

# Surface Mount Multilayer Ceramic Chip Capacitors Prohibit Surface Arc-Over in High-Voltage Applications



HVArc Guard Capacitor with no Surface Arc-over



Standard Capacitor with Surface Arc-over

## FEATURES

### For this Worldwide Patented Technology

- Specialty: high-voltage applications
- MLCC that protects against surface arc-over
- Excellent high-voltage performance
- Higher capacitances and smaller case sizes that save board space, as compared to standard high-voltage MLCCs
- Voltage breakdowns as much as twice that of competitors' products
- Available with polymer termination for increase resistance to board flex cracking. Please contact factory for availability
- Wet build process
- Reliable Noble Metal Electrode (NME) system
- 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)  
Available

## APPLICATIONS

- Power supplies
- DC/DC converters (buck and boost)
- Voltage multipliers for flyback converters
- For lighting and other AC applications please contact: [mlcc@vishay.com](mailto:mlcc@vishay.com)

## ELECTRICAL SPECIFICATIONS

COG (NP0)
<b>GENERAL SPECIFICATION</b>
<b>Note</b> Electrical characteristics at +25 °C unless otherwise specified
<b>Operating Temperature:</b> -55 °C to +125 °C
<b>Capacitance Range:</b> 10 pF to 8.2 nF
<b>Voltage Range:</b> 1000 V <sub>DC</sub> to 2500 V <sub>DC</sub>
<b>Temperature Coefficient of Capacitance (TCC):</b> 0 ppm/°C ± 30 ppm/°C from -55 °C to +125 °C
<b>Dissipation Factor (DF):</b> 0.1 % maximum at 1.0 V <sub>RMS</sub> and 1 MHz for values ≤ 1000 pF 0.1 % maximum at 1.0 V <sub>RMS</sub> and 1 kHz for values > 1000 pF
<b>Insulating Resistance:</b> 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
<b>Aging Rate:</b> 0 % maximum per decade
<b>Dielectric Strength Test:</b> performed per method 103 of EIA 198-2-E. Applied test voltages 1000 V <sub>DC</sub> -rated: 150 % of rated voltage 1500 V <sub>DC</sub> , 2500 V <sub>DC</sub> -rated: 120 % of rated voltage

X7R
<b>GENERAL SPECIFICATION</b>
<b>Note</b> Electrical characteristics at +25 °C unless otherwise specified
<b>Operating Temperature:</b> -55 °C to +125 °C
<b>Capacitance Range:</b> 220 pF to 270 nF
<b>Voltage Range:</b> 250 V <sub>DC</sub> to 1000 V <sub>DC</sub>
<b>Temperature Coefficient of Capacitance (TCC):</b> ± 15 % from -55 °C to +125 °C, with 0 V <sub>DC</sub> applied
<b>Dissipation Factor (DF):</b> 2.5 % maximum at 1.0 V <sub>RMS</sub> and 1 kHz
<b>Insulating Resistance:</b> 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
<b>Aging Rate:</b> 1 % maximum per decade
<b>Dielectric Strength Test:</b> performed per method 103 of EIA 198-2-E. Applied test voltages ≤ 250 V <sub>DC</sub> -rated: 200 % of rated voltage 500 V <sub>DC</sub> -rated: min. 150 % of rated voltage 630 V <sub>DC</sub> , 1000 V <sub>DC</sub> -rated: 120 % of rated voltage



QUICK REFERENCE DATA				
DIELECTRIC	CASE	MAXIMUM VOLTAGE (V)	CAPACITANCE	
			MINIMUM	MAXIMUM
C0G (NP0)	0805	1500	10 pF	390 pF
	1206	1500	10 pF	1.5 nF
	1210	1500	10 pF	2.7 nF
	2220	1500	470 pF	5.6 nF
	2225	2500	470 pF	8.2 nF
X7R	0805	1000	470 pF	3.3 nF
	1206	1000	220 pF	47 nF
	1210	1000	220 pF	82 nF
	1808	1000	220 pF	100 nF
	1812	1000	220 pF	270 nF

**Note**

- Detail ratings see “Selection Chart”

ORDERING INFORMATION (4)								
VJ0805	A	101	J	X	G	A	C	5Z (2)
CASE CODE	DIELECTRIC	CAPACITANCE NOMINAL CODE	CAPACITANCE TOLERANCE	TERMINATION (6)	DC VOLTAGE RATING (1)	MARKING	PACKAGING	PROCESS CODE
0805 1206 1210 1808 1812 2220 2225	A = C0G (NP0) Y = X7R	Expressed in picofarads (pF). The first two digits are significant, the third is a multiplier. <b>Examples</b> 102 = 1000 pF 223 = 22 000 pF	J = ± 5 % K = ± 10 % M = ± 20 %	X = Ni barrier 100 % tin plated F, E = AgPd (3) B = polymer 100 % tin plated matte finish (4)	P = 250 V E = 500 V L = 630 V G = 1000 V R = 1500 V O = 2500 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	5Z / 5ZL (5) = HVArc Guard®
<p><b>Note:</b> “I” and “O” are used for “F” and “E” termination size 0805</p>								

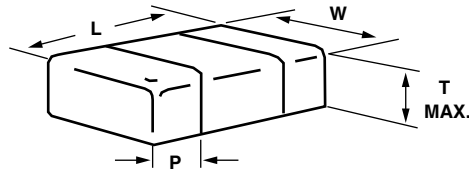
**Notes**

- (1) DC voltage rating should not be exceeded in application. Other application factors may affect the MLCC performance. Consult for questions: [mlcc@vishay.com](mailto:mlcc@vishay.com)
- (2) Process code has to be added.
- (3) Termination code “E” is for conductive epoxy assembly, contact [mlcc@vishay.com](mailto:mlcc@vishay.com) for availability.
- (4) Please contact factory for polymer termination availability
- (5) “5ZL” mandatory for size 1206 / 1210 in C0G (NP0) with 1000 V / 1500 V for capacitance < 100 pF and used for other specific part numbers, consult for questions [mlcc@vishay.com](mailto:mlcc@vishay.com).
- (6) Other termination options contact [mlcc@vishay.com](mailto:mlcc@vishay.com) for availability.

ENVIRONMENTAL STATUS			
TERMINATION CODE	TERMINATION DESCRIPTION	RoHS COMPLIANT	VISHAY GREEN
X	Ni barrier 100 % tin plated matte finish	Yes	Yes / No (1)
E	AgPd	Yes	Yes / No (1)
B	Polymer layer, 100 % tin plated matte finish	Yes	No
F	AgPd	Yes	No

**Note**

- (1) “No” for size 1206 / 1210 in C0G (NP0) with 1000 V / 1500 V for capacitance < 100 pF.

**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 ± 0.020)	0.057 (1.45)	0.010 (0.25)	0.028 (0.71)
1206	VJ1206	0.126 ± 0.008 (3.20 ± 0.20)	0.063 ± 0.008 (1.60 ± 0.20)	0.067 (1.70)	0.010 (0.25)	0.030 (0.76)
1210	VJ1210	0.126 ± 0.008 (3.20 ± 0.20)	0.098 ± 0.008 (2.50 ± 0.020)	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)	0.067 (1.70)	0.010 (0.25)	0.030 (0.76)
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)	0.030 (0.76)
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)	0.030 (0.76)
2225	VJ2225	0.220 ± 0.010 (5.59 ± 0.25)	0.250 ± 0.010 (6.35 ± 0.25)	0.090 (2.30)	0.010 (0.25)	0.030 (0.76)

**Note**

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



SELECTION CHART COG (NP0)												
DIELECTRIC		COG (NP0)										
STYLE		VJ0805		VJ1206 <sup>(1)</sup>		VJ1210 <sup>(1)</sup>		VJ2220 <sup>(1)</sup>		VJ2225 <sup>(1)</sup>		
CASE CODE		0805		1206		1210		2220		2225		
VOLTAGE (V <sub>DC</sub> )		1000	1500	1000	1500	1000	1500	1000	1500	1000	1500	2500
VOLTAGE CODE		G	R	G	R	G	R	G	R	G	R	O
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									•	•	•

Notes

<sup>(1)</sup> See soldering recommendations within this data book, or visit [www.vishay.com/doc245034](http://www.vishay.com/doc245034)

- Available in plastic carrier tape only

■ RoHS-compliant



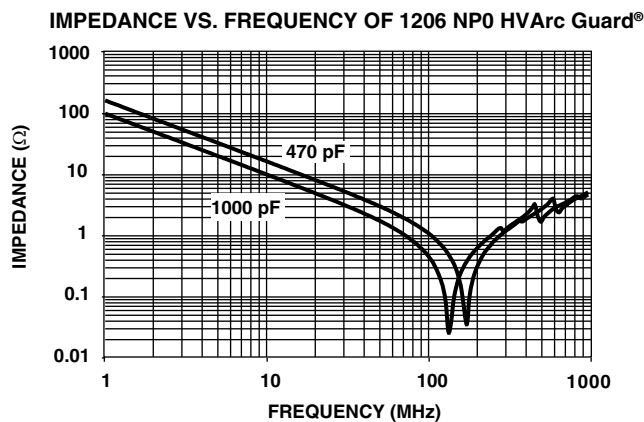
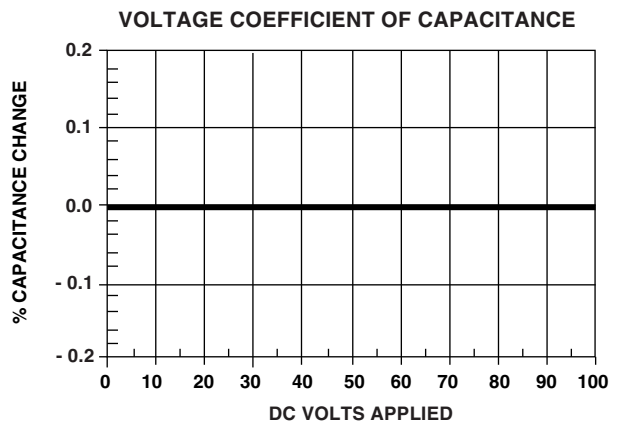
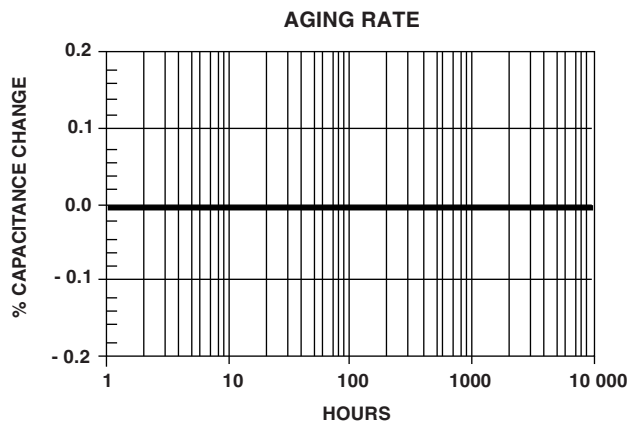
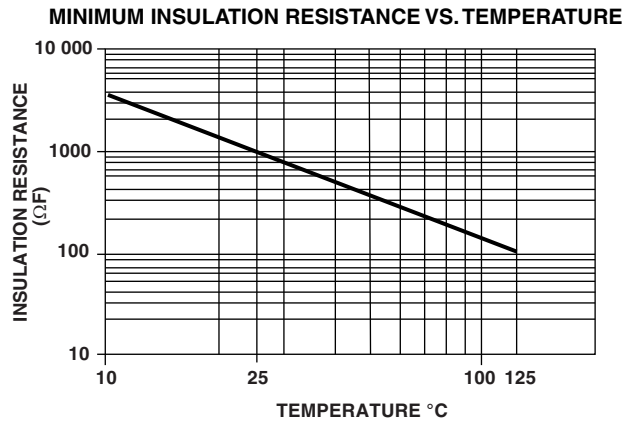
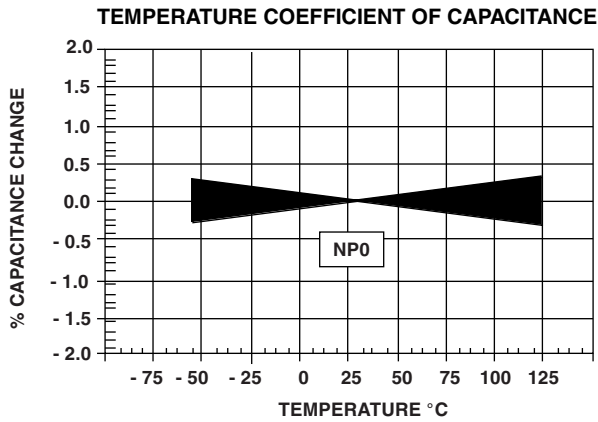
SELECTION CHART X7R																			
DIELECTRIC		X7R																	
STYLE		VJ0805		VJ1206 <sup>(1)</sup>				VJ1210 <sup>(1)</sup>				VJ1808 <sup>(1)</sup>				VJ1812 <sup>(1)</sup>			
CASE CODE		0805		1206				1210				1808				1812			
VOLTAGE (V <sub>DC</sub> )		630	1000	250	500	630	1000	250	500	630	1000	250	500	630	1000	250	500	630	1000
VOLTAGE CODE		L	G	P	E	L	G	P	E	L	G	P	E	L	G	P	E	L	G
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																		

Notes

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

- Available in plastic carrier tape only
- Only available in paper carrier tape
- RoHS-compliant

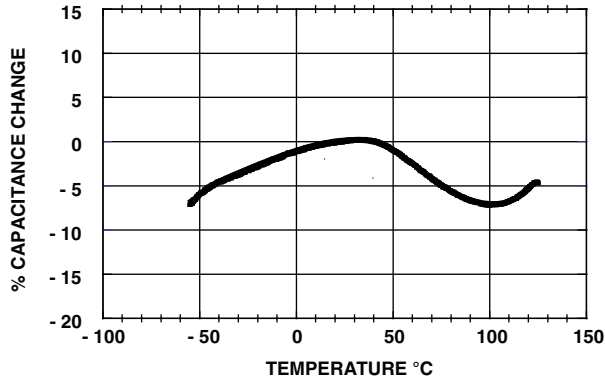
**HVArc Guard® COG (NP0) DIELECTRIC - TYPICAL PARAMETERS**



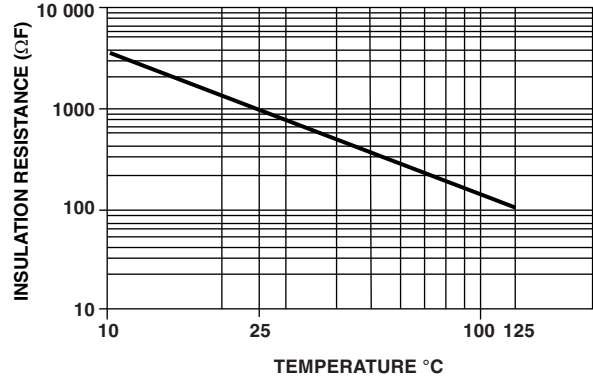


**HVArc Guard® X7R DIELECTRIC - TYPICAL PARAMETERS**

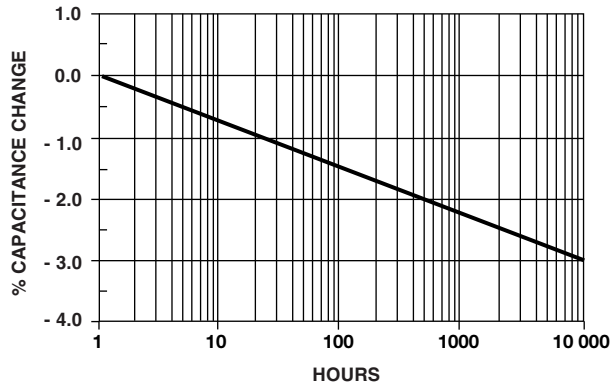
**TEMPERATURE COEFFICIENT OF CAPACITANCE**



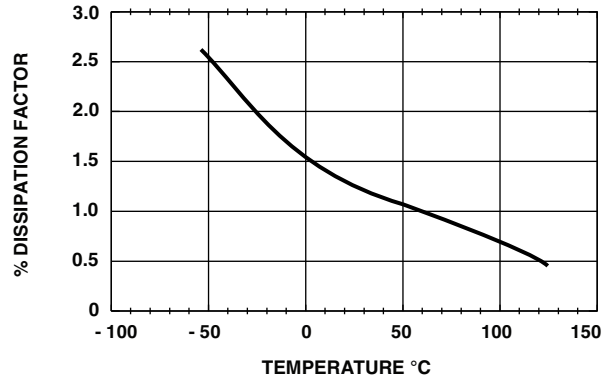
**MINIMUM INSULATION RESISTANCE VS. TEMPERATURE**



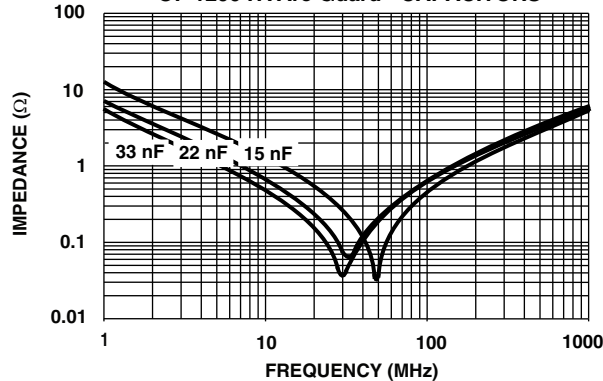
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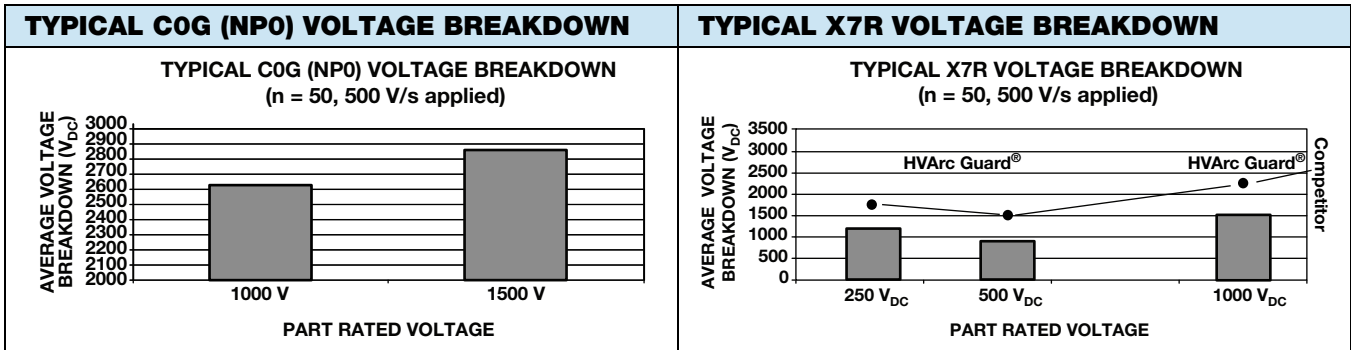


**DISSIPATION FACTOR VS. TEMPERATURE**



**IMPEDANCE VS. FREQUENCY OF 1206 HVArc Guard® CAPACITORS**





TYPICAL	ARCING ON MLCCS (shown in polarized light)
Crack caused by surface arc from end termination to top electrode layer cause component failure	Corona traces due to arc-over become conductive paths leading to component failure

APPLICATION NOTE
<ul style="list-style-type: none"> <li>Suitable only for transient voltage and not for periodical pulse(s) chain</li> <li>1000 V rated parts are not suitable for AC / lighting applications above 220 V<sub>AC</sub></li> <li>500 V and 630 V are not suitable for AC / lighting applications above 110 V<sub>AC</sub></li> <li>If further questions, please contact: <a href="mailto:mlcc@vishay.com">mlcc@vishay.com</a></li> </ul>

STANDARD PACKAGING QUANTITIES (1)(2)(3)(4)(5)					
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	8 mm	3000	3000	10 000	10 000
1206 <sup>(6)</sup>	8 mm	n/a	2500	n/a	10 000
1210 <sup>(6)</sup>	8 mm	n/a	2500	n/a	10 000
1808	12 mm	n/a	2000	n/a	10 000
1812	12 mm	n/a	1000	n/a	4000
2220	12 mm	n/a	1000	n/a	4000
2225	12 mm	n/a	1000	n/a	4000

- Notes**
- Vishay Vitramon uses embossed plastic carrier tape and punch paper carrier tape
  - Paper tape is not available for case sizes > 1206 or for component thickness > 0.035" (0.89 mm)
  - 11 1/4" reel is standard for large quantities. 13" is maybe used for large "T" dimension parts
  - Reference: EIA standard RS 481 - "Taping of Surface Mount Components for Automatic Placement"
  - n/a = not available
  - Packaging quantity can vary with product thickness  
Contact [mlcc@vishay.com](mailto:mlcc@vishay.com) with respect to specific part number requirements

STORAGE AND HANDLING CONDITIONS
<ol style="list-style-type: none"> <li>Store the components at 5 °C to 40 °C ambient temperature and ≤ 70 % relative humidity conditions.</li> <li>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.</li> </ol> <p>Precautions:</p> <ol style="list-style-type: none"> <li>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 oxidation of the terminations, which can easily lead to poor soldering.</li> <li>Store products on the shelf and avoid exposure to moisture or dust.</li> <li>Do not expose products to excessive shock, vibration, direct sunlight and so on.</li> </ol>





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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**