



### 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

- RoHS compliant and lead-free
- Fast time-to-trip
- Cured, flame retardant epoxy polymer insulating material meets UL 94V-0 requirements



### Agency Approvals

AGENCY	AGENCY FILE NUMBER
	E183209
	R50119318

### Applications

- USB hubs, ports and peripherals
- IEEE1394 ports
- Computers & peripherals
- Motor protection
- General electronics
- Automotive applications
- Industrial controls
- Transformers

### Electrical Characteristics

Part Number	$I_{hold}$ (A)	$I_{trip}$ (A)	$V_{max}$ (Vdc)	$I_{max}$ (A)	$P_d$ max. (W)	Maximum Time To Trip		Resistance		Agency Approvals	
						Current (A)	Time (Sec.)	$R_{min}$ ( $\Omega$ )	$R_{1max}$ ( $\Omega$ )		
60R010	0.10	0.20	60	40	0.38	0.50	4.00	2.500	7.500	X	X
60R020	0.20	0.40	60	40	0.41	1.00	2.20	1.830	4.400	X	X
60R025	0.25	0.50	60	40	0.45	1.25	2.50	1.250	3.000	X	X
60R030	0.30	0.60	60	40	0.49	1.50	3.00	0.880	2.100	X	X
60R040	0.40	0.80	60	40	0.56	2.00	3.80	0.550	1.290	X	X
60R050	0.50	1.00	60	40	0.77	2.50	4.00	0.500	1.170	X	X
60R065	0.65	1.30	60	40	0.88	3.25	5.30	0.310	0.720	X	X
60R075	0.75	1.50	60	40	0.92	3.75	6.30	0.250	0.600	X	X
60R090	0.90	1.80	60	40	0.99	4.50	7.20	0.200	0.470	X	X
60R110	1.10	2.20	60	40	1.50	5.50	8.20	0.150	0.380	X	X
60R135	1.35	2.70	60	40	1.70	6.75	9.60	0.120	0.300	X	X
60R160	1.60	3.20	60	40	1.90	8.00	11.40	0.090	0.220	X	X
60R185	1.85	3.70	60	40	2.10	9.25	12.60	0.080	0.190	X	X
60R250	2.50	5.00	60	40	2.50	12.50	15.60	0.050	0.130	X	X
60R300	3.00	6.00	60	40	2.80	15.00	19.80	0.040	0.100	X	X
60R375	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.

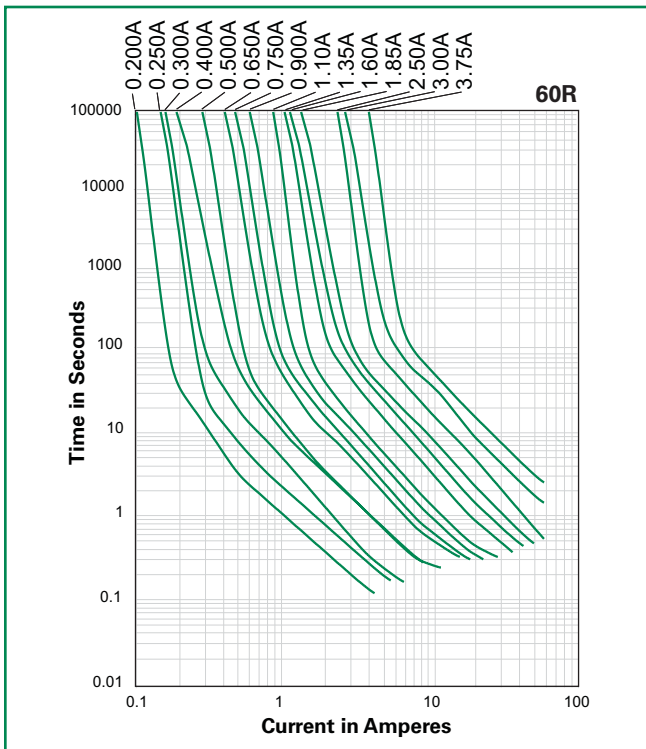
$R_{min}$  = Minimum resistance of device in initial (un-soldered) state.  
 $R_{typ}$  = Typical resistance of device in initial (un-soldered) state.  
 $R_{1max}$  = Maximum resistance of device at 20°C measured one hour after tripping or reflow soldering of 260°C for 20 sec.

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

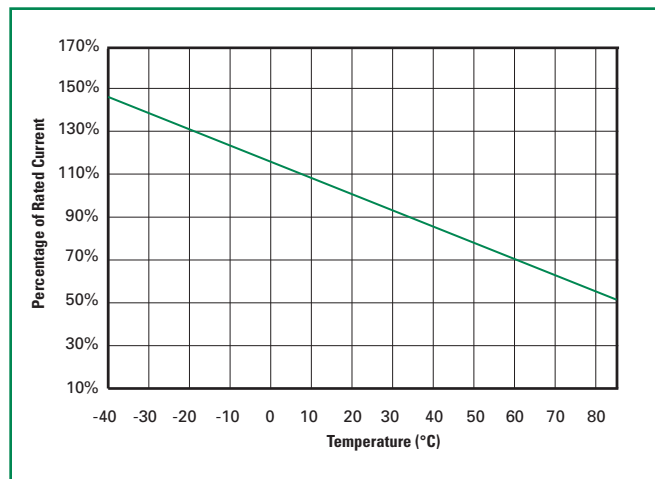
**Temperature Derating**

Part Number	Ambient Operation Temperature								
	-40°C	-20°C	0°C	23°C	40°C	50°C	60°C	70°C	85°C
60R010	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04
60R020	0.31	0.27	0.24	0.20	0.16	0.14	0.13	0.11	0.08
60R025	0.39	0.34	0.30	0.25	0.20	0.18	0.16	0.14	0.10
60R030	0.47	0.41	0.36	0.30	0.24	0.22	0.19	0.16	0.12
60R040	0.62	0.54	0.48	0.40	0.32	0.29	0.25	0.22	0.16
60R050	0.78	0.68	0.60	0.50	0.41	0.36	0.32	0.27	0.20
60R065	1.01	0.88	0.77	0.65	0.53	0.47	0.41	0.35	0.26
60R075	1.16	1.02	0.89	0.75	0.61	0.54	0.47	0.41	0.30
60R090	1.40	1.22	1.07	0.90	0.73	0.65	0.57	0.49	0.36
60R110	1.71	1.50	1.31	1.10	0.89	0.79	0.69	0.59	0.44
60R135	2.09	1.84	1.61	1.35	1.09	0.97	0.85	0.73	0.54
60R160	2.48	2.18	1.90	1.60	1.30	1.15	1.01	0.86	0.64
60R185	2.87	2.52	2.20	1.85	1.50	1.33	1.17	1.00	0.74
60R250	3.88	3.40	2.98	2.50	2.03	1.80	1.58	1.35	1.00
60R300	4.65	4.08	3.57	3.00	2.43	2.16	1.89	1.62	1.20
60R375	5.81	5.10	4.46	3.75	3.04	2.70	2.36	2.03	1.50

**Average Time Current Curves**



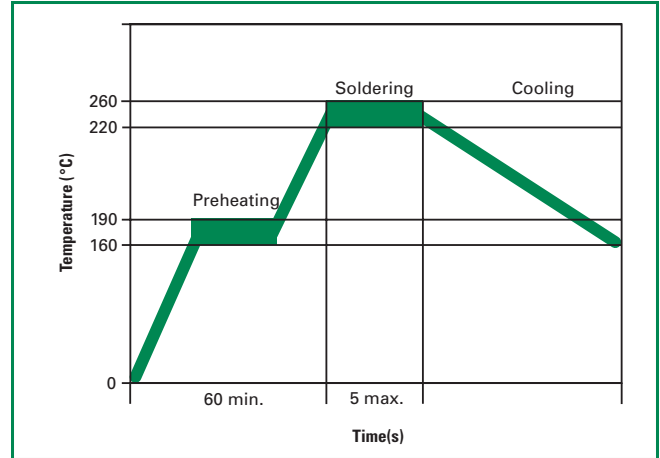
**Temperature Derating Curve**



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.

**Soldering Parameters - Wave Soldering**

<b>Pre-Heating Zone</b>	Refer to the condition recommended by the flux manufacturer. Max. ramping rate should not exceed 4°C/Sec.
<b>Soldering Zone</b>	Max. solder temperature should not exceed 260°C
<b>Cooling Zone</b>	Cooling by natural convection in air.

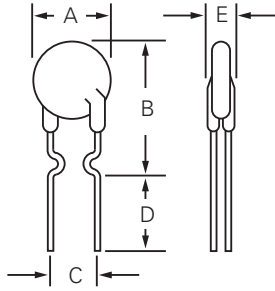

**Physical Specifications**

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

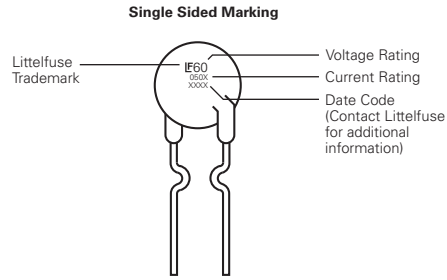
**Environmental Specifications**

<b>Operating/Storage Temperature</b>	-40°C to +85°C
<b>Maximum Device Surface Temperature in Tripped State</b>	125°C
<b>Passive Aging</b>	+85°C, 1000 hours /+ 5% typical resistance change
<b>Humidity Aging</b>	+85°C, 85% R.H., 1000 hours /+ 5% typical resistance change
<b>Thermal Shock</b>	+85°C to -40°C 10 times /+ 5% typical resistance change
<b>Solvent Resistance</b>	MIL-STD-202, Method 215F
<b>Moisture Resistance Level</b>	Level 2, J-STD-020C

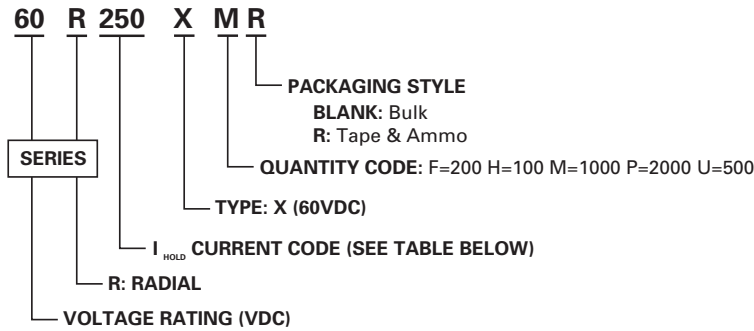
**Dimensions**



**Part Marking System**



Part Number	A		B		C		D		E		Physical Characteristics		
	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Inches	mm	Lead (dia)		Material
	Max.	Max.	Max.	Max.	Typ.	Typ.	Min.	Min.	Max.	Max.	Inches	mm	
60R010	0.29	7.4	0.50	12.7	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/CuFe
60R020	0.29	7.4	0.46	11.7	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/CuFe
60R025	0.29	7.4	0.50	12.7	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/CuFe
60R030	0.29	7.4	0.50	12.7	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/CuFe
60R040	0.30	7.6	0.53	13.5	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/CuFe
60R050	0.31	7.9	0.54	13.7	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/Cu
60R065	0.37	9.4	0.57	14.5	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/Cu
60R075	0.40	10.2	0.59	15	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/Cu
60R090	0.44	11.2	0.62	15.8	0.20	5.1	0.30	7.6	0.12	3.1	0.02	0.51	Sn/Cu
60R110	0.51	13	0.72	18.2	0.20	5.1	0.30	7.6	0.12	3.1	0.03	0.81	Sn/Cu
60R135	0.53	13.58	0.78	19.8	0.20	5.1	0.30	7.6	0.12	3.1	0.03	0.81	Sn/Cu
60R160	0.60	15.36	0.85	21.6	0.20	5.1	0.30	7.6	0.12	3.1	0.03	0.81	Sn/Cu
60R185	0.66	16.76	0.91	23	0.20	5.1	0.30	7.6	0.12	3.1	0.03	0.81	Sn/Cu
60R250	0.78	19.93	1.03	26.2	0.40	10.2	0.30	7.6	0.12	3.1	0.03	0.81	Sn/Cu
60R300	0.91	23.11	1.15	29.3	0.40	10.2	0.30	7.6	0.12	3.1	0.03	0.81	Sn/Cu
60R375	1.04	26.3	1.22	31.1	0.40	10.2	0.30	7.6	0.12	3.1	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
60R010	60R010XU	0.10	010	Bulk	500	U
	60R010XPR			Tape and Ammo	2000	PR
60R020	60R020XU	0.20	020	Bulk	500	U
	60R020XPR			Tape and Ammo	2000	PR
60R025	60R025XU	0.25	025	Bulk	500	U
	60R025XPR			Tape and Ammo	2000	PR
60R030	60R030XU	0.30	030	Bulk	500	U
	60R030XPR			Tape and Ammo	2000	PR
60R040	60R040XU	0.40	040	Bulk	500	U
	60R040XPR			Tape and Ammo	2000	PR
60R050	60R050XU	0.50	050	Bulk	500	U
	60R050XPR			Tape and Ammo	2000	PR
60R065	60R065XU	0.65	065	Bulk	500	U
	60R065XPR			Tape and Ammo	2000	PR
60R075	60R075XU	0.75	075	Bulk	500	U
	60R075XPR			Tape and Ammo	2000	PR
60R090	60R090XU	0.90	090	Bulk	500	U
	60R090XPR			Tape and Ammo	2000	PR
60R110	60R110XU	1.10	110	Bulk	500	U
	60R110XMR			Tape and Ammo	1000	MR
60R135	60R135XF	1.35	135	Bulk	200	F
	60R135XMR			Tape and Ammo	1000	MR
60R160	60R160XF	1.60	160	Bulk	200	F
	60R160XMR			Tape and Ammo	1000	MR
60R185	60R185XF	1.85	185	Bulk	200	F
	60R185XMR			Tape and Ammo	1000	MR
60R250	60R250XF	2.50	250	Bulk	200	F
	60R250XMR			Tape and Ammo	1000	MR
60R300	60R300XF	3.00	300	Bulk	200	F
60R375	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	<b>W</b>	<b>W</b>	18	-0.5 / +1.0
Hold down tape width	<b>W<sub>4</sub></b>	<b>W<sub>0</sub></b>	11	min.
Top distance between tape edges	<b>W<sub>6</sub></b>	<b>W<sub>2</sub></b>	3	max.
Sprocket hole position	<b>W<sub>5</sub></b>	<b>W<sub>1</sub></b>	9	-0.5 / +0.75
Sprocket hole diameter*	<b>D<sub>0</sub></b>	<b>D<sub>0</sub></b>	4	-0.32 / +0.2
Abscissa to plane(straight lead)	<b>H</b>	<b>H</b>	18.5	-/+ 3.0
Abscissa to plane(kinked lead)	<b>H<sub>0</sub></b>	<b>H<sub>0</sub></b>	16	-/+ 0.5
Abscissa to top 60R010-60R090	<b>H<sub>1</sub></b>	<b>H<sub>1</sub></b>	32.2	max.
Abscissa to top 60R110-60R300	<b>H<sub>1</sub></b>		47.5	max.
Overall width without lead protrusion:60R010-60R090	<b>C<sub>1</sub></b>		42.5	max.
Overall width without lead protrusion:60R110-60R300			57	
Overall width with lead protrusion:60R010-60R090	<b>C2</b>		43.2	max.
Overall width with lead protrusion:60R110-60R300			58	
Lead protrusion	<b>L<sub>1</sub></b>	<b>I<sub>1</sub></b>	1.0	max.
Protrusion of cut out	<b>L</b>	<b>L</b>	11	max.
Protrusion beyond hold-down tape	<b>I<sub>2</sub></b>	<b>I<sub>2</sub></b>	Not specified	
Sprocket hole pitch:60R010-60R090	<b>P<sub>0</sub></b>	<b>P<sub>0</sub></b>	12.7	-/+ 0.3
Sprocket hole pitch:60R110-60R300	<b>P<sub>0</sub></b>	<b>P<sub>0</sub></b>	25.4	-/+ 0.5
Pitch tolerance			20 consecutive.	-/+ 1
Device pitch:60R010-60R090			12.7	
Device pitch:60R110-60R300			25.4	
Tape thickness	<b>t</b>	<b>t</b>	0.9	max.
Tape thickness with splice	<b>t<sub>1</sub></b>		2.0	max.
Splice sprocket hole alignment			0	-/+ 0.3
Body lateral deviation	<b>Δh</b>	<b>Δh</b>	0	-/+ 1.0
Body tape plane deviation	<b>Δp</b>	<b>Δp</b>	0	-/+ 1.3
Ordinate to adjacent component lead*:60R010-60R090	<b>P<sub>1</sub></b>	<b>P<sub>1</sub></b>	3.81	-/+ 0.7
Ordinate to adjacent component lead*:60R110-60R300			7.62	-/+ 0.7
Lead spacing:60R010-60R185	<b>F</b>	<b>F</b>	5.08	-/+ 0.8
Lead spacing:60R250-60R300	<b>F</b>	<b>F</b>	10.18	-/+ 0.8

\*Differs from EIA Specification

**Tape and Ammo Diagram**

