

**RoHS SIDACTor® Balanced Series - MS-013**



**Description**

The SIDACTor® Balanced Series MS-013 are designed to protect baseband equipment from overvoltage transients. The patented "Y" configuration ensures balanced overvoltage protection.

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

**Features and Benefits**

- Balanced overvoltage protection
- Low voltage overshoot
- Low on-state voltage
- Does not degrade with use
- Fails short circuit when surged in excess of ratings
- Replaces three discrete devices
- Meets UL/IEC 60950-1 creepage and clearance

**Agency Approvals**

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

**Pinout Designation**



**Schematic Symbol**



**Applicable Global Standards**

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

**Electrical Characteristics**

| Part Number | Part 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/ $\mu s$ | $V_T$ | $I_S$  | $I_T$ | $I_H$  | Capacitance                  |
|-------------|--------------|---------------------------------|--------------------------|---------------------------------|--------------------------|-------|--------|-------|--------|------------------------------|
|             |              | V min                           | V max                    | V min                           | V max                    | V max | mA max | A max | mA min |                              |
|             |              | Pins 1 & 6-3, 1 & 6-4           |                          | Pins 3-4                        |                          |       |        |       |        |                              |
| P1553UALxx  | P1553UA      | 130                             | 180                      | 130                             | 180                      | 8     | 800    | 2.2   | 150    | See Capacitance Values table |
| P1803UALxx  | P1803UA      | 150                             | 210                      | 150                             | 210                      | 8     | 800    | 2.2   | 150    |                              |
| P2103UALxx  | P2103UA      | 170                             | 250                      | 170                             | 250                      | 8     | 800    | 2.2   | 150    |                              |
| P2353UALxx  | P2353UA      | 200                             | 270                      | 200                             | 270                      | 8     | 800    | 2.2   | 150    |                              |
| P2703UALxx  | P2703UA      | 230                             | 300                      | 230                             | 300                      | 8     | 800    | 2.2   | 150    |                              |
| P3203UALxx  | P3203UA      | 270                             | 350                      | 270                             | 350                      | 8     | 800    | 2.2   | 150    |                              |
| P3403UALxx  | P3403UA      | 300                             | 400                      | 300                             | 400                      | 8     | 800    | 2.2   | 150    |                              |
| P5103UALxx  | P5103UA      | 420                             | 600                      | 420                             | 600                      | 8     | 800    | 2.2   | 150    |                              |

Table continues on next page.

Notes:  
 - Absolute maximum ratings measured at  $T_A = +25^\circ C$  (unless otherwise noted).  
 - Devices are bi-directional.  
 - **XX** = Part Number Suffix: 'TP' (Tube Pack) or 'RP' (Reel Pack).  
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**Electrical Characteristics (continued)**

| Part Number | Part 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/ $\mu s$ | $V_T$ | $I_S$  | $I_T$ | $I_H$  | Capacitance                        |
|-------------|--------------|---------------------------------|--------------------------|---------------------------------|--------------------------|-------|--------|-------|--------|------------------------------------|
|             |              | V min                           | V max                    | V min                           | V max                    | V max | mA max | A max | mA min |                                    |
|             |              | Pins 1 & 6-3, 1 & 6-4           |                          | Pins 3-4                        |                          |       |        |       |        |                                    |
| P1553UBLxx  | P1553UB      | 130                             | 180                      | 130                             | 180                      | 8     | 800    | 2.2   | 150    | See<br>Capacitance<br>Values table |
| P1803UBLxx  | P1803UB      | 150                             | 210                      | 150                             | 210                      | 8     | 800    | 2.2   | 150    |                                    |
| P2103UBLxx  | P2103UB      | 170                             | 250                      | 170                             | 250                      | 8     | 800    | 2.2   | 150    |                                    |
| P2353UBLxx  | P2353UB      | 200                             | 270                      | 200                             | 270                      | 8     | 800    | 2.2   | 150    |                                    |
| P2703UBLxx  | P2703UB      | 230                             | 300                      | 230                             | 300                      | 8     | 800    | 2.2   | 150    |                                    |
| P3203UBLxx  | P3203UB      | 270                             | 350                      | 270                             | 350                      | 8     | 800    | 2.2   | 150    |                                    |
| P3403UBLxx  | P3403UB      | 300                             | 400                      | 300                             | 400                      | 8     | 800    | 2.2   | 150    |                                    |
| P5103UBLxx  | P5103UB      | 420                             | 600                      | 420                             | 600                      | 8     | 800    | 2.2   | 150    |                                    |
| P1553UCLxx  | P1553UC      | 130                             | 180                      | 130                             | 180                      | 8     | 800    | 2.2   | 150    |                                    |
| P1803UCLxx  | P1803UC      | 150                             | 210                      | 150                             | 210                      | 8     | 800    | 2.2   | 150    |                                    |
| P2103UCLxx  | P2103UC      | 170                             | 250                      | 170                             | 250                      | 8     | 800    | 2.2   | 150    |                                    |
| P2353UCLxx  | P2353UC      | 200                             | 270                      | 200                             | 270                      | 8     | 800    | 2.2   | 150    |                                    |
| P2703UCLxx  | P2703UC      | 230                             | 300                      | 230                             | 300                      | 8     | 800    | 2.2   | 150    |                                    |
| P3203UCLxx  | P3203UC      | 270                             | 350                      | 270                             | 350                      | 8     | 800    | 2.2   | 150    |                                    |
| P3403UCLxx  | P3403UC      | 300                             | 400                      | 300                             | 400                      | 8     | 800    | 2.2   | 150    |                                    |
| P5103UCLxx  | P5103UC      | 420                             | 600                      | 420                             | 600                      | 8     | 800    | 2.2   | 150    |                                    |

**Capacitance Values**

| Part Number | Pin 3-4<br>Tip-Ring |        | Pins 1 & 6-3, 1 & 6-4<br>Tip-Ground, Ring-Ground |        |
|-------------|---------------------|--------|--|--------|
|             | pF min              | pF max | pF min   | pF max |
| P1553UALxx  | 20                  | 95     | 10   | 60     |
| P1803UALxx  | 20                  | 85     | 10   | 55     |
| P2103UALxx  | 15                  | 85     | 10   | 55     |
| P2353UALxx  | 15                  | 75     | 10   | 50     |
| P2703UALxx  | 15                  | 75     | 10   | 50     |
| P3203UALxx  | 15                  | 70     | 10   | 45     |
| P3403UALxx  | 15                  | 65     | 10   | 45     |
| P5103UALxx  | 10                  | 60     | 10   | 40     |
| P1553UBLxx  | 25                  | 95     | 15   | 60     |
| P1803UBLxx  | 25                  | 85     | 15   | 55     |
| P2103UBLxx  | 20                  | 85     | 15   | 55     |
| P2353UBLxx  | 20                  | 75     | 15   | 50     |
| P2703UBLxx  | 20                  | 75     | 10   | 50     |
| P3203UBLxx  | 20                  | 70     | 10   | 45     |
| P3403UBLxx  | 15                  | 65     | 10   | 45     |
| P5103UBLxx  | 15                  | 60     | 10   | 40     |
| P1553UCLxx  | 30                  | 95     | 20   | 60     |
| P1803UCLxx  | 30                  | 85     | 15   | 55     |
| P2103UCLxx  | 30                  | 85     | 15   | 55     |
| P2353UCLxx  | 25                  | 75     | 15   | 50     |
| P2703UCLxx  | 25                  | 75     | 15   | 50     |
| P3203UCLxx  | 25                  | 70     | 15   | 45     |
| P3403UCLxx  | 20                  | 65     | 15   | 45     |
| P5103UCLxx  | 20                  | 60     | 10   | 40     |

 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 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 to +85°C  
 - The device must initially be in thermal equilibrium with -40°C  $\leq$  T<sub>j</sub>  $\leq$  +150°C

**Thermal Considerations**

| Package  | Symbol           | Parameter                               | Value       | Unit |
|--|------------------|---|-------------|------|
| Modified MS-013<br> | T <sub>J</sub>   | Operating Junction Temperature Range    | -40 to +150 | °C   |
|  | T <sub>S</sub>   | Storage Temperature Range               | -65 to +150 | °C   |
|  | R <sub>θJA</sub> | Thermal Resistance: Junction to Ambient | 60          | °C/W |

**V-I Characteristics**



**t<sub>r</sub> x t<sub>d</sub> Pulse Waveform**



**Normalized V<sub>S</sub> 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 |

**Part Marking**



**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 Numbering**



**Packing Options**

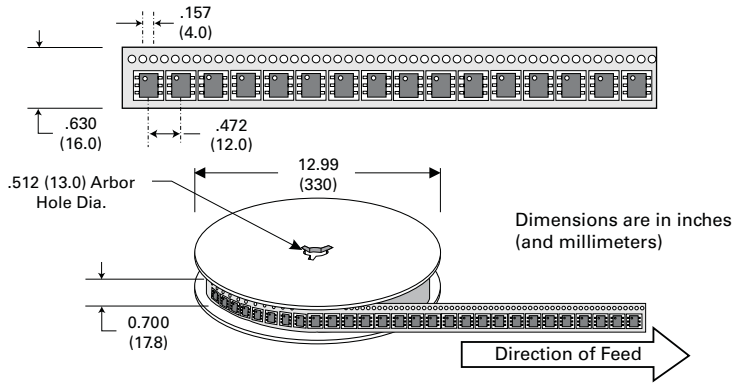
| Package Type | Description                              | Quantity          | Added Suffix | Industry Standard |
|--------------|--|-------------------|--------------|-------------------|
| U            | Modified MS-013 6-pin Tape and Reel Pack | 1500              | RP           | EIA-481-D      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

**Dimensions — MS-013**

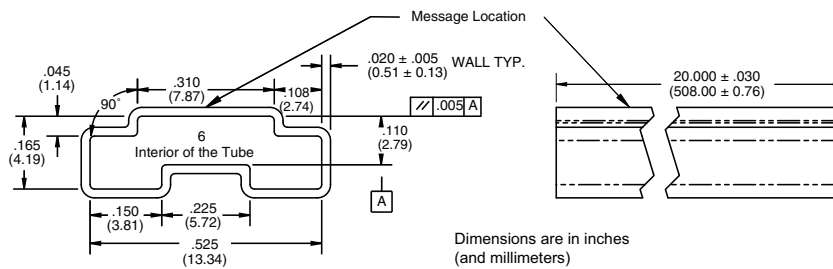


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.360  | 0.364 | 9.14        | 9.25  |
| B          | 0.352  | 0.356 | 8.94        | 9.04  |
| C          | 0.400  | 0.412 | 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  |

**Tape and Reel Specification — MS-013**



**Tube Pack Specification — MS-013**





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