Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications Class 1 and Class 2, 50 V_{DC}, 100 V_{DC}, 200 V_{DC}

FEATURES

- AEC-Q200 qualified with PPAP available
- High reliability MLCC insert with wet build process
- High operating temperature up to 160 °C
- High capacitance with small size
- Radial mounting style
- Crimp and straight leadstyles
- Parts compliant with ELV directive
- For new designs the series K...G is recommended (www.vishay.com/ppg?45250)
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Automotive

QUICK REFERENCE DATA								
DESCRIPTION	VALUE							
Ceramic class	1			2				
Ceramic dielectric	C0G			X7R			X8R	
Voltage (V_{DC})	50	100	200	50	100	200	50	100
Min. capacitance (pF)	100	100	100	470	470	330	470	470
Max. capacitance (pF)	8200	8200	1000	1 000 000	470 000	100 000	150 000	27 000
Mounting	Radial							

MARKING

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

OPERATING TEMPERATURE RANGE

-55 °C to +160 °C (50 % rated voltage above 150 °C)

TEMPERATURE CHARACTERISTICS

Class 1: C0G

Class 2: X7R, X8R

SECTIONAL SPECIFICATIONS

Climatic category (acc. to EN 60058-1)

Class 1 and 2: 55/125/21

APPROVALS

EIA 198

IEC 60384-9

AEC-Q200

DESIGN

- The capacitors consist of a high reliability MLCC
- The lead wires are 0.5 mm and are made of 100 % tinned copper clad steel wire (nickel wires for welding are available on request)
- 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 black colored 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

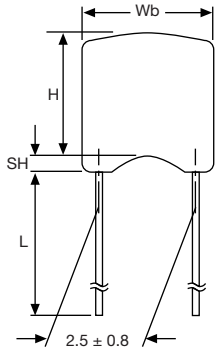
100 GΩ or 1000 ΩF whichever is less at rated voltage within 2 min of charging.

DISSIPATION FACTOR

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

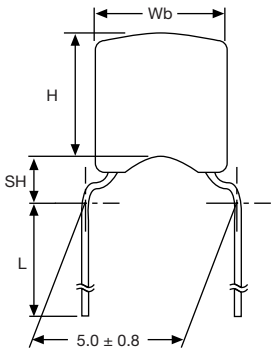
Class 2: 2.5 % max. (at 1 kHz, 1 V)

LEAD CONFIGURATION AND DIMENSIONS in millimeters



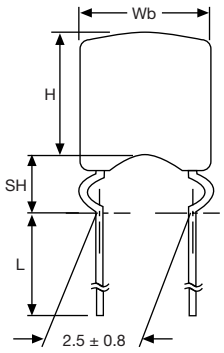
L2

Component outline for lead spacing 2.5 mm ± 0.8 mm (straight leads)



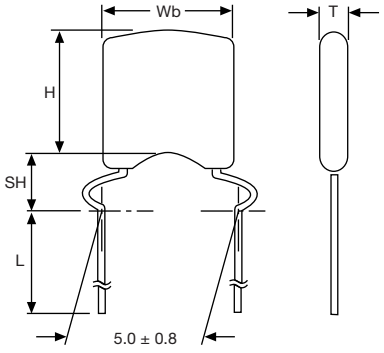
H5

Component outline for lead spacing 5.0 mm ± 0.8 mm (flat bent leads)



K2

Component outline for lead spacing 2.5 mm ± 0.8 mm (outside kink)



K5

Component outline for lead spacing 5.0 mm ± 0.8 mm (outside kink)

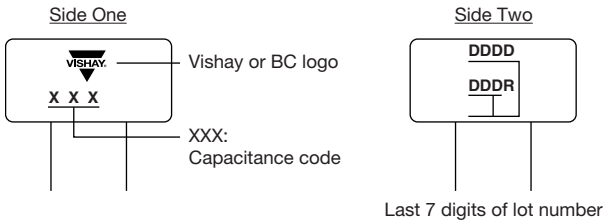
SIZE CODE	$Wb_{MAX.}$	$H_{MAX.}$	$T_{MAX.}$	Lead Diameter	MAXIMUM SEATING HEIGHT (SH)			
					L2	H5	K2	K5
15	3.0 - 3.8	2.0 - 3.8	1.6 - 2.6	0.50 ± 0.05	1.6	2.6	3.5	3.5
20	4.3 - 5.1	2.5 - 5.1	1.9 - 3.2	0.50 ± 0.05	1.6	2.6	3.5	3.5

Notes

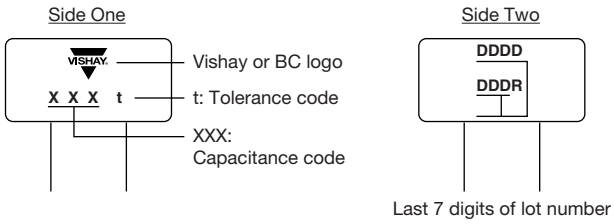
- Bulk packed types have a standard lead length L = 30 mm ± 5 mm
- L2 and H5 are preferred styles

MARKING

SIZE 15



SIZE 20



Notes

- Two significant digits followed by one digit for the multiplier as given following: 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	X7R	F	5	3	H	5	R
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**
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 datasheet	Please refer to relevant datasheet	F = 50 V_{DC} H = 100 V_{DC} K = 200 V_{DC}	5 = 0.50 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	R = AEC-Q200 qualified and RoHS-compliant

ORDERING CODES

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

Notes

- Lead diameter is 0.5 mm
- # 5th digit is capacitance tolerance code: ± 5 % = J; ± 10 % = K
- # 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

DIELECTRIC X7R			
CAP. (pF)	50 V_{DC}	100 V_{DC}	200 V_{DC}
330	-	-	K331#15X7RK5###R
390	-	-	K391#15X7RK5###R
470	K471#15X7RF5###R	K471#15X7RH5###R	K471#15X7RK5###R
560	K561#15X7RF5###R	K561#15X7RH5###R	K561#15X7RK5###R
680	K681#15X7RF5###R	K681#15X7RH5###R	K681#15X7RK5###R
820	K821#15X7RF5###R	K821#15X7RH5###R	K821#15X7RK5###R
1000	K102#15X7RF5###R	K102#15X7RH5###R	K102#15X7RK5###R
1200	K122#15X7RF5###R	K122#15X7RH5###R	K122#15X7RK5###R
1500	K152#15X7RF5###R	K152#15X7RH5###R	K152#15X7RK5###R
1800	K182#15X7RF5###R	K182#15X7RH5###R	K182#15X7RK5###R
2200	K222#15X7RF5###R	K222#15X7RH5###R	K222#15X7RK5###R
2700	K272#15X7RF5###R	K272#15X7RH5###R	K272#15X7RK5###R
3300	K332#15X7RF5###R	K332#15X7RH5###R	K332#15X7RK5###R
3900	K392#15X7RF5###R	K392#15X7RH5###R	K392#15X7RK5###R
4700	K472#15X7RF5###R	K472#15X7RH5###R	K472#15X7RK5###R
5600	K562#15X7RF5###R	K562#15X7RH5###R	K562#15X7RK5###R
6800	K682#15X7RF5###R	K682#15X7RH5###R	K682#15X7RK5###R
8200	K822#15X7RF5###R	K822#15X7RH5###R	K822#15X7RK5###R
10 000	K103#15X7RF5###R	K103#15X7RH5###R	K103#15X7RK5###R
12 000	K123#15X7RF5###R	K123#15X7RH5###R	K123#15X7RK5###R
15 000	K153#15X7RF5###R	K153#15X7RH5###R	K153#15X7RK5###R
18 000	K183#15X7RF5###R	K183#15X7RH5###R	K183#15X7RK5###R
22 000	K223#15X7RF5###R	K223#15X7RH5###R	K223#15X7RK5###R
27 000	K273#15X7RF5###R	K273#15X7RH5###R	K273#15X7RK5###R
33 000	K333#15X7RF5###R	K333#15X7RH5###R	K333#20X7RK5###R
39 000	K393#15X7RF5###R	K393#15X7RH5###R	K393#20X7RK5###R
47 000	K473#15X7RF5###R	K473#15X7RH5###R	K473#20X7RK5###R
56 000	K563#15X7RF5###R	K563#15X7RH5###R	K563#20X7RK5###R
68 000	K683#15X7RF5###R	K683#15X7RH5###R	K683#20X7RK5###R
82 000	K823#15X7RF5###R	K823#15X7RH5###R	K823#20X7RK5###R
100 000	K104#15X7RF5###R	K104#15X7RH5###R	K104#20X7RK5###R
150 000	K154#15X7RF5###R	K154#20X7RH5###R	-
220 000	K224#20X7RF5###R	K224#20X7RH5###R	-
330 000	K334#20X7RF5###R	K334#20X7RH5###R	-
470 000	K474#20X7RF5###R	K474#20X7RH5###R	-
560 000	K564#20X7RF5###R	-	-
680 000	K684#20X7RF5###R	-	-
1 000 000	K105#20X7RF5###R	-	-

Notes

- Lead diameter is 0.5 mm
- # 5th digit is capacitance tolerance code: ± 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

DIELECTRIC X8R		
CAP. (pF)	50 V_{DC}	100 V_{DC}
470	K471#15X8RF5###R	K471#15X8RH5###R
560	K561#15X8RF5###R	K561#15X8RH5###R
680	K681#15X8RF5###R	K681#15X8RH5###R
820	K821#15X8RF5###R	K821#15X8RH5###R
1000	K102#15X8RF5###R	K102#15X8RH5###R
1200	K122#15X8RF5###R	K122#15X8RH5###R
1500	K152#15X8RF5###R	K152#15X8RH5###R
1800	K182#15X8RF5###R	K182#15X8RH5###R
2200	K222#15X8RF5###R	K222#15X8RH5###R
2700	K272#15X8RF5###R	K272#15X8RH5###R
3300	K332#15X8RF5###R	K332#15X8RH5###R
3900	K392#15X8RF5###R	K392#15X8RH5###R
4700	K472#15X8RF5###R	K472#15X8RH5###R
5600	K562#15X8RF5###R	K562#15X8RH5###R
6800	K682#15X8RF5###R	K682#15X8RH5###R
8200	K822#15X8RF5###R	K822#15X8RH5###R
10 000	K103#15X8RF5###R	K103#15X8RH5###R
12 000	K123#15X8RF5###R	K123#15X8RH5###R
15 000	K153#15X8RF5###R	K153#15X8RH5###R
18 000	K183#15X8RF5###R	K183#15X8RH5###R
22 000	K223#15X8RF5###R	K223#15X8RH5###R
27 000	K273#15X8RF5###R	K273#15X8RH5###R
33 000	K333#15X8RF5###R	-
39 000	K393#15X8RF5###R	-
47 000	K473#15X8RF5###R	-
56 000	K563#15X8RF5###R	-
68 000	K683#20X8RF5###R	-
82 000	K823#20X8RF5###R	-
100 000	K104#20X8RF5###R	-
150 000	K154#20X8RF5###R	-

Notes

- Lead diameter is 0.5 mm
- # 5th digit is capacitance tolerance code: ± 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

TAPING AND PACKAGING

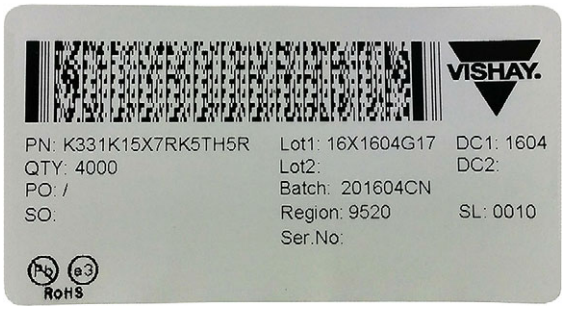
LABELLING

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:

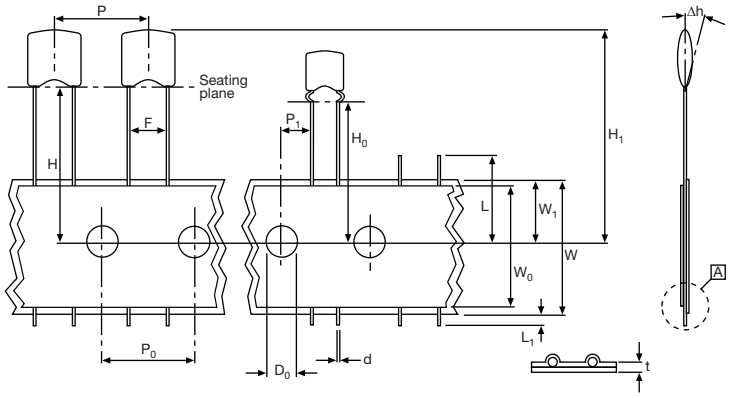


PACKAGING QUANTITIES AND BOX DIMENSIONS			
PACKAGING	**SIZE CODE**	**SMALLEST PACKAGING QUANTITY (SPQ)**	**BOX DIMENSIONS L x W x H (mm)**
Tape on reel	15	4000	370 x 370 x 60
	20	3000	
Ammopack	15, 20	2500	335 x 290 x 50
Bulk [1]	15, 20	5000	245 x 120 x 65

Note

[1] 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	≤ 0.443
Lead end protrusion	L_1	≤ 1.0	≤ 0.039
Height to seating plane (straight leads)	H	≥ 18.0	≥ 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	0.0 ± 1.0	0.000 ± 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	4.00 ± 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
Taping pitch	P	12.7 REF.	0.50 REF.

REEL DATA

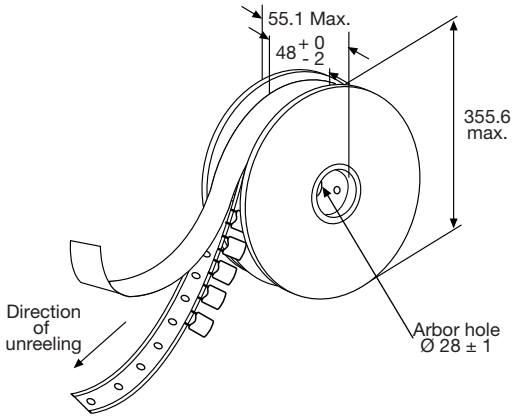
A maximum of 0.5 % of the total number of capacitors per reel may be missing.

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

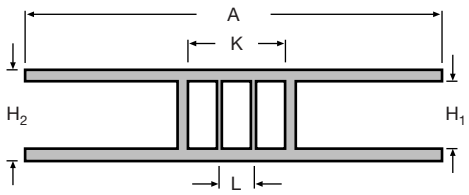
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

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.

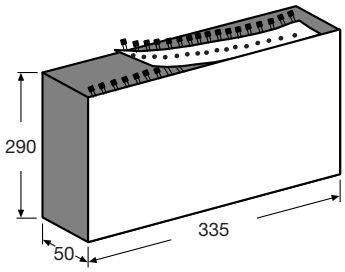
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

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 ± 0.5) mm from the capacitor seating plane.

AMMOPACK



RELATED DOCUMENTS

General Information	www.vishay.com/doc?45214

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