

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

 AUTOMOTIVE
GRADE

RoHS*
Available

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 | COG | | | 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: COG

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.

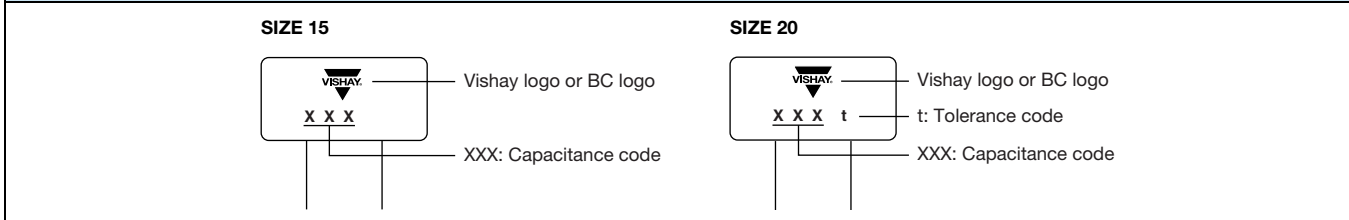
(at 1 kHz, 1 V)

LEAD CONFIGURATION AND DIMENSIONS in millimeters


| SIZE CODE | W _b 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 $L = 30 \text{ mm} \pm 5 \text{ mm}$.
- L2 and H5 are preferred styles.

MARKING

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

| 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 = $\pm 5 \%$ K = $\pm 10 \%$ M = $\pm 20 \%$ | 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 COG | | | |
|----------------|--------------------|---------------------|---------------------|
| 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/doc245233

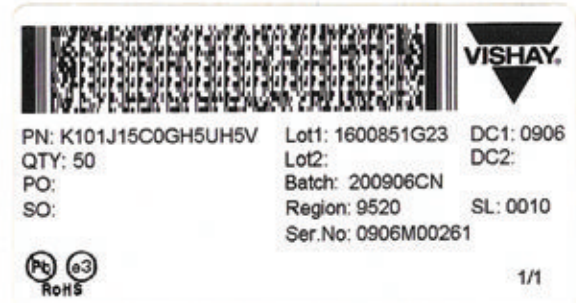
TAPING AND PACKAGING
LABELLING

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.

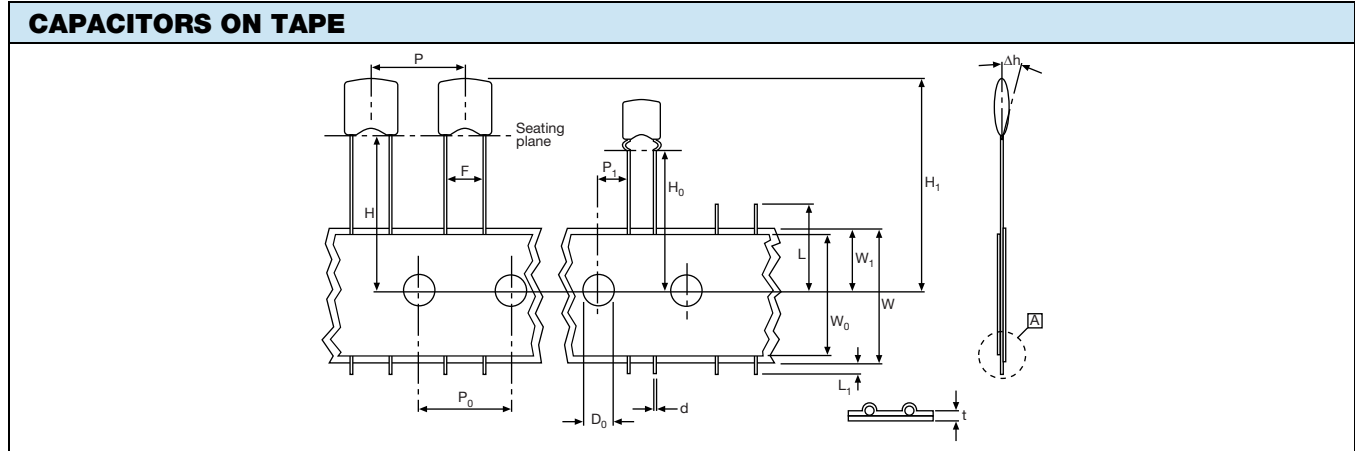
For example:



| 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 | |
| Ampopack | 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.



| 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. |

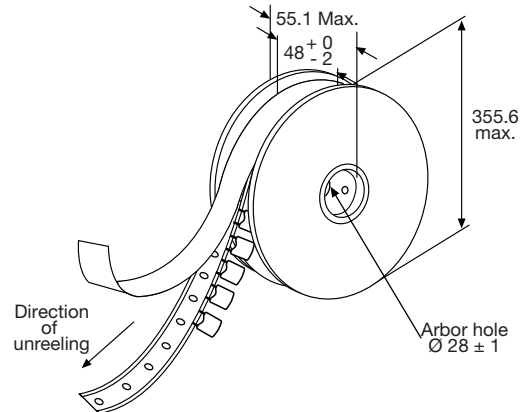
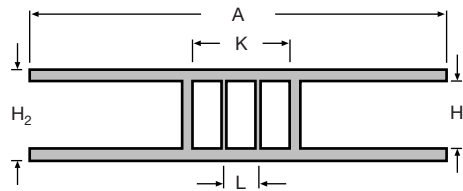
REEL DATA

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.

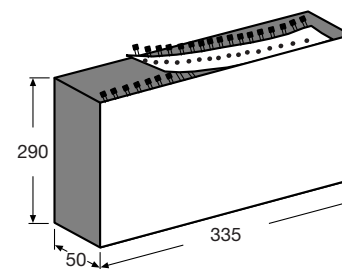
A maximum of 1 consecutive vacant positions is followed by 6 consecutive components.

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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