# TVS Diode

Transient Voltage Suppressor Diodes

# ESD3V3S1B Series

Ultra Low Clamping Bi-directional ESD / Transient Protection Diode

ESD3V3S1B-02LRH
ESD3V3S1B-02LS

## Data Sheet

Revision 1.1, 2011-11-28
Final

Industrial and Multi-Market

**Edition 2011-11-28**

**Published by**
**Infineon Technologies AG**
**81726 Munich, Germany**



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| Revision History | |
|---|---|
| **Page or Item** | **Subjects (major changes since previous revision)** |
| **Revision 1.1, 2011-11-28** | |
| **Revision 1.1; 2011-11-28** | Features 1.1; Table 3-1; Table 3-3; Table 3-4 |
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Last Trademarks Update 2010-10-26

# Table of Contents

# List of Figures

# List of Tables

# 1 Ultra Low Clamping Bi-directional ESD / Transient Protection Diode

## 1.1 Features

- ESD / transient protection of signal lines in low voltage applications according to:
  - IEC61000-4-2 (ESD): ±30 kV (contact)
  - IEC61000-4-4 (EFT): 40 A (5/50 ns)
  - IEC61000-4-5 (surge): 8 A (8/20 µs)
- Bi-directional, symmetrical working voltage up to $V_{RWM}$ = ±3.3 V
- Ultra low clamping voltage $V_{CL}$ = 7 V typ. @ $I_{PP}$ = 16 A (TLP)
- Ultra low dynamic resistance $R_{DYN}$ = 0.13 Ω typ.
- Smallest form factor: 0.62 x 0.32 x 0.31 $mm^3$
- Pb-free (RoHS compliant) and halogen free package

## 1.2 Application Examples

- Audio Line, Speaker, Headset, Microphone Protection
- Human Interface Devices (Keyboard, Touchpad, Buttons)

# 2 Product Description

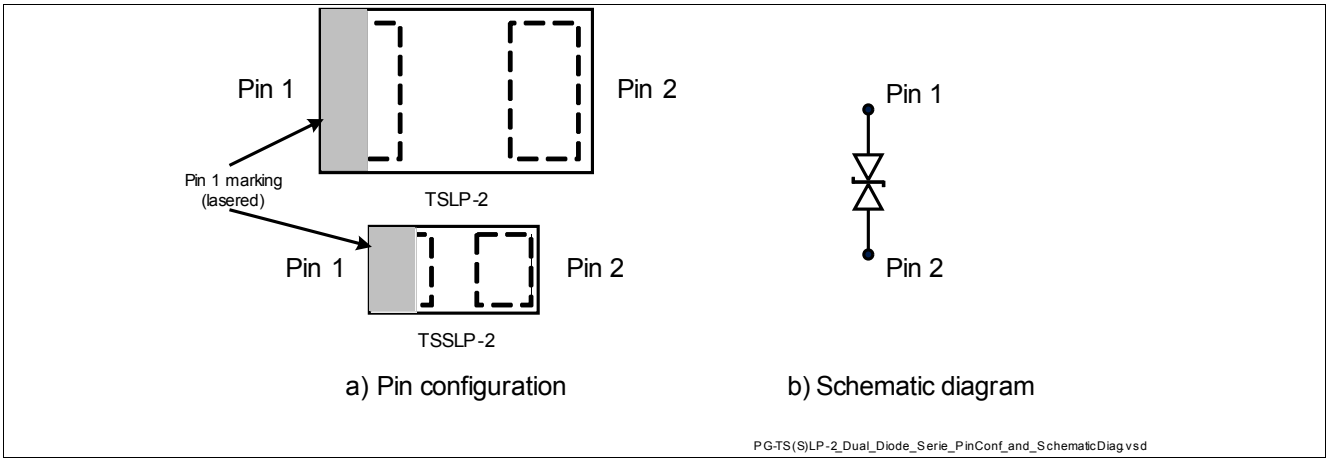



**Figure 2-1 Pin Configuration and Schematic Diagram**

**Table 2-1 Ordering Information**

| Type | Package | Configuration | Marking code |
|---|---|---|---|
| ESD3V3S1B-02LRH | PG-TSLP-2-17 | 1 line, bi-directional | Y |
| ESD3V3S1B-02LS | PG-TSSLP-2-1 | 1 line, bi-directional | Y |

# 3 Characteristics

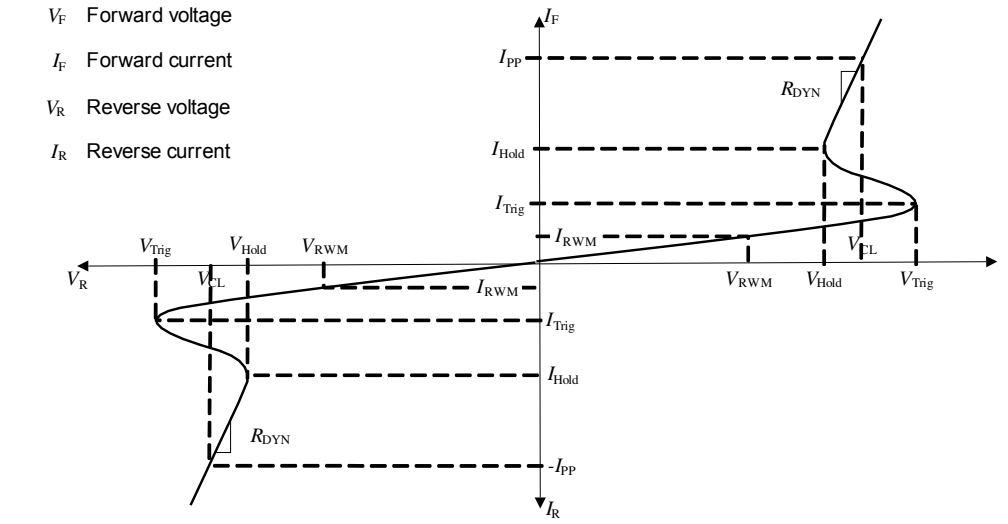
**Table 3-1 Maximum Ratings** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| ESD contact discharge[1)] | $V_{ESD}$ | – | – | 30 | kV |
| Peak pulse current ($t_p$ = 8/20 µs)[2)] | $I_{PP}$ | – | – | 8 | A |
| Operating temperature range | $T_{OP}$ | -40 | – | 125 | °C |
| Storage temperature | $T_{stg}$ | -65 | – | 150 | °C |

1) $V_{ESD}$ according to IEC61000-4-2

2) $I_{PP}$ according to IEC61000-4-5

## 3.1 Electrical Characteristics at $T_A$ = 25 °C, unless otherwise specified




| | | | |
|---|---|---|---|
| $R_{DYN}$ | Dynamic resistance | $V_{FC}$ | Forward clamping voltage |
| $V_{Trig}$ | Triggering reverse voltage | $I_{Trig}$ | Triggering reverse current |
| $V_{CL}$ | Clamping voltage | $I_{Hold}$ | Holding reverse current |
| $V_{Hold}$ | Holding reverse voltage | $I_{PP}$ | Peak pulse current |
| $V_{RWM}$ | Reverse working voltage maximum | $I_{RWM}$ | Reverse working current maximum |

Diode_Characteristic_Curve_with _snapback_Bi-directional.vsd

**Figure 3-1 Definitions of electrical characteristics**

**Table 3-2 DC Characteristics** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Reverse working voltage | $V_{RWM}$ | -3.3 | – | 3.3 | V | |
| Reverse current | $I_R$ | – | – | 50 | nA | $V_R$ = 3.3 V |

**Table 3-3 RF Characteristics** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Line capacitance | $C_L$ | – | 14 | 20 | pF | $V_R$ = 0 V, $f$ = 1 MHz |

**Table 3-4 ESD Characteristics** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Clamping voltage[1)] | $V_{CL}$ | – | 7 | – | V | $I_{PP}$ = 16 A, $t_p$ = 100 ns |
| | | – | 9 | – | V | $I_{PP}$ = 30 A, $t_p$ = 100 ns |
| Clamping voltage[2)] | $V_{CL}$ | – | 4.5 | – | V | $I_{PP}$ = 1 A, $t_p$ = 8/20 µs |
| | | – | 6.8 | – | V | $I_{PP}$ = 8 A, $t_p$ = 8/20 µs |
| Dynamic resistance[1)] | $R_{DYN}$ | – | 0.13 | – | Ω | |

1) Please refer to Application Note AN210 [1]. TLP parameter: $Z_0$ = 50 Ω, $t_p$ = 100ns, $t_r$ = 300ps, averaging window: $t_1$ = 30 ns to $t_2$ = 60 ns, extraction of dynamic resistance using least squares fit of TLP charactertistics between $I_{PP1}$ = 10 A and $I_{PP2}$ = 40 A.

2) $I_{PP}$ according to IEC61000-4-5

## 3.2 Typical Characteristics at $T_A$ = 25 °C, unless otherwise specified

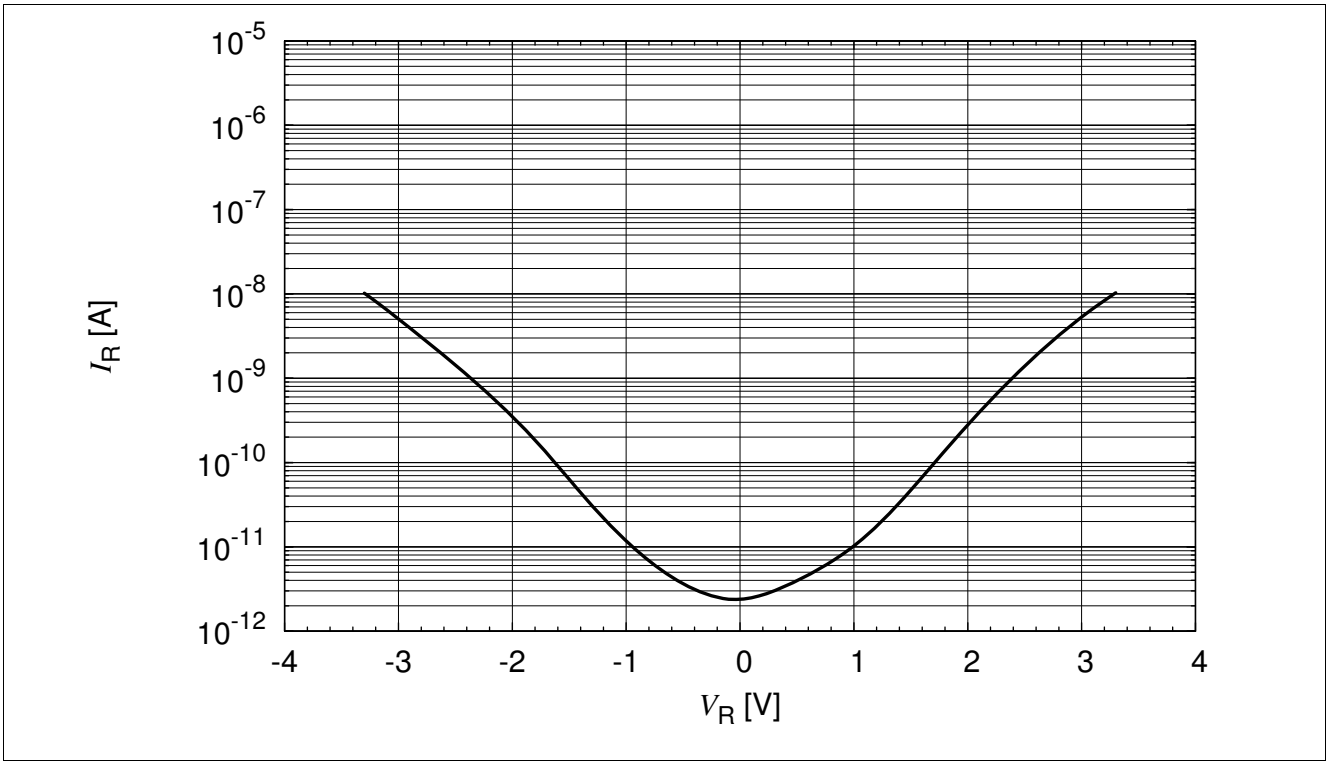



**Figure 3-2 Reverse current: $I_R = f(V_R)$**

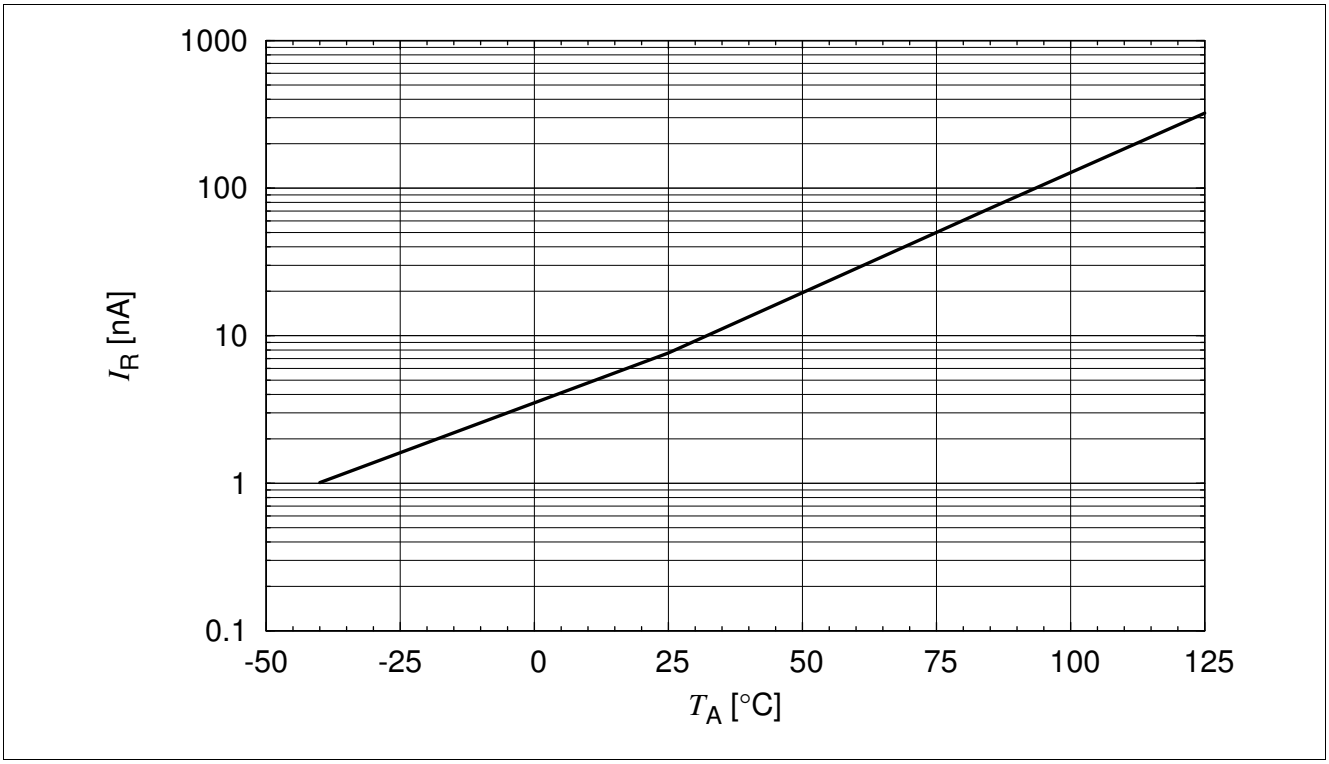



**Figure 3-3 Reverse current: $I_R = f(T_A)$ , $V_R$ = 3.3 $V$**

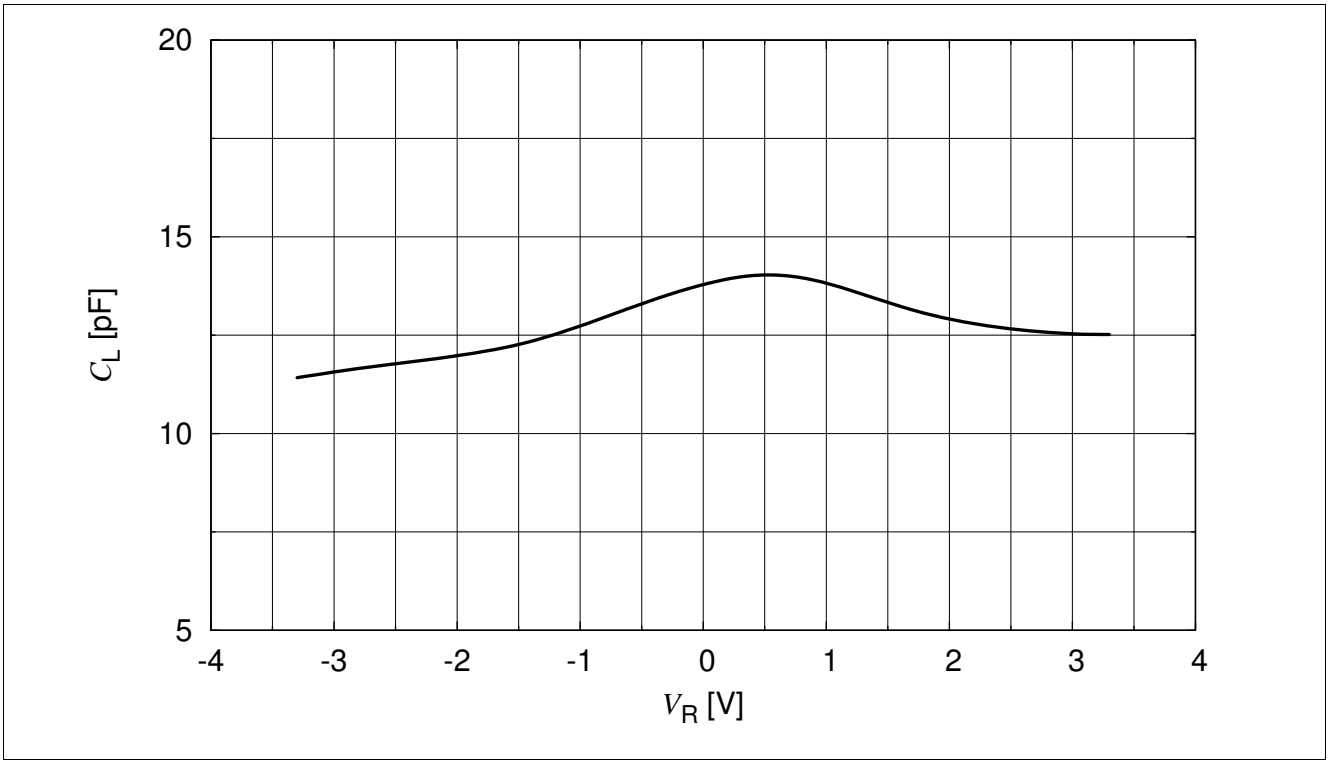



**Figure 3-4 Line capacitance: $C_L = f(V_R), f$ = 1MHz**

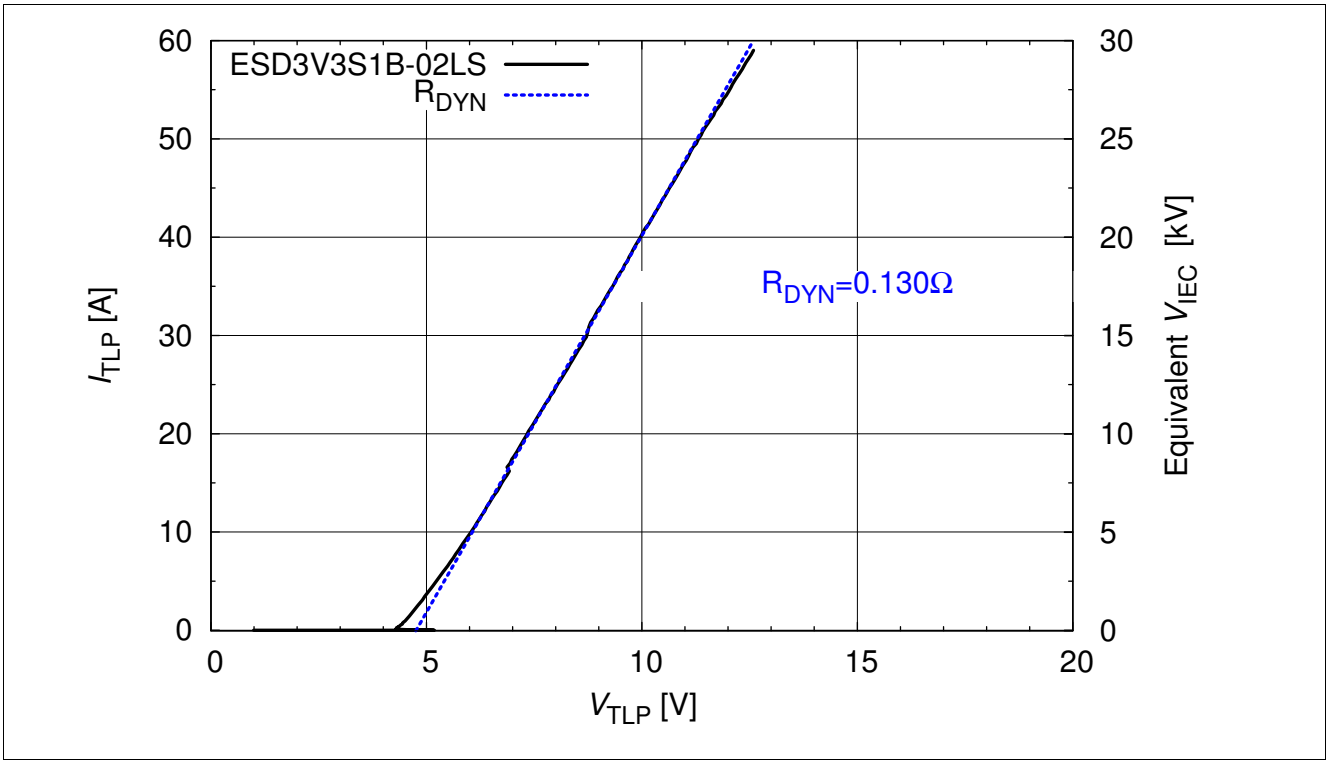



**Figure 3-5 Clamping voltage (TLP): $I_{TLP} = f(V_{TLP})$, from pin 1 to pin 2 [1]**

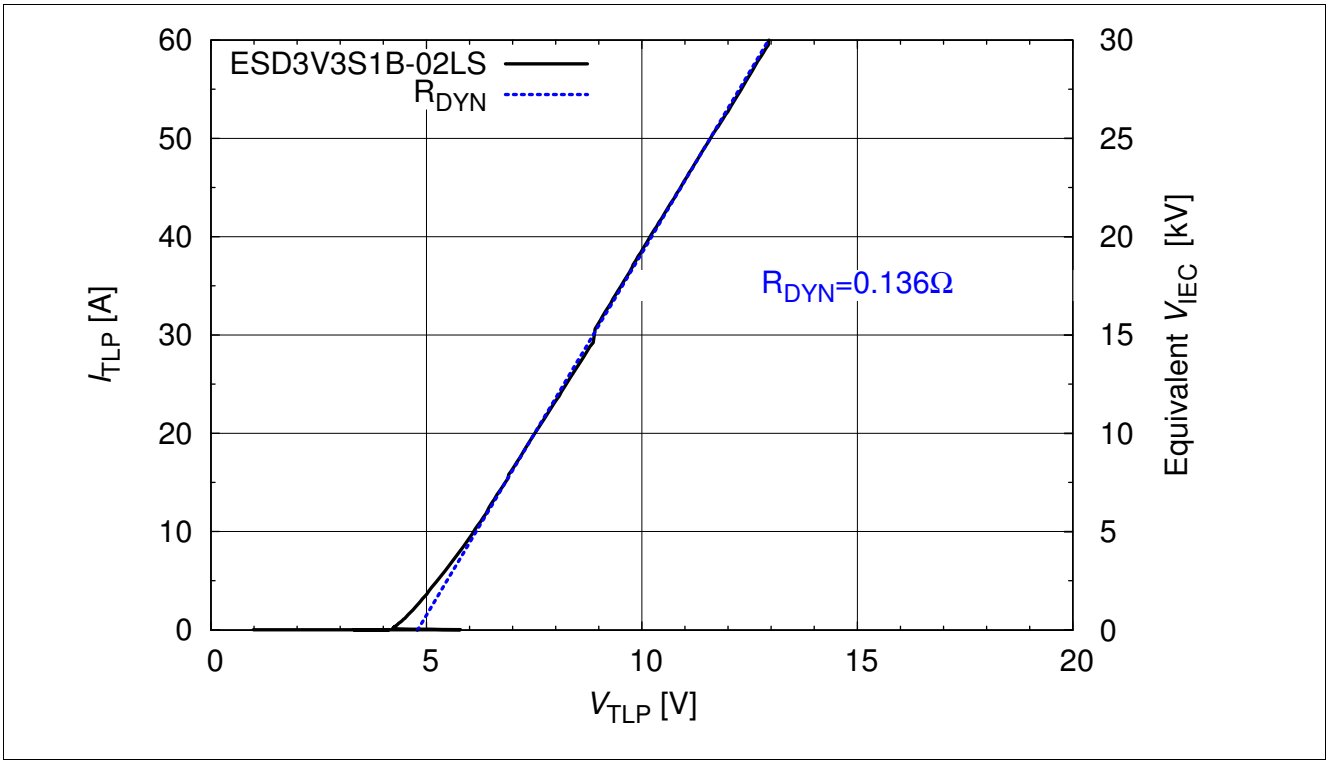



**Figure 3-6 Clamping voltage (TLP): $I_{TLP} = f(V_{TLP})$, from pin 2 to pin 1 [1]**

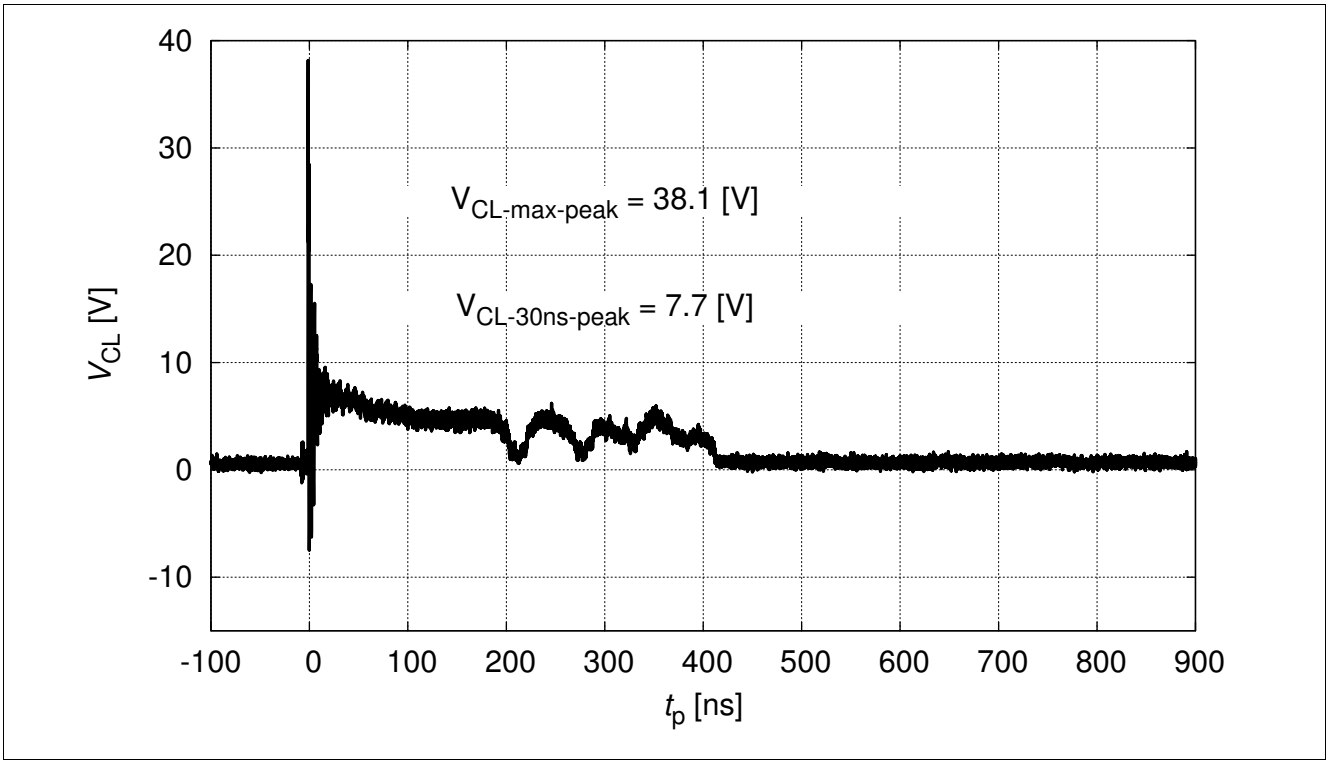



**Figure 3-7 IEC61000-4-2 : $V_{CL} = f(t)$, 8 kV positive pulse from pin 1 to pin 2**

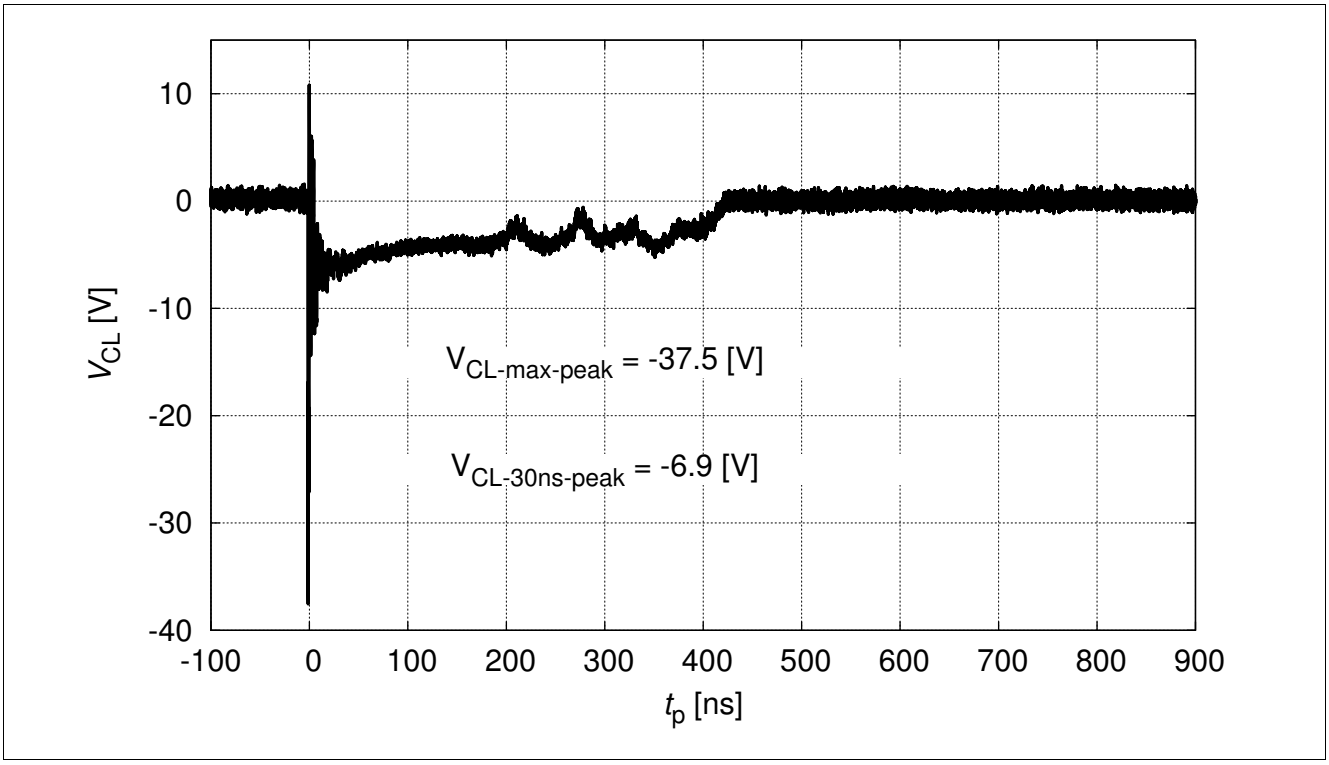



**Figure 3-8 IEC61000-4-2 : $V_{CL} = f(t)$, 8 kV negative pulse from pin 1 to pin 2**

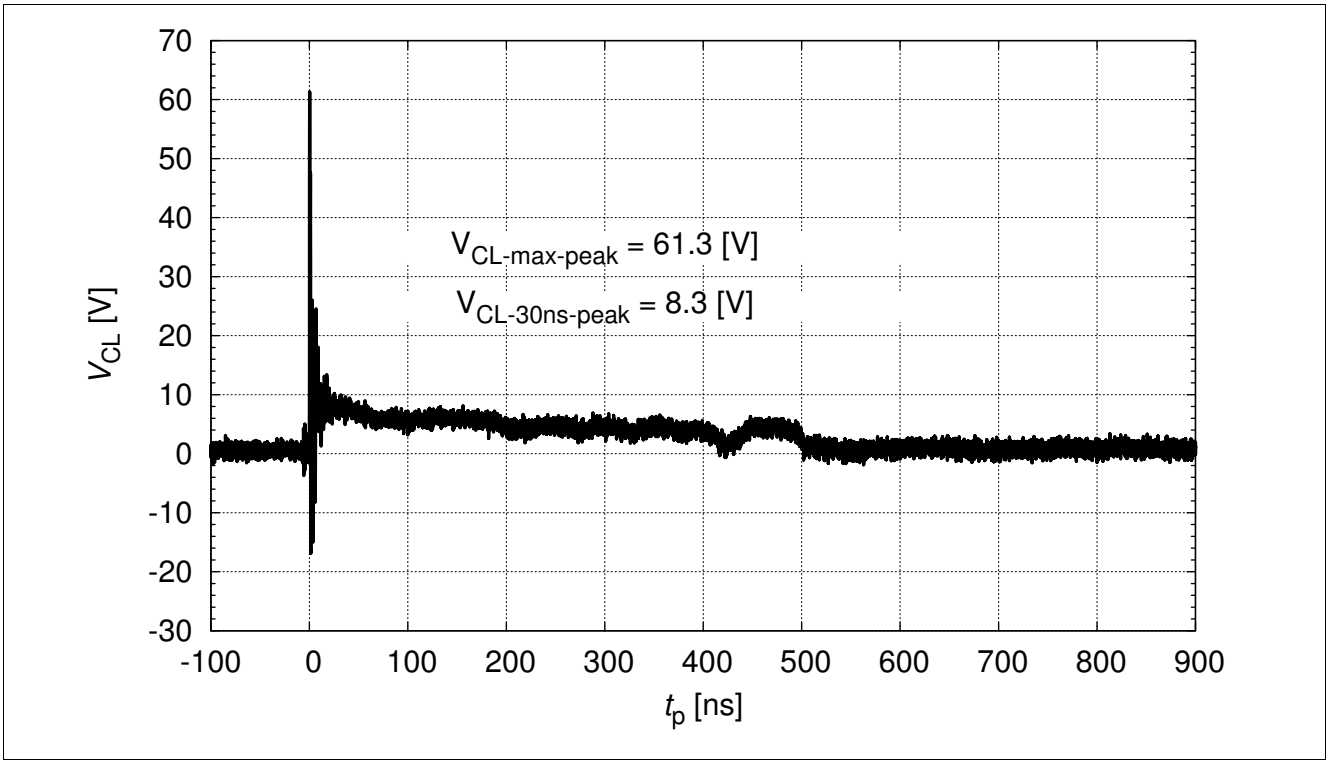



**Figure 3-9 IEC61000-4-2 : $V_{CL} = f(t)$, 15 kV positive pulse from pin 1 to pin 2**

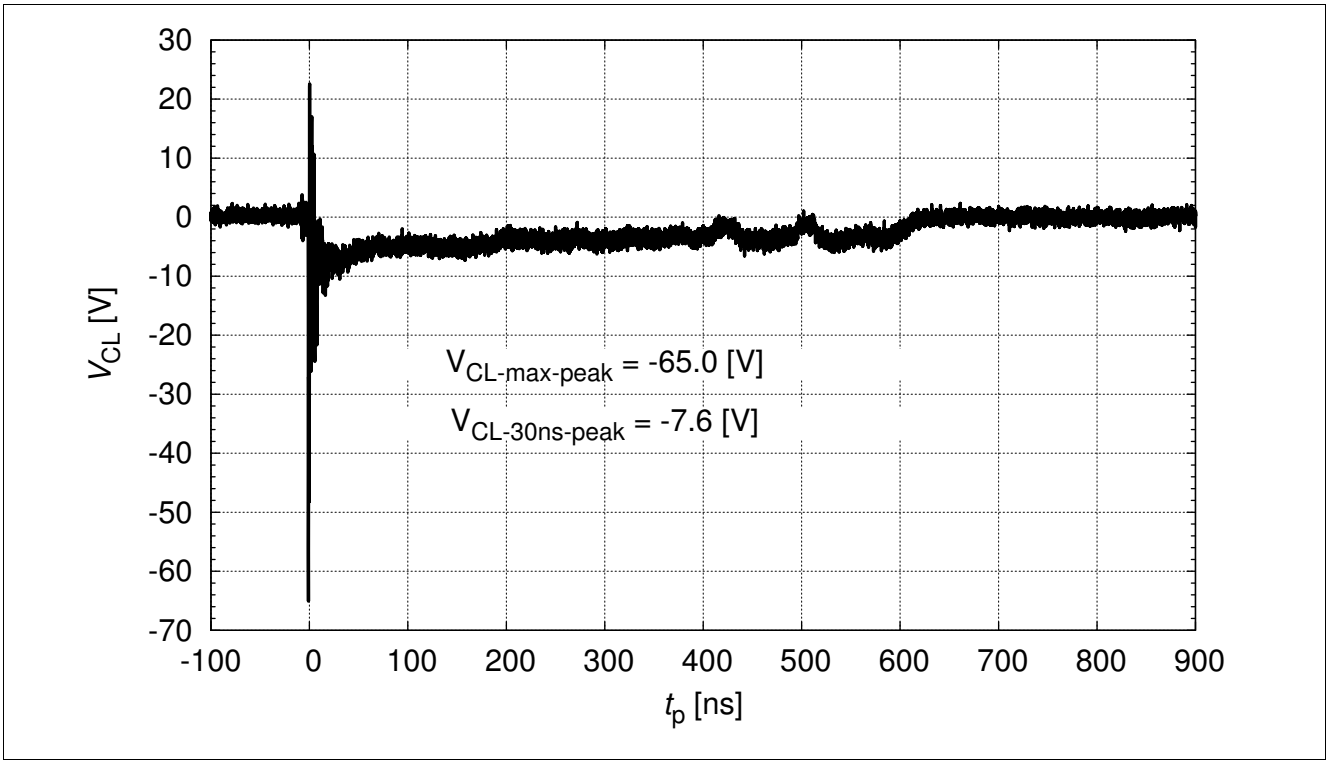



**Figure 3-10 IEC61000-4-2 : $V_{CL} = f(t)$, 15 kV negative pulse from pin 1 to pin 2**

# 4 Application Information

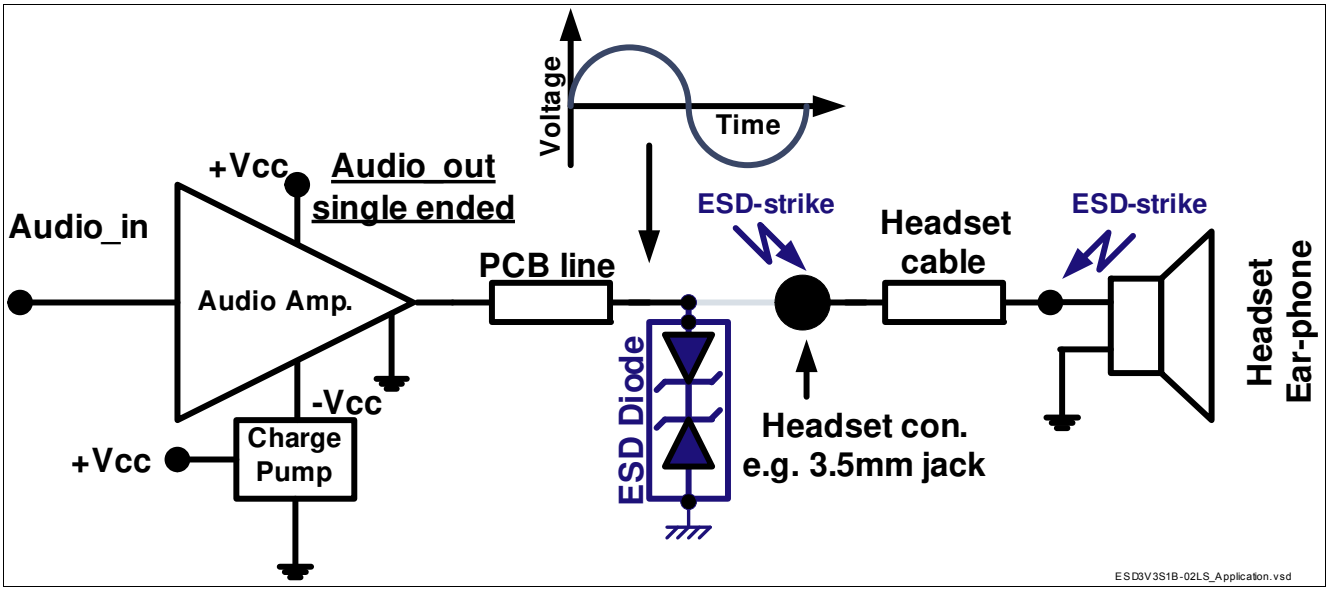



**Figure 4-1 Single line, bi-directional ESD / Transient protection**

# 5 Ordering Information Scheme (Examples)

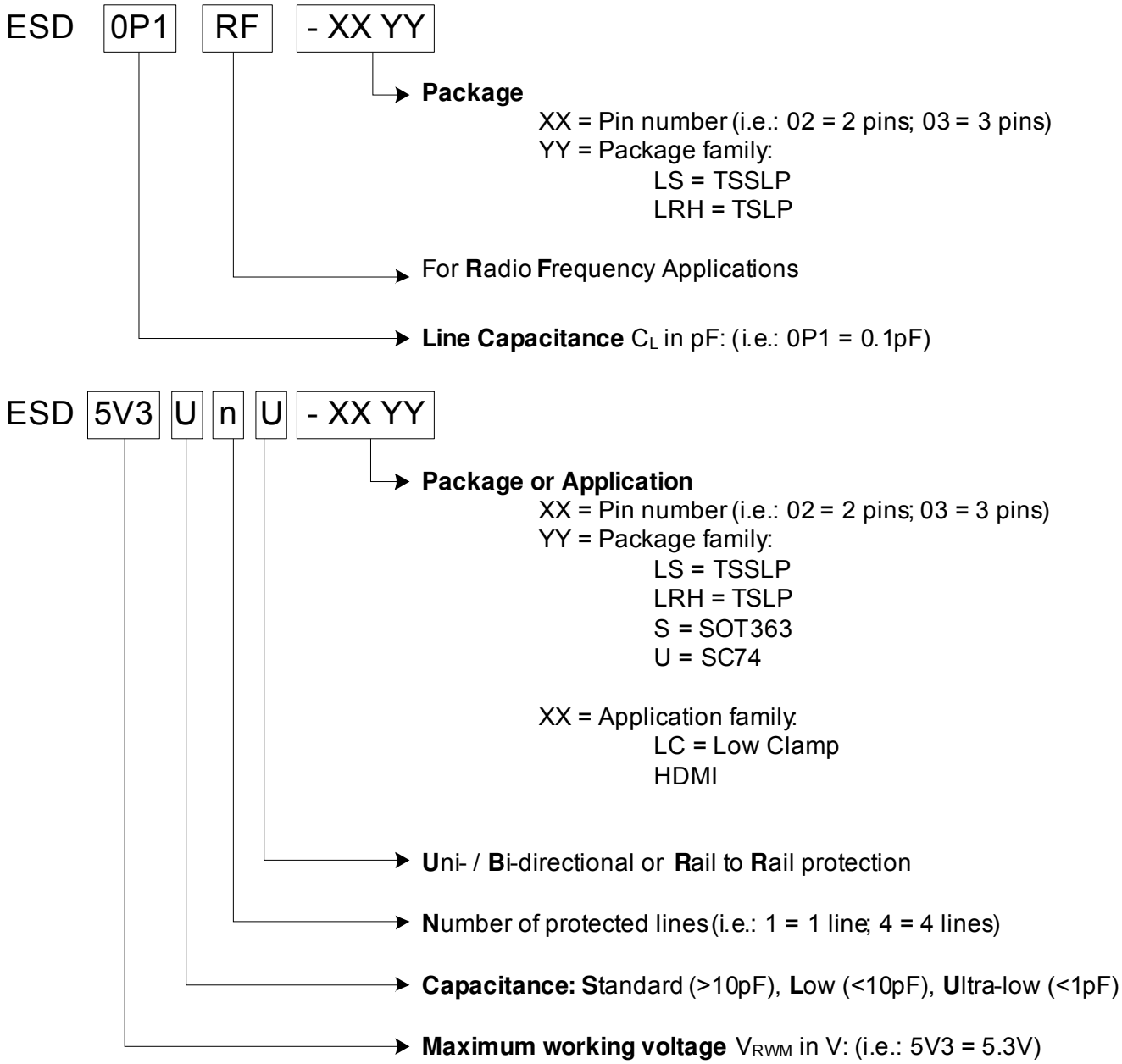



**Figure 5-1 Ordering information scheme**

# 6 Package Information

## 6.1 PG-TSLP-2-17 (mm) [2]

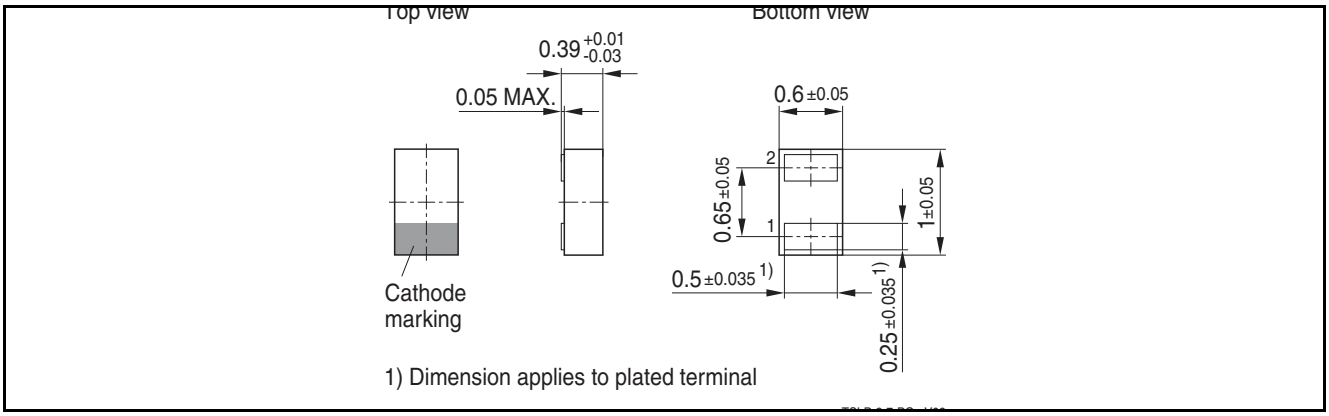



**Figure 6-1 PG-TSLP-2-17: Package overview**

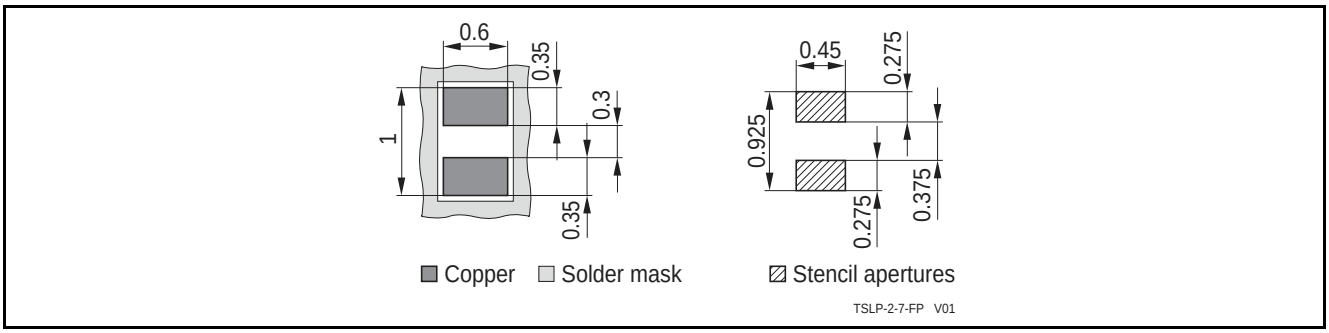



**Figure 6-2 PG-TSLP-2-17: Footprint**

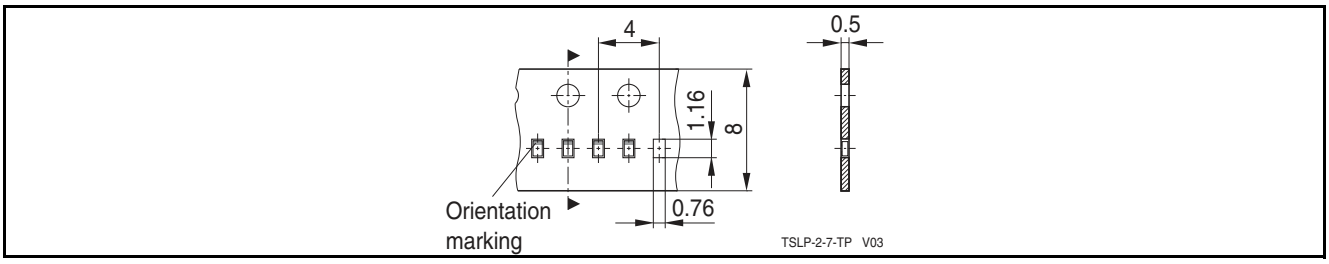



**Figure 6-3 PG-TSLP-2-17: Packing**

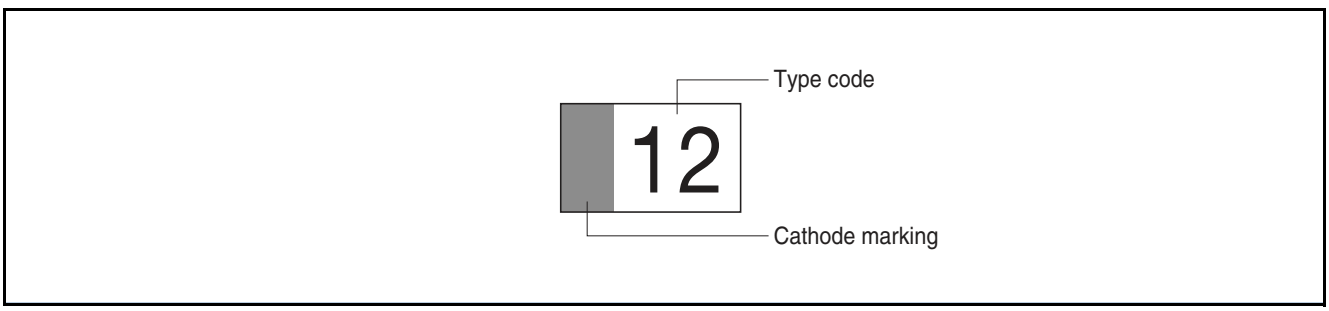



**Figure 6-4 PG-TSLP-2-17: Marking (example)**

## 6.2 PG-TSSLP-2-1 (mm) [2]

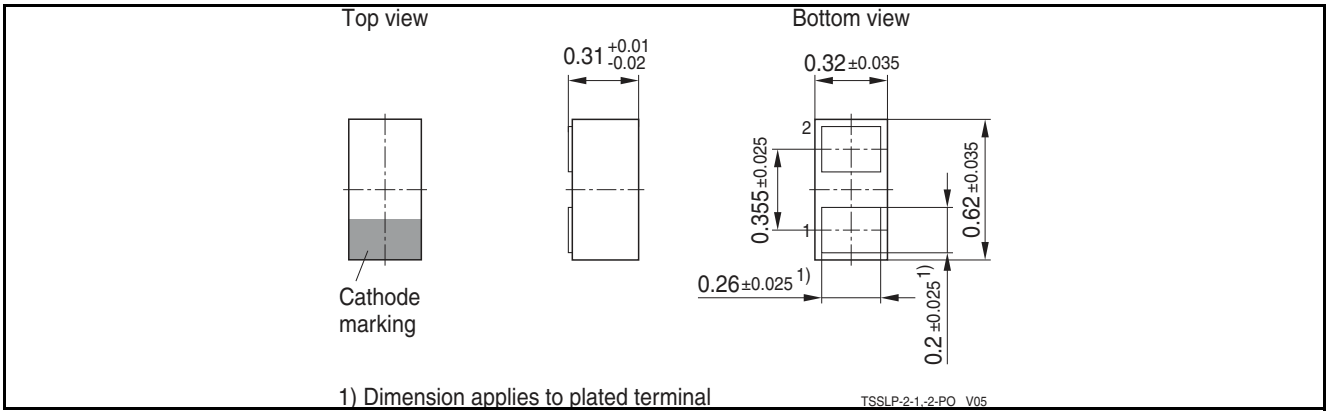



**Figure 6-5 PG-TSSLP-2-1: Package overview**

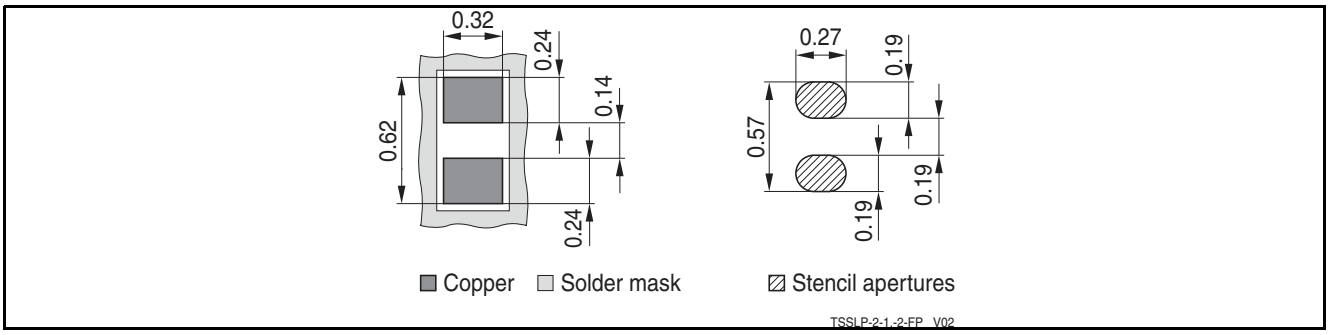



**Figure 6-6 PG-TSSLP-2-1: Footprint**

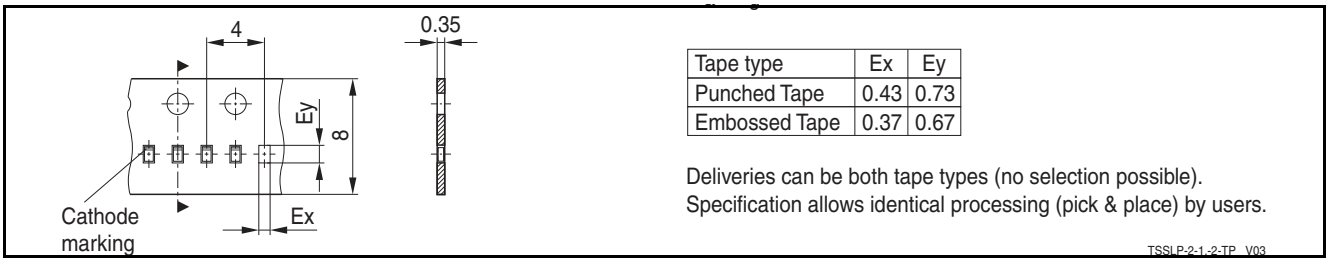



**Figure 6-7 PG-TSSLP-2-1: Packing**

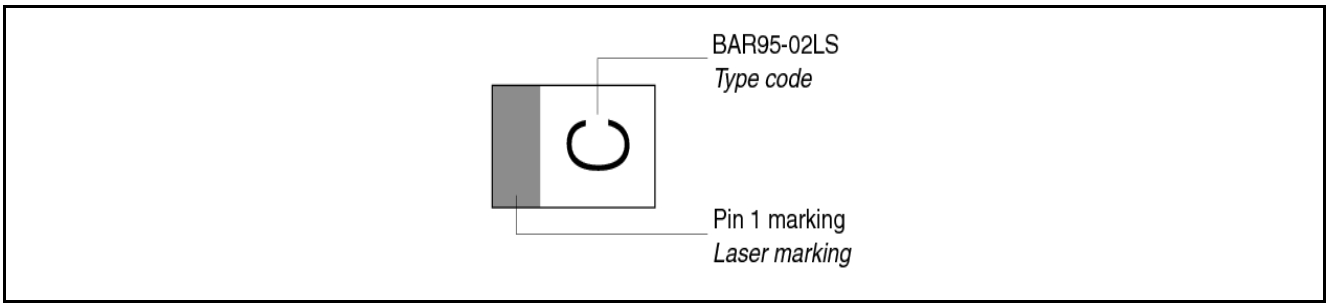



**Figure 6-8 PG-TSSLP-2-1: Marking (example)**

# References

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

[2] Infineon AG - Recommendations for PCB Assembly of Infineon TSLP and TSSLP Packages

# Terminology

| | |
|---|---|
| $C_L$ | Line capacitance |
| EFT | Electrical Fast Transient |
| ESD | Electrostatic Discharge |
| $I_{PP}$ | Peak pulse current |
| $I_R$ | Reverse current |
| LCD | Liquid Crystal Display |
| $\boldsymbol{P_{PK}}$ | Peak pulse power |
| $R_{DYN}$ | Dynamic resistance |
| RoHs | Restriction of Hazardous Substance directive |
| $T_A$ | Ambient temperature |
| $T_{OP}$ | Operation temperature |
| $t_p$ | Pulse duration |
| $T_{stg}$ | Storage temperature |
| $V_{BR}$ | Breakdown voltage |
| $V_{CL}$ | Reverse clamping voltage |
| $V_{ESD}$ | Electrostatic discharge voltage |
| $V_R$ | Reverse voltage |
| $V_{RWM}$ | Reverse working voltage maximum |

# Predefined Names

| Name | Initial Cross-Reference |
|---|---|
| X-GOLD | **X-GOLD** |
| XMM | **XMM** |
| | |
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