



**THE DATASHEET OF
TPSMB13A-801E3**



TPSMB Series



Agency Approvals

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

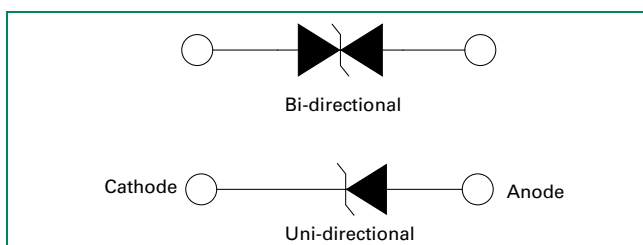
Maximum Ratings and Thermal Characteristics (T_A=25°C unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|--------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs waveform (Fig.1)(Note 1), (Note 2) | P _{PPM} | 600 | W |
| Power Dissipation on infinite heat sink at T _L =50°C | P _{M(AV)} | 5.0 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | I _{FSM} | 100 | A |
| Maximum Instantaneous Forward Voltage at 50A for Unidirectional only (Note 4) | V _F | 3.5 | V |
| Operating Junction Temperature Range (V _{BR} ≤ 91V) | T _J | -65 to 175 | °C |
| Operating Junction Temperature Range (V _{BR} > 91V) | T _J | -65 to 150 | |
| Storage Temperature Range | T _{STG} | -65 to 175 | |
| Typical Thermal Resistance Junction to Lead | R _{θJL} | 20 | °C/W |
| Typical Thermal Resistance Junction to Ambient | R _{θJA} | 100 | °C/W |

Notes:

1. Non-repetitive current pulse, per Fig.4 and derated above T_A=25°C per Fig. 3.
2. Mounted on copper pad area of 0.2x0.2" (5.0 x 5.0mm) to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional component only, duty cycle=4 per minute maximum.
4. VF < 3.5V for part number below 300A, VF < 5.0V for part number with 300A or above.

Functional Diagram



Description

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

Features

- High reliability application and automotive grade AEC Q101 qualified
- Surface mount component 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
- ESD protection of data lines in accordance with IEC 61000-4-2 30kV(Air), 30kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Glass passivated chip junction
- 600W PPM (peak pulse power) capability at 10/1000µs waveform, repetition rate (duty cycles):0.01%
- Fast response time: typically less than 1.0ns from 0V to V_{BR} min
- Excellent clamping capability
- Low incremental surge resistance
- Typical I_R ≤ 1µA for V_R>10.2V
- UL Recognized compound meeting flammability rating V-0
- Meet MSL level1, per J-STD-020, High temperature soldering guaranteed: 260°C/10 seconds at terminals
- 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 components are ideal for the protection of I/O Interfaces, V_{CC} bus and other vulnerable circuits used in Automotive applications.

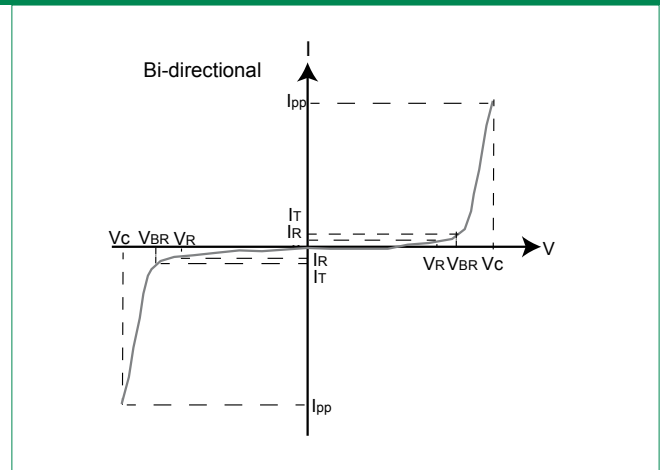
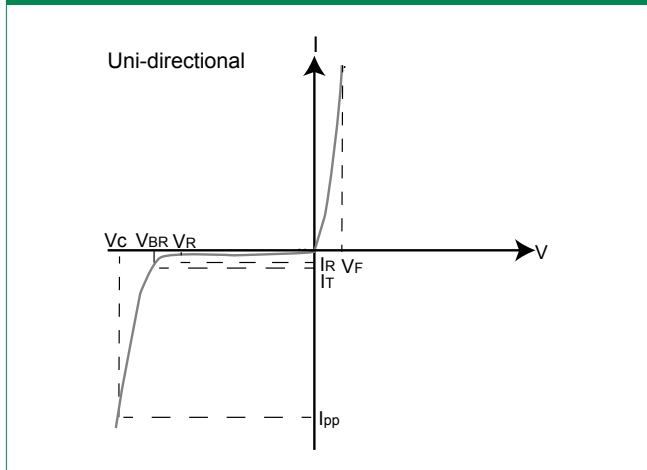
Electrical Characteristics (T_A=25°C unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Marking | | Typical I _s @ 150°C (μA) | 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 (μA) | Maximum Temperature coefficient of V _{BR} (%/°C) | Agency Approval  |
|-------------------|------------------|---------|------|-------------------------------------|--|--|--------|----------------------------------|---|--|--|---|---|
| | | UNI | BI | | | MIN | MAX | | | | | | |
| TPSMB75A | - | 7V5AA | - | 500 | 6.40 | 7.13 | 7.88 | 10 | 11.3 | 54.0 | 500 | 0.052 | X |
| TPSMB8.2A | - | 8V2AA | - | 200 | 7.02 | 7.79 | 8.61 | 10 | 12.1 | 50.4 | 200 | 0.058 | X |
| TPSMB9.1A | - | 9V1AA | - | 50 | 7.78 | 8.65 | 9.55 | 1 | 13.4 | 45.5 | 50 | 0.063 | X |
| TPSMB10A | TPSMB10CA | 10AA | 10CA | 20 | 8.55 | 9.50 | 10.50 | 1 | 14.5 | 42.1 | 10 | 0.066 | X |
| TPSMB11A | TPSMB11CA | 11AA | 11CA | 8 | 9.40 | 10.50 | 11.60 | 1 | 15.6 | 39.1 | 5 | 0.069 | X |
| TPSMB12A | TPSMB12CA | 12AA | 12CA | 8 | 10.20 | 11.40 | 12.60 | 1 | 16.7 | 36.5 | 5 | 0.071 | X |
| TPSMB13A | TPSMB13CA | 13AA | 13CA | 8 | 11.10 | 12.40 | 13.70 | 1 | 18.2 | 33.5 | 1 | 0.074 | X |
| TPSMB15A | TPSMB15CA | 15AA | 15CA | 8 | 12.80 | 14.30 | 15.80 | 1 | 21.2 | 28.8 | 1 | 0.076 | X |
| TPSMB16A | TPSMB16CA | 16AA | 16CA | 8 | 13.60 | 15.20 | 16.80 | 1 | 22.5 | 27.1 | 1 | 0.080 | X |
| TPSMB18A | TPSMB18CA | 18AA | 18CA | 8 | 15.30 | 17.10 | 18.90 | 1 | 25.5 | 24.2 | 1 | 0.083 | X |
| TPSMB20A | TPSMB20CA | 20AA | 20CA | 8 | 17.10 | 19.00 | 21.00 | 1 | 27.7 | 22.0 | 1 | 0.085 | X |
| TPSMB22A | TPSMB22CA | 22AA | 22CA | 8 | 18.80 | 20.90 | 23.10 | 1 | 30.6 | 19.9 | 1 | 0.088 | X |
| TPSMB24A | TPSMB24CA | 24AA | 24CA | 8 | 20.50 | 22.80 | 25.20 | 1 | 33.2 | 18.4 | 1 | 0.091 | X |
| TPSMB27A | TPSMB27CA | 27AA | 27CA | 8 | 23.10 | 25.70 | 28.40 | 1 | 37.5 | 16.3 | 1 | 0.092 | X |
| TPSMB30A | TPSMB30CA | 30AA | 30CA | 8 | 25.60 | 28.50 | 31.50 | 1 | 41.4 | 14.7 | 1 | 0.093 | X |
| TPSMB33A | TPSMB33CA | 33AA | 33CA | 8 | 28.20 | 31.40 | 34.70 | 1 | 45.7 | 13.3 | 1 | 0.094 | X |
| TPSMB36A | TPSMB36CA | 36AA | 36CA | 8 | 30.80 | 34.20 | 37.80 | 1 | 49.9 | 12.2 | 1 | 0.096 | X |
| TPSMB39A | TPSMB39CA | 39AA | 39CA | 8 | 33.30 | 37.10 | 41.00 | 1 | 53.9 | 11.3 | 1 | 0.097 | X |
| TPSMB43A | TPSMB43CA | 43AA | 43CA | 8 | 36.80 | 40.90 | 45.20 | 1 | 59.3 | 10.3 | 1 | 0.098 | X |
| TPSMB47A | TPSMB47CA | 47AA | 47CA | 8 | 40.20 | 44.70 | 49.40 | 1 | 64.8 | 9.4 | 1 | 0.099 | X |
| TPSMB51A | TPSMB51CA | 51AA | 51CA | 8 | 43.60 | 48.50 | 53.60 | 1 | 70.1 | 8.7 | 1 | 0.100 | X |
| TPSMB56A | TPSMB56CA | 56AA | 56CA | 8 | 47.80 | 53.20 | 58.80 | 1 | 77.0 | 7.9 | 1 | 0.101 | X |
| TPSMB58A | TPSMB58CA | 58AA | 58CA | 8 | 52.78 | 55.10 | 60.90 | 1 | 79.8 | 7.7 | 1 | 0.101 | - |
| TPSMB62A | TPSMB62CA | 62AA | 62CA | 8 | 53.00 | 58.90 | 65.10 | 1 | 85.0 | 7.2 | 1 | 0.102 | X |
| TPSMB68A | TPSMB68CA | 68AA | 68CA | 8 | 58.10 | 64.60 | 71.40 | 1 | 92.0 | 6.6 | 1 | 0.103 | X |
| TPSMB75A | TPSMB75CA | 75AA | 75CA | 8 | 64.10 | 71.30 | 78.80 | 1 | 103.0 | 5.9 | 1 | 0.104 | X |
| TPSMB82A | TPSMB82CA | 82AA | 82CA | 8 | 70.10 | 77.90 | 86.10 | 1 | 113.0 | 5.4 | 1 | 0.105 | X |
| TPSMB91A | TPSMB91CA | 91AA | 91CA | 8 | 77.80 | 86.50 | 95.50 | 1 | 125.0 | 4.9 | 1 | 0.106 | X |
| TPSMB100A | TPSMB100CA | 100A | 100C | 8 | 85.50 | 95.00 | 105.00 | 1 | 137.0 | 4.5 | 1 | 0.106 | X |
| TPSMB110A | TPSMB110CA | 110A | 110C | 8 | 94.00 | 105.00 | 116.00 | 1 | 152.0 | 4.0 | 1 | 0.107 | X |
| TPSMB120A | TPSMB120CA | 120A | 120C | 8 | 102.00 | 114.00 | 126.00 | 1 | 165.0 | 3.7 | 1 | 0.107 | X |
| TPSMB130A | TPSMB130CA | 130A | 130C | 8 | 111.00 | 124.00 | 137.00 | 1 | 179.0 | 3.4 | 1 | 0.107 | X |
| TPSMB150A | TPSMB150CA | 150A | 150C | 8 | 128.00 | 143.00 | 158.00 | 1 | 207.0 | 2.9 | 1 | 0.108 | X |
| TPSMB160A | TPSMB160CA | 160A | 160C | 8 | 136.00 | 152.00 | 168.00 | 1 | 219.0 | 2.8 | 1 | 0.108 | X |
| TPSMB170A | TPSMB170CA | 170A | 170C | 8 | 145.00 | 162.00 | 179.00 | 1 | 234.0 | 2.6 | 1 | 0.108 | X |
| TPSMB180A | TPSMB180CA | 180A | 180C | 8 | 154.00 | 171.00 | 189.00 | 1 | 246.0 | 2.5 | 1 | 0.108 | X |
| TPSMB200A | TPSMB200CA | 200A | 200C | 8 | 171.00 | 190.00 | 210.00 | 1 | 274.0 | 2.2 | 1 | 0.108 | X |
| TPSMB210A | TPSMB210CA | 210A | 210C | 8 | 179.60 | 199.50 | 220.50 | 1 | 288.0 | 2.1 | 1 | 0.110 | - |
| TPSMB220A | TPSMB220CA | 220A | 220C | 8 | 185.00 | 209.00 | 231.00 | 1 | 328.0 | 1.9 | 1 | 0.110 | X |
| TPSMB250A | TPSMB250CA | 250A | 250C | 8 | 214.00 | 237.00 | 263.00 | 1 | 344.0 | 1.8 | 1 | 0.110 | X |
| TPSMB300A-A | TPSMB300CA-A | 300A | 300C | 8 | 256.00 | 285.00 | 315.00 | 1 | 414.0 | 1.5 | 1 | 0.110 | X |
| TPSMB350A-A | TPSMB350CA-A | 350A | 350C | 8 | 300.00 | 332.00 | 368.00 | 1 | 482.0 | 1.3 | 1 | 0.112 | - |
| TPSMB400A-A | TPSMB400CA-A | 400A | 400C | 8 | 342.00 | 380.00 | 420.00 | 1 | 548.0 | 1.1 | 1 | 0.112 | - |
| TPSMB440A-A | TPSMB440CA-A | 440A | 440C | 8 | 376.00 | 418.00 | 462.00 | 1 | 602.0 | 1.0 | 1 | 0.112 | - |
| TPSMB480A-A | TPSMB480CA-A | 480A | 480C | 8 | 408.00 | 456.00 | 504.00 | 1 | 658.0 | 0.9 | 1 | 0.112 | - |
| TPSMB510A-A | TPSMB510CA-A | 510A | 510C | 8 | 434.00 | 485.00 | 535.00 | 1 | 698.0 | 0.9 | 1 | 0.112 | - |
| TPSMB520A-A | TPSMB520CA-A | 520A | 520C | 8 | 443.00 | 494.50 | 545.50 | 1 | 718.0 | 0.9 | 1 | 0.112 | - |
| TPSMB530A-A | TPSMB530CA-A | 530A | 530C | 8 | 451.00 | 503.50 | 556.50 | 1 | 725.0 | 0.8 | 1 | 0.112 | - |
| TPSMB540A-A | TPSMB540CA-A | 540A | 540C | 8 | 460.00 | 513.00 | 567.00 | 1 | 740.0 | 0.8 | 1 | 0.112 | - |
| TPSMB550A-A | TPSMB550CA-A | 550A | 550C | 8 | 468.00 | 522.50 | 577.50 | 1 | 760.0 | 0.8 | 1 | 0.112 | - |
| - | TPSMB600CA-A | - | 600C | 8 | 511.00 | 570.00 | 630.00 | 1 | 828.0 | 0.8 | 1 | 0.112 | - |
| - | TPSMB650CA-A | - | 650C | 8 | 553.00 | 617.50 | 682.50 | 1 | 897.0 | 0.8 | 1 | 0.112 | - |

Note:

- For bidirectional type having V_s of 10 volts and less, the I_s limit is double.
- V_{BR} @ T_J = V_{BR} @ 25°C x (1 + αT x (T_J - 25)) (αT: Temperature Coefficient).
- The CTI (Comparative Tracking Index) of TPSMB600CA-A and TPSMB650CA-A is 600 and other parts is 550

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 TVS 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

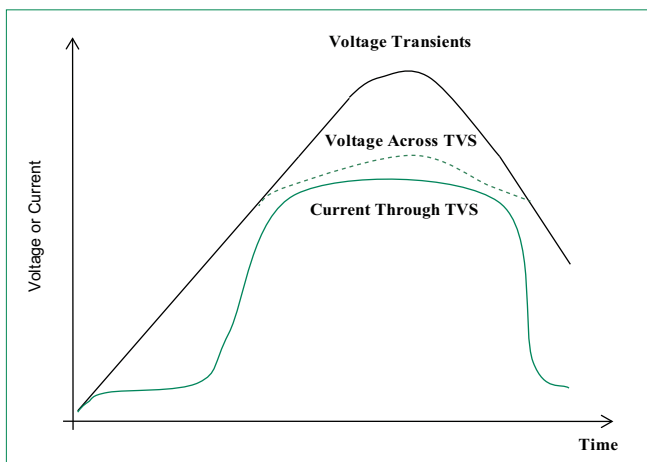
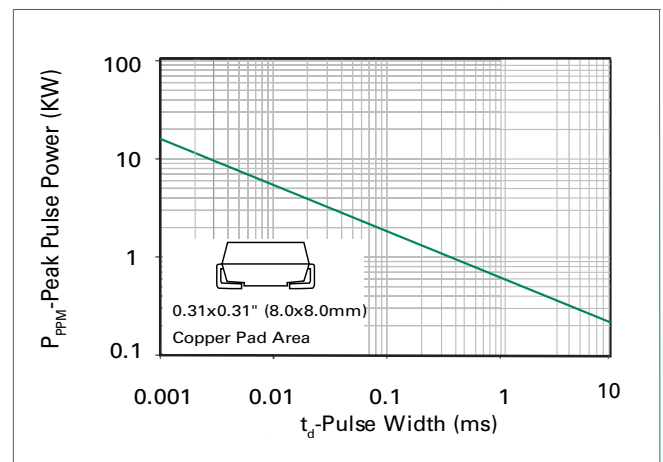


Figure 2 - Peak Pulse Power Rating Curve



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

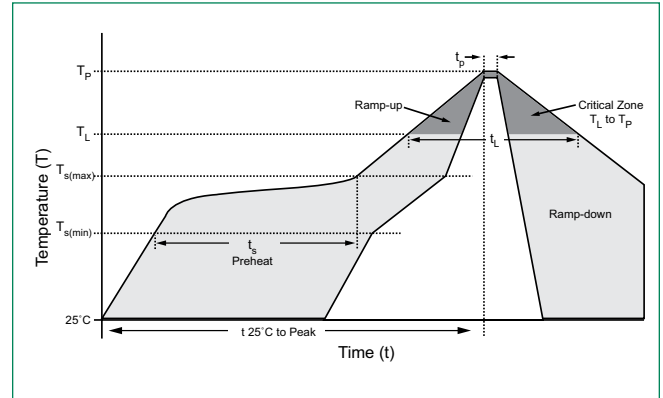


Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



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 ^{+0/-5} °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 |



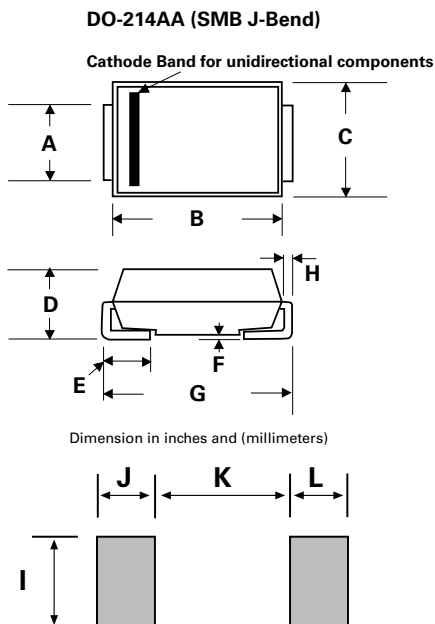
Physical Specifications

| | |
|-----------------|---|
| Weight | 0.003 ounce, 0.093 grams |
| Case | JEDEC DO214AA. Molded plastic body over glass passivated junction |
| Polarity | Color band denotes cathode for unidirectional components. |
| Terminal | Matte Tin-plated leads, Solderable per JESD22-B102 |

Environmental Specifications

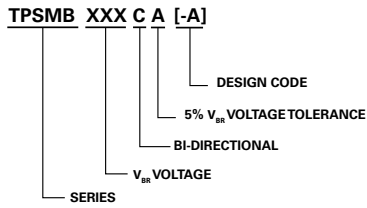
| | |
|----------------------------|--------------------------|
| High Temp. Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Temperature Cycling | JESD22-A104 |
| MSL | JEDEC-J-STD-020, Level 1 |
| H3TRB | JESD22-A101 |
| RSH | JESD22-A111 |

Dimensions

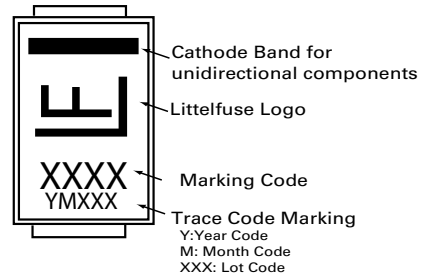


| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.077 | 0.086 | 1.950 | 2.200 |
| B | 0.160 | 0.180 | 4.060 | 4.570 |
| C | 0.130 | 0.155 | 3.300 | 3.940 |
| D | 0.084 | 0.096 | 2.130 | 2.440 |
| E | 0.030 | 0.060 | 0.760 | 1.520 |
| F | - | 0.008 | - | 0.203 |
| G | 0.205 | 0.220 | 5.210 | 5.590 |
| H | 0.006 | 0.012 | 0.152 | 0.305 |
| I | 0.089 | - | 2.260 | - |
| J | 0.085 | - | 2.160 | - |
| K | - | 0.107 | - | 2.740 |
| L | 0.085 | - | 2.160 | - |

Part Numbering System



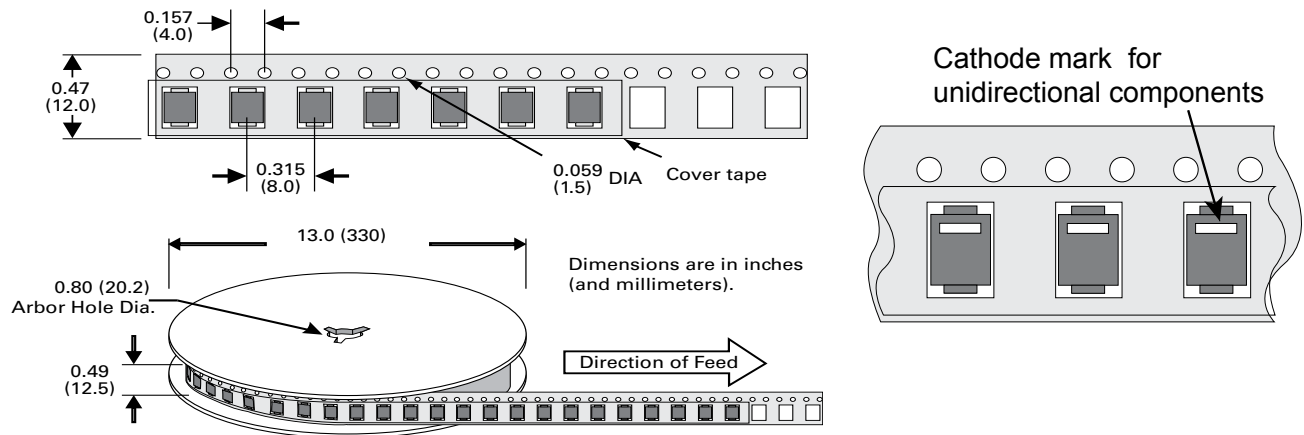
Part Marking System



Packaging

| Part number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|----------------------------------|-------------------------|
| TPSMBxxxXX | DO-214AA | 3000 | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481 |

Tape and Reel Specification



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