3.3V ESD Protection Diodes

Ultra Low Capacitance ESD Protection Diode for High Speed Data Line

ESDL1531

The ESDL1531 ESD protection diodes are designed to protect high speed data lines from ESD. Ultra−low capacitance and low ESD clamping voltage make this device an ideal solution for protecting voltage sensitive high speed data lines.

Features

- Low Capacitance (0.15 pF Typ, I/O to GND)
- Protection for the Following IEC Standards: IEC 61000−4−2 (Level 4)
- Low ESD Clamping Voltage
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- USB 2.0/3.x
- Thunderbolt
- MHL 2.0
- eSATA

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Operating Junction Temperature Range	T_J	−55 to +150	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C
Lead Solder Temperature − Maximum (10 Seconds)	T_L	260	°C
IEC 61000−4−2 Contact IEC 61000−4−2 Air	ESD	±30 ±30	kV kV

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.

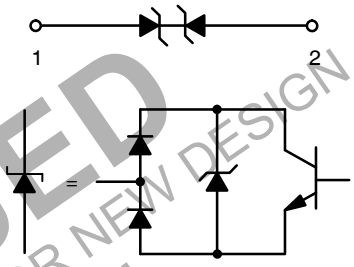
See Application Note AND8308/D for further description of survivability specs.

MARKING DIAGRAM

ESDL1531
X4DFN2 (01005)
CASE 718AA

J = Device Code
M = Date Code

PIN CONFIGURATION AND SCHEMATIC



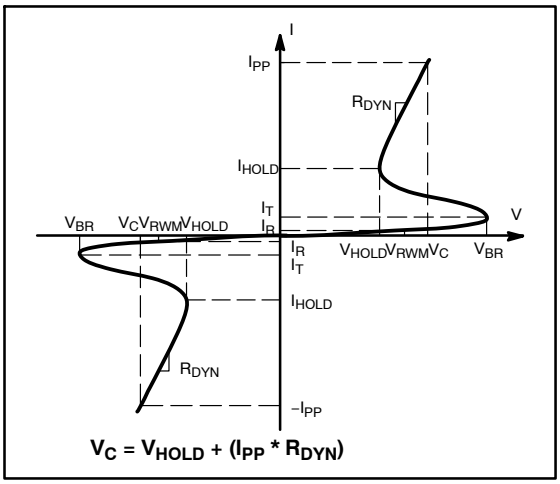
ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted)

Symbol	Parameter
V_{RWM}	Working Peak Voltage
I_R	Maximum Reverse Leakage Current @ V_{RWM}
V_{BR}	Breakdown Voltage @ I_T
I_T	Test Current
V_{HOLD}	Holding Reverse Voltage
I_{HOLD}	Holding Reverse Current
R_{DYN}	Dynamic Resistance
I_{PP}	Maximum Peak Pulse Current
V_C	Clamping Voltage @ I_{PP} $V_C = V_{HOLD} + (I_{PP} * R_{DYN})$



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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	V_{RWM}	I/O Pin to GND			3.3	V
Breakdown Voltage	V_{BR}	I_T = 1 mA, I/O Pin to GND	5.5		8.6	V
Reverse Leakage Current	I_R	V_{RWM} = 3.3 V, I/O Pin to GND			1.0	μA
Reverse Holding Voltage	V_{HOLD}	I/O Pin to GND		2.1		V
Holding Reverse Current	I_{HOLD}	I/O Pin to GND		17		mA
Clamping Voltage TLP (Note 1)	V_C	I_{PP} = 8 A } IEC 61000−4−2 Level 2 equivalent (±4 kV Contact, ±4 kV Air)		6.5		V
		I_{PP} = 16 A } IEC 61000−4−2 Level 2 equivalent (±8 kV Contact, ±15 kV Air)		10.2		
Reverse Peak Pulse Current	I_{PP}	IEC61000−4−5 (8/20 μs)	5.7	7.5		A
Clamping Voltage (8/20 μs)	V_C	I_{PP} = 5.7 A		5.6	6.5	V
Dynamic Resistance	R_{DYN}	I/O Pin to GND		0.46		Ω
Junction Capacitance	C_J	V_R = 0 V, f = 1 MHz		0.15	0.3	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.

1. ANSI/ESD STM5.5.1 − Electrostatic Discharge Sensitivity Testing using Transmission Line Pulse (TLP) Model.
   TLP conditions: Z_0 = 50 Ω, t_p = 100 ns, t_r = 1 ns, averaging window; t_1 = 70 ns to t_2 = 90 ns.

TYPICAL CHARACTERISTICS

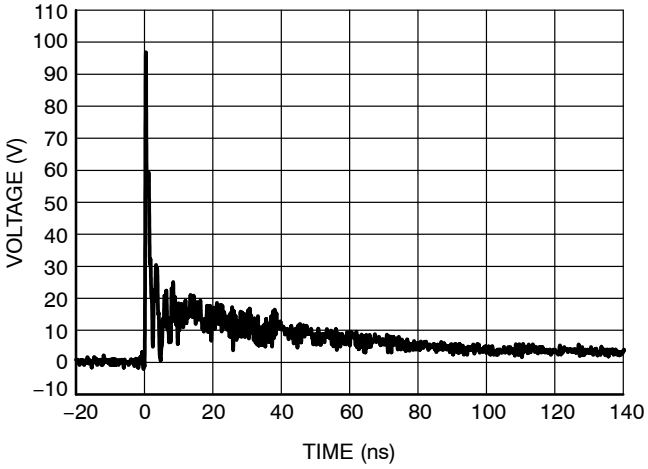


Figure 1. ESD Clamping Voltage − Pin 1 to Pin 2 8 kV Contact per IEC61000−4−2

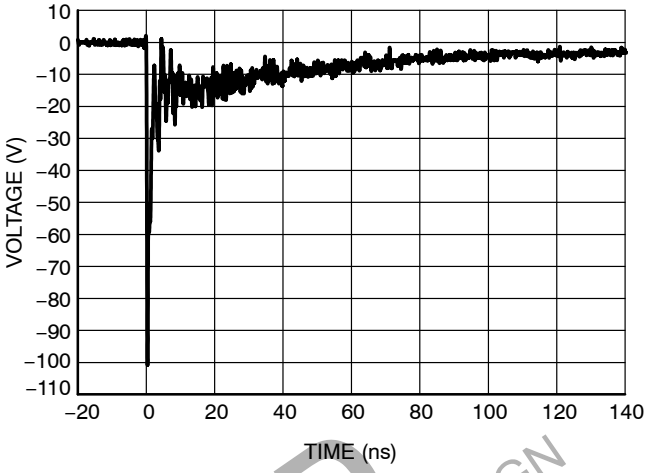


Figure 2. ESD Clamping Voltage − Pin 2 to Pin 1 8 kV Contact per IEC61000−4−2

TYPICAL CHARACTERISTICS

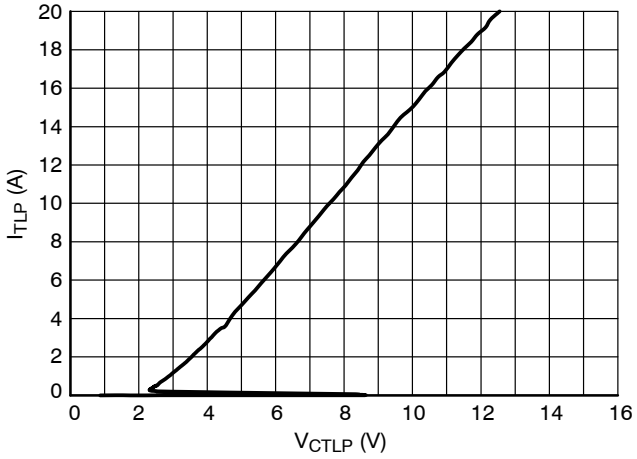


Figure 3. 100 ns TLP I–V Curve – Pin 1 to Pin 2

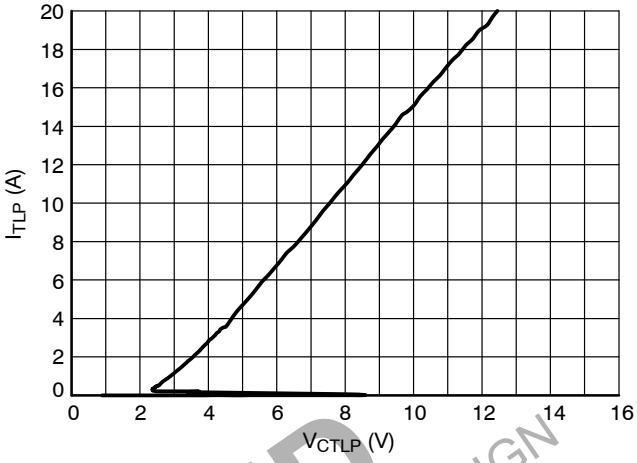


Figure 4. 100 ns TLP I–V Curve – Pin 2 to Pin 1

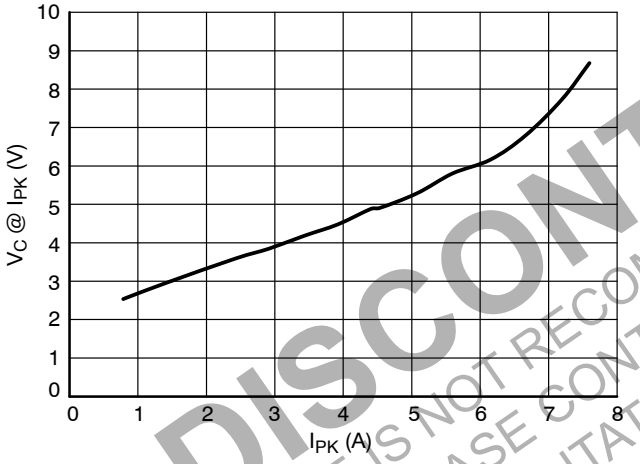


Figure 5. Clamping Voltage vs. Peak Pulse Current – Pin 1 to Pin 2 (t_p = 8/20 μs)

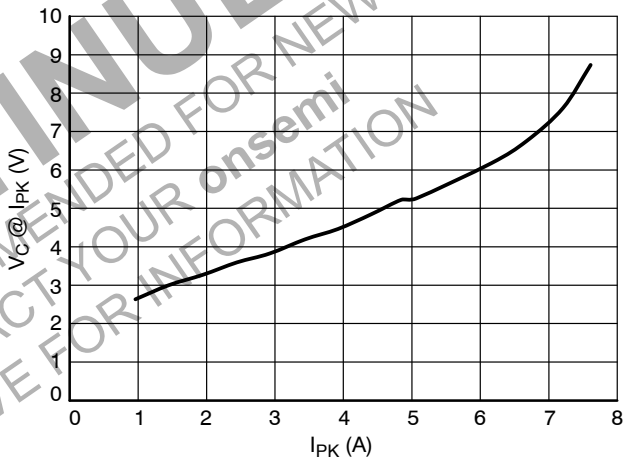


Figure 6. Clamping Voltage vs. Peak Pulse Current – Pin 2 to Pin 1 (t_p = 8/20 μs)

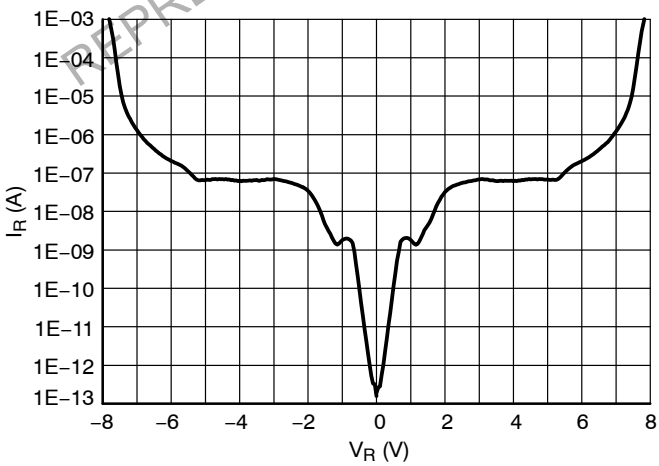


Figure 7. Reverse Leakage Current

TYPICAL CHARACTERISTICS

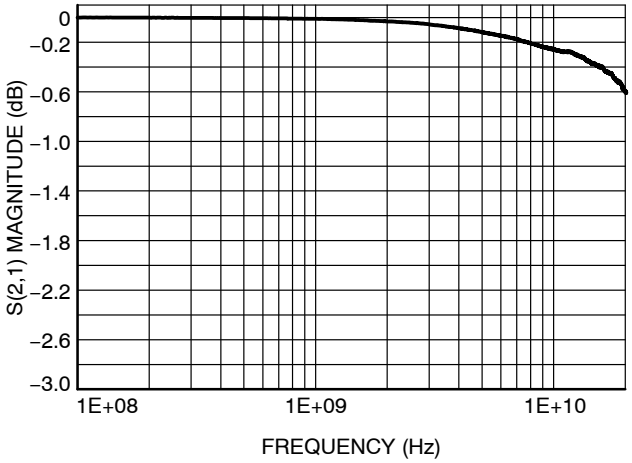


Figure 8. Insertion Loss

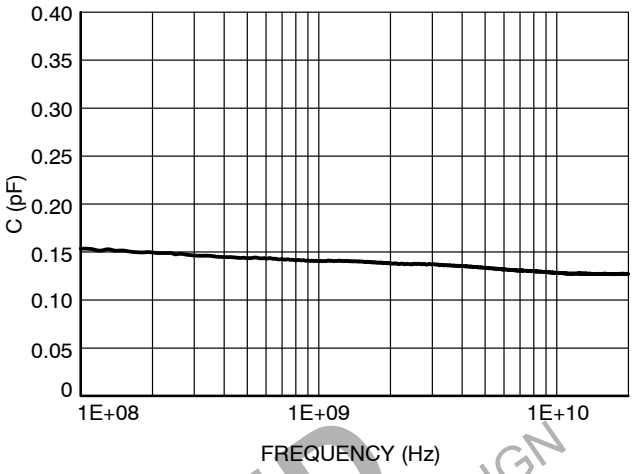


Figure 9. Capacitance Over Frequency

ORDERING INFORMATION

Device	Package	Shipping†
ESDL1531MX4T5G	X4DFN2 (Pb−Free)	10,000 / 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.

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

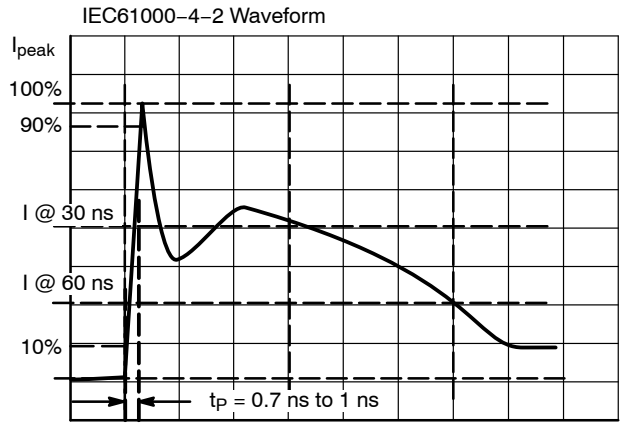


Figure 10. IEC61000−4−2 Spec

Transmission Line Pulse (TLP) Measurement

Transmission Line Pulse (TLP) provides current versus voltage (I−V) curves in which each data point is obtained from a 100 ns long rectangular pulse from a charged transmission line. A simplified schematic of a typical TLP system is shown in Figure 11. TLP I−V curves of ESD protection devices accurately demonstrate the product's ESD capability because the 10s of amps current levels and under 100 ns time scale match those of an ESD event. This is illustrated in Figure 12 where an 8 kV IEC 61000−4−2 current waveform is compared with TLP current pulses at 8 A and 16 A. A TLP I−V curve shows the voltage at which the device turns on as well as how well the device clamps voltage over a range of current levels.

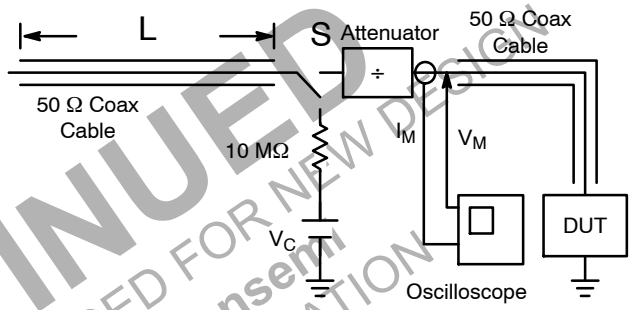


Figure 11. Simplified Schematic of a Typical TLP System

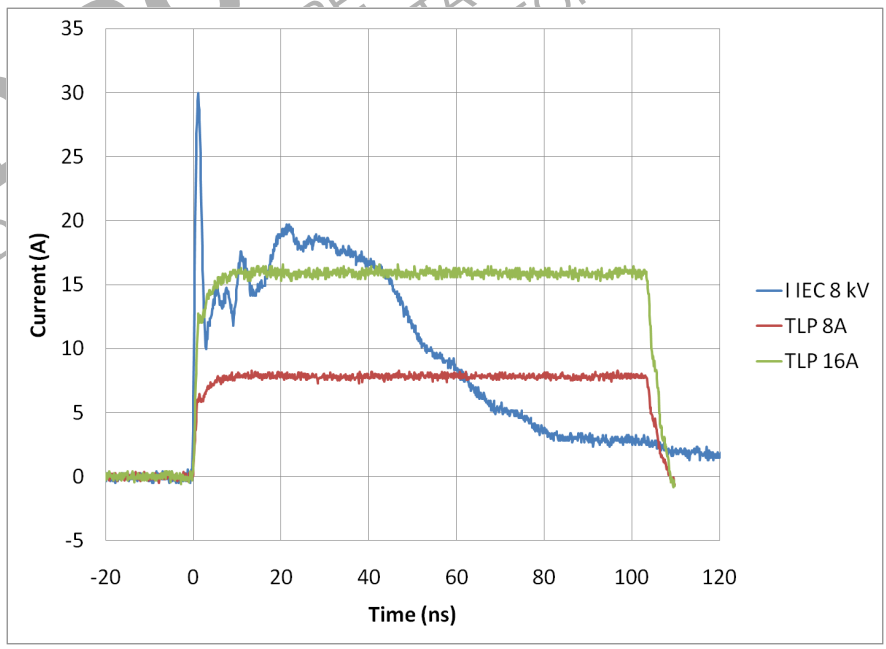
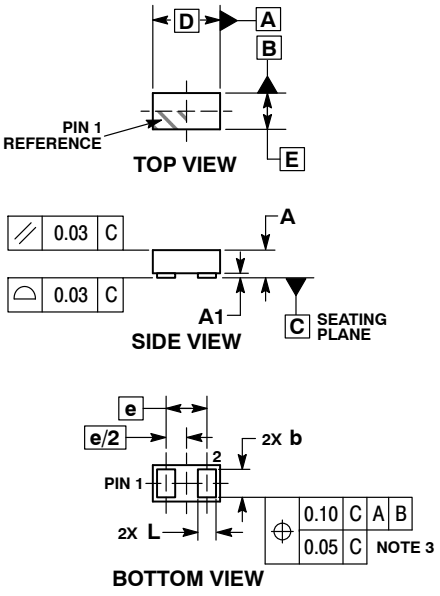


Figure 12. Comparison Between 8 kV IEC 61000−4−2 and 8 A and 16 A TLP Waveforms

X4DFN2, 0.445x0.24, 0.27P
CASE 718AA
ISSUE A

SCALE 10:1

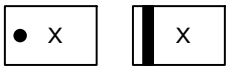
DATE 21 MAR 2017



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

	MILLIMETERS		
DIM	MIN	NOM	MAX
A	0.15	0.18	0.21
A1	---	---	0.03
b	0.170	0.185	0.200
D	0.415	0.445	0.475
E	0.210	0.240	0.270
e	0.270 BSC		
L	0.105	0.120	0.135

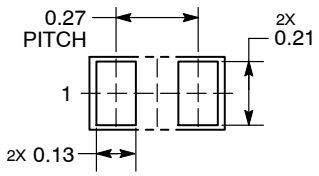
GENERIC MARKING DIAGRAMS*



X = Specific Device Code

*This information is generic. Please refer to device data sheet for actual part marking. Some products may not follow the Generic Marking.

RECOMMENDED MOUNTING FOOTPRINT*



DIMENSIONS: MILLIMETERS

See Application Note AND8398/D for more mounting details

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

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DESCRIPTION:	**X4DFN2, 0.445X0.24, 0.27P**		**PAGE 1 OF 1**

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

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For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales