# Protection Devices

TVS (Transient Voltage Suppressor)

# ESD102-U1-02ELS

Uni-directional, 3.3 V, 0.4 pF, 0201, RoHS

ESD102-U1-02ELS

## Data Sheet

Revision 1.2, 2015-12-14
Final

Power Management & Multimarket

**Edition 2015-12-14**

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



### Information

For further information on technology, delivery terms and conditions and prices, please contact the nearest Infineon Technologies Office (**www.infineon.com**)

### Warnings

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.

Infineon Technologies components may be used in life-support devices or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

# 1 Product Overview

## 1.1 Features

- ESD / transient protection of high speed data lines according to:
  - **IEC61000-4-2 (ESD): ±20 kV (air / contact)**
  - **IEC61000-4-4 (EFT): ±2.5 kV / 50 A (5/50 ns)**
  - **IEC61000-4-5 (surge): ±3 A (8/20 µs)**
- Uni-directional working voltage: **$V_{RWM}$ = 3.3 V**
- Ultra low capacitance: **$C_L$ = 0.4 pF (typical)**
- Very low clamping voltage: **$V_{CL}$ = 8 V (typical) at $I_{PP}$ = 16 A**
- Low reverse current: **$I_R$ = 1 nA (typical)**
- Very low dynamic resistance: **$R_{DYN}$ = 0.19 Ω (typical)**
- Pb-free (RoHS compliant) and halogen free package, very small form factor 0.62 x 0.32 x 0.31 mm$^3$

## 1.2 Application Examples

- USB 3.0, 10/100/1000 Ethernet, Firewire, DVI, HDMI, S-ATA, DisplayPort
- Mobile HDMI Link, MDDI, MIPI, SWP / NFC

## 1.3 Product Description

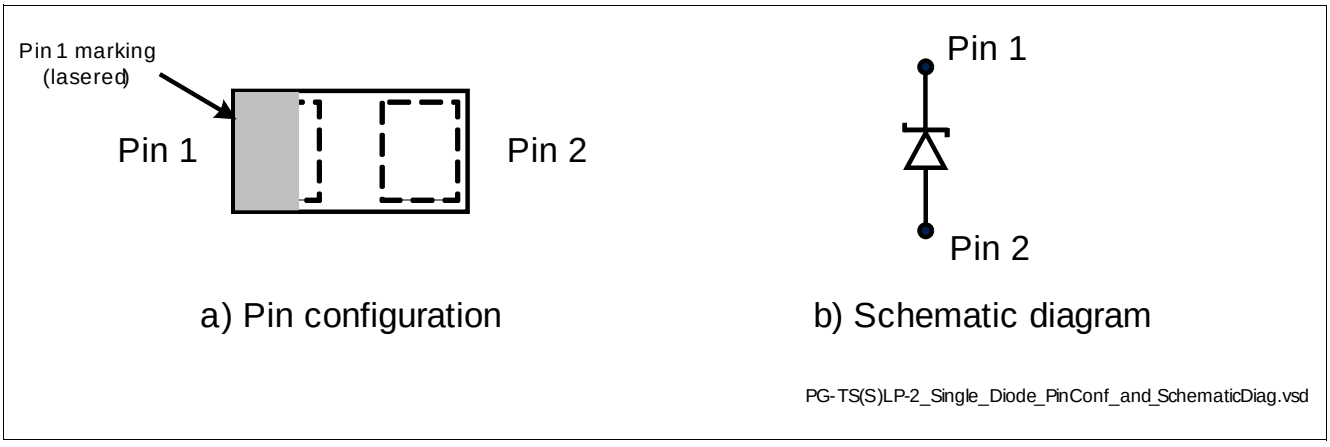


**Figure 1 Pin Configuration and Schematic Diagram**

**Table 1 Part Information**

| Type | Package | Configuration | Marking code |
|---|---|---|---|
| ESD102-U1-02ELS | TSSLP-2-3 | 1 line, uni-directional | F |

# 2 Maximum Ratings

**Table 2 Maximum Rating** *at $T_A$ = 25 °C, unless otherwise specified*

| Parameter | Symbol | Values | Unit |
|---|---|---|---|
| ESD air discharge[1)]<br>ESD contact discharge[1)] | $V_{ESD}$ | ±20<br>±20 | kV |
| Peak pulse current[2)] | $I_{PP}$ | ±3 | A |
| Operating temperature | $T_{OP}$ | -55 to 125 | °C |
| Storage temperature | $T_{stg}$ | -65 to 150 | °C |

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

2) Stress pulse: 8/20µs current waveform according to IEC61000-4-5

***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.***

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

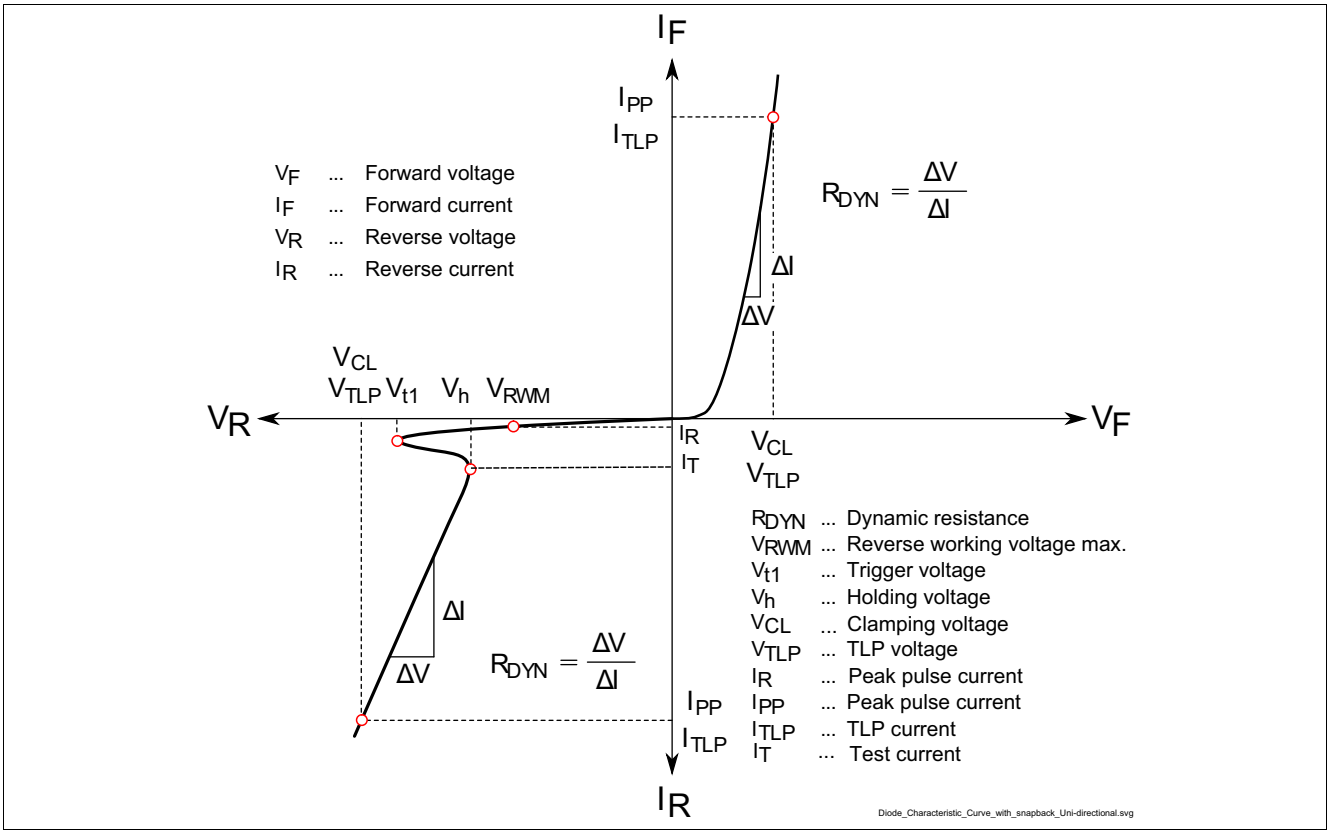


**Figure 2 Definitions of Electrical Characteristics**

**Table 3 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 | V | Pin 1 to Pin 2 |
| Trigger voltage | $V_{t1}$ | – | 6.2 | – | | |
| Holding voltage | $V_h$ | 3.35 | 4 | 4.4 | | Pin 1 to Pin 2, $I_R$ = 10 mA |
| Reverse current | $I_R$ | – | 1 | 50 | nA | $V_R$ = 3.3 V, from Pin 1 to Pin 2 |

**Table 4 AC Characteristics** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Line capacitance | $C_L$ | – | 0.4 | 0.65 | pF | $V_R$ = 0 V, $f$ = 1 MHz |
| | | – | 0.4 | 0.65 | pF | $V_R$ = 0 V, $f$ = 1 GHz |
| Series inductance | $L_S$ | – | 0.2 | – | nH | |

**Table 5 ESD and Surge Characteristics** at $T_A$ = 25 °C, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Clamping voltage[1)] | $V_{CL}$ | – | 8 | – | V | $I_{TLP}$ = 16 A, $t_p$ = 100 ns, from Pin 1 to Pin 2 |
| | | – | 11 | – | | $I_{TLP}$ = 30A, $t_p$ = 100 ns from Pin 1 to Pin 2 |
| Forward clamping voltage[1)] | $V_{FC}$ | – | 6 | – | | $I_{TLP}$ = 16 A, $t_p$ = 100 ns, from Pin 2 to Pin 1 |
| | | – | 9 | – | | $I_{TLP}$ = 30 A, $t_p$ = 100 ns, from Pin 2 to Pin 1 |
| Dynamic resistance[1)] | $R_{DYN}$ | – | 0.19 | – | Ω | $t_p$ = 100 ns from Pin 1 to Pin 2 |
| | | – | 0.23 | – | Ω | $t_p$ = 100 ns from Pin 2 to Pin 1 |

1) Please refer to Application Note AN210[1]. TLP parameter: $Z_0$ = 50 Ω , $t_p$ = 100ns, $t_r$ = 0.6 ns.

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

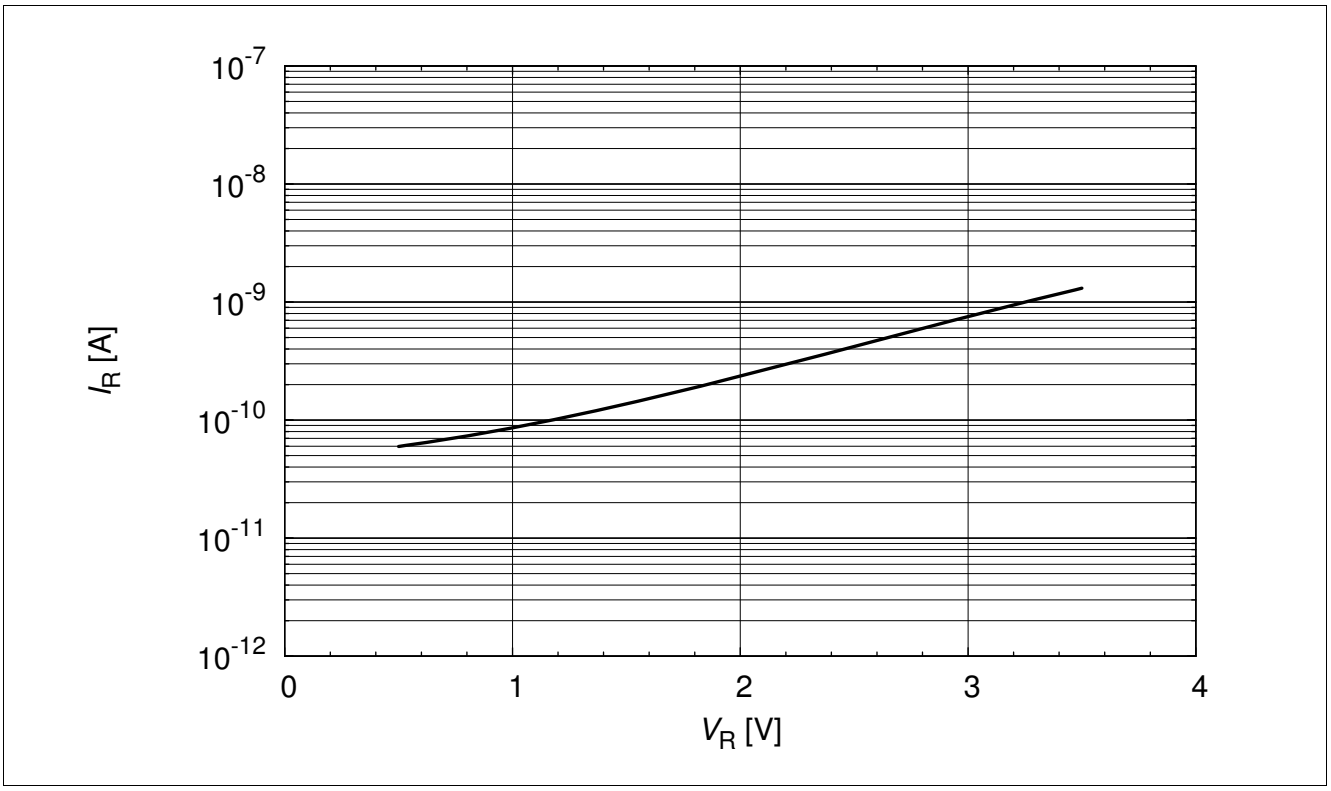


**Figure 3 Reverse leakage current, $I_R = (V_R)$**

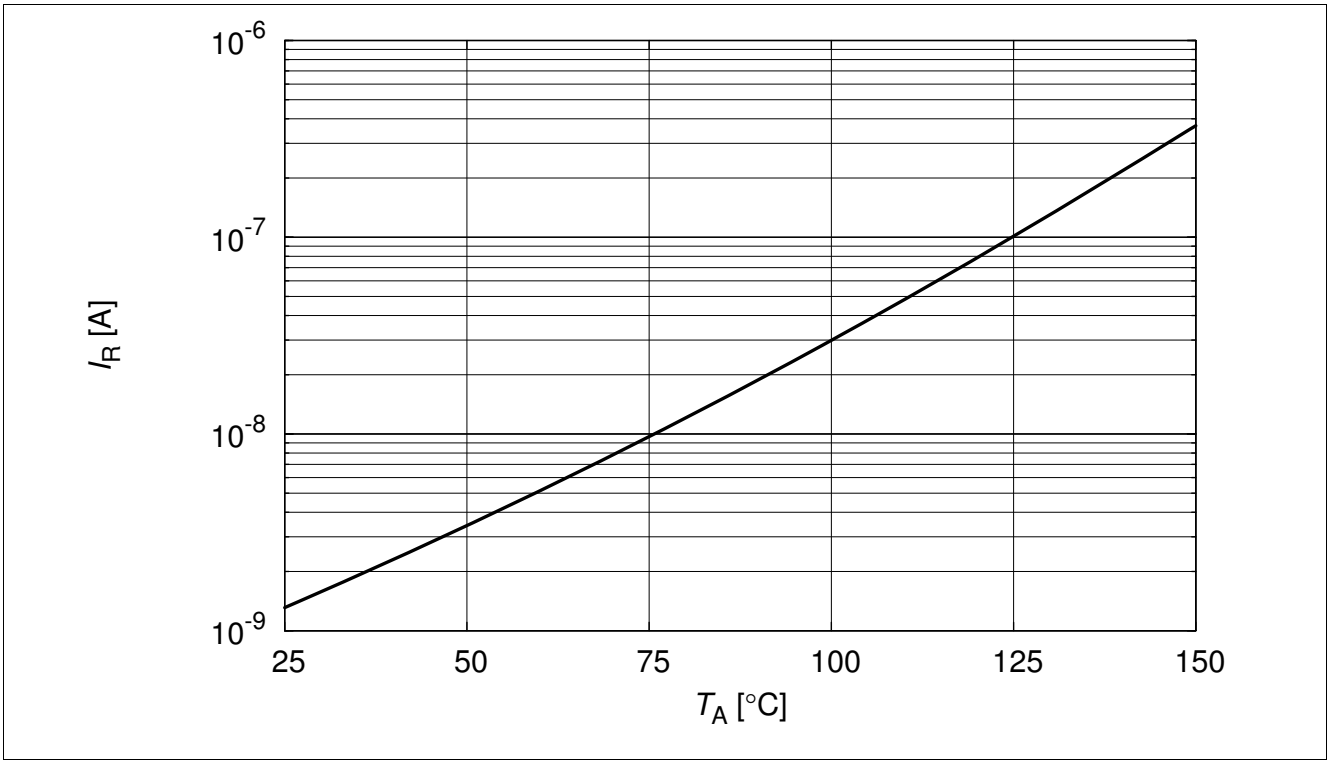


**Figure 4 Reverse current $I_R = f(T_A)$, $V_R$ = 3.3 V**

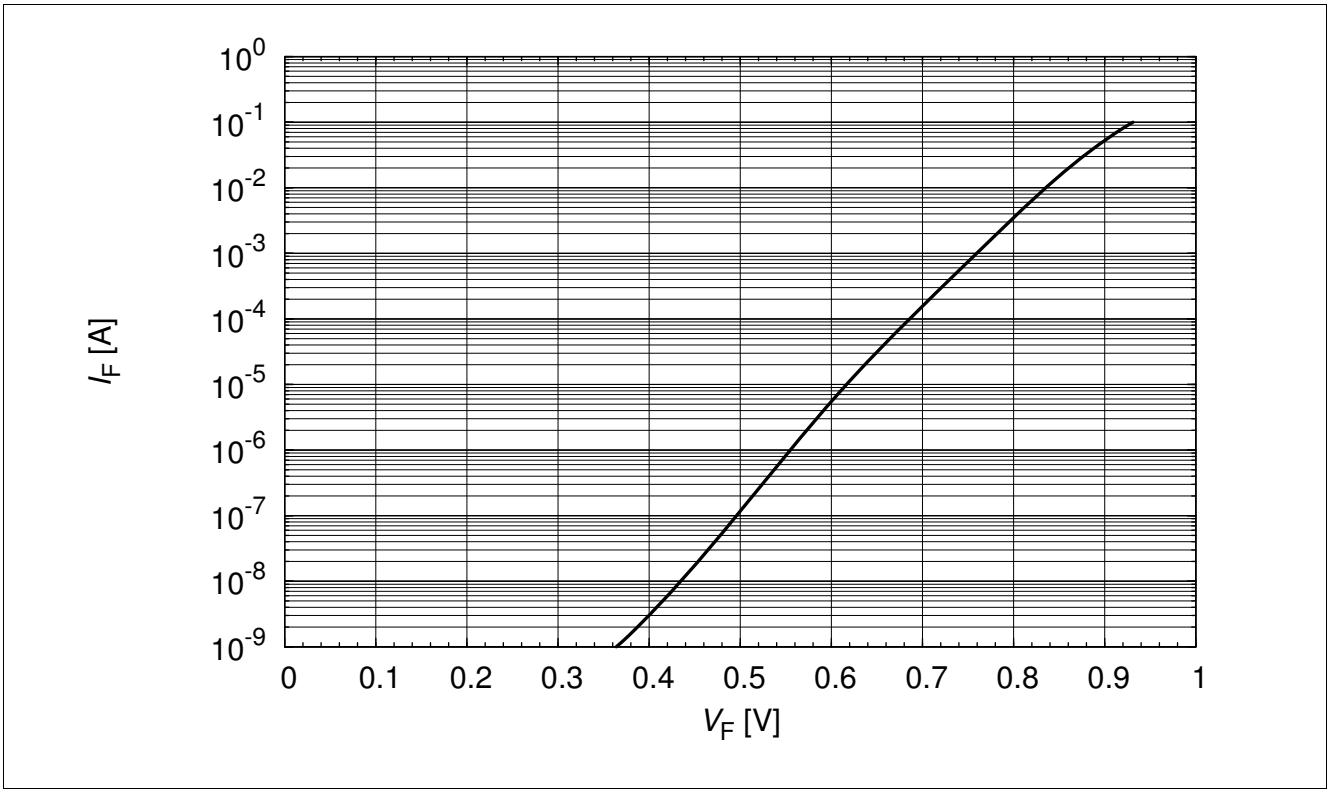


**Figure 5 Forward current, $I_F = (V_F)$**

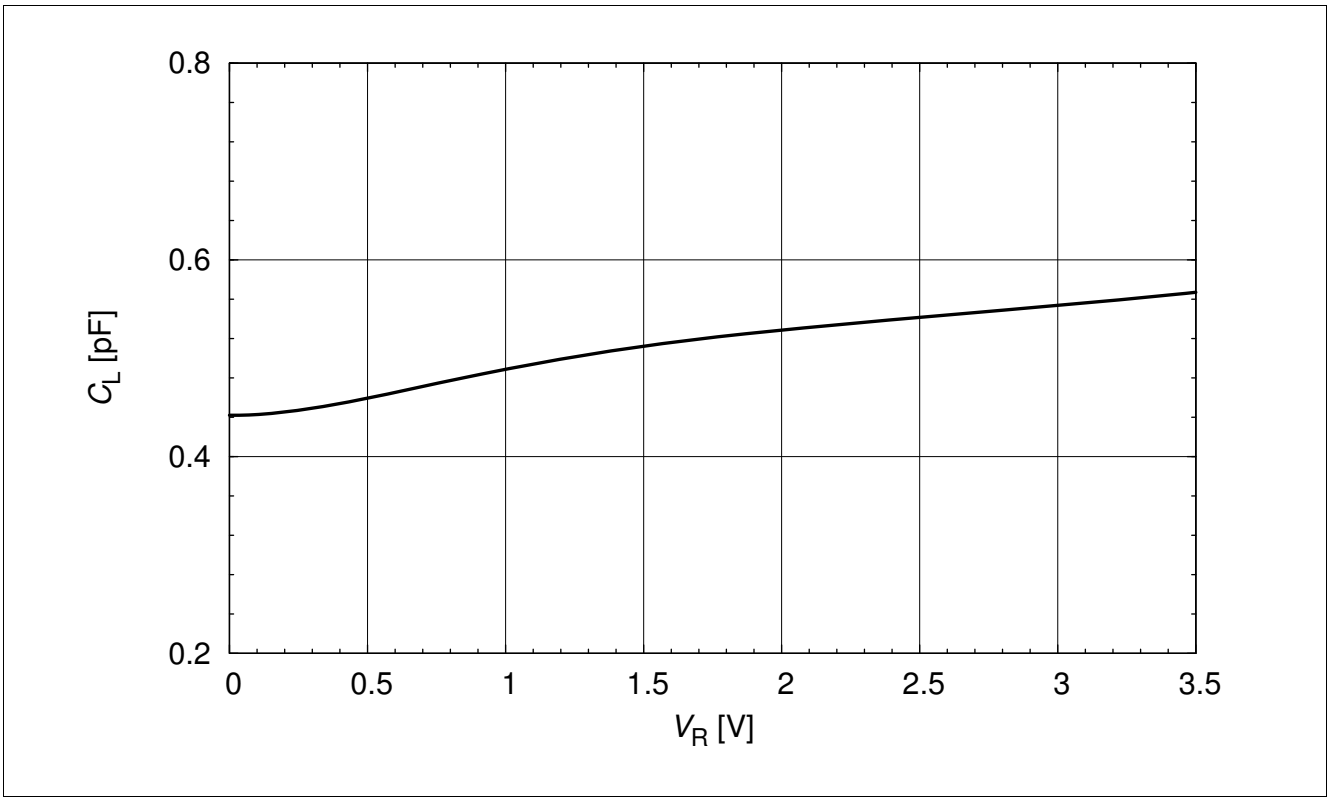


**Figure 6 Line capacitance $C_L = f(V_R)$, $f$ = 1MHz, from pin 1 to pin 2**

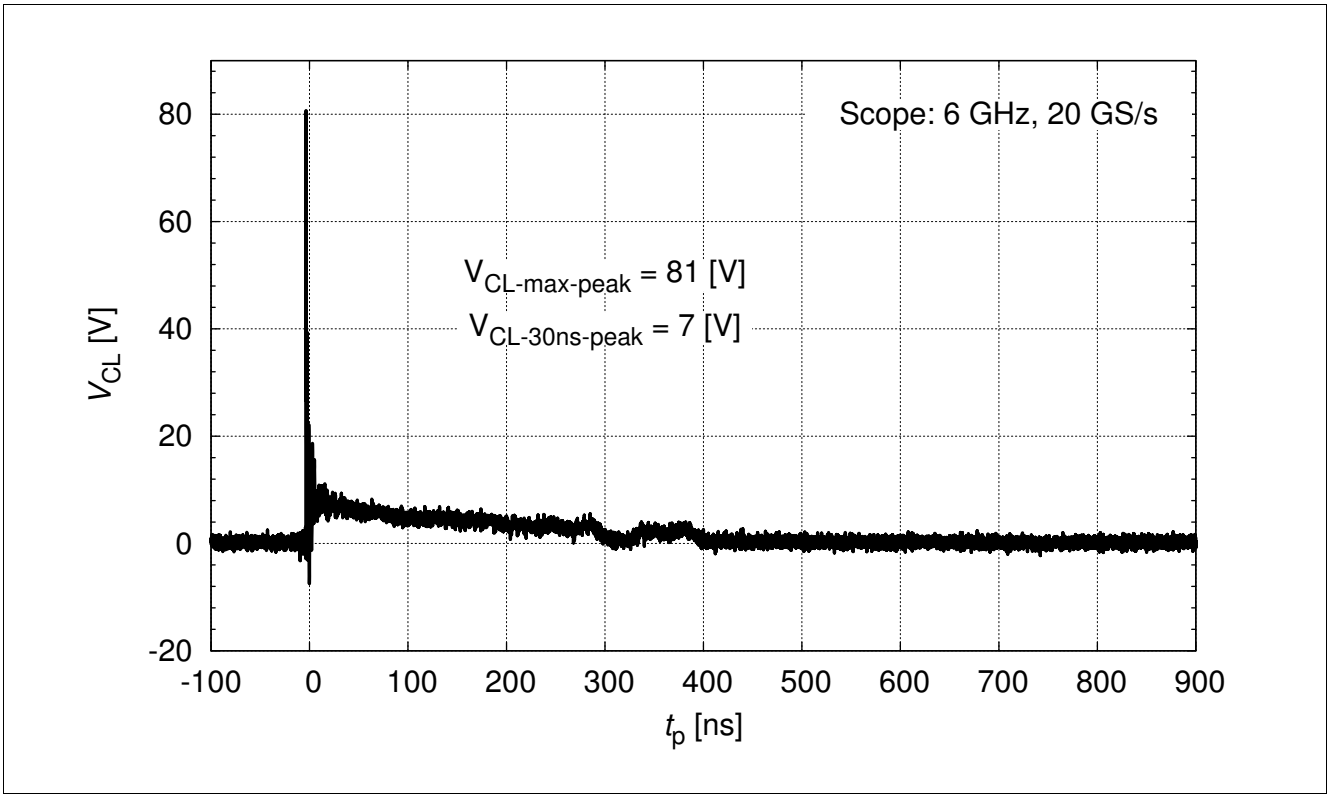


**Figure 7 Clamping voltage (ESD): $V_{CL}$ = $f(t)$, 8 kV positive pulse from pin 1 to pin 2**

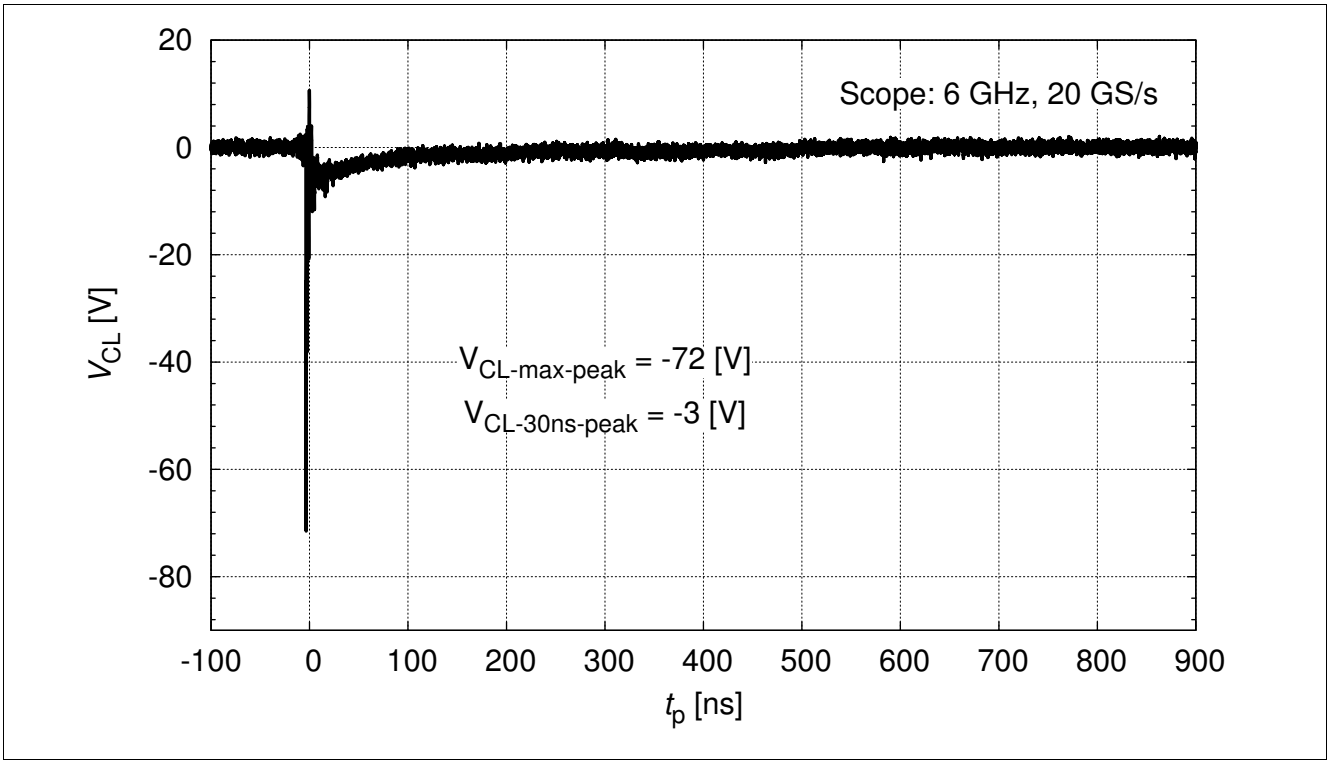


**Figure 8 Clamping voltage (ESD): $V_{CL}$ = $f(t)$, 8 kV negative pulse from pin 1 to pin 2**

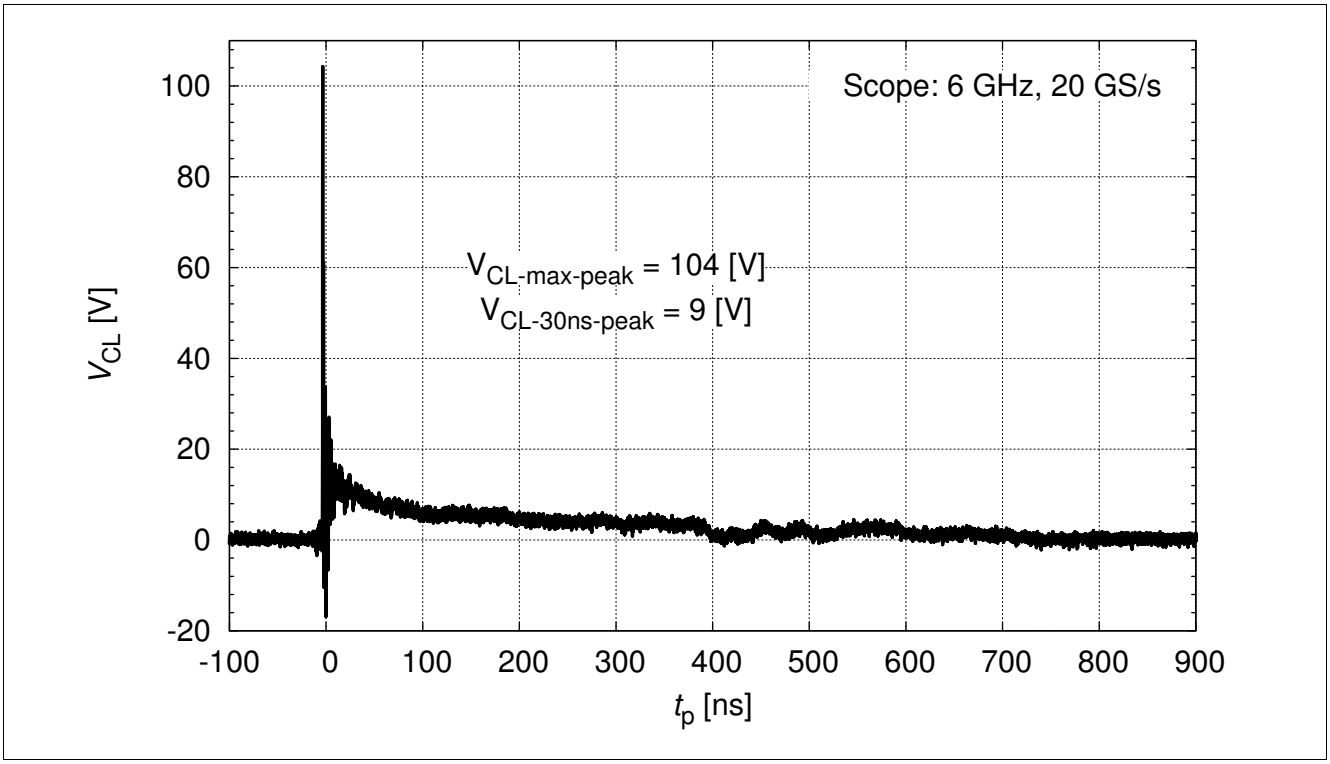


**Figure 9 Clamping voltage (ESD): $V_{CL}$ = *f*(*t*), 15 kV positive pulse from pin 1 to pin 2**

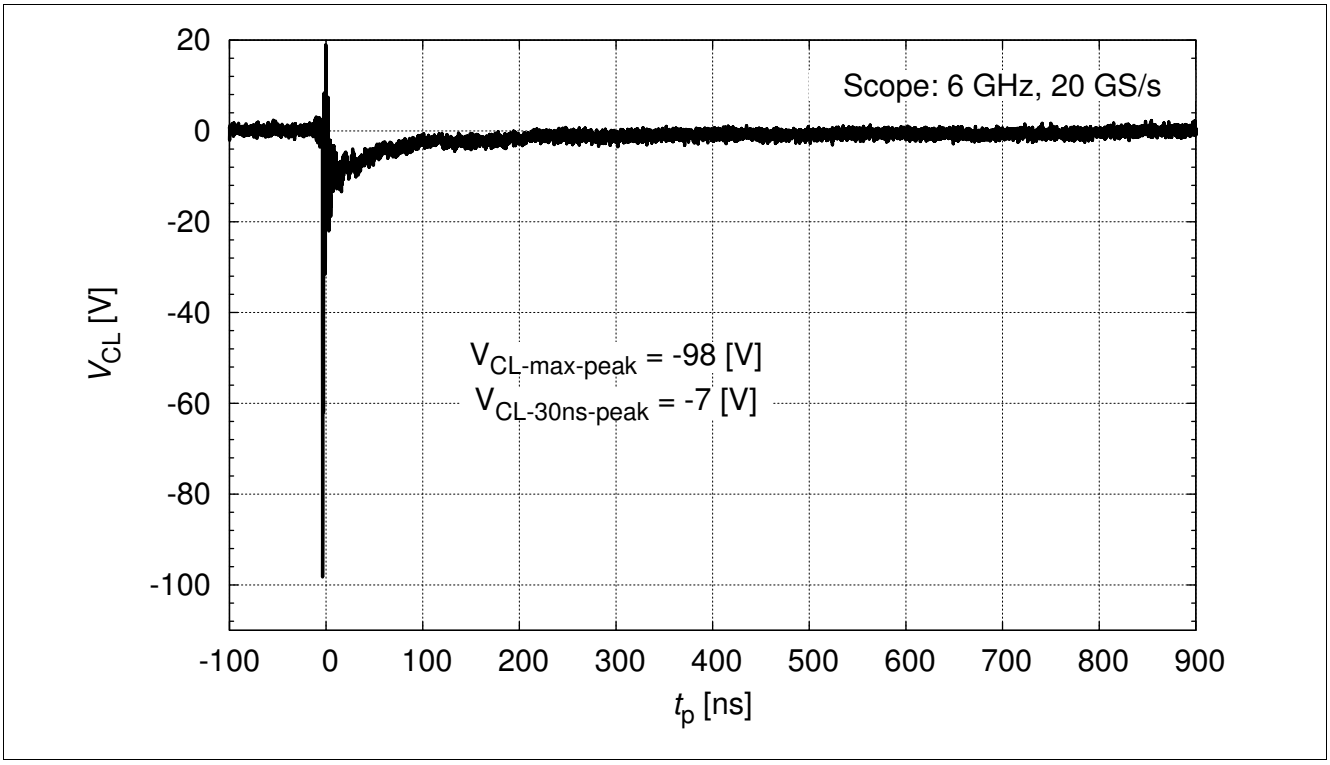


**Figure 10 Clamping voltage (ESD): $V_{CL}$ = *f*(*t*), 15 kV negative pulse from pin 1 to pin 2**

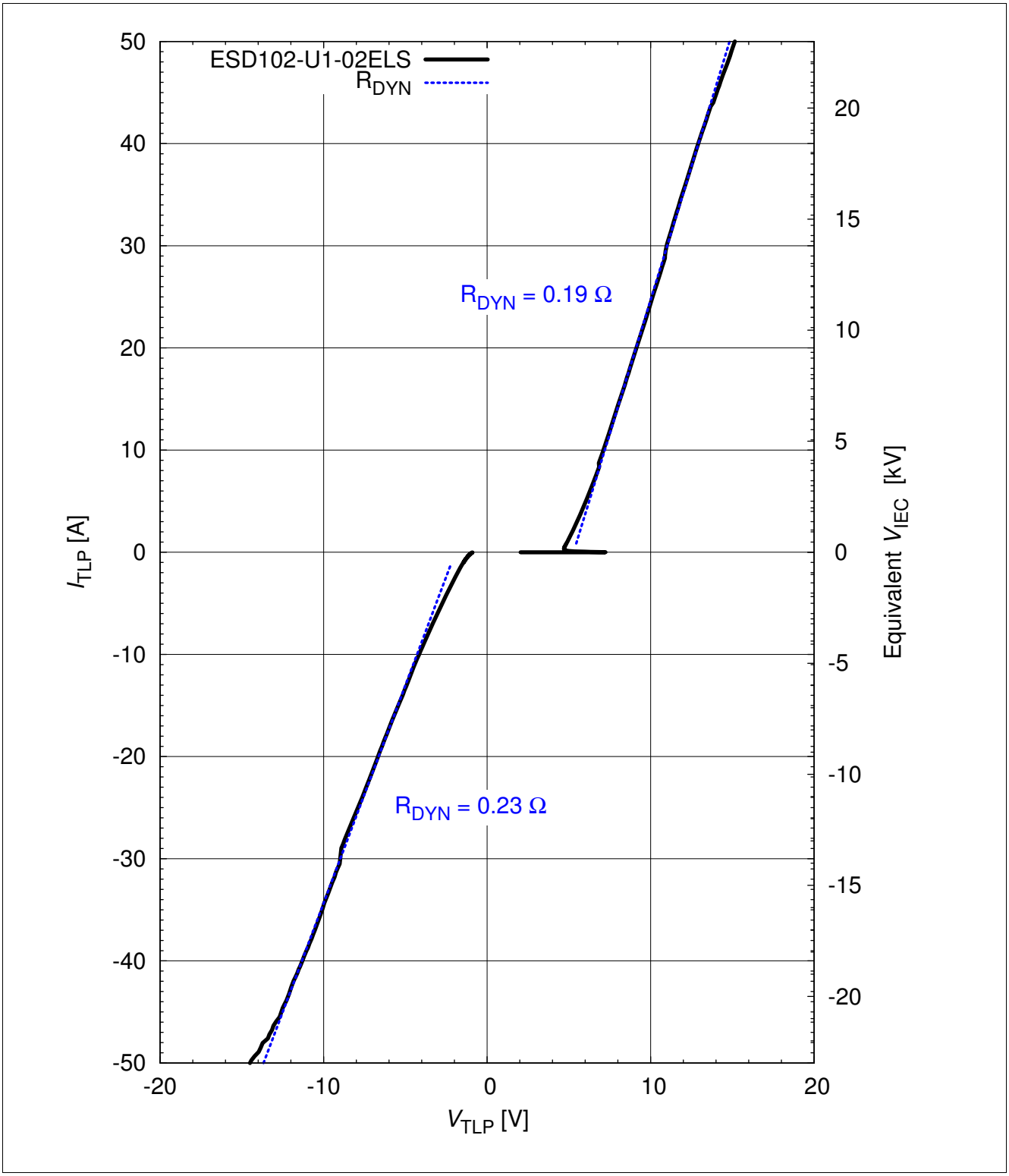


**Figure 11 Clamping voltage (TLP): $I_{TLP} = f(V_{TLP})$ [1], pin 1 to pin 2**

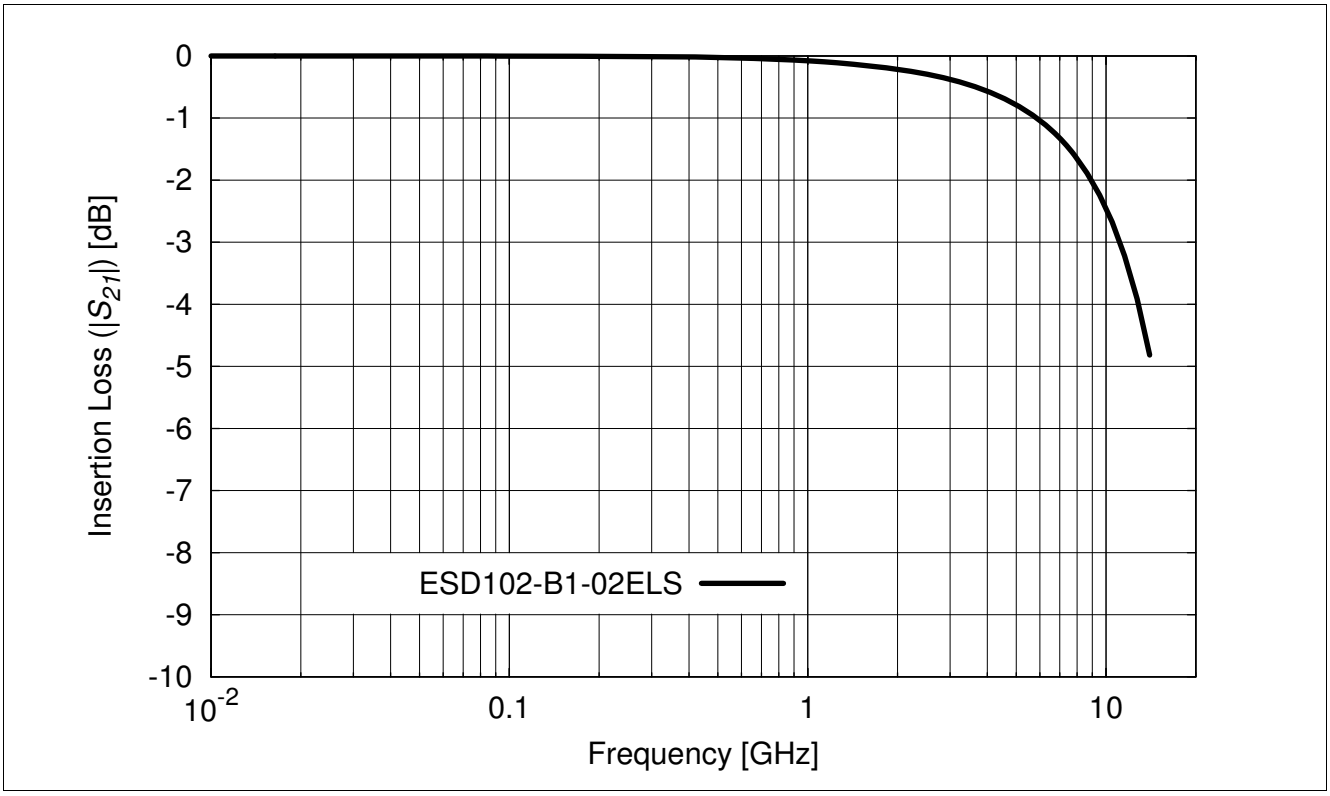


**Figure 12 Insertion loss vs. frequency in a 50 Ω system**

# 5 Application Information

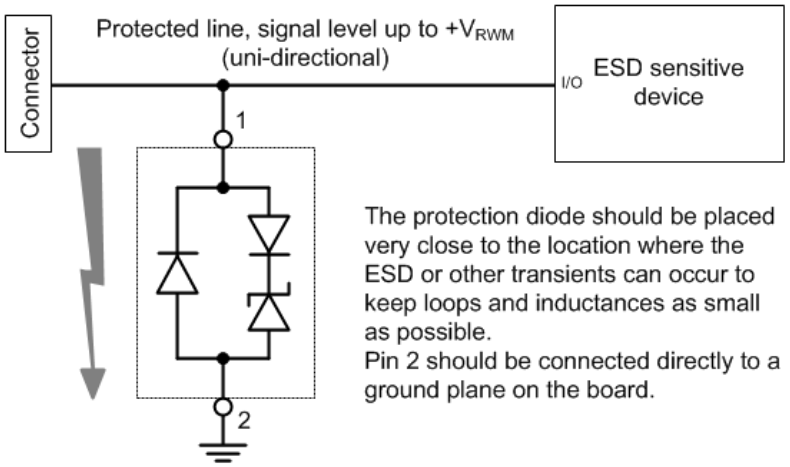


**Figure 13 Single line, uni-directional ESD / Transient protection[2]**

# 6 Package Information

## 6.1 TSSLP-2-3

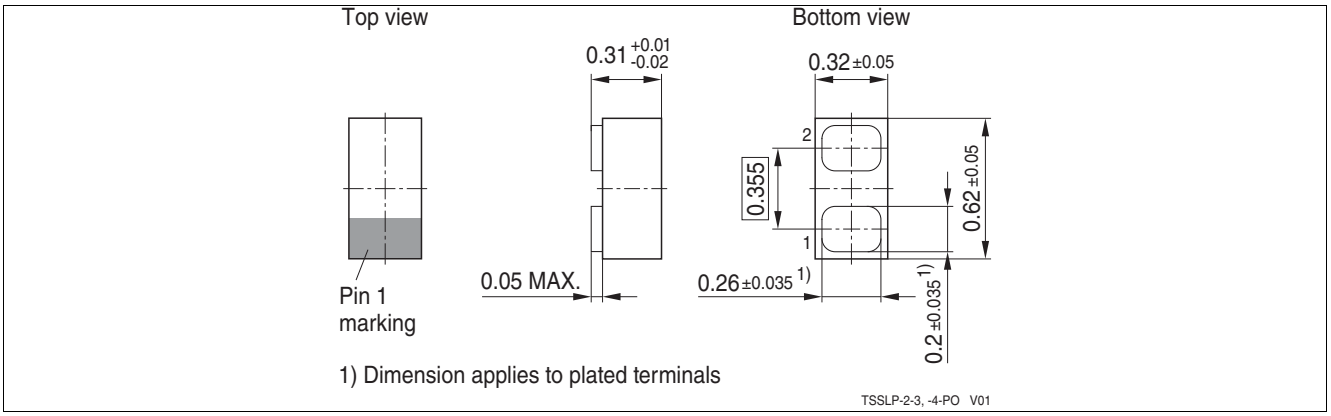


**Figure 14 TSSLP-2-3 Package outline (dimension in mm)**

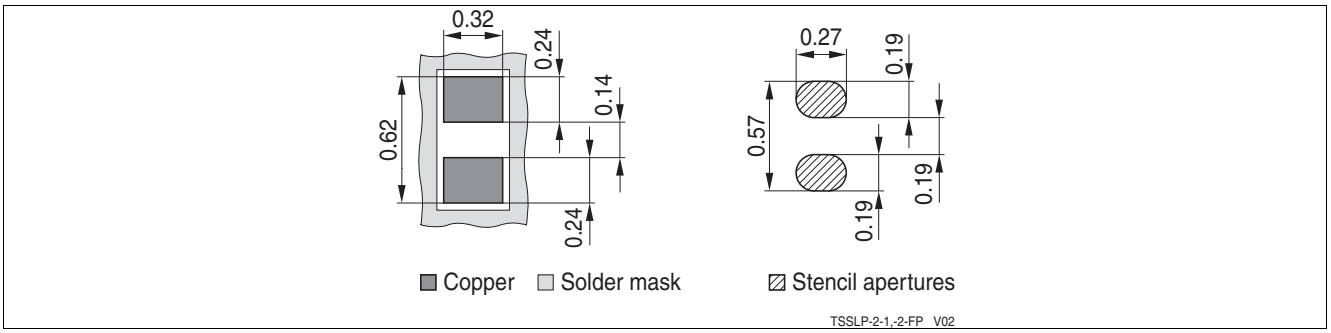


**Figure 15 TSSLP-2-3 Footprint (dimension in mm)**

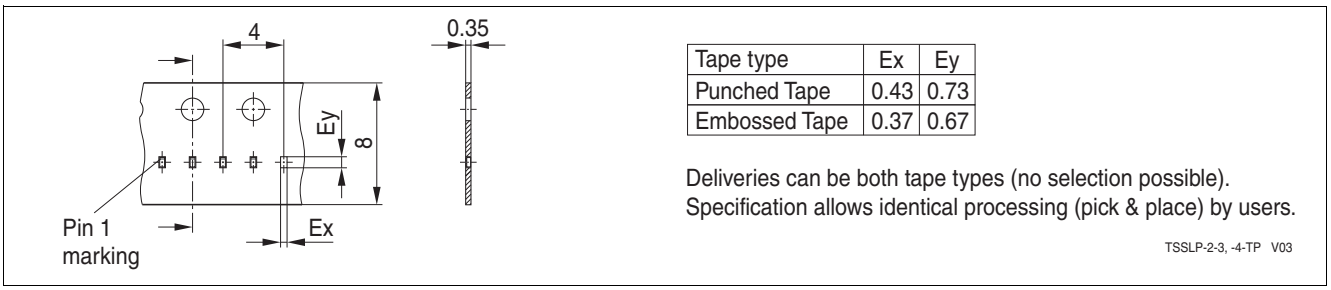


**Figure 16 TSSLP-2-3 Packing (dimension in mm)**

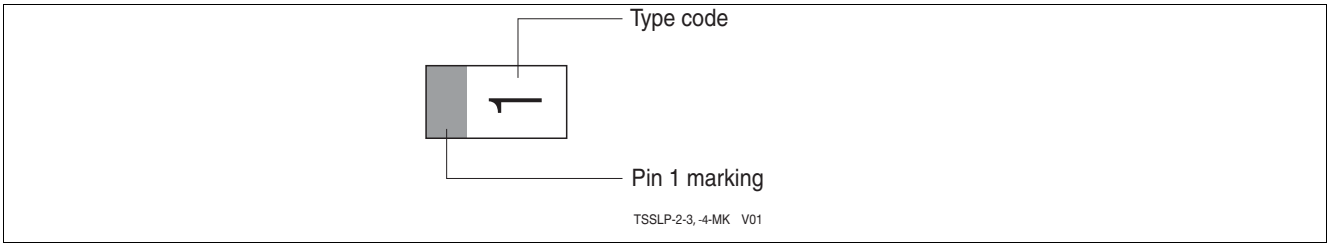


**Figure 17** TSSLP-2-3 **Marking example** **Table 1 "Part Information" on Page 3**

# References

[1] On-chip ESD protection for integrated circuits, Albert Z. H. Wang, ISBN:0-7923-7647-1

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

[3] Infineon AG - Recommendations for PCB Assembly of Infineon TSLP and TSSLP Package

| Revision History: Revision 1.1, 2014-02-13 | |
|---|---|
| **Page or Item** | **Subjects (major changes since previous revision)** |
| **Revision 1.2, 2015-12-14** | |
| All | Layout change |
| | |
| | |
| | |
| | |

### Trademarks of Infineon Technologies AG

AURIX™, BlueMoon™, COMNEON™, C166™, CROSSAVE™, CanPAK™, CIPOS™, CoolMOS™, CoolSET™, CORECONTROL™, DAVE™, EasyPIM™, EconoBRIDGE™, EconoDUAL™, EconoPACK™, EconoPIM™, EiceDRIVER™, EUPEC™, FCOS™, HITFET™, HybridPACK™, ISOFACE™, I²RF™, IsoPACK™, MIPAQ™, ModSTACK™, my-d™, NovalithIC™, OmniTune™, OptiMOS™, ORIGA™, PROFET™, PRO-SIL™, PRIMARION™, PrimePACK™, RASIC™, ReverSave™, SatRIC™, SIEGET™, SINDRION™, SMARTi™, SmartLEWIS™, TEMPFET™, thinQ!™, TriCore™, TRENCHSTOP™, X-GOLD™, XMM™, X-PMU™, XPOSYS™.

### Other Trademarks

Advance Design System™ (ADS) of Agilent Technologies, AMBA™, ARM™, MULTI-ICE™, PRIMECELL™, REALVIEW™, THUMB™ of ARM Limited, UK. AUTOSAR™ is licensed by AUTOSAR development partnership. Bluetooth™ of Bluetooth SIG Inc. CAT-iq™ of DECT Forum. COLOSSUS™, FirstGPS™ of Trimble Navigation Ltd. EMV™ of EMVCo, LLC (Visa Holdings Inc.). EPCOS™ of Epcos AG. FLEXGO™ of Microsoft Corporation. FlexRay™ is licensed by FlexRay Consortium. HYPERTERMINAL™ of Hilgraeve Incorporated. IEC™ of Commission Electrotechnique Internationale. IrDA™ of Infrared Data Association Corporation. ISO™ of INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. MATLAB™ of MathWorks, Inc. MAXIM™ of Maxim Integrated Products, Inc. MICROTEC™, NUCLEUS™ of Mentor Graphics Corporation. Mifare™ of NXP. MIPI™ of MIPI Alliance, Inc. MIPS™ of MIPS Technologies, Inc., USA. muRata™ of MURATA MANUFACTURING CO., MICROWAVE OFFICE™ (MWO) of Applied Wave Research Inc., OmniVision™ of OmniVision Technologies, Inc. Openwave™ Openwave Systems Inc. RED HAT™ Red Hat, Inc. RFMD™ RF Micro Devices, Inc. SIRIUS™ of Sirius Sattelite Radio Inc. SOLARIS™ of Sun Microsystems, Inc. SPANSION™ of Spansion LLC Ltd. Symbian™ of Symbian Software Limited. TAIYO YUDEN™ of Taiyo Yuden Co. TEAKLITE™ of CEVA, Inc. TEKTRONIX™ of Tektronix Inc. TOKO™ of TOKO KABUSHIKI KAISHA TA. UNIX™ of X/Open Company Limited. VERILOG™, PALLADIUM™ of Cadence Design Systems, Inc. VLYNQ™ of Texas Instruments Incorporated. VXWORKS™, WIND RIVER™ of WIND RIVER SYSTEMS, INC. ZETEX™ of Diodes Zetex Limited.

Last Trademarks Update 2010-06-09

w w w . i n f i n e o n . c o m

Published by Infineon Technologies AG

# X-ON Electronics

Largest Supplier of Electrical and Electronic Components

***Click to view similar products for*** ESD Suppressors / TVS Diodes ***category:***

***Click to view products by*** Infineon ***manufacturer:***

Other Similar products are found below :

60KS200C D12V0H1U2WS-7 D18V0L1B2LP-7B 82356050220 D5V0F4U5P5-7 D5V0M5U6V-7 NTE4902 P4KE27CA P6KE11CA P6KE39CA-TP P6KE8.2A SA110CA SA60CA SA64CA SMBJ12CATR SMBJ8.0A SMLJ30CA-TP ESD112-B1-02EL E6327 ESD119B1W01005E6327XTSA1 ESD5V0J4-TP ESD5V0L1B02VH6327XTSA1 ESD7451N2T5G 19180-510 CPDT-5V0USP-HF 3.0SMCJ33CA-F 3.0SMCJ36A-F HSPC16701B02TP D3V3Q1B2DLP3-7 D55V0M1B2WS-7 DESD5V0U1BL-7B DRTR5V0U4SL-7 SCM1293A-04SO ESD203-B1-02EL E6327 SM12-7 SMF8.0A-TP SMLJ45CA-TP CEN955 W/DATA 82350120560 82356240030 VESD12A1A-HD1-GS08 CPDUR5V0R-HF CPDUR24V-HF CPDQC5V0U-HF CPDQC5V0USP-HF CPDQC5V0-HF D1213A-01LP4-7B D1213A-02WL-7 ESDLIN1524BJ-HQ 5KP100A 5KP15A