ESD7501

ESD Protection Diode

Micro−Packaged Diodes for ESD Protection

The ESD7501 is designed to protect voltage sensitive components that require low capacitance from ESD and transient voltage events. 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, the part is well suited for use in high frequency designs such as USB 2.0 high speed applications.

Features

- Low Capacitance 0.45 pF (Typ)
- Low Clamping Voltage
- Small Body Outline Dimensions: 0.60 mm x 0.30 mm
- Low Body Height: 0.3 mm
- Stand−off Voltage: 5 V
- IEC61000−4−2 Level 4 ESD Protection
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- USB 2.0/3.0
- MHL 2.0
- eSATA

MAXIMUM RATINGS

Rating		Symbol	Value	Unit
IEC 61000−4−2 (ESD)	Contact Air		±16 ±16	kV
Total Power Dissipation on FR−5 Board (Note 1) @ T_A = 25°C Thermal Resistance, Junction−to−Ambient		P_D $R_{\theta JA}$	250 400	mW °C/W
Junction and Storage Temperature Range		T_J, T_{stg}	−55 to +150	°C
Lead Solder Temperature − Maximum (10 Second Duration)		T_L	260	°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.

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

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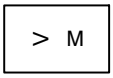




X3DFN2
CASE 152AF

MARKING DIAGRAM

PIN 1



V = Specific Device Code
M = Date Code

ORDERING INFORMATION

Device	Package	Shipping†
ESD7501MUT5G	X3DFN2 (Pb−Free)	15000 / 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.

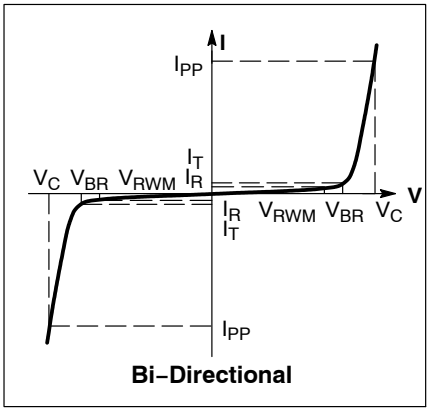
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ELECTRICAL CHARACTERISTICS

(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

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



Bi−Directional

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	V_{RWM}				5.0	V
Breakdown Voltage (Note 2)	V_{BR}	I_T = 1 mA	5.5			V
Reverse Leakage Current	I_R	V_{RWM} = 5 V			1.0	μA
Clamping Voltage 8x20 μs	V_C	I_{PP} = 0.5 A		8.4	8.9	V
Clamping Voltage 8x20 μs	V_C	I_{PP} = 1.0 A		9	9.5	V
Clamping Voltage (Note 3)	V_C	I_{PP} = 2 A			11.5	V
ESD Clamping Voltage	V_C	Per IEC61000−4−2	See Figures 1 and 2			
Junction Capacitance	C_J	V_R = 0 V, f = 1 MHz		0.45	0.75	pF
Dynamic Resistance	R_{DYN}	TLP Pulse Pin 1 to Pin 2 Pin 2 to Pin 1		0.28 0.42		Ω
Insertion Loss		f = 1 GHz f = 5 GHz f = 10 GHz		0.08 0.55 1.77		dB

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. Breakdown voltage is tested from pin 1 to 2 and pin 2 to 1.
3. Non−repetitive current pulse at T_A = 25°C, per IEC61000−4−5 waveform.

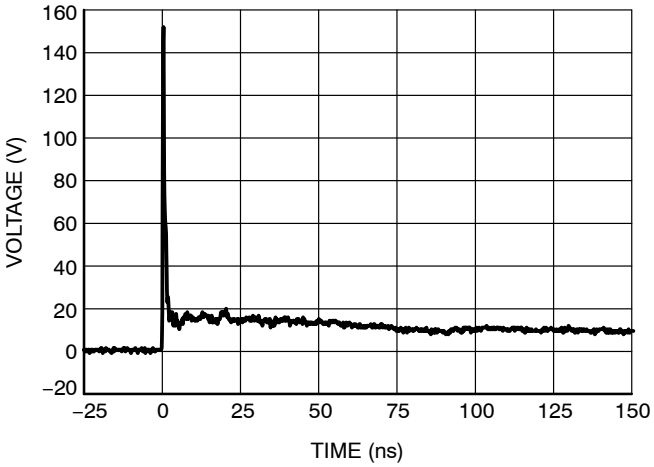


Figure 1. IEC61000−4−2 + 8 kV Contact ESD Clamping Voltage

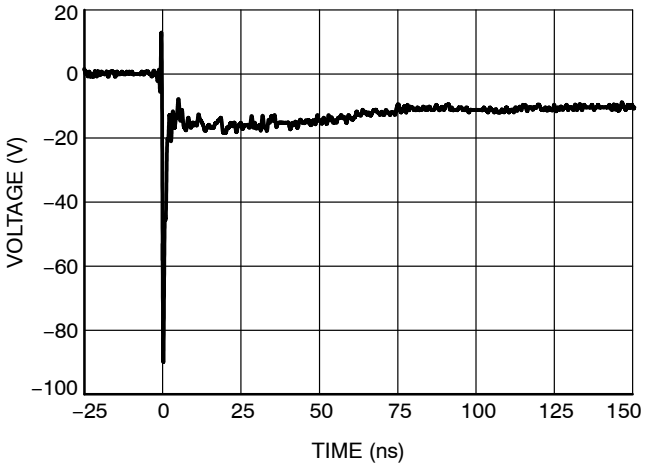


Figure 2. IEC61000−4−2 − 8 kV Contact ESD Clamping Voltage

TYPICAL CHARACTERISTICS

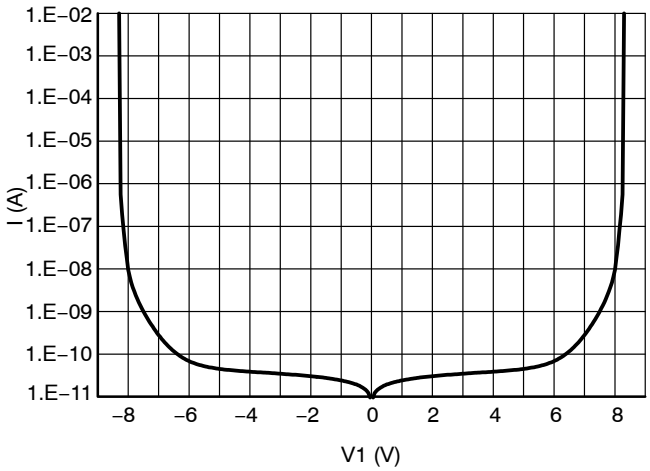


Figure 3. IV Characteristics

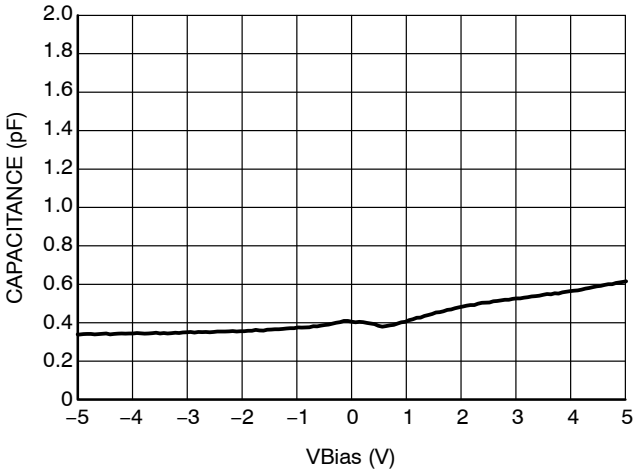


Figure 4. CV Characteristics

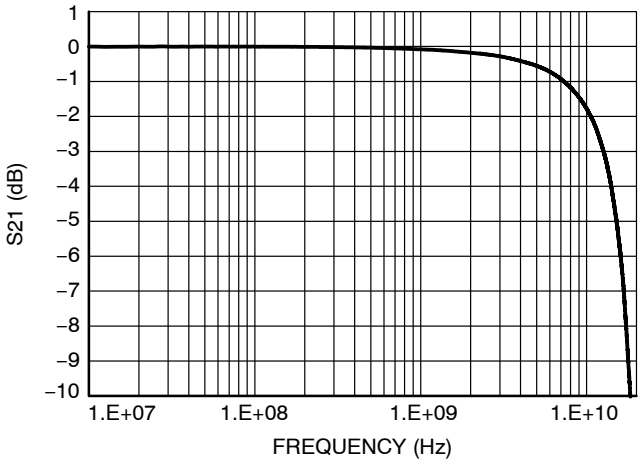


Figure 5. Insertion Loss

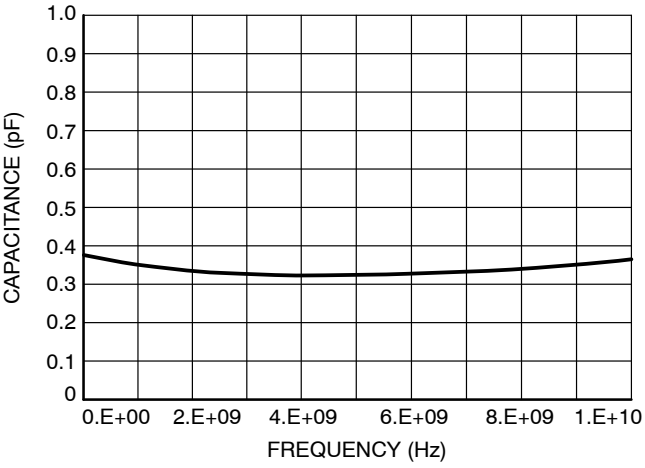


Figure 6. Typical Capacitance over Frequency

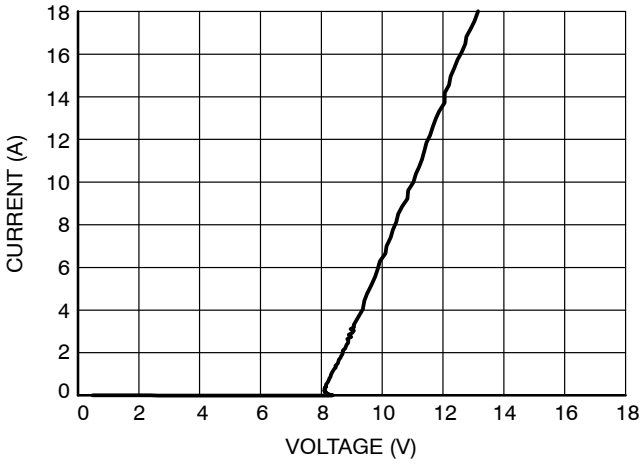


Figure 7. Pin 1 to Pin 2 TLP IV Curve

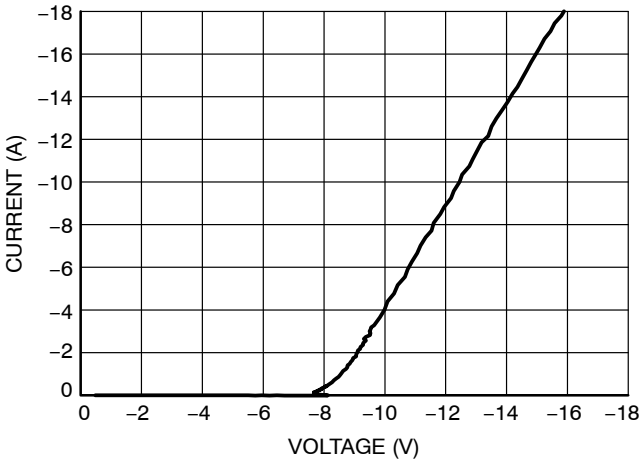


Figure 8. Pin 2 to Pin 1 TLP IV Curve

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

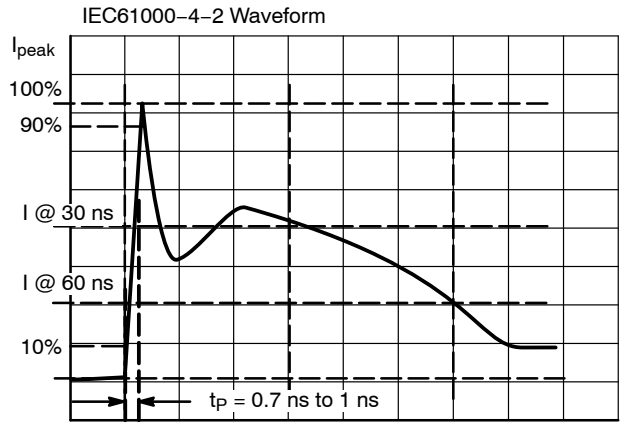


Figure 9. IEC61000−4−2 Spec

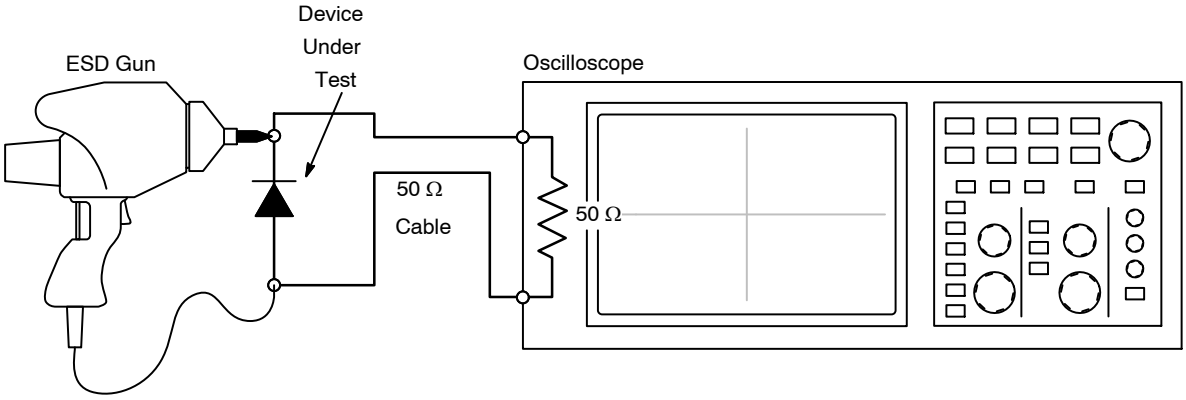


Figure 10. Diagram of ESD Test Setup

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.

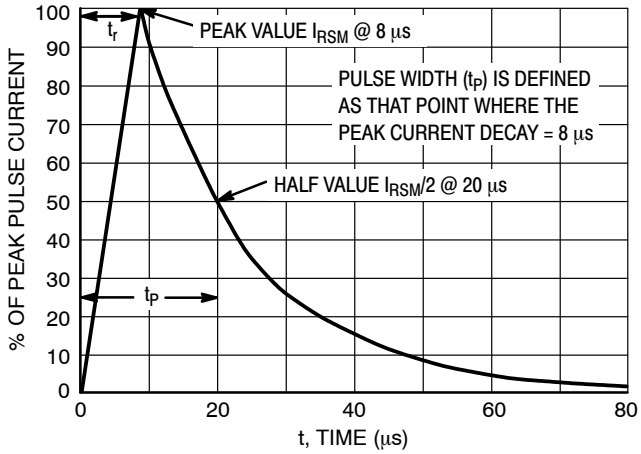
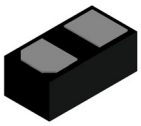
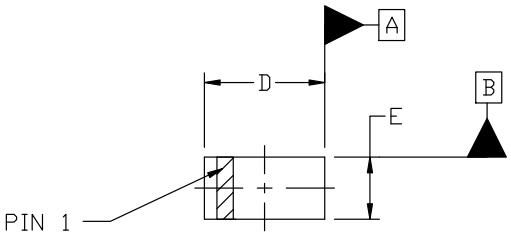


Figure 11. 8 x 20 μs Pulse Waveform

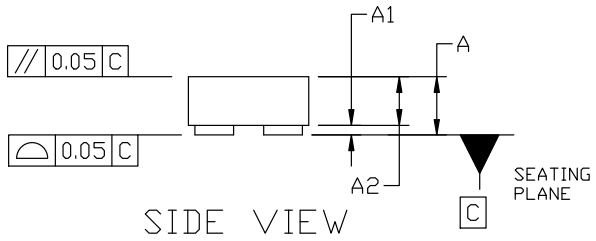


X3DFN2 0.62x0.32x0.24, 0.35P
CASE 152AF
ISSUE C

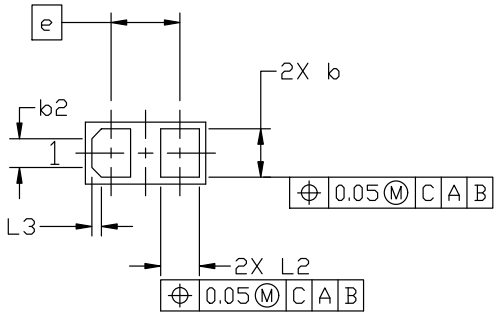
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TOP VIEW



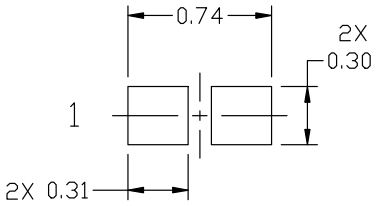
SIDE VIEW



BOTTOM VIEW

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

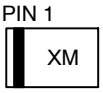
	MILLIMETERS		
DIM	MIN.	NOM.	MAX.
A	0.25	0.29	0.33
A1	0.00	---	0.05
A2	0.14	0.24	0.34
b	0.22	0.25	0.28
b2	0.150 REF		
D	0.58	0.62	0.66
E	0.28	0.32	0.36
e	0.355 BSC		
L2	0.17	0.20	0.23
L3	0.050 REF		



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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