



Data Sheet

Customer :	
Product :	Multilayer Ceramic Chip Capacitor – MC Series
Size :	0201/0402/0603/0805/1206/1210/1808/1812/0612
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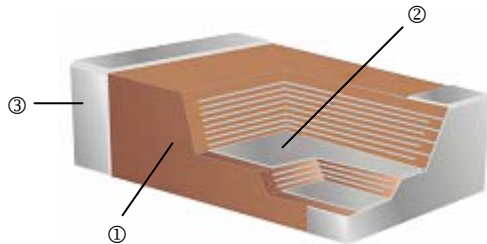
Multilayer Ceramic Capacitor (MC Series)

Features

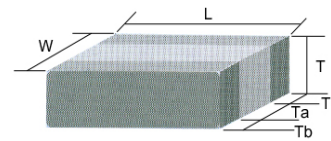
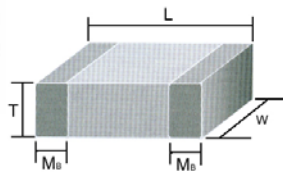
- Wide capacitance range, extremely compact size
- Low inductance of capacitor for high frequency application
- Excellent solderability and resistance to soldering heat, suitable for flow and reflow soldering
- Adaptable to high-speed surface mount assembly
- Conform to EIAJ-RC3402, and also compatible with EIA-RS198 and IEC PUB. 384-10



Construction



①	Ceramic Material	③	Termination:
②	Inner Electrodes		NPO: Ag/Ni/Sn dielectric X7R, Y5V, X5R: Cu/Ni/Sn dielectric



Dimensions

MC / MCHL / MCRF Type

Unit: mm

Type	Size (Inch)	L	W	T / Symbol		Mb	Packaging (7" Reel)	
							Paper tape	Plastic tape
01	0201	0.6±0.03	0.3±0.03	0.3±0.03	L	0.15±0.05	15K	-
02	0402	1.00±0.05	0.50±0.05	0.50±0.05	N	0.25 +0.05 / -0.10	10K	-
03	0603	1.60±0.10	0.80±0.10	0.80±0.07	S	0.40±0.15	4K	-
		1.60 +0.15 / -0.10	0.80 +0.15 / -0.10	0.80 +0.05 / -0.10	X		4K	
05	0805	2.00±0.15	1.25±0.10	0.60±0.10	A	0.50±0.20	4K	-
				0.80±0.10	B		4K	-
				1.25±0.10	D		-	3K
		0.85±0.10	T	4K	-			
		1.25±0.20	I	-	3K			
06	1206	3.20±0.15	1.60±0.15	0.80±0.10	B	0.60±0.20	4K	-
				0.95±0.10	C		-	3K
				1.25±0.10	D		-	3K
		1.15±0.15	J	-	3K			
		1.60±0.20	G	-	2K			
3.20±0.20	1.60±0.20	1.60±0.20	1.60±0.3 / -0.1	1.60±0.3 / -0.1	P	-	2K	
10	1210	3.20±0.30	2.50±0.20	0.95±0.10	C	0.75±0.25	-	3K
				1.25±0.10	D		-	3K
				1.60±0.20	G		-	2K
		2.00±0.20	K	-	1K			
		2.50±0.30	M	-	1K			
08	1808	4.50±0.40	2.03±0.25	1.25±0.10	D	0.75±0.25	-	2K
				2.00±0.20	K		-	1K
12	1812	4.50±0.40	3.20±0.30	1.25±0.10	D	0.75±0.25	-	1K
				2.00±0.20	K		-	1K
		3.20±0.40	2.50±0.30	M	-		0.5K	

Low Inductance Capacitors for MCLI Type

Unit: mm

Type	Size (Inch)	L	W	T / Symbol		Ta min.	Tb min.	Packaging (7" Reel)	
								Paper tape	Plastic tape
MCLI43	0612	3.20±0.15	1.60±0.15	0.80±0.10	B	0.5	0.13	4K	-

Part Numbering

MC	03	J	T	N	250	3R9
Product Type	Dimensions (L×W)	Capacitance Tolerance	Packaging	Dielectric	Voltage (VDCW)	Capacitance
MC : General; Ultra-small Middle and High Voltage MCHL: High Q and Low ESR MCRF: Ultra High Q and Low ESR (RF) MCLI: Low Inductance	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 08: 1808 12: 1812 43: 0612	B: ±0.1pF (Cap≤5pF) C: ±0.25pF (Cap≤5pF) D: ±0.5pF (5pF<Cap<10pF) F: ±1% G: ±2% J: ±5% K: ±10% M: ±20% Z: +80/-20%	T: Taping Reel	N: NPO (COG) B: X7R F: Y5V X: X5R	6V3: 6.3V 250: 25V 500: 50V 101: 100V 102: 1000V 202: 2000V 302: 3000V	3R9: 3.9pF 150: 15pF 181: 180pF 225: 2.2μF 476: 47μF 107: 100μF

General Capacitance & Voltage

Capacitance & Voltage (NPO)

Dielectric		NPO														
EIA	Size	0402					0603					0805				
Code	VDCW	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V
0R5	0.5pF	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
0R6	0.6	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
0R7	0.7	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
0R8	0.8	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
0R9	0.9	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
1R0	1.0	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
1R2	1.2	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
1R5	1.5	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
1R8	1.8	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
2R2	2.2	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
2R7	2.7	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
3R3	3.3	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
3R9	3.9	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
4R7	4.7	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
5R6	5.6	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
6R8	6.8	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
8R2	8.2	N^	N^	N^	N^	N^	S	S	S	S	S	A	A	A	A	A
100	10pF	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
120	12	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
150	15	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
180	18	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
220	22	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
270	27	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
330	33	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
390	39	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
470	47	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
560	56	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
680	68	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
820	82	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
101	100pF	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
121	120	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
151	150	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
181	180	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
221	220	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
271	270	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
331	330	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
391	390	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B
471	470	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B
561	560	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B
681	680	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B
821	820	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B
102	1000pF	N	N	N	N	N	S	S	S	S	S	B	B	B	B	B
122	1200	X	X	X	X	X	X	X	X	X	X	B	B	B	B	B
152	1500	X	X	X	X	X	X	X	X	X	X	B	B	B	B	B
182	1800	X	X	X	X	X	X	X	X	X	X	B	B	B	B	B
222	2200	X	X	X	X	X	X	X	X	X	X	B	B	B	B	B
272	2700	X	X	X	X	X	X	X	X	X	X	D	D	D	D	D
332	3300	X	X	X	X	X	X	X	X	X	X	D	D	D	D	D
392	3900											D	D	D	D	D
472	4700											D	D	D	D	D
562	5600											D^	D^			
682	6800											D^	D^			
822	8200											D^	D^			
103	0.01uF											D^	D^			
123	0.012											D^	D^			

■ The letter in cell is expressed the symbol of product thickness

■ The "A" mark is expressed product with Ag/Ni/Sn



Capacitance & Voltage (NPO)

Dielectric		NPO												
EIA Code	Size	1206					1210					1812		
	VDCW	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	16V	50V	100V
1R8	1.8	B	B	B	B	B								
2R2	2.2	B	B	B	B	B								
2R7	2.7	B	B	B	B	B								
3R3	3.3	B	B	B	B	B								
3R9	3.9	B	B	B	B	B								C ^A
4R7	4.7	B	B	B	B	B								C ^A
5R6	5.6	B	B	B	B	B								C ^A
6R8	6.8	B	B	B	B	B								C ^A
8R2	8.2	B	B	B	B	B								C ^A
100	10pF	B	B	B	B	B								C ^A
120	12	B	B	B	B	B								C ^A
150	15	B	B	B	B	B								C ^A
180	18	B	B	B	B	B								C ^A
220	22	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
270	27	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
330	33	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
390	39	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
470	47	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
560	56	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
680	68	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
820	82	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
101	100pF	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
121	120	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
151	150	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
181	180	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
221	220	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
271	270	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
331	330	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
391	390	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
471	470	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
561	560	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
681	680	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
821	820	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A			D ^A
102	1000pF	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
122	1200	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
152	1500	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
182	1800	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
222	2200	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
272	2700	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
332	3300	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
392	3900	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
472	4700	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
562	5600	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
682	6800	C	C	C	C	C	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
822	8200	D	D	D	D	D	C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
103	0.01uF	D	D	D	D		C ^A	C ^A	C ^A	C ^A	C ^A	D ^A	D ^A	D ^A
123	0.012	D ^A	D ^A				C ^A	C ^A	D ^A	D ^A	D ^A	D ^A	D ^A	D ^A
153	0.015	D ^A	D ^A				C ^A	C ^A	D ^A	D ^A	D ^A	D ^A	D ^A	D ^A
183	0.018	D ^A	D ^A									D ^A	D ^A	D ^A
223	0.022	D ^A	D ^A									D ^A	D ^A	D ^A
273	0.027	D ^A	D ^A									D ^A	D ^A	D ^A
333	0.033	D ^A	D ^A									D ^A	D ^A	D ^A
393	0.039	G ^A	G ^A											D ^A

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Capacitance & Voltage (X7R)

Dielectric		X7R															
EIA	Size	0402				0603						0805					
Code	VDCW	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	100V	6.3V	10V	16V	25V	50V	100V
101	100pF	N	N	N	N		S	S	S	S	S		B	B	B	B	B
121	120	N	N	N	N		S	S	S	S	S		B	B	B	B	B
151	150	N	N	N	N		S	S	S	S	S		B	B	B	B	B
181	180	N	N	N	N		S	S	S	S	S		B	B	B	B	B
221	220	N	N	N	N		S	S	S	S	S		B	B	B	B	B
271	270	N	N	N	N		S	S	S	S	S		B	B	B	B	B
331	330	N	N	N	N		S	S	S	S	S		B	B	B	B	B
391	390	N	N	N	N		S	S	S	S	S		B	B	B	B	B
471	470	N	N	N	N		S	S	S	S	S		B	B	B	B	B
561	560	N	N	N	N		S	S	S	S	S		B	B	B	B	B
681	680	N	N	N	N		S	S	S	S	S		B	B	B	B	B
821	820	N	N	N	N		S	S	S	S	S		B	B	B	B	B
102	1000pF	N	N	N	N		S	S	S	S	S		B	B	B	B	B
122	1200	N	N	N	N		S	S	S	S	S		B	B	B	B	B
152	1500	N	N	N	N		S	S	S	S	S		B	B	B	B	B
182	1800	N	N	N	N		S	S	S	S	S		B	B	B	B	B
222	2200	N	N	N	N		S	S	S	S	S		B	B	B	B	B
272	2700	N	N	N	N		S	S	S	S	S		B	B	B	B	B
332	3300	N	N	N	N		S	S	S	S	S		B	B	B	B	B
392	3900	N	N	N	N		S	S	S	S	S		B	B	B	B	B
472	4700	N	N	N	N		S	S	S	S	S		B	B	B	B	B
562	5600	N	N	N	N		S	S	S	S	S		B	B	B	B	B
682	6800	N	N	N	N		S	S	S	S	S		B	B	B	B	B
822	8200	N	N	N	N		S	S	S	S	S		B	B	B	B	B
103	0.01μF	N	N	N	N		S	S	S	S	S		B	B	B	B	B
123	0.012	N	N	N			S	S	S	S			B	B	B	B	B
153	0.015	N	N	N			S	S	S	S			B	B	B	B	B
183	0.018	N	N	N			S	S	S	S			B	B	B	B	B
223	0.022	N	N	N			S	S	S	S			B	B	B	B	B
273	0.027	N	N	N			S	S	S	S			B	B	B	B	D
333	0.033	N	N	N			S	S	S	X			B	B	B	B	D
393	0.039	N	N	N			S	S	S	X			B	B	B	B	D
473	0.047	N	N	N			S	S	S	X			B	B	B	B	D
563	0.056	N	N				S	S	S	X			B	B	B	B	D
683	0.068	N	N				S	S	S	X			B	B	B	B	D
823	0.082	N	N				S	S	S	X			B	B	B	B	D
104	0.10μF	N	N				S	S	S	X			B	B	B	B	D
124	0.12						S	X	X				D	D	D	D	
154	0.15						S	X	X				D	D	D	D	
184	0.18						S	X	X				D	D	D	D	
224	0.22					X	S	X	X				D	D	D	D	
274	0.27					X	X	X	X				D	D	D	I	
334	0.33					X	X	X	X				D	D	D	I	
394	0.39					X	X	X	X				D	D	D	I	
474	0.47					X	X	X	X				D	D	D	I	
564	0.56					X	X						D	D	D		
684	0.68					X	X						D	D	D		
824	0.82					X	X						D	D	D		
105	1.0μF					X	X						D	D	D		
155	1.5												I	I			
225	2.2											I	I	I	I		
335	3.3																
475	4.7																

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Capacitance & Voltage (X7R)

Dielectric		X7R																
EIA	Size	1206						1210					1812					
Code	VDCW	6.3V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	
101	100pF																	
121	120																	
151	150		B	B	B	B	B											
181	180		B	B	B	B	B											
221	220		B	B	B	B	B											
271	270		B	B	B	B	B											
331	330		B	B	B	B	B											
391	390		B	B	B	B	B											
471	470		B	B	B	B	B											
561	560		B	B	B	B	B											
681	680		B	B	B	B	B											
821	820		B	B	B	B	B											
102	1000pF		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
122	1200		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
152	1500		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
182	1800		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
222	2200		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
272	2700		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
332	3300		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
392	3900		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
472	4700		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
562	5600		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
682	6800		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
822	8200		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
103	0.01μF		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
123	0.012		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
153	0.015		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
183	0.018		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
223	0.022		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
273	0.027		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
333	0.033		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
393	0.039		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
473	0.047		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
563	0.056		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
683	0.068		B	B	B	B	B	C	C	C	C	C	D	D	D	D	D	D
823	0.082		B	B	B	B	D	C	C	C	C	C	D	D	D	D	D	D
104	0.10μF		B	B	B	B	D	C	C	C	C	C	D	D	D	D	D	D
124	0.12		B	B	B	B	D	C	C	C	C	C	D	D	D	D	D	D
154	0.15		C	C	C	C	G	C	C	C	C	C	D	D	D	D	D	D
184	0.18		C	C	C	C	G	C	C	C	C	C	D	D	D	D	D	D
224	0.22		C	C	C	C	G	C	C	C	C	C	D	D	D	D	D	D
274	0.27		C	C	C	D		C	C	C	C	G	D	D	D	D	D	D
334	0.33		C	C	C	D		C	C	C	D	G	D	D	D	D	D	D
394	0.39		C	C	C	J	P		C	C	C	D	M	D	D	D	D	D
474	0.47		J	J	J	J	P		C	C	C	D	M	D	D	D	D	K
564	0.56		J	J	J	J	P		D	D	D	D	M	D	D	D	D	K
684	0.68		J	J	J	J	P		D	D	D	D	K	D	D	D	K	K
824	0.82		J	J	J	J	P		D	D	D	D	K	D	D	D	K	K
105	1.0μF		J	J	J	J	P		D	D	D	D	K	D	D	D	K	K
155	1.5	J	J	J														K
225	2.2	J	J	J	P				K	G							M	M
335	3.3	P	P	P	P													
475	4.7	P	P	P	P				K	K								
106	10	P	P						K	K								

■ The letter in cell is expressed the symbol of product thickness

Capacitance & Voltage (X5R)

Dielectric		X5R																			
EIA	Size	0402				0603				0805				1206				1210			
Code	VDCW	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	
273	0.027μF			N																	
333	0.033			N																	
393	0.039			N																	
473	0.047			N																	
563	0.056		N	N																	
683	0.068		N	N																	
823	0.082	N	N	N																	
104	0.10μF	N	N	N	N																
224	0.22	N	N						X	X											
274	0.27							X	X												
334	0.33	N				X	X	X	X												
394	0.39							X	X												
474	0.47	N						X	X	X											
684	0.68	N						X	X	X											
824	0.82					X	X	X	X												
105	1.0μF	N	N			X	X	X	X												
155	1.5					X				I	I				J	J			K	K	
225	2.2	N				X	X			I	I	I	I		J	J	P		K	K	
335	3.3									I	I	I	I		P	P	P				
475	4.7					X				I	I	I	I	P	P	P	P		K	K	
685	6.8													P	P						
106	10μF									I	I			P	P	P	P	K	K	K	
226	22													P	P						

Capacitance & Voltage (Y5V)

Dielectric		Y5V																																			
EIA	Size	0402					0603					0805					1206					1210					1812										
Code	VDCW	6.3	10V	16V	25V	50V	6.3	10V	16V	25V	50V	6.3	10V	16V	25V	50V	100	10V	16V	25V	35V	50V	100	6.3	10V	16V	25V	35V	50V	100	10V	16V	25V	50V	100		
103	0.010μF	N	N	N	N		S	S	S	S		A	A	A	A	B	B	B	B	B	B	B	B							C						D	
153	0.015	N	N	N	N		S	S	S	S		A	A	A	A	B	B	B	B	B	B	B	B							C						D	
223	0.022	N	N	N	N		S	S	S	S		A	A	A	A	B	B	B	B	B	B	B	B							C						D	
333	0.033	N	N	N	N		S	S	S	S		A	A	A	A	B	B	B	B	B	B	B	B							C						D	
473	0.047	N	N	N			S	S	S	S		A	A	A	A	B	B	B	B	B	B	B	B							C						D	
683	0.068	N	N	N			S	S	S	S		A	A	A	A	B	B	B	B	B	B	B	B							C						D	
104	0.10μF	N	N	N			S	S	S	S		A	A	A	A	B	B	B	B	B	B	B	B							C	C	D	D	D	D	D	
154	0.15	N					S	S	S	S		A	A	A	A	B	B	B	B	B	B	C							C	C	C	C	C	D	D	D	D
224	0.22	N	N				S	S	S	S		A	A	A	A	B	B	B	B	B	B	C							C	C	C	C	C	D	D	D	D
334	0.33	N	N				S	S	S			B	B	B	B	B	B	B	B	B	B	B							C	C	C	C	C	D	D	D	D
474	0.47	N	N				S	S	X			B	B	B	B/D	B	B	B	B	B	B							C	C	C	C	C	D	D	D	D	
684	0.68	N					S	X				B	B	D	D	B	B	B	B	B	B							C	C	C	C	C	D	D	D	D	
105	1.0μF	N	N				S	X	X			B	B	D	D	C	C	C	C/D									C	C	C	C	C	D	D	D	D	
155	1.5						S					D	D					C	C	C							C	C	C			D	D	D	D		
225	2.2						S	S	X			D	D	I				C	C	C	J						C	C	C	G		D	D	D	D		
335	3.3											D	D					J	J	J							C	C	C			D	D	D	D		
475	4.7						X					D	D	I				J	J	J	J						C	C	D	G		D	D	D	D		
685	6.8											I						J	J								C	C	D			D	D	D	D		
106	10μF										I	I						J	J	P							D	D	G	K		D	D	D			
226	22μF																	P									K	K									
476	47μF																										K	K								M	
107	100μF																										M										

Environmental Characteristics

Size	0402, 0603, 0805, 1206, 1210, 1812			
Dielectric	NPO	X7R	X5R	Y5V
Capacitance*	0.5pF~0.039μF	100pF~10μF	27nF~22μF	10nF~100μF
Capacitance tolerance	Cap ≤ 5pF: B (±0.1pF), C (±0.25pF) 5pF < Cap < 10pF: C (±0.25pF), D (±0.50pF) Cap ≥ 10pF: J (±5%)	J (± 5%) K (±10%)		M (±20%) Z (-20 / +80%)
Rated voltage (VDCW)	10V, 16V, 25V, 50V, 100V	6.3V, 10V, 16V, 25V, 50V, 100V		
Q*	Cap < 30pF: Q ≥ 400 +20C Cap ≥ 30pF: Q ≥ 1000	Note 1		
Insulation resistance at Ur**	≥ 10GΩ or R×C ≥ 500Ω×F Whichever is less			
Operating temperature	-55 to +125°C		-55 to 85°C	-25 to +85°C
Capacitance change	±30 ppm	±15%		+30/-80%
Termination	Ni/Sn (lead-free termination)			

■ **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, 1.0 KHz±10% for Cap > 1000pF, 25°C ambient temperature

■ X7R: Apply 1.0±0.2Vrms, 1.0KHz±10% at the condition of 25°C ambient temperature

■ Y5V: Apply 1.0±0.2Vrms, 1.0 KHz±10% at the condition of 20°C ambient temperature

Note 1:

X7R / X5R

Rated vol.	D.F.	Exception of D.F.	
≥ 50V	≤ 2.5%	≤ 3%	0603 ≥ 0.047μF 0805 ≥ 0.18μF 1206 ≥ 0.47μF
25V	≤ 3.5%	≤ 5%	0805 ≥ 1μF 1210 ≥ 10μF
		≤ 7%	0603 ≥ 0.33μF 1206 ≥ 4.7μF
		≤ 10%	0402 ≥ 0.10μF 0603 ≥ 0.47μF 0805 ≥ 2.2μF 1206 ≥ 6.8μF
16V	≤ 3.5%	≤ 5%	0402 ≥ 0.033μF 0603 ≥ 0.15μF 0805 ≥ 0.68μF 1206 ≥ 2.2μF 1210 ≥ 4.7μF
		≤ 10%	0603 ≥ 0.68μF 0805 ≥ 0.68μF 1206 ≥ 4.7μF 1210 ≥ 22μF
10V	≤ 5.0%	≤ 10%	0402 ≥ 0.33μF 0603 ≥ 0.33μF 0805 ≥ 2.2μF 1206 ≥ 2.2μF 1210 ≥ 22μF
		≤ 15%	0402 ≥ 1μF
6.3V	≤ 10%	≤ 15%	0603 ≥ 10μF 0805 ≥ 4.7μF 1210 ≥ 100μF
		≤ 20%	0402 ≥ 2.2μF

Y5V

Rated vol.	D.F.	Exception of D.F.	
≥ 50V	≤ 5.0%	≤ 7%	0603 ≥ 0.1μF 0805 ≥ 0.47μF 1206 ≥ 4.7μF
35V	7%	—	—
25V	≤ 5.0%	≤ 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
16V (C < 1.0μF)	≤ 7.0%	≤ 9%	0402 ≥ 0.068μF 0603 ≥ 0.68μF
		≤ 12.5%	0402 ≥ 0.22μF
16V (C ≥ 1.0μF)	≤ 9.0%	≤ 12.5%	0603 ≥ 2.2μF 0805 ≥ 3.3μF 1206 ≥ 10μF 1210 ≥ 22μF 1812 ≥ 47μF
10V	≤ 12.5%	≤ 20%	0402 ≥ 0.47μF
6.3V	≤ 20%	—	—

■ Middle and High Voltage

Capacitance & Voltage (NPO 200V~3KV)

Dielectric		NPO																												
EIA	Size	0603				0805				1206					1210					1808			1812							
Code	VDCW	200	250	200	250	500	630	200	250	500	630	1000	2000	200	250	500	630	1000	2000	1000	2000	3000	200	250	500	630	1000	2000	3000	
0R5	0.5pF	S	S	A	A	A	A																							
1R0	1	S	S	A	A	A	A																							
1R2	1.2	S	S	A	A	A	A																							
1R5	1.5	S	S	A	A	A	A	B	B	B	B	B	B																	
1R8	1.8	S	S	A	A	A	A	B	B	B	B	B	B																	
2R2	2.2	S	S	A	A	A	A	B	B	B	B	B	B							D	D	D								
2R7	2.7	S	S	A	A	A	A	B	B	B	B	B	B							D	D	D								
3R3	3.3	S	S	A	A	A	A	B	B	B	B	B	B							D	D	D								
3R9	3.9	S	S	A	A	A	A	B	B	B	B	B	B							D	D	D								
4R7	4.7	S	S	A	A	A	A	B	B	B	B	B	B							D	D	D								
5R6	5.6	S	S	A	A	A	A	B	B	B	B	B	B							D	D	D								
6R8	6.8	S	S	A	A	A	A	B	B	B	B	B	B							D	D	D								
8R2	8.2	S	S	A	A	A	A	B	B	B	B	B	B							D	D	D								
100	10pF	S	S	A	A	A	A	B	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
120	12	S	S	A	A	A	A	B	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
150	15	S	S	A	A	A	A	B	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
180	18	S	S	A	A	A	A	B	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
220	22	S	S	A	A	A	A	B	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
270	27	S	S	A	A	A	A	B	B	B	B	B	B	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
330	33	S	S	A	A	A	A	B	B	B	B	B	B	C	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D
390	39	S	S	A	A	A	A	B	B	B	B	B	B	C	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D
470	47	S	S	A	A	A	A	B	B	B	B	C	C	C ^A	C ^A	C ^A	C ^A	C	C	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
560	56	S	S	A	A	A	A	B	B	B	B	C	D	C ^A	C ^A	C ^A	C ^A	C	D	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
680	68	S	S	A	A	A	A	B	B	B	B	C	D	C ^A	C ^A	C ^A	C ^A	C	D	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
820	82	S	S	A	A	B	B	B	B	B	B	D	D	C ^A	C ^A	C ^A	C ^A	C	D	D	D	D	D ^A	D ^A	D ^A	D ^A	D	D	D	
101	100pF	S	S	A	B	B	B	B	B	B	B	D	D	C ^A	C ^A	C ^A	C ^A	C	D	D	D	D	K	D ^A	D ^A	D ^A	D ^A	D	D	D
121	120	S	S	A	B	D	D	B	B	B	B	D	G	C ^A	C ^A	C ^A	C ^A	D	D	D	D	K	D ^A	D ^A	D ^A	D ^A	D	D	D	
151	150	S	S	B	D	D	D	B	B	B	B	D	G	C ^A	C ^A	C ^A	C ^A	D	G	D	K	K	D ^A	D ^A	D ^A	D ^A	D	D	D	
181	180	S	S	B	D	D	D	B	B	B	B	G	G	C ^A	C ^A	C ^A	C ^A	D	G	D	K	K	D ^A	D ^A	D ^A	D ^A	D	D	K	
221	220	S	S	D	D	D	D	B	B	B	B	G	G	C ^A	C ^A	C ^A	C ^A	G	G	D	K	K	D ^A	D ^A	D ^A	D ^A	D	D	K	
271	270			D	D	D	D	B	C	C	C	G		C ^A	C ^A	C ^A	C ^A	G		K	K	K	D ^A	D ^A	D ^A	D ^A	D	K	K	
331	330			D	D	D	D	B	C	C	C	G		C ^A	C ^A	C ^A	C ^A	G		K	K	K	D ^A	D ^A	D ^A	D ^A	D	K	K	
391	390			D	D	D	D	B	C	C	C	G		C ^A	C ^A	C ^A	C ^A	G		K	K		D ^A	D ^A	D ^A	D ^A	D	K	K	
471	470			D				C	C	C	C	G		C ^A	C ^A	C ^A	C ^A	G		K	K		D ^A	D ^A	D ^A	D ^A	K	K	K	
561	560			D				C	D	D	D			C ^A	C ^A	C ^A	C ^A			K	K		D ^A	D ^A	D ^A	D ^A	K	K		
681	680			D				C	D	D	D			C ^A	C ^A	C ^A	C ^A			K	K		D ^A	D ^A	D ^A	D ^A	K	K		
821	820			D				C	G	G	G			C ^A	C ^A	C ^A	C ^A			K			D ^A	D ^A	D ^A	D ^A	K	K		
102	1000pF			D				C	G	G	G			D ^A	D ^A	D ^A	D ^A			K			D ^A	D ^A	D ^A	D ^A	K	K		
122	1200							C	G	G	G			D ^A	D ^A	D ^A	D ^A						D ^A	D ^A	D ^A	D ^A	K			
152	1500							D	G	G	G			D ^A	D ^A	D ^A	D ^A						D ^A	D ^A	D ^A	D ^A	K			
182	1800							D	G	G	G			D ^A	D ^A	D ^A	D ^A						D ^A	D ^A	D ^A	D ^A				
222	2200							D	G	G	G			D ^A	D ^A								D ^A	D ^A	D ^A	D ^A				
272	2700													D ^A	D ^A								D ^A	D ^A	D ^A	D ^A				
332	3300													D ^A									D ^A	D ^A	D ^A	D ^A				
392	3900													D ^A									D ^A							
472	4700																						D ^A							
562	5600																						D ^A							
682	6800																						D ^A							

■ The letter in cell is expressed the symbol of product thickness

■ The "A" mark is expressed product with Ag/Ni/Sn termination

Capacitance & Voltage (X7R 200V~3KV)

Dielectric		X7R																								
EIA	Size	0805				1206						1210					1808			1812						
Code	VDCW	200V	250V	500V	630V	200V	250V	500V	630V	1000V	2000V	200V	250V	500V	630V	1000V	1000V	2000V	3000V	200V	250V	500V	630V	1000V	2000V	3000V
101	100pF	B	B	B	B																					
121	120	B	B	B	B																					
151	150	B	B	B	B	D	D	D	D	D	D						D	D	D							
181	180	B	B	B	B	D	D	D	D	D	D						D	D	D							
221	220	B	B	B	B	D	D	D	D	D	D						D	D	D							
271	270	B	B	B	B	D	D	D	D	D	D						D	D	D					D	D	
331	330	B	B	B	B	D	D	D	D	D	D						D	D	K					D	D	
391	390	B	B	B	B	D	D	D	D	D	D						D	D	K					D	D	
471	470	B	B	B	B	D	D	D	D	D	D						D	D	K					D	D	
561	560	B	B	B	B	D	D	D	D	D	D						D	D	K					D	D	
681	680	B	B	B	B	D	D	D	D	D	D						D	D	K					D	D	K
821	820	B	B	B	B	D	D	D	D	D	G						D	D	K					D	D	K
102	1000pF	B	B	B	B	D	D	D	D	D	G	C	C	D	D	D	D	K	K	D	D	D	D	D	D	K
122	1200	B	B	B	B	D	D	D	D	D	G^	C	C	D	D	D	D	K		D	D	D	D	D	D	
152	1500	B	B	B	B	D	D	D	D	D	G^	C	C	D	D	D	D	K		D	D	D	D	D	D	
182	1800	B	B	B	B	D	D	D	D	D		C	C	D	D	D	D	K		D	D	D	D	D	D	
222	2200	B	B	B	B	D	D	D	D	D		C	C	D	D	D	D	K^		D	D	D	D	D	D	
272	2700	B	B	B	B	D	D	D	D	D		C	C	D	D	D	D			D	D	D	D	D	D	
332	3300	B	B	B	B	D	D	D	D	D		C	C	D	D	D	D			D	D	D	D	D	D	K
392	3900	B	B	B	B	D	D	D	D	D		C	C	D	D	G	D			D	D	D	D	D	D	K
472	4700	B	D			D	D	D	D	D		C	C	D	D	G	D			D	D	D	D	D	D	K
562	5600	D	D			D	D	D	D	D		C	C	D	D	G	K			D	D	D	D	D	D	
682	6800	D	D			D	D	D	D	D		C	C	D	D	G	K			D	D	D	D	D	D	
822	8200	D	D			D	D	D	D	D		C	C	D	D	G	K			D	D	D	D	D	D	
103	0.010μF	D	D			D	D	D	D	D		C	C	D	D	G	K			D	D	D	D	D	D	
123	0.012	D				D	D	D	D			C	C	D	D					D	D	D	D	D	K	
153	0.015	D				D	D	D	D			C	C	D	D					D	D	D	D	D	K	
183	0.018	D				D	D	D	D			C	C	D	D					D	D	D	D	D	D	
223	0.022	D				D	D	G	G			C	C	D	D					D	D	D	D	D	D	
273	0.027					D	D	G	G			C	C	G	G					D	D	D	D	D	D	
333	0.033					G	G	G	G			C	C	G	G					D	D	D	D	D	D	
393	0.039					G	G					C	C	G	G					D	D	D	D	D	D	
473	0.047					G	G					D	D	G	G					D	D	D	D	D	D	
563	0.056					G	G					D	D	G	G					D	D	K	K	D	D	
683	0.068					G	G					G	G							D	D	K	K	D	D	
823	0.082					G	G					G	G							D	D	K	K	D	D	
104	0.10μF					G	G					G	G							D	D	K	K	D	D	
124	0.12											G	G							D	D					
154	0.15											M	M							K	K					
184	0.18											M	M							K	K					
224	0.22											M	M							K	K					
274	0.27											M	M							K	K					
334	0.33											M	M							K	K					
394	0.39											M	M							K	K					
474	0.47											M	M							K	K					

- The letter in cell is expressed the symbol of product thickness
- The “^” mark is expressed product with Ag/Ni/Sn terminations

Capacitance & Voltage (Y5V 200V~250V)

Dielectric		Y5V							
EIA	Size	0805		1206		1210		1812	
Code	VDCW	200	250	200	250	200	250	200	250
103	0.010 μ F	B	B	B	B	C	C	D	D
153	0.015	B	B	B	B	C	C	D	D
223	0.022	B	B	B	B	C	C	D	D
333	0.033	B	B	B	B	C	C	D	D
473	0.047	B	B	B	B	C	C	D	D
683	0.068	B	B	B	B	C	C	D	D
104	0.10 μ F			B	B	C	C	D	D
154	0.15			C	C	C	C	D	D
224	0.22							D	D
334	0.33							D	D
474	0.47							D	D
684	0.68							D	D

■ The letter in cell is expressed the symbol of product thickness

Electrical data

Dielectric	NP0	X7R	Y5V
Size	0603,0805,1206,1210,1808,1812	0805,1206,1210,1808,1812	0805,1206,1210,1812
Capacitance*	0.5pF~6800pF	100pF~0.47 μ F	0.01 μ F~0.68 μ F
Capacitance tolerance	Cap \leq 5pF: C (\pm 0.25pF) 5pF<Cap<10pF: D (\pm 0.50pF) Cap \geq 10pF: J (\pm 5%), K (\pm 10%)	K (\pm 10%) M (\pm 20%)	Z (-20 / +80%)
Rated voltage (VDCW)	200V to 3KV		200V, 250V
Q*	Cap<30pF: Q \geq 400 +20C Cap \geq 30pF: Q \geq 1000	\leq 2.5%	\leq 5%
Insulation resistance at Ur**	Ur=200~630V: \geq 10G Ω or R \times C \geq 100 Ω -F Whichever is smaller Ur=1000~3000V: \geq 10G Ω		
Dielectric Strength	200~300V: \geq 2 \times VDCW 500~999V: \geq 1.5 \times VDCW 1000~3000V: \geq 1.2 \times VDCW		
Operating temperature	-55 to +125 $^{\circ}$ C		-25 to +85 $^{\circ}$ C
Capacitance change	\pm 30 ppm	\pm 15%	+30/-80%
Termination	Ni/Sn (lead-free termination)		

■ **Measured at the condition of 30~70% related humidity

■ NP0: Apply 1.0 \pm 0.2Vrms, 1.0MHz \pm 10% for Cap \leq 1000pF and 1.0 \pm 0.2Vrms, 1.0KHz \pm 10% for Cap>1000pF, 25 $^{\circ}$ C ambient temperature

■ X7R, X5R: Apply 1.0 \pm 0.2Vrms, 1.0KHz \pm 10% at the condition of 20 $^{\circ}$ C ambient temperature

■ ****Measured at 500V_{DC} for 60 sec. for Ur > 500V_{DC}



Ultra-small 0201 Capacitors

Capacitance & Voltage

EIA	Size	0201		
		Dielectric		
Dielectric		NPO		
Code	VDCW	16V	25V	50V
0R3	0.3pF		L [^]	L [^]
0R4	0.4		L [^]	L [^]
0R5	0.5		L [^]	L [^]
1R0	1.0		L [^]	L [^]
1R2	1.2		L [^]	L [^]
1R5	1.5		L [^]	L [^]
1R8	1.8		L [^]	L [^]
2R2	2.2		L [^]	L [^]
2R7	2.7		L [^]	L [^]
3R3	3.3		L [^]	L [^]
3R9	3.9		L [^]	L [^]
4R0	4.0		L [^]	L [^]
4R7	4.7		L [^]	L [^]
5R6	5.6		L [^]	L [^]
6R8	6.8		L [^]	L [^]
8R2	8.2		L [^]	L [^]
100	10		L [^]	L [^]
120	12		L [^]	L [^]
150	15		L [^]	L [^]
180	18		L [^]	L [^]
220	22		L [^]	L [^]
270	27		L [^]	L [^]
330	33		L [^]	L [^]
390	39		L [^]	L [^]
470	47		L [^]	L [^]
560	56	L [^]	L [^]	
680	68	L [^]	L [^]	
820	82	L [^]	L [^]	
101	100	L [^]	L [^]	

EIA	Size	0201									
		Dielectric		X7R					X5R		
Dielectric		6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
Code	VDCW										
101	100pF			L	L	L			L	L	L
121	120			L	L	L			L	L	L
151	150			L	L	L			L	L	L
181	180			L	L	L			L	L	L
221	220			L	L	L			L	L	L
271	270			L	L	L			L	L	L
331	330			L	L	L			L	L	L
391	390			L	L	L			L	L	L
471	470			L	L	L			L	L	L
561	560			L	L	L			L	L	L
681	680			L	L	L			L	L	L
821	820			L	L	L			L	L	L
102	1000	L	L	L	L	L			L	L	L
152	1500	L	L	L				L	L		
222	2200	L	L	L				L	L		
272	2700	L	L	L				L	L		
332	3300	L	L	L				L	L		
472	4700	L	L	L				L	L		
682	6800	L	L					L			
103	0.010μF	L	L					L	L		
153	0.015							L			
223	0.022							L			
333	0.033							L			
473	0.047							L			
683	0.068							L			
104	0.100							L			

- The letter in cell is expressed the symbol of product thickness
- The “^” mark is expressed product with Ag/Ni/Sn terminations

Electrical Data

Size	0201			
	Dielectric	NPO	X7R	X5R
Capacitance*	0.3pF~100pF	100pF~10nF	100pF~0.1μF	
Capacitance tolerance	Cap ≤ 5pF: C (±0.25pF) 5pF < Cap < 10pF: D (±0.50pF) Cap ≥ 10pF: J (±5%)	J (±5%) K (±10%)	K (±10%) M (±20%)	
Rated voltage (VDCW)	16V, 25V, 50V	6.3V, 10V, 16V, 25V, 50V	6.3V, 10V, 16V, 25V, 50V	
Tan δ/Q*	Cap < 30pF: Q ≥ 400 +20C Cap ≥ 30pF: Q ≥ 1000	Ur=50V: ≤ 3.0% Ur=16V, 25V: ≤ 3.5% Ur=10V: ≤ 5.0% Ur=6.3V: ≤ 10%	Ur=50V: ≤ 3.0% Ur=16V, 25V: ≤ 3.5% Ur=10V: ≤ 5.0% Ur=6.3V: ≤ 10%	
Insulation resistance at Ur	≥ 10GΩ	≥ 10GΩ or R×C ≥ 500Ω×F Whichever is less		
Operating temperature	-55 to +125°C		-55 to +85°C	
Capacitance change	±30 ppm	±15%		
Termination	Ni/Sn (lead-free termination)			

- **Measured at 30~70% related humidity
- NPO: Apply 1.0±0.2Vrms, 1.0MHz±10% at the condition of 25°C ambient temperature
- X7R, X5R: Apply 1.0±0.2Vrms, 1.0KHz±10% at the condition of 25°C ambient temperature

High Q and Low ESR Capacitors for MCHL Series

Capacitance & Voltage

Dielectric		NPO								
EIA	Size	0402			0603				0805	
Code	VDCW	16V	25V	50V	16V	25V	50V	100V	50V	100V
0R5	0.5pF	N^	N^	N^	S^	S^	S^	S^	A^	A^
0R6	0.6pF	N^	N^	N^	S^	S^	S^	S^	A^	A^
0R7	0.7	N^	N^	N^	S^	S^	S^	S^	A^	A^
0R8	0.8	N^	N^	N^	S^	S^	S^	S^	A^	A^
0R9	0.9	N^	N^	N^	S^	S^	S^	S^	A^	A^
1R0	1.0	N^	N^	N^	S^	S^	S^	S^	A^	A^
1R2	1.2	N^	N^	N^	S^	S^	S^	S^	A^	A^
1R5	1.5	N^	N^	N^	S^	S^	S^	S^	A^	A^
1R8	1.8	N^	N^	N^	S^	S^	S^	S^	A^	A^
2R2	2.2	N^	N^	N^	S^	S^	S^	S^	A^	A^
2R7	2.7	N^	N^	N^	S^	S^	S^	S^	A^	A^
3R3	3.3	N^	N^	N^	S^	S^	S^	S^	A^	A^
3R9	3.9	N^	N^	N^	S^	S^	S^	S^	A^	A^
4R7	4.7	N^	N^	N^	S^	S^	S^	S^	A^	A^
5R6	5.6	N^	N^	N^	S^	S^	S^	S^	A^	A^
6R8	6.8	N^	N^	N^	S^	S^	S^	S^	A^	A^
8R2	8.2	N^	N^	N^	S^	S^	S^	S^	A^	A^
100	10	N	N	N	S	S	S	S	A^	A^
120	12	N	N	N	S	S	S	S	A^	A^
150	15	N	N	N	S	S	S	S	A^	A^
180	18	N	N	N	S	S	S	S	A^	A^
220	22	N	N	N	S	S	S	S	A^	A^
270	27	N	N	N	S	S	S	S	A^	A^
330	33	N	N	N	S	S	S	S	A^	A^
390	39	N	N	N	S	S	S	S	A^	A^
470	47	N	N	N	S	S	S	S	A^	A^
560	56	N	N	N	S	S	S	S	A^	A^
680	68	N	N	N	S	S	S	S	A^	A^
820	82	N	N	N	S	S	S	S	A^	A^
101	100	N	N	N	S	S	S	S	A^	A^
121	120	N	N	N	S	S	S	S	A^	A^
151	150	N	N	N	S	S	S	S	A^	A^
181	180	N	N	N	S	S	S	S		
221	220	N	N	N	S	S	S	S		
271	270	N	N	N	S	S	S	S		
331	330	N	N	N	S	S	S	S		
391	390	N	N	N	S	S	S	S		
471	470	N	N	N	S	S	S	S		
561	560				S	S	S			
681	680				S	S	S			
821	820				S	S	S			
102	1000				S	S	S			
122	1200				X	X	X			
152	1500				X	X	X			
182	1800				X	X	X			
222	2200				X	X	X			
272	2700				X	X	X			
332	3300				X	X	X			

- The letter in cell is expressed the symbol of product thickness
- The "A^" mark is expressed product with Ag/Ni/Sn terminations
- 0402, Capacitance<0.5pF: On request

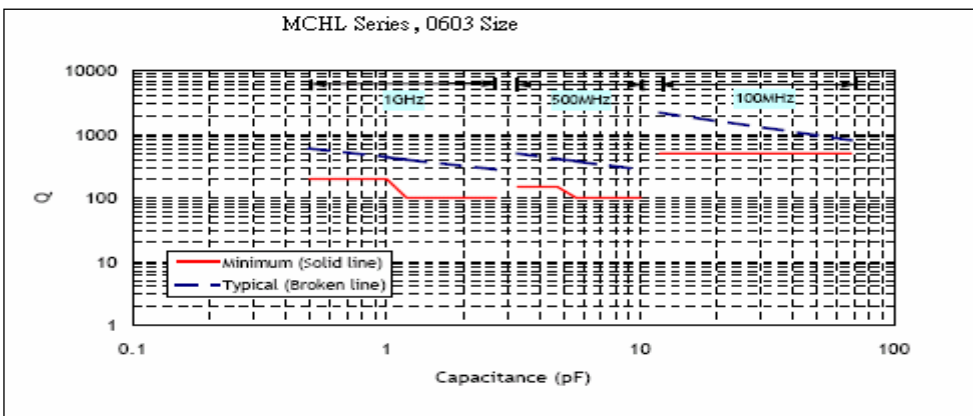
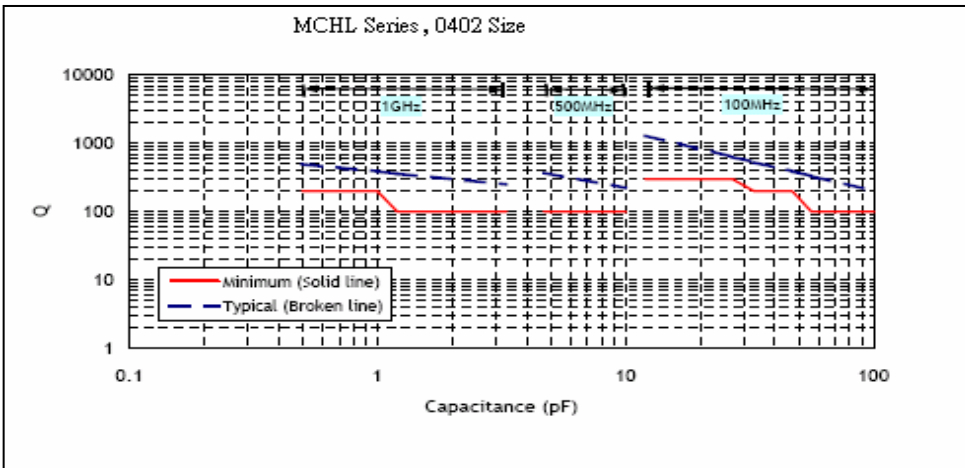
Electrical Data

Dielectric	NPO
Size	0402, 0603, 0805
Capacitance*	0402: 0.5pF ~ 470pF(<0.5pF: on requested) 0603: 0.5pF ~ 3300pF 0805: 0.5pF ~ 150pF
Capacitance tolerance	Cap ≤ 5pF: B(±0.1pF), C(±0.25pF) 5pF < Cap < 10pF: C(±0.25pF), D(±0.50pF) Cap ≥ 10pF: J(±5%)
Rated voltage (VDCW)	16V, 25V, 50V, 100V
Q *	Cap < 30pF: Q ≥ 400 + 20C Cap ≥ 30pF: Q ≥ 1000
Insulation resistance at Ur	≥ 10GΩ
Operating temperature	-55 to +125°C
Capacitance change	±30 ppm
ESR	Cap < 2.2pF: ≤ 1000mΩ @ 900±100MHz 2.2pF ≤ Cap ≤ 470pF: ≤ 500mΩ @ 900±100MHz Cap > 470pF: ≤ 500mΩ @ 60±10MHz
Termination	Ni/Sn (lead-free termination)

■ **Measured at the conditions of 25°C ambient temperature and 30~70% related humidity

■ Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap ≤ 1000pF; 1.0KHz±10% for Cap > 1000pF

Electrical characteristics



■ Ultra High Q & Low ESR Capacitors for MCRF Series

Capacitance & Voltage

Dielectric		NPO											
EIA	Size	0201			0402			0603			0805		
Code	VDCW	6.3V	10V	25V	50V	100V	50V	100V	250V	50V	100V	250V	
0R1	0.1pF	L	L	L	N	N							
0R2	0.2	L	L	L	N	N							
0R3	0.3	L	L	L	N	N	S	S	S	T	T	T	
0R4	0.4	L	L	L	N	N	S	S	S	T	T	T	
0R5	0.5	L	L	L	N	N	S	S	S	T	T	T	
0R6	0.6	L	L	L	N	N	S	S	S	T	T	T	
0R7	0.7	L	L	L	N	N	S	S	S	T	T	T	
0R8	0.8	L	L	L	N	N	S	S	S	T	T	T	
0R9	0.9	L	L	L	N	N	S	S	S	T	T	T	
1R0	1.0	L	L	L	N	N	S	S	S	T	T	T	
1R2	1.2	L	L	L	N	N	S	S	S	T	T	T	
1R5	1.5	L	L	L	N	N	S	S	S	T	T	T	
1R8	1.8	L	L	L	N	N	S	S	S	T	T	T	
2R2	2.2	L	L	L	N	N	S	S	S	T	T	T	
2R7	2.7	L	L	L	N	N	S	S	S	T	T	T	
3R3	3.3	L	L	L	N	N	S	S	S	T	T	T	
3R9	3.9	L	L	L	N	N	S	S	S	T	T	T	
4R7	4.7	L	L	L	N	N	S	S	S	T	T	T	
5R6	5.6	L	L	L	N	N	S	S	S	T	T	T	
6R8	6.8	L	L	L	N	N	S	S	S	T	T	T	
8R2	8.2	L	L	L	N	N	S	S	S	T	T	T	
100	10	L	L	L	N	N	S	S	S	T	T	T	
120	12	L	L	L	N		S	S	S	T	T	T	
150	15	L	L	L	N		S	S	S	T	T	T	
180	18	L	L	L	N		S	S	S	T	T	T	
220	22				N		S	S	S	T	T	T	
330	33						S	S		T	T	T	
390	39						S	S		T	T	T	
470	47						S	S		T	T	T	
560	56									T	T	T	
680	68									T	T	T	
820	82									T	T	T	
101	100									T	T	T	

■ The letter in cell is expressed the symbol of product thickness

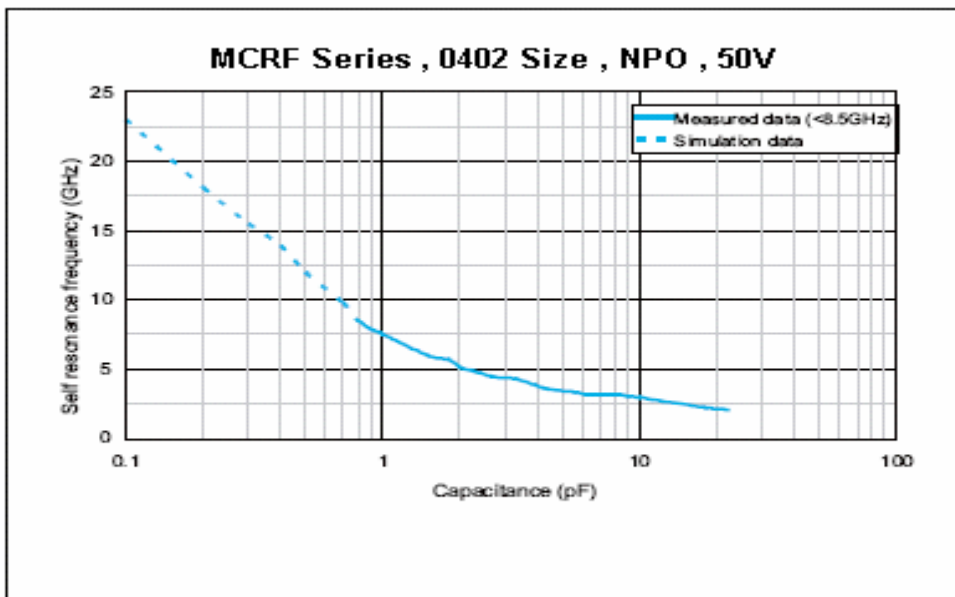
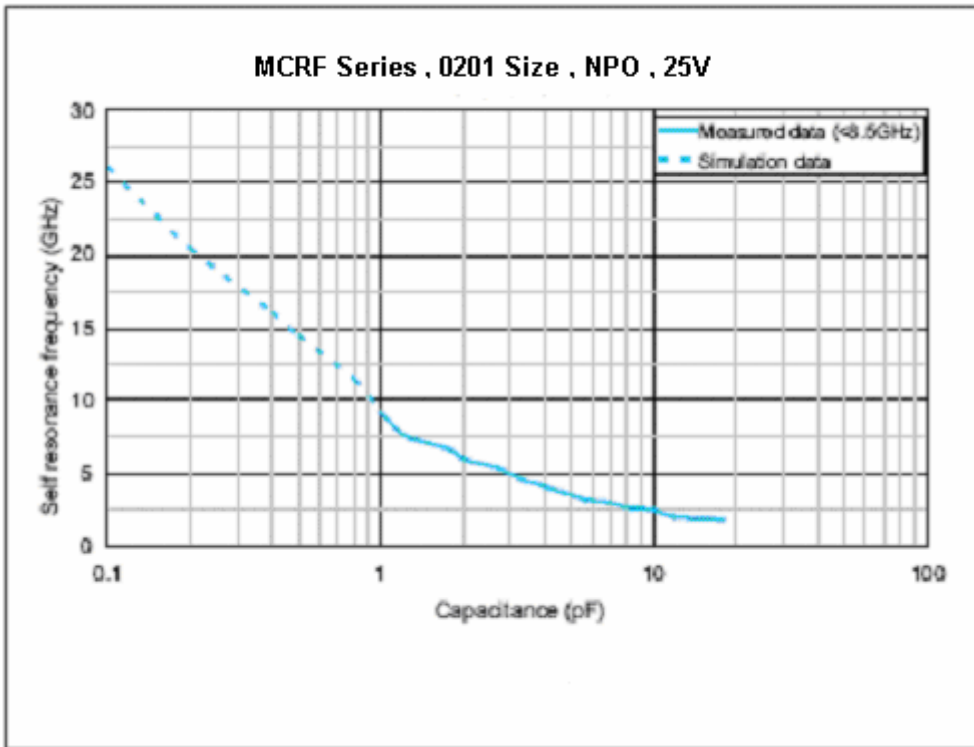
Electrical Data

Dielectric	NPO
Size	0201, 0402, 0603, 0805
Capacitance*	0201: 0.1pF ~ 18pF, 0402: 0.1pF ~ 22pF 0603: 0.3pF ~ 47pF, 0805: 0.3pF ~ 100pF
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 (VDCW)	6.3V, 10V, 25V, 50V, 100V, 250V
Q *	Cap ≥ 30pF: Q ≥ 1000, Cap < 30pF: Q ≥ 400+20C;
Insulation resistance at Ur	≥ 10GΩ
Operating temperature	-55 to +125°C
Capacitance	±30 ppm
Termination	Ni/Sn (lead-free termination)

■ **Measured at the conditions of 25°C ambient temperature and 30~70% related humidity

■ Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap ≤ 1000pF; 1.0KHz±10% for Cap > 1000pF

Electrical characteristics



Low Inductance Capacitors for MCLI Series

Capacitance & Voltage

Dielectric		X7R
EIA	Size	0612
Code	VDCW	50V
103	10nF	B
123	12	B
153	15	B
183	18	B
223	22	B
273	27	B
333	33	B
393	39	B
473	47	B
563	56	B
683	68	B
823	82	B
104	100	B
124	120	B
154	150	B

■ The letter in cell is expressed the symbol of product thickness

General Electrical data

Dielectric	X7R
Size	0612
Capacitance*	10nF~150nF
Capacitance tolerance	K (±10%) M (±20%)
Rated voltage (WVDC)	50V
Tan δ *	≤2.5%
Insulation resistance at Ur	≥ 10GΩ or R×C ≥ 500Ω×F Whichever is less
Operating temperature	-55 to +125°C
Capacitance change	±15%
Termination	Ni/Sn (lead-free termination)
ESL	500pH

■ **Measured at 1.0±0.2Vrms, 1.0KHz±10%, 30~70% related humidity, 25°C ambient temperature

Environmental Characteristics

Item	Requirement	Test Method																																																																						
External Appearance	No defects which may affect performance	Visual inspection & Dimension measurement																																																																						
Capacitance(Cap.)	Within the specified tolerance that refers on page2	NPO: (Class I) Cap \leq 1000pF 1.0 \pm 0.2Vrms, 1MHz \pm 10% Cap \leq 1000pF 1.0 \pm 0.2Vrms, 1KHz \pm 10%																																																																						
Dissipation Factor (D.F.) or Quality factor (Q=1/D.F.)	<p>NPO: Cap\geq 30pF, Q\geq 1000; Cap$<$30pF, Q\geq 400+20C X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th colspan="2">Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td>\geq 50V</td> <td>2.5%</td> <td>3%</td> <td>0201(50V); 0603\geq 0.047μF 0805\geq 0.18μF; 1206\geq 0.47μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">3.5%</td> <td>5%</td> <td>0805\geq 1μF; 1210\geq 10μF</td> </tr> <tr> <td>7%</td> <td>0603\geq 0.33μF; 1206\geq 4.7μF</td> </tr> <tr> <td>10%</td> <td>0402\geq 0.10μF; 0603\geq 0.47μF 0805\geq 2.2μF; 1206\geq 6.8μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">3.5%</td> <td>5%</td> <td>0402\geq 0.033μF; 0603\geq 0.15μF 0805\geq 0.68μF; 1206\geq 2.2μF 1210\geq 4.7μF</td> </tr> <tr> <td>10%</td> <td>0603\geq 0.68μF; 0805\geq 2.2μF 1206\geq 4.7μF; 1210\geq 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">5%</td> <td>10%</td> <td>0402\geq 0.33μF; 0603\geq 0.33μF 0805\geq 2.2μF; 1206\geq 2.2μF 1210\geq 22μF</td> </tr> <tr> <td>15%</td> <td>0201\geq 0.1μF; 0402\geq 1μF</td> </tr> <tr> <td rowspan="2">6.3V</td> <td rowspan="2">10%</td> <td>15%</td> <td>0603\geq 10μF; 0805\geq 4.7μF 1210\geq 100μF</td> </tr> <tr> <td>20%</td> <td>0402\geq 2.2μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. \leq</th> <th colspan="2">Exception of D.F. \leq</th> </tr> </thead> <tbody> <tr> <td>\geq 50V</td> <td>5%</td> <td>7%</td> <td>0603\geq 0.1μF; 0805\geq 0.47μF 1206\geq 4.7μF</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\geq 0.047μF; 0603\geq 0.1μF 0805\geq 0.33μF; 1206\geq 1μF 1210\geq 0.47μF</td> </tr> <tr> <td>9%</td> <td>0402\geq 0.068μF; 0603\geq 0.47μF 1206\geq 4.7μF; 1210\geq 22μF</td> </tr> <tr> <td rowspan="2">16V (C < 1.0μF)</td> <td rowspan="2">7%</td> <td>9%</td> <td>0402\geq 0.068μF; 0603\geq 0.68μF</td> </tr> <tr> <td>12.5%</td> <td>0402\geq 0.22μF</td> </tr> <tr> <td>16V (C \geq 1.0μF)</td> <td>9%</td> <td>12.5%</td> <td>0603\geq 2.2μF; 0805\geq 3.3μF 1206\geq 10μF; 1210\geq 22μF 1812\geq 47μF</td> </tr> <tr> <td>10V</td> <td>12.5%</td> <td>20%</td> <td>0402\geq 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>20%</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	Rated vol.	D.F. \leq	Exception of D.F. \leq		\geq 50V	2.5%	3%	0201(50V); 0603 \geq 0.047 μ F 0805 \geq 0.18 μ F; 1206 \geq 0.47 μ F	25V	3.5%	5%	0805 \geq 1 μ F; 1210 \geq 10 μ F	7%	0603 \geq 0.33 μ F; 1206 \geq 4.7 μ F	10%	0402 \geq 0.10 μ F; 0603 \geq 0.47 μ F 0805 \geq 2.2 μ F; 1206 \geq 6.8 μ F	16V	3.5%	5%	0402 \geq 0.033 μ F; 0603 \geq 0.15 μ F 0805 \geq 0.68 μ F; 1206 \geq 2.2 μ F 1210 \geq 4.7 μ F	10%	0603 \geq 0.68 μ F; 0805 \geq 2.2 μ F 1206 \geq 4.7 μ F; 1210 \geq 22 μ F	10V	5%	10%	0402 \geq 0.33 μ F; 0603 \geq 0.33 μ F 0805 \geq 2.2 μ F; 1206 \geq 2.2 μ F 1210 \geq 22 μ F	15%	0201 \geq 0.1 μ F; 0402 \geq 1 μ F	6.3V	10%	15%	0603 \geq 10 μ F; 0805 \geq 4.7 μ F 1210 \geq 100 μ F	20%	0402 \geq 2.2 μ F	Rated vol.	D.F. \leq	Exception of D.F. \leq		\geq 50V	5%	7%	0603 \geq 0.1 μ F; 0805 \geq 0.47 μ F 1206 \geq 4.7 μ F	35V	7%	—	—	25V	5%	7%	0402 \geq 0.047 μ F; 0603 \geq 0.1 μ F 0805 \geq 0.33 μ F; 1206 \geq 1 μ F 1210 \geq 0.47 μ F	9%	0402 \geq 0.068 μ F; 0603 \geq 0.47 μ F 1206 \geq 4.7 μ F; 1210 \geq 22 μ F	16V (C < 1.0 μ F)	7%	9%	0402 \geq 0.068 μ F; 0603 \geq 0.68 μ F	12.5%	0402 \geq 0.22 μ F	16V (C \geq 1.0 μ F)	9%	12.5%	0603 \geq 2.2 μ F; 0805 \geq 3.3 μ F 1206 \geq 10 μ F; 1210 \geq 22 μ F 1812 \geq 47 μ F	10V	12.5%	20%	0402 \geq 0.47 μ F	6.3V	20%	-	-	<p>X7R, X5R, Y5V: (Class II) Cap\leq 10μF 1.0\pm0.2Vrms, 1KHz\pm10% Cap$>$10μF 0.5\pm0.2Vrms, 120Hz\pm10%</p>
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Dielectric Strength	No evidence of damage or flash over during test	<p>To apply voltage(\leq 100V) 250% Duration: 1 to 5sec Charge and discharge current less than 50mA</p> <p>To apply voltage: 200V~300V \geq 2 time VDC 500V~999V \geq 1.5 time VDC 1000V~3000V \geq 1.2 time VDC Cut-off, set at 10mA TEST=15 sec. RAMP=0</p>																																																																						

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Insulation Resistance	10GΩ or RxC ≥ 500Ω-F Whichever is smaller X7R, X5R, Y5V:	To apply rated voltage for max. 120sec																				
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≥ 10GΩ or 100Ω-F whichever is smaller Rated voltage: 200V~630V	To apply rated voltage(500V max.) for 60sec.																					
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Temperature Characteristic of Capacitance	<table border="1"> <tr> <th>T.C.</th> <th>Capacitance Change</th> </tr> <tr> <td>NPO</td> <td>±30 (ppm/°C)</td> </tr> <tr> <td>X7R</td> <td>±15%</td> </tr> <tr> <td>X5R</td> <td>±15%</td> </tr> <tr> <td>Y5V</td> <td>+30%~-80%</td> </tr> </table>	T.C.	Capacitance Change	NPO	±30 (ppm/°C)	X7R	±15%	X5R	±15%	Y5V	+30%~-80%	<p>With no electrical load.</p> <table border="1"> <tr> <th>T.C.</th> <th>Operating Temp</th> </tr> <tr> <td>NPO</td> <td>-55 ~ 125°C at 25°C</td> </tr> <tr> <td>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>	T.C.	Operating Temp	NPO	-55 ~ 125°C at 25°C	X7R	-55 ~ 125°C at 25°C	X5R	-55 ~ 85°C at 25°C	Y5V	-25 ~ 85°C at 20°C
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Adhesive Strength of Termination	No remarkable damage or removal of the terminations	Pressurizing force: 0201:2N 0402&0603:5N>0603:10N Test time: 10±1 sec																				
Vibration Resistance	No remarkable damage Cap change and Q/D.F.: To meet initial spec	Vibration frequency: 10~55Hz/min Total amplitude: 1.5mm Test time: 6hrs.(tow hrs each in three mutually Perpendicular directions.)																				
Solderability	95% min. coverage of all metalized area.	Solder temperature: 235±5°C Dipping time: 2±0.5 sec.																				
Bending Test	No remarkable damage Cap change: NPO: within±5% or 0.5pF whichever is larger X7R, 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.)	The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm and then the pressure shall be maintained for 5±1sec. Measurement to be made after keeping at room temp. for 24±2hrs(Class I) or 48±4hrs(Class II) (Thickness>1.0mm, Thickness ≤ 1.0mm)																				
Resistance to Soldering Heat	No remarkable damage Cap change: NPO: within±2.5% or 0.25pF whichever is larger X7R, 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.	Solder temperature: 270±5°C Dipping time: 10±1sec Preheating: 120 to 150°C for 1minute before immerse the capacitor in a eutectic solder. Before initial measurement(Class II only): Perform 150+0/-10°C for 1hr and then set for 48±4hrs at room temp. Measurement to be made after keep at room temp. for 24±2 hrs.(Class I) or 48±4 hrs.(Class II).																				
Temperature Cycle	No remarkable damage. Cap change: NPO: within±2.5% or 0.25pF whichever is larger X7R, X5R: within±7.5% Y5V: within±20% Q/D.F., I.R. and dielectric strength: To meet initial requirements.	Conduct the five cycles according to the temperature and time.																				
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Humidity (steady state)	<p>No remarkable damage. Cap change: NPO: within±5% or 0.5pF whichever is large X7R, X5R: ≥ 10V, within±12.5%; 6.3V, within±25% Y5V: ≥ 10V, within±30%; 6.3V, within+30/-40% Q/D.F. value: NPO: More than 30pF Q ≥ 350, 10pF ≤ C ≤ 30pF, Q ≥ 275+2.5C Less than 10pF Q ≥ 200+10C X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50V</td> <td>3.0%</td> <td>6%</td> <td>0201(50V);0603 ≥ 0.047μF 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">5.0%</td> <td>10%</td> <td>0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td>14%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.1μF; 0603 ≥ 0.47μF 0805 ≥ 2.2μF; 1206 ≥ 6.8μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5%</td> <td>10%</td> <td>0603 ≥ 0.15μF; 0603 ≥ 0.68μF 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>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>0402 ≥ 0.33μF; 0603 ≥ 0.33μF 0805 ≥ 2.2μF; 1206 ≥ 2.2μF 1210 ≥ 22μF</td> </tr> <tr> <td>20%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>6.3V</td> <td>15%</td> <td>30%</td> <td>0402 ≥ 2.2μF; 0603 ≥ 10μF 0805 ≥ 4.7μF; 1210 ≥ 100μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50 V</td> <td>7.5%</td> <td>10%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF 1206 ≥ 4.7μF</td> </tr> <tr> <td>35V</td> <td>10%</td> <td>—</td> <td>—</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10%</td> <td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF 0805 ≥ 0.33μF; 1206 ≥ 1μF 1210 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V (C < 1.0μF)</td> <td rowspan="2">10%</td> <td>12.5%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>20%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td rowspan="2">16V (C ≥ 0.0μF)</td> <td rowspan="2">12.5%</td> <td>20%</td> <td>0603 ≥ 2.2μF; 0805 ≥ 3.3μF 1206 ≥ 10μF; 1210 ≥ 22μF 1812 ≥ 47μF</td> </tr> <tr> <td>30%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>10V</td> <td>20%</td> <td>30%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>I.R.: ≥ 10V 1GΩ or 50Ω-F whichever is smaller. Class II (X7R, X5R, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="5">RxC ≥ 10Ω-F</td> </tr> <tr> <td>16V: 0402 ≥ 0.22uF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47uF 0603 ≥ 0.47uF; 0805 ≥ 2.2uF 1206 ≥ 4.7uF; 1210 ≥ 47uF</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	3.0%	6%	0201(50V);0603 ≥ 0.047μF 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	25V	5.0%	10%	0805 ≥ 1μF; 1210 ≥ 10μF	14%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	15%	0402 ≥ 0.1μF; 0603 ≥ 0.47μF 0805 ≥ 2.2μF; 1206 ≥ 6.8μF	16V	5%	10%	0603 ≥ 0.15μF; 0603 ≥ 0.68μF 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	15%	0402 ≥ 0.033μF; 0603 ≥ 0.68μF 0805 ≥ 2.2μF; 1206 ≥ 4.7μF 1210 ≥ 22μF	10V	7.5%	15%	0402 ≥ 0.33μF; 0603 ≥ 0.33μF 0805 ≥ 2.2μF; 1206 ≥ 2.2μF 1210 ≥ 22μF	20%	0201 ≥ 0.1μF; 0402 ≥ 1μF	6.3V	15%	30%	0402 ≥ 2.2μF; 0603 ≥ 10μF 0805 ≥ 4.7μF; 1210 ≥ 100μF	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50 V	7.5%	10%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF 1206 ≥ 4.7μF	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 ≥ 0.0μF)	12.5%	20%	0603 ≥ 2.2μF; 0805 ≥ 3.3μF 1206 ≥ 10μF; 1210 ≥ 22μF 1812 ≥ 47μF	30%	0402 ≥ 0.47μF	10V	20%	30%	0402 ≥ 0.47μF	6.3V	30%	-	-	Rated voltage	Insulation Resistance	100V: X7R	RxC ≥ 10Ω-F	16V: 0402 ≥ 0.22uF	10V: 0201 ≥ 47nF; 0402 ≥ 0.47uF 0603 ≥ 0.47uF; 0805 ≥ 2.2uF 1206 ≥ 4.7uF; 1210 ≥ 47uF	6.3V	<p>Test temp: 40±2°C Humidity: 90~95% RH Test time: 500+24/-0hrs Measurement to be made after keeping at room temp. for 24±2hrs.(Class I) or 48±4 hrs.(Class II).</p>
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Humidity load	<p>No remarkable damage. Cap change: NPO:±7.5% or 0.75pF whichever is larger X5R, X5R:≥ 10V, within±12.5%; 6.3V, within±25% Y5V:≥ 10V, within±30%; 6.3V, within+30/-40% Q/D.F. value: NPO: C ≥ 30pF, Q ≥ 200; C < 30pF, Q ≥ 100+10/3C</p> <p>X7R, X5R:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td rowspan="2">≥ 50V</td> <td rowspan="2">3.0%</td> <td>6%</td> <td>0201(50V);0603 ≥ 0.047μF 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td> </tr> <tr> <td>10%</td> <td>0805 ≥ 1μF; 1210 ≥ 10μF</td> </tr> <tr> <td rowspan="3">25V</td> <td rowspan="3">5.0%</td> <td>14%</td> <td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.10μF; 0603 ≥ 0.47μF 0805 ≥ 2.2μF; 1206 ≥ 6.8μF</td> </tr> <tr> <td>10%</td> <td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF 1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td> </tr> <tr> <td rowspan="2">16V</td> <td rowspan="2">5%</td> <td>15%</td> <td>0402 ≥ 0.033μF; 0603 ≥ 0.68μF 0805 ≥ 2.2μF; 1206 ≥ 4.7μF 1210 ≥ 22μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.22μF; 0603 ≥ 0.33μF 0805 ≥ 2.2μF; 1206 ≥ 2.2μF 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">10V</td> <td rowspan="2">7.5%</td> <td>20%</td> <td>0201 ≥ 0.1μF; 0402 ≥ 1μF</td> </tr> <tr> <td>30%</td> <td>0402 ≥ 2.2μF; 0603 ≥ 10μF 0805 ≥ 4.7μF; 1210 ≥ 100μF</td> </tr> </tbody> </table> <p>Y5V:</p> <table border="1"> <thead> <tr> <th>Rated vol.</th> <th>D.F. ≤</th> <th colspan="2">Exception of D.F. ≤</th> </tr> </thead> <tbody> <tr> <td>≥ 50 V</td> <td>7.5%</td> <td>10%</td> <td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF 1206 ≥ 4.7μF</td> </tr> <tr> <td>35V</td> <td>10%</td> <td>—</td> <td>—</td> </tr> <tr> <td rowspan="2">25V</td> <td rowspan="2">7.5%</td> <td>10%</td> <td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF 0805 ≥ 0.033μF; 1206 ≥ 1μF 1210 ≥ 4.7μF</td> </tr> <tr> <td>15%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.1μF 1206 ≥ 4.7μF; 1210 ≥ 22μF</td> </tr> <tr> <td rowspan="2">16V (C < 1.0μF)</td> <td rowspan="2">10%</td> <td>12.5%</td> <td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td> </tr> <tr> <td>20%</td> <td>0402 ≥ 0.22μF</td> </tr> <tr> <td>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</td> </tr> <tr> <td>10V</td> <td>20%</td> <td>30%</td> <td>0402 ≥ 0.47μF</td> </tr> <tr> <td>6.3V</td> <td>30%</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>I.R.: ≥ 10V 500MΩ or 25Ω-F (Whichever is smaller) Class II (X7R, X5R, Y5V)</p> <table border="1"> <thead> <tr> <th>Rated voltage</th> <th>Insulation Resistance</th> </tr> </thead> <tbody> <tr> <td>100V: X7R</td> <td rowspan="5">Rx ≥ 5Ω-F</td> </tr> <tr> <td>16V: 0402 ≥ 0.22uF</td> </tr> <tr> <td>10V: 0201 ≥ 47nF; 0402 ≥ 0.47uF 0603 ≥ 0.47uF; 0805 ≥ 2.2uF 1206 ≥ 4.7uF; 1210 ≥ 47uF</td> </tr> <tr> <td>6.3V</td> </tr> </tbody> </table>	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50V	3.0%	6%	0201(50V);0603 ≥ 0.047μF 0805 ≥ 0.18μF; 1206 ≥ 0.47μF	10%	0805 ≥ 1μF; 1210 ≥ 10μF	25V	5.0%	14%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF	15%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF 0805 ≥ 2.2μF; 1206 ≥ 6.8μF	10%	0603 ≥ 0.15μF; 0805 ≥ 0.68μF 1206 ≥ 2.2μF; 1210 ≥ 4.7μF	16V	5%	15%	0402 ≥ 0.033μF; 0603 ≥ 0.68μF 0805 ≥ 2.2μF; 1206 ≥ 4.7μF 1210 ≥ 22μF	15%	0402 ≥ 0.22μF; 0603 ≥ 0.33μF 0805 ≥ 2.2μF; 1206 ≥ 2.2μF 1210 ≥ 22μF	10V	7.5%	20%	0201 ≥ 0.1μF; 0402 ≥ 1μF	30%	0402 ≥ 2.2μF; 0603 ≥ 10μF 0805 ≥ 4.7μF; 1210 ≥ 100μF	Rated vol.	D.F. ≤	Exception of D.F. ≤		≥ 50 V	7.5%	10%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF 1206 ≥ 4.7μF	35V	10%	—	—	25V	7.5%	10%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF 0805 ≥ 0.033μF; 1206 ≥ 1μF 1210 ≥ 4.7μF	15%	0402 ≥ 0.068μF; 0603 ≥ 0.1μF 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%	-	-	Rated voltage	Insulation Resistance	100V: X7R	Rx ≥ 5Ω-F	16V: 0402 ≥ 0.22uF	10V: 0201 ≥ 47nF; 0402 ≥ 0.47uF 0603 ≥ 0.47uF; 0805 ≥ 2.2uF 1206 ≥ 4.7uF; 1210 ≥ 47uF	6.3V	<p>Test temp: 40±2℃ Humidity: 90~95%RH Test time: 500+24/-0 hrs To apply voltage: Rated voltage(Max. 500V) Measurement to be made after keeping at room temp for 24±2hrs.(Class I) or 48±4hrs.(Class II)</p>
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D.F. \leq	Exception of D.F. \leq		$\geq 50V$	7.5%	10%	0603 $\geq 0.1\mu F$; 0805 $\geq 0.47\mu F$ 1206 $\geq 4.7\mu F$	35V	10%	—	—	25V	7.5%	10%	0402 $\geq 0.047\mu F$; 0603 $\geq 0.1\mu F$ 0805 $\geq 0.33\mu F$; 1206 $\geq 1\mu F$ 1210 $\geq 4.7\mu F$	15%	0402 $\geq 0.068\mu F$; 0603 $\geq 0.47\mu F$ 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$	16V ($C < 1.0\mu F$)	10%	12.5%	0402 $\geq 0.068\mu F$; 0603 $\geq 0.68\mu F$	20%	0402 $\geq 0.22\mu F$	16V ($C \geq 1.0\mu F$)	12.5%	20%	0603 $\geq 2.2\mu F$; 0805 $\geq 3.3\mu F$ 1206 $\geq 10\mu F$; 1210 $\geq 22\mu F$ 1812 $\geq 47\mu F$	30%	0402 $\geq 0.47\mu F$	6.3V	30%	-	-	Rated voltage	Insulation Resistance	100V: X7R	Rx C $\geq 10\Omega$ -F	16V: 0402 $\geq 0.22\mu F$	10V: 0201 $\geq 47nF$; 0402 $\geq 0.47\mu F$ 0603 $\geq 0.47\mu F$; 0805 $\geq 2.2\mu F$ 1206 $\geq 4.7\mu F$; 1210 $\geq 47\mu F$	6.3V	<p>Test temp: NPO, X7R: 125\pm3$^{\circ}C$ X5R, Y5V: 85\pm3$^{\circ}C$ Test Time: 1000+25/-0 hrs To apply voltage: (1.1) 100% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0201</td> <td>X5R</td> <td>6.3V, 10V</td> <td>$C \geq 0.1\mu F$</td> </tr> <tr> <td>0402</td> <td>X5R, Y5V</td> <td>6.3V, 10V</td> <td>$C \geq 1.0\mu F$</td> </tr> <tr> <td>0603</td> <td>X5R</td> <td>6.3V, 10V</td> <td>$C \geq 4.7\mu F$</td> </tr> <tr> <td>0805</td> <td>X5R</td> <td>6.3V</td> <td>$C \geq 22\mu F$</td> </tr> </tbody> </table> <p>(1.2) 6.3V or $C \geq 10\mu F$: 150% of rated voltage (2) $10V \leq U_r < 500V$: 200% of rated voltage. 150% of rated voltage for below range.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Dielectric</th> <th>Rated voltage</th> <th>Capacitance range</th> </tr> </thead> <tbody> <tr> <td>0603</td> <td>X5R</td> <td>10V, 16V</td> <td>$C \geq 1.0\mu F$</td> </tr> <tr> <td rowspan="2">0805</td> <td rowspan="2">X5R</td> <td rowspan="2">10V</td> <td>$C \geq 4.7\mu F$</td> </tr> <tr> <td>$C \geq 2.2\mu F$ & $T = 0.85 \pm 0.1mm$</td> </tr> <tr> <td>1206</td> <td>X5R</td> <td>10V</td> <td>$C \geq 4.7\mu F$ & $T = 0.85 \pm 0.1mm$</td> </tr> </tbody> </table> <p>(3) 500V: 150% of rated voltage (4) $U_r \geq 630V$: 120% of rated voltage</p> <p>Test time: 1000+24/-0hrs Measurement to be made after keeping at room temp. for 24\pm2hrs.(Class I) or 48\pm4hrs.(Class II).</p>	Size	Dielectric	Rated voltage	Capacitance range	0201	X5R	6.3V, 10V	$C \geq 0.1\mu F$	0402	X5R, Y5V	6.3V, 10V	$C \geq 1.0\mu F$	0603	X5R	6.3V, 10V	$C \geq 4.7\mu F$	0805	X5R	6.3V	$C \geq 22\mu F$	Size	Dielectric	Rated voltage	Capacitance range	0603	X5R	10V, 16V	$C \geq 1.0\mu F$	0805	X5R	10V	$C \geq 4.7\mu F$	$C \geq 2.2\mu F$ & $T = 0.85 \pm 0.1mm$	1206	X5R	10V	$C \geq 4.7\mu F$ & $T = 0.85 \pm 0.1mm$
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16V	5%	10%	0603 $\geq 0.15\mu F$; 0805 $\geq 0.68\mu F$ 1206 $\geq 2.2\mu F$; 1210 $\geq 4.7\mu F$																																																																																																													
		15%	0402 $\geq 0.033\mu F$; 0603 $\geq 0.68\mu F$ 0805 $\geq 2.2\mu F$; 1206 $\geq 4.7\mu F$ 1210 $\geq 22\mu F$																																																																																																													
10V	7.5%	15%	0402 $\geq 0.33\mu F$; 0603 $\geq 0.33\mu F$ 0805 $\geq 2.2\mu F$; 1206 $\geq 2.2\mu F$ 1210 $\geq 22\mu F$																																																																																																													
		20%	0201 $\geq 0.1\mu F$; 0402 $\geq 1\mu F$																																																																																																													
6.3V	15%	30%	0402 $\geq 2.2\mu F$; 0603 $\geq 10\mu F$ 0805 $\geq 4.7\mu F$; 1210 $\geq 100\mu F$																																																																																																													
Rated vol.	D.F. \leq	Exception of D.F. \leq																																																																																																														
$\geq 50V$	7.5%	10%	0603 $\geq 0.1\mu F$; 0805 $\geq 0.47\mu F$ 1206 $\geq 4.7\mu F$																																																																																																													
35V	10%	—	—																																																																																																													
25V	7.5%	10%	0402 $\geq 0.047\mu F$; 0603 $\geq 0.1\mu F$ 0805 $\geq 0.33\mu F$; 1206 $\geq 1\mu F$ 1210 $\geq 4.7\mu F$																																																																																																													
		15%	0402 $\geq 0.068\mu F$; 0603 $\geq 0.47\mu F$ 1206 $\geq 4.7\mu F$; 1210 $\geq 22\mu F$																																																																																																													
16V ($C < 1.0\mu F$)	10%	12.5%	0402 $\geq 0.068\mu F$; 0603 $\geq 0.68\mu F$																																																																																																													
		20%	0402 $\geq 0.22\mu F$																																																																																																													
16V ($C \geq 1.0\mu F$)	12.5%	20%	0603 $\geq 2.2\mu F$; 0805 $\geq 3.3\mu F$ 1206 $\geq 10\mu F$; 1210 $\geq 22\mu F$ 1812 $\geq 47\mu F$																																																																																																													
		30%	0402 $\geq 0.47\mu F$																																																																																																													
6.3V	30%	-	-																																																																																																													
Rated voltage	Insulation Resistance																																																																																																															
100V: X7R	Rx C $\geq 10\Omega$ -F																																																																																																															
16V: 0402 $\geq 0.22\mu F$																																																																																																																
10V: 0201 $\geq 47nF$; 0402 $\geq 0.47\mu F$ 0603 $\geq 0.47\mu F$; 0805 $\geq 2.2\mu F$ 1206 $\geq 4.7\mu F$; 1210 $\geq 47\mu F$																																																																																																																
6.3V																																																																																																																
Size		Dielectric	Rated voltage	Capacitance range																																																																																																												
0201	X5R	6.3V, 10V	$C \geq 0.1\mu F$																																																																																																													
0402	X5R, Y5V	6.3V, 10V	$C \geq 1.0\mu F$																																																																																																													
0603	X5R	6.3V, 10V	$C \geq 4.7\mu F$																																																																																																													
0805	X5R	6.3V	$C \geq 22\mu F$																																																																																																													
Size	Dielectric	Rated voltage	Capacitance range																																																																																																													
0603	X5R	10V, 16V	$C \geq 1.0\mu F$																																																																																																													
0805	X5R	10V	$C \geq 4.7\mu F$																																																																																																													
			$C \geq 2.2\mu F$ & $T = 0.85 \pm 0.1mm$																																																																																																													
1206	X5R	10V	$C \geq 4.7\mu F$ & $T = 0.85 \pm 0.1mm$																																																																																																													

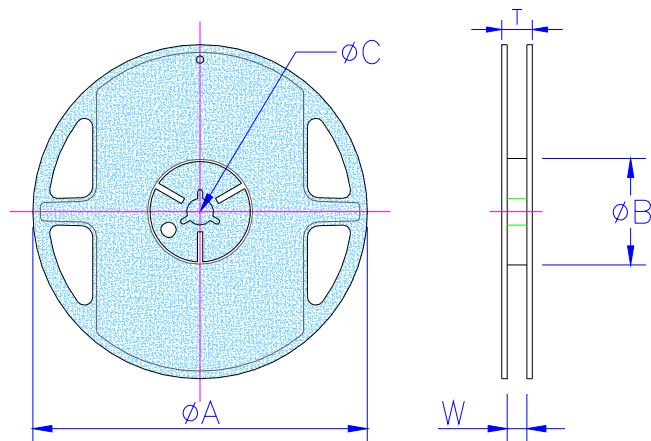
■ Packaging

Packaging Quantity

Unit: mm

Type	Thickness / Symbol		Packaging (7" Reel)	
			Paper tape	Plastic tape
0201	0.30±0.03	L	15K	-
0402	0.50±0.05	N	10K	-
0603	0.80±0.07	S	4K	-
	0.80 +0.15 / -0.10	X	4K	-
0805	0.60±0.10	A	4K	-
	0.80±0.10	B	4K	-
	0.85±0.10	T	4K	-
	1.25±0.10	D	-	3K
	1.25±0.20	I	-	3K
1206	0.80±0.10	B	4K	-
	0.95±0.10	C	-	3K
	1.15±0.15	J	-	3K
	1.25±0.10	D	-	3K
	1.60±0.20	G	-	2K
	1.60 +0.30 / -0.10	P	-	2K
1210	0.95±0.10	C	-	3K
	1.25±0.10	D	-	3K
	1.60±0.20	G	-	2K
	2.00±0.20	K	-	1K
	2.50±0.30	M	-	1K
1808	1.25±0.10	D	-	2K
	2.00±0.20	K	-	1K
1812	1.25±0.10	D	-	1K
	2.00±0.20	K	-	1K
	2.50±0.30	M	-	0.5K
0612	0.80±0.10	B	4K	-

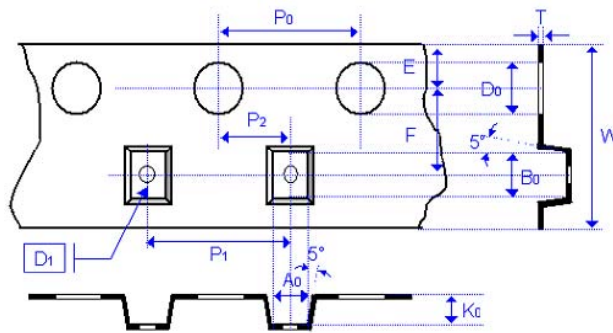
Tape and Reel



Unit: mm

Type	Chip Size							
	0201	0402	0603	0805	1206/0612	1210	1808	1812
ϕC	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0	13.0±1.0
W	9.0±1.0	9.0±1.0	9.0±1.0	9.0±1.0	9.0±1.0	9.0±1.0	13.5±1.0	13.5±1.0
ϕA	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")	178±1.0(7")
ϕB	60.5±1.0(7")	60.5±1.0(7")	60.5±1.0(7")	60.5±1.0(7")	60.5±1.0(7")	60.5±1.0(7")	80.0±1.0(7")	80.0±1.0(7")

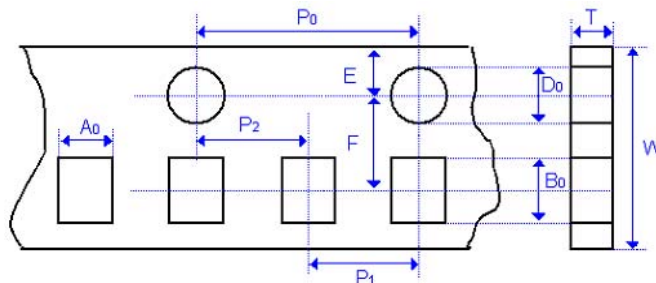
Plastic Tape Size Specification



Unit: mm

Type	0805		1206				1210					1808		1812		
	D	I	C	J	D	G	P	C	D	G	K	M	D	K	D	K
A ₀	<1.57		<1.85		<1.95		<2.97			<2.97		<2.35		<3.81		
B ₀	<2.40		<3.46		<3.67		<3.73			<3.73		<4.98	<5.00	<5.30		
T	0.23±0.05		0.23±0.05		0.23±0.05		0.23±0.05			0.23±0.05		0.25±0.05		0.25±0.05		
K ₀	<2.50		<2.50		<2.50		<2.50			<3.00		<2.50		<2.50	<3.00	
W	8.00±0.10		8.00±0.10		8.00±0.10		8.00±0.10			8.00±0.10		12.0±0.20		12.0±0.20		
P ₀	4.00±0.10		4.00±0.10		4.00±0.10		4.00±0.10			4.00±0.10		4.00±0.10		4.00±0.10		
P ₁	4.00±0.10		4.00±0.10		4.00±0.10		4.00±0.10			4.00±0.10		4.00±0.10		8.00±0.10		
P ₂	2.00±0.05		2.00±0.05		2.00±0.05		2.00±0.05			2.00±0.05		2.00±0.05		2.00±0.05		
D ₀	1.50±0.05		1.50±0.05		1.50±0.05		1.50±0.05			1.50±0.05		1.50±0.05		1.50±0.05		
D ₁	1.00±0.10		1.00±0.10		1.00±0.10		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		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		3.50±0.05		5.50±0.05		

Paper Tape Size Specification



Unit: mm

Type	0201	0402	0603		0805		1206/0612
	L	N	S	X	A	B	B
A ₀	0.45±0.05	0.62±0.05	1.02±0.05		1.50±0.10	1.50±0.10	2.00±0.10
B ₀	0.75±0.05	1.12±0.05	1.82±0.05		2.30±0.10	2.30±0.10	3.50±0.10
T	0.60±0.05	0.60±0.05	0.95±0.05		0.75±0.05	0.95±0.05	0.95±0.05
W	8.00±0.10	8.00±0.10	8.00±0.10		8.00±0.10	8.00±0.10	8.00±0.10
P ₀	4.00±0.10	4.00±0.10	4.00±0.10		4.00±0.10	4.00±0.10	4.00±0.10
P ₁	2.00±0.05	2.00±0.05	4.00±0.10		4.00±0.10	4.00±0.10	4.00±0.10
P ₂	2.00±0.05	2.00±0.05	2.00±0.05		2.00±0.05	2.00±0.05	2.00±0.05
D ₀	1.55±0.05	1.55±0.05	1.55±0.05		1.55±0.05	1.55±0.05	1.50±0.05
E	1.75±0.05	1.75±0.05	1.75±0.05		1.75±0.05	1.75±0.05	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	3.50±0.05