




SPECIFICATION SHEET NO.	R1206- SH05B221K500DC	
ORIGINAL MFG/PART NO.	Aillen Capacitors/SH0805B221K500DC	
NEXTGEN PART CODE	SH05B221K500DC	Indicate This Code For RFQ/Order
DATE	Dec. 6, 2024	
REVISION	A5	Updated With Most Recent Data
DESCRIPTION AND MAIN PARAMETRICS	<p>Soft Termination Multilayer Ceramic Chip Capacitors (MLCC), SH Series Case 0805 Metric 2012, Dimension L2.00*W1.25*H1.25mm Thickness: 1.35mm Max. Dielectric X7R, Capacitance 220pF, Tolerance ±10%, Rated Voltage 50V Operating Temp. Range -55°C ~+125°C Package in Tape/Reel, 3,000pcs/Reel REACH/RoHS/RoHS III Compliant</p>	
CUSTOMER		
CUSTOMER PART NUMBER		
CROSS REF. PART NUMBER		
MEMO		

VENDOR APPROVE		
Issued/Checked/Approved		
		
Effective Date: Dec. 6, 2024		

CUSTOMER APPROVE
DATE:

DESCRIPTION

Soft termination series MLCC is designed and with a polymer layer within end terminations of product, which can absorb mechanical stress caused by PCB handling in SMT line and reduce the mechanical impact for product. It will offer more robust and reliable performance in applications.



Image shown is a representation only.

Exact specifications should be obtained from the product dimension.

MAIN FEATURE

- MLCC's Termination Are With A Soft & Flexible Polymer Layer To Withstand High Bending Stress In SMT line
- Wide Rated Voltage Range
- A Wide Selection Of Size Is Available
- Temperature Coefficient: NP0 (COG), X7R, X5R and Y5V
- REACH/RoHS/RoHS III Compliant



APPLICATION

- Automotive industry.
- Power supply and related industries
- Lighting industry.
- The other mechanical stress concerned products

ELECTRICAL CHARACTERISTICS

- See Page 4 For Different Part Code And Rated Voltage.
- All Products Parameters are Subject To NextGen Components' Final Confirmation.

HOW TO ORDER

- Please Follow Up Part Code Guide And Indicate NextGen Part Code SH05B221K500DC For RFQ and Order.

RFQ
Request For Quotation

PART CODE GUIDE

CODE	NAME	KEY SPECIFICATION OPTION
SH	Product code	Soft Termination Multilayer Ceramic Chip Capacitors (MLCC), SH Series
05	Size Code	02: 0402 (1005 Metric) L1.00*W0.50mm; 03: 0603 (1608 Metric) L1.60*W0.80mm 05: 0805 (2012 Metric) L2.00*W1.25mm; 06: 1206 (3216 Metric) L3.20*W1.60mm 08: 1808 (4520 Metric) L4.50*W2.03mm; 10: 1210 (3225 Metric) L3.20*W2.50mm 12: 1812 (4532 Metric) L4.50*W3.20mm; 20: 2220 (5750 Metric) L5.70*W5.00mm 22: 2225 (5763 Metric) L5.70*W6.30mm; 25: 1825 (4563 Metric) L4.50*W6.30mm
B	Temperature Coefficient	N: NP0 (COG); B: X7R; W: X5R; Y: Y5V
221	Capacitance	Two significant digits followed by number of Zero, The 3rd digit signifies the multiplying factor, and letter R is decimal point. 0R2: 0.2pF; 1R0: 1.0pF; 9R0: 9.0pF; 150: 15pF; 221: 220pF; 105: 1.0μF
K	Tolerance	B: ±0.1pF; C: ±0.25pF; D: ±0.5pF; F: ±1%; G: ±2%; J: ±5%; K: ±10% ; M: ±20% Z: -20/+80%
500	Rated Voltage	6R3: 6.3 VDC; 100: 10 VDC; 160: 16 VDC; 250: 25 VDC; 500: 50 VDC; 101: 100 VDC; 201: 200 VDC; 251: 250 VDC; 401: 400 VDC; 451: 450 VDC 501: 500 VDC; 631: 630 VDC; 102: 1000 VDC; 152: 1500 VDC; 202: 2000 VDC 252: 2500 VDC; 302: 3000 VDC
D	Thickness	D: 1.25±0.10mm, See Page 5 ~ Page 6 (T's Symbol) for Different part code
C	Package	A: 1Kpcs/Reel; B: 2Kpcs/Reel; C: 3Kpcs/Reel; D: 4Kpcs/Reel; I: 10Kpcs/Reel
()	Internal Control	Blank: N/A; XX: Letter A~Z, a~z or digits (0~9) for Special/Custom Parameters

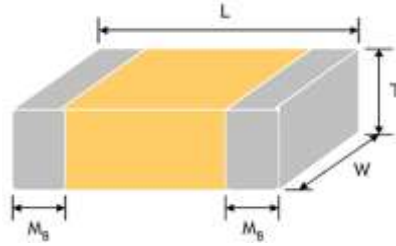
ELECTRICAL CHARACTERISTICS – 25V/50V/200V/250V/500V X7R FOR DIFFERENT PART CODE

NEXTGEN PART CODE	TEMP. COEFFICIENT	CAPACITANCE	TOLERANCE	VOLTAGE	THICKNESS (MAX.)	OPERATING TEMP. RANGE	CAPACITANCE CHARACTERISTIC
	-	-	-	V	mm	°C	-
SH06B105K250JC	X7R	1.00 µF	±10%	25	1.30	-55 to +125°C	±15%
SH03B471K500SD	X7R	470 pF	±10%	50	0.87	-55 to +125°C	±15%
SH05B221K500DC	X7R	220 pF	±10%	50	1.35	-55 to +125°C	±15%
SH05B471K201DC	X7R	470 pF	±10%	200	1.35	-55 to +125°C	±15%
SH05B102K251DC	X7R	0.001 µF	±10%	250	1.35	-55 to +125°C	±15%
SH05B152K251DC	X7R	1500 pF	±10%	250	1.35	-55 to +125°C	±15%
SH06B222K501DC	X7R	2200 pF	±10%	500	1.35	-55 to +125°C	±15%
SH06B472K501DC	X7R	4700 pF	±10%	500	1.35	-55 to +125°C	±15%
SH12B224K501MK	X7R	0.22 µF	±10%	500	3.00	-55 to +125°C	±15%
SH06B102K631DC	X7R	0.001 µF	±10%	630	1.35	-55 to +125°C	±15%
SH06B103K631DC	X7R	0.01 µF	±10%	630	1.35	-55 to +125°C	±15%

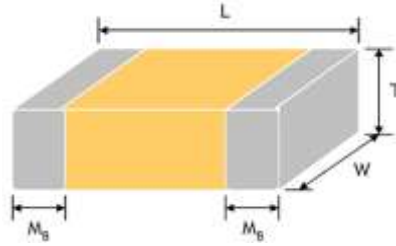
ELECTRICAL CHARACTERISTICS – 1000V NP0 (COG) FOR DIFFERENT PART CODE

NEXTGEN PART CODE	TEMP. COEFFICIENT	CAPACITANCE	TOLERANCE	VOLTAGE	THICKNESS (MAX.)	OPERATING TEMP. RANGE	CAPACITANCE CHARACTERISTIC
	-	-	-	V	mm	°C	-
SH06N101J102DC	NP0 (COG)	100 pF	±5%	1000	1.35	-55 to +125°C	±30ppm

DIMENSION (Unit: mm)



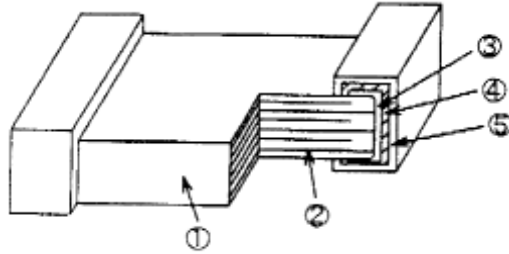
SIZE CODE	METRIC CODE	L	W	T (SYMBOL)		SOLDERING METHOD	Mb
0402	1005	1.00±0.20	0.50±0.20	0.50±0.20	E	#	0.25+0.05/-0.10
0603	1608	1.60±0.20	0.80±0.10	0.80±0.07	S		0.40±0.15
		1.60±0.30	0.80±0.30	0.80±0.30	X		
0805	2012	2.00±0.20	1.25±0.10	0.60±0.10	A		0.50±0.20
				0.80±0.10	B		
				1.25±0.10	D	#	
		2.00±0.30	1.25±0.30	1.25±0.30	I	#	
1206	3216	3.20 +0.4/-0.1	1.60±0.15	0.80±0.10	B		0.60±0.20 (0.50±0.25)*
				0.95±0.10	C	#	
				1.15±0.15	J		
				1.25±0.10	D		
		1.60±0.20	1.60±0.20	G	#		
		3.20±0.50	1.60±0.50	1.60±0.50	P	#	

DIMENSION (Unit: mm)


SIZE CODE	METRIC CODE	L	W	T (SYMBOL)		SOLDERING METHOD	Mb
1210	3225	3.20±0.40	2.50±0.20	0.95±0.10	C	#	0.75±0.25
				1.25±0.10	D		
		3.20±0.60	2.50±0.50	1.60±0.20	G		
				2.00±0.20	K		
		3.20±0.60	2.50±0.50	2.50±0.50	M		
1808	4520	4.50 ±0.60/-0.4	2.03±0.25	1.25±0.10	D	#	0.50±0.25
				2.00±0.20	K		
1812	4532	4.50 +0.6/-0.4	3.20±0.30	1.25±0.10	D	#	0.75±0.25 (0.50±0.25)*
				1.60±0.20	G		
				2.00±0.20	K		
				3.20±0.40	2.50±0.50		
1825	4563	4.50 +0.6/-0.4	6.30±0.40	2.00±0.20	K	#	0.75±0.35
				2.50±0.50	M		
				2.80±0.30	U		
2220	5750	5.70±0.50	5.00±0.40	2.00±0.20	K	#	0.85±0.35
				2.50±0.50	M		
				2.80±0.30	U		
2225	5763	5.70±0.50	6.30±0.40	2.00±0.20	K	#	0.85±0.35
				2.50±0.50	M		
				2.80±0.30	U		

Note: # Reflow soldering only is recommended. *:For 1206≥1000V, 1812_200V~4000V products.

CONSTRUCTIONS



NO.	NAME		NP0 (COG)	X7R, X5R, Y5V
①	Ceramic Material		CaZrO3 based	BaTiO3 based
②	Inner Electrode		Ni	
③	Termination	Inner Electrode	Cu + Ag Polymer	
④		Middle Layer	Ni	
⑤		Outer Layer	Sn	

GENERAL ELECTRICAL CHARACTERISTICS

DIELECTRIC	NPO (COG)	X7R	X5R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225			
Capacitance Range*	0.1pF to 0.1μF	100pF to 47μF	0.033μF to 10μF	0.01μF to 2.2μF
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%)	K (±10%), M (±20%)	K (±10%), M (±20%)	Z (-20/+80%)
Rated Voltage	6.3V to 3000V			
Operating Temperature	-55 ~ +125°C		-55 ~ +85°C	-25 ~ +85°C
Capacitance Characteristic	±30ppm	±15%	±15%	+30/-80%
Termination	Ni/Sn (lead-free termination)			

Note:

- * Measured at the condition of 30~70% related humidity.
- NPO: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap ≤ 1000pF and 1.0±0.2Vrms, 1.0kHz±10% for Cap > 1000pF, 25°C at ambient temperature.
- X7R, X5R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 25° C ambient temperature. Y5V: Apply 1.0±0.2Vrms, 1.0kHz±10%, at 20°C ambient temperature.

** Preconditioning for Class II MLCC: Perform a heat treatment at 150±10°C for 1 hour and then leave in ambient condition for 24±2 hours before measurement.

CAPACITANCE RANGE - NP0 (COG) DIELECTRIC SIZE 0402, 0603

Table 1-A

SIZE	0402					0603							
	VDC (V)	10	16	25	50	100	10	16	25	50	100	200	250
0.1pF (0R1)	E	E	E	E									
0.2pF (0R2)	E	E	E	E									
0.3pF (0R3)	E	E	E	E		S	S	S	S				
0.4pF (0R4)	E	E	E	E		S	S	S	S				
0.5pF (0R5)	E	E	E	E	E	S	S	S	S	S	S	S	S
0.6pF (0R6)	E	E	E	E	E	S	S	S	S	S	S	S	S
0.7pF (0R7)	E	E	E	E	E	S	S	S	S	S	S	S	S
0.8pF (0R8)	E	E	E	E	E	S	S	S	S	S	S	S	S
0.9pF (0R9)	E	E	E	E	E	S	S	S	S	S	S	S	S
1.0pF (1R0)	E	E	E	E	E	S	S	S	S	S	S	S	S
1.2pF (1R2)	E	E	E	E	E	S	S	S	S	S	S	S	S
1.5pF (1R5)	E	E	E	E	E	S	S	S	S	S	S	S	S
1.8pF (1R8)	E	E	E	E	E	S	S	S	S	S	S	S	S
2.2pF (2R2)	E	E	E	E	E	S	S	S	S	S	S	S	S
2.7pF (2R7)	E	E	E	E	E	S	S	S	S	S	S	S	S
3.3pF (3R3)	E	E	E	E	E	S	S	S	S	S	S	S	S
3.9pF (3R9)	E	E	E	E	E	S	S	S	S	S	S	S	S
4.7pF (4R7)	E	E	E	E	E	S	S	S	S	S	S	S	S
5.6pF (5R6)	E	E	E	E	E	S	S	S	S	S	S	S	S
6.8pF (6R8)	E	E	E	E	E	S	S	S	S	S	S	S	S
8.2pF (8R2)	E	E	E	E	E	S	S	S	S	S	S	S	S
10pF (100)	E	E	E	E	E	S	S	S	S	S	S	S	S
12pF (120)	E	E	E	E	E	S	S	S	S	S	S	S	S
15pF (150)	E	E	E	E	E	S	S	S	S	S	S	S	S
18pF (180)	E	E	E	E	E	S	S	S	S	S	S	S	S
22pF (220)	E	E	E	E	E	S	S	S	S	S	S	S	S
27pF (270)	E	E	E	E	E	S	S	S	S	S	S	S	S
33pF (330)	E	E	E	E	E	S	S	S	S	S	S	S	S
39pF (390)	E	E	E	E	E	S	S	S	S	S	S	S	S
47pF (470)	E	E	E	E	E	S	S	S	S	S	S	S	S
56pF (560)	E	E	E	E	E	S	S	S	S	S	S	S	S
68pF (680)	E	E	E	E	E	S	S	S	S	S	S	S	S
82pF (820)	E	E	E	E	E	S	S	S	S	S	S	S	S
100pF (101)	E	E	E	E	E	S	S	S	S	S	S	S	S
120pF (121)	E	E	E	E	E	S	S	S	S	S	S	S	S

CAPACITANCE RANGE - NP0 (COG) DIELECTRIC SIZE 0402, 0603

Table 1-B

SIZE	0402					0603							
	VDC (V)	10	16	25	50	100	10	16	25	50	100	200	250
150pF (151)	E	E	E	E	E	E	S	S	S	S	S	S	S
180pF (181)	E	E	E	E	E	E	S	S	S	S	S	S	S
220pF (221)	E	E	E	E	E	E	S	S	S	S	S	S	S
270pF (271)	E	E	E	E	E	E	S	S	S	S	S	X	X
330pF (331)	E	E	E	E	E	E	S	S	S	S	S	X	X
390pF (391)	E	E	E	E	E	E	S	S	S	S	S	X	X
470pF (471)	E	E	E	E	E	E	S	S	S	S	S	X	X
560pF (561)	E	E	E	E	E	E	S	S	S	S	S		
680pF (681)	E	E	E	E	E	E	S	S	S	S	S		
820pF (821)	E	E	E	E	E	E	S	S	S	S	S		
1,000pF (102)	E	E	E	E	E	E	S	S	S	S	S		
1,200pF (122)							X	X	X	X			
1,500pF (152)							X	X	X	X			
1,800pF (182)							X	X	X	X			
2,200pF (222)							X	X	X	X			
2,700pF (272)							X	X	X	X			
3,300pF (332)							X	X	X	X			

CAPACITANCE RANGE - NP0 (COG) DIELECTRIC SIZE 0805

Table 1-C

SIZE	0805										
	VDC (V)	10	16	25	50	100	200	250	500	630	1K
0.5pF (0R5)	A	A	A	A	A	A	A	A	A	A	D
0.6pF (0R6)	A	A	A	A	A	A	A	A	A	A	D
0.7pF (0R7)	A	A	A	A	A	A	A	A	A	A	D
0.8pF (0R8)	A	A	A	A	A	A	A	A	A	A	D
0.9pF (0R9)	A	A	A	A	A	A	A	A	A	A	D
1.0pF (1R0)	A	A	A	A	A	A	A	A	A	A	D
1.2pF (1R2)	A	A	A	A	A	A	A	A	A	A	D
1.5pF (1R5)	A	A	A	A	A	A	A	A	A	A	D
1.8pF (1R8)	A	A	A	A	A	A	A	A	A	A	D
2.2pF (2R2)	A	A	A	A	A	A	A	A	A	A	D
2.7pF (2R7)	A	A	A	A	A	A	A	A	A	A	D
3.3pF (3R3)	A	A	A	A	A	A	A	A	A	A	D
3.9pF (3R9)	A	A	A	A	A	A	A	A	A	A	D

CAPACITANCE RANGE - NP0 (COG) DIELECTRIC SIZE 0805

Table 1-D

SIZE	0805									
VDC (V)	10	16	25	50	100	200	250	500	630	1K
4.7pF (4R7)	A	A	A	A	A	A	A	A	A	D
5.6pF (5R6)	A	A	A	A	A	A	A	A	A	D
6.8pF (6R8)	A	A	A	A	A	A	A	A	A	D
8.2pF (8R2)	A	A	A	A	A	A	A	A	A	D
10pF (100)	A	A	A	A	A	A	A	A	A	D
12pF (120)	A	A	A	A	A	A	A	A	A	D
15pF (150)	A	A	A	A	A	A	A	A	A	D
18pF (180)	A	A	A	A	A	A	A	A	A	D
22pF (220)	A	A	A	A	A	A	A	A	A	D
27pF (270)	A	A	A	A	A	A	A	A	A	D
33pF (330)	A	A	A	A	A	A	A	A	A	D
39pF (390)	A	A	A	A	A	A	A	A	A	D
47pF (470)	A	A	A	A	A	A	A	A	A	D
56pF (560)	A	A	A	A	A	A	A	A	A	D
68pF (680)	A	A	A	A	A	A	A	A	A	D
82pF (820)	A	A	A	A	A	A	A	B	B	D
100pF (101)	A	A	A	A	A	A	B	B	B	D
120pF (121)	A	A	A	A	A	A	B	D	D	D
150pF (151)	A	A	A	A	A	B	D	D	D	D
180pF (181)	A	A	A	A	A	B	D	D	D	D
220pF (221)	A	A	A	A	A	D	D	D	D	D
270pF (271)	A	A	A	A	A	D	D	D	D	D
330pF (331)	A	A	A	A	A	D	D	D	D	D
390pF (391)	B	B	B	B	B	D	D	D	D	D
470pF (471)	B	B	B	B	B	D	D	I	I	
560pF (561)	B	B	B	B	B	D	D	I	I	
680pF (681)	B	B	B	B	B	D	D	I	I	
820pF (821)	B	B	B	B	B	D	D	I	I	
1,000pF (102)	B	B	B	B	B	D	D	I	I	
1,200pF (122)	B	B	B	B	B	D	D			
1,500pF (152)	B	B	B	B	B	D	D			
1,800pF (182)	B	B	B	B	B	D	D			
2,200pF (222)	B	B	B	B	B	D	D			

CAPACITANCE RANGE - NP0 (COG) DIELECTRIC SIZE 0805

Table 1-E

Size	0805									
VDC (V)	10	16	25	50	100	200	250	500	630	1K
2,700pF (272)	D	D	D	D	D					
3,300pF (332)	D	D	D	D	D					
3,900pF (392)	D	D	D	D	D					
4,700pF (472)	D	D	D	D	D					
5,600pF (562)	D	D	D	D	D					
6,800pF (682)	D	D	D	D	D					
8,200pF (822)	D	D	D	D						
0.010μF (103)	D	D	D	D						

CAPACITANCE RANGE - NP0 (COG) DIELECTRIC SIZE 1206

Table 1-F

SIZE	1206											
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K
1.2pF (1R2)	B	B	B	B	B							
1.5pF (1R5)	B	B	B	B	B	B	B	B	B	B	B	B
1.8pF (1R8)	B	B	B	B	B	B	B	B	B	B	B	B
2.2pF (2R2)	B	B	B	B	B	B	B	B	B	B	B	B
2.7pF (2R7)	B	B	B	B	B	B	B	B	B	B	B	B
3.3pF (3R3)	B	B	B	B	B	B	B	B	B	B	B	B
3.9pF (3R9)	B	B	B	B	B	B	B	B	B	B	B	B
4.7pF (4R7)	B	B	B	B	B	B	B	B	B	B	B	B
5.6pF (5R6)	B	B	B	B	B	B	B	B	B	B	B	B
6.8pF (6R8)	B	B	B	B	B	B	B	B	B	B	B	B
8.2pF (8R2)	B	B	B	B	B	B	B	B	B	B	B	B
10pF (100)	B	B	B	B	B	B	B	B	B	B	B	B
12pF (120)	B	B	B	B	B	B	B	B	B	B	B	B
15pF (150)	B	B	B	B	B	B	B	B	B	B	B	B
18pF (180)	B	B	B	B	B	B	B	B	B	B	B	B
22pF (220)	B	B	B	B	B	B	B	B	B	B	B	B
27pF (270)	B	B	B	B	B	B	B	B	B	B	B	B
33pF (330)	B	B	B	B	B	B	B	B	B	B	C	C
39pF (390)	B	B	B	B	B	B	B	B	B	B	C	C

CAPACITANCE RANGE - NP0 (COG) DIELECTRIC SIZE 1206

Table 1-G

SIZE	1206											
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K
47pF (470)	B	B	B	B	B	B	B	B	B	C	C	C
56pF (560)	B	B	B	B	B	B	B	B	B	C	D	D
68pF (680)	B	B	B	B	B	B	B	B	B	C	D	D
82pF (820)	B	B	B	B	B	B	B	B	B	D	D	D
100pF (101)	B	B	B	B	B	B	B	B	B	D	D	D
120pF (121)	B	B	B	B	B	B	B	B	B	D	G	G
150pF (151)	B	B	B	B	B	B	B	B	B	D	G	G
180pF (181)	B	B	B	B	B	B	B	B	B	G	G	G
220pF (221)	B	B	B	B	B	B	B	B	B	G	G	G
270pF (271)	B	B	B	B	B	B	C	C	C	G	P	P
330pF (331)	B	B	B	B	B	B	C	C	C	G	P	P
390pF (391)	B	B	B	B	B	B	C	C	C	G	P	P
470pF (471)	B	B	B	B	B	C	C	C	C	G		
560pF (561)	B	B	B	B	B	C	D	D	D	G		
680pF (681)	B	B	B	B	B	C	D	D	D	G		
820pF (821)	B	B	B	B	B	C	G	G	G	G		
1,000pF (102)	B	B	B	B	B	C	G	G	G	G		
1,200pF (122)	B	B	B	B	B	C	G	G	G			
1,500pF (152)	B	B	B	B	B	D	G	G	G			
1,800pF (182)	B	B	B	B	B	D	G	G	G			
2,200pF (222)	B	B	B	B	B	D	G	G	G			
2,700pF (272)	B	B	B	B	B	D	G	G	G			
3,300pF (332)	B	B	B	B	B	D	G	G	G			
3,900pF (392)	B	B	B	B	B	D	G	G	G			
4,700pF (472)	B	B	B	B	B	D	G	G	G			
5,600pF (562)	B	B	B	B	B							
6,800pF (682)	C	C	C	C	C							
8,200pF (822)	D	D	D	D	D							
0.010μF (103)	D	D	D	D	D							
0.012μF (123)	P	P	P	P	P							

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 1206

Table 1-H

SIZE	1206											
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K
0.015µF (153)	P	P	P	P	P							
0.018µF (183)	P	P	P	P	P							
0.022µF (223)	P	P	P	P	P							
0.027µF (273)	P	P	P	P								
0.033µF (333)	P	P	P	P								
0.039µF (393)	P	P	P	P								

CAPACITANCE RANGE - NPO (COG) DIELECTRIC SIZE 1210

Table 1-I

SIZE	1210											
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K
10pF (100)	C	C	C	C	C	C	C	C	C	C	C	C
12pF (120)	C	C	C	C	C	C	C	C	C	C	C	C
15pF (150)	C	C	C	C	C	C	C	C	C	C	C	C
18pF (180)	C	C	C	C	C	C	C	C	C	C	C	C
22pF (220)	C	C	C	C	C	C	C	C	C	C	C	C
27pF (270)	C	C	C	C	C	C	C	C	C	C	C	C
33pF (330)	C	C	C	C	C	C	C	C	C	C	C	C
39pF (390)	C	C	C	C	C	C	C	C	C	C	C	C
47pF (470)	C	C	C	C	C	C	C	C	C	C	C	C
56pF (560)	C	C	C	C	C	C	C	C	C	C	D	D
68pF (680)	C	C	C	C	C	C	C	C	C	C	D	D
82pF (820)	C	C	C	C	C	C	C	C	C	C	D	D
100pF (101)	C	C	C	C	C	C	C	C	C	D	D	D
120pF (121)	C	C	C	C	C	C	C	C	C	D	D	D
150pF (151)	C	C	C	C	C	C	C	C	C	D	G	G
180pF (181)	C	C	C	C	C	C	C	C	C	D	G	G
220pF (221)	C	C	C	C	C	C	C	C	C	G	G	G
270pF (271)	C	C	C	C	C	C	C	C	C	G	K	K
330pF (331)	C	C	C	C	C	C	C	C	C	G	K	K
390pF (391)	C	C	C	C	C	C	C	C	C	G	M	M

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 1210

Table 1-J

SIZE	1210											
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K
470pF (471)	C	C	C	C	C	C	C	C	C	G	M	M
560pF (561)	C	C	C	C	C	C	C	C	C	G		
680pF (681)	C	C	C	C	C	C	C	C	C	G		
820pF (821)	C	C	C	C	C	C	C	C	C	G		
1,000pF (102)	C	C	C	C	C	D	D	D	D	G		
1,200pF (122)	C	C	C	C	C	D	D	D	D	G		
1,500pF (152)	C	C	C	C	C	D	D	D	D	K		
1,800pF (182)	C	C	C	C	C	D	D	D	D	M		
2,200pF (222)	C	C	C	C	C	D	D	D	D	M		
2,700pF (272)	C	C	C	C	C	D	D	D	D	M		
3,300pF (332)	C	C	C	C	C	D	D	D	D	M		
3,900pF (392)	C	C	C	C	C	D	D	D	D	M		
4,700pF (472)	C	C	C	C	C	G	G					
5,600pF (562)	C	C	C	C	C	G	G					
6,800pF (682)	C	C	C	C	C	G	G					
8,200pF (822)	C	C	C	C	C	G	G					
0.010μF (103)	C	C	C	C	C	G	G					
0.012μF (123)	D	D	D	D	D							
0.015μF (153)	D	D	D	D	D							

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 1808

Table 1- K

SIZE	1808					
VDC (V)	500	630	1K	1.5K	2K	3K
2.2pF (2R2)	D	D	D	D	D	D
2.7pF (2R7)	D	D	D	D	D	D
3.3pF (3R3)	D	D	D	D	D	D
3.9pF (3R9)	D	D	D	D	D	D
4.7pF (4R7)	D	D	D	D	D	D
5.6pF (5R6)	D	D	D	D	D	D
6.8pF (6R8)	D	D	D	D	D	D
8.2pF (8R2)	D	D	D	D	D	D
10pF (100)	D	D	D	D	D	D
12pF (120)	D	D	D	D	D	D
15pF (150)	D	D	D	D	D	D
18pF (180)	D	D	D	D	D	D
22pF (220)	D	D	D	D	D	D
27pF (270)	D	D	D	D	D	D
33pF (330)	D	D	D	D	D	D
39pF (390)	D	D	D	D	D	D
47pF (470)	D	D	D	D	D	D
56pF (560)	D	D	D	D	D	D
68pF (680)	D	D	D	D	D	D
82pF (820)	D	D	D	D	D	D
100pF (101)	D	D	D	D	D	D
120pF (121)	D	D	D	D	D	K
150pF (151)	D	D	D	K	K	K
180pF (181)	D	D	D	K	K	K
220pF (221)	D	D	D	K	K	K
270pF (271)	K	K	K	K	K	K
330pF (331)	K	K	K	K	K	K
390pF (391)	K	K	K	K	K	K
470pF (471)	K	K	K	K	K	K
560pF (561)	K	K	K	K	K	K

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CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 1808

Table 1- L

SIZE	1808					
VDC (V)	500	630	1K	1.5K	2K	3K
680pF (681)	K	K	K	K	K	
820pF (821)	K	K	K	D	D	
1,000pF (102)	K	K	K	G	G	
1,200pF (122)	K	K	G			
1,500pF (152)	K	K	G			
1,800pF (182)	K	K	K			
2,200pF (222)	K	K	K			
2,700pF (272)	K	K				
3,300pF (332)	K	K				

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 1812

Table 1- M

SIZE	1812												
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K	3K
10pF (100)	D	D	D	D	D	D	D	D	D	D	D	D	D
12pF (120)	D	D	D	D	D	D	D	D	D	D	D	D	D
15pF (150)	D	D	D	D	D	D	D	D	D	D	D	D	D
18pF (180)	D	D	D	D	D	D	D	D	D	D	D	D	D
22pF (220)	D	D	D	D	D	D	D	D	D	D	D	D	D
27pF (270)	D	D	D	D	D	D	D	D	D	D	D	D	D
33pF (330)	D	D	D	D	D	D	D	D	D	D	D	D	D
39pF (390)	D	D	D	D	D	D	D	D	D	D	D	D	D
47pF (470)	D	D	D	D	D	D	D	D	D	D	D	D	D
56pF (560)	D	D	D	D	D	D	D	D	D	D	D	D	D
68pF (680)	D	D	D	D	D	D	D	D	D	D	D	D	D
82pF (820)	D	D	D	D	D	D	D	D	D	D	D	D	D
100pF (101)	D	D	D	D	D	D	D	D	D	D	D	D	D
120pF (121)	D	D	D	D	D	D	D	D	D	D	D	D	D
150pF (151)	D	D	D	D	D	D	D	D	D	D	D	D	D

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 1812

Table 1- N

SIZE	1812												
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K	3K
180pF (181)	D	D	D	D	D	D	D	D	D	D	D	D	K
220pF (221)	D	D	D	D	D	D	D	D	D	D	D	D	K
270pF (271)	D	D	D	D	D	D	D	D	D	D	K	K	K
330pF (331)	D	D	D	D	D	D	D	D	D	D	K	K	K
390pF (391)	D	D	D	D	D	D	D	D	D	D	K	K	K
470pF (471)	D	D	D	D	D	D	D	D	D	K	K	K	K
560pF (561)	D	D	D	D	D	D	D	D	D	K	K	K	
680pF (681)	D	D	D	D	D	D	D	D	D	K	K	K	
820pF (821)	D	D	D	D	D	D	D	D	D	K	K	K	
1,000pF (102)	D	D	D	D	D	D	D	D	D	K	K	K	
1,200pF (122)	D	D	D	D	D	D	D	D	D	K			
1,500pF (152)	D	D	D	D	D	D	D	D	D	K			
1,800pF (182)	D	D	D	D	D	D	D	D	D	K			
2,200pF (222)	D	D	D	D	D	D	D	D	D	K			
2,700pF (272)	D	D	D	D	D	D	D	D	D	K			
3,300pF (332)	D	D	D	D	D	D	D	D	D	K			
3,900pF (392)	D	D	D	D	D	D	D	D	D	M			
4,700pF (472)	D	D	D	D	D	D	D	D	D				
5,600pF (562)	D	D	D	D	D	D	D	D	D				
6,800pF (682)	D	D	D	D	D	D	D	D	D				
8,200pF (822)	D	D	D	D	D			D	D				
0.010μF (103)	D	D	D	D	D			D	D				
0.012μF (123)	D	D	D	D	D			G	G				
0.015μF (153)	D	D	D	D	D			G	G				
0.018μF (183)	D	D	D	D	D			K	K				
0.022μF (223)	D	D	D	D	D			K	K				
0.027μF (273)	D	D	D	D	D								
0.033μF (333)	D	D	D	D	D								

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 1825, 2220

Table 1- O

SIZE	1825						2220							
	VDC (V)	100	200 250	500 630	1K	2K	3K	100	200 250	500	630	1K	2K	3K
10pF (100)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
12pF (120)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
15pF (150)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
18pF (180)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
22pF (220)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
27pF (270)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
33pF (330)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
39pF (390)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
47pF (470)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
56pF (560)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
68pF (680)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
82pF (820)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
100pF (101)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
120pF (121)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
150pF (151)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
180pF (181)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
220pF (221)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
270pF (271)	K	K	K	K	K	K	K	K	K	K	K	K	K	K
330pF (331)	K	K	K	K	K	K	K	K	K	K	K	K	K	M
390pF (391)	K	K	K	K	K	K	K	K	K	K	K	K	K	M
470pF (471)	K	K	K	K	K	K	K	K	K	K	K	K	K	M
560pF (561)	K	K	K	K	K	K	K	K	K	K	K	K	K	M
680pF (681)	K	K	K	K	K	M	K	K	K	K	K	K	K	M
820pF (821)	K	K	K	K	K	M	K	K	K	K	K	K	K	M

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 1825, 2220

Table 1- P

SIZE	1825						2220							
	VDC (V)	100	200 250	500 630	1K	2K	3K	100	200 250	500	630	1K	2K	3K
1,000pF (102)	K	K	K	K	K	M	K	K	K	K	K	K	K	M
1,200pF (122)	K	K	K	K	K		K	K	K	K	M	M	M	
1,500pF (152)	K	K	K	K	M		K	K	K	K	M	M	M	
1,800pF (182)	K	K	K	K	M		K	K	K	K	M	M		
2,200pF (222)	K	K	K	K	M		K	K	K	K	M	M		
2,700pF (272)	K	K	K	K	M		K	K	K	K	M	M		
3,300pF (332)	K	K	K	K	M		K	K	K	K	M	M		
3,900pF (392)	K	K	K	M	M		K	K	K	K	M	M		
4,700pF (472)	K	K	K	M	M		K	K	K	K	M	M		
5,600pF (562)	K	K	K	M			K	K	K	K	M			
6,800pF (682)	K	K	K	M			K	K	K	K	M			
8,200pF (822)	K	K	K	M			K	K	K	K	M			
0.010µF (103)	K	K	K	M			K	K	K	K	M			
0.012µF (123)	K	K	K				K	K	K	K				
0.015µF (153)	K	K	K				K	K	K	K				
0.018µF (183)	K	K	K				K	K	K	K				
0.022µF (223)	K	K	K				K	K	K	K				
0.027µF (273)	K	K	K				K	K	K					
0.033µF (333)	K	K	K				K	K	K					
0.039µF (393)	K	K	M				K	K	M					
0.047µF (473)	K	K					K	M	M					
0.056µF (563)	K	M					K	M						
0.068µF (683)	K	M					K	M						
0.082µF (823)	M						M							
0.10µF (104)	M						M							

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 2225

Table 1- Q

SIZE	2225						
VDC (V)	100	200 250	500	630	1K	2K	3K
10pF (100)	K	K	K	K	K	K	K
12pF (120)	K	K	K	K	K	K	K
15pF (150)	K	K	K	K	K	K	K
18pF (180)	K	K	K	K	K	K	K
22pF (220)	K	K	K	K	K	K	K
27pF (270)	K	K	K	K	K	K	K
33pF (330)	K	K	K	K	K	K	K
39pF (390)	K	K	K	K	K	K	K
47pF (470)	K	K	K	K	K	K	K
56pF (560)	K	K	K	K	K	K	K
68pF (680)	K	K	K	K	K	K	K
82pF (820)	K	K	K	K	K	K	K
100pF (101)	K	K	K	K	K	K	K
120pF (121)	K	K	K	K	K	K	K
150pF (151)	K	K	K	K	K	K	K
180pF (181)	K	K	K	K	K	K	K
220pF (221)	K	K	K	K	K	K	K
270pF (271)	K	K	K	K	K	K	K
330pF (331)	K	K	K	K	K	K	K
390pF (391)	K	K	K	K	K	K	K
470pF (471)	K	K	K	K	K	K	K
560pF (561)	K	K	K	K	K	K	K
680pF (681)	K	K	K	K	K	K	K
820pF (821)	K	K	K	K	K	M	M

CAPACITANCE RANGE -NPO (COG) DIELECTRIC SIZE 2225

Table 1- R

SIZE	2225						
VDC (V)	100	200 250	500	630	1K	2K	3K
1,000pF (102)	K	K	K	K	K	M	M
1,200pF (122)	K	K	K	K	K	M	
1,500pF (152)	K	K	K	K	K	M	
1,800pF (182)	K	K	K	K	K	M	
2,200pF (222)	K	K	K	K	K	M	
2,700pF (272)	K	K	K	K	K	M	
3,300pF (332)	K	K	K	K	K	M	
3,900pF (392)	K	K	K	K	K	M	
4,700pF (472)	K	K	K	K	K	M	
5,600pF (562)	K	K	K	K	M	M	
6,800pF (682)	K	K	K	K	M	M	
8,200pF (822)	K	K	K	K	M	M	
0.010μF (103)	K	K	K	K	M	M	
0.012μF (123)	K	K	K	K			
0.015μF (153)	K	K	K	K			
0.018μF (183)	K	K	K	K			
0.022μF (223)	K	K	K	K			
0.027μF (273)	K	K	K	K			
0.033μF (333)	K	K	K	K			
0.039μF (393)	K	K	K	K			
0.047μF (473)	K	K	K	K			
0.056μF (563)	K	M	M	M			
0.068μF (683)	K	M	M	M			
0.082μF (823)	K	M	M				
0.10μF (104)	M	M					

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 0402, 0603

Table 2-A

SIZE	0402					0603						
	VDC (V)	10	16	25	50	100	10	16	25	50	100	200
100pF (101)	E	E	E	E	E	S	S	S	S	S	X	X
120pF (121)	E	E	E	E	E	S	S	S	S	S	X	X
150pF (151)	E	E	E	E	E	S	S	S	S	S	X	X
180pF (181)	E	E	E	E	E	S	S	S	S	S	X	X
220pF (221)	E	E	E	E	E	S	S	S	S	S	X	X
270pF (271)	E	E	E	E	E	S	S	S	S	S	X	X
330pF (331)	E	E	E	E	E	S	S	S	S	S	X	X
390pF (391)	E	E	E	E	E	S	S	S	S	S	X	X
470pF (471)	E	E	E	E	E	S	S	S	S	S	X	X
560pF (561)	E	E	E	E	E	S	S	S	S	S	X	X
680pF (681)	E	E	E	E	E	S	S	S	S	S	X	X
820pF (821)	E	E	E	E	E	S	S	S	S	S	X	X
1,000pF (102)	E	E	E	E	E	S	S	S	S	S	X	X
1,200pF (122)	E	E	E	E	E	S	S	S	S	S	X	X
1,500pF (152)	E	E	E	E	E	S	S	S	S	S	X	X
1,800pF (182)	E	E	E	E	E	S	S	S	S	S	X	X
2,200pF (222)	E	E	E	E	E	S	S	S	S	S	X	X
2,700pF (272)	E	E	E	E	E	S	S	S	S	S	X	X
3,300pF (332)	E	E	E	E	E	S	S	S	S	S	X	X
3,900pF (392)	E	E	E	E	E	S	S	S	S	S	X	X
4,700pF (472)	E	E	E	E	E	S	S	S	S	S	X	X
5,600pF (562)	E	E	E	E	E	S	S	S	S	S	X	X
6,800pF (682)	E	E	E	E	E	S	S	S	S	S	X	X
8,200pF (822)	E	E	E	E	E	S	S	S	S	S	X	X
0.010μF (103)	E	E	E	E	E	S	S	S	S	S	X	X
0.012μF (123)	E	E	E			S	S	S	S	X		
0.015μF (153)	E	E	E			S	S	S	S	X		
0.018μF (183)	E	E	E			S	S	S	S	X		
0.022μF (223)	E	E	E			S	S	S	S	X		
0.027μF (273)	E	E	E			S	S	S	S	X		
0.033μF (333)	E	E	E			S	S	S	X	X		

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 0402, 0603

Table 2-B

SIZE	0402					0603							
	VDC (V)	10	16	25	50	100	10	16	25	50	100	200	250
0.039µF (393)	E	E	E				S	S	S	X	X		
0.047µF (473)	E	E	E				S	S	S	X	X		
0.056µF (563)	E	E					S	S	S	X	X		
0.068µF (683)	E	E					S	S	S	X	X		
0.082µF (823)	E	E					S	S	S	X	X		
0.10µF (104)	E	E					S	S	S	X	X		
0.12µF (124)							S	S	X				
0.15µF (154)							S	S	X				
0.18µF (184)							S	S	X				
0.22µF (224)							S	S	X	X			
0.27µF (274)							X	X	X				
0.33µF (334)							X	X	X				
0.39µF (394)							X	X	X				
0.47µF (474)							X	X	X				
0.56µF (564)							X	X					
0.68µF (684)							X	X					
0.82µF (824)							X	X					
1.0µF (105)							X	X	X				

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 0805

Table 2-C

SIZE	0805										
	VDC (V)	10	16	25	50	100	200	250	500	630	1K
100pF (101)	D	D	D	D	D	D	D	D	B	B	B
120pF (121)	D	D	D	D	D	D	D	D	B	B	B
150pF (151)	D	D	D	D	D	D	D	D	B	B	B
180pF (181)	D	D	D	D	D	D	D	D	B	B	B
220pF (221)	D	D	D	D	D	D	D	D	B	B	B
270pF (271)	D	D	D	D	D	D	D	D	B	B	B
330pF (331)	D	D	D	D	D	D	D	D	B	B	B
390pF (391)	D	D	D	D	D	D	D	D	B	B	B
470pF (471)	D	D	D	D	D	D	D	D	B	B	B
560pF (561)	D	D	D	D	D	D	D	D	B	B	B

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 0805

Table 2-D

SIZE	0805										
	VDC (V)	10	16	25	50	100	200	250	500	630	1000
680pF (681)	D	D	D	D	D	D	D	D	B	B	B
820pF (821)	D	D	D	D	D	D	D	D	B	B	B
1,000pF (102)	D	D	D	D	D	D	D	D	B	B	B
1,200pF (122)	D	D	D	D	D	D	D	D	B	B	B
1,500pF (152)	D	D	D	D	D	D	D	D	B	B	D
1,800pF (182)	D	D	D	D	D	D	D	D	B	B	D
2,200pF (222)	D	D	D	D	D	D	D	D	B	B	D
2,700pF (272)	D	D	D	D	D	D	D	D	B	B	
3,300pF (332)	D	D	D	D	D	D	D	D	B	B	
3,900pF (392)	D	D	D	D	D	D	D	D	B	B	
4,700pF (472)	D	D	D	D	D	D	D	D	D	D	
5,600pF (562)	D	D	D	D	D	D	D	D	D	D	
6,800pF (682)	D	D	D	D	D	D	D	D	D	D	
8,200pF (822)	D	D	D	D	D	D	D	D	D	D	
0.010μF (103)	D	D	D	D	D	D	D	D	D	D	
0.012μF (123)	D	D	D	D	D	D	D	D	D	D	
0.015μF (153)	D	D	D	D	D	D	D	D	D	D	
0.018μF (183)	D	D	D	D	D	D	D	D	D	D	
0.022μF (223)	D	D	D	D	D	D	D	D	D	D	
0.027μF (273)	D	D	D	D	D	D	D	D	D	D	
0.033μF (333)	D	D	D	D	D	D	D	D	D		
0.039μF (393)	D	D	D	D	D	D	D	D			
0.047μF (473)	D	D	D	D	D	D	D	D			
0.056μF (563)	D	D	D	D	D	D	D	D			
0.068μF (683)	D	D	D	D	D	D	D	D			
0.082μF (823)	D	D	D	D	D	D	D				
0.10μF (104)	D	D	D	D	D	D	D				
0.12μF (124)	D	D	D	D	I						
0.15μF (154)	D	D	D	D	I						
0.18μF (184)	D	D	D	D	I						
0.22μF (224)	D	D	D	D	I						
0.27μF (274)	I	I	I	I							
0.33μF (334)	I	I	I	I							

CAPACITANCE RANGE –X7R DIELECTRIC SIZE 0805

Table 2-E

SIZE	0805										
	VDC (V)	10	16	25	50	100	200	250	500	630	1K
0.39µF (394)	I	I	I	I							
0.47µF (474)	I	I	I	I							
0.56µF (564)	I	I	I								
0.68µF (684)	I	I	I								
0.82µF (824)	I	I	I								
1.0µF (105)	I	I	I	I							
1.5µF (155)	I	I	I								
2.2µF (225)	I	I	I								
4.7µF (475)	I	I	I								

CAPACITANCE RANGE – X7R DIELECTRIC ZSIZE 1206

Table 2-F

SIZE	1206														
	VDC (V)	10	16	25	50	100	200	250	400	450	500	630	1K	1.5K	2K
100pF (101)							D	D			D	D	D	D	D
120pF (121)							D	D			D	D	D	D	D
150pF (151)	D	D	D	D	D	D	D	D			D	D	D	D	D
180pF (181)	D	D	D	D	D	D	D	D			D	D	D	D	D
220pF (221)	D	D	D	D	D	D	D	D			D	D	D	D	D
270pF (271)	D	D	D	D	D	D	D	D			D	D	D	D	D
330pF (331)	D	D	D	D	D	D	D	D			D	D	D	D	D
390pF (391)	D	D	D	D	D	D	D	D			D	D	D	D	D
470pF (471)	D	D	D	D	D	D	D	D			D	D	D	D	D
560pF (561)	D	D	D	D	D	D	D	D			D	D	D	D	D
680pF (681)	D	D	D	D	D	D	D	D			D	D	D	D	D
820pF (821)	D	D	D	D	D	D	D	D			D	D	D	G	G
1,000pF (102)	D	D	D	D	D	D	D	D			D	D	D	G	G
1,200pF (122)	D	D	D	D	D	D	D	D			D	D	D	G	G
1,500pF (152)	D	D	D	D	D	D	D	D			D	D	D	G	G
1,800pF (182)	D	D	D	D	D	D	D	D			D	D	D	G	G

CAPACITANCE RANGE –X7R DIELECTRIC SIZE 1206

Table 2-G

SIZE	1206													
VDC (V)	10	16	25	50	100	200	250	400	450	500	630	1K	1.5K	2K
2,200pF (222)	D	D	D	D	D	D	D			D	D	D	G	G
2,700pF (272)	D	D	D	D	D	D	D			D	D	D	G	G
3,300pF (332)	D	D	D	D	D	D	D			D	D	D	G	G
3,900pF (392)	D	D	D	D	D	D	D			D	D	D	G	
4,700pF (472)	D	D	D	D	D	D	D			D	D	D	G	
5,600pF (562)	D	D	D	D	D	D	D			D	D	D	G	
6,800pF (682)	D	D	D	D	D	D	D			D	D	D	G	
8,200pF (822)	D	D	D	D	D	D	D			D	D	D	G	
0.010μF (103)	D	D	D	D	D	D	D			D	D	D	G	
0.012μF (123)	D	D	D	D	D	D	D			D	D	G		
0.015μF (153)	D	D	D	D	D	D	D			D	D	G		
0.018μF (183)	D	D	D	D	D	D	D			D	D			
0.022μF (223)	D	D	D	D	D	D	D			G	G			
0.027μF (273)	D	D	D	D	D	D	D			G	G			
0.033μF (333)	D	D	D	D	D	G	G			G	G			
0.039μF (393)	D	D	D	D	D	G	G			G	G			
0.047μF (473)	D	D	D	D	D	G	G			G	G			
0.056μF (563)	D	D	D	D	D	G	G			G	G			
0.068μF (683)	D	D	D	D	D	G	G	G	G					
0.082μF (823)	D	D	D	D	D	G	G	G	G					
0.10μF (104)	D	D	D	D	D	G	G	G	G					
0.12μF (124)	D	D	D	D	D									
0.15μF (154)	C	C	C	C	G									

CAPACITANCE RANGE –X7R DIELECTRIC SIZE 1206

Table 2-H

SIZE	1206													
VDC (V)	10	16	25	50	100	200	250	400	450	500	630	1K	1.5K	2K
0.18µF (184)	C	C	C	C	G									
0.22µF (224)	C	C	C	C	G									
0.27µF (274)	C	C	C	D	G									
0.33µF (334)	C	C	C	D	G									
0.39µF (394)	C	C	J	P	G									
0.47µF (474)	J	J	J	P	G									
0.56µF (564)	J	J	J	P	P									
0.68µF (684)	J	J	J	P	P									
0.82µF (824)	J	J	J	P	P									
1.0µF (105)	J	J	J	P	P									
1.5µF (155)	J	J	P	P	P									
2.2µF (225)	J	J	P	P	P									
3.3µF (335)	P	P	P											
4.7µF (475)	P	P	P											
10µF (106)	P	P	P											
22µF (226)	P													

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 1210

Table 2-I

SIZE	1210													
VDC (V)	10	16	25	50	100	200	250	400	450	500	630	1K	1.5K	2K
100pF (101)										D	D	D	D	D
120pF (121)										D	D	D	D	D
150pF (151)										D	D	D	D	D
180pF (181)										D	D	D	D	D
220pF (221)										D	D	D	D	D
270pF (271)										D	D	D	D	D
330pF (331)										D	D	D	D	D

CAPACITANCE RANGE –X7R DIELECTRIC SIZE 1210

Table 2-J

SIZE	1210													
VDC (V)	10	16	25	50	100	200	250	400	450	500	630	1K	1.5K	2K
390pF (391)										D	D	D	D	D
470pF (471)										D	D	D	D	D
560pF (561)										D	D	D	D	D
680pF (681)										D	D	D	D	D
820pF (821)										D	D	D	D	D
1,000pF (102)	C	C	C	C	C	C	C			D	D	D	D	D
1,200pF (122)	C	C	C	C	C	C	C			D	D	D	M	M
1,500pF (152)	C	C	C	C	C	C	C			D	D	D	M	M
1,800pF (182)	C	C	C	C	C	C	C			D	D	D	M	M
2,200pF (222)	C	C	C	C	C	C	C			D	D	D	M	M
2,700pF (272)	C	C	C	C	C	C	C			D	D	D	M	M
3,300pF (332)	C	C	C	C	C	C	C			D	D	D	M	M
3,900pF (392)	C	C	C	C	C	C	C			D	D	G	M	M
4,700pF (472)	C	C	C	C	C	C	C			D	D	G	M	M
5,600pF (562)	C	C	C	C	C	C	C			D	D	G	M	M
6,800pF (682)	C	C	C	C	C	C	C			D	D	G	M	M
8,200pF (822)	C	C	C	C	C	C	C			D	D	G	M	M
0.010µF (103)	C	C	C	C	C	C	C			D	D	G		
0.012µF (123)	C	C	C	C	C	C	C			D	D	G		
0.015µF (153)	C	C	C	C	C	C	C			D	D	G		
0.018µF (183)	C	C	C	C	C	C	C			D	D	G		
0.022µF (223)	C	C	C	C	C	C	C			D	D	G		
0.027µF (273)	C	C	C	C	C	C	C			G	G	G		

CAPACITANCE RANGE –X7R DIELECTRIC SIZE 1210

Table 2-J

SIZE	1210													
VDC (V)	6.3	10	16	25	50	100	200	250	400	450	500	630	1K	1.5K
0.033μF (333)		C	C	C	C	C	C	C			G	G	G	
0.039μF (393)		C	C	C	C	C	C	C			G	G	K	
0.047μF (473)		C	C	C	C	C	D	D			G	G	M	
0.056μF (563)		C	C	C	C	C	D	D			G	G		
0.068μF (683)		C	C	C	C	C	G	G			K	K		
0.082μF (823)		C	C	C	C	C	G	G			K	K		
0.10μF (104)		C	C	C	C	C	G	G			K	K		
0.12μF (124)		C	C	C	C	C	G	G	M	M				
0.15μF (154)		C	C	C	C	D	M	M	M	M				
0.18μF (184)		C	C	C	C	D	M	M	M	M				
0.22μF (224)		C	C	C	C	D	M	M	M	M				
0.27μF (274)		C	C	C	C	G	M	M	M	M				
0.33μF (334)		C	C	C	D	G	M	M	M	M				
0.39μF (394)		C	C	C	D	M	M	M						
0.47μF (474)		C	C	C	D	M	M	M						
0.56μF (564)		D	D	D	D	M	M	M						
0.68μF (684)		D	D	D	D	K	M	M						
0.82μF (824)		D	D	D	D	K								
1.0μF (105)		D	D	D	D	K								
1.5μF (155)			K	G	M	M								
2.2μF (225)			K	G	M	M								
3.3μF (335)			K	G	M									
4.7μF (475)		K	K	K	M	M								
10μF (106)		K	K	M	M									
22μF (226)			M											
47μF (476)	M													

CAPACITANCE RANGE –X7R DIELECTRIC SIZE 1808

Table 2-K

SIZE	1808					
VDC (V)	500	630	1K	1.5K	2K	3K
150pF (151)	D	D	D	D	D	D
180pF (181)	D	D	D	D	D	D
220pF (221)	D	D	D	D	D	D
270pF (271)	D	D	D	D	D	D
330pF (331)	D	D	D	D	D	K
390pF (391)	D	D	D	D	D	K
470pF (471)	D	D	D	D	D	K
560pF (561)	D	D	D	D	D	K
680pF (681)	D	D	D	D	D	K
820pF (821)	D	D	D	D	D	K
1,000pF (102)	D	D	D	K	K	K
1,200pF (122)	D	D	D	K	K	K
1,500pF (152)	D	D	D	K	K	K
1,800pF (182)	D	D	D	K	K	K
2,200pF (222)	D	D	D	K	K	
2,700pF (272)	D	D	D	K	K	
3,300pF (332)	D	D	D	K	K	
3,900pF (392)	D	D	D	K	K	
4,700pF (472)	D	D	D	K	K	
5,600pF (562)	K	K	K	K	K	
6,800pF (682)	K	K	K	K	K	
8,200pF (822)	K	K	K			
0.010μF (103)	K	K	K			
0.012μF (123)	K	K	K			
0.015μF (153)	K	K	K			
0.018μF (183)	K	K	K			
0.022μF (223)	K	K	K			
0.027μF (273)	K	K	K			
0.033μF (333)	K	K	K			

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 1808

Table 2-L

SIZE	1808					
VDC (V)	500	630	1K	1.5K	2K	3K
0.039µF (393)	K	K	K			
0.047µF (473)	K	K	K			
0.056µF (563)	K	K	K			
0.068µF (683)	K	K				
0.082µF (823)	K	K				

CAPACITANCE RANGE –X7R DIELECTRIC SIZE 1812

Table 2-M

SIZE	1812												
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K	3K
270pF (271)						D	D	D	D	D	D	D	K
330pF (331)						D	D	D	D	D	D	D	K
390pF (391)						D	D	D	D	D	D	D	K
470pF (471)						D	D	D	D	D	D	D	K
560pF (561)						D	D	D	D	D	D	D	K
680pF (681)						D	D	D	D	D	D	D	K
820pF (821)						D	D	D	D	D	D	D	K
1,000pF (102)	D	D	D	D	D	D	D	D	D	D	D	D	K
1,200pF (122)	D	D	D	D	D	D	D	D	D	D	D	D	K
1,500pF (152)	D	D	D	D	D	D	D	D	D	D	D	D	K
1,800pF (182)	D	D	D	D	D	D	D	D	D	D	G	G	M
2,200pF (222)	D	D	D	D	D	D	D	D	D	D	G	G	M
2,700pF (272)	D	D	D	D	D	D	D	D	D	D	G	G	M
3,300pF (332)	D	D	D	D	D	D	D	D	D	D	K	K	M
3,900pF (392)	D	D	D	D	D	D	D	D	D	D	K	K	M
4,700pF (472)	D	D	D	D	D	D	D	D	D	D	K	K	M
5,600pF (562)	D	D	D	D	D	D	D	D	D	D	M	M	M
6,800pF (682)	D	D	D	D	D	D	D	D	D	D	M	M	M

CAPACITANCE RANGE –X7R DIELECTRIC SIZE 1812

Table 2-N

SIZE	1812												
VDC (V)	10	16	25	50	100	200	250	500	630	1K	1.5K	2K	3K
8,200pF (822)	D	D	D	D	D	D	D	D	D	D	M	M	
0.010µF (103)	D	D	D	D	D	D	D	D	D	D	M	M	
0.012µF (123)	D	D	D	D	D	D	D	D	D	K			
0.015µF (153)	D	D	D	D	D	D	D	D	D	K			
0.018µF (183)	D	D	D	D	D	D	D	D	D	M			
0.022µF (223)	D	D	D	D	D	D	D	D	D	M			
0.027µF (273)	D	D	D	D	D	D	D	D	D	M			
0.033µF (333)	D	D	D	D	D	D	D	D	D	M			
0.039µF (393)	D	D	D	D	D	D	D	D	D	M			
0.047µF (473)	D	D	D	D	D	D	D	D	D	M			
0.056µF (563)	D	D	D	D	D	D	D	K	K	M			
0.068µF (683)	D	D	D	D	D	D	D	K	K	M			
0.082µF (823)	D	D	D	D	D	D	D	K	K	M			
0.10µF (104)	D	D	D	D	D	D	D	K	K	M			
0.12µF (124)	D	D	D	D	D	D	D	M	M				
0.15µF (154)	D	D	D	D	D	K	K	M	M				
0.18µF (184)	D	D	D	D	D	K	K	M	M				
0.22µF (224)	D	D	D	D	D	K	K	M	M				
0.27µF (274)	D	D	D	D	D	K	K	M					
0.33µF (334)	D	D	D	D	D	K	K	M					
0.39µF (394)	D	D	D	D	D	K	K	M					
0.47µF (474)	D	D	D	D	K	K	K	M					
0.56µF (564)	D	D	D	D	K	M	M						
0.68µF (684)	D	D	D	K	K	M	M						
0.82µF (824)	D	D	D	K	K	M	M						
1.0µF (105)	D	D	D	K	K	M	M						
1.5µF (155)					K								
2.2µF (225)				M	M								

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 1825

Table 2-O

SIZE	1825					
VDC (V)	250	500	630	1K	2K	3K
1,000pF (102)	K	K	K	K	K	K
1,200pF (122)	K	K	K	K	K	K
1,500pF (152)	K	K	K	K	K	K
1,800pF (182)	K	K	K	K	K	K
2,200pF (222)	K	K	K	K	K	K
2,700pF (272)	K	K	K	K	K	K
3,300pF (332)	K	K	K	K	K	K
3,900pF (392)	K	K	K	K	K	K
4,700pF (472)	K	K	K	K	K	K
5,600pF (562)	K	K	K	K	K	M
6,800pF (682)	K	K	K	K	K	M
8,200pF (822)	K	K	K	K	K	M
0.010μF (103)	K	K	K	K	K	M
0.012μF (123)	K	K	K	K	M	U
0.015μF (153)	K	K	K	K	M	U
0.018μF (183)	K	K	K	K	M	U
0.022μF (223)	K	K	K	K	M	
0.027μF (273)	K	K	K	K	U	
0.033μF (333)	K	K	K	K	U	
0.039μF (393)	K	K	K	K	U	
0.047μF (473)	K	K	K	K	U	
0.056μF (563)	K	K	K	K		
0.068μF (683)	K	K	K	K		
0.082μF (823)	K	K	K	M		
0.10μF (104)	K	K	K	M		
0.12μF (124)	K	K	K			
0.15μF (154)	K	K	K			
0.18μF (184)	K	K	K			
0.22μF (224)	K	K	K			

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 1825

Table 2-P

SIZE	1825					
VDC (V)	250	500	630	1K	2K	3K
0.27µF (274)	K	K	K			
0.33 µF (334)	K	K	K			
0.39µF (394)	K	K	K			
0.47µF (474)	K	K	K			
0.56µF (564)	K	M	M			
0.68µF (684)	K					
0.82µF (824)	K					
1.0µF (105)	K					

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 2220

Table 2-Q

SIZE	2220									
VDC (V)	25	50	100	250	500	630	1K	1.5K	2K	3K
1,000pF (102)	K	K	K	K	K	K	K	K	K	K
1,200pF (122)	K	K	K	K	K	K	K	K	K	K
1,500pF (152)	K	K	K	K	K	K	K	K	K	K
1,800pF (182)	K	K	K	K	K	K	K	K	K	K
2,200pF (222)	K	K	K	K	K	K	K	K	K	K
2,700pF (272)	K	K	K	K	K	K	K	K	K	K
3,300pF (332)	K	K	K	K	K	K	K	K	K	K
3,900pF (392)	K	K	K	K	K	K	K	K	K	K
4,700pF (472)	K	K	K	K	K	K	K	K	K	K
5,600pF (562)	K	K	K	K	K	K	K	K	K	K
6,800pF (682)	K	K	K	K	K	K	K	K	K	M
8,200pF (822)	K	K	K	K	K	K	K	M	M	M
0.010µF (103)	K	K	K	K	K	K	K	M	M	M
0.012µF (123)	K	K	K	K	K	K	K	M	M	U
0.015µF (153)	K	K	K	K	K	K	K	M	M	U
0.018µF (183)	K	K	K	K	K	K	K	U	U	U

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 2220

Table 2-R

SIZE	2220									
VDC (V)	25	50	100	250	500	630	1K	1.5K	2K	3K
0.022μF (223)	K	K	K	K	K	K	K	U	U	
0.027μF (273)	K	K	K	K	K	K	K	U	U	
0.033μF (333)	K	K	K	K	K	K	K	U	U	
0.039μF (393)	K	K	K	K	K	K	K	U	U	
0.047μF (473)	K	K	K	K	K	K	K	U	U	
0.056μF (563)	K	K	K	K	K	K	K	U	U	
0.068μF (683)	K	K	K	K	K	K	K			
0.082μF (823)	K	K	K	K	K	K	K			
0.10μF (104)	K	K	K	K	K	K	K			
0.12μF (124)	K	K	K	K	K	K	M			
0.15μF (154)		K	K	K	K	K	U			
0.18μF (184)	K	K	K	K	K	K	U			
0.22μF (224)	K	K	K	K	K	K	U			
0.27μF (274)	K	K	K	K	K	K				
0.33μF (334)	K	K	K	K	K	K				
0.39μF (394)	K	K	K	K	K	K				
0.47μF (474)	K	K	K	K	K	K				
0.56μF (564)	K	K	K	K	M	M				
0.68μF (684)	K	K	K	K	M	M				
0.82μF (824)	K	K	K	K	U	U				
1.0μF (105)	K	K	K	K	U	U				
1.5μF (155)	K	K	K	M						
2.2μF (225)	K	K	K	M						
3.3μF (335)		K	K							
4.7μF (475)		K	M							
6.8μF (685)		M	U							
10μF (106)		U	U							

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 2225

Table 2-S

SIZE	2225					
VDC (V)	500	630	1K	1.5K	2K	3K
1,000pF (102)	K	K	K	K	K	K
1,200pF (122)	K	K	K	K	K	K
1,500pF (152)	K	K	K	K	K	K
1,800pF (182)	K	K	K	K	K	K
2,200pF (222)	K	K	K	K	K	K
2,700pF (272)	K	K	K	K	K	K
3,300pF (332)	K	K	K	K	K	K
3,900pF (392)	K	K	K	K	K	K
4,700pF (472)	K	K	K	K	K	K
5,600pF (562)	K	K	K	K	K	M
6,800pF (682)	K	K	K	K	K	M
8,200pF (822)	K	K	K	K	K	M
0.010μF (103)	K	K	K	K	K	M
0.012μF (123)	K	K	K	M	M	M
0.015μF (153)	K	K	K	M	M	M
0.018μF (183)	K	K	K	M	M	U
0.022μF (223)	K	K	K	M	M	
0.027μF (273)	K	K	K	M	M	
0.033μF (333)	K	K	K	M	M	
0.039μF (393)	K	K	K	M	U	
0.047μF (473)	K	K	K	M	U	
0.056μF (563)	K	K	K	M	U	
0.068μF (683)	K	K	K	M		
0.082μF (823)	K	K	K	M		
0.10μF (104)	K	K	K	M		
0.12μF (124)	K	K	U			
0.15μF (154)	K	K	U			
0.18μF (184)	K	K	U			
0.22μF (224)	K	K	U			

CAPACITANCE RANGE – X7R DIELECTRIC SIZE 2225

Table 2-T

SIZE	2225					
VDC (V)	500	630	1K	1.5K	2K	3K
0.27µF (274)	K	K				
0.33µF (334)	K	K				
0.39µF (394)	K	K				
0.47µF (474)	K	K				
0.56µF (564)	K	K				

CAPACITANCE RANGE –X5R DIELECTRIC SIZE 0402, 0603, 0805

Table 3-A

SIZE	0402				0603					0805				
VDC (V)	6.3	10	16	25	6.3	10	16	25	50	6.3	10	16	25	50
0.033µF (333)			E											
0.047µF (473)			E											
0.068µF (683)		E	E											
0.10µF (104)	E	E	E	E										
0.15µF (154)	E	E	E	E										
0.22µF (224)	E	E	E	E			X	X						
0.33µF (334)	E	E			X	X	X	X						
0.47µF (474)	E	E				X	X	X						
0.68µF (684)	E	E			X	X	X	X						
1.0µF (105)					X	X	X	X						
1.5µF (155)					X					I	I	I	I	
2.2µF (225)					X	X	X			I	I	I	I	
3.3µF (335)					X					I	I	I	I	
4.7µF (475)					X									

CAPACITANCE RANGE –X5R DIELECTRIC SIZE 1206, 1210

Table 3- B

SIZE	1206					1210				
VDC (V)	6.3	10	16	25	50	6.3	10	16	25	50
1.5μF (155)		J	J				K	K		
2.2μF (225)		J	J	P			K	K		
3.3μF (335)		P	P	P						
4.7μF (475)	P	P	P	P			K	K	K	
6.8uF (685)	P	P								
10μF (106)	P	P	P	P		K	K	K		

CAPACITANCE RANGE – Y5V DIELECTRIC SIZE 0402, 0603

Table 4

SIZE	0402					0603			
VDC (V)	6.3	10	16	25	50	10	16	25	50
0.010μF (103)		E	E	E	E	S	S	S	S
0.015μF (153)		E	E	E	E	S	S	S	S
0.022μF (223)		E	E	E	E	S	S	S	S
0.033μF (333)		E	E	E	E	S	S	S	S
0.047μF (473)		E	E	E		S	S	S	S
0.068μF (683)		E	E	E		S	S	S	S
0.10μF (104)		E	E	E		S	S	S	S
0.15μF (154)		E				S	S	S	S
0.22μF (224)	E	E				S	S	S	S
0.33μF (334)	E	E				S	S	S	
0.47μF (474)						S	S		
0.68μF (684)						S	X		
1.0μF (105)						S	X		
2.2μF (225)						S			

Note: The letter in cell is expressed the symbol of product thickness.

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

ITEM	TEST CONDITION	REQUIREMENTS
Visual and Mechanical	-	<ul style="list-style-type: none"> * No remarkable defect. * Dimensions to conform to individual spec. sheet.
Capacitance	<p>Class I: (NP0)</p> <p>$\leq 1000\mu\text{F}$, $1.0 \pm 0.2\text{Vrms}$, $1\text{MHz} \pm 10\%$</p> <p>$> 1000\mu\text{F}$, $1.0 \pm 0.2\text{Vrms}$, $1\text{KHz} \pm 10\%$</p> <p>Class II: (X7R, X7E, X6S, X5R, X7S, Y5V)</p> <p>$C \leq 10\mu\text{F}$, $1.0 \pm 0.2\text{Vrms}$, $1\text{KHz} \pm 10\%$</p> <p>** $C > 10\mu\text{F}$, $0.5 \pm 0.2\text{Vrms}$, $120\text{Hz} \pm 20\%$</p> <p>** Test condition: $0.5 \pm 0.2\text{Vrms}$, $1\text{KHz} \pm 10\%$</p> <p>X7R: 0603/475(6.3V)</p> <p>X5R: 0201 ≥ 224 (6.3V, 10V, 16V) #1, 0402 ≥ 475 (6.3V, 16V), 0402 ≥ 225(10V), 0603=106 (6.3V)</p> <p>TT18X ≥ 475(10V) , TT15X series</p> <p>X6S: 0201/474(4V), 0201 > 104 (6.3V, 10V) , 0402 ≥ 225 (6.3V), 0402/475 (10V), 0603/106 (6.3V),</p> <p>X7S: 0402/225(6.3V)</p> <p>#1 Excluding X5R/0201/105(6.3V); 225(10V), 0402X475M6R3 ($1.0 \pm 0.2\text{Vrms}$, $1\text{KHz} \pm 10\%$)</p> <p>* Before initial measurement (Class II only):</p> <p>To apply de-aging at 150°C for 1hr for 24 ± 2 hrs at room temp.</p>	<ul style="list-style-type: none"> * Shall not exceed the limits given in the detailed spec. <p>NP0:</p> <p>Cap $\geq 30\mu\text{F}$, $Q \geq 1000$;</p> <p>Cap $< 30\mu\text{F}$, $Q \geq 400 + 20C$</p> <p>X7R, X5R, X6S, X7S:</p> <p>See <Table 5></p> <p>Y5V: See <Table 7></p>
Q/D.F (Dissipation Factor)		
Dielectric Strength	<p>*To apply voltage:</p> <p>$\leq 100\text{V}$: 250% of rated voltage.</p> <p>200V ~ 300V: 200% of rated voltage.</p> <p>400V ~ 450V: 120% of rated voltage.</p> <p>500V ~ 999V: 150% of rated voltage.</p> <p>1000V ~ 3000V: 120% of rated voltage.</p> <p>4000V: 110% of rated voltage.</p> <p>*Duration: 1 to 5 sec.</p> <p>*Charge & discharge current less than 50mA.</p>	<ul style="list-style-type: none"> * No evidence of damage or flash over during test.

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

ITEM	TEST CONDITION	REQUIREMENTS
Temperature Coefficient	<p>With no electrical load. @Opertating Temp. Range</p> <p>NP0/X7R/X7S: @ -55~125° C at 25° C;</p> <p>X5R: -55~ 85° C at 25° C;</p> <p>X6S: -55~105° C at 25° C;</p> <p>Y5V: -25~ 85° C at 20° C</p> <p>* Before initial measurement (Class II only): To apply de-aging at 150° C for 1hr then set for 24±2 hrs at room temp.</p> <p>* Measurement voltage for Class II: See <Table 10></p>	<p>NP0: Within ±30ppm/° C</p> <p>X7R: Within ±15%</p> <p>X7S: Within ±22%</p> <p>X5R: Within ±15%</p> <p>X6S: Within ±22%</p> <p>Y5V: : Within +30%/-80%</p>
Adhesive Strength of Termination	<p>*Pressurizing force: 2N (0201) and 5N (≤0603) and 10N (>0603);</p> <p>* Test time: 10±1 sec.</p>	<p>* No remarkable damage or removal of the terminations.</p>
Vibration Resistance	<p>Vibration frequency: 10~55 Hz/min.</p> <p>* Total amplitude: 1.5mm</p> <p>* Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)</p> <p>* Before initial measurement (Class II only):</p> <p>To apply de-aging at 150° C for 1hr then set for 24±2 hrs at room temp. * Cap./DF(Q) Measurement to be made after de-aging a 150° C for 1hr then set for 24±2 hrs at room temp.</p>	<p>* No remarkable damage.</p> <p>* Cap change and Q/D.F.: To meet initial spec.</p>
Bending Test	<p>* The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 5 mm and then the pressure shall be maintained for 5±1 sec.</p> <p>*Before initial measurement (Class II only):</p> <p>To apply de-aging at 150° C for 1hr then set for 24±2 hrs at room temp.</p> <p>Measurement to be made after keeping at room temp. for 24±2 hrs.</p>	<p>* No remarkable damage.</p> <p>* Cap change: NP0: within ±5% or 0.5pF whichever is larger; X7R, X5R, X6S,X7S: 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.)</p>

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

ITEM	TEST CONDITION	REQUIREMENTS
Resistance to Soldering Heat	<ul style="list-style-type: none"> * Solder temperature: $260 \pm 5^{\circ} \text{C}$ * Dipping time: $10 \pm 1 \text{ sec}$ * Preheating: $120 \text{ to } 150^{\circ} \text{C}$ for 1 minute before immerse the capacitor in a eutectic solder. * Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for $24 \pm 2 \text{ hrs}$ at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for $24 \pm 2 \text{ hrs}$ at room 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NP0: within $\pm 2.5\%$ or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within $\pm 7.5\%$ Y5V: within $\pm 20\%$ * Q/D.F., I.R. and dielectric strength: To meet initial requirements. * 25% max. leaching on each edge.
Temperature Cycle	<ul style="list-style-type: none"> *Conduct the five cycles according to the temperatures and time. Time (min.): $30 \pm 3 @ \text{Min. operating temp.} +0/-3^{\circ} \text{C}$ Time (min.): $2 \sim 3 @ \text{Room temperture}$ Time (min.): $30 \pm 3 @ \text{Max. operating temp.} +3/-0^{\circ} \text{C}$ Time (min.): $2 \sim 3 @ \text{Room temperture}$ * Before initial measurement (Class II only): Perform 150°C for 1 hr and then set for $24 \pm 2 \text{ hrs}$ at room temp. * Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for $24 \pm 2 \text{ hrs}$ at room. 	<ul style="list-style-type: none"> * No remarkable damage. * Cap change: NP0: within $\pm 2.5\%$ or 0.25pF whichever is larger X7R, X5R, X6S, X7S: within $\pm 7.5\%$ Y5V: within $\pm 20\%$ * Q/D.F., I.R. and dielectric strength: To meet initial requirements.
Solderability	<ul style="list-style-type: none"> * Solder temperature: $235 \pm 5^{\circ} \text{C}$ * Dipping time: $2 \pm 0.5 \text{ sec}$. 	75% min. coverage of all metalized area

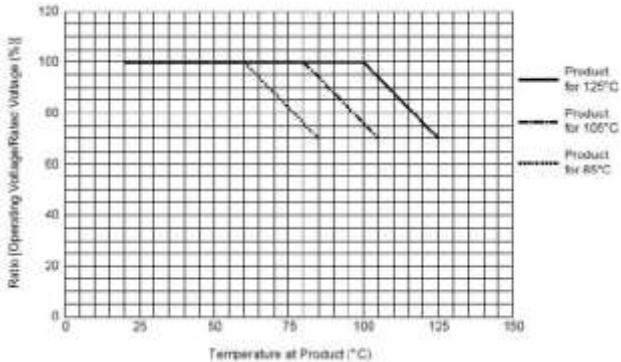
RELIABILITY TEST CONDITIONS AND REQUIREMENTS

ITEM	TEST CONDITION	REQUIREMENTS
Humidity (Damp Heat) Steady State	<p>* Test temp.: $40 \pm 2^\circ \text{C}$</p> <p>* Humidity: 90~95% RH</p> <p>* Test time: 500+24/-0hrs.</p> <p>* Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp.</p> <p>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp.</p>	<p>* No remarkable damage.</p> <p>* Cap change: NP0: within $\pm 5\%$ or 0.5pF whichever is larger X7R, X5R, X6S, X7S: $\geq 10\text{V}^{**}$, within $\pm 12.5\%$; $\leq 6.3\text{V}$ within $\pm 25\%$; TT series & C\geq 1uF, within $\pm 25\%$ ** 10V: 0603 $\geq 4.7\mu\text{F}$; 0402 $\geq 1\mu\text{F}$; 0201 $\geq 0.1\mu\text{F}$, within $\pm 25\%$; Y5V: $\geq 10\text{V}$, within $\pm 30\%$; $\leq 6.3\text{V}$, within +30/-40%</p> <p>* Q/D.F. value: NP0: More than 30pF $Q \geq 350$, $10\text{pF} \leq C \leq 30\text{pF}$, $Q \geq 275 + 2.5C$ Less than 10pF $Q \geq 200 + 10C$ X7R, X5R, X6S, X7S: See <Table 6> Y5V: See <Table 8></p> <p>*I.R.: $\geq 10\text{V}$, $1\text{G}\Omega$ or $50 \Omega\text{-F}$ whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) See <Table 11></p>
Insulation Resistance	<p>*Test temp.: Room Temperature.</p> <p>*To apply rated voltage for MAX. 120sec.</p> <p>Rated voltage: 200~630V: To apply rated voltage (500V max.) for 60 sec.</p> <p>Rated voltage: >630V: To apply 500V for 60 sec</p>	<p>$10\text{G}\Omega$ or $\text{RxC} \geq 500\Omega\text{-F}$ whichever is smaller.</p> <p>Class II (X7R, X7E, X5R, X6S, X7S, Y5V): $\geq 10\text{G}\Omega$ or $\text{RxC} \geq 100\Omega\text{-F}$ whichever is smaller. See <Table 9></p>

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

ITEM	TEST CONDITION	REQUIREMENTS
Humidity (Damp Heat) Load	<p>*Test temp.: $40 \pm 2^\circ \text{C}$</p> <p>* Humidity: 90~95%RH</p> <p>* Test time: 500+24/-0 hrs.</p> <p>* To apply voltage: Rated voltage (MAX. 500V)</p> <p>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp.</p> <p>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp.</p>	<p>* No remarkable damage.</p> <p>Cap change:</p> <p>NP0: $\pm 7.5\%$ or 0.75pF whichever is larger.</p> <p>X7R, X5R, X6S, X7S: $\geq 10V^{**}$, within $\pm 12.5\%$; $\leq 6.3V$ within $\pm 25\%$; TT series & $C \geq 1\mu\text{F}$, within $\pm 25\%$</p> <p>**10V: 0603 $4.7 \geq \mu\text{F}$; 0402 $\geq 1\mu\text{F}$; 0201 $\geq 0.1 \mu\text{F}$, within $\pm 25\%$; Y5V: $\geq 10V$, within $\pm 30\%$; $\leq 6.3V$, within +30/-40%</p> <p>Q/D.F. value: NP0: $C \geq 30\text{pF}$, $Q \geq 200$; $C < 30\text{pF}$, $Q \geq 100 + 10/3C$</p> <p>X7R, X5R, X6S, X7S: <i>See <Table 6></i></p> <p>Y5V: <i>See <Table 8></i></p> <p>* I.R.: $\geq 10V$, $500M\Omega$ or $25 \Omega\text{-F}$ whichever is smaller.</p> <p>Class II (X7R, X5R, X6S, X7S, Y5V) <i>See <Table 12></i></p>

RELIABILITY TEST CONDITIONS AND REQUIREMENTS

ITEM	TEST CONDITION	REQUIREMENTS
<p>High Temperature Load (Endurance)</p>	<p>Test temp.: NP0, X7R/X7E/X7S: $125 \pm 3^\circ \text{C}$ X6S: $105 \pm 3^\circ \text{C}$ X5R, Y5V: $85 \pm 3^\circ \text{C}$</p> <p>* Test time: 1000+24/-0 hrs.</p> <p>* To apply voltage:</p> <p>(1) 100% of rated voltage for below range <i>See <Table 13></i></p> <p>**1WV items must follow de-rating conditions.</p> <p>(2) 150% of rated voltage for below range. <i>See <Table 14></i></p> <p>(3) $\leq 6.3\text{V}$ or $C \geq 10\mu\text{F}$: 150% of rated voltage.</p> <p>(4) 10V~250V: 200% of rated voltage.</p> <p>(5) 400V~450V: 120% of rated voltage.</p> <p>(6) 500V: 150% of rated voltage.</p> <p>(7) 630V~3000V: 120% of rated voltage.</p> <p>(8) 4000V: 110% of rated voltage</p> <p>*Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp.</p> <p>* Cap. / DF(Q) / I.R. Measurement to be made after de-aging at 150°C for 1hr then set for 24 ± 2 hrs at room temp.</p> <p>** De-rating conditions:</p> 	<p>* No remarkable damage. Cap change:</p> <p>NP0: $\pm 3.0\%$ or $\pm 0.3\text{pF}$ whichever is larger</p> <p>X7R, X5R, X6S, X7S: $\geq 10\text{V}^{**}$, within $\pm 12.5\%$; $\leq 6.3\text{V}$ within $\pm 25\%$; TT series & $C \geq 1\mu\text{F}$, within $\pm 25\%$</p> <p>** 10V: 0603 $\geq 4.7\mu\text{F}$; 0402 $\geq 1\mu\text{F}$; 0201 $\geq 0.1\mu\text{F}$, within $\pm 25\%$;</p> <p>Y5V: $\geq 10\text{V}$, within $\pm 30\%$; $\leq 6.3\text{V}$, within +30/-40%</p> <p>Q/D.F. value:</p> <p>NP0: More than 30pF, $Q \geq 350$ $10\text{pF} \leq C < 30\text{pF}$, $Q \geq 275 + 2.5C$ Less than 10pF, $Q \geq 200 + 10C$</p> <p>X7R, X5R, X6S, X7S <i>See <Table 6></i></p> <p>Y5V: <i>See <Table 8></i></p> <p>*I.R.: $\geq 10\text{V}$, $1\text{G}\Omega$ or $50\Omega\text{-F}$ whichever is smaller. Class II (X7R, X5R, X6S, X7S, Y5V) <i>See <Table 11></i></p>

DISSIPATION FACTOR REQUIREMENT - X7R, X5R, X6S, X7S

Table 5

VOLTAGE	D.F. ≤	EXCEPTION OF D.F. ≤	
≥100V	≤ 2.5%	≤ 3%	1206 ≥ 0.47μF
		≤ 5%	0603 ≥ 0.068μF; 0805 > 0.1μF; 1206 ≥ 1μF; 1210 ≥ 2.2μF; TT series
		≤ 10%	0805 > 0.22μF; 1210 ≥ 3.3μF
50V	≤ 2.5%	≤ 3%	0201(50V); 0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF
		≤ 5%	0201 ≥ 0.01μF; 1210 ≥ 3.3μF
		≤ 10%	0402 ≥ 0.012μF; 0603 > 0.1μF; 0805 ≥ 1μF (0805/X7R > 0.47μF); 1206 ≥ 2.2μF; 1210 ≥ 10μF; TT series
		≤ 12.5%	1206/X5R = 10μF
35V	≤ 3.5%	≤ 10%	0603 ≥ 1μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF
25V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF (0201/X5R = 0.01μF); 0805 ≥ 1μF; 1210 ≥ 10μF*
		≤ 7%	0603 ≥ 0.33μF
		≤ 10%	0201 ≥ 0.1μF (0201/X5R > 0.01μF); 0603 ≥ 0.47μF; TT series; 0402 ≥ 0.10μF; (0402/X7R ≥ 0.056μF); 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF (1210/X5R ≥ 10μF)*
		≤ 12.5%	0402 ≥ 0.47μF; 0805/X5R/X6S = 10μF
16V	≤ 3.5%	≤ 5%	0201 ≥ 0.01μF (0201/X5R = 0.01μF); 0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
		≤ 10%	0201 ≥ 0.1μF (0201/X5R > 0.01μF; 0201/X7R ≥ 0.022μF); 0402 ≥ 0.22μF; 0603 > 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF; TT series
		≤ 12.5%	0402/X5R ≥ 1μF; 0402/X6S = 1μF; 0805/X5R/X6S = 10μF
10V	≤ 5.0%	≤ 10%	0201 ≥ 0.012μF; 0402 ≥ 0.22μF; 0603 ≥ 0.33μF; TT series; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF; 01R5/X5R
		≤ 12.5%	0805/X5R/X6S = 10μF
		≤ 15%	0201 ≥ 0.1μF (0201/X5R > 0.1μF); 0402 ≥ 1μF; 0603/X5R ≥ 10μF
6.3V	≤ 10%	≤ 15%	0201 ≥ 0.1μF (0201/X5R > 0.1μF); 0402 ≥ 1μF (0402/X6S ≥ 0.47μF); 0603 ≥ 10μF; 0805 ≥ 4.7μF; 1206 ≥ 47μF; 1210 ≥ 100μF; TT series
		≤ 20%	0402 ≥ 2.2μF
10/6/2024	≤ 15%	-	-

HUMIDITY (DAMP HEAT) STEADY STATE, (DAMP HEAT) LOAD AND HIGH TEMPERATURE LOAD

REQUIREMENT - X7R, X5R, X6S, X7S

Table 6

VOLTAGE	D.F. \leq	EXCEPTION OF D.F. \leq	
$\geq 100V$	$\leq 3\%$	$\leq 6\%$	1206 $\geq 0.47\mu F$
		$\leq 7.5\%$	0603 $\geq 0.068\mu F$; 0805 $> 0.1\mu F$; 1206 $\geq 1\mu F$; 1210 $\geq 2.2\mu F$; TT series
		$\leq 20\%$	0805 $> 0.22\mu F$; 1210 $\geq 3.3\mu F$
50V	$\leq 3\%$	$\leq 6\%$	0201(50V); 0603 $\geq 0.047\mu F$; 0805 $\geq 0.18\mu F$; 1206 $\geq 0.47\mu F$
		$\leq 10\%$	0201 $\geq 0.01\mu F$; 1210 $\geq 3.3\mu F$
		$\leq 20\%$	0402 $\geq 0.012\mu F$; 0603 $> 0.1\mu F$; 0805 $\geq 1\mu F$ (0805/X7R $> 0.47\mu F$); 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$; TT series
35V	$\leq 5\%$	$\leq 20\%$	0603 $\geq 1\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 10\mu F$
25V	$\leq 5\%$	$\leq 10\%$	0201 $\geq 0.01\mu F$ (0201/X5R = 0.01 μF); 0805 $\geq 1\mu F$; 1210 $\geq 10\mu F$ *
		$\leq 14\%$	0603 $\geq 0.33\mu F$
		$\leq 15\%$	0201 $\geq 0.1\mu F$ (0201/X5R $> 0.01\mu F$); 0603 $\geq 0.47\mu F$; TT series 0402 $\geq 0.10\mu F$ (0402/X7R $\geq 0.056\mu F$); 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$ (1210/X5R $\geq 10\mu F$) *
		$\leq 20\%$	0402 $\geq 0.47\mu F$;
16V	$\leq 5\%$	$\leq 10\%$	0603 $\geq 0.15\mu F$; 0805 $\geq 0.68\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 4.7\mu F$
		$\leq 15\%$	0201 $\geq 0.01\mu F$ (0201/X7R $\geq 0.022\mu F$); 0402 $\geq 0.033\mu F$; 0603 $> 0.47\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$; TT series
10V	$\leq 7.5\%$	$\leq 15\%$	0201 $\geq 0.012\mu F$; 0402 $\geq 0.22\mu F$; 0603 $\geq 0.33\mu F$; 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$; 1210 $\geq 22\mu F$
		$\leq 20\%$	0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$; 0603/X5R $\geq 10\mu F$; TT series; 01R5/X5R
6.3V	$\leq 15\%$	$\leq 30\%$	0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$ (0402/X6S $\geq 0.47\mu F$); 0603 $\geq 10\mu F$; 0805 $\geq 4.7\mu F$; 1206 $\geq 47\mu F$; 1210 $\geq 100\mu F$; TT series
4V	$\leq 20\%$	-	-

DISSIPATION FACTOR REQUIREMENT – Y5V

Table 7

VOLTAGE	D.F. ≤	EXCEPTION OF D.F. ≤	
≥50V	≤5%	≤7%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF; TT series
		≤12.5%	1210≥6.8μF
35V	≤7%	-	-
25V	≤5%	≤7%	0402≥0.047μF; 0603≥0.1μF; 0805≥0.33μF; 1206≥1μF; 1210≥4.7μF
		≤9%	0402≥0.068μF; 0603≥0.47μF; 1206≥4.7μF; 1210≥22μF; TT series
16V (C<1.0μF)	≤7%	≤9%	0402≥0.068μF; 0603≥0.68μF
		≤12.5%	0402≥0.22μF
16V (C≥1.0μF)	≤9%	≤12.5%	0603≥2.2μF; 0805≥3.3μF; 1206≥10μF; 1210≥22μF; 1812≥47μF; TT series
10V	≤12.5%	≤20%	0402≥0.47μF
6.3V	≤20%	-	-

HUMIDITY (DAMP HEAT) STEADY STATE, (DAMP HEAT) LOAD AND HIGH TEMPERATURE LOAD REQUIREMENT – Y5V

Table 8

VOLTAGE	D.F. ≤	EXCEPTION OF D.F. ≤	
≥50V	≤7.5%	≤10%	0603≥0.1μF; 0805≥0.47μF; 1206≥4.7μF
		≤20%	1210≥6.8μF
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
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
10V	≤20%	≤30%	0402≥0.47μF
6.3V	≤30%	-	-

INSULATION RESISTANCE REQUIREMENT - Class II (X7R, X7E, X5R,X6S,X7S,Y5V)

Table 9

RATED VOLTAGE	IR
100V: All X7R	10GΩ or $RxC \geq 100 \Omega\text{-F}$ whichever is smaller
50V: 0402 > 0.01μF; 0603 ≥ 1μF; 0805 ≥ 1μF; 1206 ≥ 4.7μF; 1210 ≥ 4.7μF	
35V: 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 10μF	
25V: 0402 ≥ 1μF; 0603 ≥ 2.2μF; 0805 ≥ 2.2μF; 1206 ≥ 10μF; 1210 ≥ 10μF	
16V: 0201 ≥ 0.1μF; 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 ; TT series; Size ≥ 1812	
All X6S items, All X7S items	
100V: 1210 ≥ 3.3μF	
50V: 0402 ≥ 0.1μF; 0603 ≥ 2.2μF; 0805 ≥ 10μF; 1206 ≥ 10μF	
35V: 0603 ≥ 1μF	
25V: 0201 ≥ 0.1μF; 0402 ≥ 0.22μF; 0603 ≥ 10μF; 0805 ≥ 10μF; 1206 ≥ 22μF	
16V: 0201 ≥ 0.22μF; 0402 ≥ 1μF; 0603 ≥ 10μF	
10V: 0201 > 0.1μF; 0402 ≥ 1μF; 0603 ≥ 10μF; 0805 ≥ 47μF; TT21 > 4.7μF	
6.3V: 0201 ≥ 0.1μF; 0402 ≥ 1μF; 0603 > 4.7μF; 0805 ≥ 47μF; 1206 ≥ 10μF;	
4V: 0603 ≥ 22μF; 0805 ≥ 47μF; 1206 ≥ 100μF	

TEMPERATURE COEFFICIENT - Test Condition - Measurement voltage for Class II

Table 10

MEASUREMENT VOLTAGE	SIZE
Cap ≤ 0.01μF: 0.5V; Cap. > 0.01μF: 0.2V (*0201X104/6.3V~25V: 0.5V; 0201X224/10V: 0.5V; 0201S104/6.3V~16V: 0.3V; 0201S224/6.3V: 0.3V; 0201X105/6.3V&10V: 0.3V)	01005
Cap < 0.1μF: 1.0V; 0.1μF ≤ Cap. < 1.0μF: 0.2V*; Cap. ≥ 1.0μF: 0.1V* (*0201X104/6.3V~25V: 0.5V; 0201X224/10V: 0.5V; 0201S104/6.3V~16V: 0.3V; 0201S224/6.3V: 0.3V; 0201X105/6.3V&10V: 0.3V)	0201
Cap < 0.1μF: 1.0V; Cap = 1μF: 0.5V**; 0402B224-16V: 0.5V; 0402B474-10V: 0.5V; 0402X475M6R3: 0.5V; 1μF < Cap < 10μF: 0.2V; **0402B105M6R3V: 0.2V; Cap ≥ 10μF: 0.1V	0402
Cap < 1.0μF: 1.0V; 1.0μF ≤ Cap. ≤ 4.7μF: 0.5V; Cap. > 4.7μF: 0.2V	0603
Cap < 10μF: 1.0V; Cap. = 10μF: 0.5V; 0805B475/6.3V~25V: 0.5V; Cap. > 10μF: 0.2V	0805
Cap ≤ 10μF: 1.0V; 10μF < Cap. ≤ 100μF: 0.5V; Cap. > 100μF: 0.2V	1206/1210

HUMIDITY (DAMP HEAT) STEADY STATE, (DAMP HEAT) LOAD AND HIGH TEMPERATURE LOAD

REQUIREMENT - - Class II (X7R, X5R, X6S, X7S, Y5V)

Table 11

MEASUREMENT VOLTAGE	IR
100V: X7R; 1210 \geq 3.3 μ F	1G Ω or RxC \geq 10 Ω -F whichever is smaller
50V: 0402 $>$ 0.01 μ F; 0603 \geq 1 μ F; 0805 \geq 1 μ F; 1206 \geq 4.7 μ F; 1210 \geq 4.7 μ F	
35V:0603 \geq 1 μ F;0805 \geq 2.2 μ F; 1206 \geq 2.2 μ F;1210 \geq 10 μ F	
25V: 0201 \geq 0.1uF; 0402 \geq 0.22 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: 0201 \geq 0.1uF; 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	
6.3V; 4V; TT series ; All X6S/X7S items; Size \geq 1812	

HUMIDITY (DAMP HEAT) LOAD REQUIREMENT - - Class II (X7R, X5R, X6S, X7S, Y5V)

Table 12

MEASUREMENT VOLTAGE	IR
100V: X7R; 1210 \geq 3.3 μ F	500M Ω or RxC \geq 5 Ω -F whichever is smaller.
50V: 0402 $>$ 0.01 μ F; 0603 \geq 1 μ F; 0805 \geq 1 μ F; 1206 \geq 4.7 μ F; 1210 \geq 4.7 μ F	
35V:0603 \geq 1 μ F;0805 \geq 2.2 μ F; 1206 \geq 2.2 μ F;1210 \geq 10 μ F	
25V: 0201 \geq 0.1uF; 0402 \geq 0.22 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: 0201 \geq 0.1uF; 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	
6.3V; 4V; TT series ; All X6S/X7S items; Size \geq 1812	

HIGH TEMPERATURE LOAD (ENDURANCE) - Test Condition 100% of Rated Voltage

Table 13

SIZE	DIELECTRIC	RATED VOLTAGE	CAPACITANCE
0201	X5R/X7R/X6S/X7S	≤10V	C≥0.1μF
		≥16V	C>0.1μF
0402	X5R	≤16V	C>1.0μF
		25V,50V	C≥1.0μF
	X6S	6.3V,10V	C>1.0μF
		16V,25V	C≥1.0μF
	X7R/X7S/Y5V	6.3V,10V	C≥1.0μF
0603	X5R/X7R/X6S/X7S	4V	C≥22μF
		6.3V,10V	C≥4.7μF
	X5R/X6S/X7S	25V	C≥1.0μF
	X7R	35V	C≥1.0μF
0805	X5R/X7R/X6S/X7S	4V	C≥47μF
		6.3V	C≥22μF
		10V, 50V	C≥10μF
	X6S	16V	C>10μF
		25V	C≥10μF
	X7R/X7S	16V, 25V	C≥10μF
	X5R		C≥22μF
1206	X5R/X7R/X6S	≤6.3V	C≥47μF
1210	X5R/X7R/X6S	16V	C≥47μF
	X7R	100V	C≥3.3μF

HIGH TEMPERATURE LOAD (ENDURANCE) - Test Condition 150% of Rated Voltage

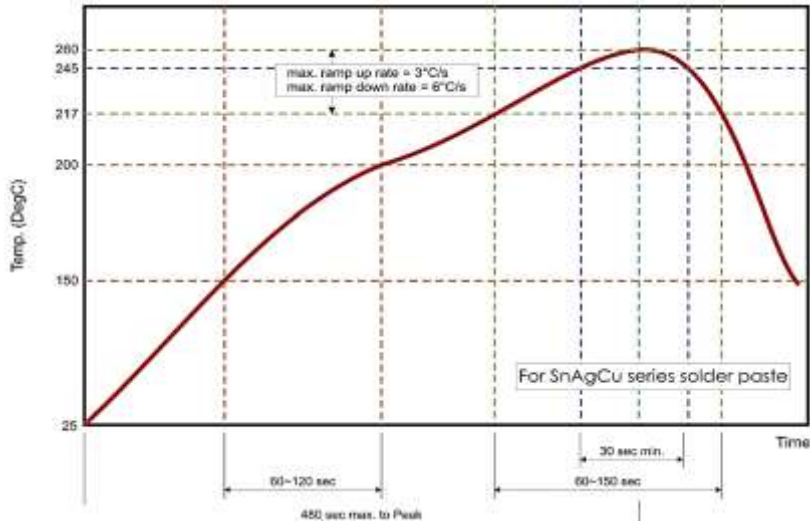
Table 14

SIZE	DIELECTRIC	RATED VOLTAGE	CAPACITANCE
0201	X5R/X6S	16V, 25V	C= 0.1 μ F
	X7R	16V	C \geq 0.022 μ F
0402	X5R/X7R/X6S	50V	C>0.01 μ F
		10-25V	C \geq 0.22 μ F
	Y5V	16V	C \geq 0.47 μ F
0603	Y7S	50V~100V	C>0.22 μ F
	X7R	50V	C>0.1 μ F
		25V	C=1.0 μ F
	X5R	50V	C \geq 1.0 μ F
	X5R/X7R/X6S/X7S	10V, 16V	C \geq 1.0 μ F
	Y5V	16V	C \geq 2.2 μ F
0805	X5R/X7R/X6S/X7S	100V	C \geq 0.47 μ F
		50V	C \geq 0.68 μ F
		35V	C \geq 2.2 μ F
		10-25V	C \geq 4.7 μ F
	Y5V	16V	C \geq 4.7 μ F
1206	X7R	100V	C \geq 1.0 μ F
		50V	C \geq 2.2 μ F
	X5R/X6S/X7S	100V	C>1.0 μ F
		50V	C=4.7 μ F
1210	X5R/X7R/X6S/X7S	50-100V	C \geq 2.2 μ F
1825,2220,2225	X7R	100V-250V	C \geq 1.0 μ F

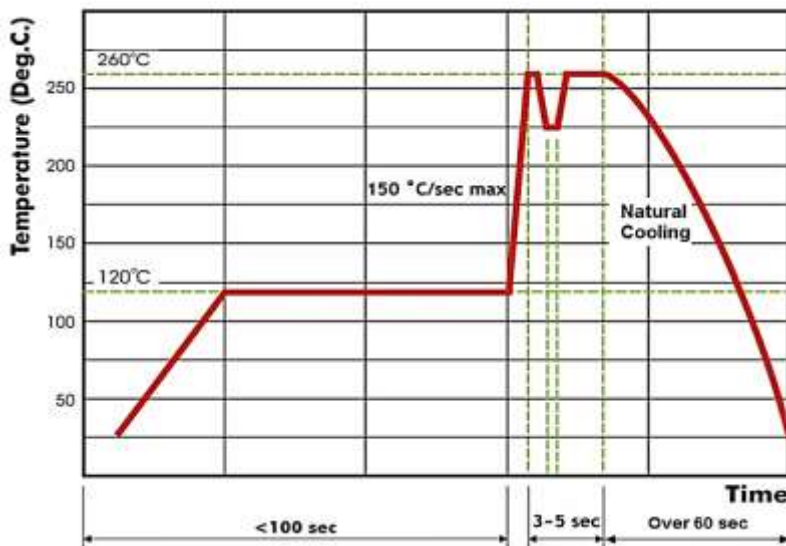
RECOMMENDED PROFILE CONDITIONS

The lead-free termination MLCCs are not only to be used on SMT against lead-free solder paste, but also suitable against lead-containing solder paste.

If the optimized solder joint is requested, increasing soldering time, temperature and concentration of N2 within oven are recommended.



Reflow Soldering Profile For SMT Process with SnAgCu series Solder Paste



Wave Soldering Profile For SMT Process with SnAgCu series Solder Paste

STORAGE AND HANDLING CONDITIONS

- To store products at 5 to 40°C ambient temperature and 20 to 70% related humidity conditions; MSL Level 1.
- The product is recommended to be used within one year after shipment. Check solder ability in case of shelf life extension is needed.

CAUTIONS

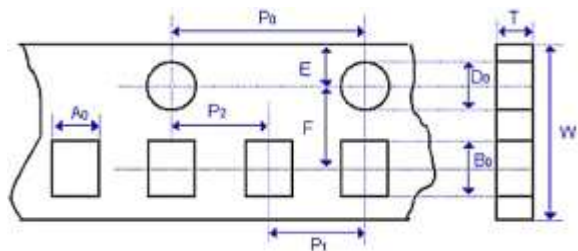
- The corrosive gas reacts on the terminal electrodes of capacitors, and results in the poor solder ability. Do not store the capacitors in the ambience of corrosive gas (e.g., hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.)
- In corrosive atmosphere, solder ability might be degraded, and silver migration might occur to cause low reliability.
- Due to the dewing by rapid humidity change, or the photochemical change of the terminal electrode by direct sun light, the solder ability and electrical performance may deteriorate. Do not store capacitors under direct sunlight or dewing condition. To store products on the shelf and avoid exposure to moisture.

Caution for SOFT TERMINATION Products

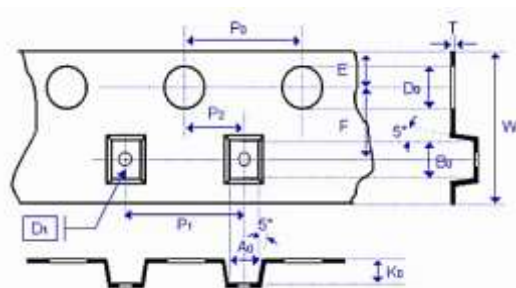
- Since the middle layer of the terminal electrode contains Ag (silver), when chip capacitors on printed circuit board (PCB), it should be protected by moisture proof-sealing to prevent electromigration of Ag under high temperature, high humidity and failure due to corrosive gas.

TAPE DIMENSION (Unit: mm)

Paper Tape



Plastic Tape



SIZE	0402	0603	0805		
Thickness	N,E	S,X	A, H	B, T	D, I
A0	0.70 ±0.20	1.05 ±0.30	1.5±0.20	1.5 ±0.20	< 1.80
B0	1.20 ±0.20	1.80 ±0.30	2.30 ±0.20	2.30 ±0.20	< 2.70
T	≤0.80	≤1.20	≤1.15	≤1.20	0.23 ±0.1
K0	-	-	-	-	< 2.50
W	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30
P0	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10
10xP0	40.0 ±0.10	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20
P1	2.00 ±0.05	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10
P2	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05
D0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D1	-	-	-	-	1.00 ±0.10
E	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10
F	3.50 ±0.05	3.50 ±0.05	3.50 ±0.05	3.50 ±0.05	3.50 ±0.05

TAPE DIMENSION (Unit: mm)

SIZE	1206			1210	
Thickness	B, T	C, J, D	G, P	C, D, G, K	M
A0	1.90 ±0.50	< 2.00	< 2.30	< 3.05	< 3.20
B0	3.50 ±0.50	< 3.70	< 4.00	< 3.80	< 4.00
T	≤1.20	0.23 ±0.1	0.23 ±0.1	0.23 ±0.1	0.23 ±0.1
K0	-	< 2.50	< 2.50	< 2.50	< 3.20
W	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30	8.00 ±0.30
P0	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10
10xP0	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20
P1	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10
P2	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05	2.00 ±0.05
D0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D1	-	1.00 ±0.10	1.00 ±0.10	1.00 ±0.10	1.00 ±0.10
E	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10
F	3.50 ±0.05	3.50 ±0.05	3.50 ±0.05	3.50 ±0.05	3.50 ±0.05

TAPE DIMENSION (Unit: mm)

SIZE	1808		1812	
	D, F, G, K	D, F, G, K	D, F, G, K	M, U
Thickness	D, F, G, K	D, F, G, K	D, F, G, K	M, U
A0	<2.50	<3.90	<3.90	<3.90
B0	<5.30	<5.30	<5.30	<5.30
T	0.25±0.1	0.25±0.1	0.25±0.1	0.25±0.1
K0	<2.50	<2.50	<2.50	<3.50
W	12.0±0.30	12.00±0.30	12.00±0.30	12.00±0.30
P0	4.00±0.10	4.00±0.10	4.00±0.10	4.00±0.10
10xP0	40.0±0.20	40.00±0.20	40.00±0.20	40.00±0.20
P1	4.00±0.10	8.00±0.10	8.00±0.10	8.00±0.10
P2	2.00±0.10	2.00±0.10	2.00±0.10	2.00±0.10
D0	1.50+0.1/-0	1.50+0.1/-0	1.50+0.1/-0	1.50+0.1/-0
D1	1.50±0.10	1.50±0.10	1.50±0.10	1.50±0.10
E	1.75±0.10	1.75±0.10	1.75±0.10	1.75±0.10
F	5.50±0.10	5.50±0.10	5.50±0.10	5.50±0.10

TAPE DIMENSION (Unit: mm)

SIZE	1825		2220		2225	
Thickness	K	M, U	K	M, U	K	M, U
A0	< 6.80	< 6.80	< 5.80	< 5.80	< 6.80	< 6.80
B0	< 5.30	< 5.30	< 6.50	< 6.50	< 6.50	< 6.50
T	0.30 ±0.1	0.30 ±0.1	0.30 ±0.1	0.30 ±0.1	0.30 ±0.1	0.30 ±0.1
K0	< 2.50	< 3.50	< 2.50	< 3.50	< 2.50	< 3.50
W	12±0.30	12±0.30	12±0.30	12±0.30	12±0.30	12±0.30
P0	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10	4.00 ±0.10
10xP0	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20	40.0 ±0.20
P1	8.00 ±0.10	8.00 ±0.10	8.00 ±0.10	8.00 ±0.10	8.00 ±0.10	8.00 ±0.10
P2	2.00 ±0.10	2.00 ±0.10	2.00 ±0.10	2.00 ±0.10	2.00 ±0.10	2.00 ±0.10
D0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0	1.50 +0.1/-0
D1	1.50 ±0.10	1.50 ±0.10	1.50 ±0.10	1.50 ±0.10	1.50 ±0.10	1.50 ±0.10
E	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10	1.75 ±0.10
F	5.50 ±0.05	5.50 ±0.05	5.50 ±0.05	5.50 ±0.05	5.50 ±0.05	5.50 ±0.05

REEL DIMENSION (Unit: mm)



SIZE CODE	0402, 0603, 0805, 1206, 1210			1808, 1812, 1825, 2220, 2225
Reel Size	7"	10"	13"	7"
C	13.0±0.5	13.0±0.5	13.0±0.5	13.0±0.5
W 1	10.0±1.5	10.0±1.5	10.0±1.5	12.4+2.0/-0
A	178.0±2.0	250.0±2.0	330.0±2.0	178.0±2.0
N	60.0+1.0/-0	50 min	50 min	60.0+1.0/-0

PACKAGING STYLE AND QUANTITY PER REEL

SIZE	THICKNESS (SYMBOL)		PAPER TAPE		PLASTIC TAPE	
			7" REEL	13" REEL	7" REEL	13" REEL
0402 (1005)	0.50±0.20	E	10,000			
0603 (1608)	0.80±0.07	S	4,000	15,000		
	0.80±0.30	X	4,000	15,000		
0805 (2012)	0.60±0.10	A	4,000	15,000		
	0.85±0.10	B	4,000	15,000		
	1.25±0.10	D			3,000	10,000
	1.25±0.30	I			3,000	10,000
1206 (3216)	0.80±0.10	B	4,000	15,000	-	-
	0.95±0.10	C	-	-	3,000	10,000
	1.15±0.15	J	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
	1.60±0.20	G	-	-	2,000	10,000
	1.60±0.50	P	-	-	2,000	9,000
1210 (3225)	0.95±0.10	C	-	-	3,000	10,000
	1.25±0.10	D	-	-	3,000	10,000
	1.60±0.20	G	-	-	2,000	-
	2.00±0.20	K	-	-	1,000	6,000
	2.50±0.30	M	-	-	1,000	6,000
1808 (4520)	1.25±0.10	D	-	-	2,000	10,000
	1.60±0.20	G			2,000	8,000
	2.00±0.20	K	-	-	1,000	6,000
1812 (4532)	1.25±0.10	D			1,000	5,000
	1.60±0.20	G			1,000	-
	2.00±0.20	K			1,000	-
	2.50±0.50	M			500	3,000
1825 (4563)	2.00±0.20	K	-	-	1,000	-
2220 (5750)	2.50±0.30	M	-	-	500	-
2225 (5763)			-	-		-

IMPORTANT NOTES AND DISCLAIMER

1. **ROHS COMPLIANCE:** The levels of RoHS restricted materials in this product are below the maximum concentration values (also referred to as the threshold limits) permitted for such substances, or are used in an exempted application, in accordance with EU RoHS Directive (EU) 2015/863 EC (RoHS3). RoHS Test Report for this product can be obtained at Download Center.
2. **REACH COMPLIANCE:** REACH substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, REACH Test Report for this product can be obtained at Download Center.
3. All Product parametric performance is indicated in the Electrical Characteristics for the listed herein test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.
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