



# THE DATASHEET OF TPSMA6L13A



### TPSMA6L Series



#### Agency Approvals

Agency	Agency File Number
	E230531

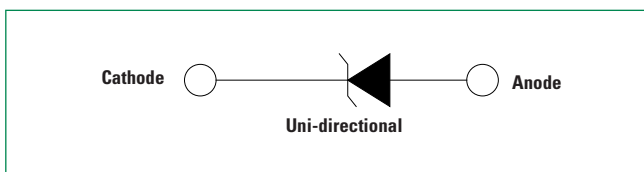
#### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation at T <sub>A</sub> =25°C by 10x1000µs Waveform (Fig.2)(Note 1), (Note 2)	P <sub>PPM</sub>	600	W
Power Dissipation on Infinite Heat Sink at T <sub>A</sub> =50°C	P <sub>M(AV)</sub>	3	W
Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)	I <sub>FSM</sub>	60	A
Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only	V <sub>F</sub>	3.5V	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>θJL</sub>	35	°C/W
Typical Thermal Resistance Junction to Ambient	R <sub>θJA</sub>	200	°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 5.0x5.0mm copper pad to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.

#### Functional Diagram



#### Description

The TPSMA6L series is designed specifically to protect sensitive electronic equipment from voltage transients induced by load dump and other transient voltage events, and it's especially suitable for high reliability and automotive application.

SMA low profile package (DO221-AC) has the same electrical performance as the SMB package but with low height profiles (1.1mm).


#### Features

- Same power as standard SMB devices (600 W)
- Hi reliability application and automotive grade AEC Q101 qualified
- SMA low profile package: less than 1.1 mm
- Footprint compatibility with standard SMA and SMB products (easy to layout)
- 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
- IEC-61000-4-2 ESD 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)
- Low inductance, excellent clamping capability
- Fast response time: typically less than 1.0ns from 0 Volts to V<sub>BR</sub> min
- Built-in strain relief
- Glass passivated junction
- High temperature soldering: 260°C/10 seconds at terminals
- Plastic package has underwriters laboratory flammability V-0
- Typical maximum temperature coefficient  $\Delta V_{BR} = 0.1\% \times V_{BR} @ 25^\circ C \times \Delta T$
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal

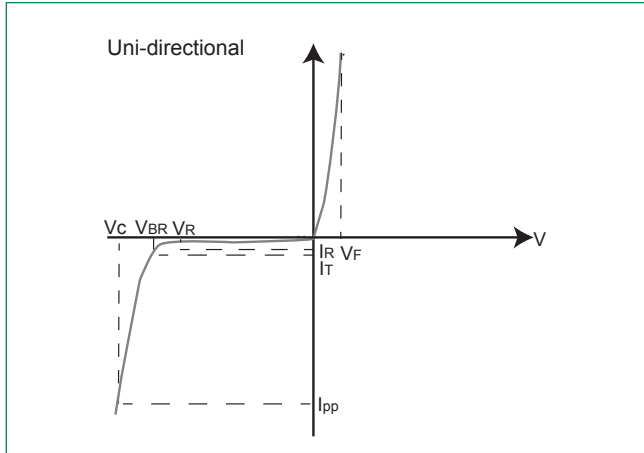
#### Applications

TVS devices 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)	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)	Agency Approval 
			MIN	MAX					
TPSMA6L5.0A	AEA	5.0	6.40	7.00	10	9.2	65.3	800	X
TPSMA6L6.0A	AGA	6.0	6.67	7.37	10	10.3	58.3	800	X
TPSMA6L6.5A	AKA	6.5	7.22	7.98	10	11.2	53.6	500	X
TPSMA6L7.0A	AMA	7.0	7.78	8.60	10	12.0	50.0	200	X
TPSMA6L7.5A	APA	7.5	8.33	9.21	1	12.9	46.6	100	X
TPSMA6L8.0A	ARA	8.0	8.89	9.83	1	13.6	44.2	50	X
TPSMA6L8.5A	ATA	8.5	9.44	10.40	1	14.4	41.7	20	X
TPSMA6L9.0A	AVA	9.0	10.00	11.10	1	15.4	39.0	10	X
TPSMA6L10A	AXA	10.0	11.10	12.30	1	17.0	35.3	5	X
TPSMA6L11A	AZA	11.0	12.20	13.50	1	18.2	33.0	1	X
TPSMA6L12A	BEA	12.0	13.30	14.70	1	19.9	30.2	1	X
TPSMA6L13A	BGA	13.0	14.40	15.90	1	21.5	28.0	1	X
TPSMA6L14A	BKA	14.0	15.60	17.20	1	23.2	25.9	1	X
TPSMA6L15A	BMA	15.0	16.70	18.50	1	24.4	24.6	1	X
TPSMA6L16A	BPA	16.0	17.80	19.70	1	26.0	23.1	1	X
TPSMA6L17A	BRA	17.0	18.90	20.90	1	27.6	21.8	1	X
TPSMA6L18A	BT A	18.0	20.00	22.10	1	29.2	20.6	1	X
TPSMA6L20A	BVA	20.0	22.20	24.50	1	32.4	18.6	1	X
TPSMA6L22A	BXA	22.0	24.40	26.90	1	35.5	16.9	1	X
TPSMA6L24A	BZA	24.0	26.70	29.50	1	38.9	15.5	1	X
TPSMA6L26A	CEA	26.0	28.90	31.90	1	42.1	14.3	1	X
TPSMA6L28A	CGA	28.0	31.10	34.40	1	45.4	13.3	1	X
TPSMA6L30A	CKA	30.0	33.30	36.80	1	48.4	12.4	1	X
TPSMA6L33A	CMA	33.0	36.70	40.60	1	53.3	11.3	1	X
TPSMA6L36A	CPA	36.0	40.00	44.20	1	58.1	10.4	1	X
TPSMA6L40A	CRA	40.0	44.40	49.10	1	64.5	9.3	1	X
TPSMA6L43A	CTA	43.0	47.80	52.80	1	69.4	8.7	1	X
TPSMA6L45A	CVA	45.0	50.00	55.30	1	72.7	8.3	1	X
TPSMA6L48A	CXA	48.0	53.30	58.90	1	77.4	7.8	1	X
TPSMA6L51A	CZA	51.0	56.70	62.70	1	82.4	7.3	1	X
TPSMA6L54A	REA	54.0	60.00	66.30	1	87.1	6.9	1	X
TPSMA6L58A	RGA	58.0	64.40	71.20	1	93.6	6.5	1	X
TPSMA6L60A	RKA	60.0	66.70	73.70	1	96.8	6.2	1	X
TPSMA6L64A	RMA	64.0	71.10	78.60	1	103.0	5.9	1	X
TPSMA6L70A	RPA	70.0	77.80	86.00	1	113.0	5.3	1	X
TPSMA6L75A	RRA	75.0	83.30	92.10	1	121.0	5.0	1	X
TPSMA6L78A	RTA	78.0	86.70	95.80	1	126.0	4.8	1	X
TPSMA6L85A	RVA	85.0	94.40	104.00	1	137.0	4.4	1	X

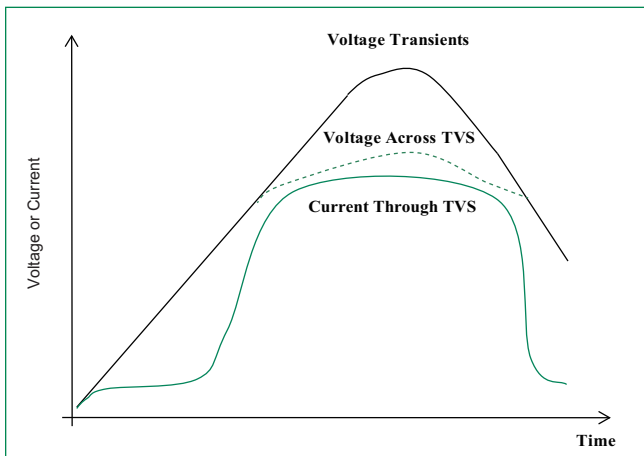
**I-V Curve Characteristics**



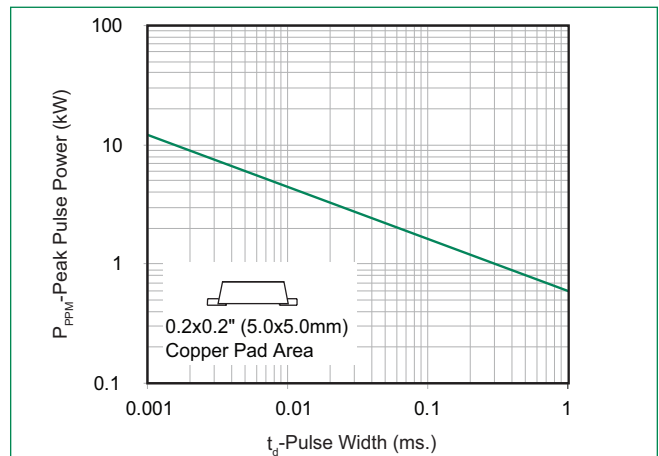
- $P_{PPM}$  **Peak Pulse Power Dissipation** - Max power dissipation
- $V_R$  **Stand-off Voltage** - Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  **Breakdown Voltage** - Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )
- $V_C$  **Clamping Voltage** - Peak voltage measured across the suppressor 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**



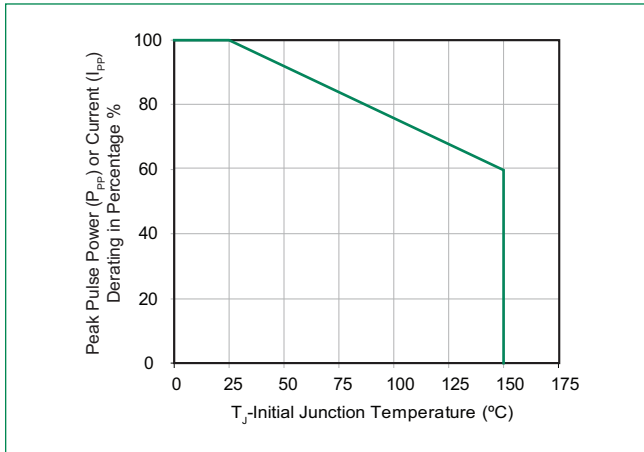
**Figure 2 - Peak Pulse Power Rating Curve**



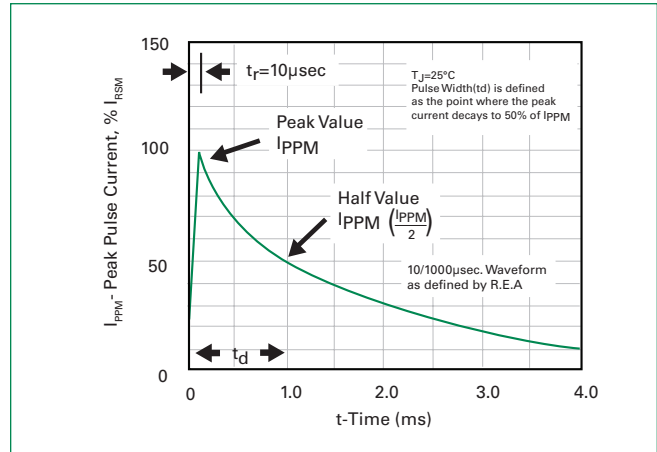
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**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted) (Continued)

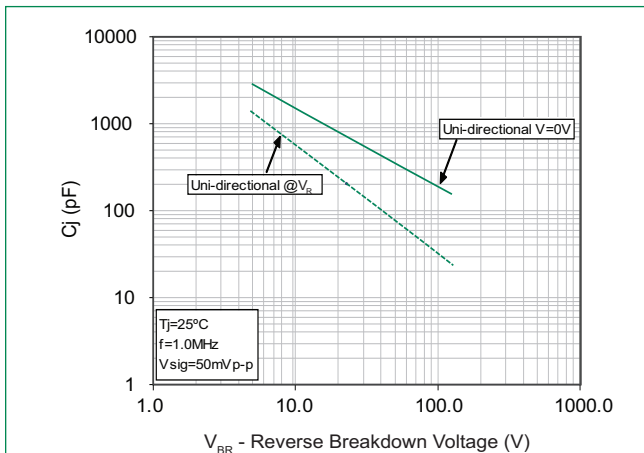
**Figure 3 - Pulse Derating Curve**



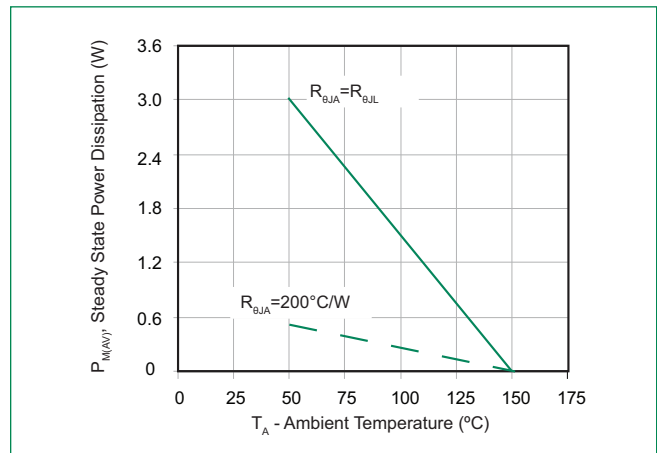
**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**

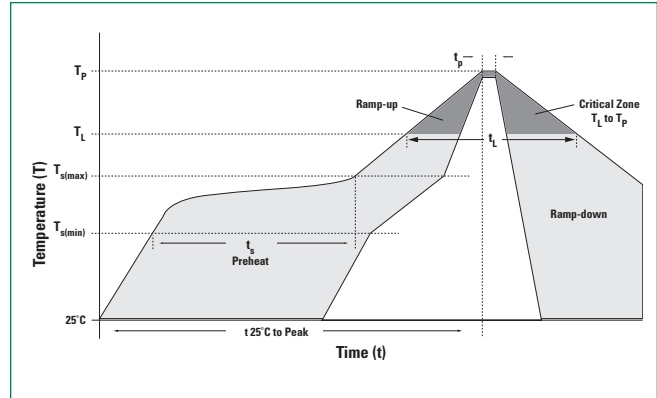


**Figure 6 - Steady State Power Dissipation Derating Curve**



### Soldering Parameters

<b>Reflow Condition</b>		Lead-free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_p$ )	60 – 120 secs
<b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak)</b>		3°C/second max
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Time (min to max) ( $t_r$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		30 seconds max
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes max.
<b>Do not exceed</b>		280°C



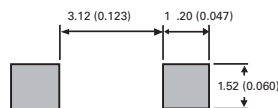
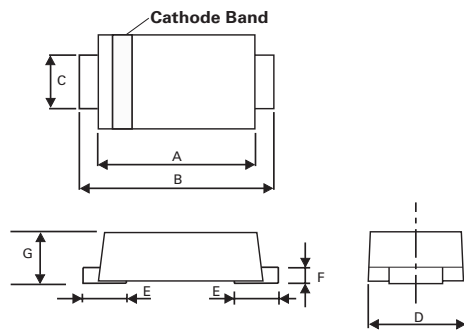
### Physical Specifications

<b>Weight</b>	0.002 ounce, 0.061 gram
<b>Case</b>	JEDEC DO-221AC Molded Plastic over glass passivated junction
<b>Polarity</b>	Color band denotes cathode except Bipolar
<b>Terminal</b>	Matte Tin-plated leads, Solderable per JESD22-B102D

### Environmental Specifications

<b>Temperature Cycle</b>	JESD22-A104
<b>Pressure Cooker</b>	JESD22-A102
<b>High Temp. Storage</b>	JESD22-A103
<b>HTRB</b>	JESD22-A108
<b>Thermal Shock</b>	JESD22-A106

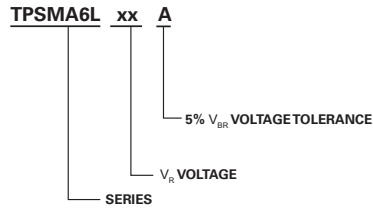
### Dimensions



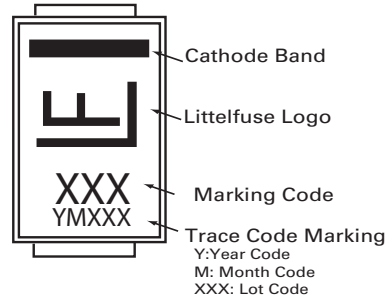
Mounting Pad Layout

Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	0.156	0.181	3.950	4.600
B	0.189	0.220	4.800	5.600
C	0.049	0.069	1.250	1.750
D	0.088	0.116	2.250	2.950
E	0.030	0.059	0.750	1.500
F	0.005	0.010	0.125	0.250
G	0.035	0.043	0.900	1.100

**Part Numbering System**



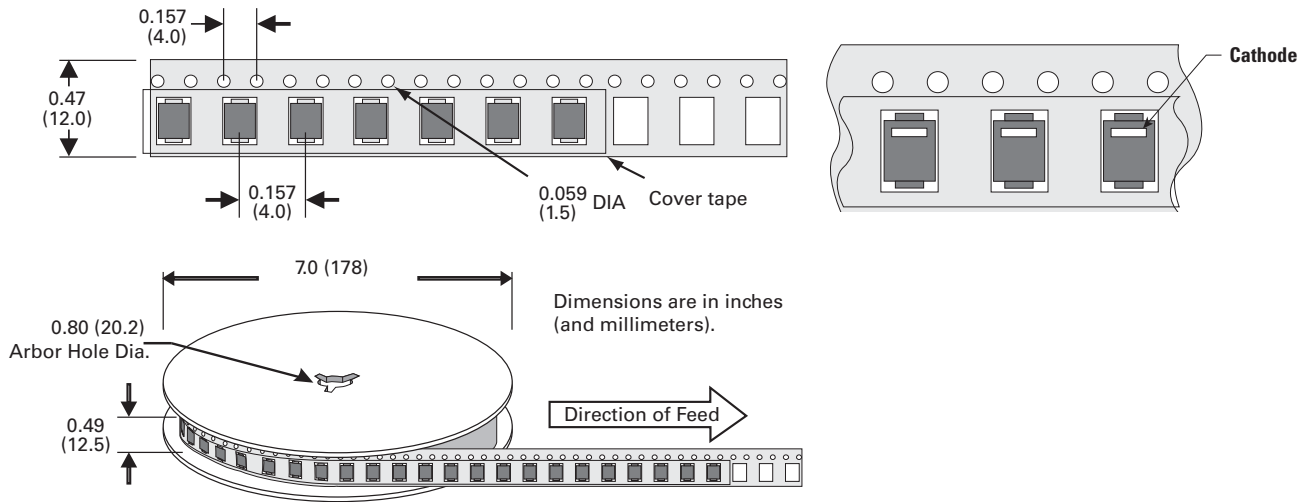
**Part Marking System**



**Packaging**


Part number	Component Package	Quantity	Packaging Option	Packaging Specification
TPSMA6LxxA	DO-221AC	3000	Tape & Reel – 12mm/7" tape	EIA RS-481

**Tape and Reel Specification**



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