

# ESDM1121

## Product Preview

### 12V ESD Protection Diodes

#### Micro-packaged Diodes for ESD Protection

The ESDM1121 Series is 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 its small size, it is suited for use in smartphone, smart-watch, or many other portable / wearable applications where board space comes at a premium.

#### Features

- Low Capacitance (15 pF Typ, I/O to GND)
- Small Body Outline Dimensions – 01005 Size: 0.435 x 0.23 mm
- 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

#### MAXIMUM RATINGS ( $T_J = 25^{\circ}\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Operating Junction Temperature Range	$T_J$	–55 to +150	$^{\circ}\text{C}$
Storage Temperature Range	$T_{\text{stg}}$	–55 to +150	$^{\circ}\text{C}$
Lead Solder Temperature – Maximum (10 Seconds)	$T_L$	260	$^{\circ}\text{C}$
ESDM1121: IEC 61000–4–2 Contact IEC 61000–4–2 Air	ESD	$\pm 15$ $\pm 15$	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.



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#### MARKING DIAGRAM

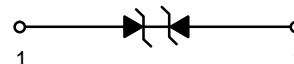


ESDM1121 (01005)  
X4DFN2  
CASE 718AA



P = Specific Device Code  
M = Date Code

#### PIN CONFIGURATION AND SCHEMATIC



#### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

# ESDM1121

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse Working Voltage	$V_{RWM}$	I/O Pin to GND			12	V
Breakdown Voltage	$V_{BR}$	$I_T = 1\text{ mA}$ , I/O Pin to GND		14		V
Reverse Leakage Current	$I_R$	$V_{RWM} = 12\text{ V}$ , I/O Pin to GND			0.5	$\mu\text{A}$
Clamping Voltage	$V_C$	$I_{PP} = 3\text{ A}$ , (8/20 $\mu\text{s}$ pulse)		20	22	V
Clamping Voltage TLP (Note 1)	$V_C$	$I_{PP} = 8\text{ A}$ } IEC 61000-4-2 Level 2 equivalent ( $\pm 4\text{ kV}$ Contact, $\pm 8\text{ kV}$ Air)			22	V
		$I_{PP} = 16\text{ A}$ } IEC 61000-4-2 Level 2 equivalent ( $\pm 8\text{ kV}$ Contact, $\pm 16\text{ kV}$ Air)			30	
Reverse Peak Pulse Current	$I_{PP}$	IEC61000-4-5 (8x20 $\mu\text{s}$ )	3.0			A
Junction Capacitance	$C_J$	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$		15	20	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:  $Z_0 = 50\ \Omega$ ,  $t_p = 100\text{ ns}$ ,  $t_r = 4\text{ ns}$ , averaging window;  $t_1 = 30\text{ ns}$  to  $t_2 = 60\text{ ns}$ .

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
ESDM1121MX4T5G	X4DFN2 (Pb-Free)	10,000 / Tape & Reel

<sup>†</sup>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.

TYPICAL CHARACTERISTICS

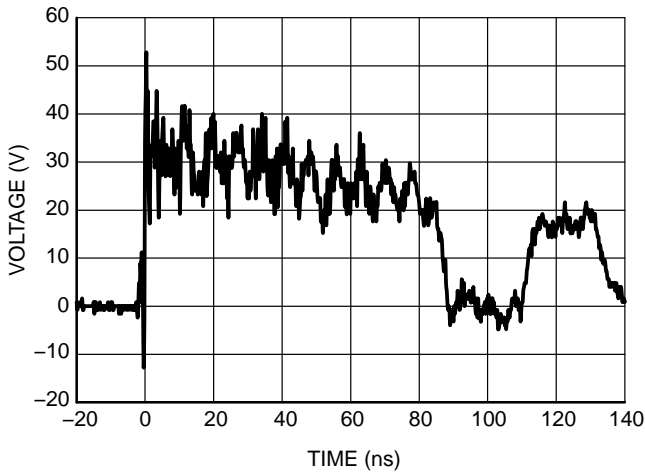


Figure 1. ESD Clamping Voltage  
Positive 8 kV Contact per IEC 61000-4-2

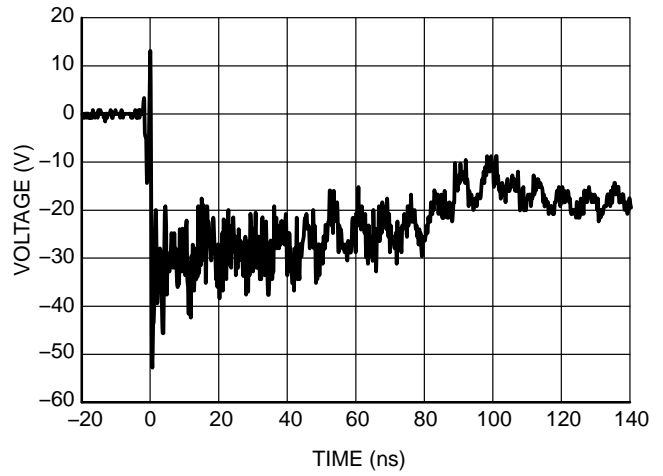


Figure 2. ESD Clamping Voltage  
Negative 8 kV Contact per IEC 61000-4-2

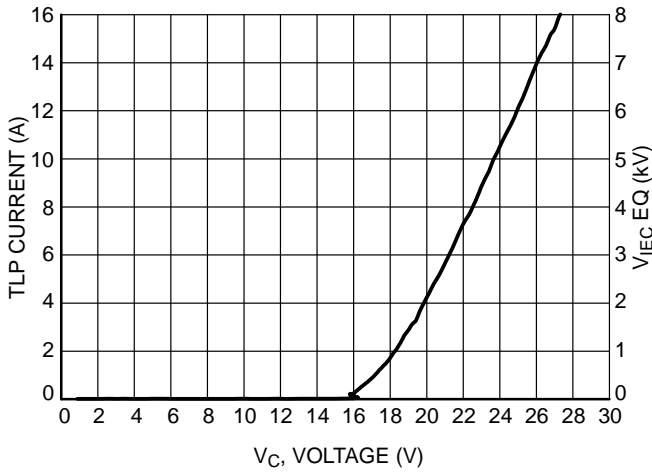


Figure 3. Positive TLP I-V Curve

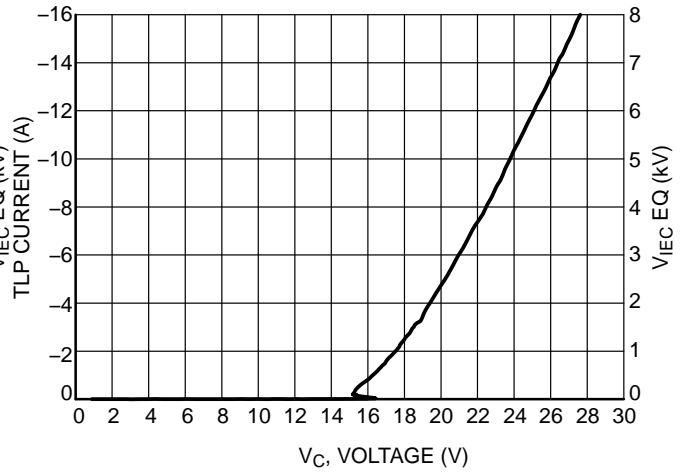


Figure 4. Negative TLP I-V Curve

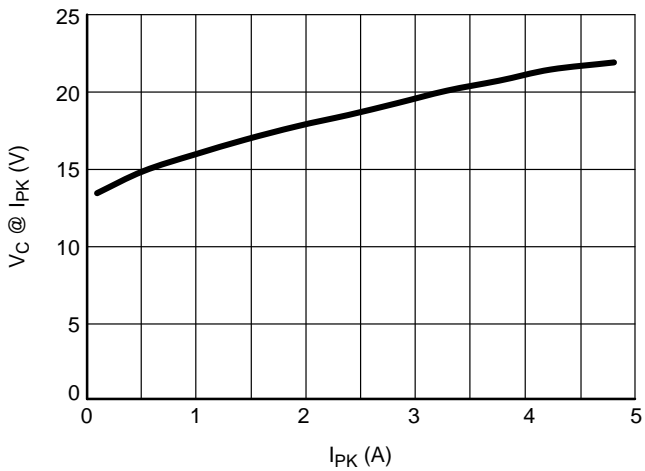


Figure 5. Positive Clamping Voltage vs. Peak  
Pulse Current ( $t_p = 8/20 \mu s$ )

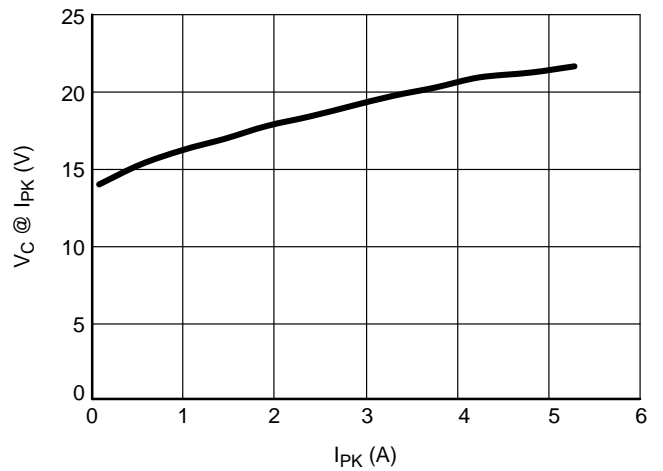


Figure 6. Negative Clamping Voltage vs. Peak  
Pulse Current ( $t_p = 8/20 \mu s$ )

TYPICAL CHARACTERISTICS

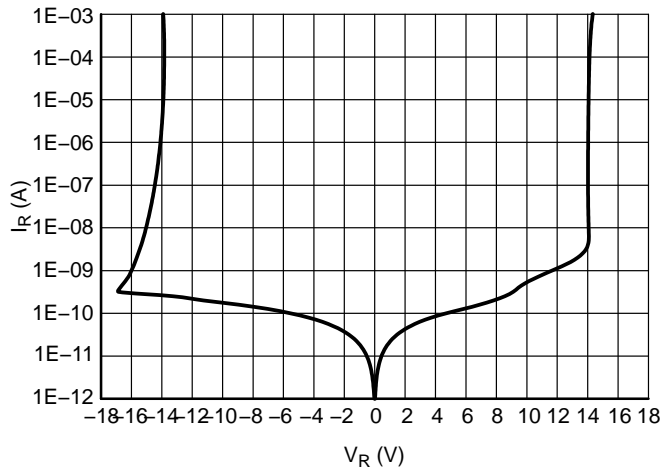


Figure 7. Breakdown Voltage

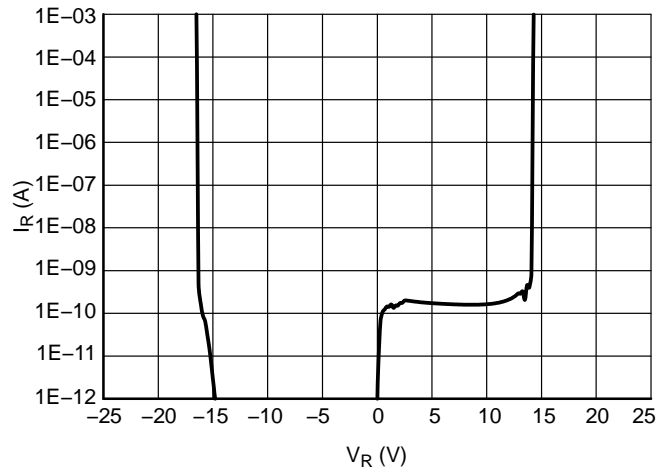


Figure 8. Reverse Leakage Current

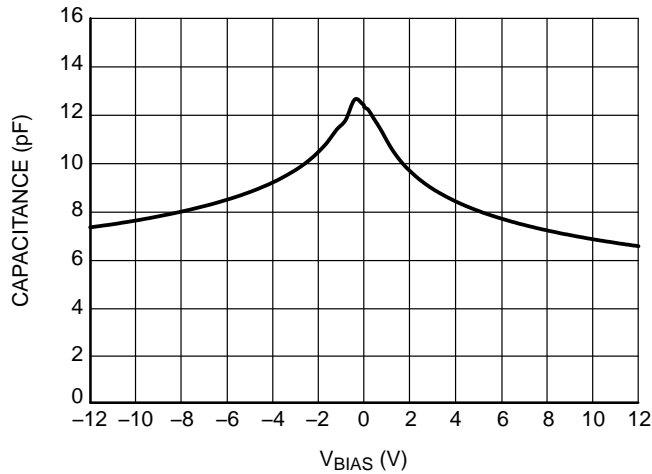


Figure 9. Line Capacitance,  $f = 1$  MHz

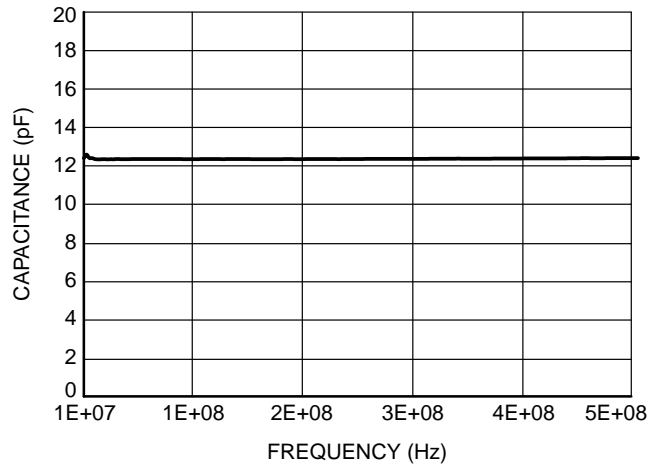


Figure 10. Capacitance over Frequency

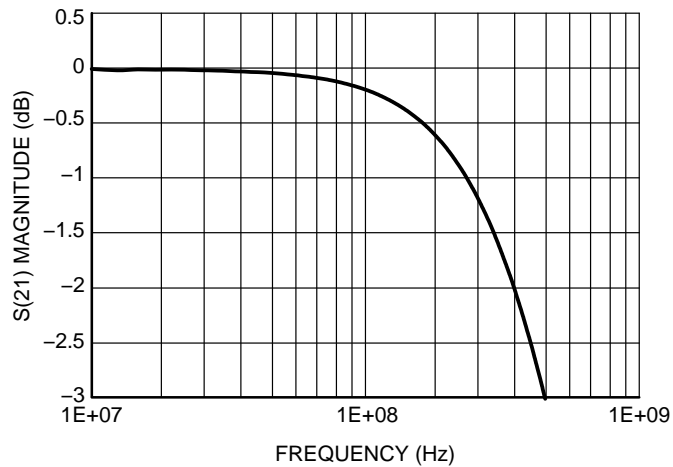


Figure 11. Insertion Loss

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

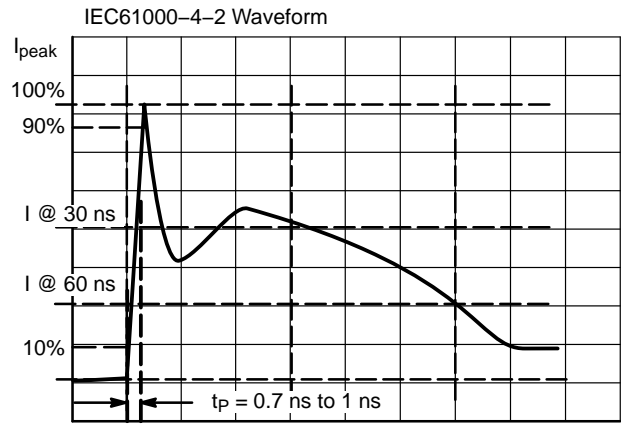


Figure 12. IEC61000-4-2 Spec

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 13. 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 14 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.

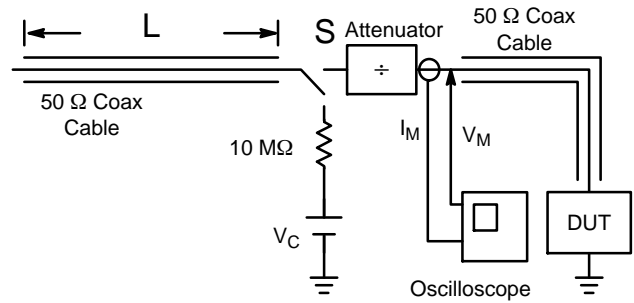


Figure 13. Simplified Schematic of a Typical TLP System

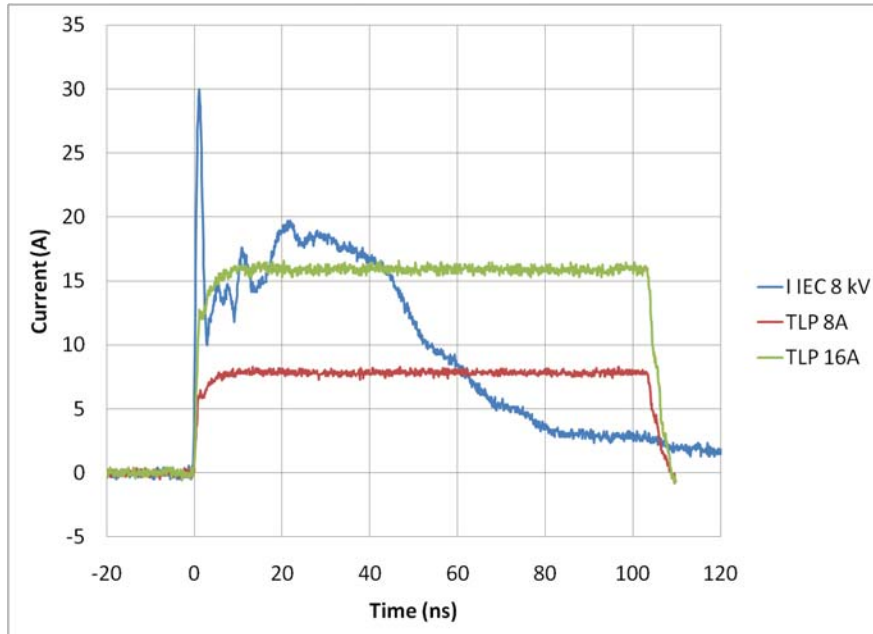


Figure 14. Comparison Between 8 kV IEC 61000-4-2 and 8 A and 16 A TLP Waveforms

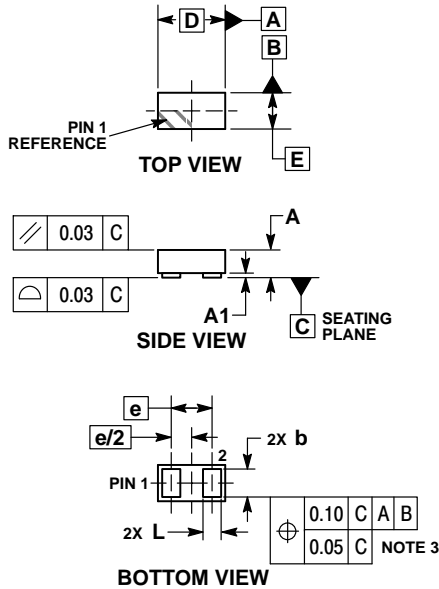
# ESDM1121

## PACKAGE DIMENSIONS – ESDM1121 (01005)

X4DFN2, 0.445x0.24, 0.27P

CASE 718AA

ISSUE A

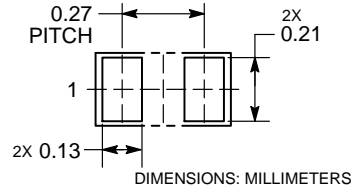


### NOTES:

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

### 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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