

TPSMB-L Series

Automotive, Ultra Low Clamping, Unidirectional Surface Mount 600 W in SMB



Agency Approvals

Agency	Agency Number
	E230531

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

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation by 10/1000 μs waveform (Fig.1)(Note 1), (Note 2)	P_{PPM}	600	W
Power Dissipation on infinite heat sink at $T_A = 50^\circ\text{C}$	$P_{M(AV)}$	5.0	W
Peak Forward Surge Current, 8.3 ms Single Half Sine Wave (Note 3)	I_{FSM}	100	A
Maximum Instantaneous Forward Voltage at 50 A for Unidirectional only	V_F	3.5	V
Operating Junction Temperature Range	T_J	-65 to 175	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-65 to 175	$^\circ\text{C}$
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	20	$^\circ\text{C/W}$
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	100	$^\circ\text{C/W}$

Notes:

1. Non-repetitive current pulse, per Fig.4 and derated above $T_A = 25^\circ\text{C}$ per Fig. 3.
2. Mounted on copper pad area of 0.2×0.2 " (5.0 x 5.0 mm) to each terminal.
3. Measured on 8.3 ms single half sine wave or equivalent square wave for unidirectional component only, duty cycle = 4 per minute maximum.
4. Equivalent with conventional 600 W TVS

Description

The TPSMB-L Series are Low Clamping Voltage TVS diodes specifically protects Analog Front End chip (AFE/BMIC) of Electric vehicle Battery Management System (BMS) from overvoltage events.

Features & Benefits

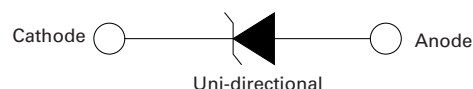
- High reliability application and automotive grade AEC-Q101 qualified
- 600 W P_{PPM} (peak pulse power) capability at 10/1000 μs waveform, repetition rate (duty cycles):0.01 %
- Surface mount component to optimize board space
- Low profile package
- Typical failure mode is short from over-specified 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 30 kV(Air), 30 kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Glass passivated chip junction
- Fast response time: typically less than 1.0 ns from 0 V to $V_{BR \min}$
- 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)
- DO-214AA (SMB) package

Applications

TVS components are ideal for the protection of I/O interfaces, V_{CC} bus and other vulnerable circuits used in automotive applications.

- Battery Management System of Electrical Vehicle
- 800 V power train of 14 cells ~20 cells Architecture


Functional Diagram



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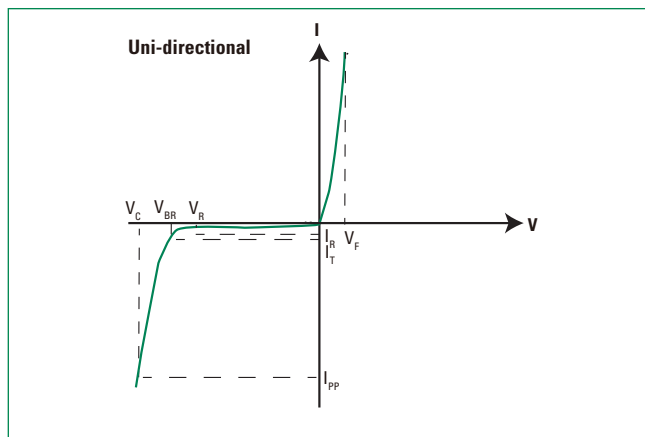
Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

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} (10/1000 μs) (V)	Maximum Peak Pulse Current I_{PP} (10/1000 μs) (A)	Maximum Clamping Voltage V_C @ $I_{PP} = 10\text{ A}$ (8/20 μs) (V)	Maximum Clamping Voltage V_C @ I_{PP} (8/20 μs) (V)	Maximum Peak Pulse Current I_{PP} (8/20 μs) (A)	Maximum Reverse Leakage I_R @ V_R (μA)	Agency Approval 
			Min	Max								
TPSMB75A-L	75AAL	64.10	70.40	78.80	1	96.0	5.4	83.0	95.0	29.5	1	X
TPSMB82A-L	82AAL	70.10	77.00	86.10	1	100.0	4.9	90.0	100.0	27.0	1	X
TPSMB91A-L	91AAL	77.80	85.40	95.50	1	114.0	6.4	100.0	109.0	24.5	1	X

Note:

- 1: $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$ (αT : Temperature
 2: The CTI (Comparative Tracking Index) is 550

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_{PP} (peak impulse current)
 I_R **Reverse Leakage Current** -- Current measured at V_R
 V_F **Forward Voltage Drop for Uni-directional**

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

Figure 1 - TVS Transients Clamping Waveform

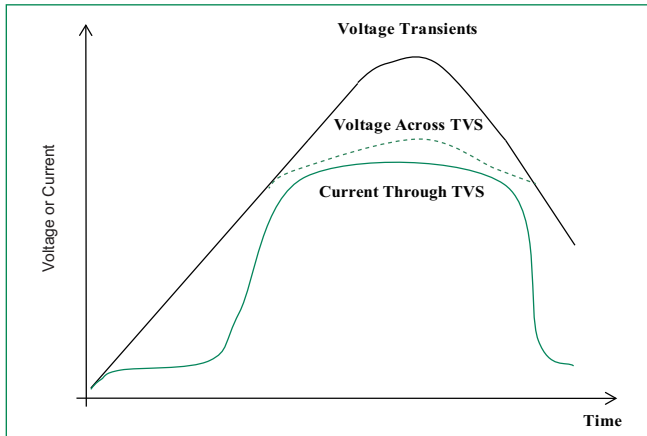


Figure 2 - Peak Pulse Power Rating Curve

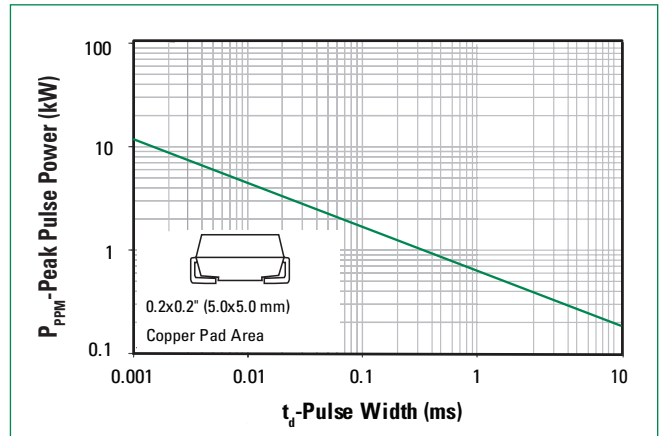


Figure 3 - Peak Pulse Power Derating Curve

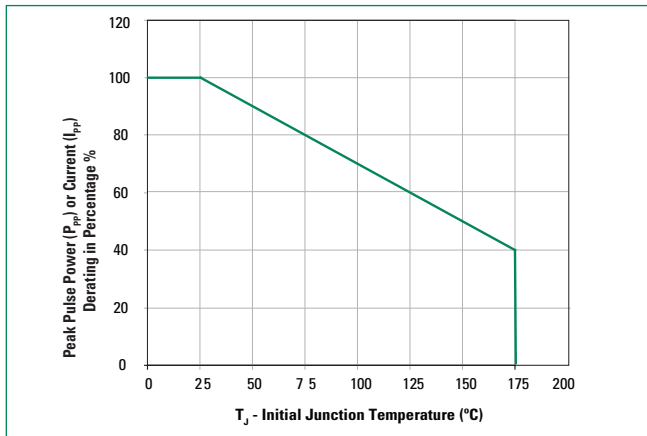


Figure 4 - Pulse Waveform

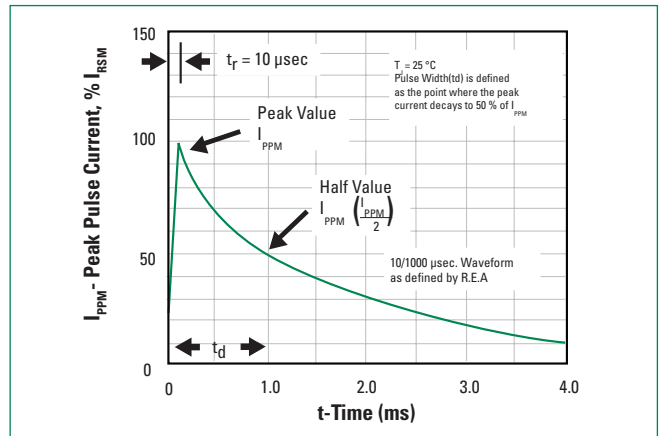


Figure 5 - Typical Junction Capacitance

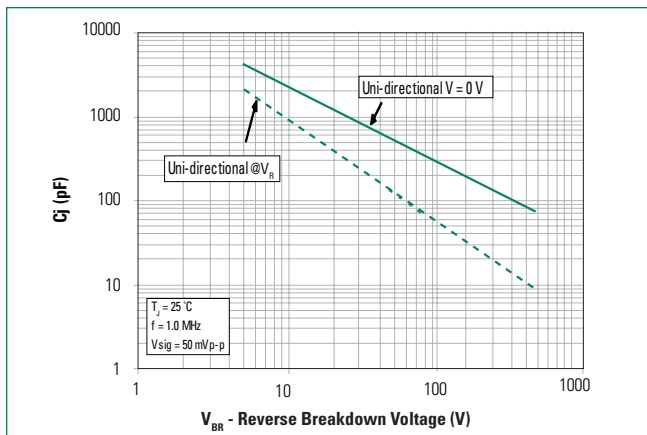
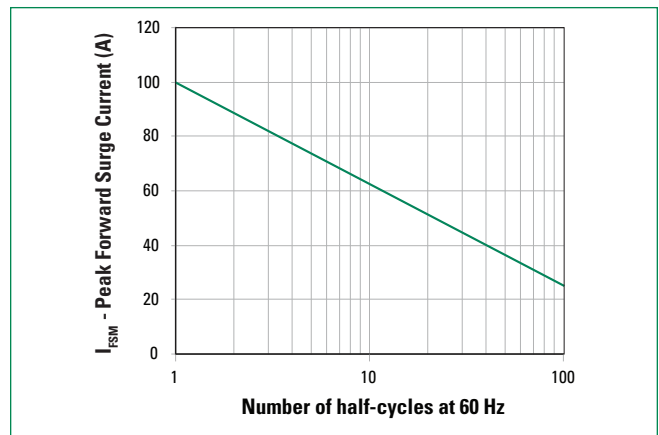


Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only

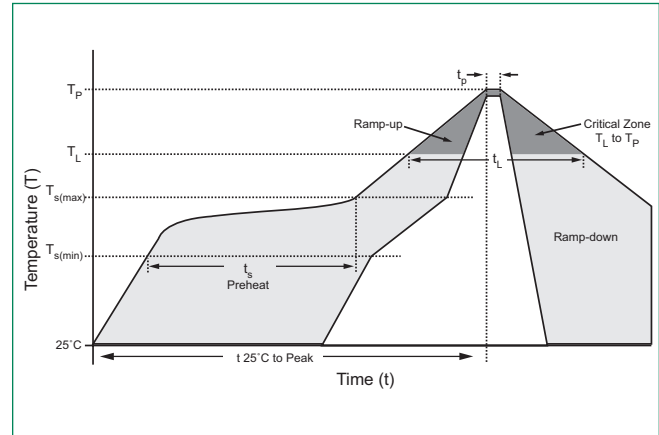


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Soldering Parameters

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 seconds
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

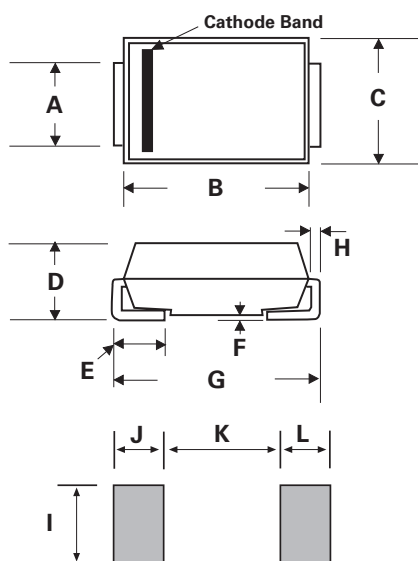
Weight	0.003 ounce, 0.093 gram
Case	JEDEC DO214AA. Molded plastic body over glass passivated junction
Polarity	Color band denotes cathode except bidirectional
Terminal	Matte tin-plated leads, solderable per JESD22-B102

Environmental Specifications

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

Dimensions

DO-214AA (SMB J-Bend)



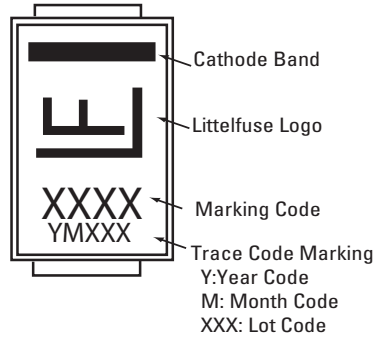
Recommended Soldering Pad Layout

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	-

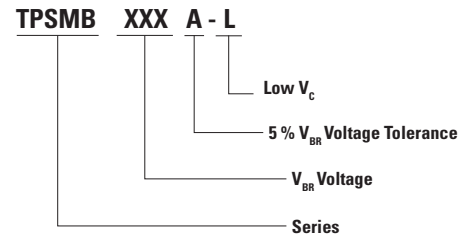
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Part Marking System



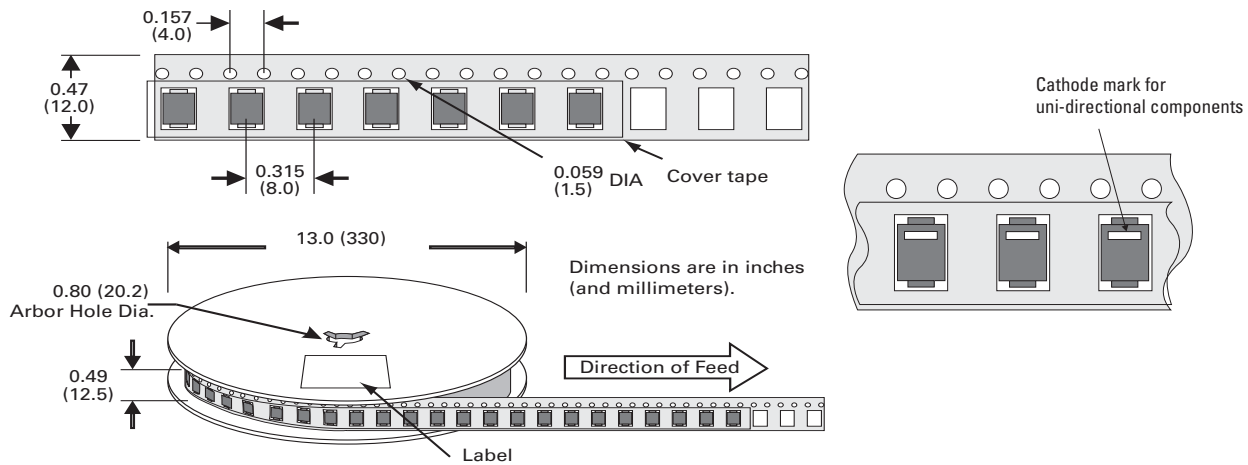
Part Numbering System



Packaging

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

Tape and Reel Specification



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