TVS Diodes

Transient Voltage Suppression Diodes

SM6SxxA-C Series

Description

Transient Voltage Suppressor (TVS) is a circuit protection component that either attenuates (reduces) or filters a transient voltage spike (overvoltage), TVS diodes provide critical protection by going into avalanche breakdown within no more than a few nanoseconds after a strike, clamping the transient voltage, and routing its current to the ground.

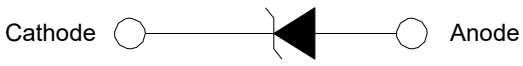
Applications

- Communication Equipment
- Security & Protection
- Industrial Control Equipment
- Power Supply
- Automotive Electronics
- New Energy
- Lightning Protection

Features

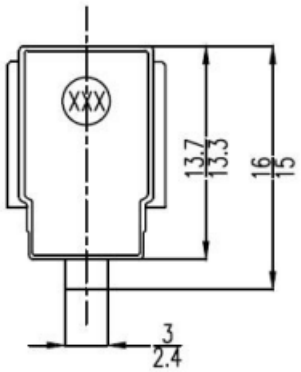
- Chip produced by chemical method
- Junction passivated by high temperature resistant insulating adhesive
- T_J = 175 °C capability suitable for high reliability and automotive requirement
- Available in Uni-directional polarity only
- Low leakage current
- Low forward voltage drop
- High surge capability
- Meets ISO16750-2 surge specification (varied by test condition)
- LF maximum peak of 245 °C
- AEC-Q101 qualified
- Meets ROHS standards
- Halogen-free
- Package:DO-218AB

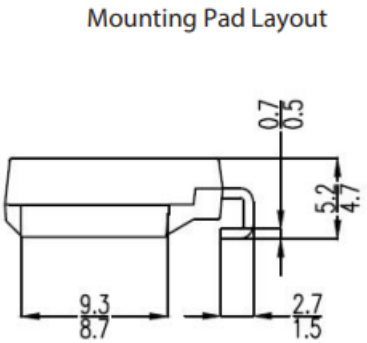
Functional Diagram

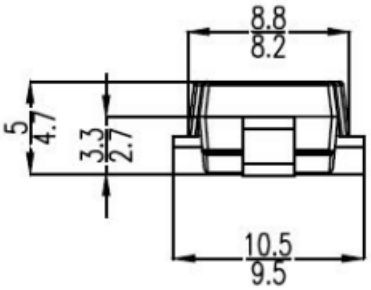


Uni-Directional

Package Outline Dimensions (DO-218AB)







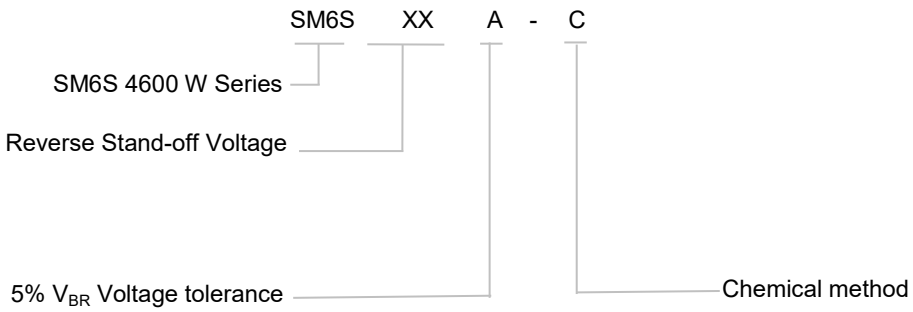
Maximum Ratings and Characteristics

(Ratings at 25°C ambient temperature unless otherwise specified.)

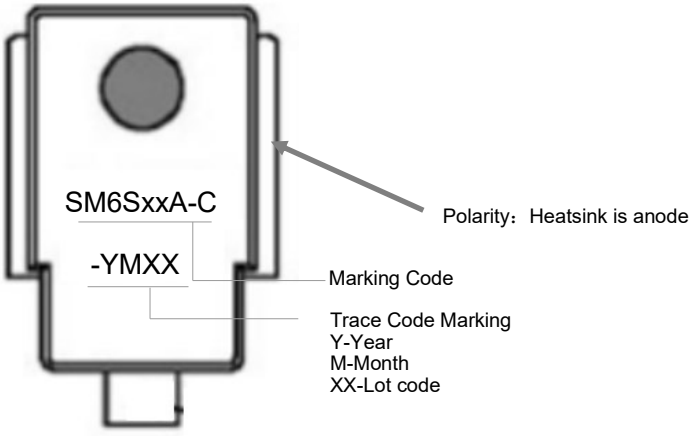
Parameter	Symbol	Value	Unit
Peak pulse power dissipation on 10/1000 μs waveform	P_{PPM}	4600	W
Peak pulse power dissipation on 10/10000 μs waveform	P_{PPM}	3600	W
Peak Power Dissipation on Infinite Heat Sink at T_C=50 °C	P_D	6.0	W
Peak pulse current with 10/1000 μs waveform	I_{PPM}	See page 6	A
Operating junction and storage temperature range	T_J ,T_{STG}	-55 to 175	°C

Note
1. Non-repetitive current pulse derated above TA = 25 °C .

Part Numbering System



Marking



Glossary

Item	Description
V_C	**Clamping Voltage** Voltage across TVS in a region of low differential resistance that serves to limit the voltage across the device terminals.
V_R	**Reverse Stand-off Voltage** Maximum voltage that can be applied to the TVS without operation. NOTE : It is also shown as V_{WM} (maximum working voltage (maximum d.c. voltage)) and known as rated stand-off voltage (V_{so}).
I_R	**Reverse Leakage Current** Current measured at V_R. NOTE : Also shown as I_D for stand-by current.
V_{BR}	**Breakdown Voltage** Voltage across TVS at a specified current I_T in the breakdown region.
I_{PPM}	**Rated Random Recurring Peak Impulse Current** Maximum-rated value of random recurring peak impulse current that may be applied to a device.
$P_{M(AV)}$	**Rated Average Power Dissipation** Maximum-rated value of power dissipation resulting from all sources, including transients and standby current, averaged over a short period of time.
P_{PPM}	**Rated Random Recurring Peak Impulse Power Dissipation** Maximum-rated value of the product of rated random recurring peak impulse current (I_{PPM}) multiplies by specified maximum clamping voltage (V_C).
C_J	**Capacitance** Capacitance across the TVS measured at a specified frequency and voltage.
V_{FS}	**Peak Forward Surge Voltage** Peak voltage across an TVS for a specified forward surge current (I_{FS}) and time duration. NOTE : Also shown as V_F.
I_{FS}	**Forward Surge Current** Pulsed current through TVS in the forward conducting region. NOTE : Also shown as I_F.
$\alpha_{V(BR)}$	**Temperature Coefficient of Breakdown Voltage** The change of breakdown voltage divided by the change of temperature.
I_{PP}	**Peak pulse Current** Peak pulse current value applied across the TVS to determine the clamping voltage V_C for a specified wave shape.
I_T	**Pulsed D.C. Test Current** Test current for measurement of the breakdown voltage V_{BR}. This is defined by the manufacturer and usually given in milliamperes with a pulse duration of less than 40 ms. NOTE : Also shown as I_{BR} .

—(GB-T 18802.321 / IEC 61643-321 / JESD210A)

Electrical Characteristics (T_A=25 °C unless otherwise noted)Table 1

Part Number	Breakdown Voltage V_{BR}@I_T		Test Current I_T	Reverse Stand-off Voltage V_R	Max. Reverse Leakage I_R@V_R		Max. Peak Pulse Current I_{PPM}	Max. Clamping Voltage V_C@I_{PPM}
	Min	Max						
Uni	(V)		(mA)	(V)	(μA @ 25 °C)	(μA @ 175 °C)	(A)	(V)
SM6S10A-C	11.1	12.3	5.0	10.0	10	150	271	17.0
SM6S11A-C	12.2	13.5	5.0	11.0	10	150	253	18.2
SM6S12A-C	13.3	14.7	5.0	12.0	10	150	231	19.9
SM6S13A-C	14.4	15.9	5.0	13.0	10	150	214	21.5
SM6S14A-C	15.6	17.2	5.0	14.0	10	150	198	23.2
SM6S15A-C	16.7	18.5	5.0	15.0	10	150	189	24.4
SM6S16A-C	17.8	19.7	5.0	16.0	10	150	177	26.0
SM6S17A-C	18.9	20.9	5.0	17.0	10	150	167	27.6
SM6S18A-C	20.0	22.1	5.0	18.0	10	150	158	29.2
SM6S20A-C	22.2	24.5	5.0	20.0	10	150	142	32.4
SM6S22A-C	24.4	26.9	5.0	22.0	10	150	130	35.5
SM6S24A-C	26.7	29.5	5.0	24.0	10	150	118	38.9
SM6S26A-C	28.9	31.9	5.0	26.0	10	150	109	42.1
SM6S28A-C	31.1	34.4	5.0	28.0	10	150	101	45.4
SM6S30A-C	33.3	36.8	5.0	30.0	10	150	95	48.4
SM6S33A-C	36.7	40.6	5.0	33.0	10	150	86	53.3
SM6S36A-C	40.0	44.2	5.0	36.0	10	150	79	58.1
SM6S40A-C	44.4	49.1	5.0	40.0	10	150	71	64.5
SM6S43A-C	47.8	52.8	5.0	43.0	10	150	66	69.4
SM6S45A-C	50.0	55.3	5.0	45.0	10	150	63	72.7
SM6S48A-C	53.3	58.9	5.0	48.0	10	150	59	77.4
SM6S51A-C	56.7	62.7	5.0	51.0	10	150	56	82.4
SM6S54A-C	60.0	66.3	5.0	54.0	10	150	53	87.1
SM6S58A-C	64.4	71.2	5.0	58.0	10	150	49	93.6
SM6S60A-C	66.7	73.7	5.0	60.0	10	150	48	96.8
SM6S64A-C	71.1	78.6	5.0	64.0	10	150	45	103
SM6S70A-C	77.8	86.0	5.0	70.0	10	150	41	113
SM6S75A-C	83.3	92.1	5.0	75.0	10	150	38	121
SM6S78A-C	86.7	95.8	5.0	78.0	10	150	37	126
SM6S85A-C	94.4	104.0	5.0	85.0	10	150	34	137

Note
1. To calculate V_{BR} vs. junction temperature, use the following formula: V_{BR} at T_J = V_{BR} at 25 °C x (1 + αT x (T_J - 25)).

Performance Curve for Reference (T_A=25 °C unless otherwise noted)

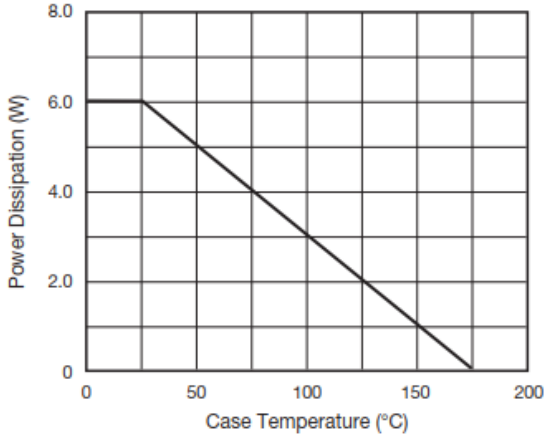


FIGURE 1
Power Derating Curve

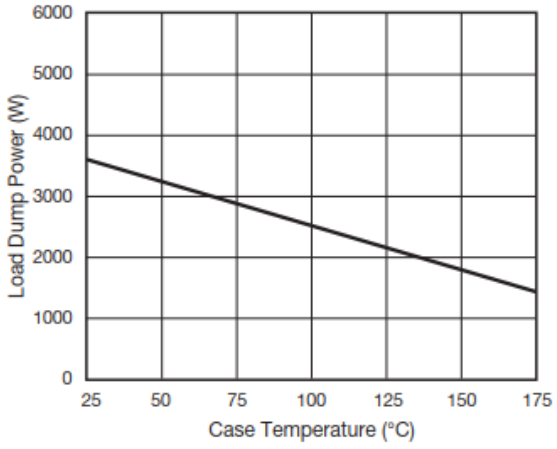


FIGURE 2
Load Dump Power Characteristics
(10 ms Exponential Waveform)

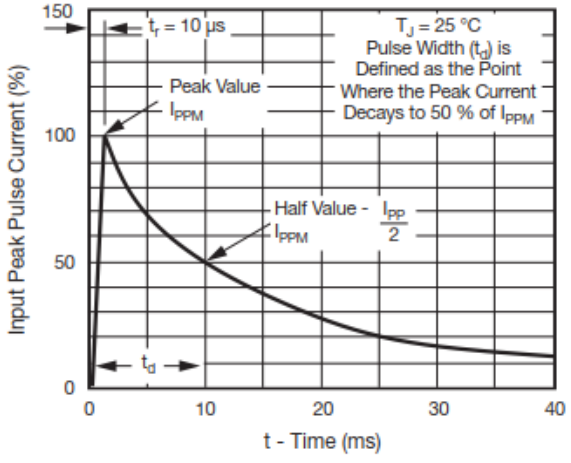


FIGURE 3
Pulse Waveform

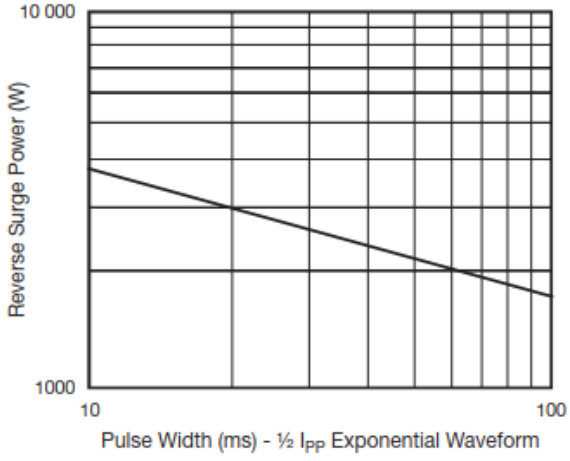


FIGURE 4
Reverse Power Capability

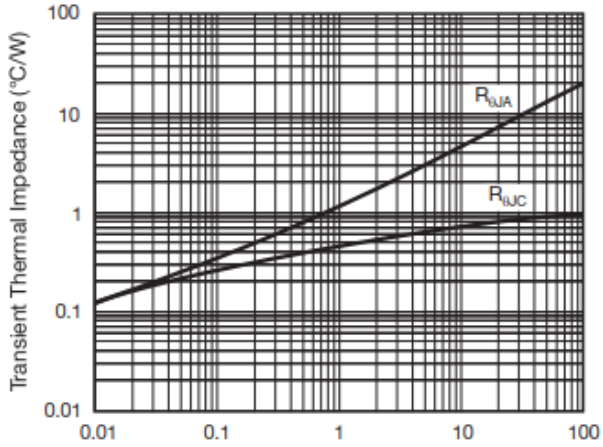
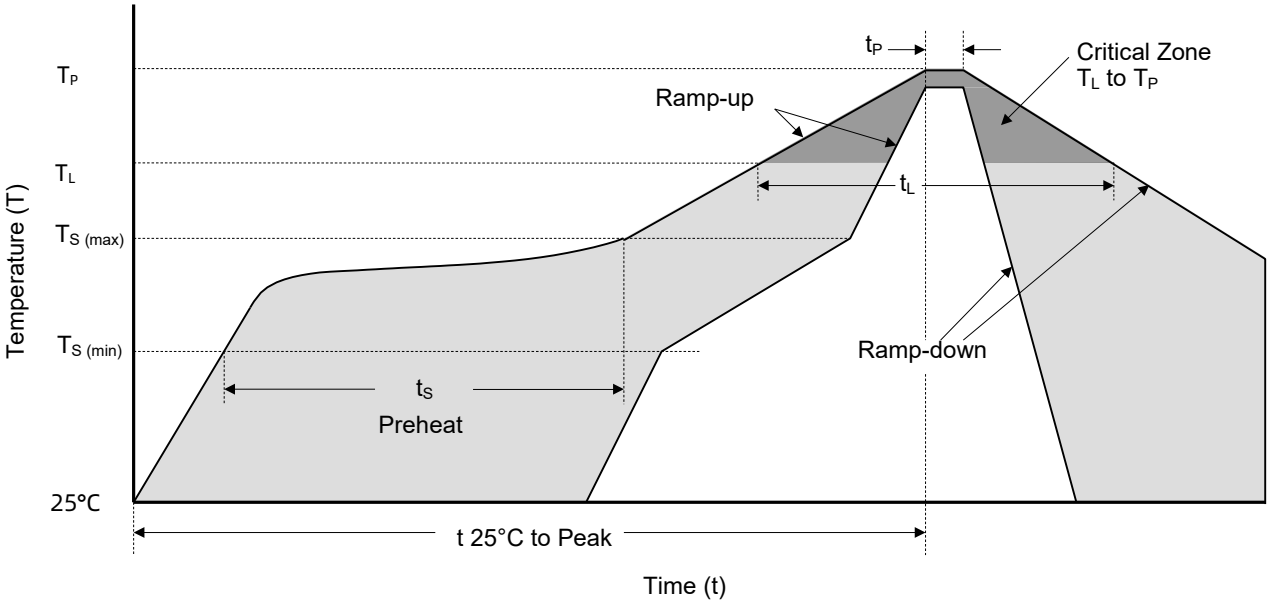


FIGURE 5
Typical Transient Thermal Impedance

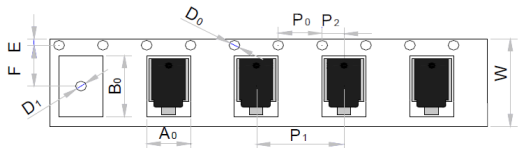
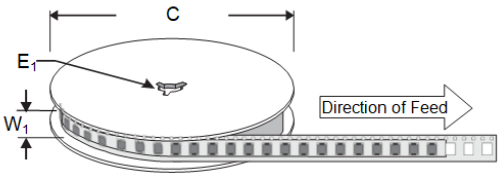
Soldering Parameters



Reflowing Condition

Reflow Soldering Parameters		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 ~ 180 seconds
Average Ramp Up Rate (Liquidus Temp (TL) 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_L)	60 ~ 150 seconds
Peak Temperature (T_P)		$245^{+0/-5}$ °C
Time of within 5 °C of Actual Peak Temperature (t_P)		20 ~ 40 seconds
Ramp-down Rate		6 °C / second max.
Time from 25 °C to Peak Temperature		8 Minutes max.
Do Not Exceed		245 °C

Packaging Information

Tape	Symbol	Dimension	
		Millimeters	Inches
	A_0	10.8 ± 0.3	0.425 ± 0.012
	B_0	16.13±0.3	0.635 ± 0.012
	C	330.0 ± 0.3	13.0 ± 0.012
	D_0	1.55 ± 0.2	0.061 ± 0.008
	D_1	1.55 ± 0.2	0.061 ± 0.008
	E	1.75 ± 0.2	0.069 ± 0.008
	E_1	13.30 ± 0.2	0.524 ± 0.008
	F	11.50 ± 0.2	0.453 ± 0.008
	P_0	4.00 ± 0.2	0.157 ± 0.008
	P_1	16.00 ± 0.2	0.630 ± 0.008
	P_2	2.00 ± 0.2	0.079 ± 0.008
	W	24.00 ± 0.2	0.945 ± 0.008
	W_1	25.85 ± 0.2	1.018 ± 0.008

Part Number	Unit Weight	Package	QTY (Reel)	Packaging Option	Packaging Specification
SM6SxxA-C	2.9 g	DO-218AB	750 PCS	Tape & Reel 13” reel	EIA STD RS-481

ATTENTION

Usage

1.TVS must be operated in the specified ambient temp.

2.Do not clean the TVS with strong polar solvent such as ketone, esters, benzene and halogenated hydrocarbon, to avoid damaging the encapsulating layer.

3.Please do not apply severe vibration, shock or pressure to TVS, to avoid element cracking.

Replacement

1.If TVS is visually damaged, please replace it.

2.TVS is a non-repairable product. For safety sake, please use equivalent TVS for replacement.

Storage

1.Storage Temp. Range: (-55 to 150) °C.

2.Do not store the TVS at the high temp., high humidity or corrosive gas environment, to avoid influencing the solder- ability of the lead wires. The product shall be used up within 1 year after receiving the goods.

Environmental Conditions

1.TVS should not be exposed to the open air, nor direct sunshine.

2.TVS should avoid rain, water vapor or other condition of high temp. and high humidity.

3.TVS should avoid sand dust, salt mist, or other harmful gases.

Max. Typical Capacitance of TVS

The typical capacitance of TVS is listed in the specifications. Designers may refer to it when designing TVS in High frequency circuit.

Installation Mechanical Stress

1.Do not knock TVS when installing, to avoid mechanical damage.

2.Please do not apply severe vibration, shock or pressure to TVS, to avoid surface resin or element cracking.

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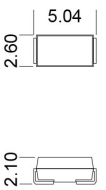
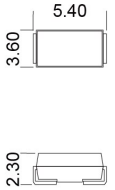
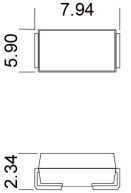
Automotive TVS Diodes (Surface Mount) Feature Overview

Package Type	Series							Page
DO-214AA	○	○	ASMB	ASMB-VR	○	○	○	○
DO-214AB	○	○	○	○	ASMC	ASMC-VR	ASMD	A5.0SMD
DO-214AC	ASMA	ASMA-VR	○	○	○	○	○	○
DO-218AB	○	○	○	○	○	○	○	○
Product Outline (mm)								
V_R / V_{WM} (V) Reverse Stand-off Voltage	5.8 ~ 468	5.0 ~ 440	5.8 ~ 553	5.0 ~ 440	5.8 ~ 512	5.0 ~ 440	5.0 ~ 100	12.0 ~ 170
P_{PPM} (W) (10/1000 μs) Rated Peak ImPulse Power Dissipation	400		600		1500		3000	5000
Operating Temperature (°C)	-55 to +150							

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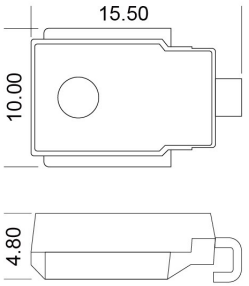
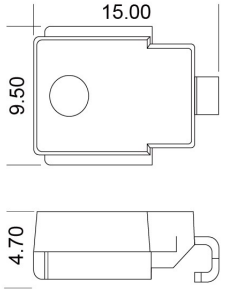
Automotive TVS Diodes (Surface Mount) Feature Overview

Package Type	SM5SxxA-C	SM5SxxCA-C	SM6SxxA-C	SM6SxxCA-C	SM8SxxA-C	SM8SxxCA-C	SM8TxxA	SM8TxxCA	Page
DO-214AA	○	○	○	○	○	○	○	○	Series
DO-214AB	○	○	○	○	○	○	○	○	
DO-214AC	○	○	○	○	○	○	○	○	
DO-218AB									
Product Outline (mm)									
V_R / V_{WM} (V) Reverse Stand-off Voltage			10.0 ~ 85.0				20.0 ~ 43.0	33.0 ~ 36.0	
P_{PPM} (W) (10/1000 μs) Rated Peak ImPulse Power Dissipation		3600		4600		6600		8000	
Operating Temperature (°C)				-55 to +175					

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