

# NUP2115L, SZNUP2115L

## Dual Line FlexRay Bus Protector

The SZ/NUP2115L has been designed to protect the FlexRay transceiver from ESD and other harmful transient voltage events. This device provides bidirectional protection for each data line with a single compact SOT-23 package, giving the system designer a low cost option for improving system reliability and meeting stringent EMI requirements.

### Features

- 200 W Peak Power Dissipation per Line (8 x 20  $\mu$ sec Waveform)
- Diode Capacitance Matching
- Low Reverse Leakage Current (< 100 nA)
- Low Capacitance High-Speed FlexRay Data Rates
- IEC Compatibility:
  - IEC 61000-4-2 (ESD): Level 4
  - IEC 61000-4-4 (EFT): 50 A – 5/50 ns
  - IEC 61000-4-5 (Lighting) 3.0 A (8/20  $\mu$ s)
- ISO 7637-1, Nonrepetitive EMI Surge Pulse 2, 8.0 A (1 x 50  $\mu$ s)
- ISO 7637-3, Repetitive Electrical Fast Transient (EFT) EMI Surge Pulses, 50 A (5 x 50 ns)
- Flammability Rating UL 94 V-0
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These are Pb-Free Devices

### Applications

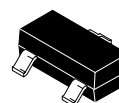
- Automotive Networks
  - ◆ FlexRay Bus



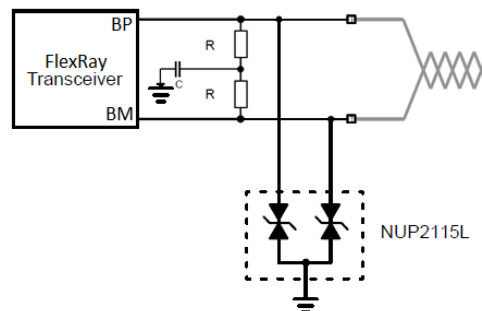
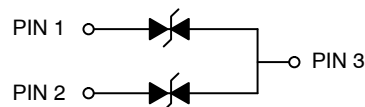
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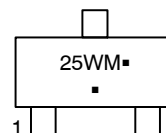
**SOT-23  
DUAL BIDIRECTIONAL  
VOLTAGE SUPPRESSOR  
200 W PEAK POWER**



**SOT-23  
CASE 318  
STYLE 27**



### MARKING DIAGRAM



25W = Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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## MAXIMUM RATINGS (T<sub>J</sub> = 25°C, unless otherwise specified)

Symbol	Rating	Value	Unit
PPK	Peak Power Dissipation, 8 x 20 μs Double Exponential Waveform (Note 1)	200	W
T <sub>J</sub>	Operating Junction Temperature Range	-55 to 150	°C
T <sub>J</sub>	Storage Temperature Range	-55 to 150	°C
T <sub>L</sub>	Lead Solder Temperature (10 s)	260	°C
ESD	Human Body Model (HBM)	8.0	kV
	Machine Model (MM)	400	V
	IEC 61000-4-2 Specification (Contact)	23	kV

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.

1. Non-repetitive current pulse per Figure 1.

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V <sub>RWM</sub>	Reverse Working Voltage	(Note 2)	24	-	-	V
V <sub>BR</sub>	Breakdown Voltage	I <sub>T</sub> = 1 mA (Note 3)	26.2	-	32	V
I <sub>R</sub>	Reverse Leakage Current	V <sub>RWM</sub> = 24 V	-	15	100	nA
V <sub>C</sub>	Clamping Voltage	I <sub>PP</sub> = 1 A (8 x 20 μs Waveform) (Note 4)	-	33.4	36.6	V
V <sub>C</sub>	Clamping Voltage	I <sub>PP</sub> = 3 A (8 x 20 μs Waveform) (Note 4)	-	44	50	V
I <sub>PP</sub>	Maximum Peak Pulse Current	8 x 20 μs Waveform (Note 4)	-	-	3.0	A
C <sub>J</sub>	Capacitance	V <sub>R</sub> = 0 V, f = 1 MHz (Line to GND)	-	-	10	pF
ΔC	Diode Capacitance Matching	V <sub>R</sub> = 0 V, 5 MHz (Note 5)	-	0.26	2	%

2. TVS devices are normally selected according to the working peak reverse voltage (V<sub>RWM</sub>), which should be equal or greater than the DC or continuous peak operating voltage level.
3. V<sub>BR</sub> is measured at pulse test current I<sub>T</sub>.
4. Pulse waveform per Figure 1.
5. ΔC is the percentage difference between C<sub>J</sub> of lines 1 and 2 measured according to the test conditions given in the electrical characteristics table.

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NUP2115LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SZNUP2115LT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
NUP2115LT3G	SOT-23 (Pb-Free)	10,000 / Tape & Reel
SZNUP2115LT3G	SOT-23 (Pb-Free)	10,000 / Tape & Reel

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

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## TYPICAL PERFORMANCE CURVES

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

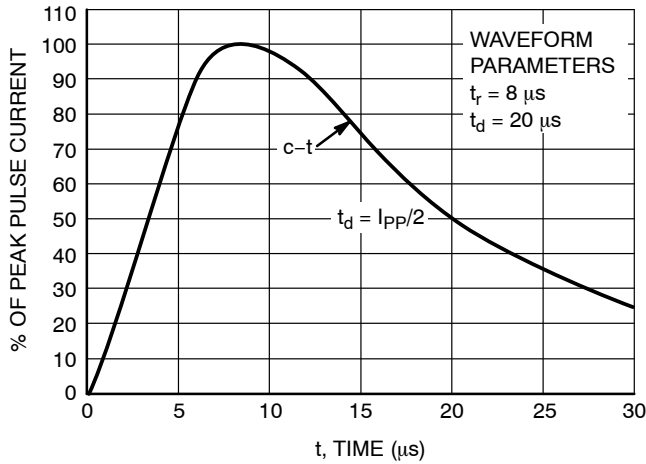


Figure 1. Pulse Waveform,  $8 \times 20 \mu\text{s}$

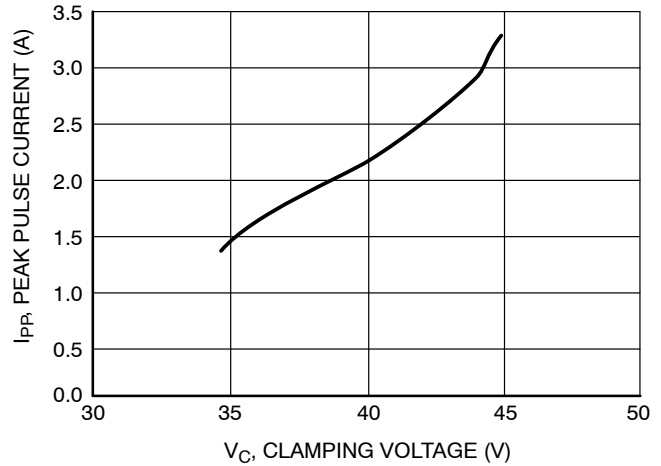


Figure 2. Clamping Voltage vs Peak Pulse Current

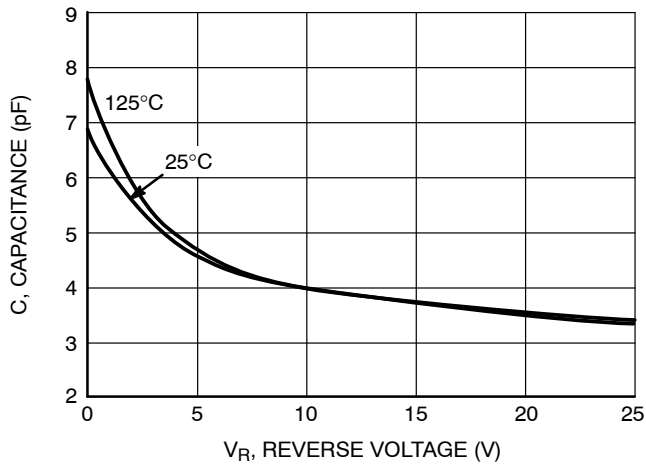


Figure 3. Typical Junction Capacitance vs Reverse Voltage

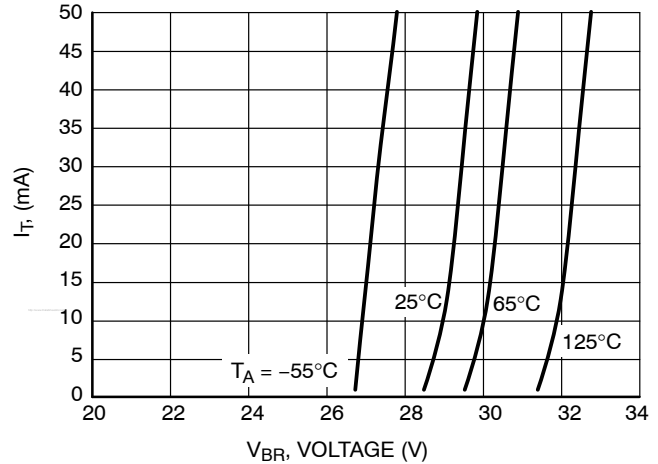


Figure 4.  $V_{BR}$  versus  $I_T$  Characteristics

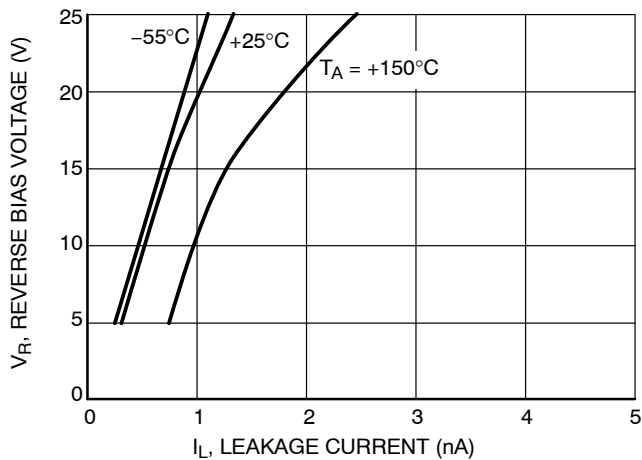


Figure 5.  $I_R$  versus Temperature Characteristics

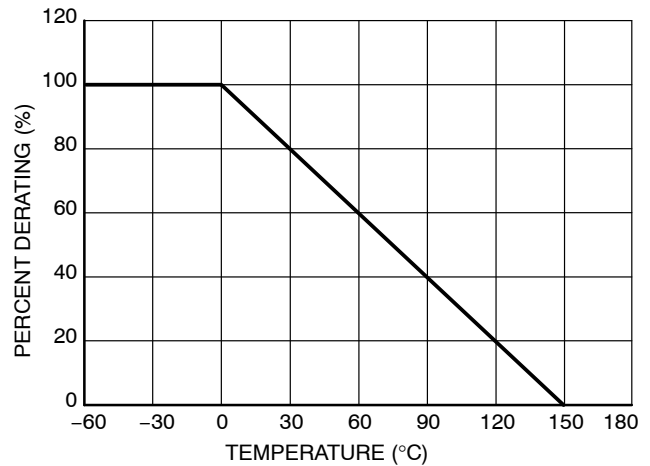


Figure 6. Temperature Power Dissipation Derating

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## APPLICATIONS

TVS diodes provide a low cost solution to conducted and radiated Electromagnetic Interference (EMI) and Electrostatic Discharge (ESD) noise problems. The noise immunity level and reliability of FlexRay transceivers can be easily increased by adding external TVS diodes to prevent transient voltage failures.

The NUP2115L provides a transient voltage suppression solution for FlexRay data communication lines. The NUP2115L is a dual bidirectional TVS device in a compact SOT-23 package. This device is based on Zener technology that optimizes the active area of a PN junction to provide robust protection against transient EMI surge voltage and ESD.

### TVS Diode Protection Circuit

TVS diodes provide protection to a transceiver by clamping a surge voltage to a safe level. TVS diodes have high impedance below and low impedance above their breakdown voltage. A TVS Zener diode has its junction optimized to absorb the high peak energy of a transient event, while a standard Zener diode is designed and specified to clamp a steady state voltage.

Figure 7 provides an example of a dual bidirectional TVS diode array that can be used for protection with the FlexRay network. The bidirectional array is created from four identical Zener TVS diodes. The clamping voltage of the composite device is equal to the breakdown voltage of the diode that is reversed biased, plus the diode drop of the second diode that is forward biased.

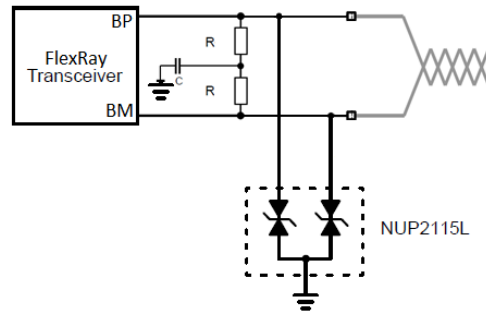
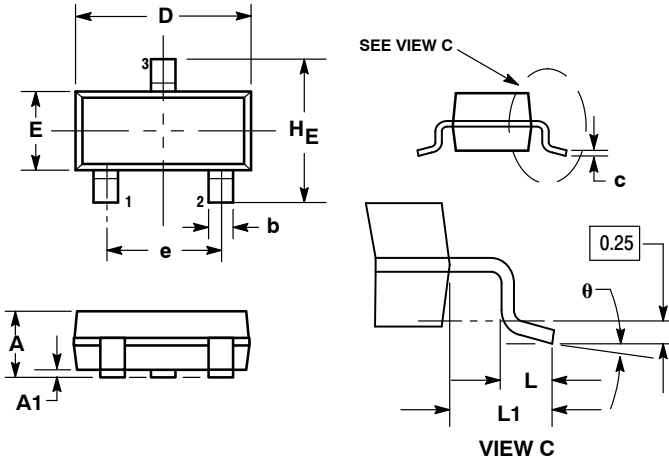


Figure 7. FlexRay TVS Protection Circuit

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## PACKAGE DIMENSIONS

SOT-23 (TO-236)  
CASE 318-08  
ISSUE AP



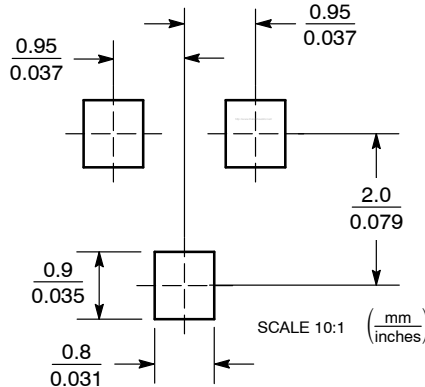
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
HE	2.10	2.40	2.64	0.083	0.094	0.104
θ	0°	---	10°	0°	---	10°

STYLE 27:  
PIN 1. CATHODE  
2. CATHODE  
3. CATHODE

### 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.

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