

TPSMC-VR Series

Surface Mount – 1500W



Agency Approvals

| Agency | Agency File Number |
|--------|--------------------|
| | E230531 |

Maximum Ratings and Thermal Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|--|-----------------|------------|----------------------|
| Peak Pulse Power Dissipation (IPP x VC) by 10/1000 μs Waveform (Fig.2) (Note 1), (Note 2) | P_{PPM} | 1500 | W |
| Power Dissipation on Infinite Heat Sink at $T_A=50^{\circ}\text{C}$ | P_{MAV} | 6.5 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave | I_{FSM} | 200 | A |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only (Note 4) | V_F | 3.5 | V |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -65 to 150 | $^{\circ}\text{C}$ |
| Typical Thermal Resistance Junction to Lead | $R_{\theta JL}$ | 15 | $^{\circ}\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | 75 | $^{\circ}\text{C/W}$ |

Notes:

- Non-repetitive current pulse per Fig. 4 and derated above $T_A = 25^{\circ}\text{C}$ per Fig. 3.
- Mounted on copper pad area of 0.31x0.31" (8.0 x 8.0mm) to each terminal.
- Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional component only, duty cycle=4 per minute maximum.

Description

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

Features & Benefits

- 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
- Built-in strain relief
- Glass passivated chip junction
- 1500W peak pulse power capability at 10/1000 μs waveform, repetition rate (duty cycles):0.01%
- Fast response time: typically less than 1.0ps from 0V to VBR min
- Excellent clamping capability
- Low incremental surge resistance
- UL Recognized compound meeting flammability rating V-0.
- Meet MSL level1, per J-STD-020, High temperature soldering guaranteed: 260 $^{\circ}\text{C}$ /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)

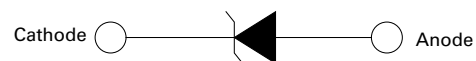
Applications

TVS components are ideal for the protection of I/O Interfaces, V_{CC} bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

Functional Diagram



Bi-directional




Uni-directional

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Electrical Characteristics

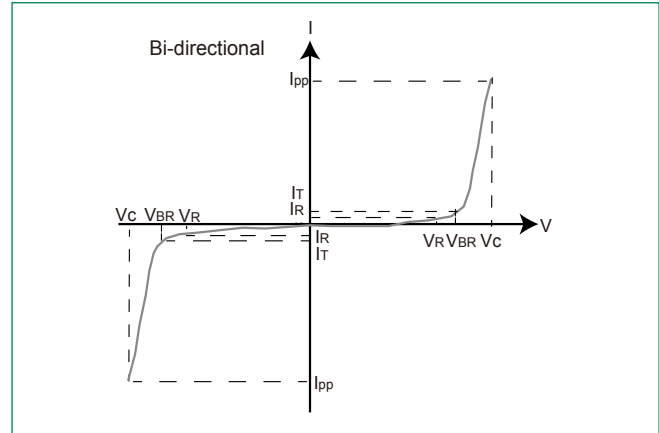
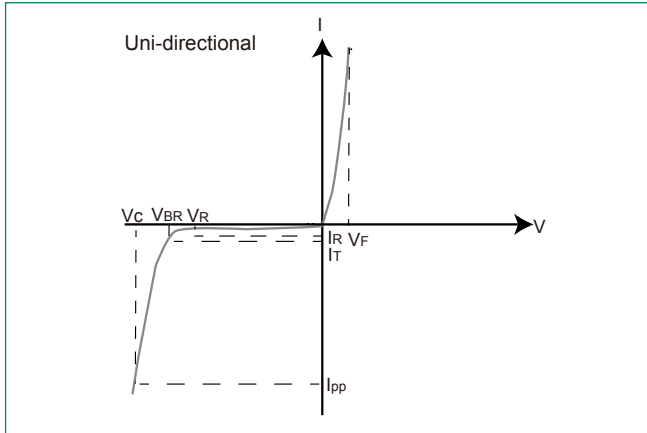
| Part Number (Uni) | Part Number (Bi) | Marking | | Reverse Stand off Voltage V_R (Volts) | Breakdown Voltage V_{BR} (Volts) @ I_T | | Test Current I_T (mA) | Maximum Clamping Voltage V_C @ I_{PP} (V) | Maximum Peak Pulse Current I_{PP} (A) | Maximum Reverse Leakage I_R @ V_R (μ A) | Maximum Temperature coefficient of V_{BR} (%/C) | Agency Approval  |
|-------------------|------------------|---------|------|---|--|--------|-------------------------|---|---|--|---|---|
| | | UNI | BI | | MIN | MAX | | | | | | |
| TPSMC11A-VR | TPSMC11CA-VR | GDZA | BDZA | 11.0 | 12.20 | 13.50 | 1 | 18.2 | 82.5 | 1 | 0.074 | X |
| TPSMC12A-VR | TPSMC12CA-VR | GEEA | BEEA | 12.0 | 13.30 | 14.70 | 1 | 19.9 | 75.4 | 1 | 0.075 | X |
| TPSMC13A-VR | TPSMC13CA-VR | GEGA | BEGA | 13.0 | 14.40 | 15.90 | 1 | 21.5 | 69.8 | 1 | 0.076 | X |
| TPSMC14A-VR | TPSMC14CA-VR | GEKA | BEKA | 14.0 | 15.60 | 17.20 | 1 | 23.2 | 64.7 | 1 | 0.080 | |
| TPSMC15A-VR | TPSMC15CA-VR | GEMA | BEMA | 15.0 | 16.70 | 18.50 | 1 | 24.4 | 61.5 | 1 | 0.083 | X |
| TPSMC16A-VR | TPSMC16CA-VR | GEPA | BEPA | 16.0 | 17.80 | 19.70 | 1 | 26.0 | 57.7 | 1 | 0.084 | X |
| TPSMC17A-VR | TPSMC17CA-VR | GERA | BERA | 17.0 | 18.90 | 20.90 | 1 | 27.6 | 54.4 | 1 | 0.085 | |
| TPSMC18A-VR | TPSMC18CA-VR | GETA | BETA | 18.0 | 20.00 | 22.10 | 1 | 29.2 | 51.4 | 1 | 0.088 | X |
| TPSMC20A-VR | TPSMC20CA-VR | GEVA | BEVA | 20.0 | 22.20 | 24.50 | 1 | 32.4 | 46.3 | 1 | 0.091 | X |
| TPSMC22A-VR | TPSMC22CA-VR | GEXA | BEXA | 22.0 | 24.40 | 26.90 | 1 | 35.5 | 42.3 | 1 | 0.092 | X |
| TPSMC24A-VR | TPSMC24CA-VR | GEZA | BEZA | 24.0 | 26.70 | 29.50 | 1 | 38.9 | 38.6 | 1 | 0.092 | X |
| TPSMC26A-VR | TPSMC26CA-VR | GFEA | BFEA | 26.0 | 28.90 | 31.90 | 1 | 42.1 | 35.7 | 1 | 0.093 | |
| TPSMC28A-VR | TPSMC28CA-VR | GFGA | BFGA | 28.0 | 31.10 | 34.40 | 1 | 45.4 | 33.1 | 1 | 0.094 | |
| TPSMC30A-VR | TPSMC30CA-VR | GFKA | BFKA | 30.0 | 33.30 | 36.80 | 1 | 48.4 | 31.0 | 1 | 0.096 | X |
| TPSMC33A-VR | TPSMC33CA-VR | GFMA | BFMA | 33.0 | 36.70 | 40.60 | 1 | 53.3 | 28.2 | 1 | 0.097 | X |
| TPSMC36A-VR | TPSMC36CA-VR | GFPA | BFPA | 36.0 | 40.00 | 44.20 | 1 | 58.1 | 25.9 | 1 | 0.098 | X |
| TPSMC40A-VR | TPSMC40CA-VR | GFRA | BFRA | 40.0 | 44.40 | 49.10 | 1 | 64.5 | 23.3 | 1 | 0.099 | |
| TPSMC43A-VR | TPSMC43CA-VR | GFTA | BFTA | 43.0 | 47.80 | 52.80 | 1 | 69.4 | 21.7 | 1 | 0.100 | X |
| TPSMC45A-VR | TPSMC45CA-VR | GFVA | BFVA | 45.0 | 50.00 | 55.30 | 1 | 72.7 | 20.6 | 1 | 0.101 | |
| TPSMC48A-VR | TPSMC48CA-VR | GFXA | BFXA | 48.0 | 53.30 | 58.90 | 1 | 77.4 | 19.4 | 1 | 0.101 | |
| TPSMC51A-VR | TPSMC51CA-VR | GFZA | BFZA | 51.0 | 56.70 | 62.70 | 1 | 82.4 | 18.2 | 1 | 0.101 | X |
| TPSMC54A-VR | TPSMC54CA-VR | GGEA | BGEA | 54.0 | 60.00 | 66.30 | 1 | 87.1 | 17.3 | 1 | 0.102 | |
| TPSMC58A-VR | TPSMC58CA-VR | GGGA | BGGA | 58.0 | 64.40 | 71.20 | 1 | 93.6 | 16.1 | 1 | 0.103 | |
| TPSMC60A-VR | TPSMC60CA-VR | GGKA | BGKA | 60.0 | 66.70 | 73.70 | 1 | 96.8 | 15.5 | 1 | 0.103 | |
| TPSMC64A-VR | TPSMC64CA-VR | GGMA | BGMA | 64.0 | 71.10 | 78.60 | 1 | 103.0 | 14.6 | 1 | 0.104 | |
| TPSMC70A-VR | TPSMC70CA-VR | GGPA | BGPA | 70.0 | 77.80 | 86.00 | 1 | 113.0 | 13.3 | 1 | 0.105 | |
| TPSMC75A-VR | TPSMC75CA-VR | GGRA | BGRA | 75.0 | 83.30 | 92.10 | 1 | 121.0 | 12.4 | 1 | 0.106 | X |
| TPSMC78A-VR | TPSMC78CA-VR | GGTA | BGTA | 78.0 | 86.70 | 95.80 | 1 | 126.0 | 11.9 | 1 | 0.106 | |
| TPSMC85A-VR | TPSMC85CA-VR | GGVA | BGVA | 85.0 | 94.40 | 104.00 | 1 | 137.0 | 11.0 | 1 | 0.106 | |
| TPSMC90A-VR | TPSMC90CA-VR | GHEA | BHEA | 90 | 100 | 111 | 1 | 145.4 | 10.3 | 1 | 0.107 | |
| TPSMC100A-VR | TPSMC100CA-VR | GHFA | BHFA | 100 | 111 | 123 | 1 | 159.9 | 9.4 | 1 | 0.107 | X |
| TPSMC110A-VR | TPSMC110CA-VR | GHGA | BHGA | 110 | 122 | 135 | 1 | 175.5 | 8.6 | 1 | 0.107 | X |
| TPSMC120A-VR | TPSMC120CA-VR | GHHA | BHHA | 120 | 133 | 147 | 1 | 191.1 | 7.9 | 1 | 0.108 | X |
| TPSMC130A-VR | TPSMC130CA-VR | GHIA | BHIA | 130 | 144 | 159 | 1 | 206.7 | 7.3 | 1 | 0.108 | X |
| TPSMC150A-VR | TPSMC150CA-VR | GHKA | BHKA | 150 | 167 | 185 | 1 | 240.5 | 6.2 | 1 | 0.108 | X |
| TPSMC160A-VR | TPSMC160CA-VR | GHLA | BHLA | 160 | 178 | 197 | 1 | 256.1 | 5.9 | 1 | 0.108 | X |
| TPSMC170A-VR | TPSMC170CA-VR | GHMA | BHMA | 170 | 189 | 209 | 1 | 271.7 | 5.5 | 1 | 0.108 | X |
| TPSMC180A-VR | TPSMC180CA-VR | GHNA | BHNA | 180 | 201 | 222 | 1 | 288.6 | 5.2 | 1 | 0.108 | X |
| TPSMC188A-VR | TPSMC188CA-VR | GHOA | BHOA | 188 | 209 | 231 | 1 | 300.3 | 5.0 | 1 | 0.11 | |
| TPSMC200A-VR | TPSMC200CA-VR | GHPA | BHPA | 200 | 224 | 247 | 1 | 321.1 | 4.7 | 1 | 0.11 | X |

$V_{BR} @ T_j = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha T \times (T_j - 25))$ (α : Temperature Coefficient, typical value is 0.1%)

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I-V Curve Characteristics



P_{PPM} Peak Pulse Power Dissipation ($I_{pp} \times V_C$) – 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

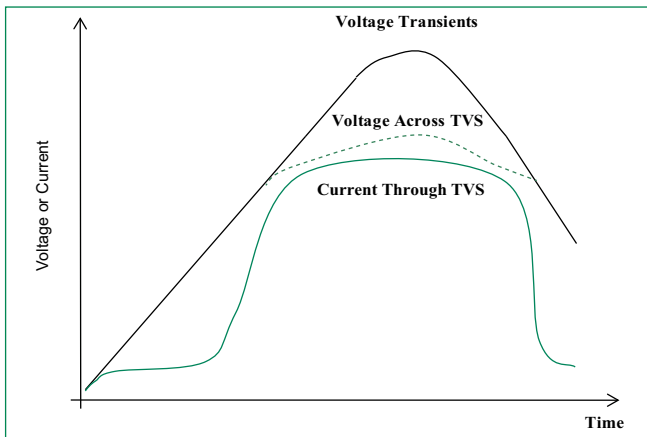


Figure 2: Peak Pulse Power Rating

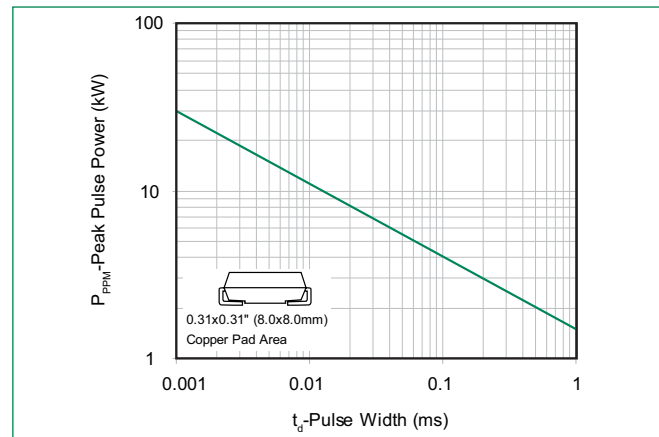


Figure 3: Peak Pulse Power Derating Curve

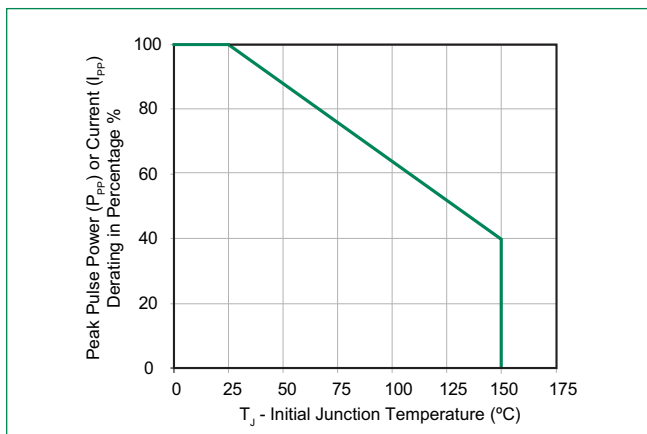
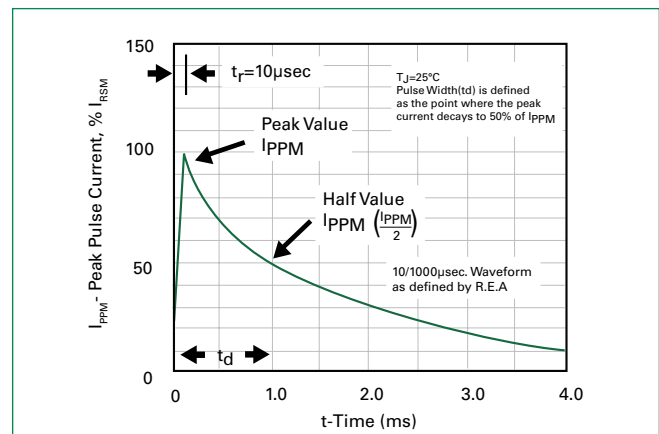


Figure 4: Pulse Waveform



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Figure 5 - Typical Junction Capacitance

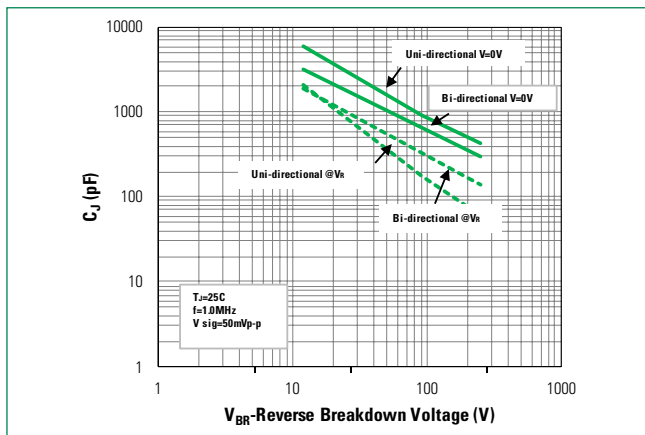
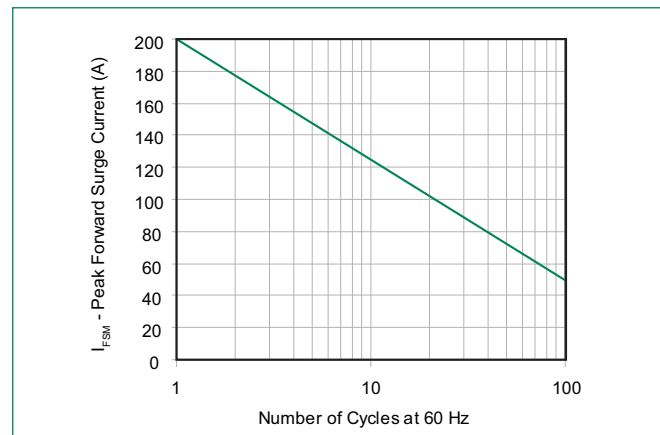
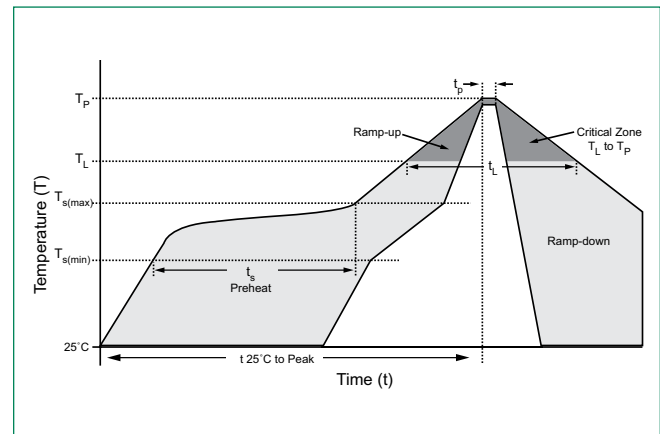


Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



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_2) | 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_2) | 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 | 0.007 ounce, 0.21 grams |
| Case | JEDEC DO214AB. Molded plastic body over glass passivated junction |
| Polarity | Color band denotes cathode for unidirectional components |
| Terminal | Matte Tin-plated leads, Solderable per JESD22-B102 |

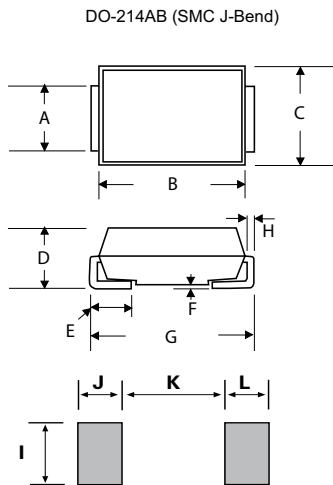
Environmental Specifications

| | |
|----------------------------|--------------------------|
| 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 |

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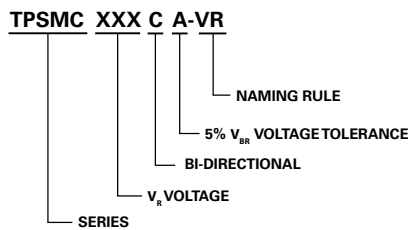
Surface Mount – 1500W

Dimensions

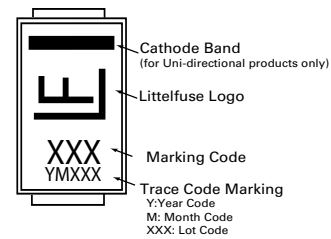


| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.114 | 0.126 | 2.900 | 3.200 |
| B | 0.260 | 0.280 | 6.600 | 7.110 |
| C | 0.220 | 0.245 | 5.590 | 6.220 |
| D | 0.079 | 0.103 | 2.060 | 2.620 |
| E | 0.030 | 0.060 | 0.760 | 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



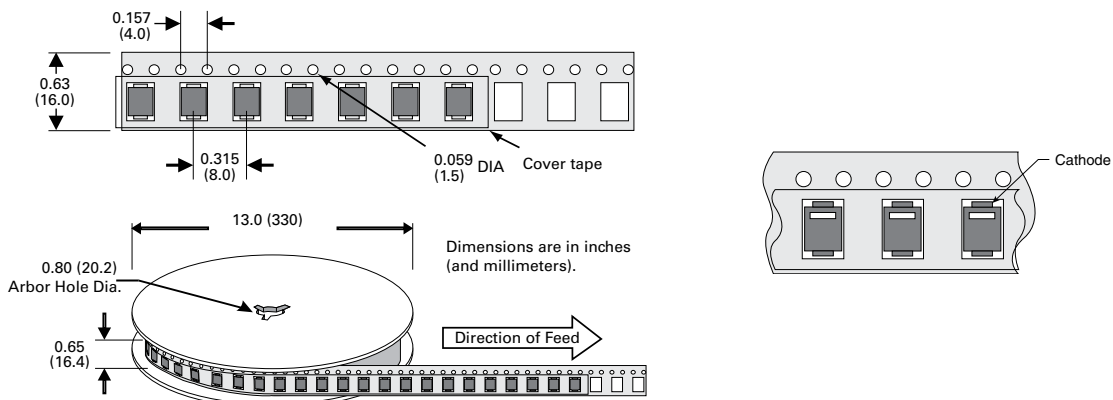
Part Marking System



Packaging

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

Tape and Reel Specification



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