



## Surface Mount Multilayer Ceramic Chip Capacitors for Commodity Applications



### FEATURES

- Dry sheet manufacturing technology
- Six standard sizes
- High capacitance per unit volume
- Supplied in tape on reel
- Ni-barrier with 100 % tin terminations
- Ni-barrier with epoxy 100 % tin termination for boardflex sensitive applications
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### APPLICATIONS

- Consumer electronics
- Telecommunications
- Data processing

### ELECTRICAL SPECIFICATIONS

#### Note

- Electrical characteristics at +25 °C unless otherwise specified

#### Operating Temperature:

C0G (NP0): -55 °C to +125 °C

X5R: -55 °C to +85 °C

X7R: -55 °C to +125 °C

#### Capacitance Range:

C0G (NP0): 0.5 pF to 33 nF

X5R: 100 nF to 100 μF

X7R: 100 pF to 22 μF

#### Voltage Range:

4 V<sub>DC</sub> to 100 V<sub>DC</sub>

#### Temperature Coefficient of Capacitance (TCC):

With zero (0) V<sub>DC</sub> applied

C0G (NP0): 0 ± 30 ppm/°C from -55 °C to +125 °C

X5R: ± 15 % from -55 °C to +85 °C

X7R: ± 15 % from -55 °C to +125 °C

#### Dielectric Strength Test:

This is the maximum voltage the capacitors are tested for 1 s to 5 s period and the charge / discharge current does not exceed 50 mA

C0G (NP0): < 100 V<sub>DC</sub>: 300 % of rated voltage

X5R, X7R: < 100 V<sub>DC</sub>: 250 % of rated voltage

100 V<sub>DC</sub>: 200 % of rated voltage

ORDERING INFORMATION							
VJ0402	A	101	J	X	Q	C	W2BC
SIZE CODE	DIELECTRIC	CAPACITANCE	TOLERANCE	TERMINATION	VOLTAGE	PACKAGING	PROCESS CODE FOR BASIC COMMODITY
0201 0402 0603 0805 1206 1210	A = C0G (NP0) G = X5R Y = X7R	Two significant digits followed by the number of zeros: 1R0 = 1 pF 101 = 100 pF 152 = 1500 pF 103 = 10 000 pF	C0G (NP0): Cap. < 10 pF C = ± 0.25 pF Cap. ≥ 10 pF F <sup>(1)</sup> = ± 1 % G <sup>(1)</sup> = ± 2 % J = ± 5 % X5R: K = ± 10 % M = ± 20 % X7R: J <sup>(1)</sup> = ± 5 % K = ± 10 %	X = Ni barrier, 100 % tin plate matte finish B = Ni barrier, epoxy, 100 % tin plate, matte finish	S = 4 V Y = 6.3 V Q = 10 V J = 16 V X = 25 V Z = 35 V A = 50 V B = 100 V	C, S = 7" reel / paper tape P, Y = 13" reel / paper tape E, X = 7" reel / plastic tape M, L = 13" reel / plastic tape	

#### Note

- <sup>(1)</sup> Tight tolerance, please contact our sales office for availability



SELECTION CHART													
DIELECTRIC		COG (NP0)											
STYLE		VJ0402			VJ0603			VJ0805			VJ1206		
SIZE CODE		0402			0603			0805			1206		
VOLTAGE (V <sub>DC</sub> )		25	50	100	25	50	100	25	50	100	25	50	100
VOLTAGE CODE		X	A	B	X	A	B	X	A	B	X	A	B
CAP. CODE	CAP.												
0R5	0.5 pF		N			B			A				
1R0	1.0 pF		N			B			A				
1R2	1.2 pF		N			B			A				
1R5	1.5 pF		N			B			A				
1R8	1.8 pF		N			B			A				
2R2	2.2 pF		N			B			A				
2R7	2.7 pF		N			B			A				
3R3	3.3 pF		N			B			A				
3R9	3.9 pF		N			B			A				
4R7	4.7 pF		N			B			A				
5R6	5.6 pF		N			B			A				
6R8	6.8 pF		N			B			A				
8R2	8.2 pF		N			B			A				
100	10 pF		N			B			A				
120	12 pF		N			B			A				
150	15 pF		N			B			A				
180	18 pF		N			B			A				
220	22 pF		N			B			A				
270	27 pF		N			B			A				
330	33 pF		N			B			A				
390	39 pF		N			B			A				
470	47 pF		N			B			A				
560	56 pF		N			B			A				
680	68 pF		N			B			A				
820	82 pF		N			B			A				
101	100 pF		N			B			A				
121	120 pF		N			B			A				
151	150 pF		N			B			A				
181	180 pF		N			B			A				
221	220 pF		N			B			A				
271	270 pF		N			B			A				
331	330 pF		N			B			A				
391	390 pF		N			B			A				
471	470 pF		N			B			A				
561	560 pF					B			A				
681	680 pF					B			C				
821	820 pF					B			C				
102	1000 pF					B			C			E	
122	1200 pF					B			F			E	
152	1500 pF					B			F			E	
182	1800 pF					B			F			E	
222	2200 pF					B			F			E	
272	2700 pF								F			F	
332	3300 pF								F			F	
392	3900 pF								F			F	
472	4700 pF								F			F	
562	5600 pF								F			H	
682	6800 pF								F			H	
822	8200 pF								F			H	
103	0.01 μF								F			H	
123	0.012 μF											H	
153	0.015 μF											H	
183	0.018 μF											H	
223	0.022 μF											H	
273	0.027 μF											H	
333	0.033 μF											H	
393	0.039 μF											H	
473	0.047 μF												
563	0.056 μF												
683	0.068 μF												
823	0.082 μF												
104	0.1 μF												

Notes

- Letters indicate product thickness, see packaging quantities
- Special values, thickness, please contact our sales office for availability



SELECTION CHART																	
DIELECTRIC		X5R															
STYLE		VJ0201		VJ0402					VJ0603				VJ0805				
SIZE CODE		0201		0402					0603				0805				
VOLTAGE (V <sub>DC</sub> )		4	6.3	4	6.3	10	16	25	6.3	10	16	25	4	6.3	10	16	25
VOLTAGE CODE		S	Y	S	Y	Q	J	X	Y	Q	J	X	S	Y	Q	J	X
CAP. CODE	CAP.																
473	0.047 μF																
563	0.056 μF																
683	0.068 μF																
823	0.082 μF																
104	0.1 μF	L	L	N	N	N	N	N									
124	0.12 μF				N	N											
154	0.15 μF				N	N											
184	0.18 μF																
224	0.22 μF		L		N	N						B					
274	0.27 μF																
334	0.33 μF				N	N		N					B				
394	0.39 μF																
474	0.47 μF				N	N						B					
564	0.56 μF																
684	0.68 μF				N				B	B							
824	0.82 μF																
105	1 μF	L <sup>(1)</sup>	L		N	N	N		B	B	B	B				F	F
155	1.5 μF																
225	2.2 μF				N <sup>(1)</sup>	N <sup>(1)</sup>	N		B	B				C/F	F	F	
335	3.3 μF																
475	4.7 μF				N <sup>(1)</sup>	N <sup>(1)</sup>	N		B	B	B			F	F	F	F
685	6.8 μF																
106	10 μF				N <sup>(1)</sup>	N			B	B				C/F	F	F	Y
156	15 μF																
226	22 μF								B				C <sup>(1)</sup>	C/F	C <sup>(1)</sup>		
336	33 μF																
476	47 μF												Y	Y			
686	68 μF																
107	100 μF																

**Note**<sup>(1)</sup> Dimensions tolerance increased

SELECTION CHART											
DIELECTRIC		X5R									
STYLE		VJ1206					VJ1210				
SIZE CODE		1206					1210				
VOLTAGE (V <sub>DC</sub> )		6.3	10	16	25	50	6.3	10	16	25	50
VOLTAGE CODE		Y	Q	J	X	A	Y	Q	J	X	A
CAP. CODE	CAP.										
105	1 μF										
155	1.5 μF										
225	2.2 μF			H	H	H					
335	3.3 μF										
475	4.7 μF		H	H	E/H					U	
685	6.8 μF										
106	10 μF	H	H	E/H	H				E/J	E/J	
156	15 μF										
226	22 μF	H	H	E/H	H			J	J	J	
336	33 μF										
476	47 μF	H									
686	68 μF										
107	100 μF	H					J				

**Notes**

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- Special values, thickness, please contact our sales office for availability



SELECTION CHART																	
DIELECTRIC		X7R															
STYLE		VJ0402					VJ0603					VJ0805					
SIZE CODE		0402					0603					0805					
VOLTAGE (V <sub>DC</sub> )		6.3	10	16	25	50	100	6.3	10	16	25	50	6.3	10	16	25	50
VOLTAGE CODE		Y	Q	J	X	A	B	Y	Q	J	X	A	Y	Q	J	X	A
CAP. CODE	CAP.																
101	100 pF					N						B					A
121	120 pF																A
151	150 pF					N						B					A
181	180 pF																
221	220 pF					N						B					A
271	270 pF																
331	330 pF					N						B					A
391	390 pF																
471	470 pF					N						B					A
561	560 pF																
681	680 pF					N						B					A
821	820 pF																
102	1000 pF					N						B					A
122	1200 pF																
152	1500 pF					N						B					A
182	1800 pF																
222	2200 pF					N						B					A
272	2700 pF																
332	3300 pF					N						B					A
392	3900 pF																
472	4700 pF					N						B					A
562	5600 pF																
682	6800 pF					N						B					A
822	8200 pF																
103	0.01 µF			N		N						B					A
123	0.012 µF																
153	0.015 µF				N							B					A
183	0.018 µF																
223	0.022 µF				N							B					A
273	0.027 µF																
333	0.033 µF		N	N								B					A
393	0.039 µF																
473	0.047 µF		N	N								B				A	C
563	0.056 µF																
683	0.068 µF		N	N								B				A	C
823	0.082 µF																
104	0.1 µF		N	N						B	B	B			A	C	C
124	0.12 µF																
154	0.15 µF									B					A	F	F
184	0.18 µF																
224	0.22 µF			N						B	B				C	F	F
274	0.27 µF																
334	0.33 µF									B	B				C	F	F/D
394	0.39 µF																
474	0.47 µF									B	B	B			F	F	F
564	0.56 µF																
684	0.68 µF													F	F		
824	0.82 µF																
105	1 µF							B	B	B	B			F	F	F <sup>(1)</sup>	F
155	1.5 µF																D
225	2.2 µF							B	B					F/D	F	D	
335	3.3 µF																
475	4.7 µF													F			
685	6.8 µF																
106	10 µF													F			
156	15 µF																
226	22 µF																
336	33 µF																
476	47 µF																
686	68 µF																
107	100 µF																

Notes

- Letters indicate product thickness, see packaging quantities
- Special values, thickness, please contact our sales office for availability
- (1) Dimensions tolerance increased



SELECTION CHART													
DIELECTRIC		X7R											
STYLE		VJ1206						VJ1210					
SIZE CODE		1206						1210					
VOLTAGE (V <sub>DC</sub> )		6.3	10	16	25	35	50	100	10	16	25	50	100
VOLTAGE CODE		Y	Q	J	X	Z	A	B	Q	J	X	A	B
CAP. CODE	CAP.												
102	1000 pF												
122	1200 pF												
152	1500 pF												
182	1800 pF												
222	2200 pF												
272	2700 pF												
332	3300 pF												
392	3900 pF												
472	4700 pF												
562	5600 pF												
682	6800 pF												
822	8200 pF												
103	0.01 μF												
123	0.012 μF												
153	0.015 μF												
183	0.018 μF												
223	0.022 μF												
273	0.027 μF												
333	0.033 μF												
393	0.039 μF												
473	0.047 μF												
563	0.056 μF												
683	0.068 μF												
823	0.082 μF												
104	0.1 μF						E					F	F
124	0.12 μF												
154	0.15 μF											F	F
184	0.18 μF												
224	0.22 μF						F					F	H
274	0.27 μF												
334	0.33 μF						F					F	H
394	0.39 μF												
474	0.47 μF						H				F	F	J
564	0.56 μF												
684	0.68 μF						H					F	J
824	0.82 μF												
105	1 μF			F	H		H	H			F	H	J
155	1.5 μF												
225	2.2 μF		F	H	H		H				U	J	
335	3.3 μF												
475	4.7 μF		H	H	H		H			U	J	U	
685	6.8 μF												
106	10 μF	H	H	H	H	H			U	J	J		
156	15 μF												
226	22 μF									J	J		
336	33 μF												
476	47 μF												
686	68 μF												
107	100 μF												

## Notes

- Letters indicate product thickness, see packaging quantities
- Special values, thickness, please contact our sales office for availability



SELECTION CHART EPOXY TERMINATION (CODE "B")													
DIELECTRIC		VJ0603				X7R				VJ1206			
STYLE		0603				VJ0805				1206			
SIZE CODE		0603				0805				1206			
VOLTAGE (V <sub>DC</sub> )		16	25	50	100	16	25	50	100	16	25	50	100
VOLTAGE CODE		J	X	A	B	J	X	A	B	J	X	A	B
CAP. CODE	CAP.												
101	100 pF												
121	120 pF												
151	150 pF												
181	180 pF												
221	220 pF												
271	270 pF												
331	330 pF												
391	390 pF												
471	470 pF			B				A					
561	560 pF												
681	680 pF												
821	820 pF												
102	1000 pF			B				A					
122	1200 pF												
152	1500 pF												
182	1800 pF												
222	2200 pF			B				A					
272	2700 pF												
332	3300 pF												
392	3900 pF												
472	4700 pF			B				A					
562	5600 pF												
682	6800 pF												
822	8200 pF												
103	0.01 μF		B	B				A					
123	0.012 μF												
153	0.015 μF							A					
183	0.018 μF												
223	0.022 μF			B				A					
273	0.027 μF												
333	0.033 μF												
393	0.039 μF												
473	0.047 μF			B				C					
563	0.056 μF												
683	0.068 μF												
823	0.082 μF												
104	0.1 μF	B		B				C	F			E	
124	0.12 μF												
154	0.15 μF												
184	0.18 μF												
224	0.22 μF						F	F	F				
274	0.27 μF												
334	0.33 μF												
394	0.39 μF												
474	0.47 μF						F	F		F			
564	0.56 μF												
684	0.68 μF												
824	0.82 μF												
105	1 μF					F	F					H	
155	1.5 μF												
225	2.2 μF												
335	3.3 μF												
475	4.7 μF												
685	6.8 μF												
106	10 μF												
156	15 μF												
226	22 μF												
336	33 μF												
476	47 μF												
686	68 μF												
107	100 μF												

Notes

- Letters indicate product thickness, see packaging quantities
- Detail part numbers, special values, thickness, please contact our sales office for availability

**DIMENSIONS** in inches (millimeters)

	SIZE CODE	L	W	T MAX.	MB
	0201 (0603)	$0.024 \pm 0.0012$ ( $0.60 \pm 0.03$ )	$0.012 \pm 0.0012$ ( $0.30 \pm 0.05$ )	$0.013$ (0.33)	$0.006 \pm 0.002$ ( $0.15 \pm 0.05$ )
0402 (1005)	$0.040 \pm 0.002$ ( $1.00 \pm 0.05$ )	$0.020 \pm 0.002$ ( $0.50 \pm 0.05$ )	$0.022$ (0.55)	$0.010 \pm 0.004$ ( $0.25 \pm 0.10$ )	
0603 (1608)	$0.063 + 0.006 / - 0.004$ ( $1.60 + 0.15 / - 0.10$ )	$0.030 + 0.006 / - 0.004$ ( $0.80 + 0.15 / - 0.10$ )	$0.038$ (0.95)	$0.012 - 0.008 / + 0.010$ ( $0.30 - 0.20 / + 0.25$ )	
0805 (2012)	$0.080 \pm 0.008$ ( $2.00 \pm 0.20$ )	$0.050 \pm 0.008$ ( $1.25 \pm 0.20$ )	$0.057$ (1.45)	$0.020 - 0.012 / + 0.008$ ( $0.50 - 0.30 / + 0.20$ )	
1206 (3216)	$0.126 + 0.012 / - 0.008$ ( $3.20 + 0.30 / - 0.20$ )	$0.063 + 0.012 / - 0.008$ ( $1.60 + 0.30 / - 0.20$ )	$0.075$ (1.90)	$0.020 \pm 0.012$ ( $0.50 \pm 0.30$ )	
1210 (3225)	$0.126 \pm 0.016$ ( $3.20 \pm 0.40$ )	$0.098 \pm 0.012$ ( $2.50 \pm 0.30$ )	$0.11$ (2.80)	$0.026 \pm 0.014$ ( $0.65 \pm 0.35$ )	

**PACKAGING QUANTITIES**

SIZE CODE (inch/mm)	MAX. THICKNESS (mm)	THICKNESS SYMBOL	PAPER TAPE				PLASTIC TAPE			
			7" REEL (C)	7" REEL (S)	13" REEL (P)	13" REEL (Y)	7" REEL (E)	7" REEL (X)	13" REEL (M)	13" REEL (L)
0201 (0603)	0.33	L		10K		50K				
0402 (1005)	0.55	N	10K		50K					
0603 (1608)	0.95	B	4K			10K				
0805 (2012)	0.75	A		4K		10K				
	0.95	C		4K		10K				
	1.40	D					3K			
	1.40	F						2K		10K
1206 (3216)	1.45	Y						2K		10K
	1.00	E		4K		10K				
	1.80	H						2K		8K
1210 (3225)	1.00	E					2K		10K	
	1.45	F						2K		10K
	1.80	H						2K		8K
	2.20	U						2K		4K
	2.70	J						1K		4K
	2.80	V					1K		4K	

**STORAGE OF PRODUCTS****Storage Environment**

Tape packing materials are designed to withstand long-term storage, but they will degrade more rapidly in the presence of high temperature or high humidity. Therefore, the products must be stored in an ambient 5 °C to 40 °C with a relative humidity of 20 % to 70 %. Allowable storage period is within 6 months from the outgoing date of delivery.

**Corrosive Gases**

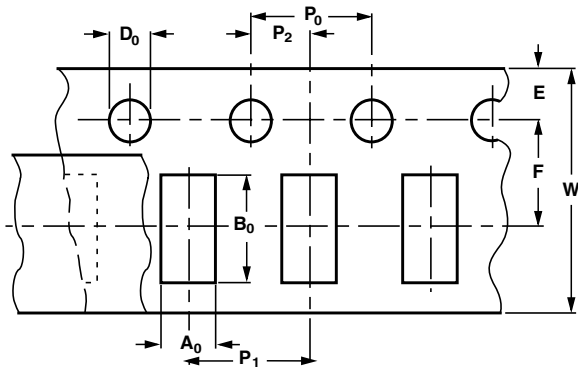
Since sulfure and chlorine may degrade the solderability of the end termination, it is important to store the capacitors in an environment free of these gases.

**Temperature Fluctuations**

Since dew condensation may occur by the differences of temperature when the products are taken out of storage, it is important to maintain a temperature-controlled environment.



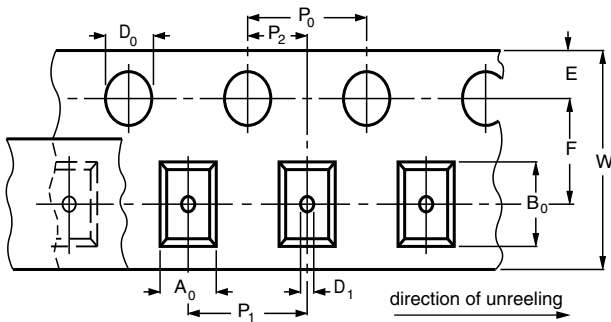
**PAPER TAPE SPECIFICATIONS**



**DIMENSIONS OF PAPER TAPE**  
in millimeters

SYM.	SIZE CODE				
	0201	0402	0603	0805	1206
$A_0$	$0.38 \pm 0.03$	$0.62 \pm 0.04$	$1.01 \pm 0.03$	$1.60 \pm 0.20$	$2.00 \pm 0.20$
$B_0$	$0.68 \pm 0.03$	$1.12 \pm 0.04$	$1.82 \pm 0.05$	$2.30 \pm 0.10$	$3.50 \pm 0.10$
$W$	$8.00 \pm 0.3$	$8.00 \pm 0.30$	$8.00 \pm 0.30$	$8.00 \pm 0.30$	$8.00 \pm 0.30$
$E$	$1.75 \pm 0.10$	$1.75 \pm 0.10$	$1.75 \pm 0.10$	$1.75 \pm 0.10$	$1.75 \pm 0.10$
$F$	$3.5 \pm 0.05$	$3.50 \pm 0.05$	$3.50 \pm 0.05$	$3.50 \pm 0.05$	$3.50 \pm 0.05$
$D_0$	$1.55 \pm 0.05$	$1.55 \pm 0.05$	$1.55 \pm 0.05$	$1.55 \pm 0.05$	$1.55 \pm 0.05$
$P_0$	$4.00 \pm 0.10$	$4.00 \pm 0.10$	$4.00 \pm 0.10$	$4.00 \pm 0.10$	$4.00 \pm 0.10$
$P_1$	$2.00 \pm 0.05$	$2.00 \pm 0.05$	$4.00 \pm 0.10$	$4.00 \pm 0.10$	$4.00 \pm 0.10$
$P_2$	$2.00 \pm 0.05$	$2.00 \pm 0.05$	$2.00 \pm 0.05$	$2.00 \pm 0.05$	$2.00 \pm 0.05$

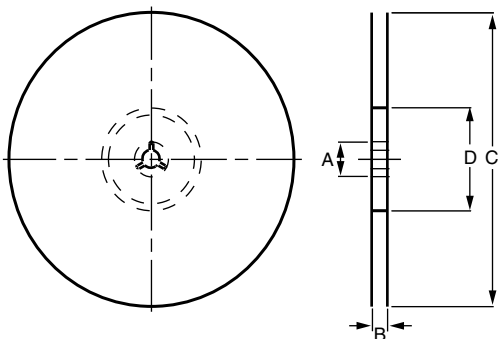
**BLISTER TAPE SPECIFICATIONS**



**DIMENSIONS OF BLISTER TAPE**  
in millimeters

SYM.	SIZE CODE		
	0805	1206	1210
$A_0$	$1.45 \pm 0.15$	$1.90 \pm 0.20$	$2.80 \pm 0.20$
$B_0$	$2.30 \pm 0.20$	$3.50 \pm 0.20$	$3.60 \pm 0.20$
$W$	$8.00 \pm 0.30$	$8.00 \pm 0.30$	$8.00 \pm 0.30$
$E$	$1.75 \pm 0.10$	$1.75 \pm 0.10$	$1.75 \pm 0.10$
$F$	$3.50 \pm 0.05$	$3.50 \pm 0.05$	$3.50 \pm 0.05$
$D_0$	$1.35 \pm 0.05$	$1.55 \pm 0.05$	$1.55 \pm 0.05$
$P_0$	$1.00 \pm 0.10$	$1.00 \pm 0.10$	$1.00 \pm 0.10$
$P_1$	$4.00 \pm 0.10$	$4.00 \pm 0.10$	$4.00 \pm 0.10$
$P_2$	$4.00 \pm 0.10$	$4.00 \pm 0.10$	$4.00 \pm 0.10$

**REEL SPECIFICATIONS**



**REEL DIMENSIONS AND TAPE WIDTH**  
in millimeters

SYM.	$\varnothing 180 \text{ mm}; 7''$	$\varnothing 330 \text{ mm}; 13''$
$A$	$13.0 \pm 0.5$	$13.0 \pm 0.5$
$B$	$9.0 \pm 1.0$	$9.0 \pm 1.0$
$C$	$180.0 + 0/- 3.0$	$330.0 \pm 2.0$
$D$	$60.0 \pm 1.0$	$80.0 \pm 1.0$





VJ....W2BC TEST PROCEDURES AND REQUIREMENTS					
NO.	ITEM		PERFORMANCE		TEST CONDITIONS
1	Appearance		No abnormal exterior appearance		Visual inspection through microscope (x 10)
2	Insulation Resistance		10 000 M $\Omega$ min. or 500 M $\Omega$ x $\mu$ F min. or whichever is smaller 100 M $\Omega$ x $\mu$ F min. <sup>(3)</sup> product whichever is smaller Rated voltage $\leq$ 16 V: 10 000 M $\Omega$ min. or 100 M $\Omega$ x $\mu$ F min. product whichever is smaller		Apply the rated voltage for 60 s to 120 s
3	Withstanding Voltage		No dielectric breakdown or mechanical breakdown		Apply the specified voltage <sup>(3)</sup> for 1 s to 5 s Charge / discharge current limit: 50 mA max. Class I - "A" COG (NP0) (rated voltage < 100 V): 300 % of rated voltage Class II - "G" X5R, "Y" X7R (rated voltage < 100 V): 250 % of rated voltage In the case of rated voltage 100 V: 200 % of the rated voltage
4	Capacitance	Class I - "A" COG (NP0)	Within the specified tolerance		$\leq$ 1000 pF; 1 MHz $\pm$ 10 %; 0.5 V <sub>RMS</sub> to 5 V <sub>RMS</sub> > 1000 pF; 1 kHz $\pm$ 10 %; 0.5 V <sub>RMS</sub> to 5 V <sub>RMS</sub>
		Class II - "G" X5R, "Y" X7R	Within the specified tolerance		$\leq$ 10 $\mu$ F; 1 kHz $\pm$ 10 %; 1.0 V <sub>RMS</sub> $\pm$ 0.2 V <sub>RMS</sub> > 10 $\mu$ F; 120 Hz $\pm$ 20 %; 0.5 V <sub>RMS</sub> $\pm$ 0.1 V <sub>RMS</sub> ; 1 kHz $\pm$ 10 %; 0.5 V <sub>RMS</sub> $\pm$ 0.1 V <sub>RMS</sub> <sup>(3)</sup>
5	Q	Class I - "A" COG (NP0)	Capacitance $\geq$ 30 pF: Q $\geq$ 1000 Capacitance < 30 pF: Q $\geq$ 400 + 20 x C (C: Capacitance)		$\leq$ 1000 pF; 1 MHz $\pm$ 10 %; 0.5 V <sub>RMS</sub> to 5 V <sub>RMS</sub> > 1000 pF; 1 kHz $\pm$ 10 %; 0.5 V <sub>RMS</sub> to 5 V <sub>RMS</sub>
		Class II - "G" X5R; "Y" X7R	"G" X5R	50 V / 35 V: 0.025 max. / 0.05 max. <sup>(3)</sup> 25 V: 0.025 max. / 0.05 max. / 0.10 max. <sup>(3)</sup> 16 V: 0.035 max. / 0.05 max. / 0.10 max. <sup>(3)</sup> $\leq$ 10 V: 0.05 max. / 0.10 max. <sup>(3)</sup>	$\leq$ 10 $\mu$ F; 1 kHz $\pm$ 10 %; 1.0 V <sub>RMS</sub> $\pm$ 0.2 V <sub>RMS</sub> > 10 $\mu$ F; 120 Hz $\pm$ 20 %; 0.5 V <sub>RMS</sub> $\pm$ 0.1 V <sub>RMS</sub> 1 kHz $\pm$ 10 %; 0.5 V <sub>RMS</sub> $\pm$ 0.1 V <sub>RMS</sub> <sup>(3)</sup>
			"Y" X7R	50 V / 35 V / 25 V: 0.025 max. / 0.05 max. / 0.10 max. <sup>(3)</sup> 16 V: 0.035 max. / 0.10 max. <sup>(3)</sup> $\leq$ 10 V: 0.05 max. / 0.10 max. <sup>(3)</sup>	
6	Temperature Characteristics of Capacitance (TCC)	Class I - "A" COG (NP0)	0 ppm/ $^{\circ}$ C $\pm$ 30 ppm/ $^{\circ}$ C		Capacitance shall be measured by the steps shown in the following table Step 1: 25 $^{\circ}$ C $\pm$ 2 $^{\circ}$ C Step 2: min. operating temperature $\pm$ 2 $^{\circ}$ C Step 3: 25 $^{\circ}$ C $\pm$ 2 $^{\circ}$ C Step 4: max. operating temperature $\pm$ 2 $^{\circ}$ C Step 5: 25 $^{\circ}$ C $\pm$ 2 $^{\circ}$ C
		Class II - "G" X5R, "Y" X7R	$\pm$ 15 % (with no bias)		
7	Adhesive strength of termination		No indication of peeling shall occur on the terminal electrode		Apply <sup>(3)</sup> 200 g.f for 0201 all other 500 g.f <sup>(3)</sup> pressure for 10 s $\pm$ 1 s
8	Bending strength	Appearance	No indication of peeling shall occur		- Bending limit: 1.0 mm - Test speed: 1.0 mm/s - Keep the testboard at the limit point in 5 s - Then measure capacitance
		Capacitance	Class I - "A" COG (NP0): Capacitance change: $\pm$ 5 % or $\pm$ 0.5 pF whichever is larger		
			Class II - "G" X5R, "Y" X7R: Capacitance change: 12.5 %		

**Notes**<sup>(3)</sup> Detail specification can be checked with our sales people<sup>(4)</sup> 150 % or 100 % of rated voltage, please contact sales office for rating



VJ....W2BC TEST PROCEDURES AND REQUIREMENTS				
NO.	ITEM	PERFORMANCE	TEST CONDITIONS	
9	Solderability	More than 75 % of the terminal surface is to be soldered newly, so metal part does not come out or dissolve	<p>- Solder: Sn-3Ag-0.5Cu Solder temp.: 245 °C ± 5 °C Flux: RMA type Dip time: 3 s ± 0.3 s Pre-heating: at 80 °C to 120 °C for 10 s to 30 s</p> <p>- Solder: 63Sn-37 Pb Solder temp.: 235 °C ± 5 °C Flux: RMA type Dip time: 5 s ± 0.5 s Pre-heating: at 80 °C to 120 °C for 10 s to 30 s</p>	
10	Resistance to Soldering Heat	Appearance	No mechanical damage shall occur	<p>Solder temperature: 270 °C ± 5 °C Dip time: 10 s ± 1 s Each termination shall be fully immersed and preheated as below: Step 1: 80 °C to 100 °C for 60 s Step 2: 150 °C to 180 °C for 60 s</p> <p>Leave the capacitor in ambient condition for specified time (24 h ± 2 h)<sup>(3)</sup> before measurement.</p>
		Capacitance	Class I - "A" COG (NP0) Capacitance change: ± 2.5 % or ± 0.25 pF whichever is larger	
			Class II - "G" X5R, "Y" X7R Capacitance change: ± 7.5 %	
		Q - Class I - "A" COG (NP0)	Within the specified initial values	
		tan δ - Class II - "G" X5R, "Y" X7R	Within the specified initial values	
		Insulation resistance	Within the specified initial values	
Withstanding voltage	Within the specified initial values			
11	Vibration Test	Appearance	No mechanical damage shall occur	<p>The capacitor shall be subjected to a harmonic motion having a total amplitude of 1.5 mm changing frequency from 10 Hz to 55 Hz and back to 10 Hz in about 1 min.</p> <p>Repeat this for 2 h each in 3 mutually perpendicular directions.</p>
		Capacitance	Class I - "A" COG (NP0) Capacitance change : ± 2.5 % or ± 0.25 pF whichever is larger	
			Class II - "G" X5R, "Y" X7R : Capacitance change: ± 5 %	
		Q - Class I - "A" COG (NP0)	Within the specified initial values	
		tan δ - Class II - "G" X5R, "Y" X7R	Within the specified initial values	
		Insulation resistance	Within the specified initial values	
Withstanding voltage	Within the specified initial values			

**Notes**

<sup>(3)</sup> Detail specification can be checked with our sales people

<sup>(4)</sup> 150 % or 100 % of rated voltage, please contact sales office for rating



VJ....W2BC TEST PROCEDURES AND REQUIREMENTS					
NO.	ITEM	PERFORMANCE		TEST CONDITIONS	
12	Moisture Resistance	Appearance	No mechanical damage shall occur		<p>Applied voltage: rated voltage            Temperature: 40 °C ± 2 °C            Humidity: 90 % to 95 % RH            Duration time: 500 h + 12 h / - 0 h            Charge / discharge current : 50 mA max.</p> <p>Initial measurement:            For Class II - "G" X5R, "Y" X7R            Perform the heat treatment            150 °C + 0 °C / - 10 °C for 1 h            Then leave the capacitor in ambient condition            for 24 h ± 2 h before measurement.</p> <p>Final measurement:            Class I - "A" COG (NP0):            Leave the capacitor in ambient condition for            24 h ± 2 h before measurement.            Class II - "G" X5R, "Y" X7R:            Perform the heat treatment            150 °C + 0 °C / - 10 °C for 1 h.            Then leave the capacitor in ambient condition            for 24 h ± 2 h before measurement.</p>
		Capacitance	Class I - "A" COG(NP0): Capacitance change: ± 7.5 % or ± 0.75 pF whichever is larger		
			Class II - "G" X5R, "Y" X7R: Capacitance change: ± 12.5%		
		Q - Class I - "A" COG (NP0)	Capacitance ≥ 30 pF: Q ≥ 200 Capacitance < 30 pF: Q ≥ 100 + 10/3 x C (C: Capacitance)		
		tan δ - Class II - "G" X5R, "Y" X7R	"G" X5R	50 V / 35 V: 0.05 max. / 0.075 max. <sup>(3)</sup> 25 V / 16 V: 0.05 max. / 0.075 max. / 0.125 max. <sup>(3)</sup> ≤ 10 V: 0.075 max. / 0.125 max. <sup>(3)</sup>	
"Y" X7R	50 V / 35 V / 25 V / 16 V: 0.05 max. / 0.125 max. <sup>(3)</sup> ≤ 10 V: 0.075 max. / 0.125 max. <sup>(3)</sup>				
Insulation resistance	500 MΩ min. or 25 MΩ x μF min. product whichever is smaller / 12.5 MΩ x μF or over <sup>(3)</sup>				
13	High Temperature Resistance	Appearance	No mechanical damage shall occur		<p>Applied voltage: 200 % of rated voltage <sup>(4)</sup>            Temperature: max. operating temperature            Duration time: 1000 h + 48 h / - 0 h            Charge / discharge current: 50 mA max.</p> <p>Initial measurement:            For Class II - "G" X5R, "Y" X7R            Perform the heat treatment            150 °C + 0 °C / - 10 °C for 1 h            Then leave the capacitor in ambient condition            for 24 h ± 2 h before measurement.</p> <p>Final measurement:            Class I - "A" COG(NP0):            Leave the capacitor in ambient condition for            24 h ± 2 h before measurement.            Class II - "G" X5R, "Y" X7R :            Perform the heat treatment            150 °C + 0 °C / - 10 °C for 1 h.            Then leave the capacitor in ambient condition            for 24 h ± 2 h before measurement.</p>
		Capacitance	Class I - "A" COG(NP0): Capacitance change: ± 3 % or ± 0.3 pF whichever is larger		
			Class II - "G" X5R, "Y" X7R: Capacitance change: ± 12.5 %		
		Q - Class I - "A" COG (NP0)	Capacitance ≥ 30 pF: Q ≥ 350 10 ≤ Capacitance < 30 pF: Q ≥ 275 + 2.5 x C (C: Capacitance) Capacitance < 10 pF: Q ≥ 200 + 10 x C (C: Capacitance)		
		tan δ - Class II - "G" X5R, "Y" X7R	"G" X5R	50 V / 35 V: 0.05 max. / 0.075 max. <sup>(3)</sup> 25 V / 16 V: 0.05 max. / 0.075 max. / 0.125 max. <sup>(3)</sup> ≤ 10 V: 0.075 max. / 0.125 max. <sup>(3)</sup>	
"Y" X7R	50 V / 35 V / 25 V / 16 V: 0.05 max. / 0.125 max. <sup>(3)</sup> ≤ 10 V: 0.075 max. / 0.125 max. <sup>(3)</sup>				
Insulation resistance	1000 MΩ min. or 50 MΩ x μF min. product whichever is smaller / 25 MΩ x μF or over <sup>(3)</sup>				

**Notes**

<sup>(3)</sup> Detail specification can be checked with our sales people

<sup>(4)</sup> 150 % or 100 % of rated voltage, please contact sales office for rating



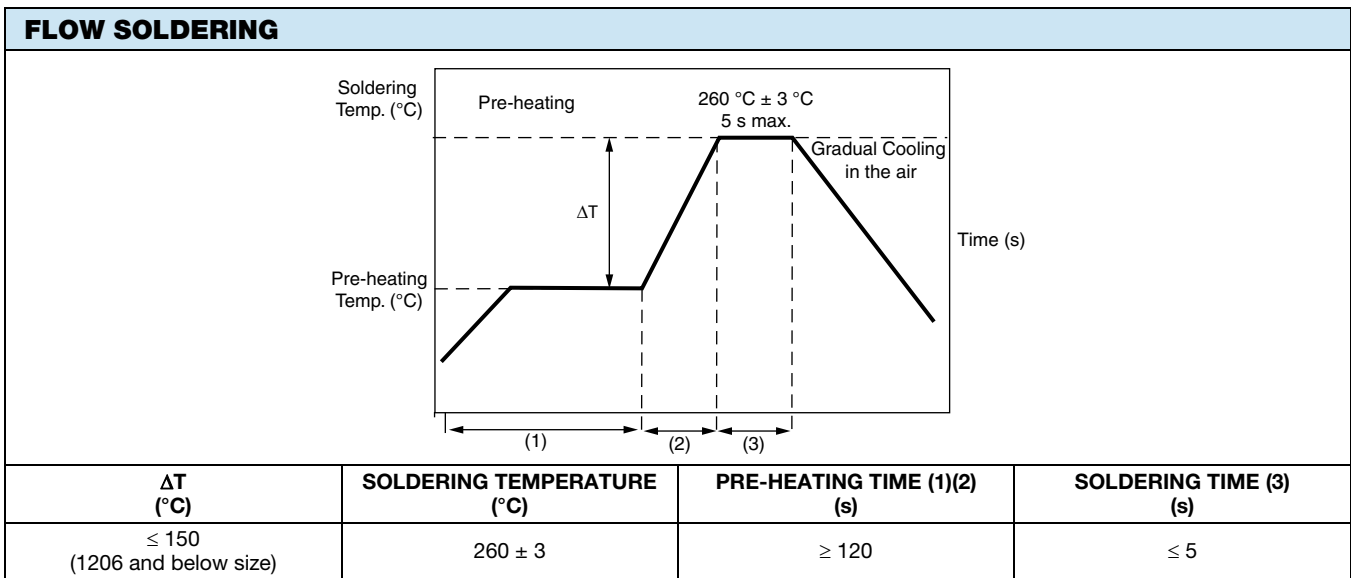
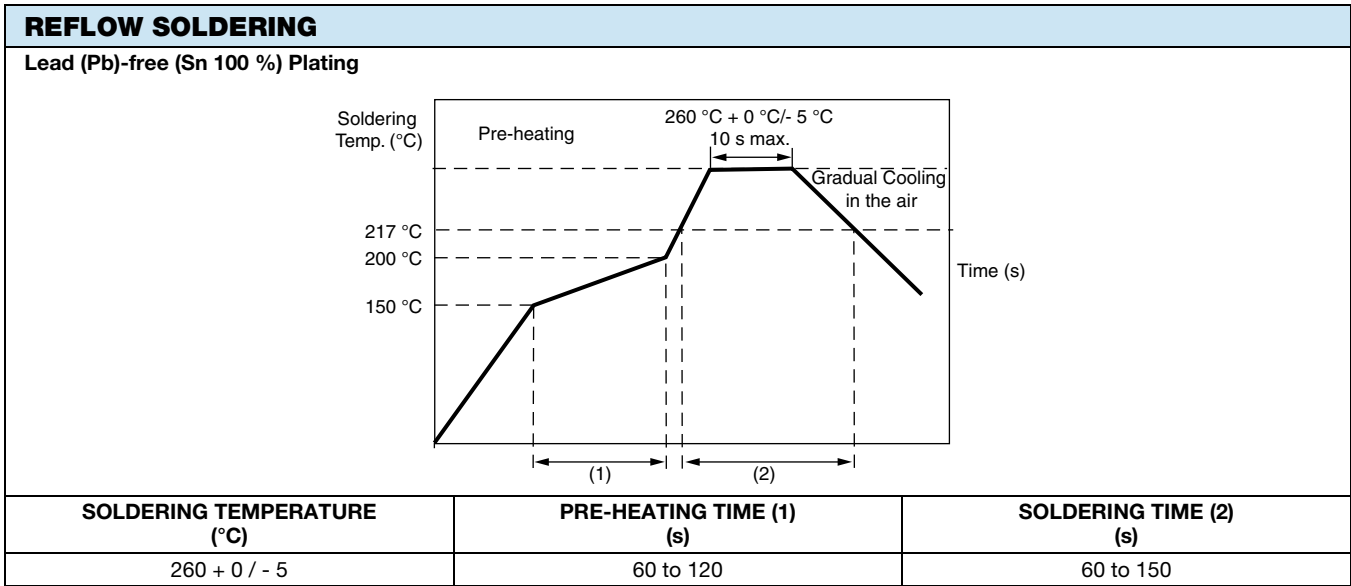
VJ....W2BC TEST PROCEDURES AND REQUIREMENTS					
NO.	ITEM	PERFORMANCE		TEST CONDITIONS	
14	Temperature Cycle	Appearance	No mechanical damage shall occur		Capacitance shall be subjected to 5 cycles. Condition for one cycle: Step 1: min. operating temperature +0 °C / -3 °C for 30 min. Step 2: 25 °C for 2 min to 3 min Step 3: max. operating temperature +0 °C / -3 °C for 30 min. Step 4: 25 °C for 2 min to 3 min  Leave the capacitor in ambient condition for specified time (24 h ± 2 h) <sup>(3)</sup> before measurement.
		Capacitance	Class I - "A" C0G (NP0): Capacitance change: ± 2.5 % or ± 0.25 pF whichever is larger		
			Class II - "G" X5R, "Y" X7R: Capacitance change: ± 7.5 %		
		Q - Class I - "A" C0G (NP0)	Within the specified initial values		
		tan δ - Class II - "G" X5R, "Y" X7R	Within the specified initial values		
Insulation resistance	Within the specified initial values				
15	Recommended Soldering Method by Size and Capacitance	Size in inch (mm)	Temperature Characteristic	Capacitance and condition	
		0201 (0603)	All	All capacitance values: reflow	
		0402 (1005)	All	All capacitance values: reflow	
		0603 (1608)	Class I "A" C0G (NP0)	All capacitance values: flow and reflow	
			Class II "G" X5R, "Y" X7R	Capacitance values < 1 µF: flow and reflow	
		0805 (2012)	Class II "G" X5R, "Y" X7R	Capacitance values ≥ 1 µF: reflow	
			Class I "A" C0G (NP0)	All capacitance values: flow and reflow	
			Class II "G" X5R, "Y" X7R	Capacitance values < 4.7 µF: flow and reflow	
		1206 (3216)	Class II "G" X5R, "Y" X7R	Capacitance values ≥ 4.7 µF: reflow	
			Class I "A" C0G (NP0)	All capacitance values: flow and reflow	
			Class II "G" X5R, "Y" X7R	Capacitance values < 10 µF: flow and reflow	
		1210 (3225)	Class II "G" X5R, "Y" X7R	Capacitance values ≥ 10 µF: reflow	
All	All capacitance values: reflow				

**Notes**

- (3) Detail specification can be checked with our sales people  
 (4) 150 % or 100 % of rated voltage, please contact sales office for rating

**SOLDERING**

Since a multilayer ceramic chip capacitor comes into direct contact with melted solder during soldering, it is exposed to potentially mechanical stress caused by the sudden temperature change. The capacitor may also be subjected to silver migration, and contamination by the flux. Because of these factors, soldering technique is critical.



**SOLDERING IRON (hand soldering)**

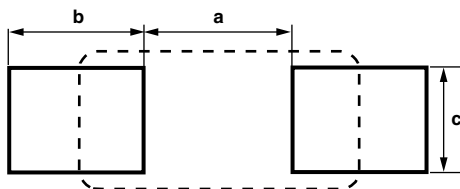
VARIATION OF TEMP. (°C)	SOLDERING TEMP. (°C)	PRE-HEATING TIME (s)	SOLDERING TIME (s)	COOLING TIME (s)	CONDITION OF IRON FACILITIES		
					WATTAGE (W)	TIP DIAMETER (mm)	SOLDERING TIME (s)
ΔT ≤ 130	300 ± 10 max.	≥ 60	≤ 4	-	20 max.	3 max.	4 max.

**Note**

- Caution - Iron tip should not contact with ceramic body directly. Manual soldering can pose a great risk of creating thermal cracks in chip capacitors. The hot soldering iron tip comes into direct contact with the end terminations, and operator's carelessness 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 close attention must be paid to the selection of the soldering iron tip and to temperature control of the tip.



### RECOMMENDED LAND PATTERN DESIGN



### REFLOW SOLDERING

SIZE CODE inch (mm)	a mm	b mm	c mm
0201 (0603)	0.20 to 0.30	0.20 to 0.30	0.20 to 0.40
0402 (1005)	0.45 to 0.55	0.40 to 0.50	0.40 to 0.60
0603 (1608)	0.60 to 0.80	0.60 to 0.80	0.60 to 0.80
0805 (2012)	1.00 to 1.20	0.80 to 1.20	0.80 to 1.10
1206 (3216)	2.10 to 2.50	1.00 to 1.40	1.00 to 1.40
1210 (3225)	2.00 to 2.40	1.00 to 1.40	1.80 to 2.20

### FLOW SOLDERING

SIZE CODE inch (mm)	a mm	b mm	c mm
0603 (1608)	0.60 to 1.00	0.60 to 0.80	0.60 to 0.80
0805 (2012)	1.00 to 1.20	0.80 to 1.20	0.80 to 1.20
1206 (3216)	2.00 to 2.40	1.00 to 1.20	1.00 to 1.40
1210 (3225)	2.00 to 2.40	1.00 to 1.20	2.00 to 2.40

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