TVS Diodes

Transient Voltage Suppression Diodes

SM5SxxCA-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
- Surge Protection

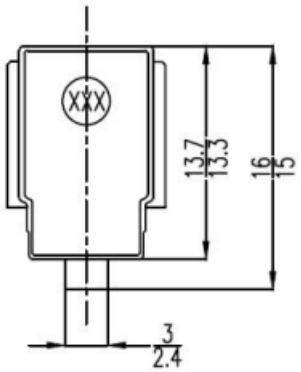
Features

- 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 Bi-directional polarity only
- Low leakage current
- 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
- Plastic package is flammability rated UL 94V-0 per Underwriters Laboratories

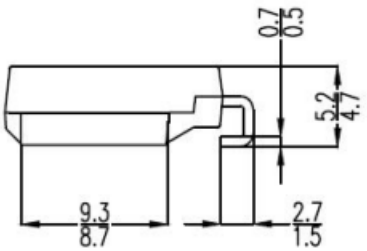
Functional Diagram

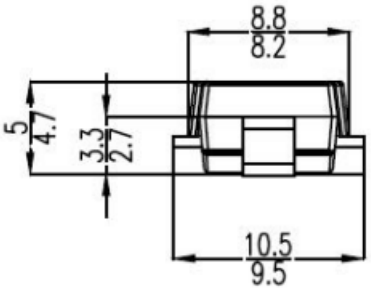
Bi-Directional

Package Outline Dimensions (DO-218AB)



Mounting Pad Layout





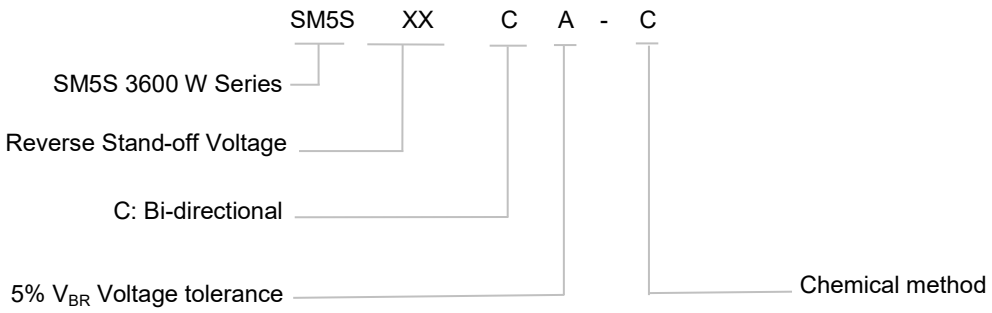
Maximum Ratings and Characteristics

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

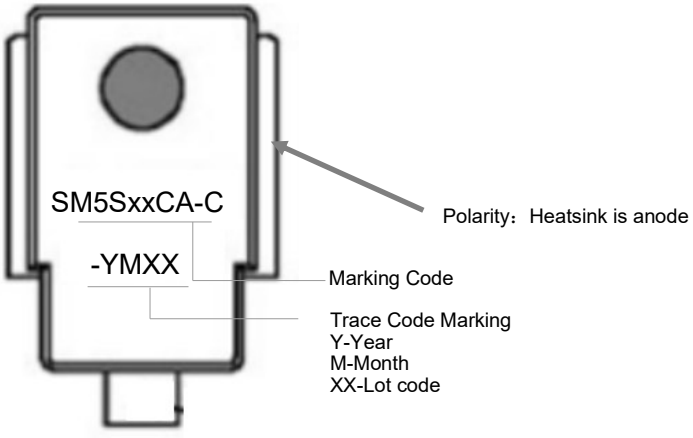
Parameter	Symbol	Value	Unit
Peak pulse power dissipation on 10/1000 μs waveform	P_{PPM}	3600	W
Peak pulse power dissipation on 10/10000 μs waveform	P_{PPM}	2800	W
Peak Power Dissipation on Infinite Heat Sink at T_C=50 °C	P_D	5.0	W
Peak pulse current with 10/1000 μs waveform	I_{PPM}	See page 6	A
Operating 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						
Bi	(V)		(mA)	(V)	(μA @ 25 °C)	(μA @ 175 °C)	(A)	(V)
SM5S10CA-C	11.1	12.3	5.0	10.0	10	150	212	17.0
SM5S11CA-C	12.2	13.5	5.0	11.0	10	150	198	18.2
SM5S12CA-C	13.3	14.7	5.0	12.0	10	150	181	19.9
SM5S13CA-C	14.4	15.9	5.0	13.0	10	150	167	21.5
SM5S14CA-C	15.6	17.2	5.0	14.0	10	150	155	23.2
SM5S15CA-C	16.7	18.5	5.0	15.0	10	150	148	24.4
SM5S16CA-C	17.8	19.7	5.0	16.0	10	150	138	26.0
SM5S17CA-C	18.9	20.9	5.0	17.0	10	150	130	27.6
SM5S18CA-C	20.0	22.1	5.0	18.0	10	150	123	29.2
SM5S20CA-C	22.2	24.5	5.0	20.0	10	150	111	32.4
SM5S22CA-C	24.4	26.9	5.0	22.0	10	150	101	35.5
SM5S24CA-C	26.7	29.5	5.0	24.0	10	150	93	38.9
SM5S26CA-C	28.9	31.9	5.0	26.0	10	150	86	42.1
SM5S28CA-C	31.1	34.4	5.0	28.0	10	150	79	45.4
SM5S30CA-C	33.3	36.8	5.0	30.0	10	150	74	48.4
SM5S33CA-C	36.7	40.6	5.0	33.0	10	150	68	53.3
SM5S36CA-C	40.0	44.2	5.0	36.0	10	150	62	58.1
SM5S40CA-C	44.4	49.1	5.0	40.0	10	150	56	64.5
SM5S43CA-C	47.8	52.8	5.0	43.0	10	150	52	69.4
SM5S45CA-C	50.0	55.3	5.0	45.0	10	150	50	72.7
SM5S48CA-C	53.3	58.9	5.0	48.0	10	150	47	77.4
SM5S51CA-C	56.7	62.7	5.0	51.0	10	150	44	82.4
SM5S54CA-C	60.0	66.3	5.0	54.0	10	150	42	87.1
SM5S58CA-C	64.4	71.2	5.0	58.0	10	150	39	93.6
SM5S60CA-C	66.7	73.7	5.0	60.0	10	150	38	96.8
SM5S64CA-C	71.1	78.6	5.0	64.0	10	150	35	103
SM5S70CA-C	77.8	86.0	5.0	70.0	10	150	32	113
SM5S75CA-C	83.3	92.1	5.0	75.0	10	150	30	121
SM5S78CA-C	86.7	95.8	5.0	78.0	10	150	29	126
SM5S85CA-C	94.4	104.0	5.0	85.0	10	150	27	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)

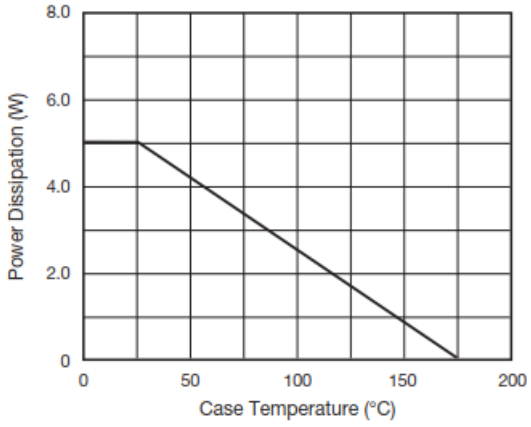


FIGURE 1
Power Derating Curve

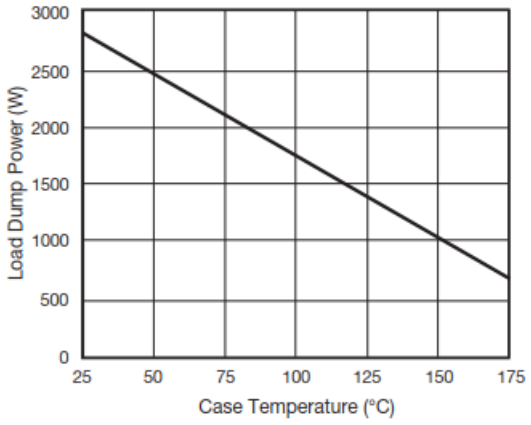


FIGURE 2
Load Dump Power Characteristics
(10 ms Exponential Waveform)

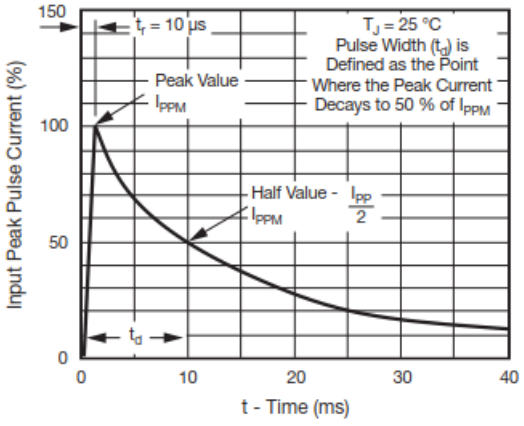


FIGURE 3
Pulse Waveform

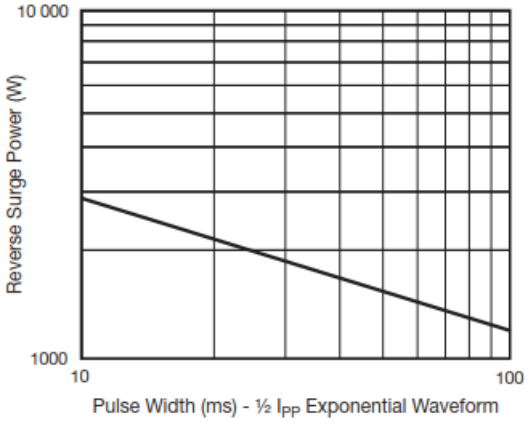
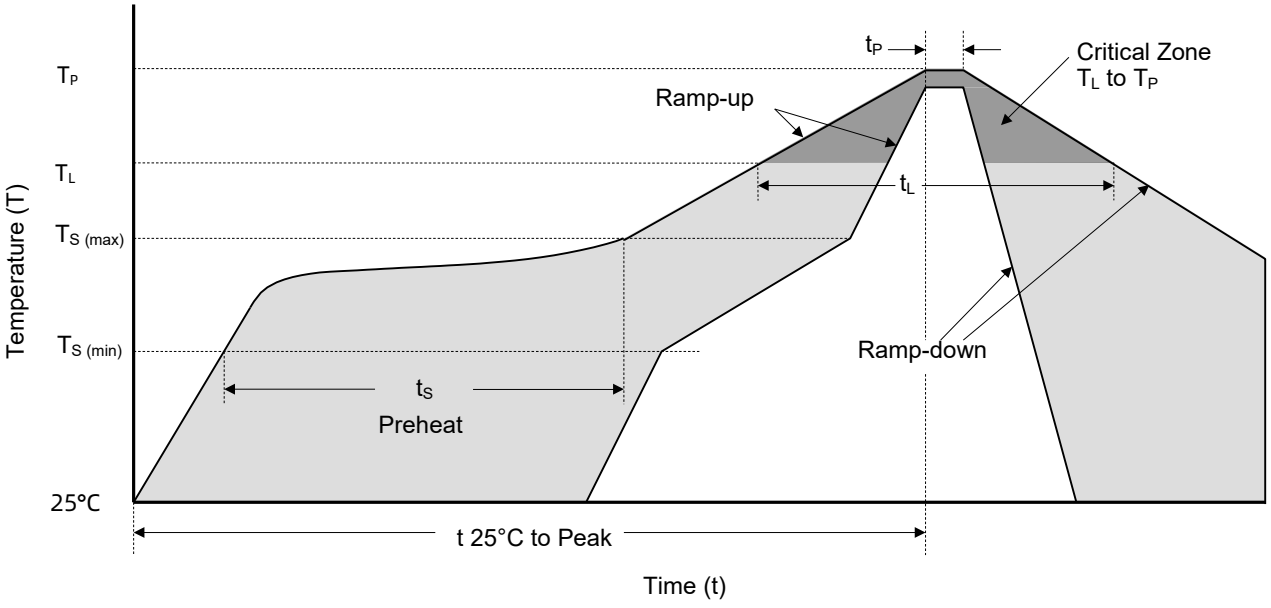


FIGURE 4
Reverse Power Capability

FIGURE 5
Typical Transient Thermal Impedance

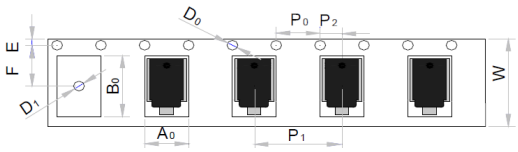
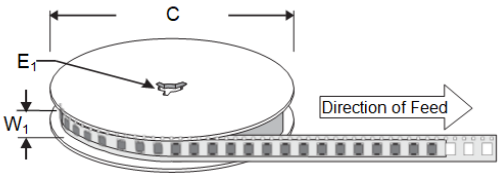
Soldering Parameters



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
SM5SxxCA-C	2.85 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.