

**RoHS SIDActo<sup>®</sup> Series - TO-92**



**Agency Approvals**

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

**Pinout Designation**



**Schematic Symbol**



**Description**

SIDActo<sup>®</sup> Series TO-92 are designed to protect baseband equipment such as modems, line cards, CPE and DSL from damaging overvoltage transients.

The series provides a robust through-hole solution that enables equipment to comply with global regulatory standards.

**Features and Benefits**

- Low voltage overshoot
- Low on-state voltage
- Does not degrade with use
- Fails short circuit when surged in excess of ratings
- Low Capacitance

**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 | $V_{DRM}$<br>@ $I_{DRM} = 5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $I_H$  | $I_S$  | $I_T$ | $V_T$<br>@ $I_T = 2.2$ Amps | Capacitance<br>@ 1MHz, 2V bias |        |
|-------------|---------|-----------------------------------|--------------------------|--------|--------|-------|-----------------------------|--------------------------------|--------|
|             |         | V min                             | V max                    | mA min | mA max | A max | V max                       | pF min                         | pF max |
| P0080EALxxx | P0080EA | 6                                 | 25                       | 50     | 800    | 2.2   | 4                           | 25                             | 150    |
| P0300EALxxx | P0300EA | 25                                | 40                       | 50     | 800    | 2.2   | 4                           | 15                             | 140    |
| P0640EALxxx | P0640EA | 58                                | 77                       | 150    | 800    | 2.2   | 4                           | 40                             | 60     |
| P0720EALxxx | P0720EA | 65                                | 88                       | 150    | 800    | 2.2   | 4                           | 35                             | 60     |
| P0900EALxxx | P0900EA | 75                                | 98                       | 150    | 800    | 2.2   | 4                           | 35                             | 55     |
| P1100EALxxx | P1100EA | 90                                | 130                      | 150    | 800    | 2.2   | 4                           | 30                             | 50     |
| P1300EALxxx | P1300EA | 120                               | 160                      | 150    | 800    | 2.2   | 4                           | 25                             | 45     |
| P1500EALxxx | P1500EA | 140                               | 180                      | 150    | 800    | 2.2   | 4                           | 25                             | 40     |
| P1800EALxxx | P1800EA | 170                               | 220                      | 150    | 800    | 2.2   | 4                           | 25                             | 35     |
| P2300EALxxx | P2300EA | 190                               | 260                      | 150    | 800    | 2.2   | 4                           | 25                             | 35     |
| P2600EALxxx | P2600EA | 220                               | 300                      | 150    | 800    | 2.2   | 4                           | 20                             | 35     |
| P3100EALxxx | P3100EA | 275                               | 350                      | 150    | 800    | 2.2   | 4                           | 20                             | 35     |
| P3500EALxxx | P3500EA | 320                               | 400                      | 150    | 800    | 2.2   | 4                           | 20                             | 35     |

Table continues on next page.

### Electrical Characteristics (continued)

| Part Number | Marking | $V_{DRM}$<br>@ $I_{DRM} = 5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $I_H$  | $I_S$  | $I_T$ | $V_T$<br>@ $I_T = 2.2$ Amps | Capacitance<br>@ 1MHz, 2V bias |        |
|-------------|---------|-----------------------------------|--------------------------|--------|--------|-------|-----------------------------|--------------------------------|--------|
|             |         | V Min                             | V Max                    | mA Min | mA Max | A Max | V Max                       | pF Min                         | pF Max |
| P0080EBLxxx | P0080EB | 6                                 | 25                       | 50     | 800    | 2.2   | 4                           | 25                             | 150    |
| P0300EBLxxx | P0300EB | 25                                | 40                       | 50     | 800    | 2.2   | 4                           | 15                             | 140    |
| P0640EBLxxx | P0640EB | 58                                | 77                       | 150    | 800    | 2.2   | 4                           | 40                             | 60     |
| P0720EBLxxx | P0720EB | 65                                | 88                       | 150    | 800    | 2.2   | 4                           | 35                             | 75     |
| P0900EBLxxx | P0900EB | 75                                | 98                       | 150    | 800    | 2.2   | 4                           | 35                             | 70     |
| P1100EBLxxx | P1100EB | 90                                | 130                      | 150    | 800    | 2.2   | 4                           | 30                             | 70     |
| P1300EBLxxx | P1300EB | 120                               | 160                      | 150    | 800    | 2.2   | 4                           | 25                             | 60     |
| P1500EBLxxx | P1500EB | 140                               | 180                      | 150    | 800    | 2.2   | 4                           | 25                             | 55     |
| P1800EBLxxx | P1800EB | 170                               | 220                      | 150    | 800    | 2.2   | 4                           | 25                             | 50     |
| P2300EBLxxx | P2300EB | 190                               | 260                      | 150    | 800    | 2.2   | 4                           | 25                             | 50     |
| P2600EBLxxx | P2600EB | 220                               | 300                      | 150    | 800    | 2.2   | 4                           | 20                             | 45     |
| P3100EBLxxx | P3100EB | 275                               | 350                      | 150    | 800    | 2.2   | 4                           | 20                             | 45     |
| P3500EBLxxx | P3500EB | 320                               | 400                      | 150    | 800    | 2.2   | 4                           | 20                             | 40     |
| P0080ECLxxx | P0080EC | 6                                 | 25                       | 50     | 800    | 2.2   | 4                           | 35                             | 260    |
| P0300ECLxxx | P0300EC | 25                                | 40                       | 50     | 800    | 2.2   | 4                           | 25                             | 250    |
| P0640ECLxxx | P0640EC | 58                                | 77                       | 150    | 800    | 2.2   | 4                           | 55                             | 155    |
| P0720ECLxxx | P0720EC | 65                                | 88                       | 150    | 800    | 2.2   | 4                           | 50                             | 150    |
| P0900ECLxxx | P0900EC | 75                                | 98                       | 150    | 800    | 2.2   | 4                           | 45                             | 140    |
| P1100ECLxxx | P1100EC | 90                                | 130                      | 150    | 800    | 2.2   | 4                           | 45                             | 115    |
| P1300ECLxxx | P1300EC | 120                               | 160                      | 150    | 800    | 2.2   | 4                           | 40                             | 105    |
| P1500ECLxxx | P1500EC | 140                               | 180                      | 150    | 800    | 2.2   | 4                           | 35                             | 95     |
| P1800ECLxxx | P1800EC | 170                               | 220                      | 150    | 800    | 2.2   | 4                           | 35                             | 90     |
| P2300ECLxxx | P2300EC | 190                               | 260                      | 150    | 800    | 2.2   | 4                           | 30                             | 80     |
| P2600ECLxxx | P2600EC | 220                               | 300                      | 150    | 800    | 2.2   | 4                           | 30                             | 80     |
| P3100ECLxxx | P3100EC | 275                               | 350                      | 150    | 800    | 2.2   | 4                           | 30                             | 70     |
| P3500ECLxxx | P3500EC | 320                               | 400                      | 150    | 800    | 2.2   | 4                           | 25                             | 65     |

Notes:  
 - Absolute maximum ratings measured at  $T_a = 25^\circ C$  (unless otherwise noted).  
 - Devices are bi-directional (unless otherwise noted).  
 - xxx part number suffix: 'AP' = Ammo Pack, 'RP1' and 'RP2' = Reel Pack, blank = Bulk Pack

### 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                                       | 30                    | 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  $-40^\circ C$  to  $+85^\circ C$   
 - The device must initially be in thermal equilibrium with  $-40^\circ C \leq T_J \leq +150^\circ C$

### Thermal Considerations

| Package   | Symbol          | Parameter                               | Value       | Unit         |
|---|-----------------|---|-------------|--------------|
| TO-92  | $T_J$           | Operating Junction Temperature Range    | -40 to +150 | $^\circ C$   |
|   | $T_S$           | Storage Temperature Range               | -65 to +150 | $^\circ C$   |
|   | $R_{\theta JA}$ | Thermal Resistance: Junction to Ambient | 90          | $^\circ C/W$ |

**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**



**Packing Options**

| Package Type | Description              | Packing Options Quantity | Added Suffix | Lead Spacing      | Industry Standard |
|--------------|--------------------------|--------------------------|--------------|-------------------|-------------------|
| E            | TO-92 Tape and Reel Pack | 2000                     | RP1          | 0.1 inch (2.54mm) | EIA-481-D         |
|              | TO-92 Ammo Pack          |                          | RP2          | 0.2 inch (5.08mm) |                   |
|              | TO-92 Bulk Pack          |                          | AP           |                   | EIA-468-B         |
|              |                          |                          | N/A          |                   | N/A               |

**Dimensions — TO-92**



|   | Inches |       | Millimeters |      |
|---|--------|-------|-------------|------|
|   | Min    | Max   | Min         | Max  |
| A | 0.176  | 0.196 | 4.47        | 4.98 |
| B | 0.500  |       | 12.70       |      |
| D | 0.095  | 0.105 | 2.41        | 2.67 |
| E | 0.150  |       | 3.81        |      |
| G | 0.135  | 0.145 | 3.43        | 3.68 |
| H | 0.088  | 0.096 | 2.23        | 2.44 |
| J | 0.176  | 0.186 | 4.47        | 4.73 |
| K | 0.088  | 0.096 | 2.23        | 2.44 |
| L | 0.013  | 0.019 | 0.33        | 0.48 |
| M | 0.013  | 0.017 | 0.33        | 0.43 |
| N |        | 0.60  |             | 1.52 |

All leads are insulated from case. Case is electrically non-conductive. (Rated at 1600 V<sub>(AC) RMS</sub> for one minute from leads to case over the operating temperature range.)

Mold flash shall not exceed 0.13 mm per side.

The TO-92 is designed to meet mechanical standards as set forth in JEDEC publication number 95.

**Ammo Pack Specification — TO-92**



**Tape and Reel Specification — TO-92**



| Dimensions | Inches |        | Millimeters |       |
|------------|--------|--------|-------------|-------|
|            | Min    | Max    | Min         | Max   |
| A          | N/A    | 14.173 | N/A         | 360.0 |
| B          | 4.016  | N/A    | 102.0       | N/A   |
| C          | 3.386  | N/A    | 86.0        | N/A   |
| D          | 0.795  | N/A    | 20.2        | N/A   |
| W1         | 1.181  | 1.968  | 30.0        | 50.0  |
| P          | 0.496  | 0.504  | 12.60       | 12.80 |
| P0         | 0.498  | 0.502  | 12.65       | 12.75 |
| F(for RP1) | 0.090  | 0.110  | 2.29        | 2.80  |
| F(for RP2) | 0.182  | 0.244  | 4.63        | 6.19  |
| H          | N/A    | 1.673  | N/A         | 42.50 |
| H1         | N/A    | 1.270  | N/A         | 32.26 |
| W          | 0.674  | 0.763  | 17.12       | 19.38 |
| W2         | 0.354  | 0.370  | 8.25        | 9.75  |
| W3         | 0.236  | N/A    | 6.00        | N/A   |
| W4         | 0.020  | N/A    | 0.50        | N/A   |



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