High Operating Temperature Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications, 50 V_{DC}, 100 V_{DC}, 200 V_{DC}

FEATURES

- Registered trademark HOTcap®
- AEC-Q200 qualified with PPAP available
- High reliability MLCC insert with wet build process
- High operating temperature up to 200 °C (1)
- Available in class 1 and class 2
- High capacitance with small size
- Radial mounting style
- Crimp and straight leadstyles
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

RoHS COMPLIANT

HALOGEN FREE

DESIGN SUPPORT TOOLS

click logo to get started

3D Models Available

APPLICATIONS

- Automotive applications up to 200 °C (1)

Note

(1) 200 °C for max. 500 hours and 175 °C unlimited time

QUICK REFERENCE DATA

DESCRIPTION	VALUE					
Ceramic Class	1			2		
Ceramic Dielectric	C0G			X0U		
Voltage (V_{DC})	50	100	200	50	100	200
Min. Capacitance (pF)	100	100	100	10 000	10 000	10 000
Max. Capacitance (pF)	12 000	12 000	8200	1 000 000	470 000	180 000
Mounting	Radial					

MARKING

Marking indicates capacitance value and tolerance in accordance with “EIA 198”.

OPERATING TEMPERATURE RANGE

-55 °C to +175 °C unlimited time
-55 °C to +200 °C for max. 500 hours
Voltage derating above 150 °C

TEMPERATURE CHARACTERISTICS

Class 1: C0G (± 30 ppm/K within -55 °C to +200 °C)
Class 2: X0U also fullfilling X7R and X9V criteria
X7R (+15 % / -15 % within -55 °C to +125 °C)
X0U (+22 % / -56 % within -55 °C to +175 °C)
X9V (+22 % / -82 % within -55 °C to +200 °C)
See also chart “Capacitance Change vs. Temperature”

SECTIONAL SPECIFICATIONS

Climatic category (acc. to EN 60058-1)
55 / 125 / 21

APPROVALS

EIA 198
IEC 60384-8
IEC 60384-9
AEC-Q200

DISSIPATION FACTOR

Class 1: 0.1 % max.
(C ≤ 1000 pF, at 1 MHz, 1 V; C > 1000 pF, at 1 kHz, 1 V)
Class 2: 2.5 % max. (at 1 kHz, 1 V)

DESIGN

- The capacitors consist of a high reliability MLCC
- Leads wires are 0.5 mm or 0.6 mm and are made of 100 % tinned copper clad steel wire
- The capacitors may be supplied with straight or kinked leads having a lead spacing of 2.5 mm and 5.0 mm
- Coating is made of flame retardant epoxy resin in accordance with UL 94 V-0

CAPACITANCE RANGE

100 pF to 1 µF

TOLERANCE ON CAPACITANCE

± 5 %, ± 10 %, ± 20 %

RATED VOLTAGE

50 V_{DC}, 100 V_{DC}, 200 V_{DC}

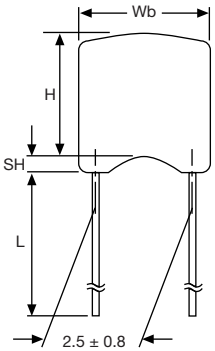
TEST VOLTAGE

- 50 V_{DC} and 100 V_{DC}: 250 % of rated voltage
- 200 V_{DC}: 200 % of rated voltage

INSULATION RESISTANCE

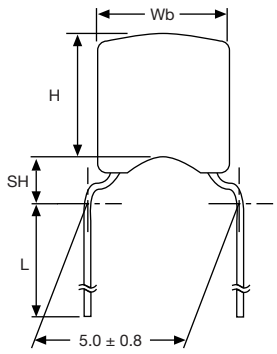
- 50 V_{DC}, 100 V_{DC}: 100 GΩ or 1000 ΩF whichever is less at rated voltage within 2 min of charging
- 200 V_{DC}: 10 GΩ or 100 ΩF whichever is less at rated voltage within 2 min of charging

LEAD CONFIGURATION AND DIMENSIONS in millimeters



L2

Component outline for lead spacing 2.5 mm ± 0.5 mm (straight leads)



H5

Component outline for lead spacing 5.0 mm ± 0.5 mm (flat bent leads)

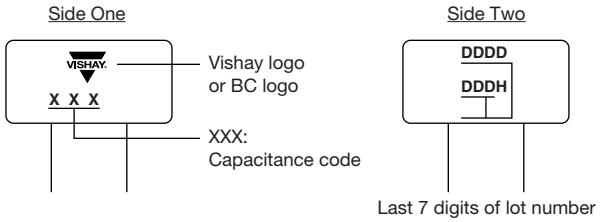
SIZE CODE	$Wb_{MAX.}$	$H_{MAX.}$	$T_{MAX.}$	LEAD DIAMETER	MAXIMUM SEATING HEIGHT (SH)	
					L2	H5
15	3.0 - 3.8	2.0 - 3.8	1.6 - 2.6	0.50 ± 0.05	1.6	2.6
20	4.3 - 5.1	2.5 - 5.1	1.9 - 3.2	0.60 ± 0.05	1.6	2.6

Notes

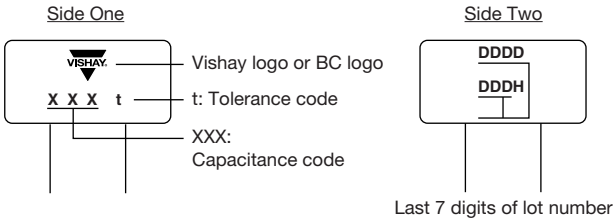
- Bulk packed types have a standard lead length L = 30 mm ± 5 mm.
- L2 and H5 are preferred styles.

MARKING (two sides)

SIZE 15 CAPACITANCE VALUE ≥ 100 pF



SIZE 20



Notes

- Two significant digits followed by one digit for the multiplier: 1 = * 10, 2 = * 100, 3 = * 1000, 4 = * 10 000, 5 = * 100 000.
- The tolerance codes are J = ± 5 %, K = ± 10 %, M = ± 20 %

ORDERING CODE INFORMATION

K	104	K	15	X0U	F	5	3	H	5	H
1	2 3 4	5	6 7	8 9 10	11	12	13	14	15	16
Product Type	**Capacitance (pF)**	**Capacitance Tolerance**	**Size Code**	**T.C. Code**	**Rated Voltage**	**Lead Diameter**	**Packaging / Lead Length**	**Lead Style**	**Lead Spacing**	**AEC-Q200 qualified**

ORDERING CODE INFORMATION										
K = radial leaded MLCC	The first two digits are the significant figures of capacitance and the last digit is a multiplier as follows: 1 = * 10 2 = * 100 3 = * 1000 4 = * 10 000 5 = * 100 000	J = ± 5 % K = ± 10 % M = ± 20 %	Please refer to relevant ordering code tables in this datasheet	Please refer to relevant ordering code tables in this datasheet	F = 50 V_{DC} H = 100 V_{DC} K = 200 V_{DC}	5 = 0.50 mm ± 0.05 mm 6 = 0.60 mm ± 0.05 mm	3 = bulk T = tape and reel U = ammo	H = flat crimp L = straight K = outside crimp	2 = 2.5 mm 5 = 5.0 mm	H = high operating temperature

ORDERING CODES

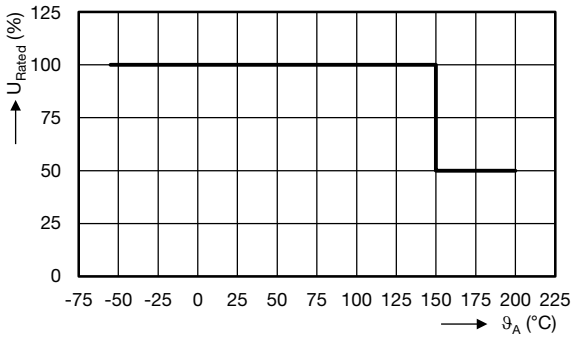
DIELECTRIC C0G			
CAP. (pF)	50 V_{DC}	100 V_{DC}	200 V_{DC}
100	K101#15C0GF5###H	K101#15C0GH5###H	K101#15C0GK5###H
120	K121#15C0GF5###H	K121#15C0GH5###H	K121#15C0GK5###H
150	K151#15C0GF5###H	K151#15C0GH5###H	K151#15C0GK5###H
180	K181#15C0GF5###H	K181#15C0GH5###H	K181#15C0GK5###H
220	K221#15C0GF5###H	K221#15C0GH5###H	K221#15C0GK5###H
270	K271#15C0GF5###H	K271#15C0GH5###H	K271#15C0GK5###H
330	K331#15C0GF5###H	K331#15C0GH5###H	K331#15C0GK5###H
390	K391#15C0GF5###H	K391#15C0GH5###H	K391#15C0GK5###H
470	K471#15C0GF5###H	K471#15C0GH5###H	K471#15C0GK5###H
560	K561#15C0GF5###H	K561#15C0GH5###H	K561#15C0GK5###H
680	K681#15C0GF5###H	K681#15C0GH5###H	K681#15C0GK5###H
820	K821#15C0GF5###H	K821#15C0GH5###H	K821#15C0GK5###H
1000	K102#15C0GF5###H	K102#15C0GH5###H	K102#15C0GK5###H
1200	K122#15C0GF5###H	K122#15C0GH5###H	K122#20C0GK6###H
1500	K152#15C0GF5###H	K152#15C0GH5###H	K152#20C0GK6###H
1800	K182#15C0GF5###H	K182#15C0GH5###H	K182#20C0GK6###H
2200	K222#15C0GF5###H	K222#20C0GH6###H	K222#20C0GK6###H
2700	K272#15C0GF5###H	K272#20C0GH6###H	K272#20C0GK6###H
3300	K332#15C0GF5###H	K332#20C0GH6###H	K332#20C0GK6###H
3900	K392#15C0GF5###H	K392#20C0GH6###H	K392#20C0GK6###H
4700	K472#20C0GF6###H	K472#20C0GH6###H	K472#20C0GK6###H
5600	K562#20C0GF6###H	K562#20C0GH6###H	K562#20C0GK6###H
6800	K682#20C0GF6###H	K682#20C0GH6###H	K682#20C0GK6###H
8200	K822#20C0GF6###H	K822#20C0GH6###H	K822#20C0GK6###H
10 000	K103#20C0GF6###H	K103#20C0GH6###H	/
12 000	K123#20C0GF6###H	K123#20C0GH6###H	/

DIELECTRIC X0U			
CAP. (pF)	50 V_{DC}	100 V_{DC}	200 V_{DC}
10 000	K103#15X0UF5###H	K103#15X0UH5###H	K103#15X0UK5###H
15 000	K153#15X0UF5###H	K153#15X0UH5###H	K153#15X0UK5###H
22 000	K223#15X0UF5###H	K223#15X0UH5###H	K223#15X0UK5###H
27 000	K273#15X0UF5###H	K273#15X0UH5###H	K273#15X0UK5###H
33 000	K333#15X0UF5###H	K333#15X0UH5###H	K333#20X0UK6###H
39 000	K393#15X0UF5###H	K393#15X0UH5###H	K393#20X0UK6###H
47 000	K473#15X0UF5###H	K473#15X0UH5###H	K473#20X0UK6###H
56 000	K563#15X0UF5###H	K563#15X0UH5###H	K563#20X0UK6###H
68 000	K683#15X0UF5###H	K683#15X0UH5###H	K683#20X0UK6###H
82 000	K823#15X0UF5###H	K823#15X0UH5###H	K823#20X0UK6###H
100 000	K104#15X0UF5###H	K104#15X0UH5###H	K104#20X0UK6###H
120 000	K124#15X0UF5###H	K124#20X0UH6###H	K124#20X0UK6###H
150 000	K154#15X0UF5###H	K154#20X0UH6###H	K154#20X0UK6###H
180 000	K184#20X0UF6###H	K184#20X0UH6###H	K184#20X0UK6###H
220 000	K224#20X0UF6###H	K224#20X0UH6###H	/
270 000	K274#20X0UF6###H	K274#20X0UH6###H	/
330 000	K334#20X0UF6###H	K334#20X0UH6###H	/
390 000	K394#20X0UF6###H	K394#20X0UH6###H	/
470 000	K474#20X0UF6###H	K474#20X0UH6###H	/
560 000	K564#20X0UF6###H	/	/
680 000	K684#20X0UF6###H	/	/
820 000	K824#20X0UF6###H	/	/
1 000 000	K105#20X0UF6###H	/	/

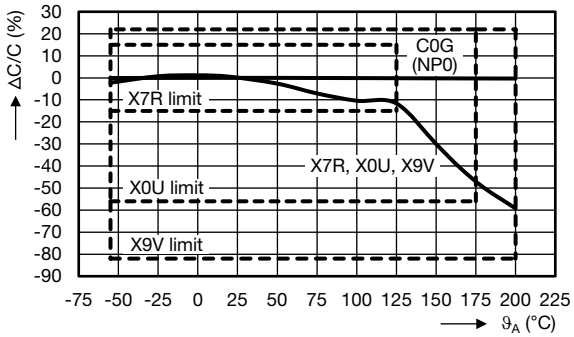
Notes

- Lead diameter is 0.5 mm or 0.6 mm
- # 5th digit is capacitance tolerance code: ± 5 % = J; ± 10 % = K; ± 20 % = M
- # 13th digit is packaging code: Bulk = 3; Reel = T; Ammo = U
- # 14th digit is lead style code: L; H; K (L and H are preferred lead configuration)
- # 15th digit is lead spacing code: 2.5 mm = 2; 5.0 mm = 5

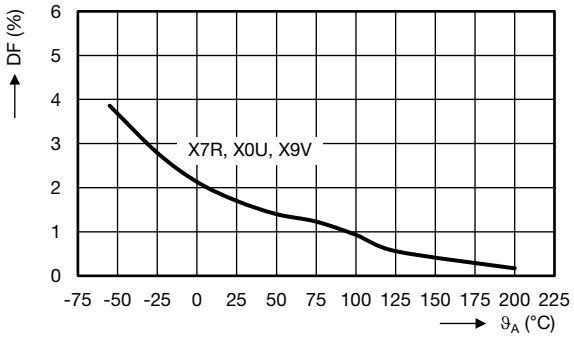
RATED VOLTAGE VS. TEMPERATURE (Typical)



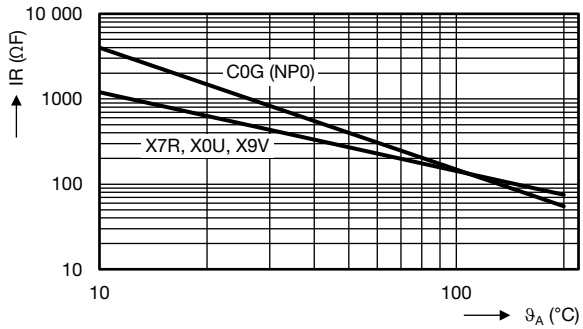
CAPACITANCE CHANGE VS. TEMPERATURE (Typical)



DISSIPATION FACTOR VS. TEMPERATURE (Typical)



INSULATION RESISTANCE VS. TEMPERATURE (Typical)



TAPING AND PACKAGING

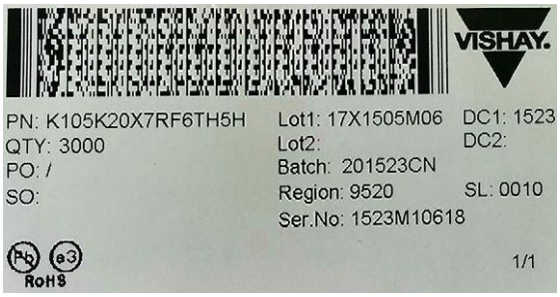
LABELLING

Each reel is provided with a label showing the following details:

Manufacturer, K style, capacitance, tolerance, batch number, quantity of components, rated voltage, dielectric.

On special request other designations can be shown.

For example:



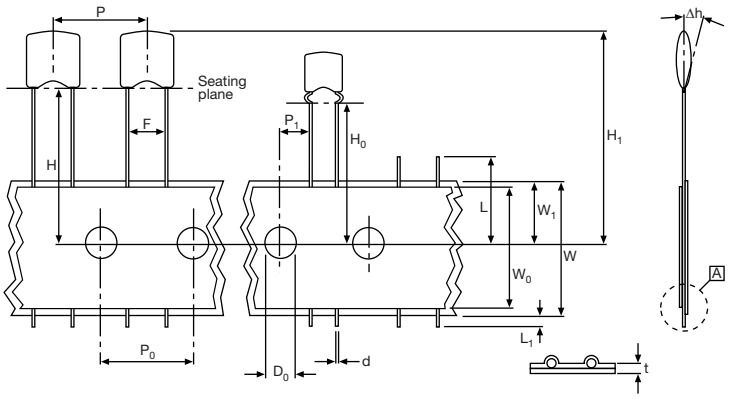
PACKAGING QUANTITIES AND BOX DIMENSIONS

PACKAGING	SIZE CODE	SMALLEST PACKAGING QUANTITY (SPQ)	BOX DIMENSIONS L x W x H (mm)
Tape on reel	15	4000	370 x 370 x 60
	20	3000	
Ammopack	15, 20	2500	335 x 290 x 50
Bulk (1)	15, 20	5000	245 x 120 x 65

Note

(2) SPQ contains one or a multiple of poly-bags, 1000 units per bag.

CAPACITORS ON TAPE



PARAMETER	SYMBOL	DIMENSIONS	
		mm	INCH
Cut-off length	L	≤ 11	≤ 0.443
Lead end protrusion	L_1	≤ 1	≤ 0.039
Height to seating plane (straight leads)	H	≥ 18	≥ 0.709
Height to seating plane (crimp leads)	H_0	16.0 ± 0.5	0.630 ± 0.020
Top of component height	H_1	≤ 32	≤ 1.26
Body inclination	Δh	0 ± 1.0	0 ± 0.039
Carrier tape width	W	18.0 +1.0/-0.5	0.709 +0.039/-0.020
Hold down tape width	W_0	15.0 REF.	0.591 REF.
Sprocket hole position	W_1	9.00 +0.075/-0.50	0.354 +0.030/-0.020
Lead space	F	2.50 +0.60/-0.40	0.100 +0.024/-0.016
		5.00 +0.60/-0.40	0.200 +0.024/-0.016
Sprocket hole pitch	P_0	12.70 ± 0.30	0.500 ± 0.012
Sprocket hole center to lead center at F = 2.5 mm	P_1	5.08 ± 0.70	0.200 ± 0.028
Sprocket hole center to lead center at F = 5 mm		3.85 ± 0.70	0.150 ± 0.028
Sprocket hole diameter	D_0	4.0 ± 0.30	0.157 ± 0.012
Overall tape thickness	t	≤ 0.90	≤ 0.035
Wire lead diameter	d	0.50 ± 0.05	0.020 ± 0.002

CAPACITORS ON TAPE			
Taping pitch	P	12.7 REF.	0.50 REF.

REEL DATA

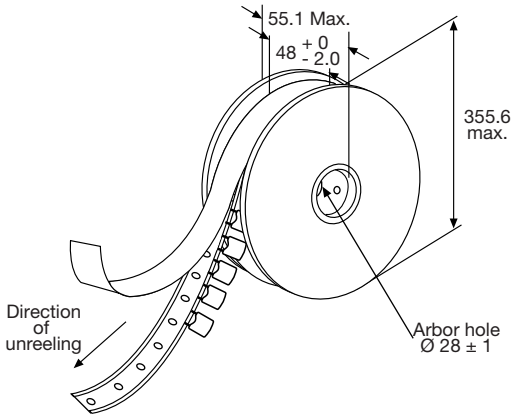
A maximum of 0.5 % of the total number of capacitors per reel may be missing.

A maximum of 1 consecutive vacant positions is followed by 6 consecutive components.

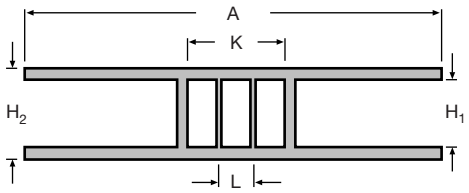
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

Maximum of 5 splicers per reel.

REEL



REEL DIMENSIONS



REEL SIZE		(mm)
A	Outer diameter	355.6 max.
L	Hole diameter	28 ± 1
K	Core diameter	90
H_1	Internal width	48 +0/-2
H_2	External width	55 max.

AMMOPACK DATA

A maximum of 0.5 % of the total number of capacitors per pack may be missing.

A maximum of 1 consecutive vacant positions is followed by 6 consecutive components.

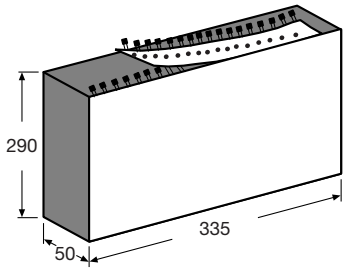
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

Maximum of 5 splicers per pack.

The cumulative pitch tolerance over 20 consecutive units is not to exceed ± 1.0 mm.

Lead space (F) shall be measured at 3.6 mm ± 0.5 mm from the capacitor seating plane.

AMMOPACK



RELATED DOCUMENTS

General Information	www.vishay.com/doc?45214

SAMPLE KIT

Part Number	HOTC-KIT-KH
Link	www.vishay.com/doc?45234

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