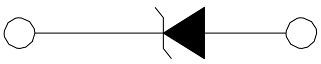
Description

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.

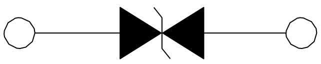
Applications

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

Functional Diagram



Uni-Directional



Bi-Directional

Features

- Meet AEC-Q101 requirement
- Low incremental surge resistance
- Excellent clamping capability
- Low profile package with built-in strain relief
- Typical I_R less than 1.0 µA above 12 V
- 1500 W peak pulse power capability with a 10/1000 µS Waveform, repetition rate (duty cycle): 0.01%
- For surface mounted applications to optimize board space
- Typical failure mode is short from over-specified voltage or current
- IEC 61000-4-2 ESD 30 kV (Air), 30 kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Very fast response time
- Glass passivated chip junction
- High temperature to reflow soldering guaranteed: 260 °C/30sec
- V_{BR} @ T_J= V_{BR}@25 °C x (1+αT x (T_J - 25)) (αT:Temperature Coefficient, typical value is 0.1%)
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Meet MSL level1, per J-STD-020
- 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)

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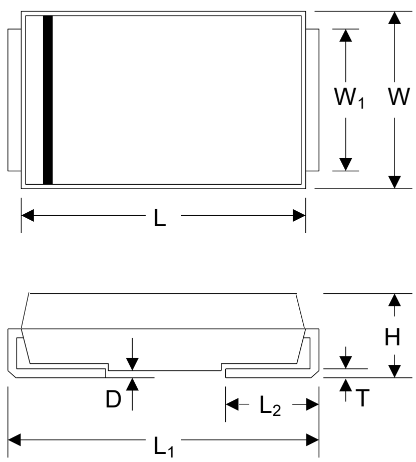
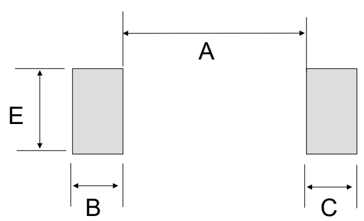
Package Outline Dimensions (DO-214AB)





Mounting Pad Layout

Symbol	Millimeters		Inches	
	Min.	Max.	Min.	Max.
L	6.60	7.11	0.260	0.280
W	5.59	6.22	0.220	0.245
W_1	2.90	3.20	0.114	0.126
H	2.06	2.62	0.079	0.103
T	0.152	0.305	0.006	0.012
L_1	7.75	8.13	0.305	0.320
L_2	0.76	1.52	0.030	0.060
D	-	0.203	-	0.008
A	-	4.20	-	0.165
B	2.40	-	0.094	-
C	2.40	-	0.094	-
E	3.30	-	0.129	-

TVS

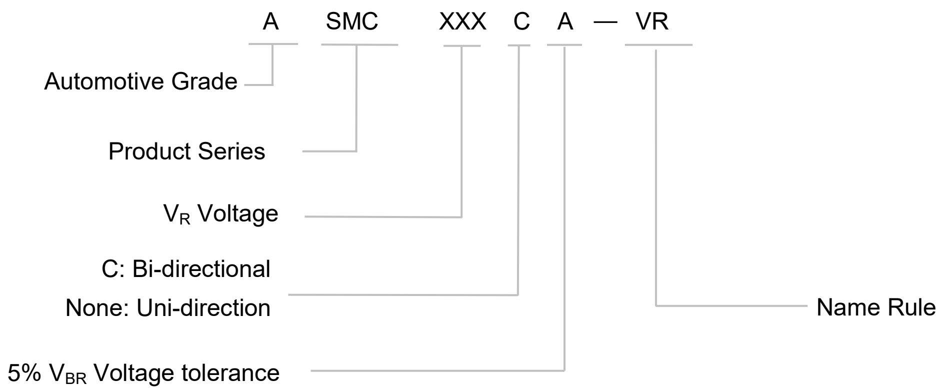
Maximum Ratings and Characteristics

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

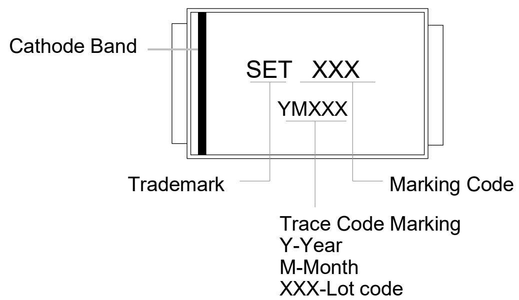
Parameter	Symbol	Value	Unit
Peak Power Dissipation with a 10/1000 µS waveform(1)(2)(Fig.1)-Single Die Parts	P_{PPM}	1500	W
Peak Pulse Power Dissipation(Fig.2) by 10/1000 uS Test Waveform(1)(2(Fig.4) - Stacked Die Parts (5)	P_{PPM}	2000	W
Peak Power Dissipation on Infinite Heat Sink at T_L=50 °C	P_D	6.5	W
Peak Forward Surge Current,8.3 ms single half sinewave superimposed on rated load (JEDEC Method)(3)	I_{FSM}	200	A
Maximum Instantaneous Forward Voltage at 100 A for Unidirectional Only(4)	V_F	3.5/5.0	V
Operating Temperature Range	T_J	-65 to 150	°C
Storage Temperature Range	T_{STG}	-65 to 175	°C
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	15	°C / W
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	75	°C / W

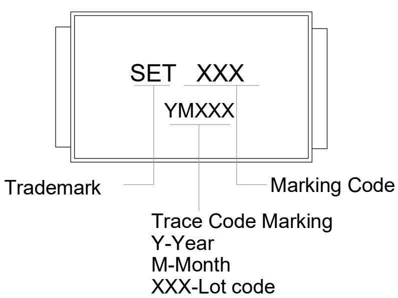
Notes
1. Non-repetitive current pulse, per Fig. 4 and derated above T_J (initial)=25 °C per Fig. 3.
2. Mounted on 8.0 mm^2 land areas.
3. Measured of 8.3 ms single half sine-wave or equivalent square wave, duty cycle=4 pulses per minute maximum.
4. V_F < 3.5 V for single die parts and V_F< 5.0 V for stacked-die parts.

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)

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Electrical Characteristics (T$_A$=25 °C unless otherwise noted)Table 1

Part Number		Device Marking Code		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	Bi	Uni	Bi	(V)		(mA)	(V)	(μA)	(A)	(V)
ASMC5.0A-VR	ASMC5.0CA-VR	AGDE	ABDE	6.4	7. 0	10	5	800	163	9.2
ASMC6.0A-VR	ASMC6.0CA-VR	AGDG	ABDG	6.67	7.37	10	6	800	145.7	10.3
ASMC6.5A-VR	ASMC6.5CA-VR	AGDK	ABDK	7.22	7.98	10	6.5	500	134	11.2
ASMC7.0A-VR	ASMC7.0CA-VR	AGDM	ABDM	7.78	8.6	10	7	200	125	12
ASMC7.5A-VR	ASMC7.5CA-VR	AGDP	ABDP	8.33	9.21	1	7.5	100	116.3	12.9
ASMC8.0A-VR	ASMC8.0CA-VR	AGDR	ABDR	8.89	9.83	1	8	50	110.3	13.6
ASMC8.5A-VR	ASMC8.5CA-VR	AGDT	ABDT	9.44	10.4	1	8.5	20	104.2	14.4
ASMC9.0A-VR	ASMC9.0CA-VR	AGDV	ABDV	10	11.1	1	9	10	97.4	15.4
ASMC10A-VR	ASMC10CA-VR	AGDX	ABDX	11.1	12.3	1	10	5	88.3	17
ASMC11A-VR	ASMC11CA-VR	AGDZ	ABDZ	12.2	13.5	1	11	1	82.5	18.2
ASMC12A-VR	ASMC12CA-VR	AGEE	ABEE	13.3	14.7	1	12	1	75.4	19.9
ASMC13A-VR	ASMC13CA-VR	AGEG	ABEG	14.4	15.9	1	13	1	69.8	21.5
ASMC14A-VR	ASMC14CA-VR	AGEK	ABEK	15.6	17.2	1	14	1	64.7	23.2
ASMC15A-VR	ASMC15CA-VR	AGEM	ABEM	16.7	18.5	1	15	1	61.5	24.4
ASMC16A-VR	ASMC16CA-VR	AGEP	ABEP	17.8	19.7	1	16	1	57.7	26
ASMC17A-VR	ASMC17CA-VR	AGER	ABER	18.9	20.9	1	17	1	54.4	27.6
ASMC18A-VR	ASMC18CA-VR	AGET	ABET	20	22.1	1	18	1	51.4	29.2
ASMC20A-VR	ASMC20CA-VR	AGEV	ABEV	22.2	24.5	1	20	1	46.3	32.4
ASMC22A-VR	ASMC22CA-VR	AGEX	ABEX	24.4	26.9	1	22	1	42.3	35.5
ASMC24A-VR	ASMC24CA-VR	AGEZ	ABEZ	26.7	29.5	1	24	1	38.6	38.9
ASMC26A-VR	ASMC26CA-VR	AGFE	ABFE	28.9	31.9	1	26	1	35.7	42.1
ASMC28A-VR	ASMC28CA-VR	AGFG	ABFG	31.1	34.4	1	28	1	33.1	45.4
ASMC30A-VR	ASMC30CA-VR	AGFK	ABFK	33.3	36.8	1	30	1	31	48.4
ASMC33A-VR	ASMC33CA-VR	AGFM	ABFM	36.7	40.6	1	33	1	28.2	53.3
ASMC36A-VR	ASMC36CA-VR	AGFP	ABFP	40	44.2	1	36	1	25.9	58.1
ASMC40A-VR	ASMC40CA-VR	AGFR	ABFR	44.4	49.1	1	40	1	23.3	64.5
ASMC43A-VR	ASMC43CA-VR	AGFT	ABFT	47.8	52.8	1	43	1	21.7	69.4
ASMC45A-VR	ASMC45CA-VR	AGFV	ABFV	50	55.3	1	45	1	20.6	72.7
ASMC48A-VR	ASMC48CA-VR	AGFX	ABFX	53.3	58.9	1	48	1	19.4	77.4

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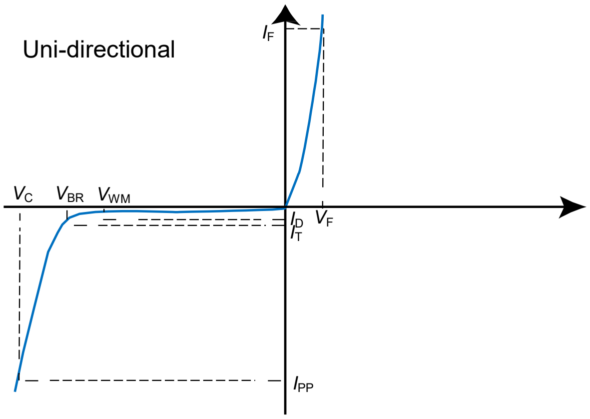
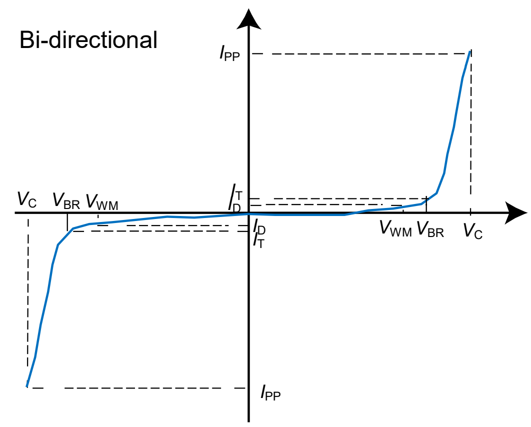
Part Number		Device Marking Code		Breakdown Voltage V_{BR}@I_T		Test Current I_T	Reverse Stand-off Voltage V_R	Max. Reverse Leakage I_R@V_R	Max. Peak Pulse Current I_{PPM}	Max. Clamping Voltage V_C@I_{PPM}
				Min	Max					
Uni	Bi	Uni	Bi	(V)		(mA)	(V)	(μA)	(A)	(V)
ASMCJ51A-VR	ASMCJ51CA-VR	AGFZ	ABFZ	56.7	62.7	1	51	1	18.2	82.4
ASMCJ54A-VR	ASMCJ54CA-VR	AGGE	ABGE	60	66.3	1	54	1	17.3	87.1
ASMCJ58A-VR	ASMCJ58CA-VR	AGGG	ABGG	64.4	71.2	1	58	1	16.1	93.6
ASMCJ60A-VR	ASMCJ60CA-VR	AGGK	ABGK	66.7	73.7	1	60	1	15.5	96.8
ASMCJ64A-VR	ASMCJ64CA-VR	AGGM	ABGM	71.1	78.6	1	64	1	14.6	103
ASMCJ70A-VR	ASMCJ70CA-VR	AGGP	ABGP	77.8	86	1	70	1	13.3	113
ASMCJ75A-VR	ASMCJ75CA-VR	AGGR	ABGR	83.3	92.1	1	75	1	12.4	121
ASMCJ78A-VR	ASMCJ78CA-VR	AGGT	ABGT	86.7	95.8	1	78	1	11.9	126
ASMCJ85A-VR	ASMCJ85CA-VR	AGGV	ABGV	94.4	104	1	85	1	11	137
ASMCJ90A-VR	ASMCJ90CA-VR	AGGX	ABGX	100	111	1	90	1	10.3	146
ASMCJ100A-VR	ASMCJ100CA-VR	AGGZ	ABGZ	111	123	1	100	1	9.3	162
ASMCJ110A-VR	ASMCJ110CA-VR	AGHE	ABHE	122	135	1	110	1	8.5	177
ASMCJ120A-VR	ASMCJ120CA-VR	AGHG	ABHG	133	147	1	120	1	7.8	193
ASMCJ130A-VR	ASMCJ130CA-VR	AGHK	ABHK	144	159	1	130	1	7.2	209
ASMCJ150A-VR	ASMCJ150CA-VR	AGHM	ABHM	167	185	1	150	1	6.2	243
ASMCJ160A-VR	ASMCJ160CA-VR	AGHP	ABHP	178	197	1	160	1	5.8	259
ASMCJ170A-VR	ASMCJ170CA-VR	AGHR	ABHR	189	209	1	170	1	5.5	275
ASMCJ180A-VR	ASMCJ180CA-VR	AGHT	ABHT	201	222	1	180	1	5.1	292
ASMCJ200A-VR	ASMCJ200CA-VR	AGHV	ABHV	224	247	1	200	1	4.6	324
ASMCJ220A-VR	ASMCJ220CA-VR	AGHX	ABHX	246	272	1	220	1	4.2	356
ASMCJ250A-VR	ASMCJ250CA-VR	AGHZ	ABHZ	279	309	1	250	1	3.7	405
ASMCJ300A-VR	ASMCJ300CA-VR	AGJE	ABJE	335	371	1	300	1	3.1	486
ASMCJ350A-VR	ASMCJ350CA-VR	AGJG	ABJG	391	432	1	350	1	2.6	567
ASMCJ400A-VR	ASMCJ400CA-VR	AGJK	ABJK	447	494	1	400	1	2.3	648
ASMCJ440A-VR	ASMCJ440CA-VR	AGJM	ABJM	492	543	1	440	1	2.1	713

Notes:
1. For bidirectional type having V_{BR} of 10 volts and less, the I_R should be doubled.
2. For parts without A in the PN , the V_{BR} tolerance is ± 10% and V_C is 5% higher than parts with A .The parts without A are currently available, but not recommended for new designs. The parts with A are preferred.

TVS

I-V Curve Characteristics





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

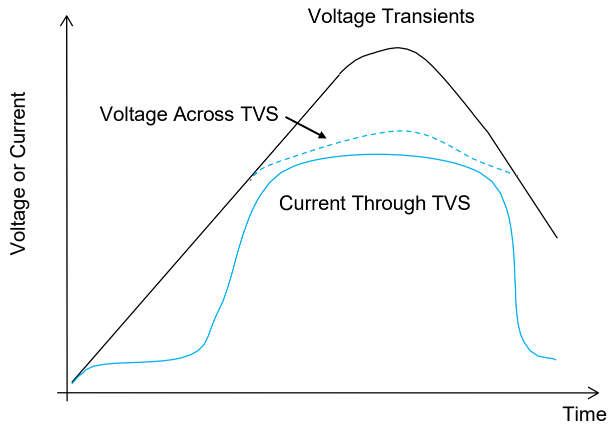


FIGURE 1 TVS Transients Clamping Waveform

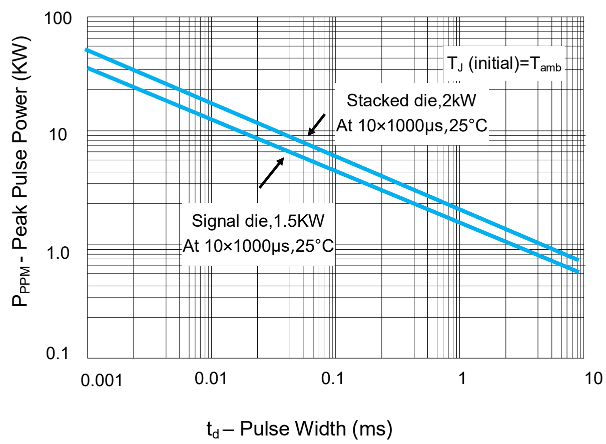


FIGURE 2 Peak Pulse Power Rating Curve

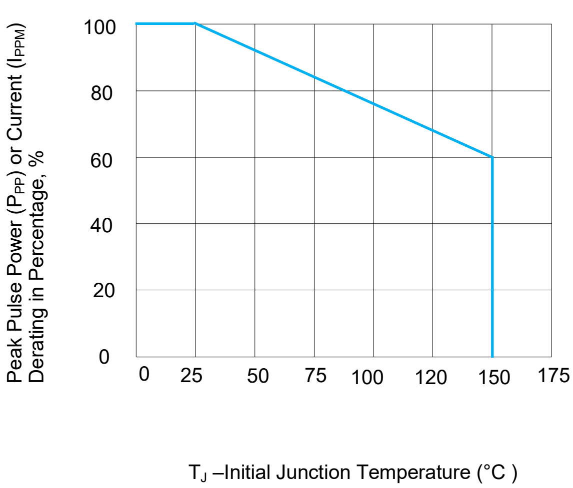


FIGURE 3 Peak Pulse Power Derating Curve

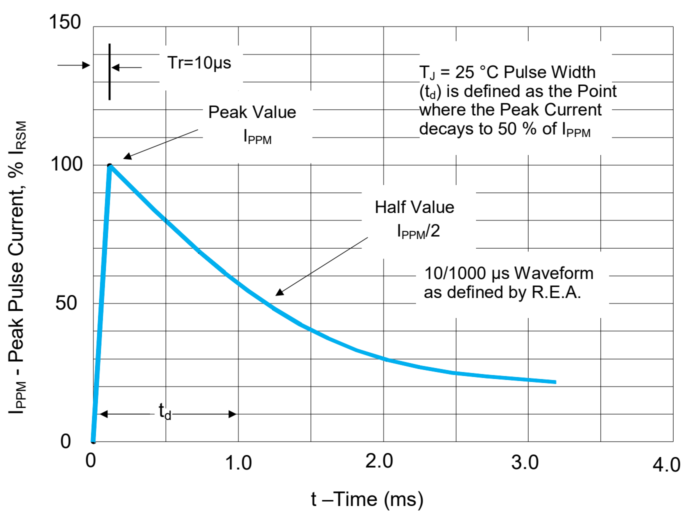


FIGURE 4 Pulse Waveform

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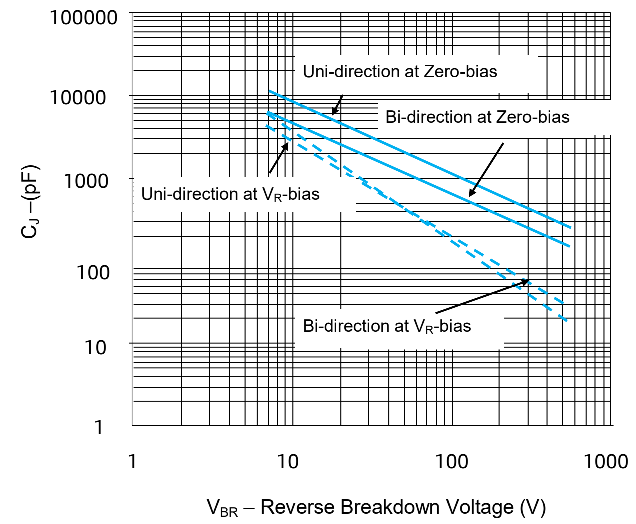


FIGURE 5 Typical Junction Capacitance

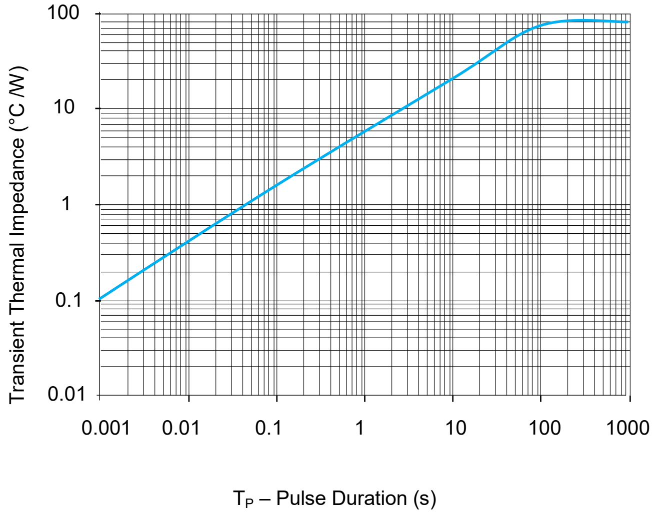


FIGURE 6 Typical Transient Thermal Impedance

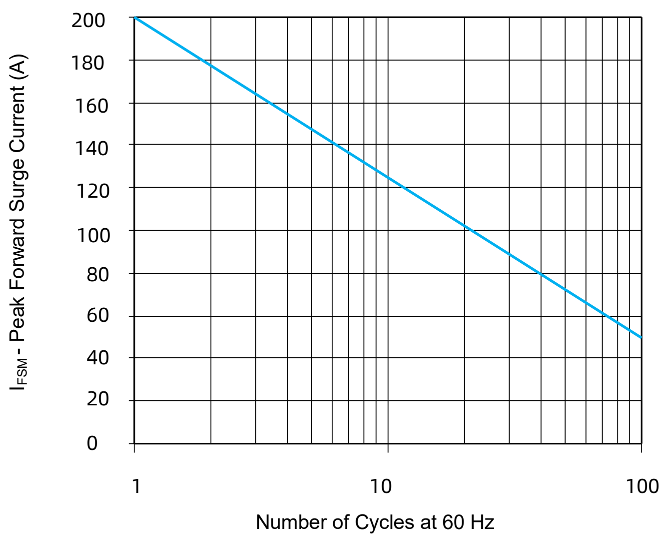


FIGURE 7 Maximum Non-Repetitive Forward Surge Current Uni-Directional only

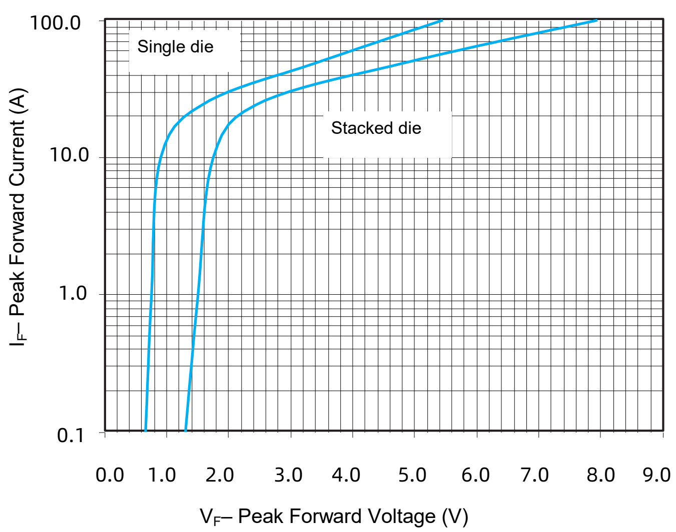


FIGURE 8 Peak Forward Drop vs Peak Forward Current (Typical Values)

Environmental Specifications

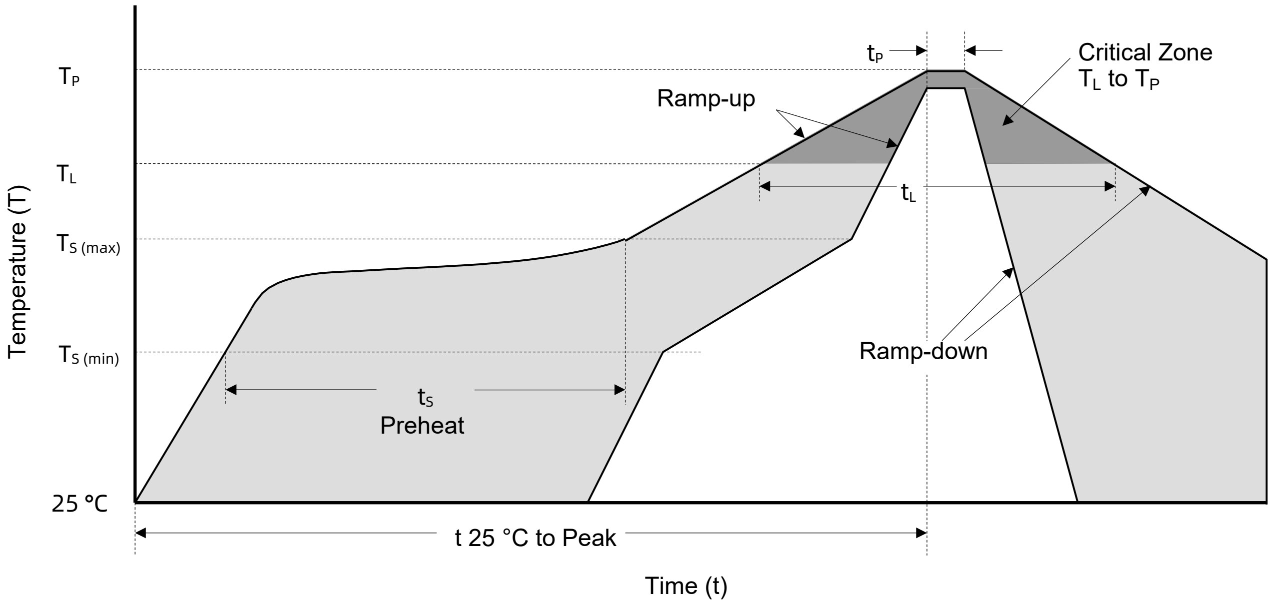
High Temp. Storage	JESD22-A103
HTRB	JESD22-A108
MSL	JESDEC-J-STD-020, Level 1
Temperature Cycling	JESD22-A104
H3TRB	JESD22-A101
RSH	JESD22-A111

Physical Specifications

Weight	0.007 ounce,0.21 grams
Case	JESD22DO214AB. Molded plastic body over glass passivated junction
Polarity	Color band denotes positive end (cathode) except Bidirectional
Terminal	Matte Tin-plated leads, Solderability per JESD22-B102

TVS

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 ~ 120 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)		$260^{+0/-5}$ °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		260 °C

TVS

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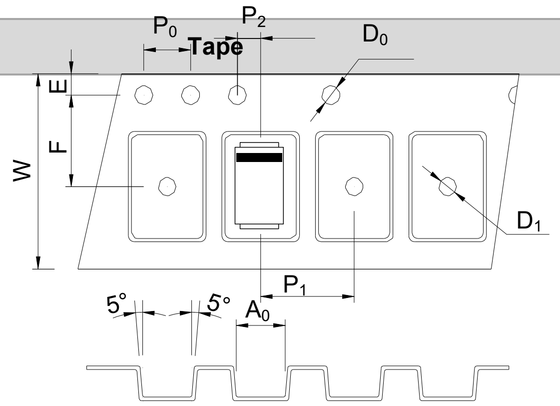
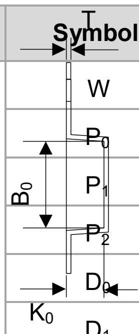
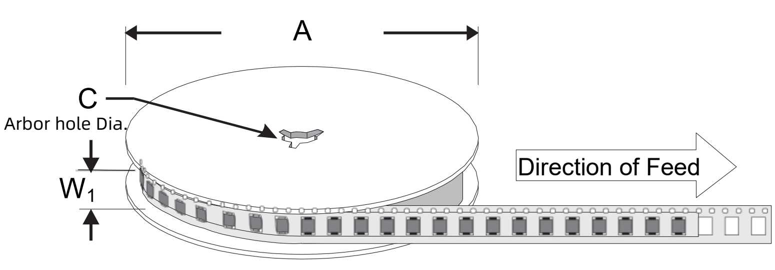
Packaging Information





Tape	Symbol	Dimension (mm)
	W	16.00 + 0.3 / - 0.10
	P_0	4.00 ± 0.10
	P_1	8.00 ± 0.10
	P_2	2.00 ± 0.10
	D_0	1.55 ± 0.05
	D_1	1.55 ± 0.05
	E	1.75 ± 0.10
	F	7.50 ± 0.10
	A_0	6.15 ± 0.10
	B_0	8.30 ± 0.10
	K_0	2.48 ± 0.10
	T	0.30 ± 0.05



Reel Size	13” Reel	
	A	330 mm
	C	13.2 mm
	W_1	16.4 mm

Part Number	Package	QTY (Reel)	Packaging Option	Packaging Specification
ASMC×××-VR	DO-214AB	3000 PCS	Tape & Reel – 16 mm tape/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.

TVS

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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