



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 Vishay or BC logo XXX: capacitance code Side two Last 7 digits of lot number				SIZE 20 Side one Vishay or BC logo t: tolerance code XXX: capacitance code Side two Last 7 digits of lot number			
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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

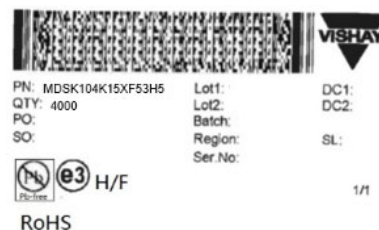
LABELLING

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:



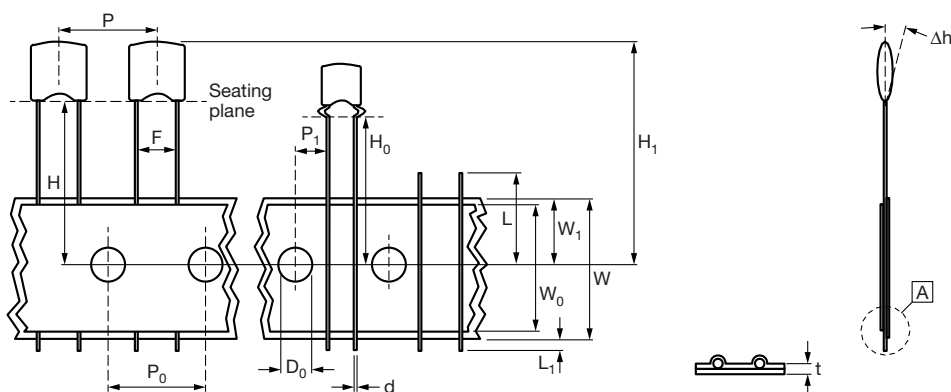
PACKAGING QUANTITIES AND BOX DIMENSIONS

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.

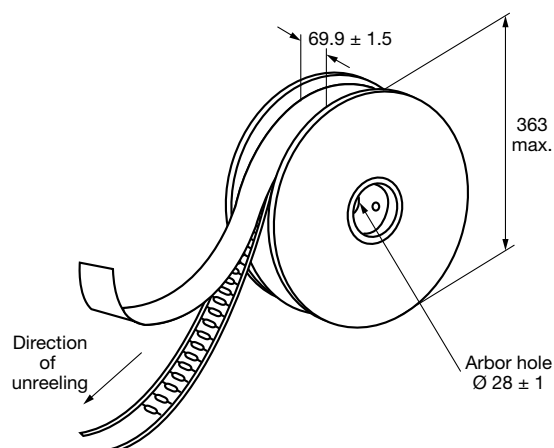
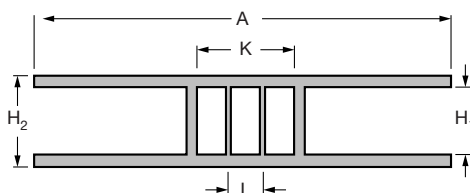
REEL DATA

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.

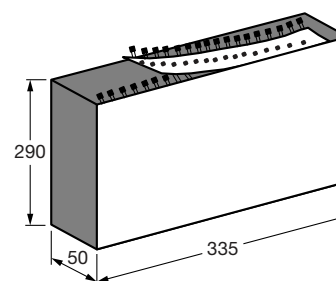
A maximum of 1 consecutive vacant positions is followed by 6 consecutive components.

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
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