

RoHS SIDACtor® Series - TO-92



Agency Approvals

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

Pinout Designation



Schematic Symbol



Description

SIDACtor® 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} @ $I_{DRM} = 5\mu A$ | V_S @ 100V/ μs | I_H | I_S | I_T | V_T @ $I_T = 2.2$ Amps | Capacitance @ 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} @ $I_{DRM} = 5\mu A$ | V_S @ 100V/ μs | I_H | I_S | I_T | V_T @ $I_T = 2.2$ Amps | Capacitance @ 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} 50/60 Hz | di/dt |
|--------|--|--|--|--|--|--|--|--|---|-----------------------|-------|
| | 0.2x310 ¹ 0.5x700 ² | 2x10 ¹ 2x10 ² | 8x20 ¹ 1.2x50 ² | 10x160 ¹ 10x160 ² | 10x560 ¹ 10x560 ² | 5x320 ¹ 9x720 ² | 10x360 ¹ 10x360 ² | 10x1000 ¹ 10x1000 ² | 5x310 ¹ 10x700 ² | | |
| | 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 μs
 2 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 $-40^\circ C$ 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

| | |
|------------------------|---|
| Lead Material | Copper Alloy |
| Terminal Finish | 100% Matte-Tin Plated |
| Body Material | UL recognized epoxy meeting flammability classification 94V-0 |

Environmental Specifications

| | |
|---|---|
| High Temp Voltage Blocking | 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 |
| 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



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_{(AC) RMS} 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



Dimensions are in inches (and millimeters).

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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