SiBar™ Thyristor Surge Protectors

Raychem Circuit Protection's SiBar™ thyristor surge protection devices are designed to help protect sensitive telecommunication equipment from the hazards caused by lightning, power contact, and power induction. These devices have a high electrical surge capability to help protect against transient faults and a high off-state impedance, rendering them virtually transparent during normal system operation.

SiBar™ thyristor surge protectors are designed to assist telecommunication and computer telephony equipment in meeting the applicable requirements and industry specifications.

4

Benefits:

- Helps provide protection for sensitive telecom electronic equipment
- Low leakage current
- Low power dissipation
- Fast, reliable operation
- No wear-out mechanisms
- Helps designers meet worldwide telecom standards
- Helps reduce warranty and service costs
- Easy installation
- Helps improve power efficiency of equipment

Features:

- RoHS complaint available on all parts
- Bidirectional crowbar transient voltage protection
- High off-state impedance
- Low on-state voltage
- High surge capability
- Short-circuit failure mode
- Surface-mount technology

Applications:

- Modems
- Fax machines
- Phones
- PBX systems
- POS systems
- Analog and digital linecards (xDSL, T1/E1...)
- Other customer premise and central office network equipment requiring protection

Protection Application Guide for SiBar™ Thyristor Surge Protectors

To use this guide, follow the steps below:

1. Select your equipment type from the guide below.
2. Select the type of protection depending on the agency and regional specifications in the second column.

Application	Region/ Specification	SiBar™ Thyristor Surge Protectors*	Overcurrent Protection Form Factor Radial-leaded	Surface-mount	Chip
Customer premises equipment, IT equipment Analog modems, V.90 modems, ISDN modems, xDSL modems, ADSL splitters, phone sets, fax machines, answering machines, caller ID, internet appliances, PBX systems, POS terminals, wall plugs	**North America** TIA-968-A (FCC Part 68), UL 1950, UL 1459	TVBxxxSA-L, TVBxxxSB-L, or TVAxxxSA-L	TRF600-15	TS600-170F TS600-200F	
	Europe/Asia/ South America ITU K.21	TVBxxxSA-L TVAxxxSA-L	TRF250-120 TRF250-120T TRF250-145 TRF250-180	TS250-130F TSV-130F	
Access network equipment (†) Remote terminals, line repeaters, multiplexers, cross-connects, WAN equipment	**North America** Telcordia GR-1089	TVBxxxSC-L	TRF600-160	TS600-170F TS600-200F TSM600-250F FT600-1250 ‡ TSM600-400F	
	Europe/Asia/ South America ITU K.45	TVBxxxSA-L TVAxxxSA-L	TRF250-120 TRF250-145 TRF250-120T TRF250-180	TS250-130F TSV250-130F	
Central office switching equipment (†) Analog/POTS linecards, ISDN linecards, xDSL modems, ADSL/VDSL splitters,	**North America** Telcordia GR-1089	TVBxxxSC-L	TRF600-160	TSM60-250F TSM600-170F TSM600-200F FT600-1250 ‡ TSM600-400F	
T1/E1 linecards, multiplexers, CSU/DSU, servers	**Europe/Asia/ South America** ITU K.20	TVBxxxSA-L TVAxxxSA-L	TRF250-120 TRF250-145 TRF250-120T TRF250-180	TS250-130F TSV250-130F	
Primary protection modules (†) MDF modules, Network Interface Devices (NID)	**North America** Telcordia GR-974	N/A	TRF250-180		
	Europe/Asia/ South America ITU K.20	TVBxxxSx-L	TRF250-120T TRF250-145T TRF250-145	TS250-130F TSV250-130F	TCF250-120T TCF250-145T
Short-haul/intrabuilding equipment (†) LAN equipment, VoIP cards, cable telephony NIU's, wireless local loop handsets	**North America** Telcordia GR-1089 intrabuilding	TVBxxxSA-L TVAxxxSA-L	TRF250-120 TRF250-145 TRF250-120T	TS250-130F TSL250-080F TSV250-130F	
	Europe/Asia/ South America ITU K.21	TVBxxxSA-L TVAxxxSA-L	TRF250-120 TRF250-15 TRF250-180	TS250-130F TSV250-130F	
LAN intrabuilding power cross protection LAN equipment, VoIP cards, IP phones		TVBxxxSA-L TVAxxxSA-L		TSL250-080F	
IEE 802.3 Power over LAN protection Powered ethernet switches and terminals, IP phones, wireless LAN base stations, microcellular base stations, VoIP cards		N/A		SMD050-2018F	
Cable telephony powering systems Power passing taps		N/A	BBRF550 BBRF750		

Notes: This list is not exhaustive. Raychem Circuit Protection welcomes our customers' input for additional application ideas.
* For more information on Raychem Circuit Protection PolySwitch resettable devices, refer to telecommunication and networking devices.
† For improved line balance in these applications, resistance-matched parts are recommended.
‡ FT600-1250 are surface mount telecom fuse devices. FT600-0500 and FT600-2000 reference also available. See FT600 section.

Table SB1 - Electrical Characteristics for SiBar™ Thyristor Surge Protectors

Part Number	V_{DM} Max.(V)	V_{BO} Max. (V)	I_H Min.(mA)	V_T Max. (V)	C1 Typ. (pF)
TVA270SA-L	270	365	150	4.0	22
TVB058SA-L	58	77	150	4.0	43
TVB170SA-L	170	265	150	4.0	20
TVB200SA-L	200	320	150	4.0	20
TVB270SA-L	270	365	150	4.0	20
TVB300SA-L	300	400	150	4.0	25
TVB200SB-L	200	320	150	4.0	25
TVB270SB-L	270	365	150	4.0	25
TVB300SB-L	300	400	150	4.0	25
TVB170SC-L	170	265	150	4.0	50
TVB200SC-L	200	320	150	4.0	50
TVB270SC-L	270	365	150	4.0	50
TVB300SC-L	300	400	150	4.0	50

Notes: All electrical characteristics are measured at 25°C.
V_{DM} measured per UL497B pulse requirements: at max. off-state leakage current (IDM) = 5 μA.
V_{BO} measured at 100V/μs.
C1 measured at 1 MHz with a 50 V_{DC} bias.

RoHS compliant, ELV compliant

Table SB2 - Surge Current Rating for SiBar™ Thyristor Surge Protectors

	TIA-968			Telcordia GR-1089*		IEC61000-4-5	ITU K.20/21/45*			
	Type A	Type B						I_{TSM}		
Part Number*	I_{pp}(A) 5 x 320 µs	I_{pp}(A) 10 x 560 µs	I_{pp}(A) 10 x 160 µs	I_{pp}(A) 10 x 1000 µs	I_{pp}(A) 2 x 10 µs	I_{pp}(A) 8 x 20 µs	I_{pp}(A) 5 x 310 µs (VOC: 10x700µs)	Min. (A)	di/dt (A/µs)	dV/dt (V/µs)
TVA270SA-L	90	70	100	50	150	150	90	22	500	2000
TVB058SA-L	90	70	70	50	150	150	80	22	500	2000
TVB170SA-L	90	70	100	50	150	150	90	22	500	2000
TVB200SA-L	90	70	100	50	150	150	90	22	500	2000
TVB270SA-L	90	70	100	50	150	150	90	22	500	2000
TVB300SA-L	90	70	100	50	150	150	90	22	500	2000
TVB200SB-L	100	100	150	80	250	250	100	30	500	2000
TVB270SB-L	100	100	150	80	250	250	100	30	500	2000
TVB300SB-L	100	100	150	80	250	250	100	30	500	2000
TVB170SC-L	100	150	200	100	500	400	150	60	500	2000
TVB200SC-L	100	150	200	100	500	400	150	60	500	2000
TVB270SC-L	100	150	200	100	500	400	150	60	500	2000
TVB300SC-L	100	150	200	100	500	400	150	60	500	2000

Notes: *Lightning current wave forms for applicable industry specification.
I_{TSM}, peak on-state surge current is measured at 60 Hz, one cycle.
di/dt: critical rate-of-rise of on-state current (pulsed power amplifier Vmax = 600V; C = 30µF).
dV/dt: critical rate-of-rise of off-stage voltage (linear wave form, V_D = rated V_{BO}, Tj = 25°C

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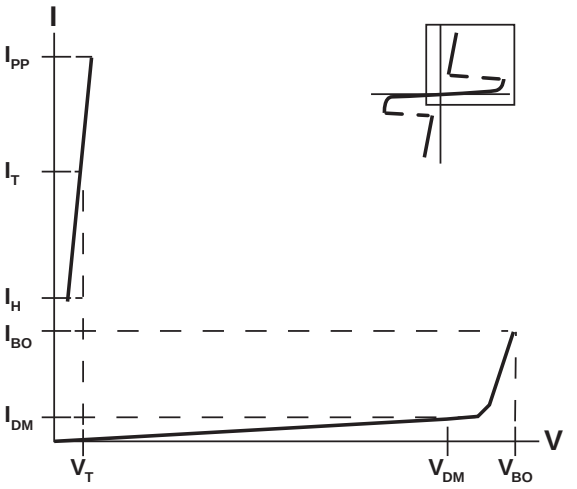
Figure SB1 - Voltage-Current Characteristics



The voltage current (V-I) is useful in depicting the electrical characteristics of the SiBar thyristor surge protectors in relation to each other.

Table SB3 - Parameter Definitions for SiBar™ Thyristor Surge Protectors

Symbol	Parameter	Definition
V_{BO}	Breakover voltage	Maximum voltage across the device at breakdown measured under a specified voltage and current rate of rise.
I_{BO}	Breakover current	Instantaneous current flowing at the breakover voltage (V_{BO}).
I_H	Hold current	Minimum current required to maintain the device in the on-state.
I_T	On-state current	Current through the device in the on-state condition.
V_T	On-state voltage	Voltage across the device in the on-state condition at a specified current (I_T).
V_{DM}	Maximum off-state voltage	Maximum DC voltage that can be applied to the device while maintaining it in the off-state condition.
I_{DM}	Off-state current	Maximum DC value of current that results from the application of the maximum off-state voltage.
I_{PP}	Peak pulse current	Rated peak pulse current of specified amplitude and waveshape that may be applied without damage.
di/dt, dv/dt	Critical rate of rise of on-state current and voltage	Maximum current and voltage rate of rise the device can withstand without damage.

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Figures SB2-SB5 - Typical Electrical Charateristics vs. Temperature for Sibar™ Thyristor Surge Protectors

Figure SB2 - Off-state Voltage vs. Temperature

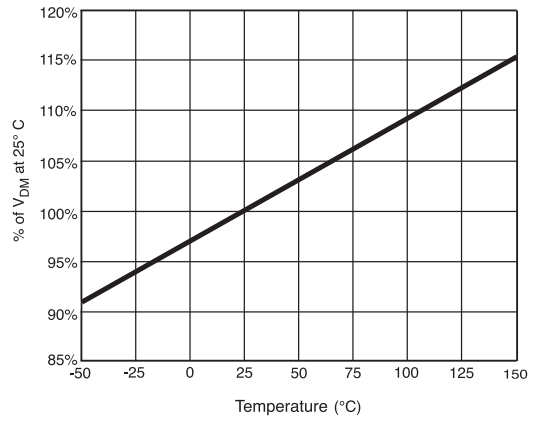

Figure SB3 - Breakover Voltage vs. Temperature

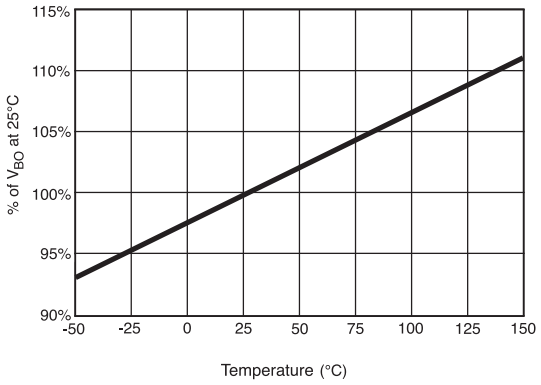

Figure SB4 - Hold Current vs. Temperature

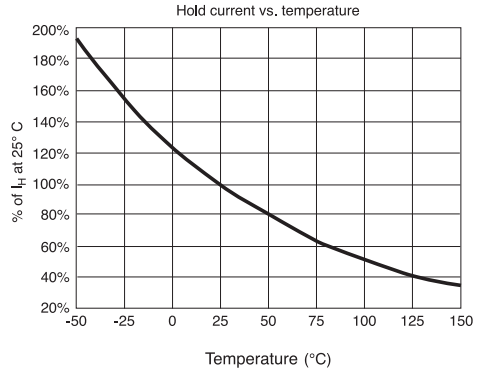

Figure SB5 - Off-state Current vs. Temperature

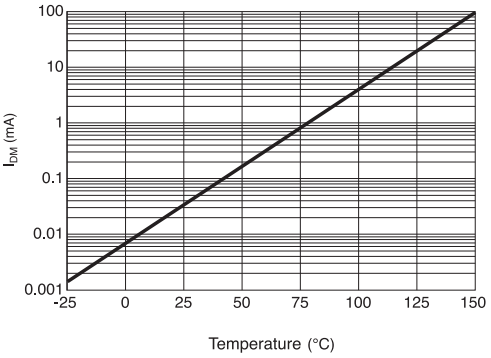

Figure SB6 - Dimension Figure

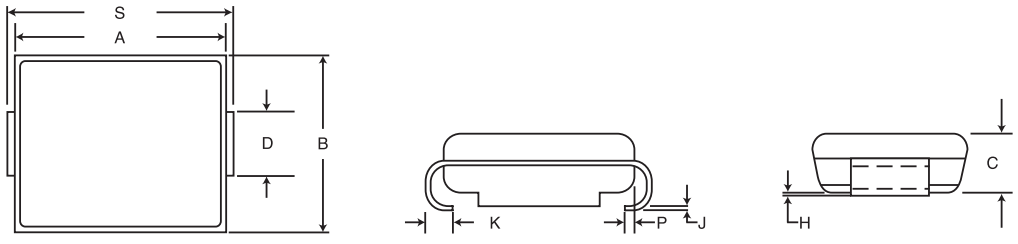

Table SB4 - Dimensions for SiBar™ Thyristor Surface Protectors in Millimeters

		A		B		C		D*		H		J		K		P	S	
	Dimension	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Ref.**	**Min.**	**Max.**
✓	TVBxxxSA -L, TVBxxxSB-L,	4.06	4.57	3.30	3.81	1.90	2.41	1.96	2.11	0.051	0.152	0.15	0.30	0.76	1.27	0.51	5.21	5.59
	TVBxxxSC -L	(0.160)	(0.180)	(0.130)	(0.150)	(0.075)	(0.095)	(0.077)	(0.083)	(0.002)	(0.006)	(0.006)	(0.012)	(0.030)	(0.050)	(0.020)	(0.205)	(0.220)
✓	TVAxxxSA -L	4.06	4.57	2.29	2.92	1.90	2.41	1.27	1.63	0.051	0.152	0.15	0.41	0.76	1.52	0.51	4.83	5.59
		(0.160)	(0.180)	(0.090)	(0.115)	(0.075)	(0.095)	(0.050)	(0.064)	(0.002)	(0.006)	(0.006)	(0.016)	(0.030)	(0.060)	(0.020)	(0.190)	(0.220)

Notes: *D dimension is measured within dimension P.
TVA series devices use industry standard SMA package type.
TVB series devices use industry standard SMB package type.
All devices are bidirectional and may be oriented in either direction for installation.

✓ RoHS compliant, ELV compliant

Table SB5 - Physical Characteristics and Environmental Specifications for SiBar™ Thyristor Surge Protectors

Lead material	Matte tin finish (-L devices)
Encapsulating material	Epoxy, meets UL94V-0 requirements
Solderability	per MIL-STD-750, Method 2026
Solder heat withstand	per MIL-STD-750, Method 2031
Solvent resistance	per MIL-STD-750, Method 1022
Mechanical shock	per MIL-STD-750, Method 2016
Vibration	per MIL-STD-750, Method 2056
Storage temperature (°C)	-55 to 150
Operating temperature (°C)	-40 to 125
Junction temperature (°C)	175

Table SB6 - Reliability Tests for SiBar™ Thyristor Surge Protectors

Test	Conditions	Duration
High temperature, reserse bias	+100°C, 50VDC bias	1000 hours
High humidity, high temperature, reserse bias	85% RH, +85°C, 50VDC bias	1000 hours
High temperature storage life	+150°C	1000 hours
Temperature cycling	-65°C to +150°C, 15 minute dwell	1000 cycles
Autoclave	100% RH, +121°C, 15 PSI	96 hours

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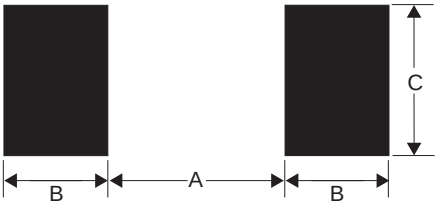
Table SB7 - Packaging and Marking Information for SiBar™ Thyristor Surge Protectors

					Recommended Pad Layout (millimeters/inchs)		
Part Description	Tape and Reel Quantity	Standard Package	Part Marking	Dimension A (Nom.)	Dimension B (Nom.)	Dimension C (Nom.)	Agency Recognition
TVA270SA-L	5,000	20,000	270A	2.0 (0.079)	2.0 (0.079)	2.0 (0.079)	UL
TVB058SA-L	2,500	10,000	058A	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB170SA-L	2,500	10,000	170A	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB200SA-L	2,500	10,000	200A	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB270SA-L	2,500	10,000	270A	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB300SA-L	2,500	10,000	300A	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB200SB-L	2,500	10,000	200B	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB270SB-L	2,500	10,000	270B	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB300SB-L	2,500	10,000	300B	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB170SC-L	2,500	10,000	170C	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB200SC-L	2,500	10,000	200C	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB270SC-L	2,500	10,000	270C	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL
TVB300SC-L	2,500	10,000	300C	2.261 (0.089)	2.159 (0.085)	2.743 (0.108)	UL

Figure SB7 - Recommended Pad Layout



Agency Recognition for SiBar™ Thyristor Surge Protectors

UL497B File # E179610

RoHS compliant, ELV compliant

Solder Reflow and Rework Recommendations for SiBar™ Thyristor Surge Protectors

SiBar thyristor devices are compatible with standard reflow and wave soldering techniques.

Solder Reflow

- Recommended reflow methods: IR, vapor phase oven, hot air oven.
- Always preheat the device to prevent excessive thermal shock and stress.
- Recommended maximum paste thickness of 0.25mm (0.010 in.).
- Devices may be cleaned using standard industry methods and solvents.

Solder Rework

- Use standard industry practices for the SiBar Thyristor Surge Protectors.

Figure SB8

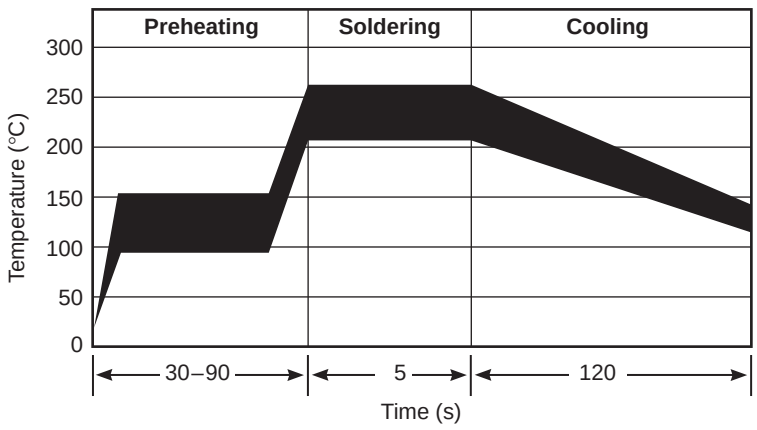


Table SB8 - Tape and Reel Specifications for SiBar™ Thyristor Surge Protectors

SiBar thyristor devices are supplied on tape and reel per EIA481-1 standard. (See Figures SB9 and SB10 for details.)

	TVB Series		TVA Series	
Description	**Dimensions (mm)**	**Tolerance (mm)**	**Dimensions (mm)**	**Tolerance (mm)**
W	12	+/- 0.30	12	+/- 0.3
P_0	4.0	+/- 0.10	4.0	+/- 0.10
P_1	8.0	+/- 0.10	8.0	+/- 0.10
P_2	2.0	+/- 0.10	2.0	+/- 0.10
A_0	4.3	—	2.9	+/- 0.10
B_0	6.2	—	5.59	+/- 0.10
B_1 max.	8.2	—	8.2	—
D0	1.5	+ 0.1, -0.0	1.5	+ 0.1, -0
F	5.5	+/- 0.05	5.5	+/- 0.05
E_1	1.75	+/- 0.10	1.75	+/- 0.10
E_2 min.	9.85	—	9.85	—
T max.	0.6	—	0.6	—
T_1 max.	0.1	—	0.1	—
K_0 max.	2.59	+/- 0.10	2.36	+/- 0.10
Leader min.	390	—	390	—
Trailer min.	160	—	160	—

Figure SB9 - EIA Referenced Taped Component Dimensions for SiBar™ Thyristor Surge Protectors

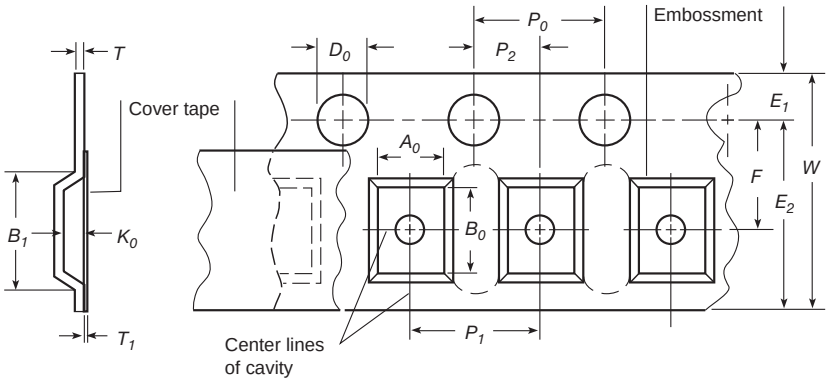
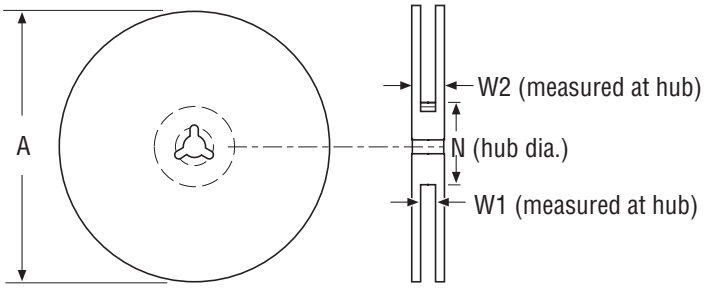


Figure SB10 - EIA Referenced Reel Dimensions for SiBar™ Thyristor Protectors

Reel Dimension	
A max.	330
N min.	50
W1	12.4 + 2.0, -0
W2 max.	18.4



Part Numbering System for SiBar™ Thyristor Surge Protectors

TV B 270 S A -L

Product family

Package type:
A: SMA package
B: SMB package

V_{DM} (max. off-state voltage indicator)

Surge current rating
A, B, C refer to Table SB2

RoHS complaint, Pb-free leads, matte tin finish

4

⚠ WARNING:

- Operation beyond the maximum ratings or improper use may result in device damage and possible electrical arcing and flame.
- The devices are intended for protection against occasional overvoltage fault conditions and should not be used when repeated fault conditions or prolonged trip events are anticipated.
- Device performance can be impacted negatively if devices are handled in a manner inconsistent with recommended electronic, thermal, and mechanical procedures for electronic components.