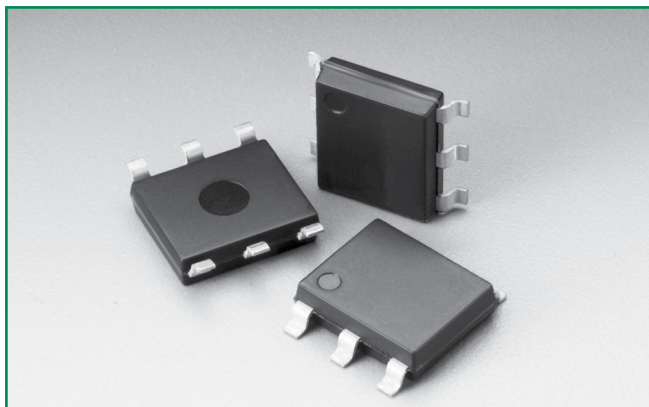


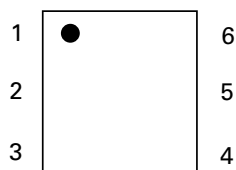
## SIDACtor® Multiport Series - MS-013



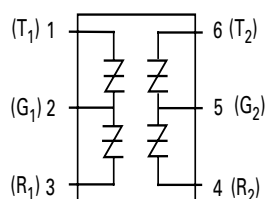
### Agency Approvals

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

### Pinout Designation



### Schematic Symbol



### Description

SIDACtor® Multiport Series thyristors MS-013 are designed to protect baseband equipment from overvoltage transients.

Targeted for voice through DS-1 applications, the series provides a dual port surface mount solution that enables equipment to comply with various global regulatory standards.

### Features and Benefits

- Low voltage overshoot
- Low on-state voltage
- Does not degrade surge capability after multiple surge events within limit.
- Replaces four discrete components
- Fails short circuit when surged in excess of ratings
- Low capacitance
- RoHS Compliant
- 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

- 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 2nd edition
- YD/T 1082
- YD/T 993
- YD/T 950

\*A-rated parts require series resistance

### Additional Information



**Datasheet**



**Resources**



**Samples**

### 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>@ $I_T=2.2$ Amps | $I_H$  | $I_S$  | $I_T$ | Capacitance                  |
|-------------|---------|---------------------------------|-------------------------|---------------------------------|-------------------------|---------------------------|--------|--------|-------|------------------------------|
|             |         | V min                           | V max                   | V min                           | V max                   | V max                     |        |        |       |                              |
|             |         | Pins 1-2, 3-2, 4-5, 6-5         |                         | Pins 1-3, 4-6                   |                         | Pins 1-2, 3-2, 4-5, 6-5   | mA min | mA max | A max |                              |
| P0084UALxx  | P0084UA | 6                               | 25                      | 12                              | 50                      | 4                         | 50     | 800    | 2.2   | See Capacitance Values Table |
| P0304UALxx  | P0304UA | 25                              | 40                      | 50                              | 80                      | 4                         | 50     | 800    | 2.2   |                              |
| P0644UALxx  | P0644UA | 58                              | 77                      | 116                             | 154                     | 4                         | 150    | 800    | 2.2   |                              |
| P0724UALxx  | P0724UA | 65                              | 88                      | 130                             | 176                     | 4                         | 150    | 800    | 2.2   |                              |
| P0904UALxx  | P0904UA | 75                              | 98                      | 150                             | 196                     | 4                         | 150    | 800    | 2.2   |                              |
| P1104UALxx  | P1104UA | 90                              | 130                     | 180                             | 260                     | 4                         | 150    | 800    | 2.2   |                              |
| P1304UALxx  | P1304UA | 120                             | 160                     | 240                             | 320                     | 4                         | 150    | 800    | 2.2   |                              |
| P1504UALxx  | P1504UA | 140                             | 180                     | 280                             | 360                     | 4                         | 150    | 800    | 2.2   |                              |

Table continues on next page.

### Electrical Characteristics (continued)

| Part Number | Marking | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $V_{DRM}$<br>@ $I_{DRM}=5\mu A$ | $V_S$<br>@ 100V/ $\mu s$ | $V_T$<br>@ $I_T=2.2$ Amps | $I_H$  | $I_S$  | $I_T$ | Capacitance                  |
|-------------|---------|---------------------------------|--------------------------|---------------------------------|--------------------------|---------------------------|--------|--------|-------|------------------------------|
|             |         | V min                           | V max                    | V min                           | V max                    | V max                     |        |        |       |                              |
|             |         | Pins 1-2, 3-2, 4-5, 6-5         |                          | Pins 1-3, 4-6                   |                          | Pins 1-2, 3-2, 4-5, 6-5   | mA min | mA max | A max |                              |
| P1804UALxx  | P1804UA | 170                             | 220                      | 340                             | 440                      | 4                         | 150    | 800    | 2.2   | See Capacitance Values Table |
| P2304UALxx  | P2304UA | 190                             | 260                      | 380                             | 520                      | 4                         | 150    | 800    | 2.2   |                              |
| P2604UALxx  | P2604UA | 220                             | 300                      | 440                             | 600                      | 4                         | 150    | 800    | 2.2   |                              |
| P3104UALxx  | P3104UA | 275                             | 350                      | 550                             | 700                      | 4                         | 150    | 800    | 2.2   |                              |
| P3504UALxx  | P3504UA | 320                             | 400                      | 640                             | 800                      | 4                         | 150    | 800    | 2.2   |                              |
| P0084UCLxx  | P0084UC | 6                               | 25                       | 12                              | 50                       | 4                         | 50     | 800    | 2.2   |                              |
| P0304UCLxx  | P0304UC | 25                              | 40                       | 50                              | 80                       | 4                         | 50     | 800    | 2.2   |                              |
| P0644UCLxx  | P0644UC | 58                              | 77                       | 116                             | 154                      | 4                         | 150    | 800    | 2.2   |                              |
| P0724UCLxx  | P0724UC | 65                              | 88                       | 130                             | 176                      | 4                         | 150    | 800    | 2.2   |                              |
| P0904UCLxx  | P0904UC | 75                              | 98                       | 150                             | 196                      | 4                         | 150    | 800    | 2.2   |                              |
| P1104UCLxx  | P1104UC | 90                              | 130                      | 180                             | 260                      | 4                         | 150    | 800    | 2.2   |                              |
| P1304UCLxx  | P1304UC | 120                             | 160                      | 240                             | 320                      | 4                         | 150    | 800    | 2.2   |                              |
| P1504UCLxx  | P1504UC | 140                             | 180                      | 280                             | 360                      | 4                         | 150    | 800    | 2.2   |                              |
| P1804UCLxx  | P1804UC | 170                             | 220                      | 340                             | 440                      | 4                         | 150    | 800    | 2.2   |                              |
| P2304UCLxx  | P2304UC | 190                             | 260                      | 380                             | 520                      | 4                         | 150    | 800    | 2.2   |                              |
| P2604UCLxx  | P2604UC | 220                             | 300                      | 440                             | 600                      | 4                         | 150    | 800    | 2.2   |                              |
| P3104UCLxx  | P3104UC | 275                             | 350                      | 550                             | 700                      | 4                         | 150    | 800    | 2.2   |                              |
| P3504UCLxx  | P3504UC | 320                             | 400                      | 640                             | 800                      | 4                         | 150    | 800    | 2.2   |                              |

#### Notes:

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

### Capacitance Values

| Part Number | Pin 1-2 / 3-2 (4-5 / 6-5)<br>Tip-Ground, Ring-Ground |        | Pin 1-3 (4-6)<br>Tip-Ring |        |
|-------------|------------------------------------------------------|--------|---------------------------|--------|
|             | pF min                                               | pF max | pF min                    | pF max |
| P0084UALxx  | 25                                                   | 155    | 15                        | 90     |
| P0304UALxx  | 15                                                   | 140    | 10                        | 90     |
| P0644UALxx  | 40                                                   | 60     | 20                        | 35     |
| P0724UALxx  | 35                                                   | 60     | 20                        | 35     |
| P0904UALxx  | 35                                                   | 55     | 20                        | 30     |
| P1104UALxx  | 30                                                   | 50     | 15                        | 30     |
| P1304UALxx  | 25                                                   | 45     | 15                        | 25     |
| P1504UALxx  | 25                                                   | 40     | 15                        | 25     |
| P1804UALxx  | 25                                                   | 35     | 10                        | 20     |
| P2304UALxx  | 25                                                   | 35     | 10                        | 20     |
| P2604UALxx  | 20                                                   | 35     | 10                        | 20     |
| P3104UALxx  | 20                                                   | 35     | 10                        | 20     |
| P3504UALxx  | 20                                                   | 35     | 10                        | 20     |
| P0084UCLxx  | 35                                                   | 285    | 20                        | 165    |
| P0304UCLxx  | 25                                                   | 250    | 10                        | 145    |
| P0644UCLxx  | 55                                                   | 155    | 30                        | 90     |
| P0724UCLxx  | 50                                                   | 145    | 25                        | 85     |
| P0904UCLxx  | 45                                                   | 135    | 25                        | 80     |
| P1104UCLxx  | 45                                                   | 115    | 25                        | 65     |
| P1304UCLxx  | 40                                                   | 105    | 20                        | 60     |
| P1504UCLxx  | 35                                                   | 95     | 20                        | 55     |
| P1804UCLxx  | 35                                                   | 90     | 15                        | 50     |
| P2604UCLxx  | 30                                                   | 85     | 15                        | 50     |
| P3104UCLxx  | 30                                                   | 80     | 15                        | 45     |
| P3504UCLxx  | 25                                                   | 75     | 15                        | 45     |

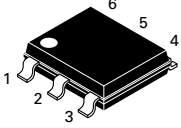
## Surge Ratings

| Series | $I_{PP}$                                     |                                        |                                          |                                            |                                            |                                          |                                            |                                              |                                           | $I_{TSM}$<br>50/60 Hz | di/dt<br>A/μs max |
|--------|----------------------------------------------|----------------------------------------|------------------------------------------|--------------------------------------------|--------------------------------------------|------------------------------------------|--------------------------------------------|----------------------------------------------|-------------------------------------------|-----------------------|-------------------|
|        | 0.2/310 <sup>1</sup><br>0.5/700 <sup>2</sup> | 2/10 <sup>1</sup><br>2/10 <sup>2</sup> | 8/20 <sup>1</sup><br>1.2/50 <sup>2</sup> | 10/160 <sup>1</sup><br>10/160 <sup>2</sup> | 10/560 <sup>1</sup><br>10/560 <sup>2</sup> | 5/320 <sup>1</sup><br>9/720 <sup>2</sup> | 10/360 <sup>1</sup><br>10/360 <sup>2</sup> | 10/1000 <sup>1</sup><br>10/1000 <sup>2</sup> | 5/310 <sup>1</sup><br>10/700 <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               |
| C      | 50                                           | 500                                    | 400                                      | 200                                        | 150                                        | 200                                      | 175                                        | 100                                          | 200                                       | 30                    | 500               |

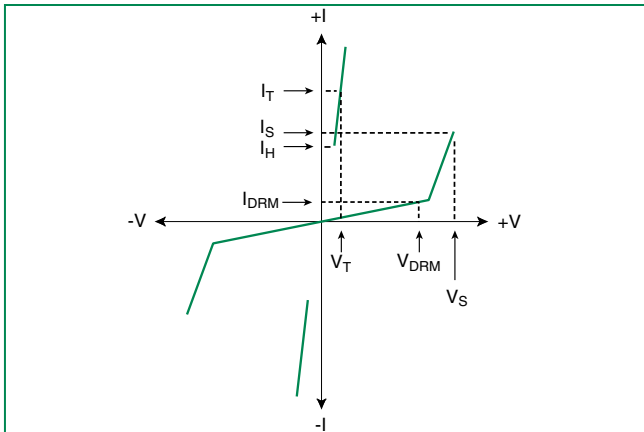
Notes:

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

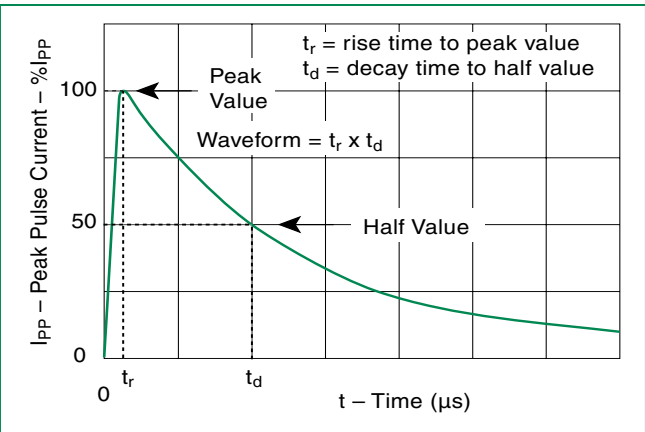
## Thermal Considerations

| Package                                                                                              | Symbol          | Parameter                               | Value       | Unit |
|------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------|-------------|------|
| <br>Modified MS-013 | $T_J$           | 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 |

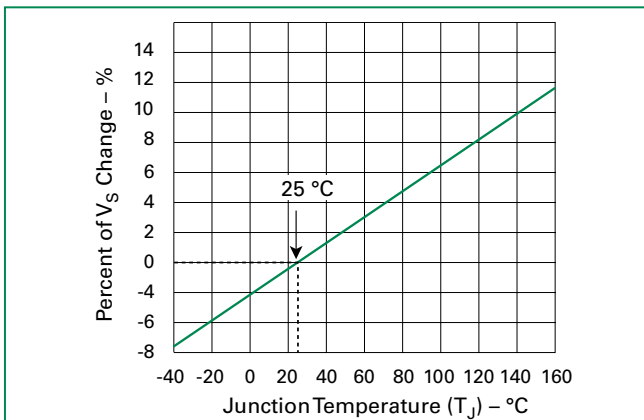
## V-I Characteristics



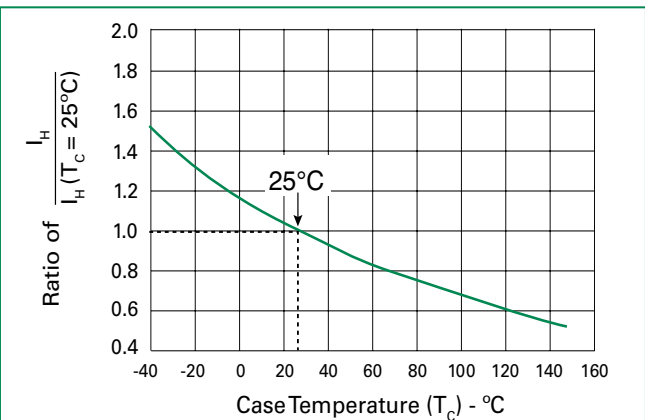
## $t_r \times t_d$ Pulse Waveform



## Normalized $V_S$ Change vs. Junction Temperature

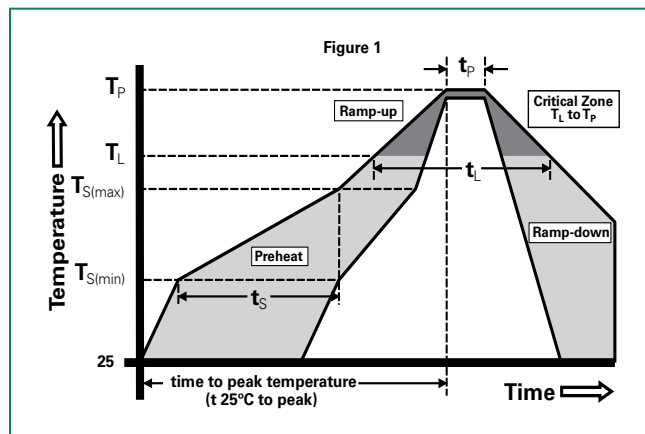


## Normalized DC Holding Current vs. Case Temperature



### 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                        |



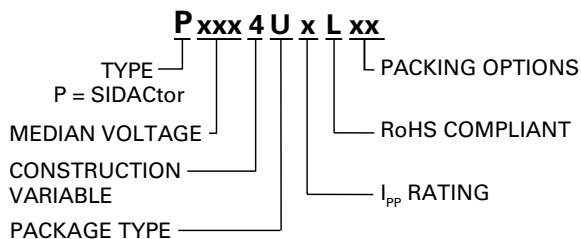
### Physical Specifications

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

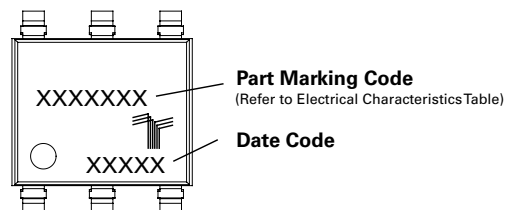
### Environmental Specifications

|                                         |                                                                                                                        |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <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-A-104                 |
| <b>Biased Temp &amp; Humidity</b>       | 52 $V_{OC}$ (+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                                        |

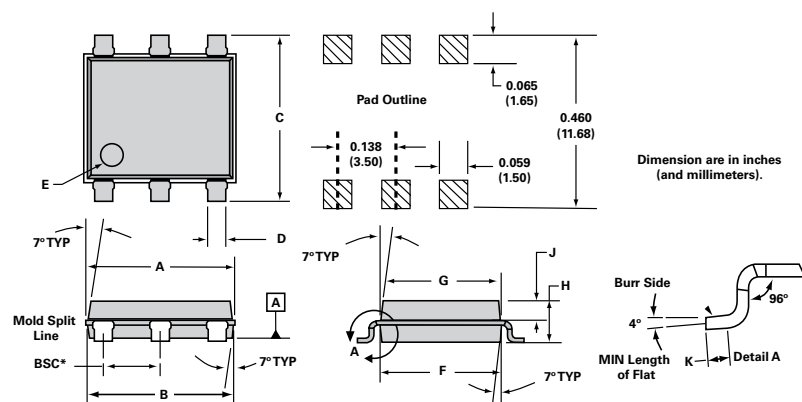
### Part Numbering



### Part Marking



## Dimensions — MS-013



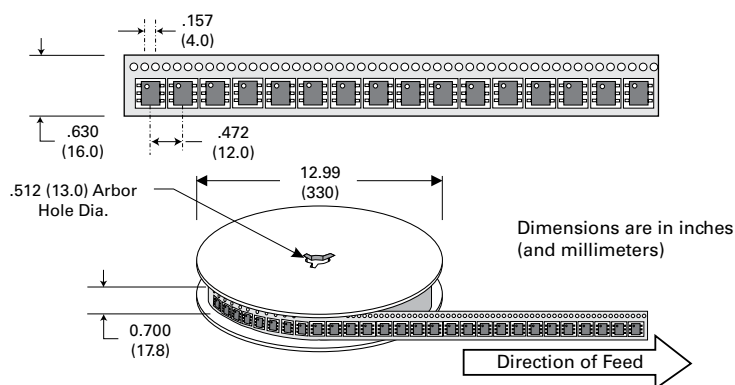
| Dimensions  | Inches |       | Millimeters |       |
|-------------|--------|-------|-------------|-------|
|             | Min    | Max   | Min         | Max   |
| <b>A</b>    | 0.360  | 0.364 | 9.14        | 9.25  |
| <b>B</b>    | 0.352  | 0.356 | 8.94        | 9.04  |
| <b>C</b>    | 0.400  | 0.412 | 10.16       | 10.46 |
| <b>D</b>    | 0.043  | 0.045 | 1.09        | 1.13  |
| <b>E</b>    | 0.047  | 0.055 | 1.19        | 1.40  |
| <b>F</b>    | 0.293  | 0.297 | 7.44        | 7.54  |
| <b>G</b>    | 0.289  | 0.293 | 7.34        | 7.44  |
| <b>H</b>    | 0.089  | 0.093 | 2.26        | 2.36  |
| <b>J</b>    | 0.041  | 0.049 | 1.04        | 1.24  |
| <b>K</b>    | 0.020  | —     | 0.51        | —     |
| <b>BSC*</b> | 0.133  | 0.143 | 3.38        | 3.63  |

\* BSC = Basic Spacing between Centers

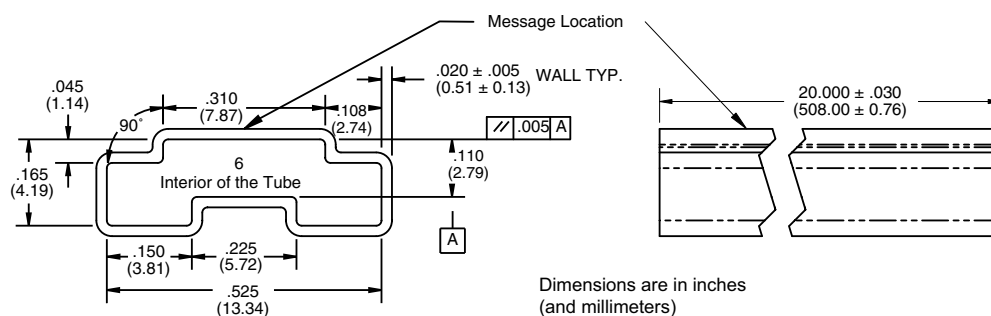
## Packing Options

| 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               |

## Tape and Reel Specification — MS-013



## Tube Pack Specification — MS-013



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[P0904UATP](#) [P1804UATP](#) [P0724UCTP](#) [P0724UCRP](#) [P0724UBRP](#) [P0724UBTP](#) [P1804UBTP](#) [P1804UBRP](#)  
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