

# ESD229-U1-W0201

Uni-directional ESD protection device, 5.5 V, 1.2 pF, 0201



## Product description

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

## Feature list

- ESD / transient protection according to:
  - IEC61000-4-2 (ESD):  $\pm 20$  kV (air) /  $\pm 20$  kV (contact)
  - IEC61000-4-4 (EFT):  $\pm 5$  kV /  $\pm 100$  A (5/50 ns)
  - IEC61000-4-5 (Surge):  $\pm 11$  A (8/20  $\mu$ s)
- Working voltage:  $V_{WM} = 5.5$  V
- Line capacitance:  $C_L = 1.2$  pF at  $f = 1$  GHz
- Clamping voltage:  $V_{cl} = 9$  V at 16 A,  $R_{dyn} = 0.12 \Omega$ ;  $V_{cl} = -2.5$  V at -16 A,  $R_{dyn} = 0.07 \Omega$
- Very low leakage current:  $I_L = 0.1$  nA
- Small form factor SMD size 0201 and low profile (0.58 x 0.28 x 0.15 mm<sup>3</sup>)



## 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

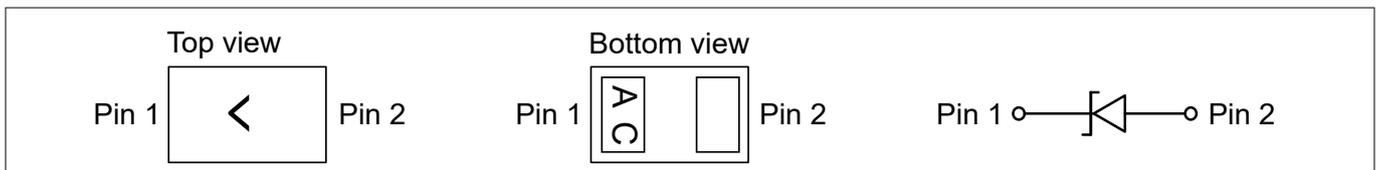


Figure 1 Pin configuration and schematic diagram

Table 1 Part information

Product name / Ordering code	Package	Pin configuration	Marking	Pieces / Reel
ESD229-U1-W0201 / ESD229U1W0201E6327XTSA1	WLL-2-5	1 line, uni-directional	AC	15 k

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## 1 Absolute maximum ratings

### 1 Absolute maximum ratings

**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	$V_{ESD}$ (contact)	-20	+20	kV	Discharge network: $R = 330 \Omega$ , $C = 150 \text{ pF}$ <sup>1)</sup>
	$V_{ESD}$ (air)	-20	+20		
Peak pulse power	$P_{PK}$	-	121	W	From pin 1 to pin 2
		-	28		From pin 2 to pin 1
Peak pulse current	$I_{PP}$	-11	+11	A	
Operating temperature	$T_{op}$	-55	+125	°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.

<sup>1</sup> Based on IEC61000-4-2.

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.

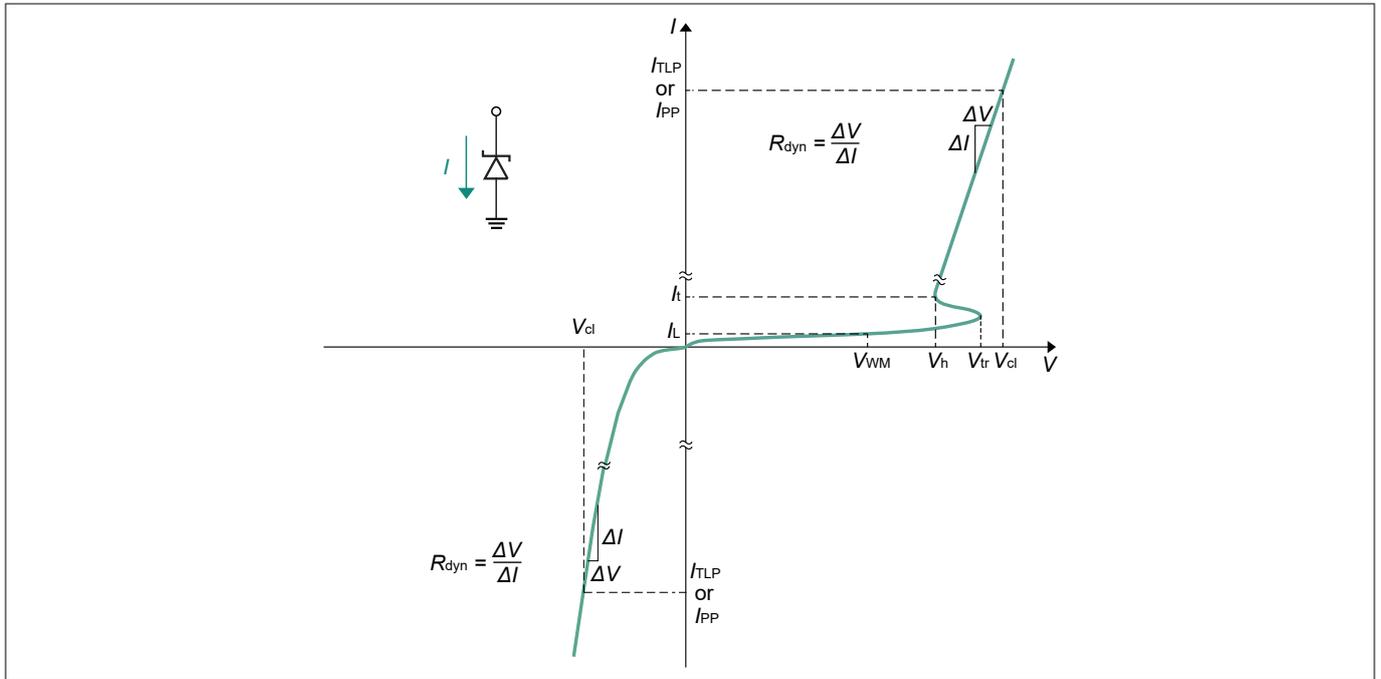


Figure 2 I/V characteristic curve

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		$I_t = 1 \text{ mA}$
Leakage 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	$C_L$	-	2	2.7	pF	$V = 0 \text{ V}, f = 1 \text{ MHz}$
		-	1.2	-		$V = 0 \text{ V}, f = 1 \text{ GHz}$
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) <sup>2) 3)</sup>	$V_{cl}$	-	7.8	-	V	$I_{TLP} = 4 \text{ A}, t_p = 100 \text{ ns}$
		-	8.2	-		$I_{TLP} = 8 \text{ A}, t_p = 100 \text{ ns}$
		-	9	-		$I_{TLP} = 16 \text{ A}, t_p = 100 \text{ ns}$
		-	10.4	-		$I_{TLP} = 30 \text{ A}, t_p = 100 \text{ ns}$
		-	-1.6	-		$I_{TLP} = -4 \text{ A}, t_p = 100 \text{ ns}$
		-	-1.9	-		$I_{TLP} = -8 \text{ A}, t_p = 100 \text{ ns}$
		-	-2.5	-		$I_{TLP} = -16 \text{ A}, t_p = 100 \text{ ns}$
		-	-3.6	-		$I_{TLP} = -30 \text{ A}, t_p = 100 \text{ ns}$
Clamping voltage (8/20 $\mu\text{s}$ ) <sup>4)</sup>		-	11	-		$I_{PP} = 11 \text{ A}$
		-	-2.5	-		$I_{PP} = -11 \text{ A}$
Dynamic resistance <sup>2)</sup>	$R_{dyn}$	-	0.12 0.07	-	Ohm	positive pulse negative pulse

<sup>2)</sup> TLP parameters:  $Z_0 = 50 \Omega$ ,  $t_p = 100 \text{ ns}$ ,  $t_r = 0.6 \text{ ns}$ , averaging window 30-60 ns.

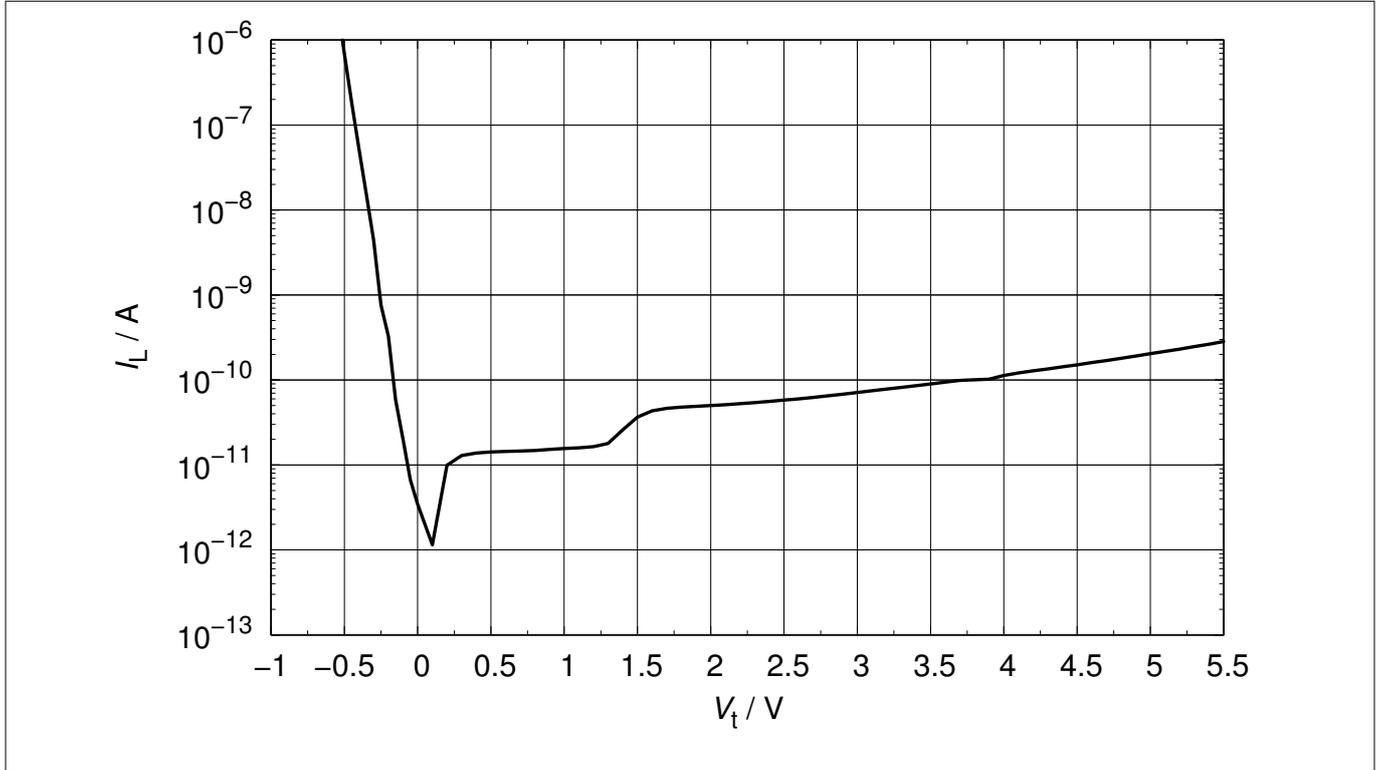
<sup>3)</sup> Refer to application note AN210 [2].

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

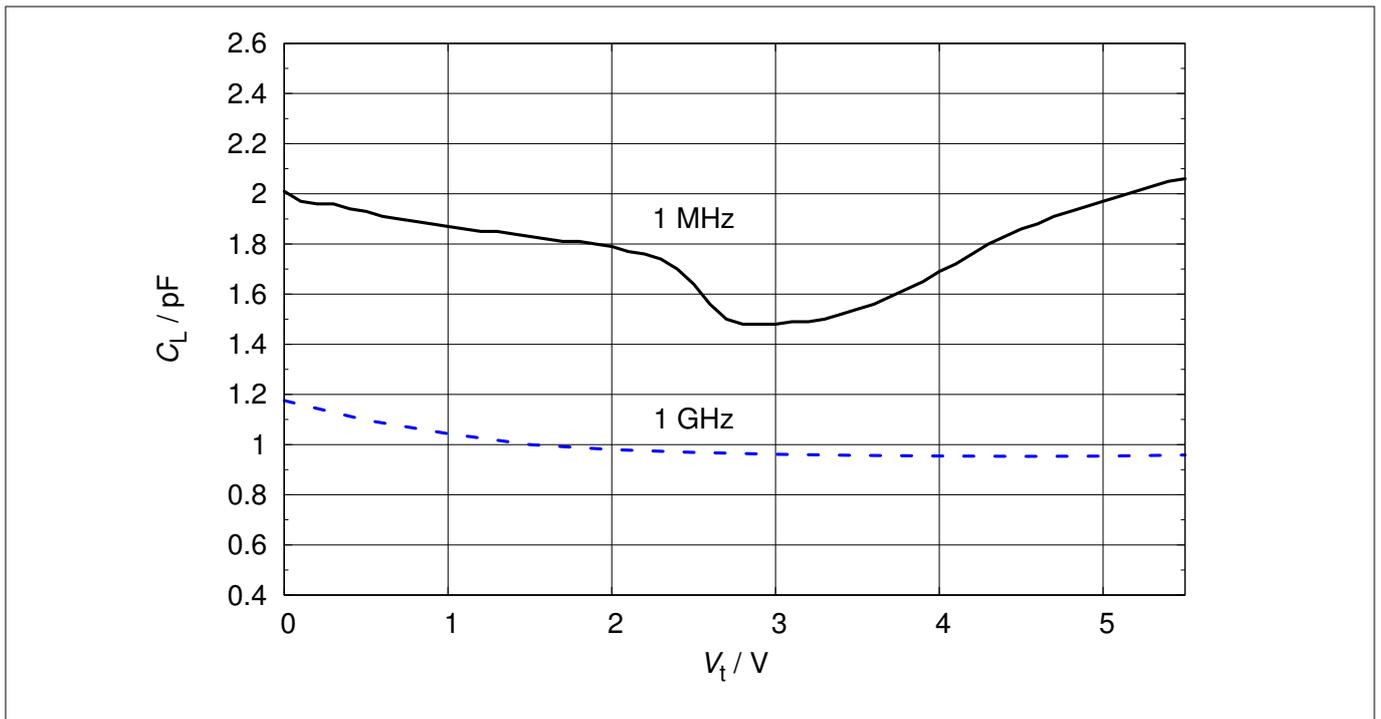
**3 Typical characteristic diagrams**

**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

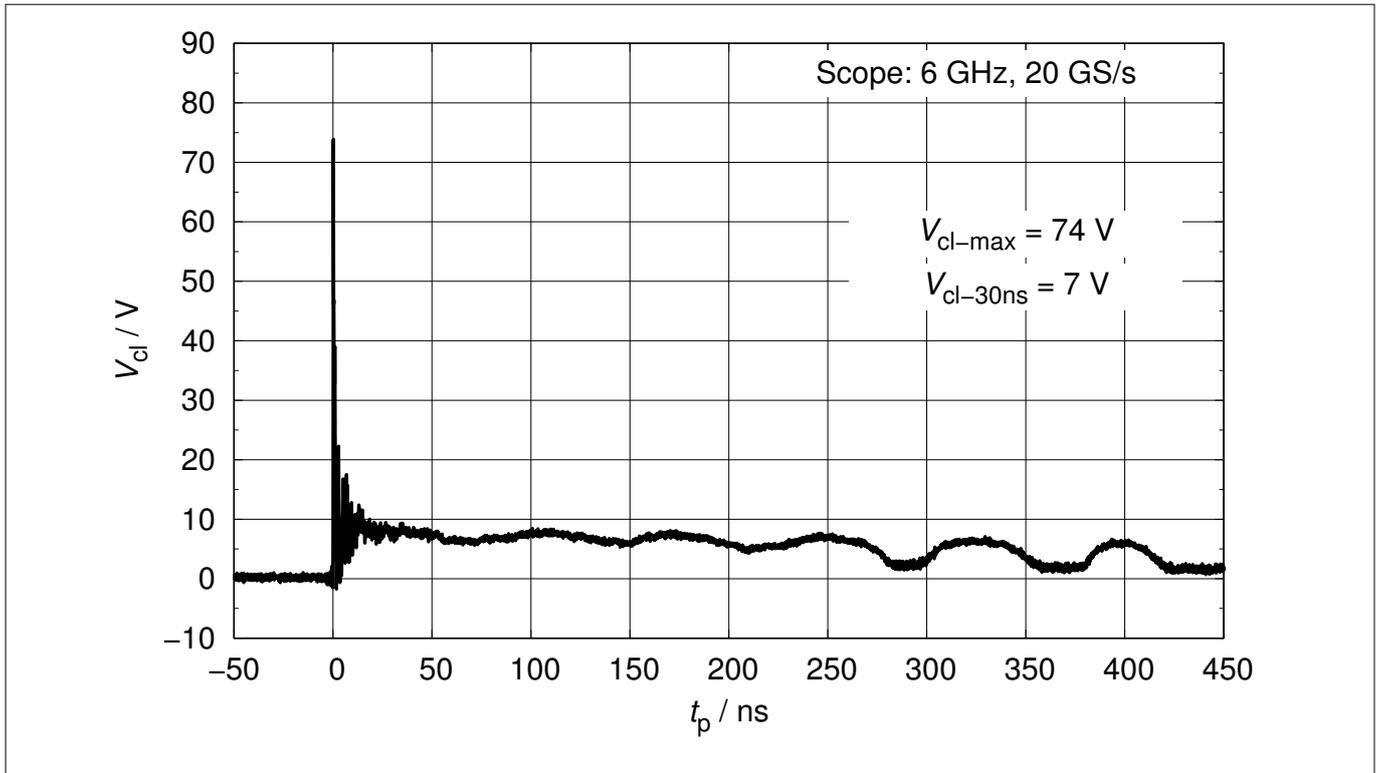


Figure 5 Clamping voltage (ESD):  $V_{cl} = f(t_p)$ , 8 kV positive pulse based on IEC61000-4-2

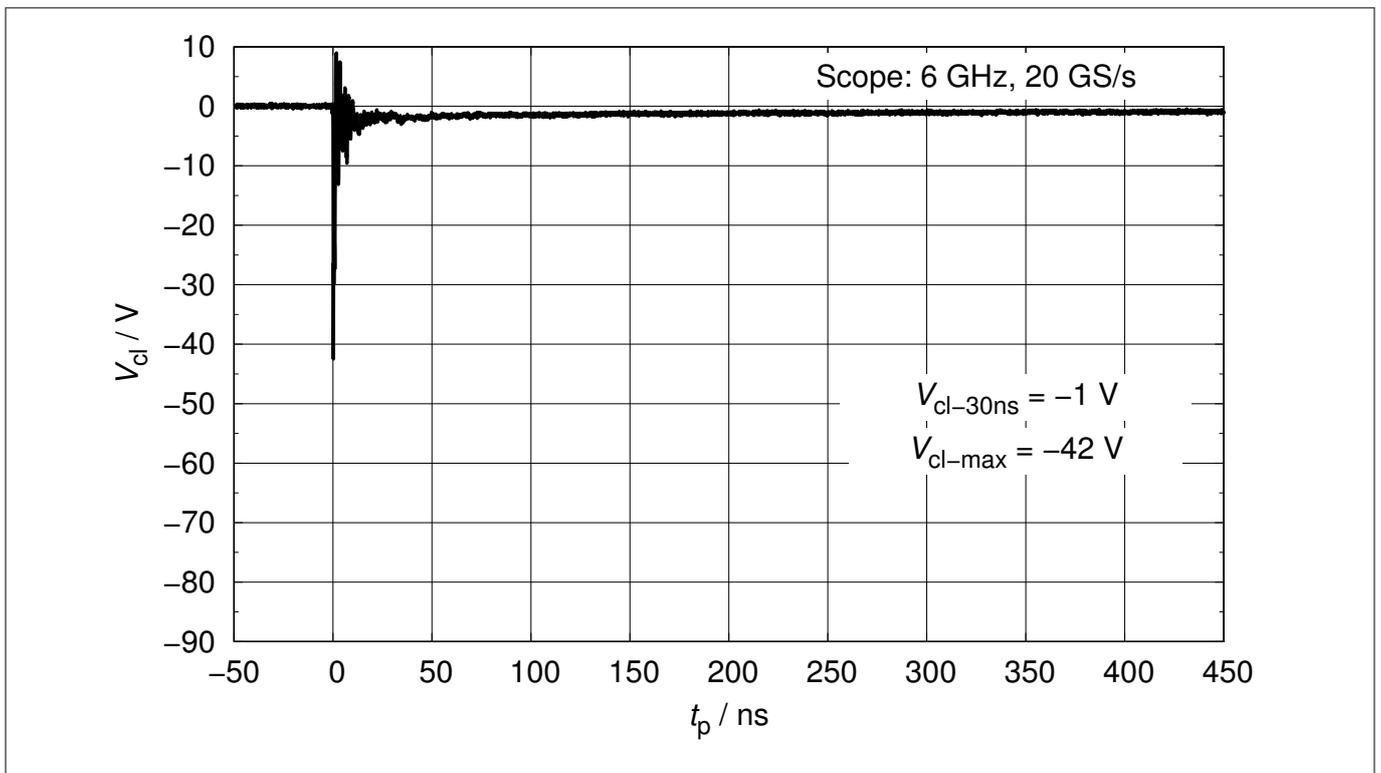


Figure 6 Clamping voltage (ESD):  $V_{cl} = f(t_p)$ , 8 kV negative pulse based on IEC61000-4-2

3 Typical characteristic diagrams

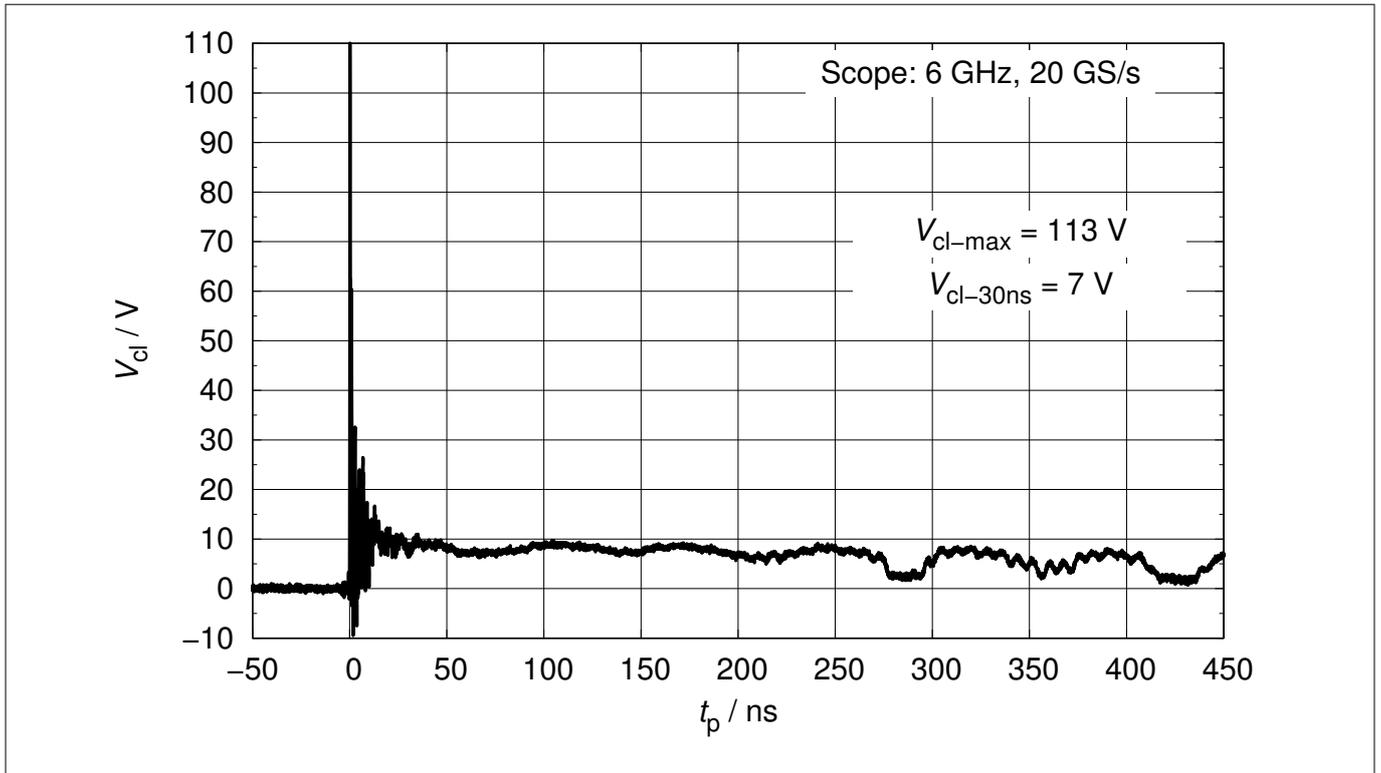


Figure 7 Clamping voltage (ESD):  $V_{cl} = f(t_p)$ , 15 kV positive pulse based on IEC61000-4-2

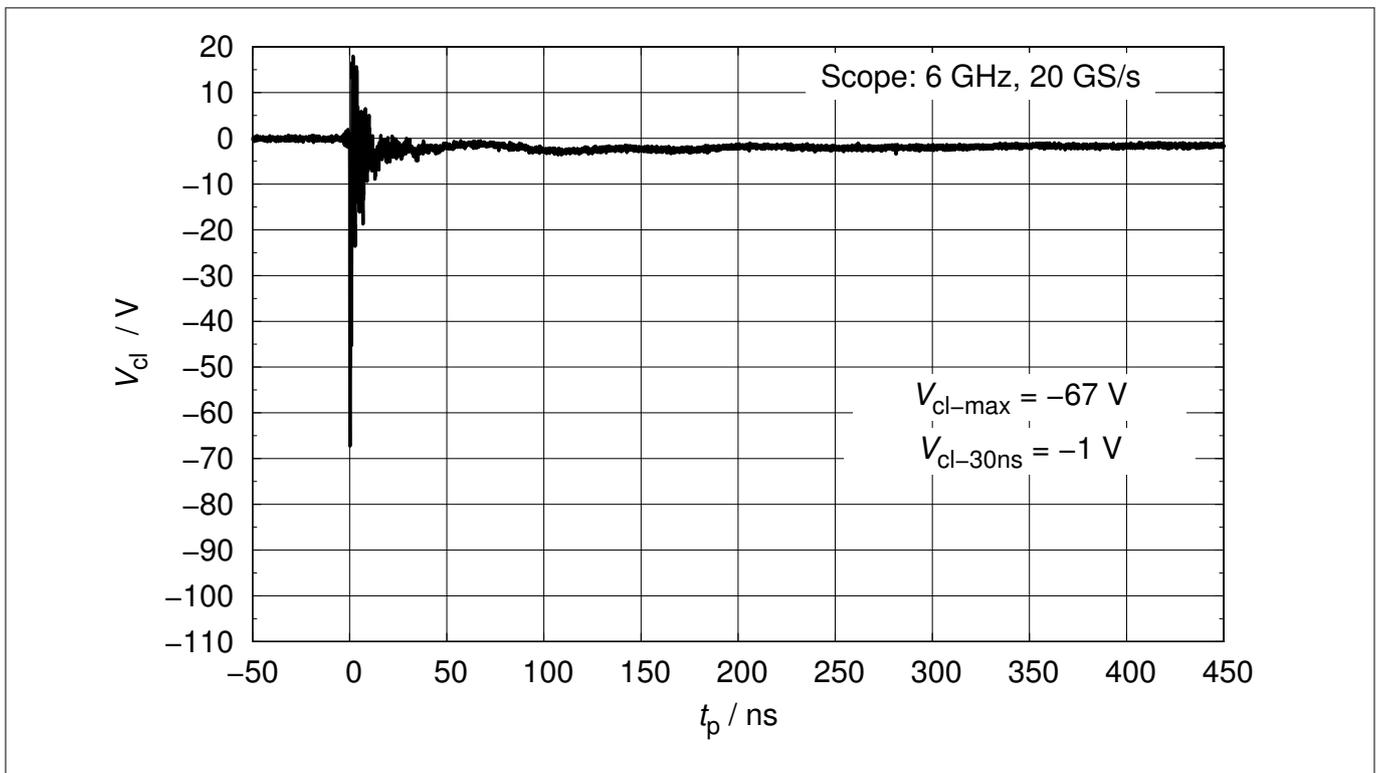
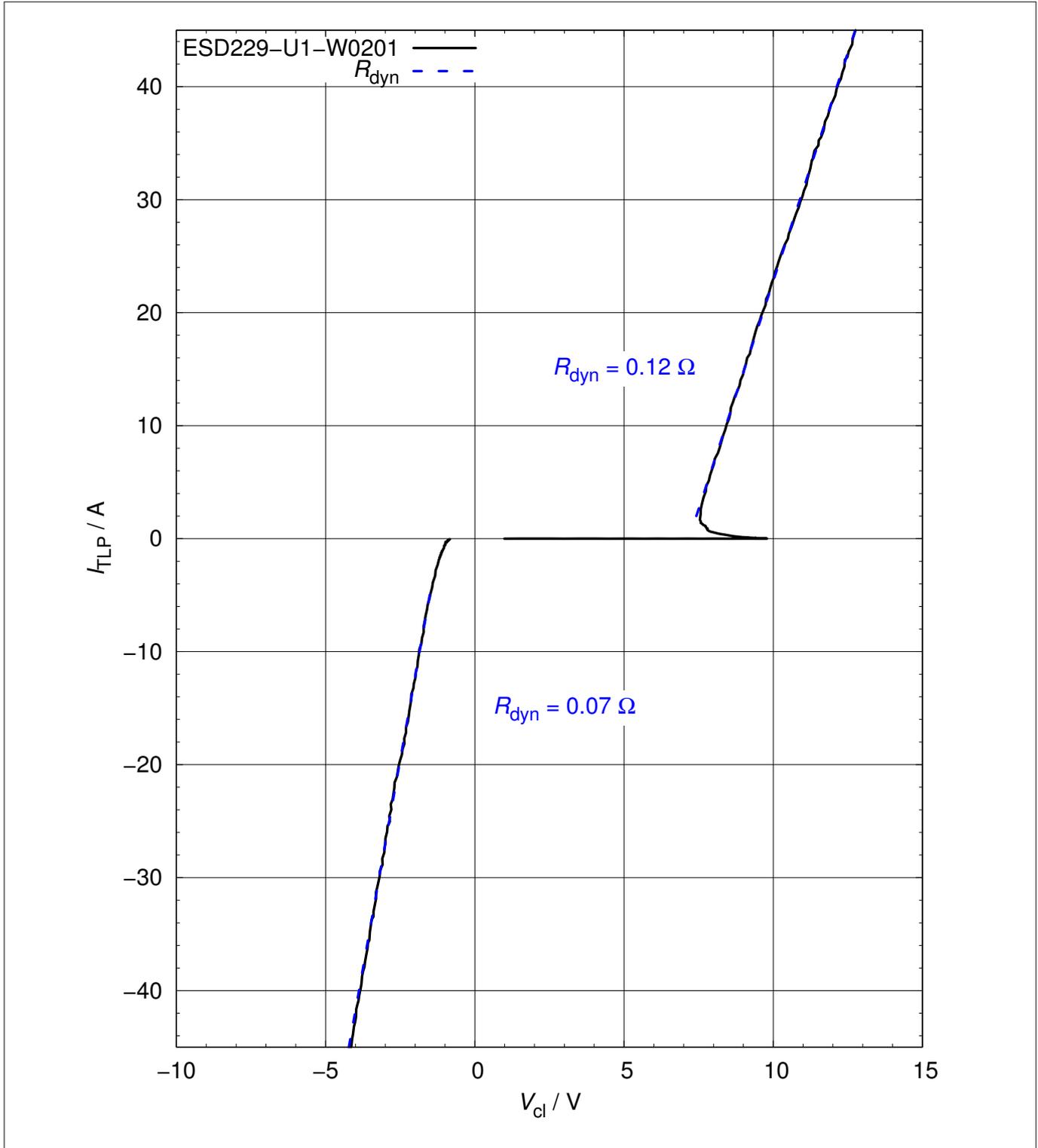


Figure 8 Clamping voltage (ESD):  $V_{cl} = f(t_p)$ , 15 kV negative pulse based on IEC61000-4-2

**3 Typical characteristic diagrams**



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

3 Typical characteristic diagrams

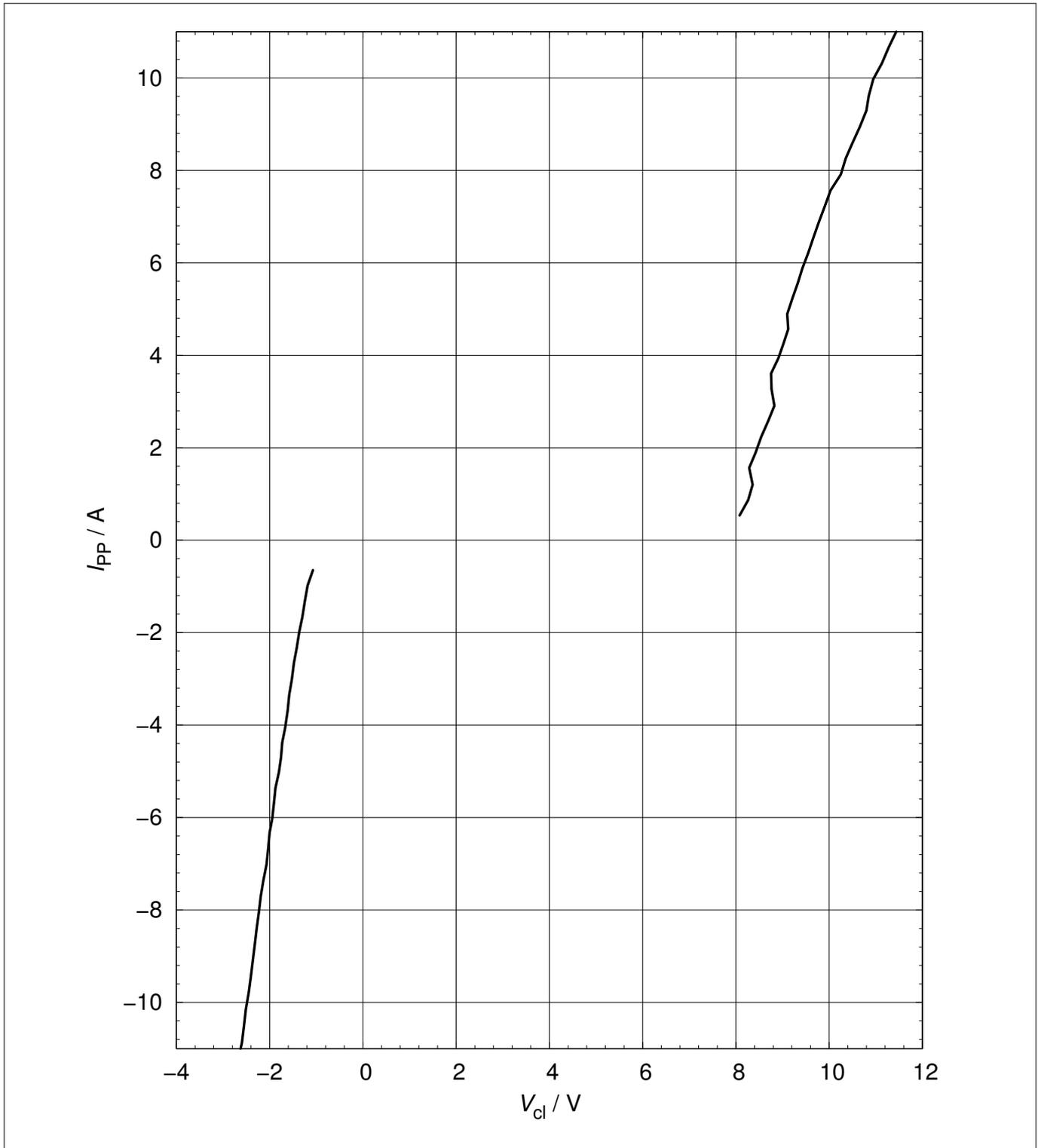


Figure 10 Clamping voltage (Surge):  $I_{PP} = f(V_{cl})$ , based on IEC61000-4-5

3 Typical characteristic diagrams

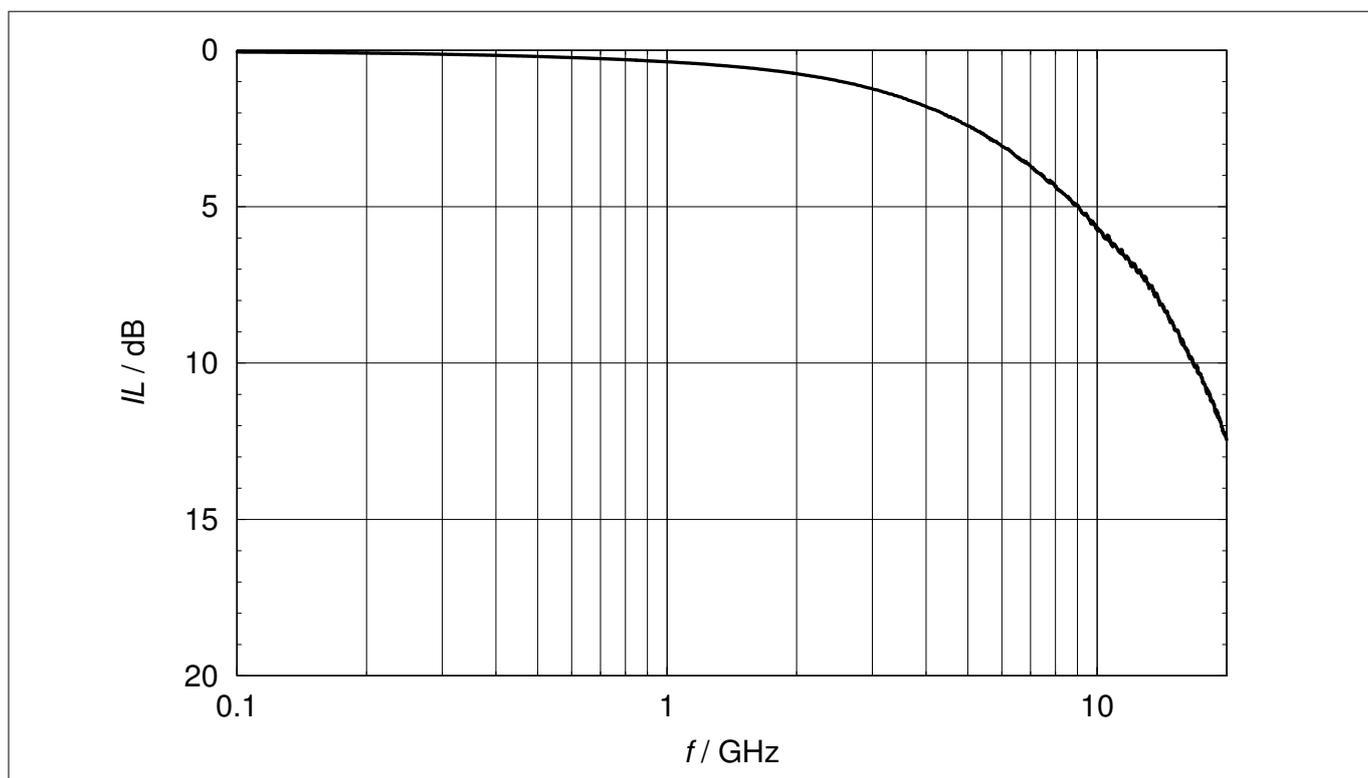
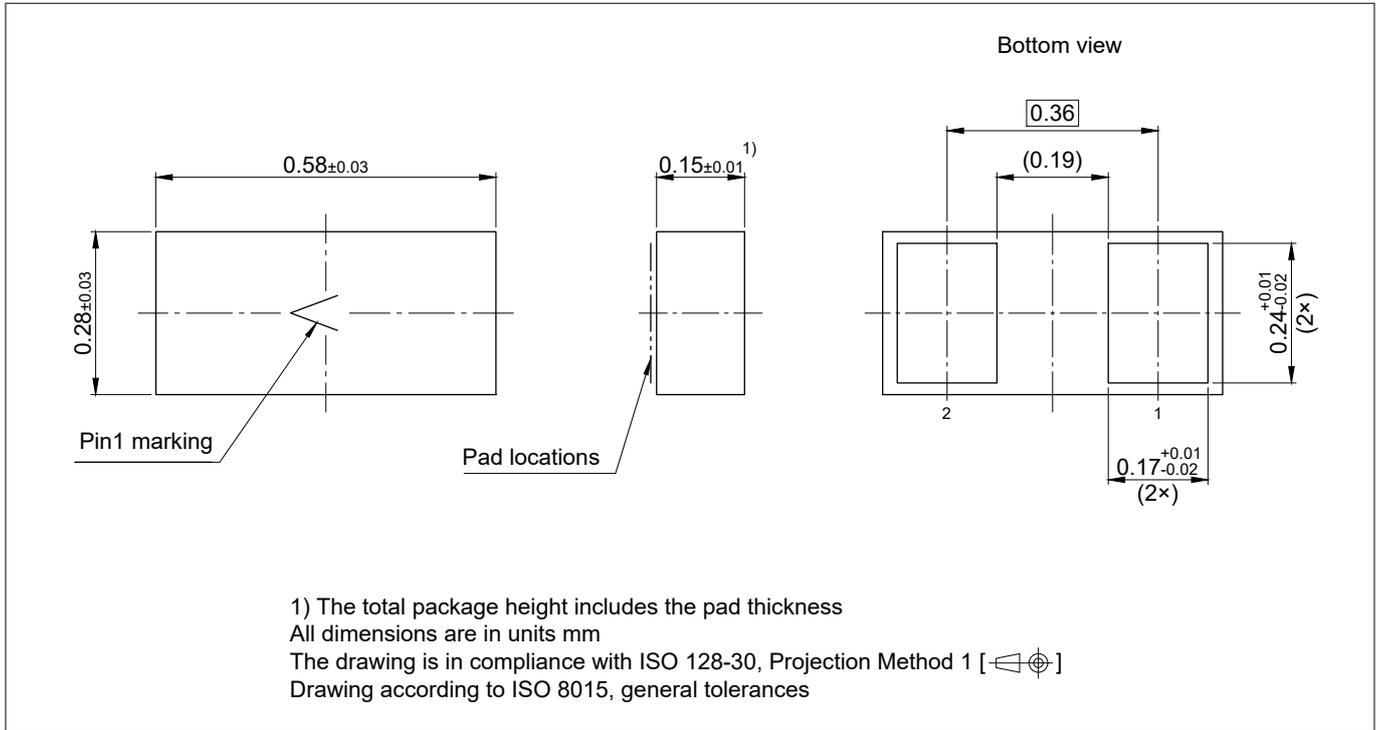


Figure 11 Insertion loss  $IL = f(f)$ , measured in a 50  $\Omega$  system

**4 Package information WLL-2-5**

**4 Package information WLL-2-5**



**Figure 12 WLL-2-5 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-2-5/>

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## 5 References

### 5 References

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

### 6 Revision history

Document version	Date of release	Description of changes
1.0	2023-07-19	<ul style="list-style-type: none"><li>First final datasheet version</li></ul>
1.1	2025-07-29	<ul style="list-style-type: none"><li>Updated new package drawing</li></ul>

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**Email: [erratum@infineon.com](mailto:erratum@infineon.com)**

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