

# 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

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**Revision History**

Page or Item	Subjects (major changes since previous revision)
<b>Revision 1.1, 2011-11-28</b>	
<b>Revision 1.1; 2011-11-28</b>	Features 1.1; Table 3-1; Table 3-3; Table 3-4

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Last Trademarks Update 2010-10-26

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# 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):  $\pm 30$  kV (contact)
  - IEC61000-4-4 (EFT): 40 A (5/50 ns)
  - IEC61000-4-5 (surge): 8 A (8/20  $\mu$ s)
- Bi-directional, symmetrical working voltage up to  $V_{RWM} = \pm 3.3$  V
- Ultra low clamping voltage  $V_{CL} = 7$  V typ. @  $I_{PP} = 16$  A (TLP)
- Ultra low dynamic resistance  $R_{DYN} = 0.13 \Omega$  typ.
- Smallest form factor:  $0.62 \times 0.32 \times 0.31$  mm<sup>3</sup>
- 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

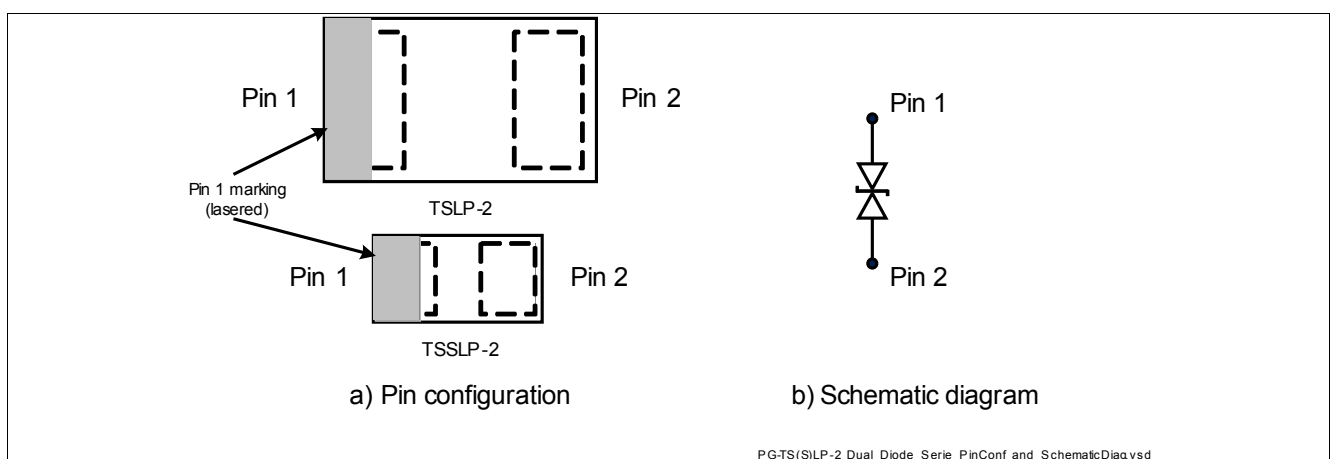


Figure 2-1 Pin Configuration and Schematic Diagram

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

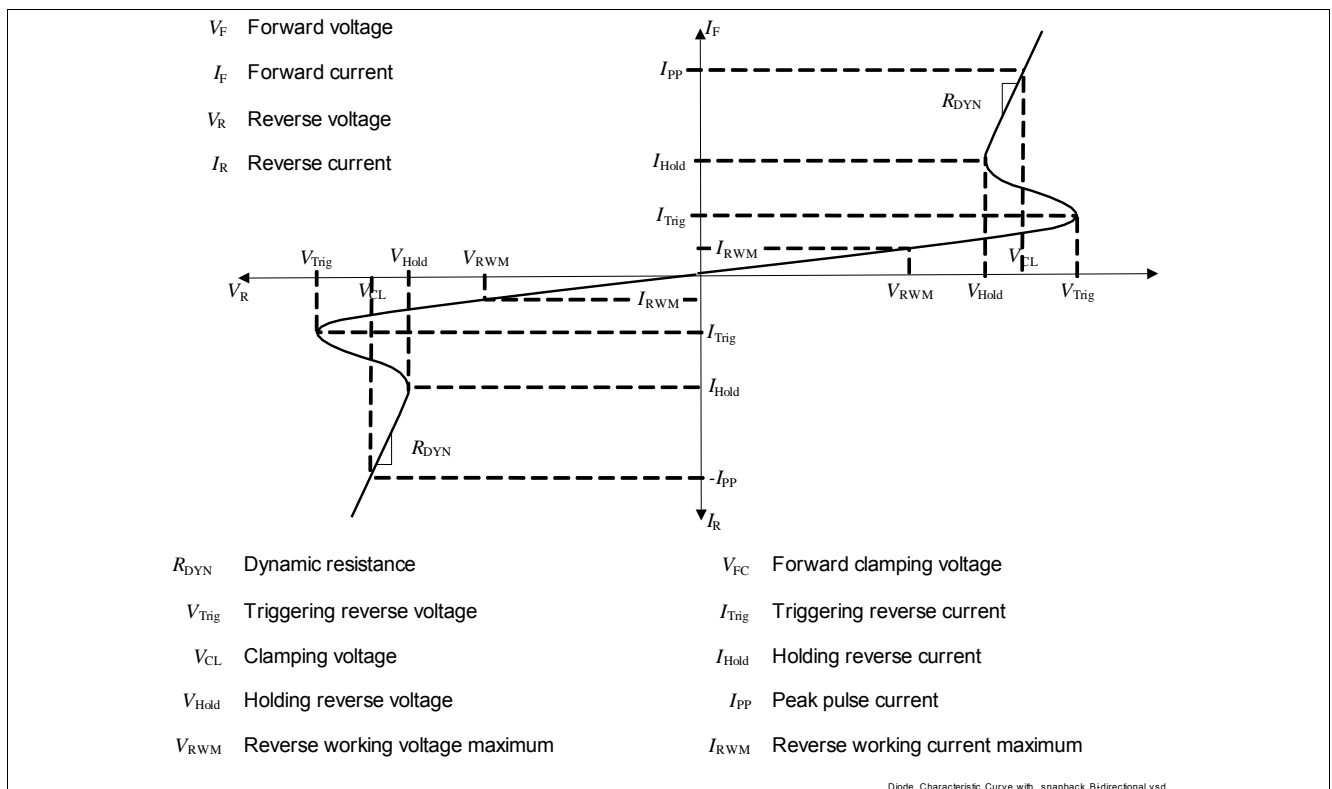
**Table 3-1 Maximum Ratings at  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
ESD contact discharge <sup>1)</sup>	$V_{ESD}$	–	–	30	kV
Peak pulse current ( $t_p = 8/20\text{ }\mu\text{s}$ ) <sup>2)</sup>	$I_{PP}$	–	–	8	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

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

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



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

**Table 3-2 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	$V_{RWM}$	-3.3	–	3.3	V	
Reverse current	$I_R$	–	–	50	nA	$V_R = 3.3\text{ V}$



**Table 3-3 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	$C_L$	–	14	20	pF	$V_R = 0\text{ V}, f = 1\text{ MHz}$

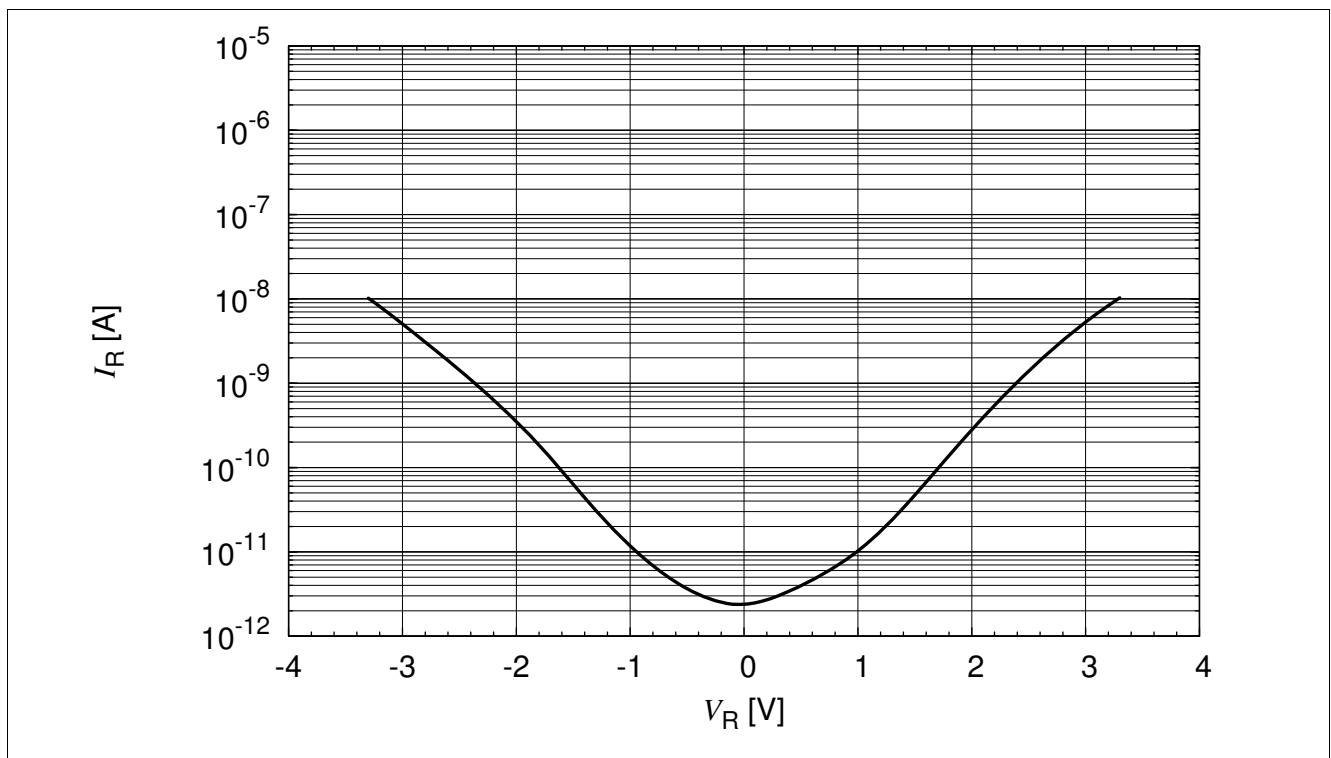
**Table 3-4 ESD Characteristics at  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Clamping voltage <sup>1)</sup>	$V_{CL}$	–	7	–	V	$I_{PP} = 16\text{ A}, t_p = 100\text{ ns}$
		–	9	–	V	$I_{PP} = 30\text{ A}, t_p = 100\text{ ns}$
Clamping voltage <sup>2)</sup>	$V_{CL}$	–	4.5	–	V	$I_{PP} = 1\text{ A}, t_p = 8/20\text{ }\mu\text{s}$
		–	6.8	–	V	$I_{PP} = 8\text{ A}, t_p = 8/20\text{ }\mu\text{s}$
Dynamic resistance <sup>1)</sup>	$R_{DYN}$	–	0.13	–	$\Omega$	

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

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

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


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

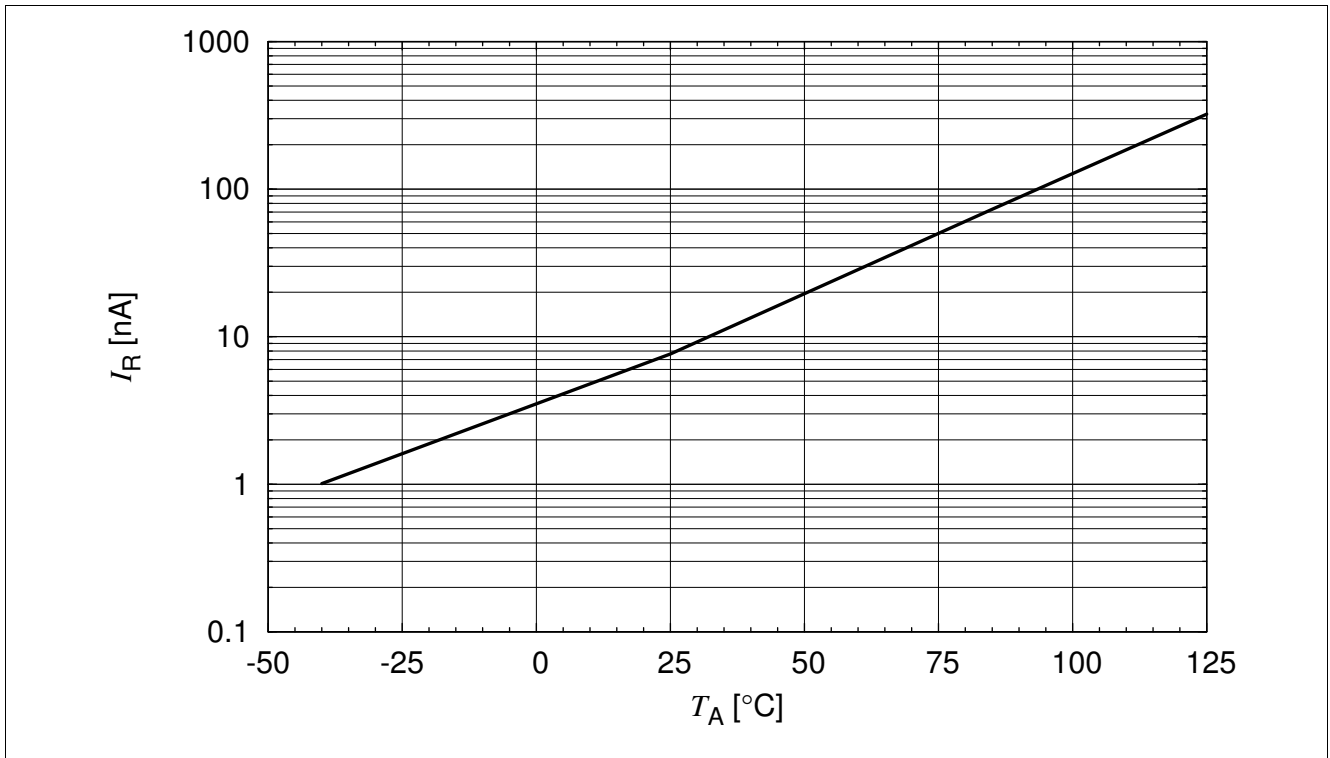


Figure 3-3 Reverse current:  $I_R = f(T_A)$ ,  $V_R = 3.3 V$

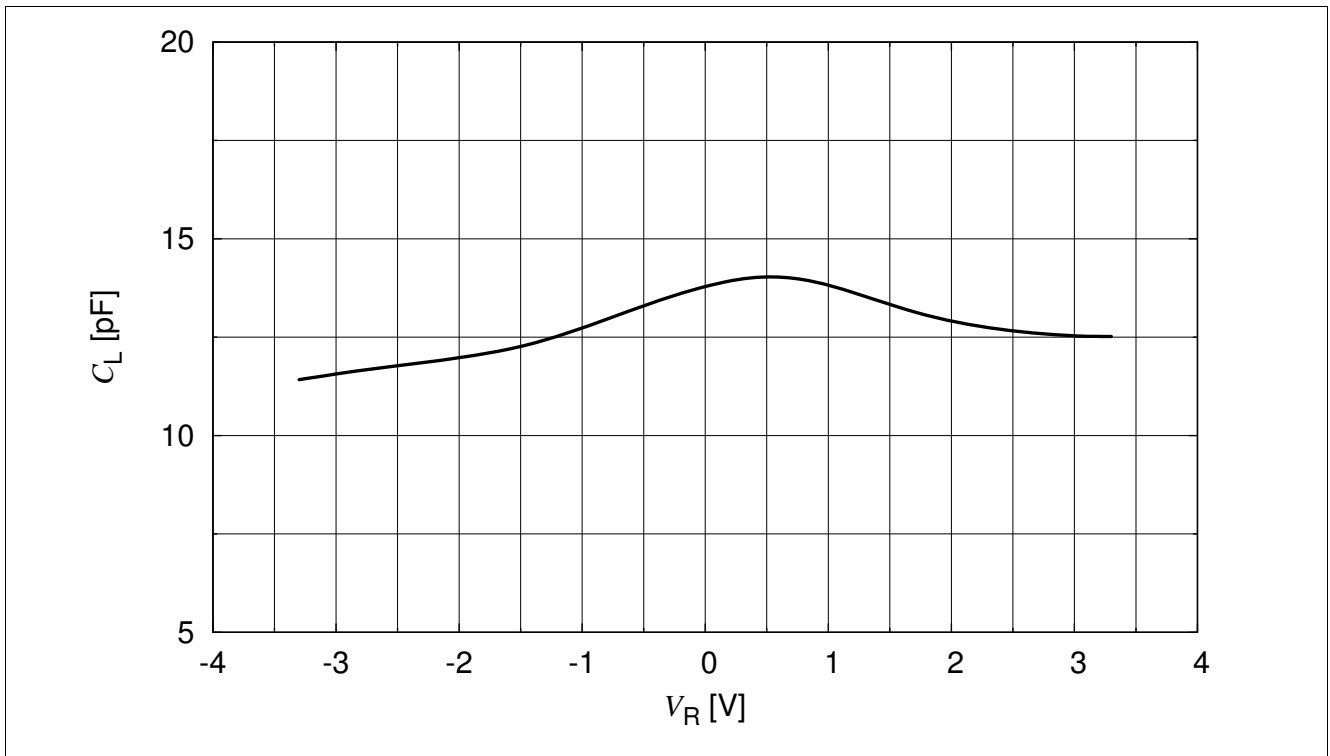


Figure 3-4 Line capacitance:  $C_L = f(V_R)$ ,  $f = 1\text{MHz}$

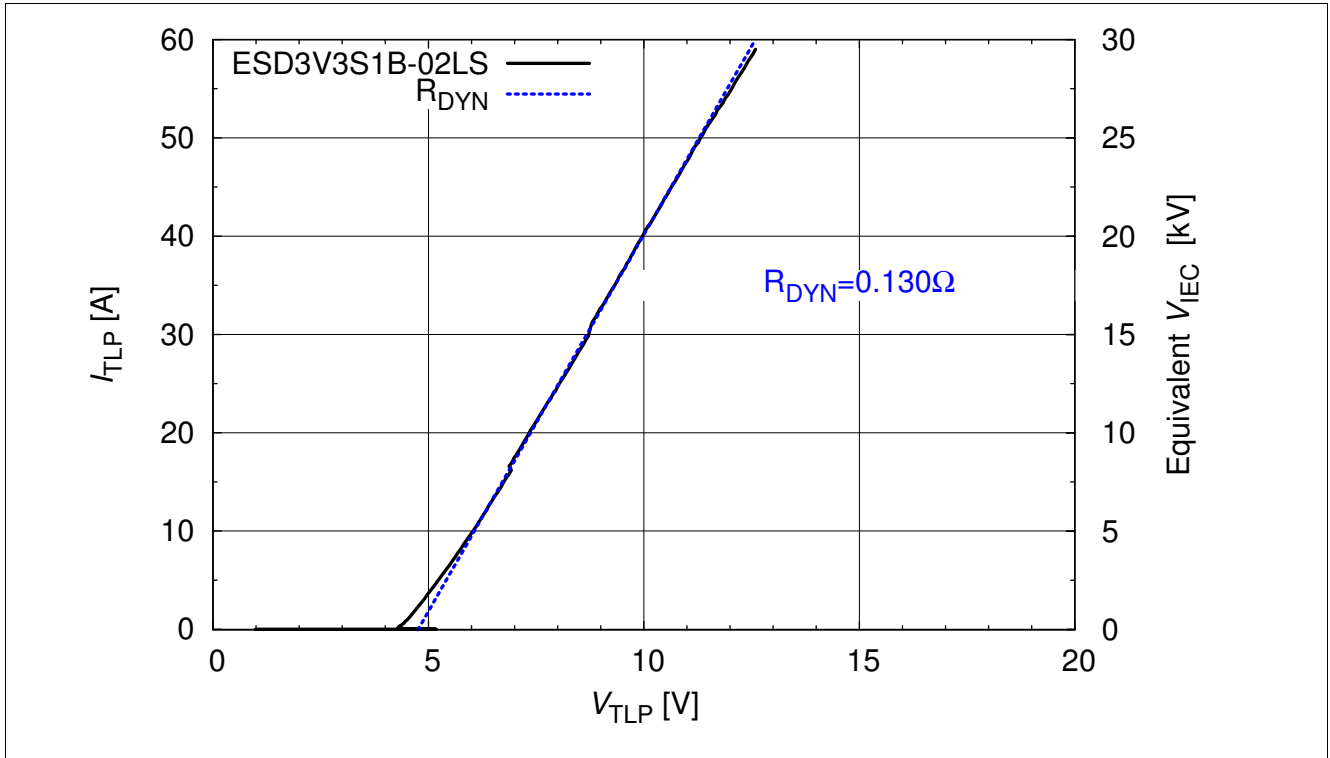


Figure 3-5 Clamping voltage (TLP):  $I_{TLP} = f(V_{TLP})$ , from pin 1 to pin 2 [1]

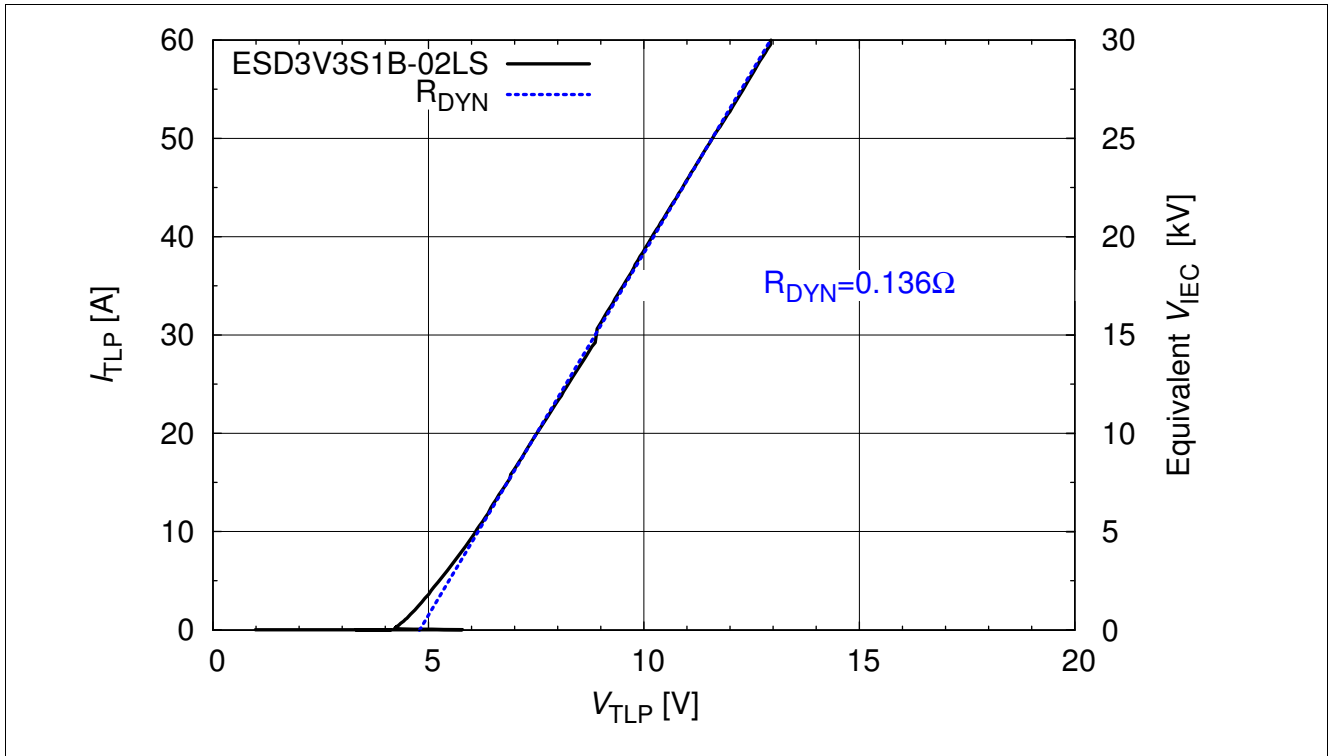


Figure 3-6 Clamping voltage (TLP):  $I_{TLP} = f(V_{TLP})$ , from pin 2 to pin 1 [1]

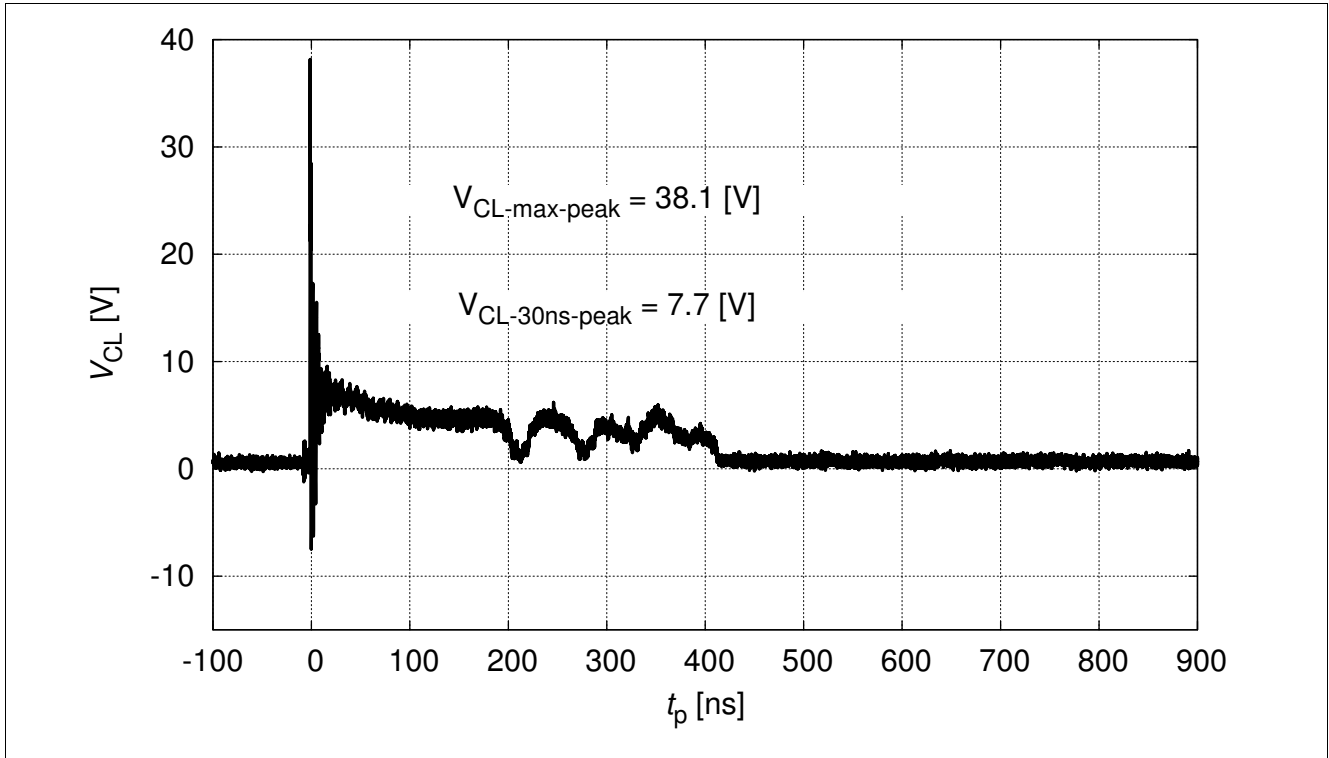


Figure 3-7 IEC61000-4-2 :  $V_{CL} = f(t)$ , 8 kV positive pulse from pin 1 to pin 2

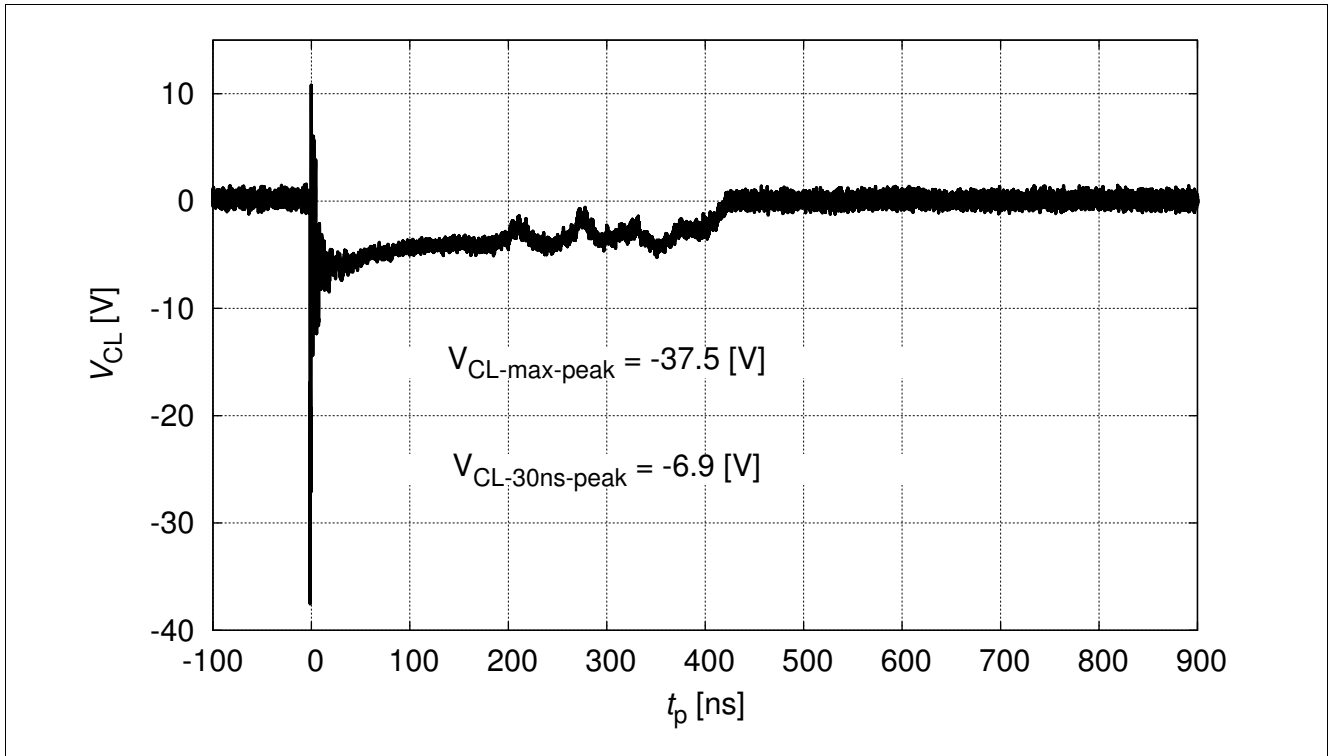


Figure 3-8 IEC61000-4-2 :  $V_{CL} = f(t)$ , 8 kV negative pulse from pin 1 to pin 2

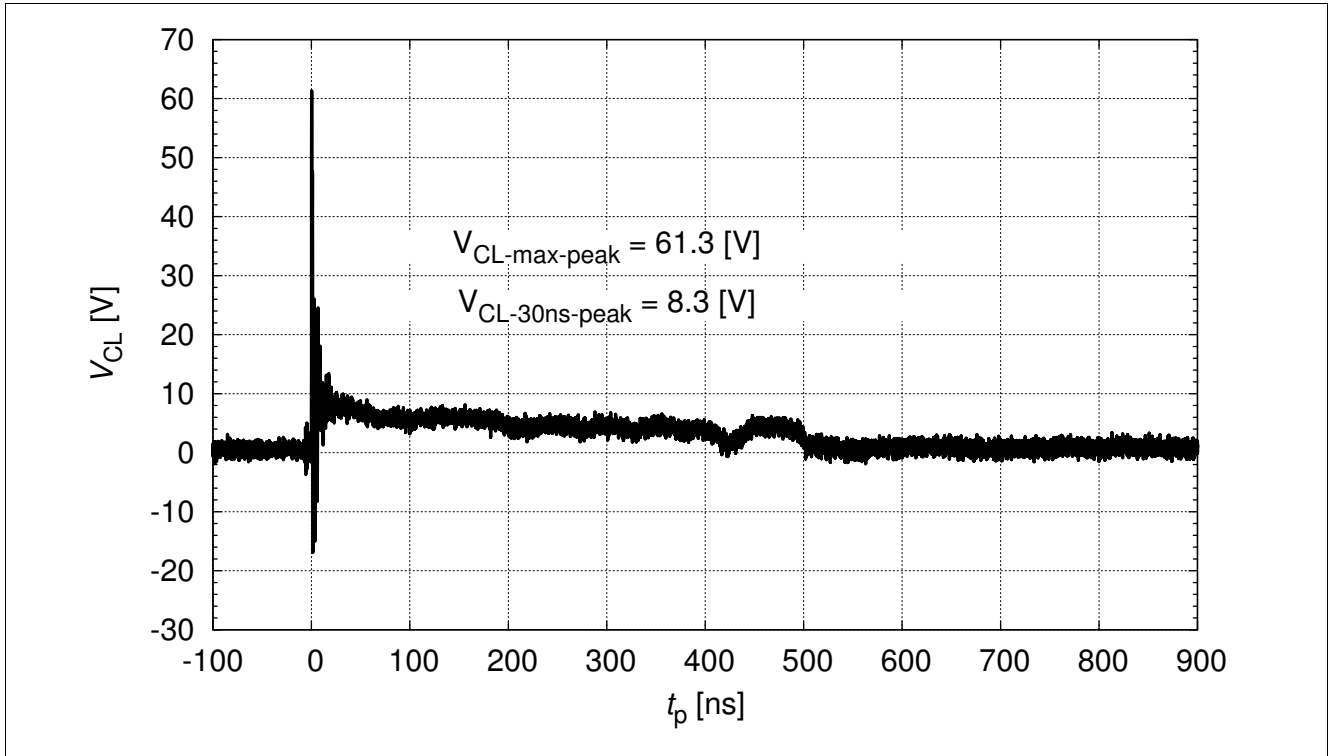


Figure 3-9 IEC61000-4-2 :  $V_{CL} = f(t)$ , 15 kV positive pulse from pin 1 to pin 2

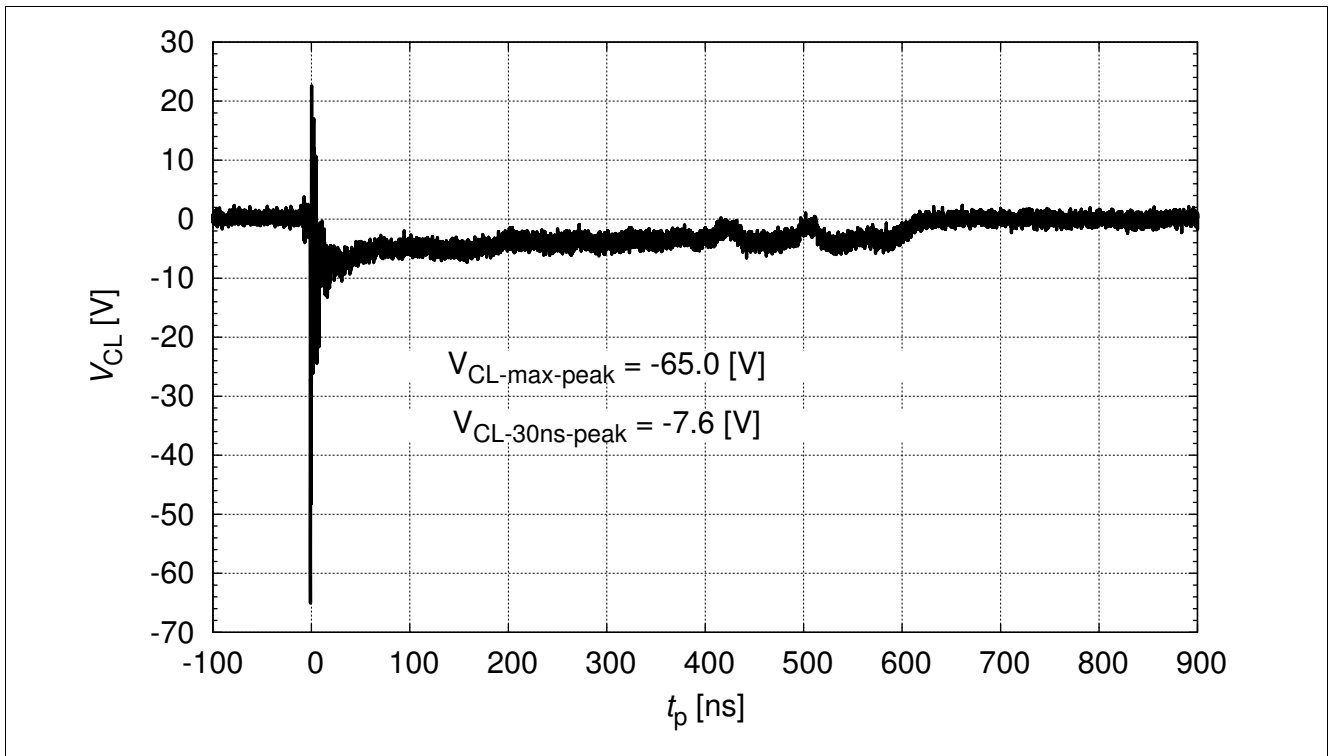


Figure 3-10 IEC61000-4-2 :  $V_{CL} = f(t)$ , 15 kV negative pulse from pin 1 to pin 2

## 4 Application Information

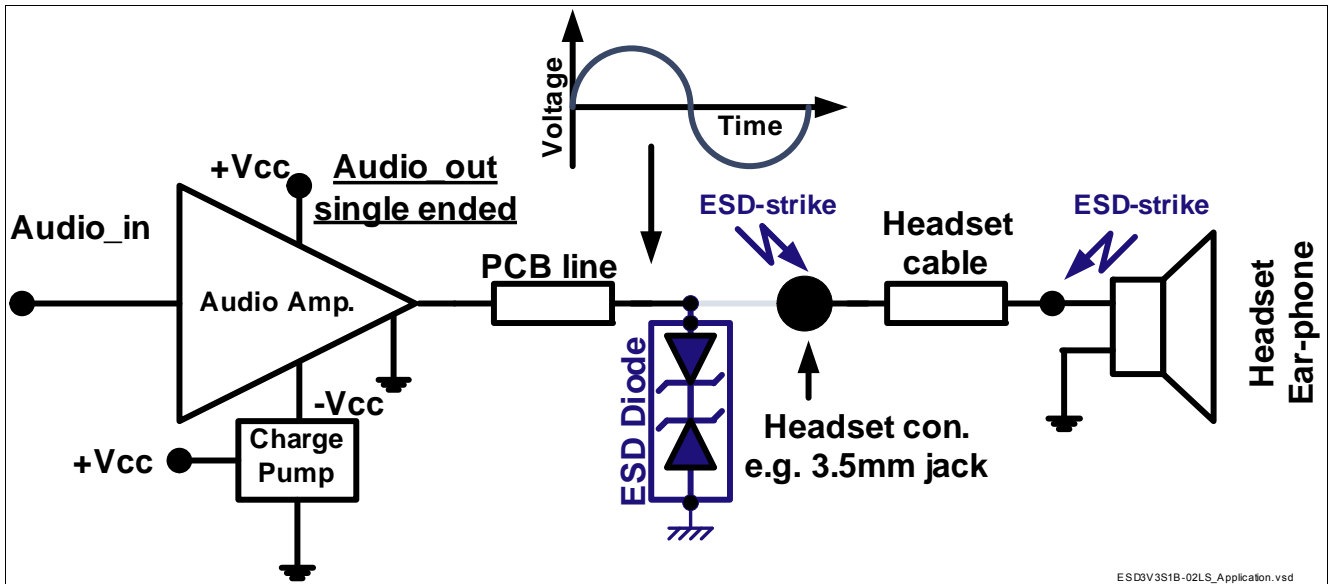


Figure 4-1 Single line, bi-directional ESD / Transient protection

## 5 Ordering Information Scheme (Examples)

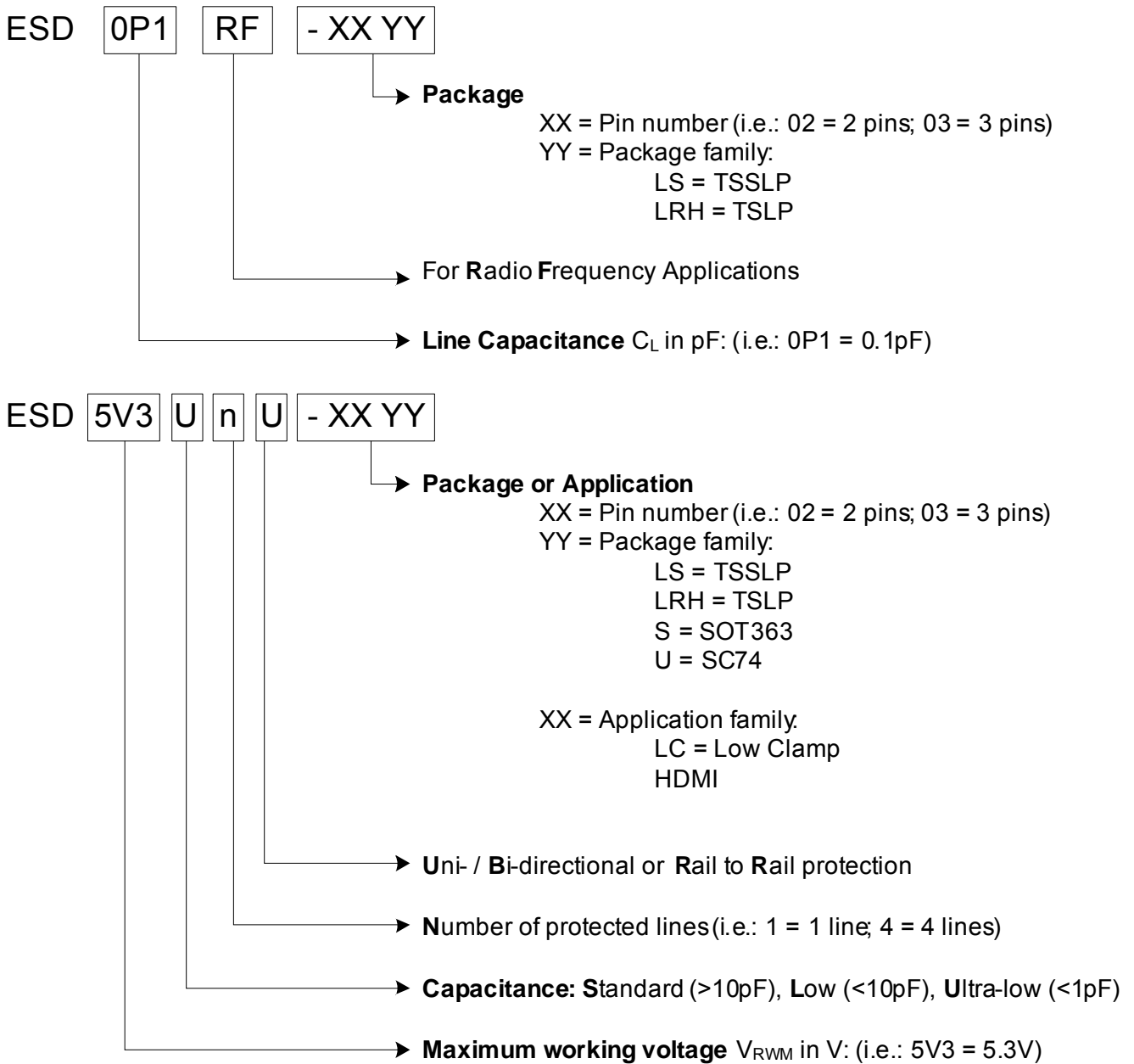


Figure 5-1 Ordering information scheme

## 6 Package Information

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

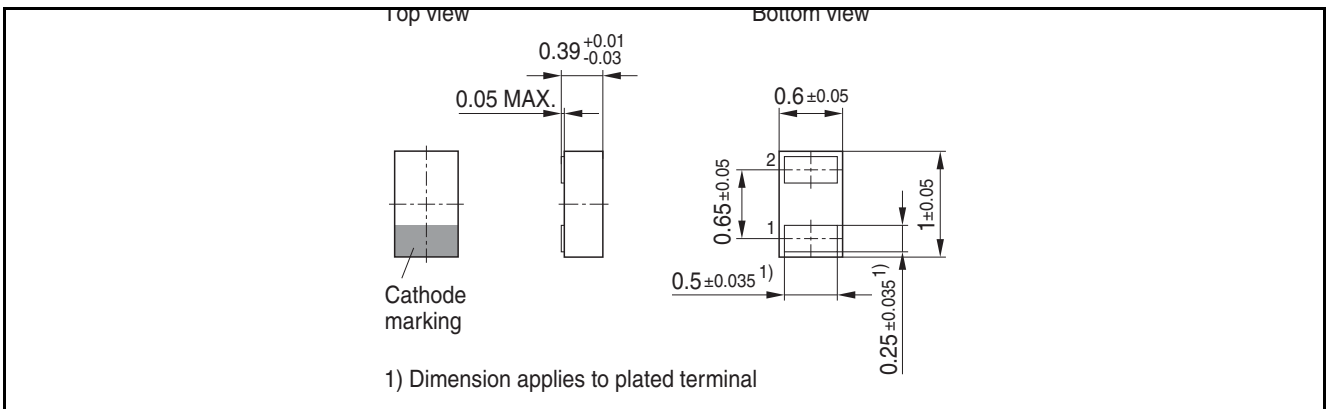


Figure 6-1 PG-TSLP-2-17: Package overview

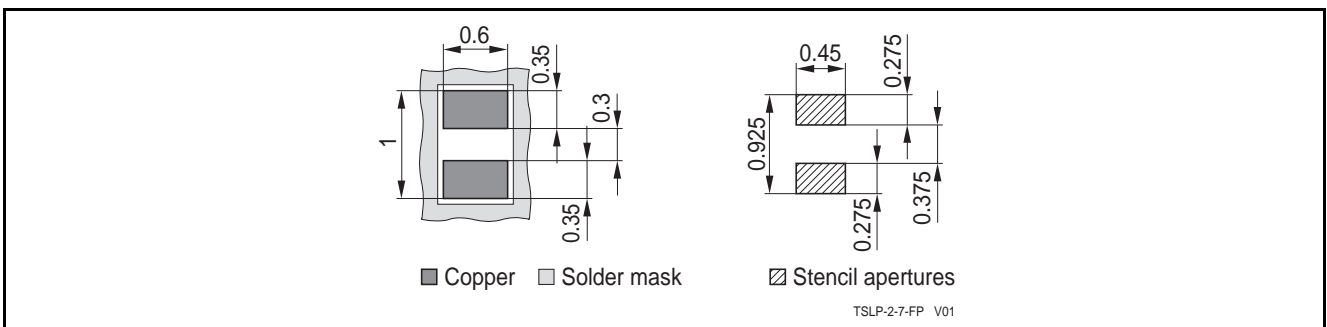


Figure 6-2 PG-TSLP-2-17: Footprint

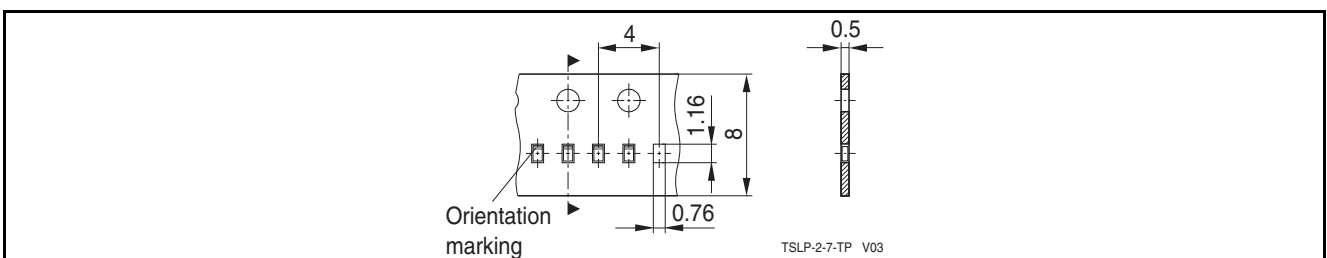


Figure 6-3 PG-TSLP-2-17: Packing

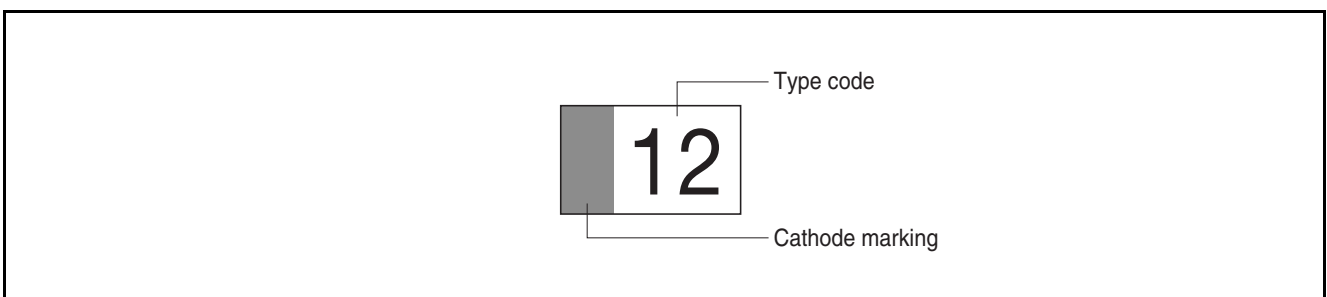


Figure 6-4 PG-TSLP-2-17: Marking (example)



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

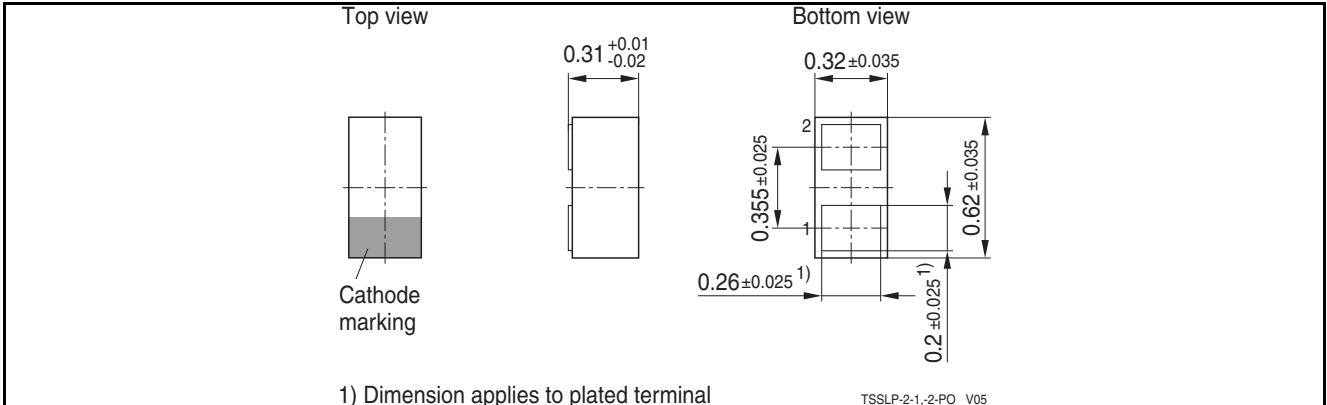


Figure 6-5 PG-TSSLP-2-1: Package overview

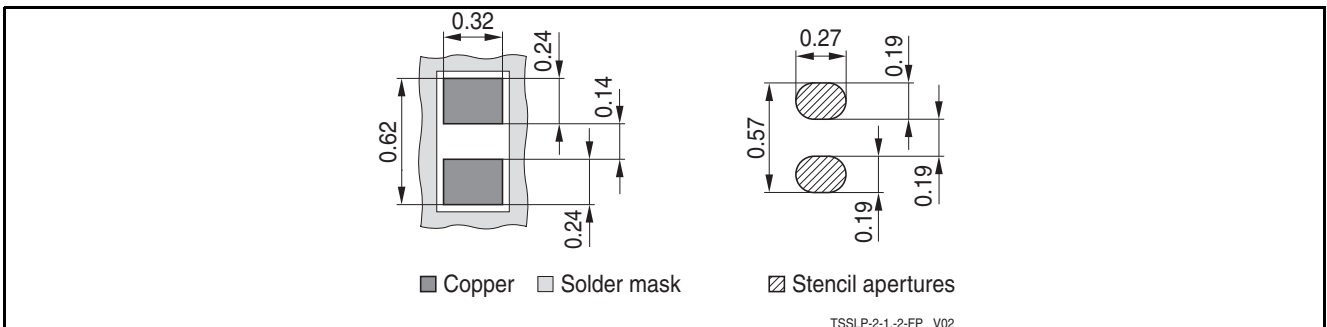


Figure 6-6 PG-TSSLP-2-1: Footprint

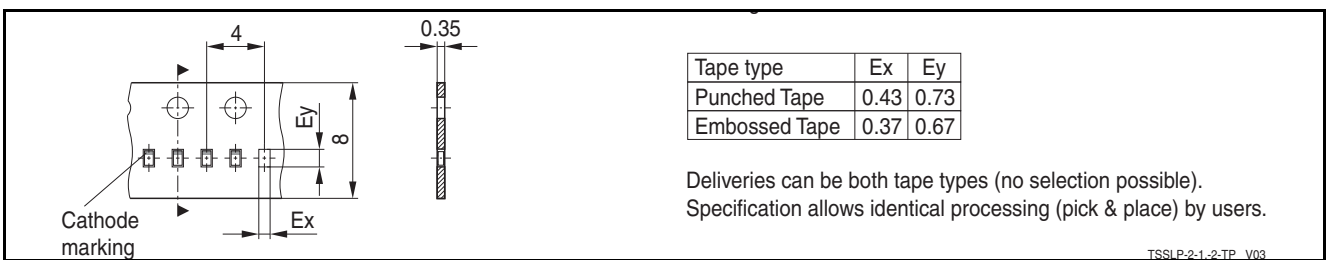


Figure 6-7 PG-TSSLP-2-1: Packing

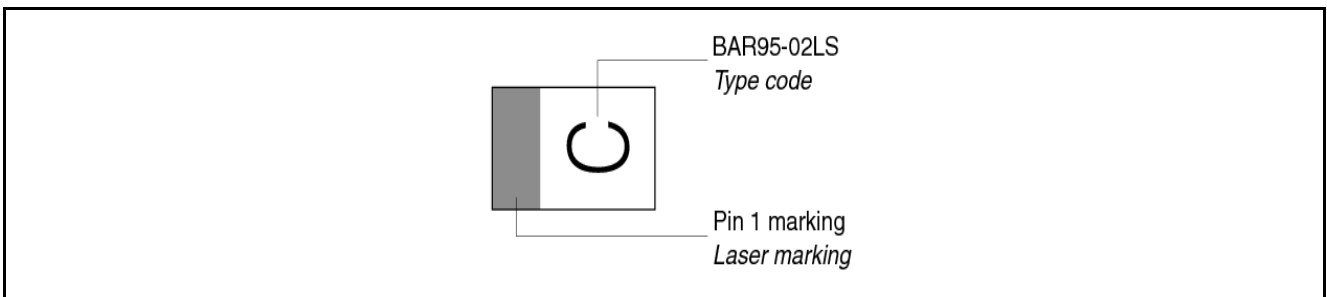


Figure 6-8 PG-TSSLP-2-1: Marking (example)

**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
$P_{PK}$	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

### Definition of “Predefined Names”

Frequently used expressions, such as component names, file names, tools releases, version numbers, proprietary variables and software links, can be used in a similar way as user variables. However, they must be listed in a special table and **not** in the standard file “Variables”.

### Correct Usage

Steps:

1. Insert all expressions into the left column of the above table.
2. Insert an initial Cross-Reference into the right column of the same row. The initial Cross-Reference is necessary to ensure that a single ID is used in all your documents using the “Predefined\_Names.fm” file (Example: X-GOLD has the unique ID = CHDGHJGH).
3. Insert a Cross-Reference (Element “CrossReference”) into your document to the Element Identifier of the “Predefined\_Names.fm” file. Set the output format of the Cross-Reference to “Variable” (example: X-GOLD).

### Notes

1. All documents in a project (such as XMM) and within a book should use the same file “Predefined Names”. This allows copying content between different documents. For this reason, local versions of “Predefined Names” must not be produced.
2. New definitions must be inserted in a new row. Never change existing definitions, as they might be used in other documents.
3. This file does not need to be included in your book, but it must be in the fm sub-folder of your document.
4. You can sort the above table with FrameMaker only if the initial cross-reference in the right column has been properly inserted. Otherwise, the table may only be sorted by hand, as the cross-references to your document would get lost.

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