

ESD231-B1-W0201

Bi-directional ESD protection device, 5.5 V, 3.5 pF, 0201



Product description

This Infineon ESD (electrostatic discharge) protection device has a bi-directional and symmetric I/V characteristic and excellent clamping performance.

Feature list

- ESD / transient protection according to:
 - IEC61000-4-2 (ESD): ± 30 kV (air) / ± 30 kV (contact)
 - IEC61000-4-4 (EFT): ± 4 kV / ± 80 A (5/50 ns)
 - IEC61000-4-5 (Surge): ± 12 A (8/20 μ s)
- Bi-directional maximum working voltage: $V_{WM} = \pm 5.5$ V
- Line capacitance: $C_L = 3.5$ pF at $f = 1$ MHz
- Clamping voltage: $V_{cl} = 12$ V at $I_{TLP} = 16$ A with $R_{dyn} = 0.3 \Omega$
- Very low leakage current: $I_L = 1$ nA
- Small form factor SMD size 0201, low profile (0.58 x 0.28 x 0.15 mm³)



Potential applications

- Low-speed USB lines (D+/D-, CC/SBU), MIPI, SD card, SIM card
- Keypads, touchpads, buttons, convenience keys, LCD displays, cameras, audio lines

Product validation

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

Device information

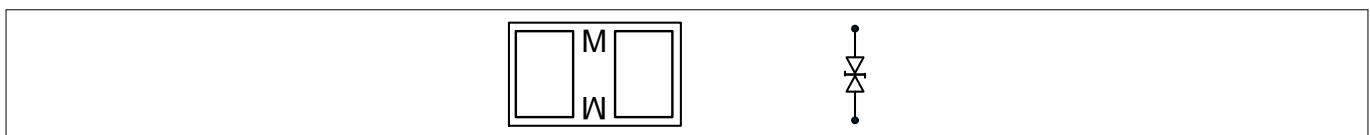


Figure 1 Pin configuration with marking (bottom view)

Table 1 Part information

Product name / Ordering code	Package	Pin configuration	Marking	Pieces / Reel
ESD231-B1-W0201/ESD231B1W0201E6327XTSA1	WLL-2-1	1 line, bi-directional	M	15 k

Table of contents

Table of contents

	Product description	1
	Feature list	1
	Potential applications	1
	Product validation	1
	Device information	1
	Table of contents	2
1	Absolute maximum ratings	3
2	Electrical characteristics	4
3	Thermal resistance	6
4	Typical characteristic diagrams	7
5	Package information WLL-2-1	13
6	References	14
7	Revision history	14
	Disclaimer	15

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}	-5.5	+5.5	V	
ESD discharge voltage	V_{ESD} (contact)	-30	+30	kV	Discharge network: $R = 330 \Omega$, $C = 150 \text{ pF}$ ¹⁾
	V_{ESD} (air)	-30	+30		
Peak pulse power	P_{PK}	-	132	W	Stress pulse: 8/20 μs current waveform ²⁾
Peak pulse current	I_{PP}	-12	+12	A	
Operating temperature	T_{op}	-55	+125	$^\circ\text{C}$	
Storage temperature	T_{stg}	-65	+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 Based on IEC61000-4-2.

² Based on IEC61000-4-5.

2 Electrical characteristics

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

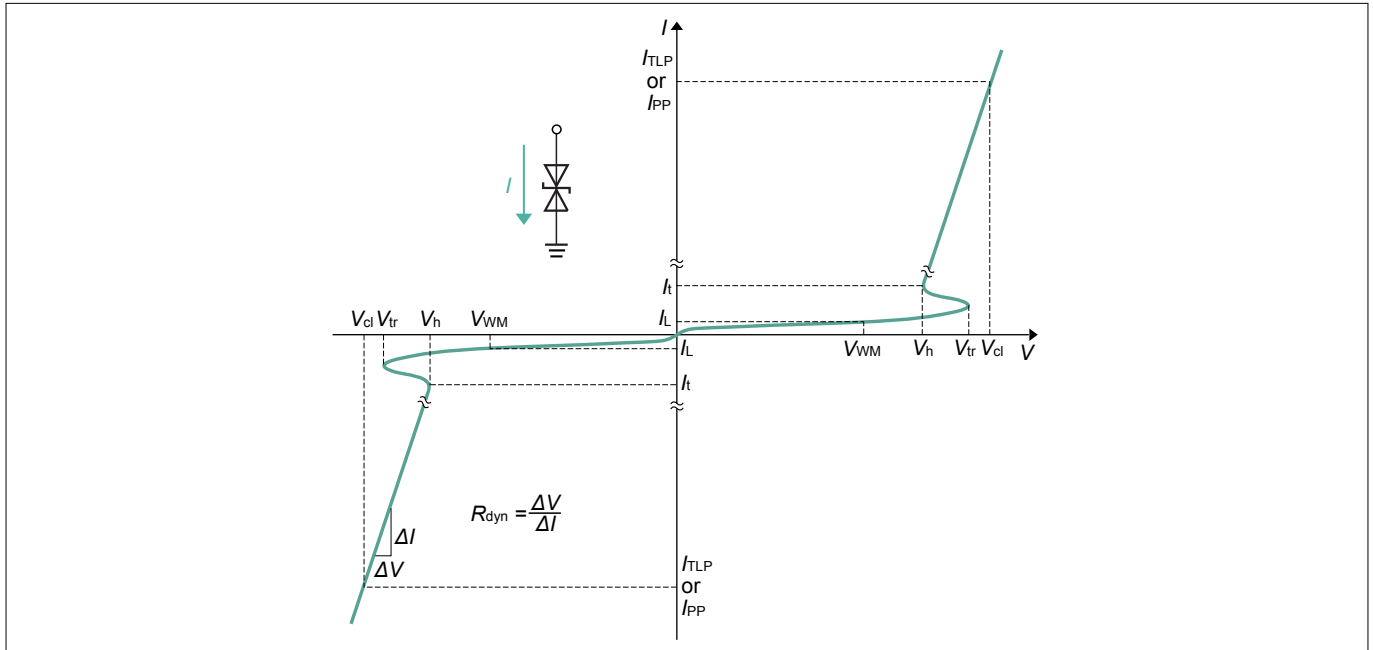


Figure 2 I/V characteristic curve

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 ³⁾	V_{tr}	6.1	9.5	–	V	
Holding voltage	V_h	6.1	7.8	12.5		$I_t = 10 \text{ mA}$
Leakage current	I_L	–	1	20	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	3	3.5	4.1	pF	$V = 0 \text{ V}, f = 1 \text{ MHz}$
		–	3.2	–		$V = 0 \text{ V}, f = 1 \text{ GHz}$
Series inductance	L_S	–	<1	–	nH	Extracted from S-parameters

Table 6 Protection characteristics

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Clamping voltage (TLP) ^{4) 5)}	V_{cl}	–	9.3	–	V	$I_{TLP} = 4 \text{ A}$
		–	10.5	–		$I_{TLP} = 8 \text{ A}$
		–	12	–		$I_{TLP} = 16 \text{ A}$
		–	16	–		$I_{TLP} = 30 \text{ A}$
Clamping voltage (8/20 μs) ⁶⁾		–	8	–		$I_{PP} = 2 \text{ A}$
		–	10	–		$I_{PP} = 9 \text{ A}$
Dynamic resistance ⁴⁾	R_{dyn}	–	0.3	–	Ω	

³ Verified by design.

⁴ TLP parameters: $Z_0 = 50 \Omega$, $t_p = 100 \text{ ns}$, $t_r = 0.6 \text{ ns}$, averaging window 30-60 ns.

⁵ Refer to application note AN210 [\[2\]](#)

⁶ $t_p = 8/20 \mu\text{s}$. Stress pulse based on IEC61000-4-5.

3 Thermal resistance

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Table 7 Thermal resistance

Parameter	Symbol	Values			Unit	Note or test condition
		Min.	Typ.	Max.		
Junction - soldering point ⁷⁾	R_{thJS}		30	–	KW	–

⁷ For calculation of R_{thJA} please refer to application note AN077 "Thermal resistance calculation"

4 Typical characteristic diagrams

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

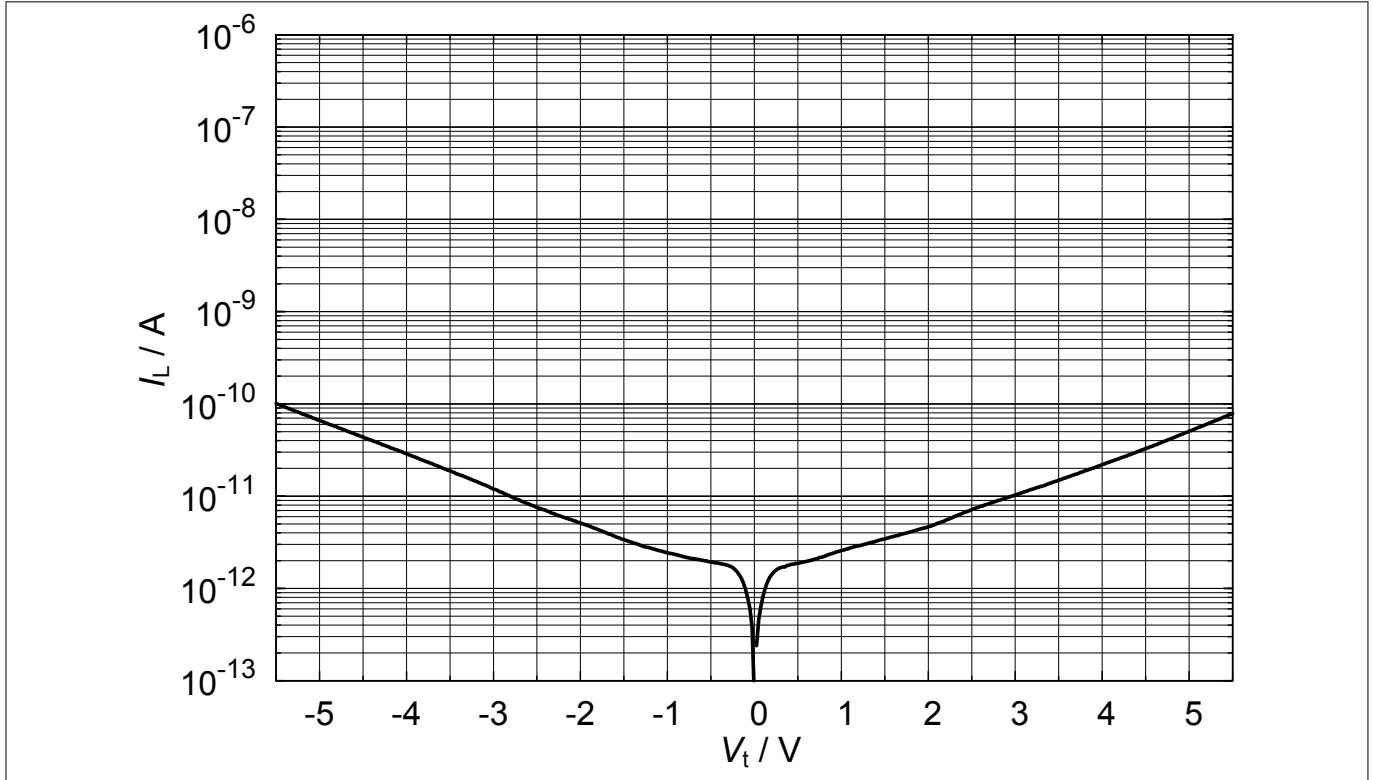


Figure 3 Leakage current: $I_L = f(V_t)$

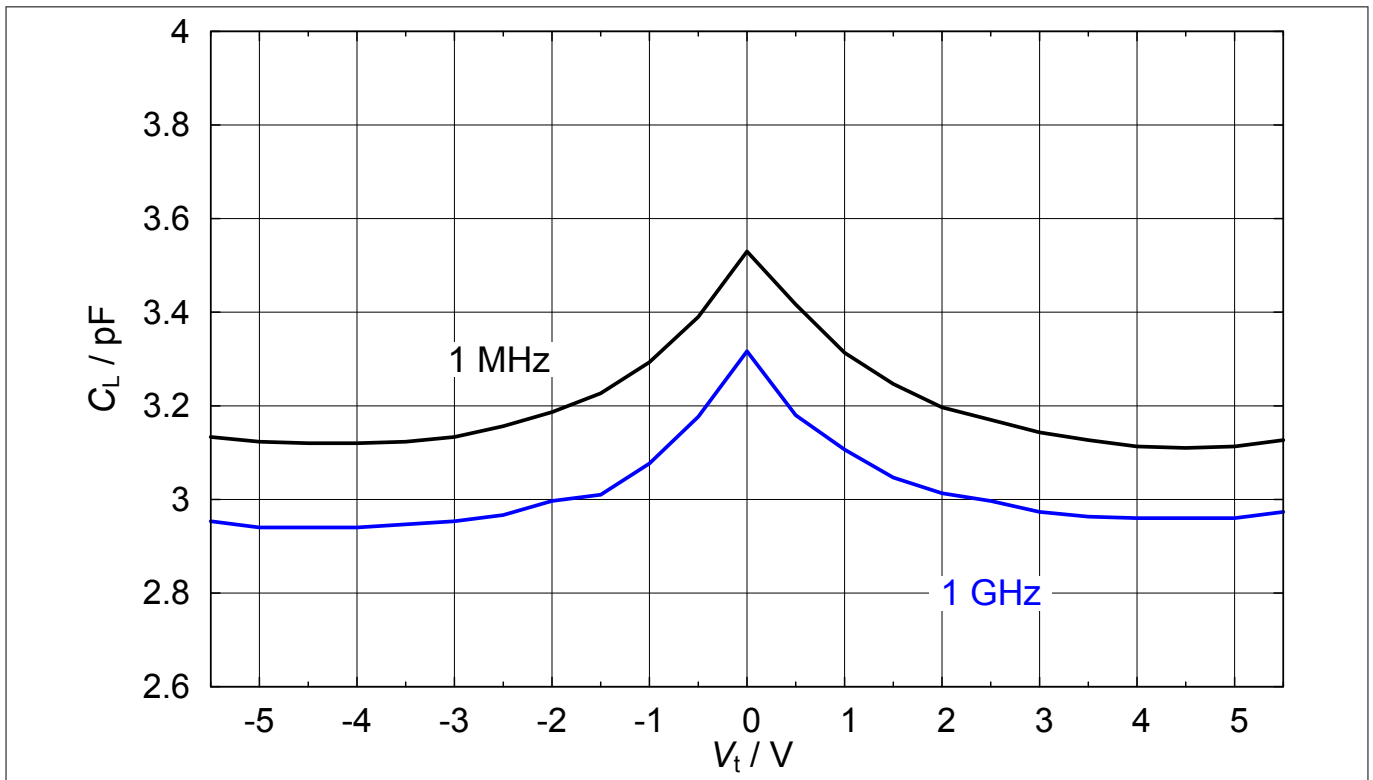


Figure 4 Line capacitance: $C_L = f(V_t)$, $f = 1\text{ MHz}, 1\text{ GHz}$

4 Typical characteristic diagrams

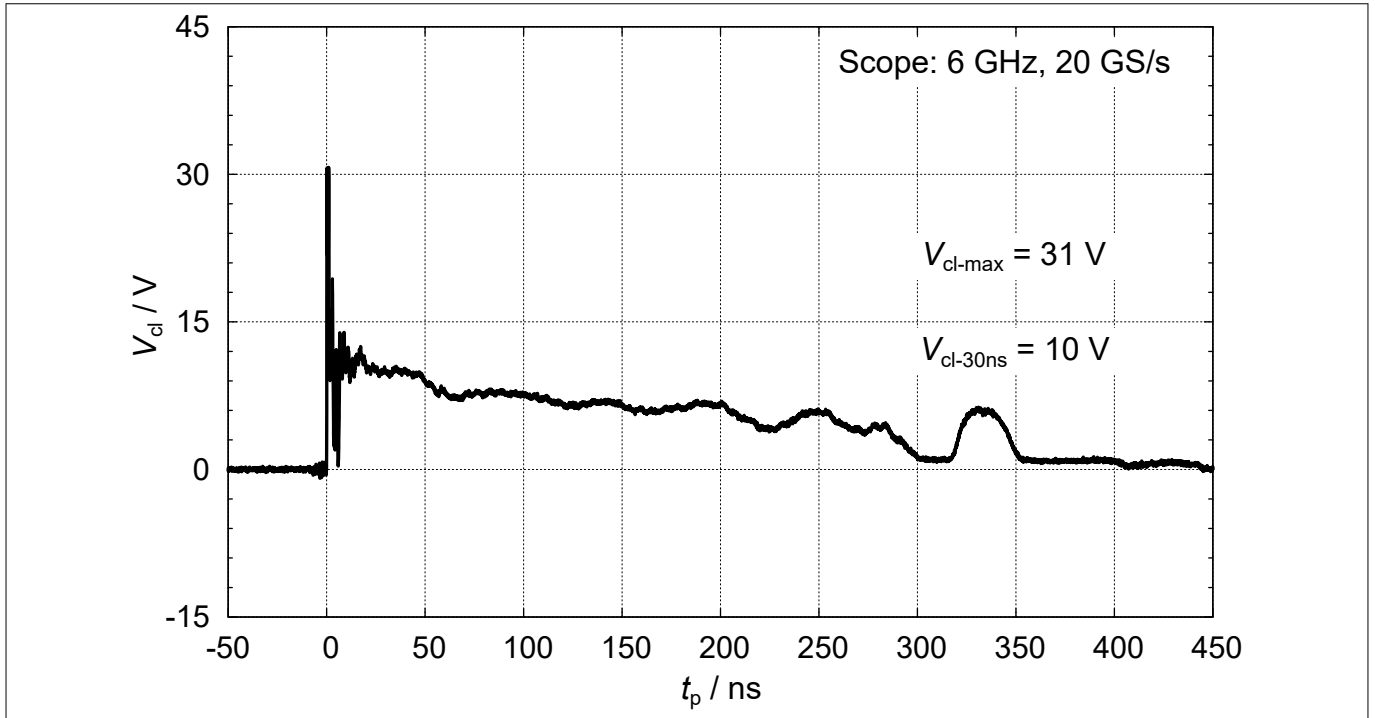


Figure 5 Clamping voltage (ESD): $V_{cl} = f(t_p)$, 8 kV positive pulse based on IEC61000-4-2

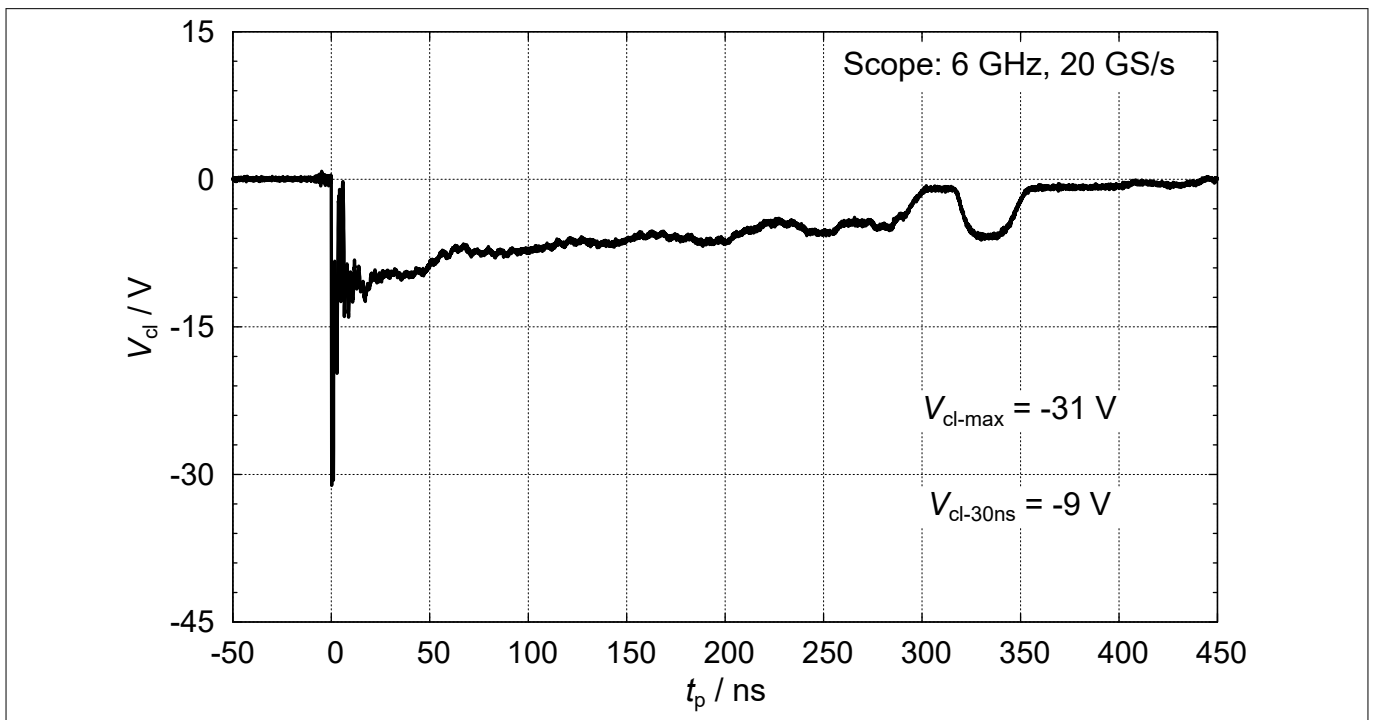


Figure 6 Clamping voltage (ESD): $V_{cl} = f(t_p)$, 8 kV negative pulse based on IEC61000-4-2

4 Typical characteristic diagrams

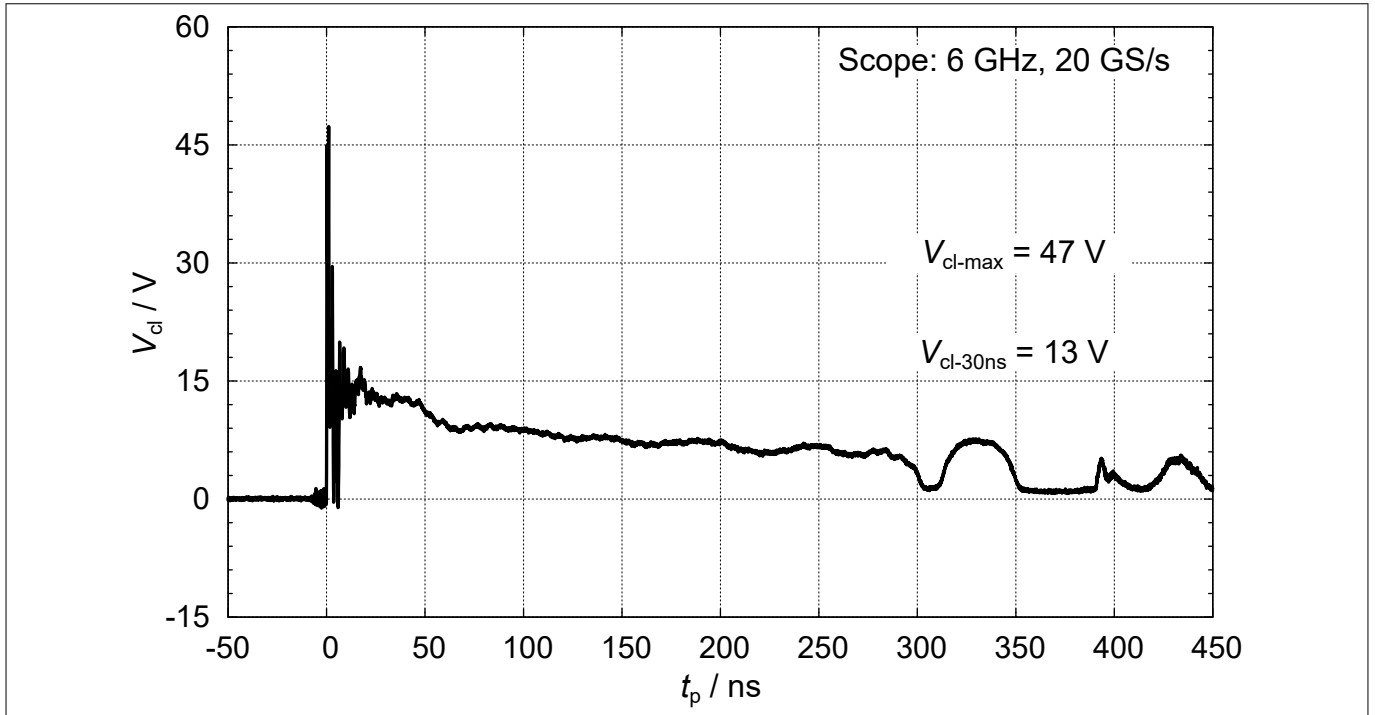


Figure 7 Clamping voltage (ESD): $V_{cl} = f(t_p)$, 15 kV positive pulse based on IEC61000-4-2

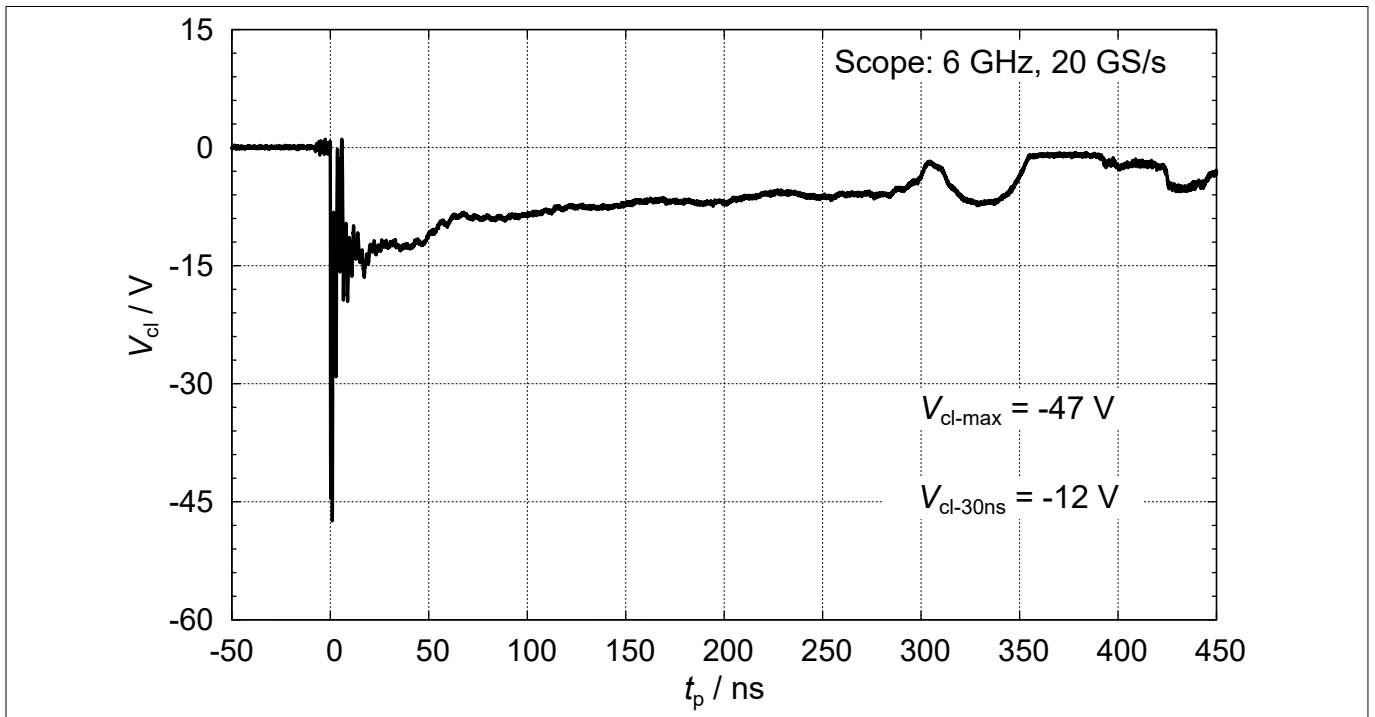


Figure 8 Clamping voltage (ESD): $V_{cl} = f(t_p)$, 15 kV negative pulse based on IEC61000-4-2

4 Typical characteristic diagrams

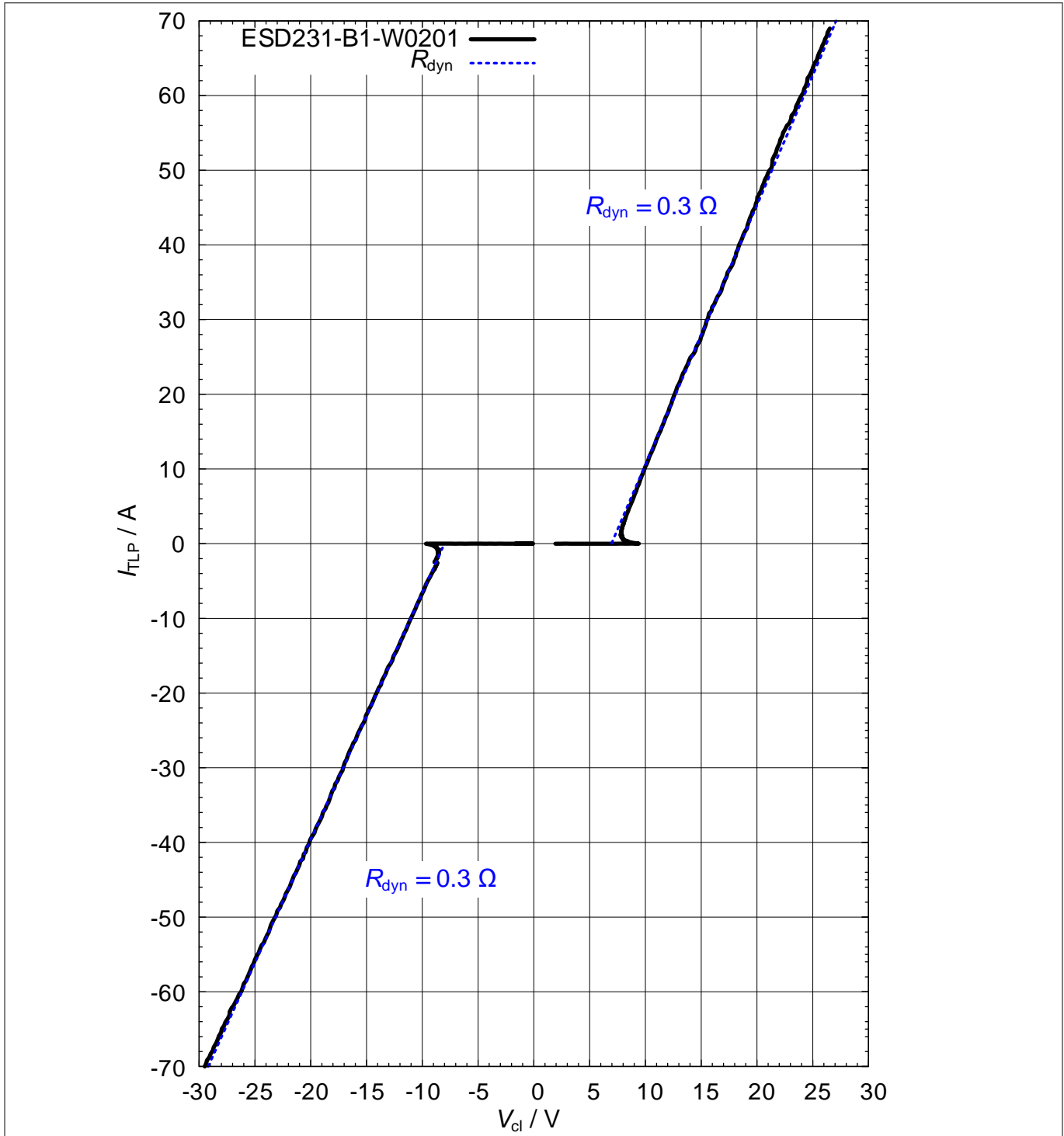


Figure 9 Clamping voltage (TLP): $I_{TLP} = f(V_{cl})$

4 Typical characteristic diagrams

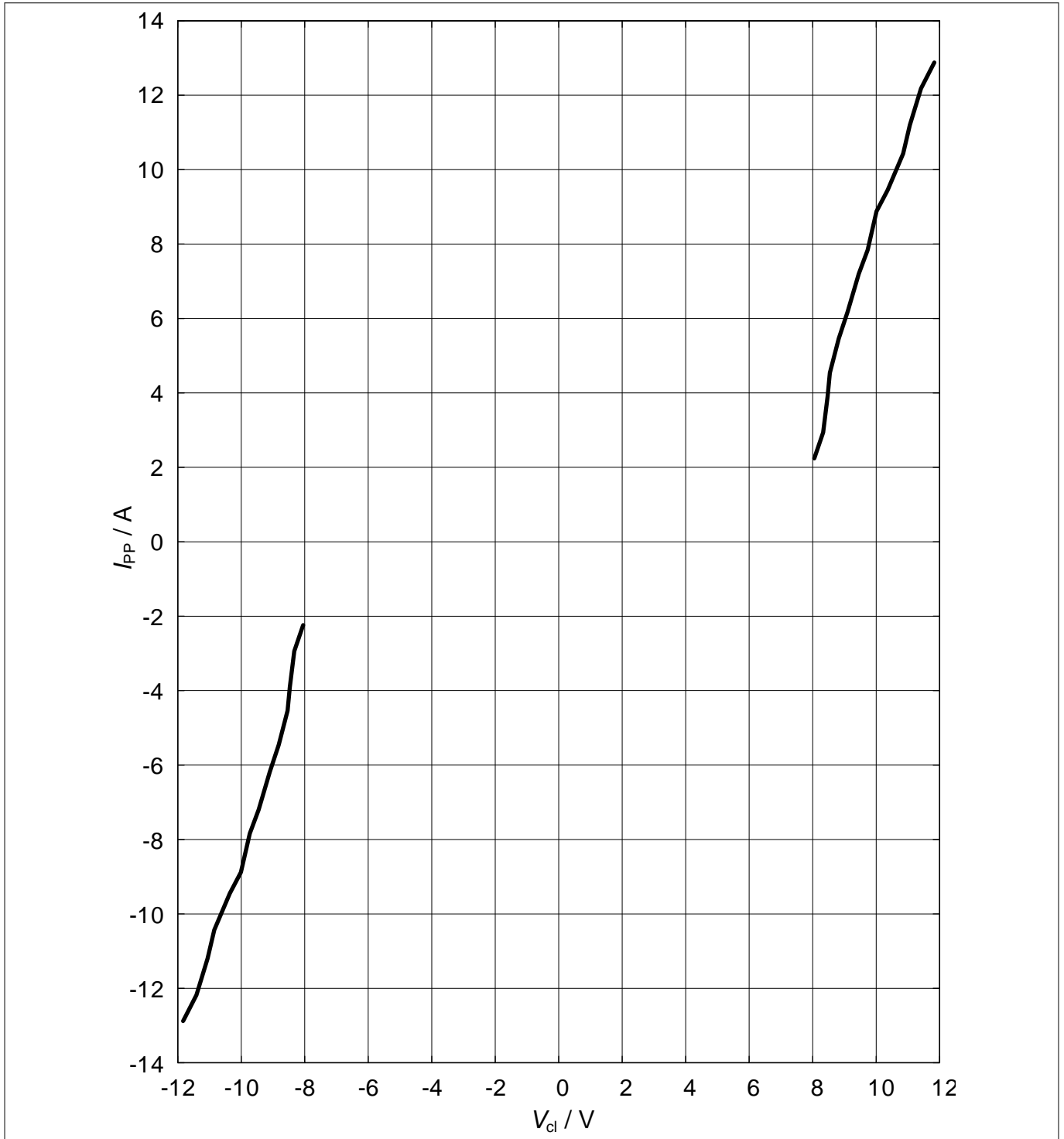


Figure 10 Clamping voltage (Surge): $I_{PP} = f(V_{cl})$, based on IEC61000-4-5

4 Typical characteristic diagrams

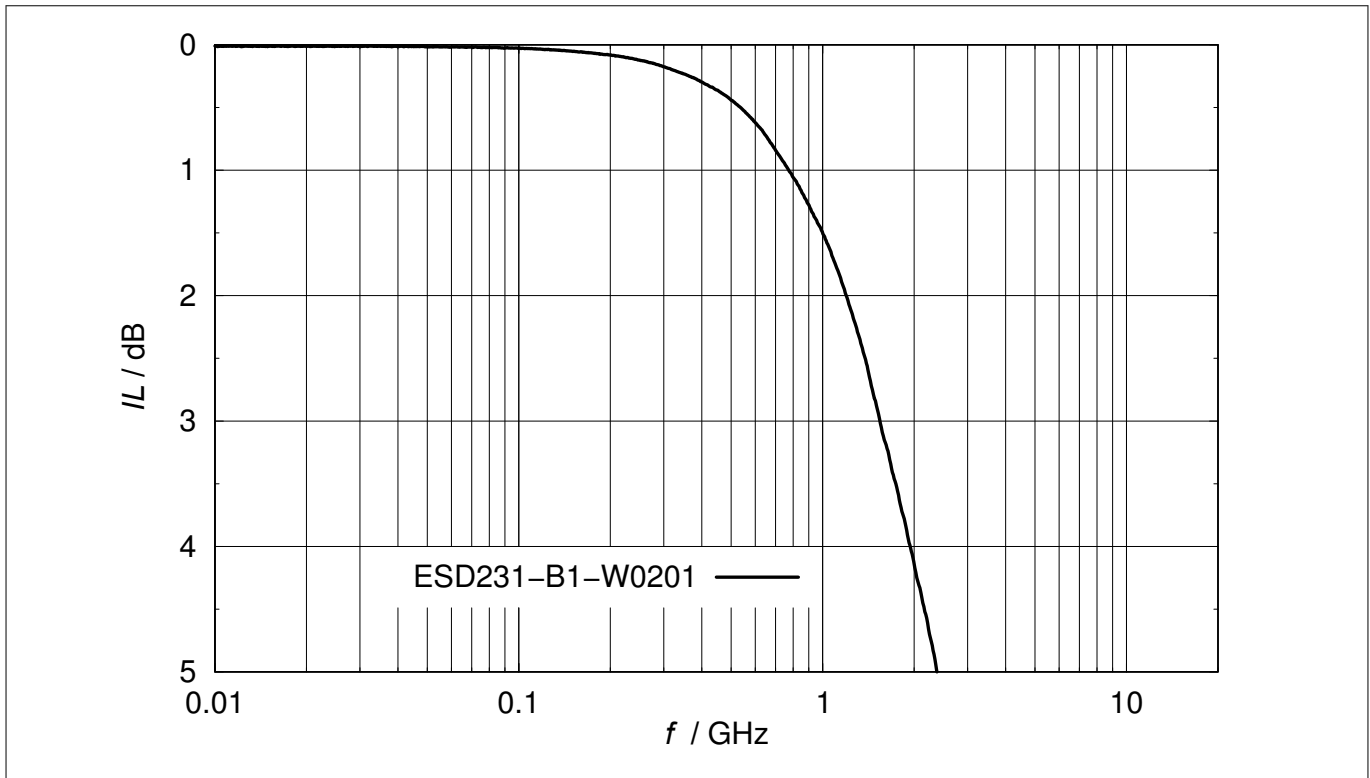


Figure 11 Insertion loss vs. frequency in a 50 Ω system

5 Package information WLL-2-1

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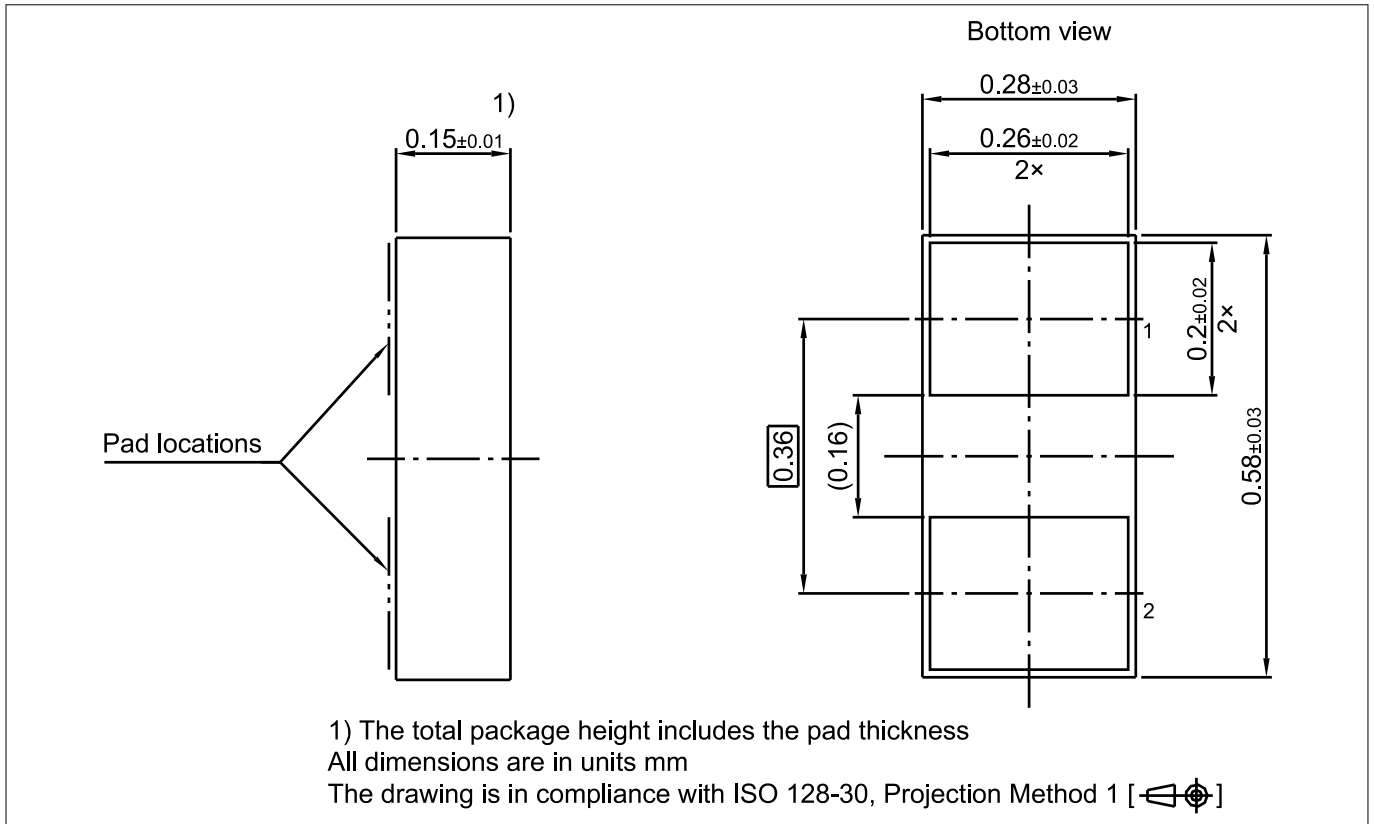


Figure 12 WLL-2-1 package

Note: For package information including footprint, packing and assembly recommendation refer to:

<https://www.infineon.com/cms/en/product/packages/SG-WLL/SG-WLL-2-1/>

6 References

6 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

7 Revision history

Document version	Date of release	Description of changes
1.2	2017-10-17	<ul style="list-style-type: none">• First final datasheet release
1.3	2018-11-07	<ul style="list-style-type: none">• Insertion loss diagram updated• Minor editorial changes
2.0	2020-11-30	<ul style="list-style-type: none">• New datasheet layout
2.1	2021-05-17	<ul style="list-style-type: none">• Diagram updated

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