

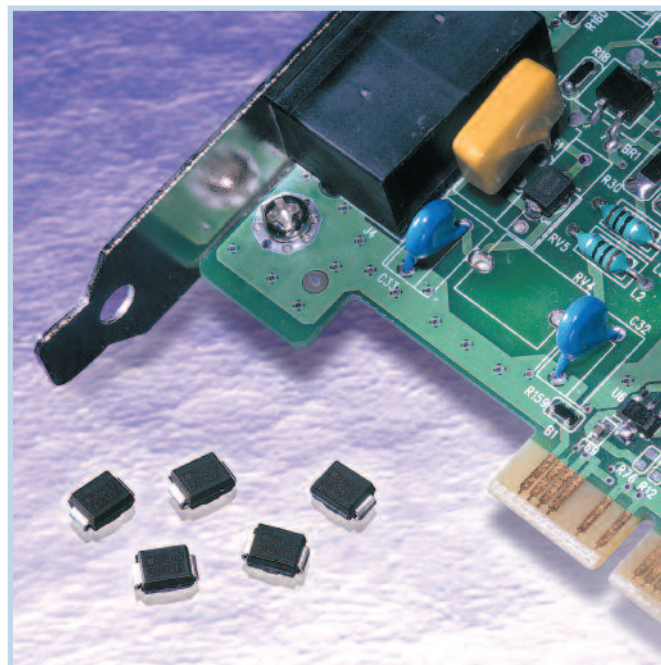


## SiBar Thyristor Surge Protectors

SiBar thyristor surge protection devices help protect sensitive telecom and datacom equipment from overvoltage events, including lightning transients, and operate as shunt devices in response to a surge that exceeds the breakover voltage. When the voltage exceeds the breakover voltage the SiBar device “folds back”, creating a low-impedance path, effectively shorting out the overvoltage condition.

Compliant with major standards such as GR-1089 Core, ITU-T-K20/K21, IEC61000-4-5 and FCC part 68, and UL1950, SiBar devices provide fast, bidirectional protection on communications network equipment, including analog and digital linecards, xDSL and ISDN modems, set-top boxes, T1 equipment, Voice over IP (VoIP) and Power over Ethernet (PoE) equipment.

The SiBar thyristor’s low on-state voltage allows for smaller form factor devices – as compared with clamping devices of comparable energy handling capability, and their relatively low capacitance makes them suitable for high data rate circuits.



### Benefits

- Helps provide protection for sensitive telecom electronic equipment
- Low leakage current
- Low power dissipation
- Lower capacitance for high speed telecom applications
- 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

### 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

### Features

- RoHS compliant available on all parts
- Bidirectional crowbar transient voltage protection
- High off-state impedance
- Low on-state voltage
- High surge capability
- New reduced and micro capacitance devices
- New expanded voltage offerings (6V-400V)
- Short-circuit failure mode
- Surface-mount technology

## 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/<br>Specification                                 | SiBar Thyristor<br>Surge Protectors*                       | Overcurrent Protection                                              |                                                                         |                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------|---------------------------|
|                                                                                                                                                                                                                                                                        |                                                          |                                                            | Form Factor<br>Radial-leaded                                        | Surface-mount                                                           | Chip                      |
| <b>Customer premises equipment, IT equipment</b><br>Analog modems, V.90 modems, ISDN modems, xDSL modems, ADSL splitters, phone sets, multifunction printers, fax machines, answering machines, caller ID, internet appliances, PBX systems, POS terminals, wall plugs | <b>North America</b><br>TIA-968-A (FCC Part 68), UL60950 | TVBxxx(N/R)SA-L,<br>TVBxxx(N/M)SB-L, or<br>TVAxxx(N/R)SA-L | TRF600-150                                                          | TS600-170F<br>TS600-200F                                                |                           |
|                                                                                                                                                                                                                                                                        | <b>Europe/Asia/<br/>South America</b><br>ITU K.21        | TVBxxx(N/R)SA-L<br>TVAxxx(N/R)SA-L                         | TRF250-120<br>TRF250-145<br>TRF250-120T<br>TRF250-180<br>TRF250-183 | TS250-130F<br>TSV250-130F                                               |                           |
| <b>Access network equipment (†)</b><br>Remote terminals, line repeaters, multiplexers, cross-connects, WAN equipment                                                                                                                                                   | <b>North America</b><br>Telcordia GR-1089                | TVBxxx(N/M/R)SC-L                                          | TRF600-160                                                          | TS600-170F<br>TS600-200F<br>TSM600-250F<br>TSM600-400F<br>FT600-1250‡   |                           |
|                                                                                                                                                                                                                                                                        | <b>Europe/Asia/<br/>South America</b><br>ITU K.45        | TVBxxx(N/R)SA-L<br>TVAxxx(N/R)SA-L                         | TRF250-120<br>TRF250-145<br>TRF250-120T<br>TRF250-180<br>TRF250-183 | TS250-130F<br>TSV250-130F                                               |                           |
| <b>Central office switching equipment (†)</b><br>Analog/POTS linecards, ISDN linecards, xDSL modems, ADSL/VDSL splitters,<br><br>T1/E1 linecards, multiplexers, CSU/DSU, servers                                                                                       | <b>North America</b><br>Telcordia GR-1089                | TVBxxx(N/M/R)SC-L                                          | TRF600-160                                                          | TSM600-250F<br>TSM600-170F<br>TSM600-200F<br>TSM600-400F<br>FT600-1250‡ |                           |
|                                                                                                                                                                                                                                                                        | <b>Europe/Asia/<br/>South America</b><br>ITU K.20        | TVBxxx(N/R)SA-L<br>TVAxxx(N/R)SA-L                         | TRF250-120<br>TRF250-145<br>TRF250-120T<br>TRF250-180<br>TRF250-183 | TS250-130F<br>TSV250-130F                                               | TCF250-180                |
| <b>Primary protection modules (†)</b><br>MDF modules, Network Interface Devices (NID)                                                                                                                                                                                  | <b>North America</b><br>Telcordia GR-974                 | N/A                                                        | TRF250-180                                                          |                                                                         |                           |
|                                                                                                                                                                                                                                                                        | <b>Europe/Asia/<br/>South America</b><br>ITU K.20        | TVBxxx(N/M/R)Sx-L                                          | TRF250-120T<br>TRF250-145T<br>TRF250-145                            | TS250-130F<br>TSV250-130F                                               | TCF250-120T<br>TCF250-180 |
| <b>Short-haul/intrabuilding equipment (†)</b><br>LAN equipment, VoIP cards, cable telephony NIU's, wireless local loop handsets                                                                                                                                        | <b>North America</b><br>Telcordia GR-1089                | TVBxxx(N/R)SA-L<br>TVAxxx(N/R)SA-L                         | TRF250-120<br>TRF250-145<br>TRF250-120T                             | TS250-130F<br>TSL250-080F<br>TSV250-130F                                |                           |
|                                                                                                                                                                                                                                                                        | <b>Europe/Asia/<br/>South America</b><br>ITU K.21        | TVBxxx(N/R)SA-L<br>TVAxxx(N/R)SA-L                         | TRF250-120<br>TRF250-145<br>TRF250-180<br>TRF250-183                | TS250-130F<br>TSV250-130F                                               |                           |
| <b>LAN intrabuilding power cross protection</b><br>LAN equipment, VoIP cards, IP phones                                                                                                                                                                                |                                                          | TVBxxx(N/R)SA-L<br>TVAxxx(N/R)SA-L                         |                                                                     | TSL250-080F                                                             |                           |
| <b>IEEE 802.3 Power over LAN protection</b><br>Powered ethernet switches and terminals, IP phones, wireless LAN base stations, microcellular base stations, VoIP cards                                                                                                 |                                                          | N/A                                                        |                                                                     | decaSMD050F/60-2                                                        |                           |
| <b>Cable telephony powering systems</b><br>Power passing taps                                                                                                                                                                                                          |                                                          | N/A                                                        | BBRF550<br>BBRF750                                                  |                                                                         |                           |

**Note :** This list is not exhaustive. Tyco Electronics welcomes our customers' input for additional application ideas.

\* For more information on Raychem Circuit Protection PolySwitch resettable devices, refer to the telecommunications and networking devices section on page 184.

† 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 on page 100.

**Table SB1** Electrical Characteristics, Part Marking and Agency Approval for SiBar Thyristor Surge Protectors

| Part Number                                      | V <sub>DM</sub> Max.<br>(V) | V <sub>BO</sub> Max.<br>(V) | I <sub>H</sub> Min.<br>(mA) | V <sub>T</sub> Max.<br>(V) | C <sub>1</sub> @50V Typ.<br>(pF) | C <sub>2</sub> @ 2V Typ.<br>(pF) | Part<br>Marking | UL Approval |
|--------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|----------------------------------|----------------------------------|-----------------|-------------|
| <b>SMA 50A Standard "SA" and "NSA" Devices</b>   |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVA170SA-L                                       | 170                         | 265                         | 150                         | 4.0                        | 20                               | 39                               | 170A            | X           |
| TVA170NSA-L                                      | 170                         | 220                         | 150                         | 4.0                        | 20                               | 39                               | 17NA            | X           |
| TVA200SA-L                                       | 200                         | 320                         | 150                         | 4.0                        | 17                               | 33                               | 200A            | X           |
| TVA220NSA-L                                      | 220                         | 300                         | 150                         | 4.0                        | 17                               | 33                               | 22NA            | X           |
| TVA270SA-L                                       | 270                         | 365                         | 150                         | 4.0                        | 16                               | 31                               | 270A            | X           |
| TVA275NSA-L                                      | 275                         | 350                         | 150                         | 4.0                        | 16                               | 31                               | 27NA            | X           |
| <b>SMA 50A Reduced Capacitance "RSA" Devices</b> |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVA065RSA-L                                      | 65                          | 88                          | 150                         | 4.0                        | 20                               | 40                               | A065            | X           |
| TVA090RSA-L                                      | 90                          | 130                         | 150                         | 4.0                        | 20                               | 40                               | A090            | X           |
| TVA120RSA-L                                      | 120                         | 160                         | 150                         | 4.0                        | 16                               | 30                               | A120            | X           |
| TVA130RSA-L                                      | 130                         | 173                         | 150                         | 4.0                        | 14                               | 30                               | A130            | X           |
| TVA170RSA-L                                      | 170                         | 220                         | 150                         | 4.0                        | 14                               | 25                               | A170            | X           |
| TVA190RSA-L                                      | 190                         | 260                         | 150                         | 4.0                        | 14                               | 25                               | A190            | X           |
| TVA220RSA-L                                      | 220                         | 295                         | 150                         | 4.0                        | 12                               | 25                               | A220            | X           |
| TVA270RSA-L                                      | 275                         | 350                         | 150                         | 4.0                        | 12                               | 25                               | A270            | X           |
| TVA300RSA-L                                      | 320                         | 400                         | 150                         | 4.0                        | 12                               | 25                               | A300            | X           |
| <b>SMB 50A Standard "SA" and "NSA" Devices</b>   |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVB058SA-L                                       | 58                          | 77                          | 150                         | 4.0                        | 43                               | 80                               | 058A            | X           |
| TVB058NSA-L                                      | 58                          | 77                          | 150                         | 4.0                        | 44                               | 84                               | 58NA            | X           |
| TVB065NSA-L                                      | 65                          | 88                          | 150                         | 4.0                        | 41                               | 79                               | 65NA            | X           |
| TVB075NSA-L                                      | 75                          | 98                          | 150                         | 4.0                        | 34                               | 65                               | 75NA            | X           |
| TVB090NSA-L                                      | 90                          | 130                         | 150                         | 4.0                        | 31                               | 58                               | 90NA            | X           |
| TVB120NSA-L                                      | 120                         | 160                         | 150                         | 4.0                        | 24                               | 46                               | 12NA            | X           |
| TVB140NSA-L                                      | 140                         | 180                         | 150                         | 4.0                        | 23                               | 44                               | 14NA            | X           |
| TVB170SA-L                                       | 170                         | 265                         | 150                         | 4.0                        | 18                               | 35                               | 170A            | X           |
| TVB170NSA-L                                      | 170                         | 220                         | 150                         | 4.0                        | 20                               | 39                               | 17NA            | X           |
| TVB180SA-L                                       | 180                         | 219                         | 150                         | 4.0                        | 30 (MAX)                         | 60 (MAX)                         | 180A            | X           |
| TVB180NSA-L                                      | 180                         | 240                         | 150                         | 4.0                        | 19                               | 37                               | 18NA            | X           |
| TVB190NSA-L                                      | 190                         | 260                         | 150                         | 4.0                        | 19                               | 36                               | 19NA            | X           |
| TVB200SA-L                                       | 200                         | 320                         | 150                         | 4.0                        | 18                               | 35                               | 200A            | X           |
| TVB220NSA-L                                      | 220                         | 300                         | 150                         | 4.0                        | 17                               | 33                               | 22NA            | X           |
| TVB270SA-L                                       | 270                         | 365                         | 150                         | 4.0                        | 15                               | 32                               | 270A            | X           |
| TVB275NSA-L                                      | 275                         | 350                         | 150                         | 4.0                        | 15                               | 31                               | 27NA            | X           |
| TVB300SA-L                                       | 300                         | 400                         | 150                         | 4.0                        | 14                               | 27                               | 300A            | X           |
| TVB320NSA-L                                      | 320                         | 400                         | 150                         | 4.0                        | 14                               | 27                               | 32NA            | X           |
| <b>SMB 50A Reduced Capacitance "RSA" Devices</b> |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVB065RSA-L                                      | 65                          | 88                          | 150                         | 4.0                        | 20                               | 40                               | 65RA            | X           |
| TVB090RSA-L                                      | 90                          | 130                         | 150                         | 4.0                        | 20                               | 40                               | 90RA            | X           |
| TVB120RSA-L                                      | 120                         | 160                         | 150                         | 4.0                        | 16                               | 30                               | 12RA            | X           |
| TVB130RSA-L                                      | 130                         | 173                         | 150                         | 4.0                        | 14                               | 30                               | 13RA            | X           |
| TVB170RSA-L                                      | 170                         | 220                         | 150                         | 4.0                        | 14                               | 25                               | 17RA            | X           |
| TVB190RSA-L                                      | 190                         | 260                         | 150                         | 4.0                        | 14                               | 25                               | 19RA            | X           |
| TVB220RSA-L                                      | 220                         | 295                         | 150                         | 4.0                        | 12                               | 25                               | 22RA            | X           |
| TVB270RSA-L                                      | 275                         | 350                         | 150                         | 4.0                        | 12                               | 25                               | 27RA            | X           |
| TVB300RSA-L                                      | 320                         | 400                         | 150                         | 4.0                        | 12                               | 25                               | 30RA            | X           |
| <b>SMB 80A Standard "SB" and "NSB" Devices</b>   |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVB006SB-L                                       | 6                           | 20                          | 50 (TYP)                    | 4.0                        | –                                | 50 (TYP)                         | B006            | X           |
| TVB058NSB-L                                      | 58                          | 77                          | 150                         | 4.0                        | 67                               | 129                              | 58NB            | X           |
| TVB065NSB-L                                      | 65                          | 88                          | 150                         | 4.0                        | 64                               | 123                              | 65NB            | X           |
| TVB075NSB-L                                      | 75                          | 98                          | 150                         | 4.0                        | 63                               | 122                              | 75NB            | X           |
| TVB090NSB-L                                      | 90                          | 130                         | 150                         | 4.0                        | 49                               | 95                               | 90NB            | X           |
| TVB120NSB-L                                      | 120                         | 160                         | 150                         | 4.0                        | 38                               | 75                               | 12NB            | X           |
| TVB140NSB-L                                      | 140                         | 180                         | 150                         | 4.0                        | 36                               | 70                               | 14NB            | X           |
| TVB170NSB-L                                      | 170                         | 220                         | 150                         | 4.0                        | 29                               | 59                               | 17NB            | X           |
| TVB180NSB-L                                      | 180                         | 240                         | 150                         | 4.0                        | 29                               | 59                               | 18NB            | X           |
| TVB190NSB-L                                      | 190                         | 260                         | 150                         | 4.0                        | 28                               | 56                               | 19NB            | X           |
| TVB200SB-L                                       | 200                         | 320                         | 150                         | 4.0                        | 30                               | 49                               | 200B            | X           |
| TVB220NSB-L                                      | 220                         | 300                         | 150                         | 4.0                        | 26                               | 52                               | 22NB            | X           |

**Table SB1** Electrical Characteristics, Part Marking and Agency Approval for SiBar Thyristor Surge Protectors

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| Part Number                                       | V <sub>DM</sub> Max.<br>(V) | V <sub>BO</sub> Max.<br>(V) | I <sub>H</sub> Min.<br>(mA) | V <sub>T</sub> Max.<br>(V) | C <sub>1</sub> @50V Typ.<br>(pF) | C <sub>2</sub> @ 2V Typ.<br>(pF) | Part<br>Marking | UL Approval |
|---------------------------------------------------|-----------------------------|-----------------------------|-----------------------------|----------------------------|----------------------------------|----------------------------------|-----------------|-------------|
| <b>SMB 80A Standard "SB" and "NSB" Devices</b>    |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVB270SB-L                                        | 270                         | 350                         | 150                         | 4.0                        | 25                               | 50                               | 270B            | X           |
| TVB275NSB-L                                       | 275                         | 350                         | 150                         | 4.0                        | 23                               | 47                               | 27NB            | X           |
| TVB300SB-L                                        | 300                         | 400                         | 150                         | 4.0                        | 21                               | 42                               | 300B            | X           |
| TVB320NSB-L                                       | 320                         | 400                         | 150                         | 4.0                        | 22                               | 44                               | 32NB            | X           |
| <b>SMB 80A Micro Capacitance "MSB" Devices</b>    |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVB120MSB-L                                       | 120                         | 160                         | 150                         | 4.0                        | 12                               | 25                               | 12MB            | X           |
| TVB140MSB-L                                       | 140                         | 180                         | 150                         | 4.0                        | 12                               | 25                               | 14MB            | X           |
| TVB170MSB-L                                       | 170                         | 220                         | 150                         | 4.0                        | 12                               | 25                               | 17MB            | X           |
| TVB190MSB-L                                       | 190                         | 260                         | 150                         | 4.0                        | 12                               | 25                               | 19MB            | X           |
| TVB220MSB-L                                       | 220                         | 295                         | 150                         | 4.0                        | 12                               | 25                               | 22MB            | X           |
| TVB270MSB-L                                       | 275                         | 350                         | 150                         | 4.0                        | 12                               | 25                               | 27MB            | X           |
| TVB300MSB-L                                       | 320                         | 400                         | 150                         | 4.0                        | 12                               | 25                               | 30MB            | X           |
| <b>SMB 100A Standard "SC" and "NSC" Devices</b>   |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVB058NSC-L                                       | 58                          | 77                          | 150                         | 4.0                        | 114                              | 222                              | 58NC            | X           |
| TVB065NSC-L                                       | 65                          | 88                          | 150                         | 4.0                        | 103                              | 198                              | 65NC            | X           |
| TVB075NSC-L                                       | 75                          | 98                          | 150                         | 4.0                        | 90                               | 176                              | 75NC            | X           |
| TVB090NSC-L                                       | 90                          | 130                         | 150                         | 4.0                        | 79                               | 154                              | 90NC            | X           |
| TVB120NSC-L                                       | 120                         | 160                         | 150                         | 4.0                        | 72                               | 140                              | 12NC            | X           |
| TVB140NSC-L                                       | 140                         | 180                         | 150                         | 4.0                        | 66                               | 130                              | 14NC            | X           |
| TVB170SC-L                                        | 170                         | 265                         | 150                         | 4.0                        | 60                               | 125                              | 170C            | X           |
| TVB170NSC-L                                       | 170                         | 220                         | 150                         | 4.0                        | 48                               | 99                               | 17NC            | X           |
| TVB180NSC-L                                       | 180                         | 240                         | 150                         | 4.0                        | 48                               | 97                               | 18NC            | X           |
| TVB190NSC-L                                       | 190                         | 260                         | 150                         | 4.0                        | 44                               | 90                               | 19NC            | X           |
| TVB200SC-L                                        | 200                         | 320                         | 150                         | 4.0                        | 55                               | 115                              | 200C            | X           |
| TVB220NSC-L                                       | 220                         | 300                         | 150                         | 4.0                        | 41                               | 81                               | 22NC            | X           |
| TVB270SC-L                                        | 270                         | 365                         | 150                         | 4.0                        | 50                               | 110                              | 270C            | X           |
| TVB275NSC-L                                       | 275                         | 350                         | 150                         | 4.0                        | 38                               | 76                               | 27NC            | X           |
| TVB300SC-L                                        | 300                         | 400                         | 150                         | 4.0                        | 47                               | 98                               | 300C            | X           |
| TVB320NSC-L                                       | 320                         | 400                         | 150                         | 4.0                        | 35                               | 71                               | 32NC            | X           |
| <b>SMB 100A Reduced Capacitance "RSC" Devices</b> |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVB006RSC-L                                       | 6                           | 25                          | 50 (typ)                    | 4.0                        | —                                | 75                               | 06RC            | X           |
| TVB025RSC-L                                       | 25                          | 40                          | 150                         | 4.0                        | —                                | 65                               | 25RC            | X           |
| TVB035RSC-L                                       | 35                          | 55                          | 150                         | 4.0                        | —                                | 55                               | 35RC            | X           |
| TVB065RSC-L                                       | 65                          | 88                          | 150                         | 4.0                        | 45                               | 90                               | 65RC            | X           |
| TVB090RSC-L                                       | 90                          | 125                         | 150                         | 4.0                        | 40                               | 80                               | 90RC            | X           |
| TVB120RSC-L                                       | 120                         | 160                         | 150                         | 4.0                        | 35                               | 75                               | 12RC            | X           |
| TVB140RSC-L                                       | 140                         | 180                         | 150                         | 4.0                        | 30                               | 65                               | 14RC            | X           |
| TVB170RSC-L                                       | 170                         | 220                         | 150                         | 4.0                        | 30                               | 60                               | 17RC            | X           |
| TVB190RSC-L                                       | 190                         | 260                         | 150                         | 4.0                        | 30                               | 60                               | 19RC            | X           |
| TVB220RSC-L                                       | 220                         | 295                         | 150                         | 4.0                        | 30                               | 60                               | 22RC            | X           |
| TVB270RSC-L                                       | 275                         | 350                         | 150                         | 4.0                        | 30                               | 60                               | 27RC            | X           |
| TVB300RSC-L                                       | 320                         | 400                         | 150                         | 4.0                        | 25                               | 50                               | 30RC            | X           |
| TVB360RSC-L                                       | 360                         | 460                         | 150                         | 4.0                        | 25                               | 50                               | 36RC            | X           |
| TVB400RSC-L                                       | 400                         | 540                         | 150                         | 4.0                        | 20                               | 45                               | 40RC            | X           |
| <b>SMB 100A Micro Capacitance "MSC" Devices</b>   |                             |                             |                             |                            |                                  |                                  |                 |             |
| TVB140MSC-L                                       | 140                         | 180                         | 150                         | 4.0                        | 30                               | 60                               | 14MC            | X           |
| TVB170MSC-L                                       | 170                         | 220                         | 150                         | 4.0                        | 25                               | 50                               | 17MC            | X           |
| TVB190MSC-L                                       | 190                         | 260                         | 150                         | 4.0                        | 25                               | 45                               | 19MC            | X           |
| TVB220MSC-L                                       | 220                         | 295                         | 150                         | 4.0                        | 20                               | 40                               | 22MC            | X           |
| TVB270MSC-L                                       | 275                         | 350                         | 150                         | 4.0                        | 20                               | 40                               | 27MC            | X           |
| TVB300MSC-L                                       | 320                         | 400                         | 150                         | 4.0                        | 20                               | 40                               | 30MC            | X           |
| TVB400MSC-L                                       | 400                         | 530                         | 150                         | 4.0                        | 15                               | 30                               | 40MC            | X           |

**Notes :** All electrical characteristics are measured at 25°C.

V<sub>DM</sub> measured per UL497B pulse requirements: at max. off-state leakage current (IDM) = 5μA.

V<sub>BO</sub> measured at 100V/μs.

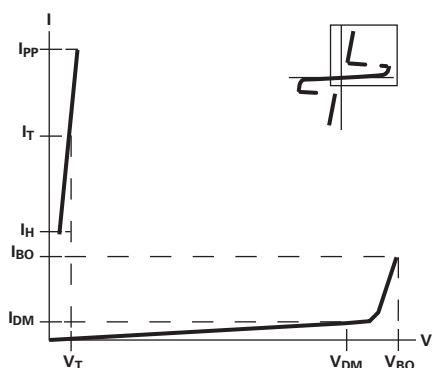
**Table SB2 Surge Current Rating for SiBar Thyristor Surge Protectors**

|  Part Number | TIA-968                   |                            |                            | Telcordia GR-1089*          |                          | IEC61000-4-5             | ITU K.20/21/45*                                           | $I_{TSM}$<br>Min.<br>(A) | di/dt<br>(A/μs) | dV/dt<br>(A/μs) |
|-----------------------------------------------------------------------------------------------|---------------------------|----------------------------|----------------------------|-----------------------------|--------------------------|--------------------------|-----------------------------------------------------------|--------------------------|-----------------|-----------------|
|                                                                                               | Type A                    | Type B                     |                            | $I_{pp}$ (A)<br>10 x 1000μs | $I_{pp}$ (A)<br>2 x 10μs | $I_{pp}$ (A)<br>8 x 20μs | $I_{pp}$ (A)<br>5 x 310μs<br>(V <sub>OC</sub> : 10x700μs) |                          |                 |                 |
|                                                                                               | $I_{pp}$ (A)<br>5 x 320μs | $I_{pp}$ (A)<br>10 x 560μs | $I_{pp}$ (A)<br>10 x 160μs |                             |                          |                          |                                                           |                          |                 |                 |
| TVAxxxSA-L                                                                                    | 90                        | 70                         | 100                        | 50                          | 150                      | 150                      | 90                                                        | 22                       | 500             | 2000            |
| TVAxxxNSA-L                                                                                   | 90                        | 70                         | 100                        | 50                          | 150                      | 150                      | 90                                                        | 22                       | 500             | 2000            |
| TVAxxxRSA-L                                                                                   | 65                        | 55                         | 75                         | 50                          | 100                      | 150                      | 65                                                        | 22                       | 500             | 2000            |
|                                                                                               |                           |                            |                            |                             |                          |                          |                                                           |                          |                 |                 |
| TVB180SA-L                                                                                    | —                         | 75                         | 110                        | 50                          | —                        | —                        | 100                                                       | 32                       | 500             | 2000            |
| TVBxxxSA-L                                                                                    | 90                        | 70                         | 100                        | 50                          | 150                      | 150                      | 90                                                        | 22                       | 500             | 2000            |
| TVBxxxNSA-L                                                                                   | 90                        | 70                         | 100                        | 50                          | 150                      | 150                      | 90                                                        | 22                       | 500             | 2000            |
| TVBxxxRSA-L                                                                                   | 65                        | 55                         | 75                         | 50                          | 100                      | 150                      | 65                                                        | 22                       | 500             | 2000            |
|                                                                                               |                           |                            |                            |                             |                          |                          |                                                           |                          |                 |                 |
| TVB006SB-L                                                                                    | 120                       | 100                        | 150                        | 75                          | 250                      | 250                      | 120                                                       | 28                       | 500             | 2000            |
| TVBxxxSB-L                                                                                    | 100                       | 100                        | 150                        | 80                          | 250                      | 250                      | 100                                                       | 30                       | 500             | 2000            |
| TVBxxxNSB-L                                                                                   | 100                       | 100                        | 150                        | 80                          | 250                      | 250                      | 100                                                       | 30                       | 500             | 2000            |
| TVBxxxMSB-L                                                                                   | 120                       | 100                        | 150                        | 80                          | 250                      | 200                      | 120                                                       | 28                       | 500             | 2000            |
|                                                                                               |                           |                            |                            |                             |                          |                          |                                                           |                          |                 |                 |
| TVBxxxSC-L                                                                                    | 150                       | 150                        | 200                        | 100                         | 500                      | 400                      | 150                                                       | 60                       | 500             | 2000            |
| TVBxxxNSC-L                                                                                   | 150                       | 150                        | 200                        | 100                         | 500                      | 400                      | 200                                                       | 60                       | 500             | 2000            |
| TVBxxxRSC-L                                                                                   | 150                       | 140                        | 200                        | 100                         | 500                      | 400                      | 150                                                       | 41                       | 500             | 2000            |
| TVBxxxMSC-L                                                                                   | 150                       | 140                        | 200                        | 100                         | 500                      | 300                      | 150                                                       | 41                       | 500             | 2000            |

Notes :  $I_{TSM}$  : 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  $V_{max} = 600V$ ;  $C = 30\mu F$ ).  
 $dV/dt$  : critical rate-of-rise of off-stage voltage (linear wave form,  $V_D = \text{rated } V_{BO}$ ,  $T_J = 25^\circ C$ )

\* Lightning current wave forms for applicable industry specification.

**Figure SB1 Voltage-Current Characteristics for SiBar Thyristor Surge Protectors**



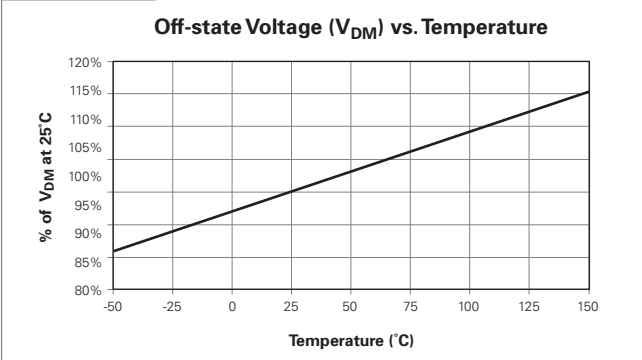
The voltage current (V-I) is useful in depicting the electrical characteristics of the SiBar thyristor surge protectors in relation to each other.

**Table SB3 Parameter Definitions for SiBar Thyristor Surge Protectors**

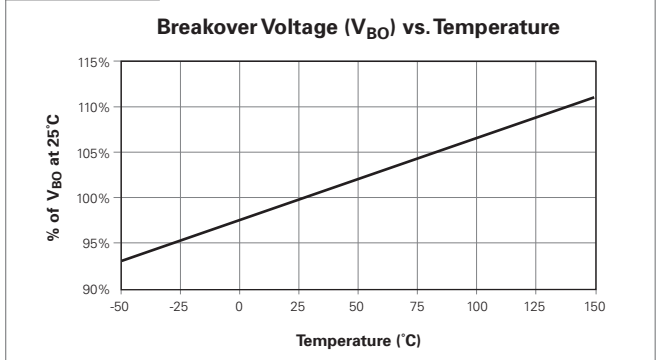
| Symbol         | Parameter                                             | Definition                                                                                                  |
|----------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| $V_{BO}$       | 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.                           |

**Figure SB2-SB5** Typical Electrical Characteristics vs. Temperature for SiBar Thyristor Surge Protectors

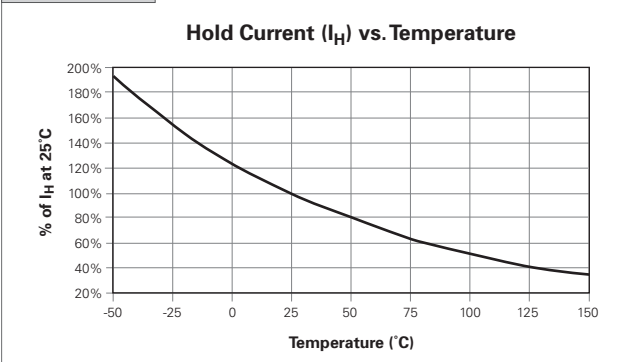
**Figure SB2**



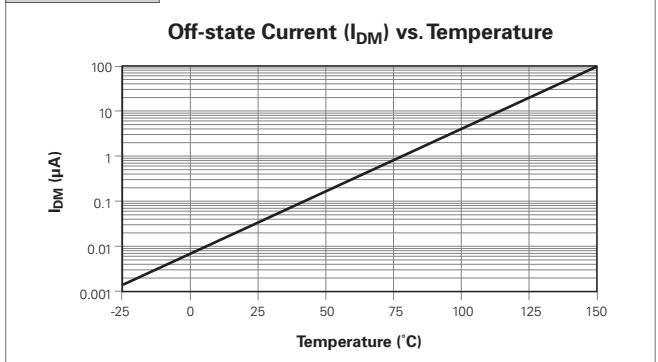
**Figure SB3**



**Figure SB4**



**Figure SB5**



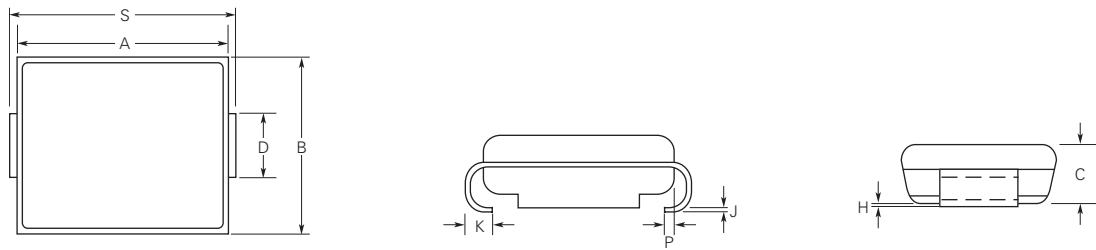
**Table SB4** Dimensions for SiBar Thyristor Surge Protectors in Millimeters (Inches)

| Dimension         | A       |         | B       |         | C       |         | D*      |         | H       |         | J       |         | K       |         | P       | S       |         |
|-------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                   | Min     | Max     | Min     | Max     | Min     | Max     | Min     | Max     | Min     | Max     | Min     | Max     | Min     | Max     | Ref.    | Min     | Max     |
| SMB Package:      | 4.06    | 4.57    | 3.30    | 3.94    | 1.90    | 2.41    | 1.95    | 2.20    | 0.051   | 0.200   | 0.150   | 0.31    | 0.76    | 1.27    | 0.51    | 5.21    | 5.59    |
| TVBxxx(M/N/R)Sx-L | (0.160) | (0.180) | (0.130) | (0.155) | (0.075) | (0.095) | (0.077) | (0.087) | (0.002) | (0.008) | (0.006) | (0.012) | (0.030) | (0.050) | (0.020) | (0.205) | (0.220) |
| SMA Package:      | 4.06    | 4.57    | 2.25    | 2.92    | 1.90    | 2.41    | 1.25    | 1.65    | 0.051   | 0.200   | 0.150   | 0.41    | 0.76    | 1.52    | 0.51    | 4.80    | 5.59    |
| TVAxix(N/R)Sx-L   | (0.160) | (0.180) | (0.089) | (0.115) | (0.075) | (0.095) | (0.049) | (0.065) | (0.002) | (0.008) | (0.006) | (0.016) | (0.030) | (0.060) | (0.020) | (0.189) | (0.220) |

**Notes :** TVA series devices use industry standard SMA package type. (JEDEC DO-214AC)  
TVB series devices use industry standard SMB package type. (JEDEC DO-214AA)  
All devices are bidirectional and may be oriented in either direction for installation.

\* D dimension is measured within dimension P.

**Figure SB6** Dimension Figure for SiBar Thyristor Surge Protectors



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

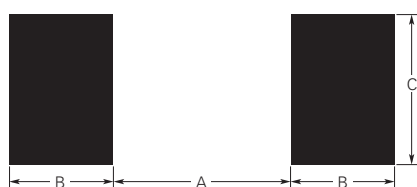
|                                                              |                                   |
|--------------------------------------------------------------|-----------------------------------|
| Lead material                                                | Matte tin finish (-L devices)     |
| 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°C to 150°C                    |
| Operating temperature (°C)                                   | -40°C to 125°C                    |
| Junction temperature (°C)                                    | 175°C                             |
| Maximum lead temperature for soldering purpose; for 10s (°C) | 260°C                             |

**Table SB6 Reliability Tests for SiBar Thyristor Surge Protectors**

| Test                                          | Conditions                            | Duration    |
|-----------------------------------------------|---------------------------------------|-------------|
| High temperature, reverse bias                | +100°C, 50V <sub>DC</sub> bias        | 1000 hours  |
| High humidity, high temperature, reverse bias | 85% RH, +85°C, 50V <sub>DC</sub> 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    |

**Table SB7 Packaging Information for SiBar Thyristor Surge Protectors**

| Part Description          | Tape and Reel Quantity | Standard Package | Recommended Pad Layout (millimeters/inches) |                    |                    |
|---------------------------|------------------------|------------------|---------------------------------------------|--------------------|--------------------|
|                           |                        |                  | Dimension A (Nom.)                          | Dimension B (Nom.) | Dimension C (Nom.) |
| TVAx <sub>xxx</sub> SA-L  | 5,000                  | 20,000           | 2.000 (0.079)                               | 2.000 (0.079)      | 2.000 (0.079)      |
| TVAx <sub>xxx</sub> NSA-L | 5,000                  | 20,000           | 2.000 (0.079)                               | 2.000 (0.079)      | 2.000 (0.079)      |
| TVAx <sub>xxx</sub> RSA-L | 5,000                  | 20,000           | 2.000 (0.079)                               | 2.000 (0.079)      | 2.000 (0.079)      |
| TVB <sub>xxx</sub> SA-L   | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> NSA-L  | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> RSA-L  | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB006SB-L                | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> SB-L   | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> NSB-L  | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> MSB-L  | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> SC-L   | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> NSC-L  | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> MSC-L  | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |
| TVB <sub>xxx</sub> RSC-L  | 2,500                  | 10,000           | 2.261 (0.089)                               | 2.159 (0.085)      | 2.743 (0.108)      |

**Figure SB7 Recommended Pad Layout for SiBar Thyristor Surge Protectors**


## Agency Recognition for SiBar Thyristor Surge Protectors

UL497B

File # E179610

## Solder Reflow and Rework Recommendations for SiBar Thyristor Surge Protectors

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

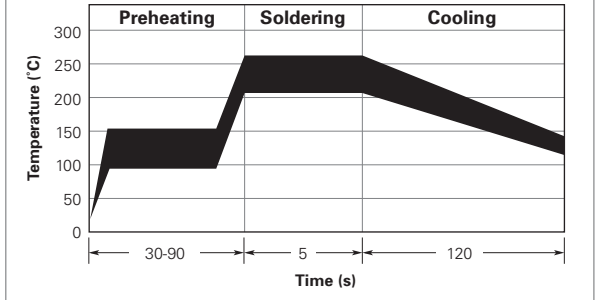
### Solder Reflow

- 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

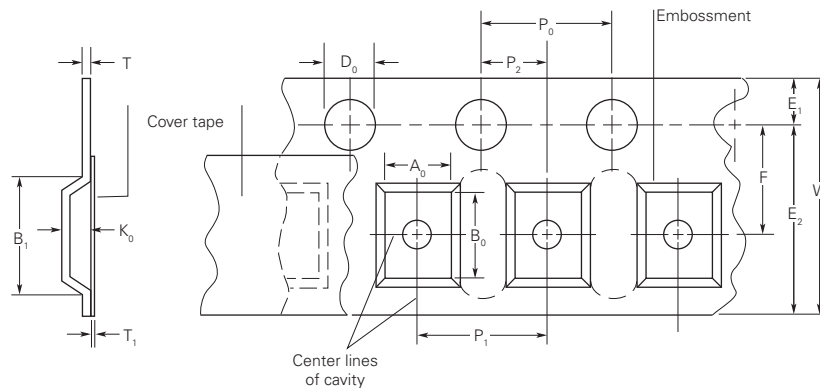


## Table SB8 Tape and Reel Specifications for SiBar Thyristor Surge Protectors

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

| Description         | TVB Series      |                | TVA Series      |                |
|---------------------|-----------------|----------------|-----------------|----------------|
|                     | Dimensions (mm) | Tolerance (mm) | Dimensions (mm) | Tolerance (mm) |
| W                   | 12              | +/- 0.30       | 12              | +/- 0.3        |
| P <sub>0</sub>      | 4.0             | +/- 0.10       | 4.0             | +/- 0.10       |
| P <sub>1</sub>      | 8.0             | +/- 0.10       | 8.0             | +/- 0.10       |
| P <sub>2</sub>      | 2.0             | +/- 0.10       | 2.0             | +/- 0.10       |
| A <sub>0</sub>      | 4.3             | —              | 2.9             | +/- 0.10       |
| B <sub>0</sub>      | 6.2             | —              | 5.59            | +/- 0.10       |
| B <sub>1</sub> max. | 8.2             | —              | 8.2             | —              |
| D <sub>0</sub>      | 1.5             | + 0.1, -0.0    | 1.5             | + 0.1, -0      |
| F                   | 5.5             | +/- 0.05       | 5.5             | +/- 0.05       |
| E <sub>1</sub>      | 1.75            | +/- 0.10       | 1.75            | +/- 0.10       |
| E <sub>2</sub> min. | 9.85            | —              | 9.85            | —              |
| T max.              | 0.6             | —              | 0.6             | —              |
| T <sub>1</sub> max. | 0.1             | —              | 0.1             | —              |
| K <sub>0</sub> max. | 2.59            | +/- 0.10       | 2.36            | +/- 0.10       |
| Leader min.         | 390             | —              | 390             | —              |
| Trailer min.        | 160             | —              | 160             | —              |

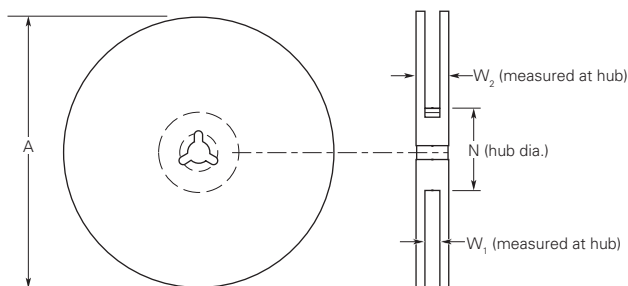
## Figure SB9 EIA Referenced Taped Component Dimensions for SiBar Thyristor Surge Protectors



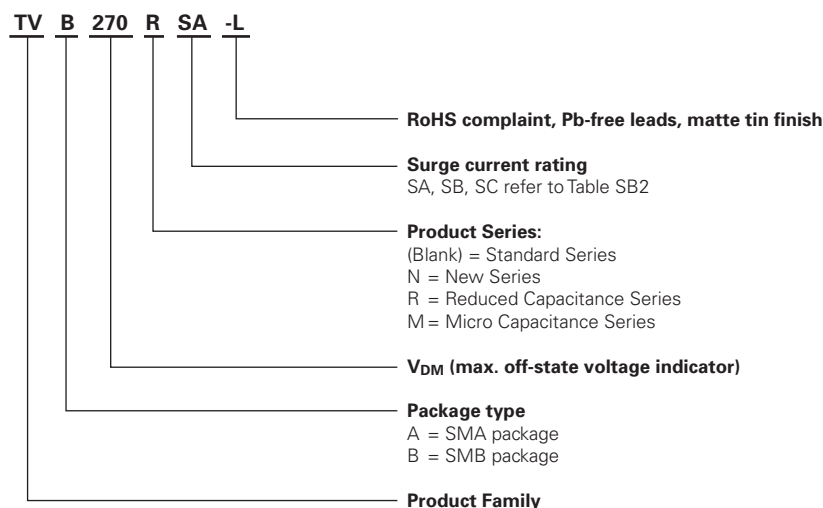
**Figure SB10 EIA Referenced Reel Dimensions for SiBar Thyristor Surge Protectors**

**Reel Dimension**

|            |                  |
|------------|------------------|
| A max.     | 330              |
| N min.     | 50               |
| $W_1$      | $12.4 + 2.0, -0$ |
| $W_2$ max. | 18.4             |



**Part Numbering System for SiBar Thyristor Surge Protectors**



**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.