



# THE DATASHEET OF TPSMA6L16A



## TPSMA6L Series



### Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
|        | E230531            |

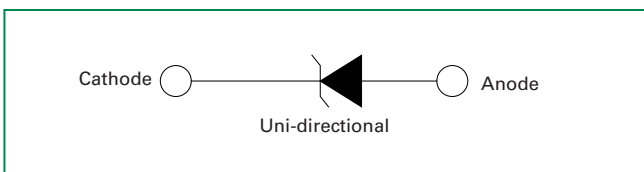
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter  | Symbol                            | Value      | Unit |
|--|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation at T <sub>A</sub> =25°C by 10x1000µs Waveform (Fig.2)(Note 1), (Note 2) | P <sub>PPM</sub>                  | 600        | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>A</sub> =50°C                                      | P <sub>M(AV)</sub>                | 3          | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                                     | I <sub>FSM</sub>                  | 60         | A    |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only                                 | V <sub>F</sub>                    | 3.5V       | V    |
| Operating Junction and Storage Temperature Range   | T <sub>J</sub> , T <sub>STG</sub> | -65 to 150 | °C   |
| Typical Thermal Resistance Junction to Lead  | R <sub>wJL</sub>                  | 35         | °C/W |
| Typical Thermal Resistance Junction to Ambient   | R <sub>wJA</sub>                  | 200        | °C/W |

**Notes:**

1. Non-repetitive current pulse, per Fig.4 and derated above T<sub>A</sub>=25°C per Fig. 3.
2. Mounted on 5.0x5.0mm copper pad to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.

### Functional Diagram



### Description

The TPSMA6L series is designed specifically to protect sensitive electronic equipment from voltage transients induced by load dump and other transient voltage events, and it's especially suitable for high reliability and automotive application.

SMA low profile package (DO221-AC) has the same electrical performance as the SMB package but with low height profiles (1.1mm).


### Features

- Same power as standard clamping capability
- Fast response time: typically less than 1.0ns from 0 Volts to V<sub>BR</sub> min
- Hi reliability application and automotive grade AEC Q101 qualified
- Built-in strain relief
- SMA low profile package: less than 1.1 mm
- Glass passivated junction
- Footprint compatibility with standard SMA and SMB products (easy to layout)
- High temperature soldering: 260°C/10 seconds at terminals
- Typical failure mode is short from over-specified voltage or current
- Plastic package has underwriters laboratory flammability V-0
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- Typical maximum temperature coefficient ΔV<sub>BR</sub> = 0.1% x V<sub>BR</sub>@25°C x ΔT
- IEC-61000-4-2 ESD 15kV(Air), 8kV (Contact)
- Matte tin lead-free plated
- ESD protection of data lines in accordance with IEC 61000-4-2
- Halogen free and RoHS compliant
- EFT protection of data lines in accordance with IEC 61000-4-4
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)
- Low inductance, excellent

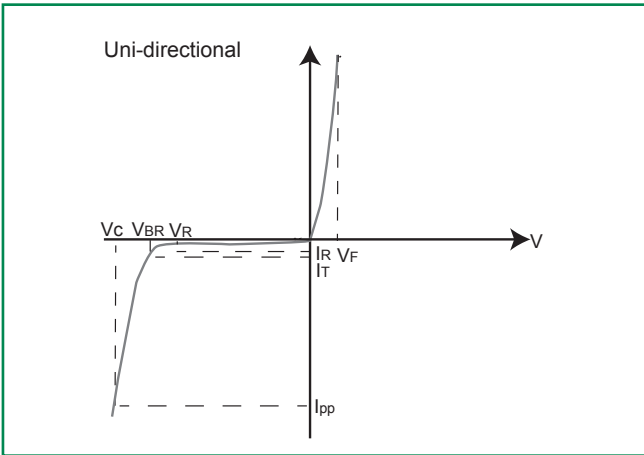
### Applications

TVS devices are ideal for the protection of I/O Interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

**Electrical Characteristics**

| Part Number (Uni) | Marking | Reverse Stand off Voltage $V_R$ (Volts) | Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$ |        | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C$ @ $I_{pp}$ (V) <sup>pp</sup> | Maximum Peak Pulse Current $I_{pp}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu$ A) | Agency Approval  |
|-------------------|---------|---|--|--------|-------------------------|---|---|--|---|
|                   |         |   | MIN  | MAX    |                         |   |   |  |   |
| TPSMA6L5.0A       | AEA     | 5.0                                     | 6.40                                       | 7.00   | 10                      | 9.2   | 65.3                                    | 800  | X   |
| TPSMA6L6.0A       | AGA     | 6.0                                     | 6.67                                       | 7.37   | 10                      | 10.3  | 58.3                                    | 800  | X   |
| TPSMA6L6.5A       | AKA     | 6.5                                     | 7.22                                       | 7.98   | 10                      | 11.2  | 53.6                                    | 500  | X   |
| TPSMA6L7.0A       | AMA     | 7.0                                     | 7.78                                       | 8.60   | 10                      | 12.0  | 50.0                                    | 200  | X   |
| TPSMA6L7.5A       | APA     | 7.5                                     | 8.33                                       | 9.21   | 1                       | 12.9  | 46.6                                    | 100  | X   |
| TPSMA6L8.0A       | ARA     | 8.0                                     | 8.89                                       | 9.83   | 1                       | 13.6  | 44.2                                    | 50   | X   |
| TPSMA6L8.5A       | ATA     | 8.5                                     | 9.44                                       | 10.40  | 1                       | 14.4  | 41.7                                    | 20   | X   |
| TPSMA6L9.0A       | AVA     | 9.0                                     | 10.00                                      | 11.10  | 1                       | 15.4  | 39.0                                    | 10   | X   |
| TPSMA6L10A        | AXA     | 10.0                                    | 11.10                                      | 12.30  | 1                       | 17.0  | 35.3                                    | 5  | X   |
| TPSMA6L11A        | AZA     | 11.0                                    | 12.20                                      | 13.50  | 1                       | 18.2  | 33.0                                    | 1  | X   |
| TPSMA6L12A        | BEA     | 12.0                                    | 13.30                                      | 14.70  | 1                       | 19.9  | 30.2                                    | 1  | X   |
| TPSMA6L13A        | BGA     | 13.0                                    | 14.40                                      | 15.90  | 1                       | 21.5  | 28.0                                    | 1  | X   |
| TPSMA6L14A        | BKA     | 14.0                                    | 15.60                                      | 17.20  | 1                       | 23.2  | 25.9                                    | 1  | X   |
| TPSMA6L15A        | BMA     | 15.0                                    | 16.70                                      | 18.50  | 1                       | 24.4  | 24.6                                    | 1  | X   |
| TPSMA6L16A        | BPA     | 16.0                                    | 17.80                                      | 19.70  | 1                       | 26.0  | 23.1                                    | 1  | X   |
| TPSMA6L17A        | BRA     | 17.0                                    | 18.90                                      | 20.90  | 1                       | 27.6  | 21.8                                    | 1  | X   |
| TPSMA6L18A        | BTA     | 18.0                                    | 20.00                                      | 22.10  | 1                       | 29.2  | 20.6                                    | 1  | X   |
| TPSMA6L20A        | BVA     | 20.0                                    | 22.20                                      | 24.50  | 1                       | 32.4  | 18.6                                    | 1  | X   |
| TPSMA6L22A        | BXA     | 22.0                                    | 24.40                                      | 26.90  | 1                       | 35.5  | 16.9                                    | 1  | X   |
| TPSMA6L24A        | BZA     | 24.0                                    | 26.70                                      | 29.50  | 1                       | 38.9  | 15.5                                    | 1  | X   |
| TPSMA6L26A        | CEA     | 26.0                                    | 28.90                                      | 31.90  | 1                       | 42.1  | 14.3                                    | 1  | X   |
| TPSMA6L28A        | CGA     | 28.0                                    | 31.10                                      | 34.40  | 1                       | 45.4  | 13.3                                    | 1  | X   |
| TPSMA6L30A        | CKA     | 30.0                                    | 33.30                                      | 36.80  | 1                       | 48.4  | 12.4                                    | 1  | X   |
| TPSMA6L33A        | CMA     | 33.0                                    | 36.70                                      | 40.60  | 1                       | 53.3  | 11.3                                    | 1  | X   |
| TPSMA6L36A        | CPA     | 36.0                                    | 40.00                                      | 44.20  | 1                       | 58.1  | 10.4                                    | 1  | X   |
| TPSMA6L40A        | CRA     | 40.0                                    | 44.40                                      | 49.10  | 1                       | 64.5  | 9.3                                     | 1  | X   |
| TPSMA6L43A        | CTA     | 43.0                                    | 47.80                                      | 52.80  | 1                       | 69.4  | 8.7                                     | 1  | X   |
| TPSMA6L45A        | CVA     | 45.0                                    | 50.00                                      | 55.30  | 1                       | 72.7  | 8.3                                     | 1  | X   |
| TPSMA6L48A        | CXA     | 48.0                                    | 53.30                                      | 58.90  | 1                       | 77.4  | 7.8                                     | 1  | X   |
| TPSMA6L51A        | CZA     | 51.0                                    | 56.70                                      | 62.70  | 1                       | 82.4  | 7.3                                     | 1  | X   |
| TPSMA6L54A        | REA     | 54.0                                    | 60.00                                      | 66.30  | 1                       | 87.1  | 6.9                                     | 1  | X   |
| TPSMA6L58A        | RGA     | 58.0                                    | 64.40                                      | 71.20  | 1                       | 93.6  | 6.5                                     | 1  | X   |
| TPSMA6L60A        | RKA     | 60.0                                    | 66.70                                      | 73.70  | 1                       | 96.8  | 6.2                                     | 1  | X   |
| TPSMA6L64A        | RMA     | 64.0                                    | 71.10                                      | 78.60  | 1                       | 103.0   | 5.9                                     | 1  | X   |
| TPSMA6L70A        | RPA     | 70.0                                    | 77.80                                      | 86.00  | 1                       | 113.0   | 5.3                                     | 1  | X   |
| TPSMA6L75A        | RRA     | 75.0                                    | 83.30                                      | 92.10  | 1                       | 121.0   | 5.0                                     | 1  | X   |
| TPSMA6L78A        | RTA     | 78.0                                    | 86.70                                      | 95.80  | 1                       | 126.0   | 4.8                                     | 1  | X   |
| TPSMA6L85A        | RVA     | 85.0                                    | 94.40                                      | 104.00 | 1                       | 137.0   | 4.4                                     | 1  | X   |

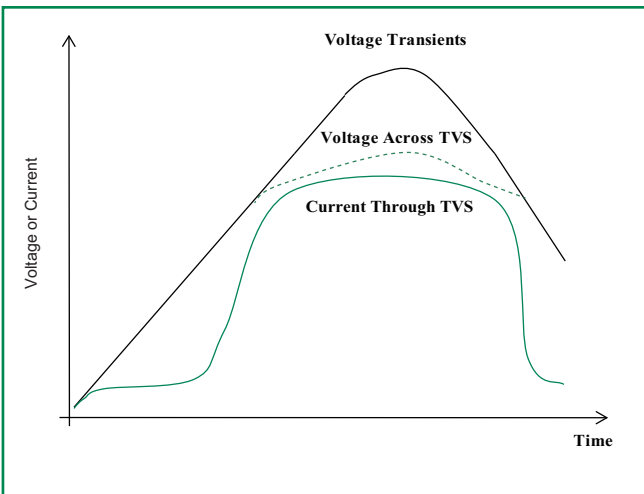
**I-V Curve Characteristics**



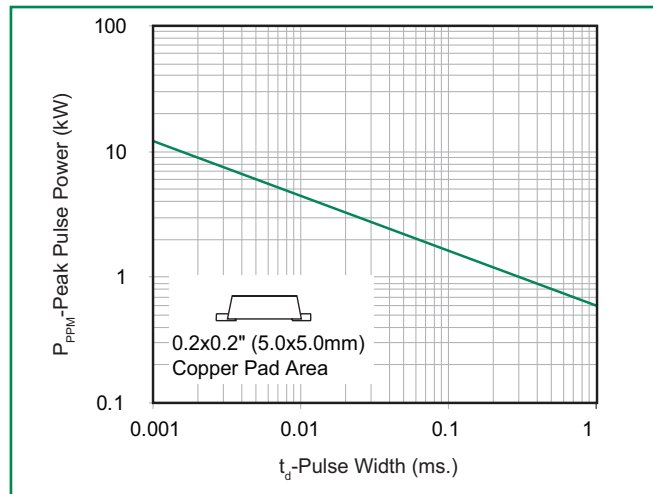
- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation
- $V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )
- $V_C$  Clamping Voltage** – Peak voltage measured across the suppressor at a specified  $I_{ppm}$  (peak impulse current)
- $I_R$  Reverse Leakage Current** – Current measured at  $V_R$
- $V_F$  Forward Voltage Drop for Uni-directional**

**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted)

**Figure 1 - TVS Transients Clamping Waveform**



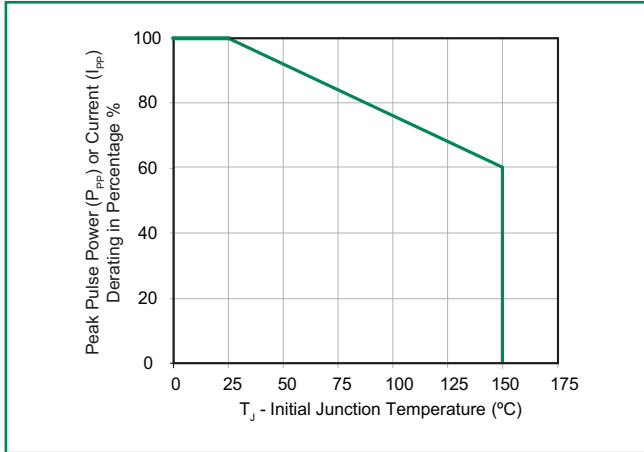
**Figure 2 - Peak Pulse Power Rating Curve**



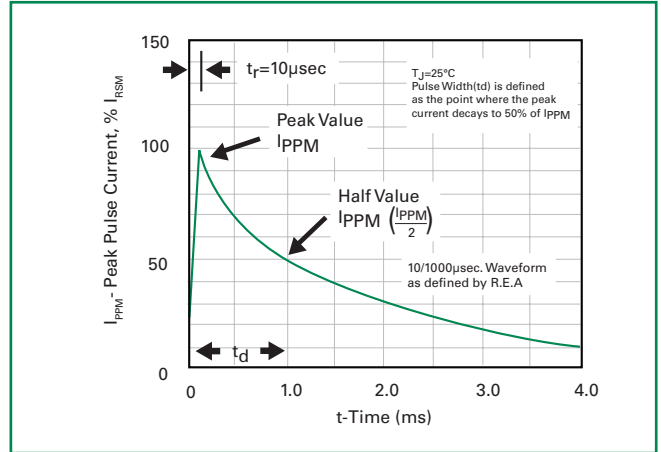
continues on next page.

**Ratings and Characteristic Curves ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Continued)**

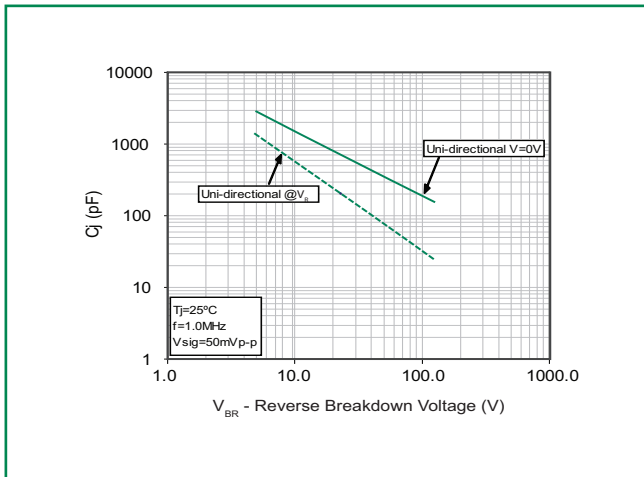
**Figure 3 - Pulse Derating Curve**



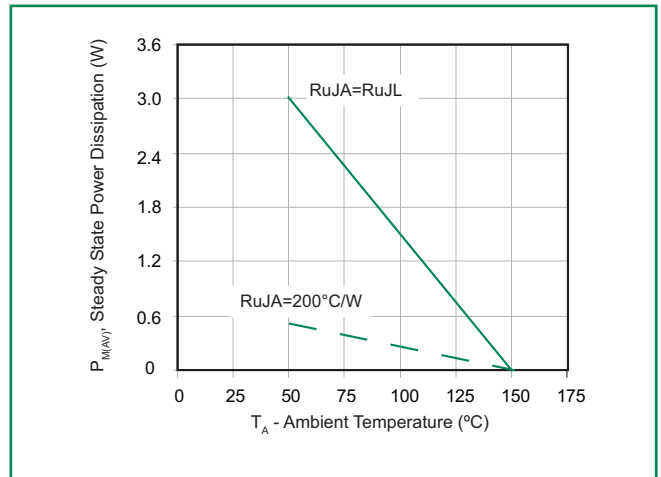
**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**

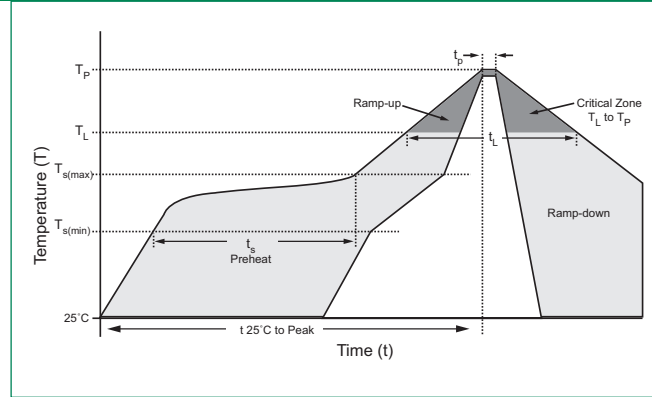


**Figure 6 - Steady State Power Dissipation Derating Curve**



**Soldering Parameters**

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | Lead-free assembly      |
| 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/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow   | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|  | - Time (min to max) ( $t_s$ )      | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                             |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 – 40 seconds         |
| Ramp-down Rate   |                                    | 6°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )                |                                    | 8 minutes Max.          |
| Do not exceed  |                                    | 260°C                   |



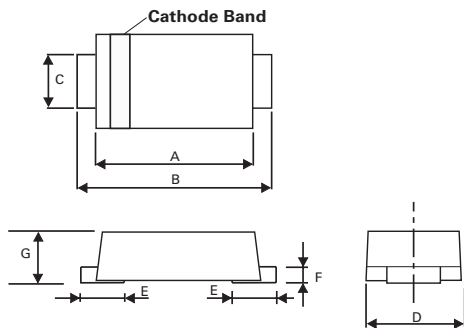
**Physical Specifications**

|                 |  |
|-----------------|--|
| <b>Weight</b>   | 0.002 ounce, 0.061 gram                                      |
| <b>Case</b>     | JEDEC DO-221AC Molded Plastic over glass passivated junction |
| <b>Polarity</b> | Color band denotes cathode except Bipolar                    |
| <b>Terminal</b> | Matte Tin-plated leads, Solderable per JESD22-B102D          |

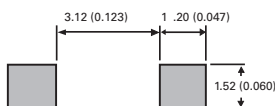
**Environmental Specifications**

|                            |                          |
|----------------------------|--------------------------|
| <b>High Temp. Storage</b>  | JESD22-A103              |
| <b>HTRB</b>                | JESD22-A108              |
| <b>Temperature Cycling</b> | JESD22-A104              |
| <b>MSL</b>                 | JEDEC-J-STD-020, Level 1 |
| <b>H3TRB</b>               | JESD22-A101              |
| <b>RSH</b>                 | JESD22-A111              |

**Dimensions**

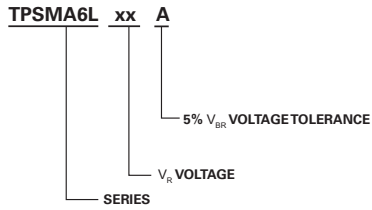


**Mounting Pad Layout**

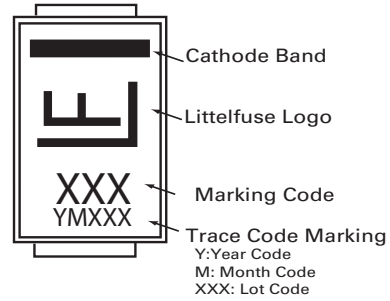


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.156  | 0.181 | 3.950       | 4.600 |
| B          | 0.189  | 0.220 | 4.800       | 5.600 |
| C          | 0.049  | 0.069 | 1.250       | 1.750 |
| D          | 0.088  | 0.116 | 2.250       | 2.950 |
| E          | 0.030  | 0.059 | 0.750       | 1.500 |
| F          | 0.005  | 0.010 | 0.125       | 0.250 |
| G          | 0.035  | 0.043 | 0.900       | 1.100 |

**Part Numbering System**



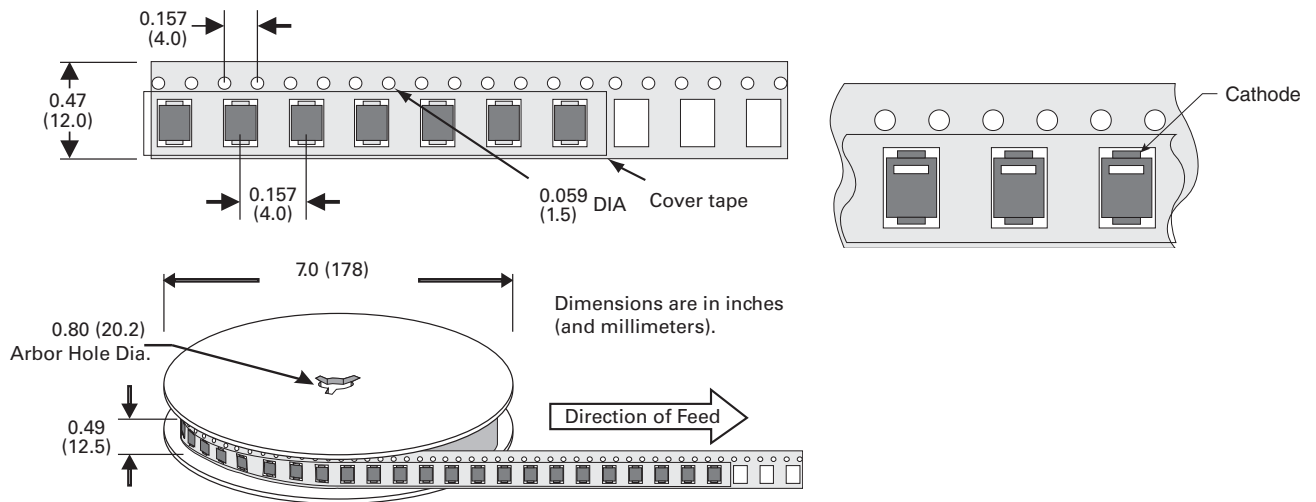
**Part Marking System**



**Packaging**

| Part number | Component Package | Quantity | Packaging Option           | Packaging Specification |
|-------------|-------------------|----------|----------------------------|-------------------------|
| TPSMA6LxxA  | DO-221AC          | 3000     | Tape & Reel – 12mm/7" tape | EIA RS-481              |

**Tape and Reel Specification**



## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View TPSMA6L16A on WIN SOURCE](#)

 [Littelfuse Inc. Information](#)

## Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management