# NUP2114 Series, SNUP2114UCMR6T1G

# **Transient Voltage Suppressors**

## Low Capacitance ESD Protection for High Speed Data

The NUP2114 transient voltage suppressor is designed to protect high speed data lines from ESD. Ultra-low capacitance and high level of ESD protection makes this device well suited for use in USB 2.0 applications.

### Features

- Low Capacitance 0.8 pF
- S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements
- AEC-Q101 Qualified and PPAP Capable SNUP2114
- Low Clamping Voltage
- Stand Off Voltage: 5 V
- Low Leakage
- ESD Rating of Class 3B (Exceeding 8 kV) per Human Body model and Class C (Exceeding 400 V) per Machine Model
- Protection for the Following IEC Standards: IEC 61000-4-2 Level 4 ESD Protection
- UL Flammability Rating of 94 V–0
- These are Pb-Free Devices

### **Typical Applications**

- High Speed Communication Line Protection
- USB 2.0 High Speed Data Line and Power Line Protection
- Monitors and Flat Panel Displays
- MP3
- Gigabit Ethernet
- Notebook Computers
- Digital Video Interface (DVI) and HDMI

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

Rating	Symbol	Value	Unit
Operating Junction Temperature Range	TJ	-40 to +125	°C
Storage Temperature Range	T <sub>stg</sub>	–55 to +150	°C
Lead Solder Temperature – Maximum (10 Seconds)	ΤL	260	°C
Human Body Model (HBM) Machine Model (MM) IEC 61000-4-2 Contact IEC61000-4-2 Air	ESD	16000 400 8000 15000	V

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.

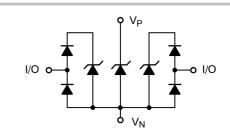
See Application Note AND8308/D for further description of survivability specs.



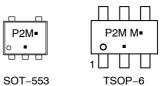
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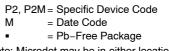
http://onsemi.com





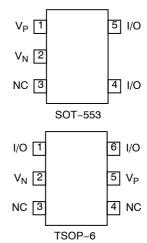
MARKING DIAGRAMS





(\*Note: Microdot may be in either location)





### **ORDERING INFORMATION**

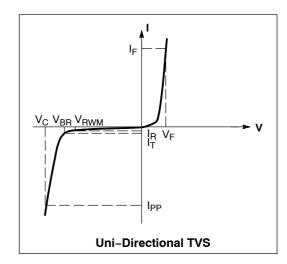
See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

### NUP2114 Series, SNUP2114UCMR6T1G

### **ELECTRICAL CHARACTERISTICS**

(T<sub>A</sub> = 25°C unless otherwise noted)

	<b>D</b> .
Symbol	Parameter
I <sub>PP</sub>	Maximum Reverse Peak Pulse Current
V <sub>C</sub>	Clamping Voltage @ I <sub>PP</sub>
V <sub>RWM</sub>	Working Peak Reverse Voltage
I <sub>R</sub>	Maximum Reverse Leakage Current @ V <sub>RWM</sub>
V <sub>BR</sub>	Breakdown Voltage @ I <sub>T</sub>
Ι <sub>Τ</sub>	Test Current
١ <sub>F</sub>	Forward Current
V <sub>F</sub>	Forward Voltage @ I <sub>F</sub>
P <sub>pk</sub>	Peak Power Dissipation
С	Max. Capacitance @ $V_R = 0$ and f = 1.0 MHz



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

Parameter	Symbol	Conditions	Min	Тур	Max	Unit
Reverse Working Voltage	V <sub>RWM</sub>	(Note 1)			5.0	V
Breakdown Voltage	V <sub>BR</sub>	I <sub>T</sub> = 1 mA, (Note 2)	5.5	7.5		V
Reverse Leakage Current	I <sub>R</sub>	V <sub>RWM</sub> = 5 V			1.0	μA
Clamping Voltage	V <sub>C</sub>	I <sub>PP</sub> = 5 A (Note 3)		9.0		V
Clamping Voltage	V <sub>C</sub>	I <sub>PP</sub> = 8 A (Note 3)		10		V
Maximum Peak Pulse Current	I <sub>PP</sub>	8x20 μs Waveform			12	А
Junction Capacitance	CJ	$V_{R}$ = 0 V, f = 1 MHz between I/O Pins and GND		0.8	1.0	pF
Junction Capacitance	CJ	$V_R = 0 V$ , f = 1 MHz between I/O Pins			0.5	pF
Clamping Voltage	V <sub>C</sub>	@ I <sub>PP</sub> = 1 A (Note 4)			12	V
Clamping Voltage	V <sub>C</sub>	Per IEC 61000-4-2 (Note 5)	Figures 1 and 2		V	

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

1. 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.

2. V<sub>BR</sub> is measured at pulse test current I<sub>T</sub>.

3. Nonrepetitive current pulse (Pin 5 to Pin 2)

4. Surge current waveform per Figure 5.

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

6. Include S-prefix devices where applicable.

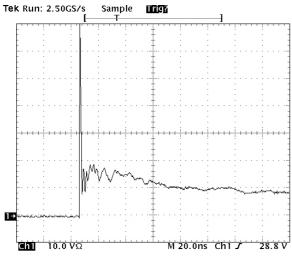
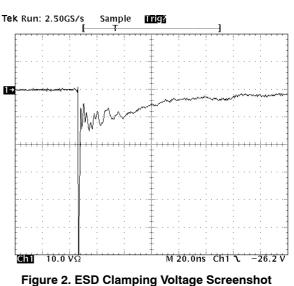


Figure 1. ESD Clamping Voltage Screenshot Positive 8 kV Contact per IEC61000-4-2



Negative 8 kV Contact per IEC61000-4-2

### NUP2114 Series, SNUP2114UCMR6T1G

### 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

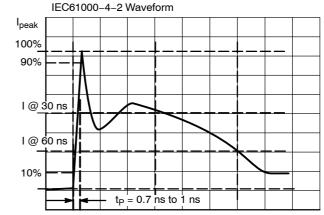


Figure 3. IEC61000-4-2 Spec

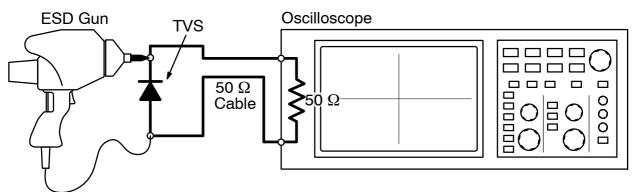


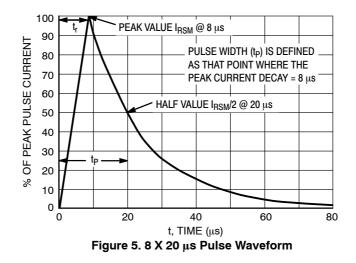
Figure 4. Diagram of ESD Test Setup

### 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.



### NUP2114 Series, SNUP2114UCMR6T1G

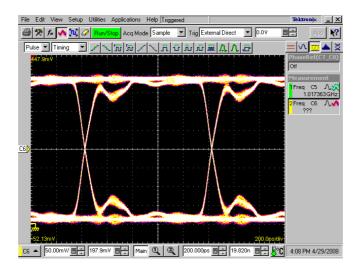


Figure 6. 500 MHz Data Pattern

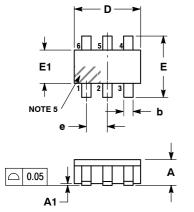
### **ORDERING INFORMATION**

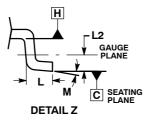
Device	Marking	Package	Shipping <sup>†</sup>
NUP2114UPXV5T1G	P2	SOT-553 (Pb-Free)	4,000 / Tape & Reel
NUP2114UCMR6T1G	P2M	TSOP-6 (Pb-Free)	3,000 / Tape & Reel
SNUP2114UCMR6T1G	P2M	TSOP-6 (Pb-Free)	3,000 / Tape & Reel

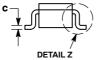
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

### PACKAGE DIMENSIONS

TSOP-6 CASE 318G-02 ISSUE U





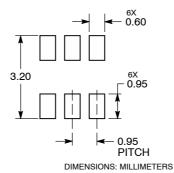


NOTES:

- NOTES:
  DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  CONTROLLING DIMENSION: MILLIMETERS.
  MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
  DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
  PIN ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

	MILLIMETERS						
DIM	MIN NOM MAX						
Α	0.90	1.00	1.10				
A1	0.01	0.06	0.10				
b	0.25	0.38	0.50				
с	0.10	0.18	0.26				
D	2.90	3.00	3.10				
Е	2.50	2.50 2.75					
E1	1.30	1.30 1.50 1.70					
e	0.85	0.95	1.05				
L	0.20	0.40	0.60				
L2	0.25 BSC						
М	0° – 10°						

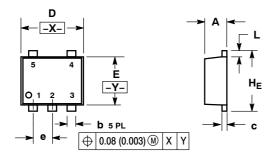
### RECOMMENDED **SOLDERING FOOTPRINT\***



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

### PACKAGE DIMENSIONS

SOT-553, 6 LEAD CASE 463B-01 ISSUE B



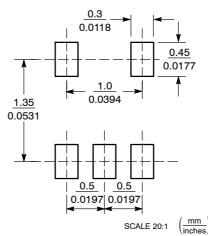
NOTES: 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

2. CONTROLLING DIMENSION: MILLIMETERS

 CONTROLLING DIMENSION, MILLINETERS MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
Α	0.50	0.55	0.60	0.020	0.022	0.024
b	0.17	0.22	0.27	0.007	0.009	0.011
С	0.08	0.13	0.18	0.003	0.005	0.007
D	1.50	1.60	1.70	0.059	0.063	0.067
Е	1.10	1.20	1.30	0.043	0.047	0.051
е	0.50 BSC			0.020 BSC		
L	0.10	0.20	0.30	0.004	0.008	0.012
HE	1.50	1.60	1.70	0.059	0.063	0.067

#### 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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