

Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications

Class 1 and Class 2, 50 V_{DC}, 100 V_{DC}, 200 V_{DC}



FEATURES

- Good performance for motor driver and sensor
- AEC-Q200 qualified with PPAP available
- Alleviation for mechanical stress
- Assembly friendly
- Parts compliant with ELV directive
- Material categorization:
for definitions of compliance please see
www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Automotive
- Motor driver and sensor
- Speed sensor
- Wiper motor
- Power window motor

QUICK REFERENCE DATA

DESCRIPTION	VALUE					
Ceramic class	1			2		
Ceramic dielectric	C0G			X7R		
Voltage (V _{DC})	50	100	200	50	100	200
Min. capacitance (pF)	10	10	10	100	100	100
Max. capacitance (pF)	47 000	47 000	15 000	1 000 000	220 000	22 000
Mounting	Radial					

MARKING

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

OPERATING TEMPERATURE RANGE

-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

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

10 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

≥ 10 GΩ or R x C ≥ 100 ΩF whichever is less at rated voltage within 2 min of charging.

DISSIPATION FACTOR OR Q VALUE

Class 1:cap. ≥ 30 pF, Q ≥ 1000

cap. < 30 pF, Q ≥ 400 + 20C

(at 1 MHz, 1 V where C ≤ 1000 pF;

at 1 kHz; 1 V where C > 1000 pF)

Class 2:DF ≤ 2.5 %, cap. < 0.18 µF

DF ≤ 3.0 %, cap. ≥ 0.18 µF

(at 1 kHz, 1 V)

LEAD CONFIGURATION AND LEAD CONFIDIMENSIONS (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	3.8	3.8	2.6	0.50 ± 0.05	1.6	2.6	3.5	3.5
20	5.1	5.1	3.2	0.60 ± 0.05	1.6	2.6	3.5	3.5
20* ⁽¹⁾	5.5	5.5	4.0	0.60 ± 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
- ⁽¹⁾ Please refer to "Ordering Codes"

MARKING

SIZE 15 Side one 		SIZE 20 Side one 	
Side two 		Side two 	

Notes

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

ORDERING CODE INFORMATION

MDSK	104	K	15	X	F	5	3	H	5
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
MDSK = radial leaded MLCC	The first two digits are the significant figures of capacitance and the last digit is a multiplier as follows: 1 = x 10 2 = x 100 3 = x 1000 4 = x 10 000 5 = x 100 000	J = ± 5 % K = ± 10 % M = ± 20 %	Please refer to relevant datasheet	X stands for X7R C stands for C0G	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



ORDERING CODES

DIELECTRIC COG			
CAP. (pF)	50 V _{DC}	100 V _{DC}	200 V _{DC}
10	MDSK100#15CF5###	MDSK100#15CH5###	MDSK100#15CK5###
12	MDSK120#15CF5###	MDSK120#15CH5###	MDSK120#15CK5###
15	MDSK150#15CF5###	MDSK150#15CH5###	MDSK150#15CK5###
18	MDSK180#15CF5###	MDSK180#15CH5###	MDSK180#15CK5###
22	MDSK220#15CF5###	MDSK220#15CH5###	MDSK220#15CK5###
27	MDSK270#15CF5###	MDSK270#15CH5###	MDSK270#15CK5###
33	MDSK330#15CF5###	MDSK330#15CH5###	MDSK330#15CK5###
39	MDSK390#15CF5###	MDSK390#15CH5###	MDSK390#15CK5###
47	MDSK470#15CF5###	MDSK470#15CH5###	MDSK470#15CK5###
56	MDSK560#15CF5###	MDSK560#15CH5###	MDSK560#15CK5###
68	MDSK820#15CF5###	MDSK820#15CH5###	MDSK820#15CK5###
82	MDSK820#15CF5###	MDSK820#15CH5###	MDSK820#15CK5###
100	MDSK101#15CF5###	MDSK101#15CH5###	MDSK101#15CK5###
120	MDSK121#15CF5###	MDSK121#15CH5###	MDSK121#15CK5###
150	MDSK151#15CF5###	MDSK151#15CH5###	MDSK151#15CK5###
180	MDSK181#15CF5###	MDSK181#15CH5###	MDSK181#15CK5###
220	MDSK221#15CF5###	MDSK221#15CH5###	MDSK221#15CK5###
270	MDSK271#15CF5###	MDSK271#15CH5###	MDSK271#15CK5###
330	MDSK331#15CF5###	MDSK331#15CH5###	MDSK331#15CK5###
390	MDSK391#15CF5###	MDSK391#15CH5###	MDSK391#15CK5###
470	MDSK471#15CF5###	MDSK471#15CH5###	MDSK471#15CK5###
560	MDSK561#15CF5###	MDSK561#15CH5###	MDSK561#15CK5###
680	MDSK681#15CF5###	MDSK681#15CH5###	MDSK681#15CK5###
820	MDSK821#15CF5###	MDSK821#15CH5###	MDSK821#15CK5###
1000	MDSK102#15CF5###	MDSK102#15CH5###	MDSK102#15CK5###
1200	MDSK122#15CF5###	MDSK122#15CH5###	MDSK122#15CK5###
1500	MDSK152#15CF5###	MDSK152#15CH5###	MDSK152#15CK5###
1800	MDSK182#15CF5###	MDSK182#15CH5###	MDSK182#15CK5###
2200	MDSK222#15CF5###	MDSK222#15CH5###	MDSK222#15CK5###
2700	MDSK272#15CF5###	MDSK272#15CH5###	MDSK272#15CK5###
3300	MDSK332#15CF5###	MDSK332#15CH5###	MDSK332#15CK5###
3900	MDSK392#15CF5###	MDSK392#15CH5###	MDSK392#15CK5###
4700	MDSK472#15CF5###	MDSK472#15CH5###	MDSK472#15CK5###
5600	MDSK562#15CF5###	MDSK562#15CH5###	MDSK562#20CK5###
6800	MDSK682#15CF5###	MDSK682#15CH5###	MDSK682#20CK5###
8200	MDSK822#15CF5###	MDSK822#15CH5###	MDSK822#20CK5###
10 000	MDSK103#15CF5###	MDSK103#15CH5###	MDSK103#20CH5###
12 000	MDSK123#15CF5###	MDSK123#20CH5###(*)	MDSK123#20CH5###(*)
15 000	MDSK153#15CF5###	MDSK153#20CH5###(*)	MDSK153#20CH5###(*)
18 000	MDSK183#15CF5###	MDSK183#20CH5###(*)	
22 000	MDSK223#15CF5###	MDSK223#20CH5###(*)	
27 000	MDSK273#20CF5###(*)	MDSK273#20CH5###(*)	
33 000	MDSK333#20CF5###(*)	MDSK333#20CH5###(*)	
39 000	MDSK393#20CF5###(*)	MDSK393#20CH5###(*)	
47 000	MDSK473#20CF5###(*)	MDSK473#20CH5###(*)	

Note

- (*) Size code 20*



DIELECTRIC X7R			
CAP. (pF)	50 V _{DC}	100 V _{DC}	200 V _{DC}
100	MDSK101#15XF5###	MDSK101#15XH5###	MDSK101#15XK5###
220	MDSK221#15XF5###	MDSK221#15XH5###	MDSK221#15XK5###
330	MDSK331#15XF5###	MDSK331#15XH5###	MDSK331#15XK5###
390	MDSK391#15XF5###	MDSK391#15XH5###	MDSK391#15XK5###
470	MDSK471#15XF5###	MDSK471#15XH5###	MDSK471#15XK5###
560	MDSK561#15XF5###	MDSK561#15XH5###	MDSK561#15XK5###
680	MDSK681#15XF5###	MDSK681#15XH5###	MDSK681#15XK5###
820	MDSK821#15XF5###	MDSK821#15XH5###	MDSK821#15XK5###
1000	MDSK102#15XF5###	MDSK102#15XH5###	MDSK102#15XK5###
1200	MDSK122#15XF5###	MDSK122#15XH5###	MDSK122#15XK5###
1500	MDSK152#15XF5###	MDSK152#15XH5###	MDSK152#15XK5###
1800	MDSK182#15XF5###	MDSK182#15XH5###	MDSK182#15XK5###
2200	MDSK222#15XF5###	MDSK222#15XH5###	MDSK222#15XK5###
2700	MDSK272#15XF5###	MDSK272#15XH5###	MDSK272#15XK5###
3300	MDSK332#15XF5###	MDSK332#15XH5###	MDSK332#15XK5###
3900	MDSK392#15XF5###	MDSK392#15XH5###	MDSK392#15XK5###
4700	MDSK472#15XF5###	MDSK472#15XH5###	MDSK472#15XK5###
5600	MDSK562#15XF5###	MDSK562#15XH5###	MDSK562#15XK5###
6800	MDSK682#15XF5###	MDSK682#15XH5###	MDSK682#15XK5###
8200	MDSK822#15XF5###	MDSK822#15XH5###	MDSK822#15XK5###
10 000	MDSK103#15XF5###	MDSK103#15XH5###	MDSK103#15XK5###
12 000	MDSK123#15XF5###	MDSK123#15XH5###	MDSK123#15XK5###
15 000	MDSK153#15XF5###	MDSK153#15XH5###	MDSK153#15XK5###
18 000	MDSK183#15XF5###	MDSK183#15XH5###	MDSK183#15XK5###
22 000	MDSK223#15XF5###	MDSK223#15XH5###	MDSK223#15XK5###
27 000	MDSK273#15XF5###	MDSK273#15XH5###	
33 000	MDSK333#15XF5###	MDSK333#15XH5###	
39 000	MDSK393#15XF5###	MDSK393#15XH5###	
47 000	MDSK473#15XF5###	MDSK473#15XH5###	
56 000	MDSK563#15XF5###	MDSK563#15XH5###	
68 000	MDSK683#15XF5###	MDSK683#15XH5###	
82 000	MDSK823#15XF5###	MDSK823#15XH5###	
100 000	MDSK104#15XF5###	MDSK104#15XH5###	
120 000	MDSK124#15XF5###	MDSK124#20XH5###	
150 000	MDSK154#15XF5###	MDSK154#20XH5###	
180 000	MDSK184#15XF5###	MDSK184#20XH5###	
220 000	MDSK224#15XF5###	MDSK224#20XH5###	-
270 000	MDSK274#15XF5###		-
330 000	MDSK334#15XF5###		-
390 000	MDSK394#15XF5###		-
470 000	MDSK474#15XF5###		-
560 000	MDSK564#20XF5###	-	-
680 000	MDSK684#20XF5###	-	-
820 000	MDSK824#20XF5###	-	-
1 000 000	MDSK105#20XF5###	-	-

TAPING AND PACKAGING

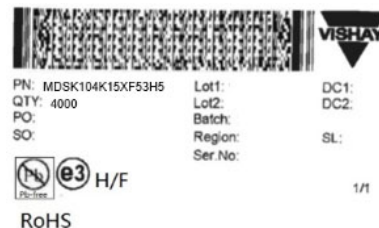
LABELLING

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

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

On special request other designations can be shown.

For example:



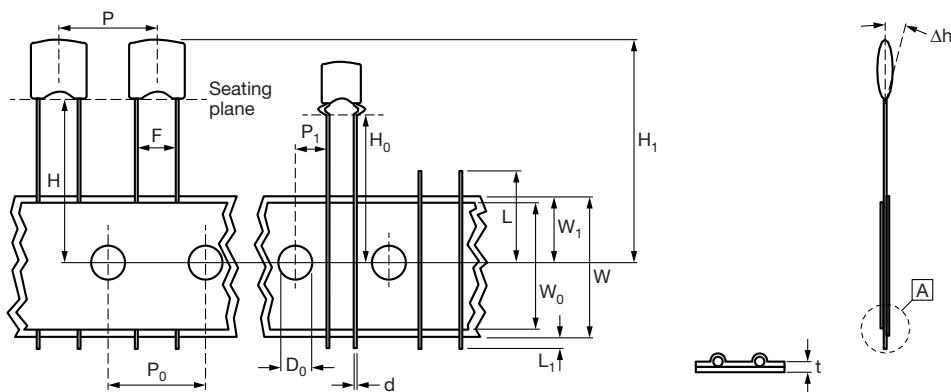
PACKAGING QUANTITIES AND BOX DIMENSIONS

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, 20*	3000	
Ammopack	15, 20, 20*	2500	335 x 290 x 50
Bulk ⁽¹⁾	15, 20, 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

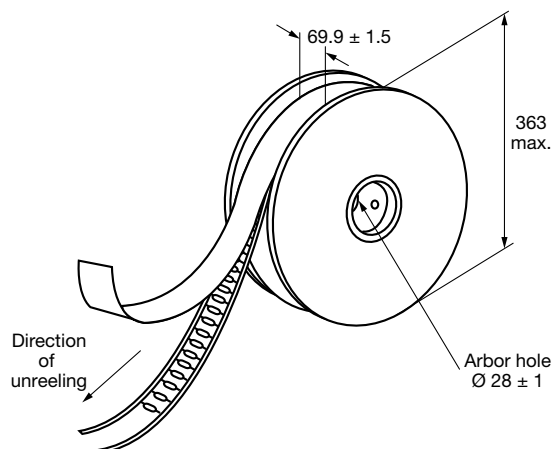
A maximum of 0.5 % of the total number of capacitors per reel may be missing.

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

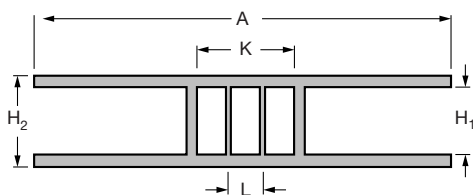
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

Maximum of 5 splicers per reel.

REEL



REEL DIMENSIONS



REEL SIZE		(mm)
A	Outer diameter	363 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.

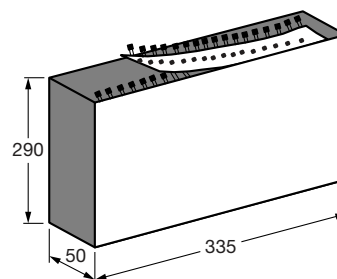
Tape begins and ends with a minimum of 4 empty positions (50 mm tape).

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
---------------------	--



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.