

ESD and Surge Protection Device, Bidirectional

Micro-Packaged Diodes for ESD Protection

ESDL3141

The ESDL3141 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 2.0/3.0 high speed applications.

Features

- Low Capacitance 1.4 pF (Typ)
- Low Clamping Voltage
- Small Body Outline Dimensions: 1.00 mm x 0.60 mm
- Low Body Height: 0.23 mm
- Stand-off Voltage: 14 V
- Protection for the following IEC Standards:
 - IEC61000-4-2 Level 4: ± 30 kV Contact Discharge
 - IEC61000-4-5 (Lightning): I_{pp} 10 A (8/20 μ s)
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- USB 2.0
- USB Type C Alternate Audio Mode

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
IEC 61000-4-2 (ESD) Contact Air		± 30 ± 30	kV
Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^{\circ}$ C
Lead Solder Temperature - Maximum (10 Second Duration)	T_L	260	$^{\circ}$ C

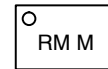
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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



X2DFN2
1.0 X 0.6
CASE 714AB

MARKING DIAGRAM



RM = Specific Device Code
M = Date Code

ORDERING INFORMATION

Device	Package	Shipping [†]
ESDL3141MXT5G	X2DFN2 (Pb-Free)	8000 / 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.

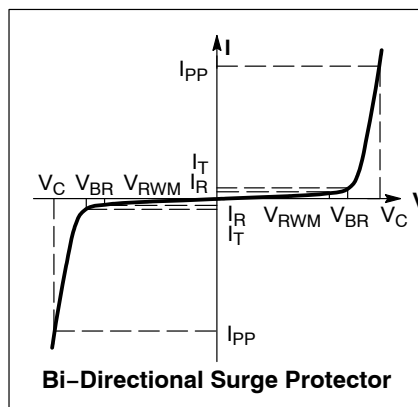
ESDL3141

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 specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	V_{RWM}	Pin 2 to Pin 1 Pin 1 to Pin 2			14 5	V
Breakdown Voltage	V_{BR}	$I_T = 10\text{ mA}$, Pin 2 to Pin 1 $I_T = 1\text{ mA}$, Pin 2 to Pin 1 $I_T = 1\text{ mA}$, Pin 1 to Pin 2	14.1 13.75 5.5	15.3 14.5 7.0	17.5 16.5 8.2	V
Reverse Leakage Current	I_R	@ 3.3 V, Pin 2 to Pin 1 @ 14 V, Pin 2 to Pin 1 @ 5.0 V, Pin 1 to Pin 2			0.1 2.0 0.1	μA
Clamping Voltage	V_C	Per IEC61000-4-2, $\pm 8\text{ kV}$ Contact	See Figures 1 & 2			V
Clamping Voltage TLP (Note 1)	V_C	$I_{PP} = 8\text{ A}$ IEC61000-4-2 Level 2 Equivalent ($\pm 4\text{ kV}$ Contact, $\pm 8\text{ kV}$ Air) (Pin 2 to Pin 1) (Pin 1 to Pin 2)		17.9 8.85		V
		$I_{PP} = 16\text{ A}$ IEC61000-4-2 Level 4 Equivalent ($\pm 8\text{ kV}$ Contact, $\pm 16\text{ kV}$ Air) (Pin 2 to Pin 1) (Pin 1 to Pin 2)		19.3 10.9		V
Reverse Peak Pulse Current	I_{PP}	IEC61000-4-5 (8x20 μs) Pin 2 to Pin 1 IEC61000-4-5 (8x20 μs) Pin 1 to Pin 2	10 13.5	12 16.5		A
Clamping Voltage 8x20 μs Waveform per Figure A (Note 2)	V_C	$I_{PP} = 10\text{ A}$ (Pin 2 to Pin 1) $I_{PP} = 13.5\text{ A}$ (Pin 1 to Pin 2)		19.5 12.3	21.5 14	V
Dynamic Resistance	R_{DYN}	I/O Pin to GND (8x20 μs) (Pin 2 to Pin 1) (Pin 1 to Pin 2)		0.35 0.52		Ω
Junction Capacitance	C_J	$V_R = 0\text{ V}$, $f = 1\text{ MHz}$		1.4	1.75	pF

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.

- ANSI/ESD STM5.5.1 – Electrostatic Discharge Sensitivity Testing using Transmission Line Pulse (TLP) Model.
TLP conditions: $Z_0 = 50$, $t_p = 100\text{ ns}$, $t_r = 1\text{ ns}$, averaging window; $t_1 = 70\text{ ns}$ to $t_2 = 90\text{ ns}$.
- Non-repetitive current pulse at $T_A = 25^\circ\text{C}$, per IEC61000-4-5 waveform.

TYPICAL CHARACTERISTICS

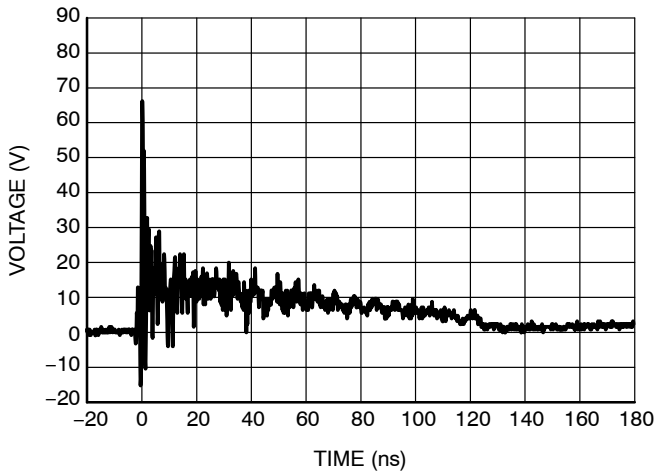


Figure 1. ESD Clamping Voltage Pin 1 to Pin 2
8 kV Contact per IEC61000-4-2

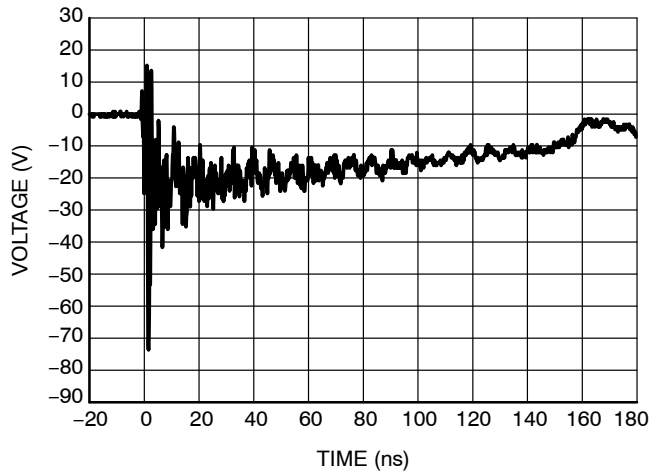


Figure 2. ESD Clamping Voltage Pin 2 to Pin 1
8 kV Contact per IEC61000-4-2

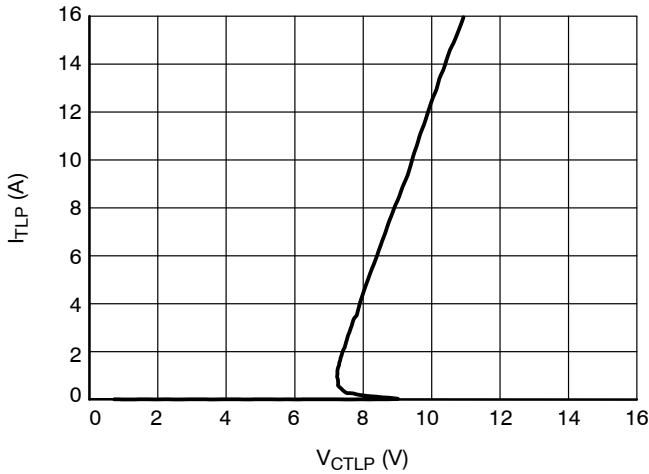


Figure 3. Pin 1 to Pin 2 100 ns TLP I-V Curve

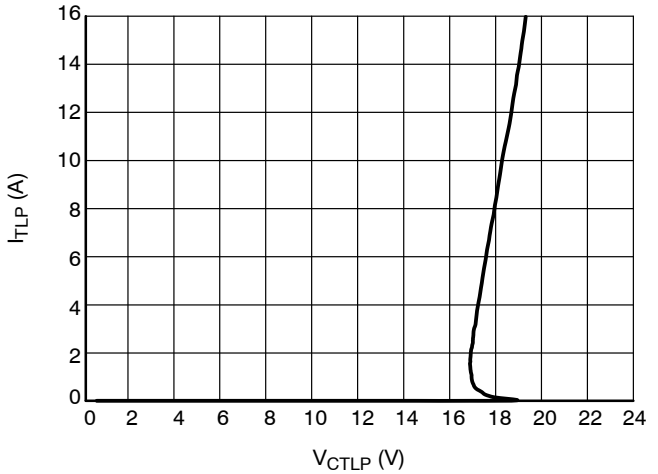


Figure 4. Pin 2 to Pin 1 TLP I-V Curve

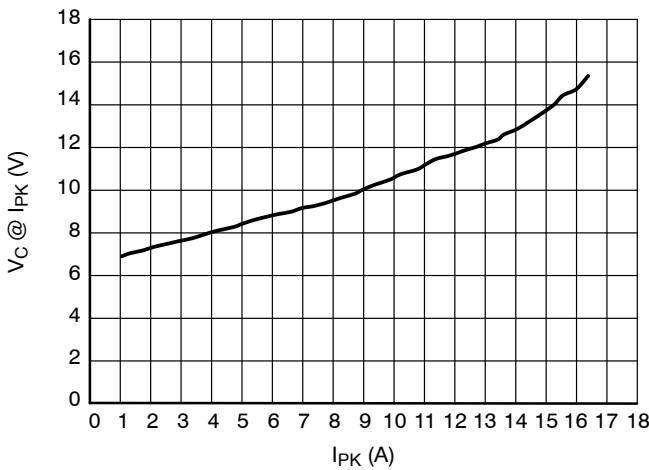


Figure 5. Pin 1 to Pin 2 Clamping Voltage vs.
Peak Pulse Current ($t_p = 8/20 \mu s$)

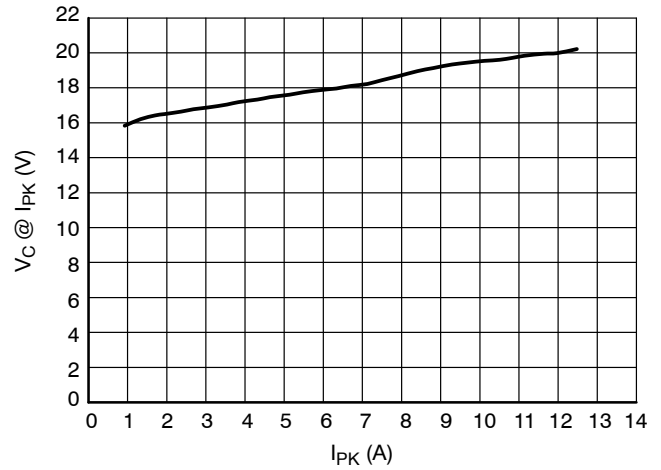


Figure 6. Pin 2 to Pin 1 Clamping Voltage vs.
Peak Pulse Current ($t_p = 8/20 \mu s$)

TYPICAL CHARACTERISTICS

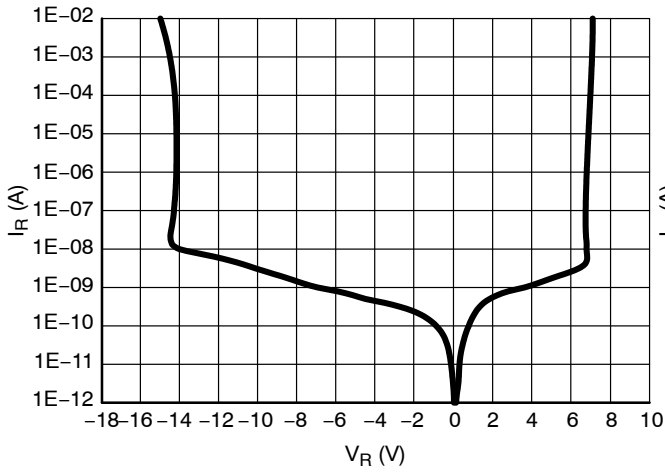


Figure 7. Breakdown Voltage

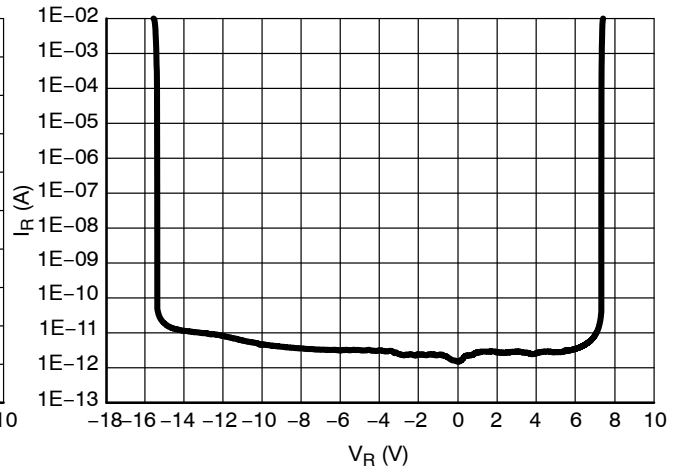


Figure 8. Reverse Leakage Current

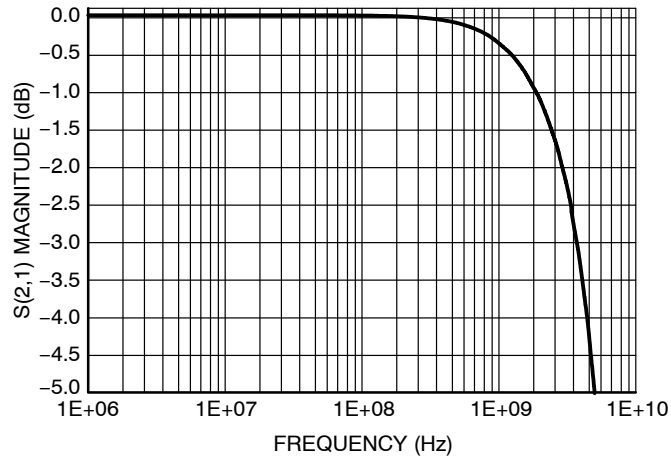


Figure 9. Insertion Loss

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

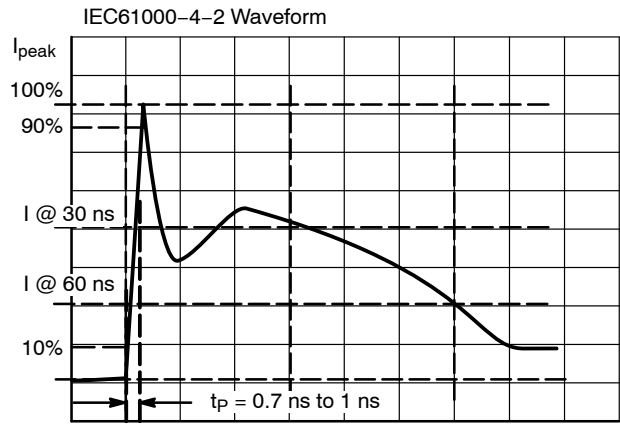


Figure 10. IEC61000-4-2 Spec

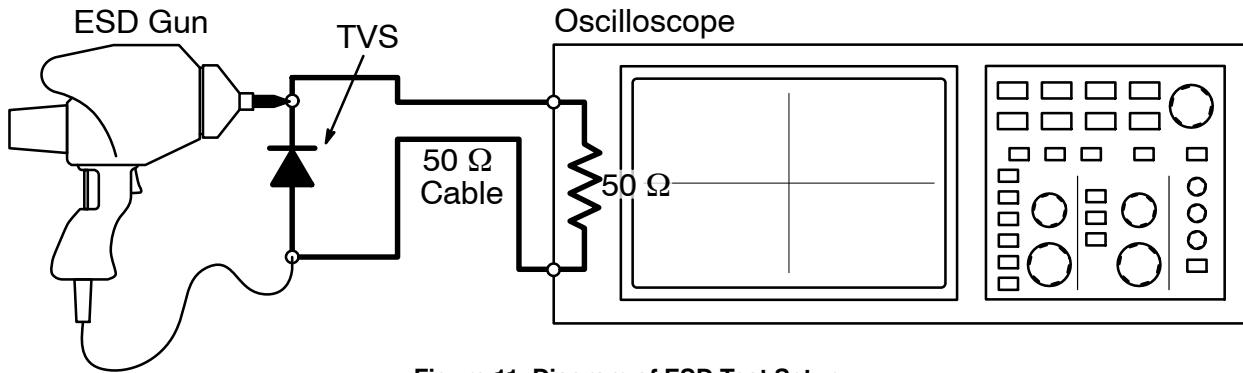


Figure 11. Diagram of ESD Test Setup

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.

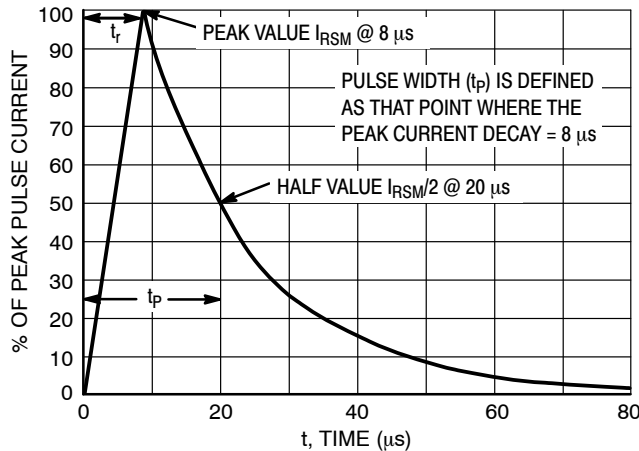
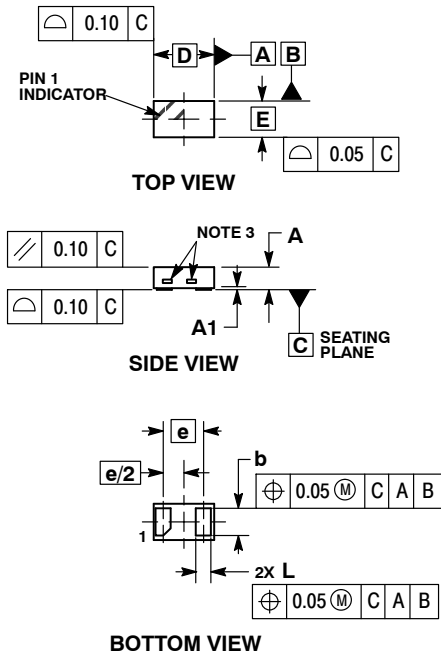


Figure 12. 8 X 20 μs Pulse Waveform

ESDL3141

PACKAGE DIMENSIONS

X2DFN2 1.0x0.6, 0.65P
CASE 714AB
ISSUE B

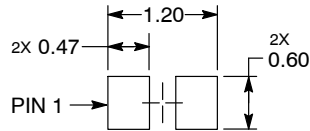


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. EXPOSED COPPER ALLOWED AS SHOWN.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.34	0.37	0.40
A1	---	0.03	0.05
b	0.45	0.50	0.55
D	0.95	1.00	1.05
E	0.55	0.60	0.65
e	0.65 BSC		
L	0.20	0.25	0.30

**RECOMMENDED
SOLDER FOOTPRINT***



DIMENSIONS: MILLIMETERS

*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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