Surface Mount Multilayer Ceramic Chip Capacitor Solutions for Boardflex Sensitive Applications



FEATURES

- Open Mode Design (OMD) reduces risk of shorts or leakage in board flex applications
- Excellent reliability and thermal shock performance
- Efficient low-power consumption, ripple current capable to 1.2 A_{RMS} at 100 kHz
- High voltage breakdown compared to standard design
- 100 % voltage conditioning available up to 630 V_{DC} rating (process code "5H") Contact mlcc@vishay.com for higher voltages
- Polymer termination available for intensive board flex requirements
- Wet build process
- Reliable Noble Metal Electrode (NME) system
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008) Available

APPLICATIONS

- Demanding boardflex applications
- Input filter capacitors
- Output filter capacitors
- Snubber capacitors reduce MOSFET voltage spikes
- Filtering for switching power supplies
- For lighting and other AC applications please contact: mlcc@vishay.com

ELECTRICAL SPECIFICATIONS

C0G (NP0)

GENERAL SPECIFICATION

Note
Electrical characteristics at +25 °C unless otherwise specified

Operating Temperature: -55 °C to +125 °C

Capacitance Range: 10 pF to 47 nF

Voltage Range: 50 V_{DC} to 3000 V_{DC}

Temperature Coefficient of Capacitance (TCC):
0 ppm/°C ± 30 ppm/°C from -55 °C to +125 °C

Dissipation Factor (DF):
0.1 % maximum at 1.0 V_{RMS} and 1 MHz for values ≤ 1000 pF
0.1 % maximum at 1.0 V_{RMS} and 1 kHz for values > 1000 pF

Insulating Resistance:
at +25 °C 100 000 MΩ min. or 1000 ΩF whichever is less
at +125 °C 10 000 MΩ min. or 100 ΩF whichever is less

Aging Rate: 0 % maximum per decade

Dielectric Strength Test:
performed per method 103 of EIA 198-2-E
Applied test voltages

≤ 200 V_{DC}-rated:	250 % of rated voltage
500 V_{DC}-rated:	200 % of rated voltage
630 V_{DC} / 1000 V_{DC}-rated:	150 % of rated voltage
1500 V_{DC} to 3000 V_{DC}-rated:	120 % of rated voltage

X7R

GENERAL SPECIFICATION

Note
Electrical characteristics at +25 °C unless otherwise specified

Operating Temperature: -55 °C to +125 °C

Capacitance Range: 100 pF to 1.8 µF

Voltage Range: 16 V_{DC} to 3000 V_{DC}

Temperature Coefficient of Capacitance (TCC):
± 15 % from -55 °C to +125 °C, with 0 V_{DC} applied

Dissipation Factor (DF):
< 50 V ratings 3.5 % maximum at 1.0 V_{RMS} and 1 kHz
≥ 50 V ratings 2.5 % maximum at 1.0 V_{RMS} and 1 kHz

Insulating Resistance:
at +25 °C 100 000 MΩ min. or 1000 ΩF whichever is less
at +125 °C 10 000 MΩ min. or 100 ΩF whichever is less

Aging Rate: 1 % maximum per decade

Dielectric Strength Test:
performed per method 103 of EIA 198-2-E
Applied test voltages

≤ 250 V_{DC}-rated:	250 % of rated voltage
500 V_{DC}-rated:	min. 150 % of rated voltage
630 V_{DC} / 1000 V_{DC}-rated:	150 % of rated voltage
1500 V_{DC} to 3000 V_{DC}-rated:	120 % of rated voltage

For technical questions, contact: mlcc@vishay.com
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QUICK REFERENCE DATA

DIELECTRIC	CASE	MAXIMUM VOLTAGE (V)	CAPACITANCE	
			MINIMUM	MAXIMUM
C0G (NP0)	1206	1500	10 pF	4.7 nF
	1210	2000	10 pF	8.2 nF
	1808	3000	27 pF	8.2 nF
	1812	3000	27 pF	18 nF
	1825	1000	15 pF	33 nF
	2220	1000	270 pF	39 nF
	2225	1000	270 pF	47 nF
X7R	0805	630	470 pF	220 nF
	1206	2000	270 pF	680 nF
	1210	2000	390 pF	1.0 µF
	1808	3000	220 pF	18 nF
	1812	3000	100 pF	1.2 µF
	1825	2000	5.6 nF	1.5 µF
	2220	3000	1.0 nF	1.8 µF
	2225	2000	5.6 nF	1.8 µF

Note

- Detail ratings see “Selection Chart”

ORDERING INFORMATION

VJ1210	Y	474	J	X	A	A	T	# (2)
CASE CODE	DIELECTRIC	CAPACITANCE NOMINAL CODE	CAPACITANCE TOLERANCE	TERMINATION (4)	DC VOLTAGE RATING (1)	MARKING	PACKAGING	PROCESS CODE
0805 1206 1210 1808 1812 1825 2220 2225	A = C0G (NP0) Y = X7R	Expressed in picofarads (pF). The first two digits are significant, the third is a multiplier. An “R” indicates a decimal point. **Examples** 474 = 470 000 pF	F = ± 1 % G = ± 2 % J = ± 5 % K = ± 10 % M = ± 20 % **Note** C0G (NP0): F, G, J, K X7R: J, K, M	X = Ni barrier 100 % tin plated matte finish E = AgPd (3) B = polymer 100 % tin plated matte finish (5)	J = 16 V X = 25 V A = 50 V B = 100 V C = 200 V P = 250 V E = 500 V L = 630 V G = 1000 V R = 1500 V F = 2000 V H = 3000 V	A = unmarked	C = 7" reel / paper tape T = 7" reel / plastic tape P = 11 1/4" / 13" reel / paper tape R = 11 1/4" / 13" reel / plastic tape O = 7" reel / flamed paper tape I = 11 1/4" / 13" reel / flamed paper tape **Note** “I” and “O” are used for “E” termination size 0805	4X = OMD cap 5H = OMD cap 100 % voltage conditioning

Notes

(1) DC voltage rating should not be exceeded in application. Other application factors may affect the MLCC performance Consult for questions: mlcc@vishay.com

(2) Process code with 2 digits has to be added

(3) Termination code E” is for conductive epoxy assembly

(4) Other termination options contact mlcc@vishay.com for availability

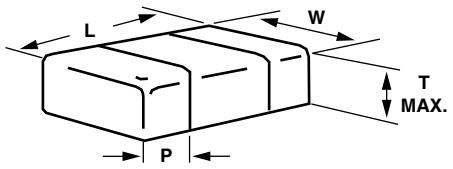
(5) Polymer termination, code “B”, only available in plastic tape “T” / “R”

ENVIRONMENTAL STATUS

TERMINATION CODE	TERMINATION DESCRIPTION	RoHS COMPLIANT	VISHAY GREEN
X	Ni barrier 100 % tin plated matte finish	Yes	Yes
E	AgPd	Yes	Yes
B	Polymer layer, 100 % tin plated matte finish	Yes	No

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DIMENSIONS in inches (millimeters)



CASE CODE	STYLE	LENGTH (L)	WIDTH (W)	MAXIMUM THICKNESS (T)	TERMINATION PAD (P)	
					MINIMUM	MAXIMUM
0805	VJ0805	0.079 ± 0.008 (2.00 ± 0.20)	0.049 ± 0.008 (1.25 ± 0.20)	0.057 (1.45)	0.010 (0.25)	0.030 (0.76)
1206	VJ1206	0.126 ± 0.010 (3.20 ± 0.25)	0.063 ± 0.010 (1.60 ± 0.25)	0.067 (1.70) (1)	0.010 (0.25)	0.030 (0.76)
1210	VJ1210	0.126 ± 0.010 (3.20 ± 0.25)	0.098 ± 0.010 (2.50 ± 0.25)	0.067 (1.70)	0.010 (0.25)	0.030 (0.76)
1808	VJ1808	0.180 ± 0.012 (4.57 ± 0.30)	0.080 ± 0.010 (2.03 ± 0.25)	0.086 (2.18)	0.010 (0.25)	0.035 (0.90)
1812	VJ1812	0.177 ± 0.012 (4.50 ± 0.30)	0.126 ± 0.008 (3.20 ± 0.20)	0.086 (2.18)	0.010 (0.25)	0.035 (0.90)
1825	VJ1825	0.177 ± 0.012 (4.50 ± 0.30)	0.252 ± 0.010 (6.40 ± 0.25)	0.086 (2.18)	0.010 (0.25)	0.035 (0.90)
2220	VJ2220	0.220 ± 0.010 (5.59 ± 0.25)	0.200 ± 0.010 (5.08 ± 0.25)	0.086 (2.18)	0.010 (0.25)	0.037 (0.95)
2225	VJ2225	0.220 ± 0.010 (5.59 ± 0.25)	0.250 ± 0.010 (6.35 ± 0.25)	0.086 (2.18)	0.010 (0.25)	0.037 (0.95)

Notes

- Polymer (B-termination) have increased dimensions: length 0.006" (0.15 mm)

(1) Maximum thickness (T) = 0.067 (1.71) for VJ1206Y104*

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SELECTION CHART

DIELECTRIC		C0G (NP0)																								
STYLE		VJ1206 (1)							VJ1210 (1)								VJ1808 (1)									
CASE CODE		1206							1210								1808									
VOLTAGE (V_{DC})		50	100	200	500	630	1000	1500	50	100	200	500	630	1000	1500	2000	50	100	200	500	630	1000	1500	2000	3000
VOLTAGE CODE		A	B	C	E	L	G	R	A	B	C	E	L	G	R	F	A	B	C	E	L	G	R	F	H
CAP. CODE	CAP.																									
100	10 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•									
120	12 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•									
150	15 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•									
180	18 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•									
220	22 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•									
270	27 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
330	33 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
390	39 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•
470	47 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•
560	56 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•
680	68 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•
820	82 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•
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	•	•	•	•	•			•	•	•	•					•	•	•	•	•	•			
561	560 pF	•	•	•	•	•			•	•	•	•					•	•	•	•	•	•			
681	680 pF	•	•	•	•	•			•	•	•	•					•	•	•	•	•	•			
821	820 pF	•	•	•	•	•			•	•	•	•					•	•	•	•	•	•			
102	1.0 nF	•	•	•	•	•			•	•	•	•					•	•	•	•	•	•			
122	1.2 nF	•	•	•					•	•	•	•					•	•	•	•					
152	1.5 nF	•	•	•					•	•	•						•	•	•	•					
182	1.8 nF	•	•	•					•	•	•						•	•	•						
222	2.2 nF	•	•	•					•	•	•						•	•	•						
272	2.7 nF	•	•						•	•	•						•	•	•						
332	3.3 nF	•	•						•	•	•						•	•	•						
392	3.9 nF	•							•	•	•						•	•	•						
472	4.7 nF	•							•	•	•						•	•	•						
562	5.6 nF								•								•	•	•						
682	6.8 nF								•								•	•							
822	8.2 nF								•								•								
103	10 nF																								
123	12 nF																								
153	15 nF																								
183	18 nF																								
223	22 nF																								
273	27 nF																								
333	33 nF																								
393	39 nF																								
473	47 nF																								
563	56 nF																								
683	68 nF																								
823	82 nF																								
104	100 nF																								

Notes

RoHS-compliant

(1) See soldering recommendations within this data book, or visit: www.vishay.com/doc?45034

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SELECTION CHART																
DIELECTRIC		C0G (NP0)														
STYLE		VJ1812 (1)									VJ1825 (1)					
CASE CODE		1812									1825					
VOLTAGE (V_{DC})		50	100	200	500	630	1000	1500	2000	3000	50	100	200	500	630	1000
VOLTAGE CODE		A	B	C	E	L	G	R	F	H	A	B	C	E	L	G
CAP. CODE	CAP.															
100	10 pF															
120	12 pF															
150	15 pF														•	•
180	18 pF														•	•
220	22 pF														•	•
270	27 pF	•	•	•	•	•	•	•	•	•					•	•
330	33 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
390	39 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
470	47 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
560	56 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
680	68 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
820	82 pF	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
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	•	•	•	•	•	•	•	•		•	•	•	•	•	•
561	560 pF	•	•	•	•	•	•	•	•		•	•	•	•	•	•
681	680 pF	•	•	•	•	•	•	•	•		•	•	•	•	•	•
821	820 pF	•	•	•	•	•	•				•	•	•	•	•	•
102	1.0 nF	•	•	•	•	•	•				•	•	•	•	•	•
122	1.2 nF	•	•	•	•	•	•				•	•	•	•	•	•
152	1.5 nF	•	•	•	•	•	•				•	•	•	•	•	•
182	1.8 nF	•	•	•	•	•	•				•	•	•	•	•	•
222	2.2 nF	•	•	•	•	•	•				•	•	•	•	•	•
272	2.7 nF	•	•	•	•						•	•	•	•		
332	3.3 nF	•	•	•	•						•	•	•	•		
392	3.9 nF	•	•	•	•						•	•	•	•		
472	4.7 nF	•	•	•							•	•	•	•		
562	5.6 nF	•	•	•							•	•	•	•		
682	6.8 nF	•	•	•							•	•	•	•		
822	8.2 nF	•	•	•							•	•	•	•		
103	10 nF	•	•	•							•	•	•			
123	12 nF	•	•								•	•	•			
153	15 nF	•									•	•	•			
183	18 nF	•									•	•	•			
223	22 nF										•	•	•			
273	27 nF										•	•				
333	33 nF										•					
393	39 nF															
473	47 nF															
563	56 nF															
683	68 nF															
823	82 nF															
104	100 nF															

Notes

RoHS-compliant

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SELECTION CHART

DIELECTRIC		C0G (NP0)											
STYLE		VJ2220 (1)						VJ2225 (1)					
CASE CODE		2220						2225					
VOLTAGE (V_{DC})		50	100	200	500	630	1000	50	100	200	500	630	1000
VOLTAGE CODE		A	B	C	E	L	G	A	B	C	E	L	G
CAP. CODE	CAP.												
100	10 pF												
120	12 pF												
150	15 pF												
180	18 pF												
220	22 pF												
270	27 pF												
330	33 pF												
390	39 pF												
470	47 pF												
560	56 pF												
680	68 pF												
820	82 pF												
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	•	•	•	•	•	•	•	•	•	•	•	•
561	560 pF	•	•	•	•	•	•	•	•	•	•	•	•
681	680 pF	•	•	•	•	•	•	•	•	•	•	•	•
821	820 pF	•	•	•	•	•	•	•	•	•	•	•	•
102	1.0 nF	•	•	•	•	•	•	•	•	•	•	•	•
122	1.2 nF	•	•	•	•	•	•	•	•	•	•	•	•
152	1.5 nF	•	•	•	•	•	•	•	•	•	•	•	•
182	1.8 nF	•	•	•	•	•	•	•	•	•	•	•	•
222	2.2 nF	•	•	•	•	•	•	•	•	•	•	•	•
272	2.7 nF	•	•	•	•	•	•	•	•	•	•	•	•
332	3.3 nF	•	•	•	•	•	•	•	•	•	•	•	•
392	3.9 nF	•	•	•	•	•	•	•	•	•	•	•	•
472	4.7 nF	•	•	•	•	•	•	•	•	•	•	•	•
562	5.6 nF	•	•	•				•	•	•	•		
682	6.8 nF	•	•	•				•	•	•	•		
822	8.2 nF	•	•	•				•	•	•	•		
103	10 nF	•	•	•				•	•	•	•		
123	12 nF	•	•	•				•	•	•	•		
153	15 nF	•	•					•	•	•			
183	18 nF	•	•					•	•	•			
223	22 nF	•	•					•	•	•			
273	27 nF	•	•					•	•	•			
333	33 nF	•						•	•	•			
393	39 nF	•						•	•				
473	47 nF							•					
563	56 nF												
683	68 nF												
823	82 nF												
104	100 nF												

Notes

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SELECTION CHART

DIELECTRIC		X7R																	
STYLE		VJ0805 (1)							VJ1206 (1)										
CASE CODE		0805							1206										
VOLTAGE (V_{DC})		16	25	50	100	200	500	630	16	25	50	100	200	500	630	1000	1500	2000
VOLTAGE CODE		J	X	A	B	C	E	L	J	X	A	B	C	E	L	G	R	F
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	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•	•	
561	560 pF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•	•	
681	680 pF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•	•	
821	820 pF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•	•	
102	1.0 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•	•	•
122	1.2 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•	•	
152	1.5 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•	•	
182	1.8 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•	•	
222	2.2 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•		
272	2.7 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•		
332	3.3 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•		
392	3.9 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•		
472	4.7 nF	••	••	••	••	••	•	•	•	•	•	•	•	•	•	•	•		
562	5.6 nF	••	••	••	••	•			•	•	•	•	•	•	•				
682	6.8 nF	••	••	••	••	•			•	•	•	•	•	•	•				
822	8.2 nF	••	••	••	••	•			•	•	•	•	•	•	•				
103	10 nF	••	••	••	••	•			•	•	•	•	•	•	•				
123	12 nF	••	••	••	•	•			•	•	•	•	•	•	•				
153	15 nF	••	••	••	•	•			•	•	•	•	•	•	•				
183	18 nF	••	••	••	•	•			•	•	•	•	•	•	•				
223	22 nF	••	••	••	•	•			•	•	•	•	•						
273	27 nF	•	•	•	•				•	•	•	•	•						
333	33 nF	•	•	•	•				•	•	•	•	•						
393	39 nF	•	•	•	•				•	•	•	•	•						
473	47 nF	•	•	•	•				•	•	•	•	•						
563	56 nF	•	•	•					•	•	•	•	•						
683	68 nF	•	•	•					•	•	•	•	•						
823	82 nF	•	•	•					•	•	•	•	•						
104	100 nF	•	•	•					•	•	•	•	•						
124	120 nF	•	•						•	•	•	•							
154	150 nF	•	•						•	•	•	•							
184	180 nF	•							•	•	•	•							
224	220 nF	•							•	•	•								
274	270 nF								•	•	•								
334	330 nF								•	•	•								
394	390 nF								•	•									
474	470 nF								•	•									
564	560 nF								•										
684	680 nF								•										
824	820 nF																		
105	1.0 µF																		
125	1.2 µF																		
155	1.5 µF																		
185	1.8 µF																		
225	2.2 µF																		

Notes

RoHS-compliant

•• Paper tape • Plastic tape

(1) See soldering recommendations within this data book, or visit: www.vishay.com/doc?45034

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SELECTION CHART

DIELECTRIC		X7R														
STYLE		VJ1210 (1)										VJ1808 (1)				
CASE CODE		1210										1808				
VOLTAGE (V_{DC})		16	25	50	100	200	500	630	1000	1500	2000	630	1000	1500	2000	3000
VOLTAGE CODE		J	X	A	B	C	E	L	G	R	F	L	G	R	F	H
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								•	•	•	•	•	•	•	•
561	560 pF								•	•	•	•	•	•	•	•
681	680 pF								•	•	•	•	•	•	•	•
821	820 pF								•	•	•	•	•	•	•	•
102	1.0 nF								•	•	•	•	•	•	•	•
122	1.2 nF								•	•	•	•	•	•	•	•
152	1.5 nF								•	•	•	•	•	•	•	•
182	1.8 nF								•	•	•	•	•	•	•	
222	2.2 nF								•	•	•	•	•	•	•	
272	2.7 nF								•	•	•	•	•	•	•	
332	3.3 nF								•	•	•	•	•	•	•	
392	3.9 nF								•	•		•	•	•		
472	4.7 nF								•	•		•	•	•		
562	5.6 nF								•			•	•	•		
682	6.8 nF								•			•	•	•		
822	8.2 nF											•	•			
103	10 nF	•	•	•	•	•	•	•	•			•	•			
123	12 nF	•	•	•	•	•	•	•				•	•			
153	15 nF	•	•	•	•	•	•	•				•	•			
183	18 nF	•	•	•	•	•	•	•				•	•			
223	22 nF	•	•	•	•	•	•	•								
273	27 nF	•	•	•	•	•	•	•								
333	33 nF	•	•	•	•	•	•	•								
393	39 nF	•	•	•	•	•	•	•								
473	47 nF	•	•	•	•	•										
563	56 nF	•	•	•	•	•										
683	68 nF	•	•	•	•	•										
823	82 nF	•	•	•	•	•										
104	100 nF	•	•	•	•	•										
124	120 nF	•	•	•	•	•										
154	150 nF	•	•	•	•	•										
184	180 nF	•	•	•	•											
224	220 nF	•	•	•	•											
274	270 nF	•	•	•	•											
334	330 nF	•	•	•	•											
394	390 nF	•	•	•	•											
474	470 nF	•	•	•	•											
564	560 nF	•	•	•												
684	680 nF	•	•	•												
824	820 nF	•	•													
105	1.0 µF	•														
125	1.2 µF															
155	1.5 µF															
185	1.8 µF															
225	2.2 µF															

Notes

RoHS-compliant

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SELECTION CHART

DIELECTRIC		X7R																
STYLE		VJ1812 (1)										VJ1825 (1)						
CASE CODE		1812										1825						
VOLTAGE (V_{DC})		50	100	200	250	500	630	1000	1500	2000	3000	100	200	500	630	1000	1500	2000
VOLTAGE CODE		A	B	C	P	E	L	G	R	F	H	B	C	E	L	G	R	F
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	•	•	•	•	•	•	•	•	•	•							
561	560 pF	•	•	•	•	•	•	•	•	•	•							
681	680 pF	•	•	•	•	•	•	•	•	•	•							
821	820 pF	•	•	•	•	•	•	•	•	•	•							
102	1.0 nF	•	•	•	•	•	•	•	•	•	•							
122	1.2 nF	•	•	•	•	•	•	•	•	•	•							
152	1.5 nF	•	•	•	•	•	•	•	•	•	•							
182	1.8 nF	•	•	•	•	•	•	•	•	•	•							
222	2.2 nF	•	•	•	•	•	•	•	•	•	•							
272	2.7 nF	•	•	•	•	•	•	•	•	•								
332	3.3 nF	•	•	•	•	•	•	•	•	•								
392	3.9 nF	•	•	•	•	•	•	•	•	•								
472	4.7 nF	•	•	•	•	•	•	•	•	•								
562	5.6 nF	•	•	•	•	•	•	•	•	•							•	•
682	6.8 nF	•	•	•	•	•	•	•	•	•							•	•
822	8.2 nF	•	•	•	•	•	•	•	•								•	•
103	10 nF	•	•	•	•	•	•	•	•			•	•	•	•	•	•	•
123	12 nF	•	•	•	•	•	•	•				•	•	•	•	•	•	•
153	15 nF	•	•	•	•	•	•	•				•	•	•	•	•	•	•
183	18 nF	•	•	•	•	•	•	•				•	•	•	•	•	•	•
203	20 nF	•	•	•	•	•	•	•				•	•	•	•	•	•	•
223	22 nF	•	•	•	•	•	•	•				•	•	•	•	•	•	•
273	27 nF	•	•	•	•	•	•	•				•	•	•	•	•	•	•
333	33 nF	•	•	•	•	•	•					•	•	•	•	•		
393	39 nF	•	•	•	•	•	•					•	•	•	•	•		
473	47 nF	•	•	•	•	•	•					•	•	•	•	•		
563	56 nF	•	•	•	•	•	•					•	•	•	•	•		
683	68 nF	•	•	•	•	•	•					•	•	•	•			
823	82 nF	•	•	•	•	•	•					•	•	•	•			
104	100 nF	•	•	•	•	•	•					•	•	•				
124	120 nF	•	•	•	•	•						•	•	•				
154	150 nF	•	•	•	•	•						•	•	•				
184	180 nF	•	•	•	•							•	•	•				
224	220 nF	•	•	•	•							•	•	•				
274	270 nF	•	•	•	•							•	•					
334	330 nF	•	•	•	•							•	•					
394	390 nF	•	•	•								•	•					
474	470 nF	•	•									•	•					
564	560 nF	•	•									•	•					
684	680 nF	•	•									•	•					
824	820 nF	•	•									•						
105	1.0 µF	•	•									•						
125	1.2 µF	•										•						
155	1.5 µF											•						
185	1.8 µF																	
225	2.2 µF																	

Notes

RoHS-compliant

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SELECTION CHART

DIELECTRIC		X7R																
STYLE		VJ2220 (1)									VJ2225 (1)							
CASE CODE		2220									2225							
VOLTAGE (V_{DC})		50	100	200	250	500	630	1000	2000	3000	100	200	500	630	1000	1500	2000
VOLTAGE CODE		A	B	C	P	E	L	G	F	H	B	C	E	L	G	R	F
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																	
561	560 pF																	
681	680 pF																	
821	820 pF																	
102	1.0 nF									•								
122	1.2 nF									•								
152	1.5 nF									•								
182	1.8 nF									•								
222	2.2 nF									•								
272	2.7 nF																	
332	3.3 nF																	
392	3.9 nF																	
472	4.7 nF																	
562	5.6 nF								•							•	•	
682	6.8 nF								•							•	•	
822	8.2 nF								•							•	•	
103	10 nF	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	
123	12 nF	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	
153	15 nF	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	
183	18 nF	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	
203	20 nF	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	
223	22 nF	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	
273	27 nF	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	
333	33 nF	•	•	•	•	•	•	•			•	•	•	•	•	•	•	
393	39 nF	•	•	•	•	•	•	•			•	•	•	•	•	•	•	
473	47 nF	•	•	•	•	•	•	•			•	•	•	•	•	•	•	
563	56 nF	•	•	•	•	•	•	•			•	•	•	•	•			
683	68 nF	•	•	•	•	•	•	•			•	•	•	•	•			
823	82 nF	•	•	•	•	•	•	•			•	•	•	•	•			
104	100 nF	•	•	•	•	•	•				•	•	•	•	•			
124	120 nF	•	•	•	•	•	•				•	•	•					
154	150 nF	•	•	•	•	•	•				•	•	•					
184	180 nF	•	•	•	•	•	•				•	•	•					
224	220 nF	•	•	•	•	•					•	•	•					
274	270 nF	•	•	•	•						•	•	•					
334	330 nF	•	•	•	•						•	•	•					
394	390 nF	•	•	•	•						•	•						
474	470 nF	•	•	•	•						•	•						
564	560 nF	•	•	•	•						•	•						
684	680 nF	•	•	•	•						•	•						
824	820 nF	•	•								•	•						
105	1.0 µF	•	•								•	•						
125	1.2 µF	•	•								•	•						
155	1.5 µF	•	•								•							
185	1.8 µF	•									•							
225	2.2 µF																	

Notes

RoHS-compliant

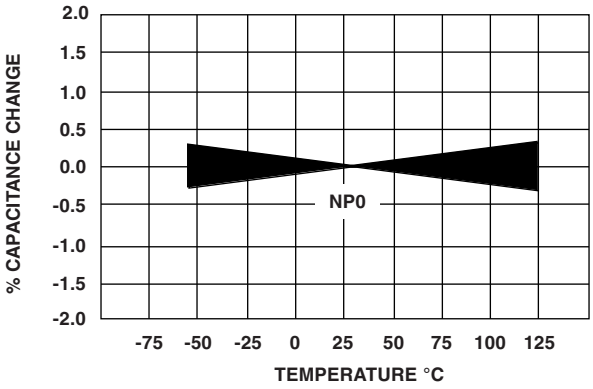
(1) See soldering recommendations within this data book, or visit: www.vishay.com/doc?45034

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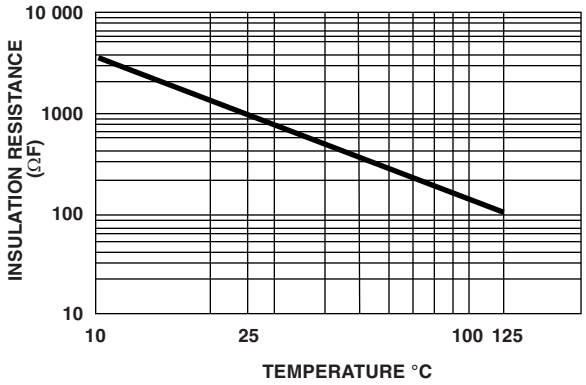
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C0G (NP0) CAPACITORS - TYPICAL PARAMETERS

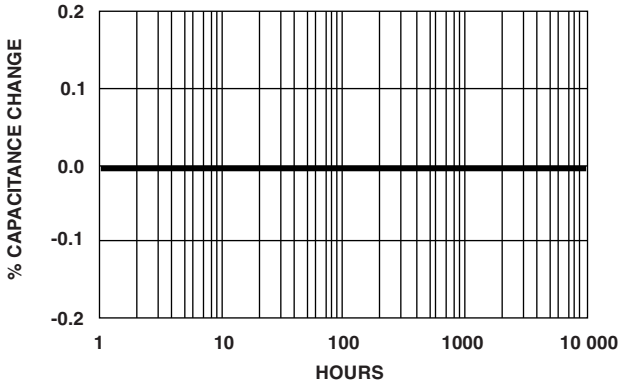
TEMPERATURE COEFFICIENT OF CAPACITANCE



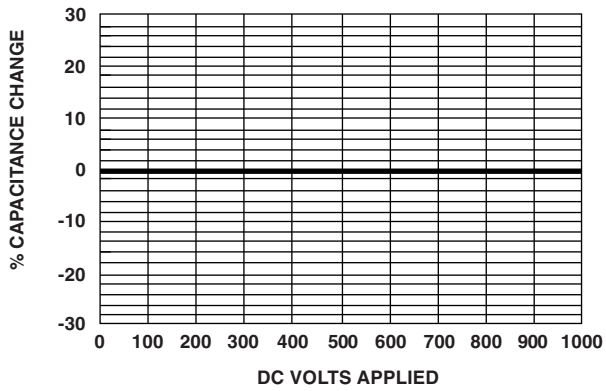
MIN. INSULATION RESISTANCE VS. TEMPERATURE



AGING RATE



VOLTAGE COEFFICIENT OF CAPACITANCE

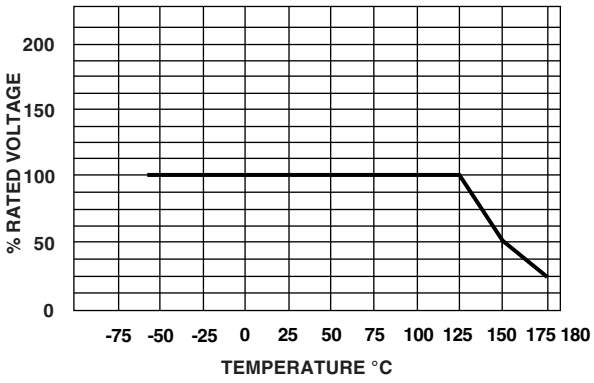


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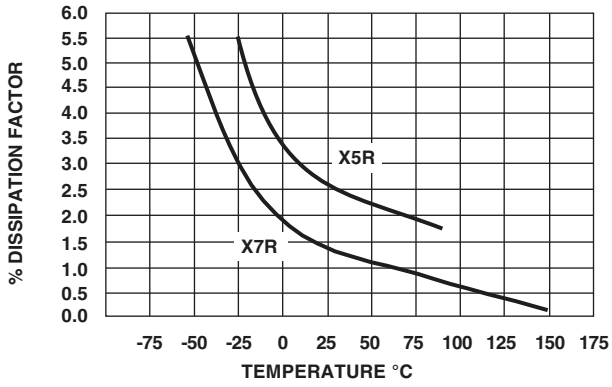
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X7R DIELECTRIC - TYPICAL PARAMETERS

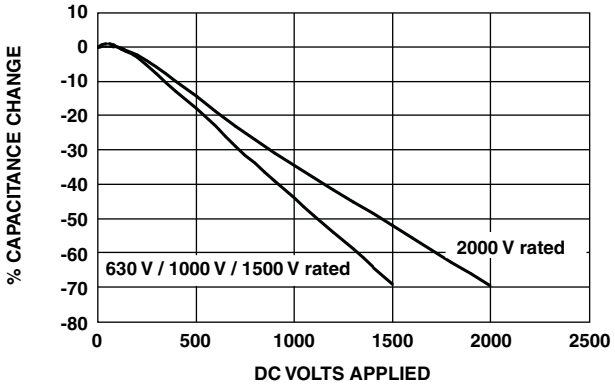
RATED VOLTAGE VS. TEMPERATURE



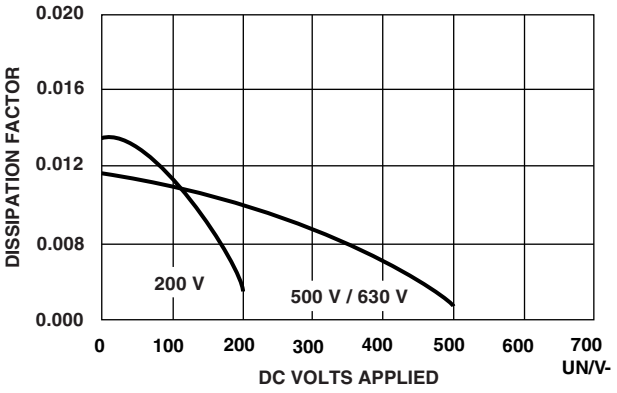
DISSIPATION FACTOR VS. TEMPERATURE



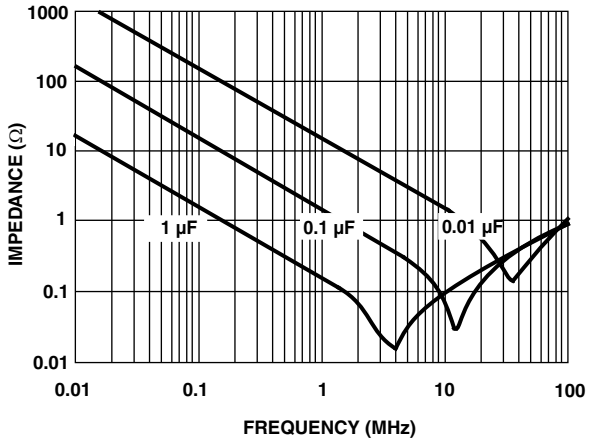
VOLTAGE COEFFICIENT OF CAPACITANCE



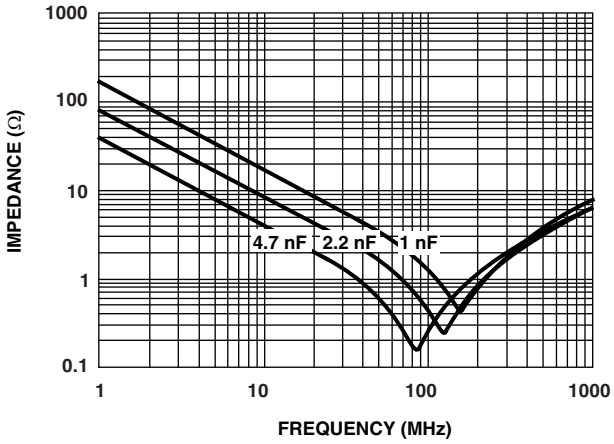
DISSIPATION FACTOR VS. VOLTAGE



IMPEDANCE VS. FREQUENCY 500 V / 630 V



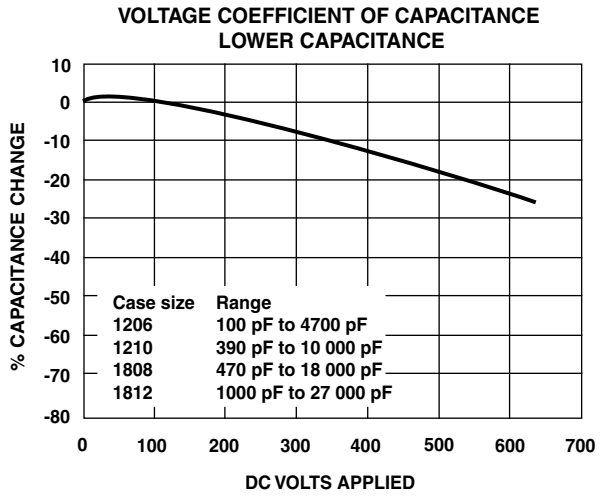
IMPEDANCE VS. FREQUENCY 2000 V

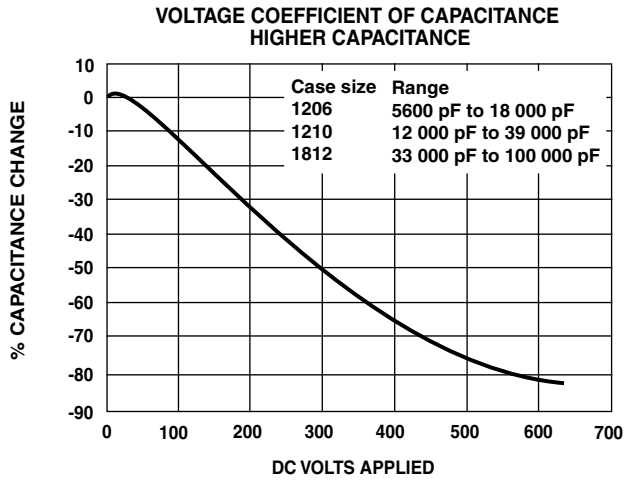


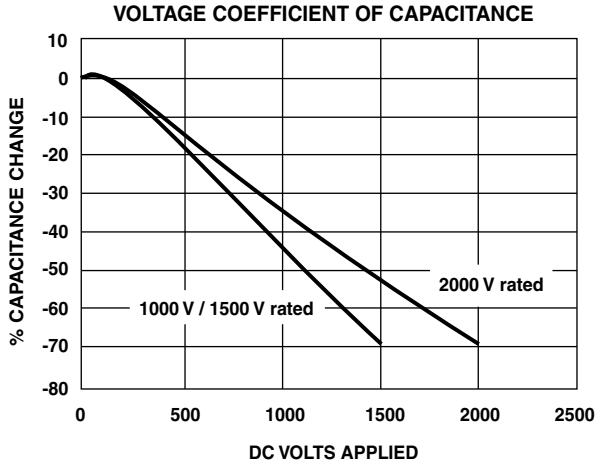
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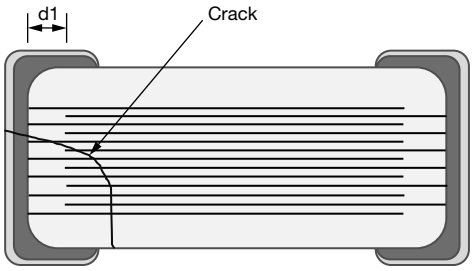
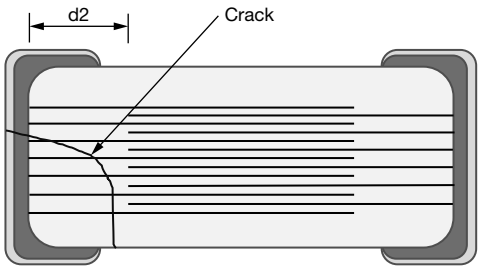
X7R DIELECTRIC - TYPICAL PARAMETERS







Cracking due to board flexure is a common failure mode for MLCC's. Using an open mode design reduces the risk of a short circuit by increasing the margin between the terminal and the electrodes. d2 > d1, therefore the same size crack does not cause a short in the open mode design.

STANDARD DESIGN: FAILS SHORT	OPEN MODE DESIGN: FAILS OPEN
	

For technical questions, contact: mlcc@vishay.com

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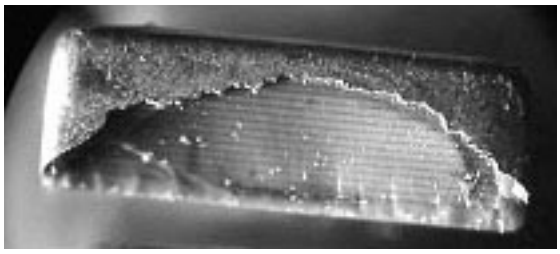
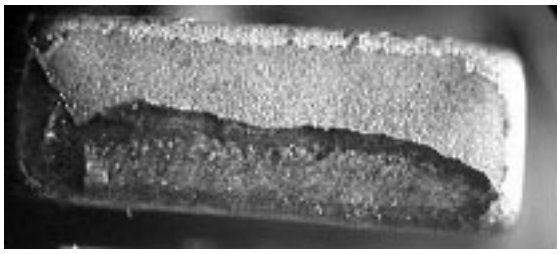
BOARDFLEX SENSITIVE APPLICATIONS - SOLUTION

A predominant failure mode in multilayer ceramic chip capacitors is cracking caused by board flexure. Cracks can then create a path for current to pass from one electrode through the dielectric to an opposing electrode or from the terminations at one end of the MLCC through the dielectric to an opposing electrode. This may subsequently result in capacitance loss, leakage - low Insulation Resistance (IR) - and / or more seriously, high current shorts. A short circuit condition in the surface mounted capacitors can cause further failures of downstream components. Vishay's Open Mode Design Capacitors (VJ OMD - Cap. series) reduce the risk of these destructive conditions through MLCC designs that prevent board flexure cracks reaching the opposing electrode.

VJ OMD - Cap. MLCCs reduce the risk of early field failures associated with board flex cracks. However, it is important to note that even in the open mode designs the presence of flexure related cracks can cause capacitance loss leading to localized stresses on the parts. eventually, depending on the application environment, including such factors and high voltage pulse frequency and thermal cycling this may lead to internal breakdown of the component.

POLYMER TERMINATION

Polymer termination provides additional protection against board flexure damage by absorbing greater mechanical and thermal stresses. Components can be packaged, transported, stored and handled the same standard terminated product. Wave and reflow soldering of MLCC does not require modification to equipment and / or process. Polymer termination greatly reduces the risk of mechanical cracking however it does not completely eliminate.

STANDARD TERMINATION	OMD CAP PLUS POLYMER TERMINATION
Exposed Electrodes = Electrical Short	No Exposed Electrodes = No Electrical Short
	

STANDARD PACKAGING QUANTITIES (1)(2)(3)

CASE CODE	TAPE SIZE	7" REEL QUANTITIES		11 1/4" AND 13" REEL QUANTITIES	
		PAPER TAPE PACKAGING CODE "C" / "O"	PLASTIC TAPE PACKAGING CODE "T"	PAPER TAPE PACKAGING CODE "P" / "I"	PLASTIC TAPE PACKAGING CODE "R"
0805 (4)(5)	8 mm	3000	3000	10 000	10 000
1206 (4)	8 mm	n/a	2500 / 3000	n/a	9000 / 10 000
1210 (4)	8 mm	n/a	2000 / 2500 / 3000	n/a	9000 / 10 000
1808 (4)	12 mm	n/a	2000	n/a	10 000
1812 (4)	12 mm	n/a	1000	n/a	4000
1825	12 mm	n/a	500	n/a	4000
2220	12 mm	n/a	1000	n/a	n/a
2225	12 mm	n/a	500	n/a	n/a

Notes

(1) Vishay Vitramon uses embossed plastic, and punch paper carrier tapes. Paper tape is not available for case sizes ≥ 1206 or for component thickness > 0.035" (0.89 mm)
(2) Reference: EIA standard RS 481 - "Taping of Surface Mount Components for Automatic Placement"
(3) n/a = not available
(4) Packaging code "C" / "O", "P / I" and lower quantities can depend from product thickness
(5) Polymer termination, code "B", only available in plastic tape "T" / "R"

STORAGE AND HANDLING CONDITIONS

(1) Store the components at 5 °C to 40 °C ambient temperature and ≤ 70 % relative humidity conditions.
(2) The product is recommended to be used within a time-frame of 2 years after shipment.
Check solderability in case extended shelf life beyond the expiry date is needed.

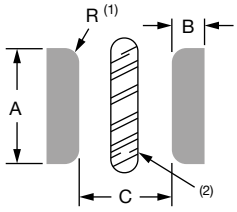
Precautions:

a. Do not store products in an environment containing corrosive elements, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. This may cause corrosion or oxidization of the terminations, which can easily lead to poor soldering.
b. Store products on the shelf and avoid exposure to moisture or dust.
c. Do not expose products to excessive shock, vibration, direct sunlight and so on.

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Solder Pad Dimensions for Vishay Surface-Mount Multilayer Ceramic Chip Capacitors

DIMENSIONS in millimeters



CASE CODE	A	B	C
0402	0.50	0.50	0.40
0505	1.35	1.00	0.60
0603	0.90	1.00	1.00 (3)
0805	1.30	1.20	1.00
1111	2.90	1.30	1.75
1206	1.80	1.20	2.10
1210	2.80	1.30	1.90
1808	2.40	1.50	3.00
1812	3.60	1.50	3.00
1825	6.50	1.50	3.00
2008	2.70	1.50	4.08
2220	5.50 (4)	1.50	4.20
2225	6.50	1.50	4.20
2525	6.60	1.50	4.50
3040	10.80	2.00	5.50
3640	10.80	2.00	7.00
3838	10.20	2.00	7.50
4044	12.30	2.00	8.00

Notes

(1) For safety capacitors and voltages above 3000 V, corner rounding (R) of 0.5 mm is recommended to suppress arcing
(2) Add a 1 mm slot in PCB between pads to allow cleaning and coating under MLCC
(3) For VJ HiFREQ Series, this dimension is 0.6 mm
(4) For safety capacitors, the A dimension should be 5.80 mm

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PRINTED CIRCUIT BOARD PCB DESIGN CONSIDERATIONS FOR HIGH VOLTAGE SURFACE-MOUNT MLCCS

Special assembly process and design considerations should be employed for today's high voltage rating MLCCs. As case sizes remain the same and voltage ratings increase, MLCC manufacturers must design, evaluate, and qualify their capacitors using methods that reduce the occurrence of corona discharge and arcover events. To meet similar capability in high voltage applications, users should employ similar cautionary design and assembly methods.

MLCC PAD LAYOUT

A capacitor's arcover inception point can degrade due to factors such as the MLCC termination, PCB pad design, PCB cleanliness, solder flux residue, surface contamination / deposits and environmental conditions. PCB pads and their design affect the air gap distance between the opposing polarities of the MLCC termination. For voltage rating greater than 1500 V_{DC} add a corner radius to the inward facing edge of the MLCC pads and as large a gap as possible between the pads. Too small of a pad gap distance will reduce the capacitor's own arcover inception voltage level. Refer to the Figure and Table Figure 1.0, MLCC Pad Layout and Table 1.0, Vishay MLCC Solder Pad Dimensions for the recommended MLCC solder pad dimensions.

SLOT OR TRENCH BETWEEN PADS

PCB assembly can deposit dust, trap solder balls, or flux residue underneath the capacitors. These contaminants will reduce conductive clearances and the arcover inception level. Assembly methods must include a final PCB cleaning process. A slot or trench can be cut into the PCB in between the pads to allow cleaners to penetrate underneath the MLCC. The slot will also allow conformal or epoxy coatings to flow underneath the MLCC and build an insulative barrier between pads. Refer to Figure 1.0 MLCC Pad Layout for slot reference location.

COATING PRINTED CIRCUIT BOARD

Coating a printed circuit board with materials such as acrylic, silicone and urethane resins provide a protective dielectric barrier that is non-conductive and will enhance the resistance to arcing. Various processes exist which include dipping, brushing, and spaying. Optimal performance will come from coating the MLCC on all sides, top and bottom. The PCB slot in between the pads should extend slightly beyond the width of the MLCC. Refer to Figure 1.0 MLCC Pad Layout for slot reference location.

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