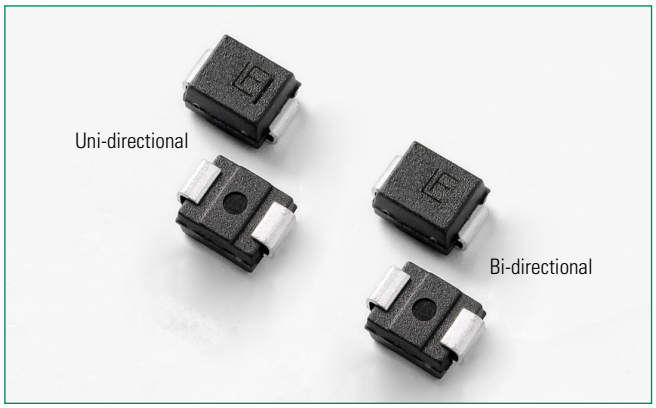
TPSMB-VR Series

AUTOMOTIVE GRADE HF RoHS



Agency Recognitions

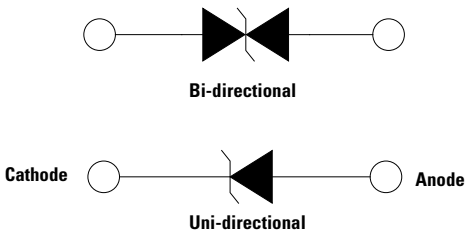
Agency	Agency File Number
	E230531

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	V_F	3.5/5	V
Operating Junction Temperature Range (V_R≤ 78V)	T_J	-65 to 175	°C
Operating Junction Temperature Range (V_R>78V)	T_J	-65 to 150	°C
Storage Temperature Range	T_{STG}	-65 to 175	°C
Typical Thermal Resistance Junction to Lead	R_{uJL}	20	°C/W
Typical Thermal Resistance Junction to Ambient	R_{uJA}	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 with Vr< 250V, VF<5.0V for part numbers with Vr>=250V .

Functional Diagram



Description

The TPSMB-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 minimize 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 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 > 10V
- High temperature soldering guaranteed: 260°C/10 seconds at terminals
- UL Recognized compound meeting flammability rating V-0.
- Meet MSL level1, per J-STD-020, high temperature soldering guaranteed.
- 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)
- Recognized to UL 497B as an Isolated Loop Circuit Protector

Applications

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

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

Part Number (Uni)	Part Number (Bi)	Marking		Typical I_R @ 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						
TPSMB6.5A-VR	-	KKA	-	500	6.5	7.22	7.98	10	11.2	53.6	500	0.052	X
TPSMB7.0A-VR	-	KMA	-	200	7.0	7.78	8.60	10	12.0	50.0	200	0.058	X
TPSMB7.5A-VR	-	KPA	-	100	7.5	8.33	9.21	1	12.9	46.6	100	0.061	X
TPSMB8.0A-VR	-	KRA	-	50	8.0	8.89	9.83	1	13.6	44.2	50	0.064	X
TPSMB8.5A-VR	TPSMB8.5CA-VR	KTA	ATA	50	8.5	9.44	10.40	1	14.4	41.7	20	0.066	X
TPSMB9.0A-VR	TPSMB9.0CA-VR	KVA	AVA	20	9.0	10.00	11.10	1	15.4	39.0	10	0.069	X
TPSMB10A-VR	TPSMB10CA-VR	KXA	AXA	8	10.0	11.10	12.30	1	17.0	35.3	5	0.071	X
TPSMB11A-VR	TPSMB11CA-VR	KZA	AZA	8	11.0	12.20	13.50	1	18.2	33.0	1	0.074	X
TPSMB12A-VR	TPSMB12CA-VR	LEA	BEA	8	12.0	13.30	14.70	1	19.9	30.2	1	0.075	X
TPSMB13A-VR	TPSMB13CA-VR	LGA	BGA	8	13.0	14.40	15.90	1	21.5	28.0	1	0.076	X
TPSMB14A-VR	TPSMB14CA-VR	LKA	BKA	8	14.0	15.60	17.20	1	23.2	25.9	1	0.080	X
TPSMB15A-VR	TPSMB15CA-VR	LMA	BMA	8	15.0	16.70	18.50	1	24.4	24.6	1	0.083	X
TPSMB16A-VR	TPSMB16CA-VR	LPA	BPA	8	16.0	17.80	19.70	1	26.0	23.1	1	0.084	X
TPSMB17A-VR	TPSMB17CA-VR	LRA	BRA	8	17.0	18.90	20.90	1	27.6	21.8	1	0.085	X
TPSMB18A-VR	TPSMB18CA-VR	LTA	BTA	8	18.0	20.00	22.10	1	29.2	20.6	1	0.088	X
TPSMB20A-VR	TPSMB20CA-VR	LVA	BVA	8	20.0	22.20	24.50	1	32.4	18.6	1	0.091	X
TPSMB22A-VR	TPSMB22CA-VR	LXA	BXA	8	22.0	24.40	26.90	1	35.5	16.9	1	0.092	X
TPSMB24A-VR	TPSMB24CA-VR	LZA	BZA	8	24.0	26.70	29.50	1	38.9	15.5	1	0.092	X
TPSMB26A-VR	TPSMB26CA-VR	MEA	CEA	8	26.0	28.90	31.90	1	42.1	14.3	1	0.093	X
TPSMB28A-VR	TPSMB28CA-VR	MGA	CGA	8	28.0	31.10	34.40	1	45.4	13.3	1	0.094	X
TPSMB30A-VR	TPSMB30CA-VR	MKA	CKA	8	30.0	33.30	36.80	1	48.4	12.4	1	0.096	X
TPSMB33A-VR	TPSMB33CA-VR	MMA	CMA	8	33.0	36.70	40.60	1	53.3	11.3	1	0.097	X
TPSMB36A-VR	TPSMB36CA-VR	MPA	CPA	8	36.0	40.00	44.20	1	58.1	10.4	1	0.098	X
TPSMB40A-VR	TPSMB40CA-VR	MRA	CRA	8	40.0	44.40	49.10	1	64.5	9.3	1	0.099	X
TPSMB43A-VR	TPSMB43CA-VR	MTA	CTA	8	43.0	47.80	52.80	1	69.4	8.7	1	0.100	X
TPSMB45A-VR	TPSMB45CA-VR	MVA	CVA	8	45.0	50.00	55.30	1	72.7	8.3	1	0.101	X
TPSMB48A-VR	TPSMB48CA-VR	MXA	CXA	8	48.0	53.30	58.90	1	77.4	7.8	1	0.101	X
TPSMB51A-VR	TPSMB51CA-VR	MZA	CZA	8	51.0	56.70	62.70	1	82.4	7.3	1	0.101	X
TPSMB54A-VR	TPSMB54CA-VR	NEA	DEA	8	54.0	60.00	66.30	1	87.1	6.9	1	0.102	X
TPSMB58A-VR	TPSMB58CA-VR	NGA	DGA	8	58.0	64.40	71.20	1	93.6	6.5	1	0.103	X
TPSMB60A-VR	TPSMB60CA-VR	NKA	DKA	8	60.0	66.70	73.70	1	96.8	6.2	1	0.103	X
TPSMB64A-VR	TPSMB64CA-VR	NMA	DMA	8	64.0	71.10	78.60	1	103.0	5.9	1	0.104	X
TPSMB70A-VR	TPSMB70CA-VR	NPA	DPA	8	70.0	77.80	86.00	1	113.0	5.3	1	0.105	X
TPSMB75A-VR	TPSMB75CA-VR	NRA	DRA	8	75.0	83.30	92.10	1	121.0	5.0	1	0.106	X
TPSMB78A-VR	TPSMB78CA-VR	NTA	DTA	8	78.0	86.70	95.80	1	126.0	4.8	1	0.106	X
TPSMB85A-VR	TPSMB85CA-VR	NVA	DVA	-	85.0	94.40	104.00	1	137.0	4.4	1	0.106	X
TPSMB90A-VR	TPSMB90CA-VR	NXA	DXA	-	90.0	100.00	111.00	1	146.0	4.1	1	0.107	X
TPSMB100A-VR	TPSMB100CA-VR	NZA	DZA	-	100.0	111.00	123.00	1	162.0	3.7	1	0.107	X
TPSMB110A-VR	TPSMB110CA-VR	PEA	EEA	-	110.0	122.00	135.00	1	177.0	3.4	1	0.107	X
TPSMB120A-VR	TPSMB120CA-VR	PGA	EGA	-	120.0	133.00	147.00	1	193.0	3.1	1	0.108	X
TPSMB130A-VR	TPSMB130CA-VR	PKA	EKA	-	130.0	144.00	159.00	1	209.0	2.9	1	0.108	X
TPSMB150A-VR	TPSMB150CA-VR	PMA	EMA	-	150.0	167.00	185.00	1	243.0	2.5	1	0.108	X
TPSMB160A-VR	TPSMB160CA-VR	PPA	EPA	-	160.0	178.00	197.00	1	259.0	2.3	1	0.108	X
TPSMB170A-VR	TPSMB170CA-VR	PRA	ERA	-	170.0	189.00	209.00	1	275.0	2.2	1	0.108	X
TPSMB180A-VR	TPSMB180CA-VR	PTA	ETA	-	180.0	201.00	222.00	1	292.0	2.1	1	0.108	X
TPSMB188A-VR	TPSMB188CA-VR	PBA	EBA	-	188.0	209.00	231.00	1	304.0	2.0	1	0.110	X
TPSMB200A-VR	TPSMB200CA-VR	PVA	EVA	-	200.0	224.00	247.00	1	324.0	1.9	1	0.110	X
TPSMB220A-VR	TPSMB220CA-VR	PXA	EXA	-	220.0	246.00	272.00	1	356.0	1.7	1	0.110	X
TPSMB250A-VR	TPSMB250CA-VR	PZA	EZA	-	250.0	279.00	309.00	1	405.0	1.5	1	0.110	X
TPSMB300A-VR	TPSMB300CA-VR	QEA	FEA	-	300.0	335.00	371.00	1	486.0	1.3	1	0.112	-
TPSMB350A-VR	TPSMB350CA-VR	QGA	FGA	-	350.0	391.00	432.00	1	567.0	1.1	1	0.112	-
TPSMB400A-VR	TPSMB400CA-VR	QKA	FKA	-	400.0	447.00	494.00	1	648.0	0.9	1	0.112	-
TPSMB440A-VR	TPSMB440CA-VR	QMA	FMA	-	440.0	492.00	543.00	1	713.0	0.9	1	0.112	-

Note:

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

V_{BR} @ T_J= V_{BR}@25°C x (1+αT x (T_J - 25))(αT:Temperature Coefficient, typical value is 0.1%)

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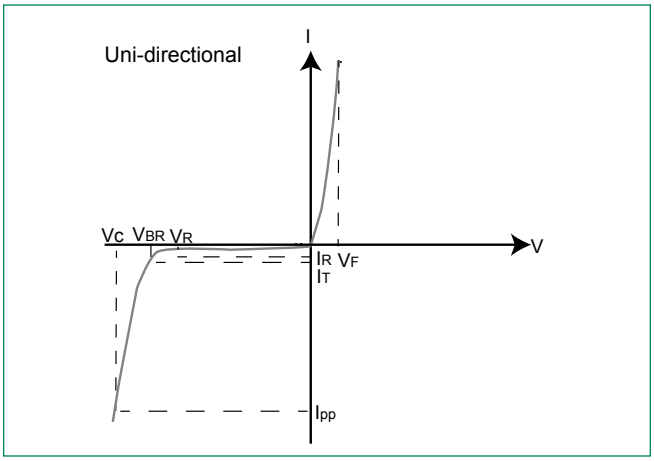
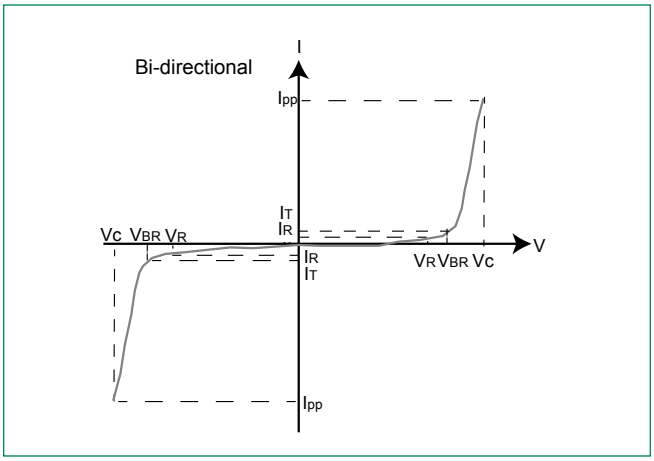
I-V Curve Characteristics





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 though the TVS at a specified test current (I_T)
V_C Clamping Voltage – Peak voltage measured across the TVS at a specified Ippm (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°C unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

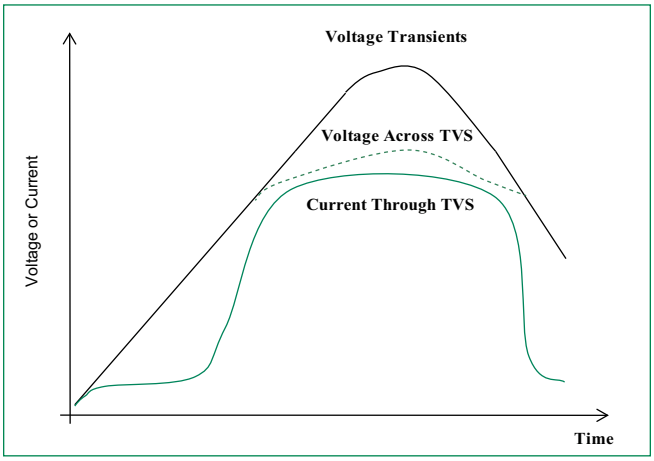
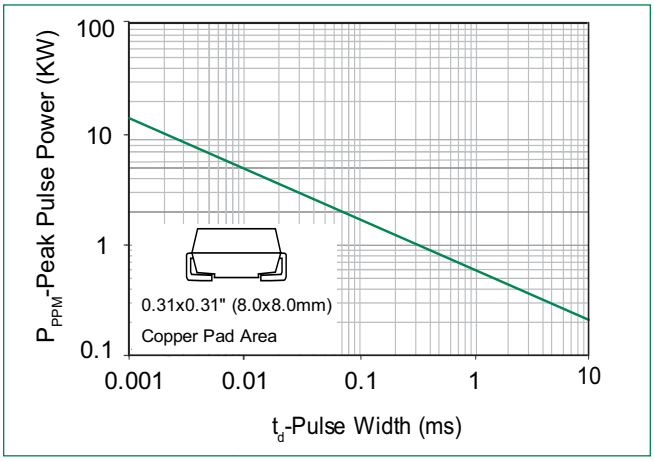


Figure 2 - Peak Pulse Power Rating Curve



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Ratings and Characteristic Curves (T_A=25°C unless otherwise noted) (Continued)

Figure 3 - Peak Pulse Power Derating Curve

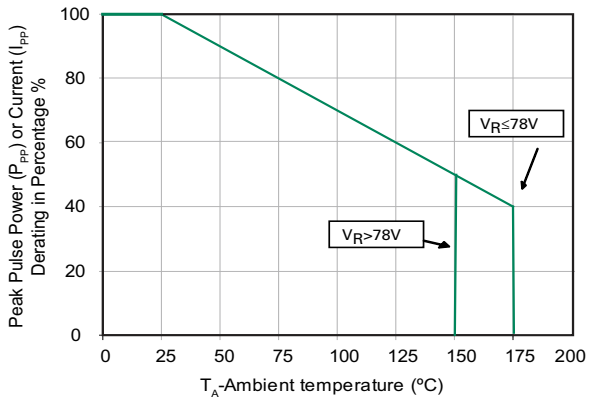


Figure 4 - Pulse Waveform

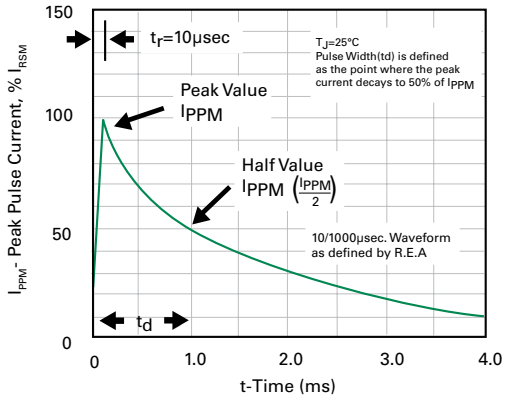


Figure 5 - Typical Junction Capacitance

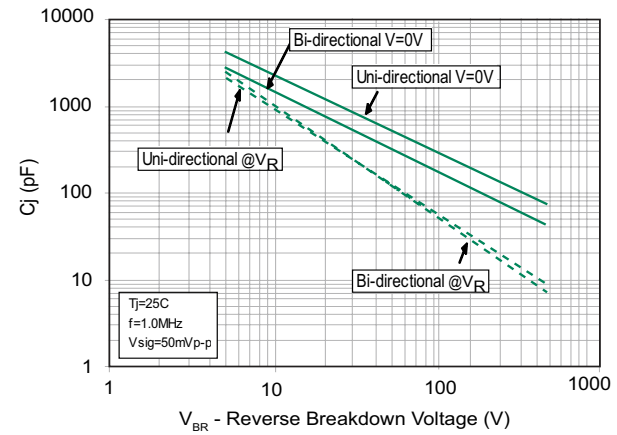
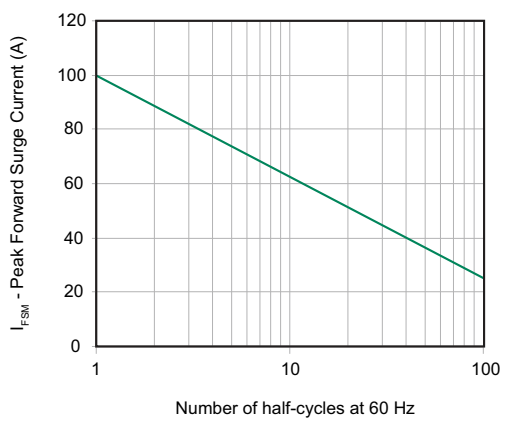
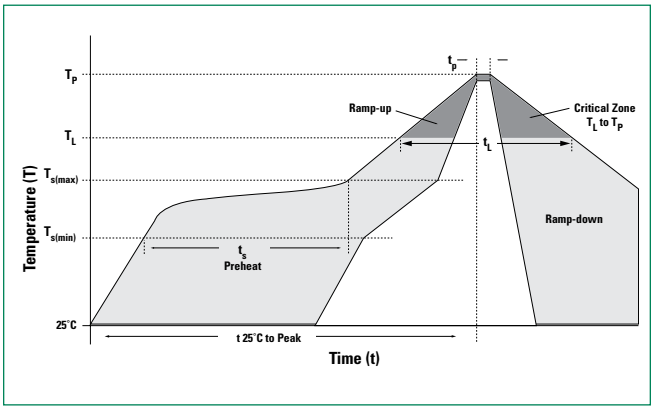


Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



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

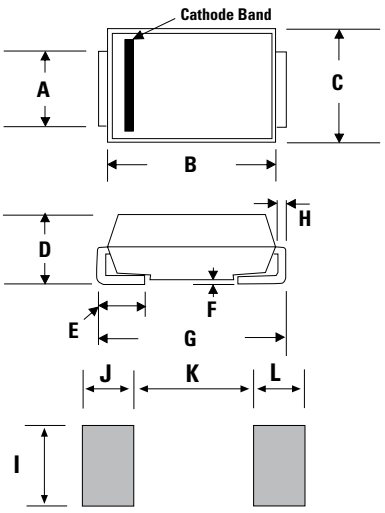
Weight	0.003 ounce, 0.093 grams
Case	JEDEC DO214AA. Molded plastic body over glass passivated junction
Polarity	Color band denotes cathode for unidirectional components
Terminal	Matte Tin-plated leads, Solderable per JESD22-B102

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

DO-214AA (SMB J-Bend)



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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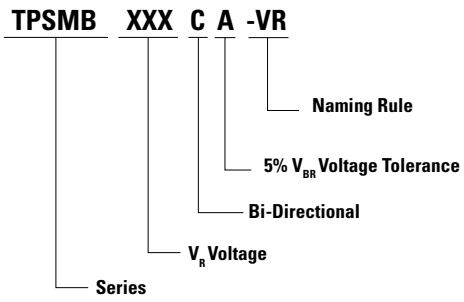
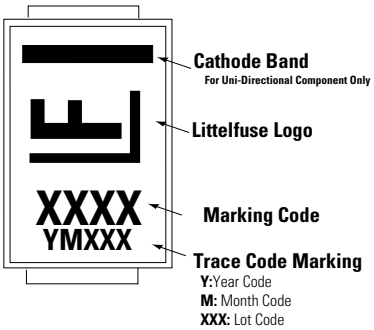
Part Numbering System



Part Marking System



Packaging

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

Tape and Reel Specification