INDEX

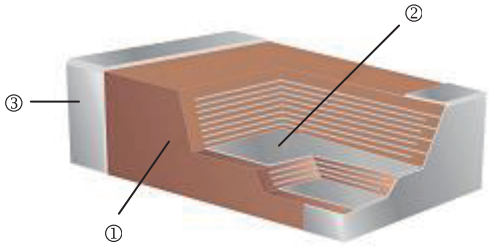
◆ Chip Capacitors

◆ Supercapacitor

◆ Conductive Polymer Aluminum Solid Electrolytic Capacitors

Multilayer Ceramic Capacitor—MC Series

■Construction



①	Ceramic Material	③	Termination
②	Inner Electrodes		

■Features

—A wide selection of sizes is available (0201~2225)
—High capacitance in given case size
—Capacitor with lead-free termination (pure Tin)
—Adaptable to high-speed surface mount assembly
—RoHS & HALOGEN compliant

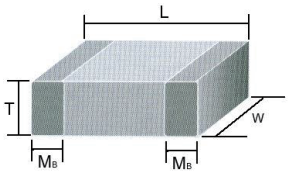
■Applications

—For General Digital Circuit
—For Power Supply Bypass Capacitors
—For Consumer Electronics
—For Telecommunication
—DC to DC Converter

■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 MCRF: Ultra High Q and Low ESR (RF)	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 08: 1808 12: 1812	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 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

Dimensions



MC / MCRF Type

Unit: mm

Type	Size (Inch)	L	W	T / Symbol		M_B	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	-
		0.6±0.05#2	0.3±0.05#2	0.3±0.05#2				
		0.6±0.09#3	0.3±0.09#3	0.3±0.09#3		0.15+0.1/-0.15		
02	0402	1.00±0.05	0.50±0.05	0.50±0.05	N	0.25 +0.05 / -0.10	10K	-
				0.50+0.02/-0.05	Q			
		1.00±0.20	0.50±0.20	0.50±0.20	E			
03	0603	1.60±0.10	0.80±0.10	0.80±010	S	0.40±0.15	4K	-
		1.60+0.15/-0.10	0.80+0.15/-0.10	0.50±010	H			
				0.80+0.15 / -0.10	X			
		1.60±0.20#1	0.80±0.20#1	0.80±020#1				
05	0805	2.00±0.15	1.25±0.10	0.50±0.10	H	0.50±0.20	4K	-
				0.60±0.15	A			-
				0.80±0.10	B			-
				1.25±0.10	D		-	3K
		2.00±0.20	1.25±0.20	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 (0.50±0.25)***	4K	-
				0.95±0.10	C		-	3K
				1.25±0.10	D		-	3K
		3.20±0.20		1.15±0.15	J		-	3K
			1.60±0.20	1.60±0.20	G		-	2K
				0.85±0.10	T		4K	-
		3.20+0.3 / -0.1	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
				0.85±0.10	T		-	3K
				1.25±0.10	D		-	3K
		3.20±0.40	2.50±0.30	1.60±0.20	G		-	2K
				2.00±0.20	K		-	1K
				2.50±0.30	M		-	1K /0.5K
08	1808	4.50±0.40 (4.5+0.5/-0.3)**	2.03±0.25	1.25±0.10	D	0.75±0.25 (0.50±0.25)***	-	2K
				1.40±0.15	F		-	2K
				1.60±0.20	G		-	2K
				2.00±0.20	K		-	1K
12	1812	4.50±0.40 (4.5+0.5/-0.3)**	3.20±0.30	1.25±0.10	D	0.75±0.25 (0.50±0.25)***	-	1K
				1.60±0.20	G		-	1K
				2.00±0.20	K		-	1K
			3.20±0.40	2.50±0.30	M		-	0.5K
				2.80±0.30	U		-	0.5K

** For 1808/1812: 200~3KV, ***For 1206:1KV~3KV; 1808/1812: 200~3KV

#1: For 0603 Cap≧10uF or 0603 Cap≧4.7uF(≦6.3V) or 0603 Cap>1uF(>10V)products；

#2: For 0201/Cap≧0.68uF products；

#3: For 0201/Cap≧1uF products

■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
0R1	0.1pF	N	N	N	N											
0R2	0.2	N	N	N	N											
0R3	0.3	N	N	N	N		S	S	S	S						
0R4	0.4	N	N	N	N		S	S	S	S						
0R5	0.5	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
2R0	2.0	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
3R0	3.0	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
4R0	4.0	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
5R0	5.0	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
6R0	6.0	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
7R0	7.0	N	N	N	N	N	S	S	S	S	S	A	A	A	A	A
8R0	8.0	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
9R0	9.0	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		S	S	S	S	S	A	A	A	A	A
331	330	N	N	N	N		S	S	S	S	S	A	A	A	A	A
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						X	X	X	X	X*	B	B	B	B	B
152	1500						X	X	X	X	X*	B	B	B	B	B
182	1800						X	X	X	X		B	B	B	B	B
222	2200						X	X	X	X		B	B	B	B	B
272	2700						X	X	X	X		D	D	D	D	D
332	3300						X	X	X	X		D	D	D	D	D
392	3900						X*	X*	X*	X*		D	D	D	D	D
472	4700						X*	X*	X*	X*		D	D	D	D	D
562	5600						X*	X*	X*	X*		D	D	D	D	D
682	6800						X*	X*	X*	X*		D	D	D	D	D
822	8200						X*	X*	X*	X*		D	D	D	D	
103	0.01uF						X*	X*	X*	X*		D	D	D	D	
123	0.012											T*	T*	T*	T*	
153	0.015											T*	T*	T*	T*	
183	0.018											D*	D*	D*	D*	
223	0.022											D*	D*	D*	D*	

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

■The letter in cell with "*" mark is expressed capacitance tolerance "J"(±5%) only

Capacitance & Voltage (NPO)

Dielectric		NPO													
EIA	Size	1206					1210					1812			
Code	VDCW	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V	16V	25V	50V	100V
1R2	1.2 pF	B	B	B	B	B									
1R5	1.5	B	B	B	B	B									
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									
4R7	4.7	B	B	B	B	B									
5R6	5.6	B	B	B	B	B									
6R8	6.8	B	B	B	B	B									
8R2	8.2	B	B	B	B	B									
100	10pF	B	B	B	B	B	C	C	C	C	C	D	D	D	D
120	12	B	B	B	B	B	C	C	C	C	C	D	D	D	D
150	15	B	B	B	B	B	C	C	C	C	C	D	D	D	D
180	18	B	B	B	B	B	C	C	C	C	C	D	D	D	D
220	22	B	B	B	B	B	C	C	C	C	C	D	D	D	D
270	27	B	B	B	B	B	C	C	C	C	C	D	D	D	D
330	33	B	B	B	B	B	C	C	C	C	C	D	D	D	D
390	39	B	B	B	B	B	C	C	C	C	C	D	D	D	D
470	47	B	B	B	B	B	C	C	C	C	C	D	D	D	D
560	56	B	B	B	B	B	C	C	C	C	C	D	D	D	D
680	68	B	B	B	B	B	C	C	C	C	C	D	D	D	D
820	82	B	B	B	B	B	C	C	C	C	C	D	D	D	D
101	100pF	B	B	B	B	B	C	C	C	C	C	D	D	D	D
121	120	B	B	B	B	B	C	C	C	C	C	D	D	D	D
151	150	B	B	B	B	B	C	C	C	C	C	D	D	D	D
181	180	B	B	B	B	B	C	C	C	C	C	D	D	D	D
221	220	B	B	B	B	B	C	C	C	C	C	D	D	D	D
271	270	B	B	B	B	B	C	C	C	C	C	D	D	D	D
331	330	B	B	B	B	B	C	C	C	C	C	D	D	D	D
391	390	B	B	B	B	B	C	C	C	C	C	D	D	D	D
471	470	B	B	B	B	B	C	C	C	C	C	D	D	D	D
561	560	B	B	B	B	B	C	C	C	C	C	D	D	D	D
681	680	B	B	B	B	B	C	C	C	C	C	D	D	D	D
821	820	B	B	B	B	B	C	C	C	C	C	D	D	D	D
102	1000pF	B	B	B	B	B	C	C	C	C	C	D	D	D	D
122	1200	B	B	B	B	B	C	C	C	C	C	D	D	D	D
152	1500	B	B	B	B	B	C	C	C	C	C	D	D	D	D
182	1800	B	B	B	B	B	C	C	C	C	C	D	D	D	D
222	2200	B	B	B	B	B	C	C	C	C	C	D	D	D	D
272	2700	B	B	B	B	B	C	C	C	C	C	D	D	D	D
332	3300	B	B	B	B	B	C	C	C	C	C	D	D	D	D
392	3900	B	B	B	B	B	C	C	C	C	C	D	D	D	D
472	4700	B	B	B	B	B	C	C	C	C	C	D	D	D	D
562	5600	B	B	B	B	B	C	C	C	C	C	D	D	D	D
682	6800	C	C	C	C	C	C	C	C	C	C	D	D	D	D
822	8200	D	D	D	D	D	C	C	C	C	C	D	D	D	D
103	0.01uF	D	D	D	D	D	C	C	C	C	C	D	D	D	D
123	0.012	P	P	P	P	P	D	D	D	D	D	D	D	D	D
153	0.015	P	P	P	P	P	D	D	D	D	D	D	D	D	D
183	0.018	P	P	P	P	P	K	K	K	K	K	D	D	D	D
223	0.022	P	P	P	P	P	K	K	K	K	K	D	D	D	D
273	0.027	P	P	P	P		K	K	K	K	K	D	D	D	D
333	0.033	P	P	P	P		K	K	K	K	K	D	D	D	D
393	0.039	P	P	P	P							M	M	M	M
473	0.047	J*	J*	J*	J*							M	M	M	M
563	0.056	J*	J*	J*	J*							M	M	M	M
683	0.068	G*	G*	G*	G*							M	M	M	M
823	0.082	G*	G*	G*	G*							M	M	M	M
104	0.10μF	G*	G*	G*	G*							M	M	M	M

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

■The letter in cell with "*" mark is expressed capacitance tolerance "J"(±5%) only

Capacitance & Voltage (X7R)

Dielectric		X7R																	
EIA	Size	0402						0603						0805					
Code	VDCW	6.3V	10V	16V	25V	50V	100V	6.3V	10V	16V	25V	50V	100V	6.3V	10V	16V	25V	50V	100V
101	100pF		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
121	120		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
151	150		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
181	180		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
221	220		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
271	270		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
331	330		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
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		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
152	1500		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
182	1800		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
222	2200		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
272	2700		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
332	3300		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
392	3900		N	N	N	N	N		S	S	S	S	S		B	B	B	B	B
472	4700		N	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	X		B	B	B	B	B
153	0.015		N	N	N				S	S	S	S	X		B	B	B	B	B
183	0.018		N	N	N				S	S	S	S	X		B	B	B	B	B
223	0.022		N	N	N				S	S	S	S	X		B	B	B	B	B
273	0.027		N	N	N				S	S	S	S	X		B	B	B	B	D
333	0.033		N	N	N				S	S	S	X	X		B	B	B	B	D
393	0.039		N	N	N				S	S	S	X	X		B	B	B	B	D
473	0.047		N	N	N	N			S	S	S	X	X		B	B	B	B	D
563	0.056		N	N					S	S	S	X	X		B	B	B	B	D
683	0.068		N	N					S	S	S	X	X		B	B	B	B	D
823	0.082		N	N					S	S	S	X	X		B	B	B	B	D
104	0.10μF	N	N	N	N	N			S	S	S	X	X		B	B	B	B	D
124	0.12								S	S	X				B	B	B	D	I
154	0.15								S	S	X				D	D	D	D	I
184	0.18								S	S	X				D	D	D	D	I
224	0.22	N	N	N	N				S	S	X	X			D	D	D	D	I
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	N	N					X	X	X	X	X			D	D	D	I	I
564	0.56							X	X	X					D	D	D		
684	0.68							X	X	X					D	D	D		
824	0.82							X	X	X					D	D	D		
105	1.0μF	N						X	X	X	X	X			D	D	D	I	
155	1.5														I	I	I		
225	2.2							X	X	X				I	I	I	I	I	
335	3.3																		
475	4.7							X						I	I	I	I		
106	10													I	I	I*			

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

■The letter in cell with ”*” mark is expressed product not in 10% (code “K”) tolerance

Capacitance & Voltage (X7R)

Dielectric		X7R																	
EIA	Size	1206							1210						1812				
Code	VDCW	6.3V	10V	16V	25V	35V	50V	100V	6.3V	10V	16V	25V	50V	100V	10V	16V	25V	50V	100V
151	150 pF		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
122	1200		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
152	1500		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
182	1800		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
222	2200		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
272	2700		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
332	3300		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
392	3900		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
472	4700		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
562	5600		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
682	6800		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
822	8200		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
103	0.01μF		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
123	0.012		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
153	0.015		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
183	0.018		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
223	0.022		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
273	0.027		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
333	0.033		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
393	0.039		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
473	0.047		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
563	0.056		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
683	0.068		B	B	B		B	B		C	C	C	C	C	D	D	D	D	D
823	0.082		B	B	B		B	D		C	C	C	C	C	D	D	D	D	D
104	0.10μF		B	B	B		B	D		C	C	C	C	C	D	D	D	D	D
124	0.12		B	B	B		B	D		C	C	C	C	C	D	D	D	D	D
154	0.15		C	C	C		C	G		C	C	C	C	D	D	D	D	D	D
184	0.18		C	C	C		C	G		C	C	C	C	D	D	D	D	D	D
224	0.22		C	C	C		C	G		C	C	C	C	D	D	D	D	D	D
274	0.27		C	C	C		D	G		C	C	C	C	G	D	D	D	D	D
334	0.33		C	C	C		D	G		C	C	C	D	G	D	D	D	D	D
394	0.39		C	C	J		P	G		C	C	C	D	M	D	D	D	D	D
474	0.47		J	J	J		P	G		C	C	C	D	M	D	D	D	D	K
564	0.56		J	J	J		P	P		D	D	D	D	M	D	D	D	D	K
684	0.68		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K
824	0.82		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K
105	1.0μF		J	J	J		P	P		D	D	D	D	K	D	D	D	K	K
155	1.5	J	J	J	P						K	G	M	M					K
225	2.2	J	J	J	P		P	P			K	G	M	M				M	M
335	3.3		P	P	P						K	G							
475	4.7	P	P	P	P		P			K	K	K	M	M					
106	10	P	P	P	P	P				K	K	K	M						
226	22	P	P	P*						M	M	M							
476	47								M	M									

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

■The letter in cell with "*" mark is expressed product not in 10% (code "K") tolerance

Capacitance & Voltage (X5R)

Dielectric		X5R																								
EIA	Size	0402					0603					0805					1206					1210				
Code	VDCW	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
273	0.027μF			N																						
333	0.033			N																						
393	0.039			N																						
473	0.047	N	N	N																						
563	0.056	N	N	N																						
683	0.068	N	N	N																						
823	0.082	N	N	N																						
104	0.10μF	N	N	N	N	N																				
154	0.15	N	N	N	N																					
224	0.22	N	N	N	N	N			X	X																
274	0.27							X	X	X																
334	0.33	N	N				X	X	X	X																
394	0.39							X	X	X																
474	0.47	N	N	E	E	E	X	X	X	X	X															
684	0.68	N	N				X	X	X	X																
824	0.82						X	X	X																	
105	1.0μF	N	N	N	N	E	X	X	X	X	X		D	D	D	I										
155	1.5						X					I	I	I	I			J	J				K	K		
225	2.2	N	N	E	E		X	X	X	X	X	I	I	I	I	I		J	J	P	P		K	K		
335	3.3						X	X				I	I	I	I			P	P	P						
475	4.7	E*	E*	E*			X	X	X	X		I	I	I	I	I	P	P	P	P	P		K	K	K	
685	6.8																P	P								
106	10μF	E*	E*				X	X	X	X*		I	I	I	I	I	P	P	P	P	P	K	K	K	K	M
226	22						X*	X*				I	I*	I*	I*		P	P	P	P		M	M	M	M	
476	47						X*					I*	I*				P	P	P*			M	M	M	M*	
107	100											I*					P					M	M			

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

■The letter in cell with "*" mark is expressed capacitance tolerance "K"(±10%) only

■Environmental Characteristics

Size	0402, 0603, 0805, 1206, 1210, 1812		
Dielectric	**NP0**	**X7R**	**X5R**
Capacitance*	0.1pF~0.1μF	100pF~47μF	27nF~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%)	
Rated voltage (VDCW)	10V,16V, 25V, 50V, 100V	6.3V, 10V, 16V, 25V, 35V, 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
Capacitance change	±30 ppm	±15%	
Termination	Ni/Sn (lead-free termination)		

■ '*'Measured at the condition of 30~70% related humidity
■ NP0: 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

Note 1:

X7R / X5R

Rated Vol.	D.F.	Exception of D.F.	
≧100V	≦2.5%	≦3%	1206≧0.47μF
		≦5%	0805＞0.1μF;06030.068μF 1206>1μF;1210≧2.2μF
		≦10%	0805＞0.22μF;1210≧3.3μF
50V	≦2.5%	≦3%	0201(50V); 0603≧0.047μF; 0805≧0.18μF;1206≧0.47μF
		≦5%	0201≧0.01uF; 1210≧4.7μF
		≦10%	0402≧0.1μF;0603>0.1μF; 0805≧1μF;1206≧2.2μF; 1210≧10μF
35V	≦3.5%	≦10%	0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF
25V	≦3.5%	≦5%	0201≧0.01μF;0805≧1μF; 1210≧10μF
		≦7%	0603≧0.33μF; 1206≧4.7μF
		≦10%	0201≧0.1μF;0402≧0.10μF;0603≧0.47μF; 0805≧2.2μF; 1206≧6.8μF ; 1210≧22μF
		≦12.5%	0402≧0.47μF
16V	≦3.5%	≦5%	0201≧0.01μF;0402≧0.033μF;0603≧0.15μF; 0805≧0.68μF;1206≧2.2μF;1210≧4.7μF
		≦10%	0201≧0.1uF(0201/X7R≧0.022μF); 0402≧ 0.22uF; 0603≧; 1206≧4.7μF; 1210≧22μF
10V	≦5.0%	≦10%	0201≧0.012μF;0402≧0.33μF(0402/X7R≧0.22μF); 0603≧0.33μF; 0805≧2.2μF; 1206≧2.2μF;1210≧22μF
		≦15%	0201≧0.1μF
6.3V	≦10%	≦15%	0201≧0.1μF;0402≧1μF;0603≧10μF;0805≧4.7μF; 1206≧47μF; 1210≧100μF
		≦20%	0402≧2.2μF

■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	1000	200	250	500	630	1000	1500 2000	200	250	500	630	1000	1500 2000	500 630	1000	1500	2000	3000	200	250	500 630	1000	1500	2000	3000
0R5	0.5pF	S	S	A	A	A	D																							
1R0	1.0	S	S	A	A	A	D																							
1R2	1.2	S	S	A	A	A	D																							
1R5	1.5	S	S	A	A	A	D	B	B	B	B	B	B																	
1R8	1.8	S	S	A	A	A	D	B	B	B	B	B	B							D										
2R2	2.2	S	S	A	A	A	D	B	B	B	B	B	B							D	D	D	D	D						
2R7	2.7	S	S	A	A	A	D	B	B	B	B	B	B							D	D	D	D	D						
3R3	3.3	S	S	A	A	A	D	B	B	B	B	B	B							D	D	D	D	D						
3R9	3.9	S	S	A	A	A	D	B	B	B	B	B	B							D	D	D	D	D						
4R7	4.7	S	S	A	A	A	D	B	B	B	B	B	B							D	D	D	D	D						
5R6	5.6	S	S	A	A	A	D	B	B	B	B	B	B							D	D	D	D	D						
6R8	6.8	S	S	A	A	A	D	B	B	B	B	B	B							D	D	D	D	D						
8R2	8.2	S	S	A	A	A	D	B	B	B	B	B	B							D	D	D	D	D						
100	10pF	S	S	A	A	A	D	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
120	12	S	S	A	A	A	D	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
150	15	S	S	A	A	A	D	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
180	18	S	S	A	A	A	D	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
220	22	S	S	A	A	A	D	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
270	27	S	S	A	A	A	D	B	B	B	B	B	B	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
330	33	S	S	A	A	A	D	B	B	B	B	B	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
390	39	S	S	A	A	A	D	B	B	B	B	B	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
470	47	S	S	A	A	A	D	B	B	B	B	C	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D
560	56	S	S	A	A	A	D	B	B	B	B	C	D	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D
680	68	S	S	A	A	A	D	B	B	B	B	C	D	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D
820	82	S	S	A	A	B	D	B	B	B	B	D	D	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D
101	100pF	S	S	A	B	B	D	B	B	B	B	D	D	C	C	C	C	D	D	D	D	D	K	K	D	D	D	D	D	D
121	120	S	S	A	B	D	D	B	B	B	B	D	G	C	C	C	C	D	D	D	D	D	K	K	D	D	D	D	D	D
151	150	S	S	B	D	D	D	B	B	B	B	D	G	C	C	C	C	D	G	D	D	K	K	K	D	D	D	D	D	D
181	180	S	S	B	D	D	D	B	B	B	B	G	G	C	C	C	C	D	G	D	D	K	K	K	D	D	D	D	D	K	K
221	220	S	S	D	D	D	D	B	B	B	B	G	G	C	C	C	C	G	G	D	D	K	K	K	D	D	D	D	D	K	K
271	270	X	X	D	D	D	D	B	C	C	C	G	P	C	C	C	C	G	K	K	K	K	K	K	D	D	D	D	K	K	K
331	330	X	X	D	D	D	D	B	C	C	C	G	P	C	C	C	C	G	K	K	K	K	K	K	D	D	D	D	K	K	K
391	390	X	X	D	D	D	D	B	C	C	C	G	P	C	C	C	C	G	M	K	K	K	K		D	D	D	D	K	K	K
471	470	X	X	D	D	I		C	C	C	C	G		C	C	C	C	G	M	K	K	K	K		D	D	D	K	K	K	K
561	560			D	D	I		C	D	D	D	G		C	C	C	C	G		K	K	K	K		D	D	D	K	K	K	
681	680			D	D	I		C	D	D	D	G		C	C	C	C	G		K	K	K	K		D	D	D	K	K	K	
821	820			D	D	I		C	G	G	G	G		C	C	C	C	G		K	K				D	D	D	K	K	K	
102	1000pF			D	D	I		C	G	G	G	G		D	D	D	D	G		K	K				D	D	D	K	K	K	
122	1200			D	D			C	G	G	G			D	D	D	D			K					D	D	D	K			
152	1500			D	D			D	G	G	G			D	D	D	D			K					D	D	D	K			
182	1800			D	D			D	G	G	G			D	D	D	D			K					D	D	D				
222	2200			D	D			D	G	G	G			D	D	D	D			K					D	D	D				
272	2700							D	G					D	D	D	D								D	D	D				
332	3300							D	G					D	D	D	D								D	D	D				
392	3900							D	G					D	D	D	D								D	D					
472	4700							D	G					G	G										D	D					
562	5600													G	G										D	D					
682	6800													G	G										D	D					
822	8200													G	G																
103	0.01uF													G	G																

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

Capacitance & Voltage (X7R 200V~3KV)

Dielectric		X7R																						
EIA	Size	0603	0805				1206					1210				1808				1812				
Code	VDCW	200V 250V	200V	250V	500V 630V	1000V	200V 250V	500V 630V	1000V	1500V	2000V	200V 250V	500V 630V	1000 V	1500V 2000V	500V 630V	1000 V	1500V 2000V	3000V	200V 250V	500V 630V	1000V	1500V 2000V	3000V
101	100pF	X	B	B	B	B	D	D	D	D	D	D	D	D	D									
121	120	X	B	B	B	B	D	D	D	D	D	D	D	D	D									
151	150	X	B	B	B	B	D	D	D	D	D	D	D	D	D	D	D	D	D					
181	180	X	B	B	B	B	D	D	D	D	D	D	D	D	D	D	D	D	D					
221	220	X	B	B	B	B	D	D	D	D	D	D	D	D	D	D	D	D	D					
271	270	X	B	B	B	B	D	D	D	D	D	D	D	D	D	D	D	D	D			D	D	K
331	330	X	B	B	B	B	D	D	D	D	D	D	D	D	D	D	D	D	K			D	D	K
391	390	X	B	B	B	B	D	D	D	D	D	D	D	D	D	D	D	D	K			D	D	K
471	470	X	B	B	B	B	D	D	D	D	D	D	D	D	D	D	D	D	K			D	D	K
561	560	X	B	B	B	B	D	D	D	D	D	D	D	D	D	D	D	D	K			D	D	K
681	680	X	B	B	B	B	D	D	D	D	D	C	D	D	D	D	D	D	K			D	D	K
821	820	X	B	B	B	B	D	D	D	D	D	C	D	D	D	D	D	D	K			D	D	K
102	1000pF	X	B	B	B	B	D	D	D	D	D	C	D	D	D	D	D	K	K	D	D	D	D	K
122	1200	X	B	B	B	B	D	D	D	G	G	C	D	D	M	D	D	K	K	D	D	D	D	K
152	1500	X	B	B	B	D	D	D	D	G	G	C	D	D	M	D	D	K	K	D	D	D	D	K
182	1800	X	B	B	B	D	D	D	D	G	G	C	D	D	M	D	D	K	K	D	D	D	G	M
222	2200	X	B	B	B	D	D	D	D	G	G	C	D	D	M	D	D	K		D	D	D	G	M
272	2700	X	B	B	B		D	D	D	G	G	C	D	D	M	D	D	K		D	D	D	G	M
332	3300	X	B	B	B		D	D	D	G	G	C	D	D	M	D	D	K		D	D	D	K	M
392	3900	X	B	B	B		D	D	D	G		C	D	G	M	D	D	K		D	D	D	K	
472	4700	X	B	B	D		D	D	D	G		C	D	G	M	D	D	K		D	D	D	K	
562	5600	X	D	D	D		D	D	D	G		C	D	G		K	K	K		D	D	D	M	
682	6800	X	D	D	D		D	D	D	G		C	D	G		K	K			D	D	D	M	
822	8200	X	D	D	D		D	D	D			C	D	G		K	K			D	D	D	M	
103	0.010μF	X	D	D	D		D	D	D			C	D	G		K	K			D	D	D	M	
123	0.012		D	D	D		D	D	G			C	D	G		K	K			D	D	K		
153	0.015		D	D	D		D	D	G			C	D	G		K	K			D	D	K		
183	0.018		D	D	D		D	D				C	D	G		K	K			D	D	M		
223	0.022		D	D	D		D	G				C	D	G		K	K			D	D	M		
273	0.027		D	D			D	G				C	G			K	K			D	D	M		
333	0.033		D	D			G	G				C	G			K	K			D	D	M		
393	0.039		D	D			G	G				C	G			K	K			D	D	M		
473	0.047		D	D			G	G				D	G			K	K			D	D	M		
563	0.056		D	D			G	G				D	G			K				D	K	M		
683	0.068		D				G					G	K			K				D	K	M		
823	0.082		D				G					G	K							D	K	M		
104	0.10μF		D				G					G	K							D	K	M		
124	0.12											G								D	M			
154	0.15											M								K	M			
184	0.18											M								K	M			
224	0.22											M								K	M			
274	0.27											M								K				
334	0.33											M								K				
394	0.39											M								K				
474	0.47											M								K				
564	0.56																			M				
684	0.68																			M				
824	0.82																			M				
105	1uF																			M				

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

Electrical data

Dielectric	NP0	X7R
Size	**0603,0805,1206,1210,1808,1812**	
Capacitance*	0.5pF~0.01μF	100pF~1.0μF
Capacitance tolerance	Cap≦5pF: C (±0.25pF) 5pF<Cap<10pF: D (±0.50pF) Cap≧10pF: J (±5%), K (±10%)	K (±10%) M (±20%)
Rated voltage (VDCW)	200V to 3KV	
DF/Q	Cap<30pF: Q≧400 +20C Cap≧30pF: Q≧1000	DF≦2.5%
Insulation resistance at Ur	Ur=200~630V:≧10GΩ or R×C≧100Ω-F Whichever is smaller Ur=1000~3000V: ≧10GΩ	
Dielectric Strength	200~300V: ≧2×VDCW 500~999V: ≧1.5×VDCW 1000~3000V: ≧1.2×VDCW	
Operating temperature	-55 to +125°C	
Capacitance change	±30 ppm	±15%
Termination	Ni/Sn (lead-free termination)	

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

■ NP0: Apply 1.0±0.2Vrms, 1.0MHz±10% for Cap≦1000pF and 1.0±0.2Vrms, 1.0KHz±10% for Cap>1000pF, 25°C ambient temperature

■ X7R, X5R: Apply 1.0±0.2Vrms, 1.0KHz±10% at the condition of 25°C ambient temperature

■Ultra-small 0201 Capacitors

Capacitance & Voltage

EIA	Size	0201		
Dielectric		NPO		
Code	VDCW	16V	25V	50V
0R1	0.1pF	L	L	L
0R2	0.2	L	L	L
0R3	0.3	L	L	L
0R4	0.4	L	L	L
0R5	0.5	L	L	L
0R6	0.6	L	L	L
0R7	0.7	L	L	L
0R8	0.8	L	L	L
0R9	0.9	L	L	L
1R0	1.0	L	L	L
1R2	1.2	L	L	L
1R5	1.5	L	L	L
1R8	1.8	L	L	L
2R2	2.2	L	L	L
2R7	2.7	L	L	L
3R0	3.0	L	L	L
3R3	3.3	L	L	L
3R9	3.9	L	L	L
4R0	4.0	L	L	L
4R7	4.7	L	L	L
5R0	5.0	L	L	L
5R6	5.6	L	L	L
6R0	6.0	L	L	L
6R8	6.8	L	L	L
7R0	7.0	L	L	L
8R2	8.2	L	L	L
9R0	9.0	L	L	L
100	10	L	L	L
120	12	L	L	L
150	15	L	L	L
180	18	L	L	L
220	22	L	L	L
270	27	L	L	L
330	33	L	L	L
390	39	L	L	L
470	47	L	L	L
560	56	L	L	L
680	68	L	L	L
820	82	L	L	L
101	100	L	L	L
121	120	L	L	L
151	150		L	L
271	270		L	
331	330		L	
391	390		L	
471	470		L	
561	560		L	

EIA	Size	0201									
Dielectric		X7R					X5R				
Code	VDCW	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
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	L
122	1200	L	L	L	L						
152	1500	L	L	L	L			L	L		
182	1800	L	L	L							
222	2200	L	L	L				L	L		
272	2700	L	L	L				L	L		
332	3300	L	L	L	L			L	L		
392	3900	L	L	L							
472	4700	L	L	L				L	L		
562	5600	L	L								
682	6800	L	L					L			
822	8200	L	L								
103	0.010μF	L	L	L	L		L	L	L	L	L
153	0.015						L	L			
223	0.022		L				L	L			
273	0.027						L	L			
333	0.033						L	L			
393	0.039						L	L			
473	0.047						L	L	L		
563	0.056						L	L			
683	0.068						L	L			
823	0.082						L	L			
104	0.100						L	L	L	L	
224	0.220						L	L	L*		
474	0.470						L				
105	1μF						L	L*			
225	2.2						L*	L*			

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

■ The letter in cell with "*" mark is expressed capacitance tolerance "K"(±10%) only

Electrical Data

Size	0201		
Dielectric	NPO	X7R	X5R
Capacitance*	0.1pF~560pF	100pF~22nF	100pF~2.2μF
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
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

■ NP0: 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

■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	25V	50V	100V	200V	50V	100V	250V	50V	100V	250V	500V
0R1	0.1pF	L	L	L	L	N	N	N	N							
0R2	0.2	L	L	L	L	N	N	N	N							
0R3	0.3	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
0R4	0.4	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
0R5	0.5	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
0R6	0.6	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
0R7	0.7	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
0R8	0.8	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
0R9	0.9	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
1R0	1.0	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
1R2	1.2	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
1R5	1.5	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
1R8	1.8	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
2R0	2.0	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
2R2	2.2	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
2R7	2.7	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
3R0	3.0	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
3R3	3.3	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
3R9	3.9	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
4R0	4.0	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
4R7	4.7	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
5R0	5.0	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
5R6	5.6	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
6R0	6.0	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
6R8	6.8	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
7R0	7.0	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
8R2	8.2	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
9R0	9.0	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
100	10	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
110	11	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
120	12	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
130	13	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
150	15	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
160	16	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
180	18	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
200	20	L	L	L	L	N	N	N	N	S	S	S	T	T	T	T
220	22	L	L	L		N	N	N	N	S	S	S	T	T	T	T
240	24	L	L	L		N	N	N	N	S	S	S	T	T	T	T
270	27	L	L	L		N	N	N	N	S	S	S	T	T	T	T
300	30	L	L	L		N	N	N	N	S	S	S	T	T	T	T
330	33	L	L	L		N	N	N		S	S	S	T	T	T	T
360	36					N	N	N		S	S	S	T	T	T	T
390	39					N	N	N		S	S	S	T	T	T	T
430	43					N	N	N		S	S	S	T	T	T	T
470	47					N	N	N		S	S	S	T	T	T	T
560	56					N				S	S	S	T	T	T	T
680	68					N				S	S	S	T	T	T	T
820	82					N				S	S	S	T	T	T	
101	100					N				S	S	S	T	T	T	

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

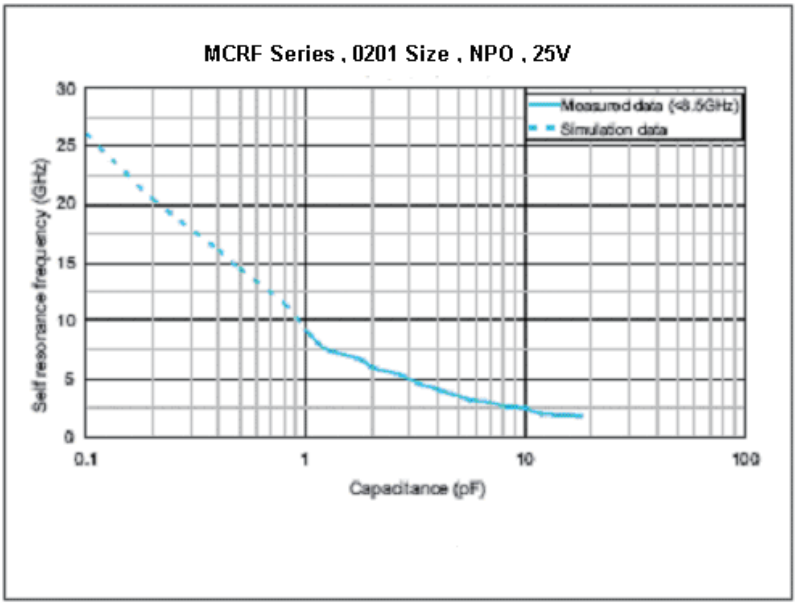
Electrical Data

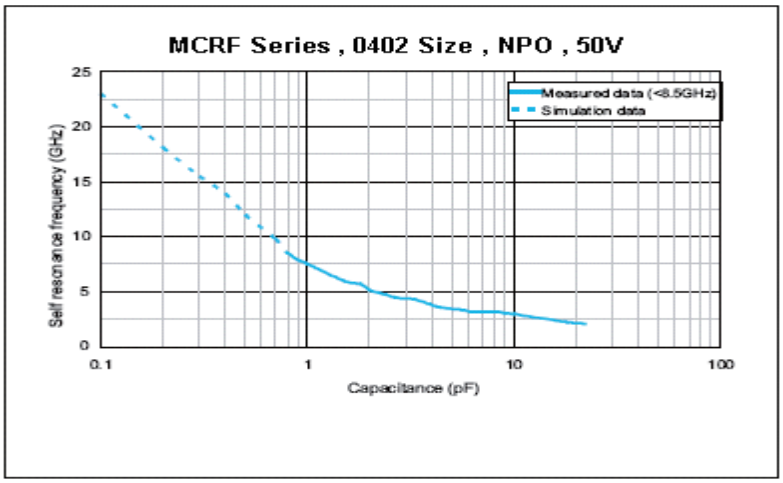
Dielectric	NPO
Size	**0201, 0402, 0603, 0805**
Capacitance*	0201: 0.1pF ~ 33pF , 0402: 0.1pF ~ 100pF 0603: 0.3pF ~ 100pF , 0805: 0.3pF ~ 100pF
Capacitance tolerance**	Cap≦5pF: A(±0.05pF), B(±0.1pF), C(±0.25pF) 5pF<Cap<10pF: B(±0.1pF), C(±0.25pF) , D(±0.5pF) Cap≧10pF: F(±1%), G(±2%), J(±5%)
Rated voltage (VDCW)	6.3V, 10V, 25V, 50V, 100V, 250V, 500V
Q *	Cap≧30pF: Q≧1000, Cap<30pF: Q≧400+20C;
Insulation resistance at Ur	≧10GΩ
Operating temperature	-55 to +125°C
Capacitance	±30 ppm; 0201 Cap≧22pF, ±60 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





■Environmental Characteristics

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>External Appearance</td><td>No defects which may affect performance</td><td>Visual inspection & Dimension measurement</td></tr>
<tr><td>Capacitance(Cap.)</td><td>Within the specified tolerance that refers on page2</td><td rowspan="2">NPO: (Class I)
Cap ≤ 1000pF 1.0±0.2Vrms, 1MHz±10%
Cap>1000pF 1.0±0.2Vrms, 1KHz±10%

X7R, X5R: (Class II)
Cap≤10uF 1.0±0.2Vrms, 1KHz±10%**
Cap>10uF 0.5±0.2Vrms, 120Hz±10%
** Test condition: 0.5±0.2Vrms，1KHz±10%
X7R:
0805=106(6.3V,10V),
0603/475(6.3V)
X5R:
0201≧224 (6.3V,10V,16V)#1
0402≧475 (6.3V,16V),
0402≧225(10V)
0603=106 (6.3V,10V),
#1 Excluding X5R/0201/105(6.3V);225(10V),
(1.0±0.2Vrms，1KHz±10%)
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set
for 24±2 hrs at room temp.</td></tr>
<tr><td>Dissipation Factor (D.F.) or Quality factor (Q=1/D.F.)</td><td>NPO: Cap≥30pF, Q≥1000; Cap<30pF, Q≥400+20C
X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F. ≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">2.5%</td><td>3%</td><td>1206≧0.047μF</td></tr>
<tr><td>5%</td><td>0603≧0.068μF; 0805≧0.1μF
1206>1μF; 1210≧2.2μF</td></tr>
<tr><td>10%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">50V</td><td rowspan="3">2.5%</td><td>3%</td><td>0201(50V); 0603≧0.047μF
0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>5%</td><td>0201≧0.01uF; 1210≧4.7μF</td></tr>
<tr><td>10%</td><td>0402≧0.1μF;0603>0.1μF;
0805≧1μF;1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>3.5%</td><td>10%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">3.5%</td><td>5%</td><td>0201≧0.01μF; 0805≧1μF;1210≧10μF</td></tr>
<tr><td>7%</td><td>0603≧0.33μF; 1206≧4.7μF</td></tr>
<tr><td>10%</td><td>0201≧0.1μF;0402≧0.10μF; 0603≧0.47μF
0805≧2.2μF; 1206≧6.8μF;1210≧22μF</td></tr>
<tr><td>12.5%</td><td>0402≥0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">3.5%</td><td>5%</td><td>0201 ≧ 0.01μF; 0402 ≧ 0.033μF;0603 ≧ 0.15μF;
0805≧0.68μF;1206≧2.2μF; 1210≧4.7μF</td></tr>
<tr><td>10%</td><td>0201≧0.1μF(0201/X7R≧0.022μF);
0402≧0.22μF; 0603≧0.68μF;0805≧2.2μF; 1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">5%</td><td>10%</td><td>0201 ≧ 0.012μF;0402 ≧ 0.33μF(0402/X7R ≧ 0.22μF)
0603≧0.33μF; 0805≧2.2μF
1206≧2.2μF;1210≧22μF</td></tr>
<tr><td>15%</td><td>0201≧0.1μF; 0402≧1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">10%</td><td>15%</td><td>0201≧0.1μF; 0402≧1μF
0603≧10μF; 0805≧4.7μF
1206≧47μF;1210≧100μF</td></tr>
<tr><td>20%</td><td>0402≧2.2μF</td></tr>
</table></td></tr>
<tr><td>Dielectric Strength</td><td>No evidence of damage or flash over during test</td><td>To apply voltage(≤100V) 250%
Duration: 1 to 5sec
Charge and discharge current less than 50mA

To apply voltage:
200V~300V ≧2 time VDC
500V~999V ≧1.5 time VDC
1000V~3000V ≧1.2 time VDC
Cut-off, set at 10mA
TEST=15 sec. RAMP=0</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td rowspan="3">Insulation Resistance</td><td>10GΩ or R×C≧500Ω-F Whichever is smaller
X7R, X5R:
<table>
<tr><th>Rated Voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="6">10GΩ or RxC≧100Ω-F Whichever is smaller</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;
1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V: 0402≥1uF;0603≥2.2uF;0805≥2.2uF
1206≥10uF;1210≥10uF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;
0805≥2.2μF;1206≥10μF;1210≥47μF</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>
</table></td><td>To apply rated voltage for max. 120sec
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.</td></tr>
<tr><td>≥10GΩ or 100Ω-F whichever is smaller
Rated voltage: 200V~630V</td><td>To apply rated voltage(500V max.) for 60sec.</td></tr>
<tr><td>≥10GΩ
Rated voltage: >630V</td><td>To apply 500V for 60sec.</td></tr>
<tr><td>Temperature Characteristic of Capacitance</td><td>
<table>
<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>
</table></td><td>With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>NPO</td><td>-55 ~ 125℃ at 25℃</td></tr>
<tr><td>X7R</td><td>-55 ~ 125℃ at 25℃</td></tr>
<tr><td>X5R</td><td>-55 ~ 85℃ at 25℃</td></tr>
</table>
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
* Measurement voltage for Class II:
<table>
<tr><td>0201</td><td>0402</td></tr>
<tr><td>Cap<0.1μF:1V</td><td>Cap<1μF: 1V</td></tr>
<tr><td>0.1μF≤Cap<1μF: 0.2V</td><td>Cap=1μF: 0.5V</td></tr>
<tr><td>Cap≥1μF: 0.1V</td><td>1μF<Cap<10μF: 0.2V</td></tr>
<tr><td></td><td>Cap≥10μF: 0.1V</td></tr>
<tr><td>0603</td><td>0805</td></tr>
<tr><td>Cap≤1μF: 1V</td><td>Cap<10μF: 1V</td></tr>
<tr><td>1μF<Cap≤4.7μF: 0.5V</td><td>Cap=10μF: 0.5V</td></tr>
<tr><td>Cap>4.7μF: 0.2V</td><td>Cap>10μF: 0.2V</td></tr>
<tr><td>1206</td><td>1210</td></tr>
<tr><td>Cap≤10μF: 1V</td><td>Cap≤10μF: 1V</td></tr>
<tr><td>10μF<Cap≤100μF: 0.5V</td><td>10μF<Cap≤100μF: 0.5V</td></tr>
<tr><td>Cap>100μF: 0.2V</td><td>Cap>100μF: 0.2V</td></tr>
</table></td></tr>
<tr><td>Adhesive Strength of Termination</td><td>No remarkable damage or removal of the terminations</td><td>Pressurizing force:
0201:2N
0402&0603:5N>0603:10N
Test time: 10±1 sec</td></tr>
<tr><td>Vibration Resistance</td><td>No remarkable damage
Cap change and Q/D.F.: To meet initial spec</td><td>Vibration frequency: 10~55Hz/min
Total amplitude: 1.5mm
Test time: 6hrs.(two hrs each in three mutually
Perpendicular directions.)
*Before initial measurement (Class II only):
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 at
150°C for 1hr then set for 24±2 hrs at room temp.</td></tr>
<tr><td>Solderability</td><td>95% min. coverage of all metalized area.</td><td>Solder temperature: 235±5℃
Dipping time: 2±0.5 sec.</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>Bending Test</td><td>No remarkable damage.
Cap change：
NP0: within ±5% or 0.5pF whichever is larger
X7R, X5R: within ±12.5%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</td><td>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 1 mm and then the pressure shall be maintained for 5±1 sec.
*Before initial measurement (Class II only):
To apply de-aging at 150°C for 1hr then set for 24±2 hrs at room temp.
Measurement to be made after keeping at room temp. for 24±2 hrs.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>No remarkable damage.
Cap change:
NP0: within ±2.5% or 0.25pF whichever is larger
X7R, X5R: within ±7.5%
Q/D.F., I.R. and dielectric strength: To meet initial requirements.
25% max. leaching on each edge</td><td>Solder temperature: 260±5°C
Dipping time: 10±1 sec
Preheating: 120 to 150°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±2 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±2 hrs at room temp</td></tr>
<tr><td>Temperature Cycle</td><td>No remarkable damage.
* Cap change：
NP0: within ±2.5% or 0.25pF whichever is larger
X7R, X5R: within ±7.5%
* Q/D.F., I.R. and dielectric strength: To meet initial requirements</td><td>Conduct the five cycles according to the temperature and time.
<table>
<tr><th>Step</th><th>Temp.(℃)</th><th>Time(min)</th></tr>
<tr><td>1</td><td>Min. operating temp.+0/-3</td><td>30±3</td></tr>
<tr><td>2</td><td>Room temp</td><td>2-3</td></tr>
<tr><td>3</td><td>Max. operating temp.+3/-0</td><td>30±3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2-3</td></tr>
</table>
Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 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±2 hrs at room temp.</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr>
<td>Humidity
(steady state)</td>
<td>
No remarkable damage.
Cap change:
NP0: within ±5% or 0.5pF whichever is larger
X7R, X5R: ≥10V**,within ±12.5%; ≦6.3V within ±25%;C≥ 1uF,within ±25%
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Q/D.F. value:
NP0: More than 30pF Q≥350, 10pF≤C≤30pF, Q≥275+2.5C Less than 10pF Q≥200+10C
X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">3%</td><td>6%</td><td>1206≧0.47μF</td></tr>
<tr><td>7.5%</td><td>0603≧0.068μF; 0805>0.1μF;1206>1μF; 1210≧2.2μF</td></tr>
<tr><td>20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">3%</td><td>6%</td><td>0201(50V); 0603≧0.047μF;0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>10%</td><td>0201≧0.01uF; 1210≧4.7μF</td></tr>
<tr><td>20%</td><td>0402≧0.1μF;0603>0.1μF;0805≧1μF;1206≧2.2μF;
1210≧10μF</td></tr>
<tr><td>35V</td><td>5%</td><td>20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">5%</td><td>10%</td><td>0201≧0.01μF; 0805≧1μF;1210≧10μF</td></tr>
<tr><td>14%</td><td>0603≧0.33μF; 1206≧4.7μF</td></tr>
<tr><td>15%</td><td>0201≧0.1μF;0402≧0.10μF; 0603≧0.47μF
0805≧2.2μF; 1206≧6.8μF;1210≧22μF</td></tr>
<tr><td>20%</td><td>0402≥0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">5%</td><td>10%</td><td>0603≧0.15μF; 0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);
0402≧0..33μF; 0603≧0.68μF;0805≧2.2μF;
1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">7.5%</td><td>15%</td><td>0201≧0.012μF;0402≧0.33μF(0402/X7R≧0.22μF)
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>0201≧0.1μF; 0402≧1μF;0603≧10μF; 0805≧4.7μF
1206≧47μF;1210≧100μF</td></tr>
</table>
I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R)
<table>
<tr><th>Rated Voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="7">10GΩ or
RxC≧10Ω-F
Whichever is smaller</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;
1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V: 0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;
0805≥2.2μF;1206≥10μF;1210≥47μF</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>
</table>
</td>
<td>
Test temp.: 40±2°C
Humidity: 90~95%RH
Test time: 500+24/-0hrs.
Before initial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 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±2 hrs at room temp.
</td>
</tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>Humidity load</td><td>
No remarkable damage.
Cap change:
NP0: ±7.5% or 0.75pF whichever is larger.
X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≦6.3V within ±25%;
TT series & C≥ 1uF,within ±25%
**10V: 0603 4.7μF;0402 1μF;0201 ≧ ≧ ≧0.1μF, within ±25%;
Q/D.F. value:
NP0: C≥30pF,Q≥200;C<30pF, Q≥100+10/3C
X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F. ≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">3%</td><td>6%</td><td>1206≧0.47μF</td></tr>
<tr><td>7.5%</td><td>0603≧0.068μF; 0805>0.1μF;1206>1μF; 1210≧2.2μF</td></tr>
<tr><td>20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">3%</td><td>6%</td><td>0201(50V); 0603≧0.047μF;0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>10%</td><td>0201≧0.01uF; 1210≧4.7μF</td></tr>
<tr><td>20%</td><td>0402≧0.1μF;0603>0.1μF;0805≧1μF;1206≧2.2μF;
1210≧10μF</td></tr>
<tr><td>35V</td><td>5%</td><td>20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">5%</td><td>10%</td><td>0201≧0.01μF; 0805≧1μF;1210≧10μF</td></tr>
<tr><td>14%</td><td>0603≧0.33μF; 1206≧4.7μF</td></tr>
<tr><td>15%</td><td>0201≧0.1μF;0402≧0.10μF; 0603≧0.47μF
0805≧2.2μF; 1206≧6.8μF;1210≧22μF</td></tr>
<tr><td>20%</td><td>0402≥0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">5%</td><td>10%</td><td>0603≧0.15μF; 0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);
0402≧0..33μF; 0603≧0.68μF;0805≧2.2μF;
1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">7.5%</td><td>15%</td><td>0201≧0.012μF;0402≧0.33μF(0402/X7R≧0.22μF)
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>0201≧0.1μF; 0402≧1μF;0603≧10μF; 0805≧4.7μF
1206≧47μF;1210≧100μF</td></tr>
</table>
I.R.: ≥10V, 500MΩ or 25 Ω-F whichever is smaller.
Class II (X7R, X5R)
<table>
<tr><th>Rated Voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="7">500MΩ or
RxC≧5Ω-F
Whichever is smaller</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;
1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V: 0201≧0.1uF; 0402≥0.22μF; 0603≥2.2μF;0805≥2.2μF;
1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;
0805≥2.2μF;1206≥10μF;1210≥47μF</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>
</table>
</td><td>
Test temp.：40±2°C
Humidity：90~95%RH
Test time：500+24/-0 hrs.
To apply voltage：
Rated voltage (MAX. 500V)
Befor einitial measurement (Class II only): To apply de-aging at 150°C for 1hr then set for 24±2 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±2 hrs at room temp.
</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>High Temperature Load (Endurance)</td><td>
No remarkable damage.
Cap change:
NP0: ±3.0% or ±0.3pF whichever is larger
X7R, X5R, X6S, X7S: ≥10V**,within ±12.5%; ≦6.3V within ±25%;
TT series & C≥ 1uF,within ±25%
**10V: 0603≧4.7μF;0402≧1μF;0201≧0.1μF, within ±25%;
Q/D.F. value:
NP0: More than 30pF, Q≥350
10pF≤C<30pF, Q≥275+2.5C
Less than 10pF, Q≥200+10C
X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F. ≦</th><th colspan="2">Exception of D.F. ≦</th></tr>
<tr><td rowspan="3">≧100V</td><td rowspan="3">3%</td><td>6%</td><td>1206≧0.47μF</td></tr>
<tr><td>7.5%</td><td>0603 ≧ 0.068μF; 0805>0.1μF;1206>1μF; 1210 ≧ 2.2μF</td></tr>
<tr><td>20%</td><td>0805＞0.22μF;1210≧3.3μF</td></tr>
<tr><td rowspan="3">≧50V</td><td rowspan="3">3%</td><td>6%</td><td>0201(50V); 0603≧0.047μF;0805≧0.18μF; 1206≧0.47μF</td></tr>
<tr><td>10%</td><td>0201≧0.01uF; 1210≧4.7μF</td></tr>
<tr><td>20%</td><td>0402≧0.1μF;0603>0.1μF;0805≧1μF;1206≧2.2μF; 1210≧10μF</td></tr>
<tr><td>35V</td><td>5%</td><td>20%</td><td>0603≧1μF;0805≥2.2μF;1206≧2.2μF;1210≧10μF</td></tr>
<tr><td rowspan="4">25V</td><td rowspan="4">5%</td><td>10%</td><td>0201≧0.01μF; 0805≧1μF;1210≧10μF</td></tr>
<tr><td>14%</td><td>0603≧0.33μF; 1206≧4.7μF</td></tr>
<tr><td>15%</td><td>0201≧0.1μF;0402≧0.10μF; 0603≧0.47μF
0805≧2.2μF; 1206≧6.8μF;1210≧22μF</td></tr>
<tr><td>20%</td><td>0402≥0.47μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">5%</td><td>10%</td><td>0603≧0.15μF; 0805≧0.68μF;1206≧2.2μF;1210≧4.7μF</td></tr>
<tr><td>15%</td><td>0201≧0.01μF(0201/X7R≧0.022μF);
0402≧0..33μF; 0603≧0.68μF;0805≧2.2μF;
1206≧4.7μF;1210≧22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">7.5%</td><td>15%</td><td>0201≧0.012μF;0402≧0.33μF(0402/X7R≧0.22μF)
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>0201≧0.1μF; 0402≧1μF;0603≧10μF; 0805≧4.7μF
1206≧47μF;1210≧100μF</td></tr>
</table>
I.R.: ≥10V, 1GΩ or 50 Ω-F whichever is smaller.
Class II (X7R, X5R)
<table>
<tr><th>Rated Voltage</th><th>Insulation Resistance</th></tr>
<tr><td>100V: X7R</td><td rowspan="7">500MΩ or
RxC≧5Ω-F
Whichever is smaller</td></tr>
<tr><td>50V: 0402>0.01μF;0603≥1μF;0805≥1μF;
1206≥4.7μF;1210≥4.7μF</td></tr>
<tr><td>35V: 0603≥1μF;0805≥2.2μF; 1206≧2.2μF;1210≧10μF</td></tr>
<tr><td>25V: 0201≥0.1uF; 0402≥0.22μF; 0603≥2.2μF;
0805≥2.2μF;1206≥10μF;1210≥10μF</td></tr>
<tr><td>16V: 0201≥0.1μF,0402≥0.22μF;0603≥1μF;
0805≥2.2μF;1206≥10μF;1210≥47μF</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>
</table>
</td><td>
Test temp. :
NP0, X7R: 125±3°C
X5R: 85±3°C
Test Time: 1000+24/-0 hrs
To apply voltage:
(1) ≦6.3V or C≧10μF : 150% of rated voltage.
(2) 10V≦Ur<500V: 200% of rated voltage.
(3) 500V: 150% of rated voltage.
(4) Ur≧630V: 120% of rated voltage.
(5) 100% of rated voltage for below range.
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance range</th></tr>
<tr><td rowspan="2">0201</td><td rowspan="2">X5R,X7R</td><td>≦10V</td><td>C≧0.1uF</td></tr>
<tr><td>≧16V</td><td>C>0.1μF</td></tr>
<tr><td>0402</td><td>X5R,X7R</td><td>6.3V,10V
16V,25V</td><td>C≧1.0uF</td></tr>
<tr><td rowspan="2">0603</td><td rowspan="2">X5R,X7R</td><td>6.3V,10V</td><td>C≧4.7uF</td></tr>
<tr><td>25V,35V</td><td>C≧1.0uF</td></tr>
<tr><td rowspan="2">0805</td><td rowspan="2">X5R,X7R</td><td>6.3V</td><td>C≧22uF</td></tr>
<tr><td>10V~50V</td><td>C≧10uF</td></tr>
<tr><td rowspan="2">1206</td><td>X5R,X7R</td><td>6.3V</td><td>C≧47uF</td></tr>
<tr><td>NPO</td><td>3000V</td><td>C≧1.5pF</td></tr>
<tr><td rowspan="2">1210</td><td>X5R,X7R</td><td>16V</td><td>C≧47uF</td></tr>
<tr><td>X7R</td><td>100V</td><td>C≧3.3uF</td></tr>
</table>
(6) 150% of rated voltage for below range
<table>
<tr><th>Size</th><th>Dielectric</th><th>Rated voltage</th><th>Capacitance range</th></tr>
<tr><td rowspan="2">0201</td><td>X5R,X7R</td><td>16V,25V</td><td>C≧0.1uF</td></tr>
<tr><td>X7R</td><td>16V</td><td>C>0.022μF</td></tr>
<tr><td rowspan="2">0402</td><td rowspan="2">X5R,X7R,</td><td>50V</td><td>C≧1.0uF</td></tr>
<tr><td>10~25V</td><td>C≧0.022uF</td></tr>
<tr><td rowspan="2">0603</td><td>X7R</td><td>50V</td><td>C≧0.1uF</td></tr>
<tr><td>X5R,X7R,</td><td>10V,16V,50V</td><td>C≧1.0uF</td></tr>
<tr><td rowspan="3">0805</td><td>X5R,X7R</td><td>10V~50V</td><td>C≧4.7uF</td></tr>
<tr><td rowspan="2">X5R,X7R</td><td>50V</td><td>C≧2.2uF</td></tr>
<tr><td>100V</td><td>C≧0.47uF</td></tr>
<tr><td>1206</td><td>X5R,X7R</td><td>100V</td><td>C≧1.0uF</td></tr>
<tr><td>1210</td><td>X5R,X7R</td><td>50V~100V</td><td>C≧2.2uF</td></tr>
</table>
</td></tr>
</table>

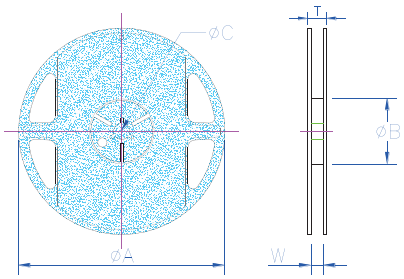
■Packaging

Packaging Quantity

Unit: mm

Type	Thickness / Symbol		Packaging (7" Reel)	
			Paper tape	Plastic tape
0201	0.30±0.03	L	15K	-
	0.30±0.05	L	15K	-
	0.30±0.09	L	15K	-
0402	0.50±0.05	N	10K	-
	0.5+0.02/-0.05	Q	10K	-
	0.50±0.20	E	10K	-
0603	0.50±0.10	H	4K	-
	0.80±0.10	S	4K	-
	0.80 +0.15 / -0.10	X	4K	-
0805	0.50±0.10	H	4K	-
	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	-
	0.85±0.10	T	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	0.85±0.10	T	-	3K
	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 0.5K
1808	1.25±0.10	D	-	2K
	1.10±0.15	F	-	2K
	1.60±0.20	G	-	2K
	2.00±0.20	K	-	1K
1812	1.25±0.10	D	-	1K
	1.60±0.20	G	-	1K
	2.00±0.20	K	-	1K
	2.50±0.30	M	-	0.5K
	2.80±0.30	U	-	0.5K
0612	0.80±0.10	B	4K	-

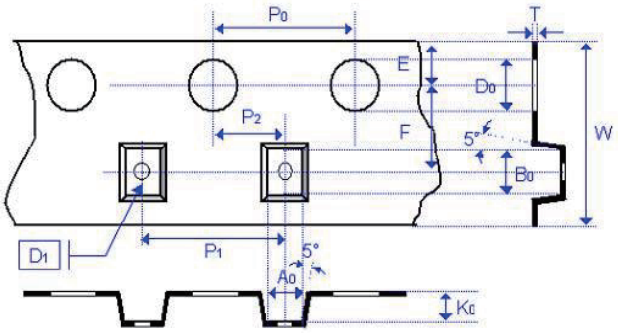
Tape and Reel



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")

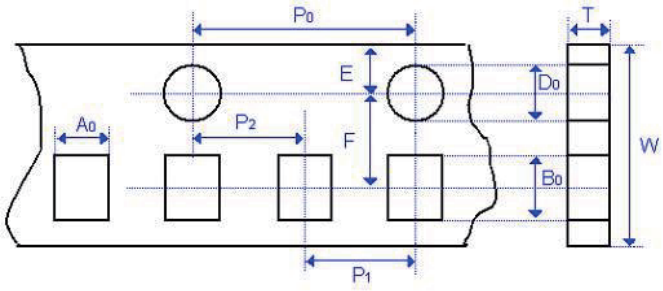
Plastic Tape Size Specification



Unit: mm

Type	0805		1206					1210						1808				1812					
Thickness	D	I	C	J	D	G	P	T	C	D	G	K	M	D	F	G	K	D	F	G	K	M	U
A_0	<1.80		<200			<2.30		<3.05	<3.05				<3.20	<2.50				<3.90					
B_0	<2.70		<3.70			<4.00		<3.80	<3.80				<3.95	<5.30				<5.30					
T	0.23±0.10		0.23±0.10			0.23±0.10		0.23±0.10	0.23±0.10				0.23±0.10	0.25±0.10				0.25±0.10					
K_0	<2.50		<2.50			<2.50		<1.50	<2.50				<3.00	<2.50				<2.50				<3.50	
W	8.00±0.20		8.00±0.20			8.00±0.20		8.00±0.20	8.00±0.20				8.00±0.20	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				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	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±0.10				2.00±0.05					
D_0	1.50+0.1/-0		1.50±0.05			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					
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	1.50±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	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±0.10				5.50±0.10					

Paper Tape Size Specification

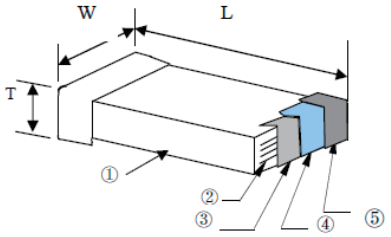


Unit: mm

Type	0201	0402		0603			0805				1206	
Thickness	L	N	E	S	H	X	A	H	B	T	B	T
A_0	0.39±0.07	0.70±0.20		1.05±0.30			1.50±0.20		1.50±0.20		1.90±0.50	
B_0	0.69±0.07	1.20±0.20		1.80±0.30			2.30±0.20		2.30±0.20		3.50±0.50	
T	≦0.50	≦0.80		≦1.20			≦1.15		≦1.30		≦1.30	
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	

Multilayer Ceramic Chip Capacitor—MCF Series

■Construction



①	Ceramic Dielectric	④	Nickel Layer:
②	Inner Electrodes	⑤	Tin Layer
③	Substrate Electrodes		

■Features for≤50V

—There is high reliability on monolithic structure of laminated layers

—And its character of excellent soldering ability and soldering resistance ability is suitable for reflow soldering and peak soldering.

—It includes high and stable capacitance

—High Frequency Type: This kind of dielectric material is considered as Class Ⅰ capacitor. COG capacitors have the most stable electrical performance, which almost does not change with the change of temperature, voltage or time, they are suitable for the low-loss and high stability requirement circuits.

—X7R、X5R: X7R、X5R material is a kind of material has high dielectric constant.
The capacitor made of this kind material is considered as Class Ⅱ capacitor whose capacitance is higher than that of class Ⅰ. These capacitors are classified as having a semi-stable temperature characteristic and used over a wide temperature range, such in these kinds of circuits, DC-blocking, decoupling, bypassing, frequency discriminating etc.

—Executive Standard: GB/T 21041-2007 GB/T 21042-2007

■Applications ≤50V

—It is suitable for all kinds of filter, coupled, harmonic vibration, bypassing and high frequency circuits.

■Features for ≥100V

—High voltage MLCC is a kind of special design MLCC that bases on the technology of general MLCC. This kind of MLCC has stable high voltage reliability and suitable to SMT. High voltage MLCC is widely applicable for many direct high voltage circuits in which it can improve the performance of the circuit.

—There is high reliability on monolithic structure of laminated layers.

—And its character of excellent soldering ability and soldering resistance ability is suitable for reflow soldering and peak soldering.

—It includes high and stable capacitance

—Executive Standard: GB/T 21041-2007 GB/T 21042-2007

■Applications ≥100V

—Analog & Digital Modems

—LAN/WAN Interface

—Lighting Ballast Circuits

—Voltage Multipliers

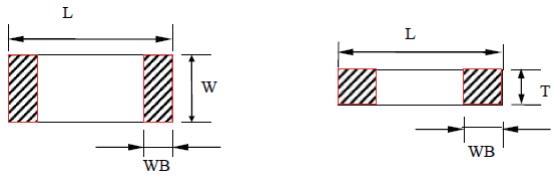
—DC-DC Converters

—Back-lighting Inverters

■Part Numbering

MCF	03	J	T	N	250	3R9
Product Type	Dimensions (L×W)	Capacitance Tolerance	Packaging	Dielectric	Voltage (VDCW)	Capacitance
	E5: 01005 01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 08: 1808 12: 1812 18: 1825 20: 2220 25: 2225	A: ±0.05pF (Cap≤10pF) B: ±0.1pF (Cap≤10pF) C: ±0.25pF (Cap≤10pF) D: ±0.5pF (Cap≤10pF) F: ±1% G: ±2% J: ±5% K: ±10% M: ±20% Z: +80/-20%	T: Taping Reel W: 13” Taping Reel	N: NPO (COG) B: X7R X: X5R	4V0: 4V 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 106: 10μF

■Dimensions



Unit: mm

Type	Size (Inch)	L	W	T/Symbol		WB
E5	01005	0.40±0.02	0.20±0.02	0.20±0.02	V	0.10±0.03
01	0201	0.60±0.03	0.30±0.03	0.30±0.03	C	0.15±0.05
		0.60±0.05	0.30±0.05	0.30±0.05	D	
02	0402	1.00±0.05	0.50±0.05	0.50±0.05	E	0.25±0.05
		1.00±0.15	0.50±0.15	0.50±0.15	F	
		1.00±0.20	0.50±0.20	0.50±0.20	N	
03	0603	1.60±0.10	0.80±0.10	0.80±0.10	H	0.35±0.20
		1.60±0.20	0.80±0.20	0.80±0.20	B	
05	0805	2.00±0.20	1.25±0.20	0.80±0.20	B	0.50±0.20
				1.25±0.20	J	
06	1206	3.20±0.30	1.60±0.30	0.80±0.20	B	0.60±0.30
				1.00±0.20	I	
				1.25±0.20	J	
				1.60±0.20	M	
				1.60±0.30	L	
10	1210	3.20±0.30	2.50±0.30	1.25±0.20	J	0.60±0.30
				1.40±0.20	K	
				1.60±0.30	L	
				1.80±0.30	P	
				2.00±0.20	R	
				2.00±0.30	S	
				2.50±0.30	O	
08	1808	4.50±0.40	2.00±0.20	1.60±0.30	L	0.60±0.30
				1.80±0.30	P	
				2.00±0.30	S	
12	1812	4.50±0.40	3.20±0.30	1.25±0.20	J	0.60±0.30
				1.60±0.20	M	
				1.60±0.30	L	
				2.00±0.20	R	
				2.00±0.30	S	
				2.50±0.30	O	
18	1825	4.50±0.40	6.30±0.50	1.60±0.30	L	0.60±0.30
				2.00±0.30	S	
20	2220	5.70±0.40	5.00±0.40	1.60±0.30	L	0.60±0.30
				2.00±0.30	S	
				2.50±0.30	O	
25	2225	5.70±0.40	6.30±0.50	1.60±0.30	L	0.60±0.30
				2.00±0.30	S	
				2.50±0.30	O	

■Temperature Coefficient /Characteristics

Dielectric	Reference Temperature Point	Temperature Coefficient	Operation Temperature Range
NOP(COG)	20℃	0±30ppm/℃	-55~125℃
X7R	20℃	±15%	-55~125℃
X5R	20℃	±15%	-55~85℃

Note：Nominal temperature coefficient and allowed tolerance of class Ⅰ are decided by the changing of the capacitance between 20℃ and 85℃. Nominal temperature coefficient of class Ⅱ are decided by the temperature of 20℃.

■Measurement method of dielectric withstanding Voltage for High Voltage MLCC

Rated Voltage Range	Measuring Method
100V≤Vr<500V	Force 200% Rated Voltage for 5 second. Max. Current should not exceed 50mA
500V≤Vr≤1000V	Force 150% Rated Voltage for 5 second. Max. Current should not exceed 50mA
1000V<Vr≤2000V	Force 120% Rated Voltage for 5 second. Max. Current should not exceed 50mA
2000V<Vr≤5000V	Force 120% Rated Voltage for 5 second. Max. Current should not exceed 10mA

■General Capacitance & Voltage

Capacitance & Voltage (NPO 10V~50V)

Dielectric		NPO																	
EIA	Size	01005				0201		0402		0603		0805		1206		1210		1812	
Code	VDCW	10V	16V	25V	50	25V	50V	25V	50V	25V	50V	25V	50V	25V	50V	25V	50V	25V	50V
0R1	0.1pF	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
0R2	0.2	V	V	V	V	C	C	E	E	H	H								
R22	0.22											B	B	B	B				
0R3	0.3											B	B	B	B				
R47	0.47											B	B	B	B				
0R5	0.5	V	V	V	V	C	C	E	E	H	H								
1R0	1.0	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
1R2	1.2	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
1R5	1.5	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
1R8	1.8	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
2R0	2.0	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
2R2	2.2	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
2R7	2.7	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
3R0	3.0	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
3R3	3.3	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
3R6	3.6	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
3R9	3.9	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
4R7	4.7	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
5R0	5.0	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
5R6	5.6	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
6R8	6.8	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
8R0	8.0	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
8R2	8.2	V	V	V	V	C	C	E	E	H	H	B	B	B	B				
100	10pF	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
120	12	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
150	15	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
180	18	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
220	22	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
270	27	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
330	33	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
390	39	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
470	47	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
560	56	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
680	68	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
101	100pF	V	V	V	V	C	C	E	E	H	H	B	B	B	B	J	J	L	L
121	120					C		E	E	H	H	B	B	B	B	J	J	L	L
151	150					C		E	E	H	H	B	B	B	B	J	J	L	L
181	180					C		E	E	H	H	B	B	B	B	J	J	L	L
221	220					C		E	E	H	H	B	B	B	B	J	J	L	L
271	270					C		E	E	H	H	B	B	B	B	J	J	L	L
331	330					C		E	E	H	H	B	B	B	B	J	J	L	L
391	390					C		E	E	H	H	B	B	B	B	J	J	L	L
471	470					C		E	E	H	H	B	B	B	B	J	J	L	L
561	560					C		E	E	H	H	B	B	B	B	J	J	L	L
681	680					C		E	E	H	H	B	B	B	B	J	J	L	L
102	1nF							E	E	H	H	B	B	B	B	J	J	L	L
152	1.5									H	H	B	B	B	B	J	J	L	L
182	1.8									H	H	B	B	B	B	J	J	L	L
222	2.2									H	H	B	B	B	B	J	J	L	L
272	2.7									H	H	B	B	B	B	J	J	L	L
332	3.3									H	H	B	B	B	B	J	J	L	L
472	4.7									H	H	B	B	B	B	J	J	L	L
682	6.8											B	B	B	B	J	J	L	L
103	10nF									H	H	B	B	J	J	J	J	L	L
123	12											J	J	L	L			L	L
223	22											J	J	L	L			L	L
333	33													L	L			L	L
473	47													L	L				
104	100nF													L	L				

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

Capacitance & Voltage (X7R 6.3V~50V)

Dielectric		X7R																				
EIA	Size	01005			0201				0402					0603					0805				
Code	VDCW	6.3V	10V	16V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
121	120 pF	V	V	V	C	C	C	C															
181	180	V	V	V	C	C	C	C															
221	220	V	V	V	C	C	C	C															
271	270	V	V	V																			
331	330	V	V	V	C	C	C	C	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
391	390	V	V	V																			
471	470	V	V	V	C	C	C	C	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
561	560	V	V	V	C	C	C	C	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
681	680	V	V	V	C	C	C	C	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
102	1nF	V	V	V	C	C	C	C	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
122	1.2				C	C	C	C	E	E	E	E	E										
222	2.2													H	H	H	H	H	B	B	B	B	B
392	3.9				C	C	C	C	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
472	4.7				C	C	C	C	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
562	5.6				C	C	C		E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
682	6.8				C	C	C		E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
103	10nF				C	C	C		E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
153	15				C	C			E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
183	18				C	C			E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
223	22				C	C			E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
333	33				C	C			E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
473	47								E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
563	56								E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
683	68								E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
104	100nF								E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
224	220								E	E	E	E		H	H	H	H	H	B	B	B	B	B
334	330								E	E	E			H	H	H	H	H	B	B	B	B	B
474	470								E	E	E			H	H	H	H	H	J	J	J	J	J
684	680								E	E				H	H	H	H	H	J	J	J	J	J
105	1uF								F	F				H	H	H	H	H	J	J	J	J	J
225	2.2													B	B	B	B		J	J	J	J	J
335	3.3													B	B				J	J	J	J	
475	4.7													B	B				J	J	J	J	
685	6.8																		J	J	J		
106	10uF																		J	J	J		

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

Capacitance & Voltage (X7R 6.3V~50V)

Dielectric		X7R																			
EIA	Size	1206					1210					1808					1812				
Code	VDCW	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
331	330pF	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
471	470	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
561	560	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
681	680	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
102	1nF	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
222	2.2	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
392	3.9	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
472	4.7	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
562	5.6	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
682	6.8	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
103	10nF	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
153	15	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
183	18	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
223	22	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
333	33	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
473	47	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
563	56	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
683	68	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
104	100nF	B	B	B	B	B	J	J	J	J	J	L	L	L	L	L	M	M	M	M	M
224	220	B	B	B	B	B	K	K	K	K	K	L	L	L	L	L	M	M	M	M	M
334	330	J	J	J	J	J	L	L	L	L	L	L	L	L	L	L	M	M	M	M	M
474	470	J	J	J	J	J	L	L	L	L	L	L	L	L	L	L	M	M	M	M	M
684	680	J	J	J	J	J	L	L	L	L	L	L	L	L	L	L	M	M	M	M	M
105	1uF	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	M	M	M	M
225	2.2	L	L	L	L	L	L	L	L	L	L	L	L	L	L		R	R	R	R	R
335	3.3	L	L	L	L	L	L	L	L	L	L	L	L	L	L		R	R	R	R	R
475	4.7	L	L	L	L	L	L	L	L	L	L	L	L	L	L		R	R	R	R	R
685	6.8	L	L	L	L	L	O	O									R	R	R	R	R
106	10uF	L	L	L	L	L	O	O													
156	15	L	L				O	O													
226	22	L	L				O	O													
476	47						O	O													

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

Capacitance & Voltage (X5R 6.3V~50V)

Dielectric		X5R																						
EIA	Size	01005			0201					0402					0603					0805				
Code	VDCW	6.3V	10V	16V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
121	120pF	V	V	V																				
181	180	V	V	V																				
221	220	V	V	V																				
271	270	V	V	V																				
331	330	V	V	V																				
391	390	V	V	V																				
471	470	V	V	V																				
561	560	V	V	V																				
681	680	V	V	V																				
102	1nF	V	V	V																				
122	1.2	V	V	V																				
152	1.5	V	V	V																				
182	1.8	V	V	V																				
222	2.2	V	V	V																				
272	2.7	V	V	V																				
332	3.3	V	V	V																				
392	3.9	V	V	V																				
472	4.7	V	V	V					C															
562	5.6	V	V	V					C															
682	6.8	V	V	V					C															
103	10nF	V	V	V					C															
153	15				C	C	C	C																
183	18				C	C	C	C																
223	22				C	C	C	C																
333	33				C	C	C	C																
473	47				D	D	D	D						E										
563	56				D	D	D	D						E										
683	68				D	D	D	D						E										
104	100nF				D	D	D	D		E	E	E	E	E										
224	220				D	D				E	E	E	E											
334	330				D	D				E	E	E	E											
474	470				D	D				E	E	E	E		H	H	H	H	H					
684	680									E	E	E	E		H	H	H	H	H					
105	1uF				D	D				F	F	F	F		H	H	H	H	H	J	J	J	J	J
225	2.2				D	D				F	F	F	F		B	B	B	B	B	J	J	J	J	J
335	3.3														B	B	B	B		J	J	J	J	J
475	4.7									F	F	F			B	B	B	B		J	J	J	J	J
685	6.8									F	F				B	B	B	B						
106	10uF									N	N				B	B	B	B						
156	15														B	B				J	J	J	J	
226	22														B	B								
476	47														B					J	J			

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

Capacitance & Voltage (X5R 6.3V~50V)

Dielectric		X5R																			
EIA	Size	1206					1210					1808					1812				
Code	VDCW	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
331	330pF											L	L	L	L	L	M	M	M	M	M
471	470											L	L	L	L	L	M	M	M	M	M
561	560											L	L	L	L	L	M	M	M	M	M
681	680											L	L	L	L	L	M	M	M	M	M
102	1nF											L	L	L	L	L	M	M	M	M	M
222	2.2											L	L	L	L	L	M	M	M	M	M
392	3.9											L	L	L	L	L	M	M	M	M	M
472	4.7											L	L	L	L	L	M	M	M	M	M
562	5.6											L	L	L	L	L	M	M	M	M	M
682	6.8											L	L	L	L	L	M	M	M	M	M
103	10nF											L	L	L	L	L	M	M	M	M	M
153	15											L	L	L	L	L	M	M	M	M	M
183	18											L	L	L	L	L	M	M	M	M	M
223	22											L	L	L	L	L	M	M	M	M	M
333	33											L	L	L	L	L	M	M	M	M	M
473	47											L	L	L	L	L	M	M	M	M	M
563	56											L	L	L	L	L	M	M	M	M	M
683	68											L	L	L	L	L	M	M	M	M	M
104	100nF											L	L	L	L	L	M	M	M	M	M
224	220											L	L	L	L	L	M	M	M	M	M
334	330											L	L	L	L	L	M	M	M	M	M
474	470											L	L	L	L	L	M	M	M	M	M
684	680											L	L	L	L	L	M	M	M	M	M
105	1uF	L	L	L	L	L						L	L	L	L	L	M	M	M	M	M
225	2.5	L	L	L	L	L						L	L	L	L		R	R	R	R	R
335	3.3	L	L	L	L	L						L	L	L	L		R	R	R	R	R
475	4.7	L	L	L	L	L	O	O	O	P	P	L	L	L	L		R	R	R	R	R
685	6.8	L	L	L	L	L						L	L	L			R	R	R	R	R
106	10uF	L	L	L	L	L															
156	15	L	L	L	L		O	O	O	O											
226	22	L	L	L	L		O	O	O	O											
476	47	L	L	L			O	O	O												
107	100uF	L					O	O													

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

■Middle and High Voltage

Capacitance & Voltage (NPO 100V~3KV)

Dielectric		NPO																
EIA	Size	0402	0603			0805					1206							
Code	VDCW	100V	100V	200V	250V	100V	200V	250V	500V	1000V	100V	200V	250V	500V	630V	1000V	2000V	3000V
0R5	0.5pF													B	I	I		
1R0	1.0													B	I	I		
1R2	1.2													B	I	I		
1R5	1.5													B	I	I		
1R8	1.8													B	I	I		
2R0	2.0													B	I	I	I	
2R2	2.2													B	I	I	I	
2R7	2.7													B	I	I	I	
3R0	3.0													B	I	I	I	
3R3	3.3													B	I	I	I	
3R6	3.6													B	I	I	I	
3R9	3.9													B	I	I	I	
4R7	4.7													B	I	I	I	
5R0	5.0													B	I	I	I	
5R6	5.6									B				B	I	I	I	
6R8	6.8									B				I	I	I	I	
8R0	8.0									B				I	I	I	I	
8R2	8.2									B				I	I	I	I	
100	10pF					B				J				I	I	I	I	
120	12					B			B	J				I	I	I	I	
150	15					B			B	J				I	I	I	I	
180	18					B			B	J				I	I	I	J	
220	22		H			B			B	J				I	I	I	J	
270	27		H			B			B	J		B		I	I	I	J	
330	33	E	H			B			B	J		B		I	I	I	J	
390	39	E	H			B			B	J		B		I	I	I	J	M
470	47	E	H			B			B	J		B		I	I	I	J	
560	56	E	H			B			B	J		B		I	I	I	J	
680	68	E	H			B			B	J		B	B	I	I	I	L	
101	100pF	E	H	H		B	B	B	B	J		B	B	I	I	I	L	
121	120	E	H	H		B	B	B	B			B	B	I	I	J	L	
151	150	E	H	H		B	B	B	B			B	B	I	I	J	L	
181	180	E	H	H	H	B	B	B	J			B	B	I	I	J	L	
221	220	E	H	H	H	B	B	B	J			B	B	I	I	J	L	
271	270	E	H	H	H	B	B	B	J			B	B	I	I	J		
331	330		H	H	H	B	B	B	J		B	B	B	I	I	J		
391	390		H	H		B	B	B	J		B	B	B	J	I	J		
471	470		H	H		B	B	B	J		B	B	B	J	J	J		
561	560		H			B	B	B			B	B	B	J	J	L		
681	680		H			B	B	B			B	B	B	J	J	L		
102	1nF		H			B	B	B			B	I	B	L	L	L		
152	1.5					B					B		B	L	L			
182	1.8					B					B		B					
222	2.2					B					B		B					
272	2.7					B												
332	3.3					B												

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

Capacitance & Voltage (NPO 100V~5KV)

Dielectric		NPO																					
EIA	Size	1210					1808					1812								1825			
Code	VDCW	100V	200V	500V	1000V	2000V	500V	1000V	2000V	3000V	5000V	100V	200V	500V	630V	1000V	2000V	3000V	5000V	200V	630V	1000V	3000V
1R0	1.0pF									L									L				
1R2	1.2									L									L				
1R5	1.5									L									L				
1R8	1.8									L									L				
2R0	2.0									L									L				
2R2	2.2									L									L				
2R7	2.7									L									L				
3R0	3.0									L	L								L				
3R3	3.3									L	L					L		L	L				
3R6	3.6									L	L					L		L	L				
3R9	3.9									L	L					L		L	L				
4R7	4.7									L	L					L		L	L				
5R0	5.0									L	L					L		L	L				
5R6	5.6									L	L					L		L	L				
6R8	6.8									L	L					L		L	L				
8R0	8.0									L	L					L		L	L				
8R2	8.2									L	L					L		L	L				
100	10pF			J						L	L					L		L	L				
120	12			J						L	L					L		L	L				
150	15			J						L	L					L		L	L				
180	18			J						L	L					L		L	L				
220	22			J						L	L			J		L	L	L	L				L
270	27			J						L	L			J		L	L	L					
330	33			J				L		L	L			J		L	L	L					
390	39			J		J		L		L	L			J		L	L	L					
470	47			J		L		L		L	L			J		L	L	L					
560	56			J		L		L		L	L	J		J		L	L	L					
680	68			J	J	L		L		L	L	J		J		L	L	L					
101	100pF	J	J	J	J	L		L	L	L	S	J		J		L	L	L					
121	120	J		J	L	L		L	L	L		J		J		L	L	L					
151	150	J		J	L	L		L	L	L		J		J		L	L	L					
181	180	J		J	L	L		L	L	L		J		J		L	L	L					
221	220	J		J	L	P		L	L	L		J		J		L	L	L					
271	270	J		J	L	P		L	L	S		J		J		L	L	L					
331	330	J		J	L	S	L	L	L	S		J		J		L	L	S					
391	390	J		J	L		L	L	L			J		J		L	L	S					
471	470	J		J	L		L	L	L			J		J		L	L	S					
561	560	J		J	L		L	L	S			J		J		L	L	S					
681	680	J		J	L		L	L	S			J		J		L	S						
102	1nF	J		L	S		L	L	S			J		J	L	L	S						
152	1.5	J		L	S		P		S			J		L	L	L							
182	1.8	J		L	S		P		S			J		L	L	O							
222	2.2	J		P	O		P					J		L	L	O							
272	2.7	J		S	O		P					J		L	L								
332	3.3	J			O		P					J		L	L								
392	3.9											J	J	L	L								
472	4.7	J			O		P					J	J	L	L								
562	5.6	J			O																		
682	6.8	J			O																		
103	10nF																					S	
153	15																				L		
223	22											O											
333	33											O								L			

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

Capacitance & Voltage (NPO 250V~3KV)

Dielectric		NPO										
EIA	Size	2220						2225				
Code	VDCW	250V	500V	1000V	2000V	3000V	5000V	1000V	1500V	2000V	2500V	3000V
100	10pF											L
120	12		L									L
150	15		L								L	L
180	18		L								L	L
220	22		L								L	L
270	27		L								L	L
330	33		L								L	L
390	39		L								L	L
470	47		L								L	L
560	56		L								L	L
680	68		L								L	L
101	100pF		L				L			L	L	L
121	120		L							L	L	L
151	150		L			L				L	L	L
181	180		L			L				L	L	L
221	220		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	S		S
471	470		L		L	L			L	S		S
561	560		L		L	L			L	S		S
681	680	L	L		L	L			L	S		S
102	1nF	L	L	L	L	S		L	L	S		S
152	1.5	L	L	S		O						S
182	1.8	L	L	S		O						O
222	2.2	L	L	S		O						O
272	2.7	L	L	S								O
332	3.3	L	L	S								O
392	3.9	L	L	S								
472	4.7	L	L	S								
562	5.6	L		S								
682	6.8	L		S								
103	10nF	L										
153	15	L										

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

Capacitance & Voltage (X7R 100V~2.5KV)

Dielectric		X7R																	
EIA	Size	0402	0603			0805							1206						
Code	VDCW	100V	100V	200V	250V	100V	200V	250V	500V	630V	1000V	2000V	100V	200V	250V	500V	630V	1000V	2000V	2500V
101	100pF		H					J	J				B	B		B	J	L	J	
121	120		H					J	J				B	B		B		L	J	
151	150		H					J	J				B	B		B		L	J	
181	180		H					J	J				B	B		B		L	J	
221	220		H			B		J	J				B	B		B		L	J	
271	270		H			B		J	J				B	B		B		L	J	
331	330		H	H		B		J	J				B	B	B	B		L	J	
391	390		H	H		B		J	J				B	B	B	B		L	J	
471	470		H	H		B		J	J				B	B	B	B		L	J	
561	560		H	H		B		J	J				B	B	B	B		L	J	
681	680		H	H		B		J	J				B	B	B	B		L	J	
102	1nF	E	H	H		B		J	J	J	J	J	B	B	B	B		L	J	J
152	1.5	E	H	H		B		J	J	J	J		B	B	B	B		L	J	
182	1.8	E	H	H		B		J	J	J	J		B	B	B	B		L	J	
222	2.2	E	H	H		B		J	J	J	J		B	B	B	B		L	J	
272	2.7	E	H	H		B		J	J	J			B	B	B	J		L	J	
332	3.3	E	H	H	H	B		J	J	J			B	B	B	J		L	J	
472	4.7	E	H	H	H	B		J	J	J			B	B	B	J	J	L	J	
562	5.6	E	H	H	H	B		J	J	J			B	B	B	J	J	L	J	
682	6.8												B	B	B	J	J	L	L	
103	10nF	E	H	H	H	B	B	J	J				B	B	B	J	J	L		
153	15		H			B	J	J	J				B	B	B	J	J			
183	18		H			B	J	J	J				B	B	B	J	J			
223	22		H			B	J	J	J				B	B	B	J	J			
333	33		H			J	J	J	J				B	J	J	J	L			
473	47		H			J			J				B	J	J	J	L			
563	56		H			J			J				B	J	J	L				
683	68		H			J			J				J	J	J	L				
104	100nF		H			J			J				J	J	L	L				
224	220					J							J	L	L					
334	330					J							J							
474	470					J							L							
684	680					J							L							
105	1.0uF					J							L							
225	2.2					J														
335	3.3					J														
475	4.7					J														

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

Capacitance & Voltage (X7R 100V~5KV)

Dielectric		X7R														
EIA	Size	1210							1808							
Code	VDCW	100V	200V	250V	500V	630V	1000V	2000V	100V	250V	500V	1000V	2000V	3000V	4000V	5000V
101	100pF												L	L		
121	120												L	L		
151	150												L	L		L
181	180												L	L		L
221	220						J	J				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		L
561	560						L	L	L			L	L	L		L
681	680					J	L	L	L			L	L	L		L
102	1nF			L		J	L	L	L	L		L	L	L	L	L
152	1.5			L		J	L	L	L	L		L	L	L		
182	1.8			L		J	L	L	L	L		L	L	L		
222	2.2			L		J	L	L	L	L		L	L	L		
272	2.7			L		J	L	L	L	L		L	L	L		
332	3.3			L	J	J	L	J	L	L		L	L	L		
472	4.7	J		L	J	J	L	J	L	L		L	L	L		
562	5.6	J		L	J	J	L	J	L	L		L	L			
682	6.8	J		L	J	J	L	L	L	L		L	L			
103	10nF	J		L	J	J	L	L	L	L		L	L			
153	15	J		L	J	J	L		L	L		L				
183	18	J		L	J	J	L		L	L		L				
223	22	J		L	J	J	L		L	L		L				
333	33	J		L	L	J			L	L						
473	47	J	J	L	L	S			L	L	L					
563	56	J		L	L	L			L	L						
683	68	J		L	L	L			L	L						
104	100nF	J		L	L	L			L	L						
224	220	L		O					L	L						
334	330	L		O					L	L						
474	470	L							L	L						
684	680	L														
105	1.0uF	L														
225	2.2	O														
335	3.3	O														
475	4.7	O														

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Capacitance & Voltage (X7R 100V~5KV)

Dielectric		X7R															
EIA	Size	1812										1825					
Code	VDCW	100V	200V	250V	500V	630V	1000V	2000V	3000V	4000V	5000V	200V	250V	500V	630V	1000V	2000V	3000V
151	150pF								L	L								
181	180								L	L								
221	220								L	L								
271	270							L	L	L								
331	330						L	L	L	L								
391	390						L	L	L	L								
471	470						L	L	L	L								
561	560						L	L	L	L								
681	680			L			L	L	L	L								
102	1nF		L	L			L	L	L	L							L	
152	1.5		L	L			L	L	L	L							L	
182	1.8		L	L	L		L	L	L	L							L	
222	2.2		L	L	L		L	L	L	L	S						L	
272	2.7		L	L	L		L	L	L	P							L	
332	3.3		L	L	L		L	L	L	P							L	
392	3.9																L	
472	4.7		L	L	L		L	L	L								L	P
562	5.6		L	L	L		L	L	S								L	S
682	6.8		L	L	L		L	L	S								L	S
103	10nF	J	L	L	L		L	L	O							L	L	S
153	15	J	L	L	L		L	S								L	L	
183	18	J	L	L	L		L	S								L	L	
223	22	J	L	L	L	L	L									L	L	
333	33	J	L	L	J	L	L							L		L		
473	47	J	L	L	L	L	L							L		L		
563	56	J	L	L	L	L	S							L		L		
683	68	J	L	L	L	L								L		L		
104	100nF	J	L	L	L	S						L		L		S		
124	120													L				
154	150													L	L			
224	220	J	L	S	S									L				
334	330	J	S	S														
474	470	J	S	O														
684	680	S	S	S														
105	1uF	S	S	S														
225	2.2	O																
335	3.3																	
475	4.7																	
685	6.8																	
106	10uF												S					

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Capacitance & Voltage (X7R 100V~5KV)

Dielectric		X7R																			
EIA	Size	2220										2225									
Code	VDCW	100V	200V	250V	500V	630V	1KV	2KV	2.5KV	3KV	4KV	5KV	100V	200V	250V	500V	1KV	1.5KV	2KV	3KV	4KV	5KV
151	150pF																			L		
181	180																			L		
221	220																L			L		
271	270																L			L		
331	330				L												L			L		
391	390				L												L			L		
471	470				L												L			L		
561	560				L												L			L		
681	680				L												L			L		
102	1nF				L			L		L	L	L			L		L			L		
152	1.5				L			L		L	L	L			L		L			L		L
182	1.8				L			L		L	L	L			L		L			L		
222	2.2			L	L			L		L	L	S			L		L		L	L	P	
272	2.7			L	L			L		L	L	S			L		L		L	L		
332	3.3			L	L			L		L	L	S			L	L	L		L	L		
392	3.9			L	L			L		L	L	S			L	L	L		L	L		
472	4.7			L	L		L	L		L	L	S			L	L	L		L	L		
562	5.6			L	L		L	L		L	L				L	L	L		L	L		
682	6.8			L	L		L	L		L	L				L	L	L		L	L		
822	8.2			L	L		L	L		L	L											
103	10nF			L	L		L	L	L	L					L	L	L		L	L		
153	15			L	L		L	L							L	L	L		L	L		
183	18			L	L		L	L							L	L	L		L	P		
223	22			L	L		L	L							L	L	L		L	P		
333	33			L	L		L	L							L	L	L		S			
473	47		L	L	L		L	L							L	L	L		P			
563	56		L	L	L		S								L	L	P		O			
683	68		L	L	L		S								L	L	P		O			
104	100nF		L	L	L		S						L		L	L	P	O	O			
124	120		L	L	L		S						L		L	L	O					
154	150		L	L	L	L	S						L		L	L						
224	220		L	L	L	L	S						L		L	L						
334	330		L	L	L	L							L		L	L						
474	470	L	L	L	L	L							L	L	L	L						
684	680	L	L	L											L	S						
105	1uF	L		L											S	O						
225	2.2	P		S											S							
335	3.3	S																				
475	4.7	S																				
685	6.8	S																				
106	10uF	S																				

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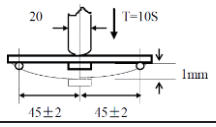
■Environmental Characteristics

<table>
<tr><th>Item</th><th colspan="9">Requirement</th><th colspan="3">Test Method</th></tr>
<tr><td>Capacitance</td><td colspan="9">Should be within the specified tolerance</td><td colspan="3">NPO: (Class I)
Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%
Cap>1000pF 1.0±0.2Vrms, 1KHz±10%
X7R, X5R: (Class II)
Test Temperature:25℃±3℃
Cap≤10uF 1.0±0.2Vrms, 1KHz±10%
Cap>10uF 0.5±0.1Vrms, 120Hz±24 Hz</td></tr>
<tr><td>Insulation Resistance</td><td colspan="9">Class Ⅰ:
C≤10 nF, Ri≥50000MΩ
C＞10 nF, Ri•C_R≥500S
Class II:
C≤25 nF, Ri≥10000MΩ
C＞25 nF, Ri•C_R＞100S
Note: S=Ω•F</td><td colspan="3">Measuring Voltage: Rated Voltage（Max 500V）
Duration: 60±5s
Test Humidity: ≤75%
Test Temperature: 25℃±3℃
Test Current: ≤50mA</td></tr>
<tr><td rowspan="20">(DF, tanδ)
Dissipation Factor</td><td rowspan="2">NPO
(Class Ⅰ)</td><td colspan="8">DF</td><td>Capacitance</td><td>Measuring Frequency</td><td>Measuring Voltage</td></tr>
<tr><td colspan="8">≤1/(400+20C)</td><td>C < 30pF</td><td rowspan="2">1MHZ±10%</td><td rowspan="2">1.0±0.2Vrms</td></tr>
<tr><td colspan="8">≤0.1%</td><td>C≥30pF</td></tr>
<tr><td rowspan="18">X7R,
X5R:
(Class II)</td><td>Voltage</td><td>DF(X10⁻⁴)</td><td>0201</td><td>0402</td><td>0603</td><td>0805</td><td>≧1206</td><td colspan="3" rowspan="18">Cap≤10uF 1.0±0.2Vrms, 1KHz±10%
Cap>10uF 0.5±0.1Vrms, 120Hz±24Hz</td></tr>
<tr><td rowspan="5">50V</td><td>≤250</td><td>≤3.3nF</td><td>≤10nF</td><td>≤100 nF</td><td>≤330 nF</td><td>≤680 nF</td></tr>
<tr><td>≤350</td><td>≤10nF</td><td>-</td><td>-</td><td>-</td><td>≤1μF</td></tr>
<tr><td>≤500</td><td>-</td><td>-</td><td>-</td><td>≤680 nF</td><td>-</td></tr>
<tr><td>≤500</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>≤1000</td><td>-</td><td>≤1μF</td><td>≤2.2μF</td><td>≤4.7μF</td><td>≤10μF</td></tr>
<tr><td rowspan="5">25V</td><td>≤250</td><td>≤3.3nF</td><td>≤10nF</td><td>≤150nF</td><td>≤330nF</td><td>≤680 nF</td></tr>
<tr><td>≤350</td><td>≤10nF</td><td>≤100nF</td><td>≤330nF</td><td>-</td><td>≤2.2μF</td></tr>
<tr><td>≤500</td><td>-</td><td>-</td><td>-</td><td>≤1μF</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>-</td><td>-</td><td>≤2.2μF</td><td>≤4.7μF</td></tr>
<tr><td>≤1000</td><td>≤100nF</td><td>≤2.2μF</td><td>≤10μF</td><td>≤22μF</td><td>≤22μF</td></tr>
<tr><td rowspan="5">16V</td><td>≤250</td><td>≤3.3nF</td><td>≤10nF</td><td>≤150nF</td><td>≤330nF</td><td>≤680 nF</td></tr>
<tr><td>≤350</td><td>≤15nF</td><td>≤100nF</td><td>≤330nF</td><td>-</td><td>≤2.2μF</td></tr>
<tr><td>≤500</td><td>≤47nF</td><td>≤220nF</td><td>≤680nF</td><td>≤2.2μF</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>-</td><td>-</td><td>≤4.7μF</td><td>≤4.7μF</td></tr>
<tr><td>≤1000</td><td>≤100nF</td><td>≤4.7μF</td><td>≤10μF</td><td>≤22μF</td><td>≤47μF</td></tr>
<tr><td rowspan="5">10V</td><td>≤250</td><td>≤3.3 nF</td><td>≤10nF</td><td>≤150nF</td><td>≤330nF</td><td>≤680 nF</td></tr>
<tr><td>≤350</td><td>≤15nF</td><td>≤100nF</td><td>≤330nF</td><td>-</td><td>≤2.2μF</td></tr>
<tr><td>≤500</td><td>≤47nF</td><td>-</td><td>≤680nF</td><td>≤2.2μF</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>≤1μF</td><td>≤2.2μF</td><td>≤4.7μF</td><td>≤10μF</td></tr>
<tr><td>≤1000</td><td>≤2.2μF</td><td>≤10μF</td><td>≤22μF</td><td>≤47μF</td><td>≤100μF</td></tr>
<tr><td rowspan="6">≤6.3V</td><td>≤250</td><td>≤3.3nF</td><td>-</td><td>≤150nF</td><td>-</td><td>≤680nF</td></tr>
<tr><td>≤350</td><td>≤15nF</td><td>≤100nF</td><td>≤330nF</td><td>-</td><td>≤2.2μF</td></tr>
<tr><td>≤500</td><td>≤47nF</td><td>≤220nF</td><td>≤680nF</td><td>-</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>≤1μF</td><td>-</td><td>10μF~22μF</td><td>≤10μF</td></tr>
<tr><td>≤1000</td><td>≤4.7μF</td><td>≤22μF</td><td>≤47μF</td><td>≤47μF</td><td>≤100μF</td></tr>
<tr><td>≥100V</td><td colspan="6">≤2.5%</td><td colspan="3">Test Temperature:25℃±3℃
Test Frequency:1KHz±10%
Test Voltage: 1.0±0.2Vrms</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>Dielectric Withstanding Voltage(DWV)
(For ≤50V)</td><td>No breakdown or damage.</td><td>Measuring Voltage:
Class Ⅰ:300% Rated voltage
Class Ⅱ:250% Rated voltage
Duration: 1～5s
Charge/ Discharge Current: 50mA max.
(This method excludes high-voltage MLCC)</td></tr>
<tr><td>Solderability</td><td>At least 95% of the terminal electrode is covered by new solder.
Visual Appearance: No visible damage.</td><td>Preheating conditions:80 to 120℃; 10~30s.
Solder Temperature: 235±5℃(Sn/Pb:63/37) Duration: 2±0.5s | Solder Temperature: 245±5℃(Lead-free) Duration: 2±0.5s</td></tr>
<tr><td>Resistance to Flexure of Substrate (Bending Strength)</td><td>Appearance: No visible damage
ΔC/C:
Class Ⅰ:≤±5% or ±0.5pF, whichever is larger
Class II: ≤±10%</td><td>Test Board: PCB
Warp: 1mm
Speed: 1 mm/sec.
Unit: mm
The measurement should be made with the board in the bending position.
 
</td></tr>
<tr><td>Resistance to Soldering Heat</td><td><table><tr><td>Item</td><td>NPO</td><td>X7R / X5R</td></tr><tr><td>ΔC/C</td><td>≤±2.5% or ±0.25pF whichever is larger</td><td>±15%</td></tr><tr><td>DF</td><td colspan="2">Same to initial value</td></tr><tr><td>IR</td><td colspan="2">Same to initial value</td></tr></table>Appearance：No visible damage.
At least 95% of the terminal electrode is covered by new solder.</td><td>Preheating conditions: 100 to 200℃; 60~120s.
Solder Temperature: 265±5℃
Duration: 10±1s
Clean the capacitor with solvent and examine it with a 10X(min.) microscope.
Recovery Time: 24±2h
Recovery condition: Room temperature</td></tr>
<tr><td>Termination Adhesion</td><td>No visible damage</td><td>Applied Force: ≤0402 size: 2N ;
≥0603 size: 5N
Duration: 10±1S</td></tr>
<tr><td>Temperature Cycle</td><td>NPO: ΔC/C:≤±1% or ±1pF, whichever is larger.
X7R/X5R: ΔC/C：-15%~+15%</td><td>Preheating conditions: up-category temperature, 1h
Recovery time: 24±1h
Initial Measurement
Cycling Times: 5 times, 1 cycle, 4 steps:<table><tr><th>Step</th><th>Temp.(℃)</th><th>Time(min)</th></tr><tr><td>1</td><td>Low- category temp
NPO/X7R/X5R : -55</td><td>30</td></tr><tr><td>2</td><td>Normal temp. (+20)</td><td>2-3</td></tr><tr><td>3</td><td>Up- category temp
NPO/X7R/ : +125
X5R: +85</td><td>30</td></tr><tr><td>4</td><td>Normal temp. (+20)</td><td>2-3</td></tr></table>Recovery time after test: 24±2h</td></tr>
<tr><td>Humidity Load</td><td>NPO:
ΔC/C :±7.5% or ±0.75pF, whichever is larger.
X7R/X5R:
ΔC/C：≤±12.5%
DF: Not more than twice of initial value.
IR:
NPO: Ri≥5000MΩ or Ri• CR≥ 50S whichever is smaller
X7R/X5R: Ri≥1000MΩ or Ri• CR≥10S whichever is smaller.
Appearance: No visible damage</td><td>Pretreatment (Class II) : After preheating at 140℃~150℃ for 1h±10min, place at room temperature for 24±2h.
Temperature: 40±2℃
Humidity: 90~95%RH
Voltage: Rated Voltage
Duration: 500h
Recovery Time: 24h±2h
Class 2：0201≥47nF、0402≥33nF、0603≥1μF、0805≥4.7μF、1206≥10μF product need to keep in 150℃、1h after the test，and measurement to be made after being kept at room temperature for 24±2h.</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>Life Test</td><td>NPO:
ΔC/C :≤±3% or ±0.3pF,whichever is larger.
X7R/X5R
ΔC/C :±20%
DF: Not more than twice of initial value.
IR:
NPO: Ri≥4000MΩ or Ri• CR≥40S whichever is smaller
X7R/X5R: Ri≥2000MΩ or Ri• CR≥50S whichever is smaller.
Visual Appearance: No visible damage</td><td>Pretreatment (ClassII) :After preheating at 140℃~150℃
for 1h±10min, place at room temperature for 24±2h.
Low-Voltage (＜100V)
Applied Voltage: 2*Ur，except the table 1
Duration: 1000h
Temperature：125℃(C0G、X7R) 85℃(X5R)
Charge/ Discharge Current: 50mA max.
Recovery Time: 24h±2h
Class 2：0201≥47nF、0402≥33nF、0603≥1μF、0805≥4.7μF、1206≥10μF product need to keep in 150℃、1h after the test，and measurement to be made after being kept at room temperature for 24±2h.

Table 1<table><tr><th>Capacitance</th><th>Test Voltage</th><th>Capacitance</th><th>Test Voltage</th></tr><tr><td>0201≥10nF</td><td rowspan="3">1.5Ur</td><td>0805≥0.47uF</td><td rowspan="3">1.5 Ur</td></tr><tr><td>0402≥47nF</td><td>1206≥1uF</td></tr><tr><td>0603≥220nF</td><td>1210≥1uF</td></tr></table></td></tr>
<tr><td>Middle
&high
voltage
Life Test</td><td>NPO:
ΔC/C :≤±3% or ±0.3pF,whichever is larger.
X7R/X5R
ΔC/C ≤±20%
DF: Not more than twice of initial value.
IR:
NPO: Ri≥4000MΩ or Ri• CR≥40S whichever is smaller
X7R/X5R: Ri≥2000MΩ or Ri• CR≥50S whichever is smaller.
Visual Appearance: No visible damage</td><td>Applied Voltage:
100V≤Rated Voltage≦200V：1.5 Multiple
200V<Rated Voltage≤500V：1.3 Multiple
500V< Rated Voltage：1.2 Multiple
Duration: 1000h
Charge/ Discharge Current: 50mA max.
Temperature : 125℃(NPO X7R) ; 85℃(X5R)
Recovery Time: 24h±2h
Class 2：0201≥47nF、0402≥33nF、0603≥1μF、0805≥4.7μF、1206≥10μF product need to keep in 150℃、1h after the test，and measurement to be made after being kept at room temperature for 24 ±2h.</td></tr>
</table>

■Pretreatment (only for class 2 capacitor) is a method to treat the capacitor before measurement. First, place the capacitor in the up-category temperature or other specified higher temperature environment for 1 hour. Then recovery the capacitor at standard pressure conditions for 24±1 hours.

■Storage Temperature: 5 ~ 40℃; Relative Humidity 20 ~70 %RH

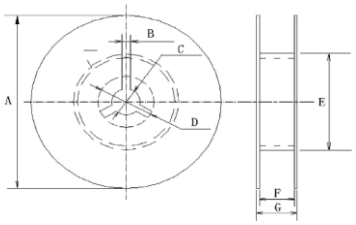
Packaging

Packaging Quantity

Unit; mm

Type	Thickness / Symbol		Packaging (7" Reel)		Packaging (13" Reel)	
			Paper tape	Plastic tape	Paper tape	Plastic tape
01005	0.20±0.02	V	20K	-	-	-
0201	0.30±0.03	C	15K	-	70K	-
	0.30±0.05	D	15K	-	70K	-
0402	0.50±0.05	E	10K	-	50K	-
	0.50±0.15	F	10K	-	50K	-
	0.50±0.20	N	10K	-	50K	-
0603	0.80±0.10	H	4K	-	15K	-
	0.80±0.20	B	4K	-	15K	-
0805	0.80±0.20	B	4K	-	15K	-
	1.25±0.20	J	-	3K	-	-
1206	0.80±0.20	B	4K	-	15K	-
	1.00±0.20	I	-	3K	-	-
	1.25±0.20	J	-	3K	-	-
	1.60±0.20	M	-	2K	-	-
	1.60±0.30	L	-	2K	-	-
1210	1.25±0.20	J	-	2K	-	-
	1.40±0.20	K	-	2K	-	-
	1.60±0.30	L	-	2K	-	-
	1.80±0.30	P	-	1K	-	-
	2.00±0.20	R	-	1K	-	-
	2.00±0.30	S	-	1K	-	-
	2.50±0.30	O	-	1K	-	-
1808	1.60±0.30	L	-	2K	-	-
	1.80±0.30	P	-	2K	-	-
	2.00±0.30	S	-	2K	-	-
1812	1.25±0.20	J	-	1K	-	-
	1.60±0.30	L	-	1K	-	-
	1.60±0.20	M	-	1K	-	-
	1.80±0.30	P	-	1K	-	-
	2.00±0.20	R	-	0.5K	-	-
	2.00±0.30	S	-	0.5K	-	-
	2.50±0.30	O	-	0.5K	-	-
1825	1.60±0.30	L	-	1K	-	-
	2.00±0.30	S	-	0.5K	-	-
2220	1.60±0.30	L	-	0.5K	-	-
	1.80±0.30	P	-	0.5K	-	-
	2.00±0.30	S	-	0.5K	-	-
	2.50±0.30	O	-	0.5K	-	-
2225	1.60±0.30	L	-	0.5K	-	-
	1.80±0.30	P	-	0.5K	-	-
	2.00±0.30	S	-	0.5K	-	-
	2.50±0.30	O	-	0.5K	-	-

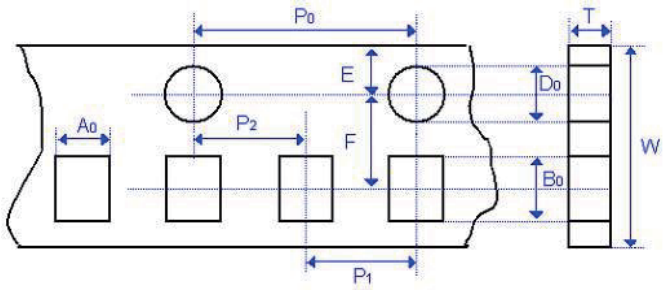
Tape and Reel



Unit: mm

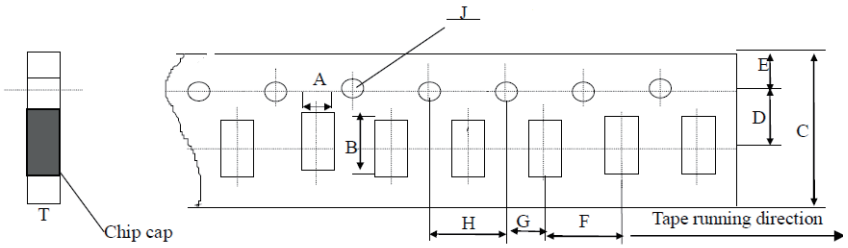
Type	01005 / 0201 / 0402 / 0603 / 0805 / 1206		1210 / 1808 / 1812 / 1825 / 2220 / 2225
Reel Size	7"	13"	7"
A	178±2.0	330±2.0	178±2.0
B	3.0	3.0	3.0
C	13.0±0.5	13.0±0.5	13.0±0.5
D	21.0±0.8	21.0±0.8	21.0±0.8
E	50 or more	50 or more	50 or more
F	10.0±1.5	10.0±1.5	10.0±1.5
G	12 max	12 max	12 max

Paper Tape Size Specification



Unit: mm

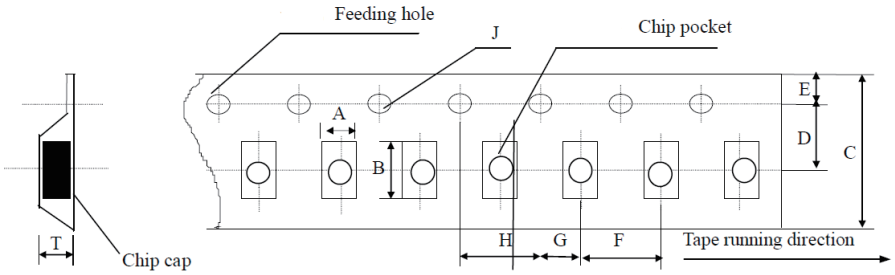
Type	A0	B0	T	W	P0	P1	P2	D0	E	F
01005	0.24±0.20	0.45±0.02	0.30 Below	8.00±0.10	4.00±0.10	2.00±0.05	2.00±0.05	1.5-0/+0.10	1.75±0.10	3.50±0.05
0201	0.37±0.10	0.67±0.10	0.80 Below	8.00±0.10	4.00±0.10	2.00±0.05	2.00±0.05	1.5-0/+0.10	1.75±0.10	3.50±0.05
0402	0.65±0.10	1.15±0.10	0.80 Below	8.00±0.10	4.00±0.10	2.00±0.05	2.00±0.05	1.5-0/+0.10	1.75±0.10	3.50±0.05



Unit: mm

Type	A	B	C	D	E	F	G	H	J	T
0603	1.10±0.10	1.90±0.10	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.5-0/+0.10	1.10 Max
0805	1.45±0.15	2.30±0.15	8.00±0.15	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.5-0/+0.10	1.10 Max
1206	1.80±0.20	3.40±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.5-0/+0.10	1.10 Max

Plastic Tape Size Specification



Unit: mm

Type	A	B	C	D	E	F	G	H	J	T
0805	1.55±0.20	2.35±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.50 Max
1206	1.95±0.20	3.60±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.85 Max
1210	2.70±0.10	3.42±0.10	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.55-0/+0.10	3.20 Max
1808	2.20±0.10	4.95±0.10	12.00±0.10	5.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50-0/+0.10	3.00 Max
1812	3.66±0.10	4.95±0.10	12.00±0.10	5.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05	4.00±0.10	1.55-0/+0.10	4.00 Max
2220	6.20±0.10	6.70±0.10	12.00±0.10	5.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05	4.00±0.10	1.55-0/+0.10	2.40±0.10
2225	6.20±0.10	6.70±0.10	12.00±0.10	5.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05	4.00±0.10	1.55-0/+0.10	2.40±0.10

Flexible Terminal Multilayer Ceramic Chip Capacitor – MCFA Series

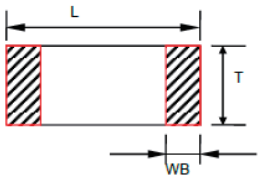
Features

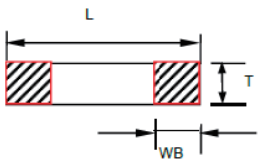
- There is high reliability on monolithic structure of laminated layers
- And its character of excellent soldering ability and soldering esistance ability is ability is suitable for reflow soldering and peak soldering
- It includes high and stable capacitance
- High mechanical performance able to withstand, 3mm bend test
- Flexible termination system
- Reduction in circuit board flex failures

Applications

- High Flexure Stress Circuit Boards
- Variable Temperature Applications

Dimensions





Unit: mm

Type	Size (Inch)	L	W	T/Symbol		WB
MCFA02	0402	1.00±0.05	0.50±0.05	0.50±0.05	E	0.25±0.05
		1.00±0.05	0.50±0.05	0.50±0.15	F	0.25±0.05
MCFA03	0603	1.60±0.10	0.80±0.10	0.80±0.10	H	0.35±0.20
		1.60±0.10	0.80±0.10	0.80±0.20	B	0.35±0.20
MCFA05	0805	2.00±0.20	1.25±0.20	0.80±0.20	B	0.50±0.20
		2.00±0.20	1.25±0.20	1.25±0.20	J	0.50±0.20
MCFA06	1206	3.20±0.30	1.60±0.30	0.80±0.20	B	0.60±0.30
		3.20±0.30	1.60±0.30	1.25±0.20	J	0.60±0.30
		3.20±0.30	1.60±0.30	1.60±0.30	L	0.60±0.30
MCFA10	1210	3.20±0.30	2.50±0.30	1.25±0.15	A	0.60±0.30
		3.20±0.30	2.50±0.30	1.25±0.20	J	0.60±0.30
		3.20±0.30	2.50±0.30	1.40±0.20	K	0.60±0.30
		3.20±0.30	2.50±0.30	1.60±0.30	L	0.60±0.30
		3.20±0.30	2.50±0.30	2.00±0.30	S	0.60±0.30
		3.20±0.30	2.50±0.30	2.50±0.30	O	0.60±0.30
MCFA08	1808	4.50±0.40	2.00±0.20	1.60±0.30	L	0.60±0.30
MCFA12	1812	4.50±0.40	3.20±0.30	1.25±0.20	J	0.60±0.30
		4.50±0.40	3.20±0.30	1.25±0.30	Q	0.60±0.30
		4.50±0.40	3.20±0.30	1.60±0.20	M	0.60±0.30
		4.50±0.40	3.20±0.30	1.60±0.30	L	0.60±0.30
		4.50±0.40	3.20±0.30	1.80±0.30	P	0.60±0.30
		4.50±0.40	3.20±0.30	2.00±0.20	R	0.60±0.30
		4.50±0.40	3.20±0.30	2.00±0.30	S	0.60±0.30
		4.50±0.40	3.20±0.30	2.50±0.30	O	0.60±0.30
MCFA20	2220	5.70±0.40	5.00±0.40	1.60±0.30	L	0.60±0.30
		5.70±0.40	5.00±0.40	1.80±0.30	P	0.60±0.30
		5.70±0.40	5.00±0.40	2.00±0.30	S	0.60±0.30
MCFA25	2225	5.70±0.50	6.30±0.50	1.60±0.30	L	0.60±0.30
		5.70±0.50	6.30±0.50	1.80±0.30	P	0.60±0.30
		5.70±0.50	6.30±0.50	2.00±0.30	S	0.60±0.30
		5.70±0.50	6.30±0.50	3.20±0.30	G	0.60±0.30

■Part Numbering

MCFA	03	J	T	N	250	3R9
Product Type	Dimensions (L×W)	Capacitance Tolerance	Packaging	Dielectric	Voltage (VDCW)	Capacitance
MCFA: Flexible termination	02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 08: 1808 12: 1812 20: 2220 25: 2225	J: ±5% K: ±10% M: ±20%	T: Taping Reel	B: X7R	6V3: 6.3V 100: 10V 500: 50V 101: 100V 102: 1000V	3R9: 3.9pF 150: 15pF 181: 180pF 225: 2.2μF 106: 10μF

■General Capacitance & Voltage

Capacitance & Voltage (6.3V~50V)

Dielectric		X7R														
EIA	Size	0402					0603					0805				
Code	VDCW	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
331	330pF	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
471	470	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
561	560	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
681	680	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
102	1nF	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
222	2.2	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
392	3.9	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
472	4.7	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
562	5.6	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
682	6.8	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
103	10nF	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
153	15	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
183	18	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
223	22	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
333	33	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
473	47	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
563	56	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
683	68	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
104	100nF	E	E	E	E	E	H	H	H	H	H	B	B	B	B	B
224	220	F	F	F	F		H	H	H	H	H	B	B	B	B	B
334	330	F	F	F			H	H	H	H	H	B	B	B	B	B
474	470	F	F	F			H	H	H	H	H	J	J	J	J	J
684	680	F	F				H	H	H	H	H	J	J	J	J	J
105	1uF	F	F				B	B	B	B	B	J	J	J	J	J
225	2.2						B	B	B			J	J	J	J	J
335	3.3						B					J	J	J	J	
475	4.7						B					J	J	J	J	
685	6.8											J				
106	10uF											J				

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

Dielectric		X7R																	
EIA	Size	1206					1210					1808					1812		
Code	VDCW	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	16V	25V	50V
331	330pF	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
471	470	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
561	560	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
681	680	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
102	1nF	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
222	2.2	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
392	3.9	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
472	4.7	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
562	5.6	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
682	6.8	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
103	10nF	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
153	15	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
183	18	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
223	22	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
333	33	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
473	47	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
563	56	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
683	68	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
104	100nF	B	B	B	B	B	A	A	A	A	A	L	L	L	L	L	M	M	M
224	220	B	B	B	B	B	K	K	K	K	K	L	L	L	L	L	M	M	M
334	330	J	J	J	J	J	L	L	L	L	L	L	L	L	L	L	M	M	M
474	470	J	J	J	J	J	L	L	L	L	L	L	L	L	L	L	M	M	M
684	680	J	J	J	J	J	L	L	L	L	L	L	L	L	L	L	M	M	M
105	1uF	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	M	M	M
225	2.2	L	L	L	L	L	L	L	L	L	L	L	L	L	L		R	R	R
335	3.3	L	L	L	L	L	L	L	L	L	L	L	L	L	L		R	R	R
475	4.7	L	L	L	L	L	L	L	L	L	L	L	L	L	L		R	R	R
685	6.8	L	L	L	L	L	O	O									R	R	R
106	10uF	L	L	L	L	L	O	O											
156	15	L	L				O	O											
226	22	L	L				O	O											
476	47						O	O											
107	100uF																		

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

■Middle and High Voltage

Capacitance & Voltage (100V~2000V)

Dielectric		X7R										
EIA	Size	0402	0603			0805						
Code	VDCW	100V	100V	200V	250V	100V	200V	250V	500V	630V	1000V	2000V
101	100pF		H					J	J			
121	120		H					J	J			
151	150		H					J	J			
181	180		H					J	J			
221	220		H			B		J	J			
271	270		H			B		J	J			
331	330		H	H		B		J	J			
391	390		H	H		B		J	J			
471	470		H	H		B		J	J			
561	560		H	H		B		J	J			
681	680		H	H		B		J	J			
102	1nF	E	H	H		B		J	J	J	J	J
152	1.5	E	H	H		B		J	J	J	J	
182	1.8	E	H	H		B		J	J	J	J	
222	2.2	E	H	H		B		J	J	J	J	
272	2.7	E	H	H		B		J	J	J		
332	3.3	E	H	H	H	B		J	J	J		
472	4.7	E	H	H	H	B		J	J	J		
562	5.6	E	H	H	H	B		J	J	J		
103	10nF		H	H	H	B	B	J	J			
153	15		H			B	J	J	J			
183	18		H			B	J	J	J			
223	22		H			B	J	J	J			
333	33		H			J	J	J	J			
473	47		H			J			J			
563	56		H			J			J			
683	68		H			J			J			
104	100nF		H			J			J			
224	220					J						
334	330					J						
474	470					J						
684	680					J						
105	1uF					J						
225	2.2					J						
335	3.3					J						
475	4.7					J						

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

Capacitance & Voltage (100V~2000V)

Dielectric		X7R														
EIA	Size	1206								1210						
Code	VDCW	100V	200V	250V	500V	630V	1000V	2000V	2500V	100V	200V	250V	500V	630V	1000V	2000V
101	100pF	B	B		B		L	J								
121	120	B	B		B		L	J								
151	150	B	B		B		L	J								
181	180	B	B		B		L	J								
221	220	B	B		B		L	J							J	J
271	270	B	B		B		L	J							L	L
331	330	B	B	B	B		L	J							L	L
391	390	B	B	B	B		L	J							L	L
471	470	B	B	B	B		L	J							L	L
561	560	B	B	B	B		L	J							L	L
681	680	B	B	B	B		L	J						J	L	L
102	1nF	B	B	B	B		L	J	J			L		J	L	L
152	1.5	B	B	B	B		L	J				L		J	L	L
182	1.8	B	B	B	B		L	J				L		J	L	L
222	2.2	B	B	B	B		L	J				L		J	L	L
272	2.7	B	B	B	J		L	J				L		J	L	L
332	3.3	B	B	B	J		L	J				L	J	J	L	J
472	4.7	B	B	B	J	J	L	J		J		L	J	J	L	J
562	5.6	B	B	B	J	J	L	J		J		L	J	J	L	J
682	6.8	B	B	B	J	J	L	L		J		L	J	J	L	L
103	10nF	B	B	B	J	J	L			J		L	J	J	L	L
153	15	B	B	B	J	J				J		L	J	J	L	
183	18	B	B	B	J	J				J		L	J	J	L	
223	22	B	B	B	J	J				J		L	J	J	L	
333	33	B	J	J	J	L				J		L	L	J		
473	47	B	J	J	J	L				J	J	L	L	S		
563	56	B	J	J	L					J		L	L	L		
683	68	J	J	J	L					J		L	L	L		
104	100nF	J	J	J	L					J		L	L	L		
224	220	J	L	L						L		O				
334	330	J								L		O				
474	470	L								L						
684	680	L								L						
105	1uF	L								L						
225	2.2									O						

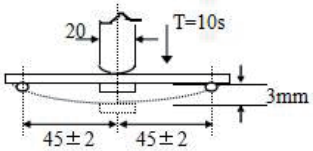
■The letter in cell is expressed the symbol of product thickness

Capacitance & Voltage (100V~5000V)

Dielectric		X7R																	
EIA	Size	1808								1812									
Code	VDCW	100V	250V	500V	1KV	2KV	3KV	4KV	5KV	100V	200V	250V	500V	630V	1KV	2KV	3KV	4KV	5KV
101	100pF					L	L												
121	120					L	L												
151	150					L	L		L								L	L	
181	180					L	L		L								L	L	
221	220				L	L	L		L							L	L	L	
271	270				L	L	L		L							L	L	L	
331	330				L	L	L		L						L	L	L	L	
391	390				L	L	L		L						L	L	L	L	
471	470	L			L	L	L		L						L	L	L	L	
561	560				L	L	L		L						L	L	L	L	
681	680				L	L	L		L			L			L	L	L	L	
102	1nF		L		L	L	L	L	L		L	L			L	L	L	L	
152	1.5		L		L	L	L				L	L			L	L	L	L	
182	1.8		L		L	L	L				L	L	L		L	L	L	L	
222	2.2		L		L	L	L				L	L	L		L	L	L	L	S
272	2.7		L		L	L	L				L	L	L		L	L	L	P	
332	3.3		L		L	L	L				L	L	L		L	L	L	P	
472	4.7		L		L	L	L				L	L	L		L	L	L		
562	5.6		L		L	L					L	L	L		L	L	S		
682	6.8		L		L	L					L	L	L		L	L	S		
103	10nF		L		L	L				J	L	L	L		L	L	O		
153	15		L		L					J	L	L	L		L	S			
183	18		L		L					J	L	L	L		L	S			
223	22		L		L					J	L	L	L	L	L				
333	33		L							J	L	L	Q	L	L				
473	47		L	L						J	L	L	L	L	L				
563	56		L							J	L	L	L	L	S				
683	68		L							J	L	L	L	L					
104	100nF		L							J	L	L	L	S					
224	220		L							J	L	S							
334	330		L							J	S	S							
474	470		L							J	S	O							
684	680									S	S	S							
105	1uF									S	S	S							
225	2.2									O									

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

■Environmental Characteristics

<table>
<tr><th>Item</th><th colspan="6">Requirement</th><th>Test Method</th></tr>
<tr><td>Capacitance</td><td colspan="6">Should be within the specified tolerance</td><td>Test Temperature: 25±3°C
Cap≤10uF 1.0±0.2Vrms, 1KHz±10%
Cap>10uF 0.5±0.1Vrms, 120Hz±24Hz</td></tr>
<tr><td rowspan="32">(DF, tanδ) Dissipation Factor</td><td>Voltage</td><td>DF(x10^{-4})</td><td>0402</td><td>0603</td><td>0805</td><td>≥1206</td><td rowspan="32">Cap≤10uF 1.0±0.2Vrms, 1KHz±10%
Cap>10uF 0.5±0.1Vrms, 120Hz±24Hz</td></tr>
<tr><td rowspan="5">50V</td><td>≤250</td><td>≤10nF</td><td><100nF</td><td>-</td><td>≤680nF</td></tr>
<tr><td>≤350</td><td>≤47nF</td><td><470nF</td><td>≤1uF</td><td>≤2.2uF</td></tr>
<tr><td>≤500</td><td>≤0.1μF</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>-</td><td>≤2.2uF</td><td>≤4.7uF</td></tr>
<tr><td>≤1000</td><td>-</td><td>≤1μF</td><td>≤1μF</td><td>≤10μF</td></tr>
<tr><td rowspan="5">25V</td><td>≤250</td><td>≤10nF</td><td><100nF</td><td>-</td><td>≤680nF</td></tr>
<tr><td>≤350</td><td>≤47nF</td><td><470nF</td><td>≤1uF</td><td>-</td></tr>
<tr><td>≤500</td><td>0.22μF</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>-</td><td>≤2.2μF</td><td>≤10μF</td></tr>
<tr><td>≤1000</td><td>-</td><td>≤2.2μF</td><td>≤4.7μF</td><td>-</td></tr>
<tr><td rowspan="5">16V</td><td>≤250</td><td>≤10nF</td><td><100nF</td><td>-</td><td>≤680nF</td></tr>
<tr><td>≤350</td><td>≤47nF</td><td><470nF</td><td>≤1uF</td><td>-</td></tr>
<tr><td>≤500</td><td>≤220nF</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>-</td><td>≤4.7μF</td><td>≤10μF</td></tr>
<tr><td>≤1000</td><td>≤470nF</td><td>≤2.2μF</td><td>≤4.7μF</td><td>-</td></tr>
<tr><td rowspan="5">10V</td><td>≤250</td><td>≤10nF</td><td><100nF</td><td>-</td><td>≤680nF</td></tr>
<tr><td>≤350</td><td>≤47nF</td><td><470nF</td><td>≤1uF</td><td>-</td></tr>
<tr><td>≤500</td><td>≤220nF</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>-</td><td>≤2.2μF</td><td>≤10μF</td></tr>
<tr><td>≤1000</td><td>≤1μF</td><td>≤2.2μF</td><td>≤4.7μF</td><td>≤47μF</td></tr>
<tr><td rowspan="5">≤6.3V</td><td>≤250</td><td>≤10nF</td><td><100nF</td><td>-</td><td>≤680nF</td></tr>
<tr><td>≤350</td><td>47nF</td><td><470nF</td><td>≤1uF</td><td>-</td></tr>
<tr><td>≤500</td><td>≤220nF</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>≤750</td><td>-</td><td>-</td><td>≤2.2uF</td><td>≤10μF</td></tr>
<tr><td>≤1000</td><td>≤1μF</td><td>≤4.7μF</td><td>≤10μF</td><td>-</td></tr>
<tr><td>Insulation Resistance</td><td colspan="6">C≤25 nF, Ri≥10000MΩ
C > 25 nF, Ri• C_R > 100S</td><td>Measuring Voltage: Rated Voltage (Max 500V)
Duration: 60±5s
Test Humidity: ≤75%
Test Temperature: 25±3°C
Test Current: ≤50mA</td></tr>
<tr><td>Resistance to Soldering Heat</td><td colspan="6">ΔC/C: ±15%
DF: Same to initial value
IR: Same to initial value
Appearance：No visible damage
At least 95% of the terminal electrode is covered by new solder.</td><td>Preheating conditions: 100 to 200°C; 60-120s.
Solder Temperature: 265±5°C Duration: 10±1s
Clean the capacitor with solvent and examine it with a 10X(min.) microscope.
Recovery Time: 24±2h.
Recovery condition: Room temperature</td></tr>
<tr><td>Resistance to Flexure of Substrate (Bending Strength)</td><td colspan="6">Appearance: No visible damage
ΔC/C: ≤±10%</td><td>Test Board: PCB Warp: 3mm
Speed: 0.5mm/sec. Unit: mm
The measurement should be made with the board in the bending position.
 
</td></tr>
<tr><td>Termination Adhesion</td><td colspan="6">Appearance: No visible damage</td><td>≤0402: Appling force 2N for 60+1 seconds
≥0603: Appling force 5N for 60+1 seconds</td></tr>
<tr><td>Temperature Cycle</td><td colspan="6">Appearance: No visible damage
ΔC/C: -15%~+15%</td><td>Preheating conditions: up-category temperature, 1h
Recovery time: 24±1h
Initial Measurement
Cycling Times: 5 times, 1 cycle, 4 steps:
<table>
<tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr>
<tr><td>1</td><td>Low- category temp: -55</td><td>30</td></tr>
<tr><td>2</td><td>Normal temp. (+20)</td><td>2-3</td></tr>
<tr><td>3</td><td>Up- category temp: +125</td><td>30</td></tr>
<tr><td>4</td><td>Normal temp. (+20)</td><td>2-3</td></tr>
</table>
Recovery time after test:24±2h</td></tr>
<tr><td>Solderability</td><td colspan="6">At least 95% of the terminal electrode is covered by new solder.
Visual Appearance: No visible damage.</td><td>Preheating conditions:80 to 120°C; 10~30s.
<table>
<tr><td>Pb-Sn soldering
Solder Temperature: 235±5°C
Duration: 2±0.5s</td><td>Lead-free soldering
Solder Temperature:245±5°C
Duration: 2±0.5s</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>Humidity load</td><td>ΔC/C: ≤ ±12.5%
DF: Not more than twice of initial value.
IR:Ri≥1000MΩ or Ri•CR≥10S whichever is smaller.
Appearance：No visible damage</td><td>Pretreatment (Class II) : After preheating at 140°C ~150°C for 1h±10min, place at room temperature for 24±2h.
Temperature: 40±2°C
Humidity: 90~95%RH
Voltage: Rated Voltage
Duration: 500h
Recovery conditions: Room temperature
Recovery Time: 24h±2h
Class 2：0201≥47nF、0402≥33nF、0603≥1μF、
0805≥4.7μF、1206≥10μF product need to keep in 150°C、
1h after the test，and measurement to be made after being kept at room temperature for 24±2h.</td></tr>
<tr><td>Life Test</td><td>ΔC/C: -20%~+20%
DF: Not more than twice of initial value.
IR:Ri≥2000MΩ or Ri•CR≥50S whichever is smaller.
Appearance：No visible damage</td><td>Pretreatment (ClassII) :After preheating at 140°C ~150°C for 1h±10min, place at room temperature for 24±2h.
Temperature:125°C (X7R)
Charge/Discharge Current:50mA max. Time:1000h.
Applied Voltage:1.Low voltage products (< 100V) 2 times rated operating voltage, except Table 1.
Medium and high pressure products:
100V≤Rated Voltage≤200V: 1.5 Multiple
200V<Rated Voltage≤500V: 1.3 Multiple
500V<Rated Voltage: 1.2 Multiple
Recovery Conditions: Room Temperature
Recovery Time: 24h±2h
Class 2: 0201≥47nF、0402≥33nF、0603≥1μF、
0805≥4.7μF、1206≥10μF product need to keep in 150°C、
1h after the test，and measurement to be made after being kept at room temperature for 24±2h.
<table><tr><td colspan="4">Table 1</td></tr><tr><td>Cap.</td><td>Test Voltage</td><td>Cap.</td><td>Test Voltage</td></tr><tr><td>0201≥10nF</td><td rowspan="3">1.5Ur</td><td>0805≥0.47uF</td><td rowspan="3">1.5Ur</td></tr><tr><td>0402≥47nF</td><td>1206≥1uF</td></tr><tr><td>0603≥220nF</td><td>1210≥1uF</td></tr></table></td></tr>
<tr><td>Dielectric Withstanding Voltage</td><td>No breakdown or damage.</td><td>Ur<100V:
Measuring Voltage:
I class:300% Ur II class :250% Ur
Duration: 1~5s Charge/ Discharge Current: 50mA max.

100V≤Ur<500V:
Force 200%Rated voltage for 5 second. Max.. current should not exceed 50mA.

500V≤Ur≤1000V:
Force 150%Rated voltage for 5 second. Max.. current should not exceed 50mA.

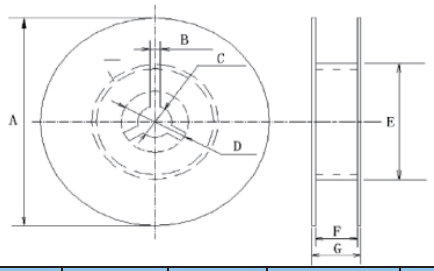
1000V＜Ur≤2000V:
Force 120%Rated voltage for 5 seconds. Max.. current should not exceed 50mA.

2000V＜Ur≤5000V:
Force 120%Rated voltage for 5 seconds. Max.. current should not exceed 10mA.</td></tr>
</table>

Note：
Pretreatment (only for class2 capacitor)Pretreatment (only for class2 capacitor) is a method to treat the capacitor before measurement. First, place the capacitor in the up-category temperature or other specified higher temperature environment for 1hour. Then recovery the capacitor at standard pressure conditions for 24±1hours。

■Packaging

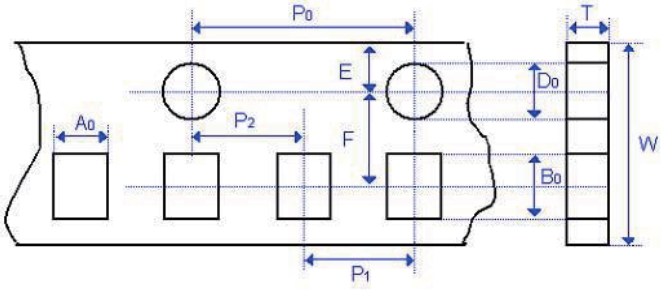
Packaging Quantity & Reel Specifications



Unit: mm

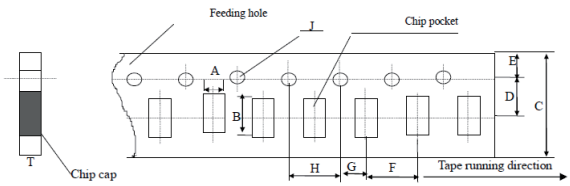
Type	A	B	C	D	E	F	G	Paper tape	Plastic tape
0402	178±2.0(7”)	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max	10K	-
0603								4K	-
0805								4K	3K
1206								4K	T≤1.35mm 3K T>1.35mm 2K
1210								-	T≤1.8mm 2K T>1.8mm 1K
1808								-	2K
1812								-	T≤1.85mm 1K T>1.85mm 0.5K
2220 2225								-	0.5K

Paper Tape Size Specification



Unit: mm

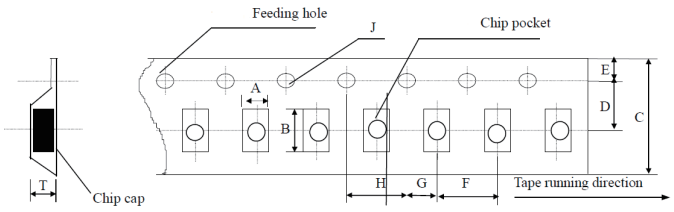
Type	A0	B0	T	W	P0	P1	P2	D0	E	F
0402	0.65±0.10	1.15±0.10	0.80 Below	8.00±0.10	4.00±0.10	2.00±0.05	2.00±0.05	1.5-0/+0.10	1.75±0.10	3.50±0.05



Unit: mm

Type	A	B	C	D	E	F	G	H	J	T
0603	1.10±0.10	1.90±0.15	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.1	1.10 max
0805	1.45±0.15	2.30±0.15	8.00±0.15	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.1	1.10 max
1206	1.80±0.20	3.40±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.1	1.10 max

Plastic Tape Size Specification



Unit: mm

Type	A	B	C	D	E	F	G	H	J	T
0805	1.55±0.20	2.35±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.1	1.50 max
1206	1.95±0.20	3.60±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.1	1.85 max
1210	2.70±0.10	3.42±0.10	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50-0/+0.1	3.20 max
1808	2.20±0.10	4.95±0.10	12.00±0.10	5.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50-0/+0.1	3.00 max
1812	3.66±0.10	4.95±0.10	12.00±0.10	5.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05	4.00±0.10	1.55-0/+0.1	4.00 max
2220	6.20±0.10	6.70±0.10	12.00±0.10	5.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05	4.00±0.10	1.55-0/+0.1	2.40±0.10
2225	6.20±0.10	6.70±0.10	12.00±0.10	5.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05	4.00±0.10	1.55-0/+0.1	2.40±0.10

■Storage Methods

The guaranteed period for solderability is 12 months (Under deliver package condition).
Storage conditions：Temperature 5~40℃ ; Relative Humidity 20~70%

■Precautions For Use

The Multi-layer Ceramic Capacitors (MLCC) may fail in a short circuit modern in an open circuit mode when subjected to severe conditions of electrical environment and / or mechanical stress beyond the specified “rating” and specified “conditions” in the specification, which will result in burn out, flaming or glowing in the worst case. Following “precautions for “safety” and Application Notes shall be taken in your major consideration. If you have a question about the precautions for handling, please contact our engineering section or factory.

Soldering Profile

To avoid the crack problem by sudden temperature change, follow the temperature profile in the adjacent graph (refer to the graph in the enclosure page).

Manual Soldering

Manual soldering can pose a great risk of creating thermal cracks in capacitors. The hot soldering iron tip comes into direct contact with the end terminations, and operator’s careless may cause the tip of the soldering iron to come into direct contact with the ceramic body of the capacitor. Therefore the soldering iron must be handled carefully, and pay much attention to the selection of the soldering iron tip and temperature contact of the tip.

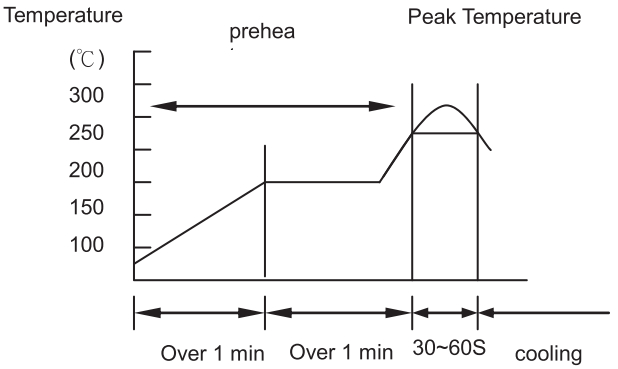
Recommended Soldering Method

Type	Dielectric	Capacitance	Soldering Method
0402	X7R	/	R
0603	X7R	C≥1uF	R
		C<1uF	R/W
0805	X7R	C≥4.7uF	R
		C<4.7uF	R/W
1206	X7R	C≥10uF	R
		C<10uF	R/W
≥1210	X7R	/	R

Soldering method：R－Reflow Soldering
W－Wave Soldering

■The temperature profile for soldering

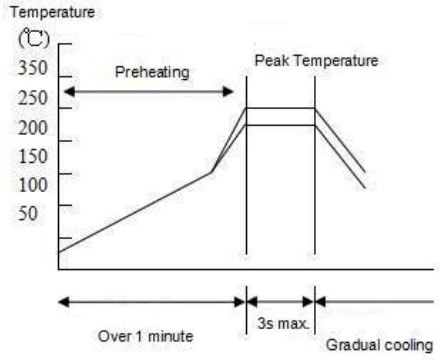
Re-flow soldering



	Pb-Sn soldering	Lead-free soldering
Peak temperature	230°C～250°C	240°C～260°C

While in preheating, please keep the temperature difference between soldering temperature and surface temperature of chips as: T≤150°C.

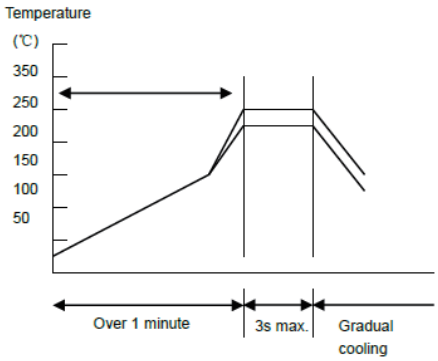
Wave soldering



	Pb-Sn soldering	Lead-free soldering
Peak temperature	230°C～260°C	240°C～270°C

While in preheating, please keep the temperature difference between soldering temperature and surface temperature of chips as: T≤150°C.

Hand soldering



Conditions:

Preheating	Temperature of soldering iron head	Power of soldering iron	Diameter of soldering iron head	Soldering time	Solder paste amount	Restricted conditions
△≤130°C	Highest temperature:350°C	20W at the highest	1mm recommended	3s at the longest	≤1/2 chip thickness	Please avoid the derect contact between soldering iron head and ceramic components

Automotive Grade Multilayer Ceramic Chip Capacitor MCF(A)..A Series

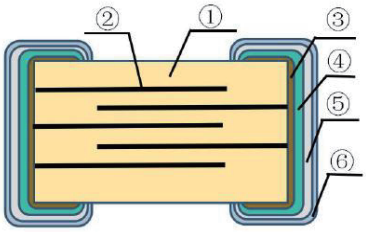
■Features

—Product is suitable for the sensing module on the automobile engines and drive, and the vehicle electronic terminal equipment

—AEC-Q200 Compliance

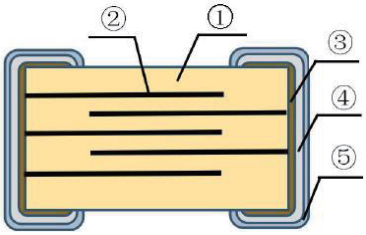
■Construction

Flexible Termination



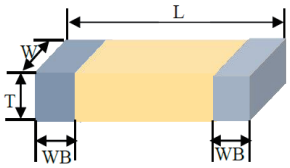
①	Ceramic Dielectric	④	Conductive Resin
②	Ni Electrode	⑤	Ni Coating
③	Cu Electrode	⑥	Sn Coating

Barrier Termaination



①	Ceramic Dielectric	④	Ni Coating
②	Ni Electrode	⑤	Sn Coating
③	Cu Electrode		

■Dimensions



Unit: mm

Type	Size (Inch)	L	W	T	WB	Notes
01	0201	0.60±0.03	0.30±0.03	0.30±0.03	0.15±0.05	C≦47nF
		0.60±0.05	0.30±0.05	0.30±0.05		C>47nF
02	0402	1.00±0.05	0.50±0.05	0.50±0.05	0.25±0.05	C<1uF
		1.00±0.15	0.50±0.15	0.50±0.15		1uF≦C<10uF
03	0603	1.60±0.10	0.80±0.10	0.50±0.05	0.35±0.20	C≦100pF
				0.80±0.10		C≦1uF
		1.60±0.20	0.80±0.20	0.80±0.20		C>1uF
05	0805	2.00±0.20	1.25±0.20	0.80±0.20	0.50±0.20	C≦0.47uF
				1.25±0.20		C>0.47uF
06	1206	3.20±0.30	1.60±0.30	0.80±0.20	0.60±0.30	-
				1.25±0.20		
				1.60±0.30		
10	1210	3.20±0.30	2.50±0.30	1.25±0.20	0.60±0.30	-
				1.60±0.30		-
				2.00±0.30		-
				2.50±0.30		-
08	1808	4.50±0.40	2.00±0.20	1.60±0.30	0.60±0.30	-
				2.00±0.30		-
12	1812	4.50±0.40	3.20±0.30	1.60±0.30	0.60±0.30	-
				2.00±0.30		-
				2.50±0.30		-
20	2220	5.70±0.40	5.00±0.40	1.60±0.30	0.60±0.30	-
				1.80±0.30		-
				2.00±0.30		-
				2.50±0.30		-

Part Numbering

MCF	05	K	T	B	500	105	A
Product Type	Dimensions (L×W)	Capacitance Tolerance	Packaging Code	Dielectric	Voltage (VDCW)	Capacitance	Function Code
MCFA:Flexible Termination MCF:Barrier Termination	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 08: 1808 12: 1812 20: 2220	A: ±0.05pF (Cap≦10pF) B: ±0.1pF (Cap≦10pF) C: ±0.25pF (Cap≦10pF) D: ±0.5pF (Cap≦10pF) F: ±1% G: ±2% J: ±5% K: ±10% M: ±20%	T: Taping Reel	N: NPO(COG) B: X7R BS: X7S X: X5R	6V3: 6.3V 100: 10V 160: 16V 250: 25V 500: 50V 101: 100V 251: 250V 501: 500V 631: 630V	0R1: 0.1pF 1R0: 1pF 100: 10pF 101: 100pF 102: 1nF 103: 10nF 104: 100nF 105: 1uF 106: 10uF 107: 100uF	A: Automotive Grade

General Capacitance & Voltage for MCFA..A Series

Capacitance & Voltage(X7R)

Dielectric		X7R											
EIA	Size	0402						0603					
Code	VDCW	6.3V	10V	16V	25V	50V	100V	6.3V	10V	16V	25V	50V	100V
121	120pF	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
151	150	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
181	180	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
221	220	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
271	270	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
331	330	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
391	390	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
471	470	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
561	560	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
681	680	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
102	1nF	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
122	1.2	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
152	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
182	1.8	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
222	2.2	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
272	2.7	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
332	3.3	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
392	3.9	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
472	4.7	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
562	5.6	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
682	6.8	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
103	10nF	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8
123	12	0.5	0.5	0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8	0.8
153	15	0.5	0.5	0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8	0.8
183	18	0.5	0.5	0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8	0.8
223	22	0.5	0.5	0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8	0.8
273	27	0.5	0.5	0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8	0.8
333	33	0.5	0.5	0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8	0.8
393	39	0.5	0.5	0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8	0.8
473	47	0.5	0.5	0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8	0.8
563	56							0.8	0.8	0.8	0.8	0.8	0.8
683	68							0.8	0.8	0.8	0.8	0.8	0.8

■List of capacity and thickness of class II capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCFA..A Series

Capacitance & Voltage(X7R)

Dielectric		X7R												
EIA	Size	0805							1206					
Code	VDCW	≦10V	16V	25V	50V	100V	250V	500V	≦25V	50V	100V	250V	500V	630V
121	120pF	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
151	150	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
181	180	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
221	220	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
271	270	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
331	330	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
391	390	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
471	470	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
561	560	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
681	680	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
102	1nF	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
122	1.2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
152	1.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
182	1.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
222	2.2	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
272	2.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8		
332	3.3	0.8	0.8	0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		
392	3.9	0.8	0.8	0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		
472	4.7	0.8	0.8	0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8		
562	5.6	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
682	6.8	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
103	10nF	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
123	12	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
153	15	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
183	18	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
223	22	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
273	27	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
333	33	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
393	39	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
473	47	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
563	56	0.8	0.8	0.8	0.8	0.8			0.8	0.8	0.8			
683	68	0.8	0.8	0.8	0.8				0.8	0.8				
104	100nF	0.8	0.8	0.8	0.8				0.8	0.8				
224	220								0.8	0.8				

Capacitance & Voltage(X5R)

Dielectric		X5R														
EIA	Size	0402				0603					0805					
Code	VDCW	6.3V	10V	16V	25V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	100V
473	47nF					0.8	0.8	0.8	0.8	0.8						
563	56	0.5	0.5	0.5	0.5						0.8	0.8	0.8	0.8	0.8	0.8
683	68	0.5	0.5	0.5	0.5						0.8	0.8	0.8	0.8	0.8	
104	100nF										0.8	0.8	0.8	0.8	0.8	

Capacitance & Voltage(X7S)

Dielectric		X7S														
EIA	Size	0402					0603					0805				
Code	VDCW	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	≤10V	16V	25V	50V	100V
393	39nF	0.5	0.5	0.5	0.5	0.5										
473	47	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8					
563	56	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
683	68	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
104	100nF											0.8	0.8	0.8	0.8	0.8

■List of capacity and thickness of class II capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCF..A Series

Capacitance & Voltage(NPO)

Dielectric		NPO															
EIA	Size	0201	0402		0603			0805				1206					
Code	VDCW	50V	50V	100V	50V	100V	250V	50V	100V	250V	500V 630V	50V	100V	250V	500V 630V	1000V	2000V
0R1	0.1pF	0.3	0.5	0.5	0.5	0.5	0.5										
0R2	0.2	0.3	0.5	0.5	0.5	0.5	0.5										
0R5	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
1R0	1pF	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
1R2	1.2	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
1R5	1.5	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
1R8	1.8	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
2R0	2.0	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
2R2	2.2	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
2R7	2.7	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
3R0	3.0	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
3R3	3.3	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
3R6	3.6	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
3R9	3.9	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
4R7	4.7	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
5R0	5.0	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
5R6	5.6	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
6R8	6.8	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
8R0	8.0	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
8R2	8.2	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
100	10pF	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
120	12	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
150	15	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
180	18	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
220	22	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
270	27	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
330	33	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
390	39	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
470	47	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
560	56	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
680	68	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
101	100pF	0.3	0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
121	120		0.5		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
151	150		0.5		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
181	180		0.5		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
221	220		0.5		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	1.60
271	270		0.5		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
331	330		0.5		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
391	390		0.5		0.8	0.8		0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
471	470		0.5		0.8	0.8		0.8	0.8	0.8	0.8	0.8	0.8	0.8	1.25	1.25	
561	560		0.5		0.8	0.8		0.8	0.8	0.8		0.8	0.8	0.8	1.25	1.60	
681	680		0.5		0.8	0.8		0.8	0.8	0.8		0.8	0.8	0.8	1.25	1.60	
102	1nF		0.5		0.8	0.8		0.8	0.8	0.8		0.8	0.8	0.8	1.60		
152	1.5				0.8			0.8	0.8			1.25	1.25	1.25			
182	1.8				0.8			0.8	0.8			1.25	1.25	1.25			
222	2.2				0.8			0.8	0.8			1.25	1.25	1.25			
272	2.7							0.8				1.25					
332	3.3							0.8				1.25					
472	4.7							0.8				1.25					
682	6.8							0.8				1.60					
103	10nF							0.8				1.60					

■List of capacity and thickness of class I capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCF..A Series

Capacitance & Voltage(NPO)

Dielectric		NPO								
EIA	Size	1210				1808				
Code	VDCW	250V	500V 630V	1000V	2000V	250V	500V 630V	1000V	2000V	3000V
1R0	1pF	1.25	1.25			1.6	1.6			
1R2	1.2	1.25	1.25			1.6	1.6			
1R5	1.5	1.25	1.25			1.6	1.6			
1R8	1.8	1.25	1.25			1.6	1.6			
2R0	2.0	1.25	1.25			1.6	1.6			
2R2	2.2	1.25	1.25			1.6	1.6			
2R7	2.7	1.25	1.25			1.6	1.6			
3R0	3.0	1.25	1.25			1.6	1.6			
3R3	3.3	1.25	1.25			1.6	1.6			
3R6	3.6	1.25	1.25			1.6	1.6			
3R9	3.9	1.25	1.25			1.6	1.6			
4R7	4.7	1.25	1.25			1.6	1.6			
5R0	5.0	1.25	1.25			1.6	1.6			
5R6	5.6	1.25	1.25			1.6	1.6			
6R8	6.8	1.25	1.25			1.6	1.6			
8R0	8.0	1.25	1.25			1.6	1.6			
8R2	8.2	1.25	1.25			1.6	1.6			
100	10pF	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
120	12	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
150	15	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
180	18	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
220	22	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
270	27	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
330	33	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
390	39	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
470	47	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
560	56	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
680	68	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
101	100pF	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
121	120	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
151	150	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
181	180	1.25	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6
221	220	1.25	1.25	1.6	1.6	1.6	1.6	1.6	1.6	1.6
271	270	1.25	1.25	1.6		1.6	1.6	1.6	1.6	
331	330	1.25	1.25	1.6		1.6	1.6	1.6		
391	390	1.25	1.25			1.6	1.6	1.6		
471	470	1.25	1.25			1.6	1.6	1.6		
561	560	1.25	1.25			1.6	1.6	1.6		
681	680	1.25	1.25			1.6	1.6	1.6		
102	1nF	1.25	1.6			1.6	1.6			
152	1.5	1.25	1.6			1.6	1.6			
182	1.8	1.25	2.0			1.6	2.0			
222	2.2	1.6				1.6	2.0			
272	2.7	1.6				1.6				
332	3.3	1.6				1.6				
392	3.9	1.6				1.6				

■List of capacity and thickness of class I capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCF..A Series

Capacitance & Voltage(NPO)

Dielectric		NPO									
EIA	Size	1812					2220				
Code	VDCW	250V	500V 630V	1000V	2000V	3000V	250V	500V 630V	1000V	2000V	3000V
100	10pF	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
120	12	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
150	15	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
180	18	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
220	22	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
270	27	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
330	33	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
390	39	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
470	47	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
560	56	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
680	68	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
101	100pF	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
121	120	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
151	150	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.0	2.0
181	180	1.6	1.6	1.6	1.6	2.0	1.6	1.6	1.6	2.0	2.0
221	220	1.6	1.6	1.6	1.6	2.0	1.6	1.6	1.6	2.0	2.0
271	270	1.6	1.6	1.6	1.6	2.0	1.6	1.6	1.6	2.0	2.0
331	330	1.6	1.6	1.6	1.6	2.0	1.6	1.6	1.6	2.0	2.0
391	390	1.6	1.6	1.6	1.6		1.6	1.6	1.6	2.0	2.0
471	470	1.6	1.6	1.6	1.6		1.6	1.6	1.6	2.0	2.0
561	560	1.6	1.6	1.6	2.0		1.6	1.6	1.6	2.0	2.0
681	680	1.6	1.6	1.6	2.0		1.6	1.6	1.6	2.0	2.0
102	1nF	1.6	1.6	2.0			1.6	1.6	1.6	2.0	2.0
152	1.5	1.6	1.6				1.6	1.6	2.0		
182	1.8	1.6	1.6				1.6	1.6	2.0		
222	2.2	1.6	1.6				1.6	1.6	2.0		
272	2.7	1.6	2.0				1.6	1.6			
332	3.3	1.6	2.0				1.6	1.6			
392	3.9	1.6	2.0				1.6	1.6			
472	4.7	1.6	2.0				1.6	1.6			
562	5.6	2.0					1.6	1.6			
682	6.8	2.0					1.6	1.6			
103	10nF						1.6				
153	15						1.6				

■List of capacity and thickness of class I capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCF..A Series

Capacitance & Voltage(X7R)

Dielectric		X7R						
EIA	Size	0201		0402				
Code	VDCW	≤25V	50V	6.3V	10V	16V	25V	50V
121	120pF	0.3	0.3					
151	150	0.3	0.3					
181	180	0.3	0.3					
221	220	0.3	0.3					
271	270	0.3	0.3					
331	330	0.3	0.3					
391	390	0.3	0.3					
471	470	0.3	0.3					
561	560	0.3	0.3					
681	680	0.3	0.3					
102	1nF	0.3	0.3					
122	1.2	0.3	0.3					
152	1.5	0.3	0.3					
182	1.8	0.3	0.3					
222	2.2	0.3	0.3					
272	2.7	0.3	0.3					
332	3.3	0.3	0.3					
392	3.9	0.3	0.3					
472	4.7	0.3	0.3					
562	5.6	0.3						
682	6.8	0.3						
103	10nF							
104	100nF			0.8	0.8	0.8	0.8	0.8

Capacitance & Voltage(X7R)

Dielectric		X7R												
EIA	Size	0603						0805						
Code	VDCW	6.3V	10V	16V	25V	50V	100V	≤10V	16V	25V	50V	100V	250V	500V
332	3.3nF													1.25
392	3.9													1.25
472	4.7													1.25
562	5.6												1.25	1.25
682	6.8												1.25	1.25
103	10nF												1.25	1.25
123	12												1.25	
153	15												1.25	
183	18												1.25	
223	22												1.25	
683	68											1.25		
104	100nF	0.8	0.8	0.8	0.8	0.8	0.8					1.25		
224	220	0.8	0.8	0.8	0.8	0.8		0.8	0.8	0.8	0.8	1.25		
334	330							0.8	0.8	0.8	0.8			
474	470							1.25	1.25	1.25	1.25			
684	680							1.25	1.25	1.25	1.25			
105	1uF							1.25	1.25	1.25	1.25			

■List of capacity and thickness of class I capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCF..A Series

Capacitance & Voltage(X7R)

Dielectric		X7R												
EIA	Size	1206							1210					
Code	VDCW	≤25V	50V	100V	250V	500V 630V	1000V	2000V	≤50V	100V	250V	500V 630V	1000V	2000V
121	120pF						1.25	1.25						
151	150						1.25	1.25						
181	180						1.25	1.25						
221	220						1.25	1.25						
271	270						1.25	1.25						
331	330						1.25	1.25						
391	390						1.25	1.25						
471	470						1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
561	560						1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
681	680						1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
102	1nF						1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
122	1.2					1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
152	1.5					1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
182	1.8					1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
222	2.2					1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
272	2.7					1.25	1.25		1.25	1.25	1.25	1.25	1.25	1.25
332	3.3					1.25	1.25		1.25	1.25	1.25	1.25	1.25	1.25
392	3.9					1.25	1.25		1.25	1.25	1.25	1.25	1.25	1.25
472	4.7					1.25	1.25		1.25	1.25	1.25	1.25	1.25	1.25
562	5.6				1.25	1.25	1.25		1.25	1.25	1.25	1.25	1.25	1.60
682	6.8				1.25	1.25	1.25		1.25	1.25	1.25	1.25	1.60	1.60
103	10nF				1.25	1.25	1.25		1.25	1.25	1.25	1.25	1.60	2.00
123	12				1.25	1.25			1.25	1.25	1.25	1.25	1.60	
153	15				1.25	1.25			1.25	1.25	1.25	1.25	1.60	
183	18				1.25	1.25			1.25	1.25	1.25	1.25	1.60	
223	22				1.25	1.25			1.25	1.25	1.25	1.25	1.60	
273	27				1.25	1.25			1.25	1.25	1.25	1.60		
333	33				1.25	1.25			1.25	1.25	1.25	1.60		
393	39				1.25				1.25	1.25	1.25	1.60		
473	47				1.25				1.25	1.25	1.25	2.00		
563	56				1.25				1.25	1.25	1.25			
683	68			1.25	1.25				1.25	1.25	1.25			
104	100nF			1.25	1.25				1.25	1.25	1.25			
224	220			1.25					1.60	1.60	1.60			
334	330	1.60	1.60	1.60					1.60	1.60				
474	470	1.60	1.60	1.60					1.60	1.60				
684	680	1.60	1.60	1.60					1.60	1.60				
105	1uF	1.60	1.60	1.60					1.60	1.60				
225	2.2	1.60	1.60						2.50	2.50				
335	3.3								2.50					
475	4.7								2.50					

■List of capacity and thickness of class I capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCF..A Series

Capacitance & Voltage(X7R)

Dielectric		X7R									
EIA	Size	1808					1812				
Code	VDCW	≤250V	500V 630V	1000V	2000V	3000V	≤250V	500V 630V	1000V	2000V	3000V
121	120pF	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
151	150	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
181	180	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
221	220	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
271	270	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
331	330	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
391	390	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
471	470	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
561	560	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
681	680	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
102	1nF	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
122	1.2	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
152	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
182	1.8	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
222	2.2	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
272	2.7	1.6	1.6	1.6	1.6		1.6	1.6	1.6	1.6	1.6
332	3.3	1.6	1.6	1.6	1.6		1.6	1.6	1.6	1.6	1.6
392	3.9	1.6	1.6	1.6	1.6		1.6	1.6	1.6	1.6	1.6
472	4.7	1.6	1.6	1.6	1.6		1.6	1.6	1.6	1.6	1.6
562	5.6	1.6	1.6	1.6	1.6		1.6	1.6	1.6	1.6	1.6
682	6.8	1.6	1.6	1.6	1.6		1.6	1.6	1.6	1.6/2.5	2.5
103	10nF	1.6	1.6	1.6	1.6		1.6	1.6	1.6	1.6/2.5	2.5
123	12	1.6	1.6	1.6			1.6	1.6	1.6	1.6/2.5	
153	15	1.6	1.6	1.6			1.6	1.6	1.6		
183	18	1.6	1.6	1.6			1.6	1.6	1.6		
223	22	1.6	1.6	1.6			1.6	1.6	1.6		
273	27	1.6	1.6				1.6	1.6	1.6		
333	33	1.6	1.6				1.6	1.6	1.6		
393	39	1.6	1.6				1.6	1.6	1.6		
473	47	1.6	1.6				1.6	1.6	1.6		
563	56	1.6					1.6	1.6			
683	68	1.6					1.6	1.6			
104	100nF	1.6					1.6	2.5			
224	220	1.6					1.6				
334	330	1.6					2.0				
474	470	1.6					2.0				
684	680						2.0				
105	1uF						2.0				

Dielectric		X7R						
EIA	Size	2220						
Code	VDCW	100V	250V	500V	630V	1000V	2000V	3000V
102	1nF	1.6	1.6	1.6	1.6	1.6	1.6	1.6
122	1.2	1.6	1.6	1.6	1.6	1.6	1.6	1.6
152	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6
182	1.8	1.6	1.6	1.6	1.6	1.6	1.6	1.6
222	2.2	1.6	1.6	1.6	1.6	1.6	1.6	1.6
332	3.3	1.6	1.6	1.6	1.6	1.6	1.6	1.6
472	4.7	1.6	1.6	1.6	1.6	1.6	1.6	2.0
562	5.6	1.6	1.6	1.6	1.6	1.6	1.6	
682	6.8	1.6	1.6	1.6	1.6	1.6	1.6	
103	10nF	1.6	1.6	1.6	1.6	1.6	1.6	
153	15	1.6	1.6	1.6	1.6	1.6	1.6	
183	18	1.6	1.6	1.6	1.6	1.6	1.6	
223	22	1.6	1.6	1.6	1.6	1.6	1.6	
273	27	1.6	1.6	1.6	1.6	1.6	1.8	
333	33	1.6	1.6	1.6	1.6	1.6	1.8	
393	39	1.6	1.6	1.6	1.6	1.6	1.8	
473	47	1.6	1.6	1.6	1.6	1.6	2.0	
563	56	1.6	1.6	1.6	1.6	1.6		
104	100nF	1.6	1.6	1.6	1.6	2.0		
224	220	1.6	1.6	1.6	1.6			
334	330	1.6	1.6	1.6	1.6			
474	470	1.6	1.6	2.0	2.0			
105	1uF	1.6	1.6					
106	10uF	2.0						

■List of capacity and thickness of class I capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCF..A Series

Capacitance & Voltage(X7S)

Dielectric		X7S													
EIA	Size	0201				0402					0603				
Code	VDCW	≤10V	16V	25V	50V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V
472	4.7nF	0.3	0.3	0.3	0.3										
562	5.6	0.3	0.3	0.3											
682	6.8	0.3	0.3	0.3											
103	10nF	0.3	0.3	0.3											
123	12	0.3	0.3												
153	15	0.3	0.3												
183	18	0.3	0.3												
223	22	0.3	0.3												
273	27	0.3													
333	33	0.3													
104	100nF					0.5	0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8
224	220					0.5	0.5				0.8	0.8	0.8	0.8	0.8
334	330										0.8	0.8	0.8	0.8	
474	470										0.8	0.8	0.8	0.8	
684	680										0.8	0.8	0.8		
105	1uF										0.8	0.8	0.8		

Dielectric		X7S										
EIA	Size	0805					1206			1210		
Code	VDCW	≤10V	16V	25V	50V	100V	≤25V	50V	100V	25V	50V	100V
104	100nF											
224	220	0.8	0.8	0.8	0.8	0.8				1.60	1.60	1.60
334	330	0.8	0.8	0.8	0.8	0.8				1.60	1.60	1.60
474	470	1.25	1.25	1.25	1.25	1.25				1.60	1.60	1.60
684	680	1.25	1.25	1.25	1.25					1.60	1.60	1.60
105	1uF	1.25	1.25	1.25	1.25		1.60	1.60	1.60	1.60	1.60	1.60
225	2.2uF	1.25	1.25				1.60	1.60		2.50	2.50	2.50
335	3.3						1.60			2.50	2.50	
475	4.7						1.60			2.50	2.50	

■List of capacity and thickness of class II capacitors with specific voltage. Unit: mm

■General Capacitance & Voltage for MCF..A Series

Capacitance & Voltage(X5R)

Dielectric		X5R												
EIA	Size	0201				0402				0603				
Code	VDCW	≦10V	16V	25V	50V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	50V
121	120pF	0.3	0.3	0.3	0.3									
151	150	0.3	0.3	0.3	0.3									
181	180	0.3	0.3	0.3	0.3									
221	220	0.3	0.3	0.3	0.3									
271	270	0.3	0.3	0.3	0.3									
331	330	0.3	0.3	0.3	0.3									
391	390	0.3	0.3	0.3	0.3									
471	470	0.3	0.3	0.3	0.3									
561	560	0.3	0.3	0.3	0.3									
681	680	0.3	0.3	0.3	0.3									
102	1nF	0.3	0.3	0.3	0.3									
122	1.2	0.3	0.3	0.3	0.3									
152	1.5	0.3	0.3	0.3	0.3									
182	1.8	0.3	0.3	0.3	0.3									
222	2.2	0.3	0.3	0.3	0.3									
272	2.7	0.3	0.3	0.3	0.3									
332	3.3	0.3	0.3	0.3	0.3									
392	3.9	0.3	0.3	0.3	0.3									
472	4.7	0.3	0.3	0.3	0.3									
562	5.6	0.3	0.3	0.3										
682	6.8	0.3	0.3	0.3										
103	10nF	0.3	0.3	0.3										
123	12	0.3	0.3											
153	15	0.3	0.3											
183	18	0.3	0.3											
223	22	0.3	0.3											
273	27	0.3	0.3											
333	33	0.3	0.3											
393	39	0.3												
473	47	0.3												
563	56	0.3												
683	68	0.3												
104	100nF	0.3				0.5	0.5	0.5	0.5	0.8	0.8	0.8	0.8	0.8
224	220					0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8
334	330					0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8
474	470					0.5	0.5	0.5		0.8	0.8	0.8	0.8	0.8
684	680					0.5	0.5			0.8	0.8	0.8	0.8	
105	1uF					0.5	0.5			0.8	0.8	0.8	0.8	
225	2.2									0.8	0.8	0.8		
335	3.3									0.8				
475	4.7									0.8				

Capacitance & Voltage(X5R)

Dielectric		X5R										
EIA	Size	0805						1206				
Code	VDCW	6.3V	10V	16V	25V	50V	100V	6.3V	10V	16V	25V	50V
563	56nF											
683	68						1.25					
104	100nF						1.25					
224	220	0.8	0.8	0.8	0.8	0.8	1.25					
334	330	0.8	0.8	0.8	0.8	0.8						
474	470	1.25	1.25	1.25	1.25	1.25						
684	680	1.25	1.25	1.25	1.25	1.25						
105	1uF	1.25	1.25	1.25	1.25	1.25						
225	2.2	1.25	1.25	1.25	1.25			1.6	1.6	1.6	1.6	1.6
335	3.3	1.25	1.25	1.25	1.25			1.6	1.6	1.6	1.6	1.6
475	4.7	1.25	1.25	1.25	1.25			1.6	1.6	1.6	1.6	
685	6.8	1.25	1.25					1.6	1.6	1.6	1.6	
106	10uF	1.25	1.25					1.6	1.6	1.6	1.6	
156	15							1.6				
226	22							1.6				

■List of capacity and thickness of class II capacitors with specific voltage. Unit: mm

■Environmental Characteristics

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>Capacitance</td><td>Should be within the specified tolerance</td><td>Test Temperature: 25±3℃

NPO: (Class I)
Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%
Cap>1000pF 1.0±0.2Vrms, 1KHz±10%

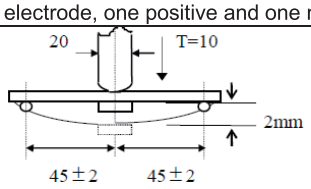
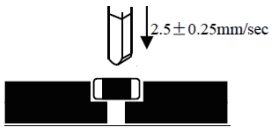
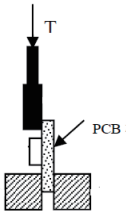
X7R/X7S/X5R: (Class II)
Cap≤10uF 1.0±0.2Vrms, 1KHz±10%
Cap>10uF 0.5±0.1Vrms, 120Hz±24Hz</td></tr>
<tr><td>IR</td><td>NPO: C≦10nF, Ri≧100000MΩ
C>10 nF, Ri·CR≧1000S

X7R/X7S: C≦25nF, Ri≧10000MΩ
C>25 nF, Ri·CR≧100S</td><td>Measuring Voltage: Rated Voltage
Duration: 60±5s
Test Humidity: ≦75%
Test Temperature: 25±3℃
Test Current: ≦50mA</td></tr>
<tr><td>(DF, tanδ)
Dissipation
Factor</td><td>NPO: DF≦0.1%, Cr≧30pF, 1MHz±10%, 1±0.2Vrms
DF≦0.15%, Cr<30pF, 1MHz±10%, 1±0.2Vrms

X7R/X7S/X5R:
<table>
<tr><th>Voltage</th><th>DF</th><th>0201</th><th>0402</th><th>0603</th><th>0805</th><th>≧1206</th></tr>
<tr><td>≧100V</td><td>≤5%</td><td>-</td><td>≦10nF</td><td>≦100nF</td><td>≦330nF</td><td>≦680nF</td></tr>
<tr><td rowspan="4">50V</td><td>≦2.5%</td><td>≦3.3nF</td><td>≦10nF</td><td>≦100nF</td><td>≦330nF</td><td>≦680nF</td></tr>
<tr><td>≦3.5%</td><td>≦10nF</td><td>-</td><td>-</td><td>-</td><td>≦1uF</td></tr>
<tr><td>≦5%</td><td>-</td><td>-</td><td>-</td><td>≦680nF</td><td>-</td></tr>
<tr><td>≦10%</td><td>-</td><td>≦1uF</td><td>≦2.2uF</td><td>≦4.7uF</td><td>≦10uF</td></tr>
<tr><td rowspan="5">25V</td><td>≦2.5%</td><td>≦3.3nF</td><td>≦10nF</td><td>≦100nF</td><td>≦330nF</td><td>≦680nF</td></tr>
<tr><td>≦3.5%</td><td>≦10nF</td><td>≦100nF</td><td>≦330nF</td><td>-</td><td>≦2.2uF</td></tr>
<tr><td>≦5%</td><td>-</td><td>-</td><td>-</td><td>≦1uF</td><td>-</td></tr>
<tr><td>≦7.5%</td><td>-</td><td>-</td><td>-</td><td>≦2.2uF</td><td>≦4.7uF</td></tr>
<tr><td>≦10%</td><td>≦10nF</td><td>≦2.2uF</td><td>≦10uF</td><td>≦22uF</td><td>≦22uF</td></tr>
<tr><td rowspan="5">16V</td><td>≦2.5%</td><td>≦3.3nF</td><td>≦10nF</td><td>≦100nF</td><td>≦330nF</td><td>≦680nF</td></tr>
<tr><td>≦3.5%</td><td>≦15nF</td><td>≦100nF</td><td>≦330nF</td><td>-</td><td>≦22uF</td></tr>
<tr><td>≦5%</td><td>≦47nF</td><td>≦220nF</td><td>≦680nF</td><td>≦22uF</td><td>-</td></tr>
<tr><td>≦7.5%</td><td>-</td><td>-</td><td>-</td><td>≦4.7uF</td><td>≦4.7uF</td></tr>
<tr><td>≦10%</td><td>≦100nF</td><td>≦4.7uF</td><td>≦10uF</td><td>≦22uF</td><td>≦47uF</td></tr>
<tr><td rowspan="5">10V</td><td>≦2.5%</td><td>≦3.3nF</td><td>≦10nF</td><td>≦100nF</td><td>≦330nF</td><td>≦680nF</td></tr>
<tr><td>≦3.5%</td><td>≦15nF</td><td>≦100nF</td><td>≦330nF</td><td>-</td><td>≦2.2uF</td></tr>
<tr><td>≦5%</td><td>≦47nF</td><td>-</td><td>≦680nF</td><td>≦2.2uF</td><td>-</td></tr>
<tr><td>≦7.5%</td><td>-</td><td>≦1uF</td><td>≦2.2uF</td><td>≦4.7uF</td><td>≦10uF</td></tr>
<tr><td>≦10%</td><td>≦2.2uF</td><td>≦10uF</td><td>≦22uF</td><td>≦47uF</td><td>≦100uF</td></tr>
<tr><td rowspan="5">≦6.3V</td><td>≦2.5%</td><td>≦3.3nF</td><td>-</td><td>≦150nF</td><td>-</td><td>≦680nF</td></tr>
<tr><td>≦3.5%</td><td>≦15nF</td><td>≦100nF</td><td>≦330nF</td><td>-</td><td>≦2.2uF</td></tr>
<tr><td>≦5%</td><td>≦47nF</td><td>≦220nF</td><td>≦680nF</td><td>-</td><td>-</td></tr>
<tr><td>≦7.5%</td><td>-</td><td>≦1uF</td><td>-</td><td>10~22uF</td><td>≦10uF</td></tr>
<tr><td>≦10%</td><td>≦4.7uF</td><td>≦22uF</td><td>≦47uF</td><td>≦47uF</td><td>≦100uF</td></tr>
</table></td><td>NPO: (Class I)
1.0±0.2Vrms, 1MHz±10%

X7R/X7S/X5R: (Class II)
Cap≤10uF 1.0±0.2Vrms, 1KHz±10%
Cap>10uF 0.5±0.1Vrms, 120Hz±24Hz</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>DWV</td><td>No breakdown or damage on dielectric.</td><td>Ur<100V:
Measuring Voltage: NPO: 300% Rated voltage
X7R/X7S:250% Rated voltage
Duration: 1~5s
Charge / Discharge Current: 50mA max.
100V≤Ur<500V:
Force 200%Rated voltage for 5 second. Max.. current should not exceed 50 mA.
500V≤Ur≤1000V:
Force 150%Rated voltage for 5 second. Max.. current should not exceed 50 mA.
1000V<Ur≤2000V:
Force 120%Rated voltage for 5 seconds. Max..current should not exceed 50 mA.
Ur >2000V:
Force 120%Rated voltage for 5 seconds. Max..current should not exceed 10 mA.</td></tr>
<tr><td>High Temperature Exposure</td><td>NPO: ΔC/C: ≤±2.5% or ±0.25pF whichever is larger
X7R/X7S/X5R: ΔC/C: ≤±12.5%
DF & IR:Same as initial value</td><td>Temperature: 125℃
Voltage: without
Duration: 1000h
Recovery conditions: Room temperature
Recovery Time: 24h (NPO) or 48h(X7R/X7S/X5R)</td></tr>
<tr><td>Temperature Cycle</td><td>NPO: ΔC/C: ≤±2.5% or ±0.25pF whichever is larger
X7R/X7S/X5R: ΔC/C: ≤±12.5%
DF & IR: Same as initial value
No damage on surface.</td><td>Up-category temperature, 1h；Recovery time: 24±1h
Initial Measurement
Cycling Times: 1000 times, 1 cycle, 4 steps:
<table>
<tr><th>Step</th><th>Temperature</th><th>Time</th></tr>
<tr><td>1</td><td>-55℃</td><td>30min</td></tr>
<tr><td>2</td><td>20℃</td><td>1min</td></tr>
<tr><td>3</td><td>NPO/X7R/X7S:+125℃
X5R: +85</td><td>30min</td></tr>
<tr><td>4</td><td>20℃</td><td>1min</td></tr>
</table>
Recovery time after test: 24±2h</td></tr>
<tr><td>Temperature shock</td><td>NPO: ΔC/C: ≤±1% or ±1pF whichever is larger
X7R/X7S/X5R: ΔC/C: -10~+10%
DF & IR: Same as initial value
No damage on surface.</td><td>Up-category temperature, 1h；Recovery time: 24±1h
Initial Measurement
Cycling Times: 1000 times:
Recovery time after test: 24±2h</td></tr>
<tr><td>Destructive Physical Analysis</td><td>No defects or abnormalities</td><td>Accounting to EIA-469</td></tr>
<tr><td>Biased Humidity</td><td>NPO: ΔC/C: ≤±3.0% or ±0.3pF whichever is larger
X7R/X7S/X5R: ΔC/C: ≤±12.5%
DF & IR: Same as initial value
No damage on surface.</td><td>Preheating conditions(Only for Class II):
Preheat at 140 ° C~ 150 ° C for 1 hour.And recovery time: 24±1h。
Test method: 85±2℃，80~85%R.H，A 100KΩ in series, rated voltage applied, 1000 hours</td></tr>
<tr><td>Physical Dimension</td><td>Within the specified dimensions</td><td>Use caliper</td></tr>
<tr><td>Appearance</td><td>No visible damage</td><td>Visual inspection</td></tr>
<tr><td>Vibration</td><td>NPO: ΔC/C: ≤±2.5% or ±0.25pF whichever is larger
X7R/X7S:ΔC/C: -10%~+10%
DF / IR: Same to initial value
Appearance: No visible damage</td><td>5 g's for 20 minutes, 12 cycles each of 3 orientations.
Note: Use 8" x 5" PCB. 0.31" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10-2000 Hz.</td></tr>
<tr><td>Mechanical Shock</td><td>NPO: ΔC/C: ≤±2.5% or ±0.25pF whichever is larger
X7R/X7S:ΔC/C: -10%~+10%
DF / IR: Same to initial value
Appearance: No visible damage</td><td>Three shocks in each direction shall be applied along the three mutually perpendicular axes of the test specimen (18 shocks)
Waveform: Half-sin
Peak value: 1,500 g's
Duration: 0.5 ms
Velocity change: 4.7 m/s</td></tr>
<tr><td>Solderability</td><td>At least 95% of the terminal electrode is covered by new solder.
Visual Appearance: No visible damage.</td><td>Preheating conditions:80 to 120℃; 10~30s.
<table>
<tr><td>Solder Temperature: 235±5℃(Sn/Pb:63/37)
Duration: 2±0.5s</td><td>Solder Temperature: 245±5℃(Lead-free)
Duration: 3±0.3s</td></tr>
</table></td></tr>
<tr><td>Resistance to Soldering Heat</td><td>NPO: ΔC/C: ≤±1% or ±1pF whichever is larger
X7R/X7S/5X5R: ΔC/C: -15%~+15%
DF / IR: Same to initial value
Appearance：No visible damage. At least 95% of the terminal electrode is covered by new solder.</td><td>Preheating conditions: 100 to 200℃; 60~120s.
Solder Temperature: 265±5℃
Duration: 10±1s
Clean the capacitor with solvent and examine it with a 10X(min.) microscope.
Recovery Time: 24±2h
Recovery condition: Room temperature</td></tr>
</table>

Item	Requirement	Test Method
Life Test	NPO: ΔC/C: ≤±2.5% or ±0.25pF whichever is larger X7R/X7S/X5R: ΔC/C: ≤±15% DF: Same to initial value IR: NPO: Ri≥5000MΩ or Ri•CR≥50S whichever is smaller X7R/X7S/X5R: Ri≥1000MΩ or Ri•CR≥10S whichever is smaller Appearance: No visible damage.	Applied Voltage: Ur < 100V ：2× Rated Voltage(NPO) 100V≤Ur < 500V：2× Rated Voltage 500V≤Ur≤630V：1.5× Rated Voltage Ur>630V：1×Rated Voltage Duration: 1000h Temperature：125℃(X7*) , 85℃(X5*) Charge/ Discharge Current: 50mA max. Recovery Conditions: Room Temperature Recovery Time: 24h (NPO) or 48h(X7R/X7S/X5R)
ESD	NPO/X7R/X7S: C&DF&IR: Same to initial value Appearance：No visible damage	Conditions: contact discharge Discharge voltage: 500V Each sample was subjected to two discharges at each electrode, one positive and one negative.
Bending Strength	NPO: ΔC/C: ≤±5.0% or ±0.5pF whichever is larger X7R/X7S:ΔC/C: -10%~+10% DF / IR: Same to initial value Appearance: No visible damage	 Test Board: Al2O3 or PCB Warp: ≥2mm Speed: 1mm/sec. Unit: mm The measurement should be made with the board in the bending position.
Beam Load Test	≦0805: thickness >0.5mm, 20N thickness ≦0.5mm,8N ≧1206: thickness >1.25mm, 54N thickness ≦1.25mm,15N	Products in the process of testing the procelain body when fracture force must be greater than the minimum pressure. 
Terminal Strength(SMD)	NPO: ΔC/C: ≤±0.5% X7R/X7S:ΔC/C: -10%~+10% DF / IR: Same to initial value Appearance: No visible damage	Slowly put a T of force on the capacitor side porcelain body, and keep the 60+1 s 0402:4N 0603:10N >0603:17.7N 
Temperature Character	NPO: ΔC/C: ±30ppm X7R: ΔC/C ±15% X7S:ΔC/C: ±22% X5R:ΔC/C: ±15%	NPO/X7R/X7S: At -55℃, 20℃, 125℃ X5R: At -55℃, 20℃, 85℃

■Temperature Coefficient / Characteristics

Dielectric	Reference Temperature Point	Temperature Coefficient	Operation Temperature Range
NPO(COG)	20℃	0±30 ppm/℃	-55℃~125℃
X5R	20℃	±15%	-55℃~85℃
X7R	20℃	±15%	-55℃~125℃
X7S	20℃	±22%	-55℃~125℃

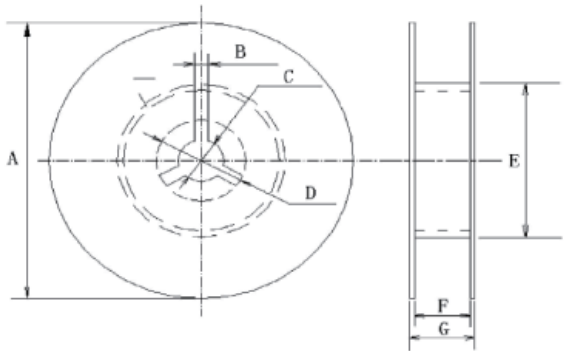
Note : Nominal temperature coefficient and allowed tolerance of class Ⅰ are decided by the changing of the capacitance between 20°C and 85°C.
Nominal temperature coefficient of class Ⅱ are decided by the temperature of 20°C

■Packaging

Packaging Quantity

Type	Thickness	Packaging (7” Reel)	
		Paper tape	Plastic tape
0201	0.30±0.03	15K	-
	0.30±0.05	15K	-
0402	0.50±0.05	10K	-
	0.50±0.15	10K	-
0603	0.50±0.05	4K	-
	0.80±0.10	4K	-
	0.80±0.20	4K	-
0805	0.80±0.20	4K	-
	1.25±0.20	-	3K
1206	0.80±0.20	4K	-
	1.25±0.20	-	3K
	1.60±0.30	-	2K
1210	1.25±0.20	-	2K
	1.60±0.30	-	2K
	2.00±0.30	-	1K
	2.50±0.30	-	1K
1808	1.60±0.30	-	2K
	2.00±0.30	-	2K
1812	1.60±0.30	-	1K
	2.00±0.30	-	0.5K
	2.50±0.30	-	0.5K
2220	1.60±0.30	-	0.5K
	1.80±0.30	-	0.5K
	2.00±0.30	-	0.5K
	2.50±0.30	-	0.5K

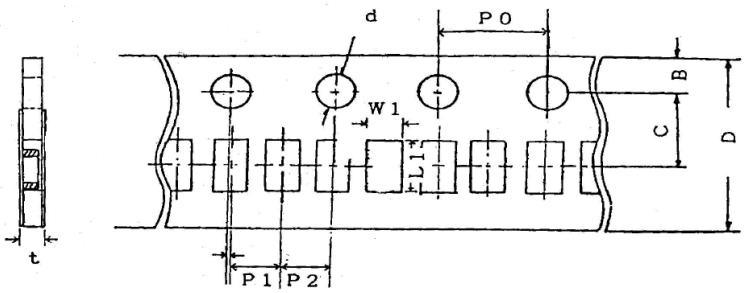
Tape and Reel



Unit: mm

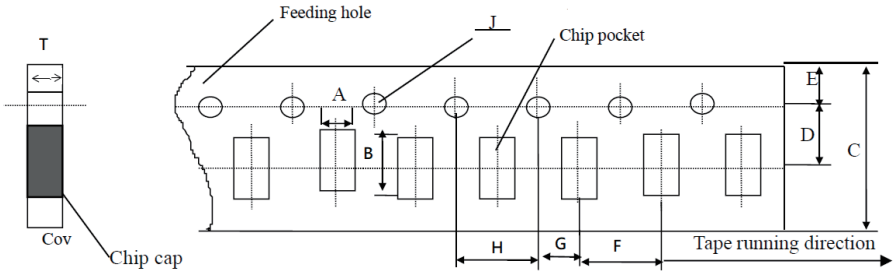
Type	A	B	C	D	E	F	G
0201	178±2.0(7”)	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
0402	178±2.0(7”)	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
0603	178±2.0(7”)	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
0805	178±2.0(7”)	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1206	178±2.0(7”)	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1210	178±2.0(7”)	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1808	330±2.0(13”)	3.0	13.0±0.5	21.0±0.8	50 or more	12.6 max	13.6 max
1812	330±2.0(13”)	3.0	13.0±0.5	21.0±0.8	50 or more	12.6 max	13.6 max
2220	330±2.0(13”)	3.0	13.0±0.5	21.0±0.8	50 or more	12.6 max	13.6 max

Paper Tape Size Specification



Unit: mm

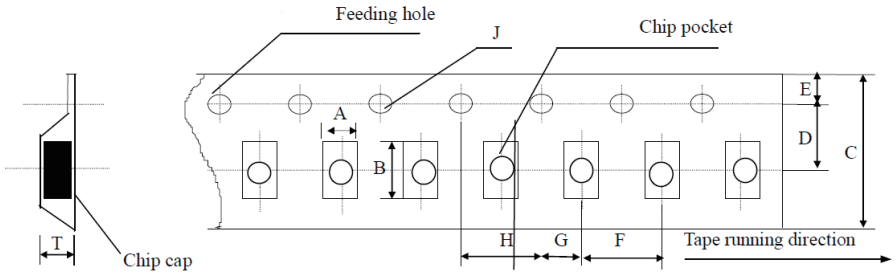
Type	W1	L1	D	C	B	P1	P2	P0	d	t
0201	0.37±0.10	0.67±0.10	8.00±0.10	3.50±0.05	1.75±0.10	2.00±0.05	2.00±0.05	4.00±0.10	1.50-0/+0.10	0.80 Below
0402	0.65±0.10	1.15±0.10	8.00±0.10	3.50±0.05	1.75±0.10	2.00±0.05	2.00±0.05	4.00±0.10	1.50-0/+0.10	0.80 Below



Unit: mm

Type	A	B	C	D	E	F	G	H	J	I
0603	1.10±0.10	1.90±0.10	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.10 max
0805	1.45±0.15	2.30±0.15	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.10 max
1206	1.80±0.20	3.40±0.20	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.10 max

Plastic Tape Size Specification

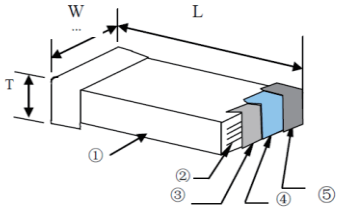


Unit: mm

Type	A	B	C	D	E	F	G	H	J	I
0805	1.55±0.20	2.35±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.50 max
1206	1.95±0.20	3.60±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.85 max
1210	2.70±0.10	3.42±0.10	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50-0/+0.10	3.20 max
1808	2.20±0.10	4.95±0.10	12.0±0.10	5.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50-0/+0.10	3.00 max
1812	3.66±0.10	4.95±0.10	12.0±0.10	5.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05	4.00±0.10	1.50-0/+0.10	4.00 max
2220	6.20±0.10	6.70±0.10	12.0±0.10	3.50±0.05	1.75±0.10	8.00±0.10	2.00±0.05	4.00±0.10	1.50-0/+0.10	2.40±0.10

Industrial MLCC – IM Series

■Construction



①	Ceramic Dielectric	④	Nickel Layer:
②	Inner Electrodes	⑤	Tin Layer
③	Substrate Electrodes		

■Feature

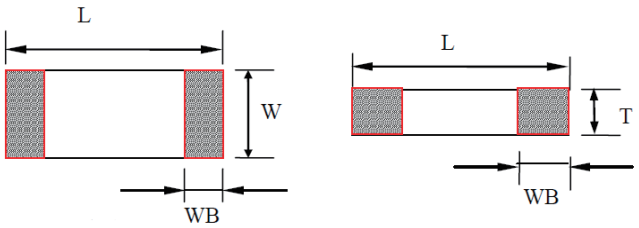
−The product has high reliability and is suitable for various electronic products with harsh application conditions, high quality requirements and low failure rate.

−Executive Standard: GH/T 21041-2007, GH/T 21042-2007

■Applications

−The products are specially designed and applied to industrial electronic automation equipment, network core equipment and related electronic products.

■Dimensions



Capacitance ≦ 50V

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	WB (mm)	Special Instructions
01	0201	0.60±0.03	0.30±0.03	0.30±0.03	0.15±0.05	C<220nF
		0.60±0.05	0.30±0.05	0.30±0.05	0.15±0.05	C≧220nF
02	0402	1.00±0.05	0.50±0.05	0.50±0.05	0.25±0.05	C<1uF
		1.00±0.15	0.50±0.15	0.50±0.15	0.25±0.05	1uF≦C<10uF
		1.00±0.20	0.50±0.20	0.50±0.20	0.25±0.05	C≧10uF
03	0603	1.60±0.10	0.80±0.10	0.80±0.10	0.35±0.20	C<10uF
		1.60±0.20	0.80±0.20	0.80±0.20	0.35±0.20	C≧10uF
05	0805	2.00±0.20	1.25±0.20	0.80±0.20	0.50±0.20	C<1uF
				1.25±0.20	0.50±0.20	C≧1uF
06	1206	3.20±0.30	1.60±0.30	0.80±0.20	0.60±0.30	C≦330nF
				1.00±0.20		330nF<C<470nF
				1.25±0.20		470nF≦C<2.2uF
				1.60±0.30		C≧2.2uF
10	1210	3.20±0.30	2.50±0.30	≦2.80	0.60±0.30	All
08	1808	4.50±0.40	2.00±0.20	≦2.20	0.60±0.30	All
12	1812	4.50±0.40	3.20±0.30	≦3.50	0.60±0.30	All

Note: The specific thickness of the product can read capacity range and voltage in this approval sheet.

Capacitance > 50V

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	WB (mm)
02	0402	1.00±0.05	0.50±0.05	0.50±0.05	0.25±0.10
03	0603	1.60±0.10	0.80±0.10	0.80±0.10	0.30±0.10
05	0805	2.00±0.20	1.25±0.20	≦0.55	0.50±0.20
				0.80±0.20	
				1.00±0.20	
				1.25±0.20	
06	1206	3.20±0.30	1.60±0.30	0.80±0.20	0.60±0.30
				1.00±0.20	
				1.25±0.20	
				1.60±0.30	
10	1210	3.20±0.30	2.50±0.30	≦2.80	0.60±0.30
08	1808	4.50±0.40	2.00±0.20	≦2.20	0.60±0.30
12	1812	4.50±0.40	3.20±0.30	≦3.50	0.60±0.30

Note: The specific thickness of the product can read capacity range and voltage in this approval sheet.

■Part Numbering

IM	03	J	T	N	250	3R9
Product Type	Dimensions (L×W)	Capacitance Tolerance	Packaging	Dielectric	Voltage (VDCW)	Capacitance
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 08: 1808 12: 1812	A: ±0.05pF (Cap≦10pF) B: ±0.1pF (Cap≦10pF) C: ±0.25pF (Cap≦10pF) D: ±0.5pF (Cap≦10pF) F: ±1% G: ±2% J: ±5% K: ±10% M: ±20%	T: Taping Reel	N: NPO (COG) B: X7R BS: X7S S: X6S X: X5R	4V0: 4V 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 106: 10μF

■Temperature Coefficient /Characteristics

Dielectric	Reference Temperature Point	Temperature Coefficient	Operation Temperature Range
NOP(COG)	20℃	0±30ppm/℃	-55~125℃
X5R	20℃	±15%	-55~85℃
X7R	20℃	±15%	-55~125℃
X7S	20℃	±22%	-55~125℃
X6S	20℃	±22%	-55~105℃

Note：Nominal temperature coefficient and allowed tolerance of class Ⅰ are decided by the changing of the capacitance between 20℃ and 85℃.
Nominal temperature coefficient of class Ⅱ are decided by the temperature of 20℃.

■Capacitance & Voltage

Type	Rated Voltage	Capacitance				
		NPO(COG)	X7R	X7S	X6S	X5R
0201	≦16V	-	101~223【0.3】	-	153~104【0.3】	153~224【0.3】
	25V	-	101~103【0.3】	-	153~104【0.3】	153~104【0.3】
	50V	0R1~221【0.3】	101~102【0.3】	-	-	472~103【0.3】
0402	≦10V	-	101~473【0.5】	104~474【0.5】	104~105【0.5】	223~105【0.5】
	16V	-	101~224【0.5】	473~224【0.5】	104~105【0.5】	223~105【0.5】
	25V	-	101~104【0.5】	223~224【0.5】	103~104【0.5】	223~224【0.5】
	50V	0R1~102【0.5】	101~473【0.5】	472~103【0.5】	-	472~104【0.5】
	100V	0R1~101【0.5】	151~103【0.5】	-	-	-
0603	≦10V	-	151~225【0.8】	474~225【0.8】	104~225【0.8】	474~225【0.8】
	16V	-	151~225【0.8】	474~105【0.8】	104~105【0.8】	474~225【0.8】
	25V	-	151~105【0.8】	474~105【0.8】	-	474~225【0.8】
	50V	0R1~682【0.8】	151~474【0.8】	474~105【0.8】	-	474~105【0.8】
	100V	0R1~102【0.8】	151~104【0.8】	-	-	-
	200V	0R1~471【0.8】	151~103【0.8】	-	-	-
	250V	0R1~471【0.8】	151~103【0.8】	-	-	-
0805	≦10V	-	151~474【0.8】 564~475【1.25】	105~106【1.25】	104~474【0.8】 564~475【1.25】	564~106【1.25】
	16V	-	151~474【0.8】 564~225【1.25】	154~474【0.8】 564~225【1.25】	-	564~475【1.25】
	25V	-	151~474【0.8】 564~105【1.25】	154~474【0.8】 564~105【1.25】	-	474~225【0.8】
	50V	0R1~822【0.8】 103~223【1.25】	151~334【0.8】 364~474【1.25】	154~334【0.8】 364~474【1.25】	-	564~105【1.25】
	100V	0R1~332【0.8】	151~563【0.8】 683~224【1.25】	-	-	-
	200V ~ 250V	0R1~102【0.8】 122~152【1.25】	151~183【0.8】 203~223【1.25】	-	-	-
	500V ~ 630V	0R1~331【0.8】 471~561【1.25】	151~562【0.8】 682~103【1.25】	-	-	-
	1000V	0R1~101【1.25】	-	-	-	-
1206	4V	-	-	225~226【1.6】	225~226【1.6】	105~155【0.8】 225~106【1.6】
	6.3V	-	201~334【0.8】 474~155【1.25】 225~106【1.6】	225~1.6【1.6】	104~155【0.8】 225~226【1.6】	225~106【1.6】
	10V	-	201~334【0.8】 474~155【1.25】 225~106【1.6】	225~106【1.6】	104~155【0.8】 225~226【1.6】	225~106【1.6】
	16V	-	201~334【0.8】 474~155【1.25】 225~106【1.6】	105~155【0.8】 225~106【1.6】	104~155【0.8】 225~106【1.6】	225~106【1.6】
	25V	-	201~334【0.8】 474~155【1.25】 225~106【1.6】	105~155【0.8】 225~106【1.6】	104~155【0.8】 225~475【1.6】	225~475【1.6】
	50V	0R3~822【0.8】 103~104【1.6】	201~334【0.8】 474~155【1.25】 225~475【1.6】	105~155【0.8】 225~474【1.6】	-	225~475【1.6】
	100V	0R1~332【0.8】	151~563【0.8】 683~334【1.25】 474~105【1.6】	-	-	-
	200V ~ 250V	0R1~182【0.8】 202~272【1.25】	151~273【0.8】 333~154【1.25】 184~224【1.6】	-	-	-
	500V ~ 630V	0R1~100【0.8】 110~471【1】 561~152【1.25】	151~272【0.8】 332~333【1.25】	-	-	-
	1000V	0R1~121【1】 151~102【1.25】	151~102【0.8】 112~123【1.25】	-	-	-
	2000V	0R1~390【1】 470~680【1.25】 820~271【1.6】	151~272【1.25】	-	-	-

■【】General thickness corresponds to the capacity, unit: mm

■Capacitance & Voltage

Type	Rated Voltage	Capacitance				
		NPO(COG)	X7R	X7S	X6S	X5R
1210	4V	-	-	-	104~474【1.25】 564~106【1.6】	475~106【1.6】
	6.3V	-	221~474【1.25】 564~106【1.6】	475~106【1.6】	104~474【1.25】 564~106【1.6】	475~106【1.6】
	10V	-	221~474【1.25】 564~106【1.6】	-	104~474【1.25】 564~106【1.6】	475~106【1.6】
	16V	-	221~474【1.25】 564~106【1.6】	225~106【1.6】	104~474【1.25】 564~106【1.6】	475~106【1.6】
	25V	-	221~474【1.25】 564~475【1.6】	225~106【1.6】	104~474【1.25】 564~106【1.6】	475~106【1.6】
	50V	100~104【1.25】	221~474【1.25】 564~475【1.6】	105~106【1.6】	-	475~106【1.6】
	100V	1R0~682【1.25】	151~224【1.25】 334~225【1.6】	-	-	-
	200V ~ 250V	1R0~332【1.25】	151~154【1.25】 184~224【1.25】	-	-	-
	500V ~ 630V	1R0~122【1.25】 152~222【1.6】	151~563【1.25】 683~104【1.6】	-	-	-
	1000V	1R0~681【1.25】 821~122【1.6】	151~392【1.25】 472~223【1.6】	-	-	-
	2000V	1R0~271【1.25】 301~471【1.6】	151~272【1.25】 332~103【1.6】	-	-	-
1808	6.3V	-	221~475【1.6】	-	-	475~106【1.6】
	10V	-	221~475【1.6】	-	-	475~106【1.6】
	16V	-	221~475【1.6】	-	-	475~106【1.6】
	25V	-	221~475【1.6】	-	-	475~106【1.6】
	50V	100~104【1.6】	221~475【1.6】	-	-	-
	100V	2R0~472【1.6】	221~225【1.6】	-	-	-
	200V ~ 250V	2R0~392【1.6】	221~224【1.6】	-	-	-
	500V ~ 630V	2R0~272【1.6】	221~683【1.6】	-	-	-
	1000V	2R0~102【1.6】	151~223【1.6】	-	-	-
	2000V	2R0~471【1.6】	151~103【1.6】	-	-	-
	3000V	2R0~331【1.6】	151~472【1.6】	-	-	-
	4000V	2R0~330【1.6】	151~222【1.6】	-	-	-
	5000V	2R0~330【1.6】	-	-	-	-
1812	6.3V	-	-	-	-	-
	10V	-	-	-	-	-
	16V	-	471~105【1.6】 125~685【2.5】	-	-	-
	25V	-	471~105【1.6】 125~475【2.5】	-	-	475~106【2.5】
	50V	100~104【1.25】	471~105【1.6】 125~475【2.5】	-	-	-
	100V	3R0~103【1.25】	271~564【1.6】 684~105【2】	-	-	-
	200V ~ 250V	3R0~682【1.25】	271~224【1.6】 334~564【2】	-	-	-
	500V ~ 630V	3R0~102【1.25】 122~472【1.6】	281~104【1.6】 124~224【2】	-	-	-
	1000V	3R0~122【1.6】	271~473【1.6】 563【2】	-	-	-
	2000V	3R0~102【1.6】	271~123【1.6】	-	-	-
	3000V	3R0~561【1.6】	271~472【1.6】	-	-	-
	4000V	3R0~221【1.6】	271~332【1.6】	-	-	-
	5000V	3R0~680【1.6】	-	-	-	-

■【】General thickness corresponds to the capacity, unit: mm

■Environmental Characteristics

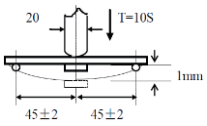
<table>
<tr><th>Item</th><th colspan="9">Requirement</th><th colspan="3">Test Method</th></tr>
<tr><td>Capacitance</td><td colspan="9">Should be within the specified tolerance</td><td colspan="3">NPO: (Class I)
Cap≤1000pF 1.0±0.2Vrms, 1MHz±10%
Cap>1000pF 1.0±0.2Vrms, 1KHz±10%
X7R,X7S,X6S,X5R: (Class II)
Test Temperature:25℃±3℃
Cap≤10uF 1.0±0.2Vrms, 1KHz±10%
Cap>10uF 0.5±0.1Vrms, 120Hz±24 Hz</td></tr>
<tr><td rowspan="20">(DF, tanδ) Dissipation Factor</td><td rowspan="3">NPO (Class Ⅰ)</td><td colspan="8">DF</td><td>Capacitance</td><td>Measuring Frequency</td><td>Measuring Voltage</td></tr>
<tr><td colspan="8">≤0.1%</td><td>Cr≦30 pF</td><td rowspan="2">1MHz±10%</td><td rowspan="2">1.0 ±0.2Vrms</td></tr>
<tr><td colspan="8">≤1/(400+20Cr)</td><td>Cr< 30 pF</td></tr>
<tr><td rowspan="17">X7R,X7S, X6S,X5R: (Class II)</td><td>Voltage</td><td>DF</td><td>0201</td><td>0402</td><td>0603</td><td>0805</td><td>≧1206</td><td colspan="3" rowspan="17">Cap≤10uF 1.0±0.2Vrms, 1KHz±10%
Cap>10uF 0.5±0.1Vrms, 120Hz±24Hz</td></tr>
<tr><td>>100V</td><td>≦250</td><td colspan="5">all</td></tr>
<tr><td rowspan="2">100V</td><td>≦250</td><td>-</td><td>≦10nF</td><td>≦100 nF</td><td>≦220 nF</td><td>≦680 nF</td></tr>
<tr><td>≦350</td><td>-</td><td>-</td><td>-</td><td>-</td><td>≦1μF</td></tr>
<tr><td rowspan="4">50V</td><td>≦250</td><td>≦3.3nF</td><td>≦10nF</td><td>≦ 100nF</td><td>≦330nF</td><td>≦680 nF</td></tr>
<tr><td>≦350</td><td>≦10nF</td><td>-</td><td>-</td><td>-</td><td>≦1μF</td></tr>
<tr><td>≦500</td><td>-</td><td>-</td><td>-</td><td>≦680nF</td><td>-</td></tr>
<tr><td>≦1000</td><td>-</td><td>≦ 100μF</td><td>≦1μF</td><td>≦1μF</td><td>≦4.7μF</td></tr>
<tr><td rowspan="4">25V</td><td>≦250</td><td>≦3.3nF</td><td>≦10nF</td><td>≦ 150nF</td><td>≦330nF</td><td>≦680 nF</td></tr>
<tr><td>≦350</td><td>≦10nF</td><td>-</td><td>≦ 330nF</td><td>-</td><td>≦2.2μF</td></tr>
<tr><td>≦500</td><td>-</td><td>-</td><td>-</td><td>≦1μF</td><td>-</td></tr>
<tr><td>≦750</td><td>-</td><td>-</td><td>-</td><td>≦2.2μF</td><td>≦4.7μF</td></tr>
<tr><td rowspan="4">16V</td><td>≦1000</td><td>≦ 100nF</td><td>≦ 100nF</td><td>≦2.2μF</td><td>-</td><td>≦10μF</td></tr>
<tr><td>≦250</td><td>≦3.3 nF</td><td>≦10nF</td><td>≦ 150nF</td><td>≦330nF</td><td>≦680 nF</td></tr>
<tr><td>≦350</td><td>≦15nF</td><td>≦ 100nF</td><td>≦ 330nF</td><td>-</td><td>≦2.2μF</td></tr>
<tr><td>≦500</td><td>≦47nF</td><td>≦ 220nF</td><td>≦ 680nF</td><td>≦2.2μF</td><td>-</td></tr>
<tr><td>≦750</td><td>-</td><td>-</td><td>-</td><td>≦4.7μF</td><td>≦4.7μF</td></tr>
<tr><td rowspan="4">≦10V</td><td>≦1000</td><td>≦ 100nF</td><td>≦1μF</td><td>≦2.2μF</td><td>-</td><td>≦10μF</td></tr>
<tr><td>≦250</td><td>≦3.3nF</td><td>≦10nF</td><td>≦ 150nF</td><td>≦330nF</td><td>≦ 680nF</td></tr>
<tr><td>≦350</td><td>≦15nF</td><td>≦ 100nF</td><td>≦ 330nF</td><td>-</td><td>≦2.2μF</td></tr>
<tr><td>≦500</td><td>≦47nF</td><td>≦ 220nF</td><td>≦ 680nF</td><td>≦2.2μF</td><td>-</td></tr>
<tr><td>≦750</td><td>-</td><td>-</td><td>-</td><td>≦4.7μF</td><td>≦10μF</td></tr>
<tr><td>≦1000</td><td>≦ 100nF</td><td>≦1μF</td><td>≦2.2μF</td><td>≦10μF</td><td>≦22μF</td></tr>
<tr><td>Appearance</td><td colspan="9">No visible damage</td><td colspan="3">Visual inspection</td></tr>
<tr><td>Physical Dimension</td><td colspan="9">Within the specified dimensions</td><td colspan="3">Use caliper</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>Dielectric Withstanding Voltage(DWV)</td><td>No breakdown or damage.</td><td>Ur<100V
Measuring Voltage:
Class Ⅰ:300% Ur
Class Ⅱ:250% Ur
Duration: 1~5s
Charge/Discharge Current: 50mA max.

100V≦Vr≦500V Force 200% Rated voltage for 5 seconds. Max current should not exceed 50mA.

500V≦Vr≦1000V Force 150% Rated voltage for 5 seconds. Max current should not exceed 50mA.

1000V≦Vr≦2000V Force 120% Rated voltage for 5 seconds. Max current should not exceed 50mA.

2000V≦Vr≦5000V Force 120% Rated voltage for 5 seconds. Max current should not exceed 10mA.</td></tr>
<tr><td rowspan="2">Solderability</td><td rowspan="2">At least 95% of the terminal electrode is covered by new solder.
Visual Appearance: No visible damage.</td><td colspan="2">Preheating conditions:80 to 120℃; 10~30s.</td></tr>
<tr><td>Solder Temperature:
235±5℃(Sn/Pb:63/37)
Duration: 2±0.5s</td><td>Solder Temperature:
245±5℃(Lead-free)
Duration: 3±0.3s</td></tr>
<tr><td>Resistance to Flexure of Substrate (Bending Strength)</td><td>NPO: ΔC/C:≤±1% or ±1pF, whichever is larger.
X7R/X7S/X6S/X5R: ΔC/C: -10%~10%
DF&IR: Same to initial value
Appearance: no visible damage.</td><td>Test Board: Al2O3 or PCB
Warp: 1mm
Speed: 1 mm/sec.
Unit: mm
The measurement should be made with the board in the bending position.
 
</td></tr>
<tr><td>Resistance to Soldering Heat</td><td><table>
<tr><td>Item</td><td>NPO</td><td>X7R/X7S/X6S/X5R</td></tr>
<tr><td>ΔC/C</td><td>≤±1% or ±1pF whichever is larger</td><td>-15~+15%</td></tr>
<tr><td>DF</td><td colspan="2">Same to initial value</td></tr>
<tr><td>IR</td><td colspan="2">Same to initial value</td></tr>
<tr><td colspan="3">Appearance：No visible damage.
At least 95% of the terminal electrode is covered by new solder.</td></tr>
</table></td><td>Preheating conditions: 100 to 200℃; 60~120s.
Solder Temperature: 265±5℃
Duration: 10±1s
Clean the capacitor with solvent and examine it with a 10X(min.) microscope.
Recovery Time: 24±2h
Recovery condition: Room temperature</td></tr>
<tr><td>Termination Adhesion</td><td>No visible damage</td><td>Applied Force: 5N
Duration: 10±1S</td></tr>
<tr><td>Vibration</td><td>NPO: ΔC/C:≤±1% or ±1pF, whichever is larger.
X7R/X7S/X6S/X5R: ΔC/C: -10%~10%
DF&IR: Same to initial value
Appearance: no visible damage.</td><td>5 g's for 20 minutes, 12 cycles each of 3 orientations.
Note: Use 8"x5" PCB. 0.31" thick 7 secure points on one long side and 2 secure points at corners of opposite side. Parts mounted within 2" form any secure point. Test from 10~2000Hz.</td></tr>
<tr><td>Humidity Load</td><td>NPO: ΔC/C :±2.5% or ±2.5pF, whichever is larger.
X7R/X7S/X6S/X5R:ΔC/C: ≤±10%
DF: Same to initial value.
IR:Class I: C≦10nF, Ri≧10000MΩ
C>10nF,Ri·CR≧100S
Class II: C≦25nF, Ri≧2000MΩ
C>25nF,Ri·CR≧20S
Appearance: No visible damage</td><td>Preconditioning, class 2 only:
At 140~150℃ 1hour, then keep for 24±1 hour at room temp.
Test condition:
40℃, 95%RH Add 100KΩ resistor, applied Ur and 1.3 to 1.5 volts for 500 hours.</td></tr>
</table>

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Method</th></tr>
<tr><td>Temperature Cycle</td><td>NPO: ΔC/C:≤±1% or ±1pF, whichever is larger.
X7R/X7S/X6S/X5R: ΔC/C: -10%~10%
DF&IR: Same to initial value
Appearance: no visible damage.</td><td>Preheating conditions: up-category temperature, 1h
Recovery time: 24±1h
Initial Measurement
Cycling Times: 1000 times, 1 cycle, 4 steps:
<table>
<tr><th>Step</th><th>Temp.(℃)</th><th>Time (min)</th></tr>
<tr><td>1</td><td>Low- category temp
NPO/X7R/X7S/X6S/X5R : -55</td><td>30</td></tr>
<tr><td>2</td><td>Normal temp. (+20)</td><td>1</td></tr>
<tr><td>3</td><td>Up- category temp
NPO/X7R/X7S : +125
X5R: +85 X6S:+105</td><td>30</td></tr>
<tr><td>4</td><td>Normal temp. (+20)</td><td>1</td></tr>
</table>
Recovery time after test: 24±2h</td></tr>
<tr><td>Life Test</td><td>NPO:ΔC/C :≤±2% or ±1pF,whichever is larger.
X7R/X7S/X6S/X5RΔC/C ≤±20%
DF: Same to initial value.
IR:Class I: Ri≧5000MΩ or Ri·CR≧50S whichever is smaller
Class II: Ri≧1000MΩ or Ri·CR≧10S whichever is smaller
Visual Appearance: No visible damage</td><td>Low-Voltage:
Ur<100V: 2x Rated Voltage
100V≦Ur<500V: 2x Rated Voltage
500V≦Ur≦1000V: 1.5x Rated Voltage
Ur>1000V: 1.2x Rated Voltage
Duration: 1000h
Temperature：125℃（NPO/X7R/X7S）
85℃（X5R） 105℃(X6S)
Charge/ Discharge Current: 50mA max.
Recovery Conditions: Room Temperature
Recovery Time: 24h (Class 1), or 48h (Class2)
<table>
<tr><td colspan="4">Table 1</td></tr>
<tr><td>Capacitance</td><td>Test Voltage</td><td>Capacitance</td><td>Test Voltage</td></tr>
<tr><td>0201≧ 47nF</td><td rowspan="3">1.5Ur</td><td>0805≧ 1uF</td><td rowspan="3">1.5 Ur</td></tr>
<tr><td>0402≧ 330nF</td><td>1206≧ 10uF</td></tr>
<tr><td>0603≧ 470nF</td><td>1210≧ 10uF</td></tr>
</table></td></tr>
<tr><td>High Temperature Exposure</td><td>NPO: ΔC/C:≤±1% or ±1pF, whichever is larger.
X7R/X7S/X6S/X5R: ΔC/C: -10%~10%
DF&IR: Same to initial value</td><td>Temperature: 125℃(NPO/X7R/X7S) 85℃(X5R) 105℃(X6S)
Voltage: without
Duration: 1000h
Recovery conditions: room temperature
Recovery Time: 24h(Class I) or 48h(Class II)</td></tr>
<tr><td>Destructive Physical Analysis</td><td>No defects or abnormalities</td><td>Accounting to EIA-469</td></tr>
<tr><td>Insulation Resistnace(IR)</td><td>I : C≦10nF,Ri≧50000MΩ
C>10nF,Ri·CR≧500S
II: C≦25nF,Ri≧10000MΩ
C>25nF,Ri·CR≧100S</td><td>Measuring Voltage: Rated Voltage
Duration: 60±5s
Test Humidity: ≦75%
Test Temperature: 25±3℃
Test Current: ≦50mA</td></tr>
</table>

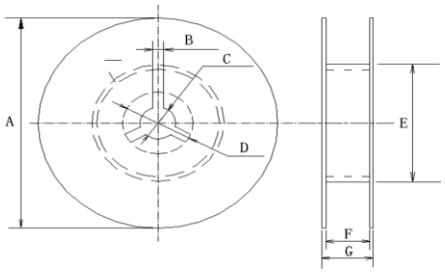
■**Storage Temperature: 5 ~ 40℃; Relative Humidity 20 ~70 %RH**

■Packaging

Packaging Quantity

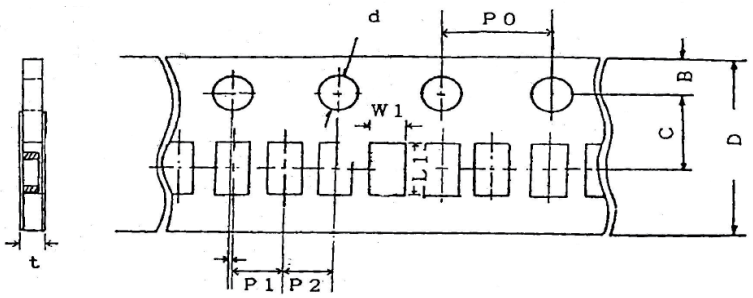
Type	Packaging (7" Reel)	
	Paper tape	Plastic tape
0201	15K	-
0402	10K	-
0603	4K	-
0805	4K	3K
1206	4K	T≦1.35mm 3K T>1.35mm 2K
1210	-	T≦1.80mm 2K T>1.80mm 1K
1808	-	2K
1812	-	T≦1.85mm 1K T>1.85mm 0.5K

Tape and Reel



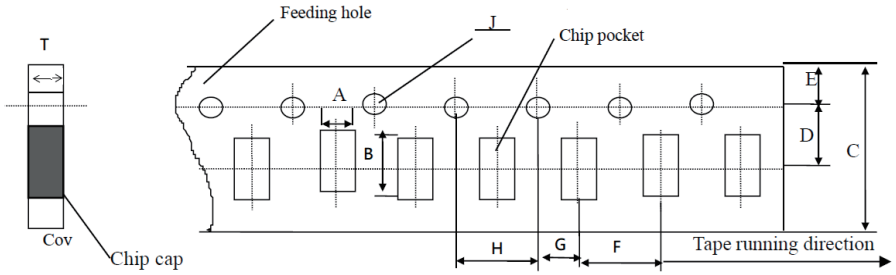
Type	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)
0201	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
0402	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
0603	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
0805	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1206	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1210	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1808	330±2.0(13")	3.0	13.0±0.5	21.0±0.8	50 or more	12.6 max	13.6 max
1812	330±2.0(13")	3.0	13.0±0.5	21.0±0.8	50 or more	12.6 max	13.6 max

Paper Tape Size Specification



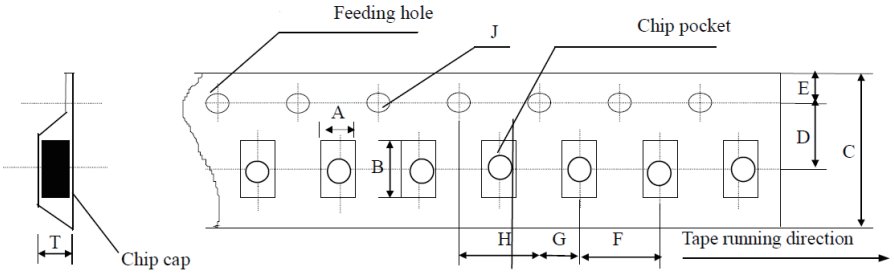
Type	W1 (mm)	L1 (mm)	D (mm)	C (mm)	B (mm)	P1 (mm)	P2 (mm)	P0 (mm)	d (mm)	t (mm)
0201	0.37±0.10	0.67±0.10	8.00±0.10	3.50±0.05	1.75±0.10	2.00±0.05	2.00±0.05	4.00±0.10	1.50-0/+0.10	0.80 Below
0402	0.65±0.10	1.15±0.10	8.00±0.10	3.50±0.05	1.75±0.10	2.00±0.05	2.00±0.05	4.00±0.10	1.50-0/+0.10	0.80 Below

Paper Tape Size Specification



Type	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	J (mm)	T (mm)
0603	1.10±0.10	1.90±0.10	8.00±0.10	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.10 max
0806	1.45±0.15	2.30±0.15	8.00±0.15	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.10 max
1206	1.80±0.20	3.40±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.10	4.00±0.10	1.50-0/+0.10	1.10 max

Plastic Tape Size Specification



Type	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	J (mm)	T (mm)
0805	1.55±0.20	2.35±0.20	8.00±0.20	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.50 Max
1206	1.95±0.20	3.60±0.20	8.00±0.20	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.85 Max
1210	2.70±0.10	3.42±0.10	8.00±0.10	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.05	4.00 ±0.10	1.55 -0/+0.10	3.20 Max
1808	2.20±0.10	4.95±0.10	12.00±0.10	5.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.05	4.00 ±0.10	1.50 -0/+0.10	3.00 Max
1812	3.66±0.10	4.95±0.10	12.00±0.10	5.50 ±0.05	1.75 ±0.10	8.00 ±0.10	2.00 ±0.05	4.00 ±0.10	1.55 -0/+0.10	4.00 Max

■Recommended Soldering Method

Type	Dielectric	Capacitance	Soldering Method
0201	NPO	-	R
	X7R/X7S/X6S/X5R	-	R
0402	NPO	-	R
	X7R/X7S/X6S/X5R	-	R
0603	NPO	-	R
	X7R/X7S/X6S/X5R	C≧1uF	R
		C<1uF	
0805	NPO	-	R
	X7R/X7S/X6S/X5R	C≧4.7uF	R
		C<4.7uF	
1206	NPO	-	R
	X7R/X7S/X6S/X5R	C≧10uF	R
		C<10uF	
≧1210	NPO	-	R
	X7R/X7S/X6S/X5R	-	R

Soldering method：R－Reflow Soldering

Open-Mode Design MLCC – OP Series

Property

- Open circuit during capacitor cracking can protect the circuit.
- This type of capacitor adopts special inner electrode designs as fig.2 and fig.3 below
- Executive Standard: GH/T 21041-2007, GH/T 21042-2007

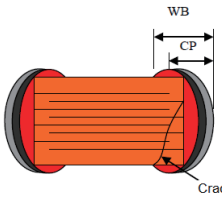


Fig.1 Normal design (CP<WB) circuit leakage during cracking.

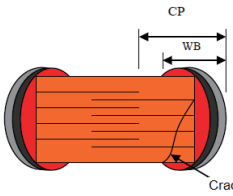


Fig.2 Open-mode design (CP>WB) circuit open during cracking.

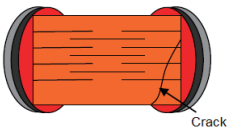
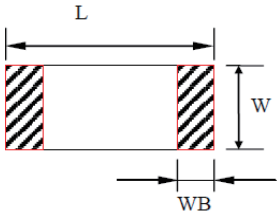
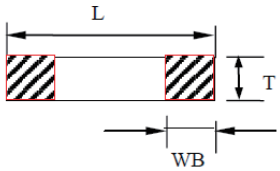


Fig.3 Floating design circuit open during cracking.

Dimensions





Type	Size (Inch)	L (mm)	W (mm)	T (mm)	WB (mm)
03	0603	1.60±0.20	0.80±0.20	0.80±0.20	0.35±0.20
05	0805	2.00±0.20	1.25±0.20	≦0.55 0.80±0.20 1.25±0.20	0.50±0.20
06	1206	3.20±0.30	1.60±0.30	0.80±0.20 1.25±0.20 1.60±0.30	0.60±0.30
10	1210	3.20±0.30	2.50±0.30	≦2.80	0.60±0.30
12	1812	4.50±0.40	3.20±0.30	≦3.50	0.60±0.30

Part Numbering

OP	05	K	T	B	201	331
Product Type	Dimensions (L×W)	Capacitance Tolerance	Packaging	Dielectric	Voltage	Capacitance
	03: 0603 05: 0805 06: 1206 10: 1210 12: 1812	B: ±0.1pF C: ±0.25pF D: ±0.5pF F: ±1% G: ±2% J: ±5% K: ±10% M: ±20%	T: Taping Reel	N: NPO(COG) B: X7R X: X5R	4V0: 4V 6V3: 6.3V 100: 10V 101: 100V 102: 1000V	331: 330pF 102: 1000pF 222: 2200pF

■General Capacitance & Voltage

Type	Rated Voltage	NPO	X7R	X5R
0603	4V	---	151~474	103~474
	6.3V	---	151~474	103~474
	10V	---	151~104	103~104
	16V	---	151~104	103~104
	25V	---	151~104	103~104
	50V	0R1~102	151~104	103~104
	100V	0R1~102	151~153	102~153
	200V	0R1~221	151~472	102~472
	250V	0R1~221	151~472	102~472
0805	4V	---	151~105	103~105
	6.3V	---	151~105	103~105
	10V	---	151~474	103~474
	16V	---	151~224	103~224
	25V	---	151~104	103~104
	50V	0R3~222	151~104	103~104
	100V	0R3~222	151~473	103~473
	200V	0R3~102	151~223	102~223
	250V	0R3~102	151~223	102~223
	500V	0R3~471	151~103	102~103
	1000V	0R3~101	---	---
1206	4V	---	201~225	103~225
	6.3V	---	201~225	103~225
	10V	---	201~225	103~225
	16V	---	201~105	103~105
	25V	---	201~105	103~105
	50V	0R3~332	201~105	103~105
	100V	0R3~332	201~103	103~104
	200V	0R3~222	201~473	102~473
	250V	0R3~222	201~473	102~473
	500V	0R3~102	201~223	102~223
	630V	0R3~102	201~223	102~223
	1000V	0R3~681	201~103	102~103
	2000V	0R3~221	201~332	102~332
1210	4V	---	221~475	103~475
	6.3V	---	221~475	103~475
	10V	---	221~475	103~475
	16V	---	221~475	103~475
	25V	---	221~225	103~225
	50V	100~392	221~225	103~225
	100V	100~392	221~105	103~105
	200V	100~332	221~473	102~473
	250V	100~332	221~473	102~473
	500V	100~182	221~273	102~273
	630V	100~182	221~273	102~273
	1000V	100~102	221~223	102~223
	2000V	100~331	221~103	102~103
1812	4V	---	---	103~106
	6.3V	---	---	103~106
	10V	---	---	103~106
	16V	---	---	103~106
	25V	---	---	103~475
	50V	100~103	---	103~475
	100V	100~103	471~105	103~105
	200V	100~562	471~474	102~474
	250V	100~562	471~474	102~474
	500V	---	471~104	102~104
	630V	---	471~104	102~104
	1000V	---	471~563	102~563
	2000V	---	471~123	102~123
	3000V	---	471~103	102~103
	4000V	---	471~332	102~332
	5000V	---	471~102	102

■Environmental Characteristics

<table>
<tr><th>Item</th><th colspan="2">Requirement</th><th colspan="3">Test Method</th></tr>
<tr><td rowspan="3">Capacitance</td><td rowspan="2">NPO</td><td rowspan="3">Should be within the specified tolerance</td><td>Capacitance</td><td>Measuring Frequency</td><td>Measuring Voltage</td></tr>
<tr><td>≤1000pF</td><td>1MHZ±10%</td><td>1.0±0.2Vrms</td></tr>
<tr><td>X7R
X5R</td><td>＞1000 pF</td><td>1KHZ±10%</td><td>1.0±0.2Vrms</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3">Test Temperature: 25℃±3℃
Test Frequency: 1KHZ±10%
Test Voltage: 1.0±0.2Vrms</td></tr>
<tr><td rowspan="6">(DF, tanδ)
Dissipation Factor</td><td rowspan="4">NPO</td><td>DF</td><td>Capacitance</td><td>Measuring Frequency</td><td>Measuring Voltage</td></tr>
<tr><td>≤0.56%</td><td>Cr＜5 pF</td><td>1MHZ±10%</td><td>1.0±0.2Vrms</td></tr>
<tr><td>1.5[(150/Cr)+7]×10^{-4}</td><td>5pF≤Cr＜50pF</td><td>1MHZ±10%</td><td>1.0±0.2Vrms</td></tr>
<tr><td>≤0.15%</td><td>50pF≤Cr≤1000pF</td><td>1MHZ±10%</td><td>1.0±0.2Vrms</td></tr>
<tr><td rowspan="2">X7R</td><td>≤0.15%</td><td>＞1000pF</td><td>1KHZ±10%</td><td>1.0±0.2Vrms</td></tr>
<tr><td>≥50V</td><td colspan="3" rowspan="2">C≤10μF
Test Frequency: 1KHZ±10%
Test Voltage: 1.0±0.2Vrms</td></tr>
<tr><td></td><td>≤2.5%</td></tr>
<tr><td rowspan="2">Insulation
Resistance</td><td>NPO</td><td>C≤10 nF, Ri≥50000MΩ
C＞10 nF, Ri•CR≥500S</td><td colspan="3" rowspan="2">Measuring Voltage: Rated Voltage（Max 500V）
Duration: 60±5s
Test Humidity: ≤75%
Test Temperature: 25℃±3℃
Test Current: ≤50mA</td></tr>
<tr><td>X7R</td><td>C≤25 nF, Ri≥ 10000MΩ
C＞25 nF, Ri•CR＞100S</td></tr>
<tr><td>Dielectric
Withstanding
Voltage</td><td colspan="2">No defects or abnormalities</td><td colspan="3">100V≤Vr＜500V
50mA/ Force 200% Rated voltage for 5 second.
Max current should not exceed 50 mA
Vr＝ 500V
50mA/ Force 150% Rated voltage for 5 second.
Max current should not exceed 50 mA.</td></tr>
<tr><td rowspan="2">Solderability</td><td colspan="2" rowspan="2">At least 95% of the terminal electrode is covered by new solder.
Visual Appearance: No visible damage.</td><td colspan="3">Preheating conditions:80 to 120℃; 10~30s.</td></tr>
<tr><td colspan="2">Lead solder:（Sn/Pb：63/37）
Solder Temperature:235±5℃
Duration: 2±0.5s</td><td>Lead-free solder:
Solder Temperature: 245±5℃
Duration: 2±0.5</td></tr>
<tr><td>Resistance to
Soldering Heat</td><td colspan="2"><table><tr><td>Item</td><td>NPO</td><td>X7R</td></tr><tr><td>ΔC/C</td><td>≤±0.5% or ±0.5pF，whichever larger</td><td>-5~+10%</td></tr><tr><td>DF</td><td colspan="2">Same to initial value</td></tr><tr><td>IR</td><td colspan="2">Same to initial value</td></tr></table>Appearance：No visible damage.At least 95% of the terminal electrode is covered by new solder.</td><td colspan="3">Preheating conditions: 100 to 200℃;10±2min.
Solder Temperature: 265±5℃
Duration: 10±1s
Clean the capacitor with solvent and examine it with a 10X(min.) microscope.
Recovery Time: 24±2h
Recovery condition: Room temperature</td></tr>
<tr><td>Resistance to
Flexure of Substrate
(Bending Strength)</td><td colspan="2">Appearance: No visible damage.
ΔC/C: ≤±10%</td><td colspan="3">Test Board: Al2O3 or PCB
Warp: 1mm
Speed: 0.5mm/sec.
Unit: mm
The measurement should be made with the board in the bending position.</td></tr>
<tr><td>Termination
Adhesion</td><td colspan="2">No visible damage</td><td colspan="3">Applied Force: 5N
Duration: 10±1S</td></tr>
<tr><td>Temperature
Cycle</td><td colspan="2">ΔC/C:
Class Ⅰ: ≤±1% or ±1pF, whichever is larger.
Class Ⅱ: B: ≤±10%</td><td colspan="3">Preheating conditions: up-category temperature, 1h
Recovery time: 24±1h
Initial Measurement
Cycling Times: 5 times, 1 cycle, 4 steps:<table><tr><th>Step</th><th>Temperature（℃）</th><th>Time (min.)</th></tr><tr><td>1</td><td>Low- category temp. (NPO/X7R: -55)</td><td>30</td></tr><tr><td>2</td><td>Normal temp. (+20)</td><td>2～3</td></tr><tr><td>3</td><td>Up- category temp. (NPO/X7R: +125)</td><td>30</td></tr><tr><td>4</td><td>Normal temp. (+20)</td><td>2～3</td></tr></table>Recovery time after test: 24±2h</td></tr>
</table>

Item	Requirement		Test Method
Moisture Resistance	△C/C	NPO: ≤±2% or ±1pF,whichever is larger. X7R: ≤±10%	Temperature：40±2℃ Humidity：90~95%RH Duration：500h Recovery conditions：Room temperature Recovery Time：24h (Class1) or 48h (Class2)
	DF	Not more than twice of initial value.	
	IR	Class Ⅰ:Ri≥2500MΩ or Ri•CR≥25S whichever is smaller Class Ⅱ:Ri≥1000MΩor Ri•CR≥25S whichever is smaller	
	Appearance: No visible damage		
Life Test	△C/C	Class Ⅰ:≤±2% or ±1pF, whichever is larger. X7R: ≤±20%	1.2 Multiple Duration: 1000h Charge/ Discharge Current: 50mA max. Temperature：125℃（NPO X7R）; Recovery Conditions: Room Temperature Recovery Time: 24h (Class 1), or 48h (Class2)
	DF	Not more than twice of initial value	
	IR	Class Ⅰ: Ri≥4000MΩ orRi•CR≥40S whichever is smaller. Class Ⅱ: Ri≥2000MΩ or Ri•CR≥50S whichever is smaller.	
	Visual Appearance: No visible damage		

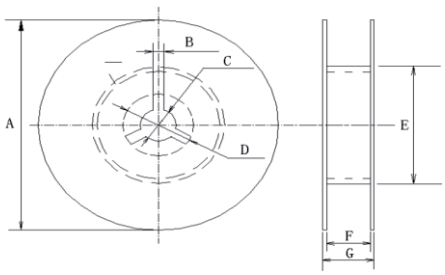
■Storage Temperature: 5~40℃; Humidity: 20~70%RH

■Packaging

Packaging Quantity

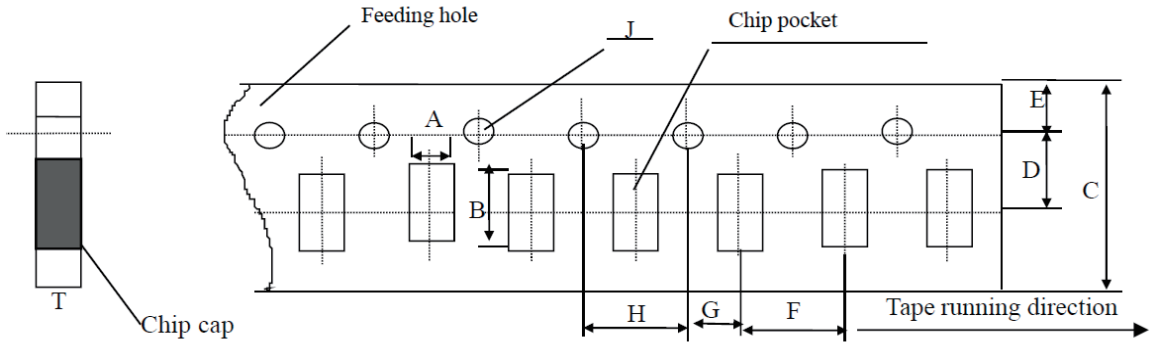
Type	Packaging (7" Reel)	
	Paper tape	Plastic tape
0603	4K	-
0805	4K	3K
1206	4K	T≦1.35mm 3K T>1.35mm 2K
1210	-	T≦1.80mm 2K T>1.80mm 1K
1812	-	T≦1.85mm 1K T>1.85mm 0.5K

Tape and Reel



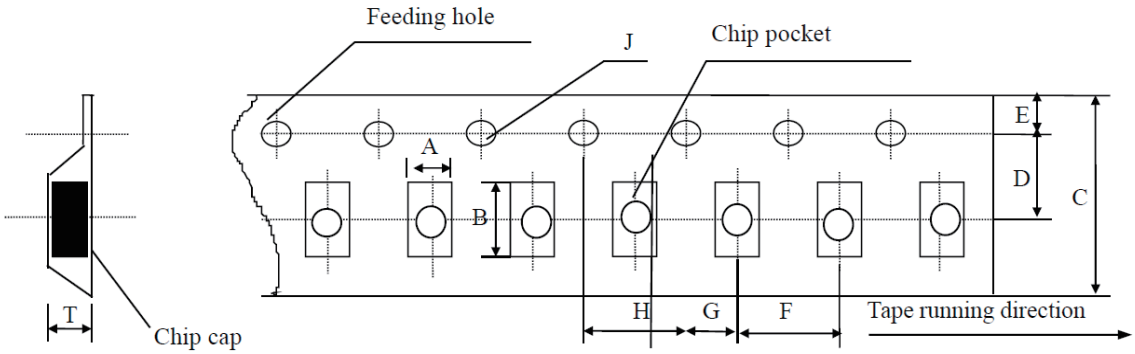
Type	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)
0603	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
0805	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1206	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1210	178±2.0(7")	3.0	13.0±0.5	21.0±0.8	50 or more	10.0±1.5	12 max
1812	330±2.0(13")	3.0	13.0±0.5	21.0±0.8	50 or more	12.6 max	13.6 max

Paper Tape Size Specification



Type	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	J (mm)	T (mm)
0603	1.10 ±0.10	1.90 ±0.10	8.00 ±0.10	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.10 max
0805	1.45 ±0.15	2.30 ±0.15	8.00 ±0.15	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.10 max
1206	1.80 ±0.20	3.40 ±0.20	8.00 ±0.20	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.10 max

Plastic Tape Size Specification



Type	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	J (mm)	T (mm)
0805	1.55 ±0.20	2.35 ±0.20	8.00 ±0.20	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.50 max
1206	1.95 ±0.20	3.60 ±0.20	8.00 ±0.20	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.10	4.00 ±0.10	1.50 -0/+0.10	1.85 Max
1210	2.70 ±0.10	3.42 ±0.10	8.00 ±0.10	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.05	4.00 ±0.10	1.55 -0/+0.10	3.20 max
1812	3.66 ±0.10	4.95 ±0.10	12.00 ±0.10	5.50 ±0.05	1.75 ±0.10	8.00 ±0.10	2.00 ±0.05	4.00 ±0.10	1.55 -0/+0.10	4.00 max

■Recommended Soldering Method

Type	Dielectric	Capacitance	Soldering Method
0603	NPO	---	R / W
	X7R/X5R	C≧1uF	R
		C<1uF	R / W
0805	NPO	---	R / W
	X7R/X5R	C≧4.7uF	R
		C<4.7uF	R / W
1206	NPO	---	R / W
	X7R/X5R	C≧10uF	R
		C<10uF	R / W
≧1210	NPO	---	R
	X7R/X5R	---	R

Soldering method：R－Reflow Soldering ; W－Wave Soldering

Supercapacitor – SC Series

■Features

■For Lithium Ion Type

- —Ultra-low self-discharge, high capacity (10 times the same volume of EDLC)
- —High operating voltage (3.8V); operating temperature range-40℃ ~ +70℃
- —High operating voltage (4.2V); operating temperature range-40℃ ~ +65℃
- —Green environmental protection，high security, reliability and maintenance-free

Coin Type

Lithium Ion Type

■For Cylindrical Type / Coin Type / Combined Type

- —Low internal resistance and high power density
- —Self-discharge rate is small, 72 hours self-discharge<20%
- —Excellent cycle life, the coulomb efficiency is more than 95%
- —Wide operating temperature ranges
- —Green, meet RoHS requirements

Cylindrical Type

Combined Type

■Applications

■For Lithium Ion Type

- —Internet of Things terminal GPS positioning and communication power supply，NB IOT/Pulse power supply
- —Electric Tool/ETC/Quick Charge power
- —Primary or backup power supply，Intelligent water、electricity and gas meter, automotive electronics, etc.

■For Cylindrical Type / Coin Type / Combined Type

- —Intelligent instrument, automobile data recorder, illumination lamp, smart home, industrial control
- —Fiscal cash register, digital camera, power tools, electric toy, emergency power supply
- —Wireless energy saving mouse, wireless handwriting board, SSD solid state drive, medical equipment.

■Product Identification

SC	2V7	L	105	M		-1
Product Type	Rated Voltage	Shape Type	Capacitance	Capacitance Tolerance	Series Code	Special
	2V7: 2.7V 3V0: 3.0V 3V6: 3.6V 3V8: 3.8V 4V2: 4.2V 5V5: 5.5V 6V0: 6.0V	C: Coin & C Type H: Coin & H Type V: Coin & V Type M: Lithium Ion Type L: Cylindrical & Radial Type Z: Combined Type	104: 0.1F 105: 1F 106: 10F 127: 120F	M: ±20% Z: +80/-20% 9 :+30/-10%	: Standard LR: Low ESR V: High Voltage H: High Temperature	

■Standard Coin Type Supercapacitor

Specifications Value of Product：Coin & C Type

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR 1kHz@25℃ (Ω)	Nominal Current (25℃, A)	Leakage Current (25℃24h, mA)	Max. stored energy (mWh)	Energy Density (Wh/kg)
SC5V5C104Z	5.5	0.10	+80%/-20%	50	0.05	0.003	0.42	0.13
SC5V5C224Z	5.5	0.22	+80%/-20%	50	0.12	0.003	0.92	0.29
SC5V5C334Z	5.5	0.33	+80%/-20%	50	0.18	0.004	1.39	0.43
SC5V5C474Z	5.5	0.47	+80%/-20%	40	0.26	0.004	1.97	0.61
SC5V5C684Z	5.5	0.68	+80%/-20%	30	0.37	0.006	2.86	0.38
SC5V5C105Z	5.5	1.00	+80%/-20%	15	0.55	0.006	4.20	0.52
SC5V5C155Z	5.5	1.50	+80%/-20%	15	0.82	0.010	6.30	0.70

Specifications Value of Product：Coin & H Type

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR AC 25℃ (Ω)	Leakage Current (25℃24h, mA)	Test Current (mA)	Max. stored energy (mWh)
SC5V5H104Z	5.5	0.10	+80%/-20%	50	0.003	1.0	0.42
SC5V5H224Z	5.5	0.22	+80%/-20%	50	0.003	2.2	0.92
SC5V5H334Z	5.5	0.33	+80%/-20%	50	0.004	3.3	1.39
SC5V5H474Z	5.5	0.47	+80%/-20%	40	0.004	4.7	1.97
SC5V5H684Z	5.5	0.68	+80%/-20%	30	0.006	6.8	2.86
SC5V5H105Z	5.5	1.00	+80%/-20%	15	0.006	10	4.20
SC5V5H155Z	5.5	1.50	+80%/-20%	15	0.010	15	6.30

Specifications Value of Product：Coin & V Type

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR 1kHz@25℃ (Ω)	Nominal Current (25℃, A)	Leakage Current (25℃24h, mA)	Max. stored energy (mWh)	Energy Density (Wh/kg)
SC5V5V104Z	5.5	0.10	+80%/-20%	50	0.05	0.003	0.42	0.28
SC5V5V224Z	5.5	0.22	+80%/-20%	50	0.12	0.003	0.92	0.61
SC5V5V334Z	5.5	0.33	+80%/-20%	50	0.18	0.004	1.39	0.91
SC5V5V474Z	5.5	0.47	+80%/-20%	40	0.26	0.004	1.97	1.32
SC5V5V684Z	5.5	0.68	+80%/-20%	30	0.37	0.006	2.86	0.49
SC5V5V105Z	5.5	1.00	+80%/-20%	15	0.55	0.006	4.20	0.72
SC5V5V155Z	5.5	1.50	+80%/-20%	15	0.82	0.010	6.30	1.09

■Body color：≤0.47F Gold；＞0.47F Black

Dimensions & Packaging Quantity

Fig.1

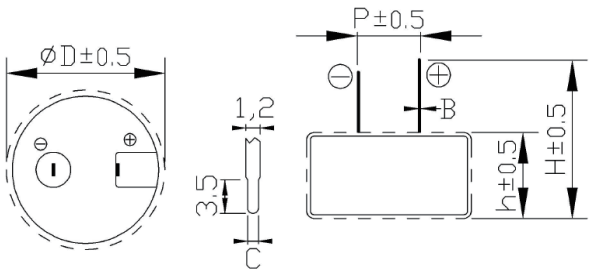


Fig.2

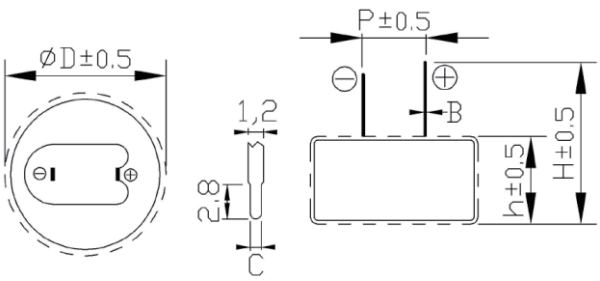


Fig.3

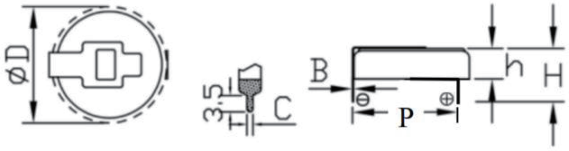


Fig.4

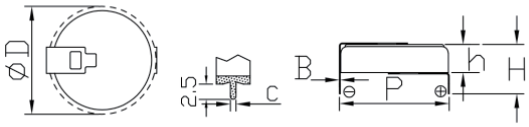


Fig.5

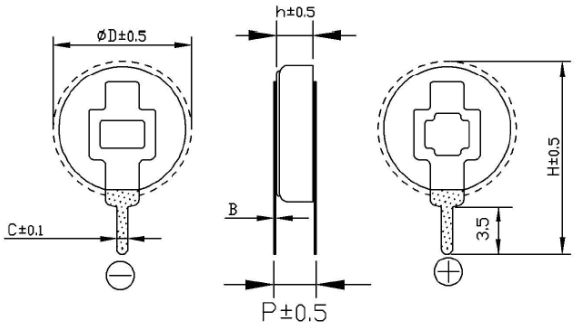
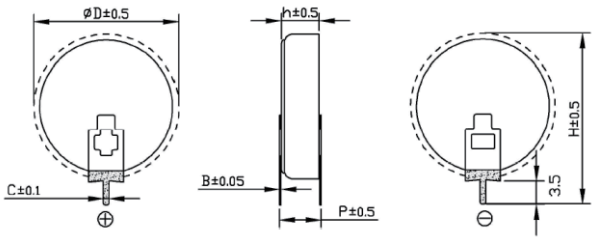


Fig.6



Part No.	Figure	D (mm)	P (mm)	C (mm)	h (mm)	H (mm)	B (mm)	Quantity (EA)
								Plastic Tray
SC5V5C104Z	2	13.2±0.5	5.0±0.5	0.8±0.10	7.0±0.5	13.0±1.0	0.4±0.10	117
SC5V5C224Z	2	13.2±0.5	5.0±0.5	0.8±0.10	7.0±0.5	13.0±1.0	0.4±0.10	117
SC5V5C334Z	2	13.2±0.5	5.0±0.5	0.8±0.10	7.0±0.5	13.0±1.0	0.4±0.10	117
SC5V5C474Z	2	13.2±0.5	5.0±0.5	0.8±0.10	7.0±0.5	13.0±1.0	0.4±0.10	117
SC5V5C684Z	1	21.0±0.5	5.5±0.5	0.8±0.15	7.5±0.5	12.5±1.0	0.5±0.10	70
SC5V5C105Z	1	21.0±0.5	5.5±0.5	0.8±0.15	7.5±0.5	12.5±1.0	0.5±0.10	70
SC5V5C155Z	1	21.0±0.5	5.5±0.5	0.8±0.15	7.5±0.5	12.5±1.0	0.5±0.10	70
SC5V5H104Z	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	168
SC5V5H224Z	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	168
SC5V5H334Z	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	168
SC5V5H474Z	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	168
SC5V5H684Z	4	19.2±0.5	19.5±0.5	1.0±0.10	4.8±0.5	9.5±1.0	0.20±0.05	70
SC5V5H105Z	4	19.2±0.5	19.5±0.5	1.0±0.10	4.8±0.5	9.5±1.0	0.20±0.05	70
SC5V5H155Z	4	19.2±0.5	19.5±0.5	1.0±0.10	4.8±0.5	9.5±1.0	0.20±0.05	70
SC5V5V104Z	5	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	196
SC5V5V224Z	5	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	196
SC5V5V334Z	5	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	196
SC5V5V474Z	5	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	196
SC5V5V684Z	6	19.2±0.5	5.0±0.5	1.0±0.10	4.8±0.5	24.0±0.5	0.20±0.05	70
SC5V5V105Z	6	19.2±0.5	5.0±0.5	1.0±0.10	4.8±0.5	24.0±0.5	0.20±0.05	70
SC5V5V155Z	6	19.2±0.5	5.0±0.5	1.0±0.10	4.8±0.5	24.0±0.5	0.20±0.05	70

■Environmental Characteristics

Item	Requirement			Test Condition
Category Temperature Range	-25°C ~+70°C			
Rated Operating Voltage	5.5V DC			
Characteristics in different temperature	Step 2	△C	Less than or equal to 30% of the initial value	Step 1：+25℃±2℃ Step 2：-25℃±2℃ Step 3：+70℃±2℃ Step 4：+25℃±2℃
		ESR	Less than or equal to 400% of the initial value	
	Step 3	△C	Less than or equal to 30% of the initial value	
		ESR	Less than or equal to the initial value	
	Step 4	△C	Satisfies the range of 20% of the initial rating	
		ESR	Satisfies the initial value	
Endurance	△C		Less than or equal to 30% of the initial value	Applied voltage：Rated voltage Temperature：Upper limit temperature Time：1000h
	ESR		Less than or equal to 4 times the initial value	
	Appearance		No leakage or mechanical damage	
Cycle life	△C		Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR		Less than or equal to 3 times the initial value	
Humidity Characteristics	△C		Satisfies the range of 30% of the initial rating	Temperature：+40℃±2℃ Relative humidity：90~95%RH Test time：240h
	ESR		Less than or equal to 4 times the initial value	
	Appearance		No leakage or mechanical damage	
Temperature cycle	△C		Less than or equal to 10% of the initial value	Temperature cycle：Lower limit temperature →normal temperature →Upper limit temperature →normal temperature Cycles：5
	Appearance		No mechanical damage or leakage	
Low temperature storage characteristics	△C		Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：Lower limit temperature Time：96h
	ESR		Less than or equal to 2 times the initial value	
	Appearance		No leakage or mechanical damage	
High temperature storage characteristics	△C		Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：Upper limit temperature Time：96h
	ESR		Less than or equal to 2 times the initial value	
	Appearance		No leakage or mechanical damage	
Self discharge characteristics (voltage holding characteristics)	Voltage between positive and negative poles≥80%U_R			Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25 ℃, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet			
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer			

■Storage Temperature: -30~50℃; Relative Humidity:<60%RH, Max. Humidity<85%RH

■Citation standards:IEC62391-1 &DL/T 1652-2016

■High Temperature Coin Type Supercapacitor

Specifications Value of Product：Coin & C Type (3.6V)

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR 1kHz@25℃ (Ω)	Nominal Current (25℃, A)	Leakage Current (25℃24h, mA)	Max. stored energy (mWh)	Energy Density (Wh/kg)
SC3V6C224ZH	3.6	0.22	+80%/-20%	50	0.008	0.003	0.40	0.12

Specifications Value of Product：Coin & C Type (5.5V)

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR AC 25℃ (Ω)	Leakage Current (25℃24h, mA)	Test Current (mA)	Max. stored energy (mWh)	Energy Density (Wh/kg)
SC5V5C104ZH	5.5	0.10	+80%/-20%	50	0.003	1.0	0.42	0.13
SC5V5C224ZH	5.5	0.22	+80%/-20%	50	0.003	2.2	0.92	0.29
SC5V5C334ZH	5.5	0.33	+80%/-20%	50	0.004	3.3	1.39	0.43
SC5V5C474ZH	5.5	0.47	+80%/-20%	50	0.004	4.7	1.97	0.61
SC5V5C684ZH	5.5	0.68	+80%/-20%	30	0.006	6.8	2.86	0.38
SC5V5C105ZH	5.5	1.00	+80%/-20%	15	0.006	10	4.20	0.52
SC5V5C155ZH	5.5	1.50	+80%/-20%	15	0.010	15	6.30	0.71

Specifications Value of Product：Coin & H Type (3.6V)

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR 1kHz@25℃ (Ω)	Nominal Current (25℃, A)	Leakage Current (25℃24h, mA)	Max. stored energy (mWh)	Energy Density (Wh/kg)
SC3V6H224ZH	3.6	0.22	+80%/-20%	50	0.08	0.003	0.40	0.26
SC3V6H105ZH	3.6	1.00	+80%/-20%	15	0.36	0.006	1.80	0.43
SC3V6H155ZH	3.6	1.50	+80%/-20%	15	0.54	0.010	2.70	0.60

Specifications Value of Product：Coin & H Type (5.5V)

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR AC 25℃ (Ω)	Leakage Current (25℃24h, mA)	Test Current (mA)	Max. stored energy (mWh)
SC5V5H104ZH	5.5	0.10	+80%/-20%	50	0.003	1.0	0.42
SC5V5H224ZH	5.5	0.22	+80%/-20%	50	0.003	2.2	0.92
SC5V5H334ZH	5.5	0.33	+80%/-20%	50	0.004	3.3	1.39
SC5V5H474ZH	5.5	0.47	+80%/-20%	50	0.004	4.7	1.97
SC5V5H684ZH	5.5	0.68	+80%/-20%	30	0.006	6.8	2.86
SC5V5H105ZH	5.5	1.00	+80%/-20%	15	0.006	10	4.20
SC5V5H155ZH	5.5	1.50	+80%/-20%	15	0.010	15	6.30

Specifications Value of Product：Coin & V Type (3.6V)

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR 1kHz@25℃ (Ω)	Nominal Current (25℃, A)	Leakage Current (25℃24h, mA)	Max. stored energy (mWh)	Energy Density (Wh/kg)
SC3V6V224ZH	3.6	0.22	+80%/-20%	50	-	0.003	0.40	-
SC3V6V105ZH	3.6	1.00	+80%/-20%	15	0.36	0.006	1.80	0.43

Specifications Value of Product：Coin & V Type (5.5V)

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max ESR AC 25℃ (Ω)	Leakage Current (25℃24h, mA)	Test Current (mA)	Max. stored energy (mWh)	Energy Density (Wh/kg)
SC5V5V104ZH	5.5	0.10	+80%/-20%	50	0.003	1.0	0.42	0.28
SC5V5V224ZH	5.5	0.22	+80%/-20%	50	0.003	2.2	0.92	0.61
SC5V5V334ZH	5.5	0.33	+80%/-20%	50	0.004	3.3	1.39	0.91
SC5V5V474ZH	5.5	0.47	+80%/-20%	50	0.004	4.7	1.97	1.32
SC5V5V684ZH	5.5	0.68	+80%/-20%	30	0.006	6.8	2.86	0.41
SC5V5V105ZH	5.5	1.00	+80%/-20%	15	0.006	10	4.20	0.61
SC5V5V155ZH	5.5	1.50	+80%/-20%	15	0.010	15	6.30	0.91

■Body color：≤0.47F Gold；＞0.47F Black

Dimensions & Packaging Quantity

Fig.1

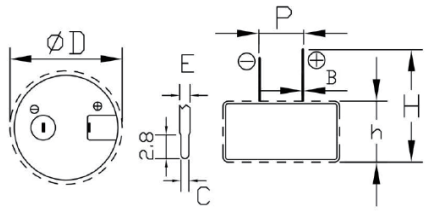


Fig.2

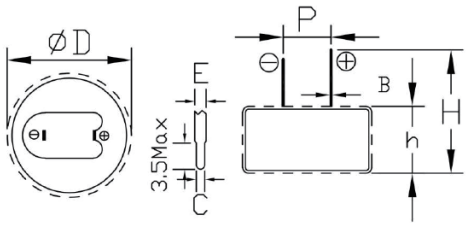


Fig.3

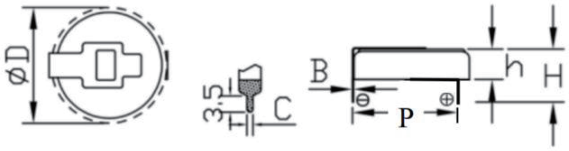


Fig.4

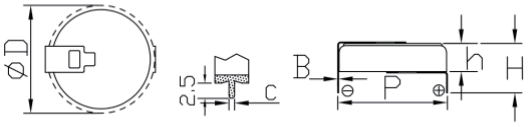


Fig.5

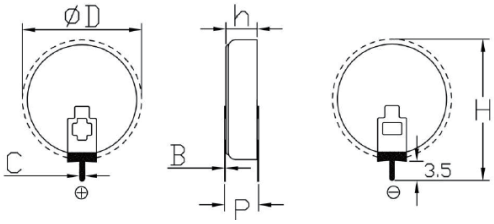
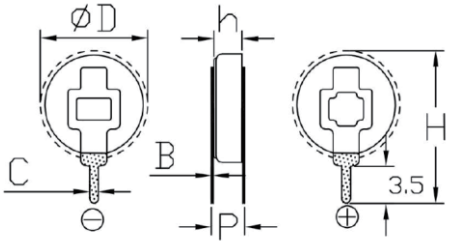


Fig.6



Part No.	Figure	D (mm)	P (mm)	C (mm)	h (mm)	H (mm)	B (mm)	E (mm)	Quantity (EA)
									Plastic Tray
SC3V6C224ZH	2	13.2±0.5	5.0±0.5	0.8±0.10	7.0±0.5	13.0±1.0	0.40±0.10	-	117
SC5V5C104ZH	2	13.2±0.5	5.0±0.5	0.8±0.10	7.0±0.5	13.0±1.0	0.40±0.10	1.0±0.2	117
SC5V5C224ZH	2	13.2±0.5	5.0±0.5	0.8±0.10	7.0±0.5	13.0±1.0	0.40±0.10	1.0±0.2	117
SC5V5C334ZH	2	13.2±0.5	5.0±0.5	0.8±0.10	7.0±0.5	13.0±1.0	0.40±0.10	1.0±0.2	117
SC5V5C474ZH	2	13.2±0.5	5.0±0.5	0.9±0.15	7.0±0.5	13.0±0.5	0.40±0.10	1.0±0.2	117
SC5V5C684ZH	1	21.0±0.5	5.5±0.5	0.8±0.10	7.5±0.5	12.5±1.0	0.50±0.10	1.1±0.2	70
SC5V5C105ZH	1	21.0±0.5	5.5±0.5	0.8±0.10	7.5±0.5	12.5±1.0	0.50±0.10	1.1±0.2	70
SC5V5C155ZH	1	21.0±0.5	5.5±0.5	0.8±0.10	7.5±0.5	12.5±1.0	0.50±0.10	1.1±0.2	70
SC3V6H224ZH	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	-	168
SC3V6H105ZH	4	19.2±0.5	19.5±0.5	1.0±0.10	4.8±0.5	9.5±1.0	0.20±0.05	-	70
SC3V6H155ZH	4	19.2±0.5	19.5±0.5	1.0±0.10	4.8±0.5	9.5±1.0	0.20±0.05	-	70
SC5V5H104ZH	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	-	168
SC5V5H224ZH	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	-	168
SC5V5H334ZH	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	-	168
SC5V5H474ZH	3	12.0±0.5	10.0±0.5	0.8±0.10	4.8±0.5	10.0±1.0	0.20±0.05	-	168
SC5V5H684ZH	4	19.2±0.5	19.5±0.5	1.0±0.10	4.8±0.5	9.5±1.0	0.20±0.05	-	70
SC5V5H105ZH	4	19.2±0.5	19.5±0.5	1.0±0.10	4.8±0.5	9.5±1.0	0.20±0.05	-	70
SC5V5H155ZH	4	19.2±0.5	19.5±0.5	1.0±0.10	4.8±0.5	9.5±1.0	0.20±0.05	-	70
SC3V6V224ZH	6	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	-	196
SC3V6V105ZH	5	19.2±0.5	5.0±0.5	1.0±0.10	4.8±0.5	24.0±0.5	0.20±0.05	-	70
SC5V5V104ZH	6	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	-	168 / 196
SC5V5V224ZH	6	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	-	196
SC5V5V334ZH	6	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	-	196
SC5V5V474ZH	6	12.0±0.5	5.0±0.5	0.8±0.10	4.8±0.5	16.2±0.5	0.20±0.05	-	196
SC5V5V684ZH	5	19.2±0.5	5.0±0.5	1.0±0.10	4.8±0.5	24.0±0.5	0.20±0.05	-	70
SC5V5V105ZH	5	19.2±0.5	5.0±0.5	1.0±0.10	4.8±0.5	24.0±0.5	0.20±0.05	-	70
SC5V5V155ZH	5	19.2±0.5	5.0±0.5	1.0±0.10	4.8±0.5	24.0±0.5	0.20±0.05	-	70

■Environmental Characteristics

Item	Requirement		Test Condition
Category Temperature Range	-40°C ~+85°C		
Rated Operating Voltage	3.6V DC , 5.0V DC		
High Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 16h and test in this environment.
	ESR	Less than or equal to the initial value	
	Appearance	No leakage or mechanical damage	
Low Temperature Characteristics	△C	Less than or equal to 50% of the initial value	Place in the lower operating temperature environment for 2h and test in this environment.
	ESR	Less than or equal to 7 times the initial value	
	Appearance	No leakage or mechanical damage	
Endurance	△C	Less than or equal to 30% of the initial value	Applied voltage：Rated voltage Temperature：Upper limit temperature Time：1000h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Cycle life	△C	Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR	Less than or equal to 3 times the initial value	
Humidity Characteristics	△C	Satisfies the range of 30% of the initial rating	Temperature：+40℃±2℃ Relative humidity：90~95%RH Test time：240h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Temperature cycle	△C	Less than or equal to 10% of the initial value	Temperature cycle：Lower limit temperature → normal Temperature →Upper limit temperature → normal temperature Cycles：5
	Appearance	No mechanical damage or leakage	
Low temperature storage characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：Upper limit temperature Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
High temperature storage characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：Upper limit temperature Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
Self discharge characteristics (voltage holding characteristics)	Voltage between positive and negative poles≥80% U_R		Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25 ℃, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet		
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer		

■Storage Temperature: -30~50℃; Relative Humidity:<60%RH, Max. Humidity<85%RH

■Citation standards:IEC62391-1 &DL/T 1652-2016

■Lithium Ion Type Supercapacitor

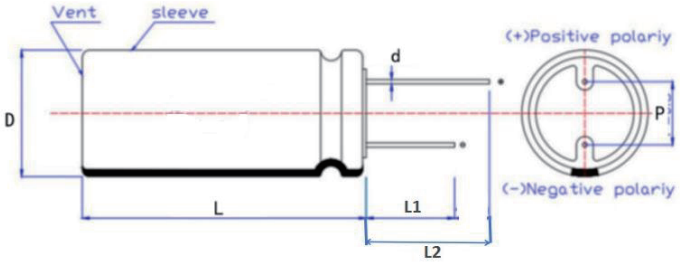
Specifications Value of Standard Product

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	MAX ESR AC,@1KHz (mΩ)	Max Discharge Current (A)	Pulse Current (<1s, A)	Store energy （mWh）	Sizs DxL (mm)
SC3V8M206Z	3.8	20	+80%/-20%	500	0.10	0.8	40.11	8.0x13.0
SC3V8M306Z	3.8	30	+80%/-20%	250	0.20	2.0	60.17	8.0x20.0
SC3V8M306Z-1	3.8	30	+80%/-20%	250	0.15	1.0	60.17	10.0x13.5
SC3V8M406Z	3.8	40	+80%/-20%	200	0.20	2.0	80.22	8.0x20.0
SC3V8M406Z-1	3.8	40	+80%/-20%	200	0.20	2.0	80.22	10.0x13.5
SC3V8M506Z	3.8	50	+80%/-20%	250	0.20	2.5	100.28	8.0x25.0
SC3V8M706Z	3.8	70	+80%/-20%	175	0.25	2.5	140.39	12.5x13.0
SC3V8M706Z-1	3.8	70	+80%/-20%	250	0.50	2.5	140.39	8.0x25.0
SC3V8M806Z	3.8	80	+80%/-20%	150	0.25	3.5	160.44	10.0x20.0
SC3V8M127Z-2	3.8	120	+80%/-20%	100	0.50	6.0	240.67	10.0x30.0
SC3V8M127Z-3	3.8	120	+80%/-20%	100	0.50	5.0	240.67	12.5x20.0
SC3V8M257Z	3.8	250	+80%/-20%	50	0.80	9.0	501.39	12.5x35.0
SC3V8M257Z-1	3.8	250	+80%/-20%	50	1.00	7.0	501.39	16.0x21.0
SC3V8M307Z	3.8	300	+80%/-20%	50	1.00	10	601.67	12.5x40.0
SC3V8M507Z	3.8	500	+80%/-20%	40	2.00	16	1002.78	16.0x41.0
SC3V8M757Z	3.8	750	+80%/-20%	35	3.00	16	1504.17	18.0x41.0
SC3V8M108Z	3.8	1000	+80%/-20%	35	6.00	20	2005.56	18.0x41.0

■Body color：Green

■Test current I(mA)=5xC_Rx (U_R-U_{min})/3.6

Dimensions & Packaging Quantity



Part No.	D (mm)	L (mm)	P (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity (EA)
							Plastic Tray
SC3V8M206Z	8±1.5	13±1.5	3.5±0.5	0.6±0.1	22.5±1.5	28.5±1.5	50
SC3V8M306Z	8±1.5	20±1.5	3.5±0.5	0.6±0.1	21.0±1.5	27.0±1.5	50
SC3V8M306Z-1	10±1.5	13.5±1.5	5.0±0.5	0.6±0.1	23.0±1.5	28.5±1.5	50
SC3V8M406Z	8±1.5	20±1.5	3.5±0.5	0.6±0.1	21.0±1.5	27.0±1.5	50
SC3V8M406Z-1	10±1.5	13.5±1.5	5.0±0.5	0.6±0.1	23.0±1.5	28.5±1.5	50
SC3V8M506Z	8±1.5	25±1.5	3.5±0.5	0.6±0.1	20.0±1.5	26.0±1.5	60
SC3V8M706Z	12.5±1.5	13±1.5	5.0±0.5	0.6±0.1	23.0±1.5	29.0±1.5	50
SC3V8M706Z-1	8±1.5	25±1.5	3.5±0.5	0.6±0.1	20.0±1.5	26.0±1.5	60
SC3V8M806Z	10±1.5	20±1.5	5.0±0.5	0.6±0.1	21.0±1.5	27.0±1.5	40
SC3V8M127Z-2	10±1.5	30±1.5	5.0±0.5	0.6±0.1	20.0±1.5	26.0±1.5	40
SC3V8M127Z-3	12.5±1.5	20±1.5	5.0±0.5	0.6±0.1	20.5±1.5	26.5±1.5	60
SC3V8M257Z	12.5±1.5	35±1.5	5.0±0.5	0.6±0.1	20.5±1.5	27.0±1.5	40
SC3V8M257Z-1	16.0±1.5	21±1.5	7.5±0.5	0.8±0.1	22.5±1.5	25.5±1.5	60
SC3V8M307Z	12.5±1.5	40±1.5	5.0±0.5	0.6±0.1	20.0±1.5	26.5±1.5	40
SC3V8M507Z	16.0±1.5	41±1.5	7.5±0.5	0.8±0.1	24.0±1.5	28.5±1.5	40
SC3V8M757Z	18.0±1.5	41±1.5	7.5±0.5	0.8±0.1	25.0±1.5	27.5±1.5	40
SC3V8M108Z	18.0±1.5	41±1.5	7.5±0.5	0.8±0.1	25.0±1.5	27.5±1.5	40

■Environmental Characteristics

Item	Requirement	Test Condition
Category temperature range	-40°C ~+70°C	
Minimum Voltage	2.5V	
Capacitance Tolerance	+80% ~ -20%	
Optimum storage condition	-10°C ~ 50°C, ≦65%RH	
Cycle life	≥100000 times	Capacitors charge/discharge 100000 times between 3.0V and 3.8V under constant current at 25°C
	Capacity Change≦30% of the initial value ESR is less than 4 times of the specified value..	
Low Temperature Characteristics	Capacitiy Change ≤50% of the value at 25°C. ESR is less than 20 times of the specified value	Tmin±2℃, 2h
High Temperature Characteristics	Capacitiy Change ≤30% of the value at 25°C. ESR is less than 2 times of the value at 25°C.	Tmax±2℃, 16h
High Temperature Load Life	Capacity Change≦30% of the initial value. ESR is less than 4 times of the specified value. Appearance no remarkable defects.	1000h, 55±2℃ @U_R
High Temperature Storage	Capacity Change≦30% of the initial value. ESR is less than 2 times of the specified value.	1000h, Tmax±2℃, 3.6V, No charging
Humidity Characteristics	Capacity Change≦30% of the initial value. ESR is less than 2 times of the specified value.	240h, 40℃, 90±2%RH

■Lithium Ion Type Supercapacitor

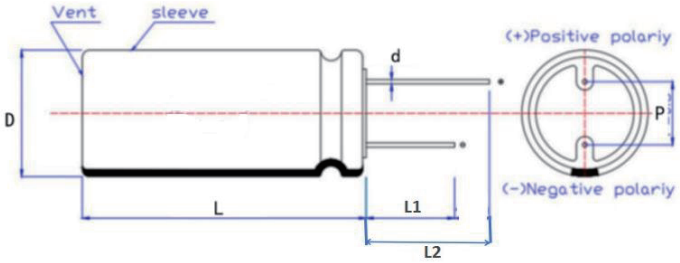
Specifications Value of Standard Product

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	MAX ESR AC,@1KHz (mΩ)	Max Discharge Current (A)	Pulse Current (<1s, A)	Store energy （mWh）	Sizs DxL (mm)
SC4V2M906Z	4.2	90	+80%/-20%	250	0.5	2.5	220.5	8.0x25.0
SC4V2M197Z	4.2	190	+80%/-20%	100	0.9	5.0	465.5	10.0x30.0
SC4V2M257Z	4.2	250	+80%/-20%	100	1.2	6.0	512.5	12.5x20.0
SC4V2M307Z	4.2	300	+80%/-20%	90	2.0	10	735.0	12.5x30.0
SC4V2M407Z	4.2	400	+80%/-20%	80	2.0	10	980.0	16.0x21.0
SC4V2M557Z	4.2	550	+80%/-20%	80	3.0	15	1347.0	12.5x40.0
SC4V2M807Z	4.2	800	+80%/-20%	60	4.0	15	1960.0	16.0x41.0
SC4V2M108Z	4.2	1000	+80%/-20%	35	6.0	20	2450.0	18.0x40.0

■Body color：Green

■Test current I(mA)=5xC_Rx (U_R-U_{min})/3.6

Dimensions & Packaging Quantity



Part No.	D (mm)	L (mm)	P (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity (EA)
							Plastic Tray
SC4V2M906Z	8±1.5	25.0±1.5	3.5±0.5	0.6±0.1	20.0±1.5	26.0±1.5	60
SC4V2M197Z	10±1.5	30±1.5	5.0±0.5	0.6±0.1	20.5±1.5	26.5±1.5	40
SC4V2M257Z	12.5±1.5	20.0±1.5	5.0±0.5	0.6±0.1	20.5±1.5	26.5±1.5	60
SC4V2M307Z	12.5±1.5	30.0±1.5	5.0±0.5	0.6±0.1	20.5±1.5	26.5±1.5	40
SC4V2M407Z	16.0±1.5	21.0±1.5	7.5±0.5	0.8±0.1	22.5±1.5	25.5±1.5	60
SC4V2M557Z	12.5±1.5	40.0±1.5	5.0±0.5	0.6±0.1	20.0±1.5	26.5±1.5	40
SC4V2M807Z	16.0±1.5	41.0±1.5	7.5±0.5	0.8±0.1	24.0±1.5	28.5±1.5	40
SC4V2M108Z	18.0±1.5	41.0±1.5	7.5±0.5	0.8±0.1	25.0±1.5	27.5±1.5	40

■Environmental Characteristics

Item	Requirement	Test Condition
Category temperature range	-40°C ~+65°C	
Minimum Voltage	2.5V	
Capacitance Tolerance	+80% ~ -20%	
Optimum storage condition	-10°C ~ 50°C, ≦65%RH	
Cycle life	≥100000 times	Capacitors charge/discharge 100000 times between 3.0V and 4.2V under constant current at 25°C
	Capacity Change≦30% of the initial value ESR is less than 4 times of the specified value..	
Low Temperature Characteristics	Capacitiy Change ≤50% of the value at 25°C. ESR is less than 20 times of the specified value	Tmin±2℃, 16h
High Temperature Characteristics	Capacitiy Change ≤30% of the value at 25°C. ESR is less than 2 times of the value at 25°C.	Tmax±2℃, 16h
High Temperature Load Life	Capacity Change≦30% of the initial value. ESR is less than 4 times of the specified value. Appearance no remarkable defects.	1000h, 55±2℃ @U_R
High Temperature Storage	Capacity Change≦30% of the initial value. ESR is less than 2 times of the specified value.	1000h, Tmax±2℃, 4.0V, No charging
Humidity Characteristics	Capacity Change≦30% of the initial value. ESR is less than 2 times of the specified value.	240h, 40℃, 90±2%RH

■Standard Cylindrical Type Supercapacitor

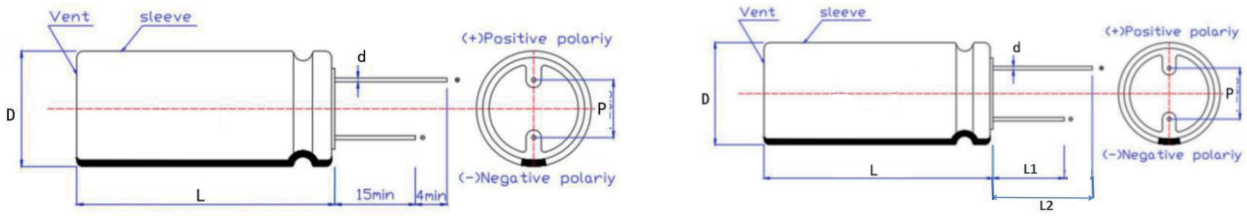
Specifications Value of Standard Product：Cylindrical & Radial Type

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max. ESR 25°C (mΩ)	Maximum Peak Current （25°C <1s, A）	Leakage Current (25°C 72h, mA)	Store energy （mWh）	Sizs DxL (mm)
SC2V7L504M	2.7	0.5	±20%	500	0.54	0.008	0.51	6.3x12.5
SC2V7L105M	2.7	1	±20%	500	0.90	0.008	1.01	6.3x12.5
SC2V7L105M-1	2.7	1	±20%	350	1.00	0.008	1.01	8.0x13.0
SC2V7L155M	2.7	1.5	±20%	500	1.16	0.008	1.52	6.3x12.5
SC2V7L155M-1	2.7	1.5	±20%	350	1.33	0.010	1.52	8.0x13.0
SC2V7L205M	2.7	2	±20%	200	1.99	0.012	2.03	8.0x16.0
SC2V7L205M-1	2.7	2	±20%	240	1.93	0.012	2.03	8.0x13.0
SC2V7L305M	2.7	3	±20%	160	2.98	0.017	3.04	8.0x20.0
SC2V7L335M	2.7	3.3	±20%	160	3.19	0.017	3.34	8.0x20.0
SC2V7L505M	2.7	5	±20%	120	4.82	0.020	5.06	8.0x24.0
SC2V7L505M-1	2.7	5	±20%	120	4.91	0.020	5.06	10.0x20.0
SC2V7L605M	2.7	6	±20%	100	5.59	0.025	6.08	10.0x20.0
SC2V7L705M	2.7	7	±20%	80	6.34	0.030	7.09	10.0x20.0
SC2V7L106M	2.7	10	±20%	65	8.18	0.050	10.13	10.0x25.0
SC2V7L106M-1	2.7	10	±20%	70	7.94	0.050	10.13	12.5x20.0
SC2V7L126M	2.7	12	±20%	65	9.01	0.050	12.15	12.5x20.0
SC2V7L156M	2.7	15	±20%	55	11.10	0.065	15.19	12.5x25.0
SC2V7L206M	2.7	20	±20%	50	14.21	0.080	20.25	12.5x25.0
SC2V7L256M	2.7	25	±20%	45	19.29	0.070	25.31	16.0x25.0
SC2V7L306M	2.7	30	±20%	30	21.32	0.078	30.38	16.0x30.0
SC2V7L406M	2.7	40	±20%	30	25.47	0.088	40.50	18.0x30.0
SC2V7L506M	2.7	50	±20%	25	30.00	0.100	50.63	18.0x40.0
SC2V7L606M	2.7	60	±20%	25	32.40	0.120	60.75	18.0x40.0

■**Maximum Peak Current：Is the current taking 1 sec. to discharge from U_R to 1/2U_R**

■**Body color：Blue**

Dimensions & Packaging Quantity



Part No.	D (mm)	L (mm)	P (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity(EA) Plastic Tray
SC2V7L504M	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC2V7L105M	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC2V7L105M-1	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC2V7L155M	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC2V7L155M-1	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC2V7L205M	8.0±1.0	16.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	140
SC2V7L205M-1	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC2V7L305M	8.0±1.0	20.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	120
SC2V7L335M	8.0±1.0	20.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	120
SC2V7L505M	8.0±1.0	24.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	100
SC2V7L505M-1	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC2V7L605M	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC2V7L705M	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC2V7L106M	10.0±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	80
SC2V7L106M-1	12.5±1.0	20.0±2.0	5.0±0.5	0.6±0.05	23.0±2.0	29.0±2.0	64
SC2V7L126M	12.5±1.0	20.0±2.0	5.0±0.5	0.6±0.05	23.0±2.0	29.0±2.0	64
SC2V7L156M	12.5±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	60
SC2V7L206M	12.5±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	60
SC2V7L256M	16.0±1.0	25.0±3.0	7.5±0.5	0.8±0.05	22.0±2.0	28.0±2.0	50
SC2V7L306M	16.0±1.0	30.0±3.0	7.5±0.5	0.8±0.05	22.0±2.0	28.0±2.0	50
SC2V7L406M	18.0±1.0	30.0±3.0	7.5±0.5	0.8±0.05	-	-	44
SC2V7L506M	18.0±1.0	40.0±3.0	7.5±0.5	0.8±0.05	-	-	26
SC2V7L606M	18.0±1.0	40.0±3.0	7.5±0.5	0.8±0.05	-	-	26

■Environmental Characteristics

Item	Requirement		Test Condition
Category Temperature Range	-40°C~+65°C@2.7V +70°C@2.5V		
Rated Operating Voltage	2.7V DC		
High Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 16h and test in this environment.
	ESR	Less than or equal to the initial value	
	Appearance	No leakage or mechanical damage	
Low Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the lower operating temperature environment for 2h and test in this environment.
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Endurance	△C	Less than or equal to 30% of the initial value	Applied voltage：2.7V Temperature：+65±2°C Time：1000h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Cycle Life	△C	Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR	Less than or equal to 4 times the initial value	
Humidity Characteristics	△C	Satisfies the range of 30% of the initial rating	Temperature：+40±2°C Relative humidity：90~95%RH Test time：240h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Temperature Cycle	△C	Less than or equal to 10% of the initial value	Temperature cycle：-25±2°C → normal temperature →+70±2°C → normal temperature Cycles：5
	Appearance	No mechanical damage or leakage	
Low Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：-40±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
High Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：+70±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
Self Discharge Characteristics	The self-discharge cut-off voltage is greater than or equal to 80% of the rated voltage		Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25°C, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet		DL/T 1652-2016
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer		DL/T 1652-2016

■Storage Temperature: -30~50℃; Relative Humidity:<60%RH, Max. Humidity<85%RH

■Low ESR Cylindrical Type Supercapacitor

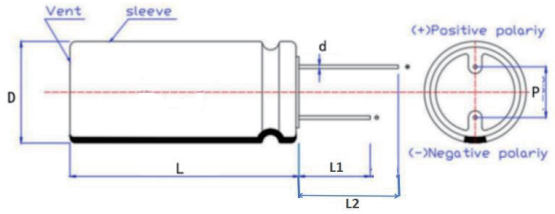
Specifications Value of Product：Cylindrical & Radial Type

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max. ESR 25°C (mΩ)	Maximum Peak Current （25°C <1s, A）	Leakage Current (25°C 72h, mA)	Store energy （mWh）	Sizs DxL (mm)
SC2V7L105MLR	2.7	1	±20%	240	1.12	0.008	1.01	6.3x12.5
SC2V7L105MLR-1	2.7	1	±20%	200	1.12	0.008	1.01	8.0x13.0
SC2V7L205MLR	2.7	2	±20%	160	2.04	0.012	2.03	8.0x13.0
SC2V7L405MLR	2.7	4	±20%	120	3.64	0.015	4.05	8.0x16.0
SC2V7L505MLR	2.7	5	±20%	100	4.50	0.020	5.06	8.0x24.0
SC2V7L505MLR-1	2.7	5	±20%	100	4.50	0.020	5.06	10.0x20.0
SC2V7L705MLR	2.7	7	±20%	60	6.65	0.030	7.09	10.0x20.0
SC2V7L106MLR	2.7	10	±20%	50	9.00	0.050	10.13	10.0x25.0
SC2V7L156MLR	2.7	15	±20%	45	12.08	0.065	15.19	12.5x25.0
SC2V7L206MLR	2.7	20	±20%	30	16.87	0.070	20.25	16.0x25.0

■Maximum Peak Current：Is the current taking 1 sec. to discharge from U_R to 1/2U_R

■Body color：Blue

Dimensions & Packaging Quantity



Part No.	D (mm)	L (mm)	P (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity(EA)
							Plastic Tray
SC2V7L105MLR	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC2V7L105MLR-1	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC2V7L205MLR	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC2V7L405MLR	8.0±1.0	16.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	140
SC2V7L505MLR	8.0±1.0	24.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	100
SC2V7L505MLR-1	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC2V7L705MLR	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC2V7L106MLR	10.0±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	80
SC2V7L156MLR	12.5±1.0	25.0±2.0	5.0±0.5	0.6±0.05	23.0±2.0	29.0±2.0	60
SC2V7L206MLR	16.0±1.0	25.0±3.0	7.5±0.5	0.8±0.05	22.0±2.0	28.0±2.0	50

■Environmental Characteristics

Item	Requirement		Test Condition
Category Temperature Range	-40°C~+65°C@2.7V +70°C@2.5V		
Rated Operating Voltage	2.7V DC		
High Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 16h and test in this environment.
	ESR	Less than or equal to the initial value	
	Appearance	No leakage or mechanical damage	
Low Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the lower operating temperature environment for 2h and test in this environment.
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Endurance	△C	Less than or equal to 30% of the initial value	Applied voltage：2.7V Temperature：+65±2°C Time：1000h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Cycle Life	△C	Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR	Less than or equal to 4 times the initial value	
Humidity Characteristics	△C	Satisfies the range of 30% of the initial rating	Temperature：+40±2°C Relative humidity：90~95%RH Test time：240h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Temperature Cycle	△C	Less than or equal to 10% of the initial value	Temperature cycle：-25±2°C → normal temperature →+70±2°C →normal temperature Cycles：5
	Appearance	No mechanical damage or leakage	
Low Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：-40±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
High Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：+70±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
Self Discharge Characteristics	The self-discharge cut-off voltage is greater than or equal to 80% of the rated voltage		Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25°C, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet		DL/T 1652-2016
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer		DL/T 1652-2016

■Storage Temperature: -30~50℃; Relative Humidity:<60%RH, Max. Humidity<85%RH

■High Voltage Cylindrical Type Supercapacitor

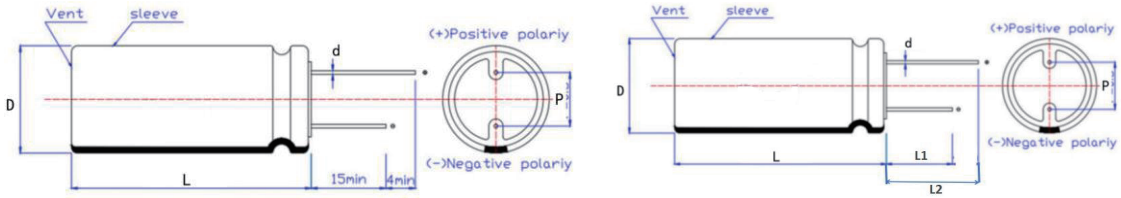
Specifications Value of Product

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max. ESR 25°C (mΩ)	Maximum Peak Current （25°C <1s, A）	Leakage Current (25°C 72h, mA)	Store energy （mWh）	Sizs DxL (mm)
SC3V0L504MV	3.0	0.5	±20%	500	0.54	0.008	0.63	6.3x12.5
SC3V0L105MV	3.0	1.0	±20%	350	1.00	0.008	1.25	8.0x13.0
SC3V0L105MV-1	3.0	1.0	±20%	500	0.90	0.008	1.25	6.3x12.5
SC3V0L155MV	3.0	1.5	±20%	500	1.16	0.008	1.88	6.3x12.5
SC3V0L155MV-1	3.0	1.5	±20%	350	1.33	0.010	1.88	8.0x13.0
SC3V0L205MV	3.0	2.0	±20%	240	1.93	0.012	2.50	8.0x13.0
SC3V0L205MV-1	3.0	2.0	±20%	200	1.99	0.012	2.50	8.0x16.0
SC3V0L305MV	3.0	3.0	±20%	160	2.98	0.013	3.75	8.0x20.0
SC3V0L335MV	3.0	3.3	±20%	160	3.19	0.013	4.13	8.0x20.0
SC3V0L505MV	3.0	5.0	±20%	120	4.82	0.016	6.25	8.0x24.0
SC3V0L505MV-1	3.0	5.0	±20%	120	4.91	0.016	6.25	10.0x20.0
SC3V0L605MV	3.0	6.0	±20%	100	5.59	0.024	7.50	10.0x20.0
SC3V0L6059V	3.0	6.0	+30%/-10%	100	5.59	0.024	7.50	10.0x20.0
SC3V0L705MV	3.0	7.0	±20%	80	6.34	0.028	8.75	10.0x20.0
SC3V0L106MV	3.0	10	±20%	65	8.18	0.030	12.50	10.0x25.0
SC3V0L106MV-1	3.0	10	±20%	70	7.94	0.030	12.50	12.5x20.0
SC3V0L126MV	3.0	12	±20%	65	9.01	0.032	15.00	12.5x20.0
SC3V0L156MV	3.0	15	±20%	55	11.10	0.050	18.75	12.5x25.0
SC3V0L156MV-1	3.0	15	±20%	70	10.97	0.050	18.75	12.5x20.0
SC3V0L206MV	3.0	20	±20%	70	11.25	0.065	25.00	12.5x30.0
SC3V0L206MV-1	3.0	20	±20%	50	14.21	0.060	25.00	12.5x25.0
SC3V0L256MV	3.0	25	±20%	45	19.29	0.070	31.25	16.0x25.0
SC3V0L2569V	3.0	25	+30%/-10%	45	19.29	0.070	31.25	16.0x25.0
SC3V0L306MV	3.0	30	±20%	30	21.32	0.078	37.50	16.0x30.0
SC3V0L406MV	3.0	40	±20%	30	25.47	0.088	50.00	18.0x30.0
SC3V0L506MV	3.0	50	±20%	25	30.00	0.100	62.50	18.0x40.0
SC3V0L606MV	3.0	60	±20%	25	32.40	0.120	75.00	18.0x40.0

■Maximum Peak Current：Is the current taking 1 sec. to discharge from U_R to 1/2U_R

■Body color：Blue

Dimensions & Packaging Quantity



Part No.	D (mm)	L (mm)	P (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity(EA) Plastic Tray
SC3V0L504MV	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC3V0L105MV	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC3V0L105MV-1	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC3V0L155MV	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC3V0L155MV-1	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC3V0L205MV	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC3V0L205MV-1	8.0±1.0	16.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	140
SC3V0L305MV	8.0±1.0	20.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	120
SC3V0L335MV	8.0±1.0	20.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	120
SC3V0L505MV	8.0±1.0	24.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	100
SC3V0L505MV-1	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC3V0L605MV	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC3V0L6059V	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC3V0L705MV	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC3V0L106MV	10.0±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	80
SC3V0L106MV-1	12.5±1.0	20.0±2.0	5.0±0.5	0.6±0.05	23.0±2.0	29.0±2.0	64
SC3V0L126MV	12.5±1.0	20.0±2.0	5.0±0.5	0.6±0.05	23.0±2.0	29.0±2.0	64
SC3V0L156MV	12.5±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	60
SC3V0L156MV-1	12.5±1.0	20.0±2.0	5.0±0.5	0.6±0.05	23.0±2.0	29.0±2.0	64
SC3V0L206MV	12.5±1.0	30.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	60
SC3V0L206MV-1	12.5±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	60
SC3V0L256MV	16.0±1.0	25.0±3.0	7.5±0.5	0.8±0.05	22.0±2.0	28.0±2.0	50
SC3V0L2569V	16.0±1.0	25.0±3.0	7.5±0.5	0.8±0.05	22.0±2.0	28.0±2.0	50
SC3V0L306MV	16.0±1.0	30.0±3.0	7.5±0.5	0.8±0.05	22.0±2.0	28.0±2.0	50
SC3V0L406MV	18.0±1.0	30.0±3.0	7.5±0.5	0.8±0.05	-	-	44
SC3V0L506MV	18.0±1.0	40.0±3.0	7.5±0.5	0.8±0.05	-	-	26
SC3V0L606MV	18.0±1.0	40.0±3.0	7.5±0.5	0.8±0.05	-	-	26

■Environmental Characteristics

Item	Requirement		Test Condition
Category Temperature Range	-40°C~+65°C@3.0V +70°C@2.7V		
Rated Operating Voltage	3.0V DC		
High Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 16h and test in this environment.
	ESR	Less than or equal to the initial value	
	Appearance	No leakage or mechanical damage	
Low Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 2h and test in this environment.
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Endurance	△C	Less than or equal to 30% of the initial value	Applied voltage：3.0V Temperature：+65±2°C Time：1000h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Cycle Life	△C	Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR	Less than or equal to 4 times the initial value	
Humidity Characteristics	△C	Less than or equal to 30% of the initial value	Temperature：+40±2°C Relative humidity：90~95%RH Test time：240h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Temperature cycle	△C	Less than or equal to 10% of the initial value	Temperature cycle：-25±2°C →normal temperature →+70±2°C→normal temperature Cycles：5
	Appearance	No leakage or mechanical damage	
Low Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：-40±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
High Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：+70±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
Self Discharge Characteristics	The self-discharge cut-off voltage is greater than or equal to 80% of the rated voltage		Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25°C, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet		DL/T 1652-2016
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer		DL/T 1652-2016

■Storage Temperature: -30~50°C; Relative Humidity:<60%RH, Max. Humidity<85%RH

■High Temperature Cylindrical Type Supercapacitor

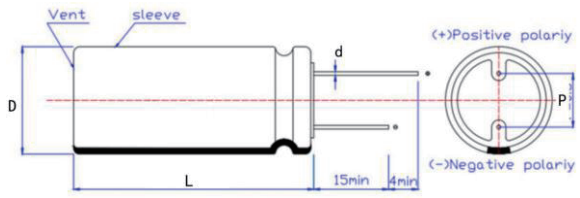
Specifications Value of Product

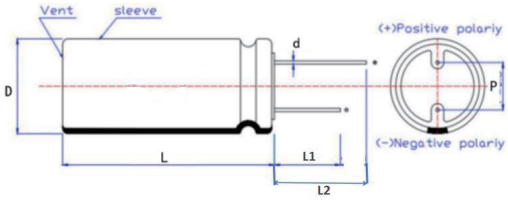
Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max. ESR 25℃ (mΩ)	Maximum Peak Current （25℃<1s, A）	Leakage Current (25℃72h, mA)	Store energy (mWh）	Sizs DxL (mm)
SC2V7L504MH	2.7	0.5	±20%	500	0.54	0.008	0.51	6.3x12.5
SC2V7L105MH	2.7	1.0	±20%	350	1.00	0.008	1.01	8.0x13.0
SC2V7L105MH-1	2.7	1.0	±20%	500	0.90	0.008	1.01	6.3x12.5
SC2V7L155MH	2.7	1.5	±20%	350	1.33	0.010	1.52	8.0x13.0
SC2V7L155MH-1	2.7	1.5	±20%	500	1.16	0.008	1.52	6.3x12.5
SC2V7L205MH	2.7	2.0	±20%	200	1.99	0.012	2.03	8.0x16.0
SC2V7L205MH-1	2.7	2.0	±20%	200	1.92	0.012	2.03	8.0x20.0
SC2V7L205MH-2	2.7	2.0	±20%	240	1.93	0.012	2.03	8.0x13.0
SC2V7L305MH	2.7	3.0	±20%	160	2.98	0.017	3.04	8.0x20.0
SC2V7L305MH-1	2.7	3.0	±20%	160	2.74	0.015	3.04	8.0x16.0
SC2V7L335MH	2.7	3.3	±20%	160	3.19	0.017	3.34	8.0x20.0
SC2V7L405MH	2.7	4.0	±20%	150	3.38	0.015	4.05	8.0x16.0
SC2V7L505MH	2.7	5.0	±20%	120	4.82	0.020	5.06	8.0x24.0
SC2V7L505MH-1	2.7	5.0	±20%	120	4.91	0.020	5.06	10.0x20.0
SC2V7L605MH	2.7	6.0	±20%	100	5.59	0.025	6.08	10.0x20.0
SC2V7L705MH	2.7	7.0	±20%	80	6.34	0.030	7.09	10.0x20.0
SC2V7L106MH	2.7	10	±20%	65	8.18	0.050	10.13	10.0x25.0
SC2V7L106MH-1	2.7	10	±20%	70	7.94	0.050	10.13	12.5x20.0
SC2V7L126MH	2.7	12	±20%	65	9.01	0.050	12.15	12.5x20.0
SC2V7L156MH	2.7	15	±20%	55	11.10	0.065	15.19	12.5x25.0
SC2V7L206MH	2.7	20	±20%	50	14.21	0.080	20.25	12.5x25.0
SC2V7L206MH-1	2.7	20	±20%	70	11.25	0.065	20.25	12.5x30.0
SC2V7L256MH	2.7	25	±20%	45	19.29	0.070	25.31	16.0x25.0
SC2V7L256MH-1	2.7	25	±20%	65	12.86	0.070	25.31	12.5x30.0
SC2V7L306MH	2.7	30	±20%	30	21.32	0.078	30.38	16.0x30.0
SC2V7L406MH	2.7	40	±20%	30	25.47	0.088	40.50	18.0x30.0
SC2V7L506MH	2.7	50	±20%	25	30.00	0.100	50.63	18.0x40.0
SC2V7L606MH	2.7	60	±20%	25	32.40	0.120	60.75	18.0x40.0

■Maximum Peak Current：Is the current taking 1 sec. to discharge from U_R to 1/2U_R

■Body color：Black

Dimensions & Packaging Quantity





Part No.	D (mm)	L (mm)	P (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity(EA) Plastic Tray
SC2V7L504MH	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC2V7L105MH	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC2V7L105MH-1	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC2V7L155MH	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC2V7L155MH-1	6.3±1.0	12.5±1.5	2.5±0.5	0.5±0.05	20.0±2.0	25.0±2.0	180
SC2V7L205MH	8.0±1.0	16.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	140
SC2V7L205MH-1	8.0±1.0	20.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	120
SC2V7L205MH-2	8.0±1.0	13.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	160
SC2V7L305MH	8.0±1.0	20.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	120
SC2V7L305MH-1	8.0±1.0	16.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	140
SC2V7L335MH	8.0±1.0	20.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	120
SC2V7L405MH	8.0±1.0	16.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	140
SC2V7L505MH	8.0±1.0	24.0±1.5	3.5±0.5	0.6±0.05	20.0±2.0	26.0±2.0	100
SC2V7L505MH-1	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC2V7L605MH	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC2V7L705MH	10.0±1.0	20.0±1.5	5.0±0.5	0.6±0.05	19.0±2.0	25.0±2.0	120
SC2V7L106MH	10.0±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	80
SC2V7L106MH-1	12.5±1.0	20.0±2.0	5.0±0.5	0.6±0.05	23.0±2.0	29.0±2.0	64
SC2V7L126MH	12.5±1.0	20.0±2.0	5.0±0.5	0.6±0.05	23.0±2.0	29.0±2.0	64
SC2V7L156MH	12.5±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	60
SC2V7L206MH	12.5±1.0	25.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	60
SC2V7L206MH-1	12.5±1.0	30.0±2.0	5.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	60
SC2V7L256MH	16.0±1.0	25.0±3.0	7.5±0.5	0.8±0.05	22.0±2.0	28.0±2.0	50
SC2V7L306MH	16.0±1.0	30.0±3.0	7.5±0.5	0.8±0.05	22.0±2.0	28.0±2.0	50
SC2V7L406MH	18.0±1.0	30.0±3.0	7.5±0.5	0.8±0.05	-	-	44
SC2V7L506MH	18.0±1.0	40.0±3.0	7.5±0.5	0.8±0.05	-	-	26
SC2V7L606MH	18.0±1.0	40.0±3.0	7.5±0.5	0.8±0.05	-	-	26

■Environmental Characteristics

Item	Requirement		Test Condition
Category temperature range	-40°C~+70°C@2.7V +85°C@2.5V		
Rated Operating Voltage	2.7V DC		
High Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 16h and test in this environment
	ESR	Less than or equal to the initial value	
	Appearance	No leakage or mechanical damage	
Low Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the lower operating temperature environment for 2h and test in this environment
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Endurance	△C	Less than or equal to 30% of the initial value	Applied voltage：2.5V Temperature：+85±2°C Time：1000h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Cycle Life	△C	Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR	Less than or equal to 4 times the initial value	
Humidity Characteristics	△C	Less than or equal to 30% of the initial value	Temperature：+40±2°C Relative humidity：90~95%RH Test time：240h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Temperature Cycle	△C	Less than or equal to 10% of the initial value	Temperature cycle：-40±2°C→normal temperature →+85±2°C→normal temperature Cycles：5
	Appearance	No leakage or mechanical damage	
Low Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：-40±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
High Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：+85±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
Self Discharge Characteristics	The self-discharge cut-off voltage is greater than or equal to 80% of the rated voltage		Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25°C, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet		DL/T 1652-2016
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer		DL/T 1652-2016

■Storage Temperature: -30~50℃; Relative Humidity:<60%RH, Max. Humidity<85%RH

■Standard Combined Type Supercapacitor

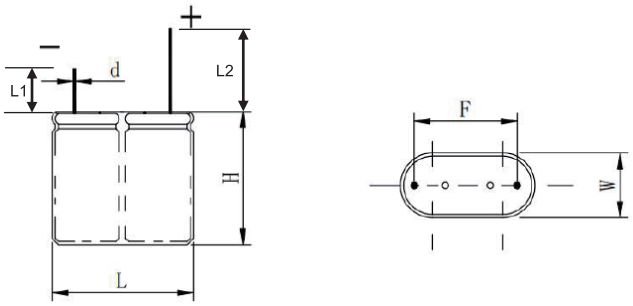
Specifications Value of Standard Product

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max. ESR 25℃ (mΩ)	Maximum Peak Current （25℃<1s, A）	Leakage Current (25℃72h, mA)	Store energy (mWh）	Sizs WxHxL (mm)
SC5V5Z224Z	5.5	0.22	+80%/-20%	1000	0.48	0.008	0.92	6.5x13.8x13.5
SC5V5Z334Z	5.5	0.33	+80%/-20%	1000	0.68	0.008	1.39	6.5x13.8x13.5
SC5V5Z3349-1	5.5	0.33	+30%/-20%	700	0.74	0.008	1.39	8.5x14.0x17.0
SC5V5Z474M	5.5	0.47	±20%	1000	0.88	0.008	1.97	6.5x13.8x13.5
SC5V5Z4749	5.5	0.47	+30%/-10%	600	1.01	0.010	1.97	8.5x14.0x17.0
SC5V5Z504M	5.5	0.50	±20%	1000	0.88	0.008	2.10	6.5x13.8x13.5
SC5V5Z504M-1	5.5	0.50	±20%	600	1.06	0.010	2.1	8.5x14.0x17.0
SC5V5Z105Z	5.5	1.0	+80%/-20%	400	1.96	0.017	4.20	8.5x21.0x17.0
SC5V5Z105M-1	5.5	1.0	±20%	360	2.02	0.012	4.20	8.5x17.0x17.0
SC5V5Z105M-2	5.5	1.0	±20%	500	1.83	0.012	4.20	8.5x14.0x17.0
SC5V5Z155M	5.5	1.5	±20%	270	3.03	0.017	6.30	8.5x21.0x17.0
SC5V5Z155M-1	5.5	1.5	±20%	300	2.84	0.016	6.30	8.5x17.0x17.0
SC5V5Z205M	5.5	2.0	±20%	220	3.93	0.020	8.40	8.5x21.0x17.0
SC5V5Z205M-1	5.5	2.0	±20%	220	4.04	0.020	8.40	8.5x25.0x17.0
SC5V5Z255M	5.5	2.5	±20%	170	4.91	0.020	10.50	8.5x25.0x17.0
SC5V5Z255M-1	5.5	2.5	±20%	200	5.00	0.020	10.50	10.0x21.0x21.0
SC5V5Z305M	5.5	3.0	±20	160	5.69	0.025	12.60	8.5x25.0x17.0
SC5V5Z305M-1	5.5	3.0	±20	180	5.69	0.025	12.60	10.0x21.0x21.0
SC5V5Z355M	5.5	3.5	±20%	160	6.31	0.030	14.70	10.0x21.0x21.0
SC5V5Z505M	5.5	5.0	±20%	120	8.59	0.050	21.01	10.0x26.0x21.0
SC5V5Z505M-1	5.5	5.0	±20%	120	8.59	0.050	21.01	13.0x27.0x26.0
SC5V5Z505M-2	5.5	5.0	±20%	120	8.59	0.050	21.01	13.0x22.0x26.0
SC5V5Z755M	5.5	7.5	±20%	120	10.86	0.065	31.51	13.0x22.0x26.0
SC5V5Z106M	5.5	10	±20%	90	14.47	0.060	42.01	16.0x28.0x33.0
SC5V5Z106M-1	5.5	10	±20%	100	14.47	0.080	42.01	13.0x27.0x26.0
SC5V5Z156M	5.5	15	±20%	70	20.12	0.078	63.02	16.0x33.0x33.0
SC5V5Z256M	5.5	25	±20%	60	27.50	0.100	105.03	18.0x43.0x37.0

■Maximum Peak Current：Is the current taking 1 sec. to discharge from U_R to 1/2U_R

■Body color：Blue

Dimensions & Packaging Quantity



Part No.	W (mm)	H (mm)	L (mm)	F (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity (EA) Plastic Tray	Quantity (EA) Plastic Bag
SC5V5Z224Z	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80	-
SC5V5Z334Z	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80	
SC5V5Z3349-1	8.5±1.0	14.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	64	
SC5V5Z474M	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80	-
SC5V5Z4749	8.5±1.0	14.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	64	-
SC5V5Z504M	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80	
SC5V5Z504M-1	8.5±1.0	14.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	64	
SC5V5Z105Z	8.5±1.0	21.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	-
SC5V5Z105M-1	8.5±1.0	17.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	-
SC5V5Z105M-2	8.5±1.0	14.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	64	
SC5V5Z155M	8.5±1.0	21.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	-
SC5V5Z155M-1	8.5±1.0	17.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	
SC5V5Z205M	8.5±1.0	21.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	
SC5V5Z205M-1	8.5±1.0	25.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	
SC5V5Z255M	8.5±1.0	25.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	-
SC5V5Z255M-1	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40	
SC5V5Z305M	8.5±1.0	25.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	
SC5V5Z305M-1	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40	
SC5V5Z355M	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40	-
SC5V5Z505M	10.0±1.0	26.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	21.0±2.0	27.0±2.0	30	-
SC5V5Z505M-1	13.0±1.0	27.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	20	-
SC5V5Z505M-3	13.0±1.0	22.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	32	
SC5V5Z755M	13.0±1.0	22.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	32	
SC5V5Z106M	16.0±1.0	28.0±2.0	33.0±1.0	24.0±0.5	0.8±0.05	21.0±2.0	27.0±2.0	20	
SC5V5Z106M-1	13.0±1.0	27.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	21.0±2.0	27.0±2.0	20	
SC5V5Z156M	16.0±1.0	33.0±2.0	33.0±1.0	24.0±0.5	0.8±0.05	21.0±2.0	27.0±2.0	16	-
SC5V5Z256M	18.0±1.0	43.0±2.0	37.0±1.0	26.0±0.5	0.8±0.05	-	-	-	40

■Environmental Characteristics

Item	Requirement		Test Condition
Category temperature range	-40°C~+70°C		
Rated Operating Voltage	5.5V DC		
High Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 16h and test in this environment
	ESR	Less than or equal to the initial value	
	Appearance	No leakage or mechanical damage	
Low Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the lower operating temperature environment for 2h and test in this environment
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Endurance	△C	Less than or equal to 30% of the initial value	Applied voltage：5.0V Temperature：+65±2°C Time：1000h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Cycle Life	△C	Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR	Less than or equal to 4 times the initial value	
Humidity Characteristics	△C	Less than or equal to 30% of the initial value	Temperature：+40±2°C Relative humidity：90~95%RH Test time：240h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Temperature Cycle	△C	Less than or equal to 10% of the initial value	Temperature cycle：-40±2°C→normal temperature →+70±2°C→normal temperature Cycles：5
	Appearance	No leakage or mechanical damage	
Low Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：-40±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
High Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：+70±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
Self Discharge Characteristics	The self-discharge cut-off voltage is greater than or equal to 80% of the rated voltage		Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25°C, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet		DL/T 1652-2016
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer		DL/T 1652-2016

■Storage Temperature: -30~50℃; Relative Humidity:<60%RH, Max. Humidity<85%RH

■High Voltage Combined Type Supercapacitor

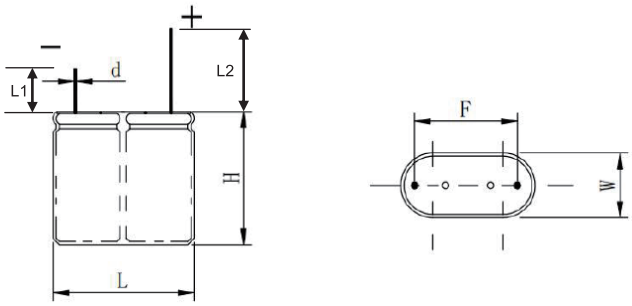
Specifications Value of Product

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max. ESR 25℃ (mΩ)	Maximum Peak Current （25℃<1s, A）	Leakage Current (25℃72h, mA)	Store energy (mWh）	Sizs WxHxL (mm)
SC6V0Z224ZV	6.0	0.22	-20%~+80%	1000	0.48	0.008	1.10	6.5x13.8x13.5
SC6V0Z334ZV	6.0	0.33	-20%~+80%	1000	0.68	0.008	1.65	6.5x13.8x13.5
SC6V0Z3349V-1	6.0	0.33	-10%~+30%	700	0.74	0.008	1.65	8.5x14.0x17.0
SC6V0Z474MV	6.0	0.47	±20%	1000	0.88	0.008	2.35	6.5x13.8x13.5
SC6V0Z4749V-1	6.0	0.47	-10%~+30%	600	1.01	0.010	2.35	8.5x14.0x17.0
SC6V0Z504MV	6.0	0.5	±20%	1000	0.88	0.008	2.50	6.5x13.8x13.5
SC6V0Z504MV-2	6.0	0.5	±20%	600	1.06	0.010	2.50	8.5x14.0x17.0
SC6V0Z105Z	6.0	1	-20%~+80%	400	1.96	0.017	5.00	8.5x21.0x17.0
SC6V0105MV-1	6.0	1	±20%	480	1.83	0.012	5.00	8.5x14.0x17.0
SC6V0105MV-2	6.0	1	±20%	400	2.02	0.012	5.00	8.5x17.0x17.0
SC6V0Z155MV	6.0	1.5	±20%	240	3.03	0.017	7.50	8.5x21.0x17.0
SC6V0Z155MV-1	6.0	1.5	±20%	320	2.84	0.016	7.50	8.5x17.0x17.0
SC6V0205MV	6.0	2.0	±20%	180	4.04	0.020	10.00	8.5x25.0x17.0
SC6V0255MV	6.0	2.5	±20%	160	4.91	0.020	12.50	8.5x25.0x17.0
SC6V0255MV-1	6.0	2.5	±20%	240	5.00	0.020	12.50	10.0x21.0x21.0
SC6V0305MV	6.0	3.0	±20%	200	5.69	0.025	15.00	10.0x21.0x21.0
SC6V0355MV	6.0	3.5	±20%	160	6.31	0.030	17.50	10.0x21.0x21.0
SC6V0Z505MV	6.0	5	±20%	130	8.59	0.050	25.00	10.0x26.0x21.0
SC6V0Z505MV-1	6.0	5	±20%	140	8.59	0.050	25.00	13.0x22.0x26.0
SC6V0Z505MV-2	6.0	5	±20%	120	8.59	0.050	25.00	13.0x27.0x26.0
SC6V0Z755MV	6.0	7.5	±20%	140	10.86	0.065	37.50	13.0x22.0x26.0
SC6V0Z755MV-1	6.0	7.5	±20%	110	11.30	0.065	37.50	13.0x27.0x26.0
SC6V0Z106MV	6.0	10	±20%	90	14.47	0.080	50.00	13.0x27.0x26.0
SC6V0Z106MV-1	6.0	10	±20%	90	14.47	0.070	50.00	16.0x28.0x33.0
SC6V0Z156MV	6.0	15	±20%	70	20.12	0.078	75.00	16.0x33.0x33.0

■Maximum Peak Current：Is the current taking 1 sec. to discharge from U_R to 1/2U_R

■Body color：Blue

Dimensions & Packaging Quantity



Part No.	W (mm)	H (mm)	L (mm)	F (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity(EA) Plastic Tray
SC6V0Z224ZV	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80
SC6V0Z334ZV	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80
SC6V0Z3349V-1	8.5±1.0	14.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	64
SC6V0Z474MV	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80
SC6V0Z4749V-1	8.5±1.0	14.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	64
SC6V0Z504MV	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80
SC6V0Z504MV-2	8.5±1.0	14.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	64
SC6V0Z105ZV	8.5±1.0	21.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48
SC6V0105MV-1	8.5±1.0	14.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	64
SC6V0105MV-2	8.5±1.0	17.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48
SC6V0Z155MV	8.5±1.0	21.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48
SC6V0Z155MV-1	8.5±1.0	17.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48
SC6V0205MV	8.5±1.0	25.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48
SC6V0255MV	8.5±1.0	25.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48
SC6V0255MV-1	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40
SC6V0305MV	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40
SC6V0355MV	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40
SC6V0Z505MV	10.0±1.0	26.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	21.0±2.0	27.0±2.0	30
SC6V0Z505MV-1	13.0±1.0	22.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	32
SC6V0Z505MV-2	13.0±1.0	27.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	21.0±2.0	27.0±2.0	20
SC6V0Z755MV	13.0±1.0	22.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	32
SC6V0Z755MV-1	13.0±1.0	27.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	21.0±2.0	27.0±2.0	20
SC6V0Z106MV	13.0±1.0	27.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	21.0±2.0	27.0±2.0	20
SC6V0Z106MV-1	16.0±1.0	28.0±2.0	33.0±1.0	24.0±0.5	0.8±0.05	21.0±2.0	27.0±2.0	20
SC6V0Z156MV	16.0±1.0	33.0±2.0	33.0±1.0	24.0±0.5	0.8±0.05	21.0±2.0	27.0±2.0	16

■Environmental Characteristics

Item	Requirement		Test Condition
Category temperature range	-40°C~+70°C		
Rated Operating Voltage	6.0V DC		
High Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 16h and test in this environment
	ESR	Less than or equal to the initial value	
	Appearance	No leakage or mechanical damage	
Low Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the lower operating temperature environment for 2h and test in this environment
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Endurance	△C	Less than or equal to 30% of the initial value	Applied voltage：5.0V Temperature：+70±2°C Time：1000h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Cycle Life	△C	Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR	Less than or equal to 4 times the initial value	
Humidity Characteristics	△C	Less than or equal to 30% of the initial value	Temperature：+40±2°C Relative humidity：90~95%RH Test time：240h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Temperature Cycle	△C	Less than or equal to 10% of the initial value	Temperature cycle：-40±2°C→normal temperature →+70±2°C→normal temperature Cycles：5
	Appearance	No leakage or mechanical damage	
Low Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：-40±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
High Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：+70±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
Self Discharge Characteristics	The self-discharge cut-off voltage is greater than or equal to 80% of the rated voltage		Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25°C, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet		DL/T 1652-2016
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer		DL/T 1652-2016

■Storage Temperature: -30~50℃; Relative Humidity:<60%RH, Max. Humidity<85%RH

■High Temperature Combined Type Supercapacitor

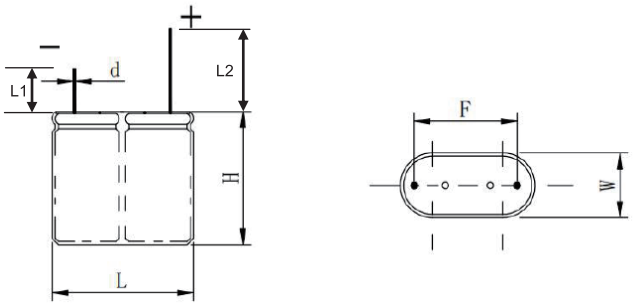
Specifications Value of Product

Part No.	Rated Voltage (V)	Rated Capacitance (F)	Tolerance	Max. ESR DC 25℃ (mΩ)	Maximum Peak Current （25℃<1s, A）	Leakage Current (25℃ 72h, mA)	Store energy (mWh）	Sizs WxHxL (mm)
SC5V5Z224ZH	5.5	0.22	-20%~+80%	1000	0.48	0.008	0.92	6.5x13.8x13.5
SC5V5Z334ZH	5.5	0.33	-20%~+80%	1000	0.68	0.008	1.39	6.5x13.8x13.5
SC5V5Z474MH	5.5	0.47	±20%	1000	0.88	0.008	1.97	6.5x13.8x13.5
SC5V5Z504MH	5.5	0.5	±20%	1000	0.88	0.008	2.10	6.5x13.8x13.5
SC5V5Z105MH	5.5	1.0	±20%	360	1.96	0.013	4.20	8.5x17.0x17.0
SC5V5Z155MH-2	5.5	1.5	±20%	270	3.03	0.017	6.30	8.5x21.0x17.0
SC5V5Z205MH	5.5	2.0	±20%	220	3.93	0.020	8.40	8.5x25.0x17.0
SC5V5Z205MH-1	5.5	2.0	±20%	220	3.72	0.020	8.40	8.5x21.0x17.0
SC5V5Z255MH	5.5	2.5	±20%	170	4.74	0.020	10.50	8.5x25.0x17.0
SC5V5Z255MH-1	5.5	2.5	±20%	200	4.58	0.020	10.50	10.0x21.0x21.0
SC5V5Z305MH	5.5	3.0	±20%	160	5.57	0.025	12.60	8.5x25.0x17.0
SC5V5Z305MH-1	5.5	3.0	±20%	180	5.36	0.025	12.60	10.0x21.0x21.0
SC5V5Z355MH	5.5	3.5	±20%	160	6.31	0.030	14.70	10.0x21.0x21.0
SC5V5Z505MH	5.5	5.0	±20%	120	7.86	0.050	21.01	13.0x22.0x26.0
SC5V5Z505MH-2	5.5	5.0	±20%	120	7.86	0.050	21.01	10.0x26.0x21.0
SC5V5Z755MH	7.5	5.0	±20%	120	10.86	0.065	31.51	13.0x22.0x26.0
SC5V5Z755MH-1	7.5	5.0	±20%	110	10.06	0.065	31.51	13.0x27.0x26.0
SC5V5Z106MH	5.5	10	±20%	90	13.75	0.060	42.01	16.0x28.0x33.0
SC5V5Z106MH-1	5.5	10	±20%	100	12.50	0.080	42.01	13.0x27.0x26.0
SC5V5Z156MH	5.5	15	±20%	70	17.55	0.078	63.02	16.0x33.0x33.0
SC5V5Z256MH	5.5	25	±20%	60	25.00	0.100	105.03	18.0x43.0x37.0

■Maximum Peak Current：Is the current taking 1 sec. to discharge from U_R to 1/2U_R

■Body color：Black

Dimensions & Packaging Quantity



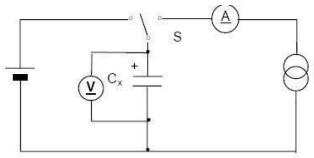
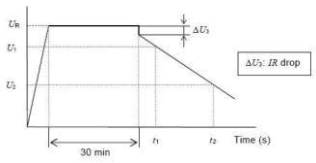
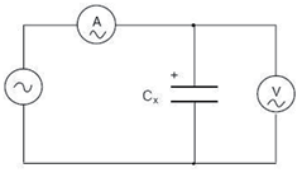
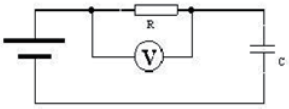
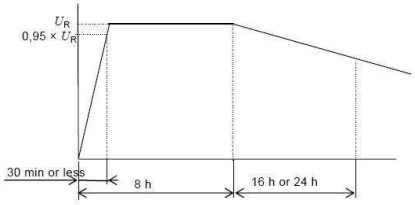
Part No.	W (mm)	H (mm)	L (mm)	F (mm)	d (mm)	L1 (mm)	L2 (mm)	Quantity(EA) Plastic Tray	Quantity(EA) Plastic Bag
SC5V5Z224ZH	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80	-
SC5V5Z334ZH	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80	-
SC5V5Z474MH	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80	-
SC5V5Z504MH	6.5±1.0	13.8±2.0	13.5±1.0	9.0±0.5	0.5±0.05	19.0±2.0	24.0±2.0	80	
SC5V5Z105MH	8.5±1.0	17.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	
SC5V5Z155MH-2	8.5±1.0	21.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	
SC5V5Z205MH	8.5±1.0	25.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	-
SC5V5Z205MH-1	8.5±1.0	21.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	
SC5V5Z255MH	8.5±1.0	25.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	-
SC5V5Z255MH-1	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40	
SC5V5Z305MH	8.5±1.0	25.0±2.0	17.0±1.0	12.0±0.5	0.6±0.05	19.0±2.0	24.0±2.0	48	
SC5V5Z305MH-1	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40	
SC5V5Z355MH	10.0±1.0	21.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	19.0±2.0	24.0±2.0	40	-
SC5V5Z505MH	13.0±1.0	22.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	32	-
SC5V5Z505MH-2	10.0±1.0	26.0±2.0	21.0±1.0	15.5±0.5	0.6±0.05	21.0±2.0	27.0±2.0	30	
SC5V5Z755MH	13.0±1.0	22.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	22.0±2.0	28.0±2.0	32	
SC5V5Z755MH-1	13.0±1.0	27.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	21.0±2.0	27.0±2.0	20	
SC5V5Z106MH	16.0±1.0	28.0±2.0	33.0±1.0	24.0±0.5	0.8±0.05	21.0±2.0	27.0±2.0	20	-
SC5V5Z106MH-1	13.0±1.0	27.0±2.0	26.0±1.0	18.0±0.5	0.6±0.05	21.0±2.0	27.0±2.0	20	
SC5V5Z156MH	16.0±1.0	33.0±2.0	33.0±1.0	24.0±0.5	0.8±0.05	21.0±2.0	27.0±2.0	16	
SC5V5Z256MH	18.0±1.0	43.0±2.0	37.0±1.0	68.0±0.5	0.8±0.05	-	-	-	40

■Environmental Characteristics

Item	Requirement		Test Condition
Category temperature range	-40°C~+85°C		
Rated Operating Voltage	5.5V DC		
High Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the higher operating temperature environment for 16h and test in this environment
	ESR	Less than or equal to the initial value	
	Appearance	No leakage or mechanical damage	
Low Temperature Characteristics	△C	Less than or equal to 30% of the initial value	Place in the lower operating temperature environment for 2h and test in this environment
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Endurance	△C	Less than or equal to 30% of the initial value	Applied voltage：5.0V Temperature：+85±2°C Time：1000h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Cycle Life	△C	Less than or equal to 30% of the initial value	Capacitors cycles 500000 times between rated voltage and half rated voltage under constant current at 25°C . Shelf for 5s between each charge and discharge.
	ESR	Less than or equal to 4 times the initial value	
Humidity Characteristics	△C	Less than or equal to 30% of the initial value	Temperature：+40±2°C Relative humidity：90~95%RH Test time：240h
	ESR	Less than or equal to 4 times the initial value	
	Appearance	No leakage or mechanical damage	
Temperature Cycle	△C	Less than or equal to 10% of the initial value	Temperature cycle：-40±2°C→normal temperature →+85±2°C→normal temperature Cycles：5
	Appearance	No leakage or mechanical damage	
Low Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：-40±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
High Temperature Storage Characteristics	△C	Satisfies the range of 10% of the initial rating	Applied voltage：0V Temperature：+85±2°C Time：96h
	ESR	Less than or equal to 2 times the initial value	
	Appearance	No leakage or mechanical damage	
Self Discharge Characteristics	The self-discharge cut-off voltage is greater than or equal to 80% of the rated voltage		Charging process: normal temperature, no load, rated voltage charge 8h Placement process: temperature less than or equal to 25°C, relative humidity less than 60% RH, open 24 h
Lead strength	No damage to the outlet		DL/T 1652-2016
Solder ability	More than 3/4 of the terminal surface is covered by a tin layer		DL/T 1652-2016

■Storage Temperature: -30~50℃; Relative Humidity:<60%RH, Max. Humidity<85%RH

■Measuring Method

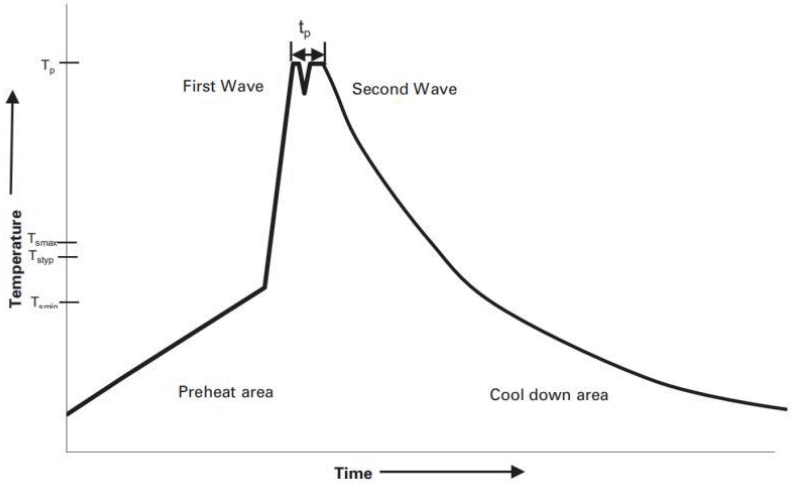
Capacitance	Measurement by Permanent electrotransport : 1.DC voltage of constant current/constant voltage source is set as rated voltage (UR). 2.Set the constant current value of the constant current discharge device. 3.Switch the switch S to dc power supply, and charge at constant voltage for 30min after the constant current/constant voltage source reaches the rated voltage. 4.After charging for 30min, switch S is changed to the constant exile device to discharge with constant current. 5.Measure the time t1 and t2 of the voltage from U1 to U2 at both ends of the capacitor, as shown in the figure, and calculate the capacitance value according to the following equation   $C = \frac{I \times (t_2 - t_1)}{U_1 - U_2}$
Resistance	AC impedance measurement The circuit as shown in the figure below is used for measurement  Capacitor resistance Ra shall be computed by the type: $R_a = \frac{U}{I}$ Ra ac impedance (Ω); Effective value of U ac voltage (V R.M.S); Effective value of I ac current (V R.M.S).
Leakage Current	DC leakage current measurement principle is as follows  1.Discharge: before the measurement begins, the capacitor should be fully discharged.The discharge process lasts from 1h to 24h. 2. Leakage current shall be measured at rated temperature and rated voltage (UR).The charging voltage reached 95% after the maximum 30min charging time. The charging time was selected from 30min ,1h , 2h , 4h , 8h , 12h , 24h , 48h , 72h and shall be specified in the detail specification 3.Stable power supply, such as dc stabilized power supply, should be used. 4. through the protection under 1000 Ω resistance to capacitor voltage
Self discharge	Before the measurement begins, the capacitor should be fully discharged. The discharge process lasts from 1h to 24h. The rated voltage U should be directly applied at both ends of the capacitor, without protection resistance. Capacitors should be placed at standard ambient temperature and pressure for 24 hours. DC voltmeter internal resistance should be greater than 1 MΩ. 

■Soldering Condition

1. The welding condition of the proposed product is flow welding, heat shock will decrease electric performance of cell, even cause swelling, leakage or crack

2. Manual soldering temperature should not exceed 350°C, soldering time should not exceed 4s. The temperature of wave soldering is recommended to be lower than 260 ℃, and the maximum temperature of capacitor body in the welding process shall not exceed 120 ℃, and the duration shall be less than 10s, while preheating temperature should be limited to less than 105°C and maximum preheating time of 60 seconds for PC boards 0.8mm or thicker

3. Carry out low-temperature welding in accordance with the above welding conditions within a short time,as shown below：



■Cautions For Use

1.Polarity problem of supercapacitor

Unlike ordinary electrolytic capacitors or batteries, the anode and cathode of supercapacitors are made of the same material, so there is no polarity in theory. However, the polarity indicated by super capacitors is formulated by the manufacturer in the production process. When the capacitor is used carelessly in the short-term reverse operation, it will not cause substantial damage to the capacitor. If adjusted to a positive direction, it can be guaranteed to be used, but it cannot be used in the long-term reverse operation, which will result in the rapid attenuation of capacitor life characteristics.Unlike supercapacitors, lithium-ion capacitors have the same polarity as electrolytic capacitors or batteries. Careless short-term reverse use during use will cause substantial damage to lithium-ion capacitors, which may lead to gas production, leakage, explosion or other question.

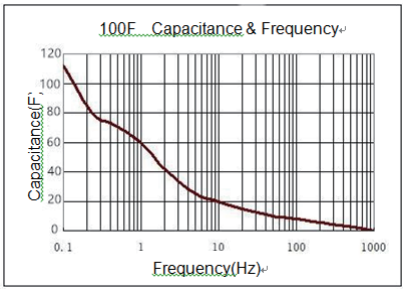
2.On the issue of supercapacitor charging

Charging of supercapacitors requires dc voltage which does not exceed rated voltage, and various charging methods such as current limit, constant current, constant power and constant voltage can be adopted. Supercapacitors can be charged by lowering the voltage of the charging power supply until the capacitors are full enough to maintain voltage balance. Lithium-ion capacitors capacitors can be charged in various ways such as current limiting, constant current, constant power, and constant voltage. During charging, the charging power supply voltage may be pulled down until the capacitor is fully charged to maintain voltage balance.

3.The problem of internal resistance and capacity of supercapacitors

In the process of charging and discharging, super capacitor resistance caused by the IR drop, lose efficiency of capacitor charging and discharging, so the size of capacitor resistance to a certain extent, determines the actor bad of character of capacitor, due to the internal resistance of the super capacitor than normal capacitors, in the process of communication charge and discharge circuit or high frequency, capacitor will fever, cause life decay quickly, which is the cause of the super capacitor only commonly used in dc.

Compared with ordinary capacitors, supercapacitors have a larger time constant, so the charge-discharge time is relatively long, and because of this, it is not suitable for continuous large current to work frequently, which will cause rapid attenuation of the heating performance. The frequency characteristic of supercapacitors is that the response time of positive and negative ions in the micro pores of carbon electrode is long at high frequency. Instead of measuring capacitors' ac capacity, the mAh method based on battery measurement is used.



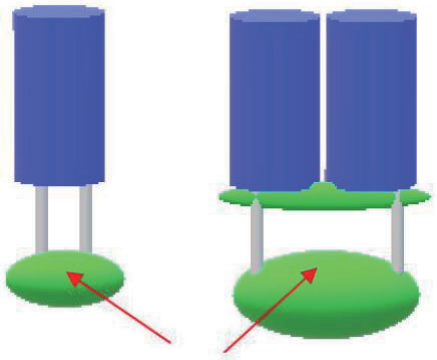
Expcept Lithium ion

4.Transport and storage

Should prevent products be affected with damp be affected with damp in product transportation, storage temperature should be - 30 ℃ to 50 ℃, relative humidity less than 60%, the maximum humidity no more than 85%, otherwise it will cause capacitance performance degradation of be affected with damp be affected with damp or rust.
Lithium ion :The Super Capacitor should be stored at room temperature, charged to about 50% ~ 80% of capacity; We recommend that Asymmetry Super Capacitor be charged about once per half a year to prevent over discharge.
Should prevent products be affected with damp be affected with damp in product transportation, storage temperature should be -20 ℃ to 50 ℃, relative humidity less than 65%, the maximum humidity no more than 65%, otherwise it will cause capacitance performance degradation of be affected with damp be affected with damp or rust.

5.Installation and welding

When the supercapacitor is used on the double-sided circuit board, it should be noted that the connection cannot pass through the reach of the capacitor, otherwise the product will be short circuit overvoltage and the capacitor will be damaged. During installation and after installation, do not twist or tilt the capacitor by force. Do not pull the lead by force. Break the needle and weld after bending. In the welding process to avoid overheating of the capacitor (1.6 mm of printed circuit board, the welding should be 260 ℃, when time is not more than 5 s), after welding, circuit board and the capacitor to clean in the net.



try not to wire here

6.Short circuit judgment of supercapacitor

The short circuit capacitance shall not be charged or discharged. The dc voltage shall be applied between the positive and negative terminals of the capacitance. The capacitance voltage shall not be increased When charging, it is normal to use ohm gauge (short circuit block) indicator as short circuit state. Capacitance is short circuit and it cannot be determined. It should be observed whether the resistance value increases or not.

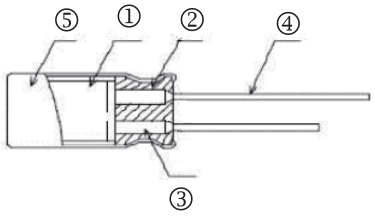
7.Series and parallel operation problem
When the same super capacitor is used in series, the total voltage = series number * monomer withstand voltage; Total capacity = unit capacity Total energy = series number x monomer capacity, total internal resistance = series number x monomer resistance.
There is a problem of voltage balancing between three or more monomers in series, so it is necessary to consider adopting equalizing circuit to ensure that the capacitance cannot be used over voltage during long-term use, thus causing capacitor life attenuation and damage.
Supercapacitors of different specifications cannot be used in series.
When the super capacitors are used in parallel, they can be connected in parallel with different capacitance values and charged by the same voltage. However, it is necessary to pay attention to the current balance between the capacitors and to isolate each other, so as to avoid reverse charging due to the potential difference after discharge.

8.For other problems in use, please consult the manufacturer or refer to the relevant technical data of the instructions for the use of supercapacitors.

9.Handling of leakage situation
Skin contact: rinse skin thoroughly with soap and water;
Eye contact: flush with flowing water or normal saline and seek medical advice; Absorb: immediately rinse with water and seek medical advice;
If the supercapacitor is found to be overheating or smelling, the power supply and load connected to the supercapacitor should be disconnected immediately to cool it, and the supercapacitor should be treated properly so that no face or hand contact with the supercapacitor is allowed.

Conductive Polymer Aluminum Solid Electrolytic Capacitors－AR5K Series

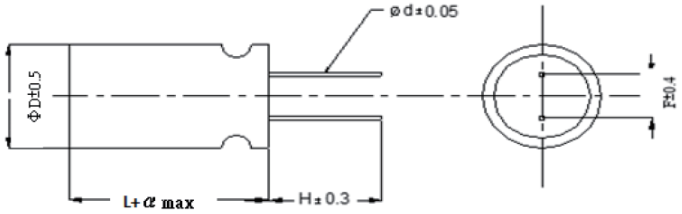
■Construction



①	Element	④	Lead Wire
②	Seal	⑤	Case
③	Aluminum Tab		

■Features

－Rated voltage：2.5~16Vdc
－Endurance：5,000 hours at 105°C
－Suitable for DC-DC converters , voltage regulators and decoupling applications
－RoHS Compliant



■Dimensions

Unit: mm

Type	D	L	α	d	F	H
AR5K0405	4.0±0.5	5.0	-0.5~1	0.45±0.05	1.5±0.4	3.2±0.3
AR5K0508	5.0±0.5	8.0	-0.5~1	0.50±0.05	2.0±0.4	3.2±0.3
AR5K0605	6.3±0.5	5.0	-0.5~1	0.45±0.05	2.5±0.4	3.2±0.3
AR5K0608	6.3±0.5	8.0	-0.5~1	0.60±0.05	2.5±0.4	3.2±0.3
AR5K0808	8.0±0.5	8.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AR5K0812	8.0±0.5	12.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AR5K1012	10.0±0.5	12.0	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3

■Product Identification

AR5K	0405	M	B	6V3	471
Product Type	Dimensions (DxL)	Capacitance Tolerance	Packaging Code	Rated Voltage	Capacitance
	0405: 4.0x5.0 0508: 5.0x8.0 0605: 6.3x5.0 0608: 6.3x8.0 0808: 8.0x8.0 0812: 8.0x12.0 1012: 10.0x12.0	M: ±20%	B: Bulk	2V5: 2.5V 3V0: 3.0V 4V0: 4.0V 6V3: 6.3V 100: 10V 160: 16V	100: 10uF 101: 100uF 102: 1000uF

■Standard Ratings

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20°C, 100K to 300KHz)	Rated Ripple Current (mArms/105°C/100KHz)	Sizs Code
AR5K0508MB2V5391	2.5 (2.9)	390	500	0.1	7	4180	0508
AR5K0508MB2V5561	2.5 (2.9)	560	500	0.1	7	4180	0508
AR5K0608MB2V5561	2.5 (2.9)	560	500	0.1	7	5000	0608
AR5K0608MB2V5821	2.5 (2.9)	820	500	0.1	7	5000	0608
AR5K0808MB2V5561	2.5 (2.9)	820	500	0.1	7	6100	0808
AR5K0808MB2V5561	2.5 (2.9)	1000	500	0.1	7	6100	0608
AR5K0608MB3V0561	3.0 (3.4)	820	500	0.1	7	5000	0608
AR5K0608MB4V0561	4.0 (4.6)	560	500	0.1	7	5000	0608
AR5K0605MB6V3101	6.3 (7.2)	100	126	0.1	35	2100	0605
AR5K0608MB6V3221	6.3 (7.2)	470	592	0.1	8	4700	0608
AR5K0608MB6V3271	6.3 (7.2)	560	705	0.1	8	4700	0608
AR5K0808MB6V3391	6.3 (7.2)	560	705	0.1	8	5700	0808
AR5K0608MB6V3471	6.3 (7.2)	820	1033	0.1	8	4700	0608
AR5K0808MB6V3471	6.3 (7.2)	820	1033	0.1	8	5700	0808
AR5K0405MB6V3471	10.0 (11.5)	10	300	0.1	80	700	0405
AR5K0605MB6V3471	16.0 (18.4)	100	320	0.1	24	2490	0605
AR5K0608MB6V3561	16.0 (18.4)	100	320	0.1	25	2820	0608
AR5K0608MB6V3561	16.0 (18.4)	270	864	0.1	10	5000	0608
AR5K0808MB6V3561	16.0 (18.4)	270	864	0.1	10	5000	0808
AR5K0812MB6V3821	16.0 (18.4)	270	864	0.1	10	5230	0812
AR5K0808MB6V3821	16.0 (18.4)	470	1505	0.1	10	5000	0808
AR5K0812MB6V3102	16.0 (18.4)	470	1505	0.1	10	5230	0812
AR5K1012MB100100	16.0 (18.4)	470	1505	0.1	10	6100	1012
AR5K0812MB160681	16.0 (18.4)	680	2176	0.1	10	5230	0812
AR5K0812MB160821	16.0 (18.4)	820	2624	0.1	12	4950	0812
AR5K1012MB160102	16.0 (18.4)	1000	3200	0.1	12	5400	1012
AR5K1012MB160122	16.0 (18.4)	1200	3840	0.1	12	5400	1012

■Category temperature range: -55~+105°C

■Surge voltage: rated voltage*1.15

■Rated ripple current: Rated ripple current shall be in accordance with standard ratings list.
These current are rms values of sine wave of 100KHz at 105°C

■Frequency Correction Factor of Allowable Ripple Current

Frequency	120Hz≦f<1KHz	1KHz≦f<10KHz	10KHz≦f<50KHz	50KHz≦f<100KHz	100KHz≦f≦300KHz
Coefficient	0.05	0.3	0.7	0.85	1

■Environmental Characteristics

General

Item	Specifications
Measurement condition	Each measurement shall be conducted at a temperature of 15 to 35°C, and relative humidity of 45 to 85%. Furthermore, these measurements shall be preferably conducted at a temperature of 20±2°C, and relative humidity of 60 to 70%, while the capacitors shall be kept enough time in the measuring temperature.
Voltage treatment	If leakage current is doubtful, measure it after performing voltage treatment, which shall contain the following steps: (1) Applied DC rated voltage to the capacitors for 60 minutes at 105±2°C. (2) Cooled down to room temperature with applying voltage. (3) Discharged through a resistor of approximately 1Ω/V.

Electrical Performance Test

Item	Requirement	Test Condition
Tolerance on Rated Capacitance	In Within standard ratings	Rated capacitance shall meet within ±20% tolerance against the rated capacitance measured at 120Hz±10% at 20±2°C.
Leakage current	In accordance within standard ratings	DC rated voltage shall be applied between anode and cathode lead wire terminations of a capacitor through 1KΩ protective resistance, and the leakage current shall be less than or equal to the value listed in accordance with electrical specification after 2 minutes with the voltage reaching the rated value at 20±2°C. If the value is doubtful, measure the leakage current after performing voltage treatment as follows Voltage treatment
Tangent of loss angle (tan δ)	tan δ values shall be less than or equal to 0.10	At 120Hz±10% at 20±2°C.
Equivalent Series Resistance (ESR)	shall be less than or equal to the value in standard ratings	Equipment: Agilent technology 4263B or equivalent Test fixture: Agilent technology 16047E or equivalent Compensation: Short and open compensation would be required, Short correction is performed using the shorting plate made of 0.5 thickness copper plate with gold coating Signal level: 500mV Frequency: 100KHz Measurement point: Point of lead wire within 1mm form the body
Impedance at high and low temperature	Impedance ratio / Performance Z(-55°C)/Z(+20°C) ≦1.25 Z(-105°C)/Z(+20°C) ≦1.25	at -55±3°C or 105±2°C, 100kHz

Mechanical Characteristies Test

Item	Requirement	Test Condition
Pull Strength Load of Lead Wire Terminations	That capacitor shall not appear any change defective in use.	With the body of a capacitor fixed, the load listed shall be applied to the lead wire termination in its draw out direction, gradually up to the specified value and held for 10±1 seconds. Pull strength load of lead wire terminations

Lead wire diameter (mm)	Load strength(N)	Load strength(kgf)
0.35<d≦0.5	5	0.51
0.35<d≦0.8	10	1.0

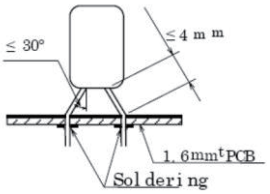
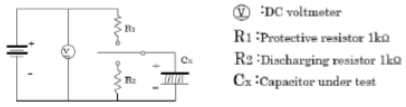
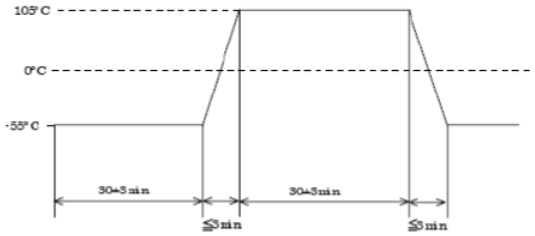
<table>
<tr><th>Item</th><th>Requirement</th><th>Test Condition</th></tr>
<tr><td>Bending Strength of Lead Wire Terminations</td><td>That capacitor shall not appear any change defective in use.</td><td>Bending strength load listed shall be hung at the end of the lead wire termination, and the body of a capacitor shall be bent 90° and return to its original position. This operation shall be performed around 2 to 3 seconds. Then the body shall be bent 90°at the opposite direction and return to its original position at same speed
Bending strength of lead wire terminations
<table>
<tr><td>Lead wire diameter (mm)</td><td>Load strength(N)</td><td>Load strength(kgf)</td></tr>
<tr><td>0.35<d≦0.5</td><td>2.5</td><td>0.255</td></tr>
<tr><td>0.35<d≦0.8</td><td>5</td><td>0.51</td></tr>
</table></td></tr>
<tr><td>Vibration</td><td>During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test.</td><td>Vibration cycle should vary from 10 to 55Hz with total amplitude of 1.5mm and return to 10Hz in about 1 minute. Vibration applied to a capacitor should be three directions, which each perpendicular to the other two as longitudinal axis of capacitor set as z axis, and last for 2 hours in each direction. During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test,. A capacitor shall be fixed at the point of 4mm or less from the body as shown in Figure 1.
 

Figure 1 Vibration test</td></tr>
<tr><td>Solderability</td><td>Least 95% of circumferential surface of the dipped portion of termination shall be covered with new solder.</td><td>A lead wire termination shall be dipped for 2±0.5 seconds in the flux of ethanol or isopropylalcohol solution (25±2%) of colophonium. Then that lead wire terminations shall be immersed to a solder (H60A, H60S or H63A) of 235±5°C and up to the point 1.5 to 2.0mm from the body and kept for 2±0.5 seconds, and pulling it out.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>
<table>
<tr><td>Characteristics</td><td>Performance</td></tr>
<tr><td>Capacitance change</td><td>Within ±5% of the value before test</td></tr>
<tr><td>tan δ</td><td>Not exceed than the value in standard ratings</td></tr>
<tr><td>Leakage current</td><td>Not exceed than the value in standard ratings</td></tr>
<tr><td>Visual</td><td>No remarkable abnormality</td></tr>
</table></td><td>A Capacitor shall be inserted to a printed circuit board having a thickness of 1.6mm up to the point 1.5 to 2.0mm from the body. Then the lead wire termination shall be dipped for 5 to 10 seconds in the flux of ethanol solution (25±2%) of colophonium. And then the lead wire termination shall be immersed to the solder (H60A, H60S or H63A) of 260±5°C and up to the point of the Printed circuit board and kept for 10±1seconds, and pulling it out.</td></tr>
<tr><td>Resistance to Solvent</td><td>Marking: easily readable
Appearance: not appear any abnormality</td><td>A Capacitor shall be immersed for 30±5 seconds in isopropylalcohol at 20 to 25°C and then pull it out</td></tr>
</table>

Environmental Performance Test

<table>
<tr><th>Item</th><th>Requirements</th><th>Test Condition</th></tr>
<tr><td>Damp Heat, Steady State</td><td rowspan="2">Appearance: No significant damage
Capacitance change: ≦±20% of the initial value
tan δ & ESR:≦150% of the initial specified value
Leakage current: ≦the initial specified value</td><td>A capacitor shall be subjected to a temperature of 60±2°C and relative humidity of 90 to 95% without voltage applied for a period of 1000+24/-0 hours. Then that capacitor shall be taken out from the above condition to a temperature of 20°C</td></tr>
<tr><td>Endurance</td><td>A capacitor shall be subjected to a temperature of 105±2°C with test voltage applied for a period of 5,000+72/-0 hours and take out from the above condition to a temperature of 20°C . Besides, the applied voltage shall increase up from 0V to test voltage step by step (maximum 5 minutes), and the impedance of the source shall be equal to about 3Ω/V.</td></tr>
</table>

Item	Requirements	Test Condition
Surge Voltage	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦150% of the initial specified value Leakage current: ≦the initial specified value	when the capacitors are restored to +20°C after the surge voltage is applied at a cycle of 360 seconds which consists charge for 30±5 seconds through a protective resistor of 1KΩand discharge for 330 seconds, for 1000 cycles at 105±2°C  Surge voltage circuit
Rapid Temperature Change	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦the initial specified value Leakage current: ≦the initial specified value	The characteristics of a capacitor kept under the temperature cycle indicated in Figure 2 for 5 cycles and followed the voltage treatment as follows Voltage treatment  Figure 2 Rapid temperature change profile

■Packing Quantity

Type	PE Bag(PCS)	Inner Box(PCS)
AR5K0405	1000	24,000
AR5K0508	500	4,000
AR5K0605	500	6,000
AR5K0608	500	4,000
AR5K0808	500	3,000
AR5K0812	500	2,000
AR5K1012	500	2,000

■Instructions of Capacitors

1. Cautions on use of Capacitor

■Polarity

Solid electrolytic capacitors are polarized capacitors. Use capacitors after verifying their positive and negative polarities. If these capacitors are installed in the reverse polarity, its life may shorten because of increasing leakage current or short circuit.

■Types of circuits in which capacitors are prohibited from being used

AR5K series may be heated by soldering to increase in its leakage current slightly. This may have some influence on the characteristics capacitors in the following circuits.

(1) Time constant circuit
(2) Coupling circuit
(3) High impedance voltage holding circuit
(4) Connection of two or more capacitors in series for higher withstand voltage.

■Over voltage

If AR5K series is applied a voltage higher than the rated voltage for an instantaneous period, it may be defected due to short circuit. Note that the voltage over the rated voltage must not be applied to capacitors

■Repeat of rapid charging and discharging

If AR5K series is used in a rapid charging and discharging circuit or receive the flow of excess rush current, its life may shorten by large leakage current or short circuit. The charging and discharging current through AR5K series should be less than 10A.

■Soldering

Capacitors should be soldered under the soldering conditions defined in the delivery specifications. Some improper soldering condition may cause the leakage current of capacitors to increase or other parameters to change.

■Use of capacitors for industrial equipment

When capacitors are used for industrial equipment, the circuits should be designed to have sufficient margins in the ratings of capacitors including capacitance and impedance. Without sufficient margins in the characteristics, the reliability of the capacitors may be reduced by their shorter life. Always contact us if you want to use capacitors for equipment affecting human lives such as space, aviation, atomic power, and medical devices. Never use capacitors for the used without our prior approval.

2. Notes on circuit designs for capacitors

■Rating and performance

Use capacitors within the rating and performance ranges defined in the brochures and delivery specification of capacitors after checking the operating and installation environments.

■Operating temperature

If AR5K series is used at a temperature higher than the upper specified temperature (105°C), its life may be remarkably shortened or the leakage current may increase to cause defective.

■Ripple current

Never make current larger than the rated ripple current through AR5K series. If excess ripple current flows through AR5K series, internal heat may be generated largely to make its life shortened or cause it to be defected due to short circuit.

■Leakage current

Depending on the soldering conditions, the leakage current of AR5K series may increase slightly. The application of DC voltage enables the capacitors to be repaired by itself. This leads the leakage current to be smaller gradually. The leakage current can be reduced fast if the DC voltage, which is less than the rating voltage, is applied at the temperature close to the upper specified temperature.

■Applied voltage

(1) To secure the reliability of capacitors, it is recommended that the voltage applied to them should be less than 80% of the rated voltage.
(2) The peak value of the ripple voltage superimposed with the DC voltage should be less than the rated voltage.

■Failure mode

AR5K series contains a conductive polymer as material of cathode electrode. Therefore, like other solid electrolyte capacitors, the life ends mostly due to random failure mode, mainly short circuit. If a current continuously flow through the capacitor due to short circuit, the capacitor would be overheated higher than 300°C and then aluminum case of the capacitor would be removed by increasing internal pressure due to the vaporization of materials.

■Insulation

(1) Plastic coated case of capacitors is not secured to insulate. Do not use capacitors in areas requiring insulation.
(2) Isolate the case of AR5K series from the positive and negative terminals and adjacent circuit patterns.

■Design of printed circuit board

Take note on the subjects when capacitors are installed on printed circuit boards:

(1) Verify that the lead spacing fit hole pitches on printed circuit board.
(2) Do not place heating components on boards to be close to capacitors or in the backside of them.
(3) If capacitors are mounted on a double-sided PC board, design the board so that extra or through holes may not be opened below them.

■Parallel connection

If AR5K series is connected with another type of a capacitor in parallel, larger ripple current may flow through one of capacitors. Take the current balance among them into account in circuit designs.

■Using temperature and frequency

The electric characteristics of capacitors depend on the variations of the ambient temperature and frequency. Check the variations in designing circuits.

3. Notes on installation of capacitors

■Notes on pre-installation of capacitors

(1) Do not reuse capacitors installed in a unit with the power supply turned on for another unit. No used capacitors shall be reused excluding those removed to measure their electric characteristics in periodical inspection.

(2) If AR5K series stored for a long period may often increase in its leakage current, connect a resistor of approximately 1kΩ to the capacitors for voltage treatment.

■Notes at installation of capacitors

(1) Install capacitors in a unit after confirming that their ratings (rated capacitance and rated voltages) meet the conditions of the unit.
(2) Install capacitors in the correct polarities.
(3) Take care not to drop capacitors on floors. Do not use capacitors dropped on floors.
(4) Do not deform capacitors to install them in units.
(5) Install AR5K series on a printed circuit board after confirming that its lead pitch is equivalent to the corresponding hole pitch.
(6) At the picking, mounting, and locating by an automatic inserter or the cutting of the leads of AR5K series by an automatic mounter, some stress may be applied to the AR5K series. Take note on the shock.
(7) Do not apply any excess force with the terminals of capacitors.

■Heating

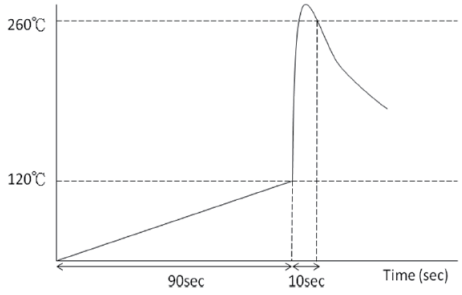
In preheating or heating for adhesion and fixing of other electronic components, the temperature put to capacitors should be less than 120°C. The total heating period should be shorter the 90 seconds

■Soldering by soldering iron

(1) Capacitors should be soldered under the conditions as follows:
The iron tip at the temperature of 400±10°C or less may be put to each lead of AR5K series for shorter than 3+1 seconds.
(2) The lead wire terminations of capacitors may be required to be processed because the distance between the terminals is not equivalent to that of corresponding holes on the printed circuit board. Process the terminations so that no stress may be applied to the capacitors itself before soldering.
(3) Do not make the tip of a soldering iron be in contact with capacitors themselves.
(4) The leakage current of soldered capacitors may increase slightly depending on several conditions including pre-heating, Soldering temperature and period, and board material and thickness. However, the leakage current decreases gradually by the self-repair characteristic of capacitors when they are used with voltage application.

■Flow soldering

(1) Do not dip capacitors themselves into melted solder in soldering. Only provide soldering for the board surface in the backside of the surface on which the capacitors are mount
(2) Solder capacitors under the soldering conditions as follows.
(a) Pre-heat condition: atmosphere temperature 120°C or less for up to 90 seconds
(b) Soldering condition: solder temperature 260°C or less for up to 10 seconds.
(3) Note that flux may not adhere to any substances except lead wires.
(4) Do not make any other components fallen at capacitors in soldering



Flow Curve

■Handling of capacitors after soldering

(1) Do not incline, bend, and twist capacitors.
(2) Do not grab capacitors as a handle to carry the printed circuit board.
(3) Do not hit objects against capacitors. When printed circuit boards are piled up, do not make them and/or other components be in contact with capacitors.
(4) Do not drop printed circuit boards with capacitors installed.

■Cleaning of printed circuit board

As long as the cleaning agents prescribed in the catalogue or the specification sheet are used, the cleaning does not give the capacitors any damage. For CFCs substitutions and other cleaning agents, consult us before actual use.

■Fixing and coating materials

Contact us for fixing and coating materials appropriate for capacitors and their heat curing conditions.

4. Notes on use of capacitors in unit

(1) Never make your fingers contact with the lead wire terminations of capacitors.
(2) Do not make lead wire terminations of AR5K series to be in contact with each other through a conductor. Do not put conductive liquid such as acid and alkali solutions on capacitors.
(3) Confirm that the unit including capacitors is placed in proper conditions. Do not place the unit in the following areas:
(a) Area in which they are directly exposed to water, brine, or oil or in condensation status.
(b) Area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and ammonia.
(c) Area to which ultraviolet and/or radial rays are radiated
(4) Provide aging for a unit containing capacitors within the period defined for them.
(5) It is recommended to use a unit containing capacitors in the normal temperature range of 15°C to 35°C and the normal humidity range of 75% or less.

5. Action at emergency

(1) At the occurrence of short circuit in AR5K series, some heat is generated from it if the short-current rather small. If the short current exceeds the above value, the capacitors is heated excessively. If so, turn off the power of the unit without your face and hands being close to the capacitors.
(2) Never lick the electrolyte of conductive polymer in capacitors. If the electrolyte is put on your skin, wash it away carefully with soap.
(3) The materials of seal rubber used for capacitors are flammable. If an adjacent component is burned, seal rubber of the capacitors may burn. Take sufficient note on the installation procedures and locations of capacitors and the pattern designs of printed circuit boards.

6. Storage

(1) Store capacitors in an area in the temperature range between 15°C to 35°C and the relative humidity of 75% or less without direct sunshine. In addition, store them in the package states if possible.
(2) Capacitors should be stored for up to three years to maintain their good soldering features and characteristics.
(3) Capacitors are recommended that you shall open the bag just before use and capacitors shall be used up. If some quantity was not need, please seal it with adhesive tape.
(4) Never store capacitors in any area in which they are directly exposed to water, brine, or oil or in condensation status.
(5) Never store capacitors in any area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, and ammonia.
(6) Never store capacitors in any area to which ultraviolet and/or radial rays are radiated.

7. Exhaustion of capacitors

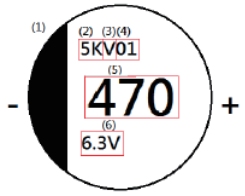
Capacitors are composed of organic compounds, resins and metals. Request an industrial dispose company to dispose of used capacitors.

8. Export Trade Control Ordinance

Item 41-4 in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of MITI' s Ordinance) and Item 7 in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of MITI' s Ordinance) state export regulations on pulse use capacitors (750V of higher) and high voltage use capacitors(5,000V or higher).
However, aluminum electrolytic capacitors are less than 750V in their voltage range, so that the regulations do not apply to the aluminum electrolytic capacitors.

■Marking

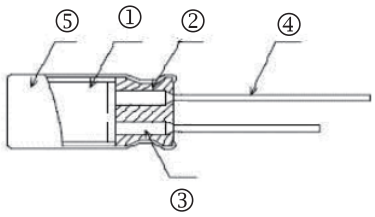
The color of marking ink is cool gray



(1)	Polarity	(4)	Production Period Code
(2)	Series	(5)	Rated Capacitance
(3)	Year Code EX:Z-2019,A-2020	(6)	Rated Voltage

Conductive Polymer Aluminum Solid Electrolytic Capacitors－ARHA Series

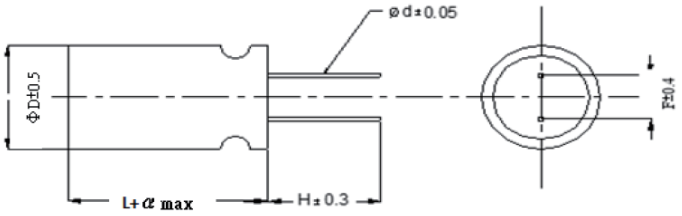
■Construction



①	Element	④	Lead Wire
②	Seal	⑤	Case
③	Aluminum Tab		

■Features

－Rated voltage：25~100Vdc
－Endurance：5,000 hours at 105°C
－Suitable for DC-DC converters , voltage regulators and decoupling applications
－RoHS Compliant



■Dimensions

Unit: mm

Type	D	L	α	d	F	H
ARHA0605	6.3±0.5	5.0	-0.5~1	0.45±0.05	2.5±0.4	3.2±0.3
ARHA0608	6.3±0.5	8.0	-0.5~1	0.60±0.05	2.5±0.4	3.2±0.3
ARHA0808	8.0±0.5	8.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
ARHA0812	8.0±0.5	12.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
ARHA0816	8.0±0.5	16.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
ARHA0820	8.0±0.5	20.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
ARHA1012	10.0±0.5	12.0	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3
ARHA1016	10.0±0.5	16.0	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3
ARHA1020	10.0±0.5	20.0	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3

■Product Identification

ARHA	0605	M	B	350	470
Product Type	Dimensions (DxL)	Capacitance Tolerance	Packaging Code	Rated Voltage	Capacitance
	0605: 6.3x5.0 0608: 6.3x8.0 0808: 8.0x8.0 0812: 8.0x12.0 0816: 8.0x16.0 0820: 8.0x20.0 1012: 10.0x12.0 1016: 10.0x16.0 1020: 10.0x20.0	M: ±20%	B: Bulk	250: 25V 350: 35V 630: 63V 800: 80V 101: 100V	220: 22uF 101: 100uF 102: 1000uF

Standard Ratings

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20°C, 100K to 300KHz)	Rated Ripple Current (mArms/105°C/100KHz)	Sizs Code
ARHA0608MB250820	25 (28.8)	82	410	0.12	28	2700	0608
ARHA0812MB250101	25 (28.8)	100	500	0.12	22	3600	0812
ARHA0812MB250221	25 (28.8)	220	1100	0.12	16	4650	0812
ARHA0812MB250331	25 (28.8)	330	1650	0.12	16	4650	0812
ARHA0812MB250471	25 (28.8)	470	2350	0.12	16	4650	0812
ARHA1012MB250561	25 (28.8)	560	2800	0.12	14	5100	1012
ARHA0816MB250681	25 (28.8)	680	3400	0.12	14	5000	0816
ARHA1012MB250681	25 (28.8)	680	3400	0.12	14	5100	1012
ARHA0820MB250821	25 (28.8)	820	4100	0.12	13	5100	0820
ARHA1016MB250102	25 (28.8)	1000	5000	0.12	13	5200	1016
ARHA1020MB250152	25 (28.8	1500	7500	0.12	13	5300	1020
ARHA0605MB350470	35 (40.3)	47	329	0.12	35	2300	0605
ARHA0608MB350680	35 (40.3)	68	476	0.12	25	2600	0608
ARHA0608MB350101	35 (40.3)	100	700	0.12	35	2350	0608
ARHA0808MB350101	35 (40.3)	100	700	0.12	23	2800	0808
ARHA0812MB350221	35 (40.3)	220	1540	0.12	25	2890	0812
ARHA1012MB350331	35 (40.3)	330	2310	0.12	24	3400	1012
ARHA1020MB350471	35 (40.3)	470	3290	0.12	20	4400	1020
ARHA1016MB350471	35 (40.3)	470	3290	0.12	25	4000	1016
ARHA1016MB350561	35 (40.3)	560	3920	0.12	23	4200	1016
ARHA1020MB350681	35 (40.3)	680	4760	0.12	20	4800	1020
ARHA0812MB500121	50 (57.5)	120	1200	0.12	28	2620	0812
ARHA1012MB500181	50 (57.5)	180	1800	0.12	28	3100	1012
ARHA1012MB500221	50 (57.5)	220	2200	0.12	28	3100	1012
ARHA1020MB500391	50 (57.5)	390	3900	0.12	23	3800	1020
ARHA0808MB630220	63 (72.5)	22	277	0.12	35	2100	0808
ARHA0812MB630470	63 (72.5)	47	592	0.12	30	2500	0812
ARHA1012MB630680	63 (72.5)	68	857	0.12	25	2500	1012
ARHA1012MB630101	63 (72.5)	100	1260	0.12	30	2700	1012
ARHA1012MB630181	63 (72.5)	180	2268	0.12	30	2700	1012
ARHA0808MB800220	80 (92)	22	352	0.12	40	1700	0808
ARHA1012MB800470	80 (92)	47	752	0.12	32	2100	1012
ARHA1012MB800820	80 (92)	82	1312	0.12	32	2200	1012
ARHA1012MB101220	100 (115)	22	440	0.12	45	1600	1012
ARHA1012MB101470	100 (115)	47	940	0.12	35	2100	1012

- Category temperature range: -55~+105℃
- Surge voltage: rated voltage*1.15
- Rated ripple current: Rated ripple current shall be in accordance with standard ratings list.
  These current are rms values of sine wave of 100KHz at 105℃

■Frequency Correction Factor of Allowable Ripple Current

Frequency	120Hz≦f＜1KHz	1KHz≦f＜10KHz	10KHz≦f＜50KHz	50KHz≦f＜100KHz	100KHz≦f≦300KHz
Coefficient	0.05	0.03	0.7	0.85	1

■Environmental Characteristics

General

Item	Specifications
Measurement condition	Each measurement shall be conducted at a temperature of 15 to 35°C, and relative humidity of 45 to 85%. Furthermore, these measurements shall be preferably conducted at a temperature of 20±2°C, and relative humidity of 60 to 70%, while the capacitors shall be kept enough time in the measuring temperature.
Voltage treatment	If leakage current is doubtful, measure it after performing voltage treatment, which shall contain the following steps: (1) Applied DC rated voltage to the capacitors for 60 minutes at 105±2°C. (2) Cooled down to room temperature with applying voltage. (3) Discharged through a resistor of approximately 1Ω/V.

Electrical Performance Test

Item	Requirement		Test Condition
Tolerance on Rated Capacitance	In Within standard ratings		Rated capacitance shall meet within ±20% tolerance against the rated capacitance measured at 120Hz±10% at 20±2°C.
Leakage current	In accordance within standard ratings		DC rated voltage shall be applied between anode and cathode lead wire terminations of a capacitor through 1KΩ protective resistance, and the leakage current shall be less than or equal to the value listed in accordance with electrical specification after 2 minutes with the voltage reaching the rated value at 20±2°C. If the value is doubtful, measure the leakage current after performing voltage treatment as follows Voltage treatment
Tangent of loss angle (tan δ)	tan δ values shall be less than or equal to 0.12		At 120Hz±10% at 20±2°C.
Equivalent Series Resistance (ESR)	shall be less than or equal to the value in standard ratings		Equipment: Agilent technology 4263B or equivalent Test fixture: Agilent technology 16047E or equivalent Compensation: Short and open compensation would be required, Short correction is performed using the shorting plate made of 0.5 thickness copper plate with gold coating Signal level: 500mV Frequency: 100KHz Measurement point: Point of lead wire within 1mm form the body
Impedance at high and low temperature	Impedance ratio	Performance	at -55±3°C or 105±3°C, 100kHz
	Z(-55°C)/Z(+20°C)	≦1.25	
	Z(-105°C)/Z(+20°C)	≦1.25	

Mechanical Characteristies Test

Item	Requirement	Test Condition
Pull Strength Load of Lead Wire Terminations	That capacitor shall not appear any change defective in use.	With the body of a capacitor fixed, the load listed shall be applied to the lead wire termination in its draw out direction, gradually up to the specified value and held for 10±1 seconds. Pull strength load of lead wire terminations

Lead wire diameter (mm)	Load strength(N)	Load strength(kgf)
0.35<d≦0.5	5	0.51
0.35<d≦0.8	10	1.0

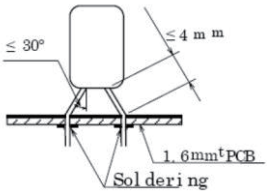
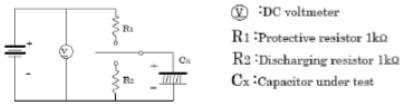
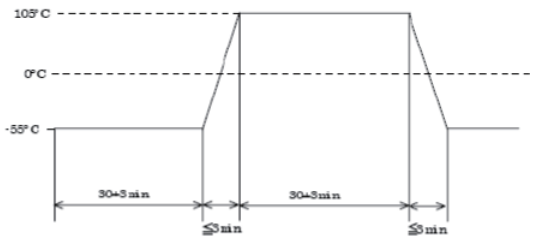
<table>
<tr><th>Item</th><th>Requirement</th><th>Test Condition</th></tr>
<tr><td>Bending Strength of Lead Wire Terminations</td><td>That capacitor shall not appear any change defective in use.</td><td>Bending strength load listed shall be hung at the end of the lead wire termination, and the body of a capacitor shall be bent 90° and return to its original position. This operation shall be performed around 2 to 3 seconds. Then the body shall be bent 90°at the opposite direction and return to its original position at same speed
Bending strength of lead wire terminations
<table>
<tr><td>Lead wire diameter (mm)</td><td>Load strength(N)</td><td>Load strength(kgf)</td></tr>
<tr><td>0.35<d≦0.5</td><td>2.5</td><td>0.255</td></tr>
<tr><td>0.35<d≦0.8</td><td>5</td><td>0.51</td></tr>
</table></td></tr>
<tr><td>Vibration</td><td>During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test.</td><td>Vibration cycle should vary from 10 to 55Hz with total amplitude of 1.5mm and return to 10Hz in about 1 minute. Vibration applied to a capacitor should be three directions, which each perpendicular to the other two as longitudinal axis of capacitor set as z axis, and last for 2 hours in each direction. During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test,. A capacitor shall be fixed at the point of 4mm or less from the body as shown in Figure 1.
 

Figure 1 Vibration test</td></tr>
<tr><td>Solderability</td><td>Least 95% of circumferential surface of the dipped portion of termination shall be covered with new solder.</td><td>A lead wire termination shall be dipped for 2±0.5 seconds in the flux of ethanol or isopropylalcohol solution (25±2%) of colophonium. Then that lead wire terminations shall be immersed to a solder (H60A, H60S or H63A) of 235±5°C and up to the point 1.5 to 2.0mm from the body and kept for 2±0.5 seconds, and pulling it out.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>
<table>
<tr><td>Characteristics</td><td>Performance</td></tr>
<tr><td>Capacitance change</td><td>Within ±5% of the value before test</td></tr>
<tr><td>tan δ</td><td>Not exceed than the value in standard ratings</td></tr>
<tr><td>Leakage current</td><td>Not exceed than the value in standard ratings</td></tr>
<tr><td>Visual</td><td>No remarkable abnormality</td></tr>
</table></td><td>A Capacitor shall be inserted to a printed circuit board having a thickness of 1.6mm up to the point 1.5 to 2.0mm from the body. Then the lead wire termination shall be dipped for 5 to 10 seconds in the flux of ethanol solution (25±2%) of colophonium. And then the lead wire termination shall be immersed to the solder (H60A, H60S or H63A) of 260±5°C and up to the point of the Printed circuit board and kept for 10±1seconds, and pulling it out.</td></tr>
<tr><td>Resistance to Solvent</td><td>Marking: easily readable
Appearance: not appear any abnormality</td><td>A Capacitor shall be immersed for 30±5 seconds in isopropylalcohol at 20 to 25°C and then pull it out</td></tr>
</table>

Environmental Performance Test

Item	Requirements	Test Condition
Damp Heat, Steady State	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦150% of the initial specified value Leakage current: ≦the initial specified value	A capacitor shall be subjected to a temperature of 60±2°C and relative humidity of 90 to 95% without voltage applied for a period of 1000+24/-0 hours. Then that capacitor shall be taken out from the above condition to a temperature of 20°C
Endurance		A capacitor shall be subjected to a temperature of 105±2°C with test voltage applied for a period of 5,000+72/-0 hours and take out from the above condition to a temperature of 20°C . Besides, the applied voltage shall increase up from 0V to test voltage step by step (maximum 5 minutes), and the impedance of the source shall be equal to about 3Ω/V.
Surge Voltage		when the capacitors are restored to +20°C after the surge voltage is applied at a cycle of 360 seconds which consists charge for 30±5 seconds through a protective resistor of 1KΩand discharge for 330 seconds, for 1000 cycles at 105±2°C  Surge voltage circuit
Rapid Temperature Change	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦the initial specified value Leakage current: ≦the initial specified value	The characteristics of a capacitor kept under the temperature cycle indicated in Figure 2 for 5 cycles and followed the voltage treatment as follows Voltage treatment  Figure 2 Rapid temperature change profile

■Packing Quantity

Type	PE Bag(PCS)	Inner Box(PCS)
ARHA0605	500	6,000
ARHA0608	500	4,000
ARHA0808	500	3,000
ARHA0812	500	2,000
ARHA0816	500	2,000
ARHA0820	400	1,600
ARHA1012	500	2,000
ARHA1016	400	1,600
ARHA1020	350	1,400

■Instructions of Capacitors

1. Cautions on use of Capacitor

■Polarity

Solid electrolytic capacitors are polarized capacitors. Use capacitors after verifying their positive and negative polarities. If these capacitors are installed in the reverse polarity, its life may shorten because of increasing leakage current or short circuit.

■Types of circuits in which capacitors are prohibited from being used

ARHA series may be heated by soldering to increase in its leakage current slightly. This may have some influence on the characteristics capacitors in the following circuits.

(1) Time constant circuit
(2) Coupling circuit
(3) High impedance voltage holding circuit
(4) Connection of two or more capacitors in series for higher withstand voltage.

■Over voltage

If ARHA series is applied a voltage higher than the rated voltage for an instantaneous period, it may be defected due to short circuit. Note that the voltage over the rated voltage must not be applied to capacitors

■Repeat of rapid charging and discharging

If ARHA series is used in a rapid charging and discharging circuit or receive the flow of excess rush current, its life may shorten by large leakage current or short circuit. The charging and discharging current through ARHA series should be less than 10A.

■Soldering

Capacitors should be soldered under the soldering conditions defined in the delivery specifications. Some improper soldering condition may cause the leakage current of capacitors to increase or other parameters to change.

■Use of capacitors for industrial equipment

When capacitors are used for industrial equipment, the circuits should be designed to have sufficient margins in the ratings of capacitors including capacitance and impedance. Without sufficient margins in the characteristics, the reliability of the capacitors may be reduced by their shorter life. Always contact us if you want to use capacitors for equipment affecting human lives such as space, aviation, atomic power, and medical devices. Never use capacitors for the used without our prior approval.

2. Notes on circuit designs for capacitors

■Rating and performance

Use capacitors within the rating and performance ranges defined in the brochures and delivery specification of capacitors after checking the operating and installation environments.

■Operating temperature

If ARHA series is used at a temperature higher than the upper specified temperature (105°C), its life may be remarkably shortened or the leakage current may increase to cause defective.

■Ripple current

Never make current larger than the rated ripple current through ARHA series. If excess ripple current flows through ARHA series, internal heat may be generated largely to make its life shortened or cause it to be defected due to short circuit.

■Leakage current

Depending on the soldering conditions, the leakage current of ARHA series may increase slightly. The application of DC voltage enables the capacitors to be repaired by itself. This leads the leakage current to be smaller gradually. The leakage current can be reduced fast if the DC voltage, which is less than the rating voltage, is applied at the temperature close to the upper specified temperature.

■Applied voltage

(1) To secure the reliability of capacitors, it is recommended that the voltage applied to them should be less than 80% of the rated voltage.
(2) The peak value of the ripple voltage superimposed with the DC voltage should be less than the rated voltage.

■Failure mode

ARHA series contains a conductive polymer as material of cathode electrode. Therefore, like other solid electrolyte capacitors, the life ends mostly due to random failure mode, mainly short circuit. If a current continuously flow through the capacitor due to short circuit, the capacitor would be overheated higher than 300°C and then aluminum case of the capacitor would be removed by increasing internal pressure due to the vaporization of materials.

■Insulation

(1) Plastic coated case of capacitors is not secured to insulate. Do not use capacitors in areas requiring insulation.
(2) Isolate the case of ARHA series from the positive and negative terminals and adjacent circuit patterns.

■Design of printed circuit board

Take note on the subjects when capacitors are installed on printed circuit boards:

(1) Verify that the lead spacing fit hole pitches on printed circuit board.
(2) Do not place heating components on boards to be close to capacitors or in the backside of them.
(3) If capacitors are mounted on a double-sided PC board, design the board so that extra or through holes may not be opened below them.

■Parallel connection

If ARHA series is connected with another type of a capacitor in parallel, larger ripple current may flow through one of capacitors. Take the current balance among them into account in circuit designs.

■Using temperature and frequency

The electric characteristics of capacitors depend on the variations of the ambient temperature and frequency. Check the variations in designing circuits.

3. Notes on installation of capacitors

■Notes on pre-installation of capacitors

(1) Do not reuse capacitors installed in a unit with the power supply turned on for another unit. No used capacitors shall be reused excluding those removed to measure their electric characteristics in periodical inspection.
(2) If ARHA series stored for a long period may often increase in its leakage current, connect a resistor of approximately 1kΩ to the capacitors for voltage treatment.

■Notes at installation of capacitors

(1) Install capacitors in a unit after confirming that their ratings (rated capacitance and rated voltages) meet the conditions of the unit.
(2) Install capacitors in the correct polarities.
(3) Take care not to drop capacitors on floors. Do not use capacitors dropped on floors.
(4) Do not deform capacitors to install them in units.
(5) Install ARHA series on a printed circuit board after confirming that its lead pitch is equivalent to the corresponding hole pitch.
(6) At the picking, mounting, and locating by an automatic inserter or the cutting of the leads of ARHA series by an automatic mounter, some stress may be applied to the ARHA series. Take note on the shock.
(7) Do not apply any excess force with the terminals of capacitors.

■Heating

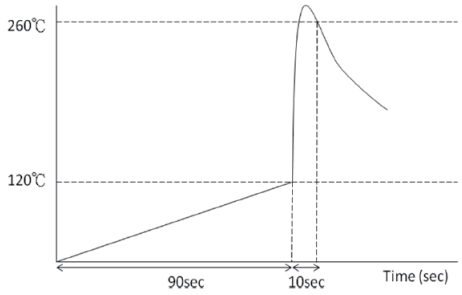
In preheating or heating for adhesion and fixing of other electronic components, the temperature put to capacitors should be less than 120°C. The total heating period should be shorter the 90 seconds

■Soldering by soldering iron

(1) Capacitors should be soldered under the conditions as follows:
The iron tip at the temperature of 400±10°C or less may be put to each lead of ARHA series for shorter than 3+1 seconds.
(2) The lead wire terminations of capacitors may be required to be processed because the distance between the terminals is not equivalent to that of corresponding holes on the printed circuit board. Process the terminations so that no stress may be applied to the capacitors itself before soldering.
(3) Do not make the tip of a soldering iron be in contact with capacitors themselves.
(4) The leakage current of soldered capacitors may increase slightly depending on several conditions including pre-heating, soldering temperature and period, and board material and thickness. However, the leakage current decreases gradually by the self-repair characteristic of capacitors when they are used with voltage application.

■Flow soldering

(1) Do not dip capacitors themselves into melted solder in soldering. Only provide soldering for the board surface in the backside of the surface on which the capacitors are mount
(2) Solder capacitors under the soldering conditions as follows.
(a) Pre-heat condition: atmosphere temperature 120°C or less for up to 90 seconds
(b) Soldering condition: solder temperature 260°C or less for up to 10 seconds.
(3) Note that flux may not adhere to any substances except lead wires.
(4) Do not make any other components fallen at capacitors in soldering



Flow Curve

■Handling of capacitors after soldering

(1) Do not incline, bend, and twist capacitors.
(2) Do not grab capacitors as a handle to carry the printed circuit board.
(3) Do not hit objects against capacitors. When printed circuit boards are piled up, do not make them and/or other components be in contact with capacitors.
(4) Do not drop printed circuit boards with capacitors installed.

■Cleaning of printed circuit board

As long as the cleaning agents prescribed in the catalogue or the specification sheet are used, the cleaning does not give the capacitors any damage. For CFCs substitutions and other cleaning agents, consult us before actual use.

■Fixing and coating materials

Contact us for fixing and coating materials appropriate for capacitors and their heat curing conditions.

4. Notes on use of capacitors in unit

(1) Never make your fingers contact with the lead wire terminations of capacitors.
(2) Do not make lead wire terminations of ARHA series to be in contact with each other through a conductor. Do not put conductive liquid such as acid and alkali solutions on capacitors.
(3) Confirm that the unit including capacitors is placed in proper conditions. Do not place the unit in the following areas:
(a) Area in which they are directly exposed to water, brine, or oil or in condensation status.
(b) Area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and ammonia.
(c) Area to which ultraviolet and/or radial rays are radiated
(4) Provide aging for a unit containing capacitors within the period defined for them.
(5) It is recommended to use a unit containing capacitors in the normal temperature range of 15°C to 35°C and the normal humidity range of 75% or less.

5. Action at emergency

(1) At the occurrence of short circuit in ARHA series, some heat is generated from it if the short-current rather small. If the short current exceeds the above value, the capacitors is heated excessively. If so, turn off the power of the unit without your face and hands being close to the capacitors.
(2) Never lick the electrolyte of conductive polymer in capacitors. If the electrolyte is put on your skin, wash it away carefully with soap.
(3) The materials of seal rubber used for capacitors are flammable. If an adjacent component is burned, seal rubber of the capacitors may burn. Take sufficient note on the installation procedures and locations of capacitors and the pattern designs of printed circuit boards.

6. Storage

(1) Store capacitors in an area in the temperature range between 15°C to 35°C and the relative humidity of 75% or less without direct sunshine. In addition, store them in the package states if possible.
(2) Capacitors should be stored for up to three years to maintain their good soldering features and characteristics.
(3) Capacitors are recommended that you shall open the bag just before use and capacitors shall be used up. If some quantity was not need, please seal it with adhesive tape.
(4) Never store capacitors in any area in which they are directly exposed to water, brine, or oil or in condensation status.
(5) Never store capacitors in any area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, and ammonia.
(6) Never store capacitors in any area to which ultraviolet and/or radial rays are radiated.

7. Exhaustion of capacitors

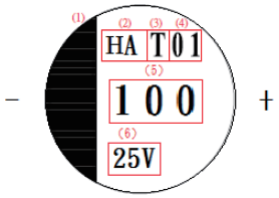
Capacitors are composed of organic compounds, resins and metals. Request an industrial dispose company to dispose of used capacitors.

8. Export Trade Control Ordinance

Item 41-4 in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of MITI' s Ordinance) and Item 7 in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of MITI' s Ordinance) state export regulations on pulse use capacitors (750V of higher) and high voltage use capacitors(5,000V or higher).
However, aluminum electrolytic capacitors are less than 750V in their voltage range, so that the regulations do not apply to the aluminum electrolytic capacitors.

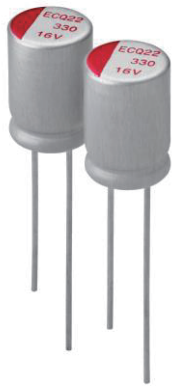
Marking

The color of marking ink is red

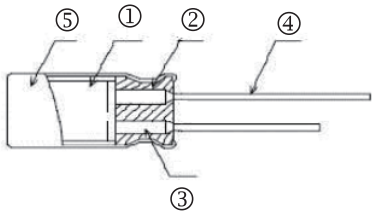


(1)	Polarity	(4)	Production Period Code
(2)	Series	(5)	Rated Capacitance
(3)	Year Code EX:Z-2019,A-2020	(6)	Rated Voltage

Conductive Polymer Aluminum Solid Electrolytic Capacitors－AREP Series



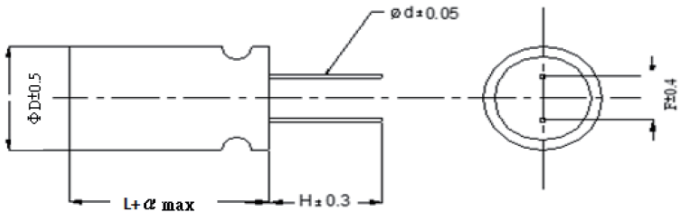
■Construction



①	Element	④	Lead Wire
②	Seal	⑤	Case
③	Aluminum Tab		

■Features

－Super low ESR, high ripple current capability
－Rated voltage：6.3~35Vdc
－Endurance：3,000 hours at 105ºC
－Suitable for DC-DC converters , voltage regulators and decoupling applications
－RoHS Compliant



■Dimensions

Unit: mm

Type	D	L	α	d	F	H
AREP0507	5.0±0.5	7.0	-0.5~1	0.50±0.05	2.0±0.4	3.2±0.3
AREP0508	5.0±0.5	8.0	-0.5~1	0.50±0.05	2.0±0.4	3.2±0.3
AREP0605	6.3±0.5	5.0	-0.5~1	0.60±0.05	2.5±0.4	3.2±0.3
AREP0608	6.3±0.5	8.0	-0.5~1	0.60±0.05	2.5±0.4	3.2±0.3
AREP0610	6.3±0.5	10.0	-0.5~1	0.60±0.05	2.5±0.4	3.2±0.3
AREP0611	6.3±0.5	11.0	-0.5~1	0.60±0.05	2.5±0.4	3.2±0.3
AREP0808	8.0±0.5	8.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AREP0810	8.0±0.5	10.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AREP0812	8.0±0.5	12.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AREP0816	8.0±0.5	16.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AREP0820	8.0±0.5	20.0	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AREP1010	10.0±0.5	10.0	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3
AREP1012	10.0±0.5	12.0	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3
AREP1016	10.0±0.5	16.0	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3
AREP1020	10.0±0.5	20.0	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3

Product Identification

AREP	0508	M	B	6V3	331
Product Type	Dimensions (DxL)	Capacitance Tolerance	Packaging Code	Rated Voltage	Capacitance
	0507: 5.0x7.0 0508: 5.0x8.0 0605: 6.3x5.0 0608: 6.3x8.0 0610: 6.3x10.0 0611: 6.3x11.0 0808: 8.0x8.0 0810: 8.0x10.0 0812: 8.0x12.0 0816: 8.0x16.0 0820: 8.0x20.0 1010: 10.0x10.0 1012: 10.0x12.0 1016: 10.0x16.0 1020: 10.0x20.0	M: ±20%	B: Bulk	6V3: 6.3V 6V8: 6.8V 7V5: 7.5V 10V: 10V 12V: 12V 16V: 16V 20V: 20V 25V: 25V 35V: 35V	331: 330uF 102: 1000uF

Standard Ratings

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20℃, 100K to 300KHz)	Rated Ripple Current (mArms/105℃/100KHz)	Sizs Code
AREP0605MB6V3221	6.3 (7.2)	220	277	0.10	15	3160	0605
AREP0507MB6V3271	6.3 (7.2)	270	340	0.10	12	3500	0507
AREP0508MB6V3331	6.3 (7.2)	330	500	0.10	8	4050	0508
AREP0605MB6V3331	6.3 (7.2)	330	500	0.10	17	3390	0605
AREP0608MB6V3331	6.3 (7.2)	330	500	0.10	8	4700	0608
AREP0508MB6V3391	6.3 (7.2)	390	500	0.10	11	3700	0508
AREP0508MB6V3471	6.3 (7.2)	470	592	0.10	8	4050	0508
AREP0608MB6V3471	6.3 (7.2)	470	592	0.10	8	4700	0608
AREP0608MB6V3561	6.3 (7.2)	560	705	0.10	8	4700	0608
AREP0608MB6V3681	6.3 (7.2)	680	857	0.10	8	4700	0608
AREP0608MB6V3821	6.3 (7.2)	820	1033	0.10	8	4700	0608
AREP0610MB6V3102	6.3 (7.2)	1000	1260	0.10	8	4700	0610
AREP0808MB6V3102	6.3 (7.2)	1000	1260	0.10	7	6100	0808
AREP0812MB6V3122	6.3 (7.2)	1200	1512	0.10	7	6100	0812
AREP0812MB6V3152	6.3 (7.2)	1500	1890	0.10	7	6100	0812
AREP1010MB6V3152	6.3 (7.2)	1500	1890	0.10	12	5025	1010
AREP1012MB6V3152	6.3 (7.2)	1500	1890	0.10	7	6640	1012
AREP0507MB6V8271	6.8 (7.8)	270	367	0.10	12	3500	0507
AREP0508MB6V8331	6.8 (7.8)	330	449	0.10	11	3800	0508
AREP0508MB6V8471	6.8 (7.8)	470	639	0.10	8	3200	0508
AREP0508MB6V8501	6.8 (7.8)	500	680	0.10	11	3800	0508
AREP0608MB6V8821	6.8 (7.8)	820	1115	0.10	8	5500	0608
AREP0610MB6V8102	6.8 (7.8)	1000	1360	0.10	8	5500	0610

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20℃, 100K to 300KHz)	Rated Ripple Current (mArms/105℃/100KHz)	Sizs Code
AREP0507MB7V5271	7.5 (8.6)	270	405	0.10	12	3500	0507
AREP0508MB7V5391	7.5 (8.6)	390	585	0.10	11	3800	0508
AREP0508MB7V5501	7.5 (8.6)	500	750	0.10	12	3500	0508
AREP0608MB7V5561	7.5 (8.6)	560	705	0.10	8	4700	0608
AREP0608MB7V5681	7.5 (8.6)	680	1020	0.10	12	4780	0608
AREP0611MB7V5821	7.5 (8.6)	820	1230	0.10	10	5200	0611
AREP0608MB100221	10 (11.5)	220	440	0.10	10	4500	0608
AREP0608MB100331	10 (11.5)	330	660	0.10	10	4500	0608
AREP0610MB100471	10 (11.5)	470	940	0.10	10	4700	0610
AREP0610MB100561	10 (11.5)	560	1120	0.10	10	4700	0610
AREP0808MB100681	10 (11.5)	680	1360	0.10	12	4700	0808
AREP0812MB100821	10 (11.5)	820	1640	0.10	7	6100	0812
AREP0812MB100102	10 (11.5)	1000	2000	0.10	8	6100	0812
AREP0812MB100152	10 (11.5)	1200	2400	0.10	12	3900	0812
AREP0610MB120471	12 (13.8)	470	1128	0.10	12	3900	0610
AREP0610MB120561	12 (13.8)	560	1344	0.10	12	3900	0610
AREP0508MB160101	16 (18.4)	100	320	0.10	18	2690	0508
AREP0508MB160221	16 (18.4)	220	704	0.10	18	2600	0508
AREP0608MB160221	16 (18.4)	220	704	0.10	15	3200	0608
AREP0608MB160271	16 (18.4)	270	864	0.10	15	3800	0608
AREP0608MB160331	16 (18.4)	330	1056	0.10	20	2800	0608
AREP0611MB160471	16 (18.4)	470	1505	0.10	16	4000	0611
AREP0808MB160471	16 (18.4)	470	1505	0.10	16	4000	0808
AREP0812MB160471	16 (18.4)	470	1505	0.10	10	5230	0812
AREP1010MB160471	16 (18.4)	470	1505	0.10	10	4350	1010
AREP1012MB160471	16 (18.4)	470	1505	0.10	10	6100	1012
AREP0611MB160561	16 (18.4)	560	1792	0.10	20	3500	0611
AREP0812MB160561	16 (18.4)	560	1792	0.10	14	4950	0812
AREP0812MB160681	16 (18.4)	680	2176	0.10	10	5230	0812
AREP0812MB160821	16 (18.4)	820	2624	0.10	10	5230	0812
AREP0816MB160102	16 (18.4)	1000	3200	0.10	10	6100	0816
AREP1012MB160102	16 (18.4)	1000	3200	0.10	12	5400	1012
AREP1012MB160122	16 (18.4)	1200	3840	0.10	10	6100	1012
AREP0816MB160152	16 (18.4)	1500	4800	0.10	10	6100	0816
AREP1020MB160222	16 (18.4)	2200	7040	0.10	8	8100	1020

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20℃, 100K to 300KHz)	Rated Ripple Current (mArms/105℃/100KHz)	Sizs Code
AREP0610MB200331	20 (23)	330	1320	0.10	16	3460	0610
AREP0810MB200391	20 (23)	390	1560	0.10	14	4970	0810
AREP0812MB200471	20 (23)	470	1880	0.10	14	4970	0812
AREP0816MB200681	20 (23)	680	2720	0.10	16	4650	0816
AREP1012MB250331	25 (28.8)	330	1650	0.10	16	5100	1012
AREP0812MB250471	25 (28.8)	470	2350	0.10	16	4650	0812
AREP1012MB250471	25 (28.8)	470	2350	0.10	17	4650	1012
AREP0816MB250561	25 (28.8)	560	2800	0.10	14	5000	0816
AREP1012MB250561	25 (28.8)	560	2800	0.10	14	5000	1012
AREP0816MB250681	25 (28.8)	680	3400	0.10	14	5000	0816
AREP1012MB250681	25 (28.8)	680	3400	0.10	14	5100	1012
AREP0820MB250821	25 (28.8)	820	4100	0.10	13	5100	0820
AREP1016MB250102	25 (28.8)	1000	5000	0.10	13	5200	1016
AREP1020MB250152	25 (28.8)	1500	7500	0.10	13	5300	1020
AREP0608MB350101	35 (40.3)	100	700	0.10	35	2350	0608
AREP1012MB350331	35 (40.3)	330	2310	0.10	24	4000	1012
AREP0820MB350471	35 (40.3)	470	3290	0.10	20	4400	0820
AREP1016MB350471	35 (40.3)	470	3290	0.10	25	4000	1016
AREP1016MB350561	35 (40.3)	560	3920	0.10	23	4200	1016
AREP1020MB350681	35 (40.3)	680	4760	0.10	20	4800	1020

■Category temperature range: -55~+105°C
■Surge voltage: rated voltage*1.15
■Rated ripple current: Rated ripple current shall be in accordance with standard ratings list.

These current are rms values of sine wave of 100KHz at 105°C

■Frequency Correction Factor of Allowable Ripple Current

Frequency	120Hz≦f<1KHz	1KHz≦f<10KHz	10KHz≦f<50KHz	50KHz≦f<100KHz	100KHz≦f≦300KHz
Coefficient	0.05	0.3	0.7	0.85	1

■Environmental Characteristics

General

Item	Specifications
Measurement condition	Each measurement shall be conducted at a temperature of 15 to 35°C, and relative humidity of 45 to 85%. Furthermore, these measurements shall be preferably conducted at a temperature of 20±2°C, and relative humidity of 60 to 70%, while the capacitors shall be kept enough time in the measuring temperature.
Voltage treatment	If leakage current is doubtful, measure it after performing voltage treatment, which shall contain the following steps: (1) Applied DC rated voltage to the capacitors for 60 minutes at 105±2°C. (2) Cooled down to room temperature with applying voltage. (3) Discharged through a resistor of approximately 1Ω/V.

Electrical Performance Test

Item	Requirement	Test Condition
Tolerance on Rated Capacitance	In Within standard ratings	Rated capacitance shall meet within ±20% tolerance against the rated capacitance measured at 120Hz±10% at 20±2°C.
Leakage current	In accordance within standard ratings	DC rated voltage shall be applied between anode and cathode lead wire terminations of a capacitor through 1KΩ protective resistance, and the leakage current shall be less than or equal to the value listed in accordance with electrical specification after 2 minutes with the voltage reaching the rated value at 20±2°C. If the value is doubtful, measure the leakage current after performing voltage treatment as follows Voltage treatment
Tangent of loss angle (tan δ)	tan δ values shall be less than or equal to 0.10	At 120Hz±10% at 20±2°C.
Equivalent Series Resistance (ESR)	shall be less than or equal to the value in standard ratings	Equipment: Agilent technology 4263B or equivalent Test fixture: Agilent technology 16047E or equivalent Compensation: Short and open compensation would be required, Short correction is performed using the shorting plate made of 0.5 thickness copper plate with gold coating Signal level: 500mV Frequency: 100KHz Measurement point: Point of lead wire within 1mm form the body
Impedance at high and low temperature	Impedance ratio / Performance Z(-55°C)/Z(+20°C) ≦1.25 Z(-105°C)/Z(+20°C) ≦1.25	at -55±3°C or 105±2°C, 100kHz

Mechanical Characteristies Test

Item	Requirement	Test Condition
Pull Strength Load of Lead Wire Terminations	That capacitor shall not appear any change defective in use.	With the body of a capacitor fixed, the load listed shall be applied to the lead wire termination in its draw out direction, gradually up to the specified value and held for 10±1 seconds. Pull strength load of lead wire terminations

Lead wire diameter (mm)	Load strength(N)	Load strength(kgf)
0.35<d≦0.5	5	0.51
0.35<d≦0.8	10	1.0

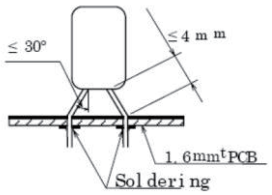
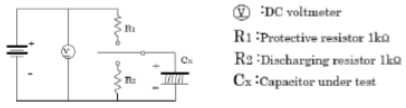
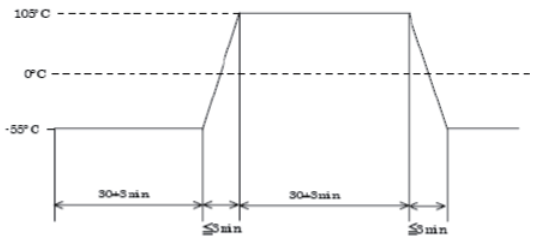
<table>
<tr><th>Item</th><th>Requirement</th><th>Test Condition</th></tr>
<tr><td>Bending Strength of Lead Wire Terminations</td><td>That capacitor shall not appear any change defective in use.</td><td>Bending strength load listed shall be hung at the end of the lead wire termination, and the body of a capacitor shall be bent 90° and return to its original position. This operation shall be performed around 2 to 3 seconds. Then the body shall be bent 90°at the opposite direction and return to its original position at same speed
Bending strength of lead wire terminations
<table>
<tr><td>Lead wire diameter (mm)</td><td>Load strength(N)</td><td>Load strength(kgf)</td></tr>
<tr><td>0.35<d≦0.5</td><td>2.5</td><td>0.255</td></tr>
<tr><td>0.35<d≦0.8</td><td>5</td><td>0.51</td></tr>
</table>
</td></tr>
<tr><td>Vibration</td><td>During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test.</td><td>Vibration cycle should vary from 10 to 55Hz with total amplitude of 1.5mm and return to 10Hz in about 1 minute. Vibration applied to a capacitor should be three directions, which each perpendicular to the other two as longitudinal axis of capacitor set as z axis, and last for 2 hours in each direction. During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test,. A capacitor shall be fixed at the point of 4mm or less from the body as shown in Figure 1.
 

Figure 1 Vibration test</td></tr>
<tr><td>Solderability</td><td>Least 95% of circumferential surface of the dipped portion of termination shall be covered with new solder.</td><td>A lead wire termination shall be dipped for 2±0.5 seconds in the flux of ethanol or isopropylalcohol solution (25±2%) of colophonium. Then that lead wire terminations shall be immersed to a solder (H60A, H60S or H63A) of 235±5°C and up to the point 1.5 to 2.0mm from the body and kept for 2±0.5 seconds, and pulling it out.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>
<table>
<tr><td>Characteristics</td><td>Performance</td></tr>
<tr><td>Capacitance change</td><td>Within ±5% of the value before test</td></tr>
<tr><td>tan δ</td><td>Not exceed than the value in standard ratings</td></tr>
<tr><td>Leakage current</td><td>Not exceed than the value in standard ratings</td></tr>
<tr><td>Visual</td><td>No remarkable abnormality</td></tr>
</table>
</td><td>A Capacitor shall be inserted to a printed circuit board having a thickness of 1.6mm up to the point 1.5 to 2.0mm from the body. Then the lead wire termination shall be dipped for 5 to 10 seconds in the flux of ethanol solution (25±2%) of colophonium. And then the lead wire termination shall be immersed to the solder (H60A, H60S or H63A) of 260±5°C and up to the point of the Printed circuit board and kept for 10±1seconds, and pulling it out.</td></tr>
<tr><td>Resistance to Solvent</td><td>Marking: easily readable
Appearance: not appear any abnormality</td><td>A Capacitor shall be immersed for 30±5 seconds in isopropylalcohol at 20 to 25°C and then pull it out</td></tr>
</table>

Environmental Performance Test

Item	Requirements	Test Condition
Damp Heat, Steady State	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦150% of the initial specified value Leakage current: ≦the initial specified value	A capacitor shall be subjected to a temperature of 60±2°C and relative humidity of 90 to 95% without voltage applied for a period of 1000+24/-0 hours. Then that capacitor shall be taken out from the above condition to a temperature of 20°C
Endurance		A capacitor shall be subjected to a temperature of 105±2°C with test voltage applied for a period of 3,000+72/-0 hours and take out from the above condition to a temperature of 20°C . Besides, the applied voltage shall increase up from 0V to test voltage step by step (maximum 5 minutes), and the impedance of the source shall be equal to about 3Ω/V.
Surge Voltage		when the capacitors are restored to +20°C after the surge voltage is applied at a cycle of 360 seconds which consists charge for 30±5 seconds through a protective resistor of 1KΩand discharge for 330 seconds, for 1000 cycles at 105±2°C  Surge voltage circuit
Rapid Temperature Change	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦the initial specified value Leakage current: ≦the initial specified value	The characteristics of a capacitor kept under the temperature cycle indicated in Figure 2 for 5 cycles and followed the voltage treatment as follows Voltage treatment  Figure 2 Rapid temperature change profile

■Packing Quantity

Type	PE Bag(PCS)	Inner Box(PCS)
AREP0507	500	4,000
AREP0508	500	4,000
AREP0605	500	6,000
AREP0608	500	4,000
AREP0610	500	3,000
AREP0611	500	3,000
AREP0808	500	3,000
AREP0810	500	2,000
AREP0812	500	2,000
AREP0816	500	2,000
AREP0820	500	1,600
AREP1010	500	2,000
AREP1012	500	2,000
AREP1016	400	1,600
AREP1020	350	1,200

■Instructions of Capacitors

1. Cautions on use of Capacitor

■Polarity

Solid electrolytic capacitors are polarized capacitors. Use capacitors after verifying their positive and negative polarities. If these capacitors are installed in the reverse polarity, its life may shorten because of increasing leakage current or short circuit.

■Types of circuits in which capacitors are prohibited from being used

AREP series may be heated by soldering to increase in its leakage current slightly. This may have some influence on the characteristics capacitors in the following circuits.

(1) Time constant circuit
(2) Coupling circuit
(3) High impedance voltage holding circuit
(4) Connection of two or more capacitors in series for higher withstand voltage.

■Over voltage

If AREP series is applied a voltage higher than the rated voltage for an instantaneous period, it may be defected due to short circuit. Note that the voltage over the rated voltage must not be applied to capacitors

■Repeat of rapid charging and discharging

If AREP series is used in a rapid charging and discharging circuit or receive the flow of excess rush current, its life may shorten by large leakage current or short circuit. The charging and discharging current through AREP series should be less than 10A.

■Soldering

Capacitors should be soldered under the soldering conditions defined in the delivery specifications. Some improper soldering condition may cause the leakage current of capacitors to increase or other parameters to change.

■Use of capacitors for industrial equipment

When capacitors are used for industrial equipment, the circuits should be designed to have sufficient margins in the ratings of capacitors including capacitance and impedance. Without sufficient margins in the characteristics, the reliability of the capacitors may be reduced by their shorter life. Always contact us if you want to use capacitors for equipment affecting human lives such as space, aviation, atomic power, and medical devices. Never use capacitors for the used without our prior approval.

2. Notes on circuit designs for capacitors

■Rating and performance

Use capacitors within the rating and performance ranges defined in the brochures and delivery specification of capacitors after checking the operating and installation environments.

■Operating temperature

If AREP series is used at a temperature higher than the upper specified temperature (105°C), its life may be remarkably shortened or the leakage current may increase to cause defective.

■Ripple current

Never make current larger than the rated ripple current through AREP series. If excess ripple current flows through AREP series, internal heat may be generated largely to make its life shortened or cause it to be defected due to short circuit.

■Leakage current

Depending on the soldering conditions, the leakage current of AREP series may increase slightly. The application of DC voltage enables the capacitors to be repaired by itself. This leads the leakage current to be smaller gradually. The leakage current can be reduced fast if the DC voltage, which is less than the rating voltage, is applied at the temperature close to the upper specified temperature.

■Applied voltage

(1) To secure the reliability of capacitors, it is recommended that the voltage applied to them should be less than 80% of the rated voltage.
(2) The peak value of the ripple voltage superimposed with the DC voltage should be less than the rated voltage.

■Failure mode

AREP series contains a conductive polymer as material of cathode electrode. Therefore, like other solid electrolyte capacitors, the life ends mostly due to random failure mode, mainly short circuit. If a current continuously flow through the capacitor due to short circuit, the capacitor would be overheated higher than 300°C and then aluminum case of the capacitor would be removed by increasing internal pressure due to the vaporization of materials.

■Insulation

(1) Plastic coated case of capacitors is not secured to insulate. Do not use capacitors in areas requiring insulation.
(2) Isolate the case of AREP series from the positive and negative terminals and adjacent circuit patterns.

■Design of printed circuit board

Take note on the subjects when capacitors are installed on printed circuit boards:
(1) Verify that the lead spacing fit hole pitches on printed circuit board.
(2) Do not place heating components on boards to be close to capacitors or in the backside of them.
(3) If capacitors are mounted on a double-sided PC board, design the board so that extra or through holes may not be opened below them.

■Parallel connection

If AREP series is connected with another type of a capacitor in parallel, larger ripple current may flow through one of capacitors. Take the current balance among them into account in circuit designs.

■Using temperature and frequency

The electric characteristics of capacitors depend on the variations of the ambient temperature and frequency. Check the variations in designing circuits.

3. Notes on installation of capacitors

■Notes on pre-installation of capacitors

(1) Do not reuse capacitors installed in a unit with the power supply turned on for another unit. No used capacitors shall be reused excluding those removed to measure their electric characteristics in periodical inspection.
(2) If AREP series stored for a long period may often increase in its leakage current, connect a resistor of approximately 1kΩ to the capacitors for voltage treatment.

■Notes at installation of capacitors

(1) Install capacitors in a unit after confirming that their ratings (rated capacitance and rated voltages) meet the conditions of the unit.
(2) Install capacitors in the correct polarities.
(3) Take care not to drop capacitors on floors. Do not use capacitors dropped on floors.
(4) Do not deform capacitors to install them in units.
(5) Install AREP series on a printed circuit board after confirming that its lead pitch is equivalent to the corresponding hole pitch.
(6) At the picking, mounting, and locating by an automatic inserter or the cutting of the leads of AREP series by an automatic mounter, some stress may be applied to the AREP series. Take note on the shock.
(7) Do not apply any excess force with the terminals of capacitors.

■Heating

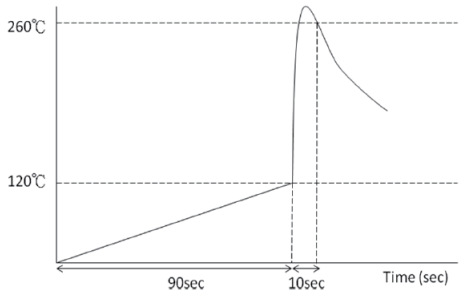
In preheating or heating for adhesion and fixing of other electronic components, the temperature put to capacitors should be less than 120°C. The total heating period should be shorter the 90 seconds

■Soldering by soldering iron

(1) Capacitors should be soldered under the conditions as follows:
The iron tip at the temperature of 400±10°C or less may be put to each lead of AREP series for shorter than 3+1 seconds.
(2) The lead wire terminations of capacitors may be required to be processed because the distance between the terminals is not equivalent to that of corresponding holes on the printed circuit board. Process the terminations so that no stress may be applied to the capacitors itself before soldering.
(3) Do not make the tip of a soldering iron be in contact with capacitors themselves.
(4) The leakage current of soldered capacitors may increase slightly depending on several conditions including pre-heating, soldering temperature and period, and board material and thickness. However, the leakage current decreases gradually by the self-repair characteristic of capacitors when they are used with voltage application.

■Flow soldering

(1) Do not dip capacitors themselves into melted solder in soldering. Only provide soldering for the board surface in the backside of the surface on which the capacitors are mount
(2) Solder capacitors under the soldering conditions as follows.
(a) Pre-heat condition: atmosphere temperature 120°C or less for up to 90 seconds
(b) Soldering condition: solder temperature 260°C or less for up to 10 seconds.
(3) Note that flux may not adhere to any substances except lead wires.
(4) Do not make any other components fallen at capacitors in soldering



Flow Curve

■Handling of capacitors after soldering

(1) Do not incline, bend, and twist capacitors.
(2) Do not grab capacitors as a handle to carry the printed circuit board.
(3) Do not hit objects against capacitors. When printed circuit boards are piled up, do not make them and/or other components be in contact with capacitors.
(4) Do not drop printed circuit boards with capacitors installed.

■Cleaning of printed circuit board

As long as the cleaning agents prescribed in the catalogue or the specification sheet are used, the cleaning does not give the capacitors any damage. For CFCs substitutions and other cleaning agents, consult us before actual use.

■Fixing and coating materials

Contact us for fixing and coating materials appropriate for capacitors and their heat curing conditions.

4. Notes on use of capacitors in unit

(1) Never make your fingers contact with the lead wire terminations of capacitors.
(2) Do not make lead wire terminations of AREP series to be in contact with each other through a conductor.
Do not put conductive liquid such as acid and alkali solutions on capacitors.
(3) Confirm that the unit including capacitors is placed in proper conditions. Do not place the unit in the following areas:
(a) Area in which they are directly exposed to water, brine, or oil or in condensation status.
(b) Area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and ammonia.
(c) Area to which ultraviolet and/or radial rays are radiated
(4) Provide aging for a unit containing capacitors within the period defined for them.
(5) It is recommended to use a unit containing capacitors in the normal temperature range of 15°C to 35°C and the normal humidity range of 75% or less.

5. Action at emergency

(1) At the occurrence of short circuit in AREP series, some heat is generated from it if the short-current rather small. If the short current exceeds the above value, the capacitors is heated excessively. If so, turn off the power of the unit without your face and hands being close to the capacitors.
(2) Never lick the electrolyte of conductive polymer in capacitors. If the electrolyte is put on your skin, wash it away carefully with soap.
(3) The materials of seal rubber used for capacitors are flammable. If an adjacent component is burned, seal rubber of the capacitors may burn. Take sufficient note on the installation procedures and locations of capacitors and the pattern designs of printed circuit boards.

6. Storage

(1) Store capacitors in an area in the temperature range between 15°C to 35°C and the relative humidity of 75% or less without direct sunshine. In addition, store them in the package states if possible.
(2) Capacitors should be stored for up to three years to maintain their good soldering features and characteristics.
(3) Capacitors are recommended that you shall open the bag just before use and capacitors shall be used up. If some quantity was not need, please seal it with adhesive tape.
(4) Never store capacitors in any area in which they are directly exposed to water, brine, or oil or in condensation status.
(5) Never store capacitors in any area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, and ammonia.
(6) Never store capacitors in any area to which ultraviolet and/or radial rays are radiated.

7. Exhaustion of capacitors

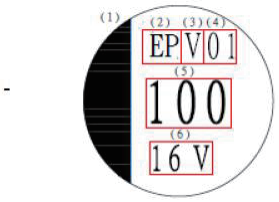
Capacitors are composed of organic compounds, resins and metals. Request an industrial dispose company to dispose of used capacitors.

8. Export Trade Control Ordinance

Item 41-4 in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of MITI' s Ordinance) and Item 7 in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of MITI' s Ordinance) state export regulations on pulse use capacitors (750V of higher) and high voltage use capacitors(5,000V or higher).
However, aluminum electrolytic capacitors are less than 750V in their voltage range, so that the regulations do not apply to the aluminum electrolytic capacitors.

■Marking

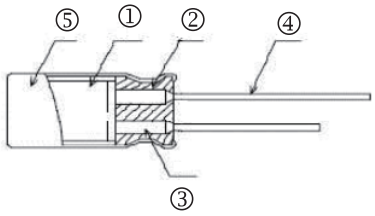
The color of marking ink is red



(1)	Polarity	(4)	Production Period Code
(2)	Series	(5)	Rated Capacitance
(3)	Year Code EX:Z-2019,A-2020	(6)	Rated Voltage

Conductive Polymer Aluminum Solid Electrolytic Capacitors－AREA Series

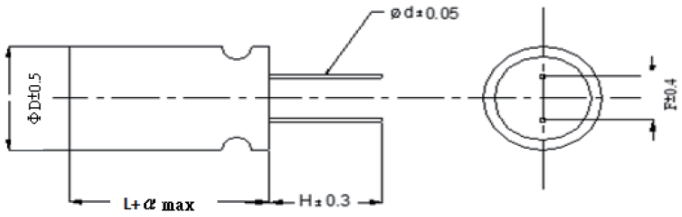
■Construction



①	Element	④	Lead Wire
②	Seal	⑤	Case
③	Aluminum Tab		

■Features

－Standard radial lead type
－Rated voltage：2.5~16Vdc
－Endurance：2,000 hours at 105ºC
－Suitable for DC-DC converters , voltage regulators and decoupling applications
－RoHS Compliant



■Dimensions

Unit: mm

Type	D	L	α	d	F	H
AREA0605	6.3±0.5	5	-0.5~1	0.45±0.05	2.5±0.4	3.2±0.3
AREA0608	6.3±0.5	8	-0.5~1	0.60±0.05	2.5±0.4	3.2±0.3
AREA0808	8.0±0.5	8	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AREA0812	8.0±0.5	12	-0.5~1	0.60±0.05	3.5±0.4	3.2±0.3
AREA1012	10.0±0.5	12	-0.5~1	0.60±0.05	5.0±0.4	3.2±0.3

■Product Identification

AREA	0605	M	B	160	101
Product Type	Dimensions (DxL)	Capacitance Tolerance	Packaging Code	Rated Voltage	Capacitance
	0605: 6.3x5.0 0608: 6.3x8.0 0808: 8.0x8.0 0812: 8.0x12.0 1012: 10.0x12.0	M: ±20%	B: Bulk	6V3: 6.3V 10V: 10V 16V: 16V	101: 100uF 102: 1000uF

■Standard Ratings

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20℃, 100K to 300KHz)	Rated Ripple Current (mArms/105℃/100KHz)	Sizs Code
AREA0605MB2V5561	2.5 (2.9)	560	280	0.12	10	3900	0605
AREA0808MB2V5821	2.5 (2.9)	820	410	0.12	10	5230	0808
AREA0506MB6V3221	6.3 (7.2)	220	277	0.12	15	3160	0605
AREA0506MB6V3331	6.3 (7.2)	330	416	0.12	17	3390	0605
AREA0808MB6V3471	6.3 (7.2)	470	592	0.12	15	4210	0808
AREA0812MB6V3821	6.3 (7.2)	820	1033	0.12	12	4710	0812
AREA0605MB160101	16 (18.4)	100	320	0.12	24	2490	0605
AREA0608MB160101	16 (18.4)	100	320	0.12	25	2820	0608
AREA1012MB160102	16 (18.4)	1000	3200	0.12	12	5400	1012

■Frequency Correction Factor of Allowable Ripple Current

Frequency	120Hz≦f<1KHz	1KHz≦f<10KHz	10KHz≦f<50KHz	50KHz≦f<100KHz	100KHz≦f≦300KHz
Coefficient	0.05	0.3	0.7	0.85	1

■Environmental Characteristics

General

Item	Specifications
Measurement condition	Each measurement shall be conducted at a temperature of 15 to 35 ℃, and relative humidity of 45 to 85%. Furthermore, these measurements shall be preferably conducted at a temperature of 20±2 ℃, and relative humidity of 60 to 70%, while the capacitors shall be kept enough time in the measuring temperature.
Voltage treatment	If leakage current is doubtful, measure it after performing voltage treatment, which shall contain the following steps: (1) Applied DC rated voltage to the capacitors for 60 minutes at 105±2 ℃. (2) Cooled down to room temperature with applying voltage. (3) Discharged through a resistor of approximately 1Ω/V.

Electrical Performance Test

Item	Requirement	Test Condition
Tolerance on Rated Capacitance	In Within specified tolerance	Rated capacitance shall meet within ±20% tolerance against the rated capacitance measured at 120Hz±10% at 20±2℃.
Leakage current	In accordance within electrical specification	DC rated voltage shall be applied between anode and cathode lead wire terminations of a capacitor through 1kΩ protective resistance, and the leakage current shall be less than or equal to the value listed in accordance with electrical specification after 2 minutes with the voltage reaching the rated value at 20±2℃. If the value is doubtful, measure the leakage current after performing voltage treatment as follows Voltage treatment
Tangent of loss angle (tan δ)	In accordance within electrical specification	At 120Hz±10% at 20±2℃.
Equivalent Series Resistance (ESR)	In accordance within electrical specification	Equipment: Agilent technology 4263B or equivalent Test fixture: Agilent technology 16047E or equivalent Compensation: Short and open compensation would be required, Short correction is performed using the shorting plate made of 0.5 thickness copper plate with gold coating Signal level: 500mV Frequency: 100KHz Measurement point: Point of lead wire within 1mm form the body
Impedance at high and low temperature	Impedance ratio / Performance Z(-55℃)/Z(+20℃) ≦1.25 Z(105℃)/Z(+20℃) ≦1.25	at -55±3℃ or 105±2℃, 100kHz

Mechanical Characteristies Test

<table>
<tr><th>Item</th><th>Requirement</th><th>Test Condition</th></tr>
<tr><td>Pull Strength Load of Lead Wire Terminations</td><td>No mechanical damage shall be observed</td><td>With the body of a capacitor fixed,
the load listed shall be applied to the lead wire termination in its draw out direction, gradually up to the specified value and held for 10±1 seconds.
Pull strength load of lead wire terminations
<table>
<tr><td>Case diameter</td><td>Load strength</td><td>Load strength</td></tr>
<tr><td>4mm</td><td>2.5N</td><td>0.255kgf</td></tr>
<tr><td>6.3mm</td><td>5N</td><td>0.51kgf</td></tr>
<tr><td>8mm</td><td>10N</td><td>1.0kgf</td></tr>
<tr><td>10mm</td><td>10N</td><td>1.0kgf</td></tr>
</table></td></tr>
<tr><td>Bending Strength of Lead Wire Terminations</td><td>No mechanical damage shall be observed</td><td>Bending strength load listed shall be hung at the end of the lead wire termination, and the body of a capacitor shall be bent 90o and return to its original position. This operation shall be performed around 2 to 3 seconds. Then the body shall be bent 90°at the opposite direction and return to its original position at same speed
Bending strength of lead wire terminations
<table>
<tr><td>Case diameter</td><td>Load strength</td><td>Load strength</td></tr>
<tr><td>4mm</td><td>2.5N</td><td>0.255kgf</td></tr>
<tr><td>6.3mm</td><td>5N</td><td>0.51kgf</td></tr>
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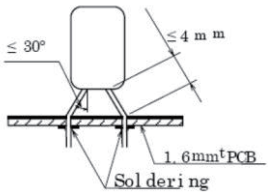
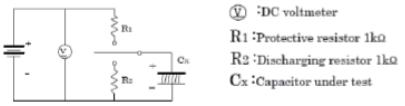
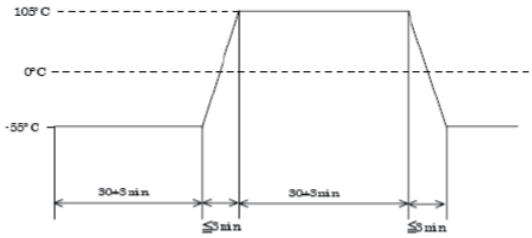
<tr><td>10mm</td><td>10N</td><td>1.0kgf</td></tr>
</table></td></tr>
<tr><td>Vibration</td><td>No visible damage</td><td>Vibration cycle should vary from 10 to 55Hz with total amplitude of 1.5mm and return to 10Hz in about 1 minute. Vibration applied to a capacitor should be three directions,
which each perpendicular to the other two as longitudinal axis of capacitor set as z axis, and last for 2 hours in each direction. During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test,. A capacitor shall be fixed at the point of 4mm or less from the body as shown in Figure 1.
 

Figure 1 Vibration test</td></tr>
<tr><td>Solderability</td><td>Least 95% of circumferential surface of the dipped portion of termination shall be covered with new solder.</td><td>A lead wire termination shall be dipped for 2±0.5 seconds in the flux of ethanol or isopropylalcohol solution (25±2%) of colophonium. Then that lead wire terminations shall be immersed to a solder (H60A, H60S or H63A) of 235±5℃ and up to the point 1.5 to 2.0mm from the body and kept for 2±0.5 seconds, and pulling it out.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>Capacitance change: within±5% of the value before test
tan δ & Leakage current: Not exceed than the value within electrical specification
Visual: no remarkable abnormality</td><td>A Capacitor shall be inserted to a printed circuit board having a thickness of 1.6mm up to the point 1.5 to 2.0mm from the body. Then the lead wire termination shall be dipped for 5 to 10 seconds in the flux of ethanol solution (25±2%) of colophonium. And then the lead wire termination shall be immersed to the solder (H60A, H60S or H63A) of 260±5 and up to the point of the Printed circuit board and kept for 10±1seconds, and pulling it out.</td></tr>
<tr><td>Resistance to Solvent</td><td>Marking: easily readable
Appearance: not appear any abnormality</td><td>A Capacitor shall be immersed for 30±5 seconds in isopropylalcohol at 20 to 25℃ and then pull it out</td></tr>
</table>

Environmental Performance Test

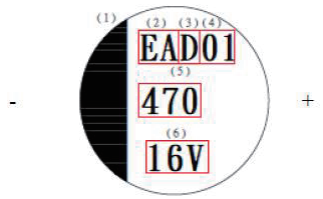
Item	Requirements	Test Condition
Damp Heat, Steady State	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦150% of the initial specified value Leakage current: ≦the initial specified value	A capacitor shall be subjected to a temperature of 60±2℃ and relative humidity of 90 to 95% without voltage applied for a period of 1000+24/-0 hours. Then that capacitor shall be taken out from the above condition to a temperature of 20℃
Endurance		A capacitor shall be subjected to a temperature of 105±2℃ with test voltage applied for a period of 2,000+72/-0 hours and take out from the above condition to a temperature of 20℃ . Besides, the applied voltage shall increase up from 0V to test voltage step by step (maximum 5 minutes), and the impedance of the source shall be equal to about 3Ω/V.
Surge Voltage		when the capacitors are restored to +20℃ after the surge voltage is applied at a cycle of 360 seconds which consists charge for 30±5 seconds through a protective resistor of 1kΩ and discharge for 330 seconds, for 1000 cycles at 105±2℃  Surge voltage circuit
Rapid Temperature Change	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦the initial specified value Leakage current: ≦the initial specified value	The characteristics of a capacitor kept under the temperature cycle indicated in Figure 2 for 5 cycles and followed the voltage treatment as follows Voltage treatment  Figure 2 Rapid temperature change profile

■Packing Quantity

Type	PE Bag(EA)	Inner Box(EA)
AREA0605	500	6,000
AREA0608	500	4,000
AREA0808	500	3,000
AREA0812	500	2,000
AREA1012	500	2,000

■Marking

The color of marking ink is red



(1)	Polarity	(4)	Production Period Code
(2)	Series	(5)	Rated Capacitance
(3)	Year Code EX:C-2022,D-2023	(6)	Rated Voltage

■Instructions of Capacitors

1. Cautions on use of Capacitor

■Polarity

Solid electrolytic capacitors are polarized capacitors. Use capacitors after verifying their positive and negative polarities. If these capacitors are installed in the reverse polarity, its life may shorten because of increasing leakage current or short circuit.

■Types of circuits in which capacitors are prohibited from being used AREA series may be heated by soldering to increase in its leakage current slightly. This may have some influence on the characteristics capacitors in the following circuits.

(1) Time constant circuit
(2) Coupling circuit
(3) High impedance voltage holding circuit
(4) Connection of two or more capacitors in series for higher withstand voltage.

■Over voltage

If AREA series is applied a voltage higher than the rated voltage for an instantaneous period, it may be defected due to short circuit. Note that the voltage over the rated voltage must not be applied to capacitors

■Repeat of rapid charging and discharging

If AREA series is used in a rapid charging and discharging circuit or receive the flow of excess rush current, its life may shorten by large leakage current or short circuit. The charging and discharging current through AREA series should be less than 10A.

■Soldering

Capacitors should be soldered under the soldering conditions defined in the delivery specifications. Some improper soldering condition may cause the leakage current of capacitors to increase or other parameters to change.

■Use of capacitors for industrial equipment

When capacitors are used for industrial equipment, the circuits should be designed to have sufficient margins in the ratings of capacitors including capacitance and impedance. Without sufficient margins in the characteristics, the reliability of the capacitors may be reduced by their shorter life. Always contact us if you want to use capacitors for equipment affecting human lives such as space, aviation, atomic power, and medical devices. Never use capacitors for the used without our prior approval.

2. Notes on circuit designs for capacitors

■Rating and performance

Use capacitors within the rating and performance ranges defined in the brochures and delivery specification of capacitors after checking the operating and installation environments.

■Operating temperature

If AREA series is used at a temperature higher than the upper specified temperature (105oC), its life may be remarkably shortened or the leakage current may increase to cause defective.

■Ripple current

Never make current larger than the rated ripple current through AREA series. If excess ripple current flows through AREA series, internal heat may be generated largely to make its life shortened or cause it to be defected due to short circuit.

■Leakage current

Depending on the soldering conditions, the leakage current of AREA series may increase slightly. The application of DC voltage enables the capacitors to be repaired by itself. This leads the leakage current to be smaller gradually. The leakage current can be reduced fast if the DC voltage, which is less than the rating voltage, is applied at the temperature close to the upper specified temperature.

■Applied voltage

(1) To secure the reliability of capacitors, it is recommended that the voltage applied to them should be less than 80% of the rated voltage.
(2) The peak value of the ripple voltage superimposed with the DC voltage should be less than the rated voltage.

■Failure mode

AREA series contains a conductive polymer as material of cathode electrode. Therefore, like other solid electrolyte capacitors, the life ends mostly due to random failure mode, mainly short circuit. If a current continuously flow through the capacitor due to short circuit, the capacitor would be overheated higher than 300°C and then aluminum case of the capacitor would be removed by increasing internal pressure due to the vaporization of materials.

■Insulation

(1) Plastic coated case of capacitors is not secured to insulate. Do not use capacitors in areas requiring insulation.
(2) Isolate the case of AREA series from the positive and negative terminals and adjacent circuit patterns.

■Design of printed circuit board

Take note on the following subjects when capacitors are installed on printed circuit boards:
(1) Verify that the lead spacing fit hole pitches on printed circuit board.
(2) Do not place heating components on boards to be close to capacitors or in the backside of them.
(3) If capacitors are mounted on a double-sided PC board, design the board so that extra or through holes may not be opened below them.

■Parallel connection

If AREA series is connected with another type of a capacitor in parallel, larger ripple current may flow through one of capacitors. Take the current balance among them into account in circuit designs.

■Using temperature and frequency

The electric characteristics of capacitors depend on the variations of the ambient temperature and frequency. Check the variations in designing circuits.

3. Notes on installation of capacitors

■Notes on pre-installation of capacitors

(1) Do not reuse capacitors installed in a unit with the power supply turned on for another unit. No used capacitors shall be reused excluding those removed to measure their electric characteristics in periodical inspection.
(2) If AREA series stored for a long period may often increase in its leakage current, connect a resistor of approximately 1kΩ to the capacitors for voltage treatment.

■Notes at installation of capacitors

(1) Install capacitors in a unit after confirming that their ratings (rated capacitance and rated voltages) meet the conditions of the unit.
(2) Install capacitors in the correct polarities.
(3) Take care not to drop capacitors on floors. Do not use capacitors dropped on floors.
(4) Do not deform capacitors to install them in units.
(5) Install AREA series on a printed circuit board after confirming that its lead pitch is equivalent to the corresponding hole pitch.
(6) At the picking, mounting, and locating by an automatic inserter or the cutting of the leads of AREA series by an automatic mounter, some stress may be applied to the AREA series. Take note on the shock.
(7) Do not apply any excess force with the terminals of capacitors.

■Heating

In preheating or heating for adhesion and fixing of other electronic components, the temperature put to capacitors should be less than 120°C. The total heating period should be shorter the 90 seconds.

■Soldering by soldering iron

(1) Capacitors should be soldered under the conditions as follows:
The iron tip at the temperature of 400±10°C or less may be put to each lead of AREA series for shorter than 3+1 seconds.
(2) The lead wire terminations of capacitors may be required to be processed because the distance between the terminals is not equivalent to that of corresponding holes on the printed circuit board. Process the terminations so that no stress may be applied to the capacitors itself before soldering.
(3) Do not make the tip of a soldering iron be in contact with capacitors themselves.
(4) The leakage current of soldered capacitors may increase slightly depending on several conditions including pre-heating, soldering temperature and period, and board material and thickness. However, the leakage current decreases gradually by the self-repair characteristic of capacitors when they are used with voltage application.

■Flow soldering

(1) Do not dip capacitors themselves into melted solder in soldering. Only provide soldering for the board surface in the backside of the surface on which the capacitors are mount
(2) Solder capacitors under the soldering conditions as follows.
(a) Pre-heat condition: atmosphere temperature 120°C or less for up to 90 seconds
(b) Soldering condition: solder temperature 260°C or less for up to 10 seconds.
(3) Note that flux may not adhere to any substances except lead wires.
(4) Do not make any other components fallen at capacitors in soldering.

■Handling of capacitors after soldering

(1) Do not incline, bend, and twist capacitors.
(2) Do not grab capacitors as a handle to carry the printed circuit board.
(3) Do not hit objects against capacitors. When printed circuit boards are piled up, do not make them and/or other components be in contact with capacitors.
(4) Do not drop printed circuit boards with capacitors installed.

■Cleaning of printed circuit board

As long as the cleaning agents prescribed in the catalogue or the specification sheets are used, the cleaning does not give the capacitors any damage. For CFCs substitutions and other cleaning agents, consult us before actual use.

■Fixing and coating materials

Contact us for fixing and coating materials appropriate for capacitors and their heat curing conditions.

4. Notes on use of capacitors in unit

(1) Never make your fingers contact with the lead wire terminations of capacitors.
(2) Do not make lead wire terminations of AREA series to be in contact with each other through a conductor. Do not put conductive liquid such as acid and alkali solutions on capacitors.
(3) Confirm that the unit including capacitors is placed in proper conditions. Do not place the unit in the following areas:
(a) Area in which they are directly exposed to water, brine, or oil or in condensation status.
(b) Area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and ammonia.
(c) Area to which ultraviolet and/or radial rays are radiated
(4) Provide aging for a unit containing capacitors within the period defined for them.
(5) It is recommended to use a unit containing capacitors in the normal temperature range of 15°C to 35°C and the normal humidity range of 75% or less.

5. Action at emergency

(1) At the occurrence of short circuit in AREA series, some heat is generated from it if the short-current rather small. If the short current exceeds the above value, the capacitors is heated excessively. If so, turn off the power of the unit without your face and hands being close to the capacitors.
(2) Never lick the electrolyte of conductive polymer in capacitors. If the electrolyte is put on your skin, wash it away carefully with soap.
(3) The materials of seal rubber used for capacitors are flammable. If an adjacent component is burned, seal rubber of the capacitors may burn. Take sufficient note on the installation procedures and locations of capacitors and the pattern designs of printed circuit boards.

6. Storage

(1) Store capacitors in an area in the temperature range between 15°C to 35°C and the relative humidity of 75% or less without direct sunshine. In addition, store them in the package states if possible.
(2) Capacitors should be stored for up to one year to maintain their good soldering features and characteristics.
(3) Capacitors are recommended that you shall open the bag just before use and capacitors shall be used up. If some quantity was not need, please seal it with adhesive tape.
(4) Never store capacitors in any area in which they are directly exposed to water, brine, or oil or in condensation status.
(5) Never store capacitors in any area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, and ammonia.
(6) Never store capacitors in any area to which ultraviolet and/or radial rays are radiated.

7. Exhaustion of capacitors

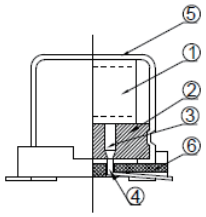
Capacitors are composed of organic compounds, resins and metals. Request an industrial dispose company to dispose of used capacitors.

8. Export Trade Control Ordinance

Item 41-4 in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of MITI' s Ordinance) and Item 7 in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of MITI' s Ordinance) state export regulations on pulse use capacitors (750V of higher) and high voltage use capacitors(5,000V or higher).
However, aluminum electrolytic capacitors are less than 750V in their voltage range, so that the regulations do not apply to the aluminum electrolytic capacitors.

Conductive Polymer Aluminum Solid Electrolytic Capacitors—AV5K Series

■Construction

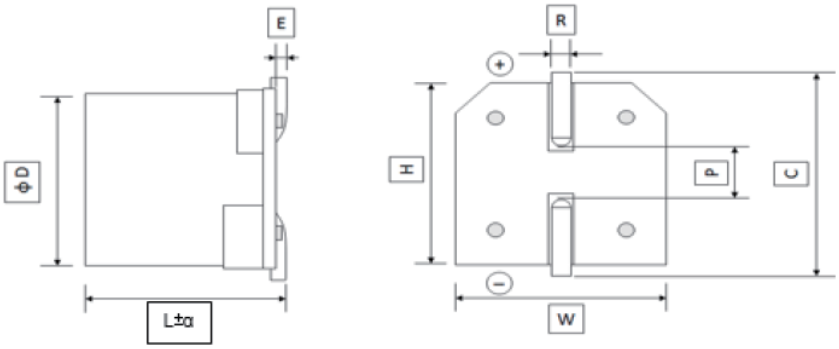


①	Element	④	Lead Wire
②	Seal	⑤	Case
③	Aluminum Tab	⑥	Base Plate

■Features

- Standard SMD type
- Rated voltage：2.5~25Vdc
- Endurance：5,000 hours at 105ºC
- Suitable for DC-DC converters , voltage regulators and decoupling applications
- RoHS Compliant

■Dimensions



Unit: mm

Type	D	L	α	E	W	H	C	R	P
AV5K0506	5.0±0.5	5.8	±0.2	0.00~0.20	5.3±0.2	5.3±0.2	6.0±0.2	0.5~0.8	1.4±0.3
AV5K0645	6.3±0.5	4.5	-0.2~+0.1	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.5~0.8	2.1±0.3
AV5K0606	6.3±0.5	5.8	±0.2	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.5~0.8	2.1±0.3
AV5K0608	6.3±0.5	7.5	±0.5	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.6~0.8	2.1±0.3
AV5K0610	6.3±0.5	9.7	±0.3	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.6~0.9	2.1±0.3
AV5K0807	8.0±0.5	6.8	±0.2	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	2.9±0.3
AV5K0810	8.0±0.5	9.7	±0.3	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	2.9±0.3
AV5K0812	8.0±0.5	12.0	±0.5	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	3.2±0.3
AV5K1012	10.0±0.5	12.3	±0.2	0.00~0.20	10.3±0.2	10.3±0.2	11.0±0.2	0.8~1.1	4.6±0.3

■Product Identification

AV5K	0606	M	T	160	101
Product Type	Dimensions (DxL)	Capacitance Tolerance	Packaging Code	Rated Voltage	Capacitance
	0506: 5.0x5.8 0645: 6.3x4.5 0606: 6.3x5.8 0608: 6.3x7.5 0610: 6.3x9.7 0807: 8.0x6.8 0810: 8.0x9.7 0812: 8.0x12.0 1012: 10.0x12.3	M: ±20%	T: Taping Reel	2V5: 2.5V 6V3: 6.3V 160: 16V 250: 25V	220: 22uF 101: 100uF 102: 1000uF

■Standard Ratings

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20°C, 100K to 300KHz)	Rated Ripple Current (mArms/105°C/100KHz)	Sizs Code
AV5K0645MT2V5331	2.5 (2.9)	330	700	0.12	16	3180	0645
AV5K0606MT2V5391	2.5 (2.9)	390	489	0.12	10	3900	0606
AV5K0606MT2V5561	2.5 (2.9)	560	700	0.12	10	3900	0606
AV5K0608MT2V5821	2.5 (2.9)	820	700	0.12	7	5000	0608
AV5K0610MT2V5821	2.5 (2.9)	820	700	0.12	10	4300	0610
AV5K0645MT6V3221	6.3 (7.2)	220	700	0.12	17	2300	0645
AV5K0606MT6V3221	6.3 (7.2)	220	277	0.12	15	3160	0606
AV5K0606MT6V3331	6.3 (7.2)	330	416	0.12	17	3390	0606
AV5K0608MT6V3561	6.3 (7.2)	560	705	0.12	8	5000	0608
AV5K0610MT6V3561	6.3 (7.2)	560	705	0.12	10	4300	0610
AV5K0506MT160101	16 (18.4)	100	320	0.12	26	3000	0506
AV5K0606MT160101	16 (18.4)	100	320	0.12	24	2490	0606
AV5K0606MT160181	16 (18.4)	180	576	0.12	21	3300	0606
AV5K0610MT160271	16 (18.4)	270	864	0.12	16	3500	0610
AV5K0807MT160271	16 (18.4)	270	864	0.12	22	3300	0807
AV5K0810MT160271	16 (18.4)	270	864	0.12	16	4400	0810
AV5K0810MT160471	16 (18.4)	470	1504	0.12	12	4700	0810
AV5K0812MT160561	16 (18.4)	560	1792	0.12	14	4950	0812
AV5K1012MT160102	16 (18.4)	1000	3200	0.12	12	5400	1012
AV5K0645MT250220	25 (28.8)	22	275	0.12	45	2350	0645
AV5K0606MT250270	25 (28.8)	27	338	0.12	40	2100	0606

■Category temperature range: -55~+105°C
■Surge voltage: rated voltage*1.15
■Rated ripple current: Rated ripple current shall be in accordance with standard ratings list.

These current are rms values of sine wave of 100KHz at 105°C

■Frequency Correction Factor of Allowable Ripple Current

Frequency	120Hz≦f<1KHz	1KHz≦f<10KHz	10KHz≦f<50KHz	50KHz≦f<100KHz	100KHz≦f≦300KHz
Coefficient	0.05	0.3	0.7	0.85	1

■Environmental Characteristics

General

Item	Specifications
Measurement condition	Each measurement shall be conducted at a temperature of 15 to 35°C, and relative humidity of 45 to 85%. Furthermore, these measurements shall be preferably conducted at a temperature of 20±2°C, and relative humidity of 60 to 70%, while the capacitors shall be kept enough time in the measuring temperature.
Voltage treatment	If leakage current is doubtful, measure it after performing voltage treatment, which shall contain the following steps: (1) Applied DC rated voltage to the capacitors for 60 minutes at 105±2°C. (2) Cooled down to room temperature with applying voltage. (3) Discharged through a resistor of approximately 1Ω/V.

Electrical Performance Test

Item	Requirement		Test Condition
Tolerance on Rated Capacitance	In Within standard ratings		Rated capacitance shall meet within ±20% tolerance against the rated capacitance measured at 120Hz±10% at 20±2°C.
Leakage current	In accordance within standard ratings		DC rated voltage shall be applied between anode and cathode lead wire terminations of a capacitor through 1KΩ protective resistance, and the leakage current shall be less than or equal to the value listed in accordance with electrical specification after 2 minutes with the voltage reaching the rated value at 20±2°C. If the value is doubtful, measure the leakage current after performing voltage treatment as follows Voltage treatment
Tangent of loss angle (tan δ)	tan δ values shall be less than or equal to 0.12		At 120Hz±10% at 20±2°C.
Equivalent Series Resistance (ESR)	shall be less than or equal to the value in standard ratings		Equipment: Agilent technology 4263B or equivalent Test fixture: Agilent technology 16047E or equivalent Compensation: Short and open compensation would be required, Short correction is performed using the shorting plate made of 0.5 thickness copper plate with gold coating Signal level: 500mV Frequency: 100KHz Measurement point: Point of lead wire within 1mm form the body
Impedance at high and low temperature	Impedance ratio	Performance	at -55±3°C or 105±2°C, 100kHz
	Z(-55°C)/Z(+20°C)	≦1.25	
	Z(-105°C)/Z(+20°C)	≦1.25	

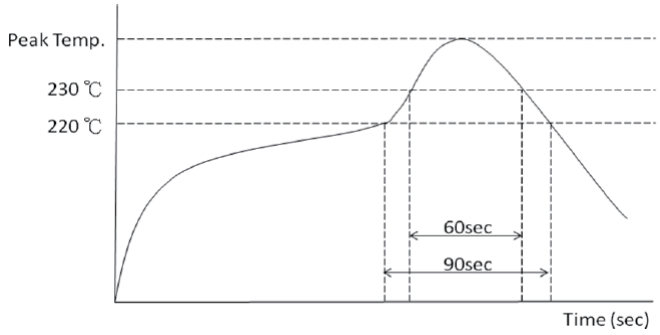
Mechanical Characteristies Test

Item	Requirement	Test Condition
Adhesion by Soldering	the soldered terminals shall not be damaged	A force of 5N shall be applied for 10 seconds to the capacitor, which was mounted on a print circuit board, in the perpendicular direction to the seal side of the capacitor
Vibration	During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test, and the appearance shall not appear any remarkable abnormality. Capacitance change shall be within ±10% of the initial measured value	Vibration cycle should vary from 10 to 55Hz with total amplitude of 1.5mm and return to 10Hz in about 1 minute. Vibration applied to a capacitor should be three directions, which each perpendicular to the other two as longitudinal axis of capacitor set as z axis, and last for 2 hours in each direction.
Solderability	Solder shall cover at least 3/4 of the lead surface immersed	The lead surface shall be immersed for 2±0.5 seconds in the flux of ethanol or isopropyl alcohol solution (25±2%) of colophonium. Then that lead surface shall be immersed to a solder (H60A, H60S or H63A) of 235±5°C and up to the point 1.5 to 2.0mm from the body and kept for 2±0.5 seconds, and pulling it out
Soldering Heat	the capacitors shall satisfy their test criteria	After the capacitors are soldered by the recommended soldering conditions below, the tests of the item Humidity resistance and Load life shall be conducted

Environmental Performance Test

Item	Requirements	Test Condition
Damp Heat, Steady State	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦150% of the initial specified value Leakage current: ≦the initial specified value	A capacitor shall be subjected to a temperature of 60±2°C and relative humidity of 90 to 95% without voltage applied for a period of 1000+48/-0 hours. Then that capacitor shall be taken out from the above condition to a temperature of 20°C
Endurance		A capacitor shall be subjected to a temperature of 105±2°C with test voltage applied for a period of 5,000+72/-0 hours and take out from the above condition to a temperature of 20°C . Besides, the applied voltage shall increase up from 0V to test voltage step by step (maximum 5 minutes), and the impedance of the source shall be equal to about 3Ω/V.
Surge Voltage		when the capacitors are restored to +20°C after the surge voltage is applied at a cycle of 360 seconds which consists charge for 30±5 seconds through a protective resistor of 1KΩand discharge for 330 seconds, for 1000 cycles at 105±2°C  Ⓥ :DC voltmeter R1 :Protective resistor 1kΩ R2 :Discharging resistor 1kΩ Cx :Capacitor under test Surge voltage circuit

■Reflow soldering

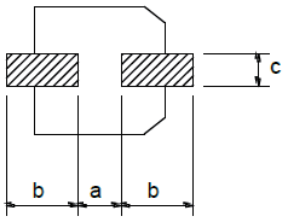


Recommended condition:

Peak temperature(max)	260°C
220°C over time(max)	90sec
230°C over time(max)	60sec
Reflow number	Only 2 time

■Soldering Pad Dimensions

Unit: mm



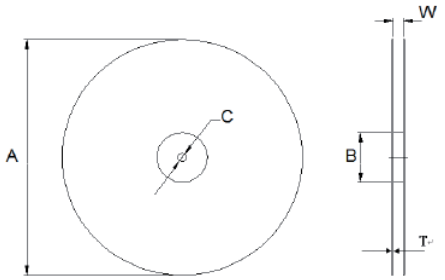
Type	a	b	c
AV5K0506	1.4	3.0	1.6
AV5K0645	2.1	3.5	1.6
AV5K0606	2.1	3.5	1.6
AV5K0608	2.1	3.5	1.6
AV5K0610	2.1	3.5	1.6
AV5K0807	2.8	4.2	1.9
AV5K0810	2.8	4.2	1.9
AV5K0812	2.8	4.2	1.9
AV5K1012	4.3	4.4	1.9

■Packaging

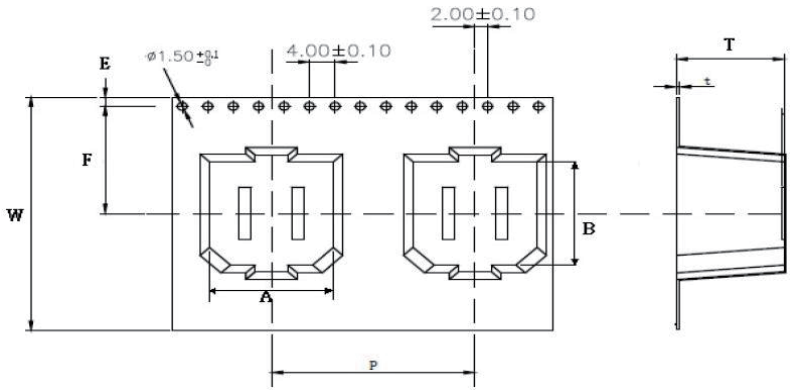
Packaging Quantity & Reel Specifications

Unit: mm

Type	A	B	C	W	T	Emboss Plastic Tape (EA)
AV5K0506	381±2	100±0.5	13±0.5	13.5±0.8	2.5±0.3	1,200
AV5K0645	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	1,500
AV5K0606	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	1,200
AV5K0608	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	900
AV5K0610	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	750
AV5K0807	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	1,000
AV5K0810	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	500
AV5K0812	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	400
AV5K1012	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	450

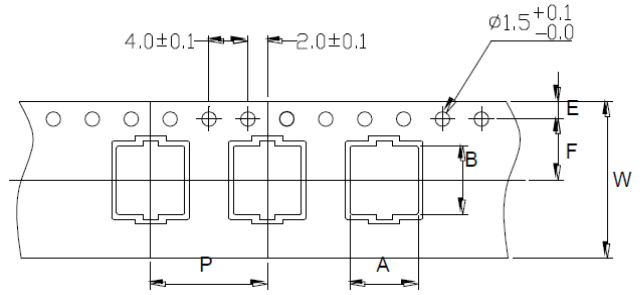


Emboss Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P	T	t
AV5K0645	6.8±0.2	6.8±0.2	16.0±0.3	1.75±0.10	7.50±0.1	12.00±0.10	4.8±0.2	0.4±0.05
AV5K0606	6.8±0.2	6.8±0.2	16.0±0.3	1.75±0.10	7.50±0.1	12.00±0.10	6.3±0.2	0.4±0.05



Unit: mm

Type	A	B	W	E	F	P	T	t
AV5K0506	5.7±0.2	5.7±0.2	12.0±0.3	1.75±0.10	5.50±0.1	12.00±0.10	6.2±0.2	0.4±0.05
AV5K0608	7.0±0.2	7.0±0.2	16.0±0.3	1.75±0.10	7.50±0.1	12.00±0.10	8.2±0.2	0.5±0.05
AV5K0610	7.0±0.2	7.0±0.2	16.0±0.3	1.75±0.10	7.50±0.1	12.00±0.10	10.0±0.2	0.5±0.05
AV5K0807	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	12.00±0.10	7.2±0.2	0.5±0.05
AV5K0810	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	10.0±0.2	0.5±0.05
AV5K0812	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	12.0±0.2	0.5±0.05
AV5K1012	10.7±0.2	10.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	13.0±0.2	0.5±0.05

■Instructions of Capacitors

1. Cautions on use of Capacitor

■Polarity

Solid electrolytic capacitors are polarized capacitors. Use capacitors after verifying their positive and negative polarities. If these capacitors are installed in the reverse polarity, its life may shorten because of increasing leakage current or short circuit.

■Types of circuits in which capacitors are prohibited from being used AV5K series may be heated by soldering to increase in its leakage current slightly. This may have some influence on the characteristics capacitors in the following circuits.

(1) Time constant circuit
(2) Coupling circuit
(3) High impedance voltage holding circuit
(4) Connection of two or more capacitors in series for higher withstand voltage.

■Over voltage

If AV5K series is applied a voltage higher than the rated voltage for an instantaneous period, it may be defected due to short circuit. Note that the voltage over the rated voltage must not be applied to capacitors

■Repeat of rapid charging and discharging

If AV5K series is used in a rapid charging and discharging circuit or receive the flow of excess rush current, its life may shorten by large leakage current or short circuit. The charging and discharging current through AV5K series should be less than 10A.

■Reflow Soldering

High soldering temperature and long soldering time will affect the characteristics of the capacitors. Use reflow soldering condition within the recommended range. Also, the temperature varies with the location and population of the components, the material and the thickness of printed circuit board. Verify temperature profiles prior to actual production run.

■Use of capacitors for industrial equipment

When capacitors are used for industrial equipment, the circuits should be designed to have sufficient margins in the ratings of capacitors including capacitance and impedance. Without sufficient margins in the characteristics, the reliability of the capacitors may be reduced by their shorter life. Always contact us if you want to use capacitors for equipment affecting human lives such as space, aviation, atomic power, and medical devices. Never use capacitors for the used without our prior approval.

2. Notes on circuit designs for capacitors

■Rating and performance

Use capacitors within the rating and performance ranges defined in the brochures and delivery specification of capacitors after checking the operating and installation environments.

■Operating temperature

If AV5K series is used at a temperature higher than the upper specified temperature (105°C), its life may be remarkably shortened or the leakage current may increase to cause defective.

■Ripple current

Never make current larger than the rated ripple current through AV5K series. If excess ripple current flows through AV5K series, internal heat may be generated largely to make its life shortened or cause it to be defected due to short circuit.

■Leakage current

Depending on the soldering conditions, the leakage current of AV5K series may increase slightly. The application of DC voltage enables the capacitors to be repaired by itself. This leads the leakage current to be smaller gradually. The leakage current can be reduced fast if the DC voltage, which is less than the rating voltage, is applied at the temperature close to the upper specified temperature.

■Applied voltage

Do not apply voltages exceeding the full rated voltage. If such voltage is applied, it may cause short circuit even though it is just a moment.

(1) Sum of DC voltage and the peak of ripple voltage AC voltage shall not exceed the rated voltage or category voltage.
(2) The sum of the DC voltage plus the negative peak AC voltage shall not allow reverse voltage.
(3) Do not apply reverse voltage.
(4) For 25V products, the applied voltage shall follow the following figure as the temperature is higher than 85°C.

■Failure mode

AV5K series contains a conductive polymer as material of cathode electrode. Therefore, like other solid electrolyte capacitors, the life ends mostly due to random failure mode, mainly short circuit. If a current continuously flow through the capacitor due to short circuit, the capacitor would be overheated higher than 300°C and then aluminum case of the capacitor would be removed by increasing internal pressure due to the vaporization of materials.

■Insulation

(1) Plastic coated case of capacitors is not secured to insulate. Do not use capacitors in areas requiring insulation.
(2) Isolate the case of AV5K series from the positive and negative terminals and adjacent circuit patterns.

■Design of printed circuit board

Take note on the subjects when capacitors are installed on printed circuit boards:

(1) For surface mount capacitors, design the copper pads/lands of a printed circuit board according to the catalog or product specifications.
(2) Do not place heating components on boards to be close to capacitors or in the backside of them.

■Parallel connection

If AV5K series is connected with another type of a capacitor in parallel, larger ripple current may flow through one of capacitors. Take the current balance among them into account in circuit designs.

■Using temperature and frequency

The electric characteristics of capacitors depend on the variations of the ambient temperature and frequency. Check the variations in designing circuits.

3. Notes on installation of capacitors

■Notes on pre-installation of capacitors

(1) Do not reuse capacitors installed in a unit with the power supply turned on for another unit. No used capacitors shall be reused excluding those removed to measure their electric characteristics in periodical inspection.
(2) If AV5K series stored for a long period may often increase in its leakage current, connect a resistor of approximately 1kΩ to the capacitors for voltage treatment.

■Notes at installation of capacitors

(1) Install capacitors in a unit after confirming that their ratings (rated capacitance and rated voltages) meet the conditions of the unit.
(2) Install capacitors in the correct polarities.
(3) Take care not to drop capacitors on floors. Do not use capacitors dropped on floors.
(4) Do not deform capacitors to install them in units.
(5) Note capacitors may be damaged by mechanical shocks caused by the vacuum head, component checker or centering operation of an automatic mounting machine.
(6) Do not dip the body of a capacitor into the solder bath.
(7) Do not solder capacitors more than once by reflow. Consult us for reflow-soldering them twice over.
(8) Do not apply mechanical stress to the capacitor after soldering to the printed circuit board.
(9) Do not use adhesives and coating materials containing halogenated solvents.

■Notes on use of capacitors in unit

(1) Never make your fingers contact with the capacitor terminals.
(2) Do not make capacitor terminals to be in contact with each other through a conductor. Do not put conductive liquid such as acid and alkali solutions on capacitors.
(3) Confirm that the unit including capacitors is placed in proper conditions. Do not place the unit in the following areas:
(a) Area in which they are directly exposed to water, brine, or oil or in condensation status.
(b) Area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and ammonia.
(c) Area to which ultraviolet and/or radial rays are radiated
(4) Provide aging for a unit containing capacitors within the period defined for them.
(5) It is recommended to use a unit containing capacitors in the normal temperature range of 15°C to 35°C and the normal humidity range of 75% or less.

■Action at emergency

(1) At the occurrence of short circuit in AV5K series, some heat is generated from it if the short-current rather small. If the short current exceeds the above value, the capacitors are heated excessively. If so, turn off the power of the unit without your face and hands being close to the capacitors.
(2) If you should expose your eyes to smoke from the capacitor or inhale it, immediately flush the open eyes and gargle with water.

■Storage

(1) Store capacitors in an area in the temperature range between 15°C to 35°C and the relative humidity of 75% or less without direct sunshine. In addition, store them in the package states if possible.
(2) SMD products are sealed in a special laminated aluminum bag. Use all capacitors once the bag is opened. Return unused capacitors to the bag, and seal it with a zipper. After the bag is opened, please use all capacitors within 6 month.
(3) Store capacitors in an airtight bag to keep the terminals in good condition.
(4)Store in a location where the capacitor is not exposed to ozone, ultraviolet radiation, or other radiation.
(5)Never store capacitors in any area in which they are directly exposed to water, brine, or oil or in condensation status.

■Exhaustion of capacitors

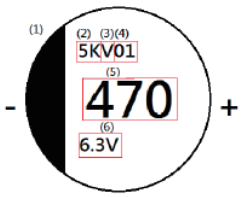
Capacitors are composed of organic compounds, resins and metals. Request an industrial dispose company to dispose of used Capacitors.

4. Export Trade Control Ordinance

Item 41-4 in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of MITI' s Ordinance) and Item 7 in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of MITI' s Ordinance) state export regulations on pulse use capacitors (750V of higher) and high voltage use capacitors(5,000V or higher).
However, aluminum electrolytic capacitors are less than 750V in their voltage range, so that the regulations do not apply to the aluminum electrolytic capacitors.

■Marking

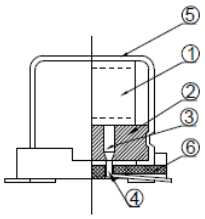
The color of marking ink is cool gray



(1)	Polarity	(4)	Production Period Code
(2)	Series	(5)	Rated Capacitance
(3)	Year Code EX:Z-2019,A-2020	(6)	Rated Voltage

Conductive Polymer Aluminum Solid Electrolytic Capacitors – AVEA Series

Construction

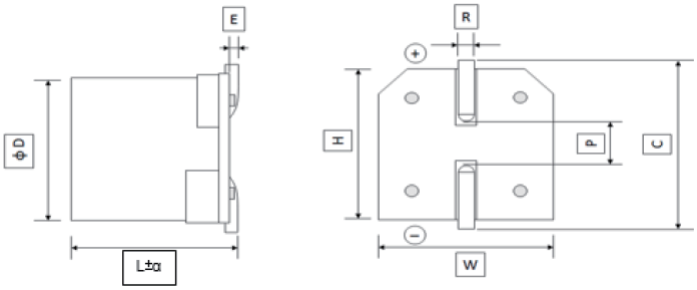


①	Element	④	Lead Wire
②	Seal	⑤	Case
③	Aluminum Tab	⑥	Base Plate

Features

- Standard SMD type
- Rated voltage：2.5~25Vdc
- Endurance：2,000 hours at 105ºC
- Suitable for DC-DC converters , voltage regulators and decoupling applications
- RoHS Compliant

Dimensions



Unit: mm

Type	D	L	α	E	W	H	C	R	P
AVEA0506	5.0±0.5	5.8	±0.2	0.00~0.20	5.3±0.2	5.3±0.2	6.0±0.2	0.5~0.8	1.4±0.3
AVEA0645	6.3±0.5	4.5	-0.2~+0.1	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.5~0.8	2.1±0.3
AVEA0606	6.3±0.5	5.8	±0.2	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.5~0.8	2.1±0.3
AVEA0610	6.3±0.5	9.7	±0.3	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.6~0.9	2.1±0.3
AVEA0807	8.0±0.5	6.8	±0.2	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	2.9±0.3
AVEA0810	8.0±0.5	9.7	±0.3	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	2.9±0.3
AVEA0812	8.0±0.5	12.0	±0.5	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	3.2±0.3
AVEA1012	10.0±0.5	12.3	±0.2	0.00~0.20	10.3±0.2	10.3±0.2	11.0±0.2	0.8~1.1	4.6±0.3

Product Identification

AVEA	0606	M	T	6V3	101
Product Type	Dimensions (DxL)	Capacitance Tolerance	Packaging Code	Rated Voltage	Capacitance
	0506: 5.0x5.8 0645: 6.3x4.5 0606: 6.3x5.8 0610: 6.3x9.7 0807: 8.0x6.8 0810: 8.0x9.7 0812: 8.0x12.0 1012: 10.0x12.3	M: ±20%	T: Taping Reel	2V5: 2.5V 6V3: 6.3V 160: 16V 250: 25V	470: 47uF 101: 100uF

■Standard Ratings

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20°C, 100K to 300KHz)	Rated Ripple Current (mArms/105°C/100KHz)	Sizs Code
AVEA0645MT2V5331	2.5 (2.9)	330	700	0.12	17	2300	0645
AVEA0506MT2V5391	2.5 (2.9)	390	700	0.12	10	3900	0506
AVEA0606MT2V5391	2.5 (2.9)	390	292	0.12	10	3900	0606
AVEA0606MT2V5561	2.5 (2.9)	560	700	0.12	10	3900	0606
AVEA0610MT2V5821	2.5 (2.9)	820	700	0.12	10	4300	0610
AVEA0645MT6V3101	6.3 (7.2)	100	315	0.12	19	2300	0645
AVEA0645MT6V3221	6.3 (7.2)	220	700	0.12	17	2300	0645
AVEA0606MT6V3221	6.3 (7.2)	220	277	0.12	15	3160	0606
AVEA0606MT6V3331	6.3 (7.2)	330	416	0.12	17	3390	0606
AVEA0610MT6V3561	6.3 (7.2)	560	705	0.12	10	4300	0610
AVEA0810MT6V3821	6.3 (7.2)	820	1033	0.12	12	4700	0810
AVEA0810MT6V3102	6.3 (7.2)	1000	1260	0.12	10	5440	0810
AVEA0606MT160470	16 (18.4)	47	376	0.12	25	2500	0606
AVEA0506MT160101	16 (18.4)	100	320	0.12	27	3000	0506
AVEA0606MT160101	16 (18.4)	100	320	0.12	24	2490	0606
AVEA0606MT160181	16 (18.4)	180	576	0.12	22	3300	0606
AVEA0807MT160271	16 (18.4)	270	864	0.12	22	3300	0807
AVEA0810MT160271	16 (18.4)	270	864	0.12	16	4400	0810
AVEA0812MT160561	16 (18.4)	560	1792	0.12	14	4950	0812
AVEA1012MT160102	16 (18.4)	1000	3200	0.12	12	5400	1012
AVEA0645MT250220	25 (28.8)	22	275	0.12	45	2350	0645
AVEA0606MT250270	25 (28.8)	27	338	0.12	40	2100	0606

■Category temperature range: -55~+105°C
■Surge voltage: rated voltage*1.15
■Rated ripple current: Rated ripple current shall be in accordance with standard ratings list.

These current are rms values of sine wave of 100KHz at 105°C

■Frequency Correction Factor of Allowable Ripple Current

Frequency	120Hz≦f＜1KHz	1KHz≦f＜10KHz	10KHz≦f＜50KHz	50KHz≦f＜100KHz	100KHz≦f≦300KHz
Coefficient	0.05	0.03	0.7	0.85	1

■Environmental Characteristics

General

Item	Specifications
Measurement condition	Each measurement shall be conducted at a temperature of 15 to 35°C, and relative humidity of 45 to 85%. Furthermore, these measurements shall be preferably conducted at a temperature of 20±2°C, and relative humidity of 60 to 70%, while the capacitors shall be kept enough time in the measuring temperature.
Voltage treatment	If leakage current is doubtful, measure it after performing voltage treatment, which shall contain the following steps: (1) Applied DC rated voltage to the capacitors for 60 minutes at 105±2°C. (2) Cooled down to room temperature with applying voltage. (3) Discharged through a resistor of approximately 1Ω/V.

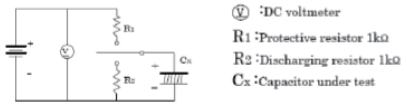
Electrical Performance Test

Item	Requirement	Test Condition
Tolerance on Rated Capacitance	In Within standard ratings	Rated capacitance shall meet within ±20% tolerance against the rated capacitance measured at 120Hz±10% at 20±2°C.
Leakage current	In accordance within standard ratings	DC rated voltage shall be applied between anode and cathode lead wire terminations of a capacitor through 1KΩ protective resistance, and the leakage current shall be less than or equal to the value listed in accordance with electrical specification after 2 minutes with the voltage reaching the rated value at 20±2°C. If the value is doubtful, measure the leakage current after performing voltage treatment as follows Voltage treatment
Tangent of loss angle (tan δ)	tan δ values shall be less than or equal to 0.12	At 120Hz±10% at 20±2°C.
Equivalent Series Resistance (ESR)	shall be less than or equal to the value in standard ratings	Equipment: Agilent technology 4263B or equivalent Test fixture: Agilent technology 16047E or equivalent Compensation: Short and open compensation would be required, Short correction is performed using the shorting plate made of 0.5 thickness copper plate with gold coating Signal level: 500mV Frequency: 100KHz Measurement point: Point of lead wire within 1mm form the body
Impedance at high and low temperature	Impedance ratio / Performance Z(-55°C)/Z(+20°C) ≦1.25 Z(-105°C)/Z(+20°C) ≦1.25	at -55±3°C or 105±2°C, 100kHz

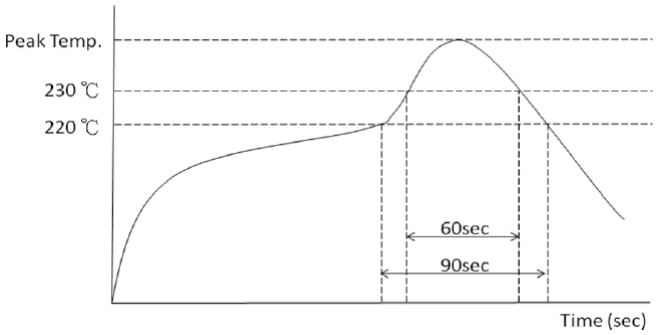
Mechanical Characteristies Test

Item	Requirement	Test Condition
Adhesion by Soldering	the soldered terminals shall not be damaged	A force of 5N shall be applied for 10 seconds to the capacitor, which was mounted on a print circuit board, in the perpendicular direction to the seal side of the capacitor
Vibration	During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test, and the appearance shall not appear any remarkable abnormality. Capacitance change shall be within ±10% of the initial measured value	Vibration cycle should vary from 10 to 55Hz with total amplitude of 1.5mm and return to 10Hz in about 1 minute. Vibration applied to a capacitor should be three directions, which each perpendicular to the other two as longitudinal axis of capacitor set as z axis, and last for 2 hours in each direction.
Solderability	Solder shall cover at least 3/4 of the lead surface immersed	The lead surface shall be immersed for 2±0.5 seconds in the flux of ethanol or isopropyl alcohol solution (25±2%) of colophonium. Then that lead surface shall be immersed to a solder (H60A, H60S or H63A) of 235±5°C and up to the point 1.5 to 2.0mm from the body and kept for 2±0.5 seconds, and pulling it out
Soldering Heat	the capacitors shall satisfy their test criteria	After the capacitors are soldered by the recommended soldering conditions below, the tests of the item Humidity resistance and Load life shall be conducted

Environmental Performance Test

Item	Requirements	Test Condition
Damp Heat, Steady State	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦150% of the initial specified value Leakage current: ≦the initial specified value	A capacitor shall be subjected to a temperature of 60±2°C and relative humidity of 90 to 95% without voltage applied for a period of 1000+48/-0 hours. Then that capacitor shall be taken out from the above condition to a temperature of 20°C
Endurance		A capacitor shall be subjected to a temperature of 105±2°C with test voltage applied for a period of 2,000+72/-0 hours and take out from the above condition to a temperature of 20°C . Besides, the applied voltage shall increase up from 0V to test voltage step by step (maximum 5 minutes), and the impedance of the source shall be equal to about 3Ω/V.
Surge Voltage		when the capacitors are restored to +20°C after the surge voltage is applied at a cycle of 360 seconds which consists charge for 30±5 seconds through a protective resistor of 1KΩand discharge for 330 seconds, for 1000 cycles at 105±2°C  Surge voltage circuit

■Reflow soldering

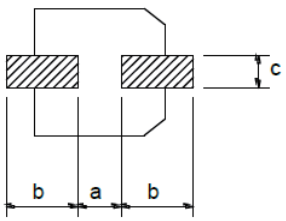


Recommended condition:

Peak temperature(max)	260°C
220°C over time(max)	90sec
230°C over time(max)	60sec
Reflow number	Only 2 time

■Soldering Pad Dimensions

Unit: mm



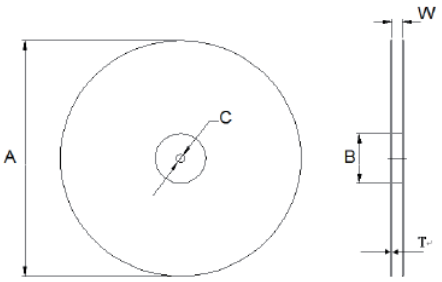
Type	a	b	c
AVEA0506	1.4	3.0	1.6
AVEA0645	2.1	3.5	1.6
AVEA0606	2.1	3.5	1.6
AVEA0610	2.1	3.5	1.6
AVEA0807	2.8	4.2	1.9
AVEA0810	2.8	4.2	1.9
AVEA0812	2.8	4.2	1.9
AVEA1012	4.3	4.4	1.9

■Packaging

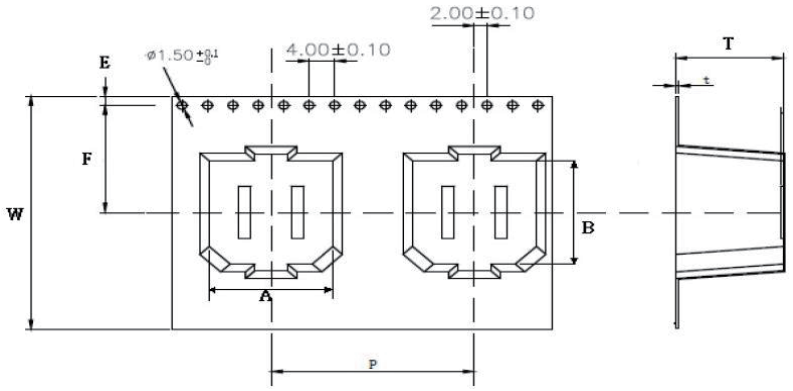
Packaging Quantity & Reel Specifications

Unit: mm

Type	A	B	C	W	T	Emboss Plastic Tape (EA)
AVEA0506	381±2	100±0.5	13±0.5	13.5±0.8	2.5±0.3	1,200
AVEA0645	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	1,500
AVEA0606	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	1,200
AVEA0610	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	750
AVEA0807	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	1,000
AVEA0810	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	500
AVEA0812	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	400
AVEA1012	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	450

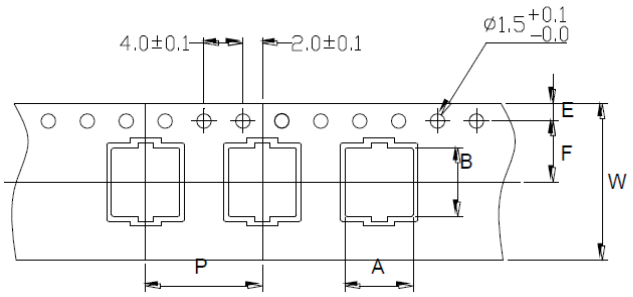


Emboss Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P	T	t
AVEA0645	5.7±0.2	5.7±0.2	16.0±0.3	1.75±0.10	5.50±0.1	12.00±0.10	4.8±0.2	0.4±0.05
AVEA0606	6.8±0.2	6.8±0.2	16.0±0.3	1.75±0.10	7.50±0.1	12.00±0.10	6.3±0.2	0.4±0.05



Unit: mm

Type	A	B	W	E	F	P	T	t
AVEA0506	5.7±0.2	5.7±0.2	12.0±0.3	1.75±0.10	5.50±0.1	12.00±0.10	6.2±0.2	0.4±0.05
AVEA0610	7.0±0.2	7.0±0.2	16.0±0.3	1.75±0.10	7.50±0.1	12.00±0.10	10.0±0.2	0.5±0.05
AVEA0807	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	12.00±0.10	7.2±0.2	0.5±0.05
AVEA0810	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	10.0±0.2	0.5±0.05
AVEA0812	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	12.0±0.2	0.5±0.05
AVEA1012	10.7±0.2	10.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	13.0±0.2	0.5±0.05

■Instructions of Capacitors

1. Cautions on use of Capacitor

■Polarity

Solid electrolytic capacitors are polarized capacitors. Use capacitors after verifying their positive and negative polarities. If these capacitors are installed in the reverse polarity, its life may shorten because of increasing leakage current or short circuit.

■Types of circuits in which capacitors are prohibited from being used AVEA series may be heated by soldering to increase in its leakage current slightly. This may have some influence on the characteristics capacitors in the following circuits.

(1) Time constant circuit
(2) Coupling circuit
(3) High impedance voltage holding circuit
(4) Connection of two or more capacitors in series for higher withstand voltage.

■Over voltage

If AVEA series is applied a voltage higher than the rated voltage for an instantaneous period, it may be defected due to short circuit. Note that the voltage over the rated voltage must not be applied to capacitors

■Repeat of rapid charging and discharging

If AVEA series is used in a rapid charging and discharging circuit or receive the flow of excess rush current, its life may shorten by large leakage current or short circuit. The charging and discharging current through AVEA series should be less than 10A.

■Reflow Soldering

High soldering temperature and long soldering time will affect the characteristics of the capacitors. Use reflow soldering condition within the recommended range. Also, the temperature varies with the location and population of the components, the material and the thickness of printed circuit board. Verify temperature profiles prior to actual production run.

■Use of capacitors for industrial equipment

When capacitors are used for industrial equipment, the circuits should be designed to have sufficient margins in the ratings of capacitors including capacitance and impedance. Without sufficient margins in the characteristics, the reliability of the capacitors may be reduced by their shorter life. Always contact us if you want to use capacitors for equipment affecting human lives such as space, aviation, atomic power, and medical devices. Never use capacitors for the used without our prior approval.

2. Notes on circuit designs for capacitors

■Rating and performance

Use capacitors within the rating and performance ranges defined in the brochures and delivery specification of capacitors after checking the operating and installation environments.

■Operating temperature

If AVEA series is used at a temperature higher than the upper specified temperature (105°C), its life may be remarkably shortened or the leakage current may increase to cause defective.

■Ripple current

Never make current larger than the rated ripple current through AVEA series. If excess ripple current flows through AVEA series, internal heat may be generated largely to make its life shortened or cause it to be defected due to short circuit.

■Leakage current

Depending on the soldering conditions, the leakage current of AVEA series may increase slightly. The application of DC voltage enables the capacitors to be repaired by itself. This leads the leakage current to be smaller gradually. The leakage current can be reduced fast if the DC voltage, which is less than the rating voltage, is applied at the temperature close to the upper specified temperature.

■Applied voltage

Do not apply voltages exceeding the full rated voltage. If such voltage is applied, it may cause short circuit even though it is just a moment.

(1) Sum of DC voltage and the peak of ripple voltage AC voltage shall not exceed the rated voltage or category voltage.
(2) The sum of the DC voltage plus the negative peak AC voltage shall not allow reverse voltage.
(3) Do not apply reverse voltage.
(4) For 25V products, the applied voltage shall follow the following figure as the temperature is higher than 85°C.

■Failure mode

AVEA series contains a conductive polymer as material of cathode electrode. Therefore, like other solid electrolyte capacitors, the life ends mostly due to random failure mode, mainly short circuit. If a current continuously flow through the capacitor due to short circuit, the capacitor would be overheated higher than 300°C and then aluminum case of the capacitor would be removed by increasing internal pressure due to the vaporization of materials.

■Insulation

(1) Plastic coated case of capacitors is not secured to insulate. Do not use capacitors in areas requiring insulation.
(2) Isolate the case of AVEA series from the positive and negative terminals and adjacent circuit patterns.

■Design of printed circuit board

Take note on the subjects when capacitors are installed on printed circuit boards:

(1) For surface mount capacitors, design the copper pads/lands of a printed circuit board according to the catalog or product specifications.
(2) Do not place heating components on boards to be close to capacitors or in the backside of them.

■Parallel connection

If AVEA series is connected with another type of a capacitor in parallel, larger ripple current may flow through one of capacitors. Take the current balance among them into account in circuit designs.

■Using temperature and frequency

The electric characteristics of capacitors depend on the variations of the ambient temperature and frequency. Check the variations in designing circuits.

3. Notes on installation of capacitors

■Notes on pre-installation of capacitors

(1) Do not reuse capacitors installed in a unit with the power supply turned on for another unit. No used capacitors shall be reused excluding those removed to measure their electric characteristics in periodical inspection.
(2) If AVEA series stored for a long period may often increase in its leakage current, connect a resistor of approximately 1kΩ to the capacitors for voltage treatment.

■Notes at installation of capacitors

(1) Install capacitors in a unit after confirming that their ratings (rated capacitance and rated voltages) meet the conditions of the unit.
(2) Install capacitors in the correct polarities.
(3) Take care not to drop capacitors on floors. Do not use capacitors dropped on floors.
(4) Do not deform capacitors to install them in units.
(5) Note capacitors may be damaged by mechanical shocks caused by the vacuum head, component checker or centering operation of an automatic mounting machine.
(6) Do not dip the body of a capacitor into the solder bath.
(7) Do not solder capacitors more than once by reflow. Consult us for reflow-soldering them twice over.
(8) Do not apply mechanical stress to the capacitor after soldering to the printed circuit board.
(9) Do not use adhesives and coating materials containing halogenated solvents.

■Notes on use of capacitors in unit

(1) Never make your fingers contact with the capacitor terminals.
(2) Do not make capacitor terminals to be in contact with each other through a conductor. Do not put conductive liquid such as acid and alkali solutions on capacitors.
(3) Confirm that the unit including capacitors is placed in proper conditions. Do not place the unit in the following areas:
(a) Area in which they are directly exposed to water, brine, or oil or in condensation status.
(b) Area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and ammonia.
(c) Area to which ultraviolet and/or radial rays are radiated
(4) Provide aging for a unit containing capacitors within the period defined for them.
(5) It is recommended to use a unit containing capacitors in the normal temperature range of 15°C to 35°C and the normal humidity range of 75% or less.

■Action at emergency

(1) At the occurrence of short circuit in AVEA series, some heat is generated from it if the short-current rather small. If the short current exceeds the above value, the capacitors are heated excessively. If so, turn off the power of the unit without your face and hands being close to the capacitors.
(2) If you should expose your eyes to smoke from the capacitor or inhale it, immediately flush the open eyes and gargle with water.

■Storage

(1) Store capacitors in an area in the temperature range between 15°C to 35°C and the relative humidity of 75% or less without direct sunshine. In addition, store them in the package states if possible.
(2) SMD products are sealed in a special laminated aluminum bag. Use all capacitors once the bag is opened. Return unused capacitors to the bag, and seal it with a zipper. After the bag is opened, please use all capacitors within 6 month.
(3) Store capacitors in an airtight bag to keep the terminals in good condition.
(4)Store in a location where the capacitor is not exposed to ozone, ultraviolet radiation, or other radiation.
(5)Never store capacitors in any area in which they are directly exposed to water, brine, or oil or in condensation status.

■Exhaustion of capacitors

Capacitors are composed of organic compounds, resins and metals. Request an industrial dispose company to dispose of used Capacitors.

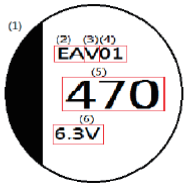
4. Export Trade Control Ordinance

Item 41-4 in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of MITI' s Ordinance) and Item 7 in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of MITI' s Ordinance) state export regulations on pulse use capacitors (750V of higher) and high voltage use capacitors(5,000V or higher).
However, aluminum electrolytic capacitors are less than 750V in their voltage range, so that the regulations do not apply to the aluminum electrolytic capacitors.

■Marking

The color of marking ink is red

(-)

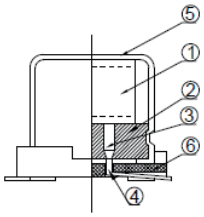


(+)

(1)	Polarity	(4)	Production Period Code
(2)	Series	(5)	Rated Capacitance
(3)	Year Code EX:Z-2019,A-2020	(6)	Rated Voltage

Conductive Polymer Aluminum Solid Electrolytic Capacitors—AVHA Series

■Construction

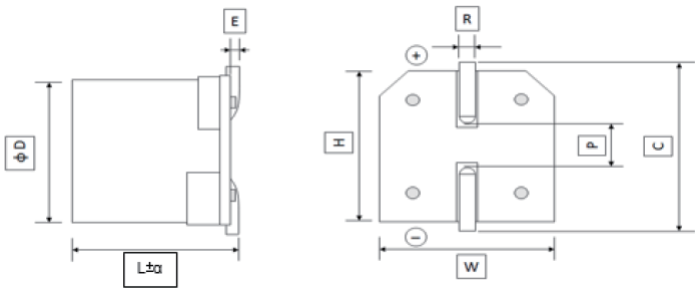


①	Element	④	Lead Wire
②	Seal	⑤	Case
③	Aluminum Tab	⑥	Base Plate

■Features

- —Standard SMD type
- —Rated voltage：25~100Vdc
- —Endurance：5,000 hours at 105ºC
- —Suitable for DC-DC converters , voltage regulators and decoupling applications
- —RoHS Compliant

■Dimensions



Unit: mm

Type	D	L	α	E	W	H	C	R	P
AVHA0606	6.3±0.5	5.8	±0.2	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.5~0.8	2.1±0.3
AVHA0608	6.3±0.5	7.5	±0.5	0.00~0.20	6.6±0.2	6.6±0.2	7.3±0.2	0.5~0.8	2.1±0.3
AVHA0807	8.0±0.5	6.8	±0.2	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	2.9±0.3
AVHA0810	8.0±0.5	9.7	±0.3	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	2.9±0.3
AVHA0812	8.0±0.5	12.0	±0.5	0.00~0.20	8.3±0.2	8.3±0.2	9.0±0.2	0.8~1.1	3.2±0.3
AVHA1012	10.0±0.5	12.3	±0.2	0.00~0.20	10.3±0.2	10.3±0.2	11.0±0.2	0.8~1.1	4.6±0.3

■Product Identification

AVHA	0606	M	T	250	470
Product Type	Dimensions (DxL)	Capacitance Tolerance	Packaging Code	Rated Voltage	Capacitance
	0606: 6.3x5.8 0608: 6.3x7.5 0807: 8.0x6.8 0810: 8.0x9.7 0812: 8.0x12.0 1012: 10.0x12.3	M: ±20%	T: Taping Reel	250: 25V 350: 35V 500: 50V 630: 63V 800: 80V 101: 100V	470: 47uF 101: 100uF

■Standard Ratings

Part No.	WV/Vdc (SV)	Capacitance (uF)	Leakage Current (uA)	tan δ	ESR (mΩmax/20°C, 100K to 300KHz)	Rated Ripple Current (mArms/105°C/100KHz)	Sizs Code
AVHA0606MT250470	25 (28.8)	47	235	0.12	30	2800	0606
AVHA0606MT250560	25 (28.8)	56	280	0.12	35	2500	0606
AVHA0807MT250101	25 (28.8)	100	500	0.12	24	3200	0807
AVHA0810MT250181	25 (28.8)	180	900	0.12	18	4100	0810
AVHA0810MT250221	25 (28.8)	220	1100	0.12	18	4100	0810
AVHA0812MT250331	25 (28.8)	330	1650	0.12	18	4100	0812
AVHA0812MT250471	25 (28.8)	470	2350	0.12	18	4650	0812
AVHA0606MT350470	35 (40.3)	47	329	0.12	35	2100	0606
AVHA0608MT350680	35 (40.3)	68	476	0.12	35	2000	0608
AVHA0810MT350101	35 (40.3)	100	700	0.12	35	2800	0810
AVHA0810MT350151	35 (40.3)	150	1050	0.12	25	3000	0810
AVHA0812MT350221	35 (40.3)	220	1540	0.12	25	2890	0812
AVHA1012MT350331	35 (40.3)	330	2310	0.12	24	3400	1012
AVHA0810MT500470	50 (57.5)	47	470	0.12	25	2700	0810
AVHA0810MT500680	50 (57.5)	68	680	0.12	25	2700	0810
AVHA1012MT500121	50 (57.5)	120	1200	0.12	19	2950	1012
AVHA1012MT500221	50 (57.5)	220	2200	0.12	17	2950	1012
AVHA0810MT630470	63 (72.5)	47	592	0.12	25	2700	0810
AVHA1012MT630560	63 (72.5)	56	705	0.12	25	2950	1012
AVHA1012MT630680	63 (72.5)	68	857	0.12	25	3280	1012
AVHA0810MT800220	80 (92)	22	352	0.12	40	1700	0810
AVHA1012MT800470	80 (92)	47	752	0.12	33	2100	1012
AVHA1012MT800680	80 (92)	68	1088	0.12	25	2950	1012
AVHA1012MT101220	100 (115)	22	440	0.12	45	1600	1012
AVHA1012MT101470	100 (115)	47	940	0.12	35	2100	1012

■Category temperature range: -55~+105°C
■Surge voltage: rated voltage*1.15
■Rated ripple current: Rated ripple current shall be in accordance with standard ratings list.

These current are rms values of sine wave of 100KHz at 105°C

■Frequency Correction Factor of Allowable Ripple Current

Frequency	120Hz≦f<1KHz	1KHz≦f<10KHz	10KHz≦f<50KHz	50KHz≦f<100KHz	100KHz≦f≦300KHz
Coefficient	0.05	0.3	0.7	0.85	1

■Environmental Characteristics

General

Item	Specifications
Measurement condition	Each measurement shall be conducted at a temperature of 15 to 35°C, and relative humidity of 45 to 85%. Furthermore, these measurements shall be preferably conducted at a temperature of 20±2°C, and relative humidity of 60 to 70%, while the capacitors shall be kept enough time in the measuring temperature.
Voltage treatment	If leakage current is doubtful, measure it after performing voltage treatment, which shall contain the following steps: (1) Applied DC rated voltage to the capacitors for 60 minutes at 105±2°C. (2) Cooled down to room temperature with applying voltage. (3) Discharged through a resistor of approximately 1Ω/V.

Electrical Performance Test

Item	Requirement	Test Condition
Tolerance on Rated Capacitance	In Within standard ratings	Rated capacitance shall meet within ±20% tolerance against the rated capacitance measured at 120Hz±10% at 20±2°C.
Leakage current	In accordance within standard ratings	DC rated voltage shall be applied between anode and cathode lead wire terminations of a capacitor through 1KΩ protective resistance, and the leakage current shall be less than or equal to the value listed in accordance with electrical specification after 2 minutes with the voltage reaching the rated value at 20±2°C. If the value is doubtful, measure the leakage current after performing voltage treatment as follows Voltage treatment
Tangent of loss angle (tan δ)	tan δ values shall be less than or equal to 0.12	At 120Hz±10% at 20±2°C.
Equivalent Series Resistance (ESR)	shall be less than or equal to the value in standard ratings	Equipment: Agilent technology 4263B or equivalent Test fixture: Agilent technology 16047E or equivalent Compensation: Short and open compensation would be required, Short correction is performed using the shorting plate made of 0.5 thickness copper plate with gold coating Signal level: 500mV Frequency: 100KHz Measurement point: Point of lead wire within 1mm form the body
Impedance at high and low temperature	Impedance ratio / Performance Z(-55°C)/Z(+20°C) / ≦1.25 Z(-105°C)/Z(+20°C) / ≦1.25	at -55±3°C or 105±2°C, 100kHz

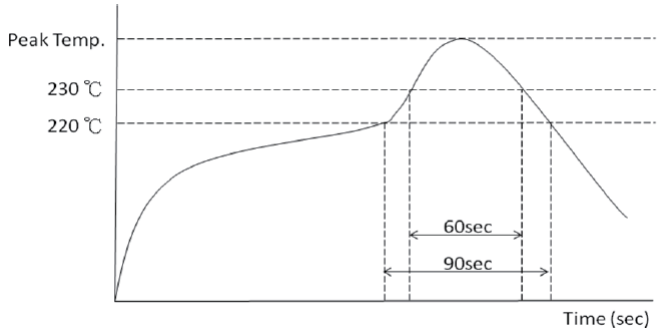
Mechanical Characteristies Test

Item	Requirement	Test Condition
Adhesion by Soldering	the soldered terminals shall not be damaged	A force of 5N shall be applied for 10 seconds to the capacitor, which was mounted on a print circuit board, in the perpendicular direction to the seal side of the capacitor
Vibration	During this test, measured electrical value shall be stabilized when that capacitor is measured 5 times within 30 minutes before completion of test, and the appearance shall not appear any remarkable abnormality. Capacitance change shall be within ±10% of the initial measured value	Vibration cycle should vary from 10 to 55Hz with total amplitude of 1.5mm and return to 10Hz in about 1 minute. Vibration applied to a capacitor should be three directions, which each perpendicular to the other two as longitudinal axis of capacitor set as z axis, and last for 2 hours in each direction.
Solderability	Solder shall cover at least 3/4 of the lead surface immersed	The lead surface shall be immersed for 2±0.5 seconds in the flux of ethanol or isopropyl alcohol solution (25±2%) of colophonium. Then that lead surface shall be immersed to a solder (H60A, H60S or H63A) of 235±5°C and up to the point 1.5 to 2.0mm from the body and kept for 2±0.5 seconds, and pulling it out
Soldering Heat	the capacitors shall satisfy their test criteria	After the capacitors are soldered by the recommended soldering conditions below, the tests of the item Humidity resistance and Load life shall be conducted

Environmental Performance Test

Item	Requirements	Test Condition
Damp Heat, Steady State	Appearance: No significant damage Capacitance change: ≦±20% of the initial value tan δ & ESR: ≦150% of the initial specified value Leakage current: ≦the initial specified value	A capacitor shall be subjected to a temperature of 60±2°C and relative humidity of 90 to 95% without voltage applied for a period of 1000+48/-0 hours. Then that capacitor shall be taken out from the above condition to a temperature of 20°C
Endurance		A capacitor shall be subjected to a temperature of 105±2°C with test voltage applied for a period of 5,000+72/-0 hours and take out from the above condition to a temperature of 20°C . Besides, the applied voltage shall increase up from 0V to test voltage step by step (maximum 5 minutes), and the impedance of the source shall be equal to about 3Ω/V.
Surge Voltage		when the capacitors are restored to +20°C after the surge voltage is applied at a cycle of 360 seconds which consists charge for 30±5 seconds through a protective resistor of 1KΩand discharge for 330 seconds, for 1000 cycles at 105±2°C  Ⓥ :DC voltmeter R1 :Protective resistor 1kΩ R2 :Discharging resistor 1kΩ Cx :Capacitor under test Surge voltage circuit

■Reflow soldering

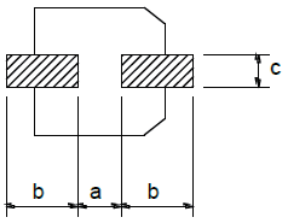


Recommended condition:

Peak temperature(max)	260°C
220°C over time(max)	90sec
230°C over time(max)	60sec
Reflow number	Only 2 time

■Soldering Pad Dimensions

Unit: mm



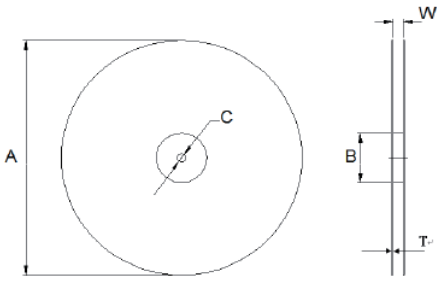
Type	a	b	c
AVHA0606	2.1	3.5	1.6
AVHA0608	2.1	3.5	1.6
AVHA0807	2.8	4.2	1.9
AVHA0810	2.8	4.2	1.9
AVHA0812	2.8	4.2	1.9
AVHA1012	4.3	4.4	1.9

■Packaging

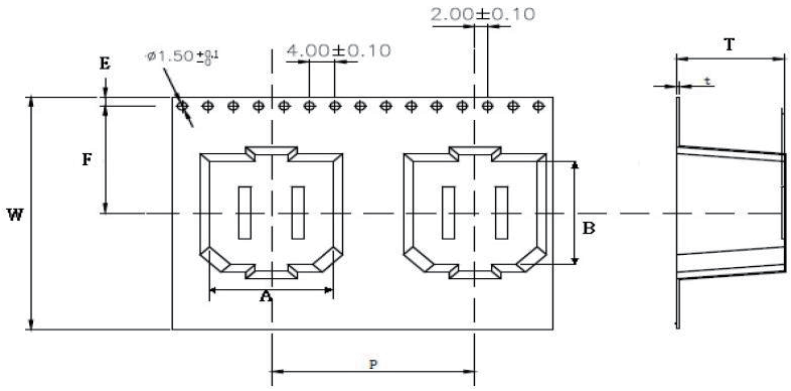
Packaging Quantity & Reel Specifications

Unit: mm

Type	A	B	C	W	T	Emboss Plastic Tape (EA)
AVHA0606	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	1,200
AVHA0608	381±2	100±0.5	13±0.5	16.5±0.8	2.5±0.3	900
AVHA0807	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	1,000
AVHA0810	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	500
AVHA0812	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	400
AVHA1012	381±2	100±0.5	13±0.5	25.9±0.8	2.5±0.3	450

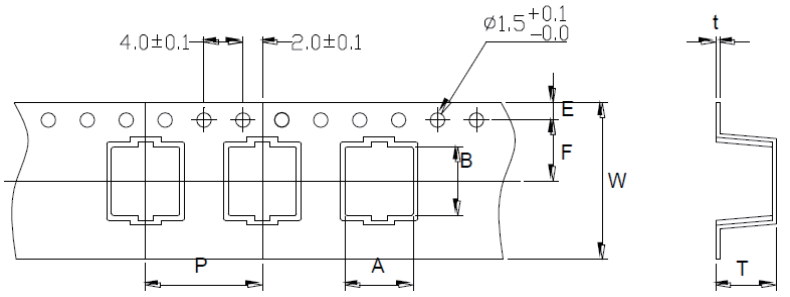


Emboss Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P	T	t
AVHA0606	6.8±0.2	6.8±0.2	16.0±0.3	1.75±0.10	7.50±0.1	12.00±0.10	6.3±0.2	0.4±0.05



Unit: mm

Type	A	B	W	E	F	P	T	t
AVHA0608	7.0±0.2	7.0±0.2	16.0±0.3	1.75±0.10	7.50±0.1	12.00±0.10	8.2±0.2	0.5±0.05
AVHA0807	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	12.00±0.10	7.2±0.2	0.5±0.05
AVHA0810	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	10.0±0.2	0.5±0.05
AVHA0812	8.7±0.2	8.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	12.0±0.2	0.5±0.05
AVHA1012	10.7±0.2	10.7±0.2	24.0±0.3	1.75±0.10	11.50±0.1	16.00±0.10	13.0±0.2	0.5±0.05

■Instructions of Capacitors

1. Cautions on use of Capacitor

■Polarity

Solid electrolytic capacitors are polarized capacitors. Use capacitors after verifying their positive and negative polarities. If these capacitors are installed in the reverse polarity, its life may shorten because of increasing leakage current or short circuit.

■Types of circuits in which capacitors are prohibited from being used AVHA series may be heated by soldering to increase in its leakage current slightly. This may have some influence on the characteristics capacitors in the following circuits.

(1) Time constant circuit
(2) Coupling circuit
(3) High impedance voltage holding circuit
(4) Connection of two or more capacitors in series for higher withstand voltage.

■Over voltage

If AVHA series is applied a voltage higher than the rated voltage for an instantaneous period, it may be defected due to short circuit. Note that the voltage over the rated voltage must not be applied to capacitors

■Repeat of rapid charging and discharging

If AVHA series is used in a rapid charging and discharging circuit or receive the flow of excess rush current, its life may shorten by large leakage current or short circuit. The charging and discharging current through AVHA series should be less than 10A.

■Reflow Soldering

High soldering temperature and long soldering time will affect the characteristics of the capacitors. Use reflow soldering condition within the recommended range. Also, the temperature varies with the location and population of the components, the material and the thickness of printed circuit board. Verify temperature profiles prior to actual production run.

■Use of capacitors for industrial equipment

When capacitors are used for industrial equipment, the circuits should be designed to have sufficient margins in the ratings of capacitors including capacitance and impedance. Without sufficient margins in the characteristics, the reliability of the capacitors may be reduced by their shorter life. Always contact us if you want to use capacitors for equipment affecting human lives such as space, aviation, atomic power, and medical devices. Never use capacitors for the used without our prior approval.

2. Notes on circuit designs for capacitors

■Rating and performance

Use capacitors within the rating and performance ranges defined in the brochures and delivery specification of capacitors after checking the operating and installation environments.

■Operating temperature

If AVHA series is used at a temperature higher than the upper specified temperature (105°C), its life may be remarkably shortened or the leakage current may increase to cause defective.

■Ripple current

Never make current larger than the rated ripple current through AVHA series. If excess ripple current flows through AVHA series, internal heat may be generated largely to make its life shortened or cause it to be defected due to short circuit.

■Leakage current

Depending on the soldering conditions, the leakage current of AVHA series may increase slightly. The application of DC voltage enables the capacitors to be repaired by itself. This leads the leakage current to be smaller gradually. The leakage current can be reduced fast if the DC voltage, which is less than the rating voltage, is applied at the temperature close to the upper specified temperature.

■Applied voltage

Do not apply voltages exceeding the full rated voltage. If such voltage is applied, it may cause short circuit even though it is just a moment.

(1) Sum of DC voltage and the peak of ripple voltage AC voltage shall not exceed the rated voltage or category voltage.
(2) The sum of the DC voltage plus the negative peak AC voltage shall not allow reverse voltage.
(3) Do not apply reverse voltage.
(4) For 25V products, the applied voltage shall follow the following figure as the temperature is higher than 85°C.

■Failure mode

AVHA series contains a conductive polymer as material of cathode electrode. Therefore, like other solid electrolyte capacitors, the life ends mostly due to random failure mode, mainly short circuit. If a current continuously flow through the capacitor due to short circuit, the capacitor would be overheated higher than 300°C and then aluminum case of the capacitor would be removed by increasing internal pressure due to the vaporization of materials.

■Insulation

(1) Plastic coated case of capacitors is not secured to insulate. Do not use capacitors in areas requiring insulation.
(2) Isolate the case of AVHA series from the positive and negative terminals and adjacent circuit patterns.

■Design of printed circuit board

Take note on the subjects when capacitors are installed on printed circuit boards:

(1) For surface mount capacitors, design the copper pads/lands of a printed circuit board according to the catalog or product specifications.
(2) Do not place heating components on boards to be close to capacitors or in the backside of them.

■Parallel connection

If AVHA series is connected with another type of a capacitor in parallel, larger ripple current may flow through one of capacitors. Take the current balance among them into account in circuit designs.

■Using temperature and frequency

The electric characteristics of capacitors depend on the variations of the ambient temperature and frequency. Check the variations in designing circuits.

3. Notes on installation of capacitors

■Notes on pre-installation of capacitors

(1) Do not reuse capacitors installed in a unit with the power supply turned on for another unit. No used capacitors shall be reused excluding those removed to measure their electric characteristics in periodical inspection.
(2) If AVHA series stored for a long period may often increase in its leakage current, connect a resistor of approximately 1kΩ to the capacitors for voltage treatment.

■Notes at installation of capacitors

(1) Install capacitors in a unit after confirming that their ratings (rated capacitance and rated voltages) meet the conditions of the unit.
(2) Install capacitors in the correct polarities.
(3) Take care not to drop capacitors on floors. Do not use capacitors dropped on floors.
(4) Do not deform capacitors to install them in units.
(5) Note capacitors may be damaged by mechanical shocks caused by the vacuum head, component checker or centering operation of an automatic mounting machine.
(6) Do not dip the body of a capacitor into the solder bath.
(7) Do not solder capacitors more than once by reflow. Consult us for reflow-soldering them twice over.
(8) Do not apply mechanical stress to the capacitor after soldering to the printed circuit board.
(9) Do not use adhesives and coating materials containing halogenated solvents.

■Notes on use of capacitors in unit

(1) Never make your fingers contact with the capacitor terminals.
(2) Do not make capacitor terminals to be in contact with each other through a conductor. Do not put conductive liquid such as acid and alkali solutions on capacitors.
(3) Confirm that the unit including capacitors is placed in proper conditions. Do not place the unit in the following areas:
(a) Area in which they are directly exposed to water, brine, or oil or in condensation status.
(b) Area filled with poisonous gases including hydrogen sulfide, sulfurous acid, nitrous acid, chlorine and ammonia.
(c) Area to which ultraviolet and/or radial rays are radiated
(4) Provide aging for a unit containing capacitors within the period defined for them.
(5) It is recommended to use a unit containing capacitors in the normal temperature range of 15°C to 35°C and the normal humidity range of 75% or less.

■Action at emergency

(1) At the occurrence of short circuit in AVHA series, some heat is generated from it if the short-current rather small. If the short current exceeds the above value, the capacitors are heated excessively. If so, turn off the power of the unit without your face and hands being close to the capacitors.
(2) If you should expose your eyes to smoke from the capacitor or inhale it, immediately flush the open eyes and gargle with water.

■Storage

(1) Store capacitors in an area in the temperature range between 15°C to 35°C and the relative humidity of 75% or less without direct sunshine. In addition, store them in the package states if possible.
(2) SMD products are sealed in a special laminated aluminum bag. Use all capacitors once the bag is opened. Return unused capacitors to the bag, and seal it with a zipper. After the bag is opened, please use all capacitors within 6 month.
(3) Store capacitors in an airtight bag to keep the terminals in good condition.
(4)Store in a location where the capacitor is not exposed to ozone, ultraviolet radiation, or other radiation.
(5)Never store capacitors in any area in which they are directly exposed to water, brine, or oil or in condensation status.

■Exhaustion of capacitors

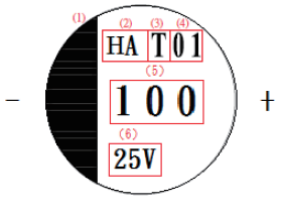
Capacitors are composed of organic compounds, resins and metals. Request an industrial dispose company to dispose of used Capacitors.

4. Export Trade Control Ordinance

Item 41-4 in Section 2 of Appendix Table 1 (Section 49 in Chapter 1 of MITI' s Ordinance) and Item 7 in Section 7 of Appendix Table 1 (Section 6 in Chapter 6 of MITI' s Ordinance) state export regulations on pulse use capacitors (750V of higher) and high voltage use capacitors(5,000V or higher).
However, aluminum electrolytic capacitors are less than 750V in their voltage range, so that the regulations do not apply to the aluminum electrolytic capacitors.

■Marking

The color of marking ink is red



(1)	Polarity	(4)	Production Period Code
(2)	Series	(5)	Rated Capacitance
(3)	Year Code EX:Z-2019,A-2020	(6)	Rated Voltage