## Benefits

- Through-hole form factor
- Operating ambient temperature of −40°C

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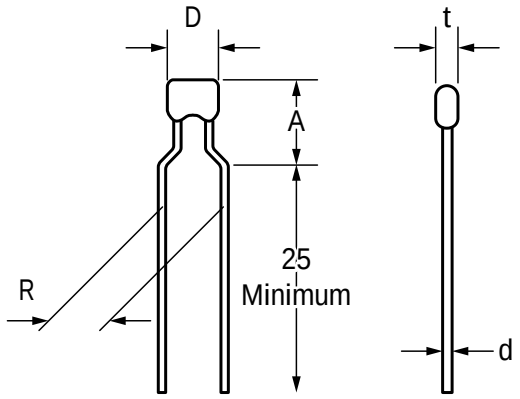
## Ordering Information

| VK | 103 | M | M | 151 | R | 002 | P050 |
|---|---|---|---|---|---|---|---|
| Series | Capacitance Code (nF) | Capacitance Tolerance Code | Tolerance of Varistor Voltage | Maximum Surge Current Code | Packaging/ Lead Style | Maximum Continuous Working Voltage (Vrms AC) | Pitch Code |
| Varistor Dual Function Leaded 125°C Low Voltage Automotive Grade Varistor/Capacitor (X7R Dielectric) | 103 = 10<br>104 = 100<br>105 = 1,000 | M = ±20% | K = ±10%<br>L = ±15%<br>M = ±20% | 151 = 150 A | B = Bulk<br>R = Reel | 002 = 2<br>004 = 4<br>006 = 6<br>008 = 8<br>011 = 11<br>014 = 14<br>017 = 17<br>020 = 20<br>025 = 25<br>030 = 30<br>035 = 35<br>040 = 40<br>050 = 50<br>060 = 60<br>095 = 95 | P050 = 5 mm |

## Dimensions – Millimeters




*As per part number table.*

## Environmental Compliance

RoHS 2 2011/65/EC, REACH

## Performance Characteristics

| Continuous | Units | Value |
|---|---|---|
| Steady State Applied Voltage | | |
| DC Voltage Range ($V_{dc}$) | V | 3 to 125 |
| AC Voltage Range ($V_{rms}$) | V | 2 to 95 |
| Transient | | |
| Non-Repetitive Surge Current, 8/20 µs Waveform ($I_{max}$) | A | 150 |
| Non-Repetitive Surge Energy, 10/1000 µs Waveform($W_{max}$) | J | 0.1 to 2.5 |
| Capacitance Range | nF | 10.02Tc - 0 Td [(1)5.5(e(1)5.8(5)-7114 T |
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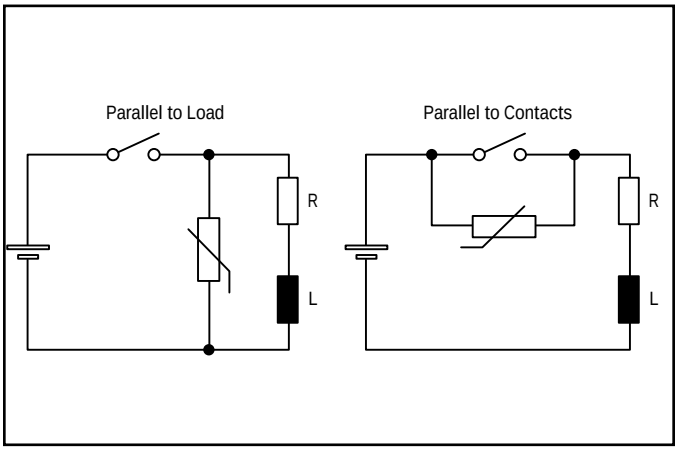
## Qualifications cont'd

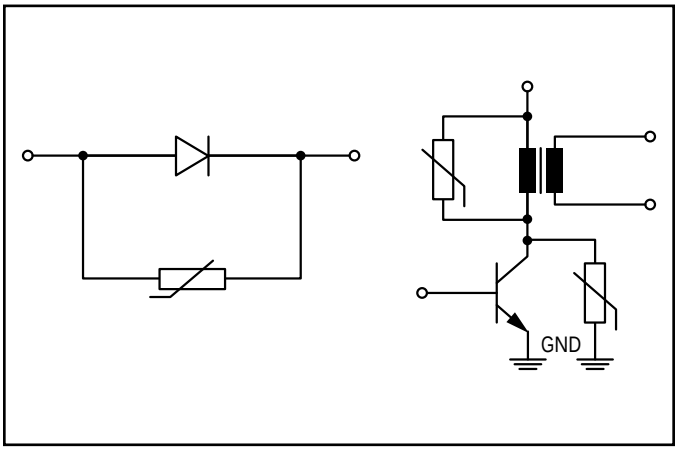
| Reliability Parameter | Test | Tested According to | Condition to be Satisfied after Testing |
|---|---|---|---|
| Charge and Discharge | | EN 132 400, Test 4.15. – 10.000 cycles of charge and discharge at the rate of one operation per minute with the test voltage of SQRT (2)*Vrms discharge rate adjusted to 100 V/µs | \|ΔC/C\| < 10 %<br>tan δ < 0,008<br>IR greater than 50 % of the applicable limits |
| Radio – Frequency Characteristics | | EN 132 400, Test 4.16. – measurement of capacitor impedance over a range of frequencies | with specification |
| Capacitance – Temperature Characteristics | | Measurement of capacitance and tan 6 in the temperature chamber at 20 °C and at UCT and LTC | with specification |
| Environmental and Storage Reliability | Climatic Sequence | EN 132 400, Test 4.11<br>a) Dry heat, 16 h, UCT, Test Ba, IEC 68–2–2<br>b) Damp heat, cyclic, the first cycle: 55°C, 93 % RH, 24 H, test DB, IEC 68–2–1<br>c) Cold, LCT, 2 h, Test Aa, IEC 68–2–1<br>d) Damp heat cyclic, remaining 5 cycles: 55°C, 93 % RH, 24 h/cycle, Test Bd, IEC 68–2–30 | no visible damage<br>\|ΔC/C\| < 20 %<br>tan δ < 0.008<br>IR greater than 50 % of the applicable limits no permanent breakdown or flash-over during voltage proof |
| | Thermal Shock | EN 132 400, Test 4.6, Test Na, IEC 68–2–14, 5 cycles UCT/LCT, 30 minutes | no visible damage |
| | Steady State Damp Heat | EN 132 400, Test 4.6, Test Na, IEC 68–2–14, 5 cycles UCT/LCT, 30 minutes | no visible damage<br>\|ΔC/C\| < 20 %<br>tan δ < 0.008<br>IR greater than 50 % of the applicable limits no permanent breakdown or flash-over during voltage proof |
| | Storage Test | ICE 68–2–2, Test Ba 1,000 h at maximum storage temperature | no visible damage<br>\|ΔC/C\| < 20 %<br>tan δ < 0.008<br>IR greater than 50 % of the applicable limits no permanent breakdown or flash-over during voltage proof |
| Mechanical Reliability | SolderabiLity | EN 132 400, Test 4.5., Test Ta, IEC 68–2–20, solder bath and reflow method | Solderable at shipment and after 2 years of storage - limits |
| | Resistance to Soldering Heat | EN 132 400, Test 4.4., Test Tb, IEC 68–2–20, solder bath and reflow method | no visible damage \|AC/C\| < 10 % |
| | Robustness of Termination | EN 132 400, Test 4.3., Test Ua, IEC 68–2–21 | no visible damage |
| | Vibration | EN 131 400, Test 4.7., Test Fc, IEC 68–2–6,<br>Frequency range 10 to 55 Hz; Amplitude 0.75 mm or 98 m/s2<br>Total duration 6 h (3 x 2 h); Waveshape – half sine | no visible damage |
| | Mechanical Shock | EN 132 400, Test 4.9, Test Ea, IEC 68–2–27<br>Acceleration = 490 m/s2; 100 g 6ms and 50 g 11 ms<br>Waveshape – half sine; Number of shocks = 3 x 6 | "\|ΔC/C\| < 10 %<br>tan δ within specification<br>no visible damage" |

## Application Circuits

(A) Eliminating sparks from relay circuits
(There is no delay in operating time)




(B) Eliminating noise from micro motors



## Application Circuits (cont'd)

(E) Protecting semi conductive components including transistors and diodes

(F) Improved thyristor configuration
Eliminating vibration better than conventional circuit

## Table 1 – Ratings & Part Number Reference

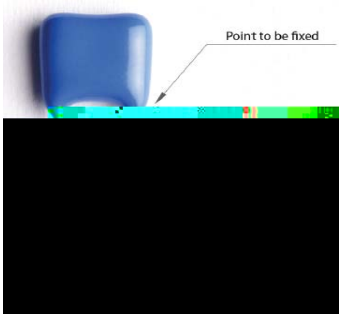
*(1) Insert packaging/lead Style code. See Ordering Options Table for available options.*(1) Ins(1) I ((1) I ( ((kagin2()kagikkagiptiongiptiable 4(b)Cn /Sgs(l)Se o)15p)(t)

## Soldering

Very often before soldering through-hole components, their leads get bent. It is important not to damage the component during lead bending. Typical damage incurred during bending is cracks in epoxy parts, which can lead to increased humidity sensitivity of a component and consequentially to a shorter life time.

In order to avoid epoxy parts damage it is necessary to:
• fix the most sensitive point (epoxy parts) of a component body
• bend the wire at least 2 mm below the end of epoxy parts

Other potential damage to a component which can lead to component failure or a shorter life time is thermal shock during manual soldering with a soldering iron. This can occur in the case when a soldering iron is placed too close to one point of the component body and most often it happens if the solder joint is too close to the varistor body.

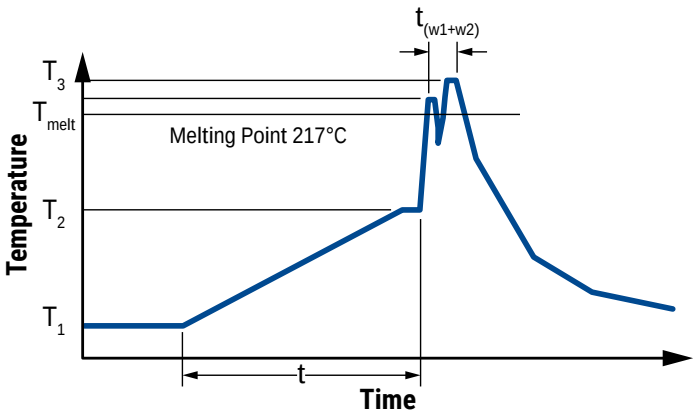



**Resistance to Soldering Heat –** In the case of automatic wave soldering, it is important to provide sufficient resistance to soldering heat. In order to prevent any potential problems the standard for testing the resistance to soldering heat of through-hole components is 300°C, 10s.

**Pb-free Wave Soldering Profile Recommendations –** Recommended soldering profiles for all above components are in accordance with JEDEC standard curves (J-STD-020D) and therefore compatible with the new Pb-free process.

## Soldering (cont'd)

### Lead-free Wave Soldering Profile

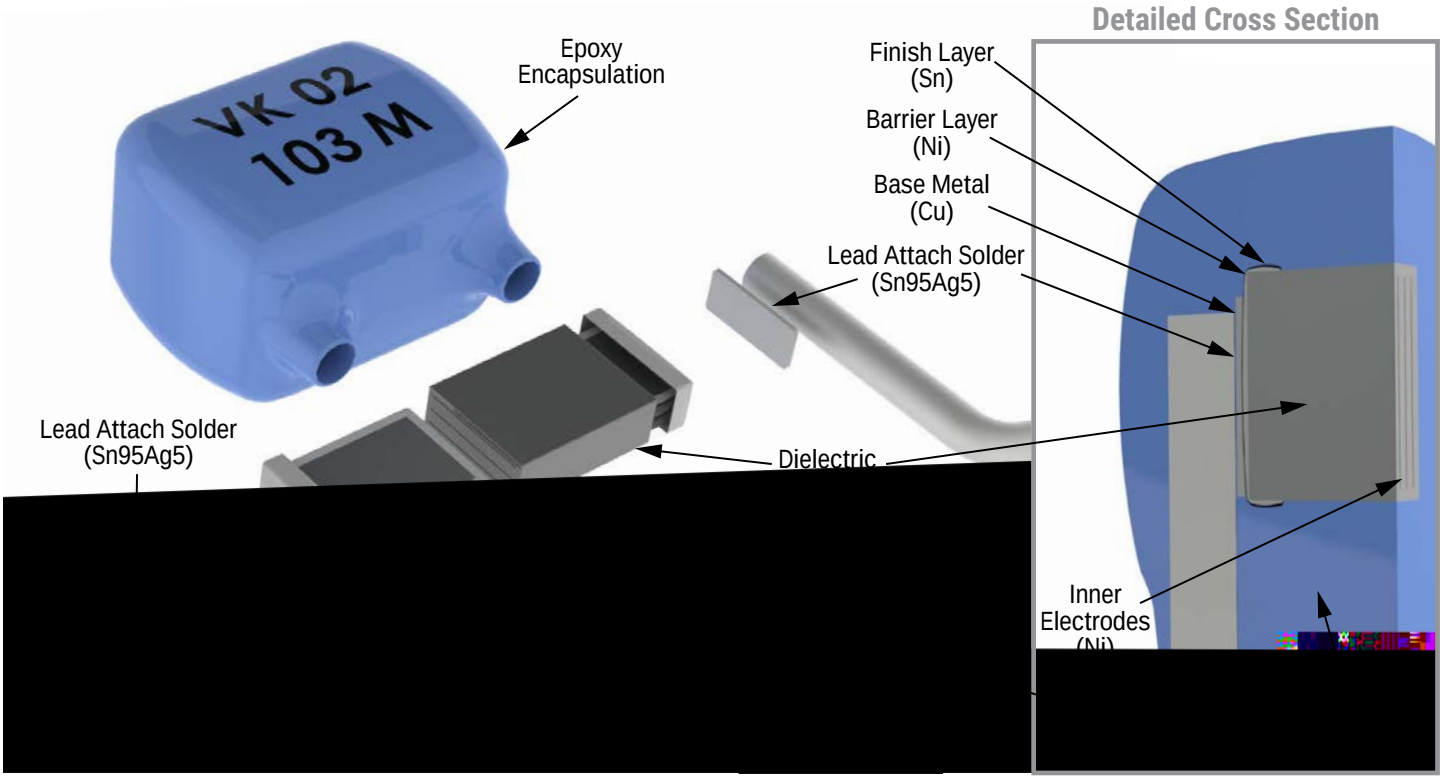



| Parameters | Symbol | Specification |
|---|---|---|
| Preheating temperature gradient | | 4°C/s maximum |
| Preheating time | $t_1$ | 2 to 5 minutes |
| Minimum preheating temperature | $T_1$ | 130°C |
| Maximum preheating temperature | $T_2$ | 180°C |
| Melting temperature/point | $T_{melt}$ | 217°C |
| Time in wave soldering phase (w1+w2) | $t_{w1+w2}$ | 10 seconds |
| Maximum wave temperature (w1+w2) | $T_3$ | 265°C +0/−5°C |
| Cooling temperature gradient | | 6°C/seconds maximum |
| Temperature jump form $T_2$ to $T_3$ (w1) | $T_3(w1) - T_3(w1) - T_2$ | 120°C maximum |
| Time from 25°C to $T_3$ (wave temperature) | | 8 minutes maximum |

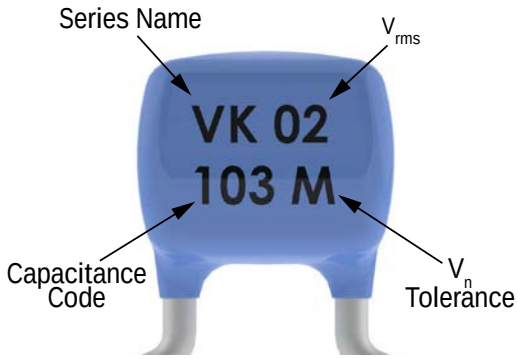
## Packaging

| B | R |
|---|---|
| 1,500 | 1,500 |

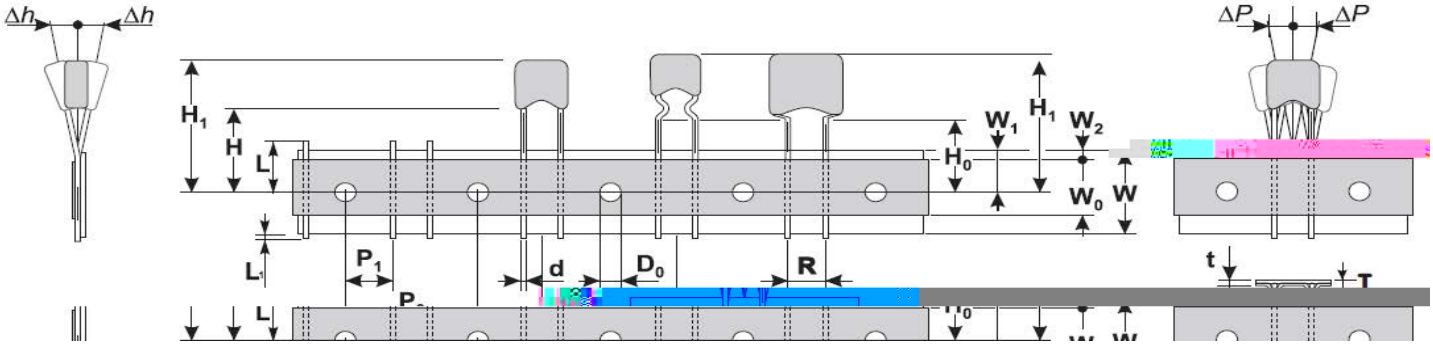
## Construction

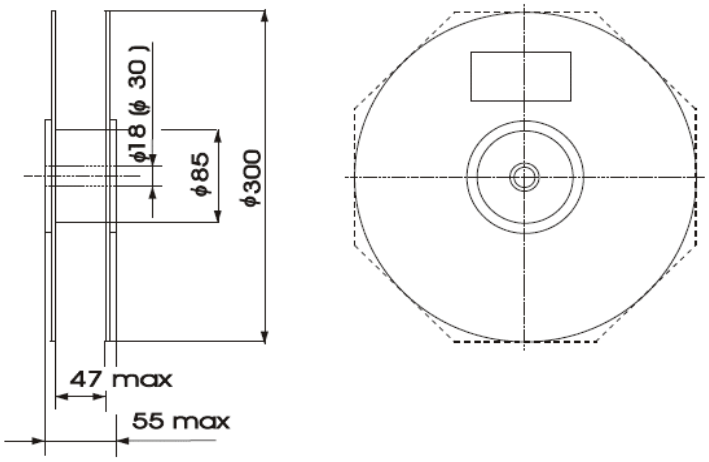



## Capacitor Marking



# Taping & Reel Specifications




| Symbol | Parameter | Dimension (mm) |
|---|---|---|
| W | Carrier tape with | 18+1.0/−0.5 |
| $W_0$ | Hold down tape width | 5 minimum |
| $W_1$ | Sprocket hole position | 9+0.75/−0.5 |
| $W_2$ | Distance between the upper edges of the carrier tape and hold-down tape | 3 maximum |
| T | Total tape thickness | 1.5 maximum |
| t | Tape thickness | 0.9 maximum |
| P | Pitch of component | 12.7±1.0 |
| $P_0$ | Feed hole pitch | 12.7±0.3 |
| $P_1$ | Feed hole center to pitch | 3.85±0.7 |
| R | Lead Spacing | 5+0.5/−0.2 |
| ΔP | Component alignment | ±1.3 maximum |
| Δh | Component alignment | ±2 maximum |
| d | Wire diameter | 0.6 maximum |
| $D_0$ | Feed hole diameter | 4±0.2 |
| H | Height from tape center to comp. base | 18+2.0/−0.0 |
| $H_0$ | Seating plane height | 16±0.5 |
| $H_1$ | Component height | 32.2 maximum |
| L | Protrusion – cut out | 11 maximum |
| $L_1$ | Protrusion – cut off | 0.5 maximum |

## Terms and Definitions

| Term | Symbol | Definition |
|---|---|---|
| Rated AC Voltage | $V_{rms}$ | Maximum continuous sinusoidal AC voltage (<5% total harmonic distortion) which may be applied to the component under continuous operation conditions at 25°C |
| Rated DC Voltage | $V_{dc}$ | Maximum continuous DC voltage (<5% ripple) which may be applied to the component under continuous operating conditions at 25°C |
| Supply | | |
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