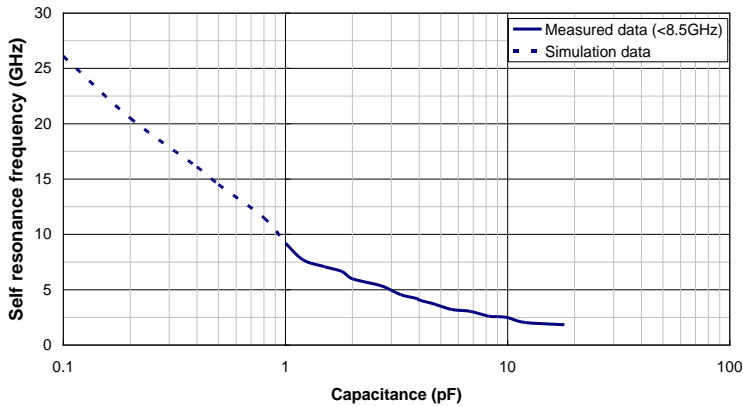
SRF vs. Capacitance (0201)



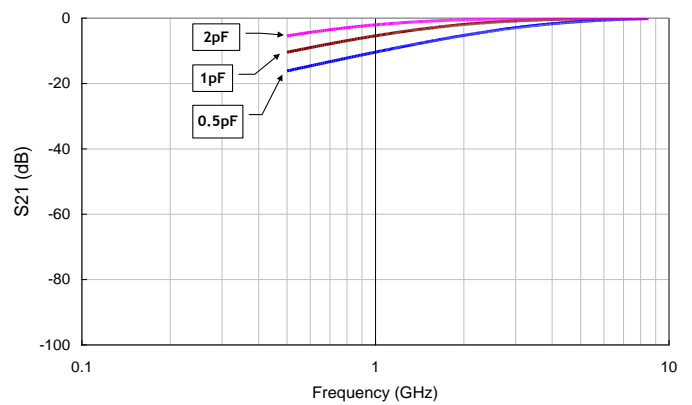
S21 vs. Frequency (0201)



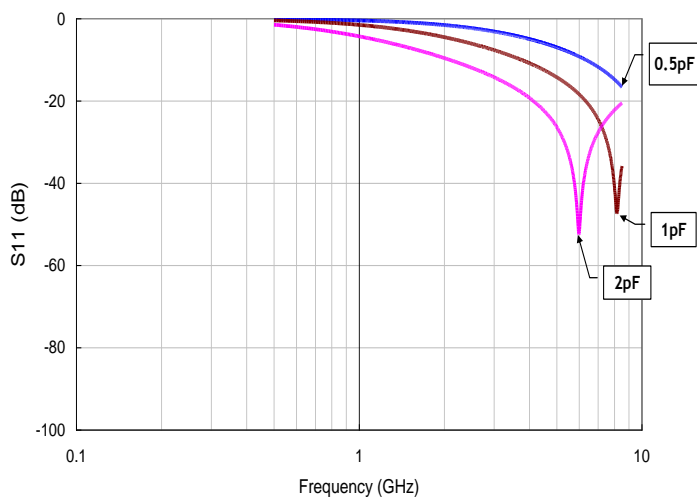
SRF vs. Capacitance (0402)



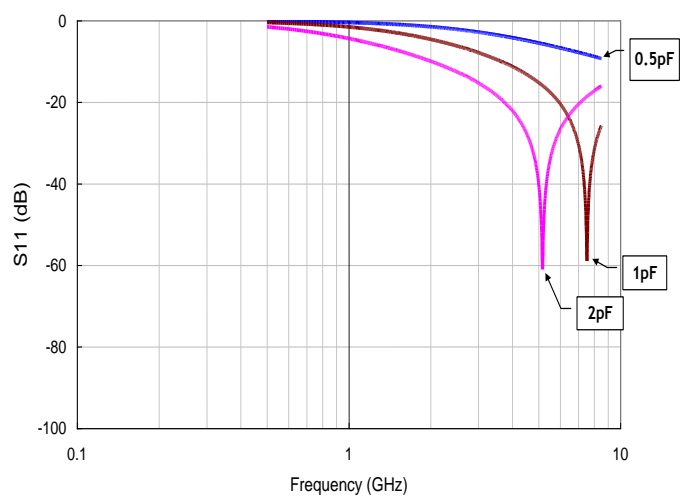
S21 vs. Frequency (0402)



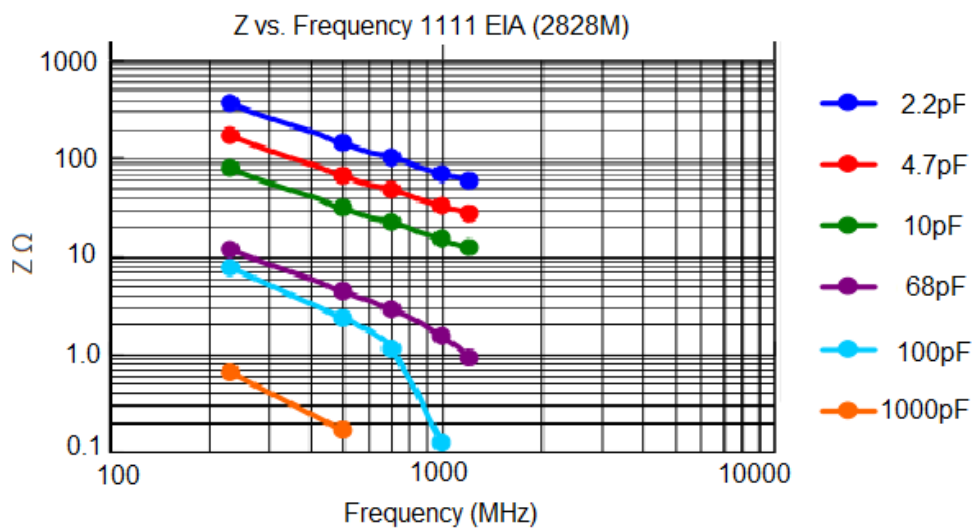
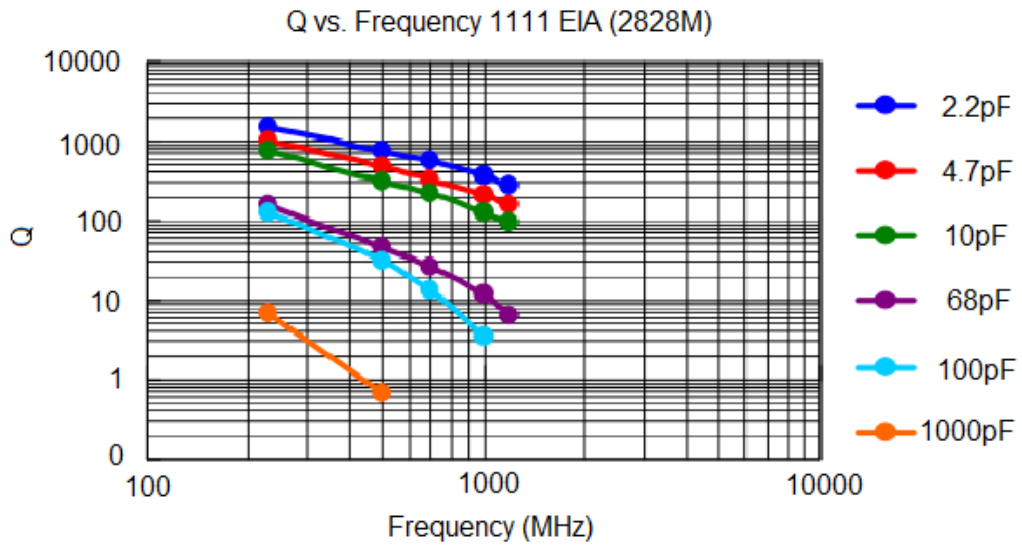
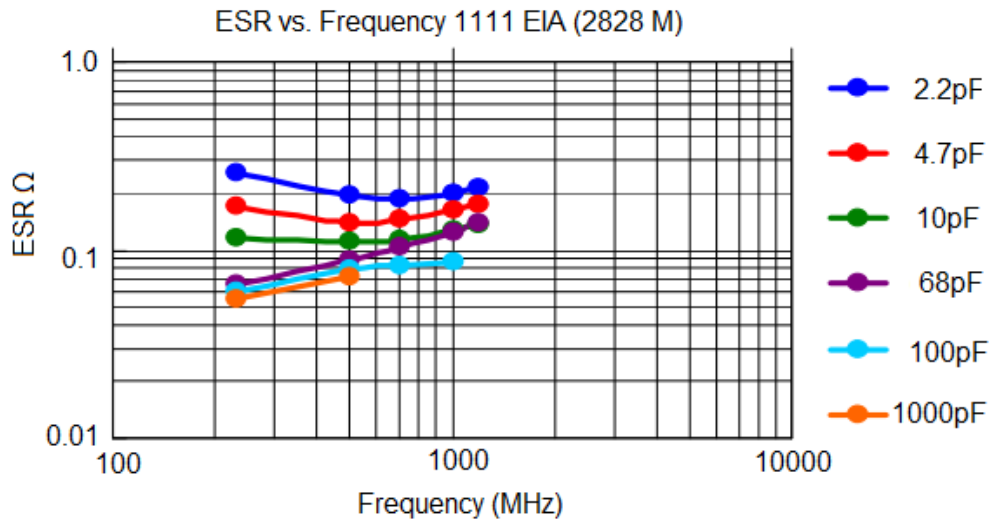
S11 vs. Frequency (0201)



S11 vs. Frequency (0402)



Electrical Characteristics



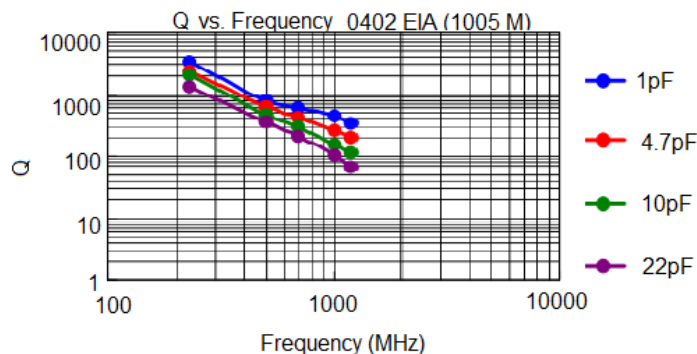
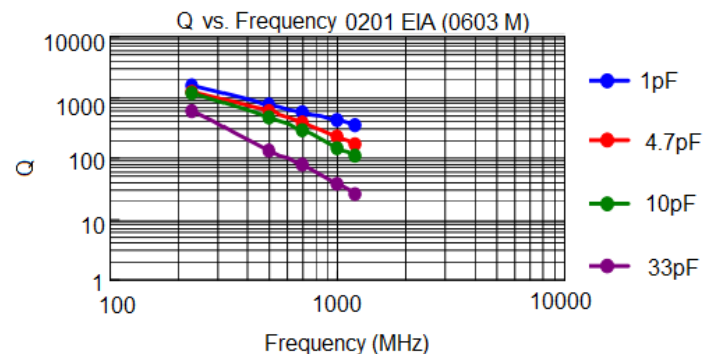
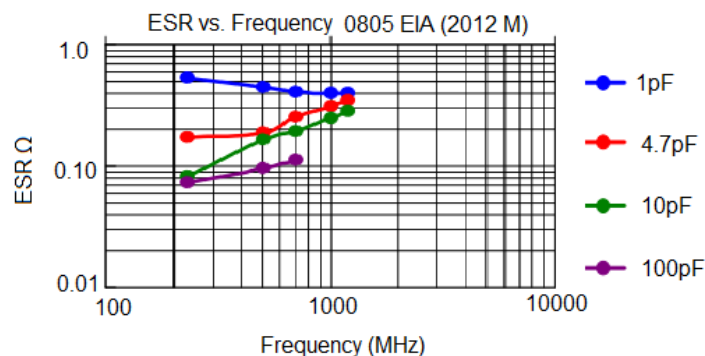
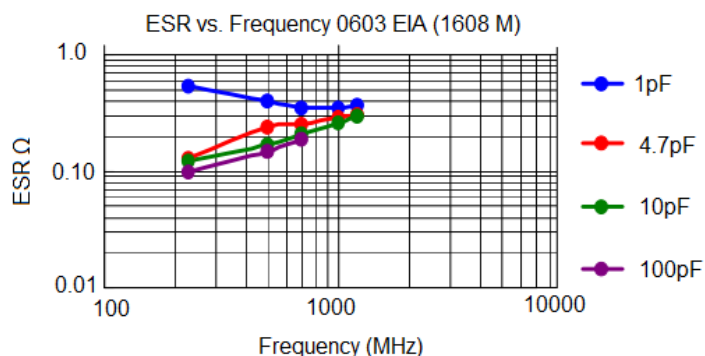
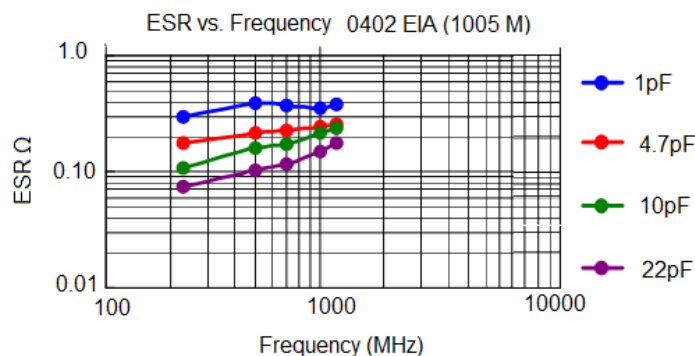
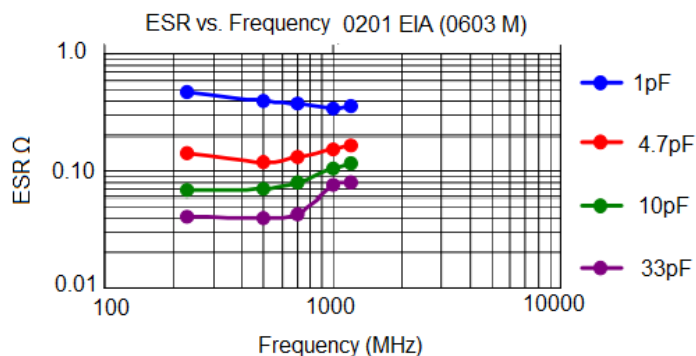
Part Number Description

0201	H	250	N	0R3	A	C	T
Size	Series	Voltage	Dielectric	Capacitance	Tolerance	Termination	Packaging
0201 (0603)	H (High Q, Low ESR)	250=25 VDC	N=NP0	0R3=0.3pF	A=±0.05pF	C=Cu/Ni/Sn	T=7" Paper Tape

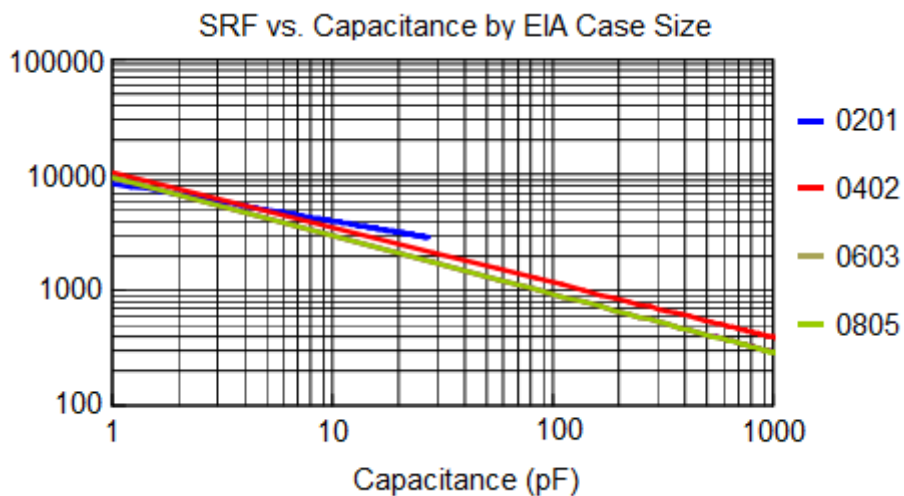
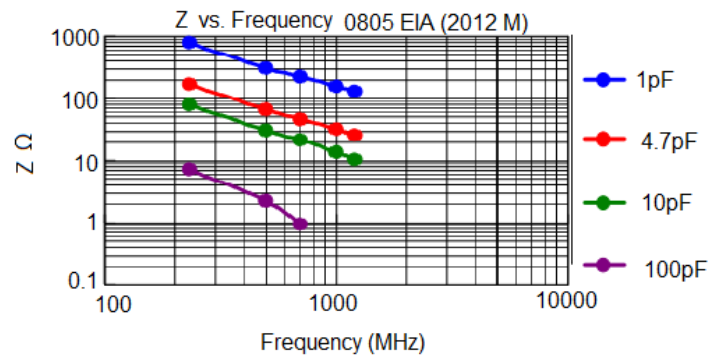
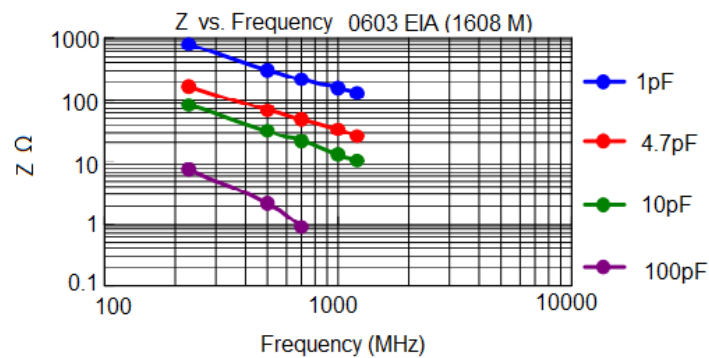
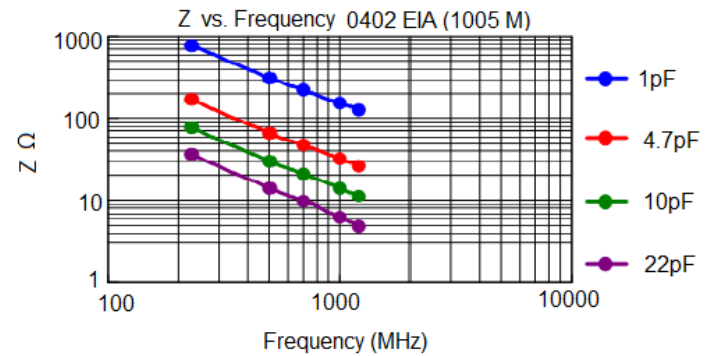
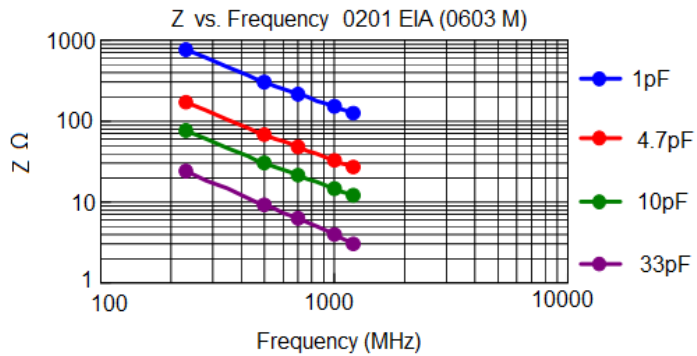
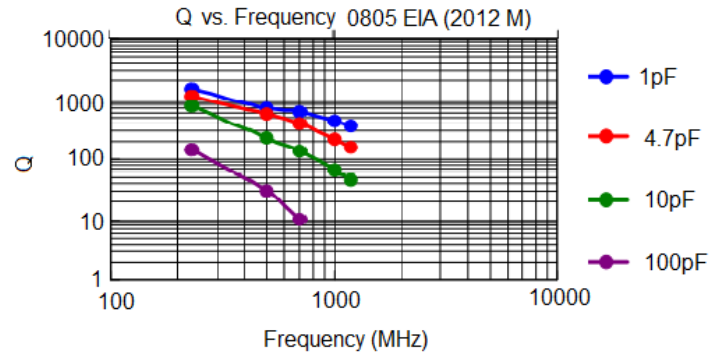
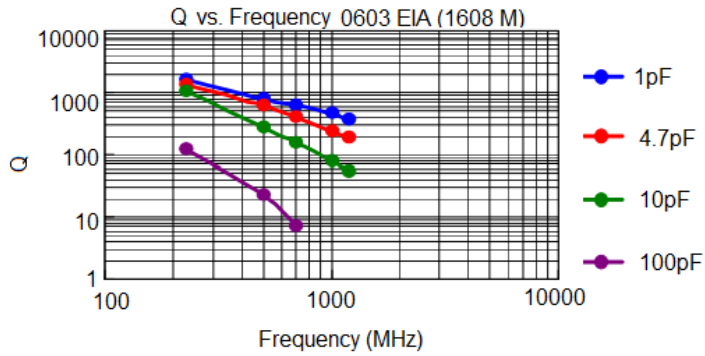
General Electrical Data

Dielectric	NP0
Size	0201, 0402, 0603, 0805
Capacitance	0402: 0.1pF to 470pF 0603: 0.5pF to 3,300pF 0805: 0.5pF to 390pF
Capacitance tolerance	Cap≤5pF: B (±0.1pF), C (±0.25pF) 5pF<Cap<10pF: C (±0.25pF), D (±0.5pF) Cap≥10pF: F (±1%), G (±2%), J (±5%)
Rated voltage (WVDC)	6.3V, 10V, 16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V
Q	Cap<30pF: Q≥400+20C Cap≥30pF: Q≥1000
Insulation resistance at Ur	≥10GΩ
Operating temperature	-55 to +125°C
Capacitance change	±30ppm
Termination	Ni/Sn (lead-free termination)

Electrical Characteristics



Electrical Characteristics



HIGH-Q, LOW ESR (H SERIES) NP0 DIELECTRIC, UP TO 1GHz



	Tolerance	0201				0402				0603					0805					
		10	16	25	50	10	25	50	100	10	16	25	50	100	200	10	25	50	200	500
		DC Volts																		
0R2	0.2pF	AA	AA	AA	AA	BA	BA	BA	BA											
0R3	0.3pF	AA	AA	AA	AA	BA	BA	BA	BA											
0R5	0.5pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC			
0R6	0.6 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC			
0R7	0.7 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC			
0R8	0.8 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC			
0R9	0.9 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC			
1R0	1.0 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
1R2	1.2 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
1R5	1.5 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
1R8	1.8 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
2R0	2.0pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
2R2	2.2 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
2R4	2.4pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
2R7	2.7 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
3R0	3.0pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
3R3	3.3 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
3R6	3.6 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
3R9	3.9 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
4R7	4.7 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
5R0	5.0pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
5R6	5.6pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
6R0	6.0pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
6R8	6.8 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
7R5	7.5 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
8R0	8.0pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
8R2	8.2pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
9R0	9.0pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
100	10 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
120	12 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
130	13pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
150	15 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
180	18 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
220	22 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
240	24pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
270	27 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
330	33 pF	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
390	39 pF					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
470	47 pF					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
560	56 pF					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
680	68 pF					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
820	82 pF					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
101	100 pF					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC	
121	120 pF					BA	BA	BA	BA	CA	CA	CA	CA		DD	DD	DD	DD	DD	
151	150 pF					BA	BA	BA	BA	CA	CA	CA	CA		DD	DD	DD	DD	DD	
181	180 pF					BA	BA	BA	BA	CA	CA	CA	CA		DD	DD	DD	DD	DD	
221	220 pF					BA	BA	BA	BA	CA	CA	CA	CA		DD	DD	DD	DD	DD	
271	270 pF					BA	BA	BA		CA	CA	CA	CA		DC	DC	DD	DD	DD	
331	330 pF					BA	BA	BA		CA	CA	CA	CA		DC	DC	DD	DD	DD	
391	390 pF					BA	BA	BA		CA	CA	CA	CA		DD	DD	DD	DD	DD	
471	470 pF					BA	BA	BA		CA	CA	CA	CA							
561	560 pF									CA	CA	CA	CA							
681	680 pF									CA	CA	CA	CA							
821	820 pF									CA	CA	CA	CA							
102	1,000 pF									CA	CA	CA	CA							
122	1,200 pF									CA	CC	CC								
152	1,500 pF									CA	CC	CC								
182	1,800 pF									CA	CC	CC								
222	2,200 pF									CA	CC	CC								
272	2,700 pF									CA	CC	CC								
332	3,300 pF									CA	CC	CC								

The letter code in the cell indicates the dimensions and package quantity. The reference table is on page 4 of the catalog.

APPENDIX I: RELIABILITY TEST CONDITIONS AND REQUIREMENTS

Item	Test Condition	Requirements																																
1	Visual and Mechanical	* No remarkable defect * Dimensions conform to individual specification sheet																																
2	Capacitance	* Shall not exceed the limits given in the detailed spec NP0: Cap \geq 30pF, Q \geq 1000, Cap $<$ 30pF, Q \geq 400+20C X7R, X5R: <table border="1"> <thead> <tr> <th>Rated voltage (DCV)</th> <th>D.F. \leq</th> <th>Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td rowspan="3">\geq 50V</td> <td rowspan="3">\leq 2.5%</td> <td>\leq3% 0201(50V), 0603 \geq 0.047μF, 0805 \geq 0.18μF, 1206 \geq 0.47μF</td> </tr> <tr> <td>\leq5% 1210 \geq 4.7μF</td> </tr> <tr> <td>\leq10% 0603\geq1μF, 0805\geq1μF, 1206\geq2.2μF, 1210\geq10μF</td> </tr> <tr> <td>35V</td> <td>\leq3.5%</td> <td>\leq10% 0805\geq2.2μF, 1210\geq10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">\leq3.5%</td> <td>\leq5% 0201\geq0.01μF, 0805\geq1μF, 1210\geq10μF</td> </tr> <tr> <td>\leq7% 0603\geq0.33μF, 1206\geq4.7μF</td> </tr> <tr> <td>\leq10% 0402\geq0.10μF, 0603\geq0.47μF, 0805\geq2.2μF,</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">\leq3.5%</td> <td>\leq5% 0201\geq0.01μF, 0402\geq0.033μF, 0603\geq0.15μF, 0805\geq0.68μF, 1206\geq2.2μF, 1210\geq4.7μF</td> </tr> <tr> <td>\leq10% 0402\geq0.22μF, 0603\geq0.68μF, 0805\geq2.2μF, 1206\geq4.7μF, 1210\geq22μF</td> </tr> <tr> <td>\leq10% 0201\geq0.012μF, 0402\geq0.33μF, 0603\geq0.33μF, 0805\geq2.2μF, 1206\geq2.2μF, 1210\geq22μF</td> </tr> <tr> <td rowspan="3">10V</td> <td rowspan="3">\leq5%</td> <td>\leq10% 0201\geq0.012μF, 0402\geq0.33μF, 0603\geq0.33μF, 0805\geq2.2μF, 1206\geq2.2μF, 1210\geq22μF</td> </tr> <tr> <td>\leq15% 0201\geq0.1μF, 0402\geq1μF</td> </tr> <tr> <td>\leq15% 0201\geq0.1μF, 0402\geq1μF, 0603\geq10μF, 0805\geq4.7μF, 1206\geq47μF, 1210\geq100μF</td> </tr> <tr> <td>6.3V</td> <td>\leq10%</td> <td>\leq15% 0201\geq0.1μF, 0402\geq1μF, 0603\geq10μF, 0805\geq4.7μF, 1206\geq47μF, 1210\geq100μF</td> </tr> <tr> <td>4V</td> <td>\leq15%</td> <td>---</td> </tr> </tbody> </table>	Rated voltage (DCV)	D.F. \leq	Exception of D.F. \leq	\geq 50V	\leq 2.5%	\leq 3% 0201(50V), 0603 \geq 0.047 μ F, 0805 \geq 0.18 μ F, 1206 \geq 0.47 μ F	\leq 5% 1210 \geq 4.7 μ F	\leq 10% 0603 \geq 1 μ F, 0805 \geq 1 μ F, 1206 \geq 2.2 μ F, 1210 \geq 10 μ F	35V	\leq 3.5%	\leq 10% 0805 \geq 2.2 μ F, 1210 \geq 10 μ F	25V	\leq 3.5%	\leq 5% 0201 \geq 0.01 μ F, 0805 \geq 1 μ F, 1210 \geq 10 μ F	\leq 7% 0603 \geq 0.33 μ F, 1206 \geq 4.7 μ F	\leq 10% 0402 \geq 0.10 μ F, 0603 \geq 0.47 μ F, 0805 \geq 2.2 μ F,	16V	\leq 3.5%	\leq 5% 0201 \geq 0.01 μ F, 0402 \geq 0.033 μ F, 0603 \geq 0.15 μ F, 0805 \geq 0.68 μ F, 1206 \geq 2.2 μ F, 1210 \geq 4.7 μ F	\leq 10% 0402 \geq 0.22 μ F, 0603 \geq 0.68 μ F, 0805 \geq 2.2 μ F, 1206 \geq 4.7 μ F, 1210 \geq 22 μ F	\leq 10% 0201 \geq 0.012 μ F, 0402 \geq 0.33 μ F, 0603 \geq 0.33 μ F, 0805 \geq 2.2 μ F, 1206 \geq 2.2 μ F, 1210 \geq 22 μ F	10V	\leq 5%	\leq 10% 0201 \geq 0.012 μ F, 0402 \geq 0.33 μ F, 0603 \geq 0.33 μ F, 0805 \geq 2.2 μ F, 1206 \geq 2.2 μ F, 1210 \geq 22 μ F	\leq 15% 0201 \geq 0.1 μ F, 0402 \geq 1 μ F	\leq 15% 0201 \geq 0.1 μ F, 0402 \geq 1 μ F, 0603 \geq 10 μ F, 0805 \geq 4.7 μ F, 1206 \geq 47 μ F, 1210 \geq 100 μ F	6.3V	\leq 10%	\leq 15% 0201 \geq 0.1 μ F, 0402 \geq 1 μ F, 0603 \geq 10 μ F, 0805 \geq 4.7 μ F, 1206 \geq 47 μ F, 1210 \geq 100 μ F	4V	\leq 15%	---
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3	Q/ DF (Dissipation Factor)	Class I: NP0 Class I: NP0 Cap \leq 1,000pF 1.0 \pm 0.2Vrms, 1KHz \pm 10% Cap $>$ 1,000pF 1.0 \pm 0.2Vrms, 1KHz \pm 10% Class II: X7R, X5R, Y5V Cap \leq 10 μ F, 1.0 \pm 0.2Vrms, 1kHz \pm 10% ** Cap $>$ 10 μ F, 0.5 \pm 0.2Vrms, 120Hz \pm 20% ** Test condition: 0.5 \pm 0.2Vrms, 1KHz \pm 10% X7R: 0603 \geq 225 (10V), 0805=106 (6.3V&10V) X5R: 0201 \geq 224 (6.3V), 0402 \geq 475 (6.3V), 0402 \geq 225(10V), 0603=106 (6.3V)																																
4	Dielectric Strength	*To apply voltage(\leq 100V) 250%. *Duration: 1 to 5 sec. *Charge & discharge current less than 50mA. *To apply voltage: 200V ~300V & LD series \geq 2 times V DC 500V ~ 999V \geq 1.5 times V DC 1000V ~ 3000V \geq 1.2 times V DC *Cut-off, set at 10mA *TEST= 15 sec. *RAMP=0 *No evidence of damage or flash over during test.																																
5	Insulation Resistance	10G Ω or RxC \geq 500 Ω -F whichever is lower. Class II (X7R, X7E, X5R, Y5V): <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="7">10GΩ or RxC\geq100 Ω-F whichever is lower.</td> </tr> <tr> <td>50V:0603\geq1μF,0805\geq1μF, 1206\geq2.2μF, 1210\geq4.7μF</td> </tr> <tr> <td>35V:0805\geq2.2μF,1210\geq10μF</td> </tr> <tr> <td>25V:0402\geq1μF,0603\geq2.2μF,0805\geq2.2μF, 1206\geq10μF,1210\geq10μF</td> </tr> <tr> <td>16V:0402\geq0.22μF,0603\geq1μF,0805\geq2.2μF, 1206\geq10μF,1210\geq47μF</td> </tr> <tr> <td>10V:0201\geq47nF,0402\geq0.47μF,0603\geq0.47μF, 0805\geq2.2μF, 1206\geq4.7μF,1210\geq47μF</td> </tr> <tr> <td>100V: X7R</td> </tr> </tbody> </table> <table border="1"> <tbody> <tr> <td>Rated Voltage: 200V ~ 630V</td> <td>To apply rated voltage (500V max.) for 60 sec.</td> <td>>10GΩ or 100Ω-F whichever is lower.</td> </tr> <tr> <td>>630V</td> <td>To apply 500V for 60sec.</td> <td>>10GΩ</td> </tr> </tbody> </table>	Rated voltage	Insulation Resistance	100V: X7R	10G Ω or RxC \geq 100 Ω -F whichever is lower.	50V:0603 \geq 1 μ F,0805 \geq 1 μ F, 1206 \geq 2.2 μ F, 1210 \geq 4.7 μ F	35V:0805 \geq 2.2 μ F,1210 \geq 10 μ F	25V:0402 \geq 1 μ F,0603 \geq 2.2 μ F,0805 \geq 2.2 μ F, 1206 \geq 10 μ F,1210 \geq 10 μ F	16V:0402 \geq 0.22 μ F,0603 \geq 1 μ F,0805 \geq 2.2 μ F, 1206 \geq 10 μ F,1210 \geq 47 μ F	10V:0201 \geq 47nF,0402 \geq 0.47 μ F,0603 \geq 0.47 μ F, 0805 \geq 2.2 μ F, 1206 \geq 4.7 μ F,1210 \geq 47 μ F	100V: X7R	Rated Voltage: 200V ~ 630V	To apply rated voltage (500V max.) for 60 sec.	>10G Ω or 100 Ω -F whichever is lower.	>630V	To apply 500V for 60sec.	>10G Ω																
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6	Temperature Coefficient	With no electrical load. <table border="1"> <thead> <tr> <th>T.C.</th> <th>Operating Temp</th> <th>T.C.</th> <th>Capacitance Change</th> </tr> </thead> <tbody> <tr> <td>NP0 (C0G)</td> <td rowspan="4">-55-125°C at 25°C</td> <td>NP0 (C0G)</td> <td>Within \pm30ppm/°C</td> </tr> <tr> <td>NP0 (C0H)</td> <td>NP0 (C0H)</td> <td>Within \pm60ppm/°C</td> </tr> <tr> <td>NP0 (C0J)</td> <td>NP0 (C0J)</td> <td>Within \pm120ppm/°C</td> </tr> <tr> <td>X7R</td> <td>X7R</td> <td>Within \pm15%</td> </tr> <tr> <td>X5R</td> <td>-55- 85°C at 25°C</td> <td>X5R</td> <td>Within \pm15%</td> </tr> <tr> <td>Y5V</td> <td>-25- 85°C at 20°C</td> <td>Y5V</td> <td>Within +30%/-80%</td> </tr> </tbody> </table>	T.C.	Operating Temp	T.C.	Capacitance Change	NP0 (C0G)	-55-125°C at 25°C	NP0 (C0G)	Within \pm 30ppm/°C	NP0 (C0H)	NP0 (C0H)	Within \pm 60ppm/°C	NP0 (C0J)	NP0 (C0J)	Within \pm 120ppm/°C	X7R	X7R	Within \pm 15%	X5R	-55- 85°C at 25°C	X5R	Within \pm 15%	Y5V	-25- 85°C at 20°C	Y5V	Within +30%/-80%							
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7	Adhesive Strength of Termination	*Pressurizing force : 0201: 2N 0402 & 0603: 5N >0603: 10N *Test time : 10 \pm 1 sec * No remarkable damage or removal of the terminations.																																

APPENDIX I: RELIABILITY TEST CONDITIONS AND REQUIREMENTS

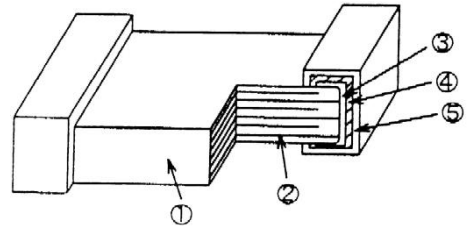
Item	Test Condition	Requirements																																																																																				
8	Vibration Resistance * Vibration frequency: 10-55 Hz/min. * Total amplitude: 1.5mm * Test time: 6 hours (Two hrs each in three mutually perpendicular directions) * Measurement to be made after keeping at room temp. for 24±2 hours	* No remarkable damage. * Cap change and Q/D.F.: To meet initial spec.																																																																																				
9	Solderability * Solder temperature: 235±5°C * Dipping time: 2±0.5 sec.	95% min. coverage of all metalized area.																																																																																				
10	Bending Test *The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of approximately 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5±1 sec. *Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Capacitance change : NP0: within ±5% or 0.5pF whichever is larger X7R, X7E, X5R: within ±12.5% Y5V: within ±30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)																																																																																				
11	Resistance to Soldering Heat * Solder temperature: 260±5°C * Dipping time: 10±1 sec * Preheating: 120 to 150°C for 1 minute before immersing the capacitor in an eutectic solder. * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Capacitance change: NP0: within ±2.5% or 0.25pF whichever is larger X7R, X7E, X5R: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.																																																																																				
12	Temperature Cycle * Conduct the five cycles according to the temperatures and time. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Step</th> <th>Temp. (°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. +0/-3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temp.</td> <td>2-3</td> </tr> <tr> <td>3</td> <td>Max. operating temp. +3/-0</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temp.</td> <td>2-3</td> </tr> </tbody> </table> * Before initial measurement (Class II only): Perform 150+0/-10°C for 1 hr and then set for 24±2 hrs at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	Step	Temp. (°C)	Time (min.)	1	Min. operating temp. +0/-3	30±3	2	Room temp.	2-3	3	Max. operating temp. +3/-0	30±3	4	Room temp.	2-3	* No remarkable damage. * Capacitance change NP0: within ±2.5% or 0.25pF whichever is larger X7R, X7E, X5R: within ±7.5% Y5V: within ±20% * Q/D.F., I.R. and dielectric strength: To meet initial requirements.																																																																					
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13	Humidity (Damp Heat) Steady State * Test temp.: 40±2°C * Humidity: 90-95% RH * Test time: 500+24/-0hrs. * Before initial measurement (Class II only): Perform 150 +0/-10°C for 1 hr and then set for 24±2 hrs. at room temp. * Measurement to be made after keeping at room temp. for 24±2 hrs.	* No remarkable damage. * Cap change: NP0: within ±5% or 0.5pF whichever is larger X7R, X7E, X5R: ≥10V**, within ±12.5%; 6.3V within ±25%; TT series, within ±25% **10V:0603≥4.7µF;0402≥1µF;0201≥0.1µF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% * Q/D.F. value: NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C, Less than 10pF Q≥200+10C X7R, X5R: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Rated voltage</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤3%</td> <td>≤6%</td> <td>0201(50V); 0603≥0.047µF; 0805≥0.18µF; 1206≥0.47µF</td> </tr> <tr> <td>≤10%</td> <td>1210≥4.7µF</td> </tr> <tr> <td>≤20%</td> <td>0603≥1µF; 0805≥1µF; 1206≥2.2µF; 1210≥10µF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤5%</td> <td>≤20%</td> <td>0805≥2.2µF; 1210≥10µF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.01µF; 0805≥1µF; 1210≥10µF</td> </tr> <tr> <td>≤14%</td> <td>0603≥0.33µF; 1206≥4.7µF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤15%</td> <td>6≥6.8µF 1210≥22µF</td> </tr> <tr> <td>≤10%</td> <td>0603≥0.15µF; 0805≥0.68µF; 1206≥2.2µF; 1210≥4.7µF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.01µF; 0402≥0.033µF; 0603≥0.68µF; 0805≥2.2µF; 1206≥4.7µF; 1210≥22µF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤15%</td> <td>0201≥0.012µF; 0402≥0.33µF; 0603≥0.33µF; 0805≥2.2µF; 1206≥2.2µF; 1210≥22µF</td> </tr> <tr> <td>≤20%</td> <td>0201≥0.1µF; 0402≥1µF</td> </tr> <tr> <td>≤30%</td> <td>0201≥0.1µF; 0402≥1µF; 0603≥10µF; 0805≥4.7µF; 1206≥47µF; 1210≥100µF</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> Y5V: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Rated voltage</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>≤10%</td> <td>0603≥0.1µF; 0805≥0.47µF; 1206≥4.7µF; Cap≥1µF</td> </tr> <tr> <td>35V</td> <td>≤10%</td> <td>---</td> <td>---</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤7.5%</td> <td>≤10%</td> <td>0402≥0.047µF; 0603≥0.1µF; 0805≥0.33µF; 1206≥1µF; 1210≥4.7µF</td> </tr> <tr> <td>≤15%</td> <td>0402≥0.068µF; 0603≥0.47µF; 1206≥4.7µF; 1210≥22µF; Cap≥1µF</td> </tr> <tr> <td>≤12.5%</td> <td>0402≥0.068µF; 0603≥0.68µF</td> </tr> <tr> <td>16V (C<1.0µF)</td> <td>≤10%</td> <td>≤20%</td> <td>0402≥0.22µF</td> </tr> <tr> <td>16V (C≥1.0µF)</td> <td>≤12.5%</td> <td>≤20%</td> <td>0603≥2.2µF; 0805≥3.3µF; 1206≥10µF; 1210≥22µF; 1812≥47µF; Cap≥1µF</td> </tr> <tr> <td>10V</td> <td>≤20%</td> <td>≤30%</td> <td>0402≥0.47µF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> *I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is lower. 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APPENDIX I: RELIABILITY TEST CONDITIONS AND REQUIREMENTS

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14	<p>Humidity (Damp Heat) Load</p> <p>* Test temp.: 40±2°C * Humidity: 90~95%RH * Test time: 500±24/-0 hrs. * Voltage : Rated voltage.(Max.500V) * Before initial measurement (Class II only): To apply test voltage for 1hr at 40°C and then set for 24±2 hrs at room temp.* Measurement to be made after keeping at room temp. for 24±2 hrs.</p>	<p>* No remarkable damage. Cap change: NP0: ±7.5% or 0.75pF whichever is larger. X7R, X7E, X5R: ≥10V**, within ±12.5%, 6.3V within ±25%; **10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% Q/D.F. value: NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤3%</td> <td>≤6%</td> <td>0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td> </tr> <tr> <td>≤10%</td> <td>1210≥4.7μF</td> </tr> <tr> <td>≤20%</td> <td>0603≥1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤5%</td> <td>≤20%</td> <td>0805≥2.2μF;1210≥10μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.01μF;0805≥1μF; 1210≥10μF</td> </tr> <tr> <td>≤14%</td> <td>0603≥0.33μF;1206≥4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤15%</td> <td>0402≥0.10μF;0603≥0.47μF;0805≥2.2μF; 1206≥6.8μF;1210≥22μF</td> </tr> <tr> <td>≤10%</td> <td>0603≥0.15μF;0805≥0.68μF;1206≥2.2μF;1210≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.01μF;0402≥0.033μF;0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤15%</td> <td>0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td> </tr> <tr> <td>≤20%</td> <td>0201≥0.1μF ;0402≥1μF</td> </tr> <tr> <td>≤30%</td> <td>0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;1206≥47μF;1210≥100μF</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>≤10%</td> <td>0603≥0.1μF; 0805≥0.47μF;1206≥4.7μF; Cap≥1μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤10%</td> <td>---</td> <td>---</td> </tr> <tr> <td>≤10%</td> <td>0402≥0.047μF;0603≥0.1μF;0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0402≥0.068μF;0603≥0.47μF;1206≥4.7μF;1210≥22μF; Cap≥1μF</td> </tr> <tr> <td rowspan="2">16V (C<1.0μF)</td> <td rowspan="2">≤10%</td> <td>≤12.5%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥0.22μF</td> </tr> <tr> <td rowspan="2">16V (C≥1.0μF)</td> <td rowspan="2">≤12.5%</td> <td>≤20%</td> <td>0603≥2.2μF;0805≥3.3μF;1206≥10μF;1210≥22μF;1812≥47μF; Cap≥1μF</td> </tr> <tr> <td>≤30%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>10V</td> <td>≤20%</td> <td>≤30%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is lower. 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(4) U≥630V: 120% of rated voltage.(5) 100% of rated voltage for below range:</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>X5R/X7R</td> <td>6.3V,10V</td> </tr> <tr> <td>0402</td> <td>X5R/X7R</td> <td>6.3V,10V</td> </tr> <tr> <td>0603</td> <td>X5R/X7R</td> <td>6.3V,10V</td> </tr> <tr> <td>0805</td> <td>X5R/X7R</td> <td>6.3V</td> </tr> <tr> <td>1206</td> <td>X5R/X7R NP0</td> <td>6.3V 3000V</td> </tr> </tbody> </table> <p>(6)150% of rated voltage for below range:</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance Range</th> </tr> </thead> <tbody> <tr> <td rowspan="2">0402</td> <td>X5R/X7R</td> <td>10V,16V,25V</td> <td>C≥0.22μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C≥0.47μF</td> </tr> <tr> <td rowspan="2">0603</td> <td>X5R/X7R</td> <td>10V,16V</td> <td>C≥1.0μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C≥2.2μF</td> </tr> <tr> <td rowspan="2">0805</td> <td>X5R/X7R</td> <td>10V</td> <td>C≥4.7μF</td> </tr> <tr> <td>Y5V</td> <td>16V</td> <td>C≥4.7μF</td> </tr> </tbody> </table> <p>*Before initial measurement (Class II only): To apply test voltage for 1hr at test temp. and then set for 24±2 hrs at room temp. *Measurement to be made after keeping at room temp. for 24±2 hrs.</p>	Size	Dielectric	Rated voltage	0201	X5R/X7R	6.3V,10V	0402	X5R/X7R	6.3V,10V	0603	X5R/X7R	6.3V,10V	0805	X5R/X7R	6.3V	1206	X5R/X7R NP0	6.3V 3000V	Size	Dielectric	Rated voltage	Capacitance Range	0402	X5R/X7R	10V,16V,25V	C≥0.22μF	Y5V	16V	C≥0.47μF	0603	X5R/X7R	10V,16V	C≥1.0μF	Y5V	16V	C≥2.2μF	0805	X5R/X7R	10V	C≥4.7μF	Y5V	16V	C≥4.7μF	<p>* No remarkable damage. Cap change: NP0: ±3.0% or ±0.3pF whichever is larger X7R, X7E, X5R: ≥10V**, within ±12.5%, 6.3V within ±25%; **10V:0603≥4.7μF;0402≥1μF;0201≥0.1μF, within ±25%; Y5V: ≥10V, within ±30%; 6.3V, within +30/-40% Q/D.F. value: NP0: More than 30pF, Q≥350; 10pF≤C<30pF, Q≥275+2.5C; Less than 10pF, Q≥200+10C X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td rowspan="3">≥50V</td> <td rowspan="3">≤3%</td> <td>≤6%</td> <td>0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF</td> </tr> <tr> <td>≤10%</td> <td>1210≥4.7μF</td> </tr> <tr> <td>≤20%</td> <td>0603≥1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF</td> </tr> <tr> <td rowspan="3">35V</td> <td rowspan="3">≤5%</td> <td>≤20%</td> <td>0805≥2.2μF;1210≥10μF</td> </tr> <tr> <td>≤10%</td> <td>0201≥0.01μF;0805≥1μF; 1210≥10μF</td> </tr> <tr> <td>≤14%</td> <td>0603≥0.33μF;1206≥4.7μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤5%</td> <td>≤15%</td> <td>0402≥0.10μF;0603≥0.47μF;0805≥2.2μF; 1206≥6.8μF;1210≥22μF</td> </tr> <tr> <td>≤10%</td> <td>0603≥0.15μF;0805≥0.68μF; 1206≥2.2μF;1210≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0201≥0.01μF;0402≥0.033μF; 0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF</td> </tr> <tr> <td rowspan="3">16V</td> <td rowspan="3">≤5%</td> <td>≤15%</td> <td>0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF; 1210≥22μF</td> </tr> <tr> <td>≤20%</td> <td>0201≥0.1μF ;0402≥1μF</td> </tr> <tr> <td>≤30%</td> <td>0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;1206≥47μF; 1210≥100μF</td> </tr> <tr> <td>4V</td> <td>≤20%</td> <td>--</td> <td>--</td> </tr> </tbody> </table> <p>X7R:DF≤3% Y5V:</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>D.F.≤</th> <th colspan="2">Exception of D.F.≤</th> </tr> </thead> <tbody> <tr> <td>≥50V</td> <td>≤7.5%</td> <td>≤10%</td> <td>0603≥0.1μF; 0805≥0.47μF;1206≥4.7μF;Cap≥1μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">≤7.5%</td> <td>≤10%</td> <td>0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF</td> </tr> <tr> <td>≤15%</td> <td>0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF;1210≥22μF;Cap≥1μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥0.22μF</td> </tr> <tr> <td rowspan="2">16V (C<1.0μF)</td> <td rowspan="2">≤10%</td> <td>≤12.5%</td> <td>0402≥0.068μF; 0603≥0.68μF</td> </tr> <tr> <td>≤20%</td> <td>0402≥0.22μF</td> </tr> <tr> <td rowspan="2">16V (C≥1.0μF)</td> <td rowspan="2">≤12.5%</td> <td>≤20%</td> <td>0603≥2.2μF;0805≥3.3μF;1206≥10μF; 1210≥22μF;1812≥47μF;Cap≥1μF</td> </tr> <tr> <td>≤30%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>10V</td> <td>≤20%</td> <td>≤30%</td> <td>0402≥0.47μF</td> </tr> <tr> <td>6.3V</td> <td>≤30%</td> <td>---</td> <td>---</td> </tr> </tbody> </table> <p>*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is lower.</p> <p>Class II (X7R, X7E, X5R, Y5V):</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="5">1GΩ or RxC≥10 Ω-F whichever is lower.</td> </tr> <tr> <td>50V:0603≥1μF;0805≥1μF; 1206≥2.2μF;1210≥4.7μF</td> </tr> <tr> <td>25V:0402≥1μF;0603≥2.2μF; 0805≥2.2μF;1206≥10μF;1210≥10μF</td> </tr> <tr> <td>16V:0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF</td> </tr> <tr> <td>10V:0201≥47nF;0402≥0.47μF; 0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF</td> </tr> </tbody> </table>	Rated voltage	D.F.≤	Exception of D.F.≤		≥50V	≤3%	≤6%	0201(50V);0603≥0.047μF; 0805≥0.18μF; 1206≥0.47μF	≤10%	1210≥4.7μF	≤20%	0603≥1μF; 0805≥1μF; 1206≥2.2μF; 1210≥10μF	35V	≤5%	≤20%	0805≥2.2μF;1210≥10μF	≤10%	0201≥0.01μF;0805≥1μF; 1210≥10μF	≤14%	0603≥0.33μF;1206≥4.7μF	25V	≤5%	≤15%	0402≥0.10μF;0603≥0.47μF;0805≥2.2μF; 1206≥6.8μF;1210≥22μF	≤10%	0603≥0.15μF;0805≥0.68μF; 1206≥2.2μF;1210≥4.7μF	≤15%	0201≥0.01μF;0402≥0.033μF; 0603≥0.68μF;0805≥2.2μF; 1206≥4.7μF; 1210≥22μF	16V	≤5%	≤15%	0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF; 1210≥22μF	≤20%	0201≥0.1μF ;0402≥1μF	≤30%	0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;1206≥47μF; 1210≥100μF	4V	≤20%	--	--	Rated voltage	D.F.≤	Exception of D.F.≤		≥50V	≤7.5%	≤10%	0603≥0.1μF; 0805≥0.47μF;1206≥4.7μF;Cap≥1μF	25V	≤7.5%	≤10%	0402≥0.047μF;0603≥0.1μF; 0805≥0.33μF;1206≥1μF; 1210≥4.7μF	≤15%	0402≥0.068μF;0603≥0.47μF; 1206≥4.7μF;1210≥22μF;Cap≥1μF	≤20%	0402≥0.22μF	16V (C<1.0μF)	≤10%	≤12.5%	0402≥0.068μF; 0603≥0.68μF	≤20%	0402≥0.22μF	16V (C≥1.0μF)	≤12.5%	≤20%	0603≥2.2μF;0805≥3.3μF;1206≥10μF; 1210≥22μF;1812≥47μF;Cap≥1μF	≤30%	0402≥0.47μF	10V	≤20%	≤30%	0402≥0.47μF	6.3V	≤30%	---	---	Rated voltage	Insulation Resistance	100V: X7R	1GΩ or RxC≥10 Ω-F whichever is lower.	50V:0603≥1μF;0805≥1μF; 1206≥2.2μF;1210≥4.7μF	25V:0402≥1μF;0603≥2.2μF; 0805≥2.2μF;1206≥10μF;1210≥10μF	16V:0402≥0.22μF;0603≥1μF; 0805≥2.2μF;1206≥10μF;1210≥47μF	10V:0201≥47nF;0402≥0.47μF; 0603≥0.47μF;0805≥2.2μF; 1206≥4.7μF;1210≥47μF
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APPENDIX II: GENERAL INFORMATION

Name		NP0/X7R	NPO/X7R/X5R/Y5V
1	Ceramic material	BaTiO ₃ based	
2	Inner electrode	Ni	
3	Termination	Inner layer	Cu
4		Middle layer	Ni
5		Outer layer	Sn



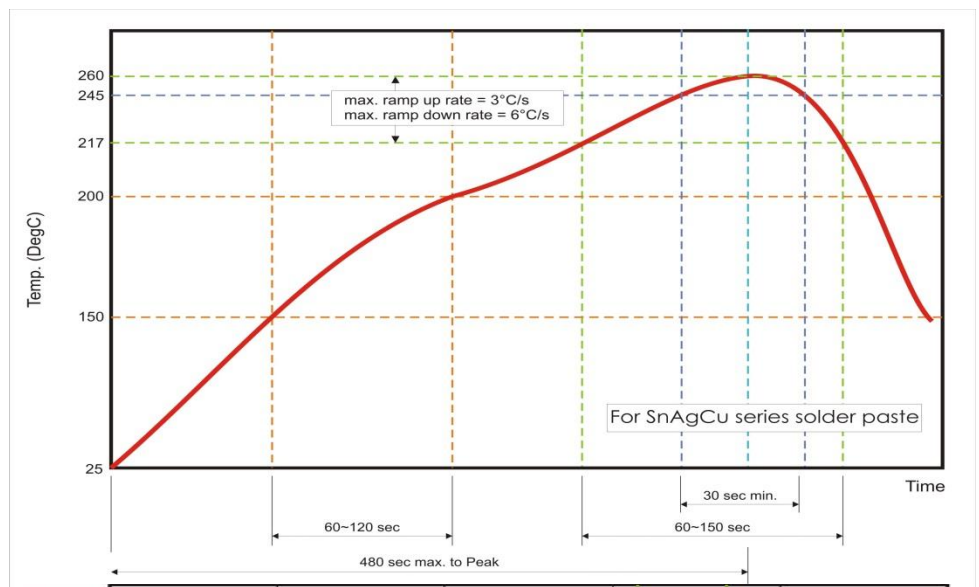
Storage and handling

- 1) Products should be stored at 5 to 40°C ambient temperatures and 20 to 70% relative humidity.
- 2) It is recommended that the product be used within one year from shipment. After one year from shipment, solderability should be checked.

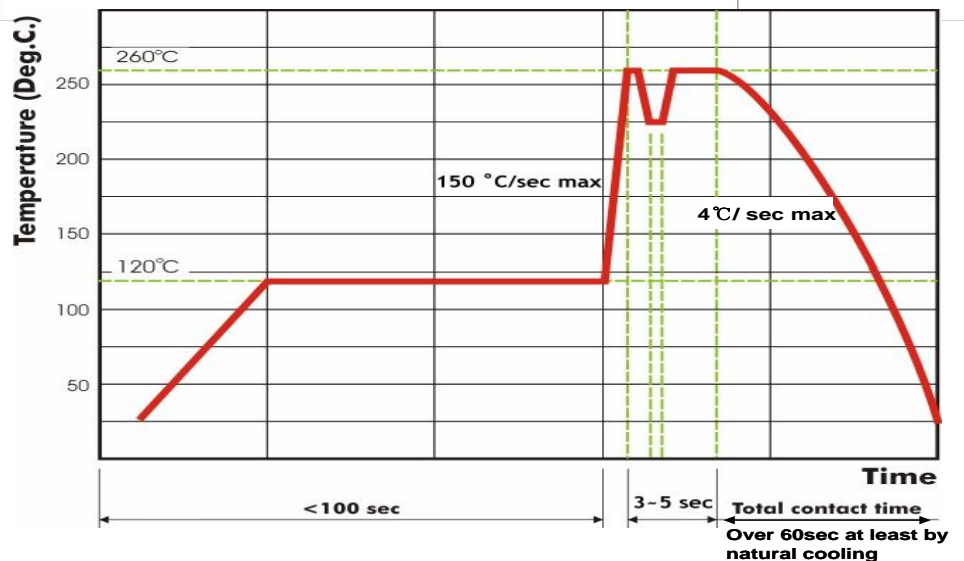
Cautions

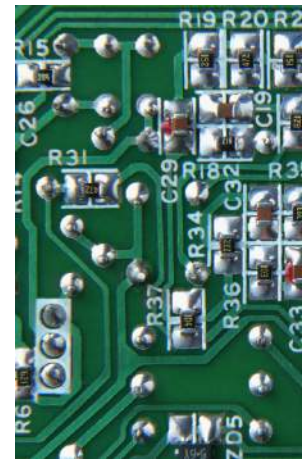
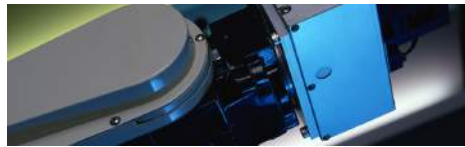
- 1) Corrosive gas reacts with the terminal electrodes of capacitors. Do not store capacitors in the proximity of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.) otherwise there may be solderability issues.
- 2) In a corrosive atmosphere, solderability might be degraded, and/or silver migration may occur which can cause lower reliability.
- 3) Dewing caused by rapid humidity changes and/or photochemical changes of the terminal electrode caused by direct contact with sunlight can affect the solderability and electrical performance. Do not store capacitors under direct sunlight or in dewing conditions.

Recommended **reflow** profile for SnAgCu solder paste:



Recommended **wave** profile for SnAgCu solder paste:





FRONTIER ELECTRONICS CORP

667 E. COCHRAN ST. SIMI VALLEY, CA 93065 • TEL: (805) 522-9998 • FAX: (805) 522-9989
1-800-929-9888 E-Mail: frontiersales@frontierusa.com www.frontierusa.com