H SERIES HIGH Q CAPACITOR SPEC Rev. C

FEATURES:

- High Q and low ESR
- Extend working range for wireless products
- Extend battery life of portable devices

PART NUMBER DESCRIPTION

0402	H	250	N	0R1	B	C	T
Size	Series	Rated Voltage (VDC)	Dielectric	Capacitance	Tolerance	Termination	Packaging
0201 (0603) 0402 (1005) 0603 (1608) 0805 (2012)	H: High Q, Low ESR	6R3=6.3 100-10 160=16 250=25 500=50 101=100 201=200 251=250 501=500 631=630	N: NP0	0R1=0.10pF 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%	C=Cu/Ni/Sn	T=7" Paper Tape U=13" Paper Tape E=7" Plastic Tape Q=13" Plastic Tape Z or blank=Bulk

General Electrical Data

Dielectric	NP0
Size	0201, 0402, 0603, 0805
Capacitance Range	0201: 0.2pF to 33pF 0402: 0.2pF to 470pF 0603: 0.5pF to 3300pF 0805: 0.5pF to 390pF
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)	16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V
Q	Cap≥30pF, Q≥1000 Cap<30pF,Q≥400+20C
Insulation resistance (25°C)	≥10GΩ
Operating temperature	-55°C to +125°C
Temperature coefficient of capacitance	±30ppm/°C
Termination	Ni/Sn (lead-free termination)

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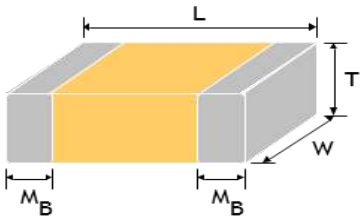
External Dimensions

Outline	Case Size EIA (mm)	L (mm)	W (mm)	T (mm)	Soldering Method	M_B (mm)
	0201 (0603)	0.6 ± 0.03	0.3 ± 0.03	0.3 ± 0.03	R	0.15 ± 0.05
	0402 (1005)	1.0 ±0.05	0.5 ±0.05	0.5 ±0.05	R	0.25 +0.05/-0.1
				0.5 +0.02/-0.05		
		1.0 ±0.2	0.5 ±0.2	0.5 ±0.2		
	0603 (1608)	1.6 ±0.1	0.8 ±0.1	0.8 ±0.07	R / W	0.4 ±0.15
		1.6 +0.15/-0.1	0.8 +0.15/-0.1	0.5 ±0.1		
				0.8 +0.15/-0.1		
		1.6 ±0.2	0.8 ±0.2	0.8 ±0.2		
	0805 (2012)	2.0 ±0.15	1.25 ±0.1	0.5 ±0.1	R / W	0.5 ±0.2
				0.6 ±0.1	R / W	
				0.8 ±0.1	R / W	
				1.25 ±0.1	R	
		2.0 ±0.2	1.25 ±0.2	0.85 ±0.1	R / W	
				1.25 ±0.2	R	

Thickness Codes/Packaging Quantity

Case Size	Size Code	Max Thickness	Length	Width	Thickness	Paper Tape		Embossed Plastic Tape	
						7" Reel	13" Reel	7" Reel	13" Reel
0201	AA	0.33	0.6 ± 0.03	0.3 ± 0.03	0.3 ± 0.03	15,000	70,000	-	-
0402	BA	0.55	1.0 ± 0.05	0.5 ± 0.05	0.5 ± 0.05	10,000	50,000	-	-
	BC	0.7	1.0 ± 0.2	0.5 ± 0.2	0.5 ± 0.2	10,000	-	-	-
0603	CA	0.87	1.6 ± 0.1	0.8 ± 0.1	0.8 ± 0.07	4,000	15,000	-	-
	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	-	-
	CD	1	1.6 ± 0.2	0.8 ± 0.2	0.8 ± 0.2	4,000	15,000	-	-
0805	DB	0.7	2.0 ± 0.15	1.25 ± 0.1	0.6 ± 0.1	4,000	15,000	-	-
	DC	0.9	2.0 ± 0.15	1.25 ± 0.1	0.8 ± 0.1	4,000	15,000	-	-
	DD	1.35	2.0 ± 0.15	1.25 ± 0.1	1.25 ± 0.1	-	-	3,000	10,000
	DE	0.95	2.0 ± 0.2	1.25 ± 0.2	0.85 ± 0.1	4,000	15,000	-	-
	DF	1.45	2.0 ± 0.2	1.25 ± 0.2	1.25 ± 0.2	-	-	3,000	10,000

H SERIES HIGH Q CAPACITOR SPEC

Rev. C

		Tolerance	0201				0402				0603					0805				
			10	16	25	50	10 16	25	50	100	10 16	25	50	100	200	10 16	25	50 100	200 250	500 630
			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	A	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
1R2	1.2 pF	A	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
1R5	1.5 pF	B	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
1R8	1.8 pF	B	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
2R0	2.0pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
2R2	2.2 pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
2R4	2.4pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
2R7	2.7 pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
3R0	3.0pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
3R3	3.3 pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
3R6	3.6 pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
3R9	3.9 pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
4R7	4.7 pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
5R0	5.0pF	B	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
5R6	5.6pF	B	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
6R0	6.0pF	B	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
6R8	6.8 pF	B	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
7R5	7.5 pF	C	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
8R0	8.0pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
8R2	8.2pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
9R0	9.0pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
100	10 pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
120	12 pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
130	13pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
150	15 pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
180	18 pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
220	22 pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
240	24pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
270	27 pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
330	33 pF	D	AA	AA	AA	AA	BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
390	39 pF	D					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
470	47 pF	D					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
560	56 pF	D					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
680	68 pF	F					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
820	82 pF	F					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
101	100 pF	F					BA	BA	BA	BA	CA	CA	CA	CA	CA	DC	DC	DC	DC	DC
121	120 pF	G					BA	BA	BA	BA	CA	CA	CA	CA		DD	DD	DD	DD	DD
151	150 pF	G					BA	BA	BA	BA	CA	CA	CA	CA		DD	DD	DD	DD	DD
181	180 pF	G					BA	BA	BA	BA	CA	CA	CA	CA		DD	DD	DD	DD	DD
221	220 pF	J					BA	BA	BA	BA	CA	CA	CA	CA		DD	DD	DD	DD	DD
271	270 pF	J					BA	BA	BA		CA	CA	CA	CA		DC	DC	DD	DD	DD
331	330 pF	J					BA	BA	BA		CA	CA	CA	CA		DC	DC	DD	DD	DD
391	390 pF	J					BA	BA	BA		CA	CA	CA	CA		DD	DD	DD	DD	DD
471	470 pF	J					BA	BA	BA		CA	CA	CA	CA						
561	560 pF	J									CA	CA	CA	CA						
681	680 pF	J									CA	CA	CA	CA						
821	820 pF	J									CA	CA	CA	CA						
102	1,000 pF	J									CA	CA	CA	CA						
122	1,200 pF	J									CA	CC	CC							
152	1,500 pF	J									CA	CC	CC							
182	1,800 pF	J									CA	CC	CC							
222	2,200 pF	J									CA	CC	CC							
272	2,700 pF	J									CA	CC	CC							
332	3,300 pF	J									CA	CC	CC							

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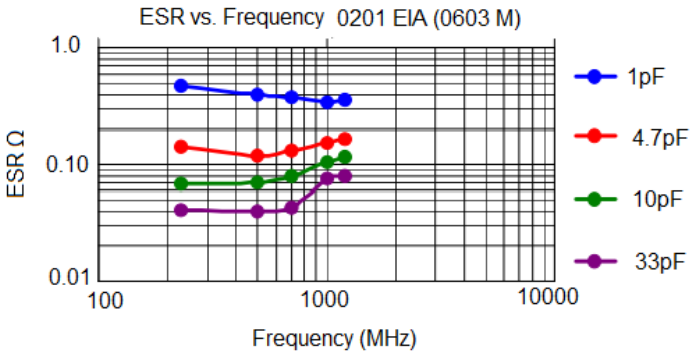
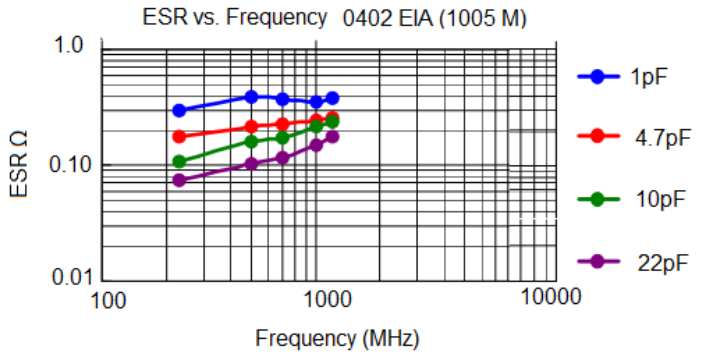
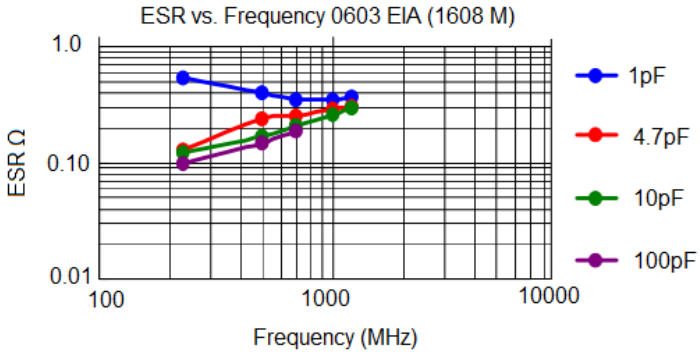
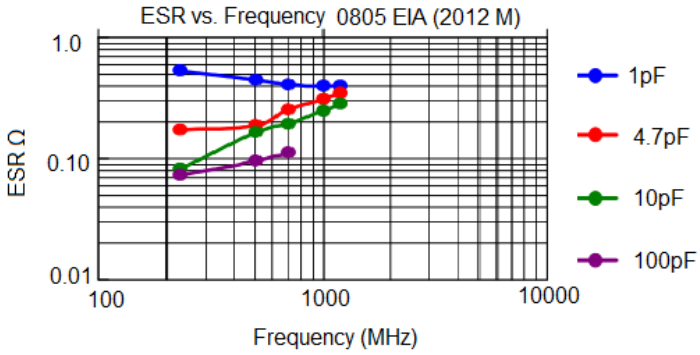
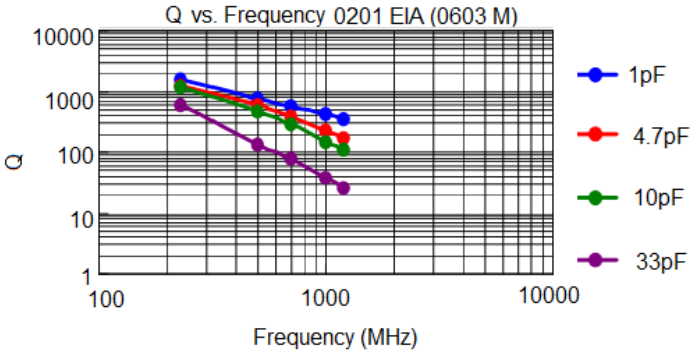
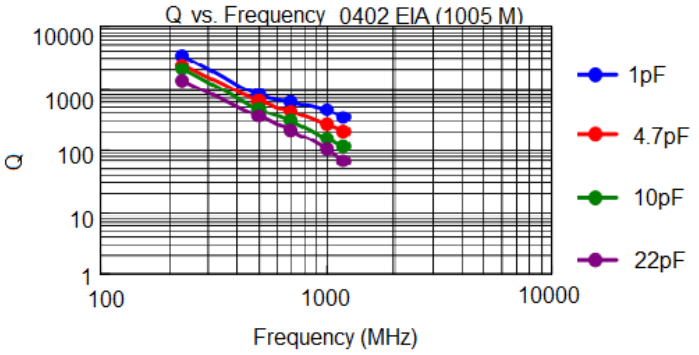

ESR vs. Frequency 0201 EIA (0603 M)
ESR Ω
1.0
0.10
0.01
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
33pF

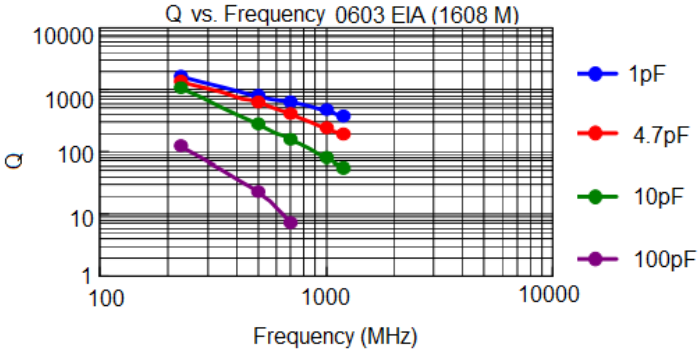

ESR vs. Frequency 0402 EIA (1005 M)
ESR Ω
1.0
0.10
0.01
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
22pF

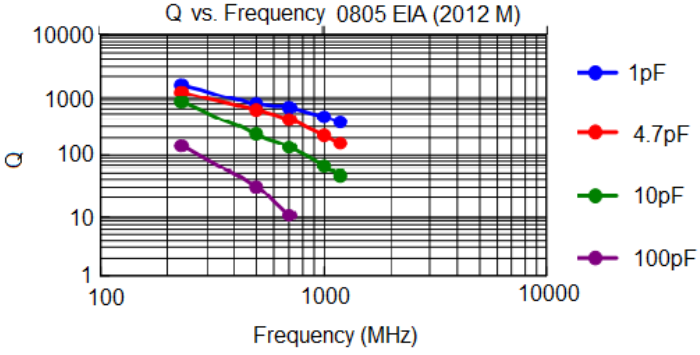

ESR vs. Frequency 0603 EIA (1608 M)
ESR Ω
1.0
0.10
0.01
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
100pF

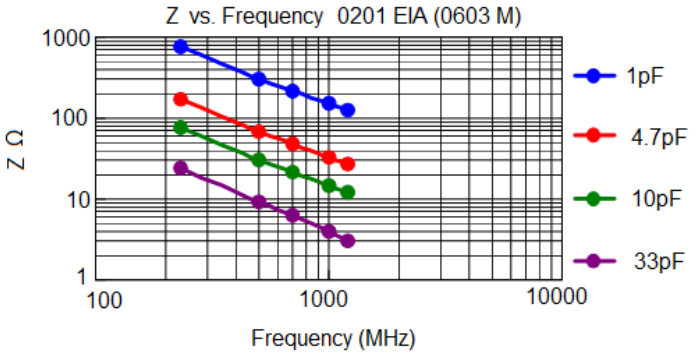

ESR vs. Frequency 0805 EIA (2012 M)
ESR Ω
1.0
0.10
0.01
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
100pF

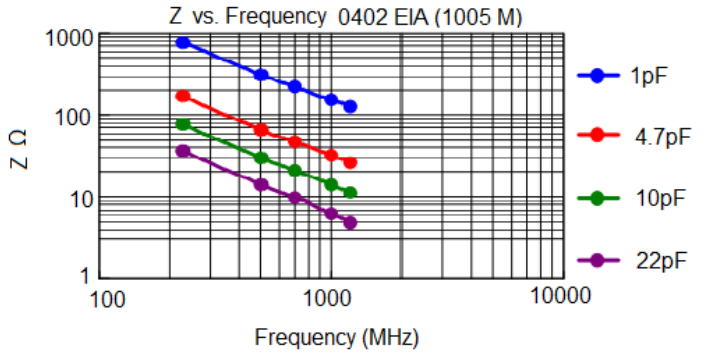

Q vs. Frequency 0201 EIA (0603 M)
Q
10000
1000
100
10
1
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
33pF

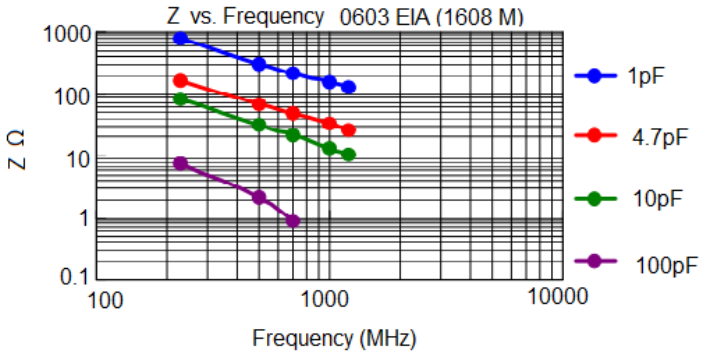

Q vs. Frequency 0402 EIA (1005 M)
Q
10000
1000
100
10
1
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
22pF

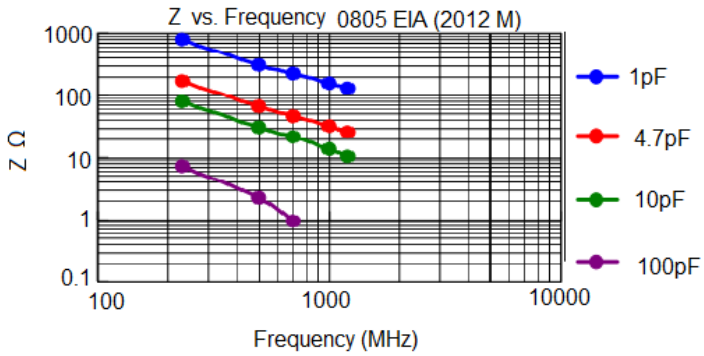

Q vs. Frequency 0603 EIA (1608 M)
Q
10000
1000
100
10
1
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
100pF

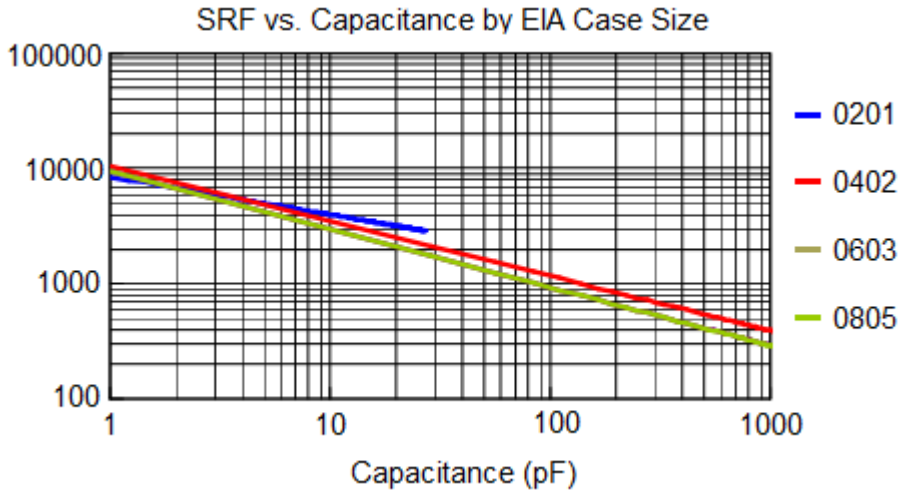

Q vs. Frequency 0805 EIA (2012 M)
Q
10000
1000
100
10
1
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
100pF


Z vs. Frequency 0201 EIA (0603 M)
Z Ω
1000
100
10
1
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
33pF


Z vs. Frequency 0402 EIA (1005 M)
Z Ω
1000
100
10
1
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
22pF


Z vs. Frequency 0603 EIA (1608 M)
Z Ω
1000
100
10
1
0.1
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
100pF


Z vs. Frequency 0805 EIA (2012 M)
Z Ω
1000
100
10
1
0.1
100
1000
10000
Frequency (MHz)
1pF
4.7pF
10pF
100pF


SRF vs. Capacitance by EIA Case Size
100000
10000
1000
100
1
10
100
1000
Capacitance (pF)
0201
0402
0603
0805

<table>
<tr><th></th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1</td><td>Visual and Mechanical</td><td>---</td><td>* No remarkable defect
* Dimensions conform to individual specification sheet</td></tr>
<tr><td>2</td><td>Capacitance</td><td rowspan="2"></td><td>* Shall not exceed the limits given in the detailed spec</td></tr>
<tr><td>3</td><td>Q/ DF (Dissipation Factor)</td><td>Class I: NP0Class I: NP0
Cap≤1,000pF 1.0±0.2Vrms, 1MHz±10%
Cap>1,000pF 1.0±0.2Vrms, 1KHz±10%

Class II: X7R, X5R,Y5V
Cap≤10μF, 1.0±0.2Vrms, 1kHz±10% **
Cap>10μF, 0.5±0.2Vrms, 120Hz±20%

** Test condition: 0.5±0.2Vrms， 1KHz±10%
X7R: 0603≥225 (10V), 0805=106 (6.3V&10V)
X5R: 0201≥224 (6.3V), 0402≥475 (6.3V),
0402≥225(10V),0603=106 (6.3V)</td><td>NP0: Cap≥30pF, Q≥1000, Cap<30pF,Q≥400+20C
X7R, X5R:
<table>
<tr><th>Rated voltage (DCV)</th><th>D.F. ≤</th><th colspan="2">Exception of D.F. ≤</th></tr>
<tr><td rowspan="3">≥ 50V</td><td rowspan="3">≤ 2.5%</td><td>≤3%</td><td>0201(50V), 0603 ≥ 0.047μF,
0805 ≥ 0.18μF, 1206 ≥ 0.47μF</td></tr>
<tr><td>≤5%</td><td>1210 ≥ 4.7μF</td></tr>
<tr><td>≤10%</td><td>0603≥1μF, 0805≥1μF,1206≥2.2μF, 1210≥10μF</td></tr>
<tr><td>35V</td><td>≤3.5%</td><td>≤10%</td><td>0805≥2.2μF, 1210≥10μF</td></tr>
<tr><td rowspan="3">25V</td><td rowspan="3">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF,0805≥1μF, 1210≥10μF</td></tr>
<tr><td>≤7%</td><td>0603≥0.33μF, 1206≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0402≥0.10μF,0603≥0.47μF, 0805≥2.2μF,</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤3.5%</td><td>≤5%</td><td>0201≥0.01μF,0402≥0.033μF, 0603≥0.15μF,
0805≥0.68μF, 1206≥2.2μF,1210≥4.7μF</td></tr>
<tr><td>≤10%</td><td>0402≥ 0.22uF, 0603≥0.68μF,0805≥2.2μF,
1206≥4.7μF, 1210≥22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤5%</td><td>≤10%</td><td>0201≥0.012μF,0402≥0.33μF,0603≥0.33μF,0805
≥2.2μF, 1206≥2.2μF,1210≥22μF</td></tr>
<tr><td>≤15%</td><td>0201≥0.1μF, 0402≥1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≤10%</td><td>≤15%</td><td>0201≥0.1μF,0402≥1μF,0603≥10μF,
0805≥4.7μF, 1206≥47μF :1210≥100μF</td></tr>
<tr><td>≤20%</td><td>0402≥2.2μF</td></tr>
<tr><td>4V</td><td>≤15%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated voltage</th><th>D.F. ≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<tr><td>≥50V</td><td>≤5%</td><td>≤7%</td><td>0603≥0.1μF, 0805≥0.47μF, 1206≥4.7μF,
Cap≥1μF</td></tr>
<tr><td>35V</td><td>≤7%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤5%</td><td>≤7%</td><td>0402≥0.047μF,0603≥0.1μF,
0805≥0.33μF,1206≥1μF, 1210≥4.7μF</td></tr>
<tr><td>≤9%</td><td>0402≥0.068μF,0603≥0.47μF, 1206≥4.7μF,
1210≥22μF, Cap≥1μF</td></tr>
<tr><td>16V
(C<1.0μF)</td><td>≤7%</td><td>≤9%
≤12.5%</td><td>0402≥0.068μF, 0603≥0.68μF
0402≥0.22μF</td></tr>
<tr><td>16V
(C≥1.0μF)</td><td>≤9%</td><td>≤12.5%</td><td>0603≥2.2μF, 0805≥3.3μF,1206≥10μF,
1210≥22μF, 1812≥47μF, Cap≥1μF</td></tr>
<tr><td>10V</td><td>≤12.5%</td><td>≤20%</td><td>0402≥0.47μF</td></tr>
<tr><td>6.3V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table></td></tr>
<tr><td>4</td><td>Dielectric Strength</td><td>*To apply voltage(≤100V) 250%.
*Duration: 1 to 5 sec.
*Charge & discharge current less than 50mA.

*To apply voltage:
200V ~300V & LD series ≥2 times V DC
500V ~ 999V ≥1.5 times V DC
1000V ~ 3000V ≥1.2 times V DC
*Cut-off, set at 10mA
*TEST= 15 sec. *RAMP=0</td><td>*No evidence of damage or flash over during test.</td></tr>
<tr><td>5</td><td>Insulation Resistance</td><td>To apply rated voltage for max. 120 sec.</td><td>10GΩ or RxC≥500Ω-F whichever is lower.
Class II (X7R, X7E, X5R, Y5V):
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="8">10GΩ or RxC≥100 Ω-F
whichever is lower.</td></tr>
<tr><td>50V:0603≥1μF,0805≥1μF, 1206≥2.2μF, 1210≥4.7μF</td></tr>
<tr><td>35V:0805≥2.2μF,1210≥10μF</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,</td></tr>
</table></td></tr>
<tr><td></td><td></td><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></td><td></td><td>>630V</td><td>To apply 500V for 60sec.</td><td>>10GΩ</td></tr>
<tr><td>6</td><td>Temperature Coefficient</td><td>With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>NPO (C0G)
NPO (C0H)
NPO (C0J)
X7R</td><td>-55~125°C at 25°C</td></tr>
<tr><td>X5R</td><td>-55~ 85°C at 25°C</td></tr>
<tr><td>Y5V</td><td>-25~ 85°C at 20°C</td></tr>
</table></td><td>
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NPO (C0G)</td><td>Within ±30ppm/°C</td></tr>
<tr><td>NPO (C0H)</td><td>Within ±60ppm/°C</td></tr>
<tr><td>NPO (C0J)</td><td>Within ±120ppm/°C</td></tr>
<tr><td>X7R</td><td>Within ±15%</td></tr>
<tr><td>X5R</td><td>Within ±15%</td></tr>
<tr><td>Y5V</td><td>Within +30%/-80%</td></tr>
</table></td></tr>
<tr><td>7</td><td>Adhesive Strength of Termination</td><td>*Pressurizing force：
0201: 2N
0402 & 0603: 5N
>0603: 10N
Test time：10 ±1 sec</td><td> No remarkable damage or removal of the terminations.</td></tr>
</table>

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<table>
<tr><th></th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>8</td><td>Vibration Resistance</td><td>* 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</td><td>* No remarkable damage.
* Cap change and Q/D.F.: To meet initial spec.</td></tr>
<tr><td>9</td><td>Solderability</td><td>* Solder temperature: 235±5°C
* Dipping time: 2±0.5 sec.</td><td>95% min. coverage of all metalized area.</td></tr>
<tr><td>10</td><td>Bending Test</td><td>*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.</td><td> 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.)</td></tr>
<tr><td>11</td><td>Resistance to Soldering Heat</td><td>* 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.</td><td>* 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.</td></tr>
<tr><td>12</td><td>Temperature Cycle</td><td>* Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (°C)</th><th>Time (min.)</th></tr>
<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>
</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.</td><td>* 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.</td></tr>
<tr><td>13</td><td>Humidity (Damp Heat) Steady State</td><td>* 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.</td><td>* 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>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<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>35V</td><td>≤5%</td><td>≤20%</td><td>0805≥2.2μF;1210≥10μF</td></tr>
<tr><td rowspan="3">25V</td><td rowspan="3">≤5%</td><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>≤15%</td><td>6≥6.8μF1210≥22μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤5%</td><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="2">10V</td><td rowspan="2">≤7.5%</td><td>≤15%</td><td>0201≥0.012μF; 0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF;</td></tr>
<tr><td>≤20%</td><td>0201≥0.1μF ;0402≥1μF</td></tr>
<tr><td>6.3V</td><td>≤15%</td><td>≤30%</td><td>0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;</td></tr>
<tr><td>4V</td><td>≤20%</td><td>---</td><td>---</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.≤</th><th colspan="2">Exception of D.F.≤</th></tr>
<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 rowspan="2">≤10%</td><td>0402≥0.047μF;0603≥0.1μF;0805≥0.33μF;</td></tr>
<tr><td>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>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></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>
</table>
*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is lower.
Class II (X7R, X7E, X5R, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="6">1GΩ or RxC≥10 Ω-F whichever is lower.</td></tr>
<tr><td>50V:0603≥1μF;0805≥1μF; 206≥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>
</table></td></tr>
</table>

H SERIES HIGH Q CAPACITOR SPEC

Rev. C

14 Humidity (Damp Heat) Load

Test Condition

* 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.

Requirements

* 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:

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
25V	≤5%	≤10%	0201≥0.01μF;0805≥1μF; 1210≥10μF
		≤14%	0603≥0.33μF;1206≥4.7μF
		≤15%	0402≥0.10μF;0603≥0.47μF;0805≥2.2μF; 1206≥6.8μF;1210≥22μF
16V	≤5%	≤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
10V	≤7.5%	≤15%	0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF; 1210≥22μF
		≤20%	0201≥0.1μF ;0402≥1μF
6.3V	≤15%	≤30%	0201≥0.1μF;0402≥1μF;0603≥10μF; 0805≥4.7μF;1206≥47μF;1210≥100μF
4V	≤20%	---	---

X7R/X7E, LD series : DF≤3%

Y5V:

Rated voltage	D.F.≤	Exception of D.F.≤	
≥50V	≤7.5%	≤10%	0603≥0.1μF; 0805≥0.47μF;1206≥4.7μF; Cap≥1μF
35V	≤10%	---	---
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
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
10V	≤20%	≤30%	0402≥0.47μF
6.3V	≤30%	---	---

*I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is lower. Class II (X7R, X7E, X5R, Y5V)

Rated voltage	Insulation Resistance
100V: X7R	500MΩ or RxC≥5 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	

15 High Temperature Load (Endurance)

Test Condition

*Test temp. :
NP0, X7R/X7E: 125±3°C
X5R, Y5V: 85±3°C
*Test time: 1000+24/-0 hrs.
*To apply voltage:
(1) 6.3V or C≥10μF 150% of rated voltage:
(2) 10V≤Ur<500V: 200% of rated voltage.
(3) 500V: 150% of rated voltage.
(4) Ur≥630V: 120% of rated voltage.(5) 100% of rated voltage for below range:

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

(6)150% of rated voltage for below range:

Size	Dielectric	Rated voltage	Capacitance
0402	X5R/X7R Y5V	10V,16V,25V 16V	C≥0.22μF C≥0.47μF
0603	X5R/X7R Y5V	10V,16V 16V	C≥1.0μF C≥2.2μF
0805	X5R/X7R Y5V	10V 16V	C≥4.7μF C≥4.7μF

*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.

Requirements

* 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:

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
25V	≤5%	≤10%	0201≥0.01μF;0805≥1μF; 1210≥10μF
		≤14%	0603≥0.33μF;1206≥4.7μF
		≤15%	0402≥0.10μF;0603≥0.47μF;0805≥2.2μF; 1206≥6.8μF;1210≥22μF
16V	≤5%	≤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
10V	≤7.5%	≤15%	0201≥0.012μF;0402≥0.33μF; 0603≥0.33μF;0805≥2.2μF; 1206≥2.2μF; 1210≥22μF
		≤20%	0201≥0.1μF ;0402≥1μF
6.3V	≤15%	≤30%	0201≥0.1μF;0402≥1μF; 0603≥10μF;0805≥4.7μF; 1206≥47μF; 1210≥100μF
4V	≤20%	--	--

X7R: DF≤3%

Y5V:

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
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
10V	≤20%	≤30%	0402≥0.47μF
6.3V	≤30%	---	---

*I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is lower.

Class II (X7R, X7E, X5R, Y5V):

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	
6.3V ; 4V	

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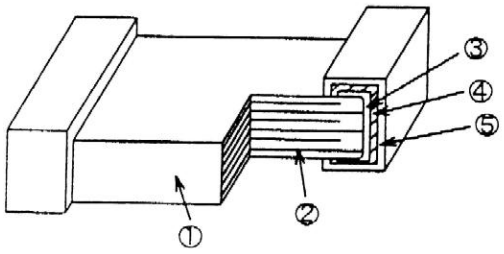


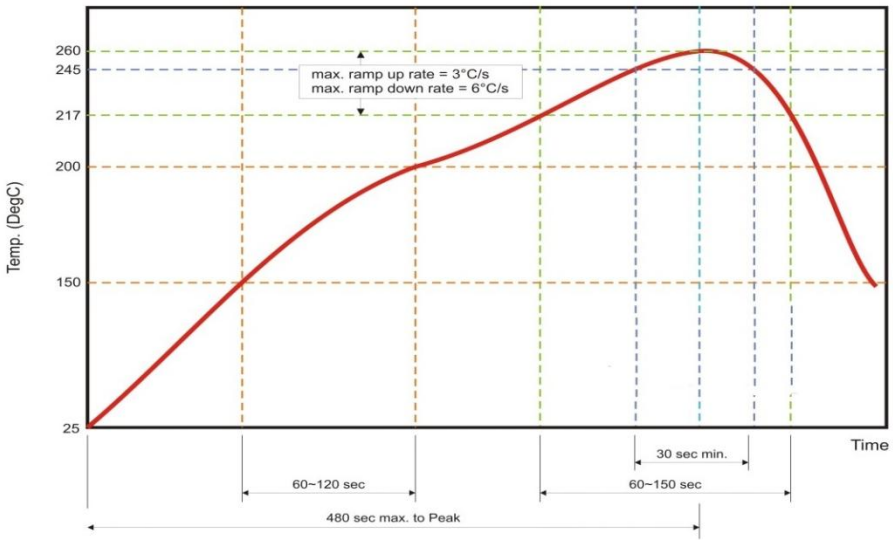
Storage and handling

(1) Products should be stored at 5 to 40°C ambient temperature and 20 to
(2) It is recommended that the product be used within one year from shipm
should be checked.

Cautions

a. 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 can be solderability issues.
b. In a corrosive atmosphere, solderability might be degraded, and/or silver migration may occur which can cause lower reliability.
c. Dewing caused by rapid humidity changes and/or photochemical changes of the terminal electrode (caused by direct sunlight contact) 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: