

Low Capacitance Diode Array for ESD Protection in a Single Data Line

NUP1301ML3T1G, SZNUP1301ML3T1G

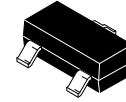
NUP1301ML3T1G is a MicroIntegration device designed to provide protection for sensitive components from possible harmful electrical transients; for example, ESD (electrostatic discharge).

Features

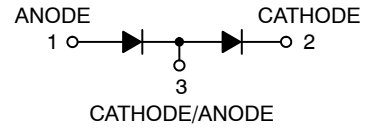
- Low Capacitance (0.9 pF Maximum)
- Single Package Integration Design
- Provides ESD Protection for JEDEC Standards JESD22
 - Machine Model = Class C
 - Human Body Model = Class 3B
- Protection for IEC61000-4-2 (Level 4)
 - 8.0 kV (Contact)
 - 15 kV (Air)
- Ensures Data Line Speed and Integrity
- Fewer Components and Less Board Space
- Direct the Transient to Either Positive Side or to the Ground
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- Pb-Free Package is Available

Applications

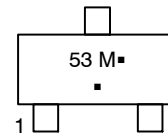
- T1/E1 Secondary IC Protection
- T3/E3 Secondary IC Protection
- HDSL, IDSL Secondary IC Protection
- Video Line Protection
- Microcontroller Input Protection
- Base Stations
- I²C Bus Protection



SOT-23
 CASE 318
 STYLE 11



MARKING DIAGRAM



53 = Device Code
 M = Date Code
 ■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NUP1301ML3T1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SZNUP1301ML3T1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel

†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.

NUP1301ML3T1G, SZNUP1301ML3T1G

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

Rating	Symbol	Value	Unit
Reverse Voltage	V_R	70	Vdc
Forward Current	I_F	215	mAdc
Peak Forward Surge Current	$I_{FM(surge)}$	500	mAdc
Repetitive Peak Reverse Voltage	V_{RRM}	70	V
Average Rectified Forward Current (Note 1) (averaged over any 20 ms period)	$I_{F(AV)}$	715	mA
Repetitive Peak Forward Current	I_{FRM}	450	mA
Non-Repetitive Peak Forward Current $t = 1.0 \mu\text{s}$ $t = 1.0 \text{ms}$ $t = 1.0 \text{S}$	I_{FSM}	2.0 1.0 0.5	A

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. $FR-5 = 1.0 \times 0.75 \times 0.062 \text{ in.}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	625	$^\circ\text{C/W}$
Lead Solder Temperature Maximum 10 Seconds Duration	T_L	260	$^\circ\text{C}$
Junction Temperature	T_J	-65 to 150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +150	$^\circ\text{C}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Reverse Breakdown Voltage ($I_{(BR)} = 100 \mu\text{A}$)	$V_{(BR)}$	70	-	-	Vdc
Reverse Voltage Leakage Current ($V_R = 70 \text{Vdc}$) ($V_R = 25 \text{Vdc}$, $T_J = 150^\circ\text{C}$) ($V_R = 70 \text{Vdc}$, $T_J = 150^\circ\text{C}$)	I_R	-	-	2.5 30 50	μAdc
Diode Capacitance (between I/O and ground) ($V_R = 0$, $f = 1.0 \text{MHz}$)	C_D	-	-	0.9	pF
Forward Voltage ($I_F = 1.0 \text{mAdc}$) ($I_F = 10 \text{mAdc}$) ($I_F = 50 \text{mAdc}$) ($I_F = 150 \text{mAdc}$)	V_F	-	-	715 855 1000 1250	mV_{dc}

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. $FR-5 = 1.0 \times 0.75 \times 0.062 \text{ in.}$

3. Alumina = $0.4 \times 0.3 \times 0.024 \text{ in.}$, 99.5% alumina.

4. Include SZ-prefix devices where applicable.

NUP1301ML3T1G, SZNUP1301ML3T1G

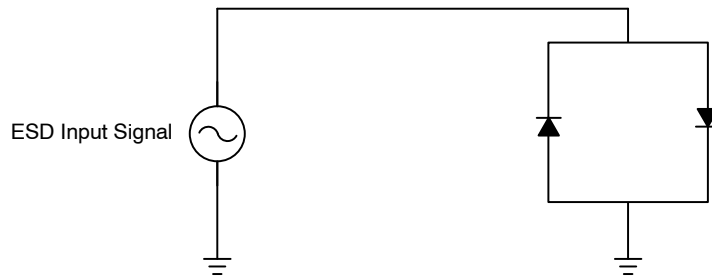


Figure 1. ESD Test Circuit

APPLICATION NOTE

Electrostatic Discharge

A common means of protecting high-speed data lines is to employ low-capacitance diode arrays in a rail-to-rail configuration. Two devices per line are connected between two fixed voltage references such as V_{CC} and ground. When the transient voltage exceeds the forward voltage (V_F) drop of the diode plus the reference voltage, the diodes direct the

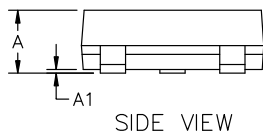
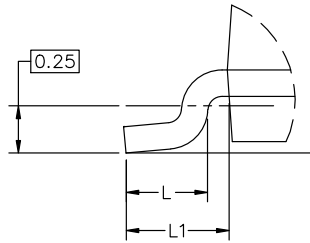
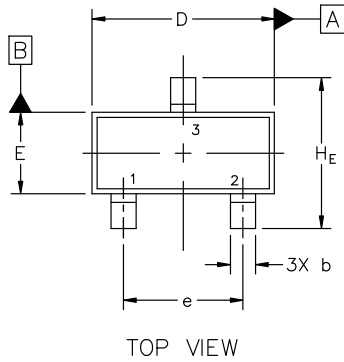
surge to the supply rail or ground. This method has several advantages including low loading capacitance, fast response time, and inherent bidirectionality (within the reference voltages). See Figure 1 for the test circuit used to verify the ESD rating for this device.



SCALE 4:1

SOT-23 (TO-236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

DATE 14 AUG 2024

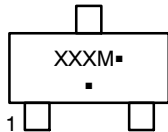


MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
HE	2.10	2.40	2.64
T	0°	---	10°

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

GENERIC MARKING DIAGRAM*



XXX = 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.



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

STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42226B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOT-23 (TO-236) 2.90x1.30x1.00 1.90P	PAGE 1 OF 2

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

SOT-23 (TO-236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

DATE 14 AUG 2024

STYLE 1 THRU 5:
CANCELLED

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

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

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

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

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

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

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE-ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

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

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

DOCUMENT NUMBER:	98ASB42226B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOT-23 (TO-236) 2.90x1.30x1.00 1.90P	PAGE 2 OF 2

onsemi and **ONSEMI** are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales

