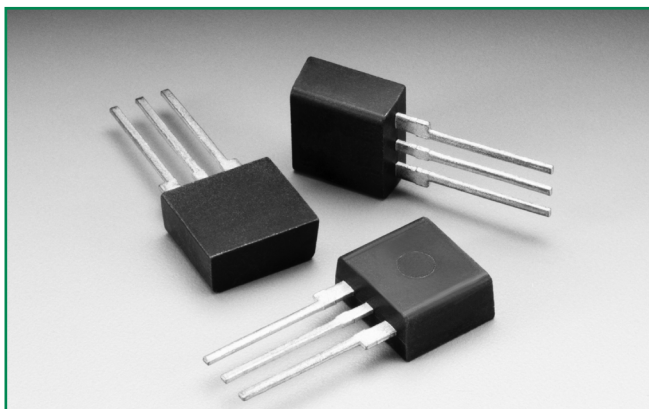


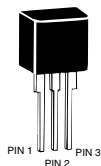
## SIDACtor® Primary Protection Series - Modified TO-220



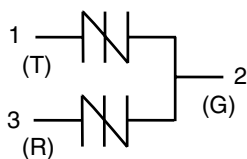
### Agency Approvals

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

### Pinout Designation



### Schematic Symbol



### Description

The SIDACtor® Primary Protection Series Modified TO-220 thyristors are components designed for use in primary protection applications.

The series provides a single port overvoltage solution that enables applications to comply with GR-974 and a range of other global regulatory standards. Please contact Littelfuse to discuss your particular application and regulatory requirements.

### Features and Benefits

- High holding current options available
- Failsafe option available
- Low voltage overshoot
- Low on-state voltage
- Does not degrade surge capability after multiple surge events within limit.
- RoHS Compliant and Halogen-Free
- Fails short circuit
- when surged in excess of ratings
- Single-port protection
- Modified TO-220 Package
- Lead forms available
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin (Sn) (IPC/JEDEC J-STD-609A.01)

### Applicable Global Standards

- GR-974
- UL 497
- ITU K.28

### Electrical Characteristics

| Part Number | Marking | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ $100V/\mu s$ | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ $100V/\mu s$ | $V_T$<br>@ $I_T=2.2 A$ | $I_H^*$ | $I_S$  | $I_T$ | Capacitance<br>@ 1MHz, 2V bias        |        |
|-------------|---------|---------------------------------|-------------------------|---------------------------------|-------------------------|------------------------|---------|--------|-------|---------------------------------------|--------|
|             |         | V min                           | V max                   | V min                           | V max                   | V max                  | mA min  | mA max | A max | pF min                                | pF max |
|             |         | Pins 1-2, 3-2                   |                         | Pins 1-3                        |                         | Pins 1-2, 3-2          |         |        |       |                                       |        |
| P0602ACLxx  | P0602AC | 25                              | 40                      | 50                              | 80                      | 4                      | 50      | 800    | 2.2   | See<br>Capacitance<br>Values<br>Table |        |
| P1402ACLxx  | P1402AC | 58                              | 77                      | 116                             | 154                     | 4                      | 150     | 800    | 2.2   |                                       |        |
| P1602ACLxx  | P1602AC | 65                              | 95                      | 130                             | 190                     | 4                      | 150     | 800    | 2.2   |                                       |        |
| P2202ACLxx  | P2202AC | 90                              | 130                     | 180                             | 260                     | 4                      | 150     | 800    | 2.2   |                                       |        |
| P2702ACLxx  | P2702AC | 120                             | 160                     | 240                             | 320                     | 4                      | 150     | 800    | 2.2   |                                       |        |
| P3002ACLxx  | P3002AC | 140                             | 180                     | 280                             | 360                     | 4                      | 150     | 800    | 2.2   |                                       |        |
| P3602ACLxx  | P3602AC | 170                             | 220                     | 340                             | 440                     | 4                      | 150     | 800    | 2.2   |                                       |        |
| P4202ACLxx  | P4202AC | 190                             | 250                     | 380                             | 500                     | 4                      | 150     | 800    | 2.2   |                                       |        |
| P4802ACLxx  | P4802AC | 220                             | 300                     | 440                             | 600                     | 4                      | 150     | 800    | 2.2   |                                       |        |
| P6002ACLxx  | P6002AC | 275                             | 350                     | 550                             | 700                     | 4                      | 150     | 800    | 2.2   |                                       |        |

Notes:  
 \* Higher holding current available by special order. Contact Littelfuse for additional information.  
 - Absolute maximum ratings measured at  $T_A = 25^\circ C$  (unless otherwise noted).  
 - Devices are bi-directional (unless otherwise noted).

- xx Part Number Suffix: 'RP' (Reel pack), 'Blank' (Bulk pack), '60' (Type 60 lead form bulk pack), 'FS1' (Failsafe option bulk pack). Refer to Part Numbering section for additional details.

### Surge Ratings

| Series | $I_{PP}$                                     |                                        |                                          |                                            |                                            |                                          |                                            |                                              |                                           |       | $I_{TSM}$<br>50/60 Hz | di/dt    |
|--------|----------------------------------------------|----------------------------------------|------------------------------------------|--------------------------------------------|--------------------------------------------|------------------------------------------|--------------------------------------------|----------------------------------------------|-------------------------------------------|-------|-----------------------|----------|
|        | 0.2x310 <sup>1</sup><br>0.5x700 <sup>2</sup> | 2x10 <sup>1</sup><br>2x10 <sup>2</sup> | 8x20 <sup>1</sup><br>1.2x50 <sup>2</sup> | 10x160 <sup>1</sup><br>10x160 <sup>2</sup> | 10x560 <sup>1</sup><br>10x560 <sup>2</sup> | 5x320 <sup>1</sup><br>9x720 <sup>2</sup> | 10x360 <sup>1</sup><br>10x360 <sup>2</sup> | 10x1000 <sup>1</sup><br>10x1000 <sup>2</sup> | 5x310 <sup>1</sup><br>10x700 <sup>2</sup> |       |                       |          |
|        | A min                                        | A min                                  | A min                                    | A min                                      | A min                                      | A min                                    | A min                                      | A min                                        | A min                                     | A min |                       |          |
| C      | 50                                           | 500                                    | 400                                      | 200                                        | 150                                        | 200                                      | 175                                        | 100                                          | 200                                       | 50    | 500                   | A/μs min |

Notes:

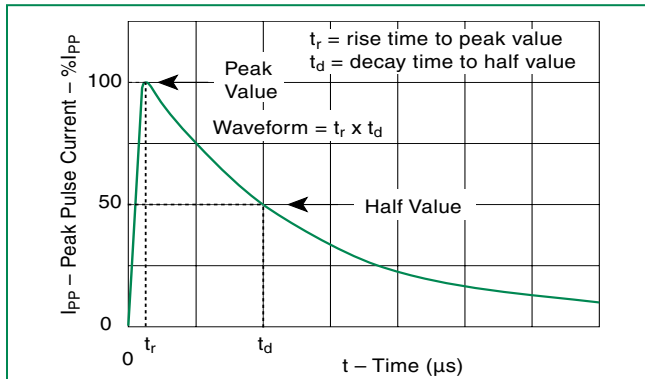
- Current waveform in μs
  - Voltage waveform in μs
- Peak pulse current rating ( $I_{PP}$ ) is repetitive and guaranteed for the life of the product.
  - $I_{PP}$  ratings applicable over temperature range of -40°C to +85°C
  - The device must initially be in thermal equilibrium with -40°C ≤  $T_J$  ≤ +150°C

### Capacitance Values

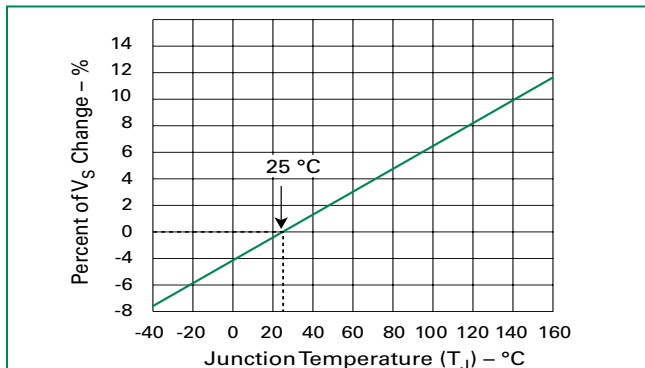
| Part Number | Pin 1-2 / 3-2<br>Tip-Ground, Ring-Ground |        | Pin 1-3<br>Tip-Ring |        |
|-------------|------------------------------------------|--------|---------------------|--------|
|             | pF min                                   | pF max | pF min              | pF max |
| P0602ACLxx  | 35                                       | 65     | 20                  | 40     |
| P1402ACLxx  | 105                                      | 155    | 60                  | 90     |
| P1602ACLxx  | 95                                       | 145    | 50                  | 85     |
| P2202ACLxx  | 75                                       | 115    | 40                  | 65     |
| P2702ACLxx  | 70                                       | 105    | 40                  | 60     |
| P3002ACLxx  | 65                                       | 95     | 35                  | 55     |
| P3602ACLxx  | 65                                       | 90     | 35                  | 50     |
| P4202ACLxx  | 60                                       | 85     | 35                  | 50     |
| P4802ACLxx  | 60                                       | 85     | 30                  | 50     |
| P6002ACLxx  | 55                                       | 80     | 30                  | 45     |

Note: Off-state capacitance ( $C_O$ ) is measured at 1 MHz with a 2 V bias.

### $t_r \times t_d$ Pulse Waveform



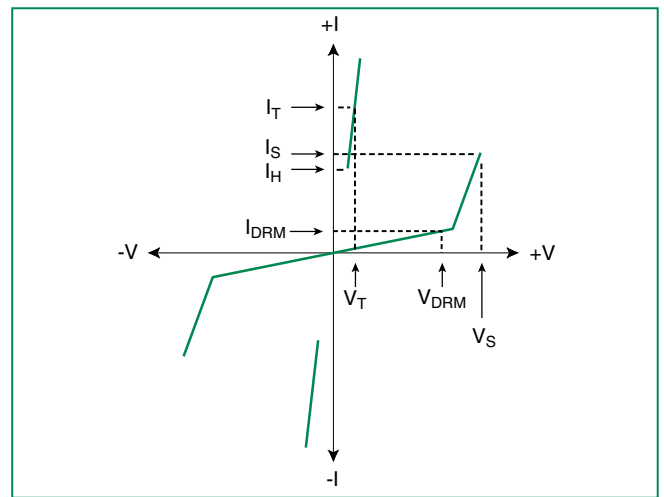
### Normalized $V_S$ Change vs. Junction Temperature



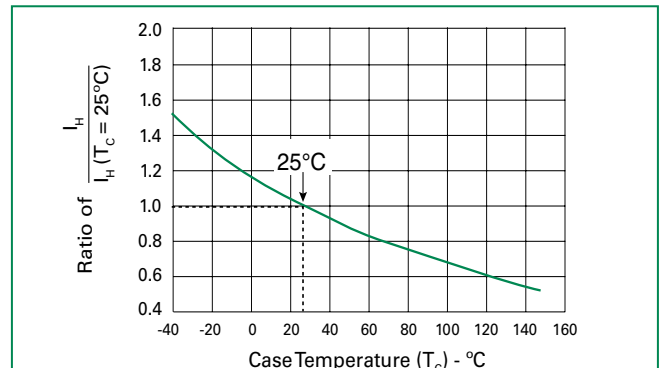
### Thermal Considerations

| Package             | Symbol          | Parameter                               | Value       | Unit |
|---------------------|-----------------|-----------------------------------------|-------------|------|
| <br>Modified TO-220 | $T_J$           | Operating Junction Temperature Range    | -40 to +150 | °C   |
|                     | $T_S$           | Storage Temperature Range               | -65 to +150 | °C   |
|                     | $R_{\theta JA}$ | Thermal Resistance: Junction to Ambient | 60          | °C/W |

### V-I Characteristics

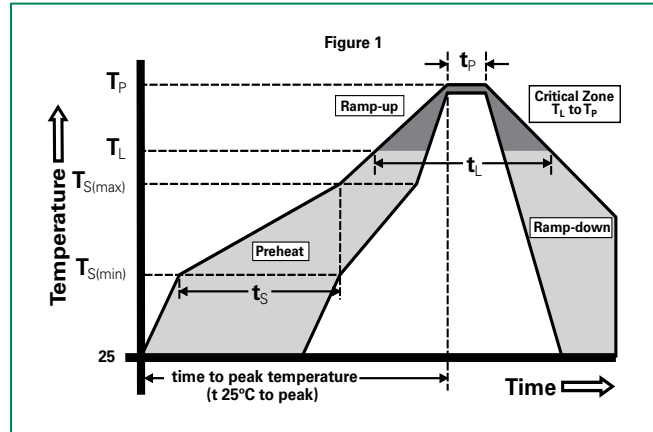


### Normalized DC Holding Current vs. Case Temperature



## 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                        |



## Physical Specifications

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

## Part Numbering

|                              |                                                                                                                        |
|------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>P xxx 2 A C L xx</b>      |                                                                                                                        |
| <b>TYPE</b><br>P = SIDACtor  | <b>PACKING OPTIONS</b><br>Blank: Bulk<br>RP: Reel Pack<br>60: Type 60 Lead Form (for type 60 orders, contact factory). |
| <b>MEDIAN VOLTAGE</b>        |                                                                                                                        |
| <b>CONSTRUCTION VARIABLE</b> | <b>RoHS COMPLIANT</b>                                                                                                  |
| <b>PACKAGE TYPE</b>          | <b>I<sub>pp</sub> RATING</b>                                                                                           |

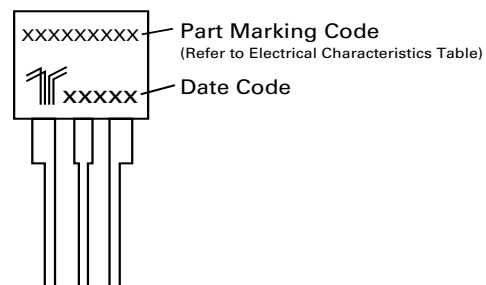
  

|                              |                                                                            |
|------------------------------|----------------------------------------------------------------------------|
| <b>P xxx 2 A C L FS1</b>     |                                                                            |
| <b>TYPE</b><br>P = SIDACtor  | <b>FAILSAFE OPTION*</b>                                                    |
| <b>MEDIAN VOLTAGE</b>        | <b>RoHS COMPLIANT</b>                                                      |
| <b>CONSTRUCTION VARIABLE</b> | <b>I<sub>pp</sub> RATING</b>                                               |
| <b>PACKAGE TYPE</b>          | * Failsafe devices are only offered in bulk pack, reel pack not available. |

## Environmental Specifications

|                                         |                                                                                                                       |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>High Temp Voltage Blocking</b>       | 80% Rated $V_{DRM}$ ( $V_{AC}$ Peak) +125°C or +150°C, 504 or 1008 hrs. MIL-STD-750 (Method 1040) JEDEC, JESD22-A-101 |
| <b>Temp Cycling</b>                     | -65°C to +150°C, 15 min. dwell, 10 up to 100 cycles. MIL-STD-750 (Method 1051) EIA/JEDEC, JESD22-A-104                |
| <b>Biased Temp &amp; Humidity</b>       | 52 $V_{DC}$ (+85°C) 85%RH, 504 up to 1008 hrs. EIA/JEDEC, JESD22-A-101                                                |
| <b>High Temp Storage</b>                | +150°C 1008 hrs. MIL-STD-750 (Method 1031) JEDEC, JESD22-A-101                                                        |
| <b>Low Temp Storage</b>                 | -65°C, 1008 hrs.                                                                                                      |
| <b>Thermal Shock</b>                    | 0°C to +100°C, 5 min. dwell, 10 sec. transfer, 10 cycles. MIL-STD-750 (Method 1056) JEDEC, JESD22-A-106               |
| <b>Autoclave (Pressure Cooker Test)</b> | +121°C, 100%RH, 2atm, 24 up to 168 hrs. EIA/JEDEC, JESD22-A-102                                                       |
| <b>Resistance to Solder Heat</b>        | +260°C, 30 secs. MIL-STD-750 (Method 2031)                                                                            |
| <b>Moisture Sensitivity Level</b>       | 85%RH, +85°C, 168 hrs., 3 reflow cycles (+260°C Peak). JEDEC-J-STD-020, Level 1                                       |

## Part Marking



## Additional Information



Datasheet

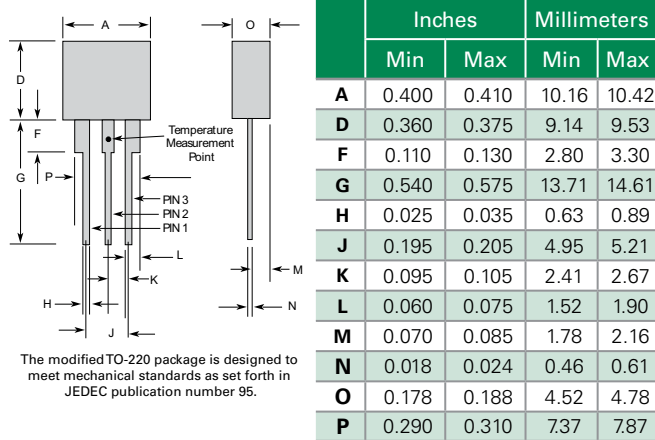


Resources

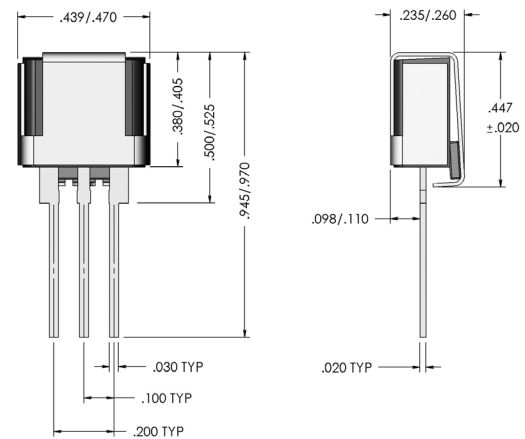


Samples

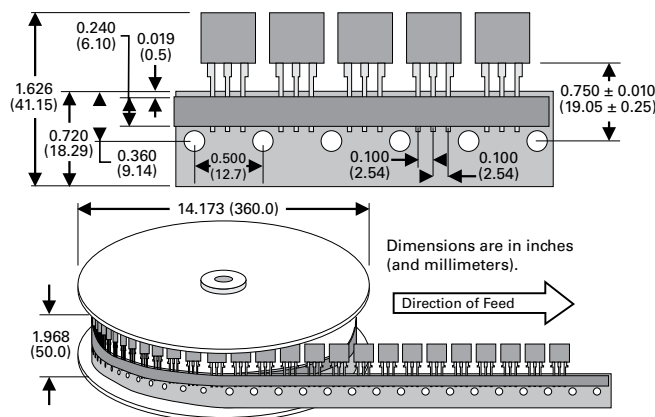
### Dimensions - Modified TO-220



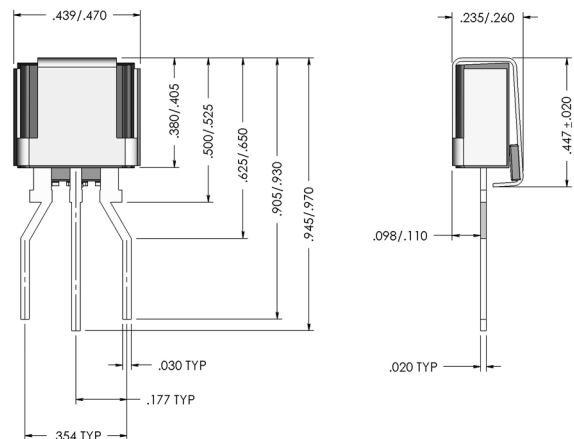
### Dimensions - Modified TO-220 with Failsafe



### Tape and Reel Specification - Modified TO-220



### Dimensions - Modified TO-220 Type 60 with Failsafe



### Packing Options

| Package Type | Description                                 | Quantity | Added Suffix                                            | Industry Standard |
|--------------|---------------------------------------------|----------|---------------------------------------------------------|-------------------|
| A            | Modified TO-220 Tape and Reel Pack          | 700      | RP                                                      | EIA-468-B         |
|              | Modified TO-220 Bulk Pack                   | 500      | (no added suffix)                                       | N/A               |
|              | Modified TO-220 Type 60 Lead Form Bulk Pack | 500      | 60<br>(special order item, contact factory for details) | N/A               |

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