

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): $\pm 16 \text{ kV}$ (air/contact discharge)
 - IEC61000-4-5 (surge): $\pm 3 \text{ A}$ (8/20 μs)
- Low clamping voltage
- Low dynamic resistance: $R_{\text{DYN}} \leq 0.2 \Omega \text{ typ.}$
- Supports applications with signal voltage between -5.5 V and 5.5 V max.
- Line capacitance: $C_L = 6.5 \text{ pF}$
- 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

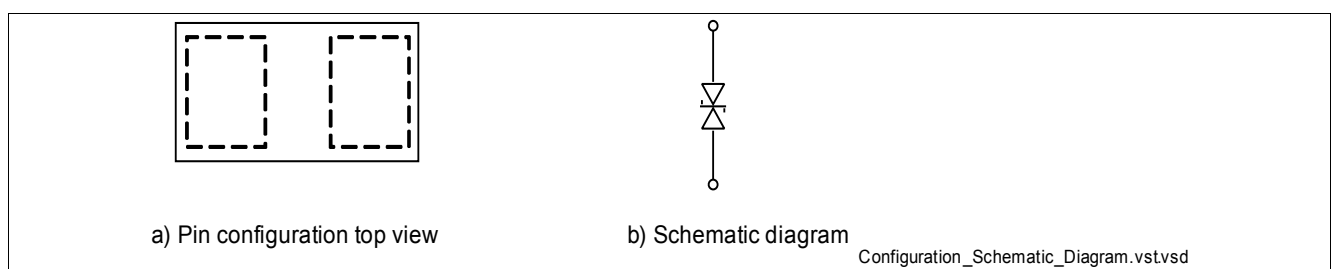


Figure 1-1 Pin Configuration and Schematic Diagram

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 ¹⁾	V_{ESD}				kV
Contact discharge		-16	-	16	
Air discharge		-16	-	16	
Peak pulse current ($t_p = 8/20\text{ }\mu\text{s}$) ²⁾	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 ($R = 330\text{ }\Omega$, $C = 150\text{ pF}$ 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

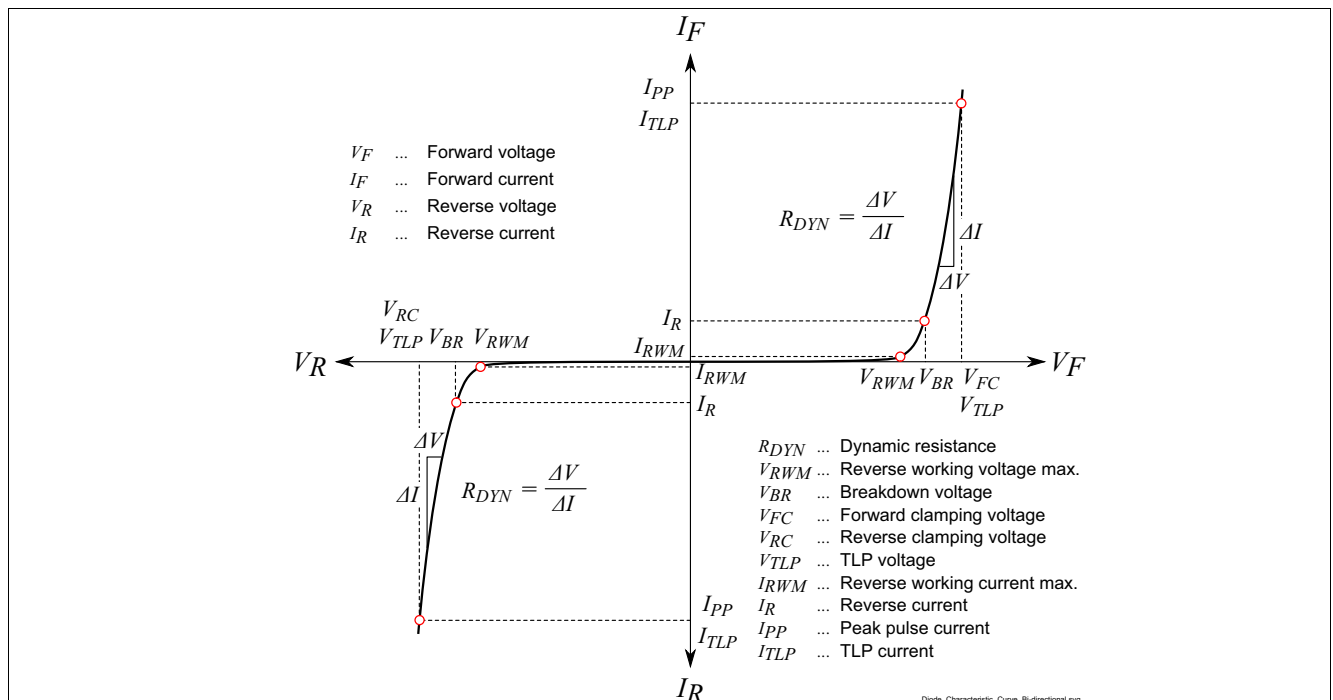


Figure 2-1 Definitions of electrical characteristics

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 ¹⁾	V _{CL}	-	12	-	V	V _{ESD} = 8 kV contact discharge
Clamping voltage ²⁾		- -	10 13	- -		I _{TLP} = 1 A I _{TLP} = 16 A
Clamping voltage ³⁾		- -	10 12.5	- -		I _{PP} = 1 A I _{PP} = 3 A
Dynamic resistance ²⁾	R _{DYN}	-	0.2	-	Ω	

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

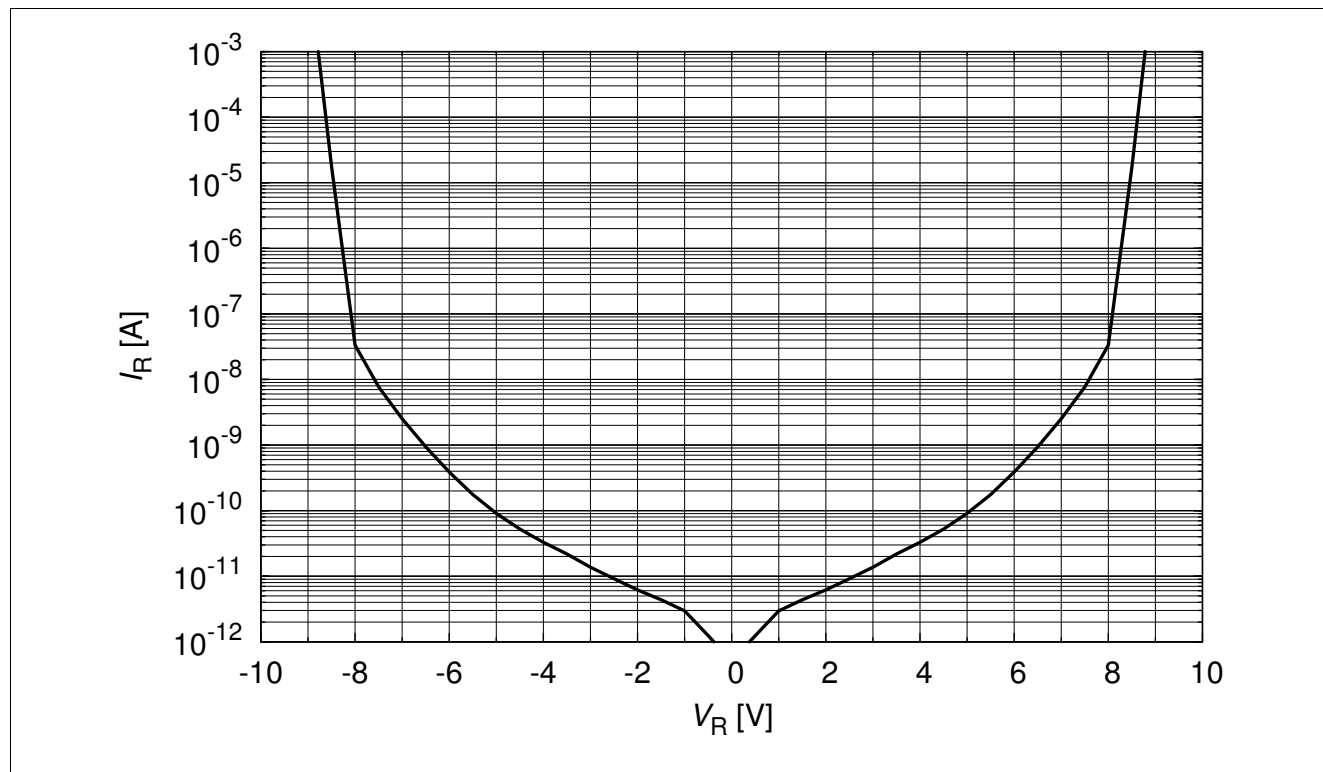


Figure 3-1 Reverse current: $I_R = f(V_R)$

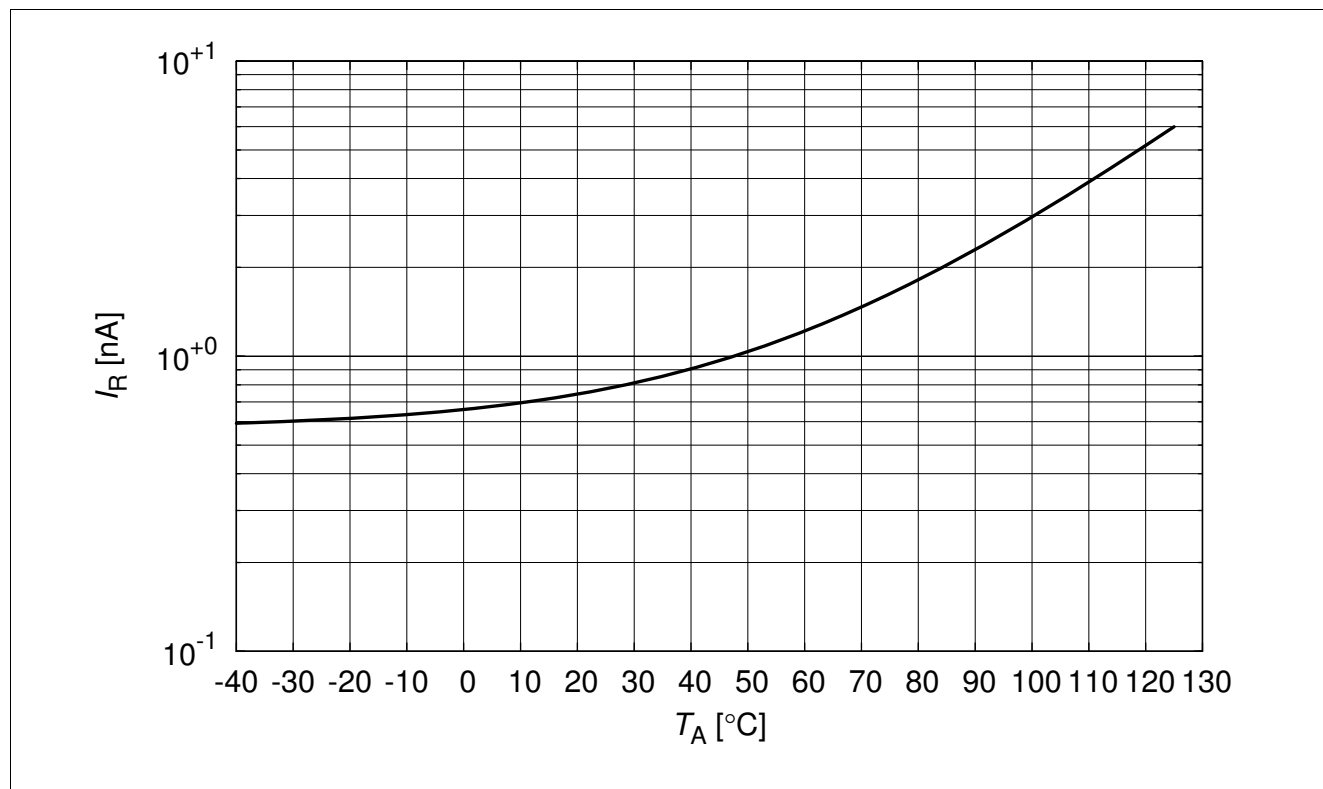


Figure 3-2 Reverse current: $I_R = f(T_A)$, $V_R = 5.5\text{ V}$

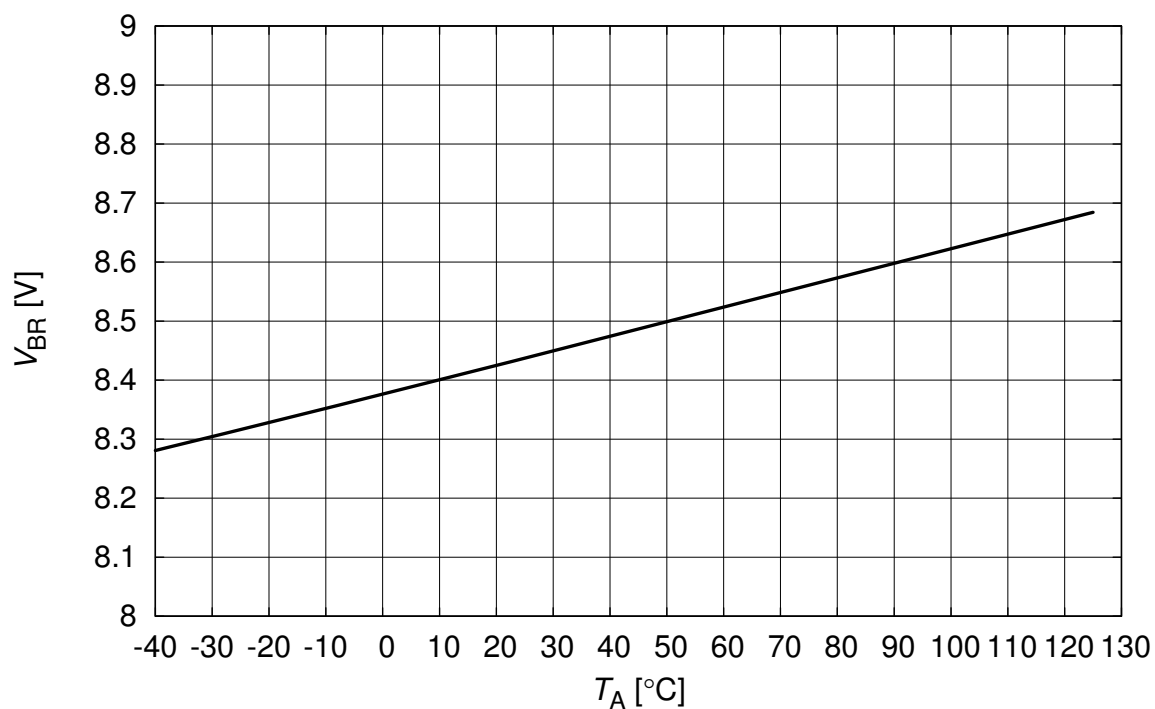


Figure 3-3 Reverse voltage: $V_{BR} = f(T_A)$, $I_R = 1$ mA

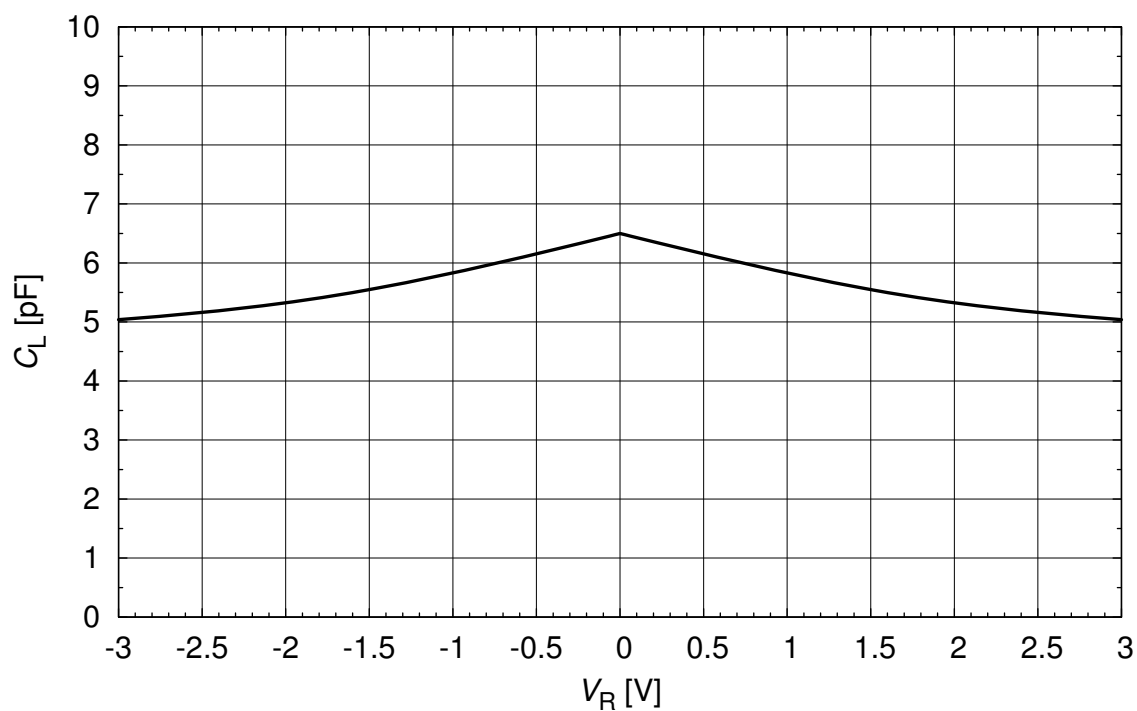


Figure 3-4 Line capacitance: $C_L = f(V_R)$, $f = 1$ MHz

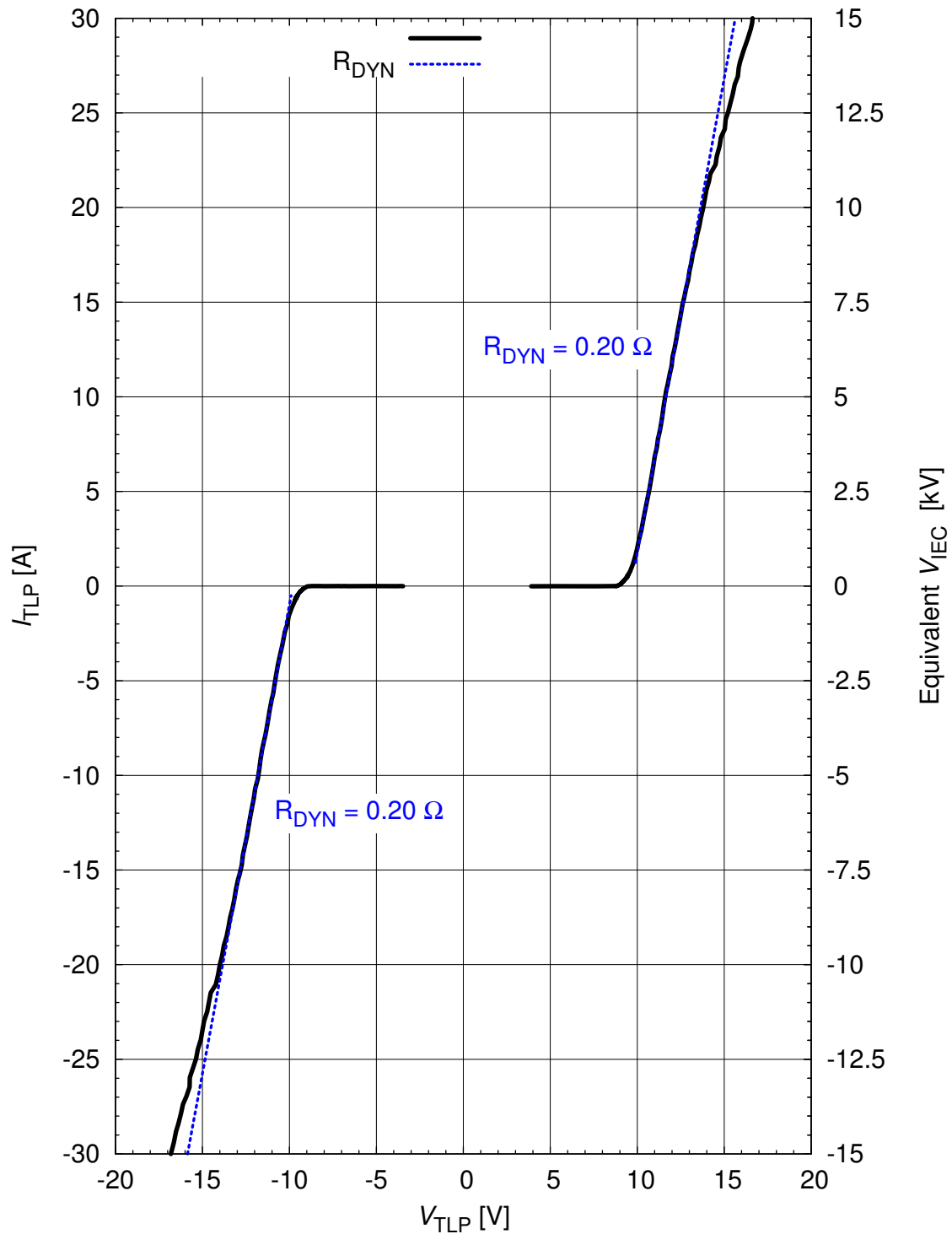


Figure 3-5 Clamping voltage (TLP): $I_{TLP} = f(V_{TLP})$ according ANSI/ESDSTM5.5.1-Electrostatic Discharge Sensitivity Testing using Transmission Line Pulse (TLP) Model. TLP conditions: $Z_0 = 50 \Omega$, $t_p = 100$ ns, $t_r = 0.6$ ns, I_{TLP} and V_{TLP} average window: $t_1 = 30$ ns to $t_2 = 60$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

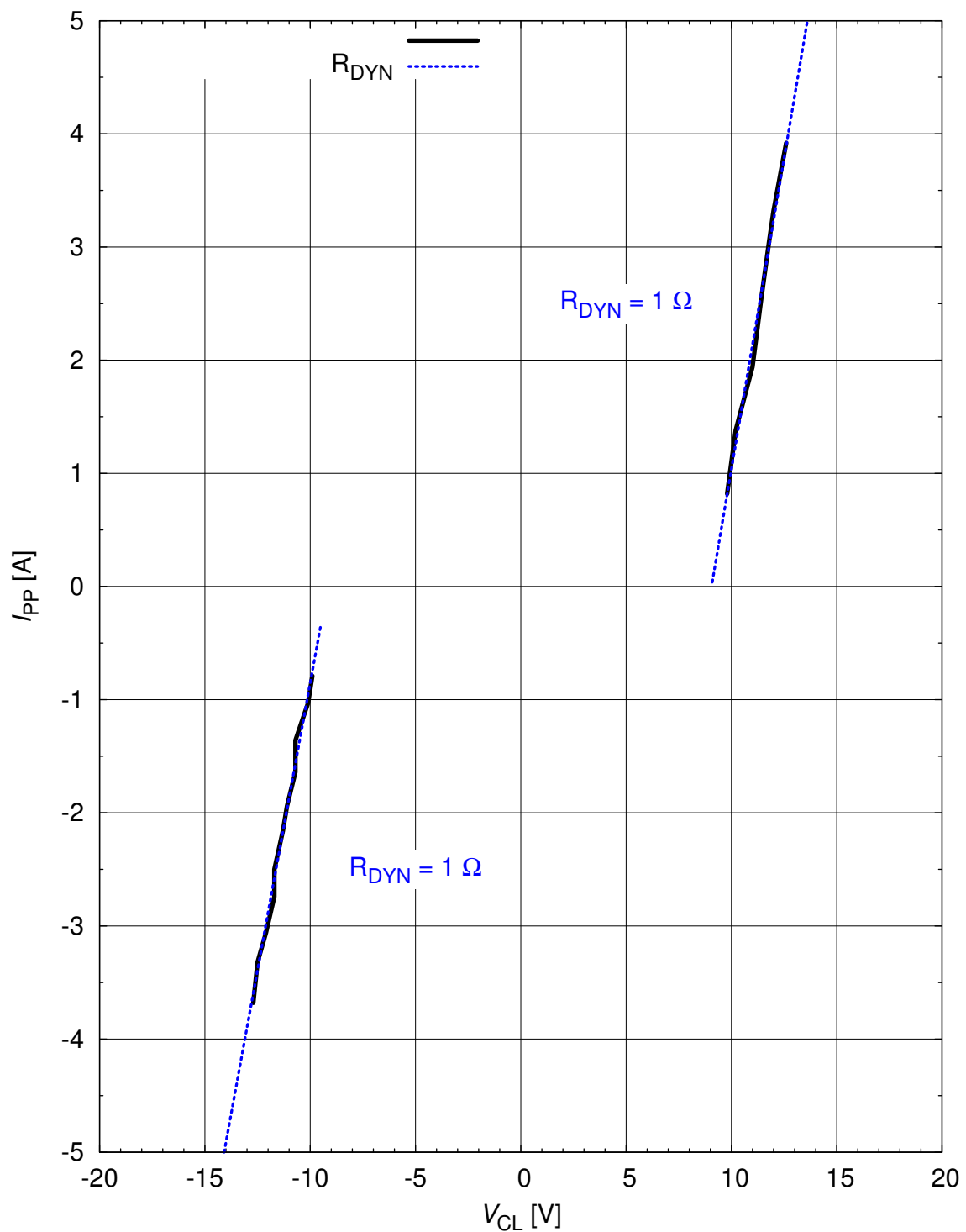


Figure 3-6 Pulse current (IEC61000-4-5) versus clamping voltage: $I_{PP} = f(V_{CL})$

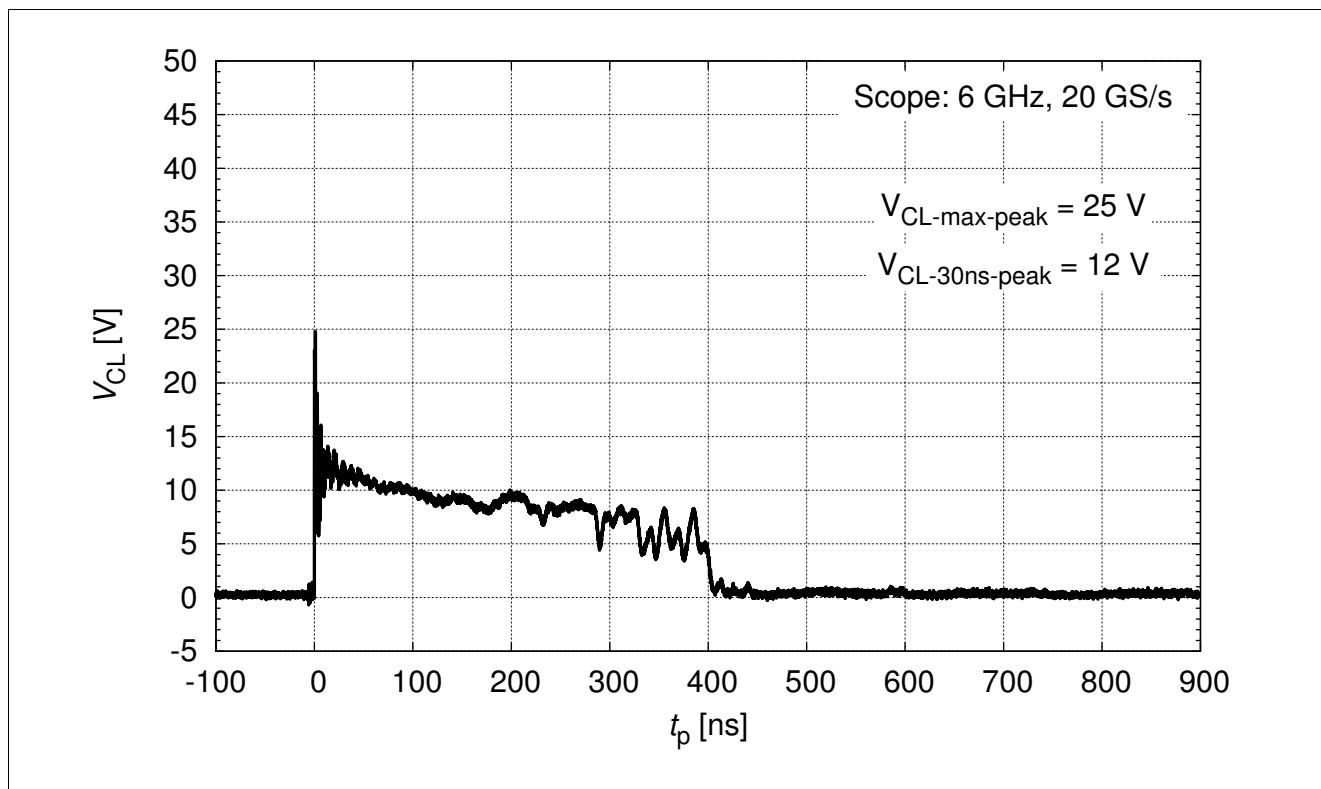


Figure 3-7 IEC61000-4-2: $V_{CL} = f(t)$, +8 kV pulse

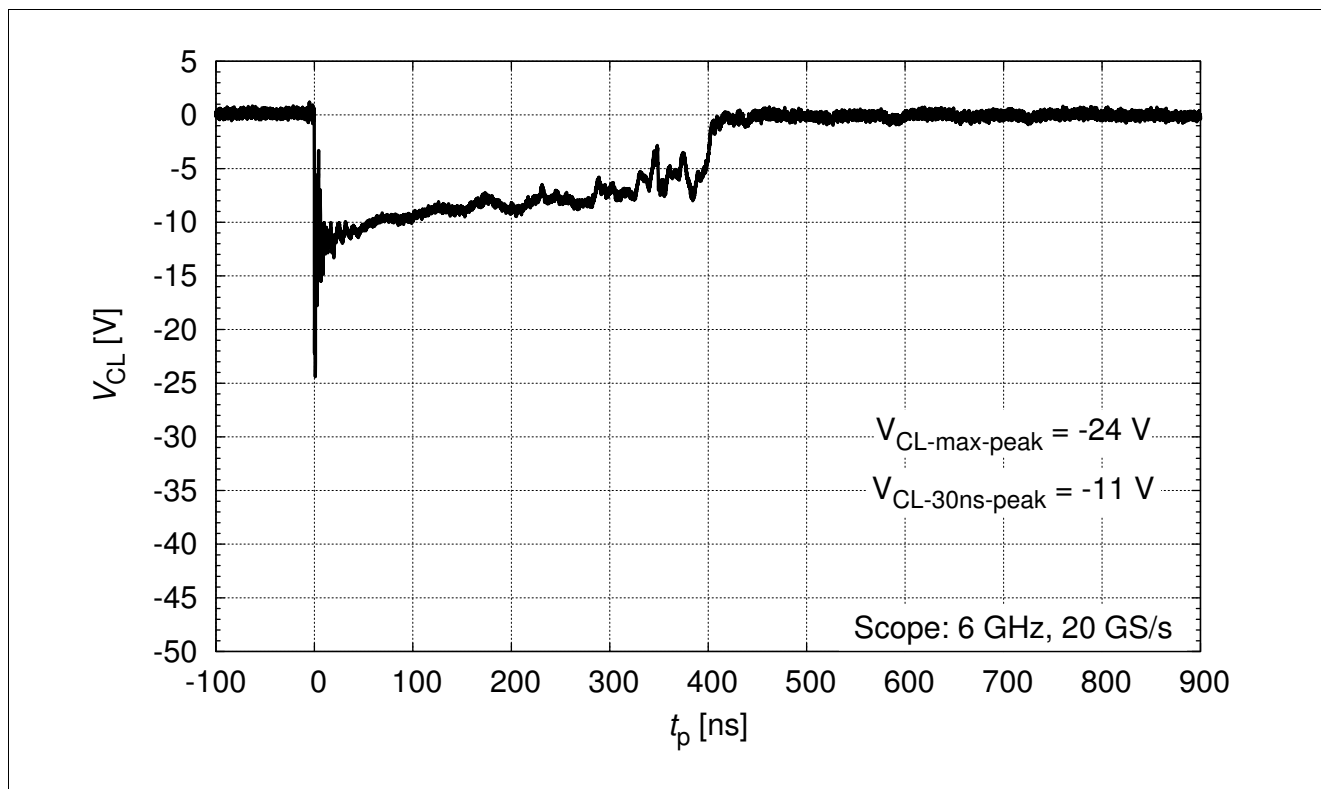


Figure 3-8 IEC61000-4-2: $V_{CL} = f(t)$, -8 kV pulse

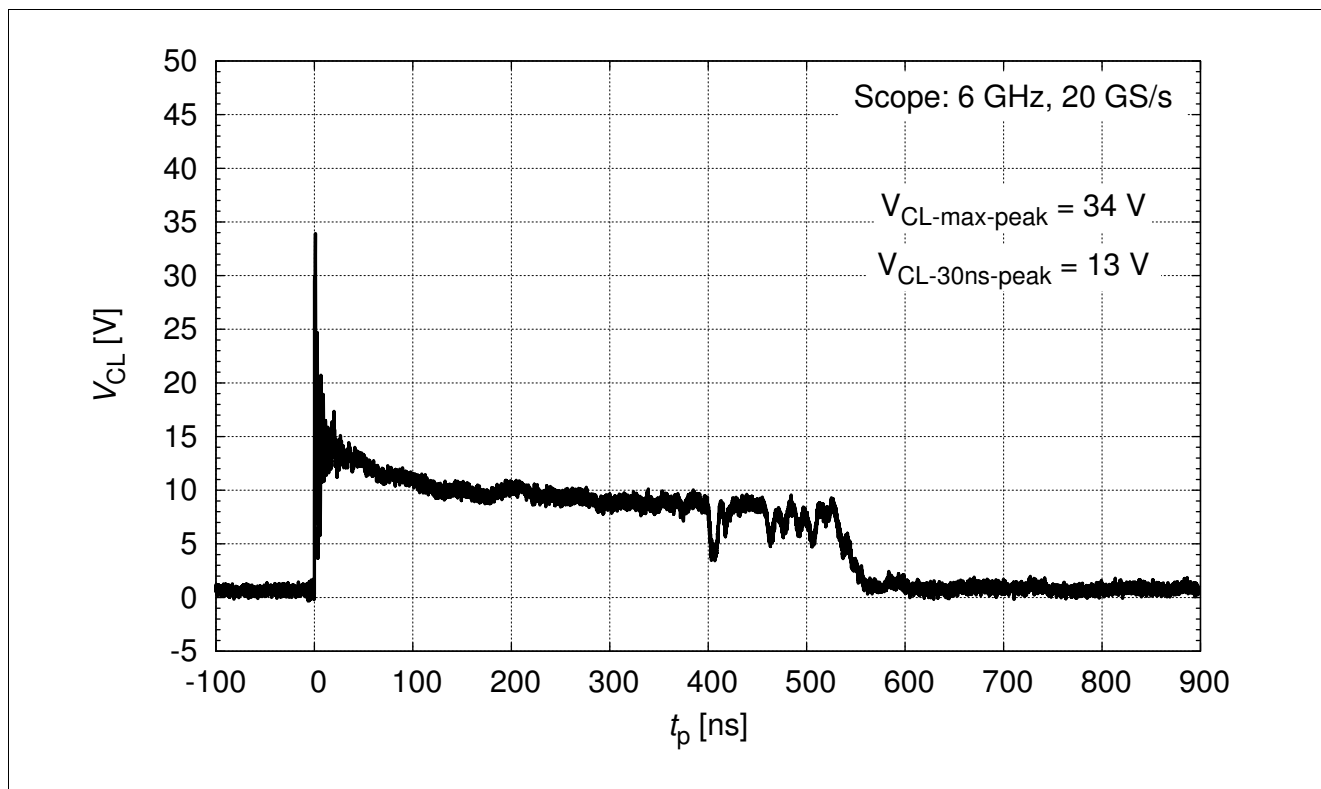


Figure 3-9 IEC61000-4-2: $V_{CL} = f(t)$, +15 kV pulse

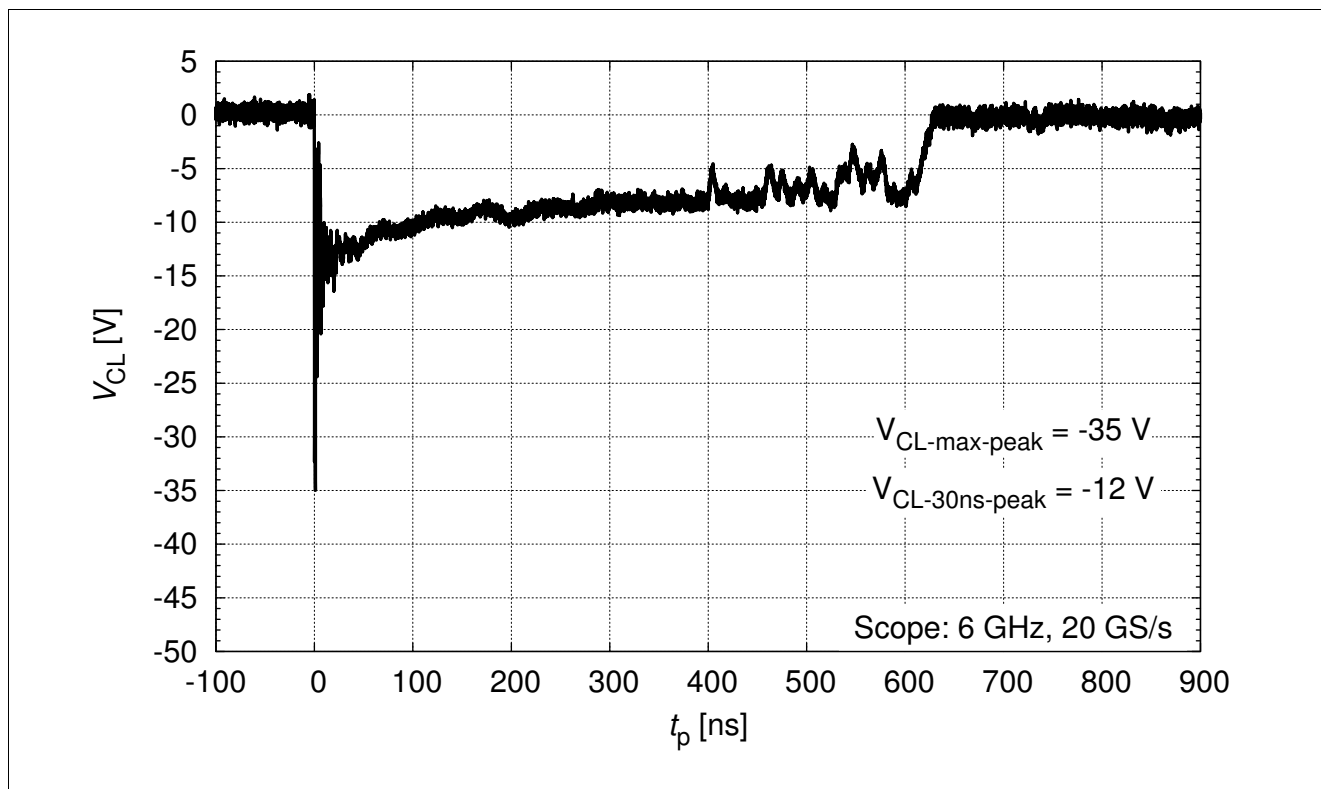


Figure 3-10 IEC61000-4-2: $V_{CL} = f(t)$, -15 kV pulse

4 Application Information

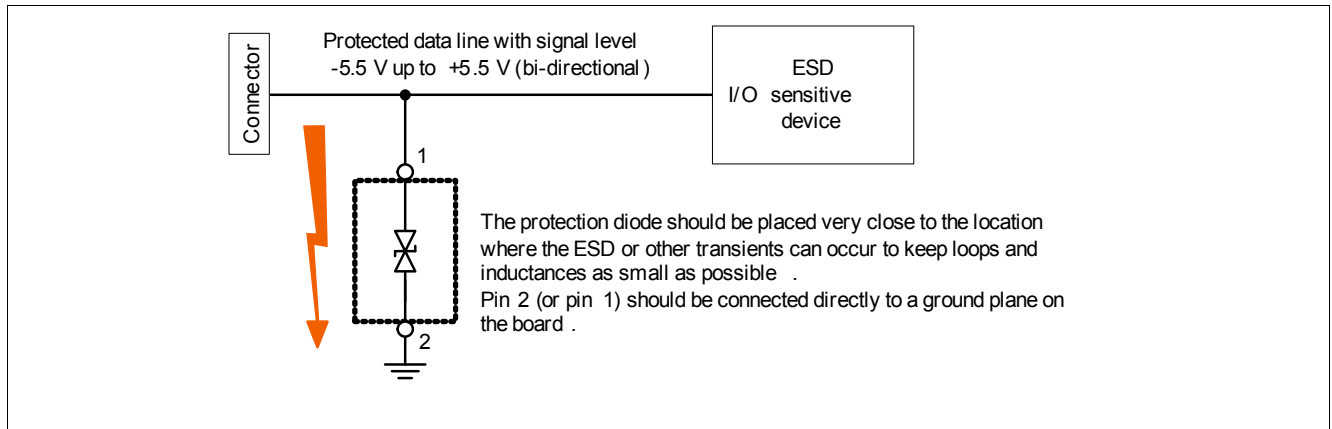


Figure 4-1 Single line, bi-directional ESD / Transient protection

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