

# ESD5381 Series

## ESD Protection Diode

### Micro-Packaged Diodes for ESD Protection

The ESD5381 series are designed to protect voltage sensitive components from ESD. Excellent clamping capability, low leakage, and fast response time provide best in class protection on designs that are exposed to ESD. Because of their small size, they are suited for use in cellular phones, MP3 players, digital cameras and many other portable applications where board space comes at a premium.

#### Specification Features

- Low Capacitance
- Low Clamping Voltage
- Small Body Outline Dimensions: 0.60 mm x 0.30 mm
- Low Body Height: 0.3 mm
- Low Leakage
- Response Time is < 1 ns
- IEC61000-4-2 Level 4 ESD Protection
- IEC61000-4-4 Level 4 EFT Protection
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### Mechanical Characteristics

**QUALIFIED MAX REFLOW TEMPERATURE: 260°C**

Device Meets MSL 1 Requirements

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
IEC 61000-4-2 (ESD) Contact Air		8	kV
Total Power Dissipation on FR-5 Board (Note 1) @ $T_A = 25^\circ\text{C}$	$P_D$	300	mW
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	400	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
Lead Solder Temperature - Maximum (10 Second Duration)	$T_L$	260	$^\circ\text{C}$

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 x 0.75 x 0.62 in.



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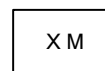
[www.onsemi.com](http://www.onsemi.com)



X3DFN2  
CASE 152AF

#### MARKING DIAGRAM

PIN 1



X = Specific Device Code  
M = Date Code  
(Specific marking on following page)

#### ORDERING INFORMATION

Device	Package	Shipping†
ESD5381MUT5G	X3DFN2 (Pb-Free)	10000 / Tape & Reel
ESD5382MUT5G	X3DFN2 (Pb-Free)	10000 / 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.

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

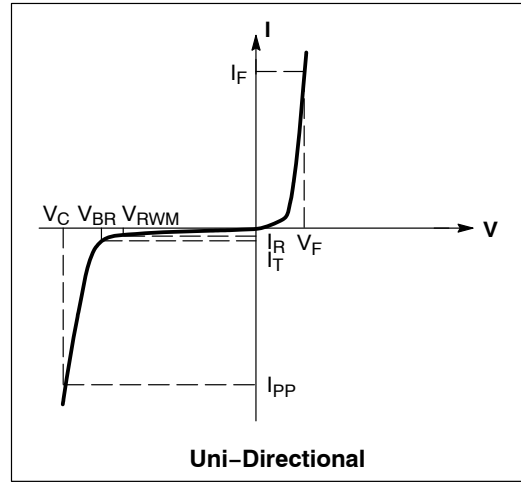
# ESD5381 Series

## 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

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



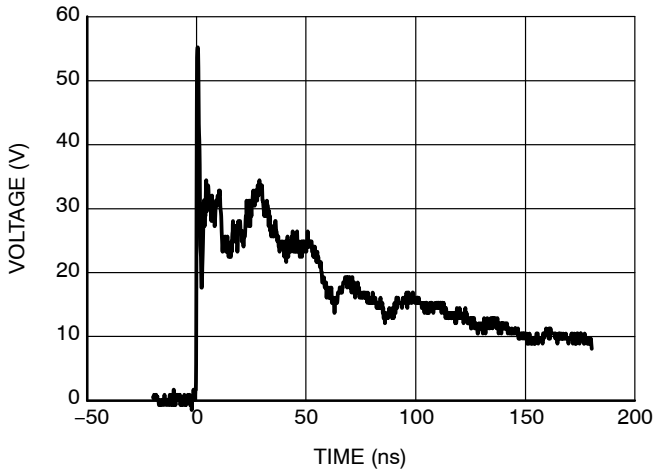
## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Device	Device Marking	$V_{RWM}$ (V)	$I_R$ (nA) @ $V_{RWM}$	$V_{BR}$ (V) @ $I_T$ (Note 2)	$I_T$ (mA)	C (pF)		$V_C$ (V) @ $I_{PP} = 1$ A	$V_C$ Per IEC61000-4-2 (Note 4)
		Max	Max	Min		Typ	Max	Max (Note 3)	
ESD5381MUT5G	J	3.0	100	6.1	1.0	12	13	10.5	Figures 1 and 2 See Below
ESD5382MUT5G	K	3.0	50	14.2	1.0	6	8	26.0	Figures 3 and 4 See Below

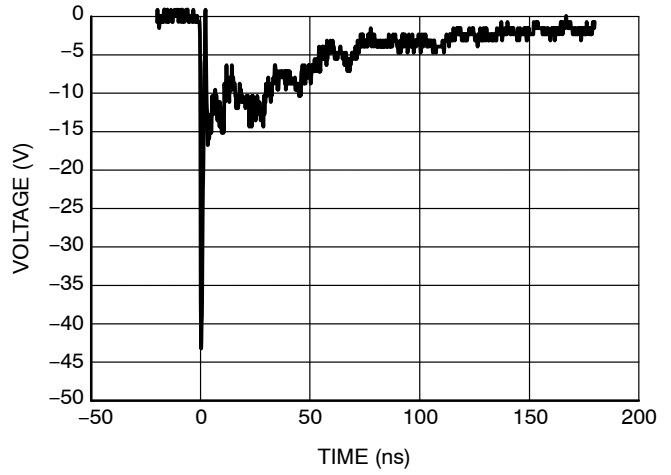
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2.  $V_{BR}$  is measured with a pulse test current  $I_T$  at an ambient temperature of  $25^\circ\text{C}$ .
3. Surge current waveforms per Figure 7.
4. For test procedure see Figures 5 and 6 and Application Note AND8307/D.

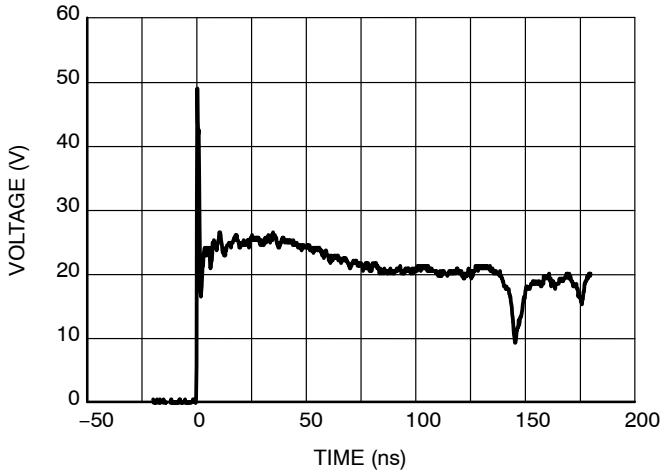
# ESD5381 Series



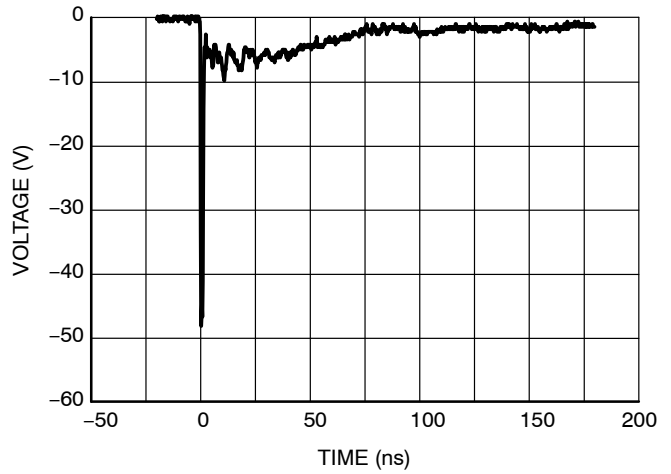
**Figure 1. ESD5381MUT5G Clamping Voltage Screenshot Positive 8 kV Contact per IEC61000-4-2**



**Figure 2. ESD5381MUT5G Clamping Voltage Screenshot Negative 8 kV Contact per IEC61000-4-2**



**Figure 3. ESD5382MUT5G Clamping Voltage Screenshot Positive 8 kV Contact per IEC61000-4-2**



**Figure 4. ESD5382MUT5G Clamping Voltage Screenshot Negative 8 kV Contact per IEC61000-4-2**

# ESD5381 Series

## 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 5. IEC61000-4-2 Spec

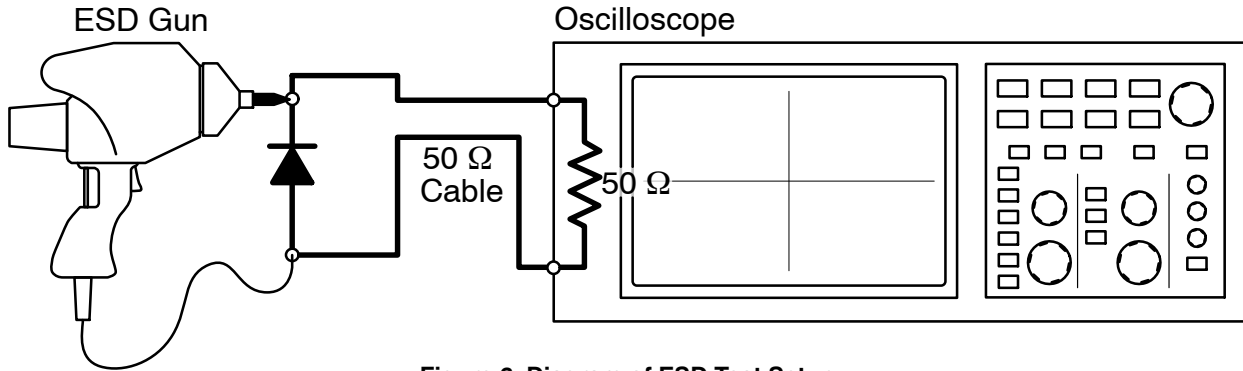


Figure 6. Diagram of ESD Test Setup

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.

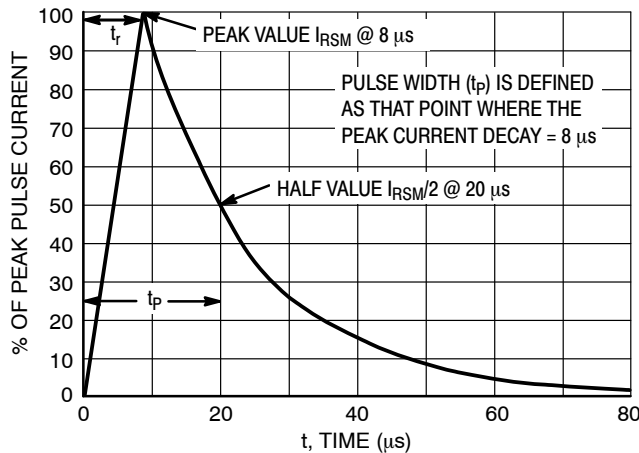
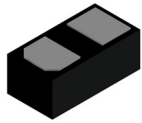


Figure 7. 8 X 20 μs Pulse Waveform

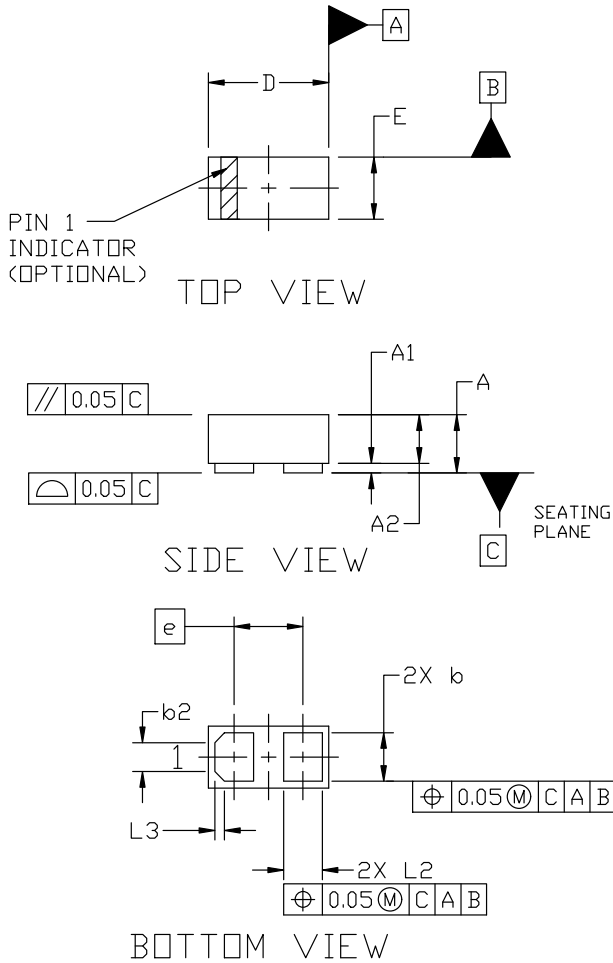
# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS



**X3DFN2 0.62x0.32x0.24, 0.35P**  
**CASE 152AF**  
**ISSUE C**

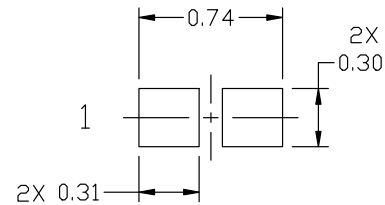
DATE 08 AUG 2023



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 0201

MILLIMETERS			
DIM	MIN.	NOM.	MAX.
A	0.25	0.29	0.33
A1	0.00	---	0.05
A2	0.14	0.24	0.34
b	0.22	0.25	0.28
b2	0.150 REF		
D	0.58	0.62	0.66
E	0.28	0.32	0.36
e	0.355 BSC		
L2	0.17	0.20	0.23
L3	0.050 REF		



**RECOMMENDED MOUNTING 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.

**GENERIC MARKING DIAGRAM\***



X = Specific Device Code  
M = Date Code

\*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.

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<b>DESCRIPTION:</b>	<b>X3DFN2 0.62x0.32x0.24, 0.35P</b>	<b>PAGE 1 OF 1</b>

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