

## TPSMC Series



### Agency Approvals

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

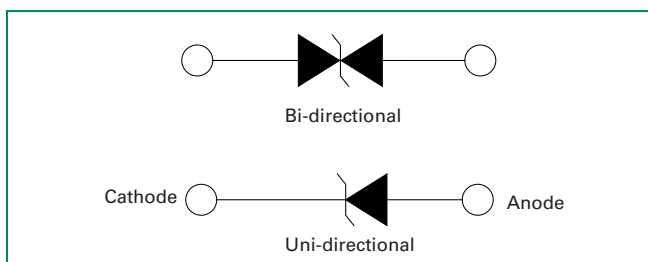
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                                            | Symbol                            | Value      | Unit |
|------------------------------------------------------------------------------------------------------|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation at T <sub>A</sub> =25°C by 10/1000µs Waveform (Fig.2)(Note 1), (Note 2) | P <sub>PPM</sub>                  | 1500       | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>A</sub> =50°C                                      | P <sub>M(AV)</sub>                | 6.5        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                                     | I <sub>FSM</sub>                  | 200        | A    |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only                                | V <sub>F</sub>                    | 3.5        | 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>uJL</sub>                  | 15         | °C/W |
| Typical Thermal Resistance Junction to Ambient                                                       | R <sub>uJA</sub>                  | 75         | °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 copper pad area of 0.31x0.31" (8.0 x 8.0mm) to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only, duty cycle=4 per minute maximum.

### Functional Diagram



### Description

The TPSMC series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

### Features

- Hi reliability application and automotive grade AEC-Q101 qualified
- For surface mounted applications to optimize board space
- Low profile package.
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Built-in strain relief
- $V_{BR} @ T_J = V_{BR} @ 25^{\circ}C \times (1 + \alpha T \times (T_J - 25))$  ( $\alpha$ : Temperature Coefficient)
- Glass passivated chip junction
- 1500W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01 %
- Fast response time: typically less than 1.0ps from 0V to BV min
- Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 1µA above 13V
- High temperature soldering guaranteed: 260°C/10 seconds at terminals
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Meet MSL level1, per J-STD-020, LF maximum peak of 260°C
- Matte tin lead-free plated
- Halogen free and 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)

### Applications

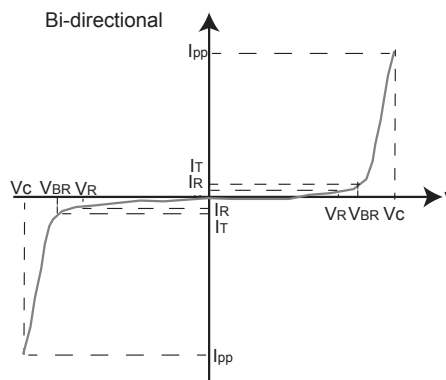
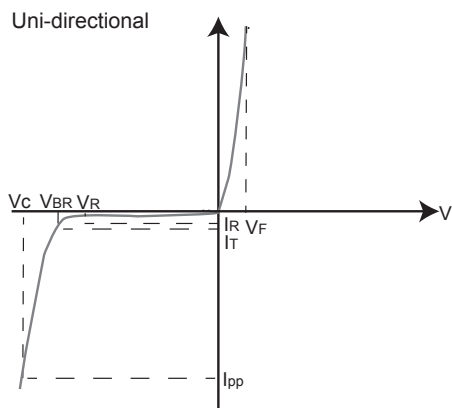
TVS devices are ideal for the protection of I/O Interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

### Electrical Characteristics

| Part Number (Uni) | Part Number (Bi) | 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) | Maximum Peak Pulse Current $I_{pp}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu$ A) | Agency Approval  |
|-------------------|------------------|---------|------|-----------------------------------------|--------------------------------------------|-------|-------------------------|-----------------------------------------------|-----------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                   |                  | UNI     | BI   |                                         | MIN                                        | MAX   |                         |                                               |                                         |                                                  |                                                                                                     |
| TPSMC12A          | TPSMC12CA        | 12AA    | 12CA | 10.20                                   | 11.40                                      | 12.60 | 1                       | 16.7                                          | 91.0                                    | 5                                                | X                                                                                                   |
| TPSMC13A          | TPSMC13CA        | 13AA    | 13CA | 11.10                                   | 12.40                                      | 13.70 | 1                       | 18.2                                          | 83.5                                    | 1                                                | X                                                                                                   |
| TPSMC15A          | TPSMC15CA        | 15AA    | 15CA | 12.80                                   | 14.30                                      | 15.80 | 1                       | 21.2                                          | 71.7                                    | 1                                                | X                                                                                                   |
| TPSMC16A          | TPSMC16CA        | 16AA    | 16CA | 13.60                                   | 15.20                                      | 16.80 | 1                       | 22.5                                          | 67.6                                    | 1                                                | X                                                                                                   |
| TPSMC18A          | TPSMC18CA        | 18AA    | 18CA | 15.30                                   | 17.10                                      | 18.90 | 1                       | 25.2                                          | 60.3                                    | 1                                                | X                                                                                                   |
| TPSMC20A          | TPSMC20CA        | 20AA    | 20CA | 17.10                                   | 19.00                                      | 21.00 | 1                       | 27.7                                          | 54.9                                    | 1                                                | X                                                                                                   |
| TPSMC22A          | TPSMC22CA        | 22AA    | 22CA | 18.80                                   | 20.90                                      | 23.10 | 1                       | 30.6                                          | 49.7                                    | 1                                                | X                                                                                                   |
| TPSMC24A          | TPSMC24CA        | 24AA    | 24CA | 20.50                                   | 22.80                                      | 25.20 | 1                       | 33.2                                          | 45.8                                    | 1                                                | X                                                                                                   |
| TPSMC27A          | TPSMC27CA        | 27AA    | 27CA | 23.10                                   | 25.70                                      | 28.40 | 1                       | 37.5                                          | 40.5                                    | 1                                                | X                                                                                                   |
| TPSMC30A          | TPSMC30CA        | 30AA    | 30CA | 25.60                                   | 28.50                                      | 31.50 | 1                       | 41.4                                          | 36.7                                    | 1                                                | X                                                                                                   |
| TPSMC33A          | TPSMC33CA        | 33AA    | 33CA | 28.20                                   | 31.40                                      | 34.70 | 1                       | 45.7                                          | 33.3                                    | 1                                                | X                                                                                                   |
| TPSMC36A          | TPSMC36CA        | 36AA    | 36CA | 30.80                                   | 34.20                                      | 37.80 | 1                       | 49.9                                          | 30.5                                    | 1                                                | X                                                                                                   |
| TPSMC39A          | TPSMC39CA        | 39AA    | 39CA | 33.30                                   | 37.10                                      | 41.00 | 1                       | 53.9                                          | 28.2                                    | 1                                                | X                                                                                                   |
| TPSMC43A          | TPSMC43CA        | 43AA    | 43CA | 36.80                                   | 40.90                                      | 45.20 | 1                       | 59.3                                          | 25.6                                    | 1                                                | X                                                                                                   |
| TPSMC47A          | TPSMC47CA        | 47AA    | 47CA | 40.20                                   | 44.70                                      | 49.40 | 1                       | 64.8                                          | 23.5                                    | 1                                                | X                                                                                                   |
| TPSMC51A          | TPSMC51CA        | 51AA    | 51CA | 43.60                                   | 48.50                                      | 53.60 | 1                       | 70.1                                          | 21.7                                    | 1                                                | X                                                                                                   |
| TPSMC56A          | TPSMC56CA        | 56AA    | 56CA | 47.80                                   | 53.20                                      | 58.80 | 1                       | 77.0                                          | 19.7                                    | 1                                                | X                                                                                                   |
| TPSMC62A          | TPSMC62CA        | 62AA    | 62CA | 53.00                                   | 58.90                                      | 65.10 | 1                       | 85.0                                          | 17.9                                    | 1                                                | X                                                                                                   |
| TPSMC68A          | TPSMC68CA        | 68AA    | 68CA | 58.10                                   | 64.60                                      | 71.40 | 1                       | 92.0                                          | 16.5                                    | 1                                                | X                                                                                                   |
| TPSMC75A          | TPSMC75CA        | 75AA    | 75CA | 64.10                                   | 71.30                                      | 78.80 | 1                       | 103.0                                         | 14.8                                    | 1                                                | X                                                                                                   |
| TPSMC82A          | TPSMC82CA        | 82AA    | 82CA | 70.10                                   | 77.90                                      | 86.10 | 1                       | 113.0                                         | 13.5                                    | 1                                                | X                                                                                                   |
| TPSMC91A          | TPSMC91CA        | 91AA    | 91CA | 77.80                                   | 86.50                                      | 95.50 | 1                       | 125.0                                         | 12.2                                    | 1                                                | X                                                                                                   |

For bidirectional type having  $V_R$  of 10 volts and less, the  $I_R$  limit is double.

## I-V Curve Characteristics



**P<sub>PPM</sub>** Peak Pulse Power Dissipation – Max power dissipation

**V<sub>R</sub>** Stand-off Voltage – Maximum voltage that can be applied to the TVS without operation

**V<sub>BR</sub>** Breakdown Voltage – Maximum voltage that flows through the TVS at a specified test current (I<sub>T</sub>)

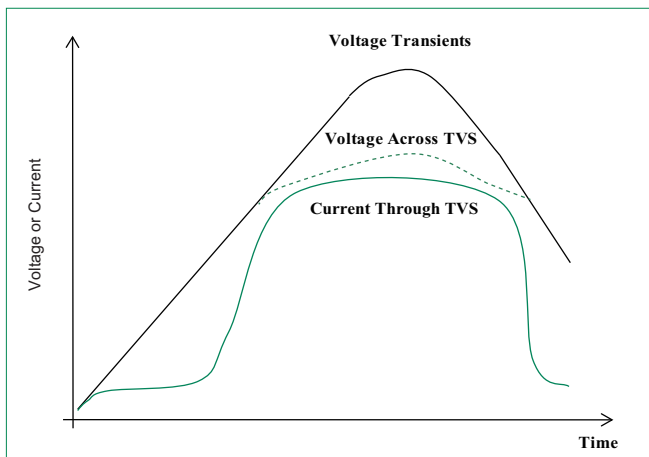
**V<sub>C</sub>** Clamping Voltage – Peak voltage measured across the TVS at a specified I<sub>ppm</sub> (peak impulse current)

**I<sub>R</sub>** Reverse Leakage Current – Current measured at V<sub>R</sub>

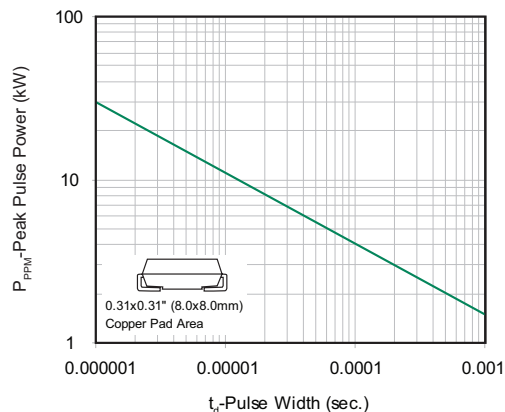
**V<sub>F</sub>** Forward Voltage Drop for Uni-directional

## Ratings and Characteristic Curves (T<sub>A</sub>=25°C unless otherwise noted)

**Figure 1 - TVS Transients Clamping Waveform**



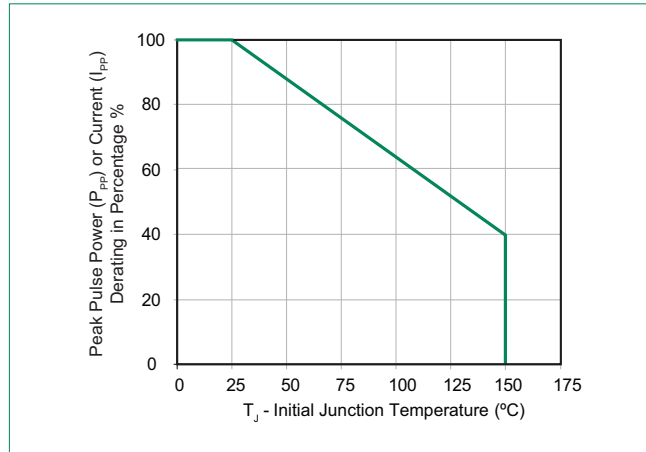
**Figure 2 - Peak Pulse Power Rating**



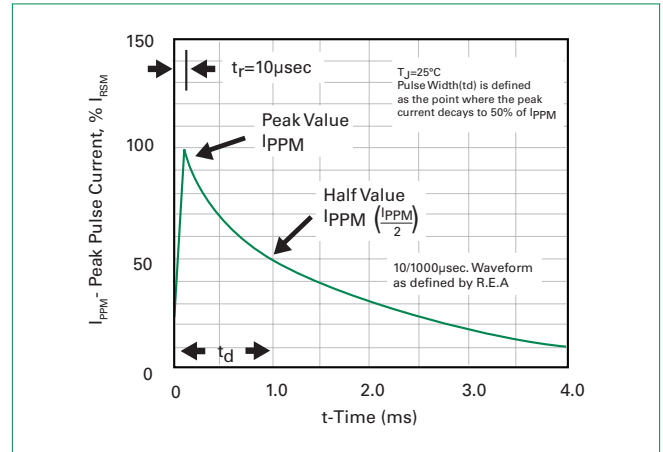
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**Ratings and Characteristic Curves** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Continued)

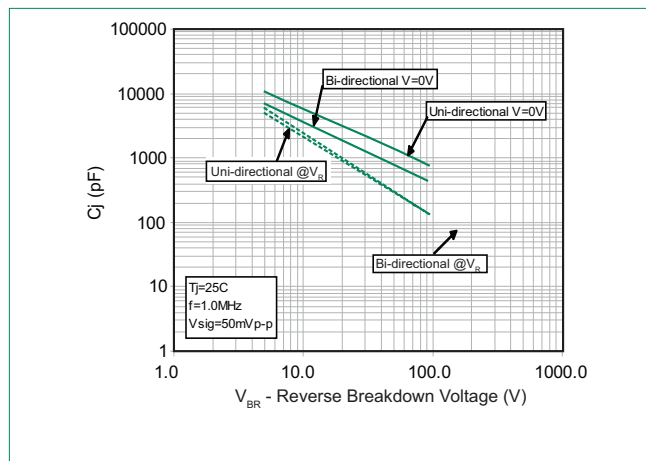
**Figure 3 - Peak Pulse Power Derating Curve**



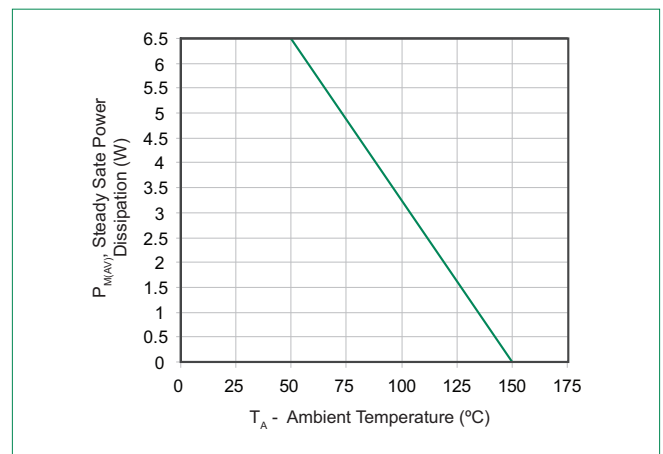
**Figure 4 - Pulse Waveform**



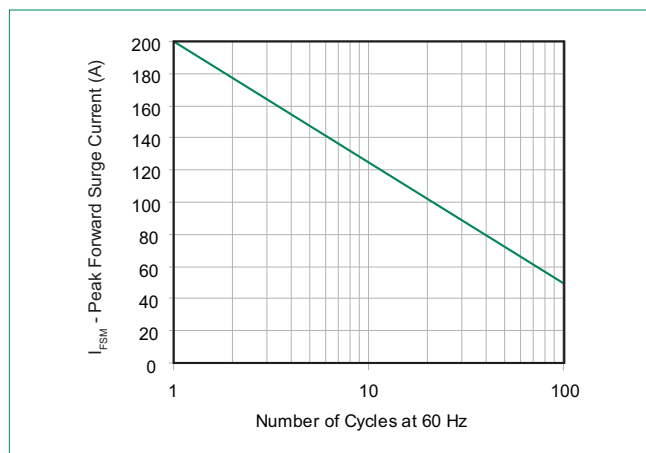
**Figure 5 - Typical Junction Capacitance**



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

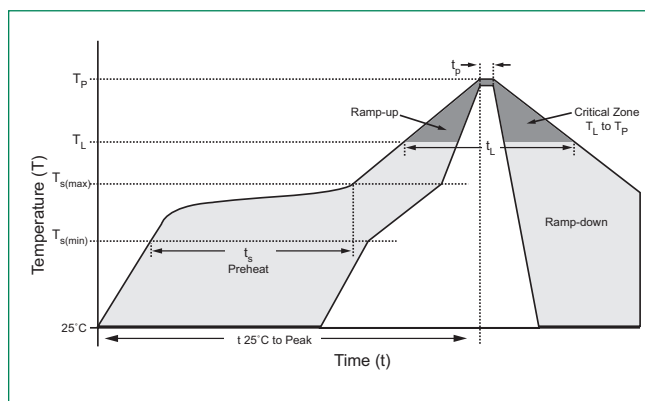


**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



## 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 – 120 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 ( $t_p$ )  |                                    | 30 seconds max          |
| Ramp-down Rate                                        |                                    | 6°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )               |                                    | 8 minutes max.          |
| Do not exceed                                         |                                    | 260°C                   |



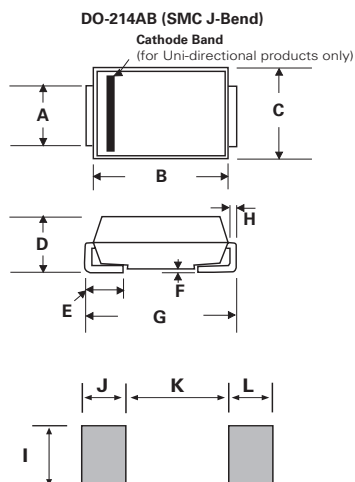
## Physical Specifications

|                 |                                                                   |
|-----------------|-------------------------------------------------------------------|
| <b>Weight</b>   | 0.007 ounce, 0.21 grams                                           |
| <b>Case</b>     | JEDEC DO214AB. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes positive end (cathode) except Bidirectional.   |
| <b>Terminal</b> | Matte Tin-plated leads, Solderable per JESD22-B102                |

## Environmental Specifications

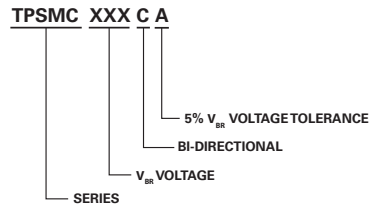
|                            |                          |
|----------------------------|--------------------------|
| <b>High Temp. Storage</b>  | JESD22-A103              |
| <b>HTRB</b>                | JESD22-A108              |
| <b>Temperature Cycling</b> | JESD22-A104              |
| <b>MSL</b>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

## Dimensions

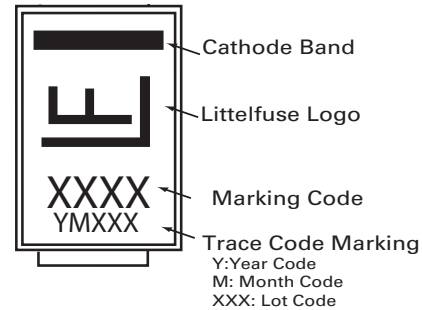


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.114  | 0.126 | 2.900       | 3.200 |
| B          | 0.260  | 0.280 | 6.600       | 7.110 |
| C          | 0.220  | 0.245 | 5.590       | 6.220 |
| D          | 0.079  | 0.103 | 2.060       | 2.620 |
| E          | 0.030  | 0.060 | 0.760       | 1.520 |
| F          | -      | 0.008 | -           | 0.203 |
| G          | 0.305  | 0.320 | 7.750       | 8.130 |
| H          | 0.006  | 0.012 | 0.152       | 0.305 |
| I          | 0.129  | -     | 3.300       | -     |
| J          | 0.094  | -     | 2.400       | -     |
| K          | -      | 0.165 | -           | 4.200 |
| L          | 0.094  | -     | 2.400       | -     |

## Part Numbering System



## Part Marking System



## Packaging

| Part number | Component Package | Quantity | Packaging Option                 | Packaging Specification |
|-------------|-------------------|----------|----------------------------------|-------------------------|
| TPSMCxxxXX  | DO-214AB          | 3000     | Tape & Reel - 16mm tape/13" reel | EIA STD RS-481          |

## Tape and Reel Specification

