

# NUP8011MU

## ESD Protection Diode Array Low Clamping Voltage

This integrated surge protection device is designed for applications requiring transient overvoltage protection. It is intended for use in sensitive equipment such as computers, printers, business machines, communication systems, and other applications. Its integrated design provides very effective and reliable protection for eight separate lines using only one package. These devices are ideal for situations where board space is at a premium.

### Features

- Low Clamping Voltage
- UDFN Package, 1.2 x 1.8 mm
- Standoff Voltage: 4.3 V
- Low Leakage Current
- IEC61000-4-2, Level 4 ESD Protection
- Moisture Sensitivity Level 1
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Benefits

- Provides Protection for ESD Industry Standards: IEC 61000, HBM
- Protects the Line Against Transient Voltage Conditions
- Minimize Power Consumption of the System
- Minimize PCB Board Space

### Applications

- ESD Protection for Data Lines
- Wireless Phones
- Handheld Products
- Notebook Computers
- LCD Displays

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

| Characteristic                                                                  | Symbol          | Value           | Unit                                             |
|---------------------------------------------------------------------------------|-----------------|-----------------|--------------------------------------------------|
| Steady State Power – 1 Diode (Note 1)                                           | $P_D$           | 380             | mW                                               |
| Thermal Resistance,<br>Junction-to-Ambient<br>Above $25^\circ\text{C}$ , Derate | $R_{\theta JA}$ | 327<br>3.05     | $^\circ\text{C/W}$<br>$\text{mW}/^\circ\text{C}$ |
| Maximum Junction Temperature                                                    | $T_{Jmax}$      | 150             | $^\circ\text{C}$                                 |
| Operating Temperature Range                                                     | $T_{OP}$        | $-40$ to $+85$  | $^\circ\text{C}$                                 |
| Storage Temperature Range                                                       | $T_{stg}$       | $-55$ to $+150$ | $^\circ\text{C}$                                 |
| Lead Solder Temperature (10 seconds duration)                                   | $T_L$           | 260             | $^\circ\text{C}$                                 |
| IEC 61000-4-2 (ESD)Contact                                                      |                 | $\pm 8.0$       | kV                                               |
| Machine Model – Class C                                                         | MM              | 400             | V                                                |
| Human Body Model – Class 3B                                                     | HBM             | 8.0             | 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.

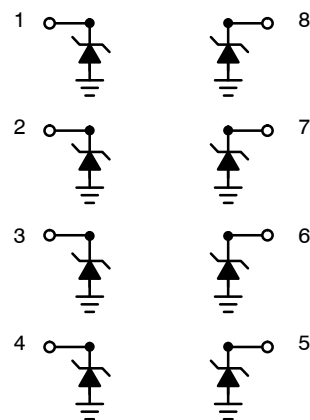
1. Only 1 diode under power. For all 4 diodes under power,  $P_D$  will be 25%. Mounted on FR-4 board with min pad.

See Application Note AND8308/D for further description of survivability specs.

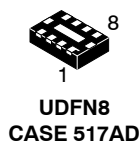


ON Semiconductor®

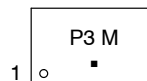
[www.onsemi.com](http://www.onsemi.com)



(Top View)

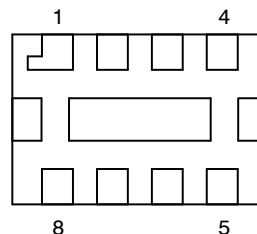


### MARKING DIAGRAM



P3 = Specific Device Code  
M = Month Code  
■ = Pb-Free Package

### PIN CONNECTIONS



### ORDERING INFORMATION

| Device       | Package         | Shipping           |
|--------------|-----------------|--------------------|
| NUP8011MUTAG | UDFN8 (Pb-Free) | 3000 / Tape & Reel |

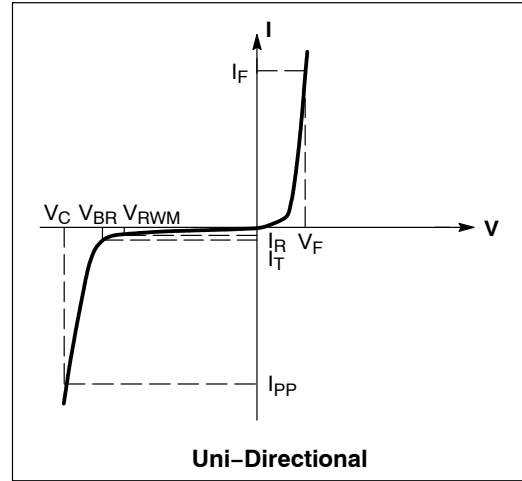
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

## 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 @ $I_F$                     |
| $P_{pk}$  | Peak Power Dissipation                      |
| C         | Capacitance @ $V_R = 0$ and $f = 1.0$ MHz   |

\*See Application Note AND8308/D for detailed explanations of datasheet parameters.



## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

| Device       | Device Marking | Breakdown Voltage<br>$V_{BR}$ @ 1 mA (V) |     |      | Leakage Current<br>$I_{RM}$ @ $V_{RM}$ |                             | Typ Capacitance<br>@ 0 V Bias (pF)<br>(Note 2) |     | Typ Capacitance<br>@ 3 V Bias (pF)<br>(Note 2) |     | $V_C$<br><br>Per IEC61000-4-2<br>(Note 3) |
|--------------|----------------|------------------------------------------|-----|------|----------------------------------------|-----------------------------|------------------------------------------------|-----|------------------------------------------------|-----|-------------------------------------------|
|              |                | Min                                      | Nom | Max  | $V_{RWM}$                              | $I_{RWM}$ ( $\mu\text{A}$ ) | Typ                                            | Max | Typ                                            | Max |                                           |
| NUP8011MUTAG | P3             | 6.47                                     | 6.8 | 7.14 | 4.3                                    | 1.0                         | 12                                             | 14  | 6.7                                            | 9.5 | Figures 1 and 2<br>(See Below)            |

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. Capacitance of one diode at  $f = 1$  MHz,  $V_R = 0$  V,  $T_A = 25^\circ\text{C}$

3. For test procedure see Figures 3 and 4 and Application Note AND8307/D.

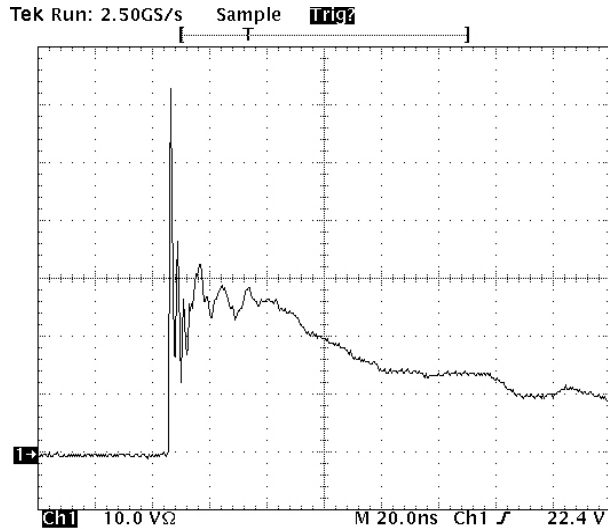


Figure 1. ESD Clamping Voltage Screenshot  
Positive 8 kV Contact per IEC61000-4-2

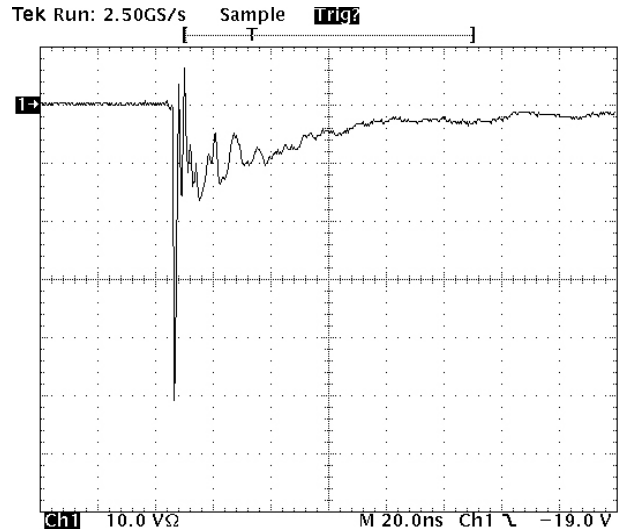


Figure 2. ESD Clamping Voltage Screenshot  
Negative 8 kV Contact per IEC61000-4-2

IEC 61000-4-2 Spec.

| Level | Test Voltage (kV) | First Peak Current (A) | Current at 30 ns (A) | Current at 60 ns (A) |
|-------|-------------------|------------------------|----------------------|----------------------|
| 1     | 2                 | 7.5                    | 4                    | 2                    |
| 2     | 4                 | 15                     | 8                    | 4                    |
| 3     | 6                 | 22.5                   | 12                   | 6                    |
| 4     | 8                 | 30                     | 16                   | 8                    |

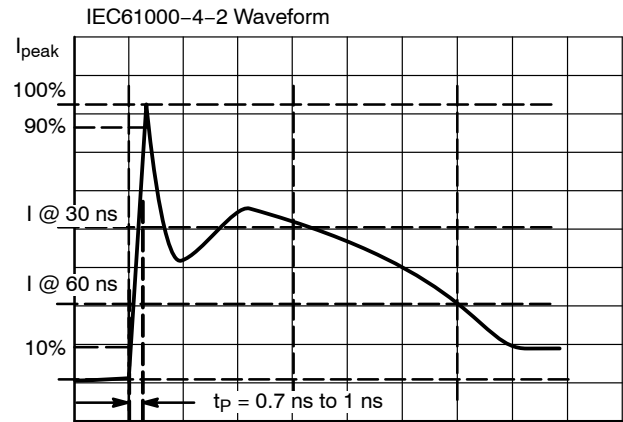


Figure 3. IEC61000-4-2 Spec

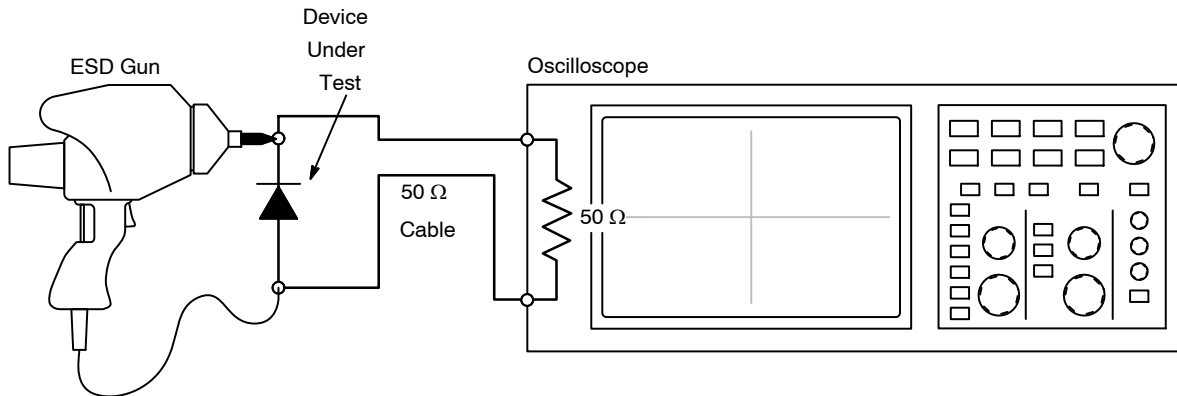


Figure 4. Diagram of ESD Test Setup

The following is taken from Application Note AND8308/D – Interpretation of Datasheet Parameters for ESD Devices.

**ESD Voltage Clamping**

For sensitive circuit elements it is important to limit the voltage that an IC will be exposed to during an ESD event to as low a voltage as possible. The ESD clamping voltage is the voltage drop across the ESD protection diode during an ESD event per the IEC61000-4-2 waveform. Since the IEC61000-4-2 was written as a pass/fail spec for larger

systems such as cell phones or laptop computers it is not clearly defined in the spec how to specify a clamping voltage at the device level. ON Semiconductor has developed a way to examine the entire voltage waveform across the ESD protection diode over the time domain of an ESD pulse in the form of an oscilloscope screenshot, which can be found on the datasheets for all ESD protection diodes. For more information on how ON Semiconductor creates these screenshots and how to interpret them please refer to AND8307/D.

TYPICAL ELECTRICAL CHARACTERISTICS

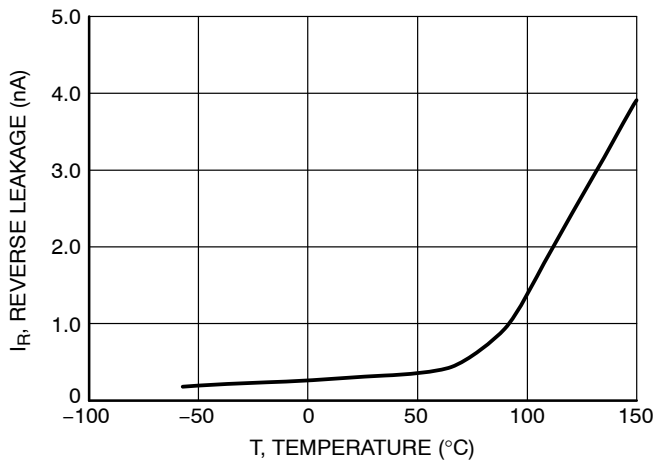


Figure 5. Reverse Leakage versus Temperature

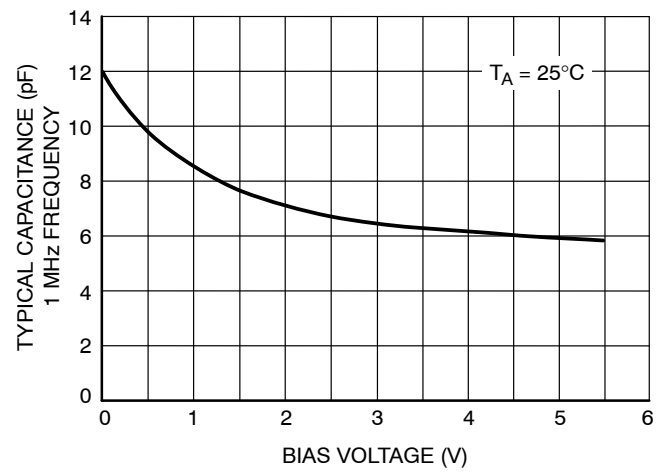


Figure 6. Capacitance

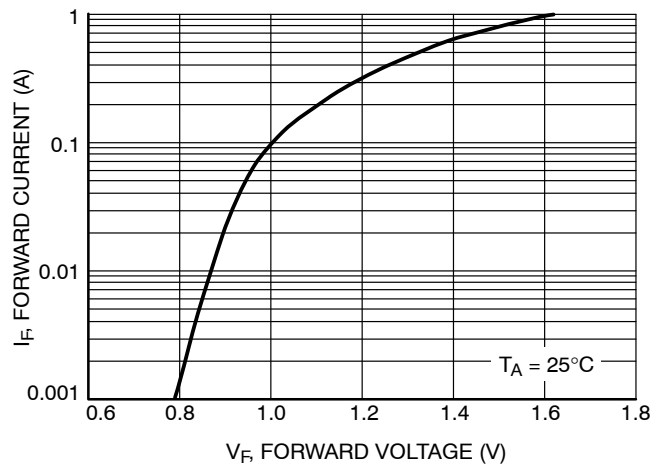


Figure 7. Forward Voltage

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

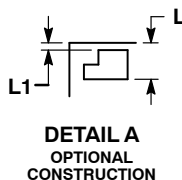
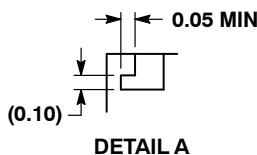
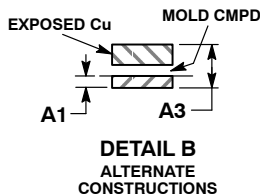
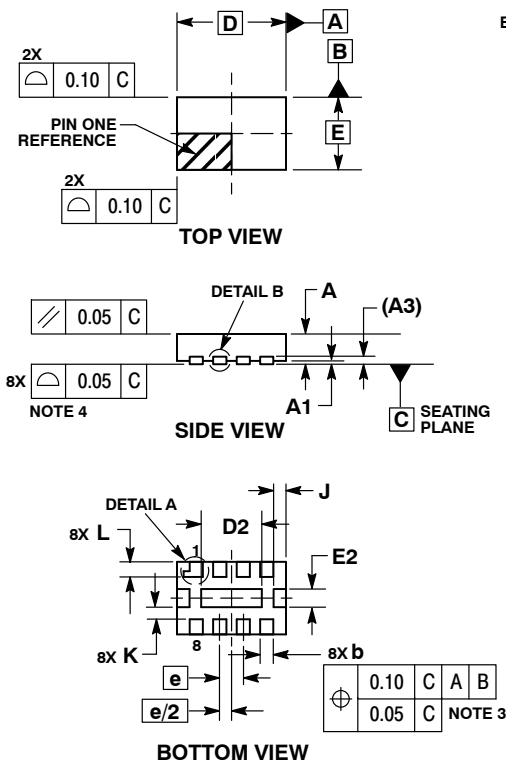
ON Semiconductor®



SCALE 4:1

UDFN8 1.8x1.2, 0.4P  
CASE 517AD  
ISSUE D

DATE 23 OCT 2012

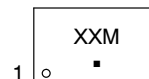


## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| MILLIMETERS |      |      |
|-------------|------|------|
| DIM         | MIN  | MAX  |
| A           | 0.45 | 0.55 |
| A1          | 0.00 | 0.05 |
| A3          | 0.13 | REF  |
| b           | 0.15 | 0.25 |
| D           | 1.80 | BSC  |
| E           | 1.20 | BSC  |
| e           | 0.40 | BSC  |
| D2          | 0.90 | 1.10 |
| E2          | 0.20 | 0.30 |
| J           | 0.19 | REF  |
| K           | 0.20 | TYP  |
| L           | 0.20 | 0.30 |
| L1          | ---  | 0.10 |

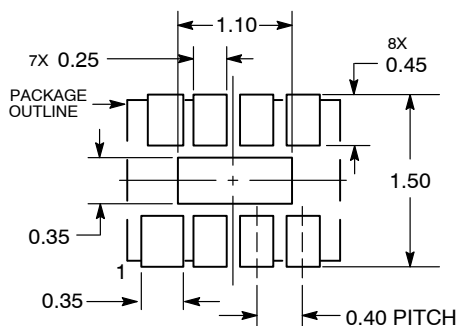
## GENERIC MARKING DIAGRAM\*



- 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", may or not be present.

## SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

|                  |                     |                                                                                                                                                                                  |
|------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98AON22154D         | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | UDFN8 1.8X1.2, 0.4P | PAGE 1 OF 1                                                                                                                                                                      |

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor 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](http://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](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)