# ESD Protection Diode
## Dual Line Automotive Bus Protector

# NUP2125, SZNUP2125

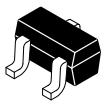
The SZ/NUP2125 has been designed to protect both CAN and LIN transceivers from ESD and other harmful transient voltage events. This device provides bidirectional protection for each data line with a single compact SC−70 (SOT−323) package, giving the system designer a low cost option for improving system reliability and meeting stringent EMI requirements.

### Features

- 200 W Peak Power Dissipation per Line (8/20 μs Waveform)
- Diode Capacitance Matching
- Low Reverse Leakage Current (< 100 nA)
- 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 μs)
- ISO 7637−1, Nonrepetitive EMI Surge Pulse 2, 8.0 A (1/50 μs)
- ISO 7637−3, Repetitive Electrical Fast Transient (EFT) EMI Surge Pulses, 50 A (5/50 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

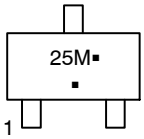
### Applications

- Automotive Networks
  - CAN / CAN−FD
  - Low and High−Speed CAN
  - Fault Tolerant CAN
  - LIN

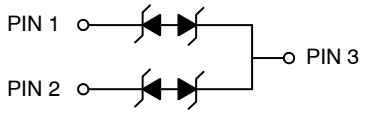


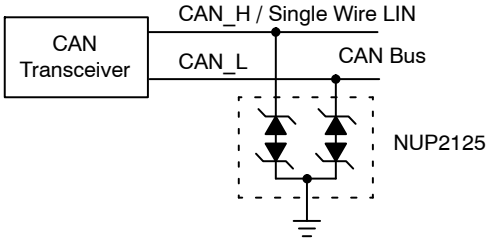
**SC−70**
**CASE 419**

**MARKING DIAGRAM**




25 = Specific Device Code
M = Date Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)




### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

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**MAXIMUM RATINGS** ($T_J$ = 25°C, unless otherwise specified)

| Symbol | Rating | Value | Unit |
|---|---|---|---|
| PPK | Peak Power Dissipation, 8/20 μs Double Exponential Waveform (Note 1) | 200 | W |
| $T_J$ | Operating Junction Temperature Range | −55 to 150 | °C |
| $T_J$ | Storage Temperature Range | −55 to 150 | °C |
| $T_L$ | Lead Solder Temperature (10 s) | 260 | °C |
| ESD | Human Body Model (HBM)<br>Machine Model (MM)<br>IEC 61000−4−2 Contact<br>IEC 61000−4−2 Air<br>ISO 10605 150 pF / 2 kΩ Contact<br>ISO 10605 330 pF / 2 kΩ Contact | ±8.0<br>±1.6<br>±30<br>±30<br>±30<br>±30 | kV<br>kV<br>kV<br>kV<br>kV<br>kV |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Non−repetitive current pulse per Figure 1.

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C, unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{RWM}$ | Reverse Working Voltage | (Note 2) | 24 | – | – | V |
| $V_{BR}$ | Breakdown Voltage | $I_T$ = 1 mA (Note 3) | 27 | 28.5 | 32 | V |
| $I_R$ | Reverse Leakage Current | $V_{RWM}$ = 24 V | – | 15 | 100 | nA |
| $V_C$ | Clamping Voltage | $I_{PP}$ = 1 A (8/20 μs Waveform) (Note 4) | – | 33.4 | 36.6 | V |
| $V_C$ | Clamping Voltage | $I_{PP}$ = 3 A (8/20 μs Waveform) (Note 4) | – | 44 | 50 | V |
| $I_{PP}$ | Maximum Peak Pulse Current | 8/20 μs Waveform (Note 4) | – | – | 3.0 | A |
| $C_J$ | Capacitance | $V_R$ = 0 V, f = 1 MHz (Line to GND) | – | 7.0 | 10 | pF |
| | | $V_R$ = 5 V, f = 1 MHz (Line to GND) | – | 4.5 | 6.0 | pF |
| | | $V_R$ = 5 V, f = 1 MHz (Line to GND), $T_A$ = +150°C | – | 5.0 | – | pF |
| ΔC | Diode Capacitance Matching | $V_R$ = 0 V, 5 MHz (Note 5) | – | 0.26 | 2 | % |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Surge protection devices are normally selected according to the working peak reverse voltage ($V_{RWM}$), which should be equal or greater than the DC or continuous peak operating voltage level.
3. $V_{BR}$ is measured at pulse test current $I_T$.
4. Pulse waveform per Figure 1.
5. ΔC is the percentage difference between $C_J$ of lines 1 and 2 measured according to the test conditions given in the electrical characteristics table.

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NUP2125WTT1G | SC−70 (Pb−Free) | 3000 / Tape & Reel |
| SZNUP2125WTT1G* | | |
| NUP2125WTT3G | | 10000 / Tape & Reel |
| SZNUP2125WTT3G* | | |

†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.

*SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable.

## TYPICAL PERFORMANCE CURVES

($T_J$ = 25°C UNLESS OTHERWISE NOTED)

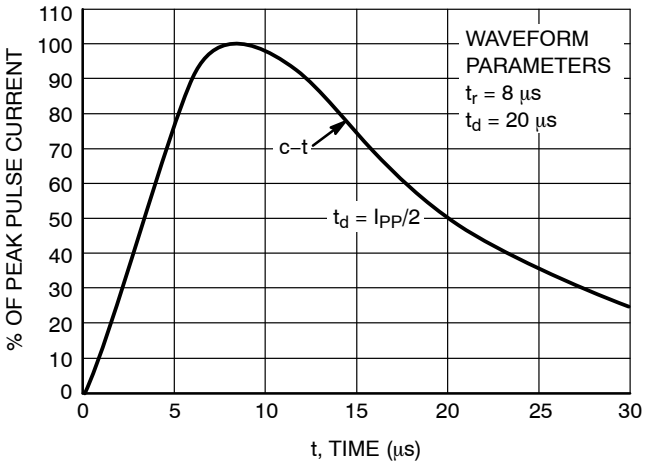


**Figure 1. Pulse Waveform, 8/20 μs**

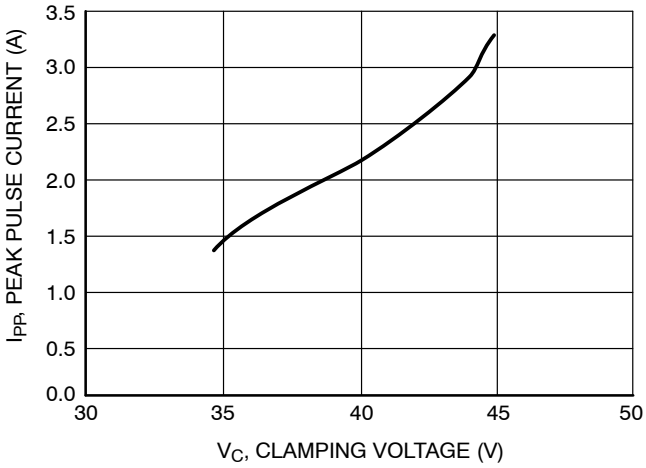


**Figure 2. Clamping Voltage vs Peak Pulse Current**

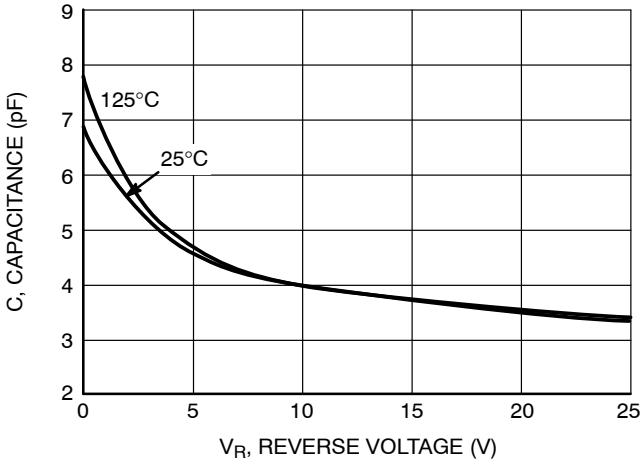


**Figure 3. Typical Junction Capacitance vs Reverse Voltage**

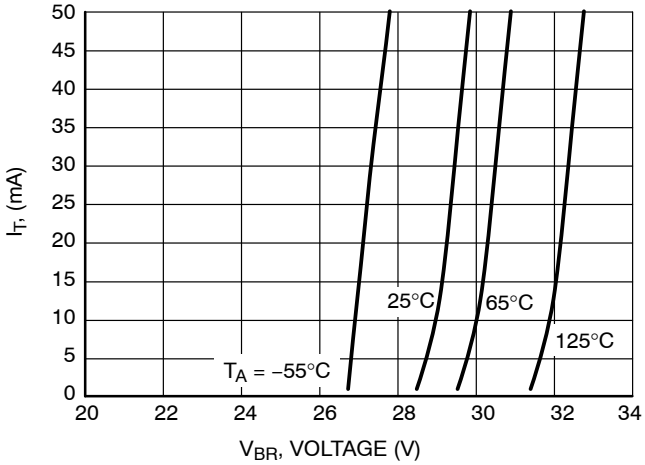


**Figure 4. $V_{BR}$ versus $I_T$ Characteristics**

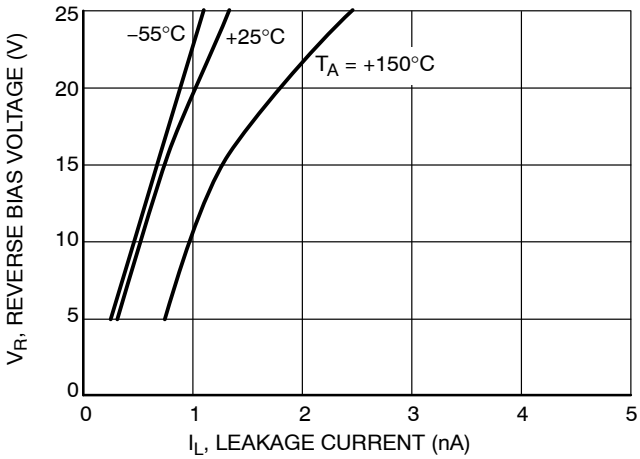


**Figure 5. $I_R$ versus Temperature Characteristics**

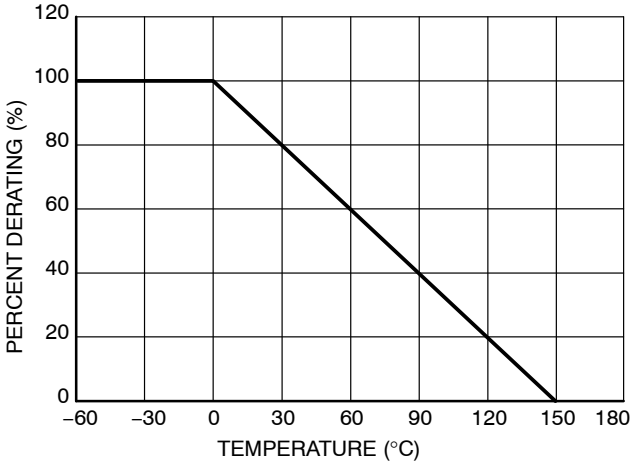


**Figure 6. Temperature Power Dissipation Derating**

**Surge Protection Diode Circuit**

Surge protection diodes provide protection to a transceiver by clamping a surge voltage to a safe level. Surge protection diodes have high impedance below and low impedance above their breakdown voltage. A surge protection 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 surge protection diode array that can be used for protection with the high−speed CAN 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 forwarded biased.

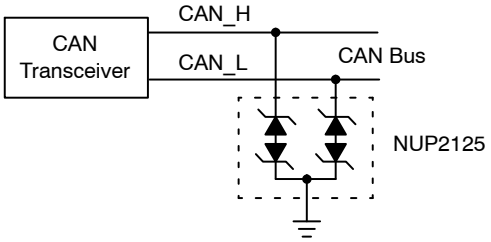


**Figure 7. High−Speed and Fault Tolerant CAN Surge Protection Circuit**

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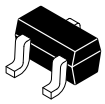
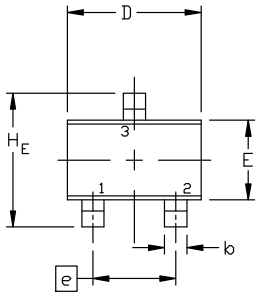
DeviceNet is a trademark of Rockwell Automation.



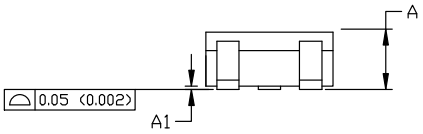
**SCALE 4:1**

**SC−70 (SOT−323)**
CASE 419
ISSUE R

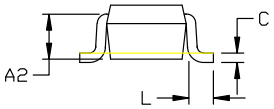
DATE 11 OCT 2022




TOP VIEW




SIDE VIEW

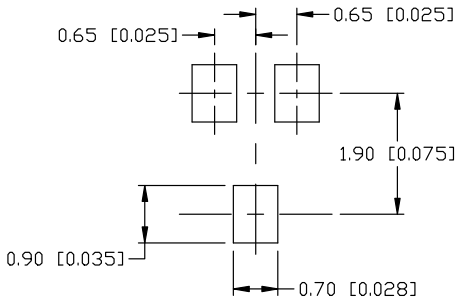



END VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH

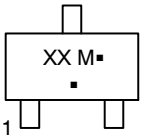
| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.80 | 0.90 | 1.00 | 0.032 | 0.035 | 0.040 |
| A1 | 0.00 | 0.05 | 0.10 | 0.000 | 0.002 | 0.004 |
| A2 | 0.70 REF | | | 0.028 BSC | | |
| b | 0.30 | 0.35 | 0.40 | 0.012 | 0.014 | 0.016 |
| c | 0.10 | 0.18 | 0.25 | 0.004 | 0.007 | 0.010 |
| D | 1.80 | 2.00 | 2.20 | 0.071 | 0.080 | 0.087 |
| E | 1.15 | 1.24 | 1.35 | 0.045 | 0.049 | 0.053 |
| e | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| e1 | 0.65 BSC | | | 0.026 BSC | | |
| L | 0.20 | 0.38 | 0.56 | 0.008 | 0.015 | 0.022 |
| $H_E$ | 2.00 | 2.10 | 2.40 | 0.079 | 0.083 | 0.095 |




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

SOLDERING FOOTPRINT

**GENERIC MARKING DIAGRAM**




XX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*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. Some products may not follow the Generic Marking.

STYLE 1:
CANCELLED

STYLE 2:
PIN 1. ANODE
2. N.C.
3. CATHODE

STYLE 3:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 4:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 5:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 6:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 7:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 8:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 10:
PIN 1. CATHODE
2. ANODE
3. ANODE−CATHODE

STYLE 11:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

| | | |
|---|---|---|
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