

# ESD101-B1-02 Series

## Protection device

TVS (transient voltage suppressor)

Bi-directional, 5.5 V, 0.1 pF, 0201, 0402, RoHS and halogen free compliant

## Features

- ESD/transient protection of high speed data lines according to:
  - IEC61000-4-2 (ESD):  $\pm 14$  kV (air),  $\pm 12$  kV (contact)
  - IEC61000-4-4 (EFT):  $\pm 1.5$  kV/ $\pm 30$  A (5/50 ns)
  - IEC61000-4-5 (surge):  $\pm 2$  A (8/20  $\mu$ s)
- Bi-directional working voltage up to:  $V_{RWM} = \pm 5.5$  V
- Extremely low capacitance  $C_L = 0.1$  pF (typical) at  $f = 1$  GHz
- Clamping voltage:  $V_{CL} = 30$  V (typical) at  $I_{TLP} = 16$  A with  $R_{DYN} = 1.5 \Omega$  (typical)
- Very low reverse current:  $I_R < 0.1$  nA
- Small form factor SMD sizes 0201 and 0402 low profile
- Bi-directional and symmetric I/V characteristics for optimized design/assembly



## Potential applications

Tailored for ESD protection of capacitance-susceptible application like:

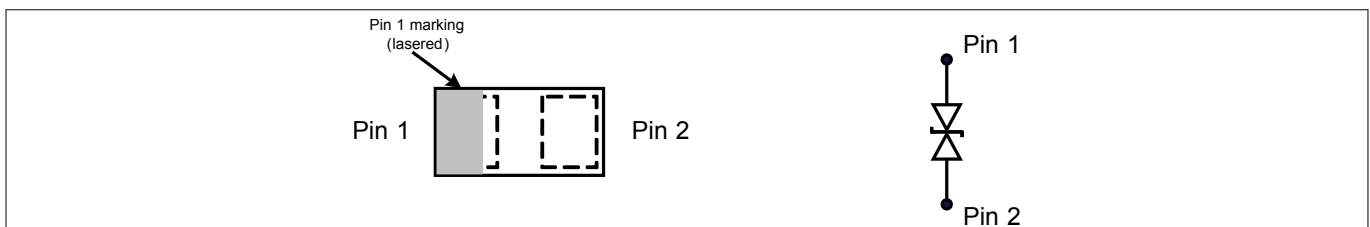
- Super high speed interface
- RF antenna

For further application information please refer to application note AN327 [3].

## Product validation

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

## Device information



**Figure 1** Pin configuration and schematic diagram

**Table 1** Part information

| Type            | Package   | Configuration          | Marking code |
|-----------------|-----------|------------------------|--------------|
| ESD101-B1-02ELS | TSSLP-2-4 | 1 line, bi-directional | <u>R</u>     |
| ESD101-B1-02EL  | TSLP-2-20 | 1 line, bi-directional | R            |

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Maximum ratings

## 1 Maximum ratings

Note:  $T_A = 25\text{ °C}$ , unless otherwise specified

**Table 2** Maximum ratings

| Parameter                           | Symbol    | Values     | Unit | Note or test condition |
|-------------------------------------|-----------|------------|------|------------------------|
| ESD air discharge <sup>1)</sup>     | $V_{ESD}$ | ±14        | kV   | –                      |
| ESD contact discharge <sup>1)</sup> |           | ±12        |      |                        |
| Peak pulse power                    | $P_{PK}$  | 30         | W    | –                      |
| Peak pulse current <sup>2)</sup>    | $I_{PP}$  | ±2         | A    | –                      |
| Operating temperature               | $T_{OP}$  | -55 to 125 | °C   | –                      |
| Storage temperature                 | $T_{stg}$ | -65 to 150 | °C   | –                      |

**Attention:** Stresses above the maximum 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 component.

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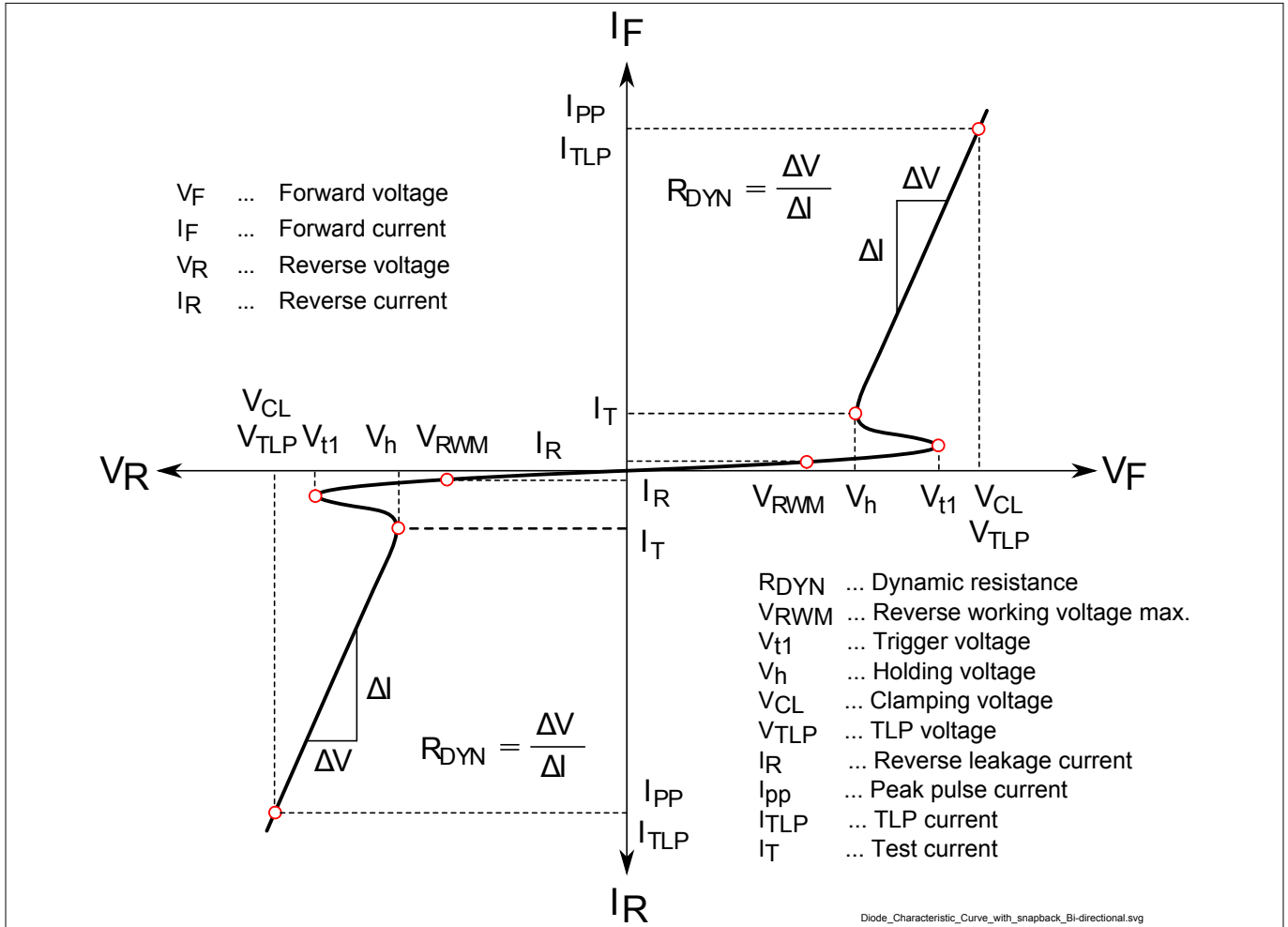
<sup>1</sup>  $V_{ESD}$  according to IEC61000-4-2

<sup>2</sup> Non-repetitive current pulse 8/20  $\mu$ s exponential decay waveform according to IEC61000-4-5

**Electrical characteristics**

**2 Electrical characteristics**

Note:  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified.  
 Device is electrically symmetrical.



**Figure 2 Definitions of electrical characteristics**

**Electrical characteristics**

**Table 3 DC characteristics**

| Parameter                     | Symbol    | Values |      |      | Unit | Note or test condition |
|-------------------------------|-----------|--------|------|------|------|------------------------|
|                               |           | Min.   | Typ. | Max. |      |                        |
| Reverse current               | $I_{RWM}$ | -5.5   | -    | 5.5  | V    |                        |
| Trigger voltage <sup>1)</sup> | $V_{t1}$  | 6.1    | -    | -    |      |                        |
| Holding voltage               | $V_h$     | 6.1    | 7.3  | 8.2  |      | $I_T = 1 \text{ mA}$   |
|                               |           | 6.1    | 7.0  | 7.9  |      | $I_T = 10 \text{ mA}$  |
| Reverse leakage current       | $I_R$     | -      | <0.1 | 20   | nA   | $V_R = 5.5 \text{ V}$  |

**Table 4 AC characteristics**

| Parameter        | Symbol | Values |      |      | Unit | Note or test condition                 |
|------------------|--------|--------|------|------|------|----------------------------------------|
|                  |        | Min.   | Typ. | Max. |      |                                        |
| Line capacitance | $C_L$  | -      | -    | 0.2  | pF   | $V_R = 0 \text{ V}, f = 1 \text{ MHz}$ |
|                  |        | -      | 0.1  | -    |      | $V_R = 0 \text{ V}, f = 1 \text{ GHz}$ |
| Serie inductance | $L_S$  | -      | 0.2  | -    | nH   | ESD101-B1-02ELS                        |
|                  |        | -      | 0.4  | -    |      | ESD101-B1-02EL                         |

**Table 5 ESD and surge characteristics**

| Parameter                        | Symbol    | Values |      |      | Unit     | Note or test condition                         |
|----------------------------------|-----------|--------|------|------|----------|------------------------------------------------|
|                                  |           | Min.   | Typ. | Max. |          |                                                |
| Clamping voltage <sup>2)</sup>   | $V_{CL}$  | -      | 18   | -    | V        | $I_{TLP} = 8 \text{ A}, t_p = 100 \text{ ns}$  |
|                                  |           | -      | 30   | -    |          | $I_{TLP} = 16 \text{ A}, t_p = 100 \text{ ns}$ |
| Clamping voltage <sup>3)</sup>   |           | -      | 9    | -    |          | $I_{PP} = 1 \text{ A}, t_p = 8/20 \mu\text{s}$ |
|                                  |           | -      | 13   | -    |          | $I_{PP} = 2 \text{ A}, t_p = 8/20 \mu\text{s}$ |
| Dynamic resistance <sup>2)</sup> | $R_{DYN}$ | -      | 1.5  | -    | $\Omega$ | $t_p = 100 \text{ ns}$                         |

<sup>1</sup> Verified by design

<sup>2</sup> Please refer to application note AN210 [1], TLP parameters:  $Z_0 = 50 \Omega$ ,  $t_p = 100 \text{ ns}$ ,  $t_r = 300 \text{ ps}$

<sup>3</sup> Non-repetitive current pulse 8/20 $\mu\text{s}$  exponential decay waveform according to IEC61000-4-5

Typical characteristic diagrams

### 3 Typical characteristic diagrams

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

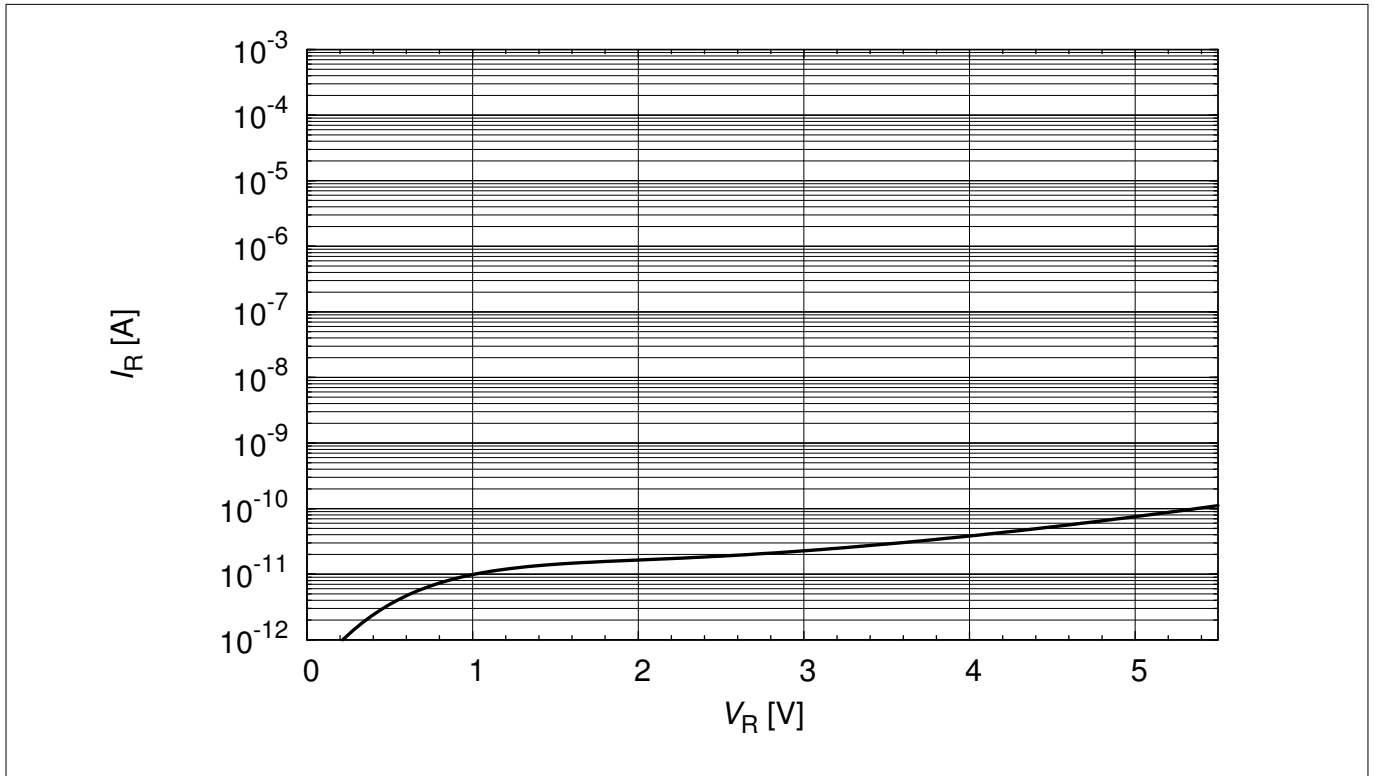


Figure 3 Reverse leakage current:  $I_R = f(V_R)$

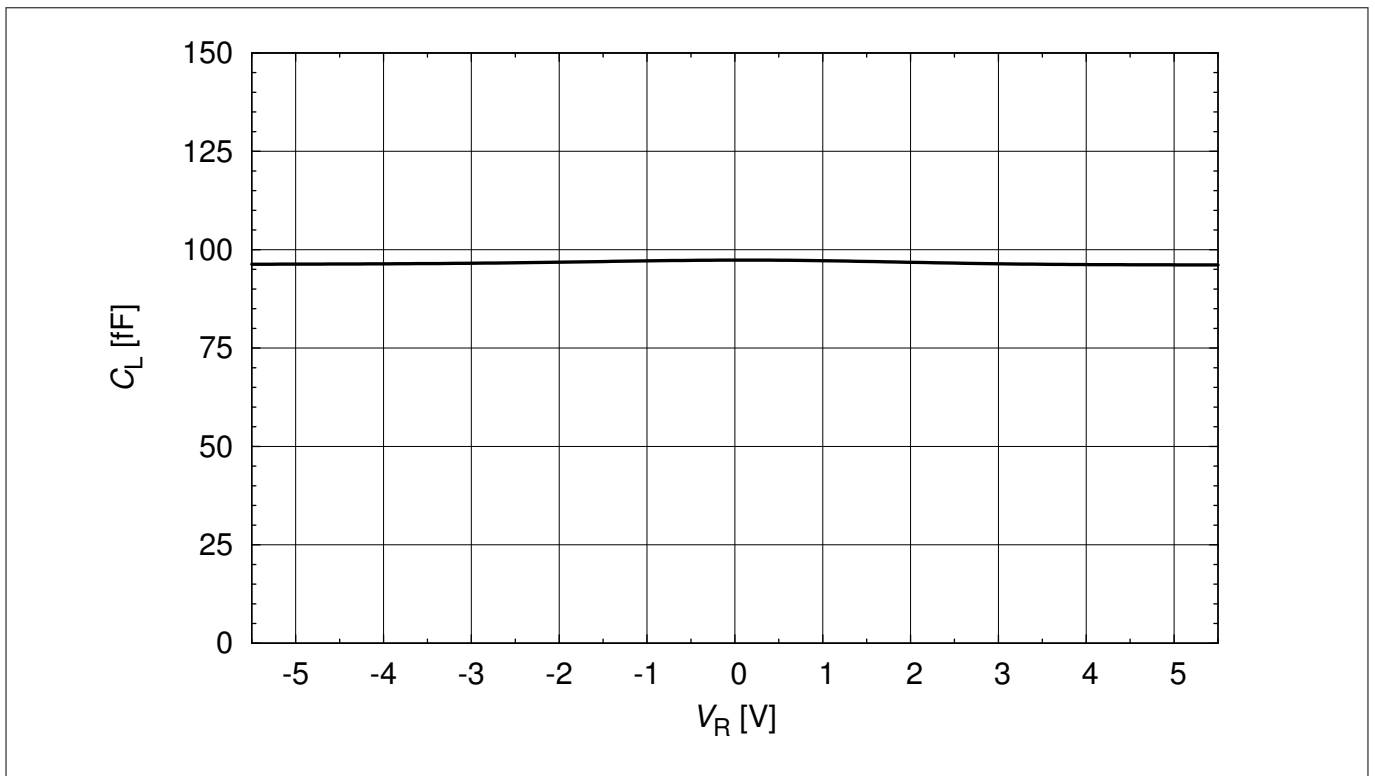


Figure 4 Line capacitance:  $C_L = f(V_R)$ ,  $f = 1\text{ GHz}$

Typical characteristic diagrams

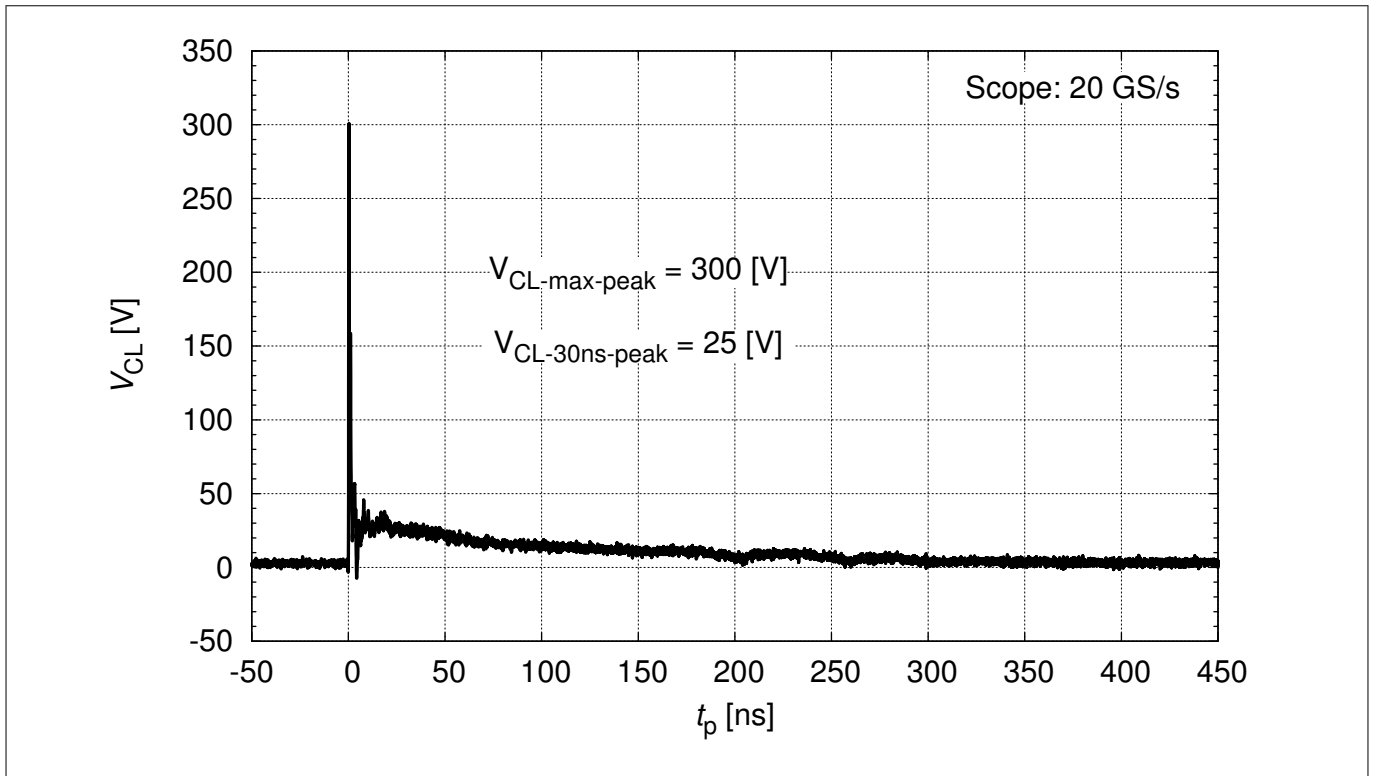


Figure 5 Clamping voltage (ESD):  $V_{CL} = f(t)$ , 8 kV positive pulse from pin 1 to pin 2

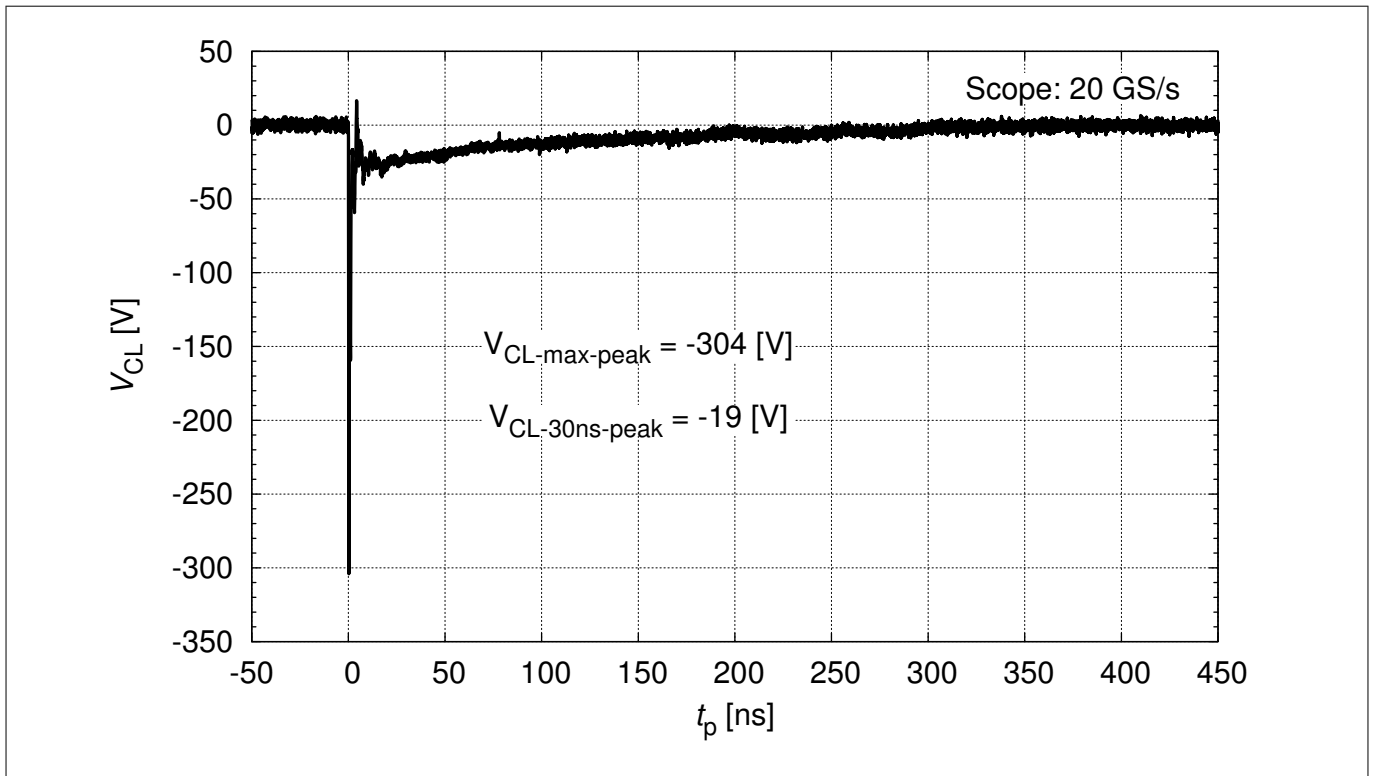
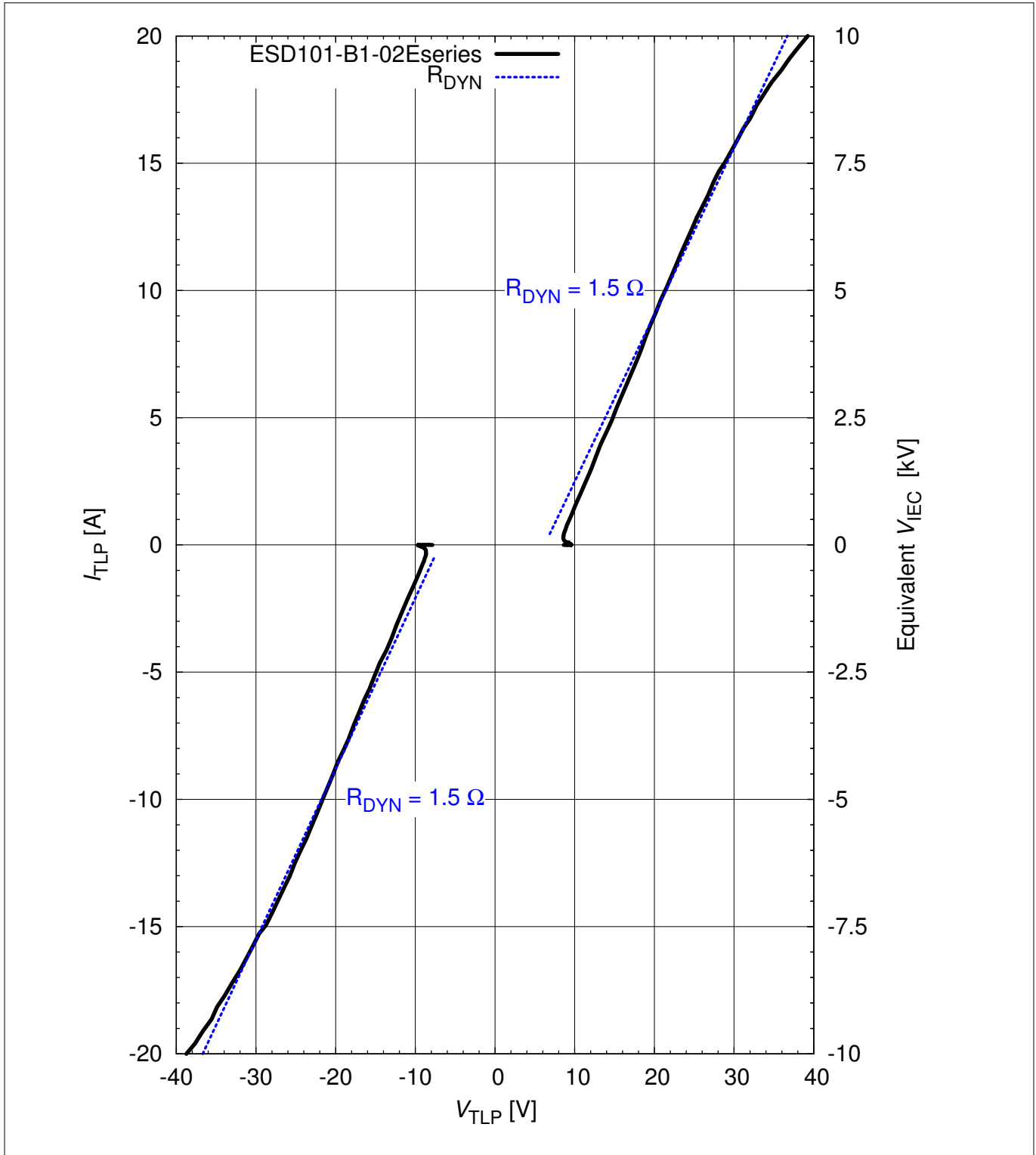


Figure 6 Clamping voltage (ESD):  $V_{CL} = f(t)$ , 8 kV negative pulse from pin 1 to pin 2

**Typical characteristic diagrams**



**Figure 7** Clamping voltage (TLP):  $I_{TLp} = f(V_{TLp})$  [1], pin 1 to pin 2



Typical characteristic diagrams

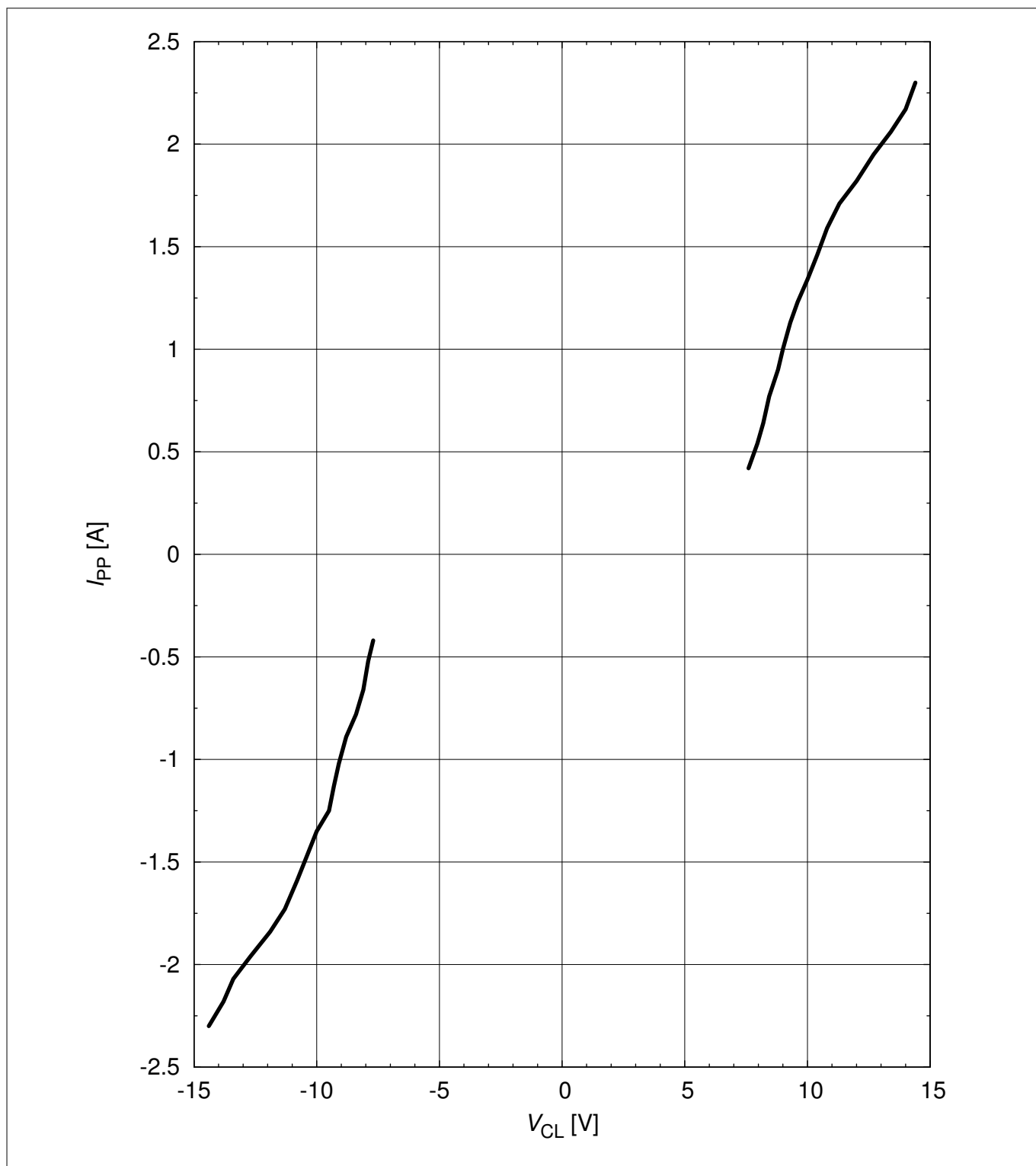


Figure 8 Clamping voltage (Surge):  $I_{PP} = f(V_{CL})$  [1], pin 1 to pin 2

Typical characteristic diagrams

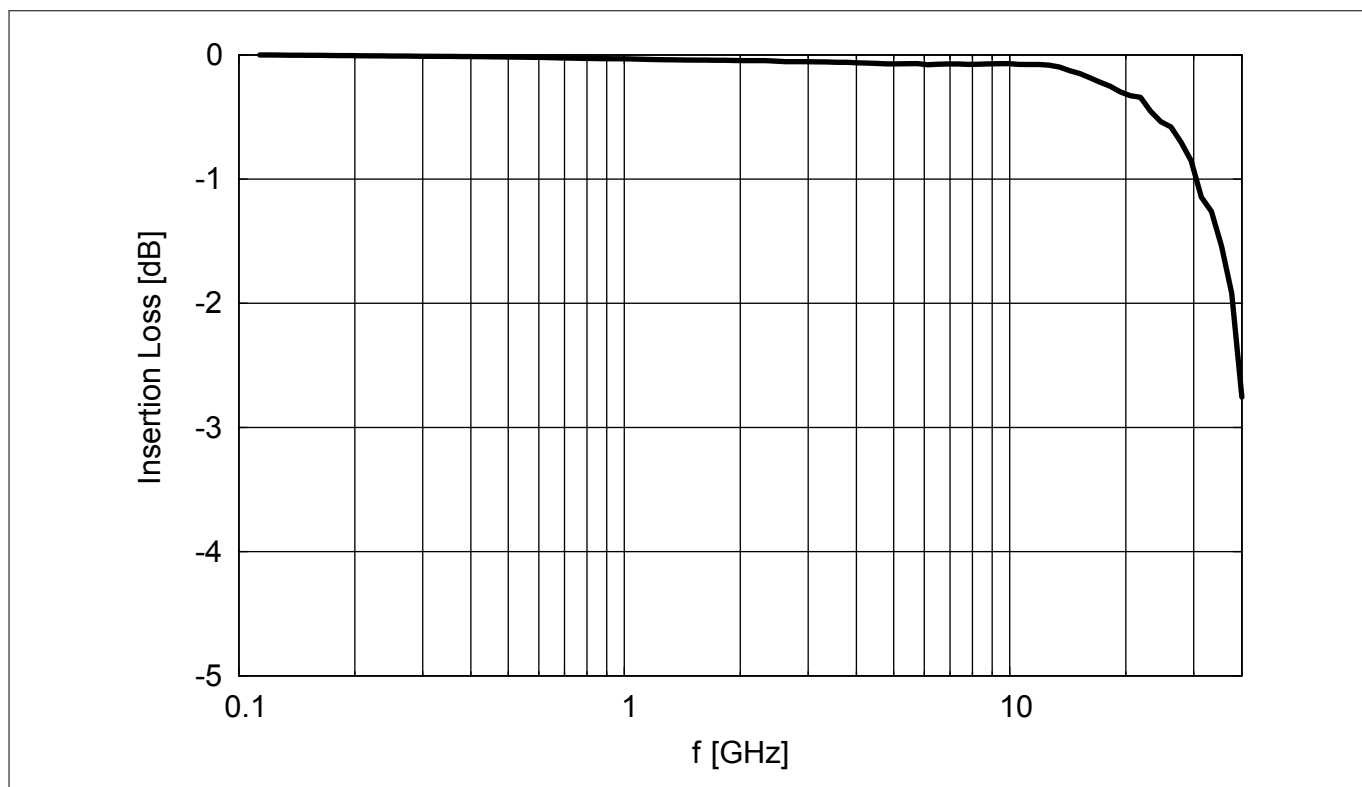


Figure 9 Insertion loss vs. frequency in a 50 Ω system

Package information

## 4 Package information

### 4.1 TSSLP-2-4

Note: Dimension in mm

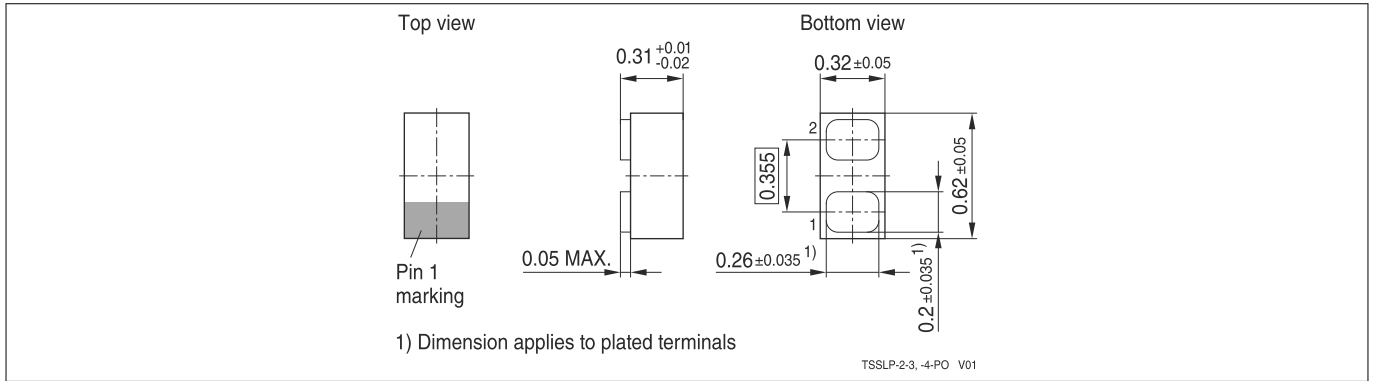


Figure 10 TSSLP-2-4 package outline

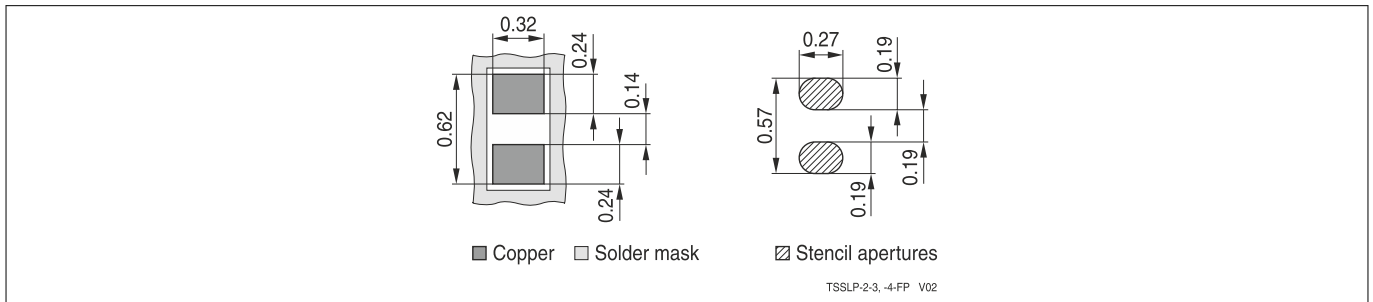


Figure 11 TSSLP-2-4 footprint

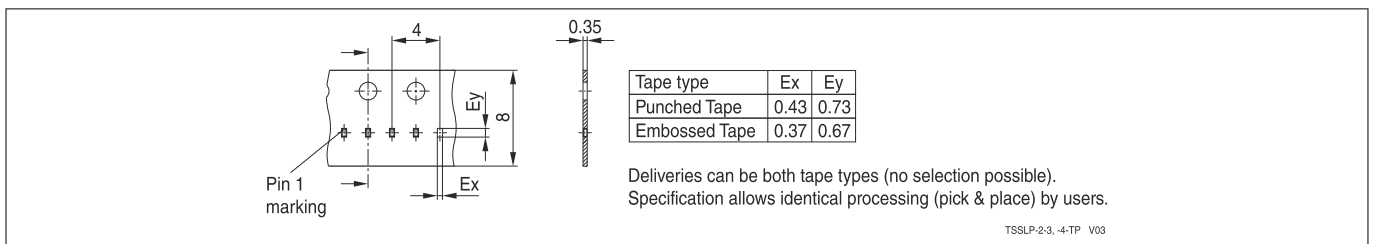


Figure 12 TSSLP-2-4 packing

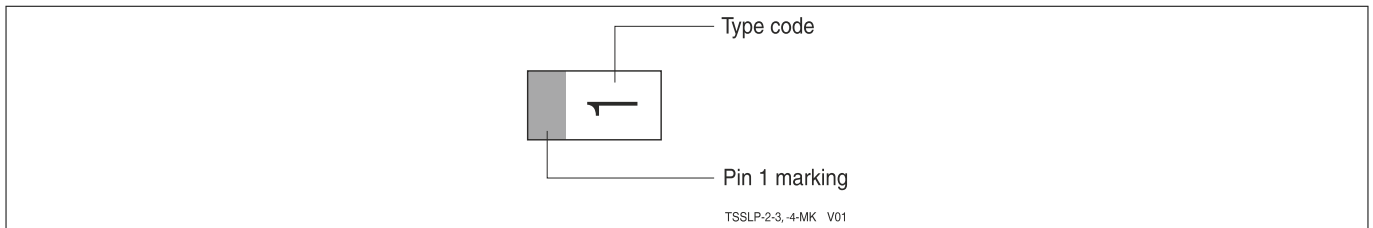
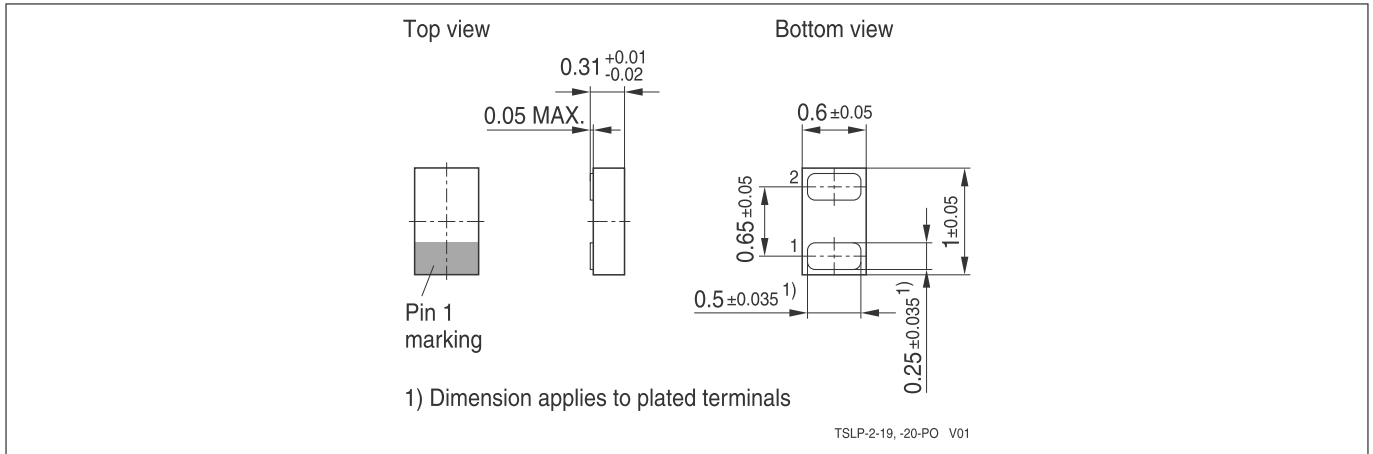


Figure 13 TSSLP-2-4 marking example

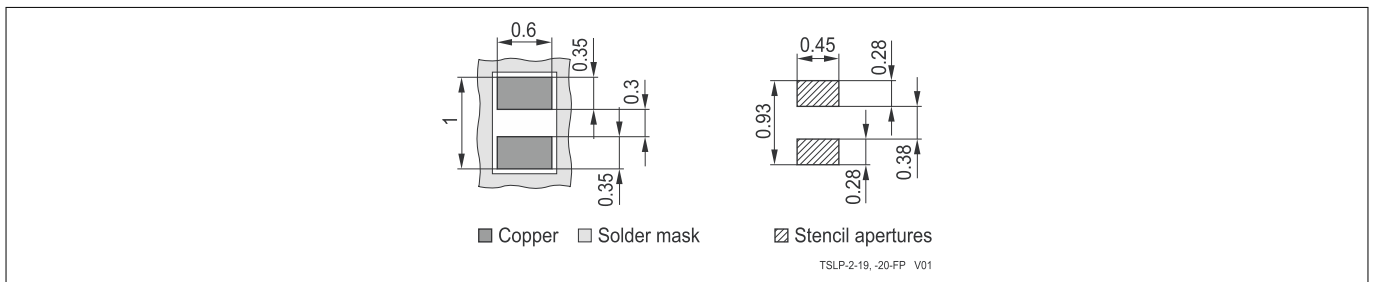
**Package information**

**4.2 TSLP-2-20**

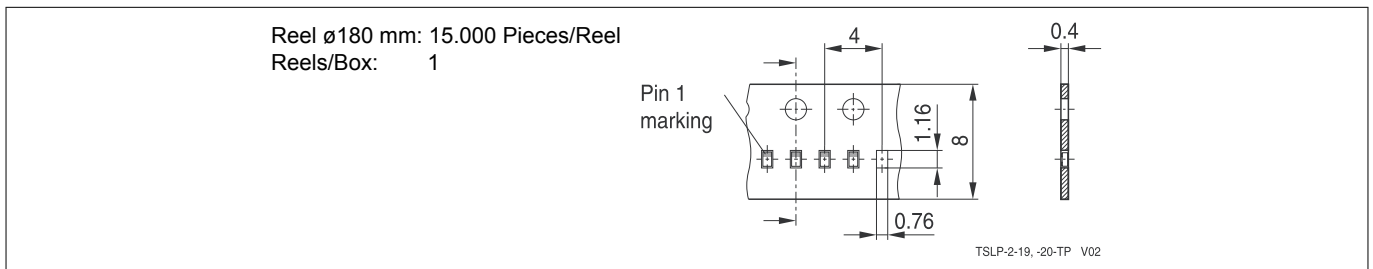
Note: Dimension in mm



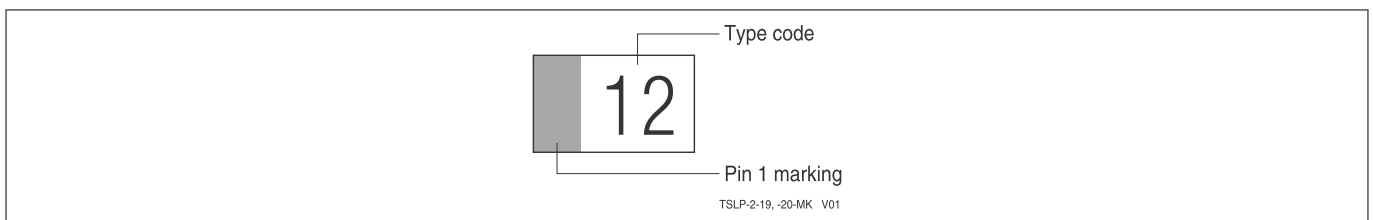
**Figure 14 TSLP-2-20 package outline**



**Figure 15 TSLP-2-20 footprint**



**Figure 16 TSLP-2-20 packing**



**Figure 17 TSLP-2-20 marking example**

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**References**

## **5                   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/TSSLP/TSNP Packages**
- [3] Infineon AG - **Application Note AN327**: ESD101-B1/ESD103-B1, Bi-directional Ultra Low Capacitance Transient Voltage Suppression Diodes for High Power RD Applications

## **Revision history**

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**Revision history: Rev. 1.3. 2015-07-13**

| <b>Page or Item</b>      | <b>Subjects (major changes since previous revision)</b> |
|--------------------------|---------------------------------------------------------|
| Revision 1.4, 2017-10-27 |                                                         |
| All                      | Datasheet layout changed                                |
|                          | Table 3 updated                                         |
|                          |                                                         |
|                          |                                                         |

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