

TVS Diodes

Transient Voltage Suppressor Diodes

ESD0P2RF Series

Bi-directional Ultra-low Capacitance ESD / Transient Protection Diode

ESD0P2RF-02LS
ESD0P2RF-02LRH

Data Sheet

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Final

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Revision History

Page or Item	Subjects (major changes since previous revision)
Revision 1.0, 2011-08-01 Page Nr.8	Package name corrected (mismatch)

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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.

1 Bi-directional Ultra-low Capacitance ESD / Transient Protection Diode

1.1 Features

- ESD / transient protection of RF signal lines according to:
 - IEC61000-4-2 (ESD): ± 20 kV (contact)
 - IEC61000-4-4 (EFT): 40 A (5/50 ns)
 - IEC61000-4-5 (surge): 3 A (8/20 μ s)
- Maximum working voltage: $V_{RWM} \pm 5.3$ V
- Extremely low capacitance: $C_L = 0.2$ pF (typical)
- Low clamping voltage: $V_{CL} = 29$ V at $I_{PP} = 16$ A (typical)
- Very low reverse current $I_R < 1$ nA typ.
- Very small form factor down to $0.62 \times 0.32 \times 0.31$ mm³
- Pb-free (RoHS compliant) and halogen free package



1.2 Application Examples

- ESD protection of sensitive RF signal lines, Bluetooth Class 2, Automated Meter Reading
- RF antenna protection, frontend module, GPS, mobile TV, FM radio, UWB

2 Product Description

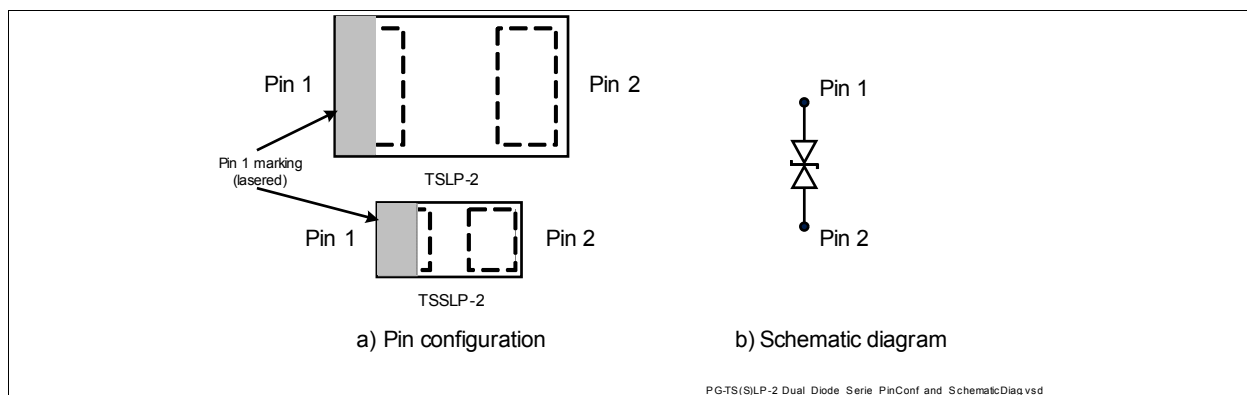


Figure 2-1 Pin Configuration and Schematic Diagram

Table 2-1 Ordering Information

Type	Package	Configuration	Marking code
ESD0P2RF-02LS	PG-TSSLP-2-1	1 line, bi-directional	T
ESD0P2RF-02LRH	PG-TSLP-2-17	1 line, bi-directional	T

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 ¹⁾	V_{ESD}	–	–	20	kV
Peak pulse current ($t_p = 8/20\ \mu\text{s}$) ²⁾	I_{PP}	–	–	3	A
Operating temperature range	T_{OP}	-55	–	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

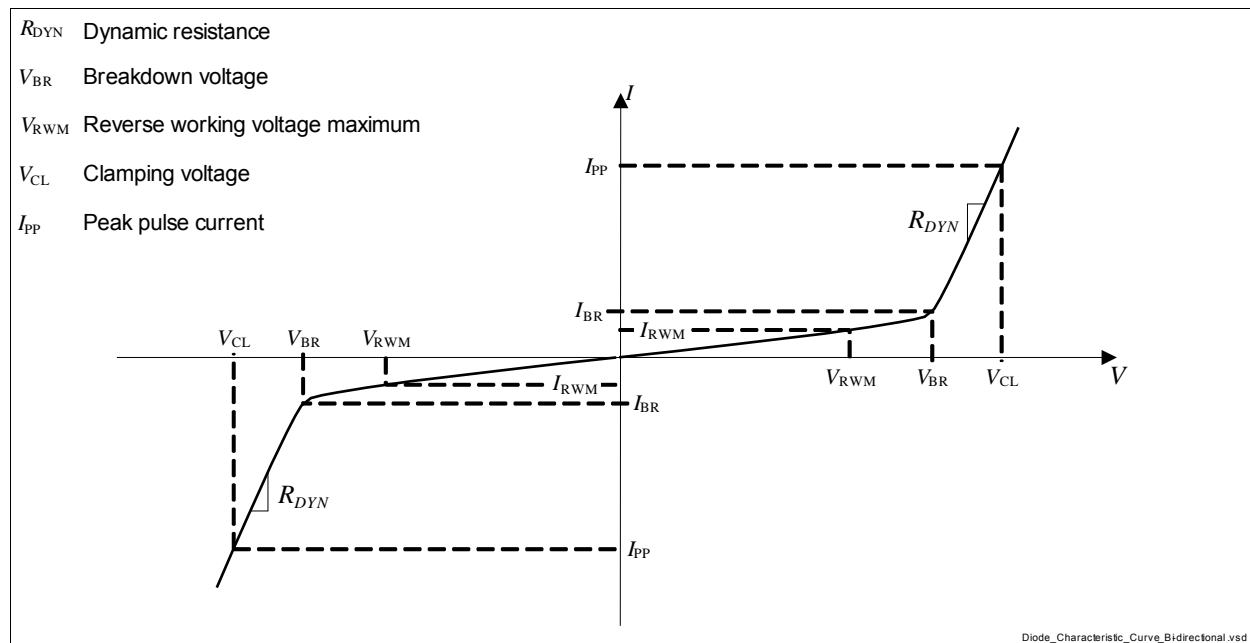


Figure 3-1 Definitions of electrical characteristics

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}	-5.3	–	5.3	V	
Breakdown voltage	V_{BR}	7	–	–	V	$I_R = 1\ \text{mA}$, from pin 1 to pin 2, from pin 2 to pin 1
Reverse current	I_R	–	<1	50	nA	$V_R = 5.3\ \text{V}$

Table 3-3 RF Characteristics at $T_A = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode capacitance	C_L	–	0.23	0.4	pF	$V_R = 0\text{ V}, f = 1\text{ MHz}$
		–	0.2	0.4	pF	$V_R = 0\text{ V}, f = 1\text{ GHz}$

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Clamping voltage ¹⁾	V_{CL}	–	29	–	V	$I_{pp} = 16\text{ A}$
		–	38	–	V	$I_{pp} = 30\text{ A}$
Dynamic resistance ¹⁾	R_{DYN}	–	1	–	Ω	
Series inductance	L_S	–	0.2	–	nH	ESD0P2RF-02LS
		–	0.4	–	nH	ESD0P2RF-02LRH

1)Please refer to Application Note AN210 [4]. TLP parameter: $Z_0 = 50\ \Omega$, $t_p = 100\text{ns}$, $t_r = 300\text{ps}$, 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 $I_{PP2} = 40\text{ A}$.

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

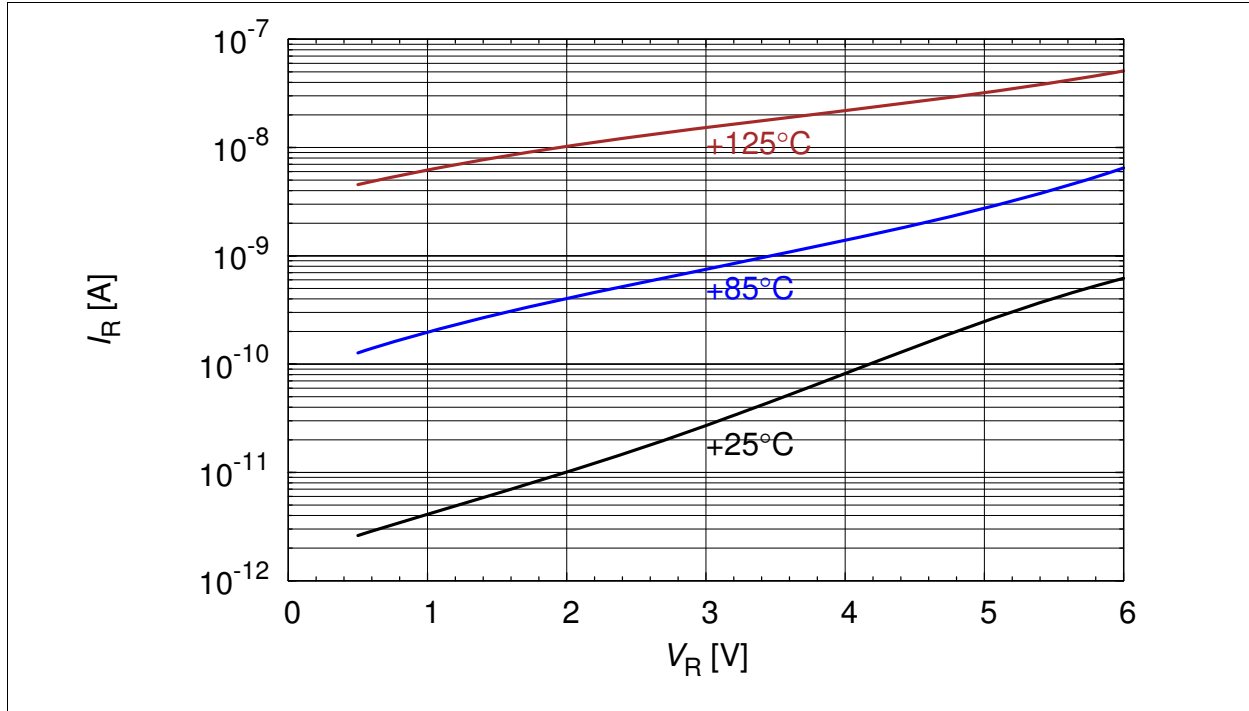


Figure 3-2 Reverse current: $I_R = f(V_R)$, $T_A = \text{parameter}$

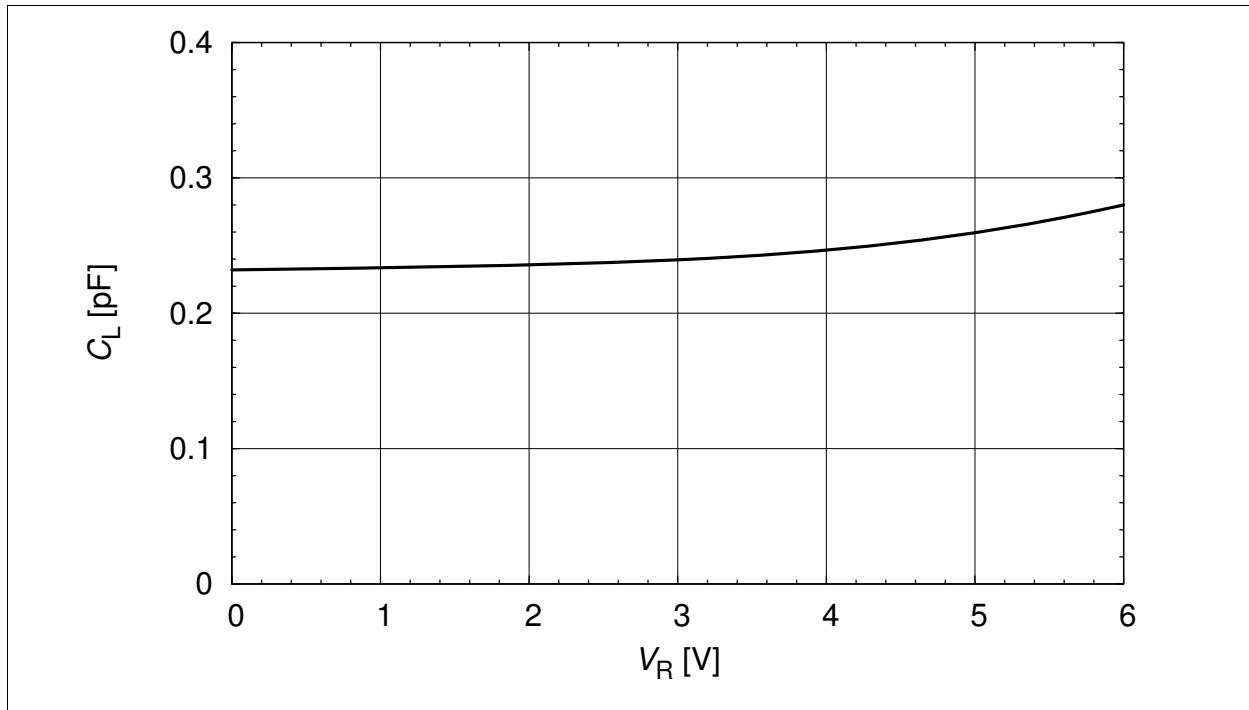


Figure 3-3 Line capacitance: $C_L = f(V_R)$, $f = 1\text{ MHz}$

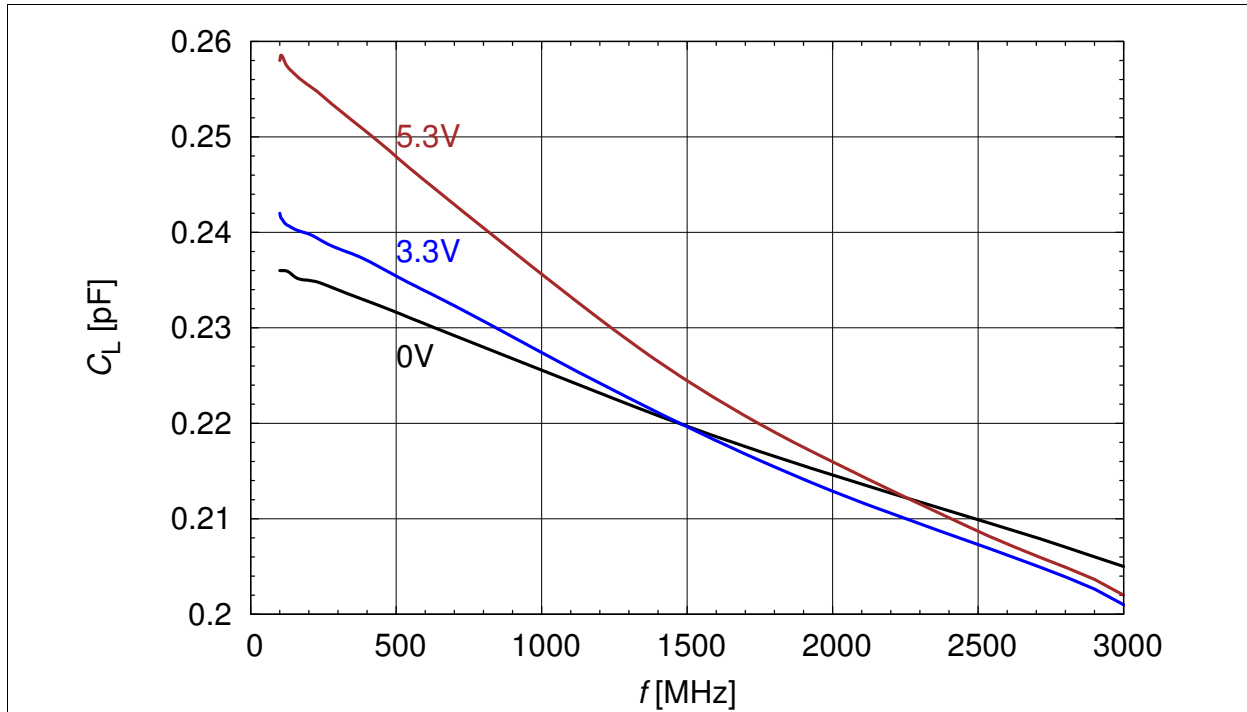


Figure 3-4 Line capacitance: $C_L = f(f)$, $V_R = \text{parameter}$

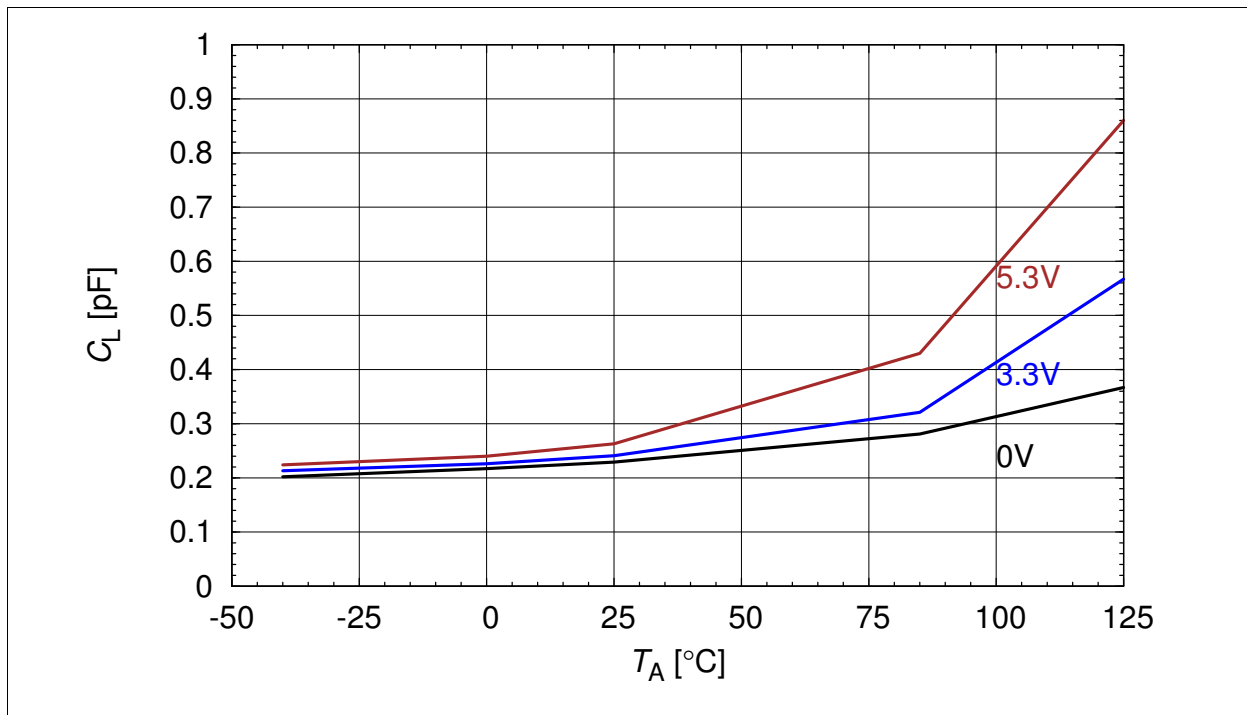


Figure 3-5 Line capacitance: $C_L = f(T_A)$, $V_R = \text{parameter}$

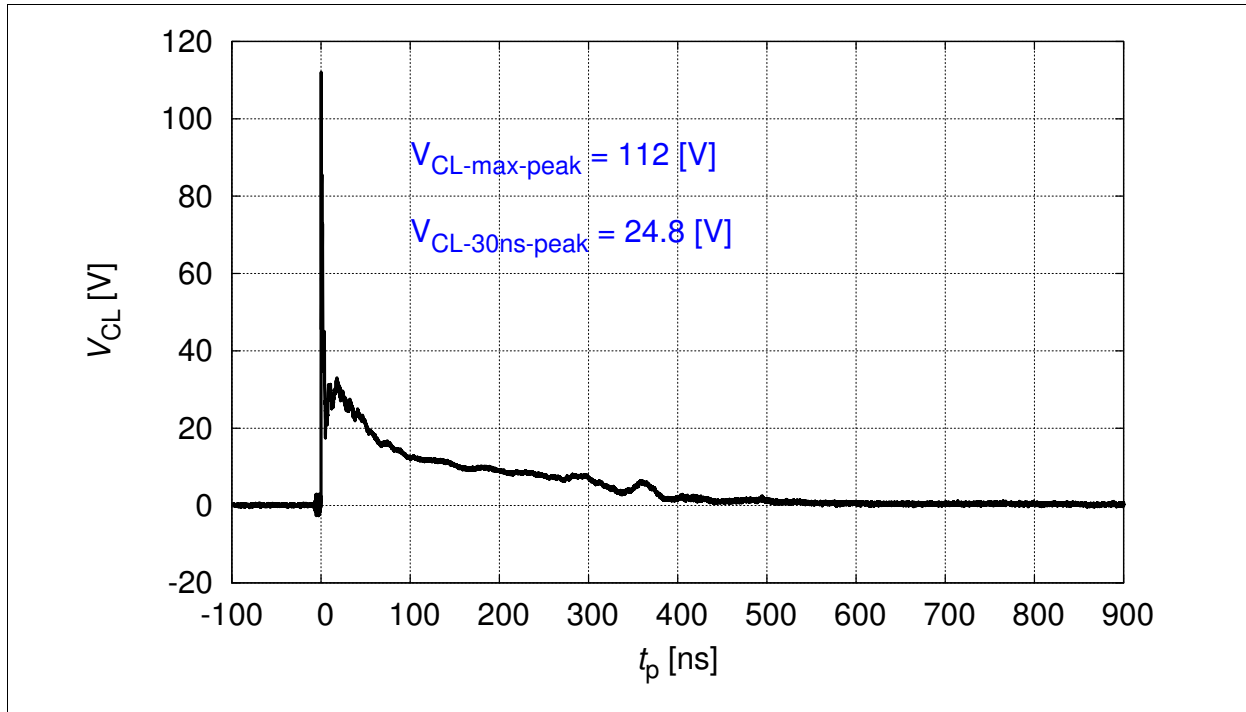


Figure 3-6 IEC61000-4-2 $V_{CL} = f(t)$, 8 kV positiv pulse from pin 1 to pin 2

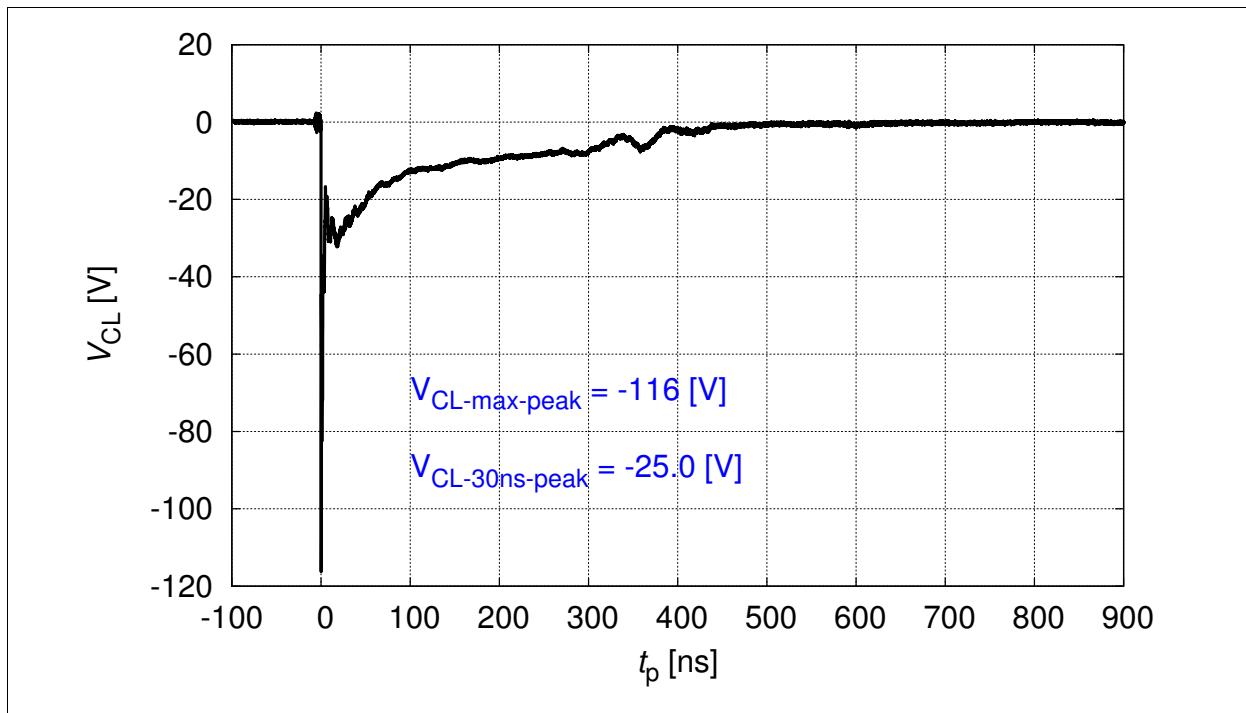


Figure 3-7 IEC61000-4-2 $V_{CL} = f(t)$, 8 kV negativ pulse from pin 1 to pin 2

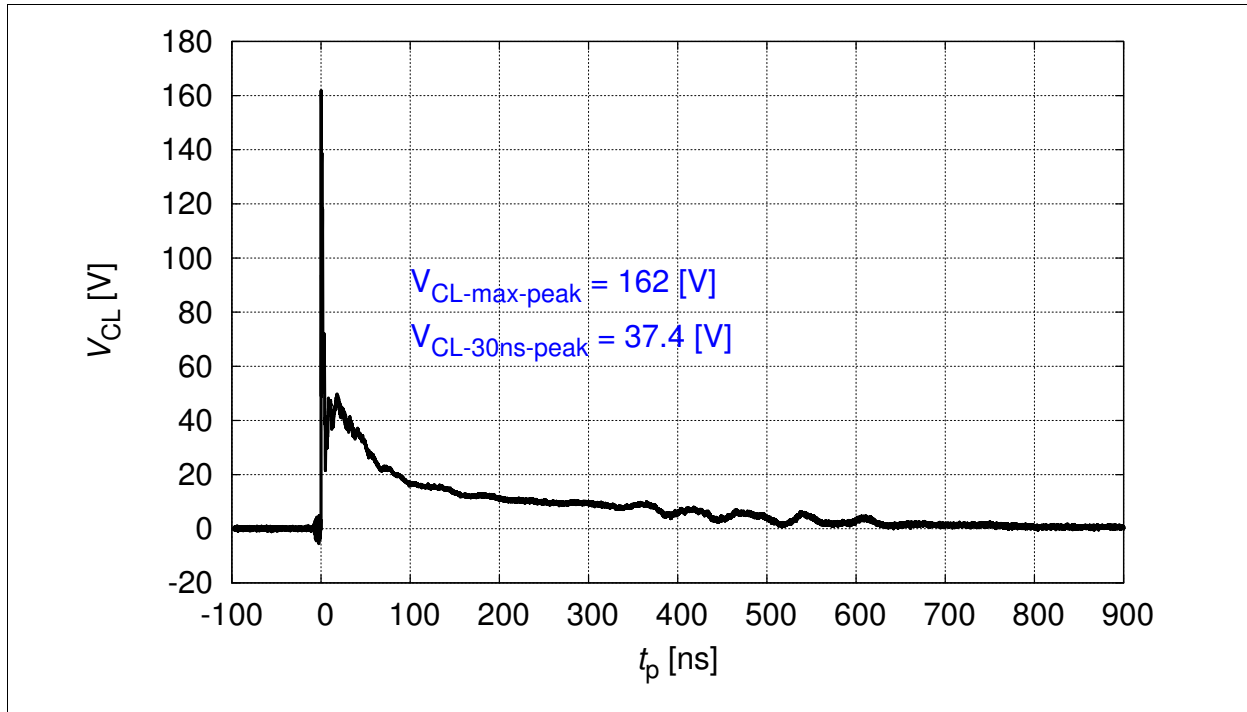


Figure 3-8 IEC61000-4-2 $V_{CL} = f(t)$, 15 kV positiv pulse from pin 1 to pin 2

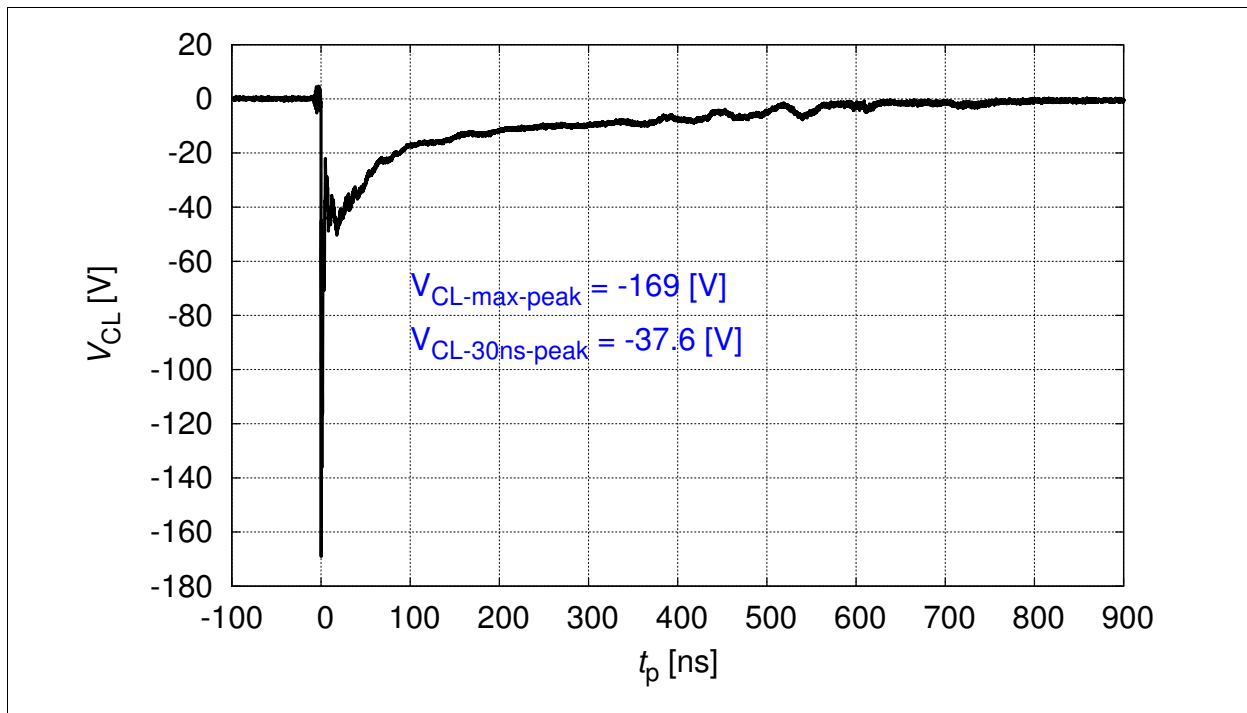


Figure 3-9 IEC61000-4-2 $V_{CL} = f(t)$, 15 kV negativ pulse from pin 1 to pin 2

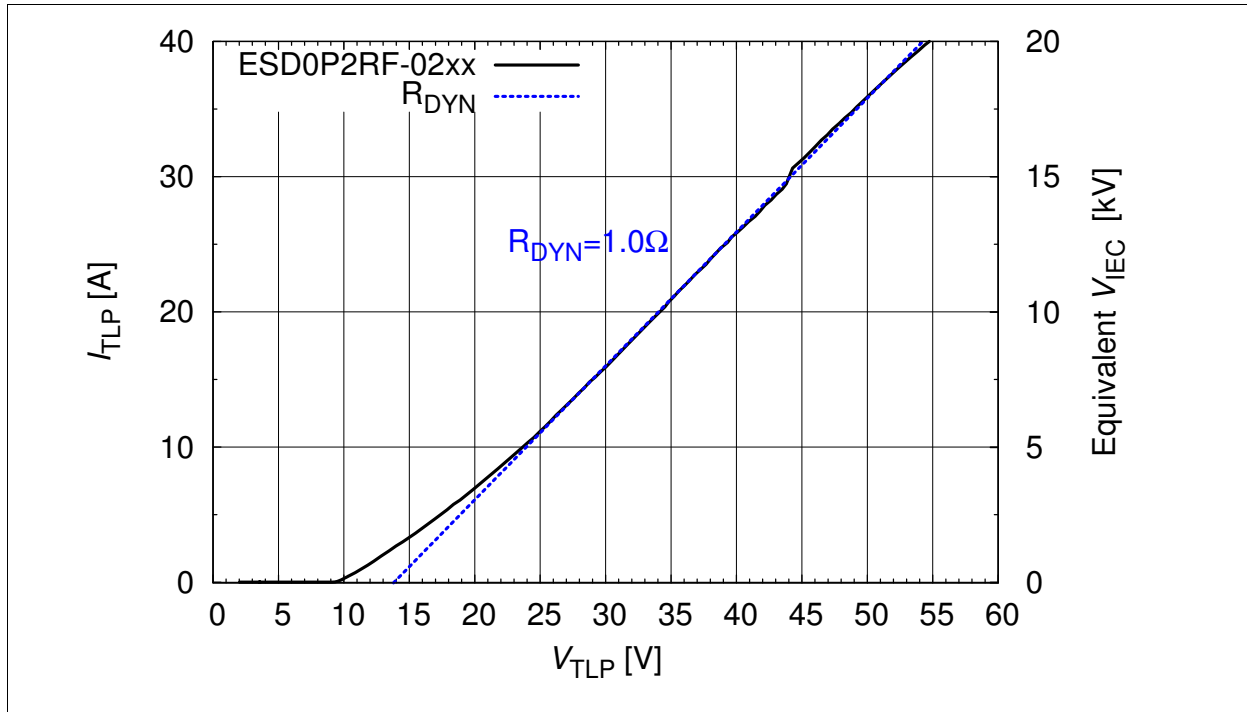


Figure 3-10 Clamping voltage : $I_{TLP} = f(V_{TLP})$ [4]

4 Application Information

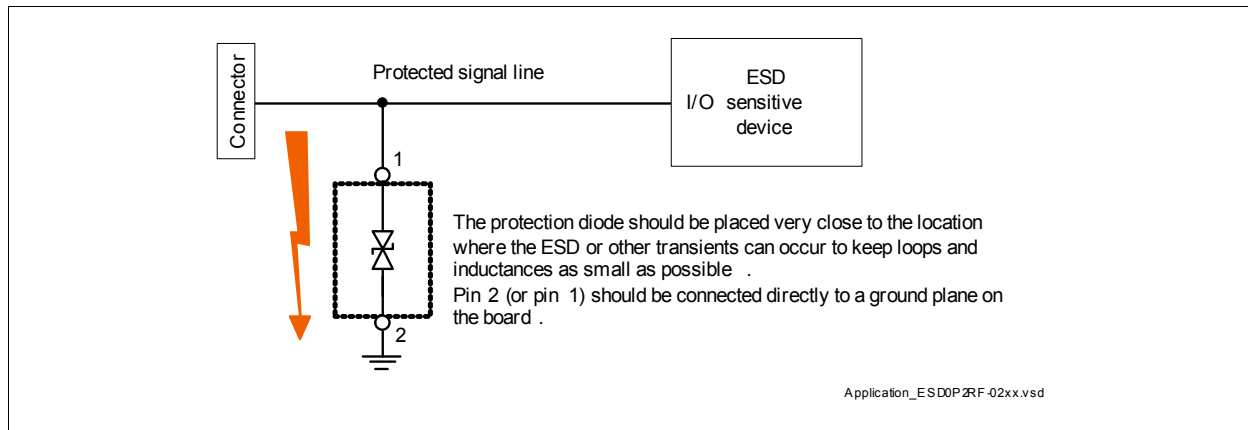


Figure 4-1 Single line, bi-directional ESD / Transient protection [1], [2], [3]

5 Ordering Information Scheme (Examples)

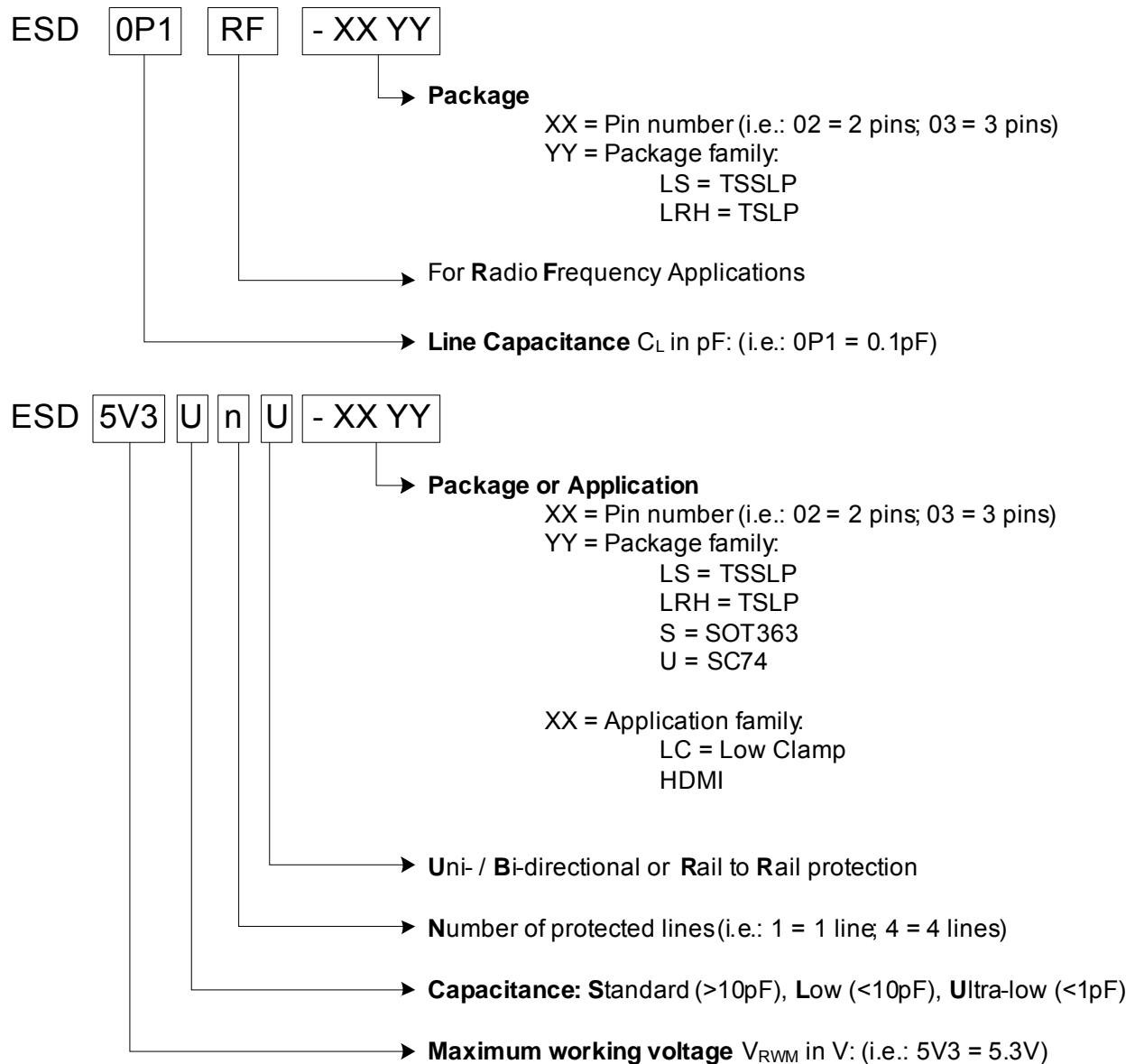


Figure 5-1 Ordering information scheme

6 Package Information

6.1 PG-TSLP-2-17 (mm) [5]

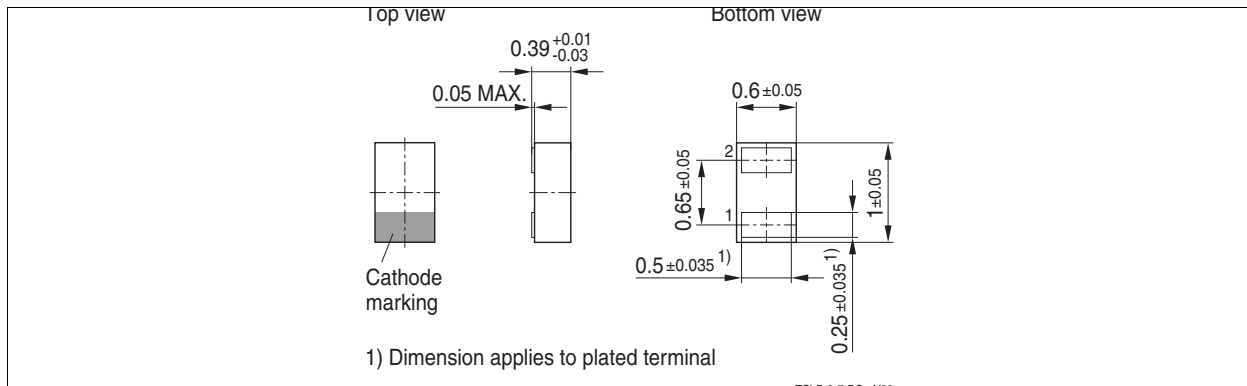


Figure 6-1 PG-TSLP-2-17: Package overview

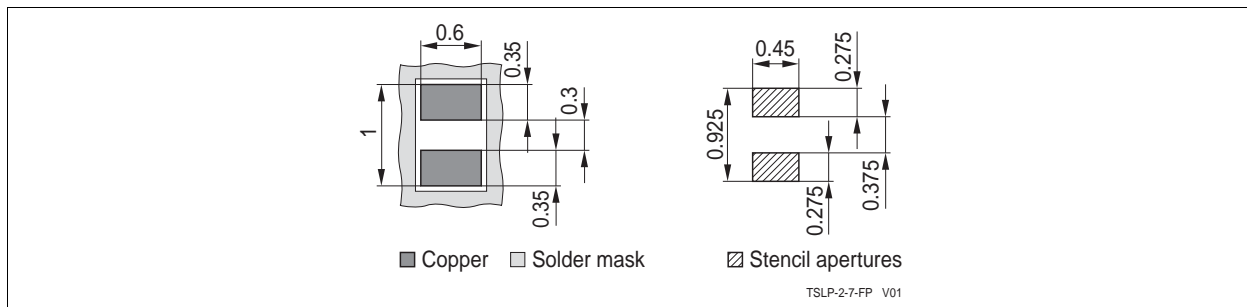


Figure 6-2 PG-TSLP-2-17: Footprint

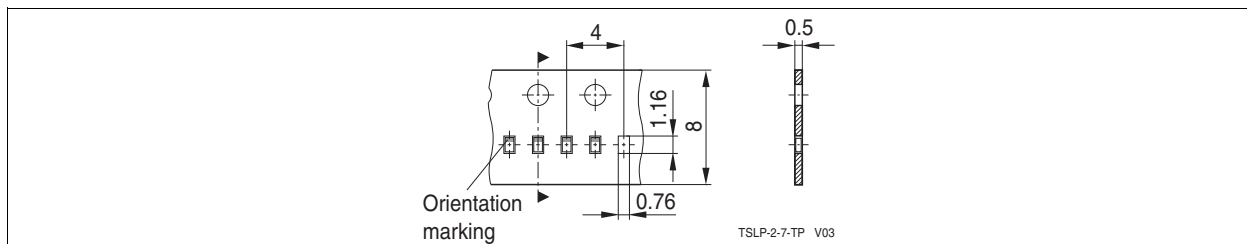


Figure 6-3 PG-TSLP-2-17: Packing

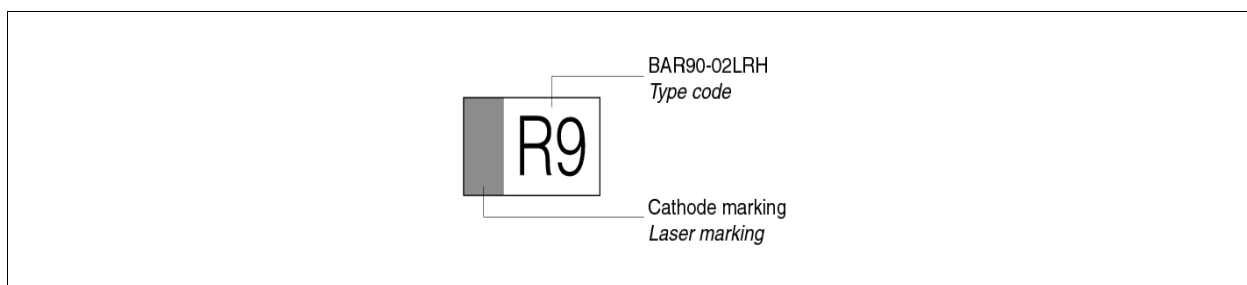


Figure 6-4 PG-TSLP-2-17: Marking (example)

7 Package Information

7.1 PG-TSSLP-2-1 (mm) [5]

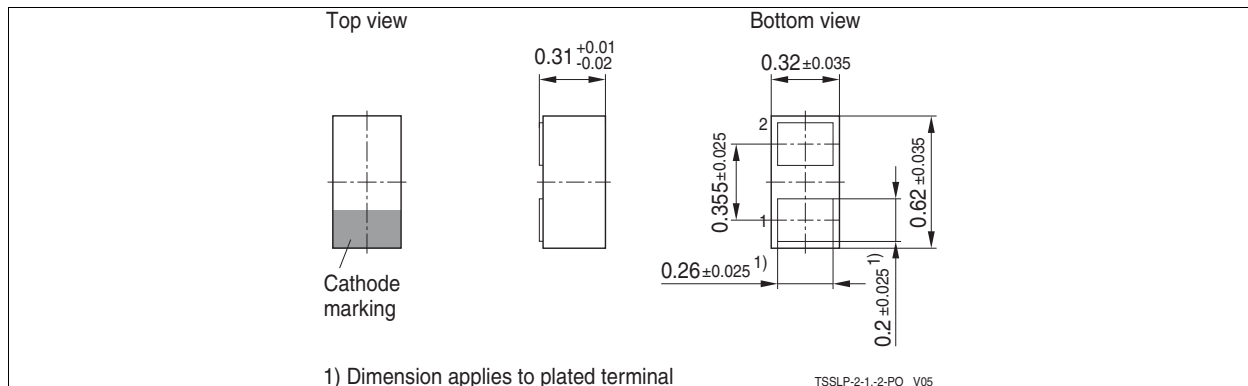


Figure 7-1 PG-TSSLP-2-1: Package overview

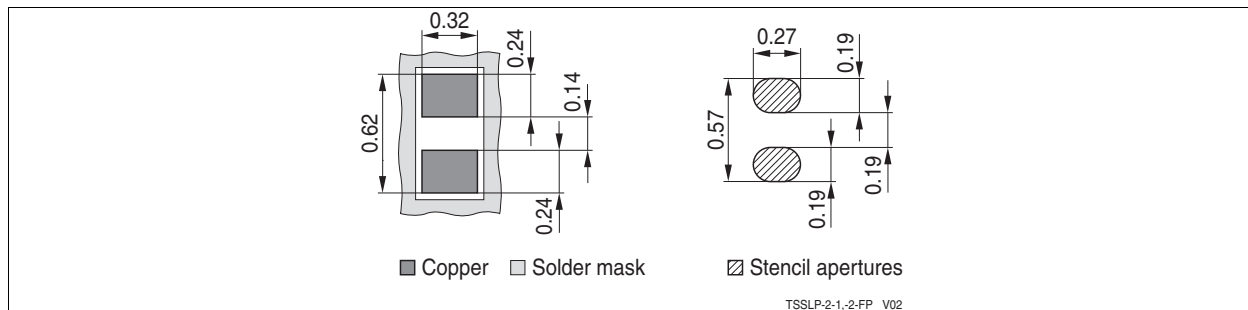


Figure 7-2 PG-TSSLP-2-1: Footprint

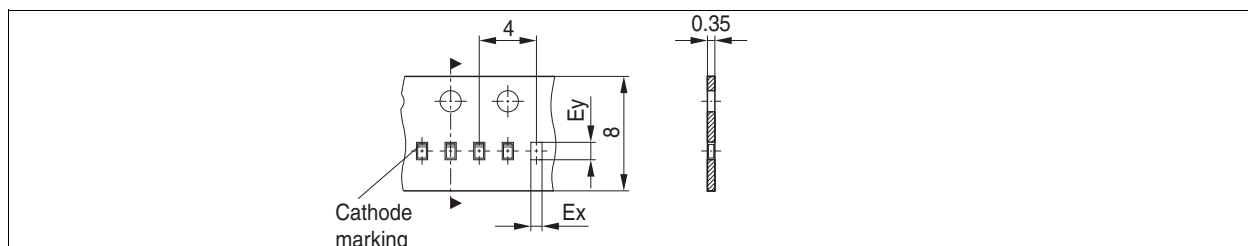


Figure 7-3 PG-TSSLP-2-1: Packing

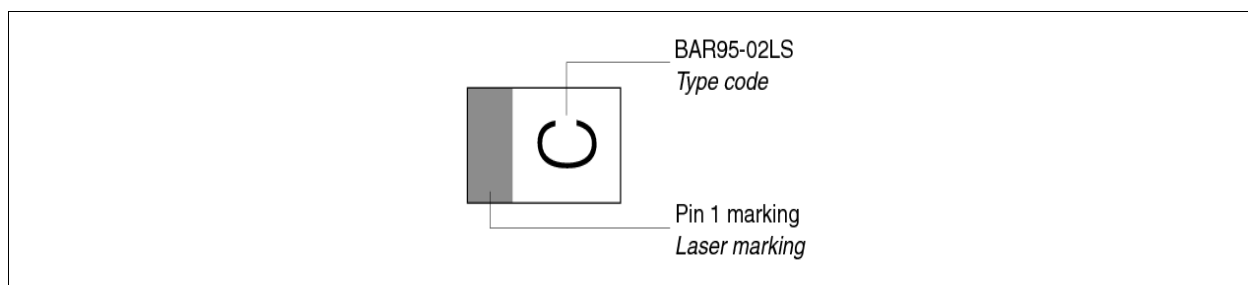


Figure 7-4 PG-TSSLP-2-1: Marking (example)

References

- [1] Infineon AG - **Application Note AN167**: ESD Protection for Broadband LNA BGA728L7 for Portable and Mobile TV Applications
- [2] Infineon AG - **Application Note AN178**: ESD Protection for RF Antennas using Infineon ESD0P4RFL and ESD0P2RF-xx
- [3] Infineon AG - **Application Note AN200**: Low Cost FM Radio LNA using BFR340F for Mobile Phone Applications
- [4] Infineon AG - **Application Note AN210**: Effective ESD Protection Design at System Level using VF-TLP Characterization Methodology
- [5] Infineon AG - Recommendations for PCB Assembly of Infineon TSLP and TSSLP Packages

Terminology

C_L	Line capacitance
EFT	Electrical Fast Transient
ESD	Electrostatic Discharge
GPS	Global Positioning System
IEC	International Electrotechnical Commission
I_{PP}	Peak pulse current
I_R	Reverse current
LNA	Low Noise Amplifier
R_{DYN}	Dynamic resistance
RoHS	Restriction of Hazardous Substances Directive
T_A	Ambient temperature
TLP	Transmission Line Pulse
T_{OP}	Operation temperature
t_p	Pulse duration
t_r	Pulse rise time
T_{stg}	Storage temperature
UWB	Ultra Wideband
V_{BR}	Breakdown voltage
V_{CL}	Reverse clamping voltage
V_{ESD}	Electrostatic discharge voltage
V_R	Reverse voltage
V_{RWM}	Maximum Reverse Working Voltage

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