Features

- Radial Leaded Devices
- Cured, flame retardant epoxy polymer insulating material meets UL 94V-0 requirements
- Bulk packaging, tape and reel and Ammo-Pak available on most models
- Agency recognition: UL,TÜV & CSA

Applications

Almost anywhere there is a low voltage power supply and a load to be protected, including:

- Computers & peripherals
- General electronics
- Automotive applications

MF-R Series - PTC Resettable Fuses

Electrical Characteristics

Model	V max. Volts	I max. Amps	I_{hold}	I_{trip}	Initial Resistance		1 Hour (R_1) Post-Trip Resistance	Max. Time To Trip at 5*I_h	Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.		
MF-R010	60	40	0.10	0.20	2.50	4.50	7.50	4.0	0.38
MF-R017	60	40	0.17	0.34	2.0	3.2	8.00	3.0	0.48
MF-R020	60	40	0.20	0.40	1.50	2.84	4.40	2.2	0.40
MF-R025	60	40	0.25	0.50	1.00	1.95	3.00	2.5	0.45
MF-R030	60	40	0.30	0.60	0.76	1.36	2.10	3.0	0.50
MF-R040	60	40	0.40	0.80	0.52	0.86	1.29	3.8	0.55
MF-R050	60	40	0.50	1.00	0.41	0.77	1.17	4.0	0.75
MF-R065	60	40	0.65	1.30	0.27	0.48	0.72	5.3	0.90
MF-R075	60	40	0.75	1.50	0.18	0.40	0.60	6.3	0.90
MF-R090	60	40	0.90	1.80	0.14	0.31	0.47	7.2	1.00
MF-R090-0-009	30	40	0.90	1.80	0.07	0.12	0.22	5.9	0.60
MF-R110	30	40	1.10	2.20	0.10	0.18	0.27	6.6	0.70
MF-R135	30	40	1.35	2.70	0.065	0.115	0.17	7.3	0.80
MF-R160	30	40	1.60	3.20	0.055	0.105	0.15	8.0	0.90
MF-R185	30	40	1.85	3.70	0.04	0.07	0.11	8.7	1.00
MF-R250	30	40	2.50	5.00	0.025	0.048	0.07	10.3	1.20
MF-R250-0-010	30	40	2.50	5.00	0.025	0.048	0.07	10.3	1.20
MF-R300	30	40	3.00	6.00	0.02	0.05	0.08	10.8	2.00
MF-R400	30	40	4.00	8.00	0.01	0.03	0.05	12.7	2.50
MF-R500	30	40	5.00	10.00	0.01	0.03	0.05	14.5	3.00
MF-R600	30	40	6.00	12.00	0.005	0.02	0.04	16.0	3.50
MF-R700	30	40	7.00	14.00	0.005	0.02	0.03	17.5	3.80
MF-R800	30	40	8.00	16.00	0.005	0.02	0.03	18.8	4.00
MF-R900	30	40	9.00	18.00	0.005	0.01	0.02	*20.0	4.20

*Tested at 40 amps

Environmental Characteristics

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 .....MIL-STD-202F, Method 107G, ...±10% typical resistance change
+125°C to -40°C,10 times
Mechanical Shock .....MIL-STD-202, Method 213, ...No resistance change
Condition 1 (100g, 6 seconds)
Solvent Resistance .....MIL-STD-202, Method 215 .....No change
Vibration .....MIL-STD-883C, Method 2007.1, ...No change
Condition A

Test Procedures And Requirements For Model MF-R Series

Test	Test Conditions	Accept/Reject Criteria
Visual/Mech.	Verify dimensions and materials	Per MF physical description
Resistance	In still air @ 23°C	Rmin ≤ R ≤ Rmax
Time to Trip	5 times Ihold, Vmax, 23°C	T ≤ max. time to trip (seconds)
Hold Current	30 min. at Ihold	No trip
Trip Cycle Life	Vmax, Imax, 100 cycles	No arcing or burning
Trip Endurance	Vmax, 48 hours	No arcing or burning

UL File Number .....(E 174545S) - 30V
CSA File Number .....(CA 110338) - All MF-R models
TÜV File Number .....(E9772255.01) - 30V

MF-R Series - PTC Resettable Fuses

BOURNS®

Product Dimensions

Model	A	B	C		D	E	Physical Characteristics		
	Max.	Max.	Nom.	Tol. ±	Min.	Max.	Style	Lead	Material
MF-R010	7.4	12.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/NiCu
MF-R017	7.4	12.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R020	7.4	12.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R025	7.4	12.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R030	7.4	13.4	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R040	7.4	13.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/CuFe
MF-R050	7.9	13.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/Cu
MF-R065	9.7	15.2	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/Cu
MF-R075	10.4	16.0	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/Cu
MF-R090	11.7	16.7	5.1	0.7	7.6	3.1	1	0.51 dia.	Sn/Cu
MF-R090-0-009	7.4	12.2	5.1	0.7	7.6	3.0	2	0.51 dia.	Sn/CuFe
MF-R110	8.9	14.0	5.1	0.7	7.6	3.0	1	0.51 dia.	Sn/Cu
MF-R135	8.9	18.9	5.1	0.7	7.6	3.0	1	0.51 dia.	Sn/Cu
MF-R160	10.2	16.8	5.1	0.7	7.6	3.0	1	0.51 dia.	Sn/Cu
MF-R185	12.0	18.4	5.1	0.7	7.6	3.0	1	0.51 dia.	Sn/Cu
MF-R250	12.0	18.3	5.1	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R-250-0-010	12.0	18.3	5.1	0.7	7.6	3.0	2	0.51 dia.	Sn/CuFe
MF-R300	12.0	18.3	5.1	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R400	14.4	24.8	5.1	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R500	17.4	24.9	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R600	19.3	31.9	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R700	22.1	29.8	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R800	24.2	32.9	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu
MF-R900	24.2	32.9	10.2	0.7	7.6	3.0	2	0.81 dia.	Sn/Cu

DIMENSIONS = MM.
0.51 (24AWG)
0.81 (20AWG)

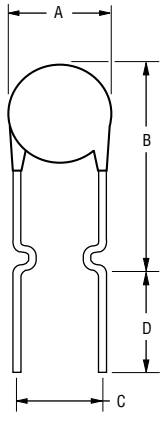
Packaging options:

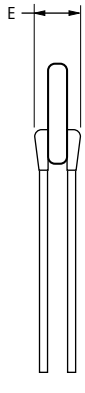
BULK: MF-R010-MF-R185 = 500 pcs. per bag; MF-R250-MF-R900 = 100 pcs. per bag;
MF-R090-0-009 & MF-R250-0-010 = 500 pcs. per bag.

TAPE & REEL: MF-R010-MF-R160 - 12.7mm device pitch = 3000 pcs. per reel; MF-R185-MF-R400 - 25.4mm device pitch = 1500 pcs. per reel;
MF-R090-0-009 & MF-R250-0-010 = 3000 pcs. per reel.

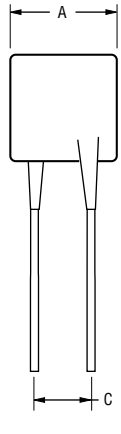
AMMO-PACK: MF-R010-MF-R160 - 12.7mm device pitch = 2000 pcs. per reel; MF-R185-MF-R400 - 25.4mm device pitch = 1000 pcs. per reel;
MF-R090-0-009 & MF-R250-0-010 = 2000 pcs. per reel.

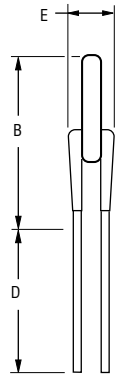
Package 1





Package 2





NOTE: Kinked lead option is available for board standoff. Contact factory for details.

MF-R Series - PTC Resettable Fuses

BOURNS®

Thermal Derating Chart - I_{hold} (Amps)

Model	Ambient Operating Temperature								
	-40°C	-20°C	0°C	23°C	40°C	50°C	60°C	70°C	85°C
MF-R010	0.16	0.14	0.12	0.10	0.08	0.07	0.06	0.05	0.04
MF-R017	0.26	0.23	0.20	0.17	0.14	0.12	0.11	0.09	0.07
MF-R020	0.31	0.27	0.24	0.20	0.16	0.14	0.13	0.11	0.08
MF-R025	0.39	0.34	0.30	0.25	0.20	0.18	0.16	0.14	0.10
MF-R030	0.47	0.41	0.36	0.30	0.24	0.22	0.19	0.16	0.12
MF-R040	0.62	0.54	0.48	0.40	0.32	0.29	0.25	0.22	0.16
MF-R050	0.78	0.68	0.60	0.50	0.41	0.36	0.32	0.27	0.20
MF-R065	1.01	0.88	0.77	0.65	0.53	0.47	0.41	0.35	0.26
MF-R075	1.16	1.02	0.89	0.75	0.61	0.54	0.47	0.41	0.30
MF-R090	1.40	1.22	1.07	0.90	0.73	0.65	0.57	0.49	0.36
MF-R090-0-009	1.40	1.22	1.07	0.90	0.73	0.65	0.57	0.49	0.36
MF-R110	1.60	1.43	1.27	1.10	0.91	0.85	0.75	0.67	0.57
MF-R135	1.96	1.76	1.55	1.35	1.12	1.04	0.92	0.82	0.70
MF-R160	2.32	2.08	1.84	1.60	1.33	1.23	1.09	0.98	0.83
MF-R185	2.68	2.41	2.13	1.85	1.54	1.42	1.26	1.13	0.96
MF-R250	3.63	3.25	2.88	2.50	2.08	1.93	1.70	1.53	1.30
MF-R250-0-010	3.63	3.25	2.88	2.50	2.08	1.93	1.70	1.53	1.30
MF-R300	4.35	3.90	3.45	3.00	2.49	2.31	2.04	1.83	1.56
MF-R400	5.80	5.20	4.60	4.00	3.32	3.08	2.72	2.44	2.08
MF-R500	7.25	6.50	5.75	5.00	4.15	3.85	3.40	3.05	2.60
MF-R600	8.70	7.80	6.90	6.00	4.98	4.62	4.08	3.66	3.12
MF-R700	10.15	9.10	8.05	7.00	5.81	5.39	4.76	4.27	3.64
MF-R800	11.60	10.40	9.20	8.00	6.64	6.16	5.44	4.88	4.16
MF-R900	13.05	11.70	10.35	9.00	7.47	6.93	6.12	5.49	4.68

How to Order

MF - R 250 -

Multifuse® Product Designator

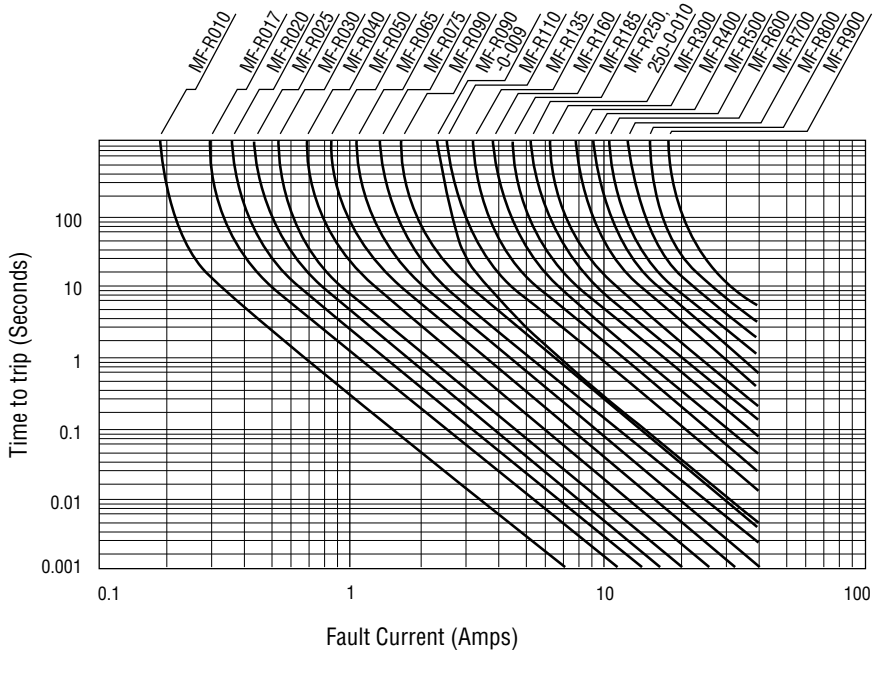
Style
- R = Radial Leaded Component
- RX = Radial Leaded Component
- S = Axial Leaded "Strap" Component
- LS = Low Temperature Axial Leaded "Strap" Component
- SM = Surface Mount Component
- MSM = 4.5mm SMD
- D = Uncoated, Unleaded "Disk" Component

Hold Current, Ihold
010-900 (100m Amps - 9.0 Amps)

Packaging Options
- - = Bulk Packaging
- - 2 = Tape and Reel*
- - AP = Ammo-Pak*

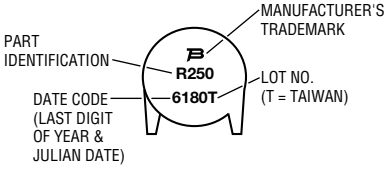
*Packaged per EIA486-B

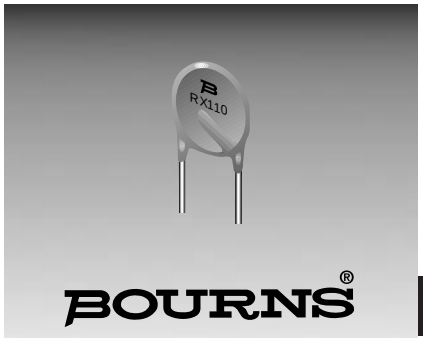
Typical Time to Trip at 23°C



Typical Part Marking

Represents total content. Layout may vary.





Features

- Radial Leaded Devices
- Cured, flame retardant epoxy polymer insulating material meets UL 94V-0 requirements
- Bulk packaging, tape and reel and Ammo-Pak available on most models
- Agency recognition: UL, TÜV & CSA (pending)

Applications

Almost anywhere there is a low voltage power supply, up to 60V and a load to be protected, including:

- Security and fire alarm systems
- Loud speakers
- Power transformers

MF-RX Series - PTC Resettable Fuses

Electrical Characteristics

Model	V max. Volts	I max. Amps	I_{hold}	I_{trip}	Initial Resistance		1 Hour (R_1) Post-Trip Resistance	Max. Time To Trip at 5*I_h	Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.		
MF-RX110	60	40	1.10	2.20	0.15	0.25	0.38	8.2	1.50
MF-RX135	60	40	1.35	2.70	0.12	0.19	0.30	9.6	1.70
MF-RX160	60	40	1.60	3.20	0.09	0.14	0.22	11.4	1.90
MF-RX185	60	40	1.85	3.70	0.08	0.12	0.19	12.6	2.10
MF-RX250	60	40	2.50	5.00	0.05	0.08	0.13	15.6	2.50
MF-RX300	60	40	3.00	6.00	0.04	0.06	0.10	19.8	2.80
MF-RX375	60	40	3.75	7.50	0.03	0.05	0.08	24.0	3.20

Environmental Characteristics

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.....MIL-STD-202F, Method 107G, +125°C to -40°C,10 times .....±10% typical resistance change
Mechanical Shock .....MIL-STD-202, Method 213, Condition 1 (100g, 6 seconds) .....No resistance change
Solvent Resistance .....MIL-STD-202, Method 215 .....No change
Vibration .....MIL-STD-883C, Method 2007.1, Condition A .....No change

Test Procedures And Requirements For Model MF-RX Series

Test	Test Conditions	Accept/Reject Criteria
Visual/Mech.	Verify dimensions and materials	Per MF physical description
Resistance	In still air @ 23°C	Rmin ≤ R ≤ Rmax
Time to Trip	5 times Ihold, Vmax, 23°C	T ≤ max. time to trip (seconds)
Hold Current	30 min. at Ihold	No trip
Trip Cycle Life	Vmax, Imax, 100 cycles	No arcing or burning
Trip Endurance	Vmax, 48 hours	No arcing or burning

Thermal Derating Chart - I_{hold} (Amps)

Part No.	Ambient Operating Temperature								
	-40˚C	-20˚C	0˚C	23˚C	40˚C	50˚C	60˚C	70˚C	85˚C
MF-RX110	1.71	1.50	1.31	1.10	0.89	0.79	0.69	0.59	0.44
MF-RX135	2.09	1.84	1.61	1.35	1.09	0.97	0.85	0.73	0.54
MF-RX160	2.48	2.18	1.90	1.60	1.30	1.15	1.01	0.86	0.64
MF-RX185	2.87	2.52	2.20	1.85	1.50	1.33	1.17	1.00	0.74
MF-RX250	3.88	3.40	2.98	2.50	2.03	1.80	1.58	1.35	1.00
MF-RX300	4.65	4.08	3.57	3.00	2.43	2.16	1.89	1.62	1.20
MF-RX375	5.81	5.10	4.46	3.75	3.04	2.70	2.36	2.03	1.50

Additional Features

■ Resettable circuit protection

MF-RX Series - PTC Resettable Fuses

BOURNS®

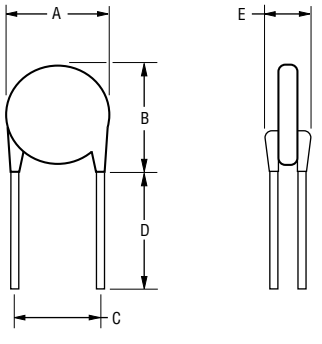
Product Dimensions

Model	A	B	C		D	E	Physical Characteristics		
	Max.	Max.	Nom.	Tol. ±	Min.	Max.	Style	Lead	Material
MF-RX110	13.0	18.0	5.1	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX135	14.5	19.6	5.1	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX160	16.3	21.3	5.1	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX185	17.8	22.9	5.1	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX250	21.3	26.4	10.2	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX300	24.9	30.0	10.2	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu
MF-RX375	28.4	33.5	10.2	0.7	7.6	3.1	1	0.81 dia.	Sn/Cu

DIMENSIONS = MM

Packaging options:
BULK: All models = 100 pcs. per bag.
TAPE & REEL: MF-RX110 – MF-RX160 = 1500 pcs. per reel; MF-RX185 = 1000 pcs. per reel
AMMO-PACK: MF-RX110 – MF-RX160 = 1000 pcs. per reel; MF-RX185 = 500 pcs. per reel

Package 1



Lead Material
0.81 dia. (20AWG)

NOTE: Kinked lead option is available for board standoff. Contact factory for details.

How to Order

MF - RX 110 -

Multifuse® Product Designator

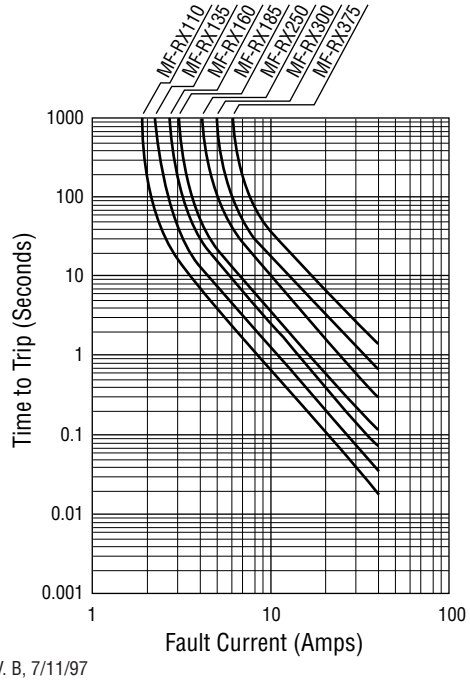
Style
- R = Radial Leaded Component
- RX = Radial Leaded Component
- S = Axial Leaded "Strap" Component
- LS = Low Temperature Axial Leaded "Strap" Component
- SM = Surface Mount Component
- MSM = 4.5mm SMD
- D = Uncoated, Unleaded "Disk" Component

Hold Current, I_{hold}
110-375 (1.10 Amps - 3.75 Amps)

Packaging Options
- __ = Bulk Packaging
- 2 = Tape and Reel*
- AP = Ammo-Pak*

*Packaged per EIA 486-B

Typical Time to Trip at 23°C



Typical Part Marking

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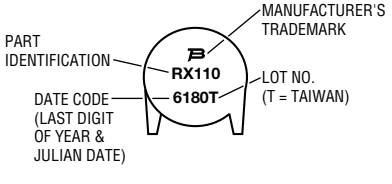
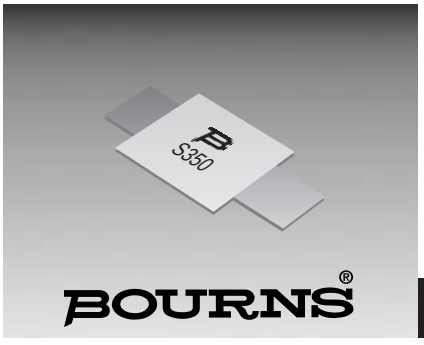




Features

- Axial leaded
- Fully compatible with current industry standards
- Weldable nickel terminals
- Very low internal resistance
- Agency recognition: UL, TÜV & CSA (pending)

Applications

- Rechargable Battery Pack Protection

MF-S Series - PTC Resettable Fuses

Electrical Characteristics

Model	V max. Volts	I max. Amps	I_{hold}	I_{trip}	Initial Resistance		1 Hour (R_1) Post-Trip Resistance	Max. Time To Trip at 5*I_h	Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.		
MF-S120	15	100	1.20	2.7	0.085	0.160	0.22	5.0	1.2
MF-S120S	15	100	1.20	2.7	0.085	0.160	0.22	5.0	1.2
MF-S150	15	100	1.50	3.00	0.05	0.09	0.11	5.0	1.30
MF-S175	15	100	1.75	3.8	0.05	0.09	0.120	4.0	1.5
MF-S175S	15	100	1.75	3.8	0.05	0.09	0.120	4.0	1.5
MF-S200	30	100	2.00	4.4	0.03	0.06	0.080	4.0	1.90
MF-S350	30	100	3.50	6.3	0.017	0.031	0.040	3.0*	2.50
MF-S420	30	100	4.20	7.6	0.012	0.024	0.040	6.0*	2.90

*Tested at 20.0 Amps

Environmental Characteristics

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 .....MIL-STD-202F, Method 107G, ...±10% typical resistance change
+125°C to -40°C,10 times
Vibration .....MIL-STD-883C, Method 2007.1, ...No change
Condition A

Test Procedures And Requirements For Model MF-S Series

Test	Test Conditions	Accept/Reject Criteria
Visual/Mech.	Verify dimensions and materials	Per MF physical description
Resistance	In still air @ 23°C	Rmin ≤ R ≤ Rmax
Time to Trip	5 times Ihold, Vmax, 23°C	T ≤ max. time to trip (seconds)
Hold Current	30 min. at Ihold	No trip
Trip Cycle Life	Vmax, Imax, 100 cycles	No arcing or burning
Trip Endurance	Vmax, 48 hours	No arcing or burning

Thermal Derating Chart - I_{hold} (Amps)

Model	Ambient Operating Temperature								
	-40˚C	-20˚C	0˚C	23˚C	40˚C	50˚C	60˚C	70˚C	85˚C
MF-S120	1.9	1.7	1.5	1.2	1.0	0.9	0.8	0.7	0.5
MF-S120S	1.9	1.7	1.5	1.2	1.0	0.9	0.8	0.7	0.5
MF-S150	2.2	2.0	1.8	1.5	1.3	1.1	1.0	0.9	0.7
MF-S175	2.5	2.3	2.0	1.7	1.5	1.3	1.2	1.1	0.9
MF-S175S	2.5	2.3	2.0	1.7	1.5	1.3	1.2	1.1	0.9
MF-S200	3.2	2.8	2.5	2.0	1.7	1.6	1.4	1.2	0.9
MF-S350	5.4	4.8	4.3	3.5	3.0	2.8	2.5	2.2	1.7
MF-S420	6.4	5.7	5.1	4.2	3.6	3.3	3.0	2.6	2.1

MF-S Series - PTC Resettable Fuses

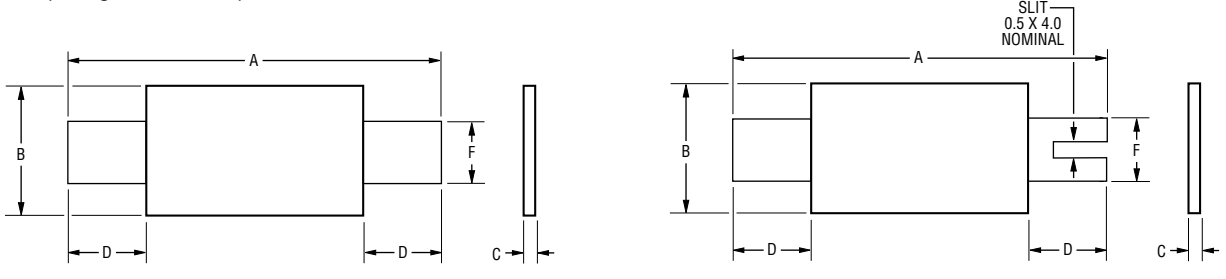
BOURNS®

Product Dimensions

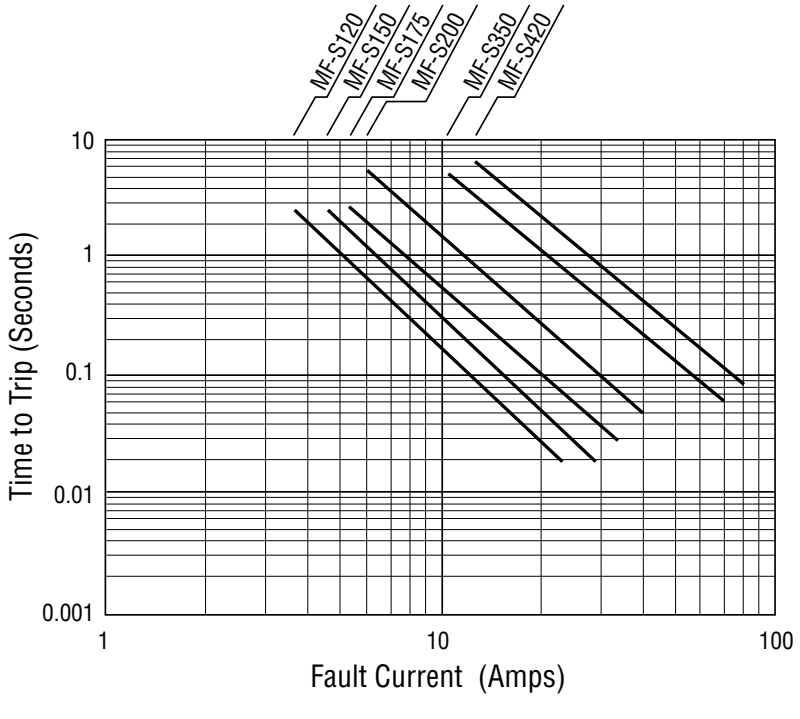
Model	A		B		C		D		F		Material
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
MF-S120	19.9	22.1	4.9	5.2	0.6	1.0	5.5	7.5	3.9	4.1	Nickel
MF-S120S	19.9	22.1	4.9	5.2	0.6	1.0	5.5	7.5	3.9	4.1	Nickel
MF-S150	21.3	23.4	10.2	11.0	0.5	1.1	4.1	5.5	4.8	5.4	Nickel
MF-S175	20.9	23.1	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	Nickel
MF-S175S	20.9	23.1	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	Nickel
MF-S200	21.3	23.4	10.2	11.0	0.5	1.1	5.0	7.6	4.8	5.4	Nickel
MF-S350	28.4	31.8	13.0	13.5	0.5	1.1	6.3	8.9	6.0	6.6	Nickel
MF-S420	30.6	32.4	12.9	13.6	0.5	1.1	5.0	7.5	6.0	6.7	Nickel

All models packaged in bulk, 500 pieces each.

DIMENSIONS = MM



Typical Time to Trip at 23°C



How To Order

MF - S 120 S

Multifuse® Product Designator

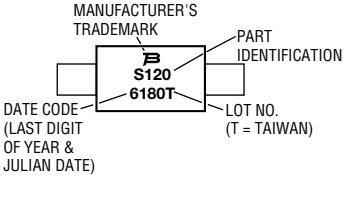
Style
- R = Radial Leaded Component
- RX = Radial Leaded Component
- S = Axial Leaded "Strap" Component
- LS = Low Temperature Axial Leaded "Strap" Component
- SM = Surface Mount Component
- MSM = 4.5mm SMD
- D = Uncoated, Unleaded "Disk" Component

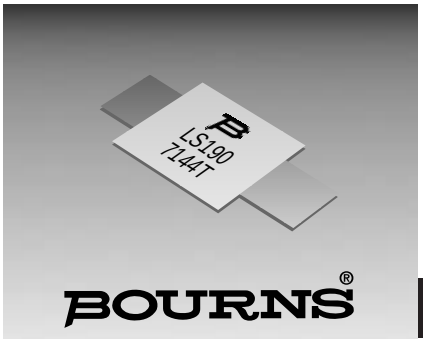
Hold Current, I_{hold}
120-420 (1.20 Amps - 4.20 Amps)

Slotted Lead Option

Typical Part Marking

Represents total content. Layout may vary.





Features

- Axial leaded
- Fully compatible with current industry standards
- Weldable nickel terminals
- Very low internal resistance
- Agency recognition: UL, TÜV & CSA (pending)

Applications

Any application that requires extra protection at elevated ambient temperatures, which the 100°C trip temperature provides.

- Rechargable battery pack protection
- Cellular phones
- Laptop computers

MF-LS Series - PTC Resettable Fuses

Electrical Characteristics

Model	V max. Volts	I max. Amps	I_{hold}	I_{trip}	Initial Resistance		1 Hour (R_1) Post-Trip Resistance	Max. Time To Trip		Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Amperes at 23°C	Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.			
MF-LS100S	24	100	1.0	2.5	0.070	0.130	0.260	5	7.0	1.5
MF-LS180	24	100	1.8	3.8	0.040	0.068	0.120	9	2.9	2.0
MF-LS180S	24	100	1.8	3.8	0.040	0.068	0.120	9	2.9	2.0
MF-LS190	24	100	1.9	4.2	0.030	0.057	0.100	10	3.0	1.9
MF-LS260	24	100	2.6	5.2	0.025	0.042	0.076	13	5.0	2.3
MF-LS300	24	100	3.0	6.3	0.015	0.031	0.055	15	4.0	2.0
MF-LS340	24	100	3.4	6.8	0.016	0.027	0.050	17	5.0	2.7

Environmental Characteristics

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 .....MIL-STD-202F, Method 107G, ...±10% typical resistance change
+125°C to -40°C,10 times
Vibration .....MIL-STD-883C, Method 2007.1, ...No change
Condition A

Test Procedures And Requirements For Model MF-LS Series

Test	Test Conditions	Accept/Reject Criteria
Visual/Mech.	Verify dimensions and materials	Per MF physical description
Resistance	In still air @ 23°C	Rmin ≤ R ≤ Rmax
Time to Trip	5 times Ihold, Vmax, 23°C	T ≤ max. time to trip (seconds)
Hold Current	30 min. at Ihold	No trip
Trip Cycle Life	Vmax, Imax, 100 cycles	No arcing or burning
Trip Endurance	Vmax, 48 hours	No arcing or burning

Thermal Derating Chart - I_{hold} (Amps)

Part No.	Ambient Operating Temperature								
	-40°C	-20°C	0°C	23°C	40°C	50°C	60°C	70°C	85°C
MF-LS100S	1.8	1.6	1.4	1.0	0.8	0.7	0.6	0.4	0.2
MF-LS180	3.1	2.6	2.2	1.8	1.3	1.1	0.9	0.6	0.2
MF-LS180S	3.1	2.6	2.2	1.8	1.3	1.1	0.9	0.6	0.2
MF-LS190	3.3	2.8	2.4	1.9	1.4	1.2	1.1	0.7	0.4
MF-LS260	4.3	3.7	3.1	2.6	1.9	1.6	1.4	1.1	0.6
MF-LS300	5.1	4.4	3.7	3.0	2.3	1.9	1.6	1.2	0.6
MF-LS340	5.5	4.7	4.0	3.4	2.6	2.2	1.9	1.5	0.8

MF-LS Series - PTC Resettable Fuses

BOURNS®

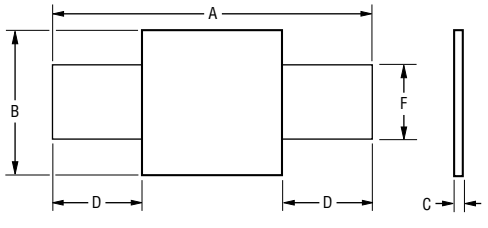
Product Dimensions

Model	A		B		C		D		F		Package Style
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
MF-LS100S	20.9	23.1	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	S
MF-LS180	24.0	26.0	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	Std.
MF-LS180S	24.0	26.0	4.9	5.2	0.6	1.0	4.1	5.5	3.9	4.1	S
MF-LS190	21.3	23.4	10.2	11.0	0.5	1.1	5.0	7.6	4.8	5.4	Std.
MF-LS260	24.0	26.0	10.8	11.9	0.6	1.0	5.0	7.0	5.9	6.1	Std.
MF-LS300	28.4	31.8	13.0	13.5	0.5	1.1	6.3	8.9	6.0	6.6	Std.
MF-LS340	24.0	26.0	14.8	15.9	0.6	1.0	4.0	5.0	5.9	6.1	Std.

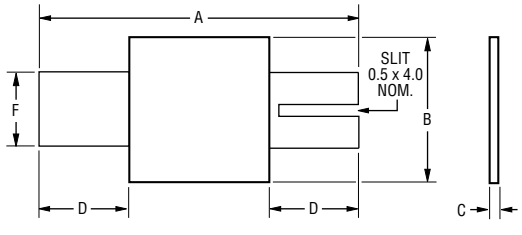
All models packaged in bulk, 500 pieces each.

DIMENSIONS = MM

Standard Package

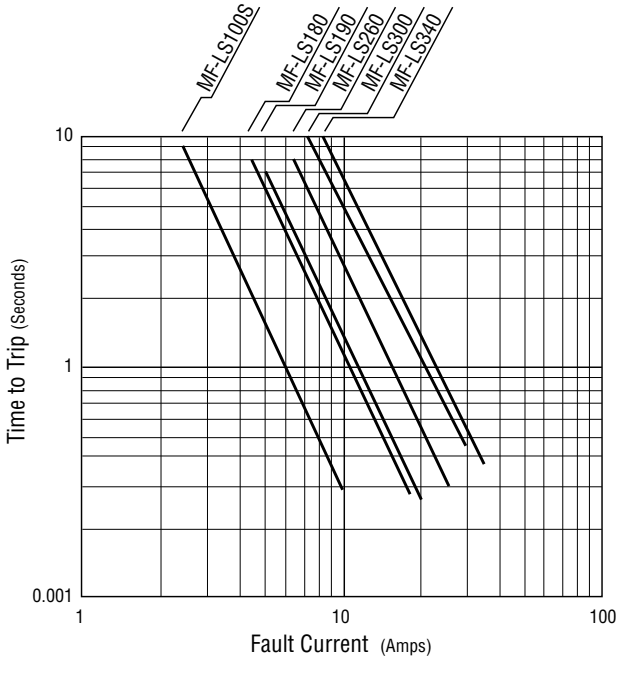


"S" Package



Typical Time to Trip at 23°C

MF-LS models offer trip temperatures lower than MF-S models for extra protection at elevated temperatures.



How To Order

MF - LS 100 S

Multifuse® Product Designator

Style

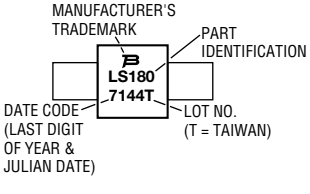
R = Radial Leaded Component
RX = Radial Leaded Component
S = Axial Leaded "Strap" Component
LS = Low Temperature Axial Leaded "Strap" Component
SM = Surface Mount Component
MSM = 4.5mm SMD
D = Uncoated, Unleaded "Disk" Component

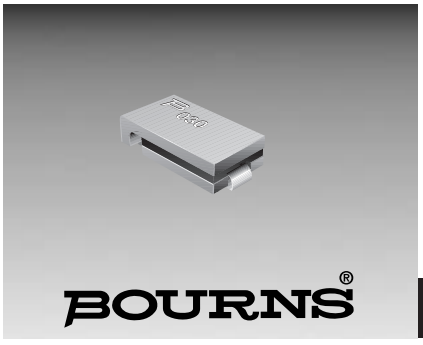
Hold Current, I_{hold}
100-340 (1.00 Amps - 3.40 Amps)

Slotted Lead Option

Typical Part Marking

Represents total content. Layout may vary.





BOURNS®

Features

- Surface Mount Devices
- Fully compatible with current industry standards
- Packaged per EIA 481-2 standard
- Agency recognition: UL, TÜV & CSA (pending)

Applications

Almost anywhere there is a low voltage power supply and a load to be protected, including:

- Computers & peripherals
- General electronics
- Automotive applications

MF-SM Series - PTC Resettable Fuses

Electrical Characteristics

Model	I max. Amps	V max. Volts	I_{hold}	I_{trip}	Initial Resistance		1 Hour (R1) Post-Reflow Resistance	Max. Time To Trip at 23°C		Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Amps	Seconds	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.		Max.	Nom.
MF-SM030	10	60	0.30	0.60	1.20	2.40	4.80	1.5	3.0	1.7
MF-SM050	10	60	0.50	1.00	0.35	0.70	1.40	2.5	4.0	1.7
MF-SM075	40	30	0.75	1.50	0.35	0.70	1.00	8.0	0.30	1.7
MF-SM100	40	30	1.10	2.20	0.12	0.24	0.48	8.0	0.50	1.7
MF-SM125	40	15	1.25	2.50	0.07	0.14	0.25	8.0	2.0	1.7
MF-SM150	40	15	1.50	3.00	0.06	0.12	0.25	8.0	5.0	1.9
MF-SM200	40	15	2.00	4.00	0.05	0.10	0.125	8.0	12.0	1.9
MF-SM250	40	15	2.50	5.00	0.035	0.08	0.085	8.0	25.0	1.9

Environmental Characteristics

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 .....MIL-STD-202F, Method 107G, ...±10% typical resistance change
+125°C to -40°C,10 times
Mechanical Shock .....MIL-STD-202, Method 213, ...No resistance change
Condition 1 (100g, 6 seconds)
Solvent Resistance .....MIL-STD-202, Method 215 .....No change
Vibration .....MIL-STD-883C, Method 2007.1, ...No change
Condition A

Test Procedures And Requirements For Model MF-SM Series

Test	Test Conditions	Accept/Reject Criteria
Visual/Mech.	Verify dimensions and materials	Per MF physical description
Resistance	In still air @ 23°C	Rmin ≤ R ≤ Rmax
Time to Trip	At specified current, Vmax, 23°C	T ≤ max. time to trip (seconds)
Hold Current	30 min. at Ihold	No trip
Trip Cycle Life	Vmax, Imax, 100 cycles	No arcing or burning
Trip Endurance	Vmax, 48 hours	No arcing or burning

Thermal Derating Chart - I_{hold} (Amps)

Model	Ambient Operating Temperature								
	-40˚C	-20˚C	0˚C	23˚C	40˚C	50˚C	60˚C	70˚C	85˚C
MF-SM030	0.45	0.40	0.35	0.30	0.25	0.23	0.20	0.17	0.14
MF-SM050	0.76	0.67	0.59	0.50	0.42	0.38	0.33	0.29	0.23
MF-SM075	1.13	1.01	0.88	0.75	0.62	0.56	0.50	0.44	0.34
MF-SM100	1.66	1.47	1.29	1.10	0.91	0.83	0.73	0.64	0.50
MF-SM125	1.89	1.68	1.46	1.25	1.04	0.94	0.83	0.73	0.56
MF-SM150	2.27	2.01	1.76	1.50	1.25	1.13	0.99	0.87	0.68
MF-SM200	3.02	2.68	2.34	2.00	1.66	1.50	1.32	1.16	0.90
MF-SM250	3.78	3.35	2.93	2.50	2.08	1.88	1.65	1.45	1.13

MF-SM Series - PTC Resettable Fuses

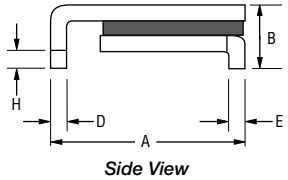
BOURNS®

Product Dimensions

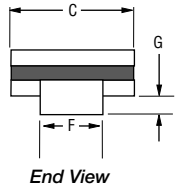
Model	A		B		C		D		E		F		G		H	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
MF-SM030	6.73	7.98		3.18		5.44	0.56	0.71	0.56	0.71	2.16	2.41	0.66	1.37	0.43	
MF-SM050	6.73	7.98		3.18		5.44	0.56	0.71	0.20	0.30	2.16	2.41	0.66	1.37	0.43	
MF-SM075	6.73	7.98		3.18		5.44	0.56	0.71	0.56	0.71	2.16	2.41	0.66	1.37	0.43	
MF-SM100	6.73	7.98		3.00		5.44	0.56	0.71	0.56	0.71	2.16	2.41	0.66	1.37	0.43	
MF-SM125	6.73	7.98		3.00		5.44	0.56	0.71	0.56	0.71	2.16	2.41	0.66	1.37	0.43	
MF-SM150	8.00	9.50		3.00		6.71	0.56	0.71	0.56	0.71	3.68	3.94	0.66	1.37	0.43	
MF-SM200	8.00	9.50		3.00		6.71	0.56	0.71	0.56	0.71	3.68	3.94	0.66	1.37	0.43	
MF-SM250	8.00	9.50		3.00		6.71	0.56	0.71	0.56	0.71	3.68	3.94	0.66	1.37	0.43	

Packaging options: DIMENSIONS = MM

TAPE & REEL: MF-SM030-MF-SM125 = 2000 pcs. per reel; MF-SM150-MF-SM250 = 1500 pcs. per reel.

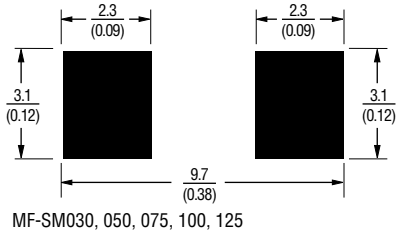


Side View



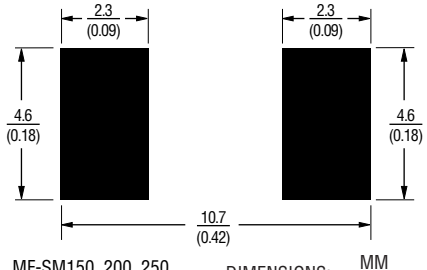
End View

Recommended Pad Layout



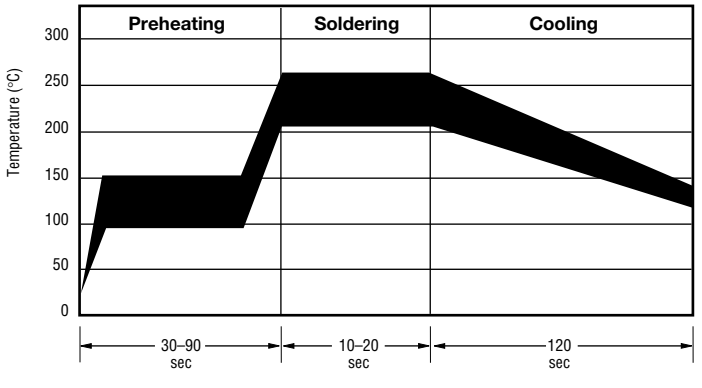
MF-SM030, 050, 075, 100, 125

Recommended Pad Layout



MF-SM150, 200, 250 DIMENSIONS: MM (INCHES)

Solder Reflow And Rework Recommendations



Solder reflow

- Recommended reflow methods: IR, vapor phase oven, hot air oven.
- Devices are not designed to be wave soldered to the bottom side of the board.
- Gluing the devices is not recommended.
- Recommended maximum paste thickness is 0.25 mm (.010 inch).
- Devices can be cleaned using standard industry methods and solvents.

Note: If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements

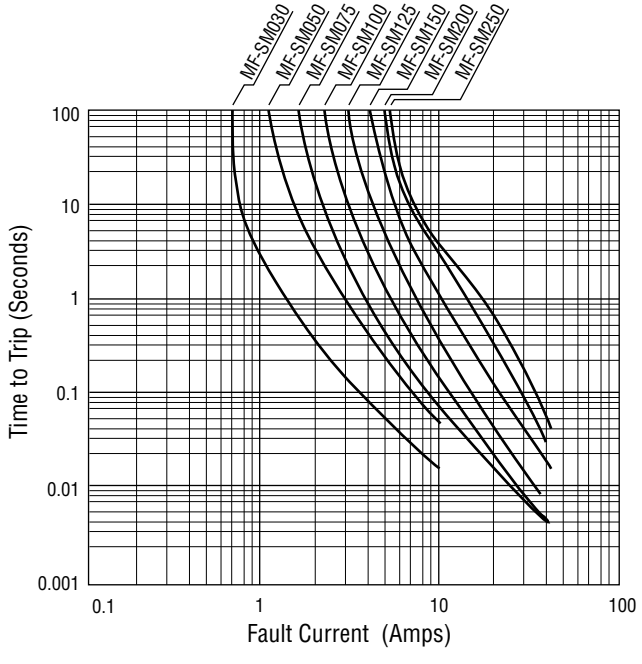
Rework

- A device should not be reworked.

MF-SM Series - PTC Resettable Fuses

BOURNS®

Typical Time to Trip at 23°C



How To Order

MF - SM 030 - 2

Multifuse® Product Designator

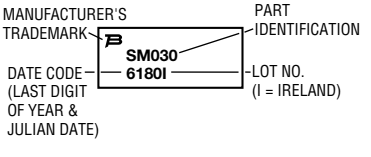
Style
- R = Radial Leaded Component
- RX = Radial Leaded Component
- S = Axial Leaded "Strap" Component
- LS = Low Temperature Axial Leaded "Strap" Component
- SM = Surface Mount Component
- MSM = 4.5mm SMD
- D = Uncoated, Unleaded "Disk" Component

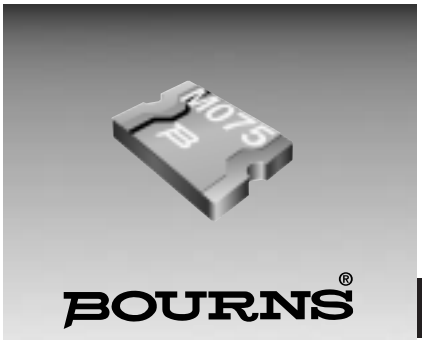
Hold Current, I_{hold}
030-250 (0.30 Amps - 2.50 Amps)

Packaging Options
Packaged per EIA 481-2
- 2 = Tape and Reel

Typical Part Marking

Represents total content. Layout may vary.





Features

- 4.5mm SMD
- Fast tripping resettable circuit protection
- Surface mount packaging for automated assembly
- Reduced component size and resistance
- Agency recognition: UL, TÜV & CSA (pending)

Applications

High Density Circuit Board Applications:

- Hard disk drives
- PC motherboards
- PC peripherals
- Point-of-sale (POS) equipment
- PCMCIA cards

MF-MSM Series - PTC Resettable Fuses

Electrical Characteristics

Model	V max. Volts	I max. Amps	I_{hold}	I_{trip}	Initial Resistance		1 Hour (R_1) Post-Reflow Resistance	Max. Time To Trip at 8.0 Amps	Tripped Power Dissipation
			Amperes at 23°C		Ohms at 23°C		Ohms at 23°C	Seconds at 23°C	Watts at 23°C
			Hold	Trip	Min.	Max.	Max.		
MF-MSM020	30.00	10	0.20	0.40	0.80	1.20	5.00	0.02	0.8
MF-MSMC035	6.0	40	0.35	0.70	0.32	0.48	1.3	0.10	0.6
MF-MSMC050	15.0	40	0.50	1.00	0.15	0.22	1.0	0.15	0.8
MF-MSM050	15.00	40	0.50	1.00	0.15	0.22	1.00	0.15	0.8
MF-MSMC075	13.2	40	0.75	1.50	0.11	0.17	0.45	0.20	0.8
MF-MSM075	13.20	40	0.75	1.50	0.11	0.17	0.45	0.20	0.8
MF-MSMC110	6.00	40	1.10	2.20	0.04	0.06	0.21	0.30	0.8

Environmental Characteristics

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 .....MIL-STD-202F, Method 107G, ...±10% typical resistance change
+125°C to -40°C,10 times
Mechanical Shock .....MIL-STD-202, Method 213, ...No resistance change
Condition 1 (100g, 6 seconds)
Solvent Resistance .....MIL-STD-202, Method 215 .....No change
Vibration .....MIL-STD-883C, Method 2007.1, ...No change
Condition A

Test Procedures And Requirements For Model MF-MSM Series

Test	Test Conditions	Accept/Reject Criteria
Visual/Mech.	Verify dimensions and materials	Per MF physical description
Resistance	In still air @ 23°C	Rmin ≤ R ≤ Rmax
Time to Trip	At 8.0 Amps, Vmax, 23°C	T ≤ max. time to trip (seconds)
Hold Current	30 min. at Ihold	No trip
Trip Cycle Life	Vmax, Imax, 100 cycles	No arcing or burning
Trip Endurance	Vmax, 48 hours	No arcing or burning

Thermal Derating Chart - I_{hold} (Amps)

Part No.	Ambient Operating Temperature								
	-40°C	-20°C	0°C	23°C	40°C	50°C	60°C	70°C	85°C
MF-MSM020	0.29	0.26	0.23	0.20	0.17	0.15	0.14	0.12	0.10
MF-MSMC035	0.47	0.45	0.40	0.35	0.30	0.28	0.24	0.21	0.18
MF-MSMC050	0.77	0.68	0.59	0.50	0.44	0.40	0.37	0.33	0.29
MF-MSM050	0.77	0.68	0.59	0.50	0.44	0.40	0.37	0.33	0.29
MF-MSMC075	1.15	1.01	0.88	0.75	0.65	0.60	0.55	0.49	0.43
MF-MSM075	1.15	1.01	0.88	0.75	0.65	0.60	0.55	0.49	0.43
MF-MSMC110	1.59	1.43	1.26	1.10	0.95	0.87	0.80	0.71	0.60

MF-MSM Series - PTC Resettable Fuses

BOURNS®

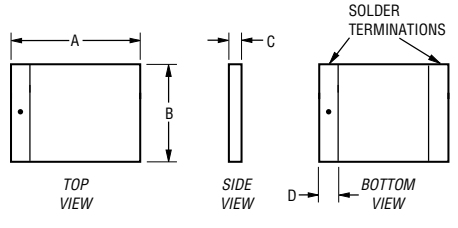
Product Dimensions

Model	A		B		C		D	E		Style
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Min.	Max.	
MF-MSM020	4.37	4.73	3.07	3.41	0.56	0.81	0.65	N/A	N/A	1
MF-MSMC035	3.00	3.43	2.35	2.80	0.38	0.62	0.35	0.25	0.50	2
MF-MSMC050	4.37	4.73	3.07	3.41	0.38	0.62	0.30	0.25	0.50	2
MF-MSM050	4.37	4.73	3.07	3.41	0.38	0.62	0.65	N/A	N/A	1
MF-MSMC075	4.37	4.73	3.07	3.41	0.38	0.62	0.30	0.25	0.50	2
MF-MSM075	4.37	4.73	3.07	3.41	0.38	0.62	0.65	N/A	N/A	1
MF-MSMC110	4.37	4.73	3.07	3.41	0.38	0.62	0.30	0.25	0.50	2

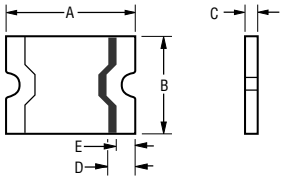
Packaging: All models = 1500 pcs. per reel.

DIMENSIONS = MM

Package 1

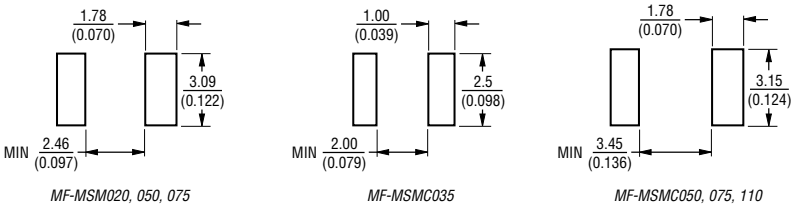


Package 2*



**These devices utilize a castalated termination which enhances the solder joint inspectability when installed on a printed circuit board.*

Recommended Pad Layout



How to Order

MF - MSM 020

Multifuse® Product Designator

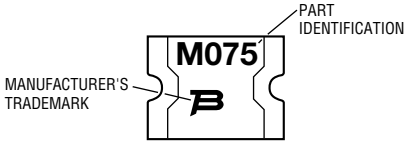
Style

- R = Radial Leaded Component
- RX = Radial Leaded Component
- S = Axial Leaded "Strap" Component
- LS = Low Temperature Axial Leaded "Strap" Component
- SM = Surface Mount Component
- MSM = 4.5mm SMD
- D = Uncoated, Unleaded "Disk" Component

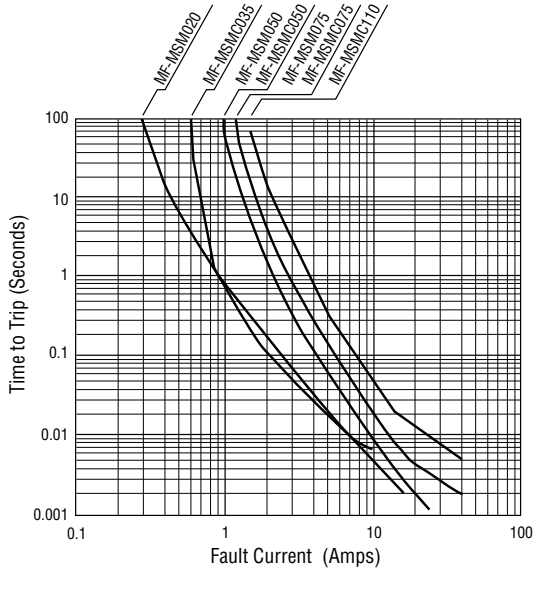
Hold Current, I_{hold}
020-110 (0.20 Amps - 1.10 Amps)

Typical Part Marking

Represents total content. Layout may vary.



Typical Time to Trip at 23°C



Soldering Profile

Note: MF-MSMC models can be wave soldered and reworked.

MF-R and MF-RX Series Tape and Reel Specifications

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Devices taped using EIA468–B/IEC286-2 standards. See table below and Figures 1 and 2 for details.

Dimension Description	IEC Mark	EIA Mark	Dimensions	
			Dim. (mm)	Tol. (mm)
Carrier tape width	*W*	*W*	18	-0.5/+1.0
Hold down tape width		*W4*	5	min.
Hold down tape	*W0*		No protrusion	
Top distance between tape edges	*W2*	*W6*	3	max.
Sprocket hole position	*W1*	*W5*	9	-0.5/+0.75
Sprocket hole diameter	*D0*	*D0*	4	± 0.2
Abscissa to plane (straight lead)	*H*	*H*	18.5	± 3.0
Abscissa to plane (kinked lead)	*H0*	*H0*	16	± 0.5
Abscissa to top	*H1*	*H1*	32.2	max.
Overall width w/lead protrusion		*C1*	43.2	max.
Overall width w/o lead protrusion		*C2*	42.5	max.
Lead protrusion	*I1*	*L1*	1.0	max.
Protrusion of cutout	*L*	*L*	11	max.
Protrusion beyond hold tape	*I2*	*I2*	Not specified	
Sprocket hole pitch	*P0*	*P0*	12.7	± 0.3
Pitch tolerance			20 seconds	± 1
Device pitch: MF-R010 – MF-R160			12.7	
Device pitch: MF-R185 – MF-R400			25.4	
Device pitch: MF-RX110 – MF-RX160			12.7	
Device pitch: MF-RX185 – MF-RX400			25.4	
Tape thickness	*t*	*t*	0.9	max.
Tape thickness with splice		*t1*	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
Lead seating plane deviation	$\Delta P1$	*P1*	0	± 0.7
Lead spacing	*F*	*F*	5.08	± 0.8
Reel width	*w*	*w*	56	max.
Reel diameter	*d*	*a*	370	max.
Space between flanges less device			4.75	± 3.25
Arbor hole diameter	*f*	*c*	26	± 12.0
Core diameter	*h*	*n*	80	max.
Box			56/372/372	max.
Consecutive missing places			3 maximum	
Empty places per reel			Not specified	

MF-R and MF-RX Series Tape and Reel Specifications

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Taped Component Dimensions

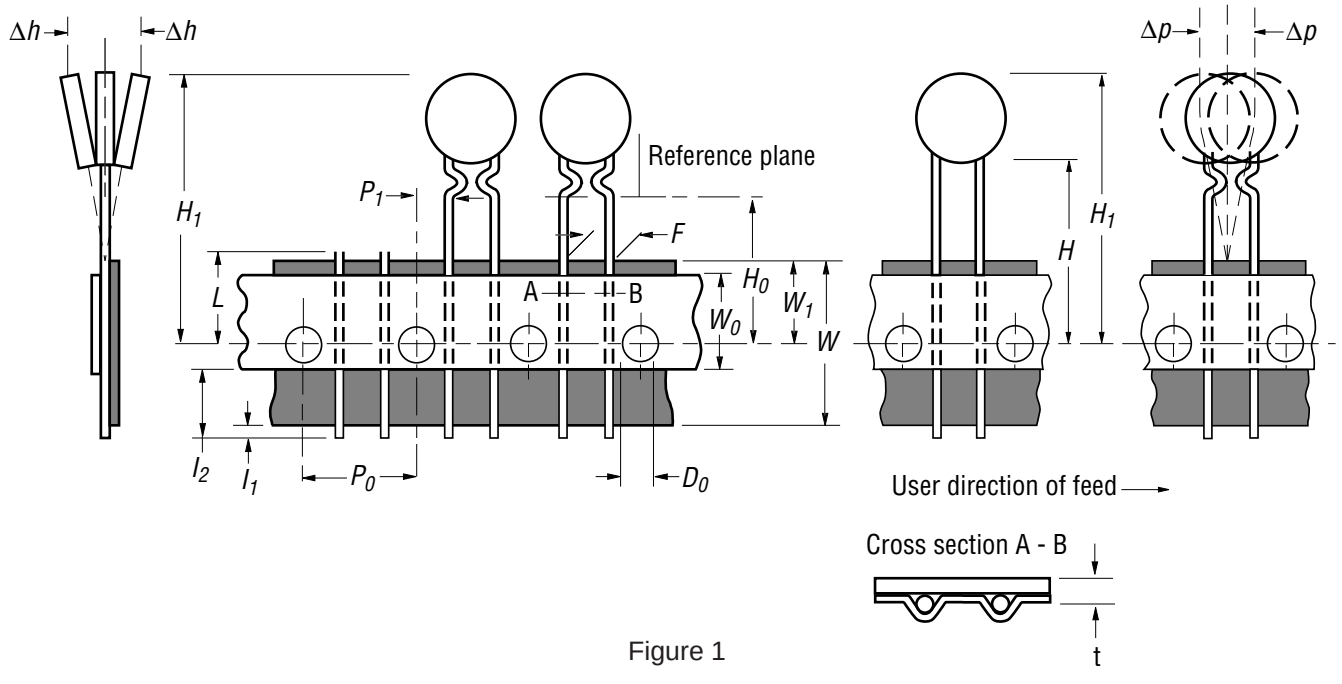

Figure 1

Reel Dimensions

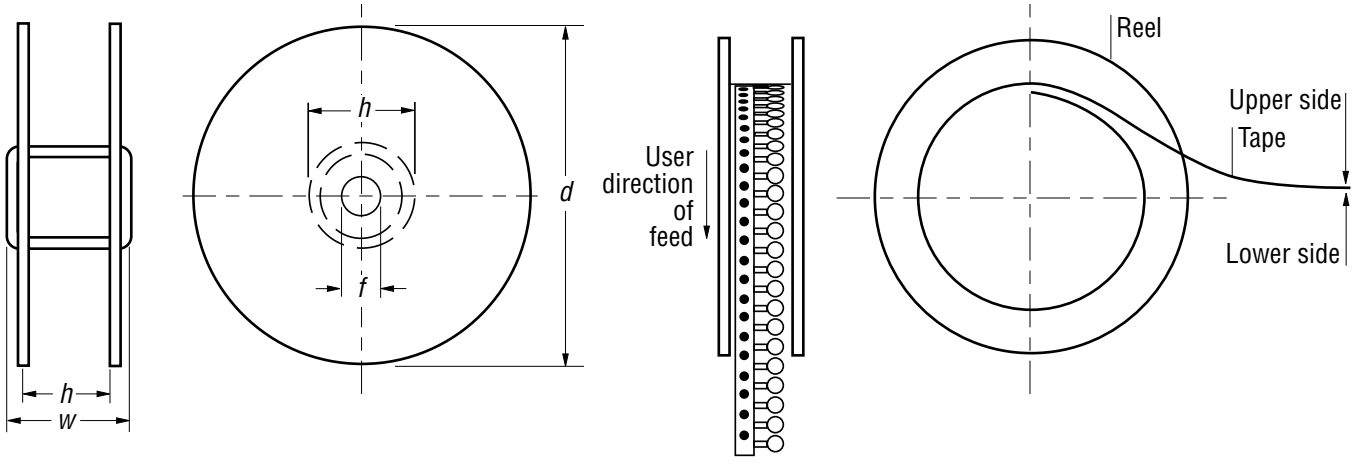

Figure 2

MF-SM Series Tape and Reel Specifications

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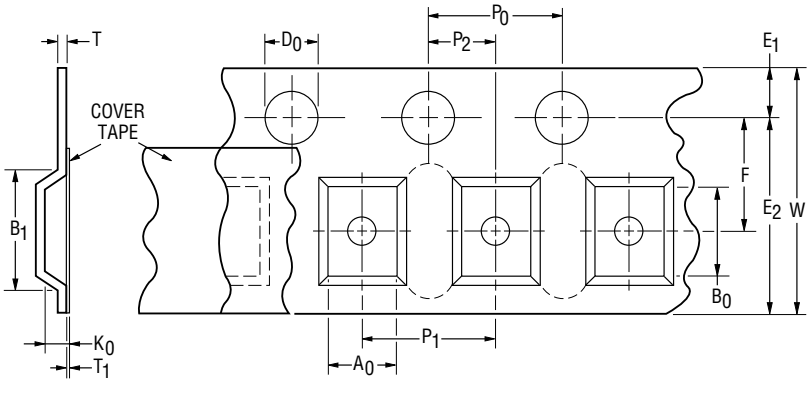
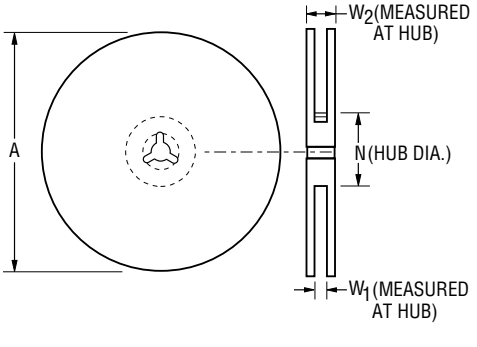
Tape Dimension Identifiers	MF-SM030, 050, 075, 100, 125 per EIA-481-2	MF-SM150, 200, 250 per EIA 481-2
W	16 ± 0.3	16 ± 0.3
P_0	4.0 ± 0.10	4.0 ± 0.10
P_1	8.0 ± 0.10	12.0 ± 0.10
P_2	2.0 ± 0.10	2.0 ± 0.10
A_0	5.7 ± 0.10	6.9 ± 0.10
B_0	8.1 ± 0.15	10.0 ± 0.10
B_1 max.	9.1	11.0
D_0	1.5 + 0.1/ - 0	1.5 + 0.1/ -0
F	7.5 ± 0.10	7.5 ± 0.10
E_1	1.75 ± 0.10	1.75 ± 0.10
E_2 min.	14.25	14.25
T max.	0.4	0.4
T_1 max.	0.1	0.1
K_0	3.4 ± 0.15	3.5 ± 0.10
Leader min.	390	390
Trailer min.	160	160
Reel Dimension Identifiers		
A max.	360	360
N min.	50	50
W_1	16.4 + 2.0/ -0	16.4 + 2.0/ -0
W_2 max.	22.4	22.4

DIMENSIONS: MM



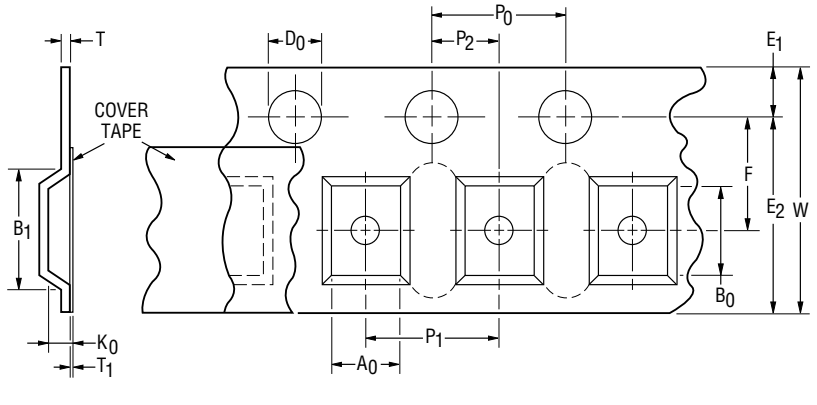


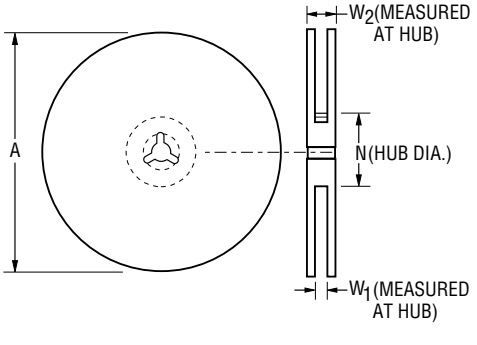
MF-MSM Series Tape and Reel Specifications

BOURNS®

Tape Dimension Identifiers	MF-MSM020, C050, 050, C075, 075, C110 per EIA-481-1	MF-MSMC035 per EIA 481-1
W	12 ± 0.3	8 ± 0.3
P_0	4.0 ± 0.10	4.0 ± 0.10
P_1	8.0 ± 0.10	4.0 ± 0.10
P_2	2.0 ± 0.05	2.0 ± 0.05
A_0	3.5 ± 0.23	2.8 ± 0.1
B_0	5.1 ± 0.15	3.5 ± 0.1
B_1 max.	5.9	4.35
D_0	1.5 + 0.1/ - 0	1.5 + 0.1/ -0
F	5.5 ± 0.05	3.5 ± 0.05
E_1	1.75 ± 0.10	1.75 ± 0.10
E_2 min.	10.25	6.25
T max.	0.6	0.6
T_1 max.	0.1	0.1
K_0	0.9 ± 0.15	1.1 ± 0.05
Leader min.	390	390
Trailer min.	160	160
Reel Dimension Identifiers		
A max.	185	185
N min.	50	50
W_1	12.4 + 2.0/ -0	8.4 + 1.5/ -0
W_2 max.	18.4	14.4

DIMENSIONS: MM





Multifuse® Product Selection Worksheet

BOURNS®

To select the correct Multifuse® resettable fuse, complete the information below, and refer to the relevant Multifuse product family page.

1. Determine the ***NORMAL*** operating current (I_{hold}): _____ Amps
2. Determine the ***MAXIMUM*** circuit voltage (V_{max}): _____ Volts
3. Determine the ***MAXIMUM*** fault current (I_{max}): _____ Amps
4. Determine the ***OPERATING TEMPERATURE*** range min._____ °C
   max. _____ °C
5. Which form factor is the most suitable for the application:

   Package 1 Through-Hole (Pages 95-99)

   MF-R010 through MF-R090 .....I_{hold} of 100 mAmps - 900 mAmps and (V_{max}) of 60.0 volts

   MF-RX110 through MF-RX375 .....I_{hold} of 1.10 Amps - 3.75 Amps and (V_{max}) of 60.0 volts

   MF-R110 through MF-R900 .....I_{hold} of 1.1 Amps - 9.0 Amps and (V_{max}) of 30.0 volts

   Package 2 Surface Mount (Pages 104-108)

   MF-SM030 through MF-SM250.....I_{hold} of 300 mAmps - 2.5 Amps

   MF-MSM020 through MF-MSMC110.....I_{hold} of 200 mAmps - 1.10 Amps

   Package 3 Battery Strap (Pages 100-103)

   MF-S120 through MF-S420 .....I_{hold} of 1.2 Amps - 4.2 Amps

   MF-LS100 through MF-LS340 .....I_{hold} of 1.0 Amps - 3.4 Amps

6. Check that the maximum ratings for V_{max} and I_{max} of the product family chosen is higher than the maximum circuit voltage and fault current in the application.
7. Using the Thermal Derating Chart on the data sheets, select the Multifuse device at the maximum operating temperature with an I_{hold} greater than or equal to the normal operating current.
8. Order samples and test in the application. Lab Design Kits for most Multifuse® product lines are available as follows. Contact your nearest Bourns sales office for more information.

Through-Hole:	Surface Mount:	Battery Strap:
MF-RLAB010-110	MF-SMLAB030-250	MF-SLAB120-420
MF-RLAB135-900	MF-MSMLAB020-110	MF-LSLAB100S-340