

# TVS Diode

Transient Voltage Suppressor Diodes

## ESD200-B1-CSP0201

Low Clamping Voltage TVS Diode in a Thin 0201 Chip Scale Package

ESD200-B1-CSP0201

## Data Sheet

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Final

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**Revision History: Revision 0.9.3, 2012-03.13**

Page or Item	Subjects (major changes since previous revision)
<b>Revision 1.0, 2013-05-21</b>	
All	Status change to final

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Last Trademarks Update 2010-10-26

# 1 Low Clamping Voltage TVS Diode in a Thin 0201 Chip Scale Package

## 1.1 Features

- ESD / Transient protection of susceptible I/O lines to:
  - IEC61000-4-2 (ESD):  $\pm 16$  kV (air/contact discharge)
  - IEC61000-4-5 (surge):  $\pm 3$  A (8/20  $\mu$ s))
- Low clamping voltage
- Low dynamic resistance:  $R_{DYN} \leq 0.2 \Omega$  typ.
- Supports applications with signal voltage between -5.5 V and 5.5 V max.
- Line capacitance:  $C_L = 6.5$  pF
- Minimized overshoot due to extremely low parasitic inductance of chip scale package
- Miniature form factor (XY) = 0201 (0.58 mm x 0.28 mm)
- Thin 0.15 mm package thickness to allow direct integration into modules
- Optimized assembly: its bidirectional and symmetric I/V characteristics allow placement on the PCB with no danger of polarity orientation issues



## 1.2 Application Examples

- ESD Protection of highly susceptible IC/ASICs in audio, headset, human digital interfaces
- Dedicated solution to boost space saving and high performance in miniaturized modern electronics

## 1.3 Product Description

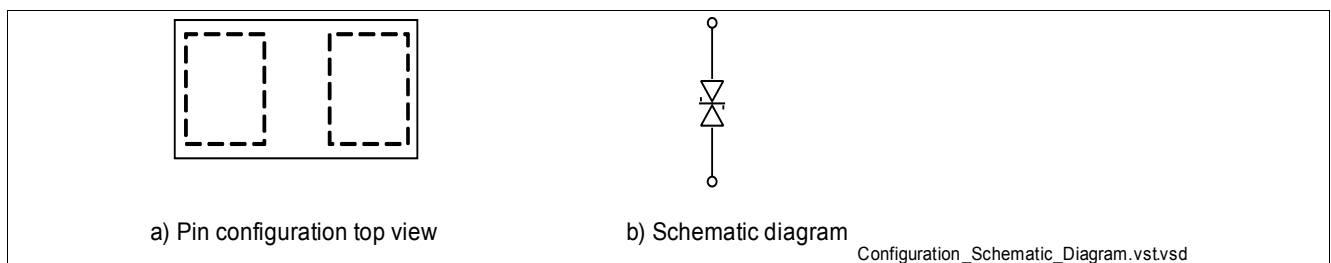


Figure 1-1 Pin Configuration and Schematic Diagram

Table 1-1 Ordering Information

Type	Package	Configuration	Marking code
ESD200-B1-CSP0201	WLL-2-1	1 line, bi-directional	A <sup>1)</sup>

1) The device does not have any marking or date code on the device backside. The Marking code is on pad side.

## 2 Characteristics

### 2.1 Maximum Ratings

**Table 2-1** Maximum Ratings at  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified

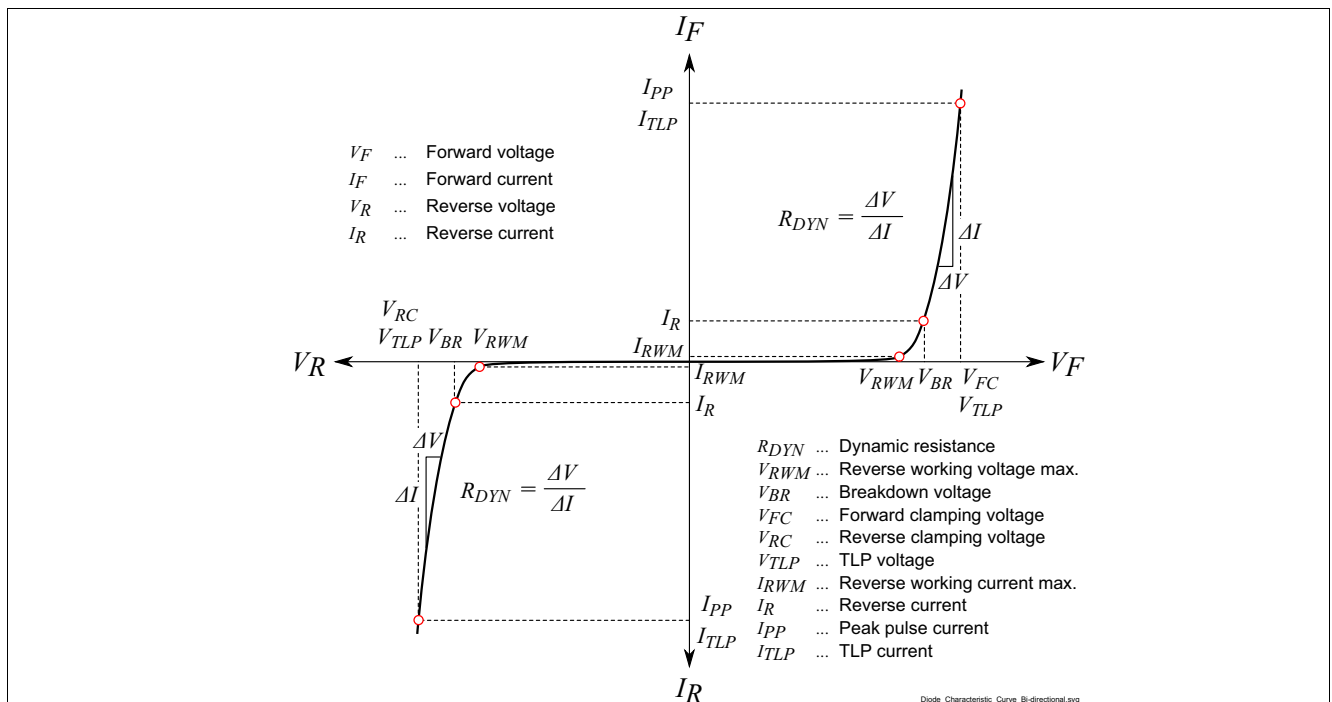
Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
ESD <sup>1)</sup>	$V_{ESD}$				kV
Contact discharge		-16	-	16	
Air discharge		-16	-	16	
Peak pulse current ( $t_p = 8/20\text{ }\mu\text{s}$ ) <sup>2)</sup>	$I_{PP}$	-3	-	3	A
Operating temperature range	$T_{OP}$	-40	-	125	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-65	-	150	$^\circ\text{C}$

1)  $V_{ESD}$  according to IEC61000-4-2 ( $R = 330$ ,  $C = 150\text{ pF}$  discharge network)

2)  $I_{PP}$  according to IEC61000-4-5 ( $t_p = 8/20\text{ }\mu\text{s}$ )

**Attention: Stresses above the max. 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 integrated circuit.**

### 2.2 Electrical Characteristics at $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified



**Figure 2-1** Definitions of electrical characteristics

**Table 2-2 DC Characteristics at  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Reverse working voltage	$V_{RWM}$	-5.5	-	5.5	V	
Breakdown voltage	$V_{BR}$	6	-	10	V	$I_{BR} = 1\text{ mA}$
Reverse current	$I_R$	-	0.1	100	nA	$V_R = 5.5\text{ V}$

**Table 2-3 RF Characteristics at  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Line capacitance	$C_L$		6.5		pF	$V_R = 0\text{ V}, f = 1\text{ MHz}$

**Table 2-4 ESD Characteristics at  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Clamping voltage <sup>1)</sup>	$V_{CL}$	-	12	-	V	$V_{ESD} = 8\text{ kV}$ contact discharge
Clamping voltage <sup>2)</sup>		-	10	-		$I_{TLP} = 1\text{ A}$
		-	13	-		$I_{TLP} = 16\text{ A}$
Clamping voltage <sup>3)</sup>		-	10	-		$I_{PP} = 1\text{ A}$
		-	12.5	-		$I_{PP} = 3\text{ A}$
Dynamic resistance <sup>2)</sup>	$R_{DYN}$	-	0.2	-	$\Omega$	

1)  $V_{ESD}$  according to IEC61000-4-2 ( $R = 330\text{ }\Omega$ ,  $C = 150\text{ pF}$  discharge network)

2) ANSI/ESDSTM5.5.1-Electrostatic Discharge Sensitivity Testing using Transmission Line Pulse (TLP) Model. TLP conditions:  $Z_0 = 50\text{ }\Omega$ ,  $t_p = 100\text{ ns}$ ,  $t_r = 0.6\text{ ns}$ ,  $I_{TLP}$  and  $V_{TLP}$  average window:  $t_1 = 30\text{ ns}$  to  $t_2 = 60\text{ ns}$ , extraction of dynamic resistance using squares fit to TLP characteristics between  $I_{TLP1} = 2.5\text{ A}$  and  $I_{TLP2} = 17\text{ A}$ . Please refer to Application Note AN210[1]

3)  $I_{PP}$  according to IEC61000-4-5 ( $t_p = 8/20\text{ }\mu\text{s}$ )

### 3 Typical Characteristics

Curves specified at  $T_A = 25\text{ °C}$ , unless otherwise specified

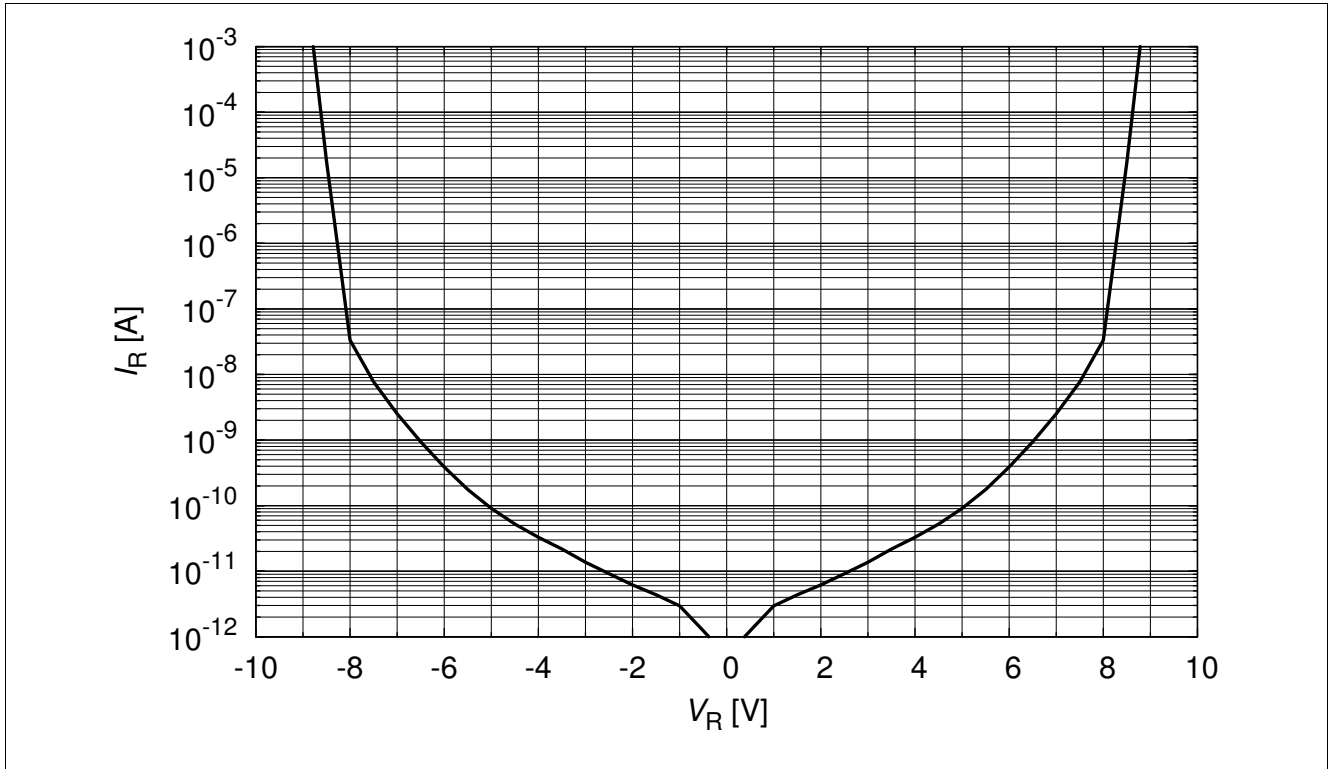


Figure 3-1 Reverse current:  $I_R = f(V_R)$

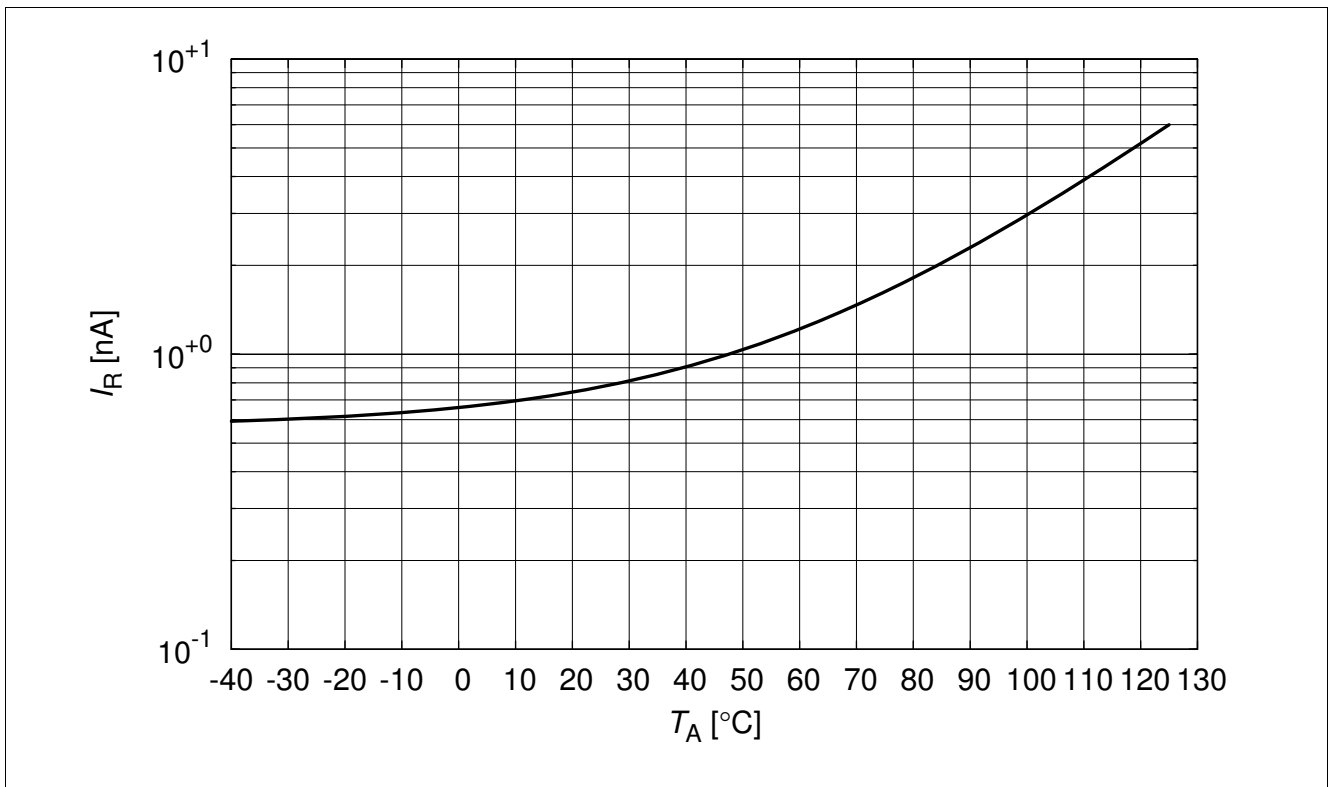


Figure 3-2 Reverse current:  $I_R = f(T_A)$ ,  $V_R = 5.5\text{ V}$

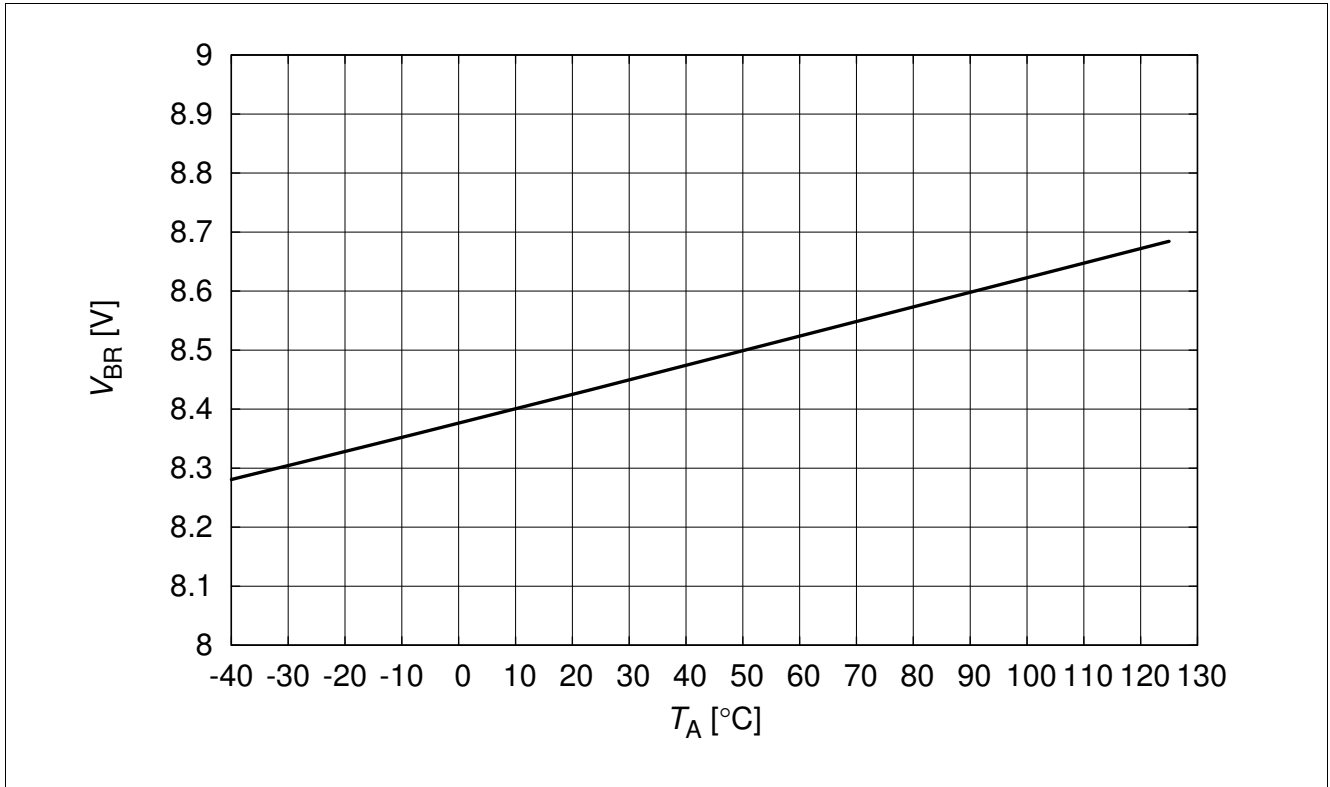


Figure 3-3 Reverse voltage:  $V_{BR} = f(T_A)$ ,  $I_R = 1$  mA

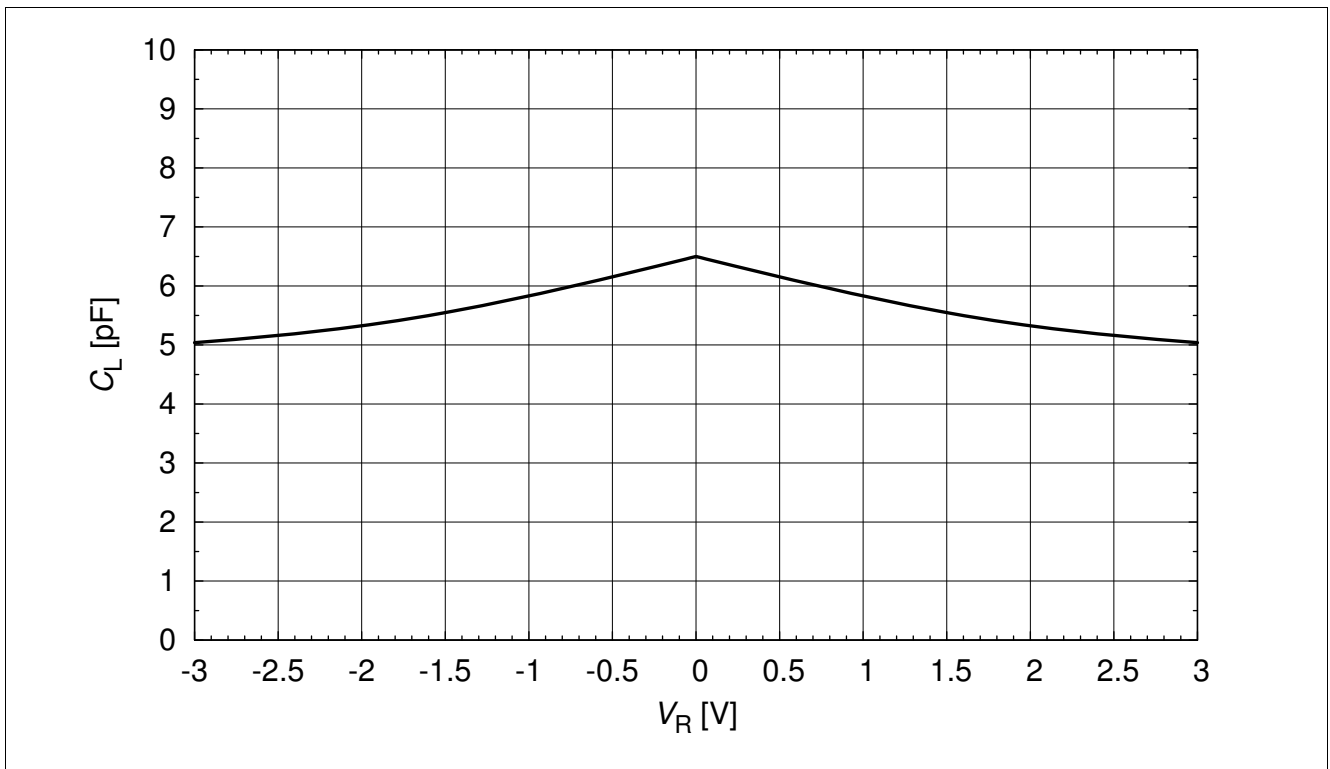
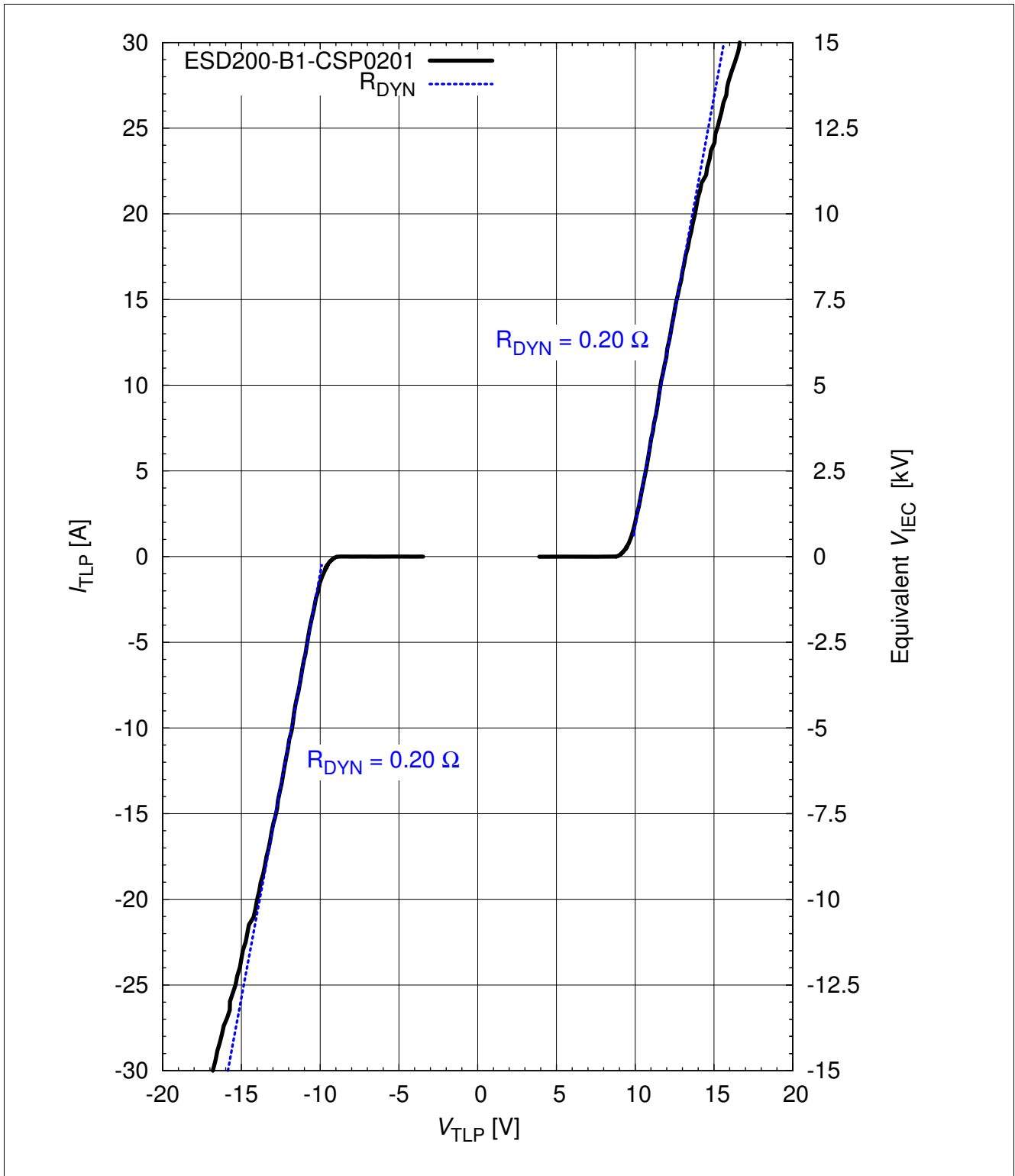


Figure 3-4 Line capacitance:  $C_L = f(V_R)$ ,  $f = 1$  MHz





**Figure 3-5 Clamping voltage (TLP):  $I_{TLP} = f(V_{TLP})$  according ANSI/ESDSTM5.5.1-Electrostatic Discharge Sensitivity Testing using Transmission Line Pulse (TLP) Model. TLP conditions:  $Z_0 = 50 \Omega$ ,  $t_p = 100 \text{ ns}$ ,  $t_r = 0.6 \text{ ns}$ ,  $I_{TLP}$  and  $V_{TLP}$  average window:  $t_1 = 30 \text{ ns}$  to  $t_2 = 60 \text{ ns}$ , extraction of dynamic resistance using squares fit to TLP characteristics between  $I_{TLP1} = 2.5 \text{ A}$  and  $I_{TLP2} = 17 \text{ A}$ . Please refer to Application Note AN210[1]**

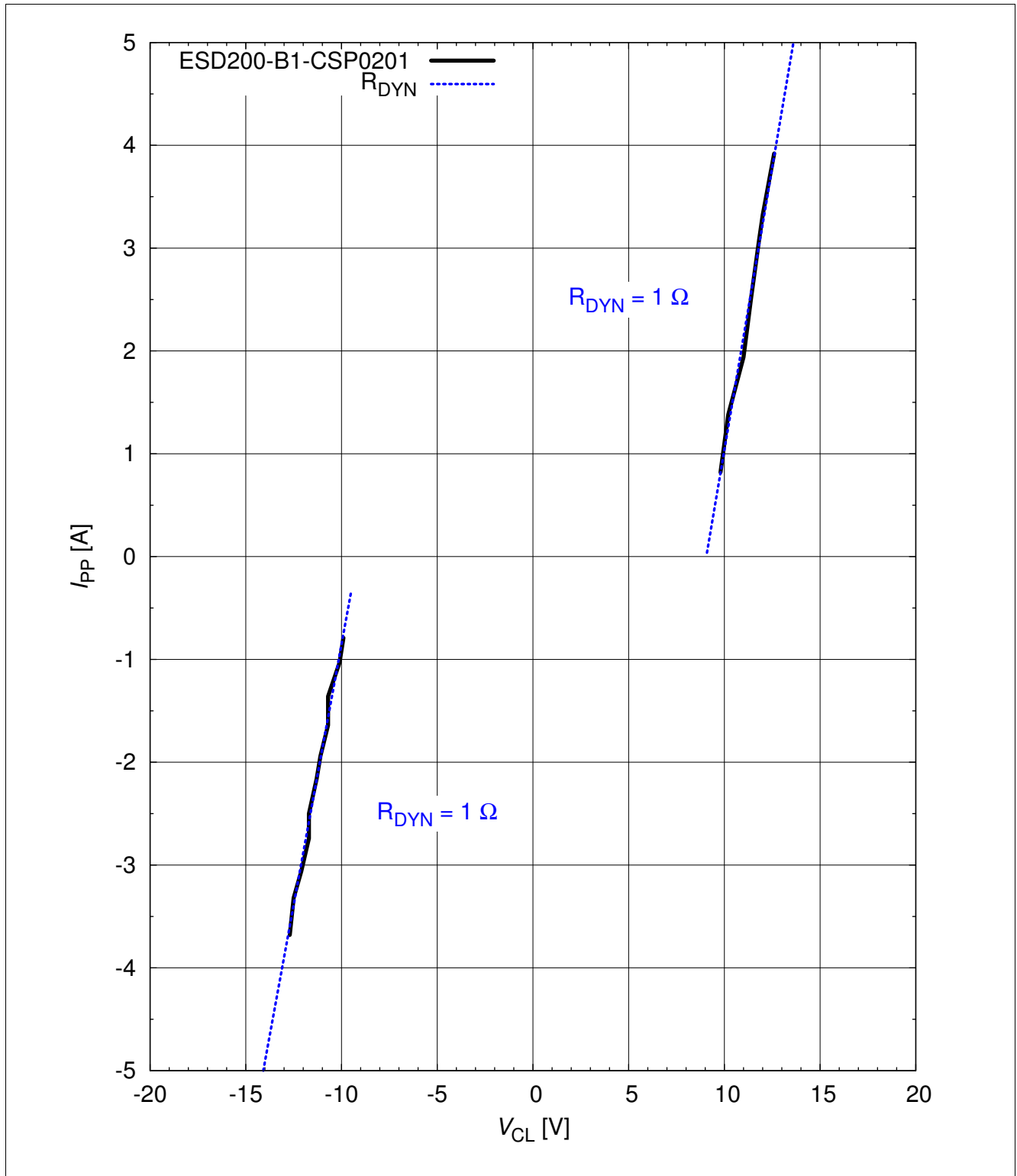


Figure 3-6 Pulse current (IEC61000-4-5) versus clamping voltage:  $I_{PP} = f(V_{CL})$

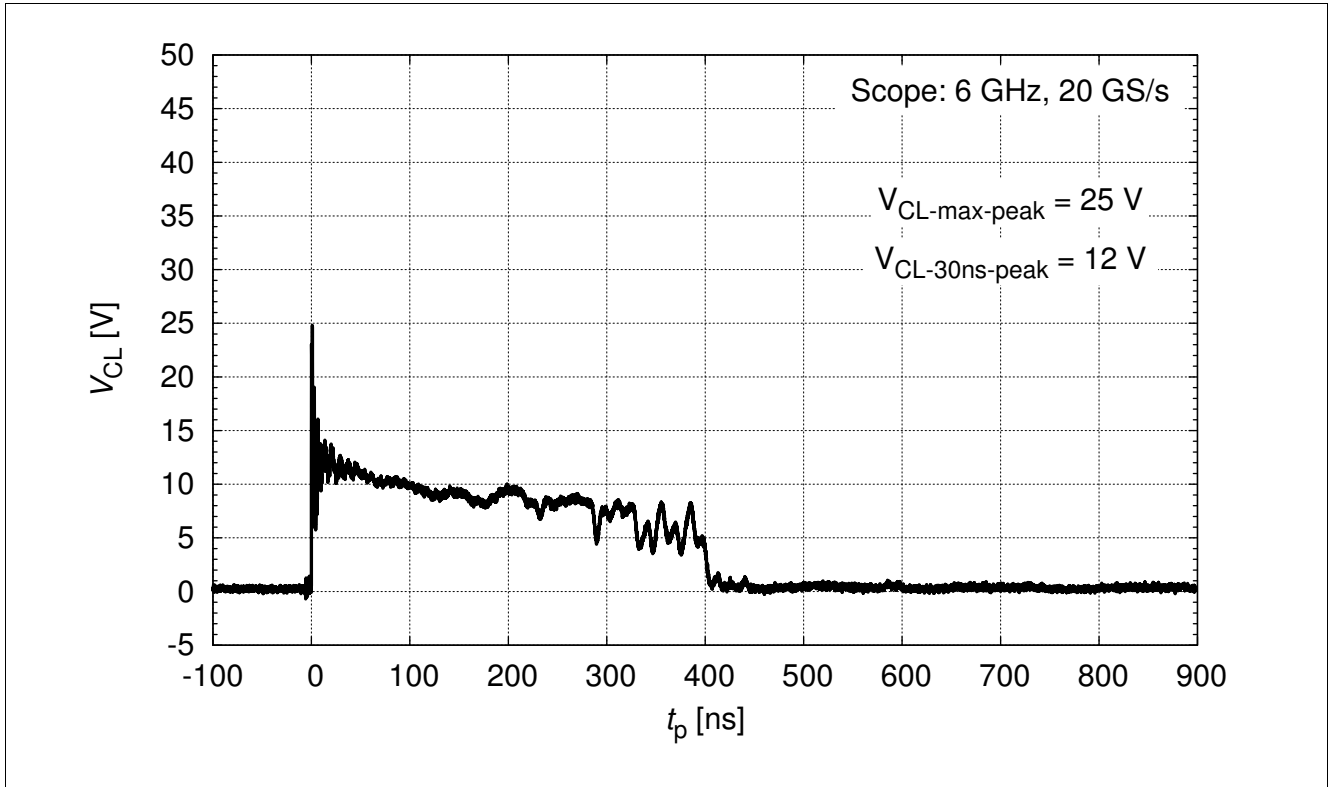


Figure 3-7 IEC61000-4-2:  $V_{CL} = f(t)$ , +8 kV pulse

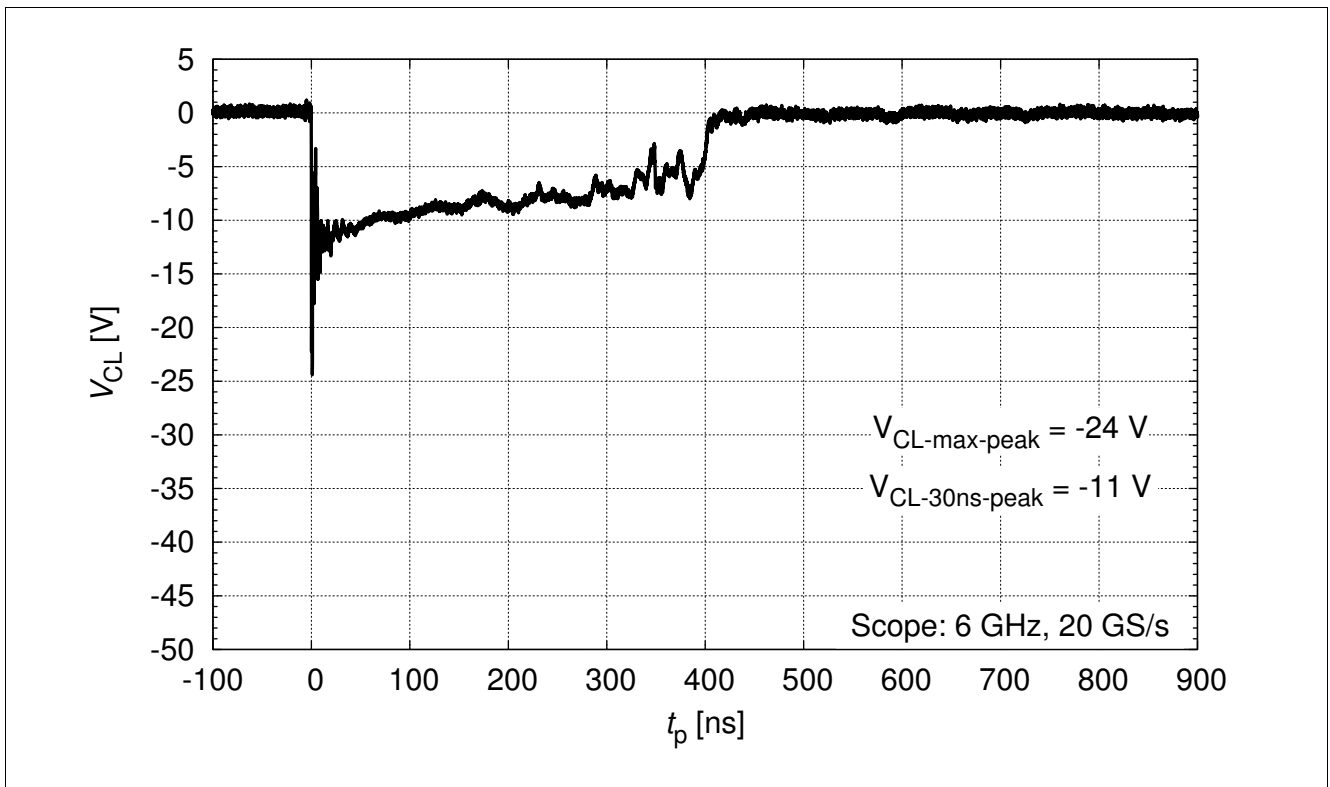


Figure 3-8 IEC61000-4-2:  $V_{CL} = f(t)$ , -8 kV pulse

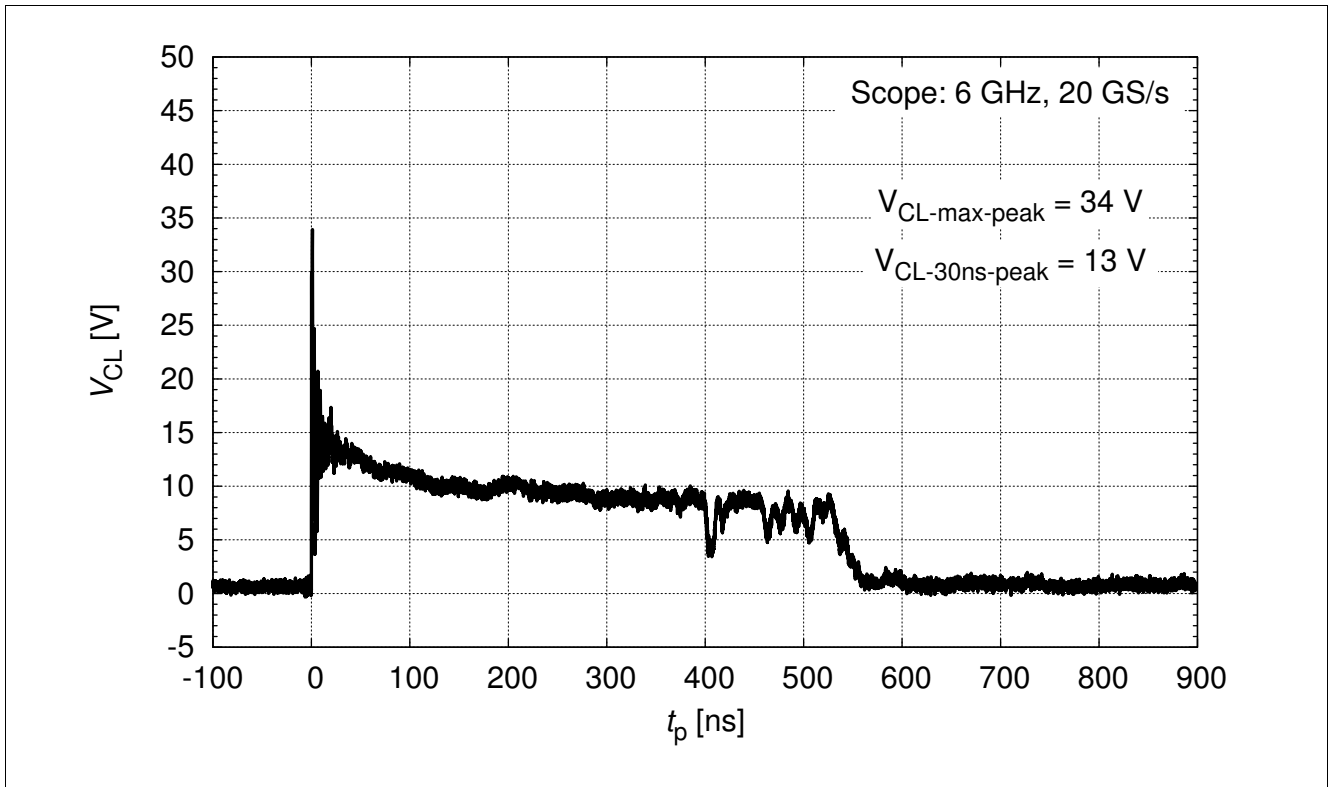


Figure 3-9 IEC61000-4-2:  $V_{CL} = f(t)$ , +15 kV pulse

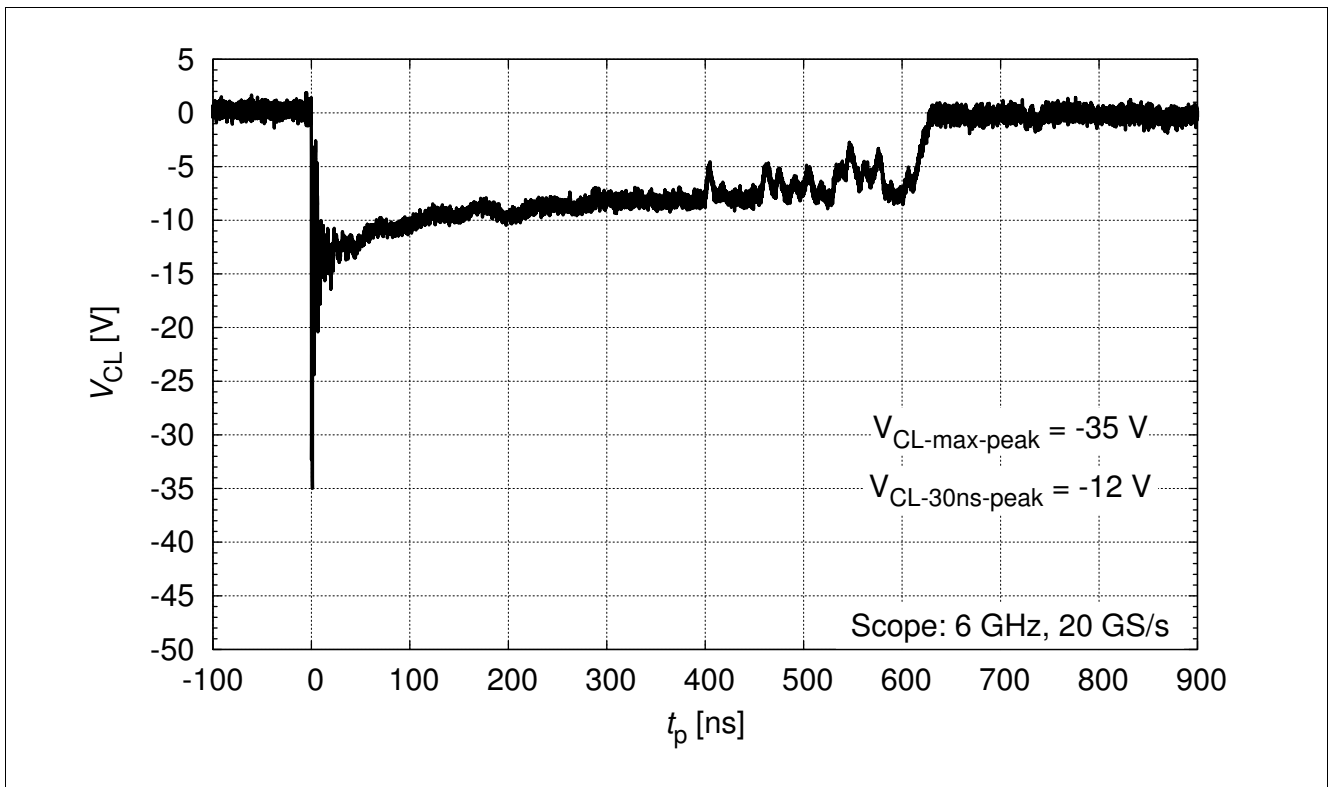
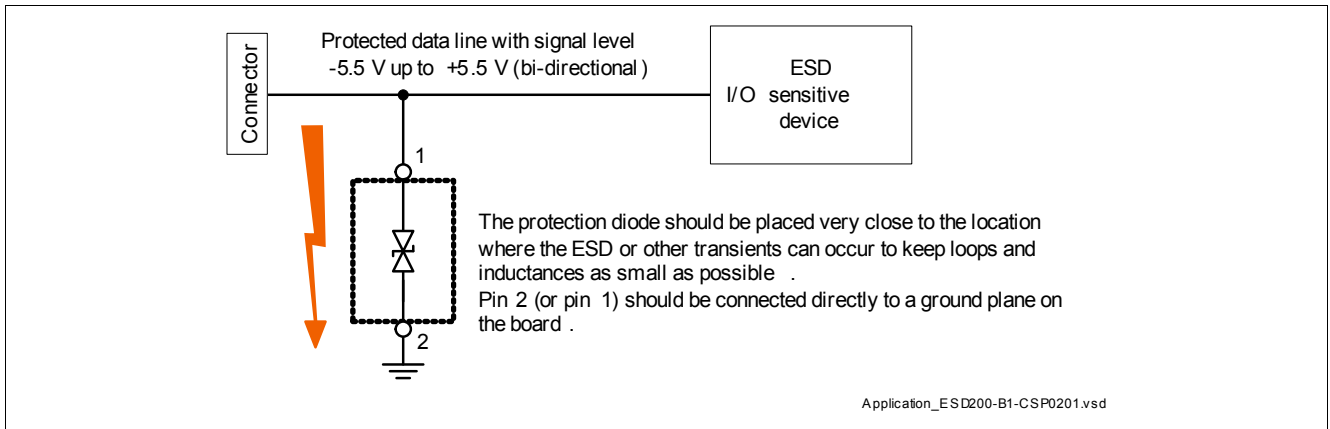


Figure 3-10 IEC61000-4-2:  $V_{CL} = f(t)$ , -15 kV pulse

## 4 Application Information



**Figure 4-1 Single line, bi-directional ESD / Transient protection**

## 5 Package

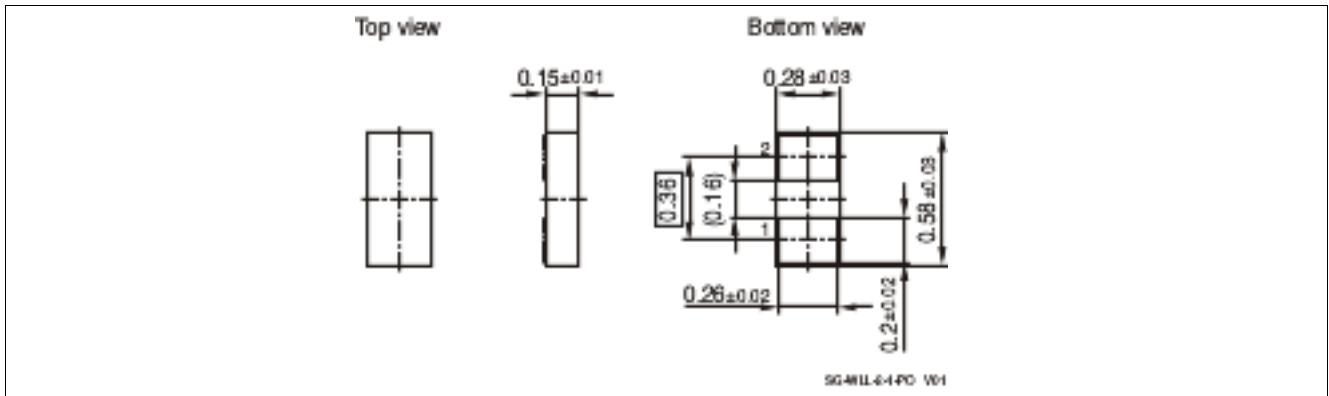


Figure 5-1 WLL-2-1 Package outline (dimension in mm)

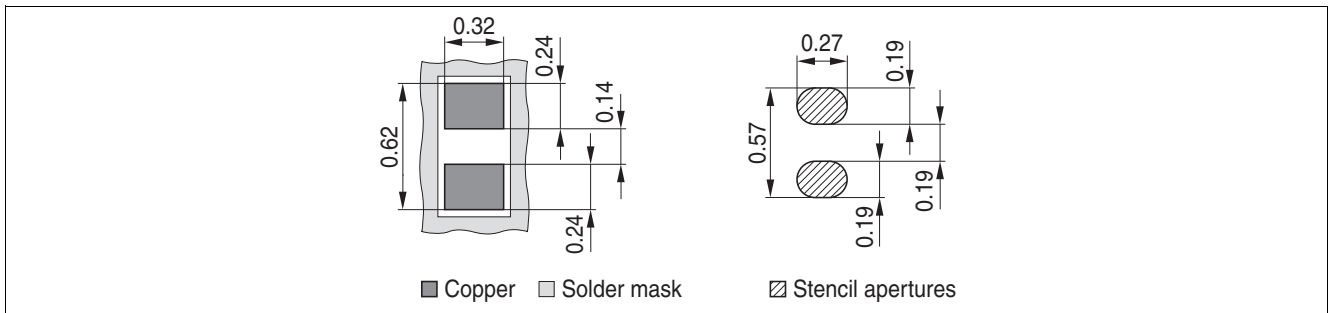


Figure 5-2 WLL-2-1 Footprint (dimension in mm)

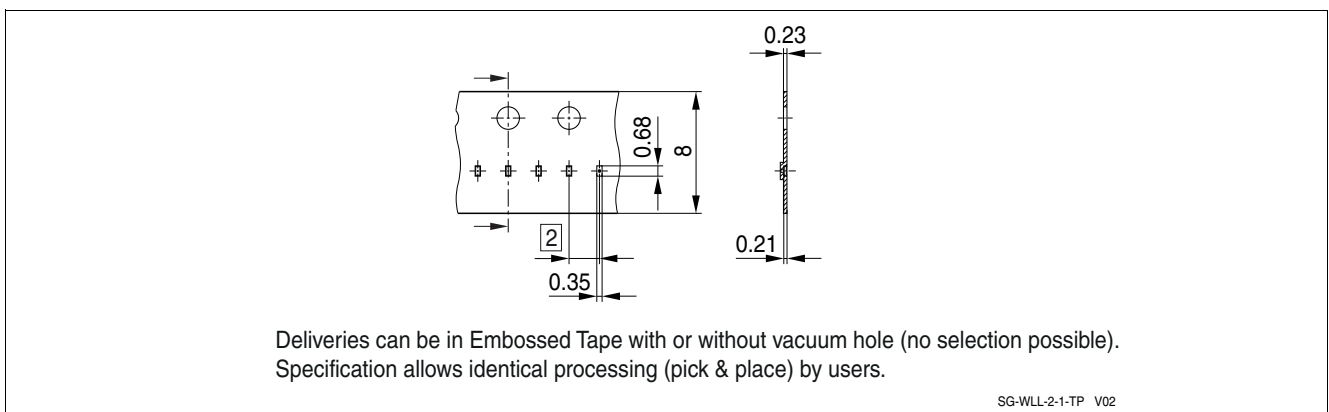


Figure 5-3 WLL-2-1 Packing (dimension in mm)

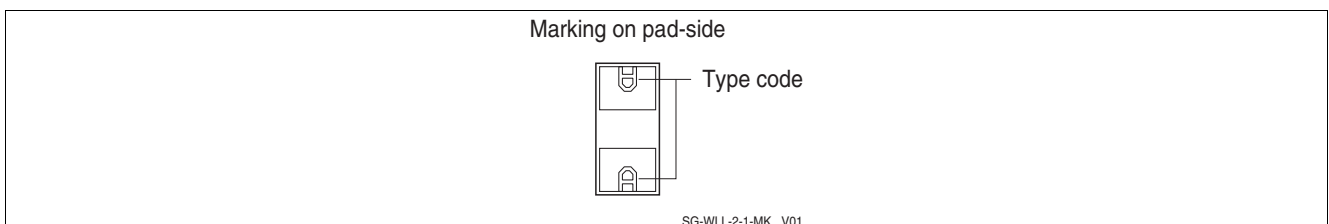


Figure 5-4 WLL-2-1 Marking (example)

**References**

- [1] Infineon AG - **Application Note AN210**: Effective ESD Protection design at System Level Using VF-TLP Characterization Methodology

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