ESD Protection Diode

Low Capacitance ESD Protection for High Speed Data

NUP3115UPMU

The three−line voltage transient suppressor array is designed to protect voltage−sensitive components that require ultra−low capacitance from ESD and transient voltage events. This device features a common anode design which protects three independent high speed data lines and a V_{CC} power line in a single six−lead UDFN low profile package.

Excellent clamping capability, low capacitance, low leakage, and fast response time make these parts ideal for ESD protection on designs where board space is at a premium. Because of its low capacitance, it is suited for use in high frequency designs such as a USB 2.0 high speed.

Features

- Low Capacitance 0.8 pF
- UDFN Package, 1.6 x 1.6 mm
- Low Profile of 0.50 mm for Ultra Slim Design
- Stand Off Voltage: 5.5 V
- Low Leakage
- Protects up to Three Data Lines Plus a V_{CC} Pin
- V_{CC} Pin = 15 V Protection
- D_1, D_2, and D_3 Pins = 6.4 V Minimum Protection
- IEC61000−4−2: Level 4 ESD Protection
- This is a Pb−Free Device

Typical Applications

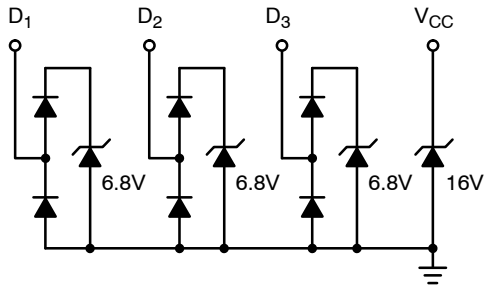
- USB 2.0 High−Speed Interface
- Cell Phones
- MP3 Players
- SIM Card Protection

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

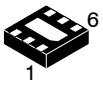
Symbol	Rating	Value	Unit
I_{PK}	Peak Pulse Current V_{CC} Diode 8x20 μsec double exponential waveform	5.0	A
T_J	Operating Junction Temperature Range	−40 to 125	°C
T_{STG}	Storage Temperature Range	−55 to 150	°C
T_L	Lead Solder Temperature − Maximum (10 seconds)	260	°C
ESD	IEC 61000−4−2 Contact	8000	V

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.

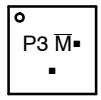
See Application Note AND8308/D for further description of survivability specs.



MARKING DIAGRAM



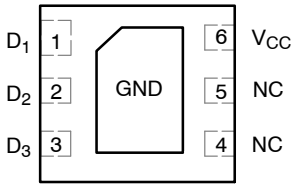
UDFN6 1.6x1.6
MU SUFFIX
CASE 517AP



P3 = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping†
NUP3115UPMUTAG	UDFN6 (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 Specification Brochure, BRD8011/D.

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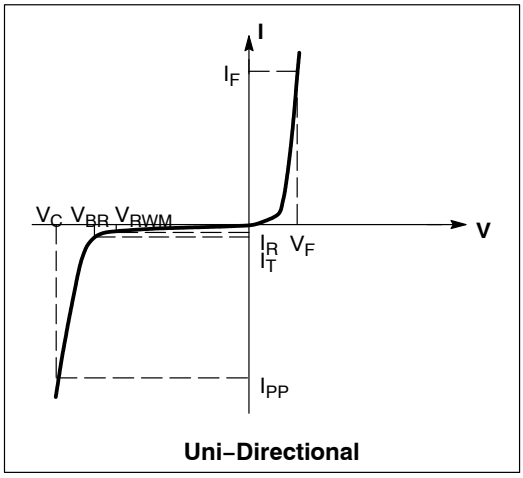
ELECTRICAL CHARACTERISTICS

(T_A = 25°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	Max. Capacitance @ V_R = 0 and f = 1.0 MHz

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



Uni−Directional

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

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Reverse Working Voltage (D_1, D_2, and D_3)	(Note 1)	V_{RWM1}	–	–	5.5	V
Reverse Working Voltage (V_{CC})	(Note 1)	V_{RWM2}	–	–	12	V
Breakdown Voltage (D_1, D_2, and D_3)	I_T = 1 mA, (Note 2)	V_{BR}	6.0	6.8	8.0	V
Breakdown Voltage (V_{CC})	I_T = 1 mA, (Note 2)	V_{BR2}	15	16	16.8	V
Reverse Leakage Current (D_1, D_2, and D_3)	@ V_{RWM1}	I_R	–	–	1.0	μA
Reverse Leakage Current (D_1, D_2, and D_3)	@ 3.3 V	I_R	–	–	85	nA
Reverse Leakage Current (V_{CC})	@ V_{RWM2}	I_R	–	–	1.0	μA
Clamping Voltage (D_1, D_2, and D_3)	I_{PP} = 1 A	V_C	–	9.4	–	V
Clamping Voltage (V_{CC})	I_{PP} = 1 A	V_C	–	18.5	–	V
Clamping Voltage (V_{CC})	I_{PP} = 3 A	V_C	–	22	–	V
Junction Capacitance (D_1, D_2, and D_3)	V_R = 0 V, f = 1 MHz (Line to GND)	C_J	–	0.8	1.0	pF
Clamping Voltage	Per IEC 61000−4−2 (Note 4)	VC	Figure 1 and 2			V

1. 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.
2. V_{BR} is measured at pulse test current I_T.
3. Surge current waveform per Figure 5.
4. Typical waveform. For test procedure see Figures 3 and 4 and Application Note AND8307/D.

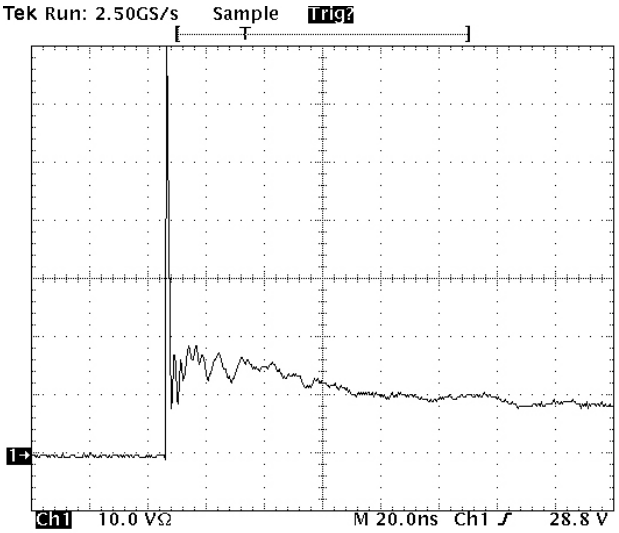


Figure 1. ESD Clamping Voltage Screenshot Positive 8 kV Contact per IEC61000−4−2

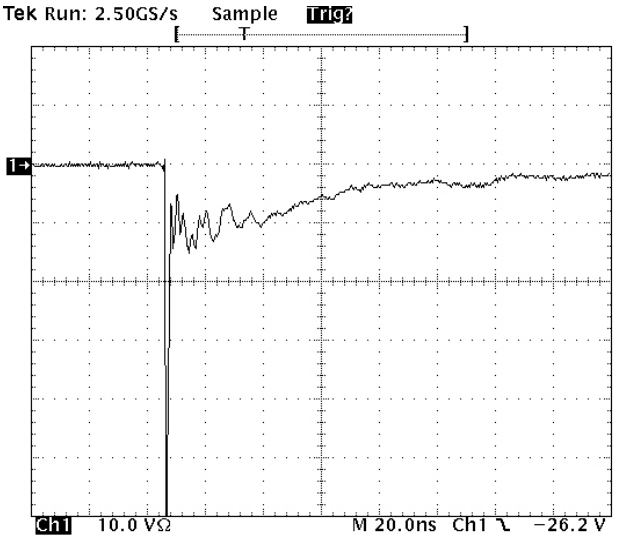


Figure 2. ESD Clamping Voltage Screenshot Negative 8 kV Contact per IEC61000−4−2

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

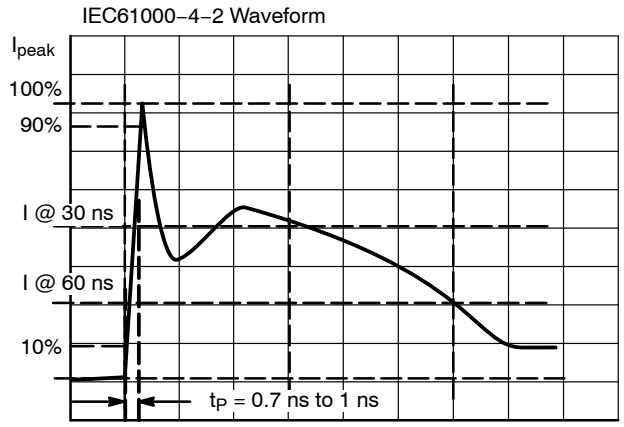


Figure 3. IEC61000−4−2 Spec

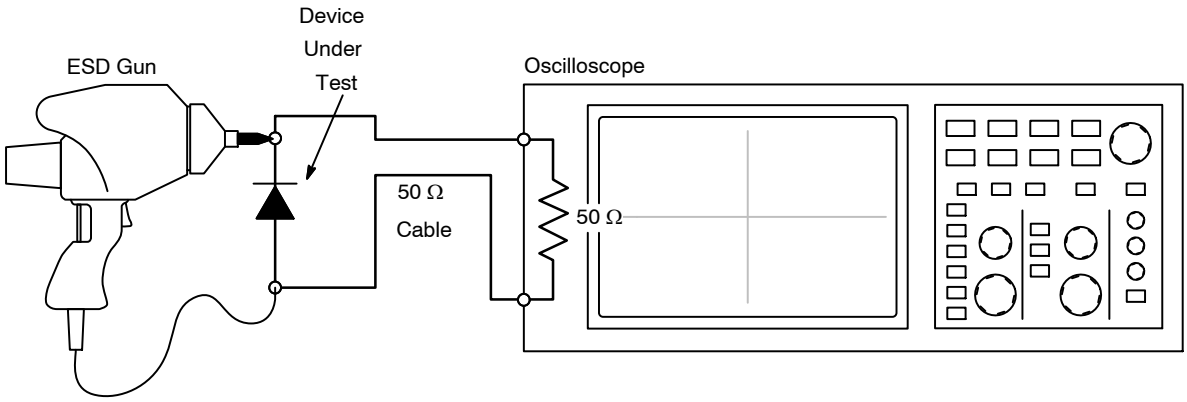


Figure 4. Diagram of ESD Test Setup

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. **onsemi** 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 **onsemi** creates these screenshots and how to interpret them please refer to AND8307/D.

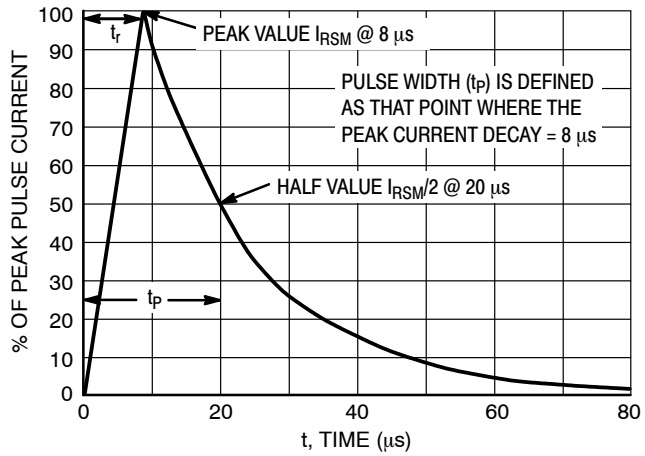


Figure 5. 8 x 20 μs Pulse Waveform

UDFN6 1.6x1.6, 0.5P
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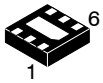
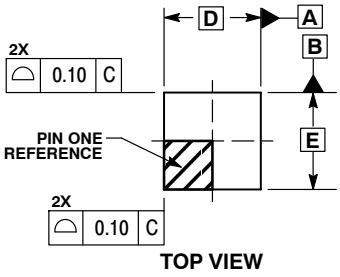
ISSUE O

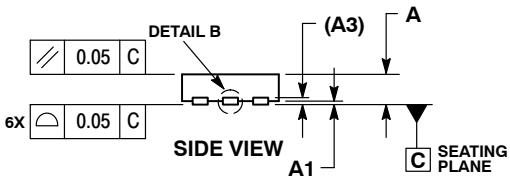
DATE 26 OCT 2007

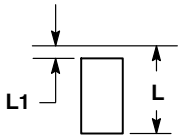


SCALE 4:1

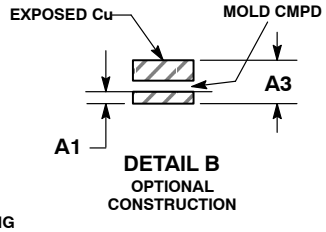


TOP VIEW

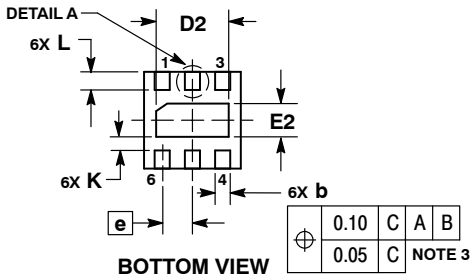




DETAIL A
OPTIONAL CONSTRUCTION

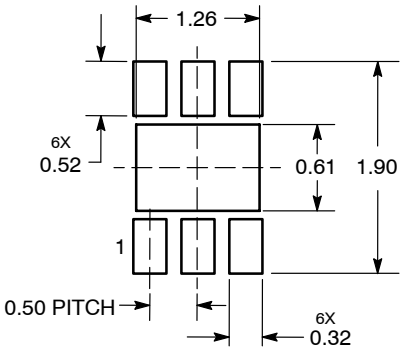


DETAIL B
OPTIONAL CONSTRUCTION



BOTTOM VIEW

SOLDERMASK DEFINED MOUNTING FOOTPRINT*



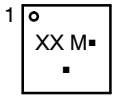
DIMENSIONS: MILLIMETERS

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

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	0.20	0.30
D	1.60 BSC	
E	1.60 BSC	
e	0.50 BSC	
D2	1.10	1.30
E2	0.45	0.65
K	0.20	---
L	0.20	0.40
L1	0.00	0.15

GENERIC MARKING DIAGRAM*



XX = Specific Device Code
M = Date Code
▪ = 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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