



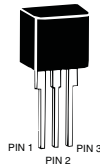
**RoHS SIDACtor® Series - Modified TO-220**



**Agency Approvals**

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

**Pinout Designation**



**Schematic Symbol**



**Description**

The SIDACtor® Series Modified TO-220 are designed to protect baseband equipment from damaging overvoltage transients.

The series provides a robust single port through-hole solution that enables voice through DS-1 equipment to comply with various global regulatory standards.

**Features and Benefits**

- Low voltage overshoot
- Low on-state voltage
- Does not degrade with use
- Modified TO-220 Package
- Fails short circuit when surged in excess of ratings
- Single-port protection
- Lead forms available

**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
- YD/T 1082
- YD/T 993
- YD/T 950

\*A/B-rated parts require series resistance

**Electrical Characteristics**

| Part Number | Marking | $V_{DRM}$          | $V_S$           | $V_{DRM}$          | $V_S$           | $V_T$         | $I_H$  | $I_S$  | $I_T$ | Capacitance @ 1MHz, 2V bias  |        |
|-------------|---------|--------------------|-----------------|--------------------|-----------------|---------------|--------|--------|-------|------------------------------|--------|
|             |         | @ $I_{DRM}=5\mu A$ | @ 100V/ $\mu s$ | @ $I_{DRM}=5\mu A$ | @ 100V/ $\mu s$ | @ $I_T=2.2 A$ |        |        |       | pF min                       | pf max |
|             |         | V min              | V max           | V min              | V max           | V max         | mA min | mA max | A max |                              |        |
|             |         | Pins 1-2, 3-2      |                 | Pins 1-3           |                 | Pins 1-2, 3-2 |        |        |       |                              |        |
| P0602AALxx  | P0602AA | 25                 | 40              | 50                 | 80              | 4             | 50     | 800    | 2.2   | See Capacitance Values Table |        |
| P1402AALxx  | P1402AA | 58                 | 77              | 116                | 154             | 4             | 150    | 800    | 2.2   |                              |        |
| P1602AALxx  | P1602AA | 65                 | 95              | 130                | 190             | 4             | 150    | 800    | 2.2   |                              |        |
| P2202AALxx  | P2202AA | 90                 | 130             | 180                | 260             | 4             | 150    | 800    | 2.2   |                              |        |
| P2702AALxx  | P2702AA | 120                | 160             | 240                | 320             | 4             | 150    | 800    | 2.2   |                              |        |
| P3002AALxx  | P3002AA | 140                | 180             | 280                | 360             | 4             | 150    | 800    | 2.2   |                              |        |
| P3602AALxx  | P3602AA | 170                | 220             | 340                | 440             | 4             | 150    | 800    | 2.2   |                              |        |
| P4202AALxx  | P4202AA | 190                | 250             | 380                | 500             | 4             | 150    | 800    | 2.2   |                              |        |
| P4802AALxx  | P4802AA | 220                | 300             | 440                | 600             | 4             | 150    | 800    | 2.2   |                              |        |
| P6002AALxx  | P6002AA | 275                | 350             | 550                | 700             | 4             | 150    | 800    | 2.2   |                              |        |

Table continues on next page.

### Electrical Characteristics (continued)

| Part Number | Marking | $V_{DRM}$          | $V_S$           | $V_{DRM}$          | $V_S$           | $V_T$         | $I_H$  | $I_S$  | $I_T$ | Capacitance                  |
|-------------|---------|--------------------|-----------------|--------------------|-----------------|---------------|--------|--------|-------|------------------------------|
|             |         | @ $I_{DRM}=5\mu A$ | @ 100V/ $\mu s$ | @ $I_{DRM}=5\mu A$ | @ 100V/ $\mu s$ | @ $I_T=2.2 A$ |        |        |       |                              |
|             |         | V min              | V max           | V min              | V max           | V max         | mA min | mA max | A max |                              |
|             |         | Pins 1-2, 3-2      |                 | Pins 1-3           |                 | Pins 1-2, 3-2 |        |        |       |                              |
| P0602ABLxx  | P0602AB | 25                 | 40              | 50                 | 80              | 4             | 50     | 800    | 2.2   | See Capacitance Values Table |
| P1402ABLxx  | P1402AB | 58                 | 77              | 116                | 154             | 4             | 150    | 800    | 2.2   |                              |
| P1602ABLxx  | P1602AB | 65                 | 95              | 130                | 190             | 4             | 150    | 800    | 2.2   |                              |
| P2202ABLxx  | P2202AB | 90                 | 130             | 180                | 260             | 4             | 150    | 800    | 2.2   |                              |
| P2702ABLxx  | P2702AB | 120                | 160             | 240                | 320             | 4             | 150    | 800    | 2.2   |                              |
| P3002ABLxx  | P3002AB | 140                | 180             | 280                | 360             | 4             | 150    | 800    | 2.2   |                              |
| P3602ABLxx  | P3602AB | 170                | 220             | 340                | 440             | 4             | 150    | 800    | 2.2   |                              |
| P4202ABLxx  | P4202AB | 190                | 250             | 380                | 500             | 4             | 150    | 800    | 2.2   |                              |
| P4802ABLxx  | P4802AB | 220                | 300             | 440                | 600             | 4             | 150    | 800    | 2.2   |                              |
| P6002ABLxx  | P6002AB | 275                | 350             | 550                | 700             | 4             | 150    | 800    | 2.2   |                              |
| P0602ACLxx  | P0602AC | 25                 | 40              | 50                 | 80              | 4             | 50     | 800    | 2.2   |                              |
| 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:  
 - 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), or **60** (Type 60 lead form bulk pack)

### Capacitance Values

| Part Number | pF<br>Pin 1-2, 3-2<br>Tip-Ground, Ring-Ground |     | pF<br>Pin 1-3<br>Tip-Ring |     |
|-------------|---|-----|---------------------------|-----|
|             | MIN   | MAX | MIN                       | MAX |
|             | P0602AALxx                                    | 15  | 145                       | 10  |
| P1402AALxx  | 40  | 60  | 20                        | 35  |
| P1602AALxx  | 35  | 60  | 20                        | 35  |
| P2202AALxx  | 30  | 50  | 15                        | 30  |
| P2702AALxx  | 25  | 45  | 15                        | 25  |
| P3002AALxx  | 25  | 40  | 15                        | 25  |
| P3602AALxx  | 25  | 35  | 10                        | 20  |
| P4202AALxx  | 25  | 35  | 10                        | 20  |
| P4802AALxx  | 20  | 35  | 10                        | 20  |
| P6002AALxx  | 20  | 35  | 10                        | 20  |
| P0602ABLxx  | 15  | 250 | 10                        | 145 |
| P1402ABLxx  | 40  | 155 | 20                        | 90  |
| P1602ABLxx  | 35  | 145 | 20                        | 85  |
| P2202ABLxx  | 30  | 115 | 15                        | 65  |
| P2702ABLxx  | 25  | 105 | 15                        | 60  |
| P3002ABLxx  | 25  | 95  | 15                        | 55  |
| P3602ABLxx  | 25  | 90  | 10                        | 50  |
| P4202ABLxx  | 25  | 85  | 10                        | 50  |
| P4802ABLxx  | 20  | 85  | 10                        | 50  |
| P6002ABLxx  | 20  | 80  | 10                        | 45  |

| Part Number | pF<br>Pin 1-2, 3-2<br>Tip-Ground, Ring-Ground |     | pF<br>Pin 1-3<br>Tip-Ring |     |
|-------------|---|-----|---------------------------|-----|
|             | MIN   | MAX | MIN                       | MAX |
|             | P0602ACLxx                                    | 25  | 250                       | 10  |
| P1402ACLxx  | 55  | 155 | 30                        | 90  |
| P1602ACLxx  | 45  | 145 | 25                        | 85  |
| P2202ACLxx  | 45  | 115 | 25                        | 65  |
| P2702ACLxx  | 40  | 105 | 20                        | 60  |
| P3002ACLxx  | 35  | 95  | 20                        | 55  |
| P3602ACLxx  | 35  | 90  | 15                        | 50  |
| P4202ACLxx  | 30  | 85  | 15                        | 50  |
| P4802ACLxx  | 30  | 85  | 15                        | 50  |
| P6002ACLxx  | 30  | 80  | 15                        | 45  |

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

**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      | 20   | 150                                    | 150                                      | 90   | 50   | 75                                       | 75   | 45   | 75  | 20                    | 500   |
| B      | 25   | 250                                    | 250                                      | 150  | 100  | 100                                      | 125  | 80   | 100                                       | 25                    | 500   |
| C      | 50   | 500                                    | 400                                      | 200  | 150  | 200                                      | 175  | 100  | 200                                       | 50                    | 500   |

Notes:

- 1 Current waveform in  $\mu$ s
- 2 Voltage waveform in  $\mu$ s

- Peak pulse current rating ( $I_{pp}$ ) is repetitive and guaranteed for the life of the product.
- $I_{pp}$  ratings applicable over temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- The device must initially be in thermal equilibrium with  $-40^{\circ}\text{C} \leq T_J \leq +150^{\circ}\text{C}$

**Thermal Considerations**

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

**V-I Characteristics**



**$t_r \times t_d$  Pulse Waveform**



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



**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 94V-0 |

**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-A104                  |
| <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 Numbering**



**Part Marking**



**Dimensions - Modified TO-220**



The modified TO-220 package is designed to meet mechanical standards as set forth in JEDEC publication number 95.

|          | Inches |       | Millimeters |       |
|----------|--------|-------|-------------|-------|
|          | Min    | Max   | Min         | Max   |
| <b>A</b> | 0.400  | 0.410 | 10.16       | 10.42 |
| <b>D</b> | 0.360  | 0.375 | 9.14        | 9.53  |
| <b>F</b> | 0.110  | 0.130 | 2.80        | 3.30  |
| <b>G</b> | 0.540  | 0.575 | 13.71       | 14.61 |
| <b>H</b> | 0.025  | 0.035 | 0.63        | 0.89  |
| <b>J</b> | 0.195  | 0.205 | 4.95        | 5.21  |
| <b>K</b> | 0.095  | 0.105 | 2.41        | 2.67  |
| <b>L</b> | 0.060  | 0.075 | 1.52        | 1.90  |
| <b>M</b> | 0.070  | 0.085 | 1.78        | 2.16  |
| <b>N</b> | 0.018  | 0.024 | 0.46        | 0.61  |
| <b>O</b> | 0.178  | 0.188 | 4.52        | 4.78  |
| <b>P</b> | 0.290  | 0.310 | 7.37        | 7.87  |

**Tape and Reel Specification — Modified TO-220**



**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      | N/A   | 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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