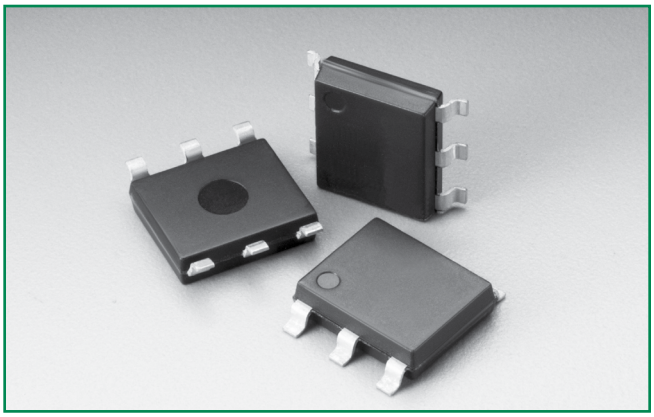
Littelfuse
Expertise Applied | Answers Delivered

# SIDACtor® Protection Thyristors
## SLIC Protection

## Battrax® Series - Single Port Negative - MS-013



## Description

The Battrax® Protection Thyristor series offers programmable SIDACtor® overvoltage protection components for SLIC applications. The Single Port Negative Battrax® Protection Thyristor series provides a programmable device that is referenced to a negative voltage souce while internal diodes provide protection from positive surge events.

## Features and Benefits

- Low voltage overshoot
- Low on-state voltage
- Does not degrade surge capability after multiple surge events within limit.
- Fails short circuit when surged in excess of ratings
- Single-port protection
- Gate triggered tracking device
- Integrated diodes for positive voltage protection
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)
- RoHS compliant and lead-free

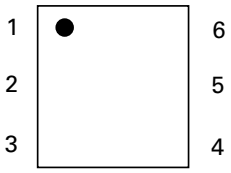
## Agency Approvals

| Agency | Agency File Number |
|---|---|
| | E133083 |

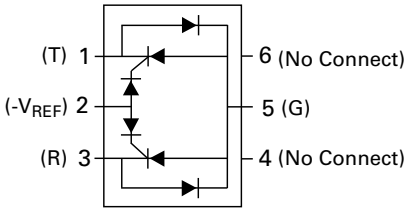
## Applicable Global Standards

- TIA-968-A
- TIA-968-B
- ITU K.20/21 Enhanced Level
- ITU K.20/21 Basic Level
- GR 1089 Inter-building
- GR 1089 Intra-building
- IEC 61000-4-5 2nd edition
- YD/T 1082
- YD/T 993
- YD/T 950

## Pinout Designation




## Schematic Symbol




## Additional Information

Datasheet | Resources | Samples

## Electrical Characteristics

| Part Number | Marking | $V_{DRM}$ @$I_{DRM}$=5µA | $V_S$ @100V/µs | $I_H$ | $I_S$ | $I_T$ | $V_T$ @$I_T$=2.2 Amps | $V_F$ | Capacitance* | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | V min | V max | mA min | mA max | A max | V max | V max | pF min | pF max |
| B1101UALxx | B1101UA | I-$V_{REF}$I + I-1.2VI | I-$V_{REF}$I + I-10VI | 100 | 100 | 2.2 | 4 | 5 | 30 | 200 |
| B1161UALxx | B1161UA | I-$V_{REF}$I + I-1.2VI | I-$V_{REF}$I + I-10VI | 160 | 100 | 2.2 | 4 | 5 | 30 | 200 |
| B1201UALxx | B1201UA | I-$V_{REF}$I + I-1.2VI | I-$V_{REF}$I + I-10VI | 200 | 100 | 2.2 | 4 | 5 | 30 | 200 |
| B1101UCLxx | B1101UC | I-$V_{REF}$I + I-1.2VI | I-$V_{REF}$I + I-10VI | 100 | 100 | 2.2 | 4 | 5 | 30 | 200 |
| B1161UCLxx | B1161UC | I-$V_{REF}$I + I-1.2VI | I-$V_{REF}$I + I-10VI | 160 | 100 | 2.2 | 4 | 5 | 30 | 200 |
| B1201UCLxx | B1201UC | I-$V_{REF}$I + I-1.2VI | I-$V_{REF}$I + I-10VI | 200 | 100 | 2.2 | 4 | 5 | 30 | 200 |

Notes:
- Absolute maximum ratings measured at $T_A$= 25ºC (unless otherwise noted).
- Components are not appropriate for positive ringing systems.
- All electrical characteristics shown are defined from Tip (pin 1) to Ground (pin 5), and Ring (pin 3) to Ground (pin 5)
- $V_{REF}$ Max Value for the negative Battrax is -200 V.
- **XX =** Part Number Suffix: **'TP'** (Tube Pack) or **'RP'** (Reel Pack).

* Off-state capacitance ($C_O$) is measured across pins 1 & 5 and 3 & 5 at 1 MHz with a 2V bias.


Revised: 02/23/17

## Surge Ratings

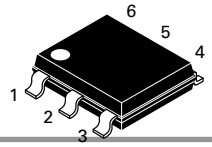
| Series | $I_{PP}$ | | | | | | | | | $I_{TSM}$ 50/60 Hz | di/dt |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.2/310 [1] 0.5/700 [2] | 2/10 [1] 2/10 [2] | 8/20 [1] 1.2/50 [2] | 10/160 [1] 10/160 [2] | 10/560 [1] 10/560 [2] | 5/320 [1] 9/720 [2] | 10/360 [1] 10/360 [2] | 10/1000 [1] 10/1000 [2] | 5/310 [1] 10/700 [2] | | |
| | A min | A min | A min | A min | A min | A min | A min | A min | A min | A min | A/µs max |
| A | 20 | 150 | 150 | 90 | 50 | 75 | 75 | 45 | 75 | 20 | 500 |
| C | 50 | 500 | 400 | 200 | 150 | 200 | 175 | 100 | 200 | 50 | 500 |

Notes:

1 Current waveform in µs
2 Voltage waveform in µs

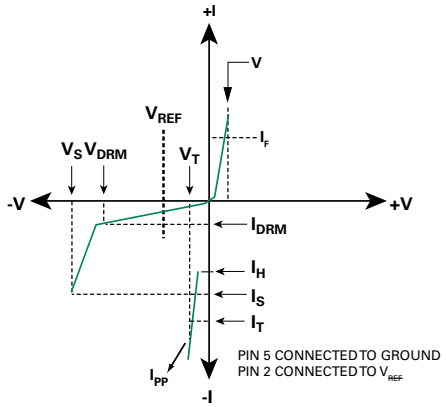
- Peak pulse current rating ($I_{PP}$) is repetitive and guaranteed for the life of the product that remains in thermal equilibrium.
- $I_{PP}$ ratings applicable over temperature range of -40°C to +85°C ($I_{PP}$ rating assumes $V_{REF}$ equals - 48 V)
- The component must initially be in thermal equilibrium with -40°C ≤ $T_J$ ≤ +150°C

## Thermal Considerations

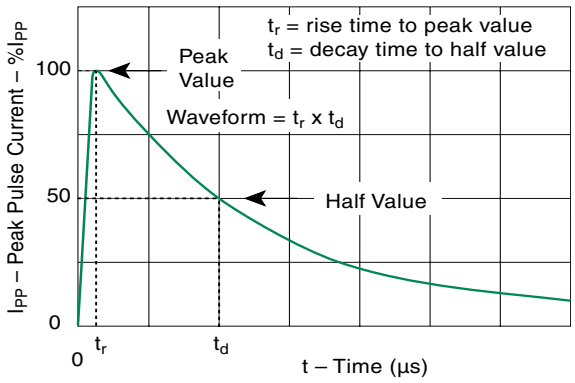
| Package | Symbol | Parameter | Value | Unit |
|---|---|---|---|---|
| Modified MS-013  | $T_J$ | Operating Junction Temperature Range | -40 to +125 | °C |
| | $T_S$ | Storage Temperature Range | -65 to +150 | °C |
| | $R_{\theta JA}$ | Thermal Resistance: Junction to Ambient | 60 | °C/W |



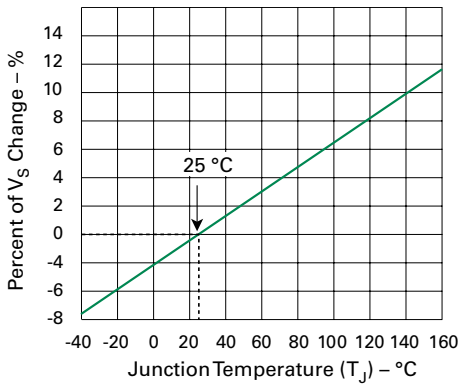
## V-I Characteristics



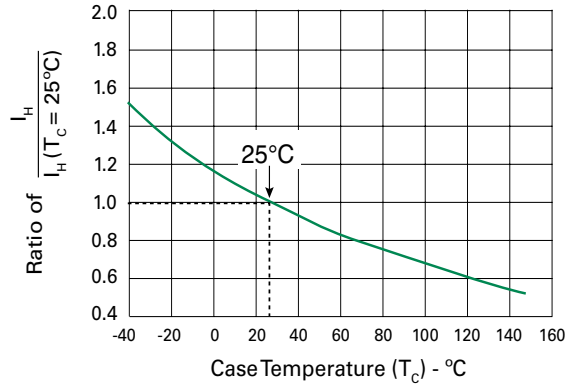

## $t_r$ x $t_d$ Pulse Waveform




## Normalized $V_S$ Change vs. Junction Temperature




## Normalized DC Holding Current vs. Case Temperature



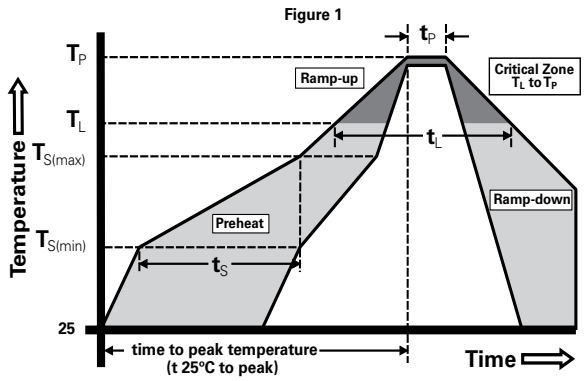


Revised: 02/23/17

## Soldering Parameters

| Reflow Condition | | Pb-Free assembly (see Fig. 1) |
|---|---|---|
| Pre Heat | -Temperature Min ($T_{s(min)}$) | +150°C |
| | -Temperature Max ($T_{s(max)}$) | +200°C |
| | -Time (Min to Max) ($t_s$) | 60-180 secs. |
| Average ramp up rate (Liquidus Temp ($T_L$) to peak) | | 3°C/sec. Max. |
| $T_{S(max)}$ to $T_L$ - Ramp-up Rate | | 3°C/sec. Max. |
| Reflow | -Temperature ($T_L$) (Liquidus) | +217°C |
| | -Temperature ($t_L$) | 60-150 secs. |
| Peak Temp ($T_P$) | | +260(+0/-5)°C |
| Time within 5°C of actual Peak Temp ($t_p$) | | 30 secs. Max. |
| Ramp-down Rate | | 6°C/sec. Max. |
| Time 25°C to Peak Temp ($T_P$) | | 8 min. Max. |
| Do not exceed | | +260°C |

Figure 1



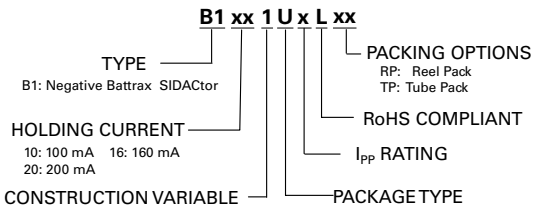

## Physical Specifications

| | |
|---|---|
| **Lead Material** | Copper Alloy |
| **Terminal Finish** | 100% Matte-Tin Plated |
| **Body Material** | UL Recognized epoxy meeting flammability classification V-0 |

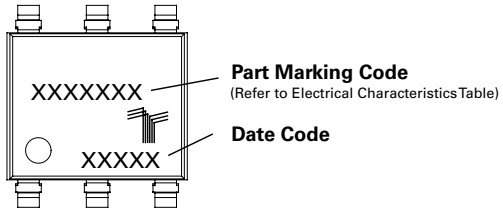
## Environmental Specifications

| | |
|---|---|
| **High Temp Voltage Blocking** | 80% Rated $V_{REF}$ Max. ($V_{DC}$ Peak) +125°C or +150°C, 504 or 1008 hrs. MIL-STD-750 (Method 1040) JEDEC, JESD22-A-101 |
| **Temp Cycling** | -65°C to +150°C, 15 min. dwell, 10 up to 100 cycles. MIL-STD-750 (Method 1051) EIA/JEDEC, JESD22-A104 |
| **Biased Temp & Humidity** | 52 $V_{DC}$ (+85°C) 85% RH, 504 up to 1008 hrs. EIA/JEDEC, JESD22-A-101 |
| **High Temp Storage** | +150°C 1008 hrs. MIL-STD-750 (Method 1031) JEDEC, JESD22-A-101 |
| **Low Temp Storage** | -65°C, 1008 hrs. |
| **Thermal Shock** | 0°C to +100°C, 5 min. dwell, 10 sec. transfer, 10 cycles. MIL-STD-750 (Method 1056) JEDEC, JESD22-A-106 |
| **Autoclave (Pressure Cooker Test)** | +121°C, 100% RH, 2atm, 24 up to 168 hrs. EIA/JEDEC, JESD22-A-102 |
| **Resistance to Solder Heat** | +260°C, 30 secs. MIL-STD-750 (Method 2031) |
| **Moisture Sensitivity Level** | 85% RH, +85°C, 168 hrs., 3 reflow cycles (+260°C Peak). JEDEC-J-STD-020, Level 1 |

## Part Numbering



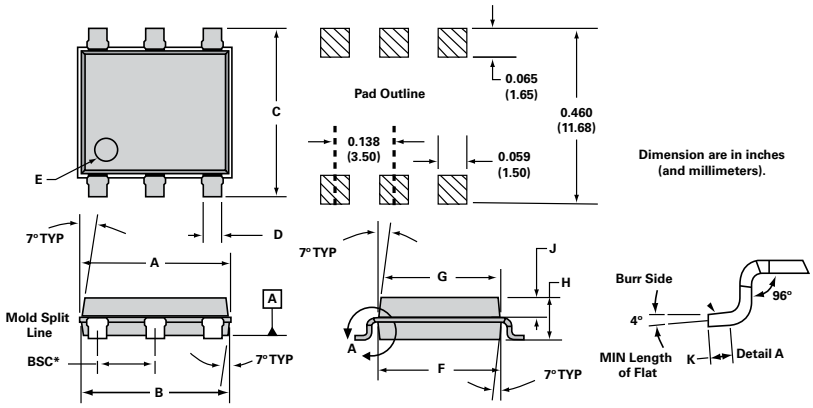

## Part Marking





Revised: 02/23/17

## Dimensions — MS-013



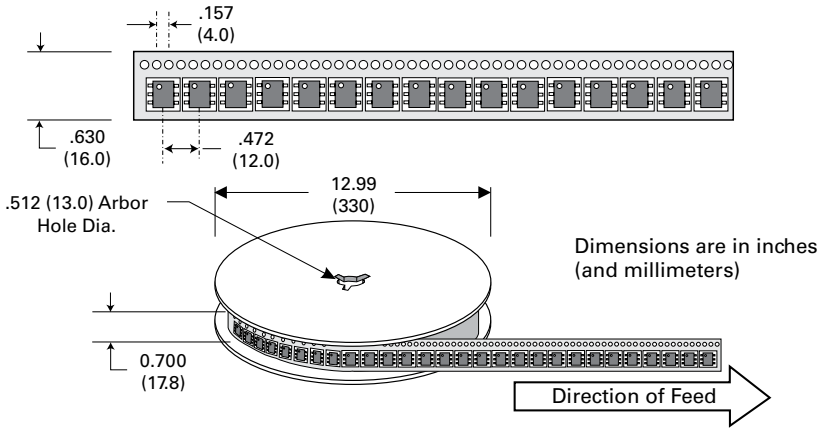

| Dimensions | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| **A** | 0.360 | 0.364 | 9.14 | 9.25 |
| **B** | 0.352 | 0.356 | 8.94 | 9.04 |
| **C** | 0.400 | 0.412 | 10.16 | 10.46 |
| **D** | 0.043 | 0.045 | 1.09 | 1.13 |
| **E** | 0.047 | 0.055 | 1.19 | 1.40 |
| **F** | 0.293 | 0.297 | 7.44 | 7.54 |
| **G** | 0.289 | 0.293 | 7.34 | 7.44 |
| **H** | 0.089 | 0.093 | 2.26 | 2.36 |
| **J** | 0.041 | 0.049 | 1.04 | 1.24 |
| **K** | 0.020 | | 0.51 | |
| **BSC*** | 0.133 | 0.143 | 3.38 | 3.63 |

* BSC = **B**asic **S**pacing between **C**enters

## Packing Options

| Package Type | Description | Quantity | Added Suffix | Industry Standard |
|---|---|---|---|---|
| U | Modified MS-013 6-pin Tape and Reel Pack | 1500 | RP | EIA-481-D |
| | Modified MS-013 6-pin Tube Pack | 500 (50 per tube) | TP | N/A |

## Tape and Reel Specification — MS-013




## Tube Pack Specification — MS-013