

Circuit Protection Devices for Battery Application

OUR EXPERTISE

Littelfuse PolySwitch Circuit Protection began almost 40 years ago, pioneering the field of resettable PPTC (polymeric positive temperature coefficient) technology with our PolySwitch product line. Today our extensive product portfolio reflects our expertise in developing different material platforms that help designers create safe and reliable applications.

BATTERY PROTECTION PRODUCTS

Our devices for battery protection include hybrid MHP-TA devices, PolySwitch PPTC strap and disc devices, low rho SMD devices and surface-mount fuses. By drawing upon our long history in materials science and customer knowledge, our products respond to evolving battery technologies to meet specific design requirements. As a result, our battery protection products offer engineers enhanced design flexibility and the ability meet regulatory requirements – all while helping them achieve energy-saving, space- and cost-effective designs.

In choosing the appropriate battery circuit protection device, designers should consider the requirements of the end use application, cell chemistry and cell geometry, in addition to the relevant electrical specifications of each application.

Typical Battery Applications

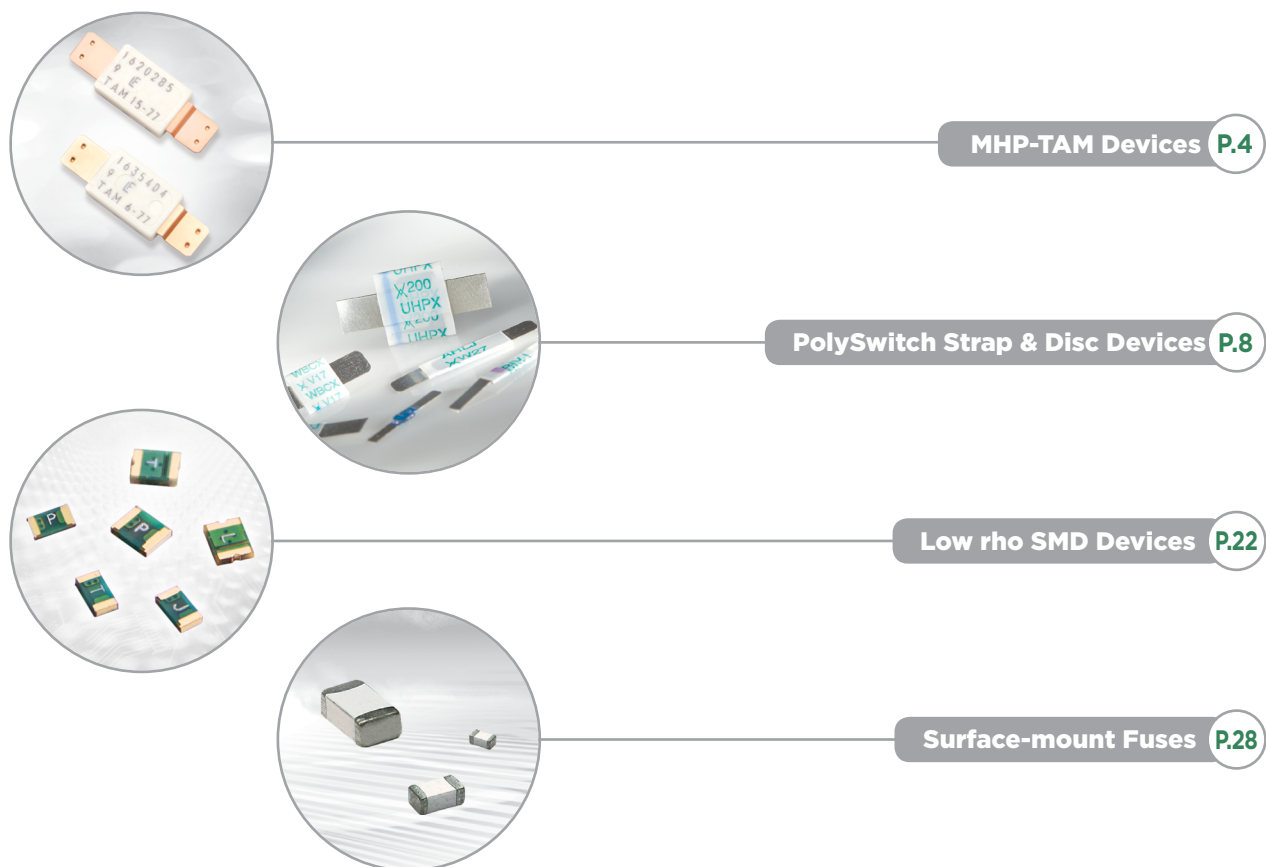
BATTERY PACKS FOR:

- Mobile Phone and Smart Phones
- Tablet PCs
- Ultra-thin Notebooks
- Mobile Radios
- Digital Cameras
- Portable Media Players

CHARGE LINES FOR:

- Power Tools

Device Offering for Battery Protection



Application Cross Reference for Battery Devices

Protection Application	Cell Capacity	Device Recommendation	Typical Hold Current @ 25°C	Installation Method
Feature Phone	< 2000mAh	Fuse Devices Size 0402, 0603, 1206	5A*	SMD
Smart Phone	< 1500mAh	Low rho Strap and SMD Devices	1.9A	SMD / Laser / Spot Welding
	1500 - 1650mAh	Low rho Strap and SMD Devices	2.5A	SMD / Laser / Spot Welding
	1700 - 2300mAh	Low rho Strap and SMD Devices	3.1A	SMD / Spot Welding
	2500 - 3100mAh	Low rho Strap Devices	4.2A	SMD / Laser / Spot Welding
	> 3100mAh	Low rho Strap Devices	6A	SMD / Laser / Spot Welding
Tablet PC	2000mAh - 5000mAh	MHP-TA Devices	6A	Laser / Spot Welding
Ultra-thin Notebook	2000mAh - 8000mAh		15A	
Notebook	2200mAh - 3200mAh	Disc	3A	Crimping

* 5A is the maximum hold current for fuse device



MHP-TAM DEVICES Helps Protect Ultra-Thin LiP / Prismatic Cells

The Metal hybrid PPTC devices with thermal activation (MHP-TA) offer the necessary combination of low thermal cut-off temperatures, high hold-current ratings and compact size required for protecting higher-capacity Lithium Polymer (LiP) and prismatic batteries found in the latest tablet and ultra-thin computing products.

The new MHP-TAM devices offer a 9V_{DC} rating and a higher current rating than typical battery thermal cutoff (TCO) devices.

Benefits

- Capable of handling voltages and battery charge rates found in high-capacity LiP and prismatic cells used in cutting-edge applications
- Helps provide resettable and accurate overtemperature protection
- Compact size and thin form factor facilitates circuit protection in ultra-thin battery pack designs
- Customization of welding leads available to facilitate design

Features

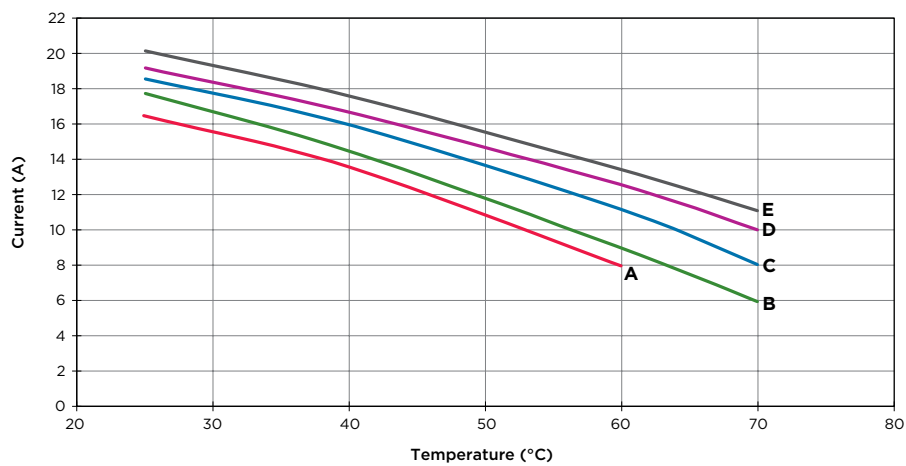
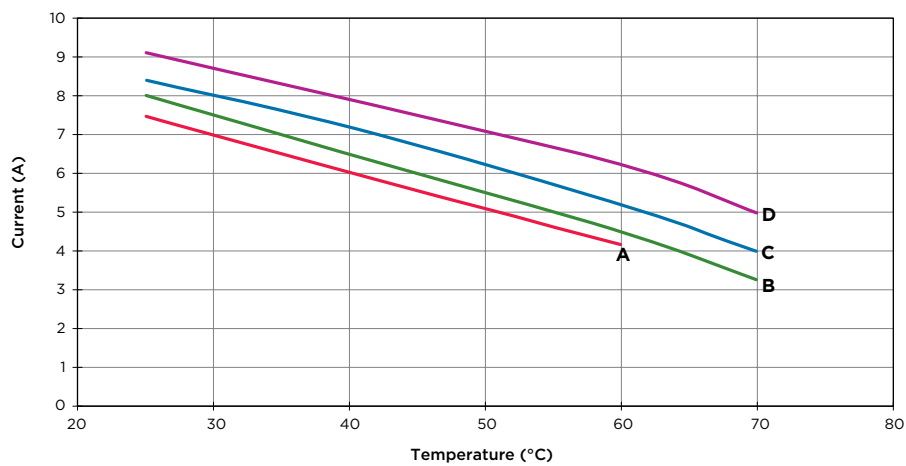
- Two levels of hold current:
 - Low current (nominal 6A hold current @25°C)
 - High current (nominal 15A hold current @25°C)
- Multiple temperature ratings
 - (72°C, 77°C, 82°C, 85°C, 90°C)
- Compact size (L:5.8mm x W:3.85mm x H:1.15mm)

Electrical Characteristics for MHP-TAM Devices (Typical)

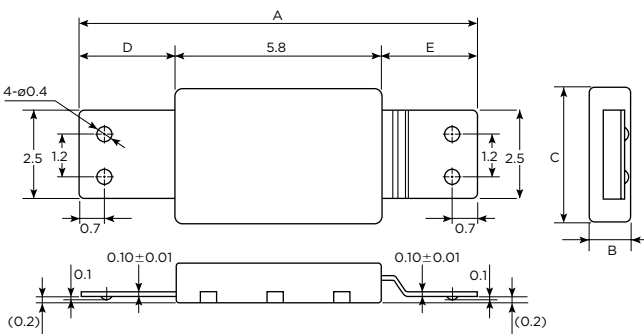
Series	Model Number	Rating [°C] Nominal	Operation Temperature [°C]		Reset Temperature [°C]		Reference Resistance [mohms] 25°C	
			Min	Max	Min	T	Typ	Max
MHP-TAM6 Series								
Typical Electrical Rating (25°C) Max. Breaking Current 5V _{DC} /40A (100 cycles) Contact Rating 9V _{DC} /12A (6000 cycles)	MHP-TAM6-9-72	72	67	77	≥40	≥7	10	15
	MHP-TAM6-9-77	77	72	82	≥40	≥10	10	15
	MHP-TAM6-9-82	82	77	87	≥40	≥10	10	15
	MHP-TAM6-9-85	85	80	90	≥40	≥10	10	15
MHP-TAM15 Series								
Typical Electrical Rating (25°C) Max. Breaking Current 5V _{DC} /80A (100 cycles) Contact Rating 9V _{DC} /25A (6000 cycles)	MHP-TAM15-9-72	72	67	77	≥40	*≥7	2.5	5
	MHP-TAM15-9-77	77	72	82	≥40	*≥10	2.5	5
	MHP-TAM15-9-82	82	77	87	≥40	*≥10	2.5	5
	MHP-TAM15-9-85	85	80	90	≥40	*≥10	2.5	5
	MHP-TAM15-9-90	90	85	95	≥40	*≥10	2.5	5

* The minimum temperature differential between the actual operation temperature of the device and the reset temperature

Hold Current vs. Temperature Curves for MHP-TAM Devices (Typical)



Dimensions and Mechanical Characteristics for MHP-TAM Devices



MHP-TAM Series:

	Min	Max
A	10.9	11.4
B	-	1.15
C	3.75	3.85
D	2.6	2.8
E	2.6	2.8

Unless otherwise specified, all tolerances are ±0.1mm.

Packaging, Marking Information and Agency Recognition for MHP-TAM Devices

Part Number	Bag Quantity	Standard Package	Part Marking	Agency Recognition
MHP-TAM6 Series	1,000	20,000	Lot ID#, Control# & Co. Logo, Product #	UL & cUL File No. E349829; CB File No. US-23966-M1-UL
MHP-TAM15 Series	1,000	20,000	Lot ID#, Control# & Co. Logo, Product #	UL & cUL File No. E349829; CB File No. US-24160-UL

Ordering Information for MHP-TAM Devices

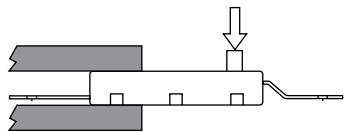
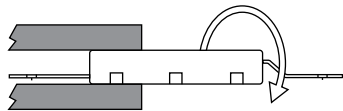
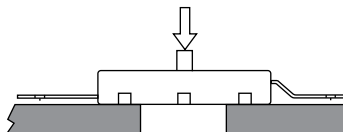
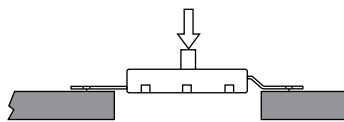
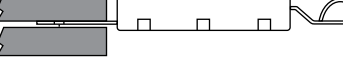
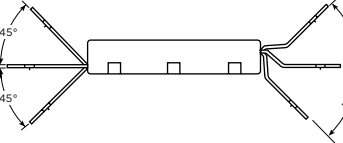
Part Number	Bag (pieces)	Box (pieces)
MHP-TAM6 Series	1,000	20,000
MHP-TAM15 Series	1,000	20,000

Precautions for Handling for MHP-TAM Devices

The device is composed of plastic parts, please do not clamp or dent the housing with a tool as this might cause a resistance increase and product damage.

When welding product terminals or mounting the breaker on a battery (cell), please be careful not to apply excessive bending, twisting or force on the product and terminals. The excessive stress might cause a resistance increase or product damage.

Please refer to following cautions:

 1. Do not apply more than 10N bend force to product.	 2. Do not apply more than 1.5cN/m twist torque to the product.	 3. Do not apply more than 20N deflection force to product.
 4. Do not apply more than 2N force to the terminals.	 5. Do not apply more than 0.6cN/m twisting torque to the terminals.	 6. Do not bend the terminal base more than 45° when the product is mounted in a fixed position.

Product terminals can be welded using direct welding and series welding methods. In either case, please use a suitable jig so that the device will not be subjected to the stress conditions listed above.

Pull strength and detach strength of the terminal welds are per user requirements. However, if the welding is controlled by resistance, the measurement should be made as close as possible to the weld point by a "4-point clip method" using milliohm meter to ensure accuracy.

Avoid putting stress on the device, as listed above, when a jig, fitting or additional welding process is used. Please reconfirm the resistance value whenever a new process is added.

Storage Conditions for MHP-TAM Devices

Device must be stored in the original, unopened bag.

Suggested storage temperature (except for packaging material)

- Temperature: -10°C - 40°C
- Humidity: 75%RH (max)

The following environments should be avoided for storage:

- Areas with salt air or with corrosive gas, such as Cl₂, H₂S, NH₃, SO₂ and NO_x.
- Areas exposed to direct sunlight.
- Areas outside of the suggested storage temperature range, as indicated above.

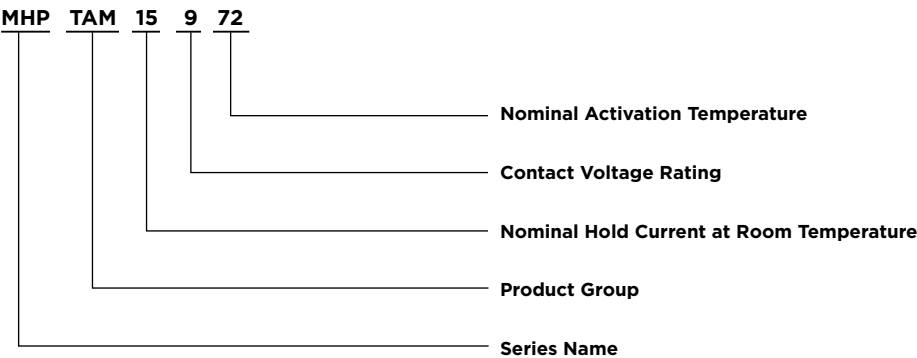
Physical Characteristics
for MHP-TAM Devices

Terminals	Copper Alloy
Molding Plastic	LCP (Liquid Crystal Polymer)

RoHS and Halogen-free Compliance
for MHP-TAM Devices

RoHS Compliant
Halogen Free per IEC 61249-2-21

Part Numbering System





STRAP AND DISC DEVICES Offer Resetability and Flexibility

PolySwitch PPTC devices for battery protection includes eight different product series (SRP, LR4, VTP, VLP, VLR, MXP, MGP and RSD), as well as disc and special application strap devices. Each of these material platforms offers different performance characteristics that offer engineers greater design flexibility.

PolySwitch annular disc devices are usually customized for each application. Contact Littelfuse representative for a custom design.

Benefits

- Compatible with high-volume electronics assembly
- Assists designers in meeting regulatory requirements
- Low-resistance helps increase application's battery operating time
- Helps design flexibility with choice of high hold currents, small profile packages and lead-shape customization
- Helps provide overtemperature protection from thermal events

Features

- Lead-free versions available for all devices
- Broad range of resettable devices help meet wide variety of application and form factor requirements
- Current ratings from 1.1A to 13A
- Voltage ratings from 6V to 30V
- Agency recognition: UL, CSA, TUV
- Fast time-to-trip
- Low resistance
- RoHS compliant

Application Selection Guide for Strap Battery Devices

The guide below lists PolySwitch strap battery devices which are typically used in applications.

The following pages contain the specifications for the part numbers recommended below.

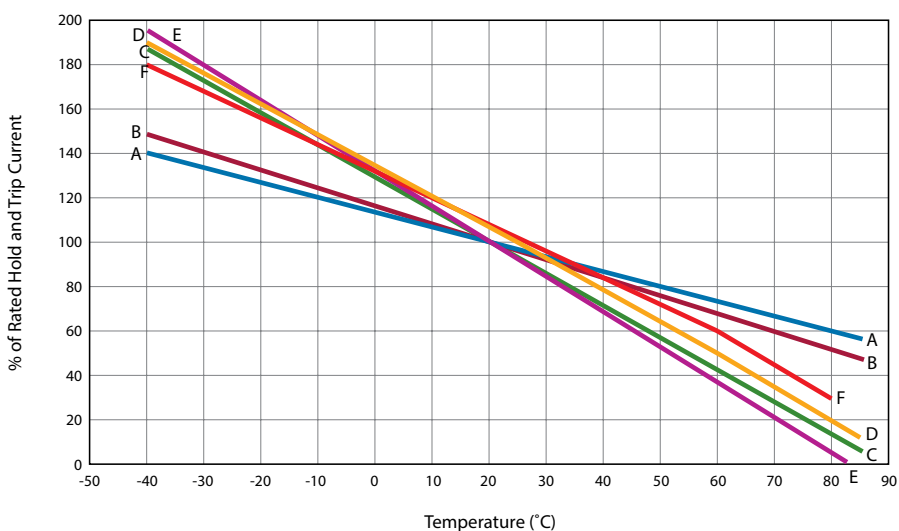
Once a device is selected, the user should evaluate and test each product for its intended application.

Protection Application	Cell Chemistry	PolySwitch Resettable Devices — Selection Criteria		
		Installation Method	Lowest Resistance	Lowest Thermal Cut-off
Mobile Phone Battery Packs	Li-ion	Surface-mount Prismatic	Refer to Low roh SMD Devices of this Catalog MXP370BD	VLR175F
Cordless Phone Battery Packs	NiMH	Cylindrical	VLP210F SRP175F	—
Mobile Radio Battery Packs	NiMH	Cylindrical	LR4-380F SRP350F	—
Computer Battery Packs	NiMH Li-ion	Cylindrical Cylindrical Prismatic	LR4-900F LR4-1300SSF Consult Local Rep	— — Consult Local Rep
Camcorder Battery Packs	NiMH or Li-ion	Prismatic	VLP270F LR4-380F	VTP210GF —
PDA Battery Packs	Li-ion	Prismatic	VLP220F	VLR175F
Power Tools (Charge Line)	NiCd, NiMH or Li-ion	Cylindrical	Custom LR4	Custom VTP

Product Series: Current Rating, Voltage Rating / Typical Resistance for Strap Battery Devices

Hold Current (A)	VLR	VLP	VTP	MXP & MGP	RSD	SRP	LR4
	Typical Activation Temperature						
	85°C	90°C	90°C	120°C	125°C	125°C	125°C
1.10	—	—	16V/0.054Ω	—	—	—	—
1.20	—	16V/0.053Ω	—	—	—	15V/0.123Ω	—
1.70	12V/0.025Ω	—	16V/0.041Ω	—	—	—	—
1.75	12V/0.024Ω	16V/0.032Ω	16V/0.040Ω	—	—	15V/0.070Ω	—
1.80	—	—	—	6V/0.0105Ω	—	—	—
1.90	—	—	—	6V/0.011Ω	—	—	15V/0.056Ω
2.00	—	—	—	—	—	30V/0.045Ω	—
2.10	—	16V/0.024Ω	16V/0.024Ω	—	—	—	—
2.20	—	16V/0.023Ω	—	—	—	—	—
2.30	12V/0.015Ω	—	—	—	—	—	—
2.50	—	—	—	6V/0.011Ω	—	—	—
2.60	—	—	—	—	—	—	15V/0.031Ω
2.70	—	16V/0.015Ω	—	6V/0.0105Ω	—	—	—
3.10	—	—	—	6V/0.0075Ω	6V/0.010Ω	—	—
3.50	—	—	—	—	—	30V/0.024Ω	—
3.70	—	—	—	6V/0.007Ω	6V/0.007Ω	—	—
3.80	—	—	—	—	—	—	15V/0.020Ω
4.20	—	—	—	—	6V/0.0065Ω	30V/0.018Ω	—
4.50	—	—	—	6V/0.0048Ω	—	—	20V/0.016Ω
4.50	—	—	—	6V/0.0045Ω	—	—	—
5.50	—	—	—	—	—	—	20V/0.013Ω
6.00	—	—	—	—	—	—	20V/0.011Ω
7.30	—	—	—	—	—	—	20V/0.009Ω
9.00	—	—	—	—	—	—	20V/0.008Ω
13.00	—	—	—	—	—	—	20V/0.006Ω

Thermal Derating Curve for Strap Battery Devices



Thermal Derating for Strap Battery Devices [Hold Current(A) at Ambient Temperature(°C)]

Part Number	Maximum Ambient Temperature												
	-40°C	-20°C	0°C	20°C	25°C	40°C	50°C	60°C	70°C	75°C	80°C	85°C	90°C
85°C Typical Activation													
VLR*													
VLR170F	3.5	2.9	2.4	1.84	1.70	1.2	1.0	0.7	0.3	—	—	—	—
VLR175F	3.5	2.9	2.4	1.87	1.75	1.3	1.0	0.8	0.3	—	—	—	—
VLR175LF	3.5	2.9	2.4	1.87	1.75	1.3	1.0	0.8	0.3	—	—	—	—
VLR230F	5.0	4.2	3.4	2.52	2.30	1.7	1.3	0.9	0.4	—	—	—	—
90°C Typical Activation													
VLP*													
VLP120UF	2.4	2.1	1.8	1.30	1.20	1.0	0.7	0.6	0.3	0.2	0.1	—	—
VLP175UAF	3.2	2.7	2.3	1.70	1.75	1.2	1.0	0.9	0.5	0.2	0.1	—	—
VLP210F	4.3	3.6	2.9	2.31	2.10	1.6	1.3	1.0	0.6	0.3	0.1	—	—
VLP220F	4.5	3.8	3.0	2.45	2.20	1.7	1.4	1.1	0.7	0.3	0.1	—	—
VLP270F	5.6	4.7	4.0	3.05	2.70	2.2	1.7	1.4	0.9	0.4	0.1	—	—
VTP*													
VTP110F	2.0	1.7	1.4	1.12	1.10	0.85	0.75	0.7	0.4	0.2	0.1	—	—
VTP170F	3.2	2.7	2.2	1.80	1.70	1.3	1.0	0.8	0.5	0.3	0.1	—	—
VTP170XSF	3.2	2.7	2.2	1.80	1.70	1.3	1.0	0.8	0.5	0.3	0.1	—	—
VTP175F	3.2	2.7	2.2	1.84	1.75	1.3	1.0	0.8	0.5	0.3	0.1	—	—
VTP175LF	3.2	2.7	2.2	1.84	1.75	1.3	1.0	0.8	0.5	0.3	0.1	—	—
VTP210GF	4.1	3.5	2.9	2.26	2.10	1.6	1.3	1.0	0.7	0.4	0.1	—	—
VTP210SF	4.1	3.5	2.9	2.26	2.10	1.6	1.3	1.0	0.7	0.4	0.1	—	—
120°C Typical Activation													
MXP*													
MXPI80	—	—	2.45	—	1.8	—	—	0.80	—	—	—	—	—
MXPI90BB	—	—	2.6	—	1.9	—	—	0.85	—	—	—	—	—
MXP250K	—	—	3.6	—	2.5	—	—	1.3	—	—	—	—	—
MXP270	—	—	3.8	—	2.7	—	—	1.4	—	—	—	—	0.3
MXP310	—	—	5.0	—	3.1	—	—	1.9	—	1.0	—	—	—
MXP370BD	—	—	5.0	—	3.7	—	—	1.9	—	—	—	—	—
120°C Typical Activation													
MGP													
MGP450	—	—	—	—	4.5	—	—	2.6	—	—	—	—	—
MGP500	—	—	—	—	5.0	—	—	3.0	2.0	—	—	—	—
125°C Typical Activation													
RSD													
RSD 310	—	—	—	—	3.1	—	—	—	—	—	—	—	—
RSD370	—	—	—	—	3.7	—	—	—	—	—	—	—	—
RSD420	—	—	—	—	4.2	—	—	—	—	—	—	—	—
125°C Typical Activation													
SRP													
SRP120F	1.9	1.7	1.5	1.20	1.17	1.0	0.9	0.8	0.6	—	0.5	0.4	—
SRP175F	2.5	2.2	2.0	1.75	1.68	1.4	1.3	1.2	1.0	—	0.9	0.8	—
SRP200F	3.1	2.8	2.5	2.00	1.97	1.7	1.5	1.4	1.2	—	1.0	0.9	—
SRP350F	5.3	4.8	4.3	3.50	3.44	3.0	2.7	2.5	2.1	—	1.8	1.7	—
SRP420F	6.3	5.7	5.1	4.20	4.11	3.6	3.3	3.0	2.6	—	2.2	2.1	—
LR4													
LR4-190F	2.8	2.5	2.3	1.9	1.86	1.6	1.5	1.4	1.2	—	1.1	1.0	—

Thermal Derating for Strap Battery Devices [Hold Current(A) at Ambient Temperature(°C)]

Part Number	Maximum Ambient Temperature												
	-40°C	-20°C	0°C	20°C	25°C	40°C	50°C	60°C	70°C	75°C	80°C	85°C	90°C
	A												
LR4-260F	3.8	3.4	3.1	2.6	2.54	2.2	2.0	1.9	1.7	—	1.4	1.3	—
LR4-380F	5.4	4.9	4.4	3.8	3.64	3.3	3.0	2.8	2.5	—	2.3	2.1	—
LR4-380XF	5.4	4.9	4.4	3.8	3.64	3.3	3.0	2.8	2.5	—	2.3	2.1	—
LR4-450F	6.5	5.8	5.3	4.5	4.38	3.9	3.6	3.3	2.9	—	2.6	2.4	—
LR4-550F	7.6	6.9	6.2	5.5	5.32	4.7	4.3	4.0	3.6	—	3.2	3.0	—
LR4-600F	8.7	7.8	7.1	6.0	5.86	5.2	4.7	4.4	3.9	—	3.4	3.2	—
LR4-600XF	8.7	7.8	7.1	6.0	5.86	5.2	4.7	4.4	3.9	—	3.4	3.2	—
LR4-730F	10.5	9.5	8.6	7.3	7.13	6.3	5.7	5.4	4.7	—	4.2	4.0	—
LR4-900F	12.7	11.4	10.0	9.0	8.50	7.5	6.8	6.2	5.5	—	4.9	4.5	—
LR4-1300SSF	17.9	16.2	14.5	13.0	12.40	11.1	10.3	9.5	8.6	—	7.7	7.2	—

* Product electrical characteristics determined at 25°C.

Electrical Characteristics for Strap Battery Devices

Part Number	I _H	I _T	V _{MAX}	I _{MAX}	P _{D MAX}	Max Time-to-trip		R _{MIN}	R _{MAX}	R _{IMAX}	Figure for Dimension
	(A)	(A)	(V _{DC})	(A)	(W)	(A)	(s)	(Ω)	(Ω)	(Ω)	
85°C Typical Activation VLR*											
VLR170F	1.70	4.1	12	100	1.4	8.50	5.0	0.018	0.032	0.064	B2
VLR175F	1.75	4.2	12	100	1.4	8.75	5.0	0.017	0.031	0.062	B2
VLR175LF	1.75	4.2	12	100	1.4	8.75	5.0	0.017	0.031	0.062	B2
VLR230F	2.30	5.0	12	100	2.5	10.00	5.0	0.012	0.018	0.036	B2
90°C Typical Activation VLP*											
VLP120UF	1.20	3.6	16	60	1.6	7.00	5.0	0.039	0.067	0.134	B4
VLP175UAF	1.75	3.9	16	60	1.8	8.75	5.0	0.023	0.041	0.082	B4
VLP210F	2.10	5.0	16	60	1.8	10.50	5.0	0.018	0.030	0.060	B1
VLP220F	2.20	5.3	16	60	1.8	11.00	5.0	0.017	0.029	0.058	B2
VLP270F	2.70	6.5	16	60	2.5	13.50	5.0	0.012	0.018	0.036	B2
VTP*											
VTP110F	1.10	2.7	16	100	1.3	5.50	5.0	0.038	0.070	0.140	B4
VTP170F	1.70	3.4	16	100	1.4	8.50	5.0	0.030	0.052	0.105	B1
VTP170XSF	1.70	3.4	16	100	1.4	8.50	5.0	0.030	0.052	0.105	B3
VTP175F	1.75	3.6	16	100	1.4	8.75	5.0	0.029	0.051	0.102	B2
VTP175LF	1.75	3.6	16	100	1.4	8.75	5.0	0.029	0.051	0.102	B2
VTP210GF	2.10	4.7	16	100	1.5	10.00	5.0	0.018	0.030	0.060	B2
VTP210SF	2.10	4.7	16	100	1.5	10.00	5.0	0.018	0.030	0.060	B3
120°C Typical Activation MXP*											

Electrical Characteristics for Strap Battery Devices (continued)

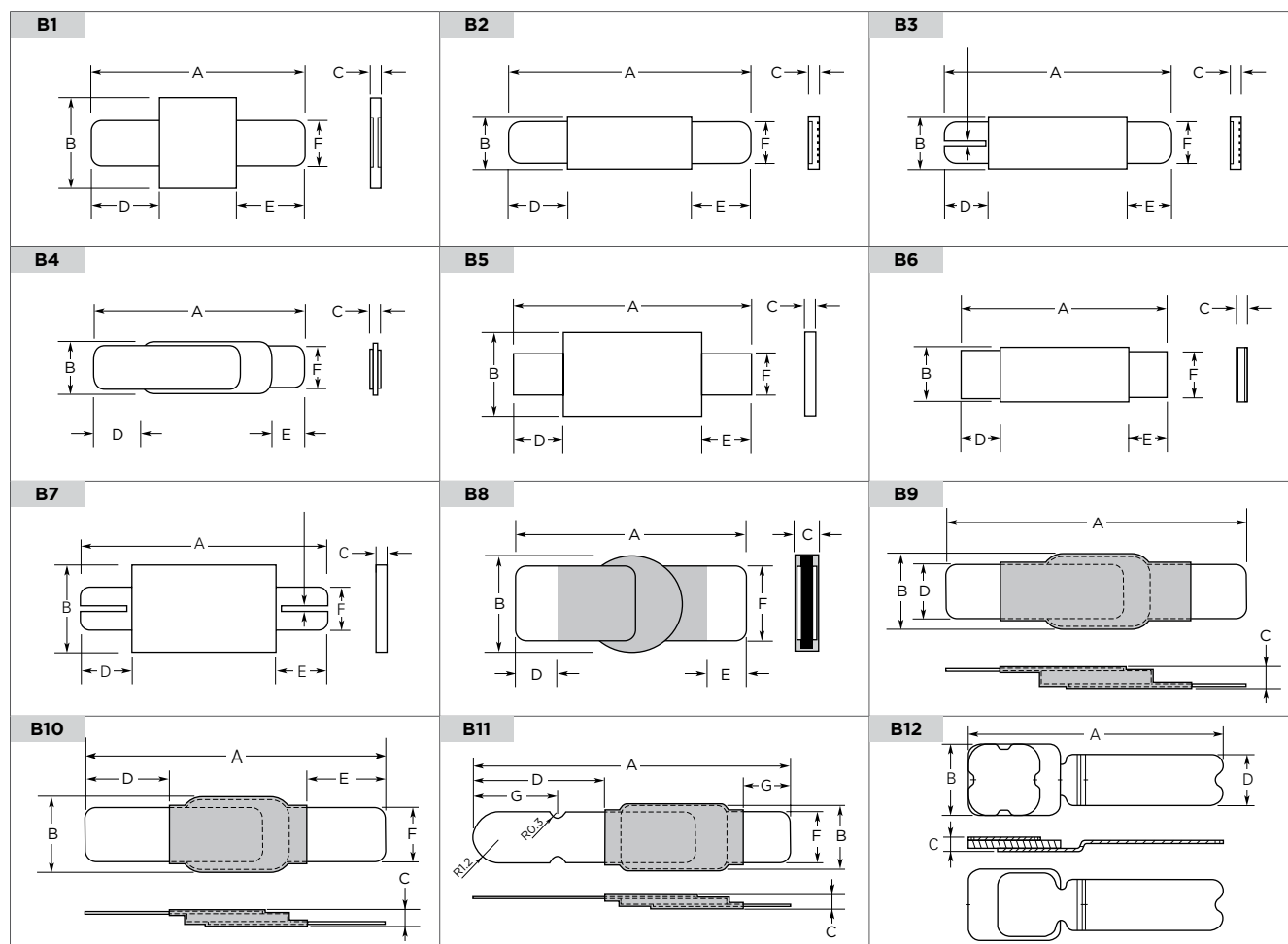
Part Number	I_H	I_T	V_{MAX}	I_{MAX}	$P_{D MAX}$	Max Time-to-trip		R_{MIN}	R_{MAX}	R_{IMAX}	Figure for Dimension
	(A)	(A)	(V _{DC})	(A)	(W)	(A)	(s)	(Ω)	(Ω)	(Ω)	
MXP180	1.80	5.2	6	50	1.0	9.00	5.0	0.007	0.014	0.024	B9
MXP190BB	1.90	4.9	6	50	1.0	9.50	2.0	0.007	0.015	0.024	B8
MXP250K	2.50	6.2	6	50	1.0	13.50	2.0	0.006	0.016	0.028	B9
MXP270	2.70	6.2	6	50	1.0	13.50	2.0	0.006	0.015	0.026	B9
MXP310	3.10	9.0	6	50	1.3	17.50	5.0	0.003	0.012	0.018	B9
MXP370BD	3.70	9.0	6	50	1.3	18.50	5.0	0.004	0.010	0.016	B9
120°C Typical Activation MGP											
MGP450	4.50	9.2	6	50	1.5	25.00	5.0	0.0025	0.007	0.013	B10
MGP500	5.00	9.2	6	50	1.5	25.00	5.0	0.0025	0.0065	0.013	B11
125°C Typical Activation RSD											
RSD310	3.10	11	6	50	1.5	15.5	5.0	0.0040	0.015	0.022	B12
RSD370	3.70	12	6	50	1.5	18.5	5.0	0.0035	0.012	0.018	B12
RSD420	4.20	13	6	50	1.5	21.0	5.0	0.0030	0.010	0.016	B12
125°C Typical Activation SRP											
SRP120F	1.20	2.7	15	100	1.2	6.00	5.0	0.085	0.160	0.220	B5
SRP175F	1.75	3.8	15	100	1.5	8.75	5.0	0.050	0.090	0.120	B5
SRP200F	2.00	4.4	30	100	1.9	10.00	4.0	0.030	0.060	0.100	B5
SRP350F	3.50	6.3	30	100	2.5	20.00	3.0	0.017	0.031	0.050	B5
SRP420F	4.20	7.6	30	100	2.9	20.00	6.0	0.012	0.024	0.040	B5
LR4											
LR4-190F	1.90	3.9	15	100	1.2	9.5	5.0	0.0390	0.0720	0.102	B6
LR4-260F	2.60	5.8	15	100	2.5	13.0	5.0	0.0200	0.0420	0.063	B6
LR4-380F	3.80	8.3	15	100	2.5	19.0	5.0	0.0130	0.0260	0.037	B6
LR4-380XF	3.80	8.3	15	100	2.5	19.0	5.0	0.0130	0.0260	0.037	B6
LR4-450F	4.50	8.9	20	100	2.3	22.5	5.0	0.0110	0.0200	0.028	B6
LR4-550F	5.50	10.5	20	100	2.8	27.5	5.0	0.0090	0.0160	0.022	B6
LR4-600F	6.00	11.7	20	100	2.8	30.0	5.0	0.0070	0.0140	0.019	B6
LR4-600XF	6.00	11.7	20	100	2.8	30.0	5.0	0.0075	0.0140	0.019	B6
LR4-730F	7.30	14.1	20	100	3.3	30.0	5.0	0.0060	0.0120	0.015	B6
LR4-900F	9.00	16.7	20	100	3.8	45.0	5.0	0.0060	0.0100	0.014	B6
LR4-1300SSF	13.00	21.2	20	100	4.5	50.0	10.0	0.0035	0.0065	0.009	B7

* Product electrical characteristics determined at 25°C.

Notes:

- I_H : Hold current: maximum current device will pass without interruption in 20°C still air unless otherwise specified.
 I_T : Trip current: minimum current that will switch the device from low-resistance to high-resistance in 20°C still air 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 voltage.
 P_D : Power dissipated from device when in the tripped state in 20°C still air unless otherwise specified.
 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.
 R_{IMAX} : Maximum resistance, measured at 20°C unless otherwise specified, of device one hour after being tripped the first time.

Dimension Figures for Strap Battery Devices



Dimensions For Strap Battery Devices In Millimeters (Inches)

Part Number	A		B		C		D		E		F		Figure
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
85°C Typical Activation VLR*													
VLR170F	20.8 (0.832)	23.2 (0.928)	3.5 (0.140)	3.9 (0.156)	— (—)	0.8 (0.032)	4.5 (0.180)	6.5 (0.260)	4.5 (0.180)	6.5 (0.260)	2.4 (0.096)	2.6 (0.104)	B2
VLR175F	23.0 (0.920)	24.5 (0.980)	2.9 (0.116)	3.3 (0.132)	0.5 (0.020)	0.8 (0.032)	4.7 (0.188)	7.2 (0.288)	3.8 (0.152)	5.4 (0.216)	2.4 (0.096)	2.6 (0.104)	B2
VLR175LF	29.3 (1.172)	31.7 (1.268)	2.9 (0.116)	3.3 (0.132)	— (—)	0.8 (0.032)	5.2 (0.208)	6.8 (0.272)	10 (0.400)	12.5 (0.500)	2.4 (0.096)	2.6 (0.104)	B2
VLR230F	20.9 (0.836)	23.1 (0.924)	4.9 (0.196)	5.3 (0.212)	— (—)	0.8 (0.032)	4.1 (0.164)	5.8 (0.232)	4.1 (0.164)	5.8 (0.232)	3.9 (0.156)	4.1 (0.164)	B2
90°C Typical Activation VLP*													

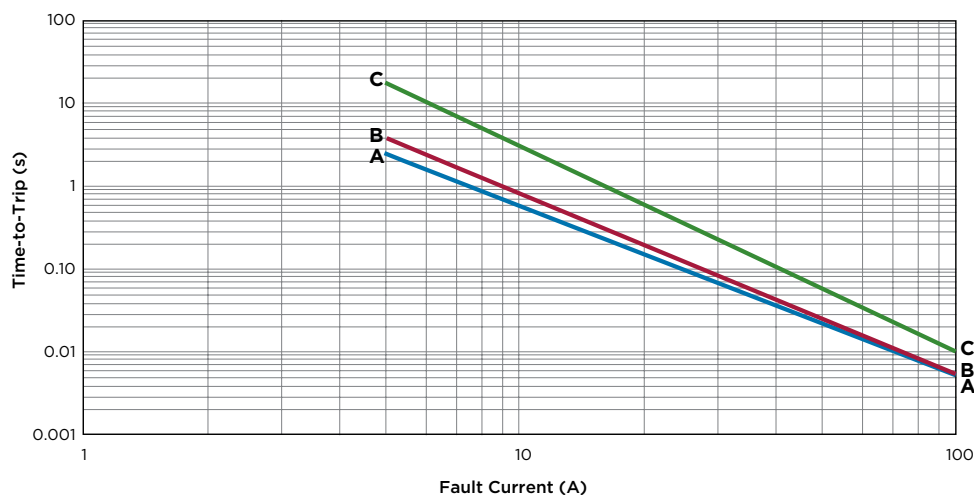
Dimensions For Strap Battery Devices In Millimeters (Inches) (continued)

Part Number	A		B		C		D		E		F		G		Figure
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
90°C Typical Activation															
VLP*															
VLP120UF	10.9 (0.430)	11.8 (0.460)	4.4 (0.170)	4.6 (0.180)	— (0.028)	0.7 (0.028)	5.5 (0.220)	6.5 (0.260)	1.65 (0.065)	1.9 (0.075)	2.3 (0.091)	2.5 (0.098)	—	—	B4
VLP175UAF	23.6 (0.944)	25.6 (1.024)	2.7 (0.108)	2.9 (0.116)	— (0.028)	0.7 (0.028)	7.0 (0.280)	8.0 (0.320)	7.0 (0.280)	8.0 (0.320)	2.3 (0.092)	2.5 (0.100)	—	—	B4
VLP210F	15.4 (0.616)	17.5 (0.700)	6.9 (0.276)	7.3 (0.292)	0.6 (0.024)	0.8 (0.032)	4.0 (0.160)	6.2 (0.248)	4.0 (0.160)	6.2 (0.248)	3.9 (0.156)	4.1 (0.164)	—	—	B1
VLP220F	21.1 (0.844)	23.3 (0.932)	3.5 (0.140)	3.9 (0.156)	0.6 (0.024)	0.8 (0.032)	5.1 (0.204)	6.8 (0.272)	5.1 (0.204)	6.8 (0.272)	2.9 (0.116)	3.1 (0.124)	—	—	B2
VLP270F	20.9 (0.836)	23.1 (0.924)	4.9 (0.196)	5.3 (0.212)	0.6 (0.024)	0.8 (0.032)	4.1 (0.164)	5.8 (0.232)	4.1 (0.164)	5.8 (0.232)	3.9 (0.156)	4.1 (0.164)	—	—	B2
VTP															
VTP110F	23.6 (0.944)	25.6 (1.024)	2.7 (0.108)	2.9 (0.116)	— (0.028)	0.7 (0.028)	7.0 (0.280)	8.0 (0.320)	7.0 (0.280)	8.0 (0.320)	2.3 (0.092)	2.5 (0.100)	—	—	B4
VTP170F	15.4 (0.616)	17.5 (0.700)	7.0 (0.280)	7.4 (0.296)	0.5 (0.020)	0.8 (0.032)	4.0 (0.160)	6.2 (0.248)	4.0 (0.160)	6.2 (0.248)	3.9 (0.156)	4.1 (0.164)	—	—	B1
VTP170XSF	20.9 (0.836)	22.9 (0.916)	4.9 (0.196)	5.3 (0.212)	0.5 (0.020)	0.8 (0.032)	6.0 (0.240)	8.6 (0.344)	6.0 (0.240)	8.6 (0.344)	3.9 (0.156)	4.1 (0.164)	—	—	B3
VTP175F	21.2 (0.848)	23.2 (0.928)	3.5 (0.140)	3.9 (0.156)	— (0.032)	0.8 (0.032)	4.6 (0.184)	6.6 (0.264)	4.6 (0.184)	6.6 (0.264)	2.9 (0.116)	3.1 (0.124)	—	—	B2
VTP175LF	25.8 (1.032)	28.2 (1.128)	3.5 (0.140)	3.9 (0.156)	— (0.032)	0.8 (0.032)	5.7 (0.228)	7.3 (0.292)	8.7 (0.348)	10.3 (0.412)	2.4 (0.096)	2.6 (0.104)	—	—	B2
VTP210GF	20.9 (0.836)	23.1 (0.924)	4.9 (0.196)	5.3 (0.212)	— (0.032)	0.8 (0.032)	4.1 (0.164)	5.8 (0.232)	4.1 (0.164)	5.8 (0.232)	3.9 (0.156)	4.1 (0.164)	—	—	B2
VTP210SF	20.9 (0.836)	23.1 (0.924)	4.9 (0.196)	5.3 (0.212)	0.6 (0.024)	0.8 (0.032)	4.1 (0.164)	5.8 (0.232)	4.1 (0.164)	5.8 (0.232)	3.9 (0.156)	4.1 (0.164)	—	—	B3
120°C Typical Activation															
MXP*															
MXP180	9.4 (0.37)	10.0 (0.39)	2.3 (0.09)	2.6 (0.10)	0.7 (0.02)	1.1 (0.04)	1.9 (0.07)	2.1 (0.08)	— (0.08)	— (0.08)	— (0.08)	— (0.08)	—	—	B9
MXP190BB	9.2 (0.36)	10.8 (0.43)	2.96 (0.12)	3.26 (0.13)	0.7 (0.03)	1.1 (0.04)	1.6 (0.06)	3.1 (0.12)	1.6 (0.06)	3.1 (0.12)	2.2 (0.09)	2.4 (0.10)	—	—	B8
MXP250K	11.75 (0.46)	12.35 (0.49)	2.3 (0.09)	2.7 (0.11)	0.7 (0.03)	1.1 (0.04)	2.4 (0.09)	2.6 (0.10)	— (0.10)	— (0.10)	— (0.10)	— (0.10)	—	—	B9
MXP270	10.3 (0.40)	11.5 (0.45)	2.3 (0.09)	2.7 (0.10)	0.7 (0.02)	1.1 (0.04)	2.1 (0.08)	— (0.08)	2.1 (0.08)	— (0.08)	1.9 (0.07)	2.1 (0.08)	—	—	B8
MXP310	14.5 (0.57)	16.5 (0.65)	2.96 (0.11)	3.26 (0.13)	0.65 (0.03)	0.95 (0.04)	4.6 (0.18)	— (0.18)	4.6 (0.18)	— (0.18)	2.2 (0.09)	2.4 (0.10)	—	—	B8
MXP370BD	10.5 (0.41)	11.3 (0.44)	2.96 (0.11)	3.26 (0.12)	0.7 (0.02)	1.1 (0.04)	2.0 (0.07)	— (0.07)	2.0 (0.07)	— (0.07)	2.2 (0.08)	2.4 (0.09)	—	—	B8
120°C Typical Activation															
MGP															
MGP450	13.0 (0.51)	14.0 (0.55)	2.96 (0.12)	3.26 (0.13)	— (0.04)	0.95 (0.04)	3.0 (0.12)	— (0.12)	3.0 (0.12)	— (0.12)	2.2 (0.09)	2.4 (0.09)	—	—	B10
MGP500	14.5	15.5	2.96	3.26	—	0.95	5.5	7.0	2.0	—	2.3	2.5	3.95	4.05	B11
	14.5	15.5	2.96	3.26	—	0.95	5.5	7.0	2.0	—	2.3	2.5	3.95	4.05	B11
125°C Typical Activation															
RSD															
RSD310	9.7 (0.382)	10.3 (0.406)	2.65 (0.106)	2.95 (0.114)	— (0.024)	0.65 (0.024)	1.9 (0.075)	2.1 (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	B12
RSD370	9.7 (0.382)	10.3 (0.406)	2.65 (0.106)	2.95 (0.114)	— (0.024)	0.65 (0.024)	1.9 (0.075)	2.1 (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	B12
RSD420	9.7 (0.382)	10.3 (0.406)	2.65 (0.106)	2.95 (0.114)	— (0.024)	0.65 (0.024)	1.9 (0.075)	2.1 (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	— (0.083)	B12

Dimensions For Strap Battery Devices In Millimeters (Inches) (continued)

Part Number	A		B		C		D		E		F		Figure
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
SRP200F	21.3 (0.852)	23.4 (0.936)	10.2 (0.408)	11.0 (0.440)	0.5 (0.020)	1.1 (0.044)	5.0 (0.200)	7.6 (0.304)	5.0 (0.200)	7.6 (0.304)	4.8 (0.192)	5.4 (0.216)	B5
SRP350F	28.4 (1.136)	31.8 (1.272)	13.0 (0.520)	13.5 (0.540)	0.5 (0.020)	1.1 (0.044)	6.3 (0.252)	8.9 (0.356)	6.3 (0.252)	8.9 (0.356)	6.0 (0.240)	6.6 (0.264)	B5
SRP420F	30.6 (1.224)	32.4 (1.296)	12.9 (0.516)	13.6 (0.544)	0.5 (0.020)	1.1 (0.044)	5.0 (0.200)	7.5 (0.300)	5.0 (0.200)	7.5 (0.300)	6.0 (0.240)	6.7 (0.268)	B5
LR4													
LR4-190F	19.9 (0.796)	22.1 (0.884)	4.9 (0.196)	5.5 (0.220)	0.6 (0.024)	1.0 (0.040)	5.5 (0.220)	7.5 (0.300)	5.5 (0.220)	7.5 (0.300)	3.9 (0.156)	4.1 (0.164)	B6
LR4-260F	20.9 (0.836)	23.1 (0.924)	4.9 (0.196)	5.5 (0.220)	0.6 (0.024)	1.0 (0.040)	4.1 (0.164)	5.5 (0.220)	4.1 (0.164)	5.5 (0.220)	3.9 (0.156)	4.1 (0.164)	B6
LR4-380F	24.0 (0.960)	26.0 (1.040)	6.9 (0.276)	7.5 (0.300)	0.6 (0.024)	1.0 (0.040)	4.1 (0.164)	5.5 (0.220)	4.1 (0.164)	5.5 (0.220)	4.9 (0.196)	5.1 (0.204)	B6
LR4-380XF	32.2 (1.288)	35.8 (1.432)	4.9 (0.196)	5.5 (0.220)	0.6 (0.024)	1.0 (0.040)	5.5 (0.220)	7.5 (0.300)	5.5 (0.220)	7.5 (0.300)	3.9 (0.156)	4.1 (0.164)	B6
LR4-450F	24.0 (0.960)	26 (1.040)	9.9 (0.396)	10.5 (0.420)	0.6 (0.024)	1.0 (0.040)	5.3 (0.212)	6.7 (0.268)	5.3 (0.212)	6.7 (0.268)	5.9 (0.236)	6.1 (0.244)	B6
LR4-550F	35.0 (1.400)	37.0 (1.480)	6.9 (0.276)	7.5 (0.300)	0.6 (0.024)	1.0 (0.040)	5.3 (0.212)	6.7 (0.268)	5.3 (0.212)	6.7 (0.268)	4.9 (0.196)	5.1 (0.204)	B6
LR4-600F	24.0 (0.960)	26.0 (1.040)	13.9 (0.556)	14.5 (0.580)	0.6 (0.024)	1.0 (0.040)	4.1 (0.164)	5.5 (0.220)	4.1 (0.164)	5.5 (0.220)	5.9 (0.236)	6.1 (0.244)	B6
LR4-600XF	40.5 (1.620)	42.7 (1.708)	6.9 (0.276)	7.5 (0.300)	0.6 (0.024)	1.0 (0.040)	5.2 (0.208)	6.8 (0.272)	5.2 (0.208)	6.8 (0.272)	4.9 (0.196)	5.1 (0.204)	B6
LR4-730F	27.1 (1.084)	29.1 (1.164)	13.9 (0.556)	14.5 (0.580)	0.6 (0.024)	1.0 (0.040)	4.1 (0.164)	5.5 (0.220)	4.1 (0.164)	5.5 (0.220)	5.9 (0.236)	6.1 (0.244)	B6
LR4-900F	45.4 (1.816)	47.6 (1.904)	7.9 (0.316)	8.5 (0.340)	0.9 (0.036)	1.3 (0.052)	4.6 (0.184)	6.2 (0.248)	4.6 (0.184)	6.2 (0.248)	5.9 (0.236)	6.1 (0.244)	B6
LR4-1300SSF	61.5 (2.460)	66.5 (2.660)	9.4 (0.376)	10.0 (0.400)	0.9 (0.036)	1.3 (0.052)	5.0 (0.200)	7.5 (0.300)	5.0 (0.200)	7.5 (0.300)	5.9 (0.236)	6.1 (0.244)	B7

Typical Time-To-Trip Curves at 20°C for Strap Battery Devices



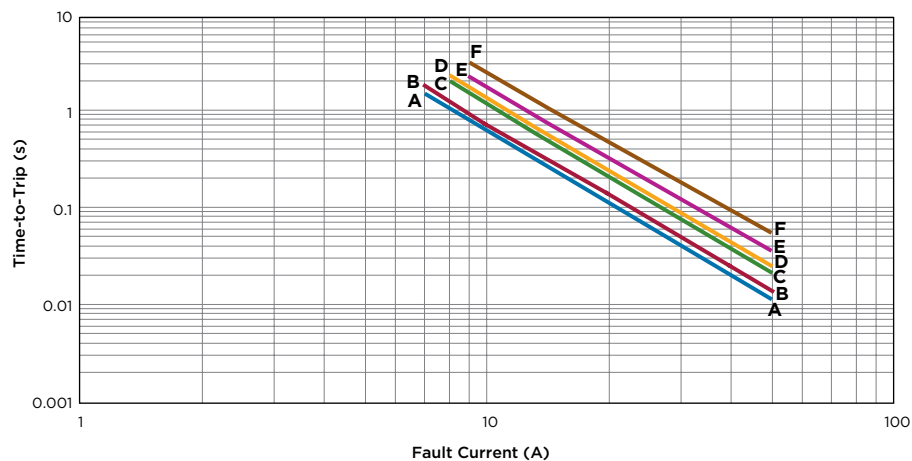
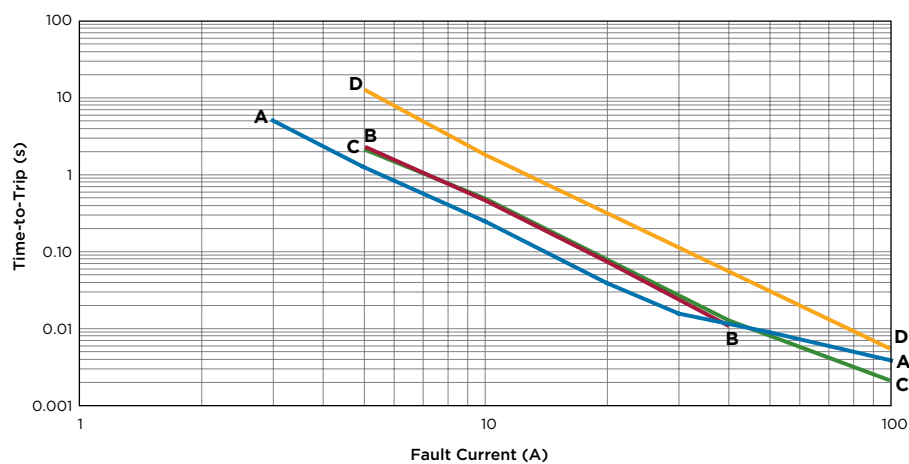
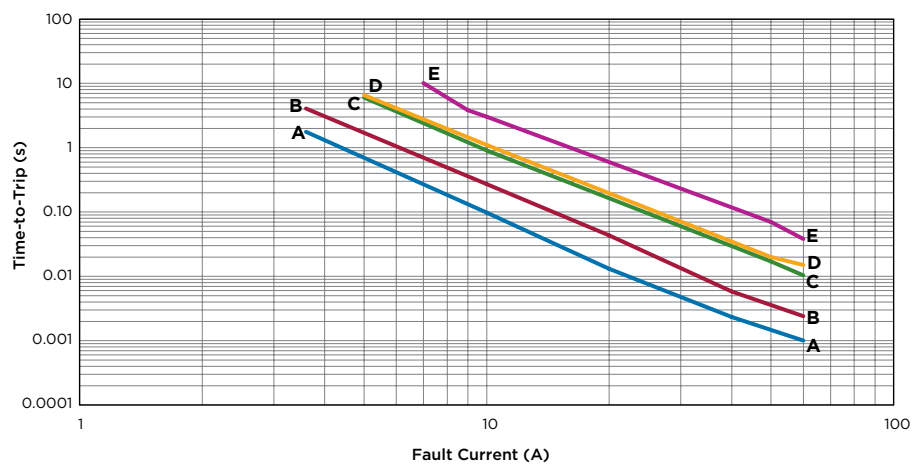
VLR (data at 25°C)

A - VLR170F

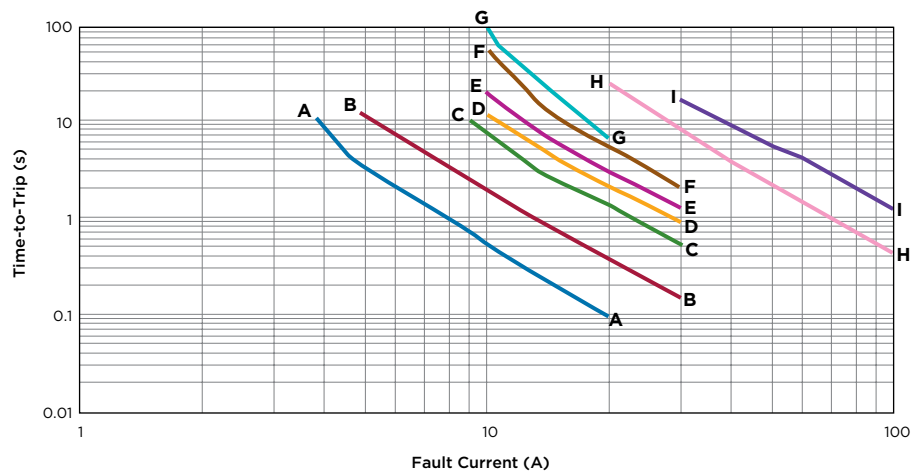
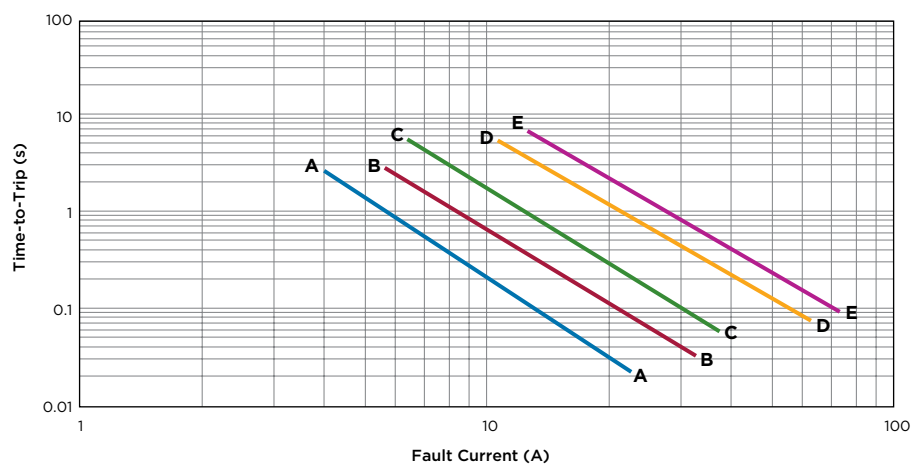
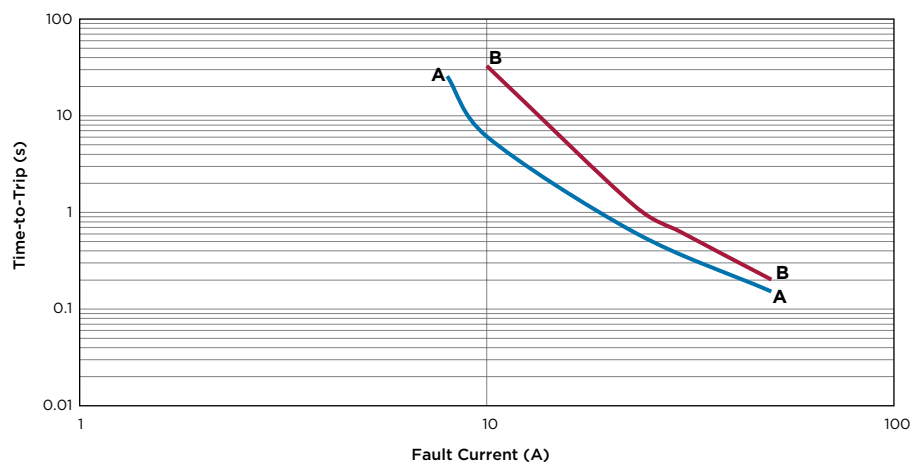
B - VLR175F

C - VLR230F

Typical Time-To-Trip Curves at 20°C for Strap Battery Devices (continued)



Typical Time-To-Trip Curves at 20°C for Strap Battery Devices (continued)



Physical Characteristics and Environmental Specifications for Strap Battery Devices

VLR		
Physical Characteristics		
Lead Material	0.125mm Nominal Thickness, Quarter-hard Nickel	
Tape Material	Polyester	
Environmental Specifications		
Test	Conditions	Resistance Change
Passive Aging	-40°C, 1000 hrs	5% typ
	60°C, 1000 hrs	20% typ
Humidity Aging	60°C/95% RH, 1000 hrs	30% typ
Thermal Shock	85°C, -40°C (10 Times)	5% typ
Vibration	MIL-STD-883D, Method 2026	No Change

VLP and VTP		
Physical Characteristics		
Lead Material	0.125mm Nominal Thickness, Quarter-hard Nickel	
Tape Material	Polyester	
Environmental Specifications		
Test	Conditions	Resistance Change
Passive Aging	-40°C, 1000 hrs	±5% typ
	60°C, 1000 hrs	±10% typ
Humidity Aging	60°C/95% RH, 1000 hrs	±10% typ
Thermal Shock	85°C, -40°C (10 Times)	±5% typ
Vibration	MIL-STD-883D, Method 2026	No Change

MXP and MGP		
Physical Characteristics		
Lead Material	0.1mm Nominal Thickness, Half-hard Nickel	
Coating Material	Epoxy	
Environmental Specifications		
Test	Conditions	Resistance Change
Passive Aging	-40°C, 1000 hrs	±5% typ
	60°C, 1000 hrs	±20% typ
Humidity Aging	60°C/95% RH, 1000 hrs	±30% typ
Thermal Shock	85°C, -40°C (10 Times)	±5% typ
Vibration	MIL-STD-883D, Method 2026	No Change

RSD		
Physical Characteristics		
Lead Material	0.1mm Nominal Thickness, Half-hard Nickel	
Environmental Specifications		
Test	Conditions	Resistance Change
Passive Aging	-40°C, 1000 hrs	±5% typ
	60°C, 1000 hrs	±10% typ
Humidity Aging	60°C/95% RH, 1000 hrs	±10% typ
Thermal Shock	85°C, -40°C (10 Times)	±5% typ
Vibration	MIL-STD-883D, Method 2026	No Change

Physical Characteristics and Environmental Specifications for Strap Battery Devices (continued)

SRP		
Physical Characteristics		
Lead Material	0.125mm Nominal Thickness, Quarter-hard Nickel	
Tape Material	Polyester	
Environmental Specifications		
Test	Conditions	Resistance Change
Passive Aging	70°C, 1000 hrs	±10% typ
Humidity Aging	85°C/85% RH, 7 Days	±5% typ
Vibration	MIL-STD-883C, Test Condition A	No Change

LR4		
Physical Characteristics		
Lead Material	0.125mm Nominal Thickness, Quarter-hard Nickel	
Tape Material	Polyester	
Environmental Specifications		
Test	Conditions	Resistance Change
Passive Aging	70°C, 1000 hrs	±10% typ
Humidity Aging	85°C/85% RH, 7 Days	±5% typ
Vibration	MIL-STD-883D, Method 2026	No Change

Note: Storage conditions: 40°C max., 70% RH max.; devices should remain in original sealed bags prior to use.
Devices may not meet specified values if these storage conditions are exceeded.

Packaging and Marking Information/Agency Recognition for Strap Battery Devices

Part Number	Bag Quantity	Tape and Reel Quantity	Standard Package Quantity	Part Marking	Agency Recognition
85°C Typical Activation					
VLR					
VLR170F	1,000	—	10,000	R17	UL, CSA, TÜV
VLR175F	1,000	—	10,000	R1X	UL, CSA, TÜV
VLR175LF	1,000	—	10,000	R1X	UL, CSA, TÜV
VLR230F	1,000	—	10,000	R23	UL, CSA, TÜV
90°C Typical Activation					
VLP					
VLP120UF	1,000	—	10,000	—	UL, CSA, TÜV
VLP175UAF	1,000	—	10,000	—	UL, CSA, TÜV
VLP210F	1,000	—	10,000	W21	UL, CSA, TÜV
VLP220F	1,000	—	10,000	W22	UL, CSA, TÜV
VLP270F	1,000	—	10,000	W27	UL, CSA, TÜV
VTP					
VTP110F	1,000	—	10,000	—	UL, CSA, TÜV
VTP170F	1,000	—	10,000	V17	UL, CSA, TÜV
VTP170XSF	1,000	—	10,000	V17	UL, CSA, TÜV
VTP175F	1,000	—	10,000	V1X	UL, CSA, TÜV
VTP175LF	1,000	—	10,000	V1X	UL, CSA, TÜV
VTP210GF	1,000	—	10,000	V21	UL, CSA, TÜV
VTP210SF	1,000	—	10,000	V21	UL, CSA, TÜV

Packaging and Marking Information/Agency Recognition for Strap Battery Devices (continued)

Part Number	Bag Quantity	Tape and Reel Quantity	Standard Package Quantity	Part Marking	Agency Recognition
120°C Typical Activation MXP					
MXP180	2,000	—	4,000	—	UL, CSA, TÜV
MXP190BB	4,000	—	8,000	—	UL, CSA, TÜV
MXP250K	2,000	—	4,000	—	UL, CSA, TÜV
MXP270	2,000	—	4,000	—	UL
MXP310	2,000	—	4,000	—	UL
MXP370BD	2,000	—	4,000	—	UL, CSA, TÜV
120°C Typical Activation MGP					
MGP450	2,000	—	4,000	—	—
MGP500	2,000	—	4,000	—	UL
125°C Typical Activation RSD					
RSD310	—	6,000	30,000	—	UL
RSD370	—	6,000	30,000	—	UL
RSD420	—	6,000	30,000	—	UL
125°C Typical Activation SRP					
SRP120F	1,000	—	10,000	120	UL, CSA, TÜV
SRP175F	2,000	—	10,000	175	UL, CSA, TÜV
SRP200F	1,000	—	10,000	200	UL, CSA, TÜV
SRP350F	500	—	10,000	350	UL, CSA, TÜV
SRP420F	500	—	10,000	420	UL, CSA, TÜV
LR4					
LR4-190F	2,000	—	10,000	E19	UL, CSA, TÜV
LR4-260F	1,000	—	10,000	E26	UL, CSA, TÜV
LR4-380F	1,000	—	10,000	E38	UL, CSA, TÜV
LR4-380XF	1,000	—	10,000	E38	UL, CSA, TÜV
LR4-450F	1,000	—	10,000	E45	UL, CSA, TÜV
LR4-550F	1,000	—	10,000	E55	UL, CSA, TÜV
LR4-600F	1,000	—	10,000	E60	UL, CSA, TÜV
LR4-600XF	1,000	—	10,000	E60	UL, CSA, TÜV
LR4-730F	1,000	—	10,000	E73	UL, CSA, TÜV
LR4-900F	500	—	10,000	E90	UL, CSA, TÜV
LR4-1300SSF	250	—	10,000	EX3	UL, CSA, TÜV

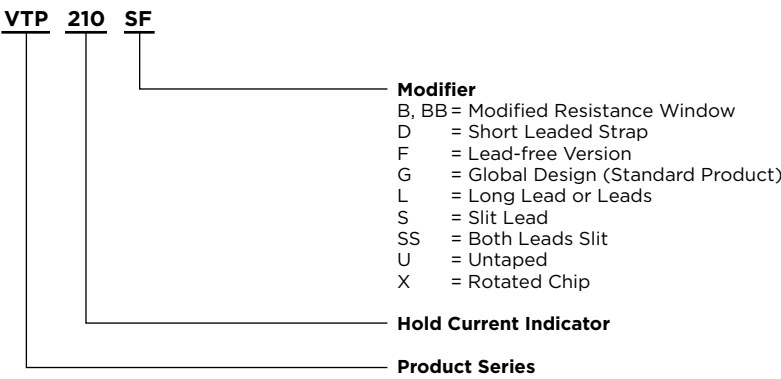
Agency Recognition for Strap Battery Devices

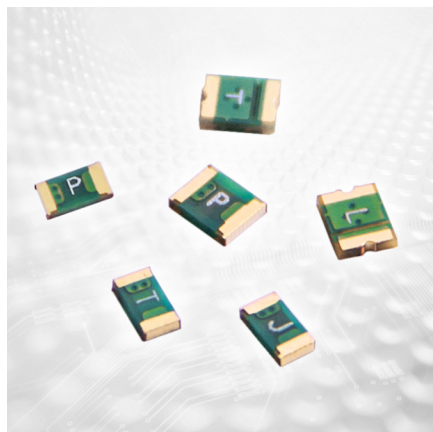
UL	File # E74889
CSA	File # 78165C
TÜV	Certificate Number Available on Request

Installation Guidelines for The Strap Family

- PPTC devices operate by thermal expansion of the conductive polymer. If devices are placed under pressure or installed in spaces that would prevent thermal expansion, they may not properly protect against damage caused by fault conditions. Designs must be selected in such a manner that adequate space is maintained over the life of the product.
- Twisting, bending, or placing the PPTC device in tension will decrease the ability of the device to protect against damage caused by electrical faults. No residual force should remain on device after installation. Mechanical damage to the PPTC device may affect device performance and should be avoided.
- Chemical contamination of PPTC devices should be avoided. Certain greases, solvents, hydraulic fluids, fuels, industrial cleaning agents, volatile components of adhesives, silicones, and electrolytes can have an adverse effect on device performance.
- PPTC strap devices are intended to be resistance welded to battery cells or to pack interconnect straps, yet some precautions must be taken when doing so. In order for the PPTC device to exhibit its specified performance, weld placement should be a minimum of 2mm from the edge of the PPTC device, weld splatter must not touch the PPTC device, and welding conditions must not heat the PPTC device above its maximum operating temperature.
- PPTC strap devices are not intended for applications where reflow onto flex circuits or rigid circuit boards is required.
- The polyester tape on PPTC strap devices is intended for marking and identification purposes only, not for electrical insulation.
- The coating on MXP devices is intended to prevent oxidization/aging of the devices. Damaging the coating or causing the coating to delaminate can have negative effects on device performance and should be avoided.
- MXP devices have a small PPTC chip size and therefore have weaker peel strength between the polymer and Ni-foil of the chip. Excessive mechanical force to the device may cause delamination of Ni-foil from the polymer.

Part Numbering System For Strap Battery Devices





LOW RHO SMD DEVICES Save Space and Cost

The ultra-compact low rho SMD (surface-mount device) series is well suited to space-constrained mobile applications. The devices can help provide both overcurrent and overtemperature protection for battery pack PCMs (protection circuit modules) used in every-smaller consumer devices such as smartphones and portable media players.

Benefits

- Small footprint helps save space in compact designs
- Surface-mount packaging on PCB facilitates ease of design and enhances flexibility
- Assembly using reflowable soldering technique helps reduce production time/costs

Features

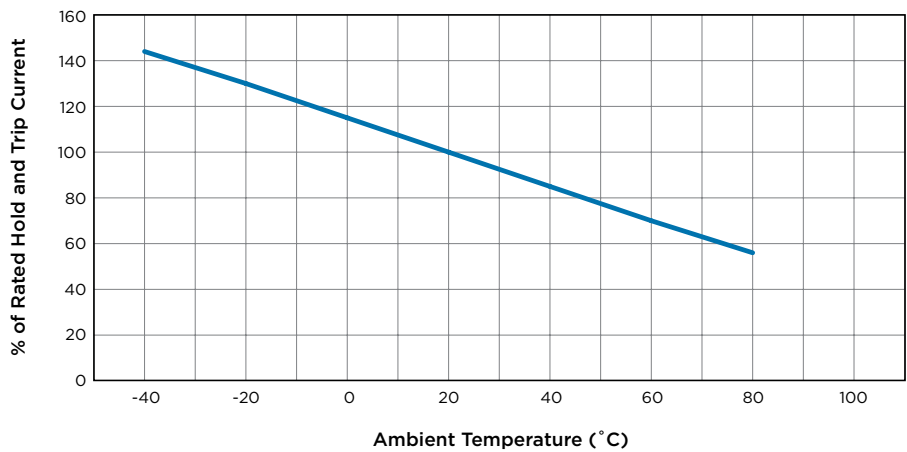
- Current ratings from 1.75 to 5.0A
- Agency recognition: UL, CSA, TUV and RoHS compliant
- Maximum electrical rating: Voltage 6V_{DC} and short circuit current 50A
- Package is more compact package than similar offerings
- Offered in industry-standard form factor (1210 or 1206)
- Maximum hold current up to 6A
- Fast time-to-trip
- Halogen free (refers to Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm)

Thermal Derating for low rho SMD Devices [Hold Current (A) at Ambient Temperature (°C)]

Part Number	Maximum Ambient Temperature										
	-40°C	-20°C	0°C	20°C	25°C	40°C	50°C	60°C	70°C	80°C	85°C
	A										
nanoSMDLR Series Size 3216mm/1206mils											
nanoSMD175LR	3.00	2.60	2.20	1.75	1.70	1.40	1.20	1.00	0.80	0.60	0.50
nanoSMD200LR	3.60	3.20	2.80	2.00	1.90	1.80	1.60	1.40	1.20	1.00	0.80
nanoSMD270LR	4.00	3.50	3.00	2.70	2.60	2.20	2.00	1.60	1.40	1.20	1.10
nanoSMD350LR	5.50	4.80	4.00	3.50	3.30	2.70	2.30	1.90	1.60	1.40	1.30
nanoSMD500LR	7.40	6.60	6.00	5.00	4.90	4.60	4.20	3.70	3.30	3.00	2.80
microSMDLR Series Size 3225mm/1210mils											
microSMD190LR	3.40	2.90	2.40	1.90	1.80	1.40	1.15	0.90	0.65	0.40	0.28
microSMD200LR	3.50	3.00	2.50	2.00	1.90	1.50	1.25	1.00	0.75	0.50	0.38
microSMD250LR	4.40	3.80	3.20	2.50	2.40	1.90	1.60	1.30	1.00	0.65	0.50
microSMD350LR	5.40	4.75	4.00	3.50	3.20	2.70	2.40	2.00	1.70	1.35	1.20
microSMD450LR	7.00	6.20	5.50	4.50	4.40	3.80	3.50	3.20	2.75	2.35	2.16

* Data is preliminary.

Thermal Derating Curve for low rho SMD Devices

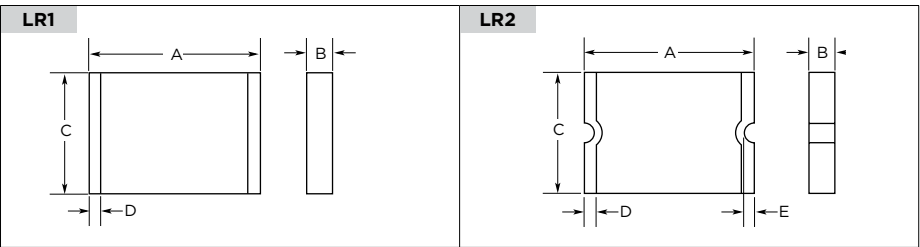


Electrical Characteristics for low rho SMD Devices at Room Temperature

Part Number	I _H	I _T	V _{MAX}	I _{MAX}	P _{D MAX}	Max Time-to-trip		R _{MIN}	R _{IMAX}	Figure for Dimension
	(A)	(A)	(V _{DC})	(A)	(W)	(A)	(s)	(Ω)	(Ω)	
nanoSMDLR Series Size 3216mm/1206mils										
nanoSMD175LR	1.75	5.00	6	50	1.00	9.50	1.00	0.008	0.034	LR1
nanoSMD200LR	2.00	6.00	6	50	1.00	9.50	3.00	0.006	0.024	LR1
nanoSMD270LR	2.70	6.30	6	50	1.00	8.00	5.00	0.005	0.018	LR1
nanoSMD350LR	3.50	6.30	6	50	1.00	8.00	5.00	0.004	0.018	LR1
nanoSMD500LR	5.00	10.00	6	50	1.00	25.00	2.00	0.002	0.008	LR1
microSMDLR Series Size 3225mm/1210mils										
microSMD190LR	1.90	4.90	6	50	1.00	9.50	4.00	0.006	0.021	LR2
microSMD200LR	2.00	5.00	6	50	1.00	9.50	4.00	0.006	0.021	LR2
microSMD250LR	2.50	5.20	6	50	1.00	9.50	5.00	0.005	0.018	LR2
microSMD350LR	3.50	9.00	6	50	1.00	9.50	10.00	0.0025	0.011	LR1
microSMD450LR	4.50	9.00	5	50	1.00	25.00	2.00	0.002	0.008	LR2

* Data is preliminary.

Dimensions Figures for low rho SMD Devices



Dimensions for low rho SMD Devices in Millimeters (Inches)

Part Number	A		B		C		D		E	Figure
	Min	Max	Min	Max	Min	Max	Min	Max	Min	
nanoSMDLR Series Size 3216mm/1206mils										
nanoSMD175LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	1.37 (0.054)	1.85 (0.073)	0.25 (0.010)	0.75 (0.030)	—	LR1
nanoSMD200LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	1.37 (0.054)	1.85 (0.073)	0.25 (0.010)	0.75 (0.030)	—	LR1
nanoSMD270LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	1.37 (0.054)	1.85 (0.073)	0.25 (0.010)	0.75 (0.030)	—	LR1
nanoSMD350LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	1.37 (0.054)	1.85 (0.073)	0.25 (0.010)	0.75 (0.030)	—	LR1
nanoSMD500LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	1.37 (0.054)	1.85 (0.073)	0.25 (0.010)	0.75 (0.030)	—	LR1
microSMDLR Series Size 3225mm/1210mils										
microSMD190LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	2.35 (0.092)	2.80 (0.110)	0.25 (0.010)	0.75 (0.030)	0.076 (0.003)	LR2
microSMD200LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	2.35 (0.092)	2.80 (0.110)	0.25 (0.010)	0.75 (0.030)	0.076 (0.003)	LR2
microSMD250LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	2.35 (0.092)	2.80 (0.110)	0.25 (0.010)	0.75 (0.030)	0.076 (0.003)	LR2
microSMD350LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	2.35 (0.092)	2.80 (0.110)	0.25 (0.010)	0.75 (0.030)	—	LR1
microSMD450LR	3.00 (0.118)	3.43 (0.135)	0.50 (0.019)	1.00 (0.039)	2.35 (0.092)	2.80 (0.110)	0.25 (0.010)	0.75 (0.030)	0.076 (0.003)	LR2

* Data is preliminary.

Physical Characteristics for low rho SMD Devices

Operating Temperature Range -40°C to 85°C

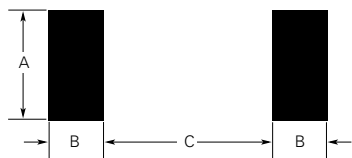
Physical Characteristics	
Terminal Pad Material	Gold with Nickel Underplate
Soldering Characteristics	ANSI/J-STD-002 Category 3
Solder Heat Withstand	per IEC-STD 68-2-20, Test Tb, Section 5, Method 1A
Flammability Resistance	per IEC 695-2-2 Needle Flame Test for 20 sec.
Recommended Storage Conditions	40°C max, 70% R.H. max; Devices May Not Meet Specified Ratings if Storage Conditions Are Exceeded.

Packaging and Marking Information for low rho SMD Devices

Part Number	Tape & Reel Quantity	Standard Package	Part Marking	Recommended Pad Layout Figures [mm (in)]			Agency Recognition
				Dimension A (Nom)	Dimension B (Nom)	Dimension C (Nom)	
nanoSMDLR Series Size 3216mm/1206mils							
nanoSMD175LR	3,000	15,000	J	1.75 (0.069)	1.10 (0.043)	2.00 (0.079)	UL, CSA, TÜV
nanoSMD200LR	3,000	15,000	T	1.75 (0.069)	1.10 (0.043)	2.00 (0.079)	UL, CSA
nanoSMD270LR	3,000	15,000	L	1.75 (0.069)	1.10 (0.043)	2.00 (0.079)	UL, CSA, TÜV
nanoSMD350LR	3,000	15,000	P	1.75 (0.069)	1.10 (0.043)	2.00 (0.079)	UL, CSA, TÜV
nanoSMD500LR	3,000	15,000	H	1.75 (0.069)	1.10 (0.043)	2.00 (0.079)	UL, CSA, TÜV
microSMDLR Series Size 3225mm/1210mils							
microSMD190LR	3,000	15,000	None	2.65 (0.104)	1.00 (0.039)	2.00 (0.079)	UL, CSA
microSMD200LR	3,000	15,000	T	2.65 (0.104)	1.00 (0.039)	2.00 (0.079)	UL, CSA
microSMD250LR	3,000	15,000	L	2.65 (0.104)	1.00 (0.039)	2.00 (0.079)	UL, CSA
microSMD350LR	3,000	15,000	P	2.65 (0.104)	1.10 (0.043)	2.00 (0.079)	UL, CSA
microSMD450LR	3,000	15,000	H	2.65 (0.104)	1.00 (0.039)	2.00 (0.079)	UL

* Data is preliminary.

Recommended Pad Layout for low rho SMD Devices



Agency Recognition for low rho SMD Devices

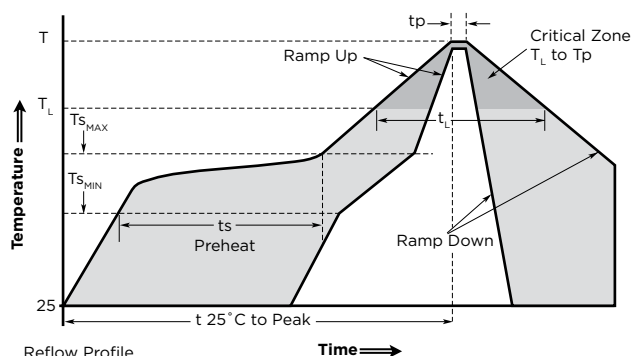
UL	File # E74889 for all low rho SMD Devices
CSA	File # CA78165 for all low rho SMD Devices
TÜV	Certificate Number Available Upon Request (Certified to IEC 60730-1)

Solder Reflow Recommendation for low rho SMD Devices

Classification Reflow Profiles

Profile Feature	Pb-Free Assembly
Average Ramp-up Rate ($T_{S_{MAX}}$ to T_p)	3°C/s max
Preheat	
• Temperature min ($T_{S_{MIN}}$)	150°C
• Temperature max ($T_{S_{MAX}}$)	200°C
• Time ($t_{S_{MIN}}$ to $t_{S_{MAX}}$)	60-120s
Time Maintained Above:	
• Temperature (T_L)	217°C
• Time (t_L)	60-150s
Peak/Classification Temperature (T_p)	260°C
Time within 5°C of Actual Peak Temperature	
Time (t_p)	30s max
Ramp down rate	2°C/s max
Time 25°C to Peak Temperature	8 mins max

Note: All temperatures refer to topside of the package measured on the package body surface.



Solder Reflow

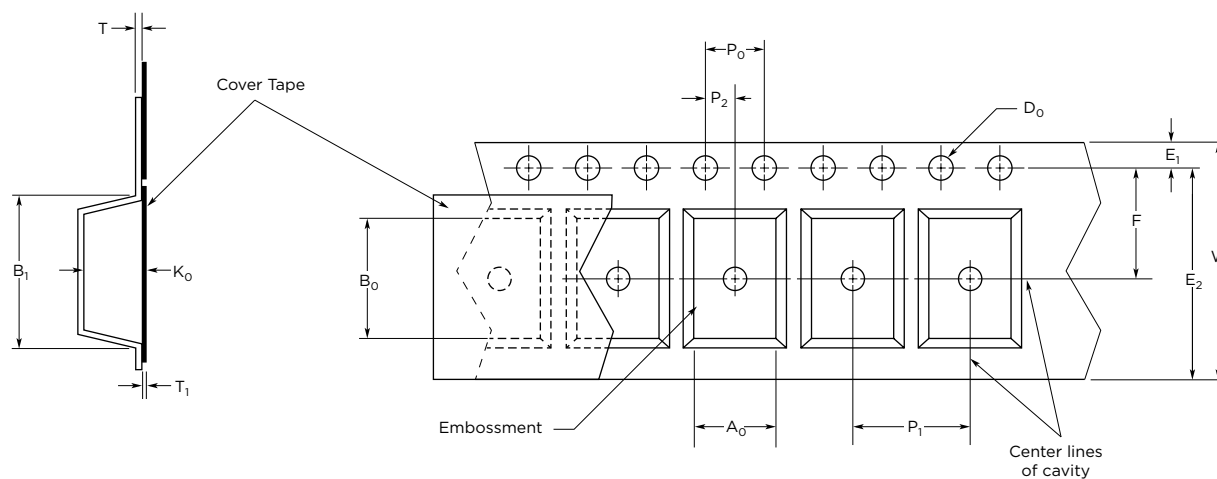
- Recommended reflow methods:
 - IR
 - Hot air
 - Nitrogen
- Recommended maximum paste thickness: 0.25mm (0.010in).
- Devices can be cleaned using standard methods and aqueous solvents.
- Experience has shown the optimum conditions for forming acceptable solder fillets occur when a reasonable amount of solder paste is placed underneath each device's termination. As such, we request that customers comply with our recommended solder pad layouts.
- Customer should validate that the solder paste amount and reflow recommendations meet its application.
- We request that customer board layouts refrain from placing raised features (e.g., vias, nomenclature, traces, etc.) underneath PolySwitch devices. It is possible that raised features could negatively impact solderability performance of our devices.

Tape and Reel Specifications for low rho SMD Devices in Millimeters

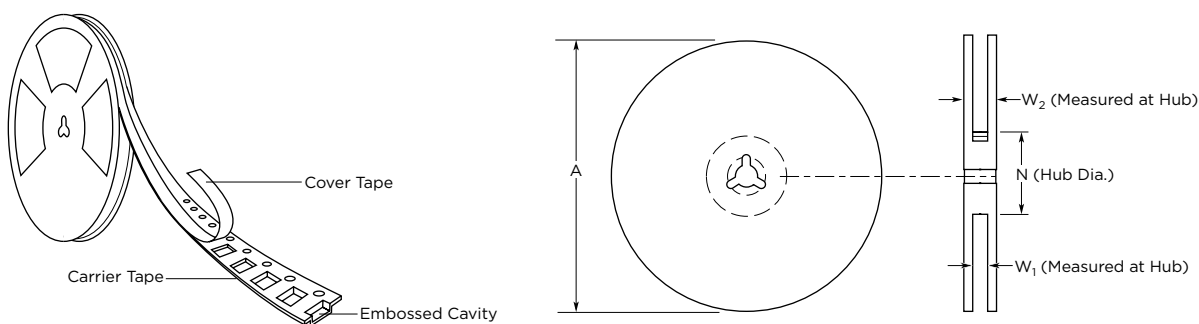
Description	nanoSMDLR Series EIA 481-1	microSMDLR Series EIA 481-1
W	8.0 ± 0.30	8.0 ± 0.30
P ₀	4.0 ± 0.10	4.0 ± 0.10
P ₁	4.0 ± 0.10	4.0 ± 0.10
P ₂	2.0 ± 0.05	2.0 ± 0.05
A ₀	1.95 ± 0.10	2.9 ± 0.10
B ₀	3.50 +0.1/-0.08	3.55 ± 0.10
B _{1 MAX}	4.35	4.35
D ₀	1.55 ± 0.05	1.55 ± 0.05
F	3.50 ± 0.05	3.50 ± 0.05
E ₁	1.75 ± 0.10	1.75 ± 0.10

Description	nanoSMDLR Series EIA 481-1	microSMDLR Series EIA 481-1
E _{2 MIN}	6.25	6.25
T _{MAX}	0.3	0.3
T _{1 MAX}	0.1	0.1
K ₀	0.89 ± 0.10	1.27 ± 0.10
A _{MAX}	185	185
n _{MIN}	50	50
W ₁	12.4 ± 2.0/-0.00	12.4 ± 2.0/-0.00
W _{2 MAX}	14.4	14.4

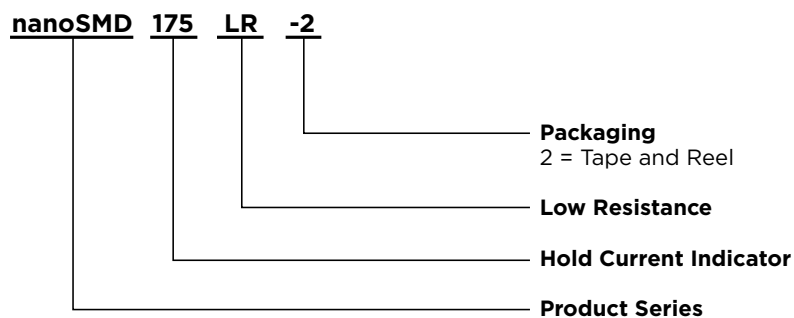
EIA Referenced Taped Component Dimensions for low rho SMD Devices

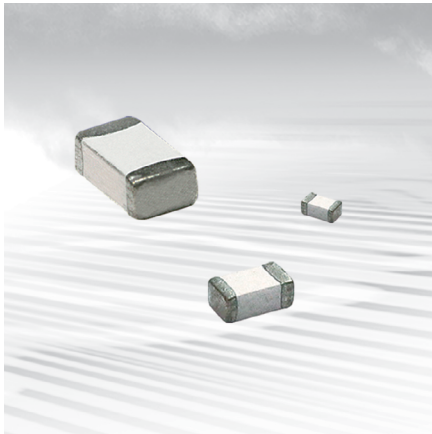


EIA Referenced Reel Dimensions for low rho SMD Devices



Part Numbering System for low rho SMD Devices





SURFACE-MOUNT FUSES

Help Provide Robust Protection

Surface-mount fuses offer robust arc suppression characteristics and help facilitate the development of more reliable, high-performance consumer electronics such as laptops, multimedia devices, cell phones and other portable electronics.

Benefits

- Small size helps save space
- Temperature stability high-current ratings help enhance reliability and resilience
- Strong arc suppression characteristics help improve reliability

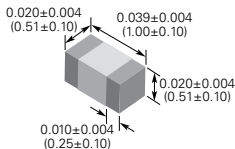
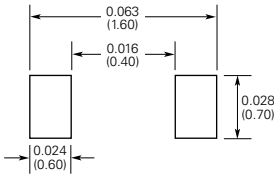
Features

- Monolithic, multilayer device structure
- High-temperature performance
- -55°C to +125°C operating temperature range
- Halogen free
(refers to Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm)
- Lead-free and RoHS compliant

Clear Time Characteristics for Fast-Acting Chip Fuses

% of Rated Current	Clear Time at 25°C
100%	4 hrs min
250%	5 s max
400%	0.05 s max

Typical Electrical Characteristics, Dimensions and Recommended Pad Layout for Fast-Acting Chip Fuses

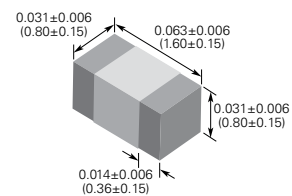
0402 (1005mm) Fast-Acting Chip Fuses						Shape and Dimensions in (mm)	
Part Number	Typical Electrical Characteristics			Max Interrupt Ratings			
	Rated Current (A)	Nominal Cold DCR (Ω)*	Nominal I²t (A²s)†	Voltage (V _{DC})	Current (A)	Recommended Pad Layout in (mm)	
0402SFF100F/24	1.00	0.120	0.0170	24	35		
0402SFF150F/24	1.50	0.056	0.0490	24	35		
0402SFF200F/24	2.00	0.035	0.0700	24	35		
0402SFF300F/24	3.00	0.021	0.1250	24	35		
0402SFF400F/24	4.00	0.014	0.2250	24	35		

Typical Electrical Characteristics, Dimensions and Recommended Pad Layout for Fast-Acting Chip Fuses (continued)

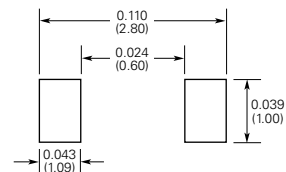
0603 (1608mm) Fast-Acting Chip Fuses

Part Number	Typical Electrical Characteristics			Max Interrupt Ratings	
	Rated Current (A)	Nominal Cold DCR (Ω)*	Nominal I^2t (A ² s) [†]	Voltage (V _{DC})	Current (A)
0603SFF050F/32	0.50	0.485	0.0029	63	35
0603SFF075F/32	0.75	0.254	0.0064	63	35
0603SFF100F/32	1.00	0.147	0.0160	63	35
0603SFF150F/32	1.50	0.059	0.0300	63	35
0603SFF200F/32	2.00	0.044	0.0600	32	35
0603SFF250F/32	2.50	0.032	0.1150	32	35
0603SFF300F/32	3.00	0.025	0.1900	32	35
0603SFF350F/32	3.50	0.024	0.2950	32	35
0603SFF400F/32	4.00	0.018	0.4000	32	35
0603SFF500F/32	5.00	0.013	0.7000	32	35
0603SFF600F/24	6.00	0.010	1.1250	24	35

Shape and Dimensions
in (mm)



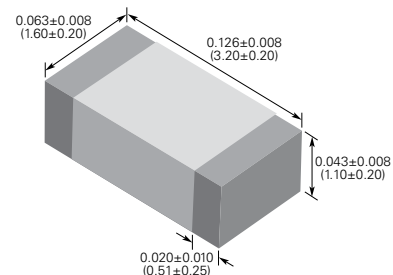
Recommended Pad Layout
in (mm)



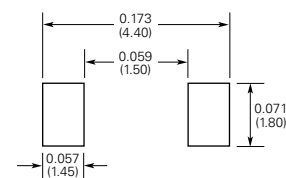
1206 (3216mm) Fast-Acting Chip Fuses

Part Number	Typical Electrical Characteristics			Max Interrupt Ratings	
	Rated Current (A)	Nominal Cold DCR (Ω)*	Nominal I^2t (A ² s) [†]	Voltage (V _{DC})	Current (A)
1206SFF050F/63	0.50	0.730	0.0021	63	50
1206SFF075F/63	0.75	0.513	0.0052	63	50
1206SFF100F/63	1.00	0.220	0.0120	63	50
1206SFF150F/63	1.50	0.120	0.0250	63	50
1206SFF175F/63	1.75	0.100	0.0450	63	50
1206SFF200F/63	2.00	0.050	0.0700	63	50
1206SFF250F/32	2.50	0.035	0.1400	32	50
1206SFF300F/32	3.00	0.031	0.2200	32	50
1206SFF400F/32	4.00	0.022	0.3800	32	45
1206SFF500F/32	5.00	0.015	0.6000	32	45
1206SFF600F/32	6.00	0.013	1.0000	32	50
1206SFF700F/32	7.00	0.011	1.7500	32	50
1206SFF800F/32	8.00	0.008	2.5000	32	50
1206SFF600F/24	6.00	0.013	1.0000	24	45
1206SFF700F/24	7.00	0.011	1.7500	24	45
1206SFF800F/24	8.00	0.008	2.5000	24	45

Shape and Dimensions
in (mm)



Recommended Pad Layout
in (mm)



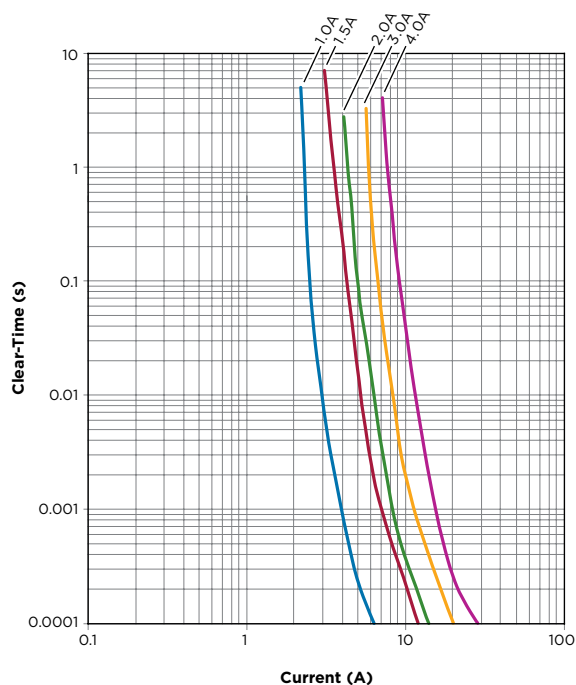
* Measured at #10% of rated current and 25°C ambient temperature.

[†] Melting I^2t at 0.001 sec clear time.

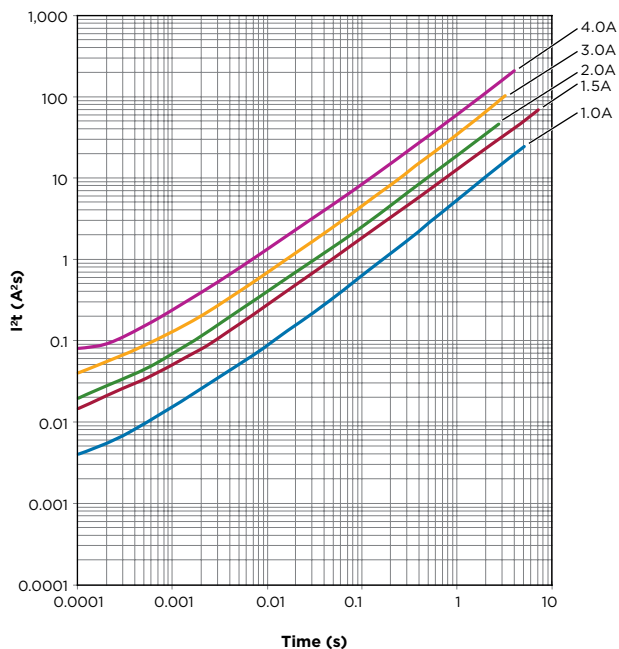
Family Performance Curves for Fast-Acting Chip Fuses

0402 (1005mm) Fast-Acting Chip Fuses

0402SFF Average Time Current Curves

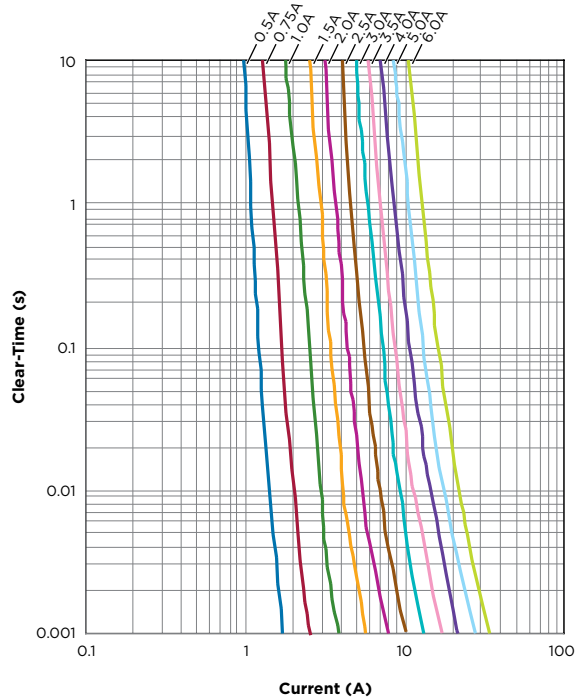


0402SFF I^2t vs. t Curves

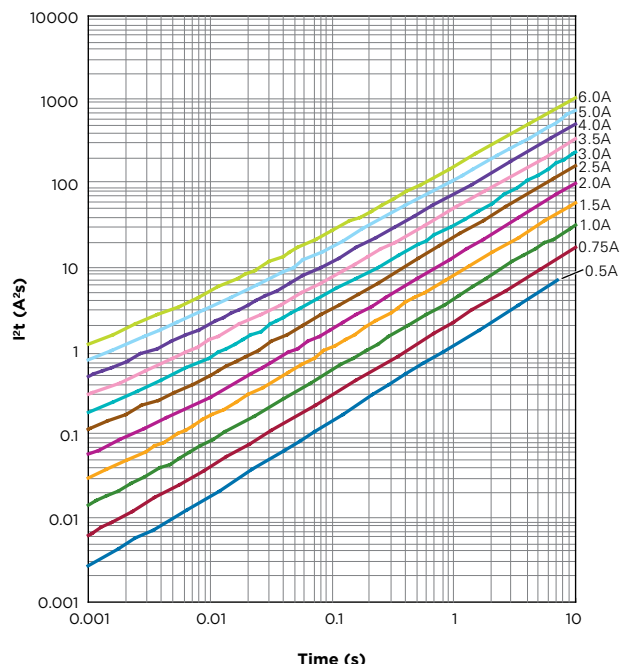


0603 (1608mm) Fast-Acting Chip Fuses

0603SFF Average Time Current Curves

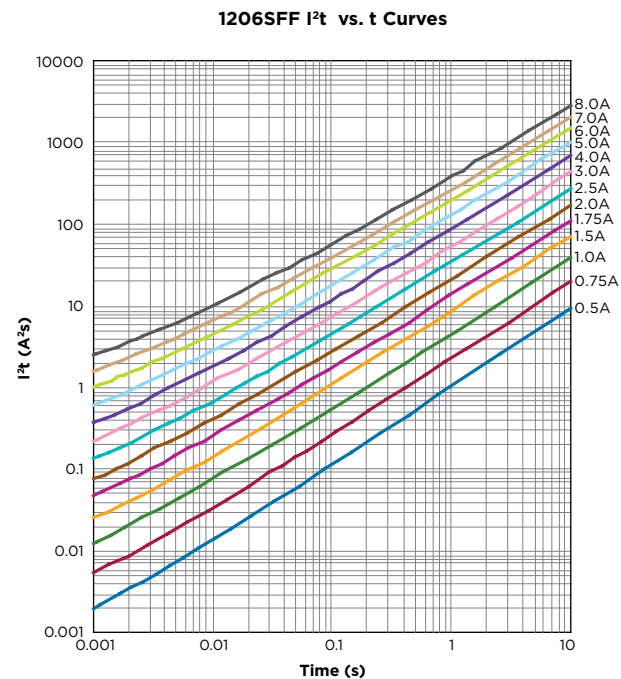
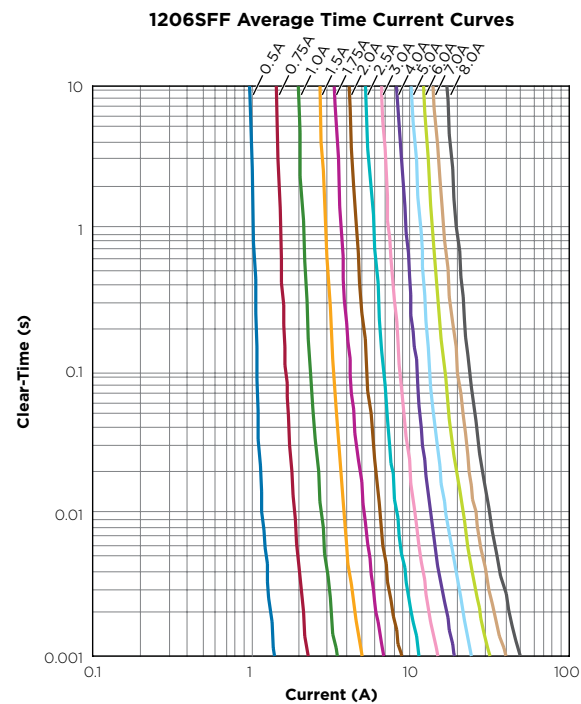


0603SFF I^2t vs. t Curves



Family Performance Curves for Fast-Acting Chip Fuses (continued)

1206 (3216mm) Fast-Acting Chip Fuses



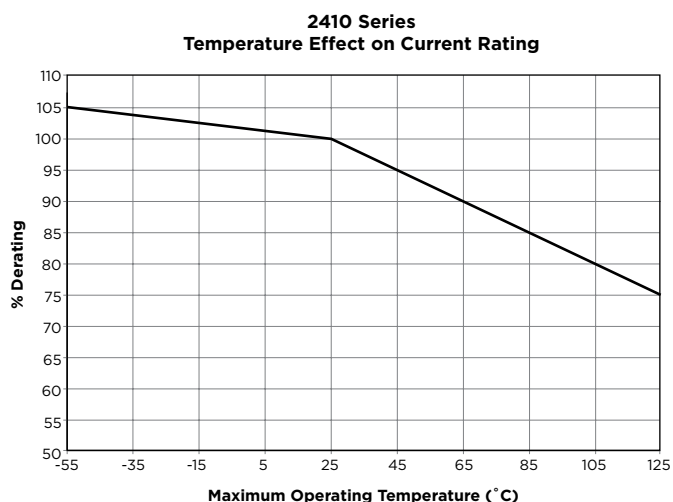
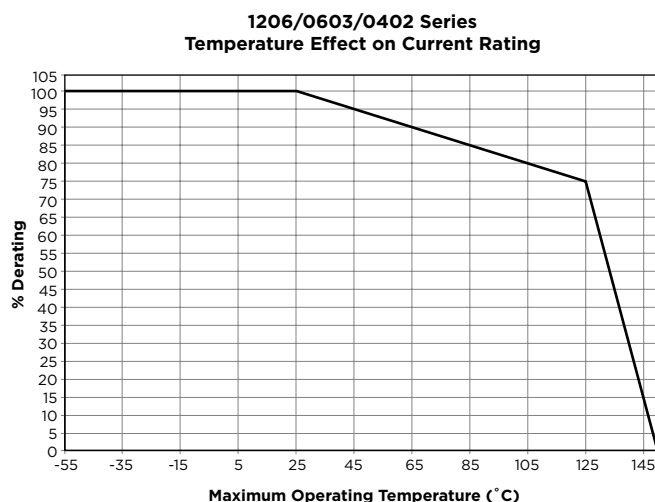
Environmental Specifications for Fuses

Operating Temperature	-55°C to +125°C
Mechanical Vibration	Withstands 5-3000 Hz at 30Gs when evaluated per Method 204 of MIL-STD-202
Mechanical Shock	Withstands 1500Gs, 0.5 millisecond half-sine pulses when evaluated per Method 213 of MIL-STD-202
Thermal Shock	Withstands 100 cycles from -65°C to +125°C when evaluated per Method 107 of MIL-STD-202
Resistance to Soldering Heat	Withstands 60 seconds at +260°C when evaluated per Method 210 of MIL-STD-202
Solderability	Meets 95% minimum coverage requirement when evaluated per Method 208 of MIL-STD-202
Moisture Resistance	Withstands 10 cycles when evaluated per Method 106 of MIL-STD-202
Salt Spray	Withstands 48-hour exposure when evaluated per Method 101 of MIL-STD-202
Storage Temperature	30°C/ 85% RH
Storage Humidity	Per MIL-STD-202F, Method 106F

Environmental Specifications for Fuses

Construction Body Material	Ceramic (1206/0603/0402); Fiberglass/Epoxy (2410)
Termination Material	Silver, Nickel, Tin
Fuse Element	Silver(1206/0603/0402); Copper/Copper Alloy (2410)

Thermal Derating Current for Fuses



Electrical Specifications for Fuses

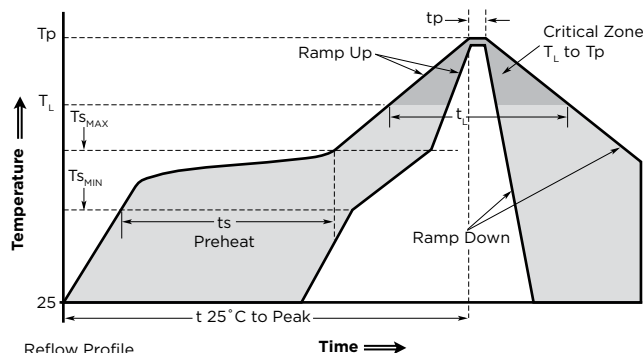
Insulation Resistance after Opening	20,000Ω minimum @ rated voltage. Fuse clearing under low-voltage conditions may result in lower post-clearing insulation values. Under normal fault conditions Littelfuse fuses help provide sufficient insulation resistance for circuit protection.
Current Carrying Capacity	Withstands 100% rated current at +25°C ambient for 4 hours when evaluated per MIL-PRF-23419.

Packaging Information for Fuses

Size	Reel Quantity (pcs)	Reel Diameter	Reel Width	Carrier Tape Size	Tape Type	Reels per Outside Shipment Box	Outside Shipment Boxes per Overpack
0402 (1005)	10,000	178mm White Plastic	9.0 ± 0.5mm	8.00 ± 0.10mm	Paper	5	1 to 10
0603 (1608)	4,000	178mm White Plastic	9.0 ± 0.5mm	8.00 ± 0.10mm	Paper	5	1 to 10
0603SFV (1608)	6,000	178mm White Plastic	9.0 ± 0.5mm	8.00 ± 0.10mm	Paper	5	1 to 10
1206 (3216)	3,000	178mm White Plastic	9.0 ± 0.5mm	8.00 ± 0.10mm	Plastic	5	1 to 10
2410 (6125)	2,000	178mm White Plastic	13.4 ± 0.5mm	12.00 ± 0.10mm	Plastic	4	1 to 10

Solder Reflow Recommendation for Fuses

Classification Reflow Profiles		
Profile Feature	1206/0603/0402	2410
Average Ramp-up Rate (Ts_{MAX} to Tp)	3°C/s max	3°C/s max
Preheat		
• Temperature min (Ts _{MIN})	150°C	150°C
• Temperature max (Ts _{MAX})	200°C	200°C
• Time (ts _{MIN} to ts _{MAX})	60-180 seconds	40-100 seconds
Time Maintained Above:		
• Temperature (T _L)	217°C	200°C
• Time (t _L)	60-150 seconds	30-90 seconds
Peak/Classification Temperature (Tp)	260°C max	250°C max
Time within 5°C of Actual Peak Temperature		
Time (tp)	20-40 seconds	30-40 seconds
From 25°C to Preheating (150°C)	8 minutes max	40-100 seconds
Ramp Down Rate	4°C/seconds max	Natural Cooling



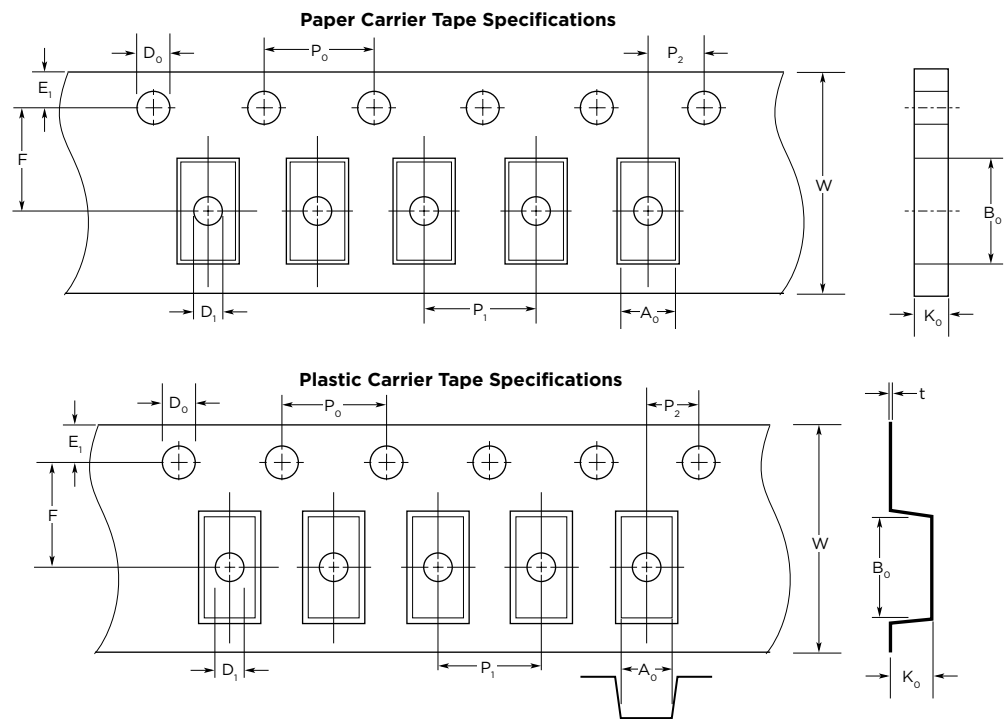
Recommended Conditions for Hand Soldering:

- Using a hot air rework station that can reflow the solder on both terminations at the same time is strongly recommended;
do not directly contact the chip termination with the tip of soldering iron.
- Preheating: 150°C, 60s (min)
Appropriate temperature (max) of soldering iron tip/soldering time (max): 280°C /10s or 350°C /3s.

Packaging Information for Fuses

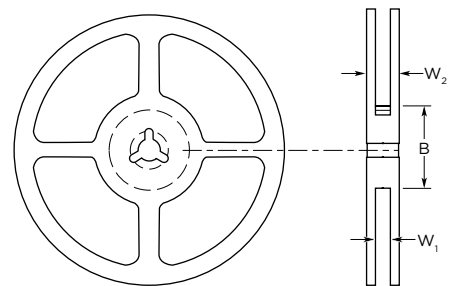
Mark	Dimension in (mm)				
	0402 (1005)	0603 (1608)	1206 (3216)	0603SFV (1608)	2410 (6125)
E ₁	0.069 ± 0.004 (1.75 ± 0.10)	0.069 ± 0.004 (1.75 ± 0.10)	0.069 ± 0.004 (1.75 ± 0.10)	0.069 ± 0.004 (1.75 ± 0.10)	0.069 ± 0.004 (1.75 ± 0.10)
F	0.138 ± 0.002 (3.50 ± 0.05)	0.138 ± 0.002 (3.50 ± 0.05)	0.138 ± 0.002 (3.50 ± 0.05)	0.138 ± 0.002 (3.50 ± 0.05)	0.217 ± 0.004 (5.50 ± 0.10)
W	0.315 ± 0.004 (8.00 ± 0.10)	0.315 ± 0.004 (8.00 ± 0.10)	0.315 ± 0.004 (8.00 ± 0.10)	0.315 ± 0.004 (8.00 ± 0.10)	0.472 ± 0.004 (12.00 ± 0.10)
P ₁	0.079 ± 0.004 (2.00 ± 0.10)	0.157 ± 0.004 (4.00 ± 0.10)	0.157 ± 0.004 (4.00 ± 0.10)	0.157 ± 0.004 (4.00 ± 0.10)	0.157 ± 0.004 (4.00 ± 0.10)
P ₀	0.157 ± 0.004 (4.00 ± 0.10)	0.157 ± 0.004 (4.00 ± 0.10)	0.157 ± 0.004 (4.00 ± 0.10)	0.157 ± 0.004 (4.00 ± 0.10)	0.157 ± 0.004 (4.00 ± 0.10)
P ₂	0.079 ± 0.002 (2.00 ± 0.05)	0.079 ± 0.002 (2.00 ± 0.05)	0.079 ± 0.002 (2.00 ± 0.05)	0.079 ± 0.002 (2.00 ± 0.05)	0.079 ± 0.004 (2.00 ± 0.10)
D ₀	0.059 ± 0.004 (1.50+0.10/-0.00)	0.059 ± 0.004 (1.50+0.10/-0.00)	0.059 ± 0.004 (1.50+0.10/-0.00)	0.059 ± 0.004 (1.50+0.10/-0.00)	0.059 ± 0.004 (1.50+0.10/-0.00)
D ₁	—	—	0.039 max (1.00 max)	—	0.61 ± 0.004 (1.55 ± 0.10)
t	—	—	0.009 ± 0.001 (0.23 ± 0.02)	—	0.010 ± 0.002 (0.25 ± 0.05)
A ₀	0.026 ± 0.004 (0.67 ± 0.10)	0.039 ± 0.004 (0.98 ± 0.10)	0.071 ± 0.004 (1.80 ± 0.10)	0.039 ± 0.004 (0.98 ± 0.10)	0.112 ± 0.004 (2.85 ± 0.10)
B ₀	0.046 ± 0.004 (1.17 ± 0.10)	0.071 ± 0.004 (1.80 ± 0.10)	0.138 ± 0.004 (3.50 ± 0.10)	0.071 ± 0.004 (1.80 ± 0.10)	0.252 ± 0.004 (6.40 ± 0.10)
K ₀	0.025 ± 0.004 (0.63 ± 0.10)	0.037 ± 0.003 (0.95 ± 0.08)	0.050 ± 0.004 (1.27 ± 0.10)	0.024 ± 0.003 (0.60 ± 0.08)	0.093 ± 0.004 (2.35 ± 0.10)

Component Tape Dimensions for Fuses



Reel Dimensions for Fuses

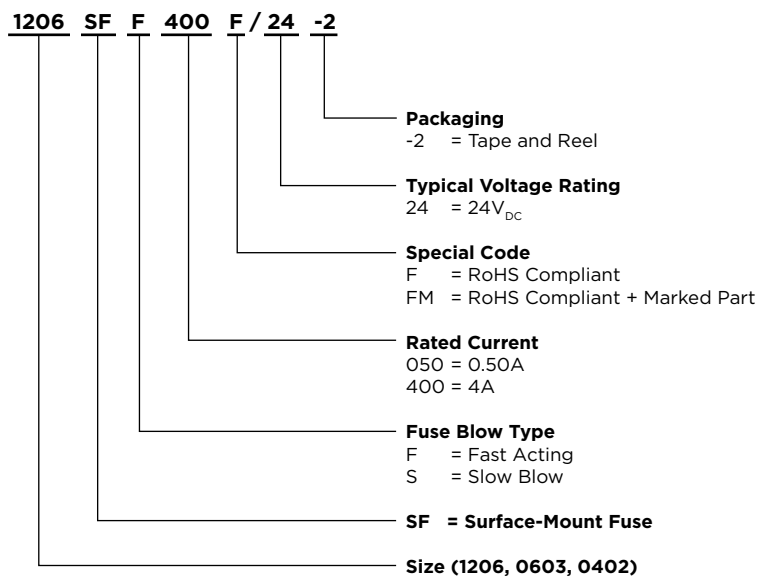
Dimension Description	Mark	Dimension (mm)	
		1206/0603/0402	2410
Hub Outer Diameter	B	60	60.2
Reel Inside Width	W_1	9	13.4
Reel Outside Width	W_2	11.4	16
Tape Width		8	



Agency Approvals for Fuses

UL	All fuses
CSA	File # 12012078873 (for 2410SFV 0.5A, 1A, 2A)
TÜV	File # 50236400 (for 2410SFV 0.5A, 0.63A, 1A, 1.25A, 2A)

Part Numbering System for Fuses



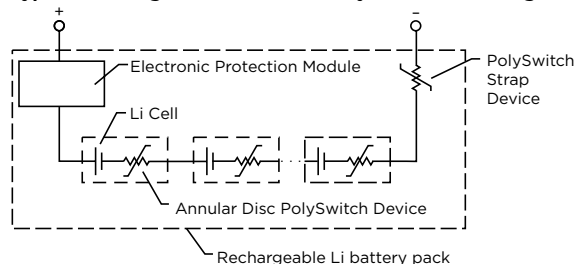
Battery Application Summaries

Protection for Lithium Cells and Lithium Battery Packs

External shorts, runaway charging conditions or abusive charging can cause considerable damage to primary and secondary Lithium (Li) cells. PolySwitch disc and strap circuit protection devices can help protect rechargeable lithium batteries used in notebook computers and cellular phones, as well as other portable electronic applications.

- PolySwitch strap devices
- PolySwitch disc devices

Typical Rechargeable Lithium Battery Pack Circuit Diagram

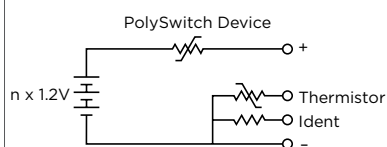


Protection for Lithium-Ion/Lithium Polymer/Nickel-Cadmium/Nickel-Metal-Hydrate Battery Packs

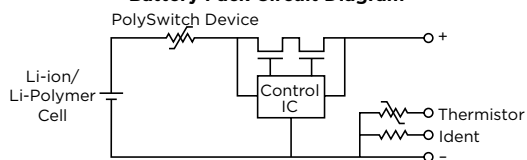
The same conditions (external shorts, runaway charging, etc.) can cause both battery cells and battery pack surrounds to sustain damage. The most common applications for PolySwitch strap devices are for helping to protect Lithium-ion (Li-ion) and Lithium-Polymer (LiP) cell battery packs used in cell phones, digital cameras and laptop/notebook computers. They are also suitable for helping to protect nickel-cadmium (NiCd) and nickel-metal-hydrate (NiMH) battery packs used in portable electronic applications.

- PolySwitch strap devices

NiMH/NiCd Battery Pack Circuit Protection Diagram



Single Cell Li-ion/Li-Polymer Battery Pack Circuit Diagram



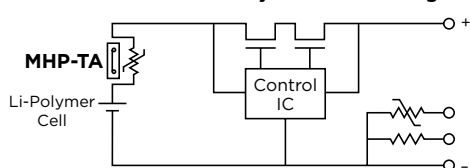
Protection for Rechargeable Lithium Polymer Cells

Tablets, ultra-thin notebook PCs and other small portable electronics that use high-capacity LiP and prismatic cells, require overtemperature protection to help prevent the cells from overheating. These applications' thin form factors, high cell capacities and high battery discharge rates create a unique set of circuit protection requirements, which are low thermal cutoff temperatures (<90°C), high hold current ratings (>60A) and compact size.

The MHP-TA series of MHP (Metal Hybrid PPTC) devices helps solve these design concerns by offering two levels of current carrying capacity (6A or 15A hold current at 25°C) as well as an ultra-thin package (L:5.8mm x W:3.85mm x H:1.15mm).

- MHP devices

MHP-TA LiP Battery Pack Circuit Diagram

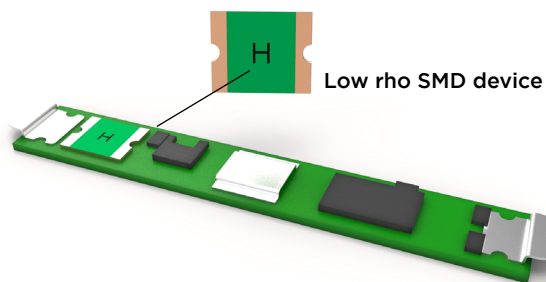


Battery Application Examples

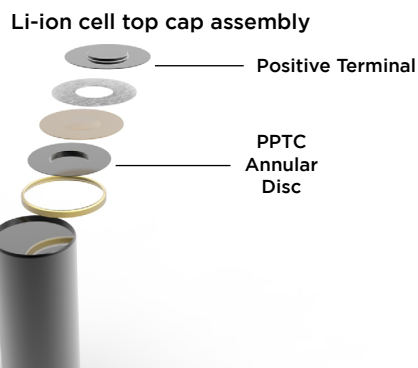
MHP-TA device connected to the positive terminal of a Li-Polymer cell



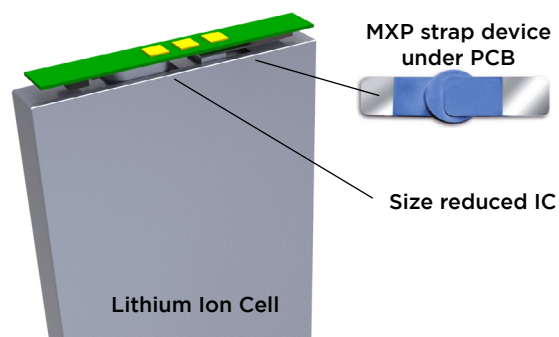
Low rho SMD device installed onto PCM board



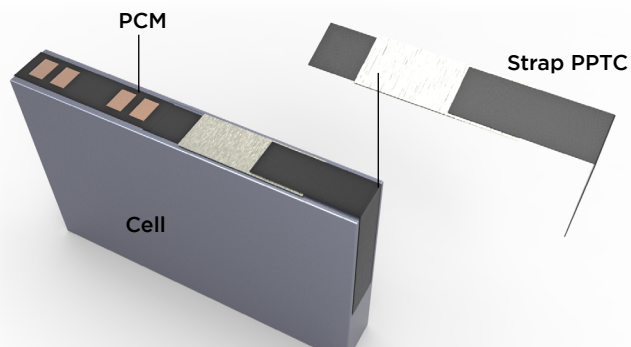
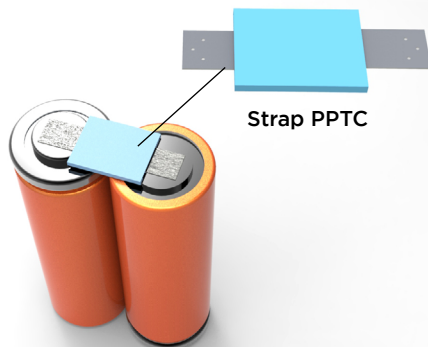
PPTC annular disc devices work in conjunction with other safety devices



The PolySwitch MXP strap device is designed for use under the PCB



PolySwitch strap devices installed onto lithium cells and battery packs



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