

60R Series



Description

The 60R Series radial leaded device is designed to provide overcurrent protection for ($\leq 60V$) applications where space is not a concern and resettable protection is preferred.

Features

- Cured, flame retardant epoxy polymer insulating material meets UL 94V-0 requirements
- Fast time-to-trip
- RoHS compliant, Lead-Free and Halogen-Free*

Applications

- USB hubs, ports and peripherals
- IEEEE1394 ports
- Computers & peripherals
- Motor protection
- General electronics
- Automotive applications
- Industrial controls
- Transformers

Agency Approvals

| Agency | Agency File Number | 60R010X & 60R017X |
|--------|--------------------|-------------------|
| | E183209 | E183209 |
| | R50119318 | N/A |

Electrical Characteristics

| Part Number | I_{hold} (A) | I_{trip} (A) | V_{max} (Vdc) | I_{max} (A) | P_d typ. (W) | Maximum Time To Trip | | Resistance | | Agency Approvals | |
|-------------|----------------|----------------|-----------------|---------------|----------------|----------------------|-------------|------------------------|-------------------------|------------------|---|
| | | | | | | Current (A) | Time (Sec.) | R_{min} (Ω) | R_{1max} (Ω) | | |
| 60R010X | 0.10 | 0.20 | 60 | 40 | 0.38 | 0.50 | 4.00 | 2.500 | 7.500 | X | X |
| 60R017X | 0.17 | 0.34 | 60 | 40 | 0.48 | 0.85 | 3.00 | 3.300 | 8.000 | X | X |
| 60R020X | 0.20 | 0.40 | 60 | 40 | 0.41 | 1.00 | 2.20 | 1.830 | 4.400 | X | X |
| 60R025X | 0.25 | 0.50 | 60 | 40 | 0.45 | 1.25 | 2.50 | 1.250 | 3.000 | X | X |
| 60R030X | 0.30 | 0.60 | 60 | 40 | 0.49 | 1.50 | 3.00 | 0.880 | 2.100 | X | X |
| 60R040X | 0.40 | 0.80 | 60 | 40 | 0.56 | 2.00 | 3.80 | 0.550 | 1.290 | X | X |
| 60R050X | 0.50 | 1.00 | 60 | 40 | 0.77 | 2.50 | 4.00 | 0.500 | 1.170 | X | X |
| 60R065X | 0.65 | 1.30 | 60 | 40 | 0.88 | 3.25 | 5.30 | 0.310 | 0.720 | X | X |
| 60R075X | 0.75 | 1.50 | 60 | 40 | 0.92 | 3.75 | 6.30 | 0.250 | 0.600 | X | X |
| 60R090X | 0.90 | 1.80 | 60 | 40 | 0.99 | 4.50 | 7.20 | 0.200 | 0.470 | X | X |
| 60R110X | 1.10 | 2.20 | 60 | 40 | 1.50 | 5.50 | 8.20 | 0.150 | 0.380 | X | X |
| 60R135X | 1.35 | 2.70 | 60 | 40 | 1.70 | 6.75 | 9.60 | 0.120 | 0.300 | X | X |
| 60R160X | 1.60 | 3.20 | 60 | 40 | 1.90 | 8.00 | 11.40 | 0.090 | 0.220 | X | X |
| 60R185X | 1.85 | 3.70 | 60 | 40 | 2.10 | 9.25 | 12.60 | 0.080 | 0.190 | X | X |
| 60R250X | 2.50 | 5.00 | 60 | 40 | 2.50 | 12.50 | 15.60 | 0.050 | 0.130 | X | X |
| 60R300X | 3.00 | 6.00 | 60 | 40 | 2.80 | 15.00 | 19.80 | 0.040 | 0.100 | X | X |
| 60R375X | 3.75 | 7.50 | 60 | 40 | 3.20 | 18.75 | 24.00 | 0.030 | 0.080 | X | X |

I_{hold} = Hold current: maximum current device will pass without tripping in 20°C still air.
 I_{trip} = Trip current: minimum current at which the device will trip in 20°C still air.
 V_{max} = Maximum voltage device can withstand without damage at rated current (I_{max})
 I_{max} = Maximum fault current device can withstand without damage at rated voltage (V_{max})
 P_d = Power dissipated from device when in the tripped state at 20°C still air.

R_{min} = Minimum resistance of device in initial (un-soldered) state.
 R_{typ} = Typical resistance of device in initial (un-soldered) state.
 R_{1max} = Maximum resistance of device at 20°C measured one hour after tripping or reflow soldering of 260°C for 20 sec.

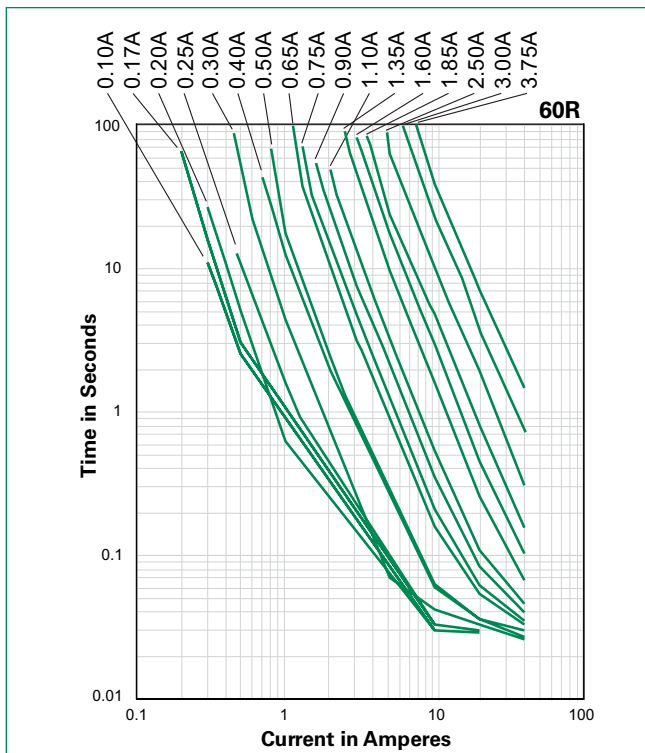
Caution: Operation beyond the specified rating may result in damage and possible arcing and flame.

* Effective January 1, 2010, all 60R PTC products will be manufactured Halogen Free (HF). Existing Non-Halogen Free 60R PTC products may continue to be sold, until supplies are depleted.

Temperature Derating

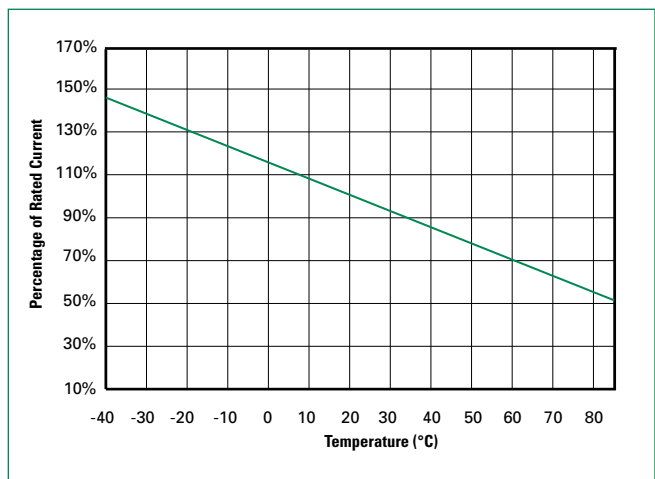
| Part Number | Ambient Operation Temperature | | | | | | | | |
|-------------|-------------------------------|-------|------|------|------|------|------|------|------|
| | -40°C | -20°C | 0°C | 20°C | 40°C | 50°C | 60°C | 70°C | 85°C |
| 60R010X | 0.16 | 0.14 | 0.12 | 0.10 | 0.08 | 0.07 | 0.06 | 0.05 | 0.04 |
| 60R017X | 0.26 | 0.23 | 0.20 | 0.17 | 0.14 | 0.12 | 0.11 | 0.09 | 0.07 |
| 60R020X | 0.31 | 0.27 | 0.24 | 0.20 | 0.16 | 0.14 | 0.13 | 0.11 | 0.08 |
| 60R025X | 0.39 | 0.34 | 0.30 | 0.25 | 0.20 | 0.18 | 0.16 | 0.14 | 0.10 |
| 60R030X | 0.47 | 0.41 | 0.36 | 0.30 | 0.24 | 0.22 | 0.19 | 0.16 | 0.12 |
| 60R040X | 0.62 | 0.54 | 0.48 | 0.40 | 0.32 | 0.29 | 0.25 | 0.22 | 0.16 |
| 60R050X | 0.78 | 0.68 | 0.60 | 0.50 | 0.41 | 0.36 | 0.32 | 0.27 | 0.20 |
| 60R065X | 1.01 | 0.88 | 0.77 | 0.65 | 0.53 | 0.47 | 0.41 | 0.35 | 0.26 |
| 60R075X | 1.16 | 1.02 | 0.89 | 0.75 | 0.61 | 0.54 | 0.47 | 0.41 | 0.30 |
| 60R090X | 1.40 | 1.22 | 1.07 | 0.90 | 0.73 | 0.65 | 0.57 | 0.49 | 0.36 |
| 60R110X | 1.71 | 1.50 | 1.31 | 1.10 | 0.89 | 0.79 | 0.69 | 0.59 | 0.44 |
| 60R135X | 2.09 | 1.84 | 1.61 | 1.35 | 1.09 | 0.97 | 0.85 | 0.73 | 0.54 |
| 60R160X | 2.48 | 2.18 | 1.90 | 1.60 | 1.30 | 1.15 | 1.01 | 0.86 | 0.64 |
| 60R185X | 2.87 | 2.52 | 2.20 | 1.85 | 1.50 | 1.33 | 1.17 | 1.00 | 0.74 |
| 60R250X | 3.88 | 3.40 | 2.98 | 2.50 | 2.03 | 1.80 | 1.58 | 1.35 | 1.00 |
| 60R300X | 4.65 | 4.08 | 3.57 | 3.00 | 2.43 | 2.16 | 1.89 | 1.62 | 1.20 |
| 60R375X | 5.81 | 5.10 | 4.46 | 3.75 | 3.04 | 2.70 | 2.36 | 2.03 | 1.50 |

Average Time Current Curves



The average time current curves and Temperature Derating curve performance is affected by a number of variables, and these curves provided as guidance only. Customer must verify the performance in their application.

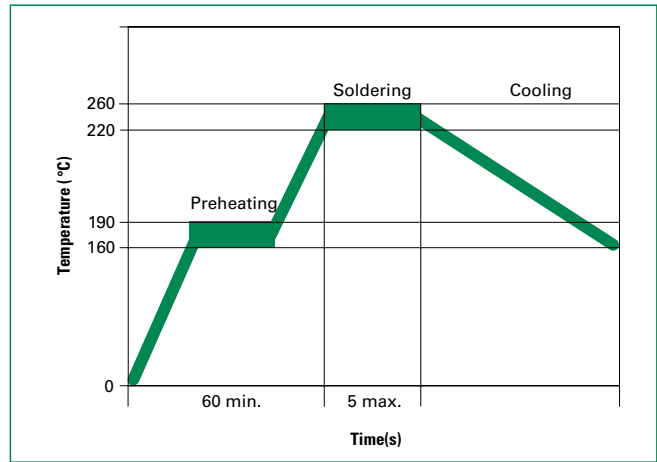
Temperature Derating Curve



Note:
Typical Temperature derating curve, refer to table for derating data

Soldering Parameters - Wave Soldering

| | |
|-------------------------|---|
| Pre-Heating Zone | Refer to the condition recommended by the flux manufacturer. Max. ramping rate should not exceed 4°C/Sec. |
| Soldering Zone | Max. solder temperature should not exceed 260°C Time within 5°C of actual Max. solder temperature within 3 - 5 seconds Total time from 25°C room to Max. solder temperature within 5 minutes including Pre-Heating time |
| Cooling Zone | Cooling by natural convection in air. Max. ramping down rate should not exceed 6°C/Sec. |



Physical Specifications

| | |
|----------------------------------|--|
| Lead Material | .20-.40A: Tin-plated Copper clad steel .50-3.75A: Tin-plated Copper |
| Soldering Characteristics | Solderability per MIL-STD-202, Method 208 |
| Insulating Material | Cured, flame retardant epoxy polymer meets UL94V-0 requirements. |
| Device Labeling | Marked with 'LF', voltage, current rating, and date code. |

Environmental Specifications

| | |
|--|---|
| Operating/Storage Temperature | -40°C to +85°C |
| Maximum Device Surface Temperature in Tripped State | 125°C |
| Passive Aging | +85°C, 1000 hours -/+ 5% typical resistance change |
| Humidity Aging | +85°C, 85% R.H., 1000 hours -/+ 5% typical resistance change |
| Thermal Shock | +85°C to -40°C 10 times 30% typical resistance change |
| Solvent Resistance | MIL-STD-202, Method 215 |
| Moisture Resistance Level | Level 1, J-STD-020 |

Additional Information



Datasheet

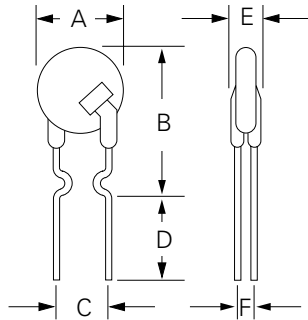


Resources

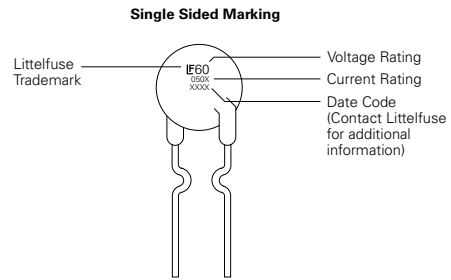


Samples

Dimensions

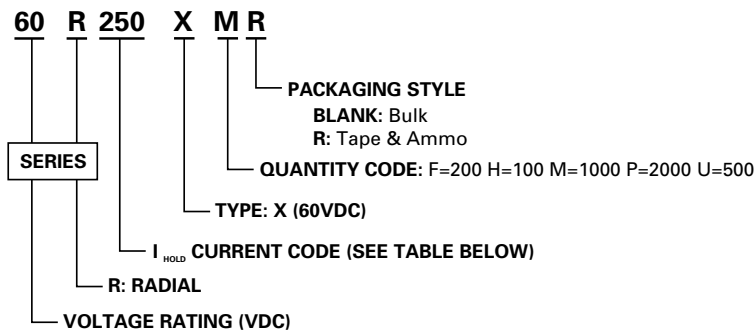


Part Marking System



| Part Number | A | | B | | C | | D | | E | | F | | Physical Characteristics | | |
|-------------|--------|-------|--------|------|--------|------|--------|------|--------|------|--------|------|--------------------------|------|----------|
| | Inches | mm | Inches | mm | Inches | mm | Inches | mm | Inches | mm | Inches | mm | Lead (dia) | | Material |
| | Max. | Max. | Max. | Max. | Typ. | Typ. | Min. | Min. | Max. | Max. | Typ. | Typ. | Inches | mm | |
| 60R010X | 0.29 | 7.4 | 0.50 | 12.7 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/CuFe |
| 60R017X | 0.29 | 7.4 | 0.50 | 12.7 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/CuFe |
| 60R020X | 0.29 | 7.4 | 0.46 | 11.7 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/CuFe |
| 60R025X | 0.29 | 7.4 | 0.50 | 12.7 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/CuFe |
| 60R030X | 0.29 | 7.4 | 0.50 | 12.7 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/CuFe |
| 60R040X | 0.30 | 7.6 | 0.53 | 13.5 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/CuFe |
| 60R050X | 0.31 | 7.9 | 0.54 | 13.7 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/Cu |
| 60R065X | 0.37 | 9.4 | 0.57 | 14.5 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/Cu |
| 60R075X | 0.40 | 10.2 | 0.59 | 15 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/Cu |
| 60R090X | 0.44 | 11.2 | 0.62 | 15.8 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.047 | 1.2 | 0.02 | 0.51 | Sn/Cu |
| 60R110X | 0.51 | 13 | 0.72 | 18.2 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.055 | 1.4 | 0.03 | 0.81 | Sn/Cu |
| 60R135X | 0.53 | 13.58 | 0.78 | 19.8 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.055 | 1.4 | 0.03 | 0.81 | Sn/Cu |
| 60R160X | 0.60 | 15.36 | 0.85 | 21.6 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.055 | 1.4 | 0.03 | 0.81 | Sn/Cu |
| 60R185X | 0.66 | 16.76 | 0.91 | 23 | 0.20 | 5.1 | 0.30 | 7.6 | 0.12 | 3.1 | 0.055 | 1.4 | 0.03 | 0.81 | Sn/Cu |
| 60R250X | 0.78 | 19.93 | 1.03 | 26.2 | 0.40 | 10.2 | 0.30 | 7.6 | 0.12 | 3.1 | 0.055 | 1.4 | 0.03 | 0.81 | Sn/Cu |
| 60R300X | 0.91 | 23.11 | 1.15 | 29.3 | 0.40 | 10.2 | 0.30 | 7.6 | 0.12 | 3.1 | 0.055 | 1.4 | 0.03 | 0.81 | Sn/Cu |
| 60R375X | 1.04 | 26.3 | 1.22 | 31.1 | 0.40 | 10.2 | 0.30 | 7.6 | 0.12 | 3.1 | 0.055 | 1.4 | 0.03 | 0.81 | Sn/Cu |

Part Ordering Number System



Packaging

| Part Number | Ordering Number | I _{hold} (A) | I _{hold} Code | Packaging Option | Quantity | Quantity & Packaging Codes |
|-------------|-----------------|-----------------------|------------------------|------------------|----------|----------------------------|
| 60R010X | 60R010XU | 0.10 | 010 | Bulk | 500 | U |
| | 60R010XPR | | | Tape and Ammo | 2000 | PR |
| 60R017X | 60R017XU | 0.20 | 020 | Bulk | 500 | U |
| | 60R017XPR | | | Tape and Ammo | 2000 | PR |
| 60R020X | 60R020XU | 0.20 | 020 | Bulk | 500 | U |
| | 60R020XPR | | | Tape and Ammo | 2000 | PR |
| 60R025X | 60R025XU | 0.25 | 025 | Bulk | 500 | U |
| | 60R025XPR | | | Tape and Ammo | 2000 | PR |
| 60R030X | 60R030XU | 0.30 | 030 | Bulk | 500 | U |
| | 60R030XPR | | | Tape and Ammo | 2000 | PR |
| 60R040X | 60R040XU | 0.40 | 040 | Bulk | 500 | U |
| | 60R040XPR | | | Tape and Ammo | 2000 | PR |
| 60R050X | 60R050XU | 0.50 | 050 | Bulk | 500 | U |
| | 60R050XPR | | | Tape and Ammo | 2000 | PR |
| 60R065X | 60R065XU | 0.65 | 065 | Bulk | 500 | U |
| | 60R065XPR | | | Tape and Ammo | 2000 | PR |
| 60R075X | 60R075XU | 0.75 | 075 | Bulk | 500 | U |
| | 60R075XPR | | | Tape and Ammo | 2000 | PR |
| 60R090X | 60R090XU | 0.90 | 090 | Bulk | 500 | U |
| | 60R090XPR | | | Tape and Ammo | 2000 | PR |
| 60R110X | 60R110XU | 1.10 | 110 | Bulk | 500 | U |
| | 60R110XMR | | | Tape and Ammo | 1000 | MR |
| 60R135X | 60R135XF | 1.35 | 135 | Bulk | 200 | F |
| | 60R135XMR | | | Tape and Ammo | 1000 | MR |
| 60R160X | 60R160XF | 1.60 | 160 | Bulk | 200 | F |
| | 60R160XMR | | | Tape and Ammo | 1000 | MR |
| 60R185X | 60R185XF | 1.85 | 185 | Bulk | 200 | F |
| | 60R185XMR | | | Tape and Ammo | 1000 | MR |
| 60R250X | 60R250XF | 2.50 | 250 | Bulk | 200 | F |
| | 60R250XMR | | | Tape and Ammo | 1000 | MR |
| 60R300X | 60R300XF | 3.00 | 300 | Bulk | 200 | F |
| 60R375X | 60R375XH | 3.75 | 375 | Bulk | 100 | H |

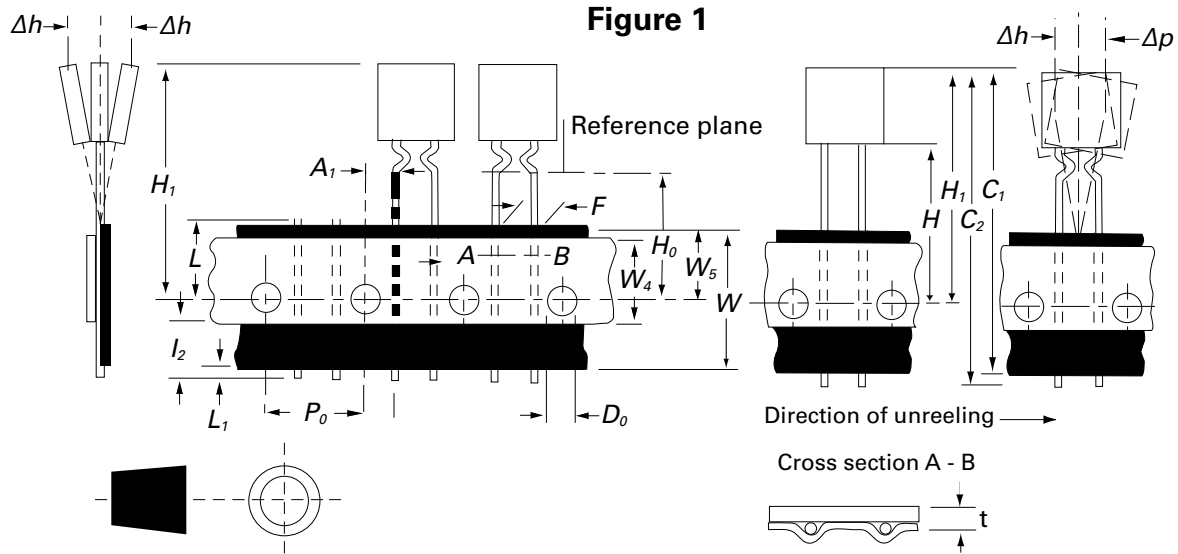
Tape and Ammo Specifications

Devices taped using EIA468-B/IE286-2 standards. See table below and Figure 1 for details.

| Dimension | EIA Mark | IEC Mark | Dimensions | |
|---|----------------|----------------|-----------------|--------------|
| | | | Dim. (mm) | Tol. (mm) |
| Carrier tape width | W | W | 18 | -0.5 / +1.0 |
| Hold down tape width | W ₄ | W ₀ | 11 | min. |
| Top distance between tape edges | W ₆ | W ₂ | 3 | max. |
| Sprocket hole position | W ₅ | W ₁ | 9 | -0.5 / +0.75 |
| Sprocket hole diameter* | D ₀ | D ₀ | 4 | -0.32 / +0.2 |
| Abscissa to plane(straight lead) | H | H | 18.5 | -/+ 3.0 |
| Abscissa to plane(kinked lead) | H ₀ | H ₀ | 16 | -/+ 0.5 |
| Abscissa to top 60R010-60R090 | H ₁ | H ₁ | 32.2 | max. |
| Abscissa to top 60R110-60R300 | H ₁ | - | 47.5 | max. |
| Overall width without lead protrusion:60R010-60R090 | C ₁ | - | 42.5 | max. |
| Overall width without lead protrusion:60R110-60R300 | - | - | 57 | - |
| Overall width with lead protrusion:60R010-60R090 | C2 | - | 43.2 | max. |
| Overall width with lead protrusion:60R110-60R300 | - | - | 58 | - |
| Lead protrusion | L ₁ | L ₁ | 1.0 | max. |
| Protrusion of cut out | L | L | 11 | max. |
| Protrusion beyond hold-down tape | l ₂ | l ₂ | Not specified | - |
| Sprocket hole pitch:60R010-60R090 | P ₀ | P ₀ | 12.7 | -/+ 0.3 |
| Sprocket hole pitch:60R110-60R300 | P ₀ | P ₀ | 25.4 | -/+ 0.5 |
| Pitch tolerance | - | - | 20 consecutive. | -/+ 1 |
| Device pitch:60R010-60R090 | - | - | 12.7 | - |
| Device pitch:60R110-60R300 | - | - | 25.4 | - |
| Tape thickness | t | t | 0.9 | max. |
| Tape thickness with splice | t ₁ | - | 2.0 | max. |
| Splice sprocket hole alignment | - | - | 0 | -/+ 0.3 |
| Body lateral deviation | Δh | Δh | 0 | -/+ 1.0 |
| Body tape plane deviation | Δp | Δp | 0 | -/+ 1.3 |
| Ordinate to adjacent component lead*:60R010-60R090 | P ₁ | P ₁ | 3.81 | -/+ 0.7 |
| Ordinate to adjacent component lead*:60R110-60R300 | - | - | 7.62 | -/+ 0.7 |
| Lead spacing:60R010-60R185 | F | F | 5.08 | -/+ 0.8 |
| Lead spacing:60R250-60R300 | F | F | 10.18 | -/+ 0.8 |

*Differs from EIA Specification

Tape and Ammo Diagram



WARNING

- Users shall independently assess the suitability of these devices for each of their applications
- Operation of these devices beyond the stated maximum ratings could result in damage to the devices and lead to electrical arcing and/or fire
- These devices are intended to protect against the effects of temporary over-current or over-temperature conditions and are not intended to perform as protective devices where such conditions are expected to be repetitive or prolonged in duration
- Exposure to silicon-based oils, solvents, electrolytes, acids, and similar materials can adversely affect the performance of these PPTC devices
- These devices undergo thermal expansion under fault conditions, and thus shall be provided with adequate space and be protected against mechanical stresses
- Circuits with inductance may generate a voltage ($L di/dt$) above the rated voltage of the PPTC device.

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