



Surface Mount Multilayer Ceramic Chip Capacitors for Safety Certified Applications



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

FEATURES

- Approved IEC 60384-14
- Specialty: safety certified capacitors
- Wet build process
- Reliable Noble Metal Electrode (NME) system
- Material categorization:
for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Power supplies
- EMI and AC line filtering
- AC equipment and appliances
- Lighting strike and voltage surge protection
- Isolators
- Facsimile and telephone

LINKS TO ADDITIONAL RESOURCES



ELECTRICAL SPECIFICATIONS

Note

- Electrical characteristics at +25 °C unless otherwise specified

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

Capacitance Range X1 (1):

X7R: 270 pF to 4.7 nF

Voltage Range: 305 V_{AC}

Temperature Coefficient of Capacitance (TCC):

X7R: ± 15 % from -55 °C to +125 °C, with 0 V_{DC} applied

Dissipation Factor (DF) (1):

X7R: 2.5 % maximum

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

Note

- (1) Test conditions per IEC 60384-14:
X7R: 1.0 V_{RMS} at 1 kHz

Aging Rate:

X7R: 1 % maximum per decade

Voltage Proof Test:

X1: min. 1500 V_{AC}

Meet 2600 V_{AC}/60 s

Peak Impulse Voltage:

X1: 5000 V

Voltage Rating DC:

X1: 2000 V_{DC}

Climatic Category According to EN 60068-1:

55 / 125 / 21



QUICK REFERENCE DATA				
DIELECTRIC	CASE	MAXIMUM VOLTAGE (V _{AC})	CAPACITANCE	
			MINIMUM	MAXIMUM
X7R (X1)	2220	305	270 pF	4.7 nF

Note

- Detail ratings see “Selection Chart”

ORDERING INFORMATION								
VJ2220	Y	102	K	X	3	S	T	### ⁽¹⁾
CASE CODE	DIELECTRIC	CAPACITANCE NOMINAL CODE	CAPACITANCE TOLERANCE	TERMINATION	AC VOLTAGE RATING	MARKING	PACKAGING	PROCESS CODE
2220	Y = X7R	Expressed in picofarads (pF). The first two digits are significant, the third is a multiplier. Examples: 101 = 100 pF 102 = 1000 pF 103 = 10 000 pF	X7R: K = ± 10 % M = ± 20 %	X = Ni barrier 100 % matte tin plate finish	3 = 305 V _{AC}	S = marked (see Part Marking table below)	T = 7" reel / plastic tape	X1 = X1

Notes

- Detail ratings see “Selection Chart”
- ⁽¹⁾ Process code must be added to control products and requirements

PART MARKING		
MARKING	1 ST DIGIT MANUFACTURER	2 ND DIGIT DIELECTRIC AND RATING
V3	V = Vishay	3 = X7R, X1 - “X” termination option

DIMENSIONS FOR “X” TERMINATION OPTION in inches (millimeters)						
CASE CODE	PART ORDERING NUMBER	LENGTH (L)	WIDTH (W)	MAXIMUM THICKNESS (T)	TERMINATION (P)	
					MINIMUM	MAXIMUM
2220	VJ2220	0.220 ± 0.008 (5.59 ± 0.20)	0.200 ± 0.010 (5.08 ± 0.25)	0.086 (2.18)	0.010 (0.25)	0.030 (0.76)

RECOMMENDED SOLDERING PAD DIMENSIONS in millimeters				
CASE CODE	A	B	C	r ⁽¹⁾
2220	5.80	1.50	4.20	0.5

Note

- ⁽¹⁾ Radius optional



SELECTION CHART		
DIELECTRIC		X7R (X1)
STYLE		VJ2220 ⁽¹⁾
CASE CODE		2220
VOLTAGE (V _{AC})		305
VOLTAGE CODE		3
CAP. CODE	CAP.	
100	10 pF	
220	22 pF	
330	33 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	

Note


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



PACKAGING QUANTITIES (1)		
CASE CODE	TAPE SIZE	7" REEL QUANTITIES
		PACKAGING CODE "T"
2220	12 mm	1000

Note

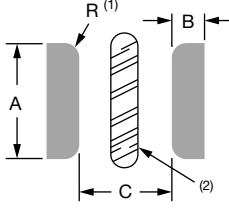
(1) Reference: EIA standard RS481 - "Taping of Surface Mount Components for Automatic Placement"

APPROVALS FOR X7R				
VDE approval mark 2026-02-17				
X1-capacitor:	X termination	40061661	270 pF to 4700 pF	305 V _{AC}
DIN EN IEC 60384-14 (VDE 0565-1-1):2024-10; EN IEC 60384-14:2023				

GENERAL CERTIFICATES	
# Quality management system according to ISO/IATF 16949	Yes
# Quality management system according to ISO 9001	Yes
# Environmental certification according to ISO 14001	Yes
# Health and safety system according to ISO 45001	Yes

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.

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



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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