KOA SPEER ELECTRONICS, INC.

spec sheet

SS-234 R1
AHA 3/14/02

NEW

Radial Leaded Resettable PPTC (Polymeric Positive Temp. Coefficient) Devices

ISO 9002 CERTIFIED

SFRL60

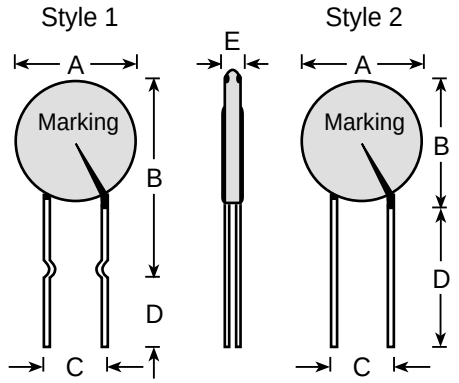
1. Features

- Radial Leaded package
- Cured, flame retardant epoxy polymer insulating material meets UL94V-0 requirements
- Bulk packaging, tape and reel and ammo-pack available on most models
- Voltage rating: 60 V

2. Applications

- Audio equipment
- Automotive electronics
- Automotive harness protection
- Battery chargers
- Computers and peripherals
- Loud speakers
- Point-of-sale (POS) equipment
- Process and industrial controls
- Satellite video receivers
- Security and fire alarm systems
- Small and medium motors
- Telecommunication equipment
- Toys
- Transformers
- Test and measurement equipment

3. Dimensions



Dimensions in inches (mm)

	A	B	C	D	E
	Max.	Max.	Typ.	Min.	Max.
SFRL60010	.291 (7.4)	.500 (12.7)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60017	.291 (7.4)	.500 (12.7)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60020	.291 (7.4)	.480 (12.2)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60025	.291 (7.4)	.500 (12.7)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60030	.291 (7.4)	.512 (13.0)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60040	.299 (7.6)	.531 (13.5)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60050	.311 (7.9)	.539 (13.7)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60065	.382 (9.7)	.571 (14.5)	.201 (5.1)	.299 (7.6)	.118 (3.0)

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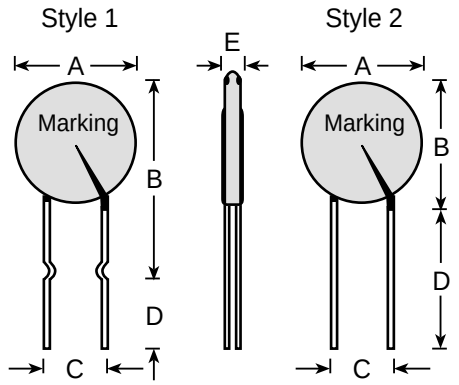
3. Dimensions (Continued)



Dimensions in inches (mm)

	A Max.	B Max.	C Typ.	D Min.	E Max.
SFRL60075	.551 (10.4)	.598 (15.2)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60090	.461 (11.7)	.622 (15.8)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60110	.512 (13.0)	.709 (18.0)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60135	.571 (14.5)	.772 (19.6)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60160	.642 (16.3)	.839 (21.3)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60185	.701 (17.8)	.902 (22.9)	.201 (5.1)	.299 (7.6)	.118 (3.0)
SFRL60250	.839 (21.3)	1.039 (26.4)	.402 (10.2)	.299 (7.6)	.118 (3.0)
SFRL60300	.980 (24.9)	1.181 (30.0)	.402 (10.2)	.299 (7.6)	.118 (3.0)
SFRL60375	1.122 (28.5)	1.319 (33.5)	.402 (10.2)	.299 (7.6)	.118 (3.0)

4. Type Designation

The type designation shall be in the following form:

SF	RL	60	L	L	010
Type	Symbol	Rated Voltage	Termination Material	Packaging	Hold Current

Termination Material:
- L: Sn/Pb
- T: 100% SN
- SFRL60-010: T
- SFRL60017~090: L
- SFRL60110~375: T

Packaging:
- BK: Bulk
- A: Ammo
- L: Lead Spool
- SFRL60010 to SFRL60090 = 3000 pcs/reel
- SFRL60110 to SFRL60185 = 1500 pcs/reel

Hold Current:
- Ex: 010 = .10 Amps

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5. Electrical Characteristics

Type	Vmax	Imax	Typical Current Trip Limits (Amps)		Initial Resistance		1 hr, Post-Trip Resist.	Max. (A)	Time to Trip	Tripped Power Dissipation	Agency Recognition	
	Volts	Amps	20°C		Ohms @ 20°C		Ohms @ 20°C		Seconds @ 20°C	P_D Typ Watts@ 20°C	UL E212329	CSA 208924
			I_H (A)	I_T (A)	R_{min}	R_{max}	R_{1max}					
SFRL60010	60	40	0.10	0.20	2.50	4.50	7.50	0.50	4.0	0.38	UL	CSA
SFRL60017	60	40	0.17	0.34	3.30	5.21	8.00	0.85	3.0	0.48	UL	CSA
SFRL60020	60	40	0.20	0.40	1.83	2.75	4.40	1.00	2.2	0.41	UL	CSA
SFRL60025	60	40	0.25	0.50	1.25	1.95	3.00	1.25	2.5	0.45	UL	CSA
SFRL60030	60	40	0.30	0.60	0.88	1.33	2.10	1.50	3.0	0.49	UL	CSA
SFRL60040	60	40	0.40	0.80	0.55	0.86	1.29	2.00	3.8	0.56	UL	CSA
SFRL60050	60	40	0.50	1.00	0.50	0.77	1.17	2.50	4.0	0.77	UL	CSA
SFRL60065	60	40	0.65	1.30	0.31	0.48	0.72	3.25	5.3	0.88	UL	CSA
SFRL60075	60	40	0.75	1.50	0.25	0.40	0.60	3.75	6.3	0.92	UL	CSA
SFRL60090	60	40	0.90	1.80	0.20	0.31	0.47	4.50	7.2	0.99	UL	CSA
SFRL60110	60	40	1.10	2.20	0.15	0.25	0.38	5.50	8.2	1.50	UL	CSA
SFRL60135	60	40	1.35	2.70	0.12	0.19	0.30	6.75	9.6	1.70	UL	CSA
SFRL60160	60	40	1.60	3.20	0.09	0.14	0.22	8.00	11.4	1.90	UL	CSA
SFRL60185	60	40	1.85	3.70	0.08	0.12	0.19	9.25	12.6	2.10	UL	CSA
SFRL60250	60	40	2.50	5.00	0.05	0.08	0.13	12.50	15.6	2.50	UL	CSA
SFRL60300	60	40	3.00	6.00	0.04	0.06	0.10	15.00	19.8	2.80	UL	CSA
SFRL60375	60	40	3.75	7.50	0.03	0.05	0.08	18.75	24.00	3.20	UL	CSA

I_H: Hold current - maximum current device will pass without interruption in 20°C still air

I_T: Trip current - minimum current that will switch the device from low resistance to high resistance in 20°C still air

R_{Min}: Minimum resistance of device as supplied at 20°C unless otherwise specified

R_{Max}: Maximum resistance of device as supplied at 20°C unless otherwise specified

V_{Max}: Maximum voltage device can withstand without damage at rated current

I_{Max}: Maximum fault current device can withstand without damage at rated current

P_D: Power dissipated from device when in the tripped state in 20°C still air

R_{1Max}: Maximum resistance of device when measured one hour post reflow (surface-mount device) or one hour post trip (radial leaded device) at 20°C

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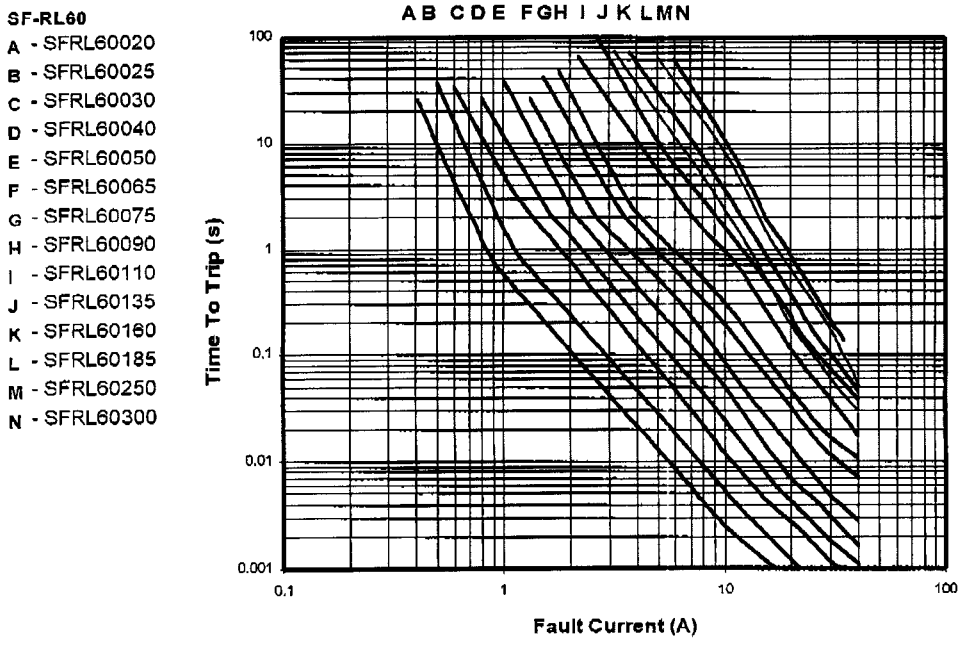
6. Thermal Derating Chart - I_{hold} / I_{trip} (Amps)

Type	Maximum Ambient Operating Temperatures								
	-40°C	-20°C	0°C	20°C	40°C	50°C	60°C	70°C	85°C
SFRL60010	0.16/0.32	0.14/0.28	0.12/0.24	0.10/0.20	0.08/0.16	0.07/0.14	0.06/0.12	0.05/0.10	0.04/0.08
SFRL60017	0.26/0.52	0.23/0.46	0.20/0.40	0.17/0.34	0.14/0.28	0.12/0.24	0.11/0.22	0.09/0.18	0.07/0.14
SFRL60020	0.31/0.62	0.27/0.54	0.24/0.48	0.20/0.40	0.16/0.32	0.14/0.28	0.13/0.26	0.11/0.22	0.08/0.16
SFRL60025	0.39/0.78	0.34/0.68	0.30/0.60	0.25/0.50	0.20/0.40	0.18/0.36	0.16/0.32	0.14/0.28	0.10/0.20
SFRL60030	0.47/0.94	0.41/0.82	0.36/0.72	0.30/0.60	0.24/0.48	0.22/0.44	0.19/0.38	0.16/0.32	0.12/0.24
SFRL60040	0.62/1.24	0.54/1.08	0.48/0.96	0.40/0.80	0.32/0.64	0.29/0.58	0.25/0.50	0.22/0.44	0.16/0.32
SFRL60050	0.78/1.56	0.68/1.36	0.60/1.20	0.50/1.00	0.41/0.82	0.36/0.72	0.32/0.64	0.27/0.54	0.20/0.40
SFRL60065	1.01/2.02	0.88/1.76	0.77/1.54	0.65/1.30	0.53/1.06	0.47/0.94	0.41/0.82	0.35/0.70	0.26/0.52
SFRL60075	1.16/2.32	1.02/2.04	0.89/1.78	0.75/1.50	0.61/1.22	0.54/1.08	0.47/0.94	0.41/0.82	0.30/0.60
SFRL60090	1.40/2.80	1.22/2.44	1.07/2.14	0.90/1.80	0.73/1.46	0.69/1.38	0.57/1.04	0.49/0.98	0.36/0.72
SFRL60110	1.71/3.20	1.50/3.00	1.31/2.62	1.10/2.20	0.89/1.78	0.79/1.58	0.69/1.38	0.59/1.18	0.44/0.88
SFRL60135	2.09/4.18	1.84/3.68	1.61/3.22	1.35/2.70	1.09/2.18	0.97/1.96	0.85/1.90	0.73/1.46	0.54/1.08
SFRL60160	2.48/4.96	2.18/4.36	1.90/3.80	1.60/3.20	1.30/2.60	1.15/2.30	1.01/2.02	0.86/1.72	0.64/1.28
SFRL60185	2.87/5.72	2.52/5.04	2.20/4.40	1.85/3.70	1.50/3.00	1.33/2.66	1.17/2.34	1.00/2.00	0.74/1.48
SFRL60250	3.88/7.76	3.40/6.80	2.98/5.96	2.50/5.00	2.03/4.06	1.80/3.60	1.58/3.16	1.35/2.70	1.00/2.00
SFRL60300	4.65/9.30	4.08/8.16	3.57/7.14	3.00/6.00	2.43/4.86	2.16/4.32	1.89/3.78	1.62/3.24	1.20/2.40
SFRL60375	5.81/11.62	5.10/10.20	4.46/8.92	3.75/7.50	3.04/6.08	2.70/5.40	2.36/4.72	2.03/4.06	1.50/3.00

7. Typical Time-to-Trip Curves at 20°C



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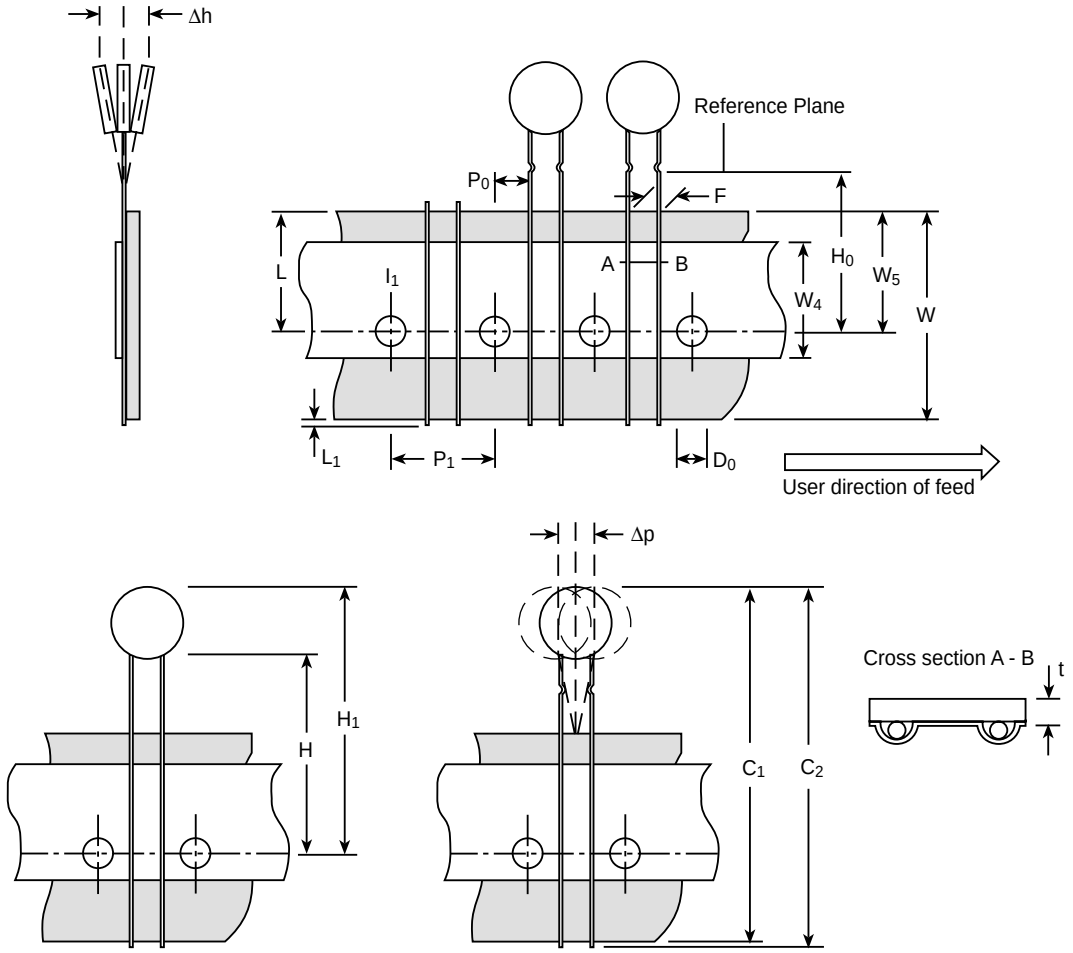
8. Characteristics

Item	Requirement	Test Methods
Visual/Mechanical	Per specified physical description	Verify dimensions and materials
Resistance	$R_{min} \leq R \leq R_{max}$	In still air @ 20°C
Time to Trip	T ≤ max. time to trip (seconds)	5 times I_{hold}, V_{max}, 20°C
Hold Current	No trip	60 mins at I_{hold}
Trip Cycle Life	No arcing or burning	V_{max}, I_{max}, 6000 cycles, 6 sec. ON, 120 sec. OFF
Trip Endurance	No arcing or burning	V_{max}, 1000 hours

9. Environmental Characteristics

Item	Requirement	Conditions
Operating/ Storage Temperature		-40°C to +85°C
Maximum Device Surface Temperature in Tripped State		125°C
Passive Aging	± 5% typical resistance change	+85°C, 1000 hours
Humidity Aging	± 5% typical resistance change	+85°C, 85% R.H. 1000 hours
Thermal Shock	± 10% typical resistance change	MIL-STD-202F, Method 107G, +125°C to -40°C, 10 times
Mechanical Shock	No resistance change	MIL-STD-202, Method 213, Condition 1 (100g, 6 seconds)
Solvent Resistance	No change	MIL-STD-202, Method 215
Vibration	No change	MIL-STD-883E, Method 2007.3
Recommended Storage Conditions		40°C max., 70% R.H. max.; devices may not meet specified ratings if storage conditions are exceeded

10. Packaging Specifications



Dimensions in inches (mm)

C_1	C_2	D_0	F	Δh	H	H_0	H_1	I_1
1.70 (43.2 max.)	1.67 (42.5 max.)	0.157 (4 ± 0.2)	0.20 (5.08 ± 0.8)	0 (0 ± 1.0)	0.728 (18.5 ± 3.0)	0.630 (16 ± 0.5)	1.27 (32.2 max.)	0.039 (1.0 max.)

L	L_1	Δp	P_0	P_1	t	W	W_4	W_5
0.433 (11 max.)	0.039 (1.0 max.)	0 (0 ± 1.3)	0.500 (12.7 ± 0.3)	0 (0 ± 0.7)	0.035 (0.9 max.)	0.709 ($18 \pm ^{+1.0}_{-0.5}$)	0.197 (5 min.)	0.354 ($9 \pm ^{+0.75}_{-0.5}$)

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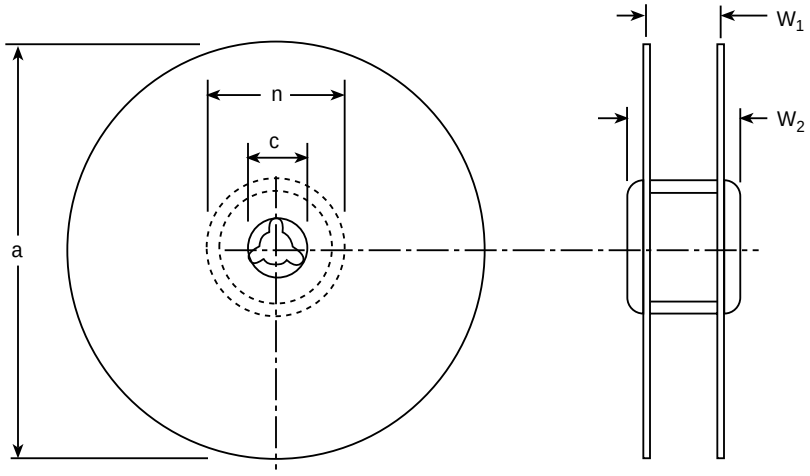
11. Reel Dimensions



Dimensions in inches (mm)

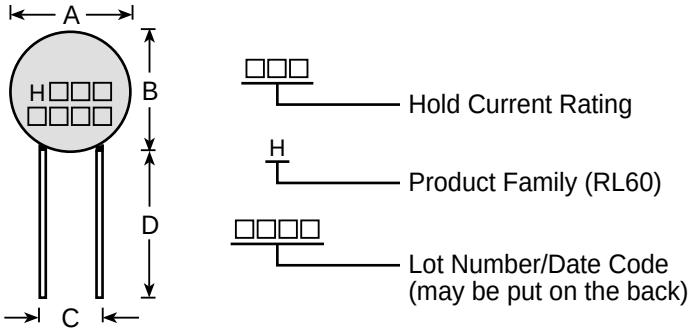
a	c	n	W_1	W_2
14.6 (370 max.)	1.02 (26 ± 12.0)	3.15 (80 max.)	2.20 (56 max.)	0.187 (4.75 ± 3.25)

12. Part Marking

Part Number	Bag Quantity	T & R Quantity	Ammo Pack	Part Marking
SFRL60010	500	3000	2000	H010
SFRL60017	500	3000	2000	H017
SFRL60020	500	3000	2000	H020
SFRL60025	500	3000	2000	H025
SFRL60030	500	3000	2000	H030
SFRL60040	500	3000	2000	H040
SFRL60050	500	3000	2000	H050
SFRL60065	500	3000	2000	H065
SFRL60075	500	3000	2000	H075
SFRL60090	500	3000	2000	H090
SFRL60110	500	1500	1000	H110
SFRL60135	500	1500	1000	H135

12. Part Marking (Continued)

Part Number	Bag Quantity	T & R Quantity	Ammo Pack	Part Marking
SFRL60160	500	1500	1000	H160
SFRL60185	500	1500	1000	H185
SFRL60250	500	–	–	H250
SFRL60300	500	–	–	H300
SFRL60375	500	–	–	H375



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