Surface Mount Multilayer Ceramic Chip Capacitors for Automotive Applications With Extended Bending Capability

FEATURES

- AEC-Q200 qualified with PPAP available
- Available in 0603, 0805, 1206, and 1210 body size
- Improved bending capability performance: in addition of meeting the bending AEC-Q200 requirements, those capacitors are able to withstand typically more than 5 mm bending
- 100 % matte tin termination for soldering process
- High operating temperature
- Wet build process
- Unique flexible termination system
- Reliable Noble Metal Electrode (NME) system
- Parts compliant with ELV directive
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE
Pb-free
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

For more than 25 years Vishay Vitramon has supported the automotive industry with robust, highly reliable MLCCs that have made it a leader in this segment. All Vishay Vitramon MLCCs are manufactured in “Precious Metal Technology” (PMT / NME) and a wet build process. They are qualified according to AEC-Q200 with PPAP available on request. Applications for these devices include automotive “under the hood”, safety and comfort electronics. Their termination finish is 100 % matte tin plate finish. A polymer (flexible) termination with 100 % matte tin plate finish is offered for boardflex sensitive applications.

C0G (NP0) DIELECTRIC

GENERAL SPECIFICATION

Note
Electrical characteristics at +25 °C unless otherwise specified

Operating Temperature: -55 °C to +150 °C
(above +125 °C changed characteristics, see 2.2)

Capacitance Range: 100 pF to 12 nF

Voltage Range: 50 V_{DC} to 630 V_{DC}

Temperature Coefficient of Capacitance (TCC):
0 ppm/°C ± 30 ppm/°C from -55 °C to +125 °C
(specific ratings can vary, please contact mlcc@vishay.com for details)

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: 0 % 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:	200 % of rated voltage
630 V_{DC}-rated:	150 % of rated voltage

X7R, X8R DIELECTRIC

GENERAL SPECIFICATION

Note
Electrical characteristics at +25 °C unless otherwise specified

Operating Temperature: -55 °C to +150 °C
(X7R above +125 °C changed characteristics, see 2.2)

Capacitance Range:
X7R: 10 nF to 470 nF
X8R: 10 nF to 220 nF

Voltage Range: 16 V_{DC} to 630 V_{DC}

Temperature Coefficient of Capacitance (TCC):
X7R: ± 15 % from -55 °C to +125 °C, with 0 V_{DC} applied
X8R: ± 15 % from -55 °C to +150 °C, with 0 V_{DC} applied

Dissipation Factor (DF):
16 V, 25 V ratings: 3.5 % maximum at 1.0 V_{RMS} and 1 kHz
> 25 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
X8R: at +150 °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}:	min. 120 % of rated voltage

QUICK REFERENCE DATA

DIELECTRIC	CASE CODE	MAXIMUM VOLTAGE (V)	CAPACITANCE	
			MINIMUM	MAXIMUM
C0G (NP0)	0603	200	100 pF	1.0 nF
	0805	500	100 pF	3.9 nF
	1206	630	100 pF	8.2 nF
	1210	630	100 pF	12 nF
X7R	0603	100	10 nF	150 nF
	0805	200	10 nF	470 nF
	1206	630	10 nF	180 nF
	1210	630	10 nF	180 nF
X8R	0603	50	10 nF	33 nF
	0805	100	10 nF	100 nF
	1206	50	10 nF	220 nF
	1210	50	10 nF	220 nF

Note

- Detail ratings see “Selection Chart”

ORDERING INFORMATION

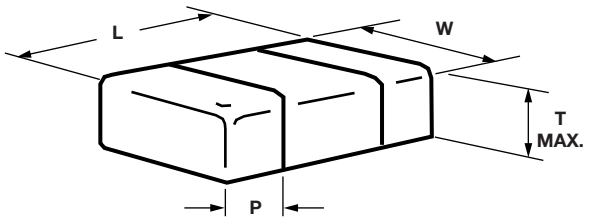
GA0805	Y	104	K	W	A	A	T	31G
CASE CODE	DIELECTRIC	CAPACITANCE NOMINAL CODE (1)	CAPACITANCE TOLERANCE	TERMINATION	DC VOLTAGE RATING (2)	MARKING	PACKAGING	PROCESS CODE
0603 0805 1206 1210	A = C0G (NP0) Y = X7R H = X8R	Expressed in picofarads (pF). The first two digits are significant, the third is a multiplier. An “R” indicates a decimal point. **Example** 102 = 1000 pF	F = ± 1 % G = ± 2 % J = ± 5 % K = ± 10 % M = ± 20 % **Note** C0G (NP0): F, G, J, K ≥ 10 pF X7R / X8R: J, K, M	W = polymer 100 % matte tin plate finish	J = 16 V X = 25 V A = 50 V B = 100 V C = 200 V E = 500 V L = 630 V	A = unmarked	T = 7" reel / plastic tape R = 11 ¼" / 13" reel / plastic tape	31G = “Green” Automotive MLCC

Notes

(1) Non-standard values, please contact: mlcc@vishay.com

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

DIMENSIONS in inches (millimeters)



CASE CODE	STYLE	LENGTH (L)	WIDTH (W)	MAXIMUM THICKNESS (T)	TERMINATIONS PAD (P)	
					MINIMUM	MAXIMUM
0603	GA0603	0.071 ± 0.006 (1.80 ± 0.15)	0.033 ± 0.006 (0.85 ± 0.15)	0.039 (1.00)	0.017 (0.43)	0.024 (0.65)
0805	GA0805	0.083 ± 0.012 (2.10 ± 0.30)	0.051 ± 0.010 (1.30 ± 0.25)	0.061 (1.55)	0.017 (0.43)	0.03 (0.9)
1206	GA1206	0.137 ± 0.012 (3.48 ± 0.30)	0.065 ± 0.010 (1.65 ± 0.25)	0.071 (1.80)	0.017 (0.43)	0.035 (1.0)
1210	GA1210	0.137 ± 0.012 (3.48 ± 0.30)	0.100 ± 0.010 (2.55 ± 0.25)	0.071 (1.80)	0.017 (0.43)	0.035 (1.0)

SELECTION CHART																
DIELECTRIC		C0G (NP0)														
STYLE		GA0603			GA0805				GA1206				GA1210			
CASE CODE		0603			0805				1206				1210			
VOLTAGE (V_{DC})		50	100	200	50	100	200	500	50	100	200	500 / 630	50	100	200	500 / 630
VOLTAGE CODE		A	B	C	A	B	C	E	A	B	C	E / L	A	B	C	E / L
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	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	0.010 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															

Note

- See soldering recommendations within this databook, or visit www.vishay.com/doc?45034

SELECTION CHART

DIELECTRIC		X7R																					
STYLE		GA0603					GA0805					GA1206						GA1210					
CASE CODE		0603					0805					1206						1210					
VOLTAGE (V_{DC})		16	25	50	100	200	16	25	50	100	200	16	25	50	100	200	500 / 630	16	25	50	100	200	500 / 630
VOLTAGE CODE		J	X	A	B	C	J	X	A	B	C	J	X	A	B	C	E / L	J	X	A	B	C	E / L
CAP. CODE	CAP.																						
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																						

Note

- See soldering recommendations within this databook, or visit www.vishay.com/doc?45034

SELECTION CHART

DIELECTRIC		X8R								
STYLE		GA0603		GA0805			GA1206		GA1210	
CASE CODE		0603		0805			1206		1210	
VOLTAGE (V_{DC})		25	50	25	50	100	25	50	25	50
VOLTAGE CODE		X	A	X	A	B	X	A	X	A
CAP. CODE	CAP.									
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									

Note

- See soldering recommendations within this databook, or visit www.vishay.com/doc?45034

STANDARD PACKAGING QUANTITIES (1)

CASE CODE	TAPE SIZE	7" REEL QUANTITIES	11 1/4" AND 13" REEL QUANTITIES
		PLASTIC TAPE PACKAGING CODE "T"	PLASTIC TAPE PACKAGING CODE "R"
0603	8 mm	4000	10 000
0805	8 mm	3000	10 000
1206	8 mm	3000	10 000
1210	8 mm	3000	10 000

Note

(1) Reference: EIA standard RS 481 - "Taping of Surface Mount Components for Automatic Placement"

1 - GENERAL CERTIFICATES

# Quality management system according to ISO/IATF 16949: 2016	Yes
# Quality management system according to ISO 9001: 2015	Yes
# Environmental certification according to ISO 14001: 2015	Yes
# Health and safety system according to ISO 45001	Yes

2 - TECHNICAL REQUIREMENTS

Unless specified in component specification, these parameters are the minimum requirements for the components.

2.1 OPERATING TEMPERATURE RANGE

For standard applications	T_A: -55 °C to +125 °C	See characteristics 2.2
For high temperature applications	T_A: -55 °C to +150 °C	See characteristics 2.2

2.2 CHARACTERISTICS

PARAMETER		CERAMIC TYPE	SYMBOL	RATINGS	TEST CONDITIONS / REMARKS
Rated voltage in temperature range	-55 °C to +125 °C	C0G (NP0)	U_R	50 V to 500 V	
		X7R		16 V to 630 V	
	-55 °C to +150 °C	X8R		25 V to 100 V	
Derating at higher temperature up to +150 °C		C0G (NP0)		50 V to 100 V	$U_{DC} \leq {}^1/_2\ U_R$
		X7R		16 V to 100 V	$U_{DC} \leq {}^1/_2\ U_R$
					$U_{DC} \leq {}^1/_4\ U_R$ for GA0603Y104*A (100 nF / 50 V)
Temperature coefficient in temperature range -55 °C to +125 °C		C0G (NP0)	α_C	≤ ± 30 ppm/°C	Specific ratings can vary, please contact mlcc@vishay.com for details
		X7R	ΔC	≤ ± 15 %	
Temperature coefficient in temperature range -55 °C to +150 °C		C0G (NP0)	α_C	≤ ± 30 ppm/°C	Specific ratings can vary, please contact mlcc@vishay.com for details
		X7R	ΔC	+ 15 % / - 30 %	
		X8R		± 15 %	

2.3 STORAGE AND HANDLING CONDITIONS

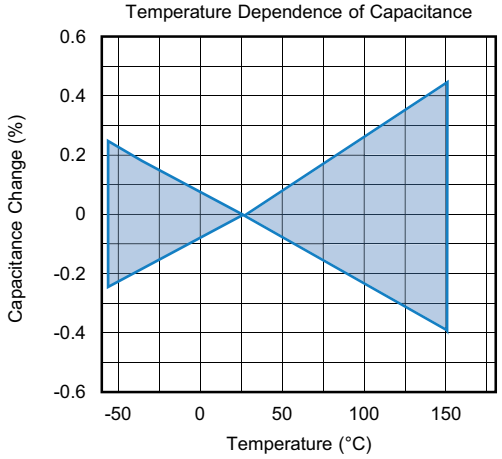
(1) Store the components at 5 °C to 40 °C ambient temperature and ≤ 70 % relative humidity conditions.
(2) The product is recommended to be used within a time-frame of 2 year after shipment.
Check solderability in case extended shelf life beyond the expiry date is needed.

Precautions:

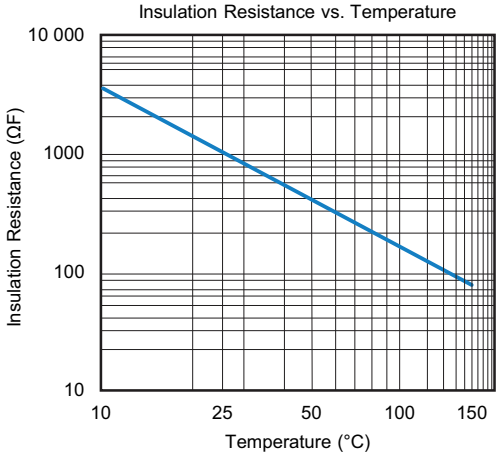
a. Do not store products in an environment containing corrosive elements, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. This may cause corrosion or oxidization of the terminations, which can easily lead to poor soldering.
b. Store products on the shelf and avoid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

C0G (NP0) DIELECTRIC - TYPICAL PARAMETERS

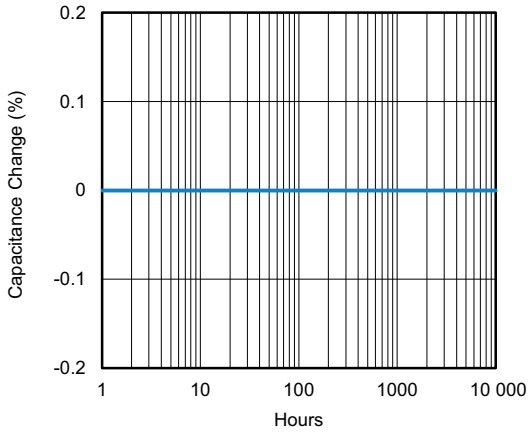
Temperature Dependence of Capacitance



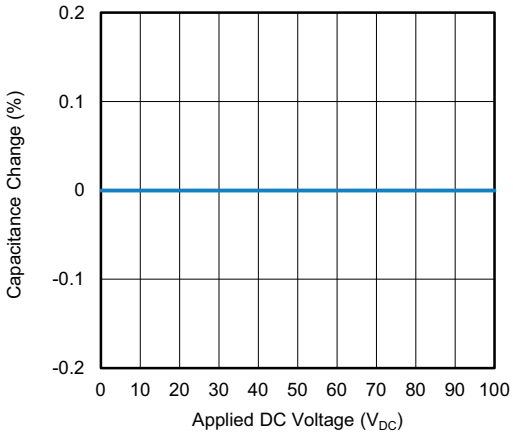
Insulation Resistance vs. Temperature



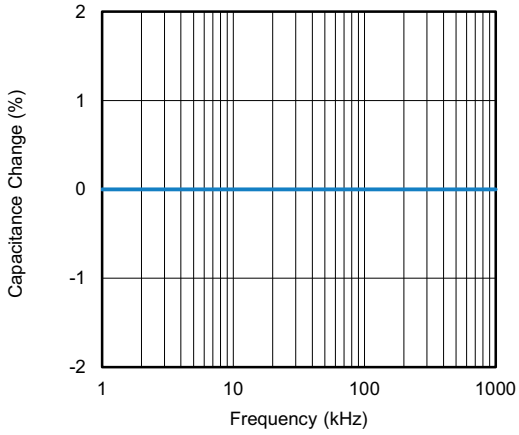
Aging Rate



Voltage Coefficient of Capacitance

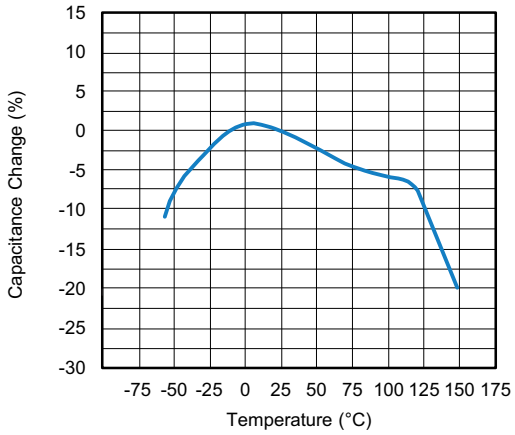


Change of Capacitance with Frequency

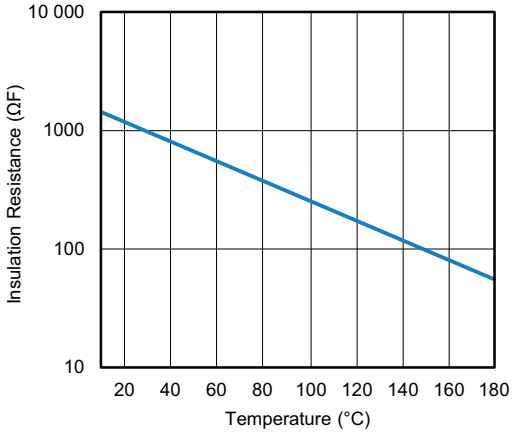


X7R DIELECTRIC - TYPICAL PARAMETERS

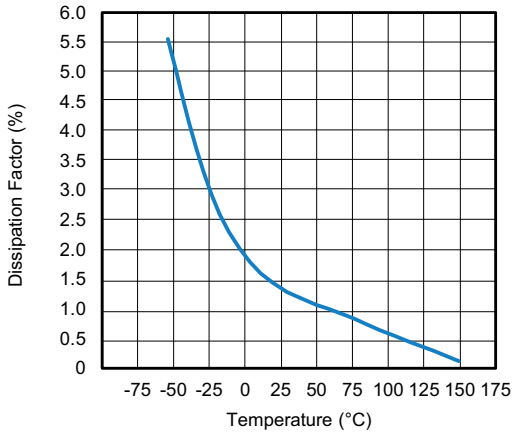
Temperature Coefficient of Capacitance



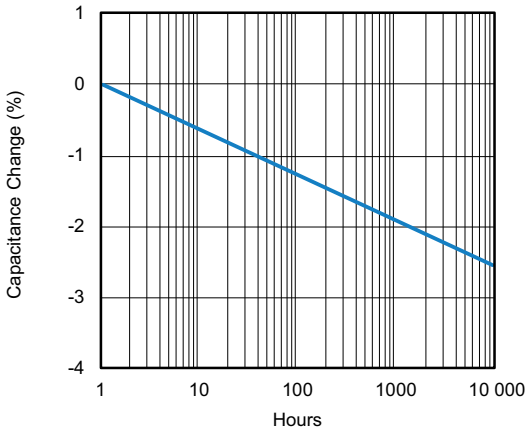
Minimum Insulation Resistance vs. Temperature



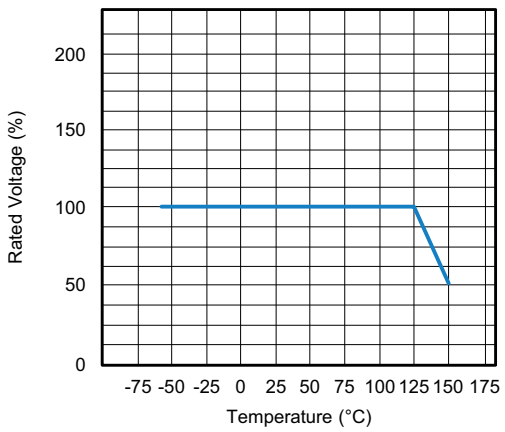
Dissipation Factor vs. Temperature



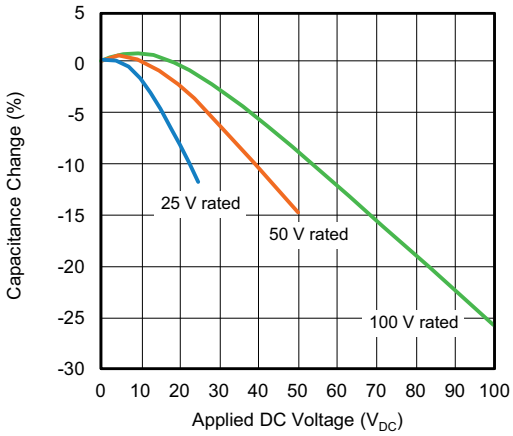
Aging Rate



Rated Voltage vs. Temperature [1]



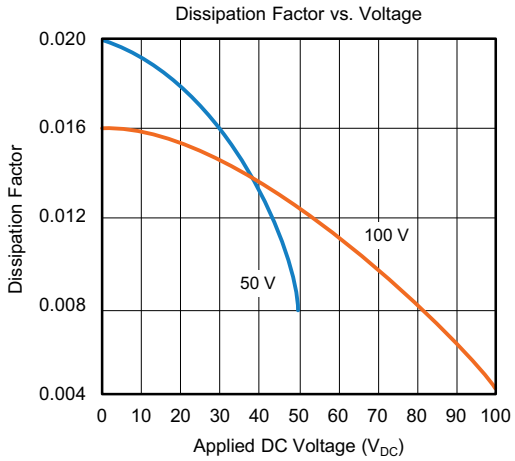
Voltage Coefficient of Capacitance

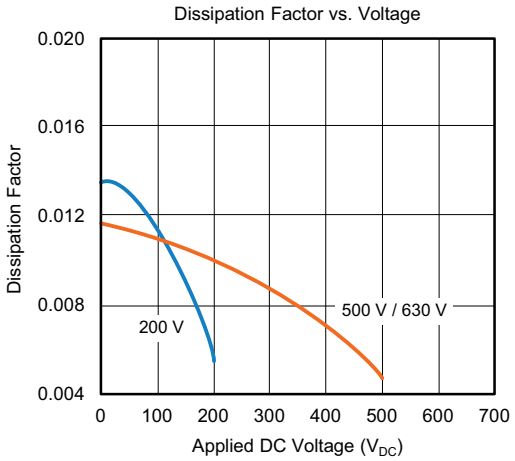


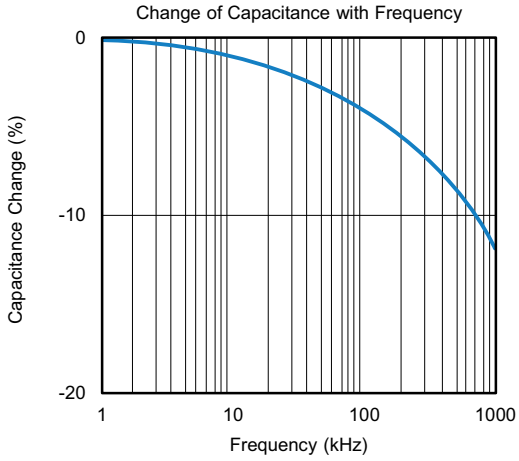
Note

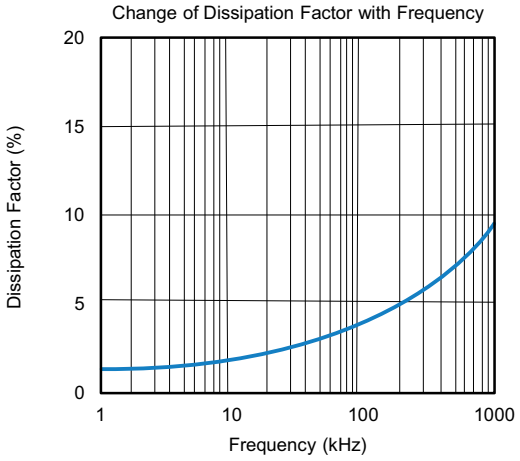
(1) Except for GA0603Y104*A (100 nF / 50 V), see section “2.2 Characteristics”

X7R DIELECTRIC - TYPICAL PARAMETERS



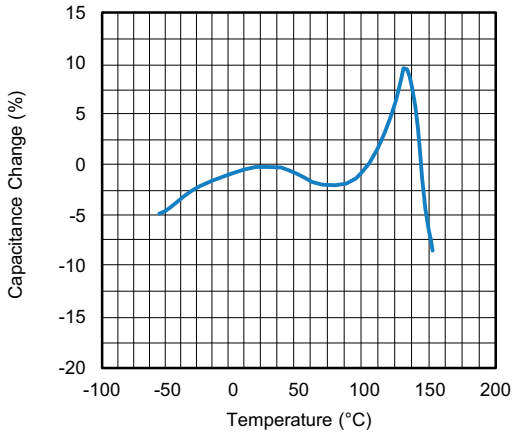




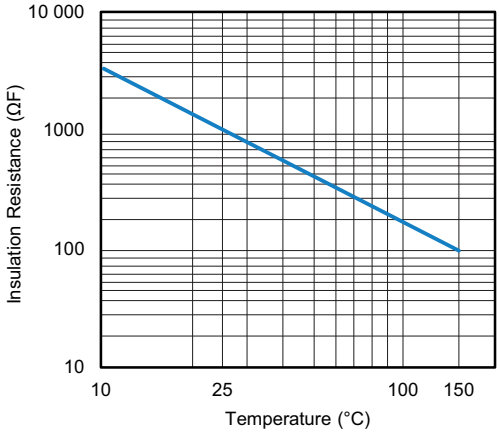


X8R DIELECTRIC - TYPICAL PARAMETERS

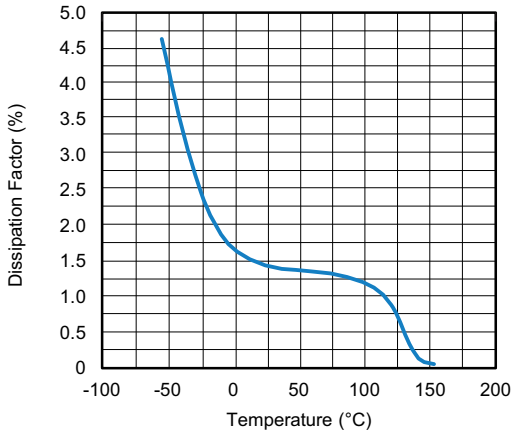
Temperature Coefficient of Capacitance



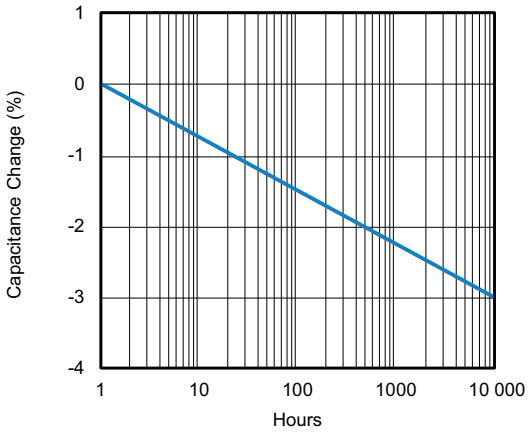
Minimum Insulation Resistance vs. Temperature



Dissipation Factor vs. Temperature



Aging Rate



3 - LOT ACCEPTANCE TESTS

Process tests available in classes (on request)

GROUP	ACTION
A	Components are tested within the monitoring program of the supplier. The supplier shall submit the part numbers of the selected component to the customer during the component specification discussions.
B	Components (customer P/N) shall be tested quarterly. Records available only on special request by the customer.
C	Test with each shipment. Records are provided on a monthly basis. Customer special requirement; requirement should be determined in a specific component specification.

Upon request the records can be submitted in electronic format on monthly basis.

3.1 THERMAL STRENGTH, THERMAL SHOCK SENSIBILITY

Sample size	200
Handling	Mounted on PCB
Thermal shock	1 x 280 °C, no pre-heat, 5 s to 10 s
IR - test (IRATS)	U = U_R, T = room temperature, verified
Burn in (BIATS)	Equivalent to 12 h burn-in, 2 x U_R/125 °C, verification time to failure

Acceptance criteria: zero defects (IRATS and BIATS).

3.2 BOARD FLEX TEST

Sample size	20 pcs/lot
Frequency	Each lot
Max. deflection	5 mm

4 - ENVIRONMENTAL REQUIREMENTS

A list of the chemical substances content, which must not be used or whose use shall be limited by international law, is available on request.

Vishay confirms that the components specified in this specification do not contain asbestos nor cadmium, not even in the smallest volumes.

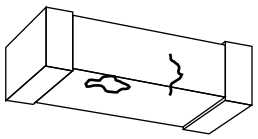
The manufacturer / supplier confirms that the component during normal handling, storage and assembly, as well as during operation in the automobile, is non toxic.

5 - INSPECTION CRITERIA

The supplier shall carry out visual examination with suitable equipment with approximately 10 x magnification and lighting appropriate to the specimen under test and the required quality level.

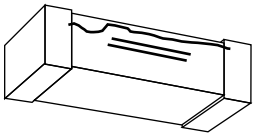
Chipping

The components shall be free of cracks or fissures. Small damages which do not deteriorate the performance of the component as defined in EIA 595.



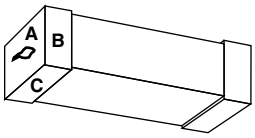
Delamination or Exposed Electrodes

No visible separation or delamination between layers of the capacitor and no exposed electrodes between the two terminals of the capacitor must be seen.



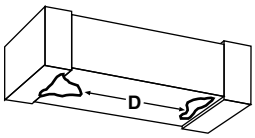
Metallization

For the metallization, no visible detachment of the metallized terminals and no exposed electrodes must be seen. Defects and gaps in the metallization on each sides of the terminal must not exceed 10 % of the total area (e.g. A, B, C, …) as defined in EIA 595.



Electrode Distance

The ceramic body shall be free of any conducting material between the terminals which reduces the distance of the electrodes. The minimum distance “D” is 350 µm for all package sizes.



6 - BOARD FLEX TEST CONDITIONS

6.1 BOARD FLEX DEFINITIONS OF TEST

PCB thickness = (1.6 ± 0.1) mm

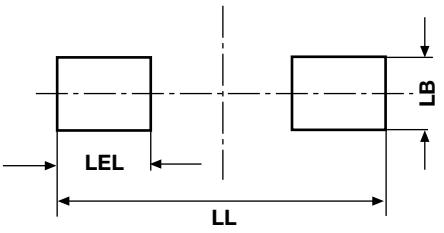
Copper thickness = 35 µm

Material FR4 (EP-GC 02 according to DIN 40 802)

LAYOUT / PAD DESIGN (Dimensions in mm)			
CASE CODE	**PAD SIZE**		
	LL	**LB**	**LEL**
0603	2.20	1.00	0.75
0805	3.40	1.30	1.20
1206	4.50	1.80	1.20
1210	4.50	2.80	1.30

Note

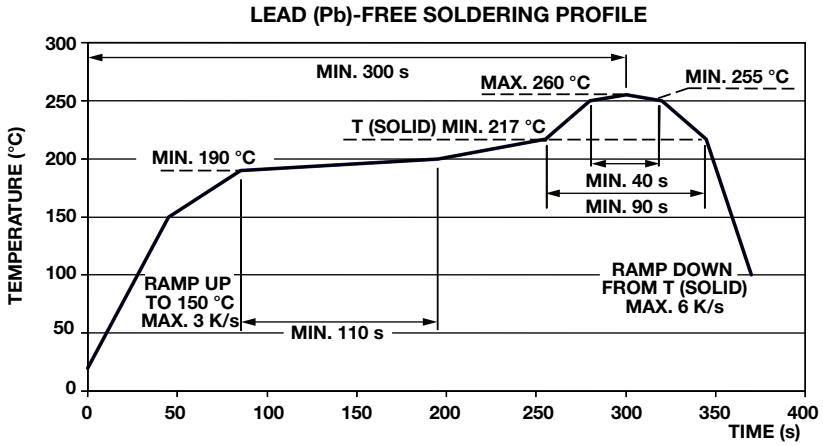
- LL = total length; LB = width of the pad; LEL = single pad length



6.2 SOLDERING INSTRUCTIONS

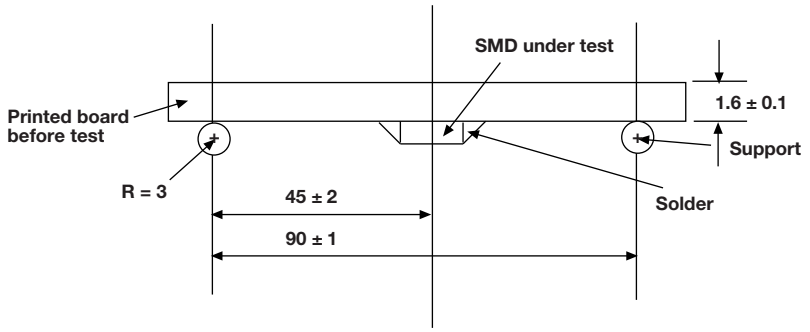
THICKNESS, RECOMMENDED FOR SOLDER PASTE (Reflow soldering)	
CASE CODE	**THICKNESS in µm**
0603	150 to 200
0805	150 to 200
1206	150 to 200
1210	150 to 200

6.3 TYPICAL TEMPERATURE PROFILE FOR REFLOW SOLDERING (Boardflex test)

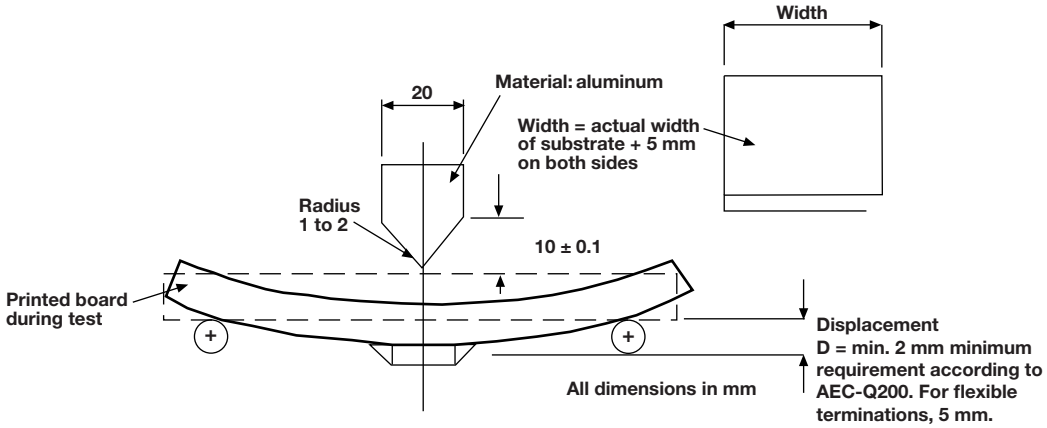


6.4 MOUNTING, DIMENSIONS, AND TESTING

Mounting



Testing



6.5 PERFORMANCE OF THE TEST(S)

A) Electrical test according to component specification (Cap, DF, IR)

B) Mounting to PCB

C) Storage at room temperature (min. 10 h)

D) Board flex test - bending to the required bending depth (5 mm) with a speed of 1 mm/s and a hold time of 5 s

6.6 DETAILS

X8R	PCB to be deflected up to 5 mm. Parametric testing (capacitance) after each step to detect eventual development of cracks
X7R	PCB to be deflected up to 5 mm. Parametric testing (capacitance) after each step to detect eventual development of cracks
C0G	PCB to be deflected up to 5 mm. Parametric testing (capacitance) after each step to detect eventual development of cracks

6.7 FAILURE CRITERIA

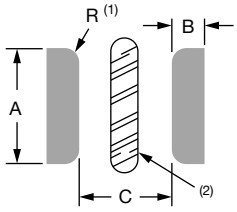
X8R	Board flex JIS-6429, AEC-Q200-005, no failure. Board flex (5 mm typical) 5 % ΔC/C
X7R	Board flex JIS-6429, AEC-Q200-005, no failure. Board flex (5 mm typical) 5 % ΔC/C
C0G	Board flex JIS-6429, AEC-Q200-005, no failure. Board flex (5 mm typical) 5 % ΔC/C
All	Electrical test according to component specification

7 - AEC-Q200 QUALIFICATION TESTING

NO.	AEC-Q200 TEST ITEM	REFERENCE
1	Pre- and post stress electrical test	User spec
3	High temp exposure (storage)	MIL-STD-202, method 108
4	Temperature cycling	JESD22, method JA-104
5	Destructive physical analysis	EIA-469
6	Moisture resistance	MIL-STD-202, method 106
7	Biased humidity	MIL-STD-202, method 103
8	Operation life	MIL-STD-202 method 108
9	External Visual	MIL-STD-883 method 2009
10	Physical dimension	JESD22, method JB-100
13	Mechanical shock	MIL-STD-202, method 213
14	Vibration	MIL-STD-202, method 204
15	Resistance to solder heat	MIL-STD-202, method 210
16	ESD	AEC-Q200-002
17	Solderability	J-STD-002
20	Electrical characterization	User spec
21	Board flex	AEC-Q200-005
22	Terminal strength	AEC-Q200-006
23	Beam load	AEC-Q200-003

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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