

ESD227-U1-W01005

Uni-directional ESD protection device, 5.5 V, 1.4 pF, 01005

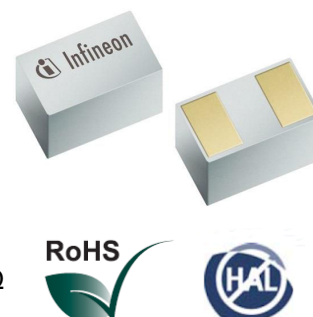


Product description

This Infineon ESD (electrostatic discharge) protection device has an unidirectional I/V characteristic and excellent clamping performance.

Feature list

- ESD / transient protection according to:
 - IEC61000-4-2 (ESD): ± 20 kV (air) / ± 20 kV (contact)
 - IEC61000-4-4 (EFT): ± 3 kV / ± 60 A (5/50 ns)
 - IEC61000-4-5 (Surge): 5 A (8/20 μ s)
- Working voltage: $V_{WM} = 5.5$ V
- Line capacitance: $C_L = 1.4$ pF at $f = 1$ MHz
- Clamping voltage: $V_{cl} = 9.5$ V at 16 A, $R_{dyn} = 0.15 \Omega$; $V_{cl} = -3.2$ V at -16 A, $R_{dyn} = 0.11 \Omega$
- Very low leakage current: $I_L = 0.1$ nA
- Small form factor SMD size 01005 and low profile (0.43 x 0.23 x 0.15 mm³)



Potential applications

- Audio interfaces, headsets
- Buttons, GPIO, digital interfaces

Product validation

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22.

Device information

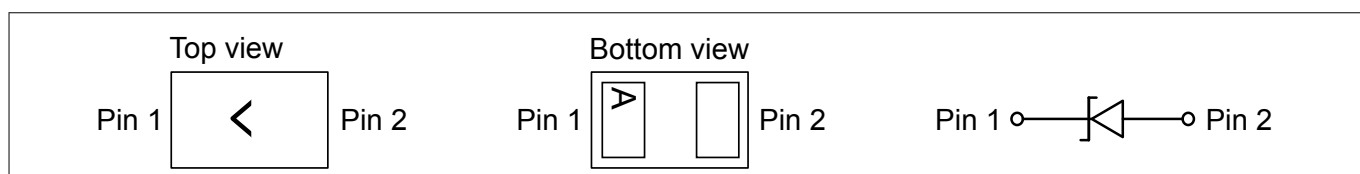


Figure 1 Pin configuration and schematic diagram

Table 1 Part information

Product name / Ordering code	Package	Pin configuration	Marking	Pieces / Reel
ESD227-U1-W01005 / ESD227U1W01005E6327XTSA1	WLL-2-7	1 line, unidirectional	A	15 k

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1 Absolute maximum ratings

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Table 2 Absolute maximum ratings at $T_A = 25^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values		Unit	Note or test condition
		Min.	Max.		
Working voltage	V_{WM}	0	+5.5	V	From pin 1 to pin 2
ESD discharge voltage ¹⁾	V_{ESD} (contact)	-20	+20	kV	
	V_{ESD} (air)	-20	+20		
Peak pulse power ²⁾	P_{PK}	-	43	W	From pin 1 to pin 2
		-	10		From pin 2 to pin 1
Peak pulse current ²⁾	I_{PP}	-5	+5	A	
Operating temperature	T_{op}	-55	+125	$^\circ\text{C}$	
Storage temperature	T_{stg}	-55	+150		

Attention: Stresses above the maximum values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings. Exceeding only one of these values may cause irreversible damage to the component.

¹ VESD according to IEC61000-4-2 (R = 330 Ω , C = 150 pF discharge network)

² Stress pulse: 8/20 μs current waveform according to IEC61000-4-5

2 Electrical characteristics

2 Electrical characteristics

Note: $T_A = 25^\circ\text{C}$, unless otherwise specified. All electrical characteristics are measured with pin 2 (anode) connected to ground.

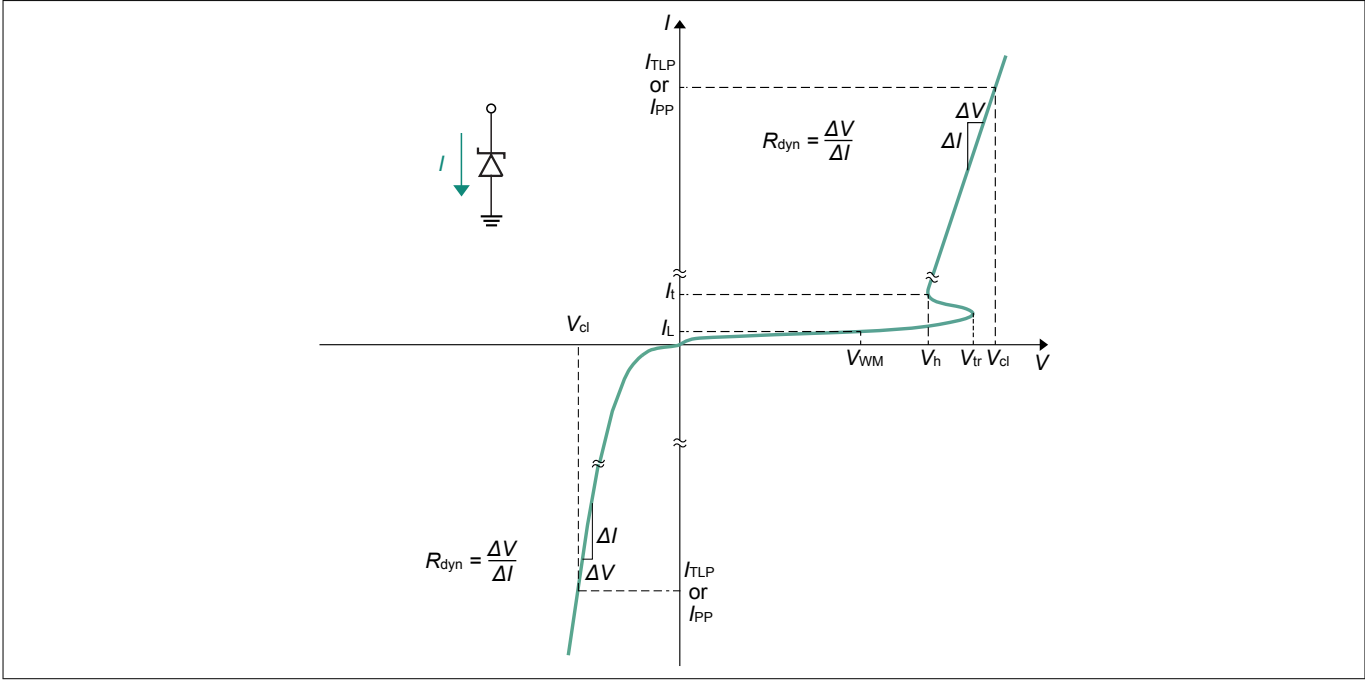


Figure 2 I/V characteristic curve

Table 3 I/V characteristic parameters

Symbol	Parameter
I_h	Holding current
I_L	Leakage current
I_{PP}	Peak pulse current, based on IEC61000-4-5
I_t	Test current
I_{TLP}	TLP current
R_{dyn}	Dynamic resistance
V_{cl}	Clamping voltage
V_h	Holding voltage
V_t	Test voltage
V_{tr}	Trigger voltage
V_{WM}	Maximum working voltage

2 Electrical characteristics

Table 4 DC characteristics

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Trigger voltage	V_{tr}	-	9.5	-	V	
Holding voltage	V_h	6	8.4	10	V	$I_t = 1\text{ mA}$
Leackage current	I_L	-	0.1	50	nA	$V_{WM} = 5.5\text{ V}$

Table 5 AC characteristics

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Line capacitance	C_L	-	1.4	2	pF	$V = 0\text{ V}, f = 1\text{ MHz}$
		-	1	-		$V = 0\text{ V}, f = 1\text{ GHz}$
Series inductance	L_S	-	<0.1	-	nH	Extracted from S-parameters

Table 6 Protection characteristics

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Clamping voltage (TLP) ^{3) 4)}	V_{cl}	-	7.7	-	V	$I_{TLP} = 4\text{ A}, t_p = 100\text{ ns}$
		-	8.0	-		$I_{TLP} = 8\text{ A}, t_p = 100\text{ ns}$
		-	9.5	-		$I_{TLP} = 16\text{ A}, t_p = 100\text{ ns}$
		-	11.8	-		$I_{TLP} = 30\text{ A}, t_p = 100\text{ ns}$
		-	-1.8	-		$I_{TLP} = -4\text{ A}, t_p = 100\text{ ns}$
		-	-2.9	-		$I_{TLP} = -8\text{ A}, t_p = 100\text{ ns}$
		-	-3.2	-		$I_{TLP} = -16\text{ A}, t_p = 100\text{ ns}$
		-	-4.8	-		$I_{TLP} = -30\text{ A}, t_p = 100\text{ ns}$
Clamping voltage (8/20 μs) ⁵⁾	V_{cl}	-	7.8	-	V	$I_{PP} = 3\text{ A}$
		-	8.4	-		$I_{PP} = 5\text{ A}$
		-	-1.7	-		$I_{PP} = -3\text{ A}$
		-	-2	-		$I_{PP} = -5\text{ A}$
Dynamic resistance ³⁾	R_{dyn}	-	0.15	-	Ohm	positive pulse
			0.11			negative pulse

³⁾ TLP parameters: $Z_0 = 50\ \Omega$, $t_p = 100\text{ ns}$, $t_r = 0.6\text{ ns}$, averaging window 30-60 ns.

⁴⁾ Refer to application note AN210 [2]

⁵⁾ $t_p = 8/20\ \mu\text{s}$. Stress pulse based on IEC61000-4-5.

3 Typical characteristic diagrams

3 Typical characteristic diagrams

Note: $T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise specified.

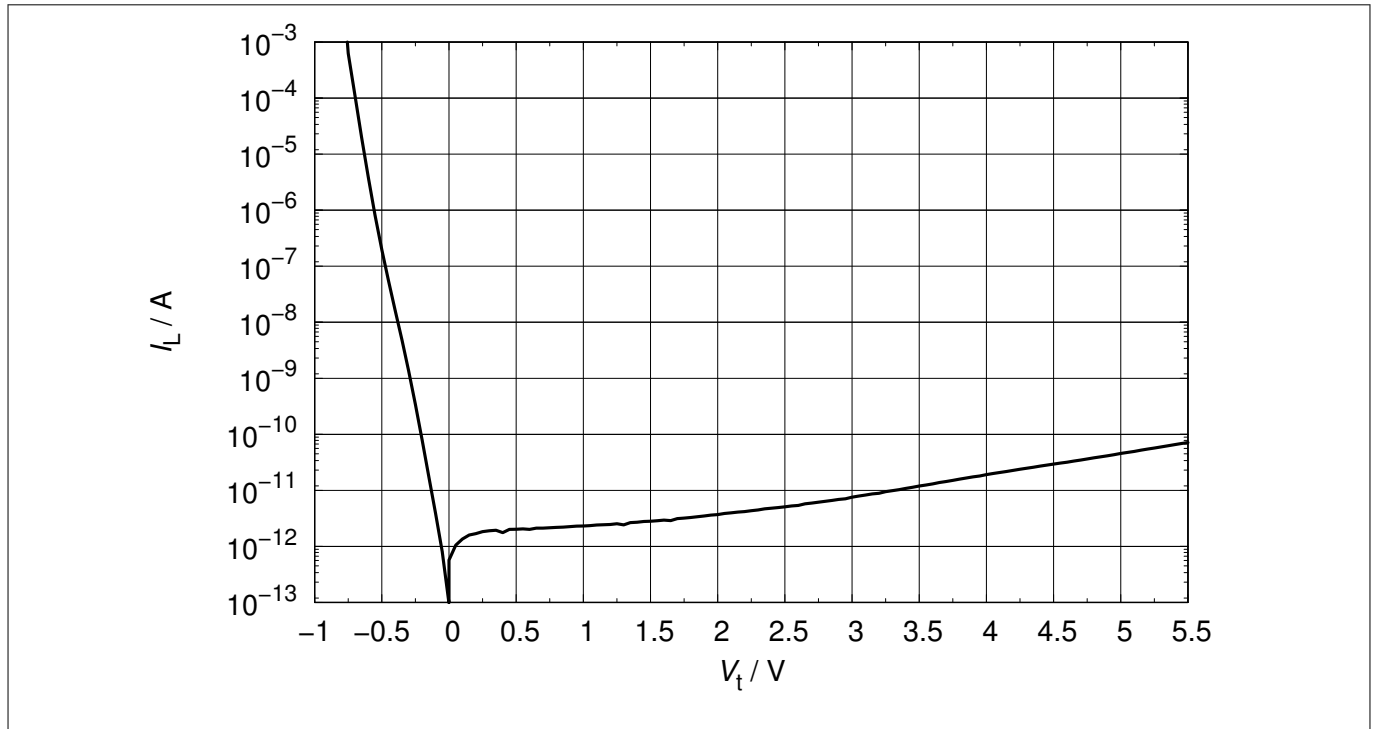


Figure 3 Leakage current: $I_L = f(V_t)$

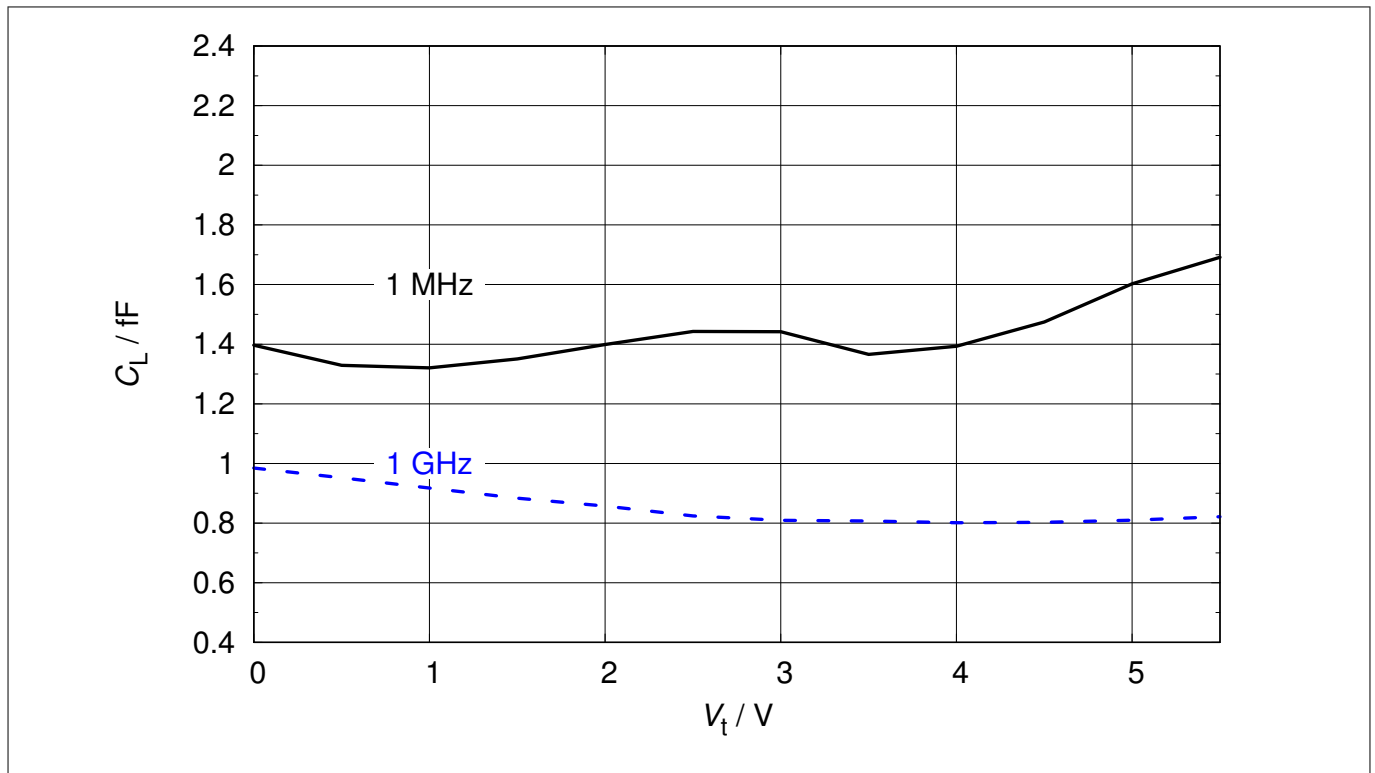


Figure 4 Line capacitance: $C_L = f(V_t)$, $f = 1\text{ MHz}, 1\text{ GHz}$

3 Typical characteristic diagrams

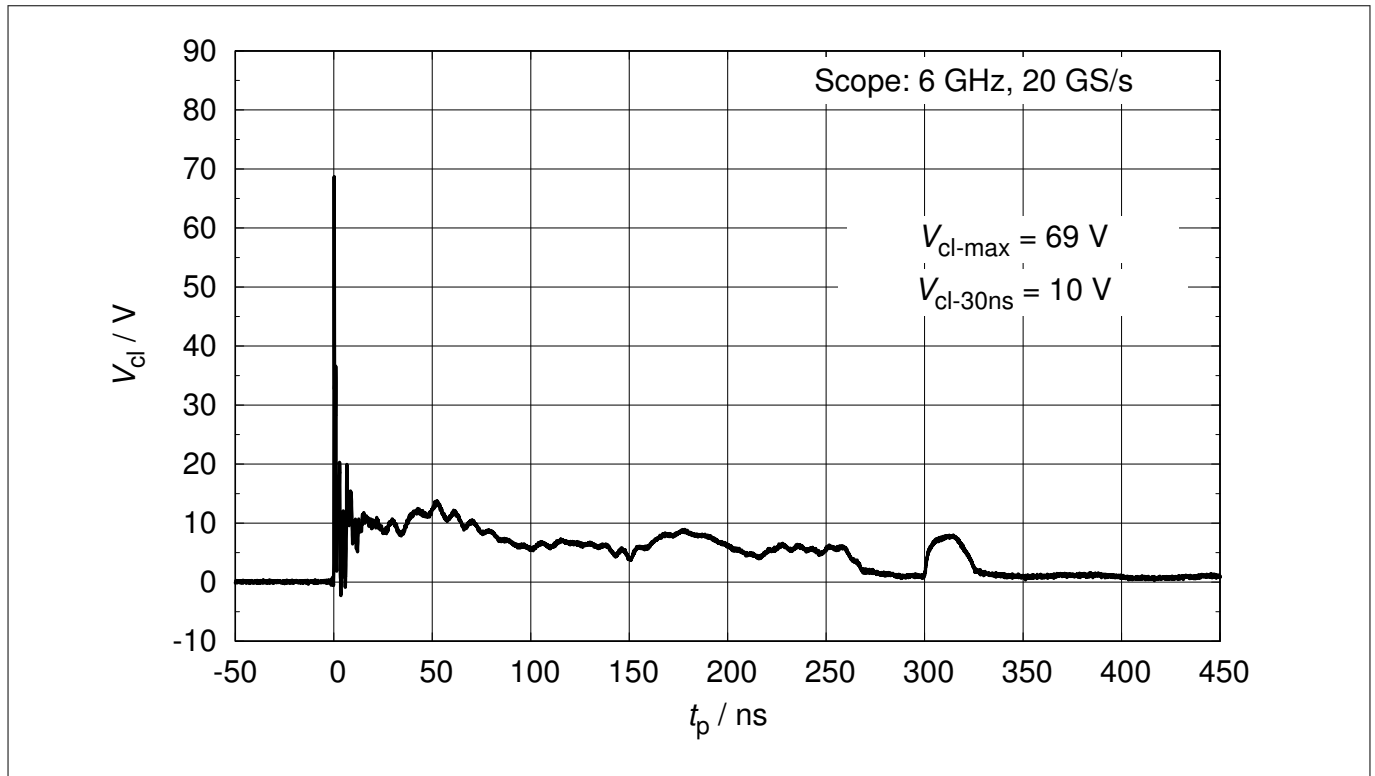


Figure 5 Clamping voltage (ESD): $V_{cl} = f(t_p)$, 8 kV positive pulse based on IEC61000-4-2

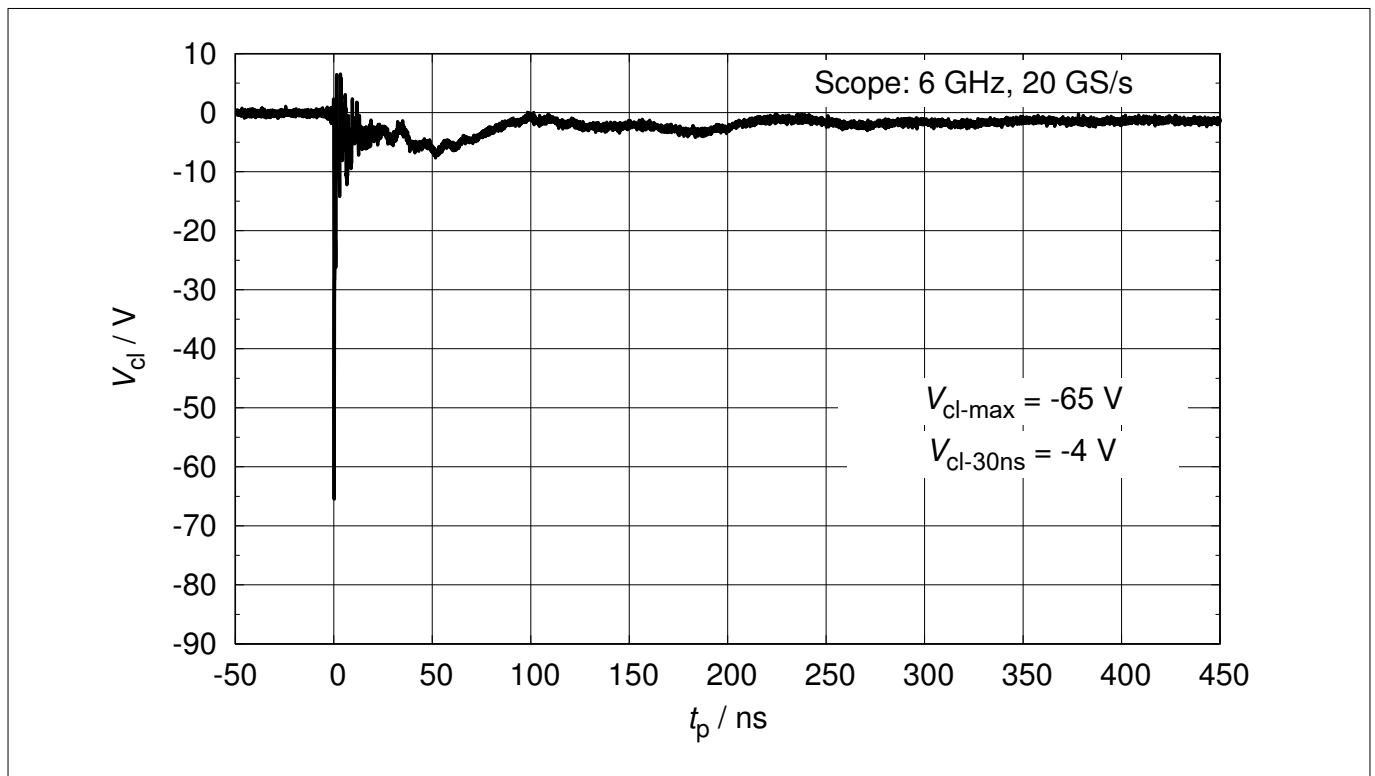


Figure 6 Clamping voltage (ESD): $V_{cl} = f(t_p)$, 8 kV negative pulse based on IEC61000-4-2

3 Typical characteristic diagrams

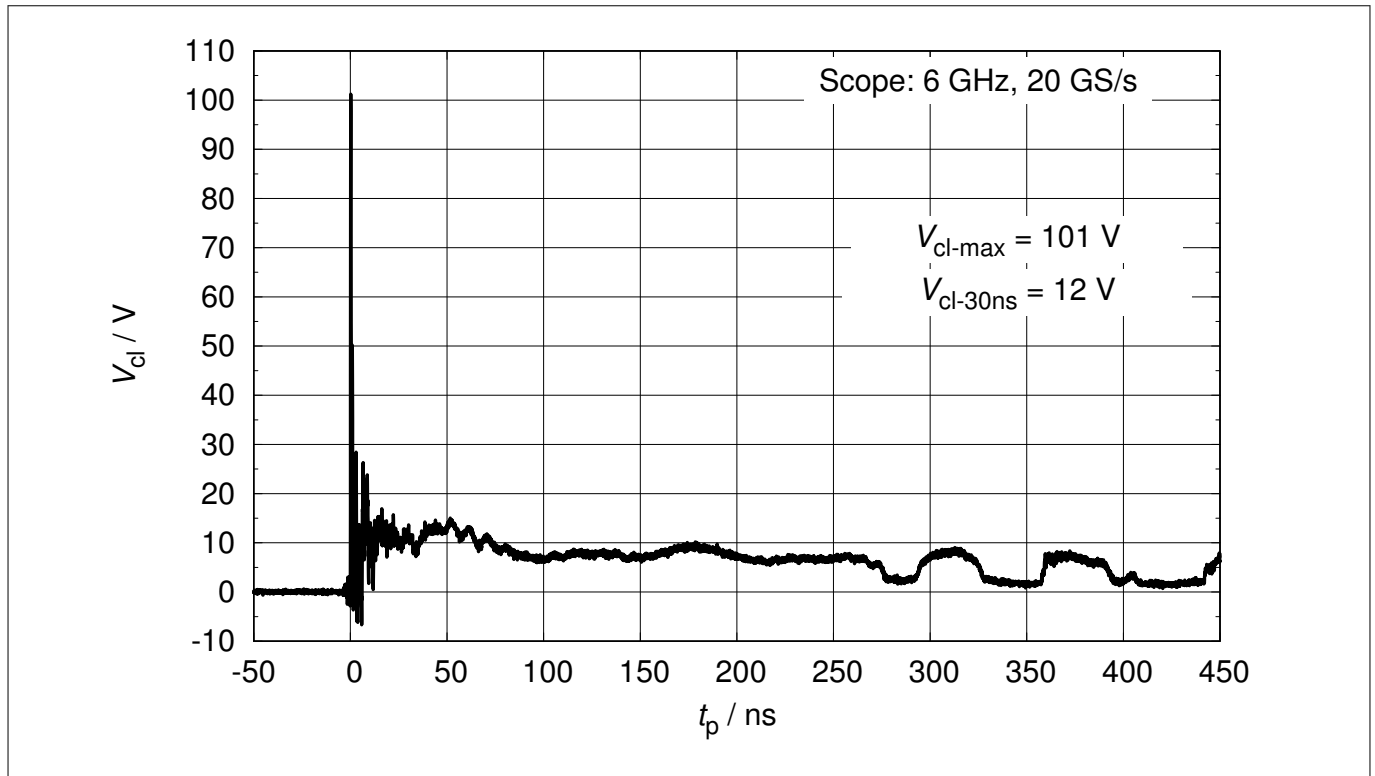


Figure 7 Clamping voltage (ESD): $V_{cl} = f(t_p)$, 15 kV positive pulse based on IEC61000-4-2

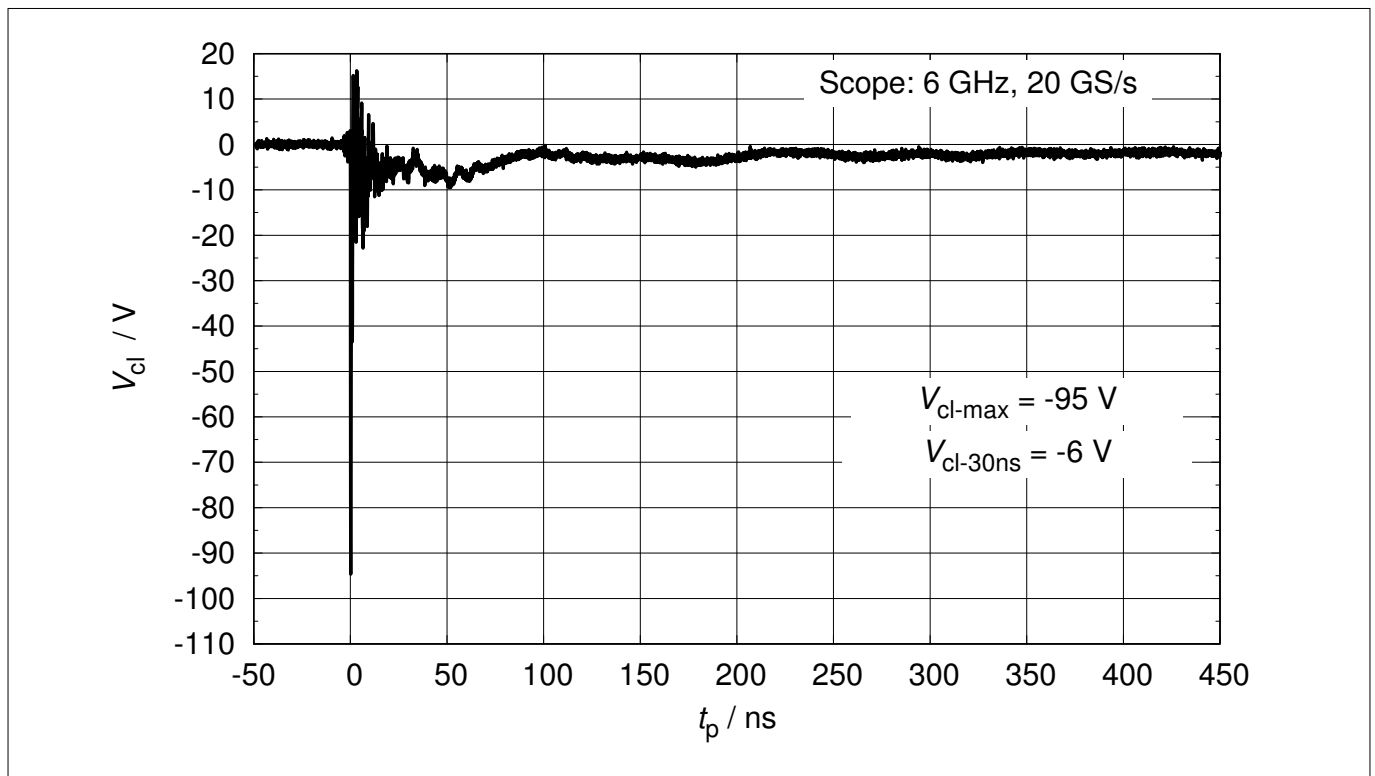


Figure 8 Clamping voltage (ESD): $V_{cl} = f(t_p)$, 15 kV negative pulse based on IEC61000-4-2

3 Typical characteristic diagrams

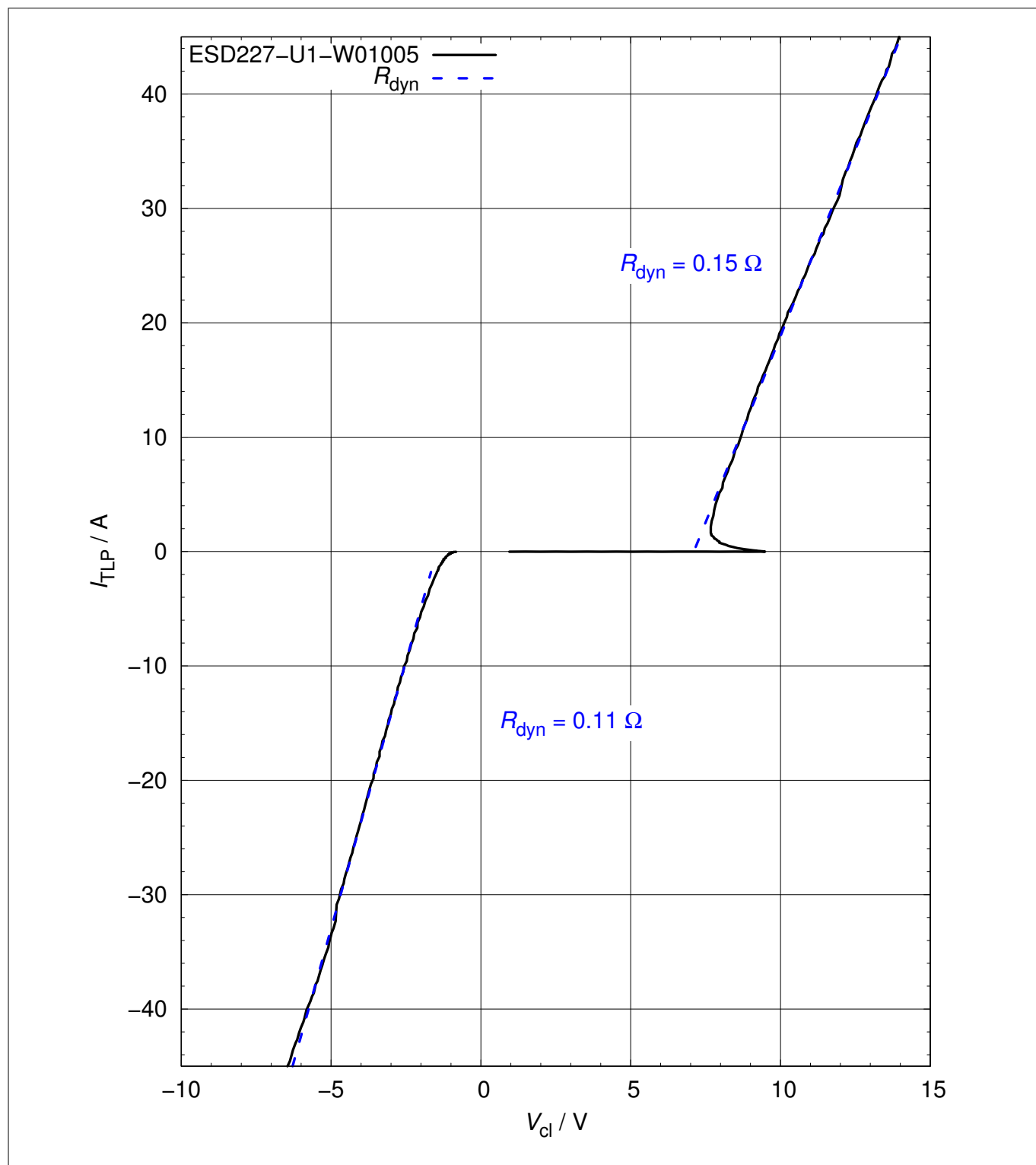


Figure 9 Clamping voltage (TLP): $I_{\text{TLP}} = f(V_{\text{cl}})$

3 Typical characteristic diagrams

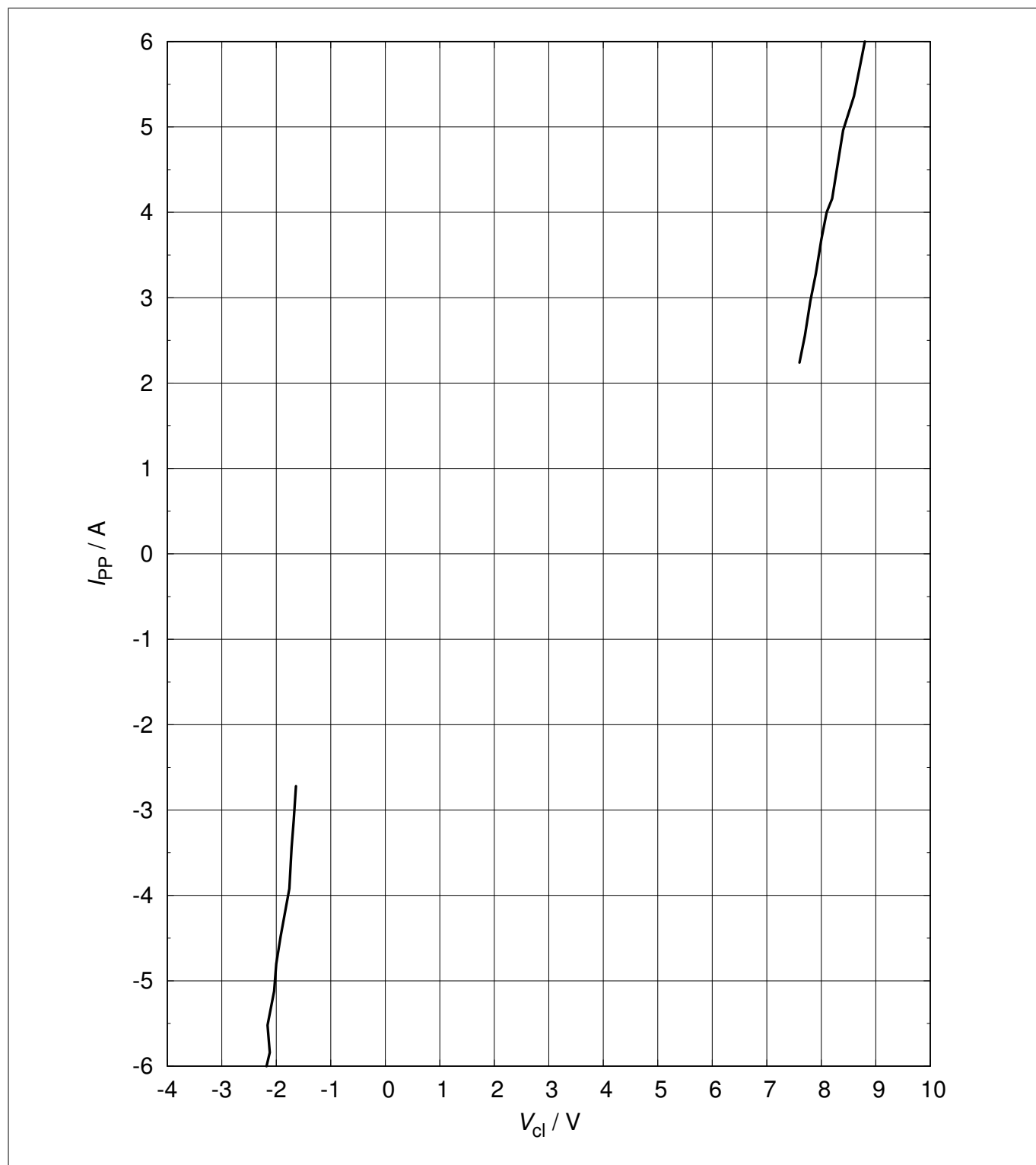


Figure 10 Clamping voltage (Surge): $I_{PP} = f(V_{CL})$, based on IEC61000-4-5

3 Typical characteristic diagrams

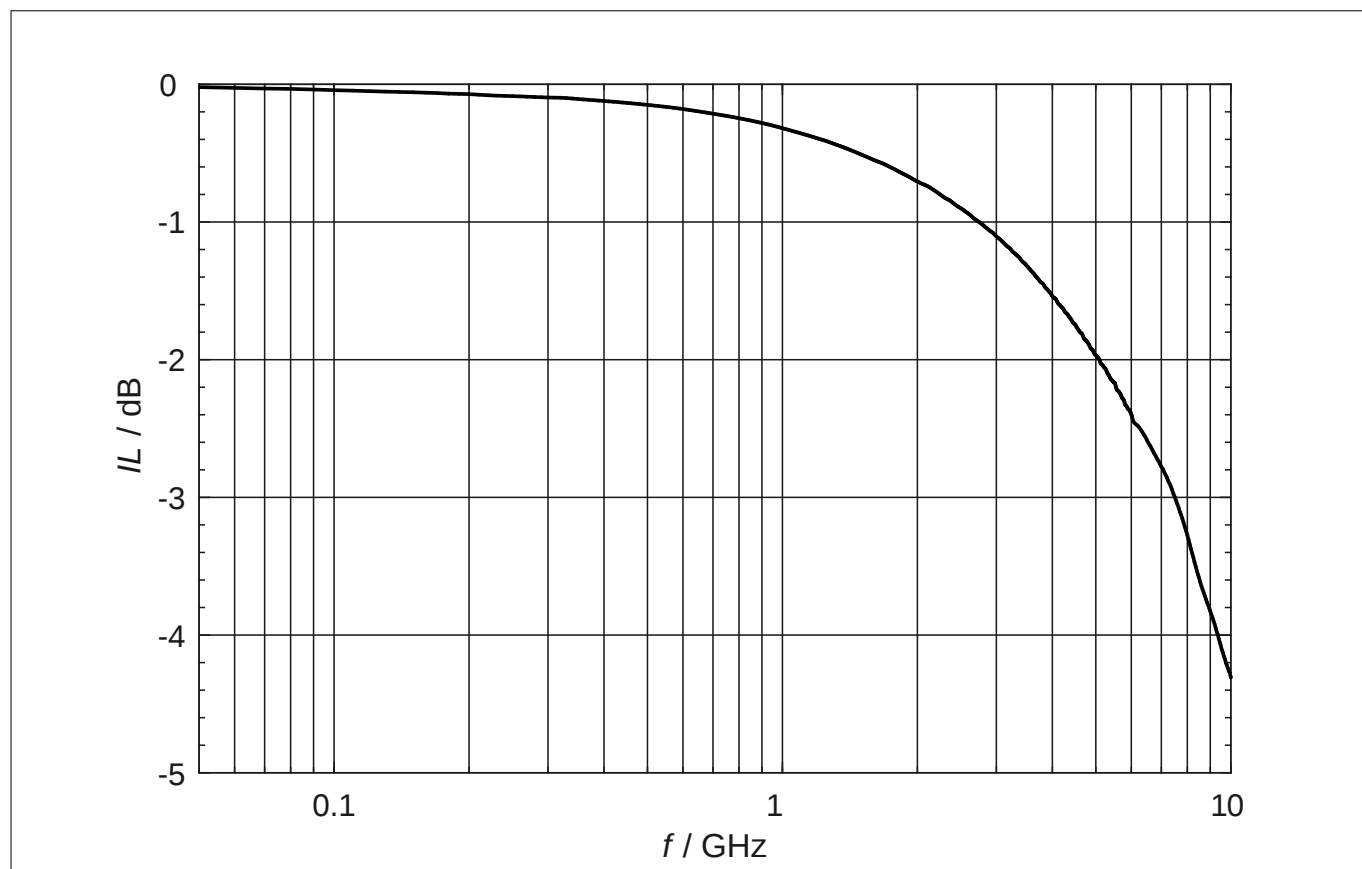


Figure 11 Insertion loss $IL = f(f)$, measured in a 50 Ω system

4 Package information WLL-2-7

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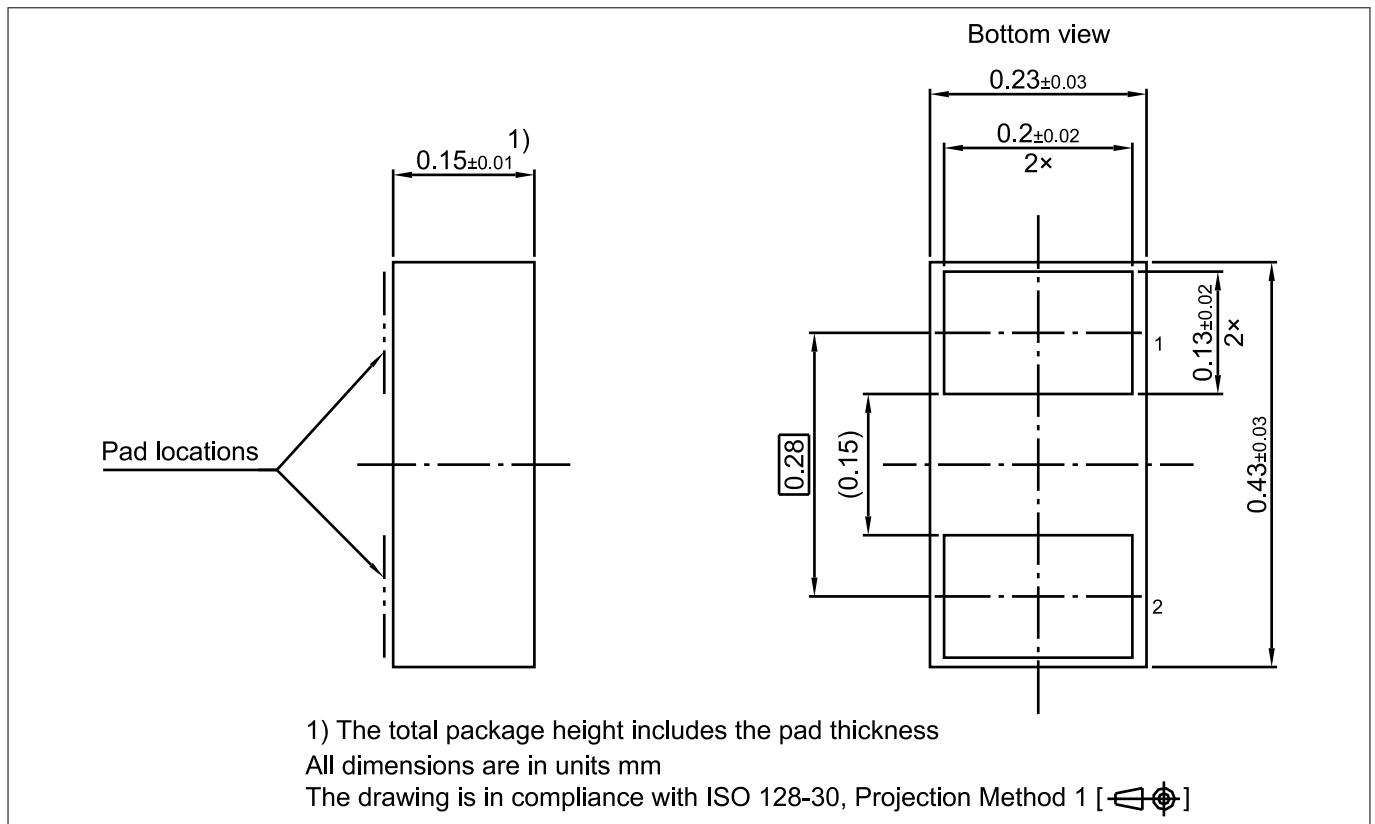


Figure 12 WLL-2-7 package

<https://www.infineon.com/cms/en/product/packages/SG-WLL/SG-WLL-2-7/>

5 References

5 References

[1]	Infineon AG - Understanding ESD protection device characteristics
[2]	Infineon AG - Application note AN210 : Effective ESD Protection Design at System Level Using VF-TLP Characterization Methodology

6 Revision history

Document version	Date of release	Description of changes
v1.0	2021-05-27	First final datasheet version
v1.1	2021-06-09	Editorial changes

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Edition 2021-06-09

Published by
Infineon Technologies AG
81726 Munich, Germany

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Document reference
IFX-xge1599569699049

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