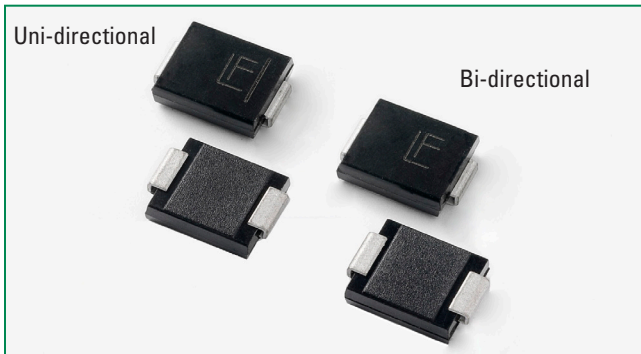


## TPSMC-VR Series



### Agency Approvals

AGENCY	AGENCY FILE NUMBER
	E230531

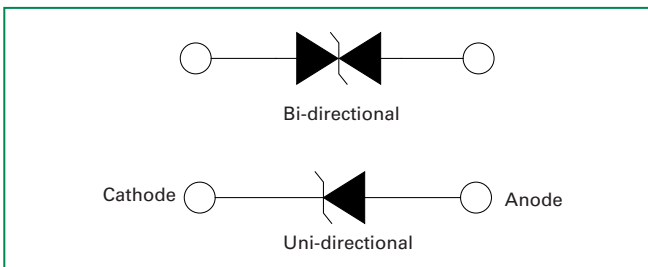
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation (IPP x VC) 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	I <sub>FSM</sub>	200	A
Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only (Note 4)	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>JL</sub>	15	°C/W
Typical Thermal Resistance Junction to Ambient	R <sub>JA</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 component only, duty cycle=4 per minute maximum.

### Functional Diagram



### 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

- 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 10/1000µs waveform, repetition rate (duty cycles):0.01 %
- Fast response time: typically less than 1.0ps from 0V to V<sub>BR</sub> 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°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

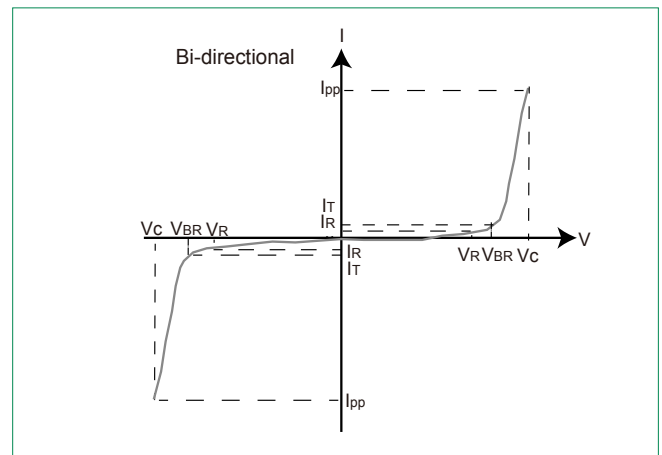
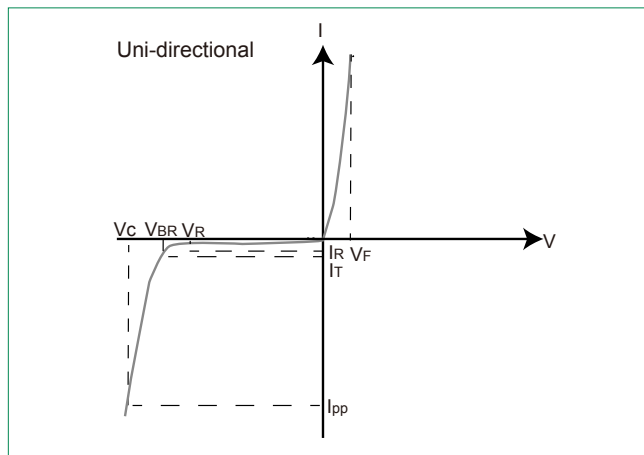
TVS components are ideal for the protection of I/O Interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

**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)	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	

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

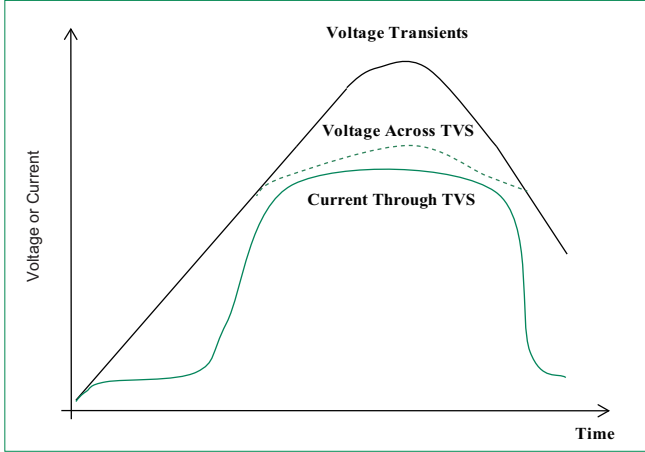
**I-V Curve Characteristics**



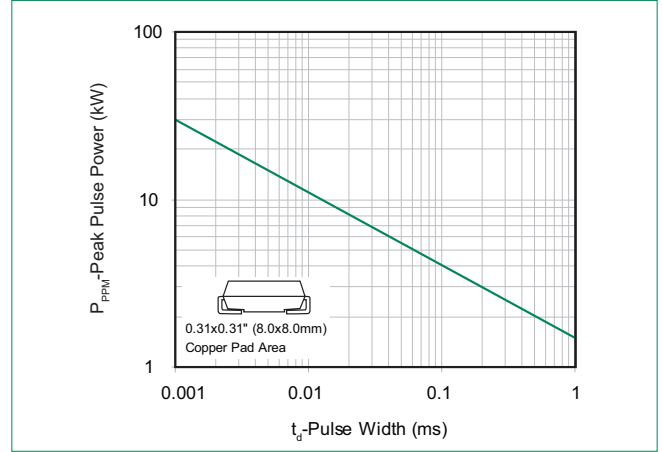
- $P_{ppm}$  Peak Pulse Power Dissipation** ( $I_{pp} \times V_C$ ) – Max power dissipation
- $V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )
- $V_C$  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)

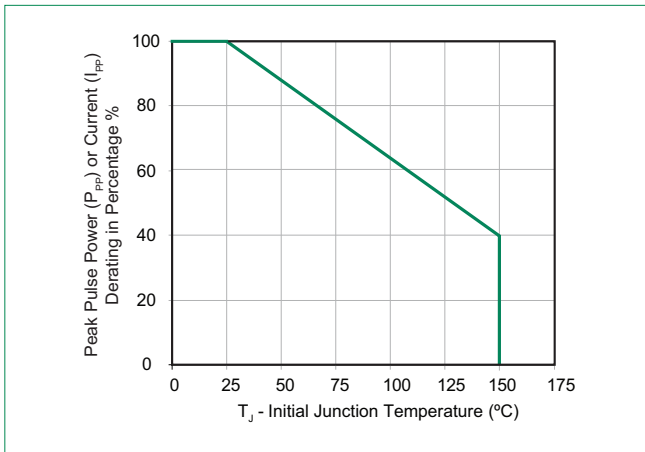
**Figure 1 - TVS Transients Clamping Waveform**



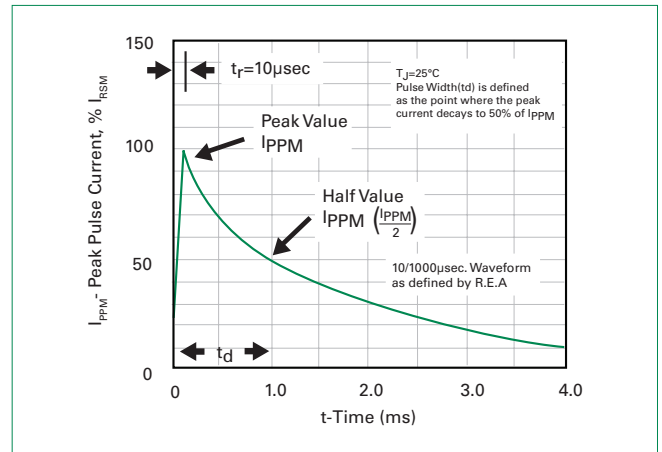
**Figure 2 - Peak Pulse Power Rating**



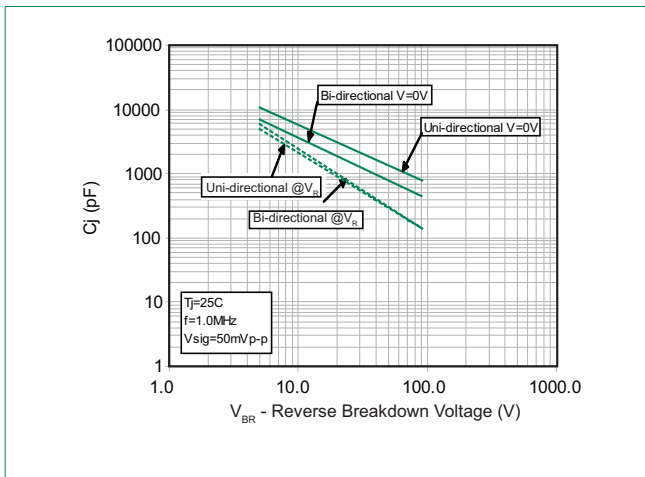
**Figure 3 - Peak Pulse Power Derating Curve**



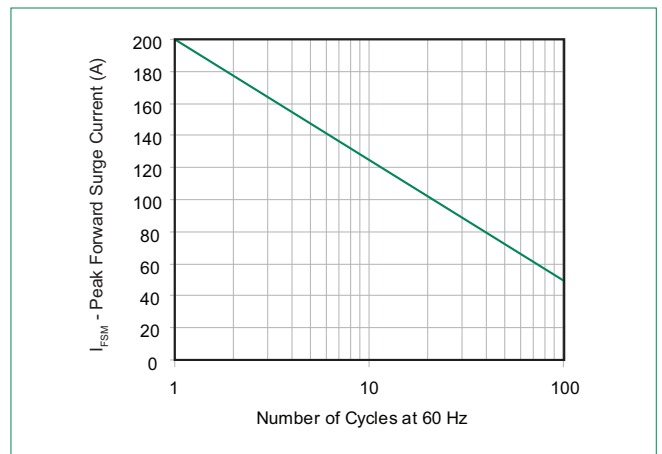
**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**

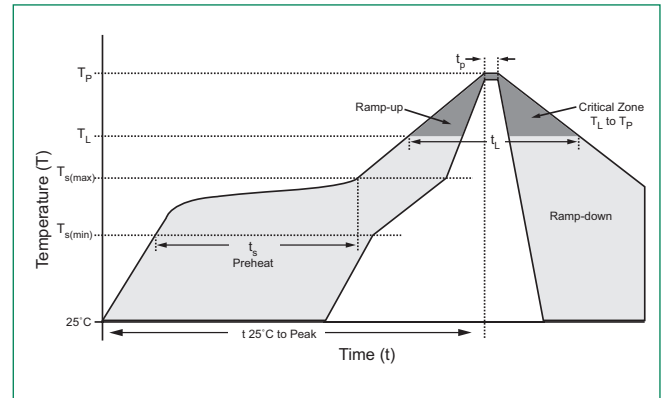


**Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



**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 <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



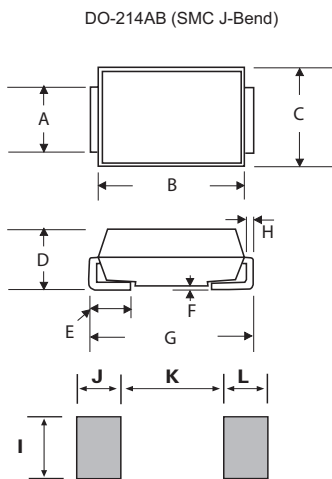
**Physical Specifications**

<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 cathode for unidirectional components
<b>Terminal</b>	Matte Tin-plated leads, Solderable per JESD22-B102

**Environmental Specifications**

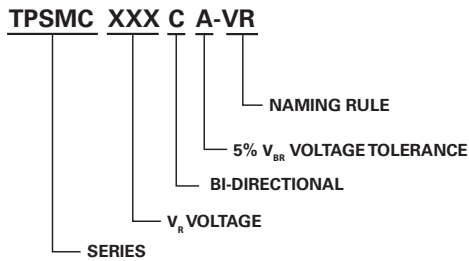
<b>High Temp. Storage</b>	JESD22-A103
<b>HTRB</b>	JESD22-A108
<b>Temperature Cycling</b>	JESD22-A104
<b>MSL</b>	JEDEC-J-STD-020, Level 1
<b>H3TRB</b>	JESD22-A101
<b>RSH</b>	JESD22-A111

**Dimensions**

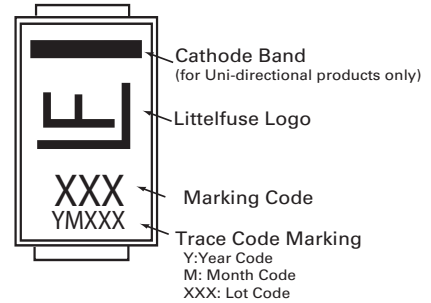


Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	0.114	0.126	2.900	3.200
B	0.260	0.280	6.600	7.110
C	0.220	0.245	5.590	6.220
D	0.079	0.103	2.060	2.620
E	0.030	0.060	0.760	1.520
F	-	0.008	-	0.203
G	0.305	0.320	7.750	8.130
H	0.006	0.012	0.152	0.305
I	0.129	-	3.300	-
J	0.094	-	2.400	-
K	-	0.165	-	4.200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

**Part Numbering System**



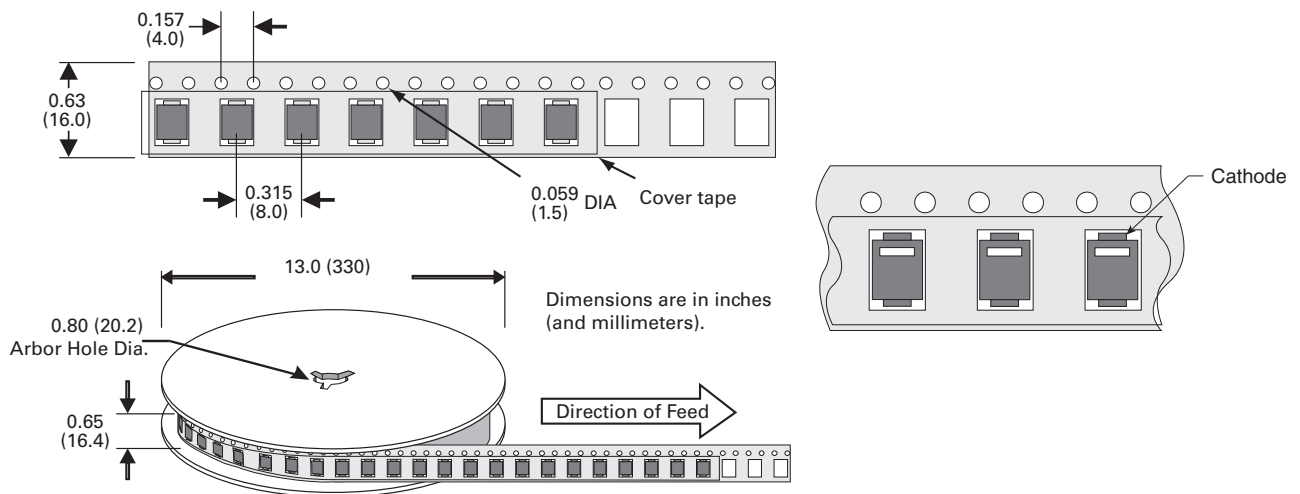
**Part Marking System**



**Packaging**

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

**Tape and Reel Specification**



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[MMAD1103e3/TR13](#) [DFLT40AQ-7](#)