

# Axial Leaded Multilayer Ceramic Capacitors for Automotive Applications

## Class 1 and Class 2, 50 V<sub>DC</sub>, 100 V<sub>DC</sub>, 200 V<sub>DC</sub>



### 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
- Axial mounting style
- Parts compliant with ELV directive
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### APPLICATIONS

- Automotive

### QUICK REFERENCE DATA

DESCRIPTION	VALUE					
Ceramic class	1			2		
Ceramic dielectric	C0G			X7R		
Voltage (V <sub>DC</sub> )	50	100	200	50	100	200
Min. capacitance (pF)	100	100	100	330	330	330
Max. capacitance (pF)	12 000	12 000	8200	1 000 000	470 000	180 000
Mounting	Axial					

### MARKING

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

### OPERATING TEMPERATURE RANGE

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

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
- 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<sub>DC</sub>, 100 V<sub>DC</sub>, 200 V<sub>DC</sub>

### TEST VOLTAGE

- 50 V<sub>DC</sub> and 100 V<sub>DC</sub>: 250 % of rated voltage
- 200 V<sub>DC</sub>: 200 % of rated voltage

### INSULATION RESISTANCE

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

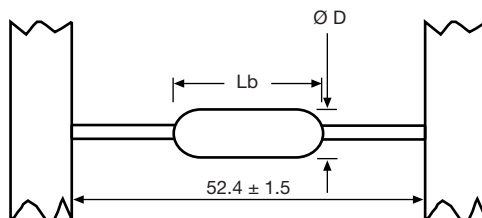
### DISSIPATION FACTOR

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.

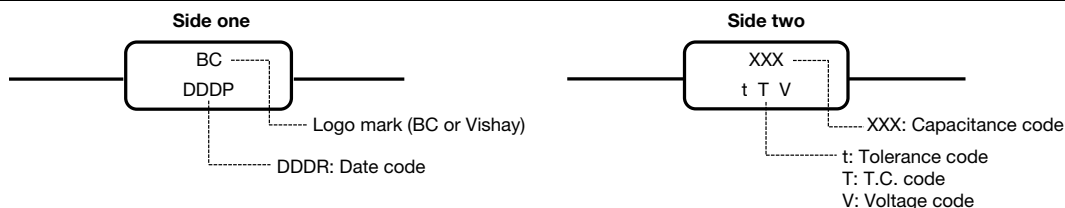
(at 1 kHz, 1 V)

**DIMENSIONS** (in millimeters)


SIZE CODE	Lb <sub>MAX.</sub>	ØD <sub>MAX.</sub>
15	3.8	2.6
20	5.1	3.1

**Note**

- The leads are matte tinned FeCu wire

**MARKING**

**MARKING CODE DESCRIPTION**

DDD	XXX	t	V	T
Date Code	Capacitance Code	Tolerance Code	Voltage Code	T.C. Code
The first digit is the year, the last two digits are the week. For example: 109 = 2011, 9 <sup>th</sup> week 217 = 2012, 17 <sup>th</sup> week	Two significant digits followed by one digit for the multiplier as given below. 1 = * 10, 2 = * 100, 3 = * 1000, 4 = * 10 000, 5 = * 100 000	J = ± 5 % K = ± 10 % M = ± 20 %	1 = 100 V 2 = 200 V 5 = 50 V	A = C0G (NP0) C = X7R

**ORDERING CODE INFORMATION**

A	104	K	15	X7R	F	5	TAA	P
1	2 3 4	5	6 7	8 9 10	11	12	13 14 15	16
Product Type	Capacitance (pF)	Capacitance Tolerance	Size Code	TC Code	Rated Voltage	Lead Diameter	Packaging	AEC-Q200 Qualified
A = axial 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 <sub>DC</sub> H = 100 V <sub>DC</sub> K = 200 V <sub>DC</sub>	5 = 0.50 mm ± 0.05 mm	TAA = reel UAA = ammo	P = AEC-Q200 qualified and lead (Pb)-free



## ORDERING CODES

DIELECTRIC C0G			
CAP. (pF)	50 V <sub>DC</sub>	100 V <sub>DC</sub>	200 V <sub>DC</sub>
100	A101#15C0GF5###P	A101#15C0GH5###P	A101#15C0GK5###P
120	A121#15C0GF5###P	A121#15C0GH5###P	A121#15C0GK5###P
150	A151#15C0GF5###P	A151#15C0GH5###P	A151#15C0GK5###P
180	A181#15C0GF5###P	A181#15C0GH5###P	A181#15C0GK5###P
220	A221#15C0GF5###P	A221#15C0GH5###P	A221#15C0GK5###P
270	A271#15C0GF5###P	A271#15C0GH5###P	A271#15C0GK5###P
330	A331#15C0GF5###P	A331#15C0GH5###P	A331#15C0GK5###P
390	A391#15C0GF5###P	A391#15C0GH5###P	A391#15C0GK5###P
470	A471#15C0GF5###P	A471#15C0GH5###P	A471#15C0GK5###P
560	A561#15C0GF5###P	A561#15C0GH5###P	A561#15C0GK5###P
680	A681#15C0GF5###P	A681#15C0GH5###P	A681#15C0GK5###P
820	A821#15C0GF5###P	A821#15C0GH5###P	A821#15C0GK5###P
1000	A102#15C0GF5###P	A102#15C0GH5###P	A102#15C0GK5###P
1200	A122#15C0GF5###P	A122#15C0GH5###P	A122#20C0GK5###P
1500	A152#15C0GF5###P	A152#15C0GH5###P	A152#20C0GK5###P
1800	A182#15C0GF5###P	A182#15C0GH5###P	A182#20C0GK5###P
2200	A222#15C0GF5###P	A222#20C0GH5###P	A222#20C0GK5###P
2700	A272#15C0GF5###P	A272#20C0GH5###P	A272#20C0GK5###P
3300	A332#15C0GF5###P	A332#20C0GH5###P	A332#20C0GK5###P
3900	A392#15C0GF5###P	A392#20C0GH5###P	A392#20C0GK5###P <sup>(1)</sup>
4700	A472#20C0GF5###P	A472#20C0GH5###P	A472#20C0GK5###P <sup>(1)</sup>
5600	A562#20C0GF5###P	A562#20C0GH5###P	A562#20C0GK5###P <sup>(1)</sup>
6800	A682#20C0GF5###P	A682#20C0GH5###P	A682#20C0GK5###P <sup>(1)</sup>
8200	A822#20C0GF5###P	A822#20C0GH5###P	A822#20C0GK5###P <sup>(1)</sup>
12 000	A123#20C0GF5###P <sup>(1)</sup>	A123#20C0GH5###P <sup>(1)</sup>	-

## Notes

- Lead diameter is 0.5 mm
- # 5<sup>th</sup> digit is capacitance tolerance code:  $\pm 5\%$  = J;  $\pm 10\%$  = K
- # 13<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> digits are packaging code: reel = TAA; ammo = UAA

<sup>(1)</sup> Ø D is 4.5 mm max.



DIELECTRIC X7R			
CAP. (pF)	50 V <sub>DC</sub>	100 V <sub>DC</sub>	200 V <sub>DC</sub>
330	A331#15X7RF5###P	A331#15X7RH5###P	A331#15X7RK5###P
390	A391#15X7RF5###P	A391#15X7RH5###P	A391#15X7RK5###P
470	A471#15X7RF5###P	A471#15X7RH5###P	A471#15X7RK5###P
560	A561#15X7RF5###P	A561#15X7RH5###P	A561#15X7RK5###P
680	A681#15X7RF5###P	A681#15X7RH5###P	A681#15X7RK5###P
820	A821#15X7RF5###P	A821#15X7RH5###P	A821#15X7RK5###P
1000	A102#15X7RF5###P	A102#15X7RH5###P	A102#15X7RK5###P
1200	A122#15X7RF5###P	A122#15X7RH5###P	A122#15X7RK5###P
1500	A152#15X7RF5###P	A152#15X7RH5###P	A152#15X7RK5###P
1800	A182#15X7RF5###P	A182#15X7RH5###P	A182#15X7RK5###P
2200	A222#15X7RF5###P	A222#15X7RH5###P	A222#15X7RK5###P
2700	A272#15X7RF5###P	A272#15X7RH5###P	A272#15X7RK5###P
3300	A332#15X7RF5###P	A332#15X7RH5###P	A332#15X7RK5###P
3900	A392#15X7RF5###P	A392#15X7RH5###P	A392#15X7RK5###P
4700	A472#15X7RF5###P	A472#15X7RH5###P	A472#15X7RK5###P
5600	A562#15X7RF5###P	A562#15X7RH5###P	A562#15X7RK5###P
6800	A682#15X7RF5###P	A682#15X7RH5###P	A682#15X7RK5###P
8200	A822#15X7RF5###P	A822#15X7RH5###P	A822#15X7RK5###P
10 000	A103#15X7RF5###P	A103#15X7RH5###P	A103#15X7RK5###P
12 000	A123#15X7RF5###P	A123#15X7RH5###P	A123#15X7RK5###P
15 000	A153#15X7RF5###P	A153#15X7RH5###P	A153#15X7RK5###P
18 000	A183#15X7RF5###P	A183#15X7RH5###P	A183#15X7RK5###P
22 000	A223#15X7RF5###P	A223#15X7RH5###P	A223#15X7RK5###P
27 000	A273#15X7RF5###P	A273#15X7RH5###P	A273#15X7RK5###P
33 000	A333#15X7RF5###P	A333#15X7RH5###P	A333#20X7RK5###P
39 000	A393#15X7RF5###P	A393#15X7RH5###P	A393#20X7RK5###P
47 000	A473#15X7RF5###P	A473#15X7RH5###P	A473#20X7RK5###P
56 000	A563#15X7RF5###P	A563#15X7RH5###P	A563#20X7RK5###P
68 000	A683#15X7RF5###P	A683#15X7RH5###P	A683#20X7RK5###P
82 000	A823#15X7RF5###P	A823#15X7RH5###P	A823#20X7RK5###P
100 000	A104#15X7RF5###P	A104#15X7RH5###P	A104#20X7RK5###P
120 000	A124#15X7RF5###P	A124#20X7RH5###P	A124#20X7RK5###P
150 000	A154#20X7RF5###P	A154#20X7RH5###P	A154#20X7RK5###P <sup>(1)</sup>
180 000	A184#20X7RF5###P	A184#20X7RH5###P	A184#20X7RK5###P <sup>(1)</sup>
220 000	A224#20X7RF5###P	A224#20X7RH5###P	-
270 000	A274#20X7RF5###P	A274#20X7RH5###P	-
330 000	A334#20X7RF5###P	A334#20X7RH5###P <sup>(1)</sup>	-
390 000	A394#20X7RF5###P	A394#20X7RH5###P <sup>(1)</sup>	-
470 000	A474#20X7RF5###P	A474#20X7RH5###P <sup>(1)</sup>	-
560 000	A564#20X7RF5###P <sup>(1)</sup>	-	-
680 000	A684#20X7RF5###P <sup>(1)</sup>	-	-
820 000	A824#20X7RF5###P <sup>(1)</sup>	-	-
1 000 000	A105#20X7RF5###P <sup>(1)</sup>	-	-

**Notes**

- Lead diameter is 0.5 mm
- # 5<sup>th</sup> digit is capacitance tolerance code:  $\pm 10\%$  = K;  $\pm 20\%$  = M
- # 13<sup>th</sup>, 14<sup>th</sup> and 15<sup>th</sup> digits are packaging code: reel = TAA; ammo = UAA

<sup>(1)</sup> Ø D is 4.5 mm max.

### TAPING AND PACKAGING

#### LABELLING

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

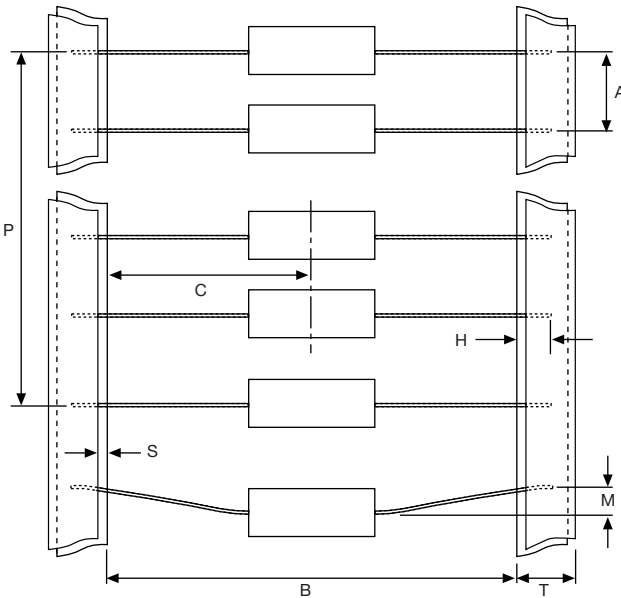
manufacturer, A style, capacitance, tolerance, batch number, quantity of components, rated voltage, dielectric.

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, 20	7000	370 x 370 x 90
	Ordering code marked with <sup>(1)</sup>	5000	
Ammopack	15, 20	4000	265 x 85 x 95
	Ordering code marked with <sup>(1)</sup>	2000	

CAPACITORS ON BANDOLIER FOR DIPPED AXIAL			
			
PARAMETER	SYMBOL	DIMENSIONS	
		mm	INCH
Inside tape spacing	B <sup>(1)</sup>	52.4 ± 1.5	2.062 ± 0.059
Center to tape spacing	C	± 0.8	± 0.031
Cumulative pitch, 6 consecutive components	P	± 1.5	± 0.059
Components pitch	A	5.0 ± 0.5	0.197 ± 0.015
Lead bend	M	< 1.2	< 0.047
Exposed adhesive	S	< 0.51	> 0.020
Tape width	T	6.35	0.250
Lead sandwich	H	> 3.96	> 0.156

#### Note

<sup>(1)</sup> Inside tape spacing 26.0 mm + 1.51 mm/- 0.0 mm is available on request

## REEL DATA

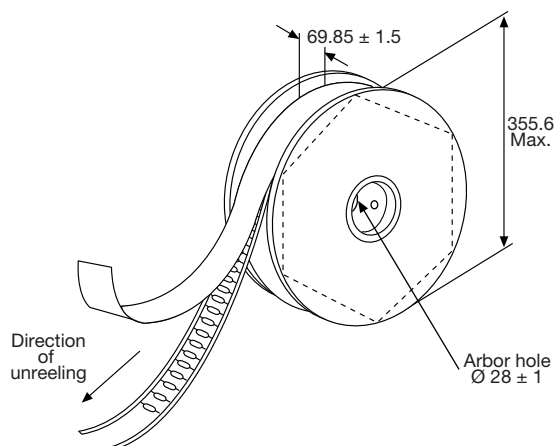
A maximum of 0.5 % of the total number of capacitors per reel may be missing.

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

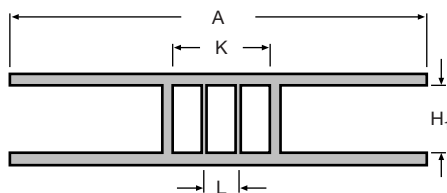
Tape begins and ends with a minimum of 4 empty positions (180 mm tape).

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 <sub>1</sub>	Internal width	69.9 ± 1.5

## AMMOPACK DATA

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

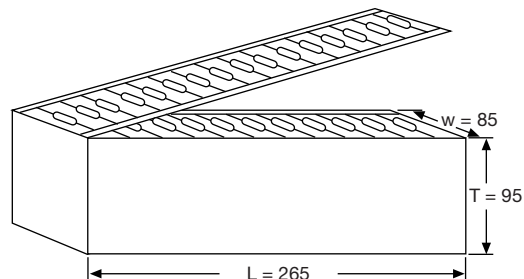
A maximum of 1 consecutive vacant positions is followed by 6 consecutive components.

Tape begins and ends with a minimum of 4 empty positions (180 mm tape).

Maximum of 5 splicers per pack.

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

## AMMOPACK



## RELATED DOCUMENTS

General Information

[www.vishay.com/doc?45214](http://www.vishay.com/doc?45214)



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<a href="#"><u>A104K15X7RH5UAAP</u></a>	<a href="#"><u>A473K15X7RF5UAAP</u></a>	<a href="#"><u>A474K20X7RF5UAAP</u></a>	<a href="#"><u>A331K15X7RF5UAAP</u></a>	<a href="#"><u>A333K15X7RH5UAAP</u></a>
<a href="#"><u>A333K20X7RK5UAAP</u></a>	<a href="#"><u>A471K15X7RF5UAAP</u></a>	<a href="#"><u>A472J20C0GK5UAAP</u></a>	<a href="#"><u>A472K15X7RF5UAAP</u></a>	<a href="#"><u>A104K20X7RK5UAAP</u></a>
<a href="#"><u>A105K20X7RF5UAAP</u></a>	<a href="#"><u>A222K15X7RF5UAAP</u></a>	<a href="#"><u>A222K15X7RK5UAAP</u></a>	<a href="#"><u>A223K15X7RF5UAAP</u></a>	<a href="#"><u>A224K20X7RF5UAAP</u></a>