

ESD Protection Diode

Micro-Packaged Diodes for ESD Protection

ESDL1012

The ESDL1012 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 speed data line applications.

Features

- Low Capacitance
- Low Clamping Voltage
- Small Body Outline Dimensions: 0.445 mm x 0.24 mm
- Low Body Height: 0.18 mm
- Stand-off Voltage: 1.0 V
- IEC61000-4-2 Level 4 ESD Protection
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- USB 3.x, USB 4.0
- PCIe 3x, 4.0
- Thunderbolt 3.0

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
IEC 61000-4-2 (ESD) Contact Air		±15 ±15	kV
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.

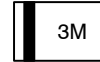
See Application Note AND8308/D for further description of survivability specs.



X4DFN2
CASE 718AA

3 = Device Code
M = Date Code

MARKING DIAGRAM



ORDERING INFORMATION

Device	Package	Shipping†
ESDL1012MX4T5G	X4DFN2 (Pb-Free)	10000 / Tape & Reel

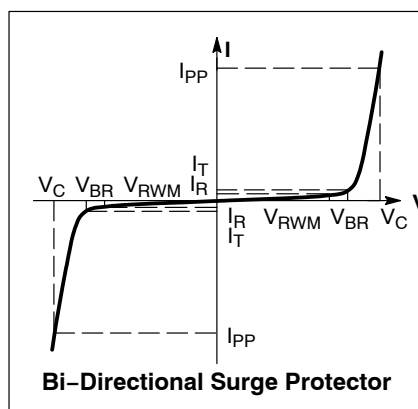
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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.



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			1.0	V
Breakdown Voltage	V _{BR}	I _T = 1 mA, I/O Pin to GND	1.4	1.6	2.1	V
Reverse Leakage Current	I _R	V _{RWM} = 1.0 V		25	500	nA
Clamping Voltage (Note 1)	V _C	IEC61000-4-2, ±8 kV Contact	Figures 1 and 2			V
Clamping Voltage 200 ns TLP	V _C	I _{PP} = 4 A } IEC61000-4-2 Level 1 Equivalent (±2 kV Contact, ±4 kV Air)		3.5	4.1	V
		I _{PP} = 8 A } IEC61000-4-2 Level 2 Equivalent (±4 kV Contact, ±8 kV Air)		4.7	5.6	
Reverse Peak Pulse Current per Figure 11	I _{PP}	per IEC61000-4-5 (1.2/50 μs), R _{eq} = 12 Ω	3.5	4.7		A
Clamping Voltage 1.2/50 μs Waveform per Figure 11	V _C	I _{PP} = 2.1 A, IEC61000-4-5 (1.2/50 μs), R _{eq} = 12 Ω		3.0	3.4	V
Clamping Voltage 1.2/50 μs Waveform per Figure 11	V _C	I _{PP} = 3.5 A, IEC61000-4-5 (1.2/50 μs), R _{eq} = 12 Ω		3.6	4.1	V
Dynamic Resistance (TLP)	R _{DYN}	I/O Pin to GND (4 A to 8 A, 200 ns TLP)		0.3		Ω
Junction Capacitance	C _J	V _R = 0 V, f = 1 MHz		0.17	0.23	pF
Insertion Loss	I _L	f = 10 GHz		0.22	0.33	dB
		f = 13 GHz		0.225	0.36	
		f = 15 GHz		0.23	0.37	
Return Loss	R _L	f = 10 GHz	14	19		dB
		f = 13 GHz	12	17		
		f = 15 GHz	11	16		

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.

- For test procedure see application note AND8307/D.
- ANSI/ESD STM5.5.1 – Electrostatic Discharge Sensitivity Testing using Transmission Line Pulse (TLP) Model.
TLP conditions: Z₀ = 50 Ω, t_p = 200 ns, t_r = 1 ns, averaging window; t₁ = 170 ns to t₂ = 190 ns.

TYPICAL CHARACTERISTICS

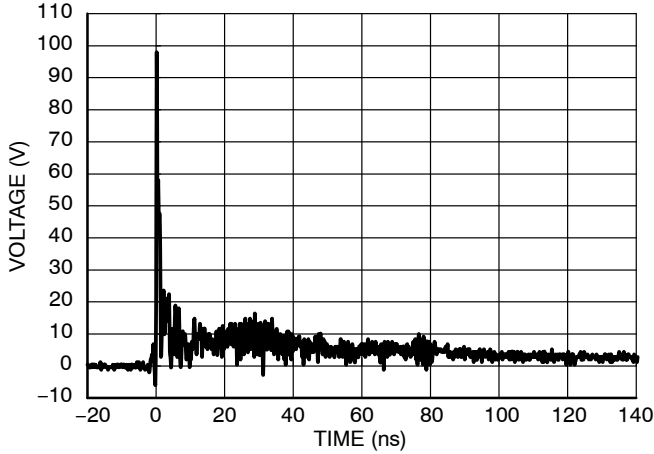


Figure 1. ESD Clamping Voltage
Positive 8 kV Contact per IEC61000-4-2

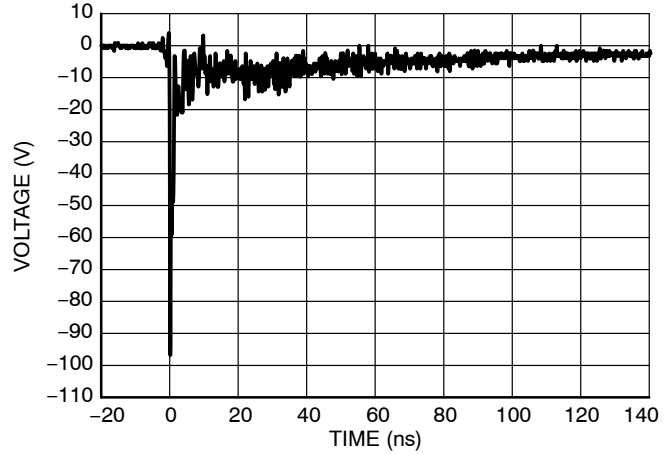


Figure 2. ESD Clamping Voltage
Negative 8 kV Contact per IEC61000-4-2

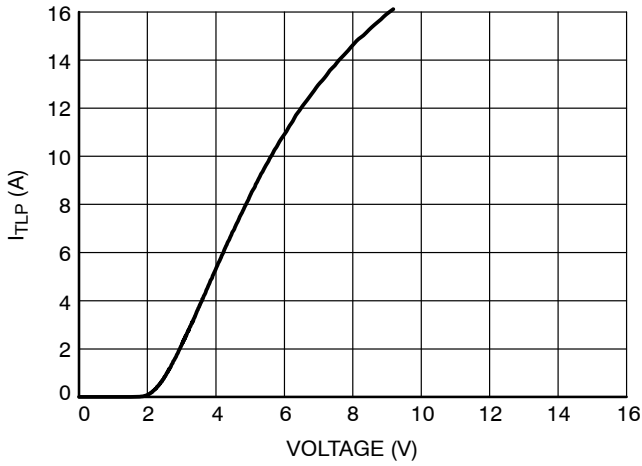


Figure 3. Positive 200 ns TLP IV Curve

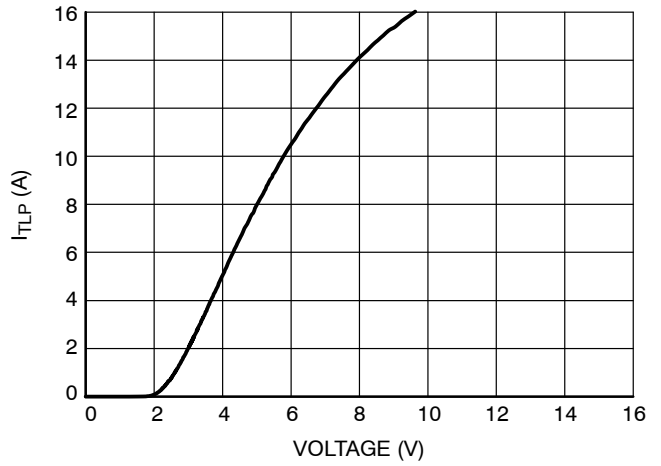


Figure 4. Negative 200 ns TLP IV Curve

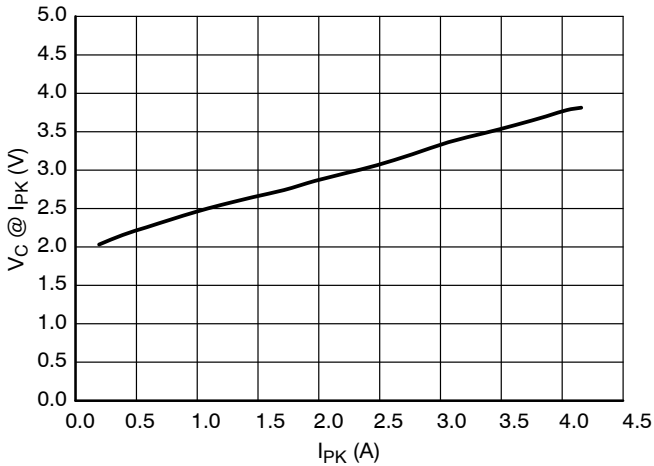


Figure 5. Positive Clamping Voltage vs. Peak Pulse Current per IEC61000-4-5 ($t_p = 1.2/50 \mu s$, $R_{eq} = 12 \Omega$)

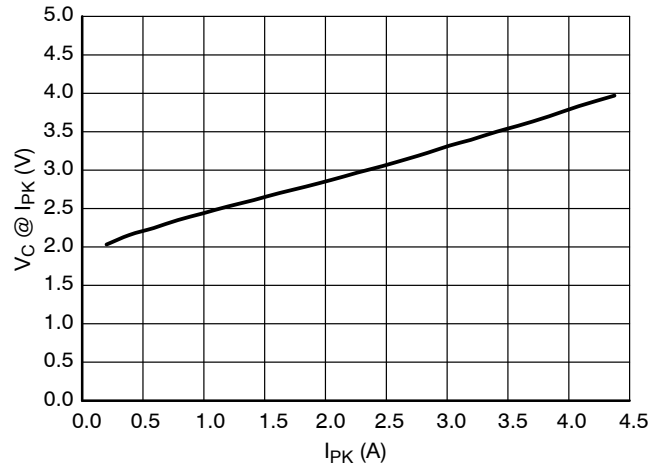


Figure 6. Negative Clamping Voltage vs. Peak Pulse Current per IEC61000-4-5 ($t_p = 1.2/50 \mu s$, $R_{eq} = 12 \Omega$)

ESDL1012

TYPICAL CHARACTERISTICS

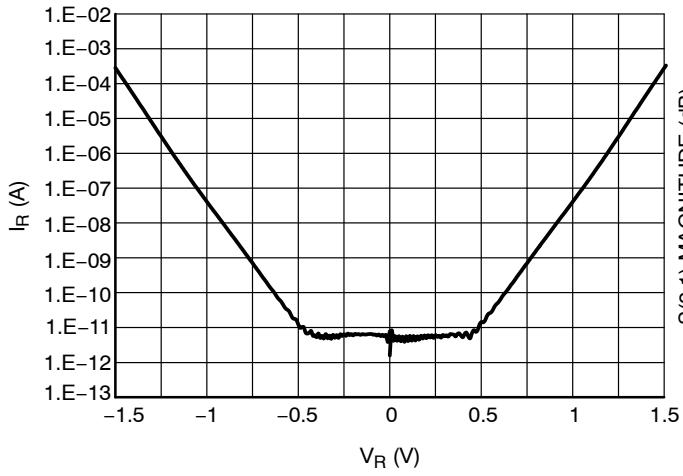


Figure 7. Reverse Leakage Current

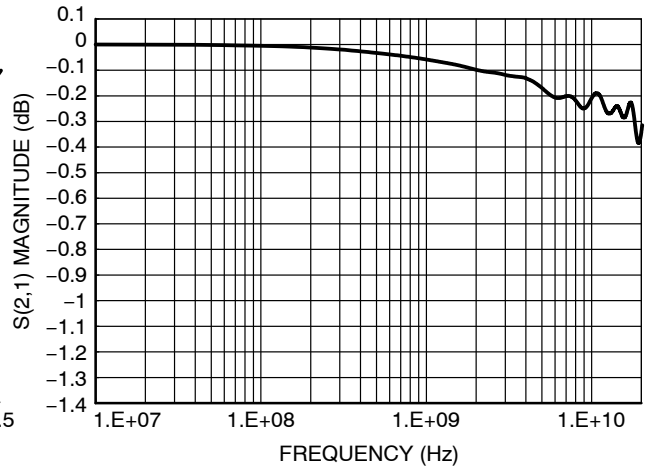


Figure 8. Insertion Loss

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

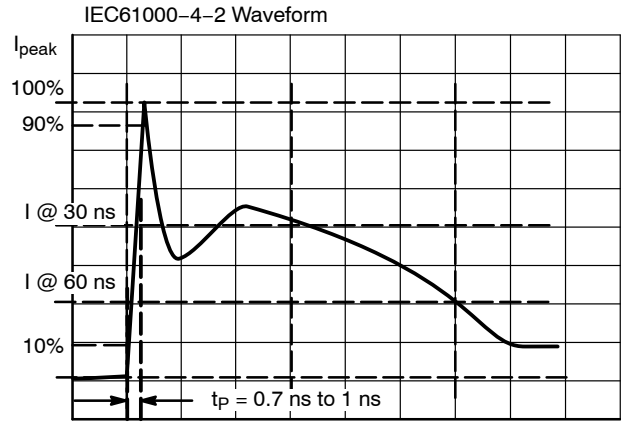


Figure 9. IEC61000-4-2 Spec

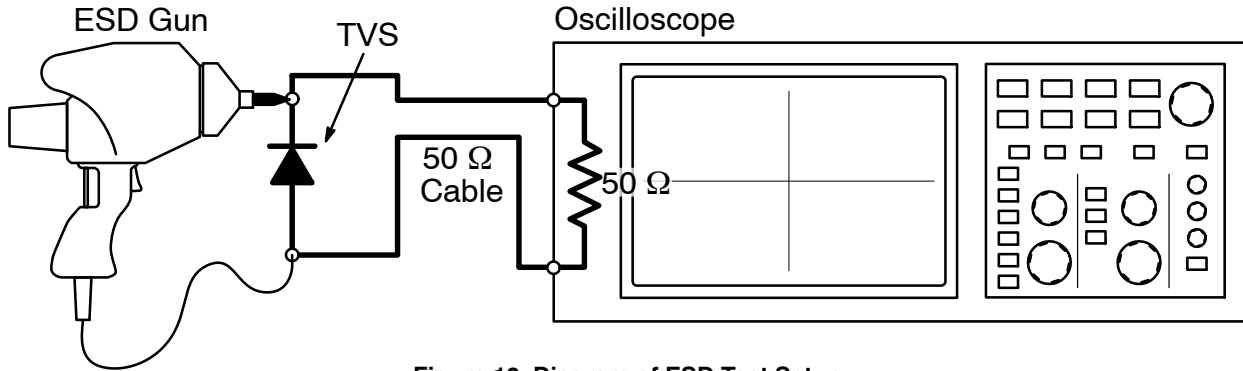


Figure 10. Diagram of ESD Test Setup

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.

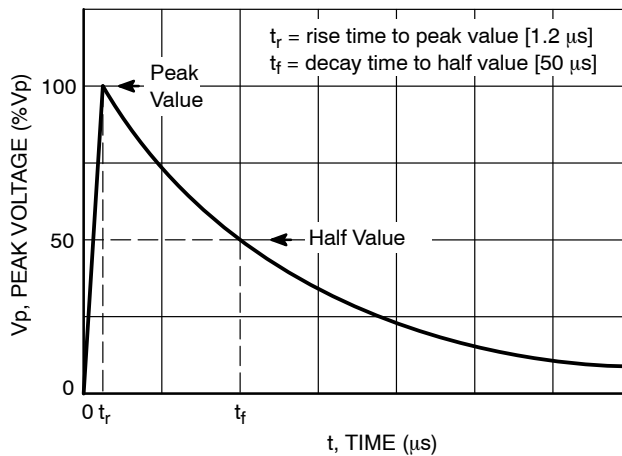


Figure 11. IEC61000-4-5 1.2/50 µs Pulse Waveform

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

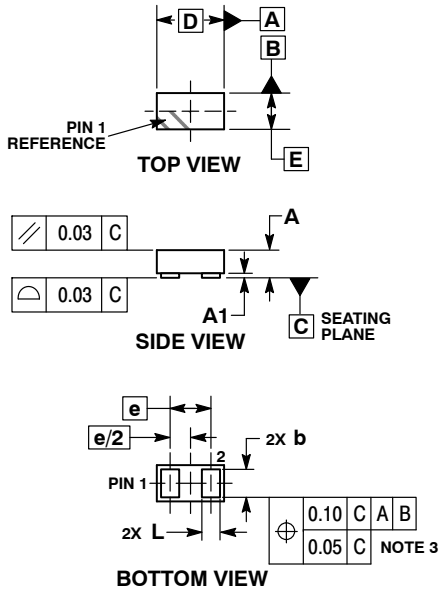
ON Semiconductor®



SCALE 10:1

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

DATE 21 MAR 2017

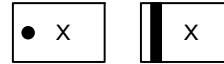


NOTES:

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	0.15	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

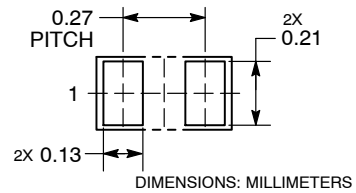
GENERIC MARKING DIAGRAMS*



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*



See Application Note AND8398/D for more mounting details
 *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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