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 fully RoHS-compliant alternative K...R Series, please refer to www.vishay.com/doc?45233
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details.

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
Min. Capacitance (pF)	100	100	100	470	470	330	470
Max. Capacitance (pF)	10 000	10 000	1000	1 000 000	470 000	100 000	330 000
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 yellow 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

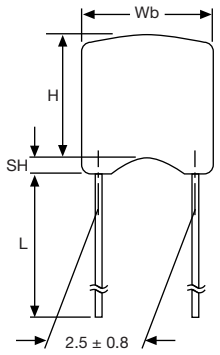
100 GΩ or 1000 ΩF whichever is less at rated voltage within 2 min of charging.

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)

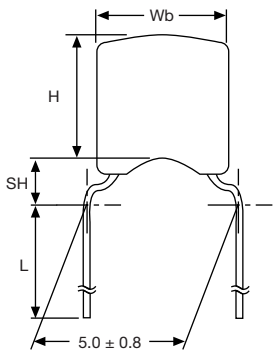
Class 2: 2.5 % max.
(at 1 kHz, 1 V)

LEAD CONFIGURATION AND DIMENSIONS in millimeters



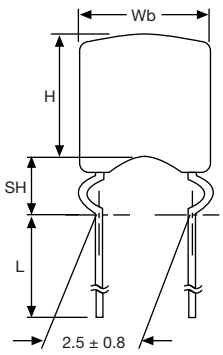
L2

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



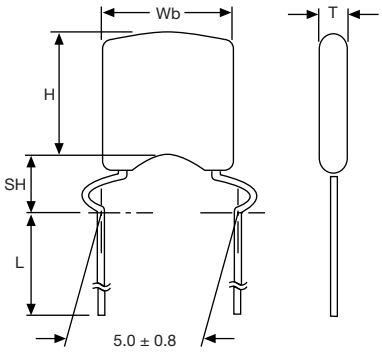
H5

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)

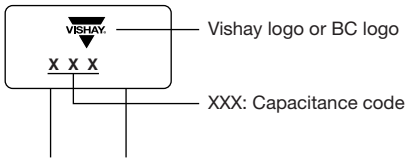
SIZE CODE	$Wb_{MAX.}$	$H_{MAX.}$	$T_{MAX.}$	Lead Diameter	MAXIMUM SEATING HEIGHT (SH)			
					L2	H5	K2	K5
15	3.0 - 3.8	2.0 - 3.8	1.6 - 2.6	0.50 ± 0.05	1.6	2.6	3.5	3.5
20	4.3 - 5.1	2.5 - 5.1	1.9 - 3.2	0.50 ± 0.05	1.6	2.6	3.5	3.5

Notes

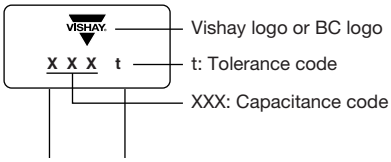
- Bulk packed types have a standard lead length L = 30 mm ± 5 mm.
- L2 and H5 are preferred styles.

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	V
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	V = AEC-Q200 qualified

ORDERING CODES

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

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

RoHS-compliant

Not RoHS-compliant, for fully RoHS-compliant alternative K...R Series, please refer to www.vishay.com/doc?45233

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

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

RoHS-compliant

Not RoHS-compliant, for fully RoHS-compliant alternative K...R Series, please refer to www.vishay.com/doc?45233

DIELECTRIC X8R	
CAP. (pF)	50 V_{DC}
470	K471#15X8RF5###V
560	K561#15X8RF5###V
680	K681#15X8RF5###V
820	K821#15X8RF5###V
1000	K102#15X8RF5###V
1200	K122#15X8RF5###V
1500	K152#15X8RF5###V
1800	K182#15X8RF5###V
2200	K222#15X8RF5###V
2700	K272#15X8RF5###V
3300	K332#15X8RF5###V
3900	K392#15X8RF5###V
4700	K472#15X8RF5###V
5600	K562#15X8RF5###V
6800	K682#15X8RF5###V
8200	K822#15X8RF5###V
10 000	K103#15X8RF5###V
12 000	K123#15X8RF5###V
15 000	K153#15X8RF5###V
18 000	K183#15X8RF5###V
22 000	K223#15X8RF5###V
27 000	K273#15X8RF5###V
33 000	K333#15X8RF5###V
39 000	K393#15X8RF5###V
47 000	K473#15X8RF5###V
56 000	K563#15X8RF5###V
68 000	K683#15X8RF5###V
82 000	K823#15X8RF5###V
100 000	K104#15X8RF5###V
150 000	K154#15X8RF5###V
220 000	K224#20X8RF5###V
330 000	K334#20X8RF5###V

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

RoHS-compliant

Not RoHS-compliant, for fully RoHS-compliant alternative K...R Series, please refer to www.vishay.com/doc?45233

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.

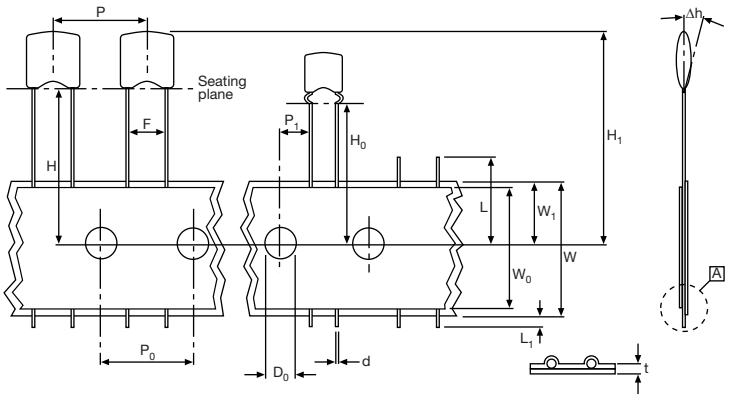
For example:

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

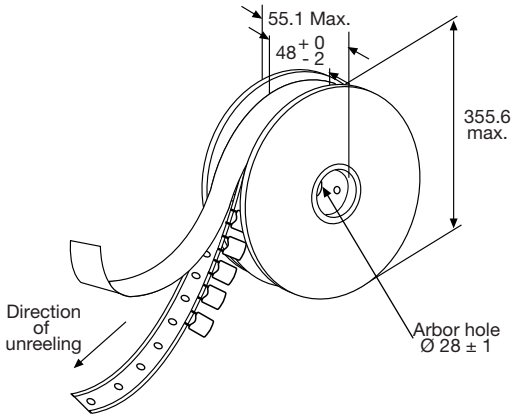
A maximum of 0.5 % of the total number of capacitors per reel may be missing.

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

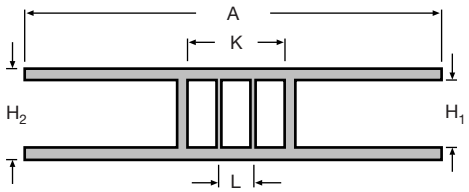
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

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.

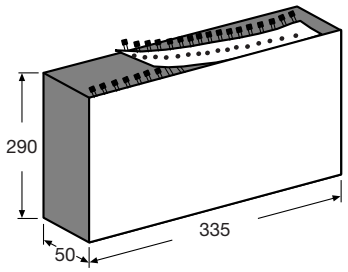
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

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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Vishay:

K105K20X7RF53H5 K271K15X7RH53L2 K471J15C0GF53H5 K180J15C0GF53L2 K224K20X7RF5TH5 K224M20X7RF5TH5 K330J15C0GH53L2 K102J15C0GF53H5 K100J15C0GF5TL2 K332K15X7RF5TL2 K180J15C0GF5TH5 K472J20C0GF53L2 K222K15X7RF5TK2 K331K15X7RF5TL2 K222K15X7RF53H5 K154K20X7RF53H5 K222J15C0GF53L2 K102J15C0GF5TH5 K122J15C0GF5TL2 K560J15C0GF5TH5 K102K15X7RH5TH5 K103K15X7RF5TH5 K472K15X7RF5TL2 K681J15C0GF53L2 K391J15C0GF53L2 K181J15C0GF53L2 K102K15X7RH53L2 K222K15X7RH53L2 K104K20X7RH5TH5 K104K20X7RH5TL2 K104K20X7RF53H5 K471J15C0GF53L2 K103M15Z5UF53L2 K101K15C0GF53L2 K221K15C0GH53L2 K104K20X7RH53H5 K104K15X7RF5TK2 K104K15X7RF5TH5 K104M20X7RH53L2 K221K15X7RF53L2 K102K15X7RF53L2 K101K15C0GH53L2 K150J15C0GH53L2 K103K15X7RH5TH5 K104M15X7RF5TH5 K224M20X7RF53H6-X2 K181J15C0GH5TH5 K102K15X7RK5TH5 K224K20X7RH5WH5 K270J15C0GF5TL2 K103K20X7RL5TH5 225232514473 K105M20X7RF53H5 K102M15X7RF5UL2 K102K15X7RH5TL2 K102J20C0GH53L2 K101J15C0GH53L2 K102J15C0GF53L2 K103M15X7RF53L2 K334M20X7RF53H5 K103K15X7RF53L2 K104M15X7RF53L2 K104M15X7RF53K2 K102K20C0GH53L2 K220K15C0GH53L2 K100K15C0GH53L2 K180J15C0GFVBWA K100J15C0GF53L2 K220J15C0GF53L2 K104K15X7RF53L2 K103K15X7RH53L2 K100K15C0GF53L2 K102K15X7RF5TL2 K105Z20Y5VF5TH5 K151J15C0GF5TH5 K104Z15Y5VF5TL2 K561J15C0GF5TL2 K683K15X7RF5TL2 K331J15C0GF5TH5 K101J15C0GF5TL2 K104Z15Y5VE5TH5 K474Z20Y5VF5TH5 K680J15C0GF5TL2 K270J15C0GF5TH5 K681K15X7RF5TL2 K104Z15Y5VF5TH5 K471J15C0GF5TL2 K821J15C0GF5TL2 K221J15C0GH5TL2 K101J15C0GH5TH5 K103K15X7RH5TL2 K103Z15Y5VF5TH5 K221J15C0GH5TH5 K102K15X7RF5TH5 K180J15C0GF5TL2 K105Z20Y5VF5TL2 K473K15X7RF5TL2 K103Z15Y5VE5TH5 K100J15C0GH5TL2 K220J15C0GH5TL2