Radial Leaded Multilayer Ceramic Capacitors for General Purpose Class 1 and Class 2, 50 V_{DC}, 100 V_{DC}, 200 V_{DC}, 500 V_{DC}



FEATURES

- High capacitance with small size
- High reliability
- Crimp and straight leadstyles
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb e3 RoHS COMPLIANT

APPLICATIONS

- Temperature compensation
- Coupling and decoupling

QUICK REFERENCE DATA

DESCRIPTION	VALUE							
Ceramic Class	1				2			
Ceramic Dielectric	C0G				X7R			
Voltage (V_{DC})	50	100	200	500	50	100	200	500
Min. Capacitance (pF)	10	10	33	33	100	100	100	100
Max. Capacitance (pF)	10 000	5600	3900	1800	1 000 000	560 000	220 000	47 000
Mounting	Radial							

MARKING

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

OPERATING TEMPERATURE RANGE

C0G, X7R: - 55 °C to + 125 °C

TEMPERATURE CHARACTERISTICS

Class 1: C0G

Class 2: X7R

SECTIONAL SPECIFICATIONS

Climatic category (acc. to EN 60058-1)

Class 1 and 2: 55/125/21

APPROVALS

EIA 198

IEC 60384-9

DESIGN

- The capacitors consist of a general purpose MLCC
- The lead wires are 0.5 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 yellow colored flame retardant epoxy resin in accordance with UL 94 V-0

CAPACITANCE RANGE

10 pF to 1 µF

TOLERANCE ON CAPACITANCE

± 5 %, ± 10 %, ± 20 %

RATED VOLTAGE

50 V_{DC}, 100 V_{DC}, 200 V_{DC}, 500 V_{DC}

TEST VOLTAGE

- 50 V_{DC} and 100 V_{DC}: 250 % of rated voltage
- 200 V_{DC}: 150 % of rated voltage + 100 V_{DC}
- 500 V_{DC}: 130 % of rated voltage + 100 V_{DC}

INSULATION RESISTANCE AT RATED VOLTAGE

- 50 V_{DC} and 100 V_{DC}: 100 GΩ or 1000 ΩF, whichever is less at rated voltage within 2 min of charging
- 200 V_{DC}, 500 V_{DC}, and size 10: 10 GΩ or 100 ΩF, whichever is less at rated voltage within 2 min of charging

DISSIPATION FACTOR

Class 1: 0.1 % max. when C ≥ 30 pF (at 1 MHz; 1 V where C ≤ 1000 pF, and at 1 kHz; 1 V where C > 1000 pF)

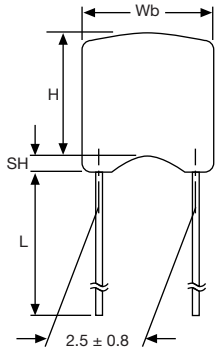
For C < 30 pF: DF = 100/(400 + 20 x C)
DF = dissipation factor in %;
C = capacitance value in pF

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

For technical questions, contact: cmll@vishay.com

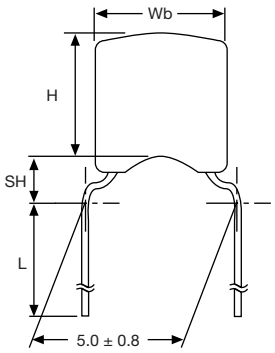
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LEAD CONFIGURATION AND DIMENSIONS (in millimeters)



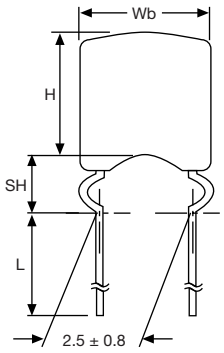
L2

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



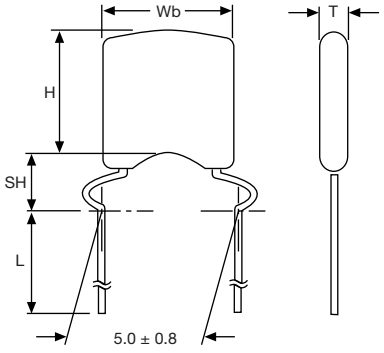
H5

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)

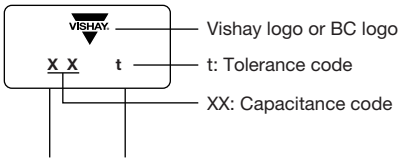
SIZE CODE	$Wb_{MAX.}$	$H_{MAX.}$	$T_{MAX.}$	MAXIMUM SEATING HEIGHT (SH)			
				L2	H5	K2	K5
10	3.6	3.6	2.3	1.6	2.6	3.5	-
15	4.0	4.0	2.6	1.6	2.6	3.5	3.5
20	5.0	5.0	3.2	1.6	2.6	3.5	3.5

Notes

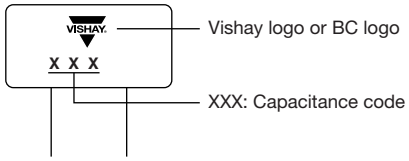
- Bulk packed types have a standard lead length L = 30 mm ± 5 mm
- The K5 lead style is not available for size 10
- L2 and H5 are preferred styles

MARKING

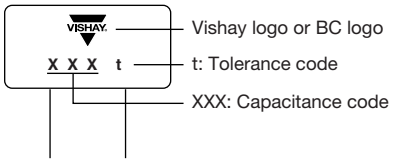
SIZE 10 AND 15 CAPACITANCE VALUE < 100 pF



SIZE 10 AND 15 CAPACITANCE VALUE ≥ 100 pF



SIZE 20



Notes

- The capacitance code indicates actual capacitance in pF when capacitance value < 100 pF
- 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
1	2 3 4	5	6 7	8 9 10	11	12	13	14	15
Product Type	**Capacitance (pF)**	**Capacitance Tolerance**	**Size Code**	**T.C. Code**	**Rated Voltage**	**Lead Diameter**	**Packaging / Lead Length**	**Lead Style**	**Lead Spacing**
K = radial leaded MLCC	The first two digits are the significant figures of capacitance and the last digit is a multiplier as follows: 0 = * 1 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} L = 500 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

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ORDERING CODES

DIELECTRIC C0G						
CAP. (pF)	50 V_{DC}		100 V_{DC}		200 V_{DC}	500 V_{DC}
	SMALLER SIZE	NORMAL SIZE	SMALLER SIZE	NORMAL SIZE	NORMAL SIZE	NORMAL SIZE
10	K100#10C0GF5###	K100#15C0GF5###	K100#10C0GH5###	K100#15C0GH5###	-	-
12	K120#10C0GF5###	K120#15C0GF5###	K120#10C0GH5###	K120#15C0GH5###	-	-
15	K150#10C0GF5###	K150#15C0GF5###	K150#10C0GH5###	K150#15C0GH5###	-	-
18	K180#10C0GF5###	K180#15C0GF5###	K180#10C0GH5###	K180#15C0GH5###	-	-
22	K220#10C0GF5###	K220#15C0GF5###	K220#10C0GH5###	K220#15C0GH5###	-	-
27	K270#10C0GF5###	K270#15C0GF5###	K270#10C0GH5###	K270#15C0GH5###	-	-
33	K330#10C0GF5###	K330#15C0GF5###	K330#10C0GH5###	K330#15C0GH5###	K330#15C0GK5###	K330#15C0GL5##5
39	K390#10C0GF5###	K390#15C0GF5###	K390#10C0GH5###	K390#15C0GH5###	K390#15C0GK5###	K390#15C0GL5##5
47	K470#10C0GF5###	K470#15C0GF5###	K470#10C0GH5###	K470#15C0GH5###	K470#15C0GK5###	K470#15C0GL5##5
56	K560#10C0GF5###	K560#15C0GF5###	K560#10C0GH5###	K560#15C0GH5###	K560#15C0GK5###	K560#15C0GL5##5
68	K680#10C0GF5###	K680#15C0GF5###	K680#10C0GH5###	K680#15C0GH5###	K680#15C0GK5###	K680#15C0GL5##5
82	K820#10C0GF5###	K820#15C0GF5###	K820#10C0GH5###	K820#15C0GH5###	K820#15C0GK5###	K820#15C0GL5##5
100	K101#10C0GF5###	K101#15C0GF5###	K101#10C0GH5###	K101#15C0GH5###	K101#15C0GK5###	K101#15C0GL5##5
120	K121#10C0GF5###	K121#15C0GF5###	K121#10C0GH5###	K121#15C0GH5###	K121#15C0GK5###	K121#15C0GL5##5
150	K151#10C0GF5###	K151#15C0GF5###	K151#10C0GH5###	K151#15C0GH5###	K151#15C0GK5###	K151#15C0GL5##5
180	K181#10C0GF5###	K181#15C0GF5###	K181#10C0GH5###	K181#15C0GH5###	K181#15C0GK5###	K181#15C0GL5##5
220	K221#10C0GF5###	K221#15C0GF5###	K221#10C0GH5###	K221#15C0GH5###	K221#15C0GK5###	K221#15C0GL5##5
270	K271#10C0GF5###	K271#15C0GF5###	K271#10C0GH5###	K271#15C0GH5###	K271#15C0GK5###	K271#15C0GL5##5
330	K331#10C0GF5###	K331#15C0GF5###	K331#10C0GH5###	K331#15C0GH5###	K331#15C0GK5###	K331#15C0GL5##5
390	K391#10C0GF5###	K391#15C0GF5###	K391#10C0GH5###	K391#15C0GH5###	K391#15C0GK5###	K391#15C0GL5##5
470	K471#10C0GF5###	K471#15C0GF5###	K471#10C0GH5###	K471#15C0GH5###	K471#15C0GK5###	K471#20C0GL5##5
560	K561#10C0GF5###	K561#15C0GF5###	K561#10C0GH5###	K561#15C0GH5###	K561#15C0GK5###	K561#20C0GL5##5
680	K681#10C0GF5###	K681#15C0GF5###	-	K681#15C0GH5###	K681#15C0GK5###	K681#20C0GL5##5
820	K821#10C0GF5###	K821#15C0GF5###	-	K821#15C0GH5###	K821#15C0GK5###	K821#20C0GL5##5
1000	K102#10C0GF5###	K102#15C0GF5###	-	K102#20C0GH5###	K102#20C0GK5###	K102#20C0GL5##5
1200	-	K122#15C0GF5###	-	K122#20C0GH5###	K122#20C0GK5###	K122#20C0GL5##5
1500	-	K152#15C0GF5###	-	K152#20C0GH5###	K152#20C0GK5###	K152#20C0GL5##5
1800	-	K182#15C0GF5###	-	K182#20C0GH5###	K182#20C0GK5###	K182#20C0GL5##5
2200	-	K222#15C0GF5###	-	K222#20C0GH5###	K222#20C0GK5###	-
2700	-	K272#20C0GF5###	-	K272#20C0GH5###	K272#20C0GK5###	-
3300	-	K332#20C0GF5###	-	K332#20C0GH5###	K332#20C0GK5###	-
3900	-	K392#20C0GF5###	-	K392#20C0GH5###	K392#20C0GK5###	-
4700	-	K472#20C0GF5###	-	K472#20C0GH5###	-	-
5600	-	K562#20C0GF5###	-	K562#20C0GH5###	-	-
6800	-	K682#20C0GF5###	-	-	-	-
8200	-	K822#20C0GF5###	-	-	-	-
10 000	-	K103#20C0GF5###	-	-	-	-

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

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DIELECTRIC X7R						
CAP. (pF)	50 V_{DC}		100 V_{DC}		200 V_{DC}	500 V_{DC}
	SMALLER SIZE	NORMAL SIZE	SMALLER SIZE	NORMAL SIZE	NORMAL SIZE	NORMAL SIZE
100	K101#10X7RF5###	K101#15X7RF5###	K101#10X7RH5###	K101#15X7RH5###	K101#15X7RK5###	K101#15X7RL5##5
120	K121#10X7RF5###	K121#15X7RF5###	K121#10X7RH5###	K121#15X7RH5###	K121#15X7RK5###	K121#15X7RL5##5
150	K151#10X7RF5###	K151#15X7RF5###	K151#10X7RH5###	K151#15X7RH5###	K151#15X7RK5###	K151#15X7RL5##5
180	K181#10X7RF5###	K181#15X7RF5###	K181#10X7RH5###	K181#15X7RH5###	K181#15X7RK5###	K181#15X7RL5##5
220	K221#10X7RF5###	K221#15X7RF5###	K221#10X7RH5###	K221#15X7RH5###	K221#15X7RK5###	K221#15X7RL5##5
270	K271#10X7RF5###	K271#15X7RF5###	K271#10X7RH5###	K271#15X7RH5###	K271#15X7RK5###	K271#15X7RL5##5
330	K331#10X7RF5###	K331#15X7RF5###	K331#10X7RH5###	K331#15X7RH5###	K331#15X7RK5###	K331#15X7RL5##5
390	K391#10X7RF5###	K391#15X7RF5###	K391#10X7RH5###	K391#15X7RH5###	K391#15X7RK5###	K391#15X7RL5##5
470	K471#10X7RF5###	K471#15X7RF5###	K471#10X7RH5###	K471#15X7RH5###	K471#15X7RK5###	K471#15X7RL5##5
560	K561#10X7RF5###	K561#15X7RF5###	K561#10X7RH5###	K561#15X7RH5###	K561#15X7RK5###	K561#15X7RL5##5
680	K681#10X7RF5###	K681#15X7RF5###	K681#10X7RH5###	K681#15X7RH5###	K681#15X7RK5###	K681#15X7RL5##5
820	K821#10X7RF5###	K821#15X7RF5###	K821#10X7RH5###	K821#15X7RH5###	K821#15X7RK5###	K821#15X7RL5##5
1000	K102#10X7RF5###	K102#15X7RF5###	K102#10X7RH5###	K102#15X7RH5###	K102#15X7RK5###	K102#15X7RL5##5
1200	K122#10X7RF5###	K122#15X7RF5###	K122#10X7RH5###	K122#15X7RH5###	K122#15X7RK5###	K122#15X7RL5##5
1500	K152#10X7RF5###	K152#15X7RF5###	K152#10X7RH5###	K152#15X7RH5###	K152#15X7RK5###	K152#15X7RL5##5
1800	K182#10X7RF5###	K182#15X7RF5###	K182#10X7RH5###	K182#15X7RH5###	K182#15X7RK5###	K182#15X7RL5##5
2200	K222#10X7RF5###	K222#15X7RF5###	K222#10X7RH5###	K222#15X7RH5###	K222#15X7RK5###	K222#15X7RL5##5
2700	K272#10X7RF5###	K272#15X7RF5###	K272#10X7RH5###	K272#15X7RH5###	K272#15X7RK5###	K272#15X7RL5##5
3300	K332#10X7RF5###	K332#15X7RF5###	K332#10X7RH5###	K332#15X7RH5###	K332#15X7RK5###	K332#20X7RL5##5
3900	K392#10X7RF5###	K392#15X7RF5###	K392#10X7RH5###	K392#15X7RH5###	K392#15X7RK5###	K392#20X7RL5##5
4700	K472#10X7RF5###	K472#15X7RF5###	K472#10X7RH5###	K472#15X7RH5###	K472#15X7RK5###	K472#20X7RL5##5
5600	K562#10X7RF5###	K562#15X7RF5###	K562#10X7RH5###	K562#15X7RH5###	K562#15X7RK5###	K562#20X7RL5##5
6800	K682#10X7RF5###	K682#15X7RF5###	K682#10X7RH5###	K682#15X7RH5###	K682#15X7RK5###	K682#20X7RL5##5
8200	K822#10X7RF5###	K822#15X7RF5###	K822#10X7RH5###	K822#15X7RH5###	K822#15X7RK5###	K822#20X7RL5##5
10 000	K103#10X7RF5###	K103#15X7RF5###	K103#10X7RH5###	K103#15X7RH5###	K103#15X7RK5###	K103#20X7RL5##5
12 000	K123#10X7RF5###	K123#15X7RF5###	-	K123#15X7RH5###	K123#15X7RK5###	K123#20X7RL5##5
15 000	K153#10X7RF5###	K153#15X7RF5###	-	K153#15X7RH5###	K153#15X7RK5###	K153#20X7RL5##5
18 000	K183#10X7RF5###	K183#15X7RF5###	-	K183#15X7RH5###	K183#15X7RK5###	K183#20X7RL5##5
22 000	K223#10X7RF5###	K223#15X7RF5###	-	K223#15X7RH5###	K223#15X7RK5###	K223#20X7RL5##5
27 000	K273#10X7RF5###	K273#15X7RF5###	-	K273#20X7RH5###	K273#20X7RK5###	K273#20X7RL5##5
33 000	K333#10X7RF5###	K333#15X7RF5###	-	K333#20X7RH5###	K333#20X7RK5###	K333#20X7RL5##5
39 000	K393#10X7RF5###	K393#15X7RF5###	-	K393#20X7RH5###	K393#20X7RK5###	K393#20X7RL5##5
47 000	K473#10X7RF5###	K473#15X7RF5###	-	K473#20X7RH5###	K473#20X7RK5###	K473#20X7RL5##5
56 000	K563#10X7RF5###	K563#15X7RF5###	-	K563#20X7RH5###	K563#20X7RK5###	-
68 000	K683#10X7RF5###	K683#15X7RF5###	-	K683#20X7RH5###	K683#20X7RK5###	-
82 000	K823#10X7RF5###	K823#15X7RF5###	-	K823#20X7RH5###	K823#20X7RK5###	-
100 000	K104#10X7RF5###	K104#15X7RF5###	-	K104#20X7RH5###	K104#20X7RK5###	-
150 000	-	K154#20X7RF5###	-	K154#20X7RH5###	K154#20X7RK5###	-
220 000	-	K224#20X7RF5###	-	K224#20X7RH5###	K224#20X7RK5###	-
330 000	-	K334#20X7RF5###	-	K334#20X7RH5###	-	-
470 000	-	K474#20X7RF5###	-	K474#20X7RH5###	-	-
560 000	-	K564#20X7RF5###	-	K564#20X7RH5###	-	-
680 000	-	K684#20X7RF5###	-	-	-	-
1 000 000	-	K105#20X7RF5###	-	-	-	-

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

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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	10, 15	4000	370 x 370 x 60
	20	3000	
Ammopack	10, 15, 20	2500	335 x 290 x 50
Bulk [1]	10, 15, 20	5000	245 x 120 x 65

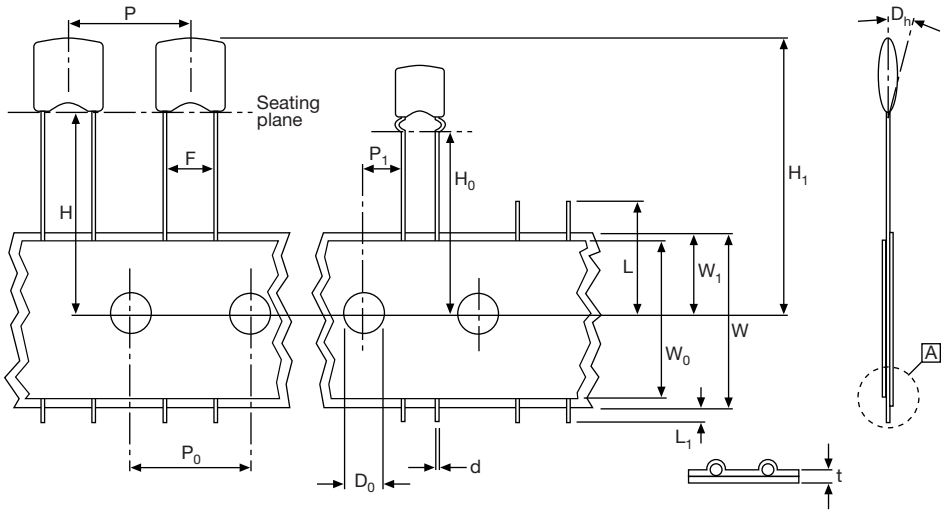
Note

[1] SPQ contains one or a multiple of poly-bags, 1000 units per bag

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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 ± 0.3	0.500 ± 0.012
Sprocket hole center to lead center at F = 2.5 mm	P_1	5.08 ± 0.7	0.200 ± 0.028
Sprocket hole center to lead center at F = 5 mm		3.85 ± 0.7	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.

For technical questions, contact: cmll@vishay.com

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REEL DATA

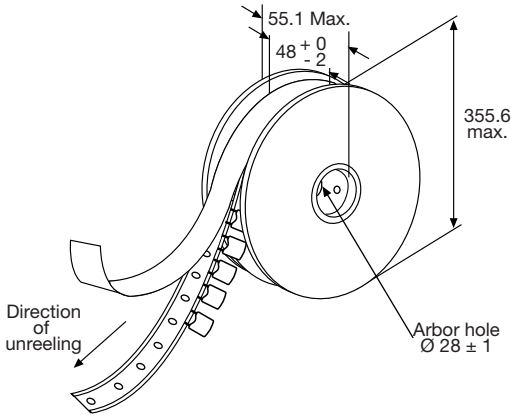
A maximum of 0.5 % of the total number of capacitors per reel may be missing.

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

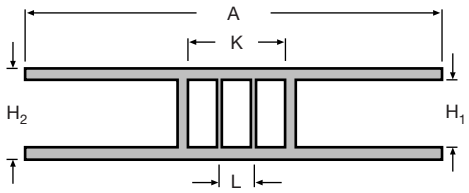
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

Maximum of 5 splicers per reel.

REEL



REEL DIMENSIONS



REEL SIZE		(mm)
A	Outer diameter	355.6 max.
L	Hole diameter	28 ± 1.5
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 box may be missing.

A maximum of 2 consecutive vacant positions is followed by 6 consecutive components.

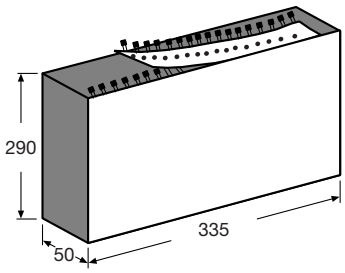
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

Maximum of 5 splicers per reel.

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?45163

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