

# NSB13ANT3G

## 600 Watt Peak Power Zener Transient Voltage Suppressor

### Unidirectional

The NSB13ANT3G is designed to protect voltage sensitive components from high voltage, high energy transients. This device has excellent clamping capability, high surge capability, low zener impedance and fast response time. The NSB13ANT3G is ideally suited for use in computer hard disk drives, communication systems, automotive, numerical controls, process controls, medical equipment, business machines, power supplies, and many other industrial/consumer applications.

#### Specification Features:

- Working Peak Reverse Voltage Range - 13 V
- Peak Power - 600 Watts @ 1 ms at Maximum Clamp Voltage @ Peak Pulse Current
- ESD Rating of Class 3 (> 16 kV) per Human Body Model
- ESD Rating IEC 61000-4-2 Level 4 (> 30 kV)
- Low Leakage < 5  $\mu$ A at 13 V
- UL 497B for Isolated Loop Circuit Protection
- Response Time is Typically < 1 ns
- Pb-Free Package is Available

#### Mechanical Characteristics:

**CASE:** Void-free, transfer-molded, thermosetting plastic

**FINISH:** All external surfaces are corrosion resistant and leads are readily Solderable

**MAXIMUM CASE TEMPERATURE FOR SOLDERING PURPOSES:**  
260°C for 10 Seconds

**LEADS:** Modified L-Bend providing more contact area to bond pads

**POLARITY:** Cathode indicated by polarity band

**MOUNTING POSITION:** Any

#### MAXIMUM RATINGS

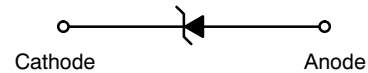
Please See the Table on the Following Page



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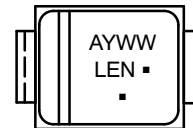
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### PLASTIC SURFACE MOUNT ZENER OVERVOLTAGE TRANSIENT SUPPRESSOR 600 WATT PEAK POWER



SMB  
CASE 403A  
PLASTIC

#### MARKING DIAGRAM



- A = Assembly Location
- Y = Year
- WW = Work Week
- LEN = Specific Device Code
- = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping†
NSB13ANT3G	SMB (Pb-Free)	2500/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

# NSB13ANT3G

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Power Dissipation (Note 1) @ $T_L = 25^\circ\text{C}$ , Pulse Width = 1 ms	$P_{PK}$	600	W
DC Power Dissipation @ $T_L = 75^\circ\text{C}$ Measured Zero Lead Length (Note 2) Derate Above $75^\circ\text{C}$	$P_D$	3.0	W
Thermal Resistance from Junction to Lead	$R_{\theta JL}$	40 25	mW/ $^\circ\text{C}$ $^\circ\text{C}/\text{W}$
DC Power Dissipation (Note 3) @ $T_A = 25^\circ\text{C}$ Derate Above $25^\circ\text{C}$	$P_D$	0.55	W
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	4.4 226	mW/ $^\circ\text{C}$ $^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

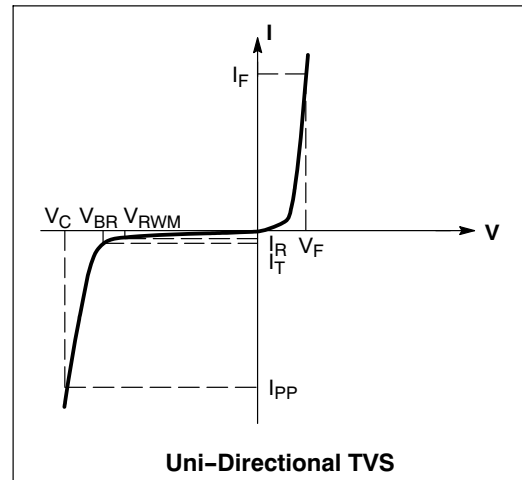
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

- 10 X 1000  $\mu\text{s}$ , non-repetitive at maximum  $I_{PPM}$  and  $V_{CM}$ , see electrical characteristics.
- 1" square copper pad, FR-4 board
- FR-4 board, using ON Semiconductor minimum recommended footprint, as shown in 403A case outline dimensions spec.

## ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter
$I_{PP}$	Maximum Reverse Peak Pulse Current
$V_C$	Clamping Voltage @ $I_{PP}$
$V_{RWM}$	Working Peak Reverse Voltage
$I_R$	Maximum Reverse Leakage Current @ $V_{RWM}$
$V_{BR}$	Breakdown Voltage @ $I_T$
$I_T$	Test Current
$I_F$	Forward Current
$V_F$	Forward Voltage @ $I_F$



## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Zener Voltage (Note 5)	$I_T = 1 \text{ mA}$	$V_{BR}$	14.4	15.15	15.9	V
Reverse Leakage Current	$V_{RWM} = 13 \text{ V}$	$I_R$			5.0	$\mu\text{A}$
Clamping Voltage	$I_{PPM} = 27.9 \text{ A}$ (Per Figure 1, Note 6)	$V_{CM}$			21.5	V
Forward Peak Voltage	$I_F = 30 \text{ A}$ (Note 4)	$V_F$			3.5	V
Capacitance	$V_R = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{typ}$			1160	pF

- 1/2 sine wave (or equivalent square wave),  $PW = 8.3 \text{ ms}$ , non-repetitive duty cycle.
- $V_Z$  measured at pulse test  $I_T$  at an ambient temperature of  $25^\circ\text{C}$ .
- Absolute Maximum Peak Current,  $I_{PPM}$ .

# NSB13ANT3G

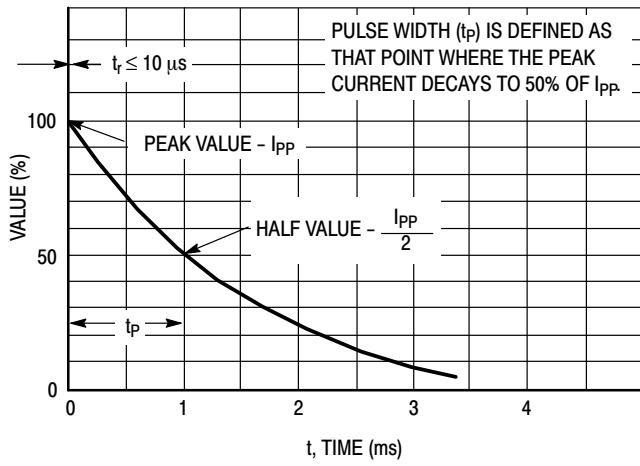


Figure 1.  $10 \times 1000 \mu\text{s}$  Pulse Waveform

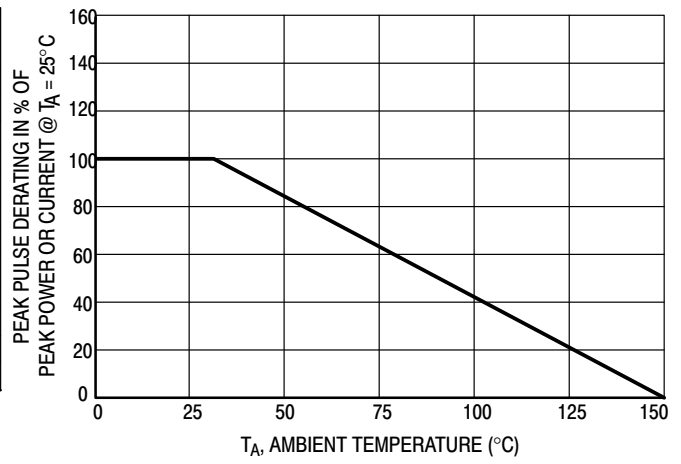
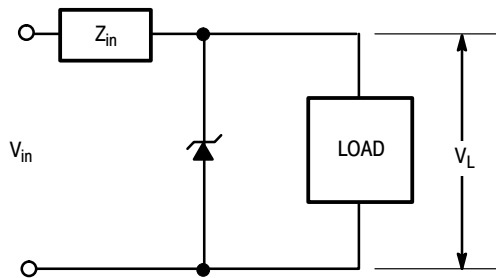


Figure 2. Pulse Derating Curve

## TYPICAL PROTECTION CIRCUIT



APPLICATION NOTES

RESPONSE TIME

In most applications, the transient suppressor device is placed in parallel with the equipment or component to be protected. In this situation, there is a time delay associated with the capacitance of the device and an overshoot condition associated with the inductance of the device and the inductance of the connection method. The capacitive effect is of minor importance in the parallel protection scheme because it only produces a time delay in the transition from the operating voltage to the clamp voltage as shown in Figure 3.

The inductive effects in the device are due to actual turn-on time (time required for the device to go from zero current to full current) and lead inductance. This inductive effect produces an overshoot in the voltage across the equipment or component being protected as shown in Figure 4. Minimizing this overshoot is very important in the application, since the main purpose for adding a transient suppressor is to clamp voltage spikes. The SMB series have

a very good response time, typically < 1 ns and negligible inductance. However, external inductive effects could produce unacceptable overshoot. Proper circuit layout, minimum lead lengths and placing the suppressor device as close as possible to the equipment or components to be protected will minimize this overshoot.

Some input impedance represented by  $Z_{in}$  is essential to prevent overstress of the protection device. This impedance should be as high as possible, without restricting the circuit operation.

DUTY CYCLE DERATING

If the duty cycle increases, the peak power must be reduced as indicated by the curves of Figure 5. Average power must be derated as the lead or ambient temperature rises above 25°C. The average power derating curve normally given on data sheets may be normalized and used for this purpose.

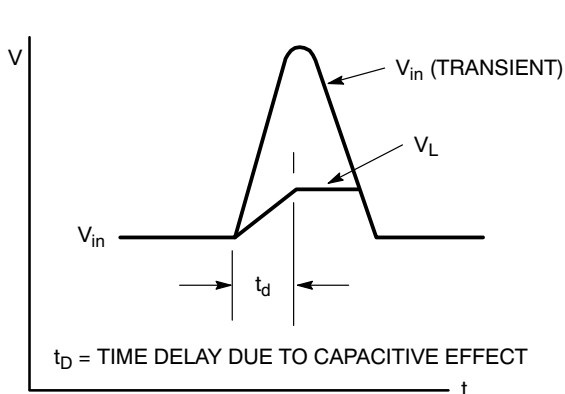


Figure 3.

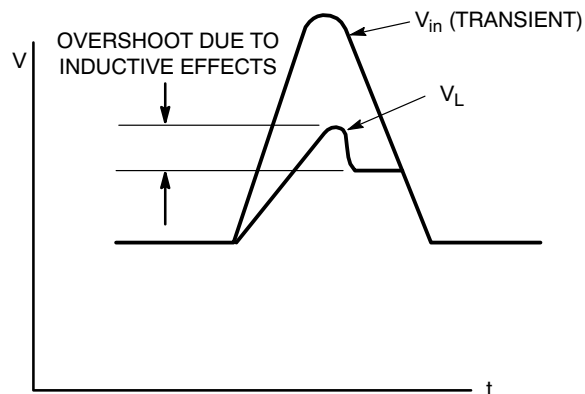


Figure 4.

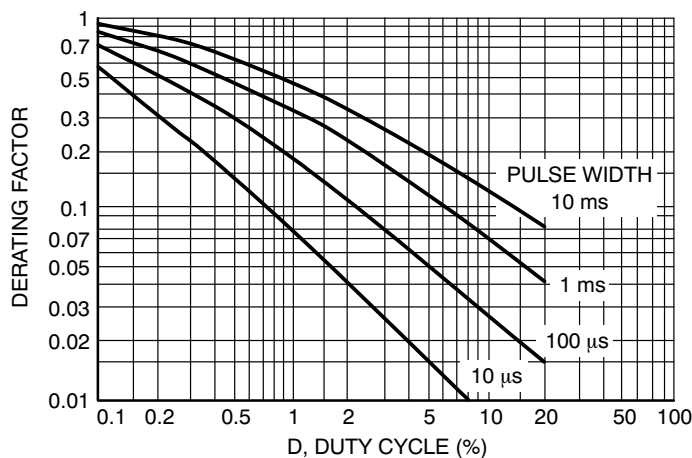


Figure 5. Typical Derating Factor for Duty Cycle

# NSB13ANT3G

## UL RECOGNITION

The entire series has *Underwriters Laboratory Recognition* for the classification of protectors (QVGV2) under the UL standard for safety 497B and File #116110. Many competitors only have one or two devices recognized or have recognition in a non-protective category. Some competitors have no recognition at all. With the UL497B recognition, our parts successfully passed several tests

including Strike Voltage Breakdown test, Endurance Conditioning, Temperature test, Dielectric Voltage-Withstand test, Discharge test and several more.

Whereas, some competitors have only passed a flammability test for the package material, we have been recognized for much more to be included in their Protector category.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 1:1

Polarity Band

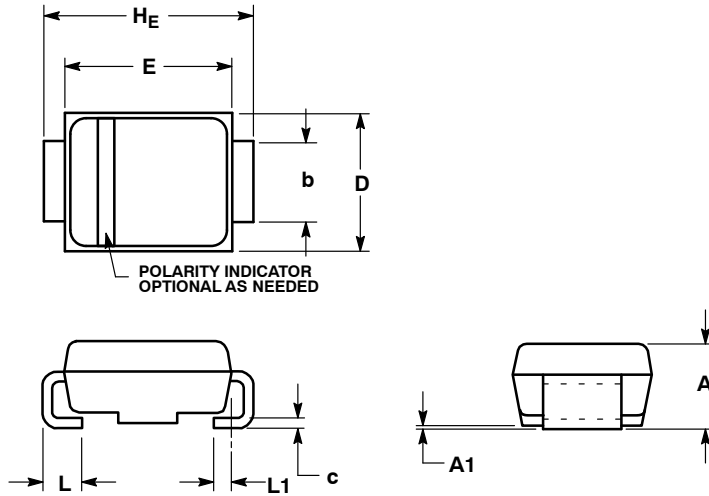


SCALE 1:1

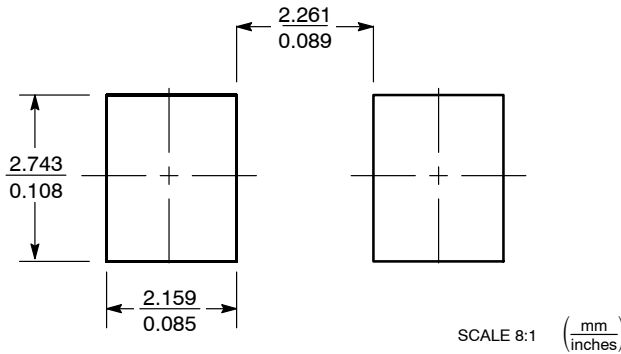
Non-Polarity Band

**SMB**  
CASE 403A-03  
ISSUE J

DATE 19 JUL 2012



### SOLDERING FOOTPRINT\*



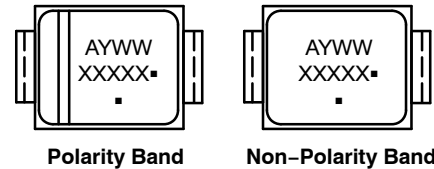
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION b SHALL BE MEASURED WITHIN DIMENSION L1.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.95	2.30	2.47	0.077	0.091	0.097
A1	0.05	0.10	0.20	0.002	0.004	0.008
b	1.96	2.03	2.20	0.077	0.080	0.087
c	0.15	0.23	0.31	0.006	0.009	0.012
D	3.30	3.56	3.95	0.130	0.140	0.156
E	4.06	4.32	4.60	0.160	0.170	0.181
HE	5.21	5.44	5.60	0.205	0.214	0.220
L	0.76	1.02	1.60	0.030	0.040	0.063
L1	0.51 REF			0.020 REF		

### GENERIC MARKING DIAGRAM\*




- XXXXX = Specific Device Code
  - A = Assembly Location
  - Y = Year
  - WW = Work Week
  - = Pb-Free Package
- (Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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