



# Protection Device

TVS (Transient Voltage Suppressor)

## ESD114-U1-02 Series

Uni-directional, 5.3 V, 0.4 pF, 0402, 0201, RoHS and Halogen Free compliant

ESD114-U1-02ELS  
ESD114-U1-02EL

## Data Sheet

Revision 1.0, 2014-10-30  
Final

Power Management & Multimarket

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## 1 Product Overview

### 1.1 Features

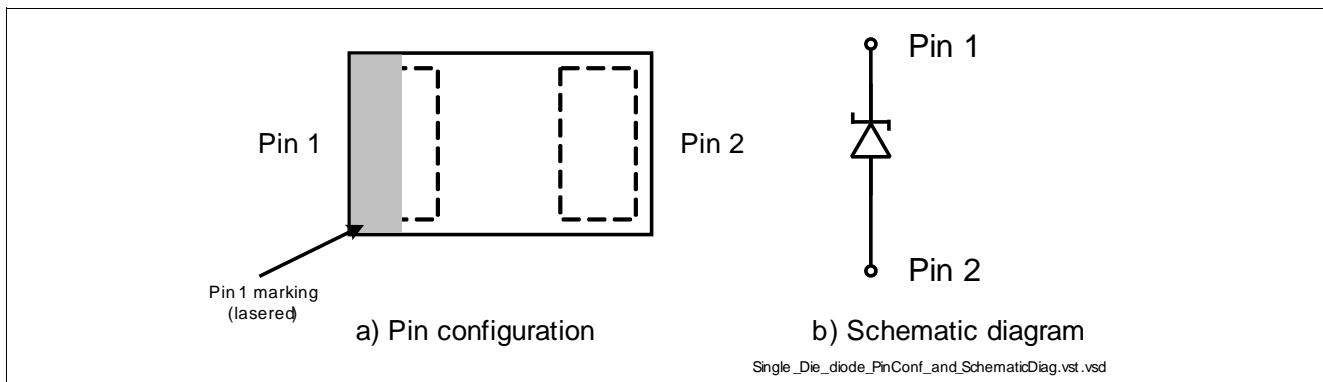
- ESD / Transient protection of high speed data lines exceeding
  - IEC61000-4-2 (ESD):  $\pm 20$  kV (contact)
  - IEC61000-4-4 (EFT):  $\pm 2$  kV /  $\pm 40$  A (5/50 ns)
  - IEC61000-4-5 (surge):  $\pm 3$  A (8/20  $\mu$ s)
- Maximum working voltage:  $V_{RWM} = \pm 5.3$  V
- Ultra low capacitance:  $C_L = 0.4$  pF (typical)
- Very low clamping voltage  $V_{CL} = +20 / -15$  V (typical) at  $I_{TLP} = 16$  A
- Low dynamic resistance  $R_{DYN} = 0.5$   $\Omega$  (typical)
- Very small form factor down to  $0.62 \times 0.32 \times 0.31$  mm<sup>3</sup>
- Pb-free (RoHS compliant) and halogen free package



### 1.2 Application Examples

- USB 2.0, Mobile HDMI Link, MDDI, MIPI, etc.
- HDMI, DisplayPort, DVI, Ethernet, Firewire, S-ATA

### 1.3 Product Description



**Figure 1 Pin Configuration and Schematic Diagram**

**Table 1 Ordering Information**

Type	Package	Configuration	Marking code
ESD114-U1-02ELS	TSSLP-2-3	1 line, uni-directional	K
ESD114-U1-02EL	TSLP-2-19	1 line, uni-directional	K

## 2 Maximum Ratings

**Table 2 Maximum Ratings** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values	Unit
ESD contact discharge <sup>1)</sup>	$V_{\text{ESD}}$	$\pm 20$	kV
Peak pulse current ( $t_p = 8/20 \mu\text{s}$ ) <sup>2)</sup>	$I_{\text{PP}}$	$\pm 3$	A
Operating temperature range	$T_{\text{OP}}$	-55 to 125	$^\circ\text{C}$
Storage temperature	$T_{\text{stg}}$	-65 to 150	$^\circ\text{C}$

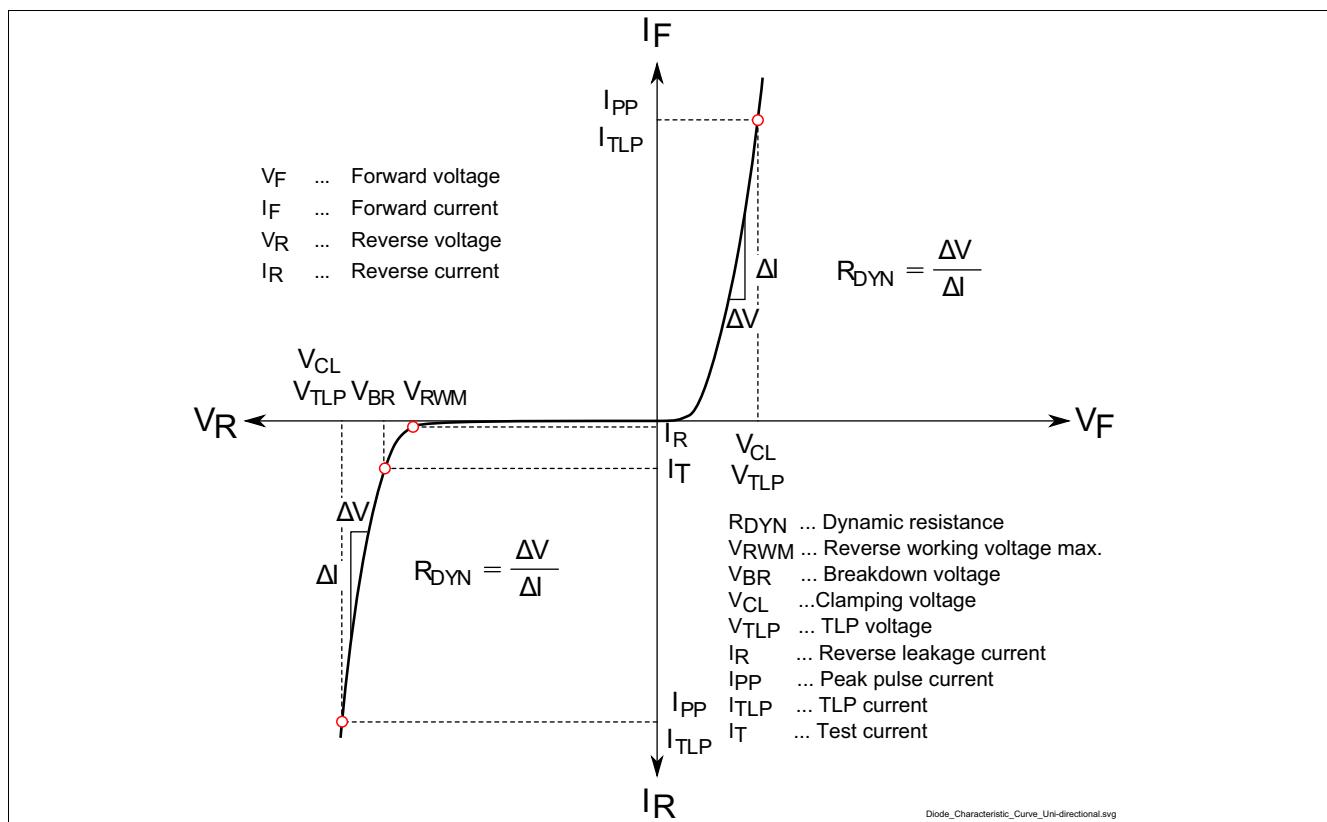
1)  $V_{\text{ESD}}$  according to IEC61000-4-2

2) Non-repetitive current pulse 8/20μs exponential decay 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 $T_A = 25^\circ\text{C}$ , unless otherwise specified



**Figure 2 Definitions of Electrical Characteristics**

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

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Reverse working voltage	$V_{\text{RWM}}$	—	—	5.3	V	Pin 1 to Pin 2
Breakdown voltage	$V_{\text{BR}}$	6	—	—	V	$I_{\text{BR}} = 1 \text{ mA}$ , from Pin 1 to Pin 2
Reverse current	$I_R$	—	<10	100	nA	$V_R = 5.3 \text{ V}$ , from Pin 1 to Pin 2

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Line capacitance <sup>1)</sup>	$C_L$	—	0.4	0.6	pF	$V_R = 0 \text{ V}, f = 1 \text{ MHz}$
Serie inductance	$L_S$	—	0.2	—	nH	ESD114-U1-02ELS
		—	0.4	—	nH	ESD114-U1-02EL

1) Total capacitance line to ground

**Table 5 ESD Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Clamping voltage	$V_{\text{CL}}$	—	10	—	V	$I_{\text{TLP}} = 1 \text{ A}$ , from Pin 1 to Pin 2
		—	20	—		$I_{\text{TLP}} = 16 \text{ A}$ , from Pin 1 to Pin 2
		—	28	—		$I_{\text{TLP}} = 30 \text{ A}$ , from Pin 1 to Pin 2
		—	3	—		$I_{\text{TLP}} = 1 \text{ A}$ , from Pin 2 to Pin 1
		—	15	—		$I_{\text{TLP}} = 16 \text{ A}$ , from Pin 2 to Pin 1
		—	21	—		$I_{\text{TLP}} = 30 \text{ A}$ , from Pin 2 to Pin 1
Dynamic resistance <sup>1)</sup>	$R_{\text{DYN}}$	—	0.56	—	V	Pin 1 to Pin 2
		—	0.43	—	V	Pin 2 to Pin 1

1) Please refer to Application Note AN210[1]. 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  $I_{\text{PP1}} = 10 \text{ A}$  and  $I_{\text{PP2}} = 40 \text{ A}$ .

## Typical Characteristics Diagrams

## 4 Typical Characteristics Diagrams

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

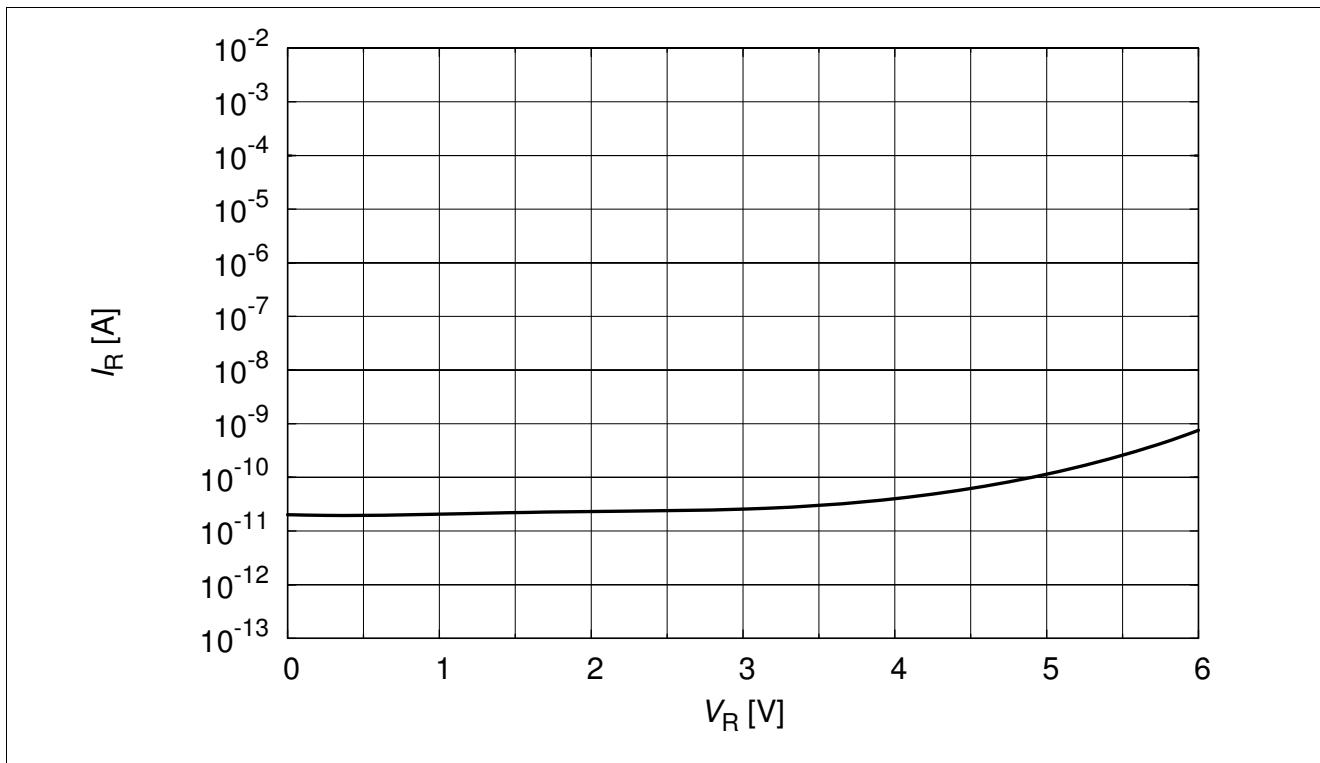


Figure 3 Reverse leakage current:  $I_R = f(V_R)$

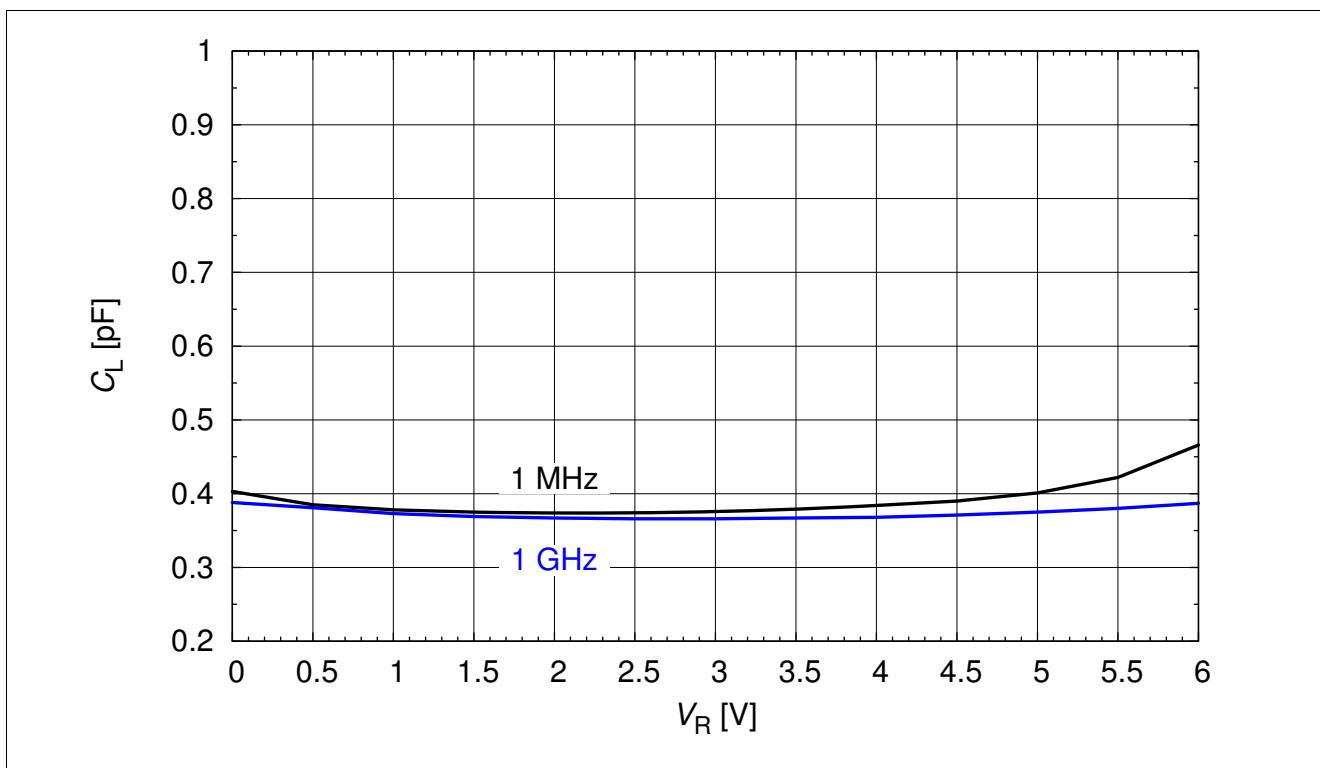


Figure 4 Line capacitance:  $C_L = f(V_R)$

## Typical Characteristics Diagrams

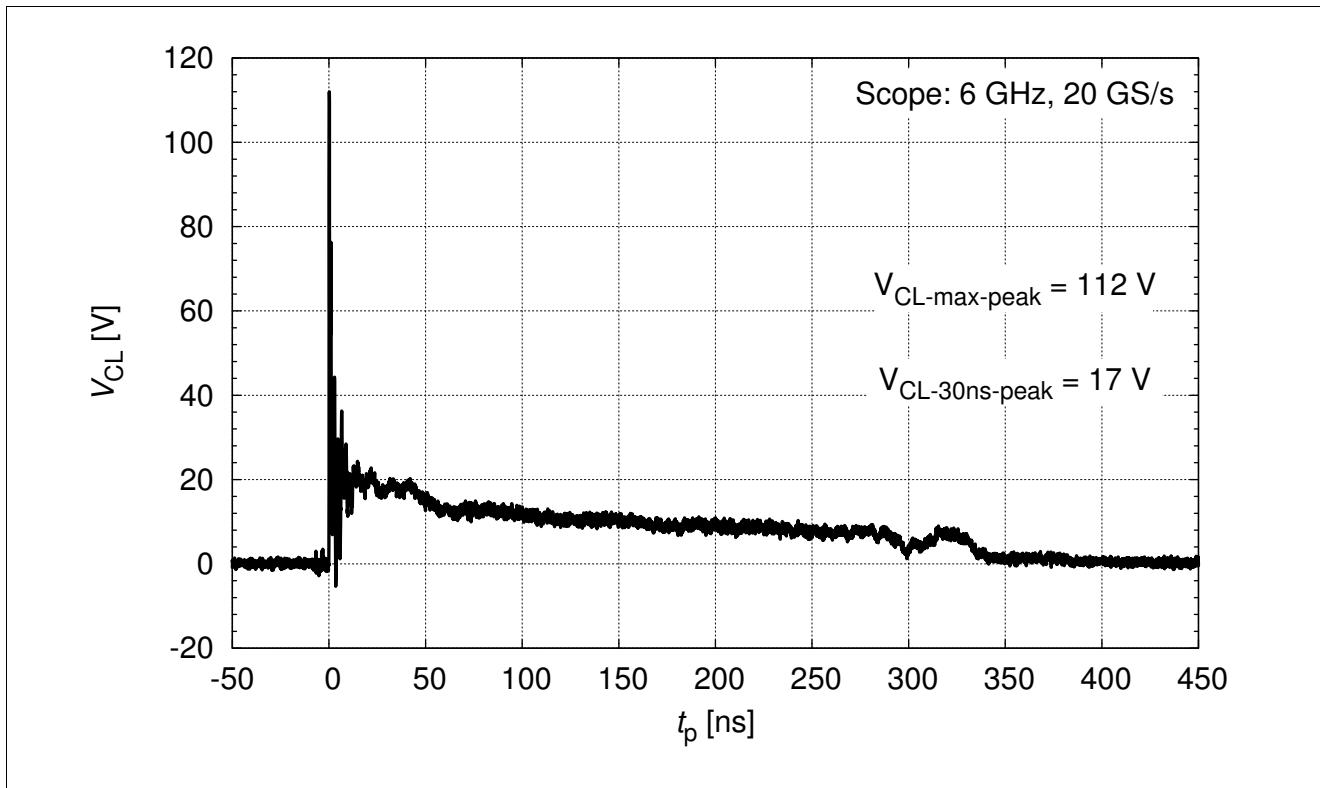


Figure 5 IEC61000-4-2 :  $V_{CL} = f(t)$ , 8 kV positive pulse from pin 1 to pin 2

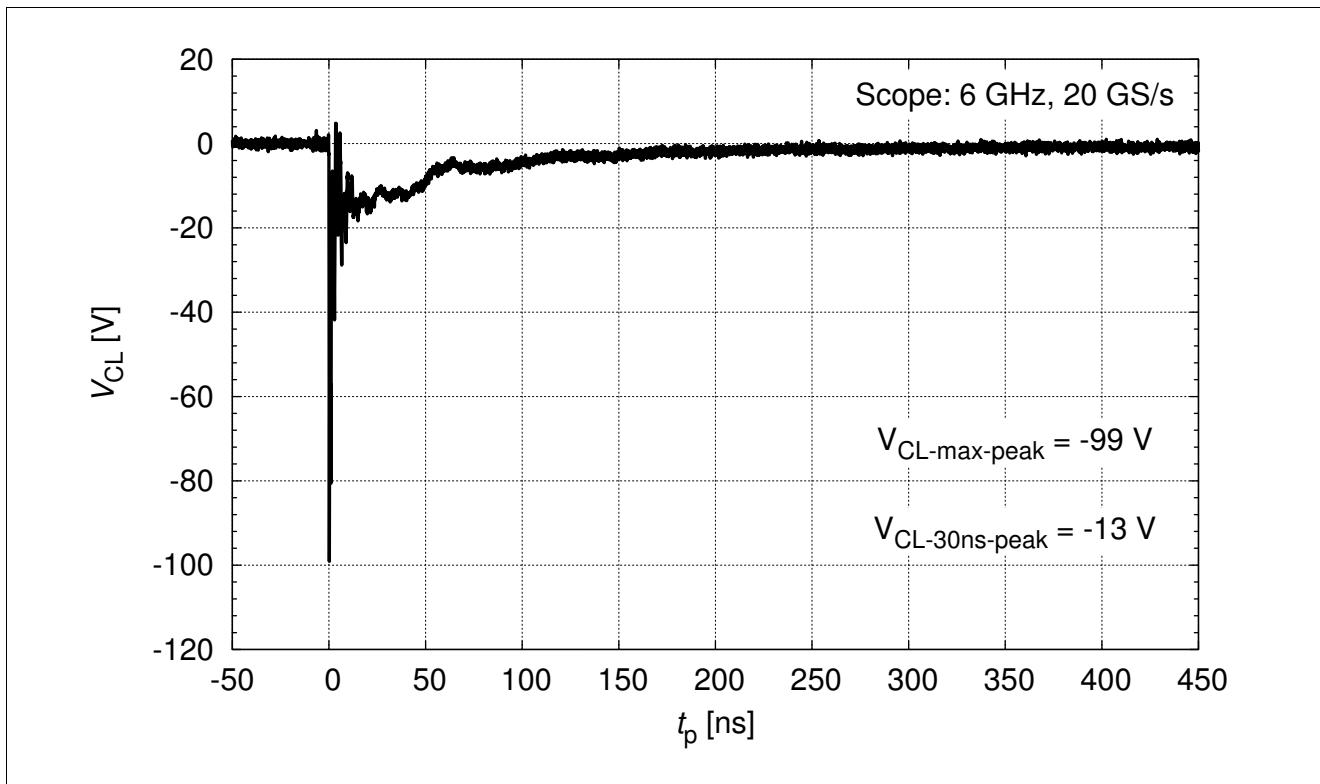


Figure 6 IEC61000-4-2 :  $V_{CL} = f(t)$ , 8 kV negative pulse from pin 1 to pin 2

## Typical Characteristics Diagrams

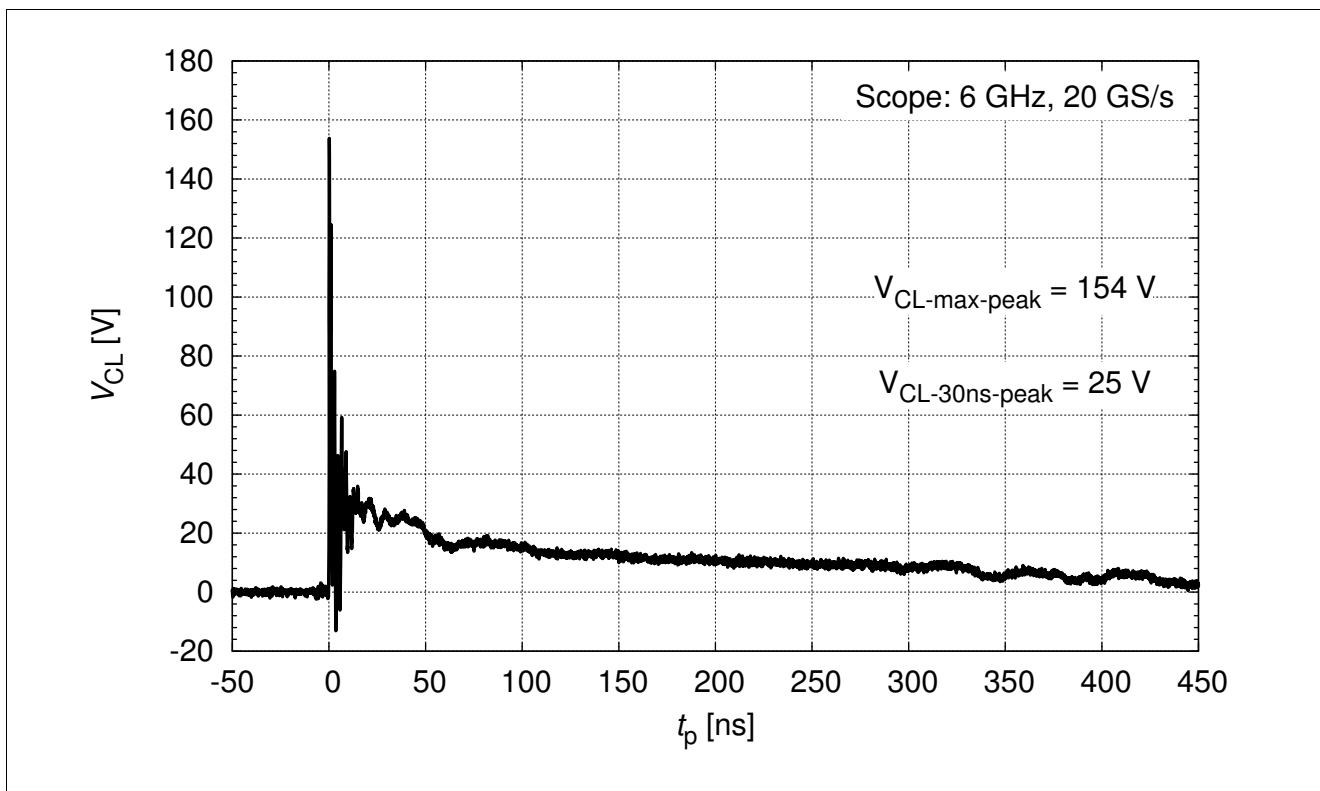


Figure 7 IEC61000-4-2 :  $V_{CL} = f(t)$ , 15 kV positive pulse from pin 1 to pin 2

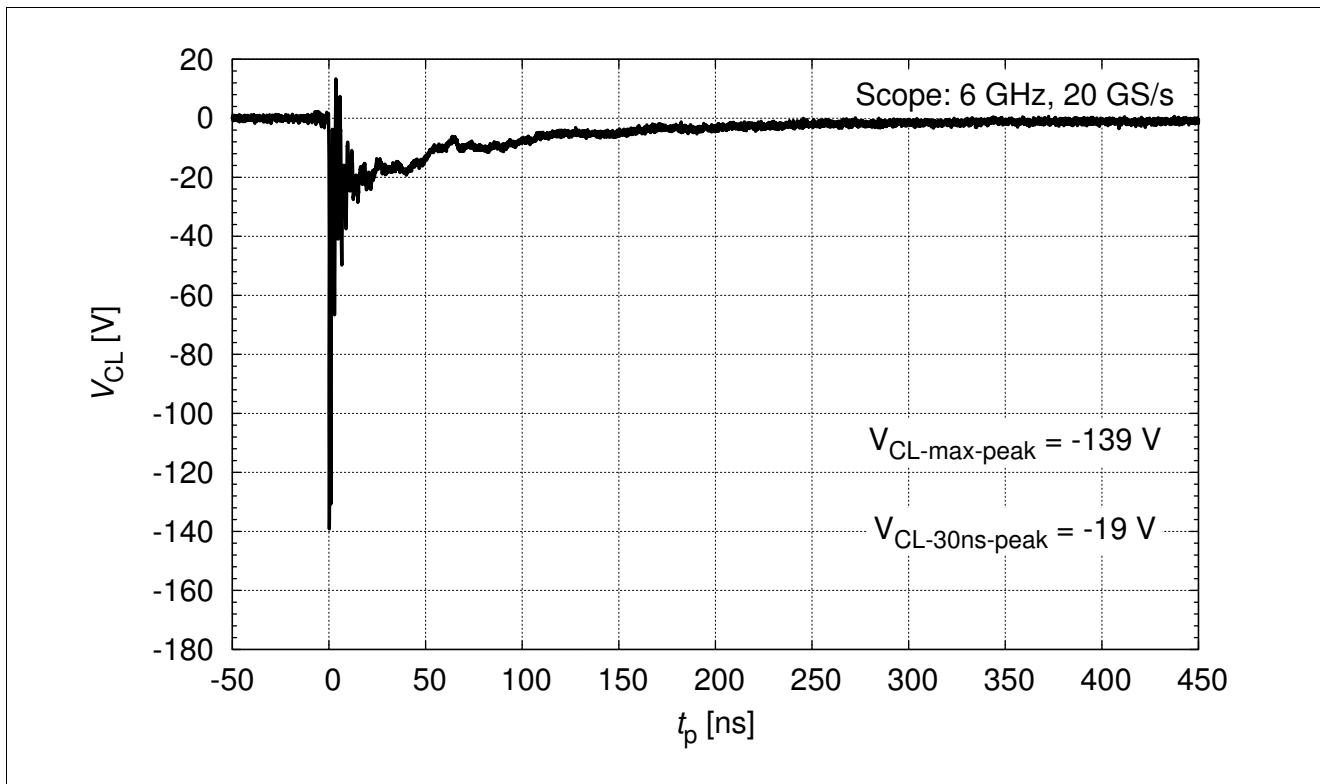
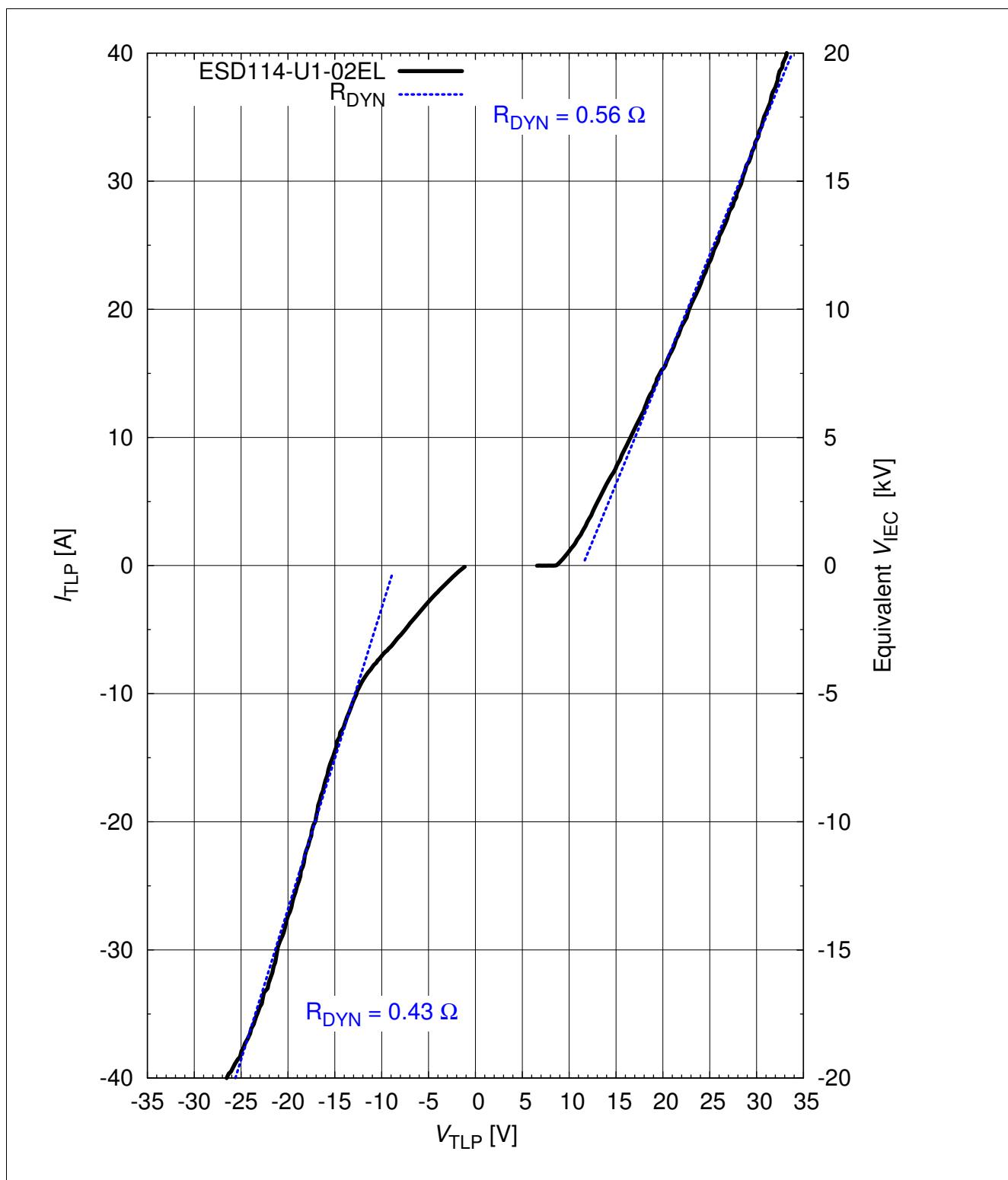


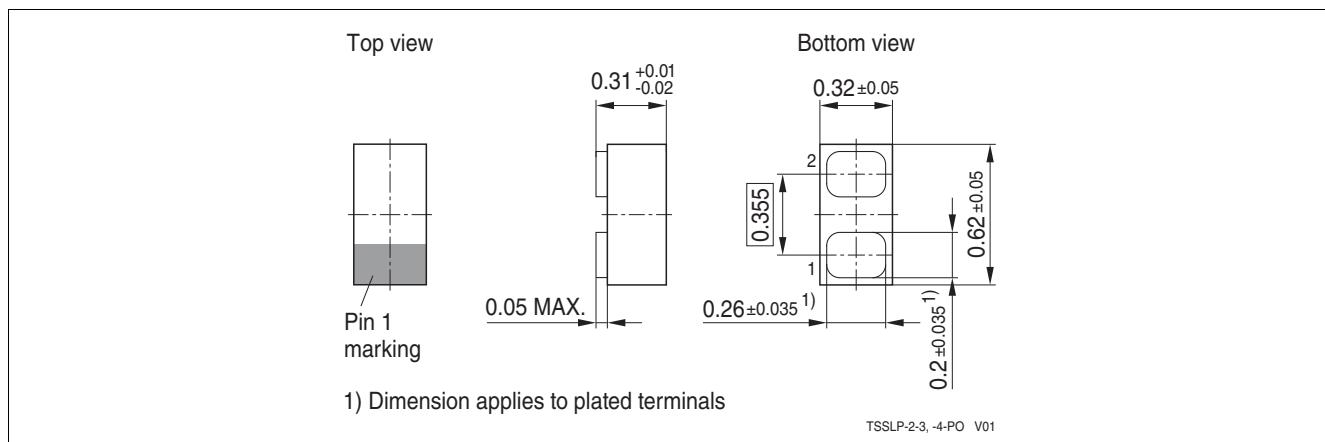
Figure 8 IEC61000-4-2 :  $V_{CL} = f(t)$ , 15 kV negative pulse from pin 1 to pin 2

## Typical Characteristics Diagrams

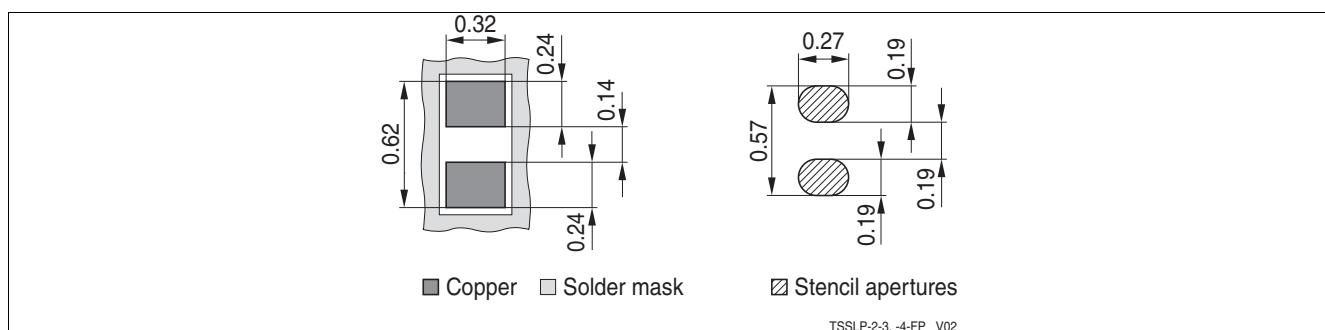

 Figure 9 Clamping voltage (TLP):  $I_{TLP} = f(V_{TLP})$  [1], pin 1 to pin 2

## 5 Package Information

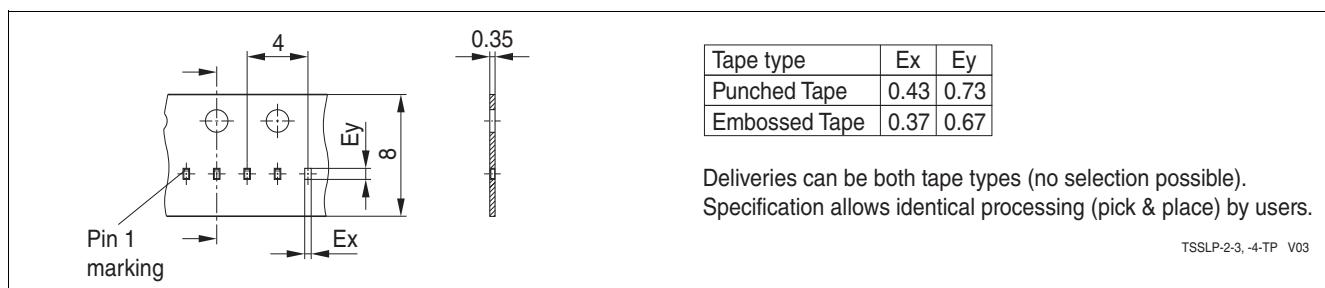
### 5.1 TSSLP-2-3 (mm)[3]



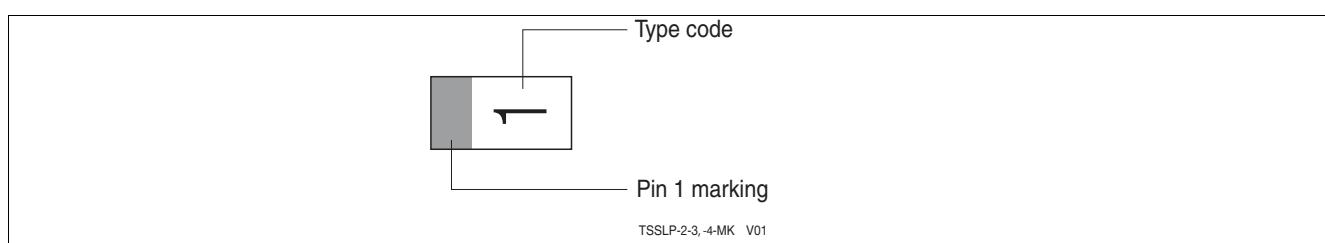
**Figure 10 TSSLP-2-3: Package overview**



**Figure 11 TSSLP-2-3 Footprint**

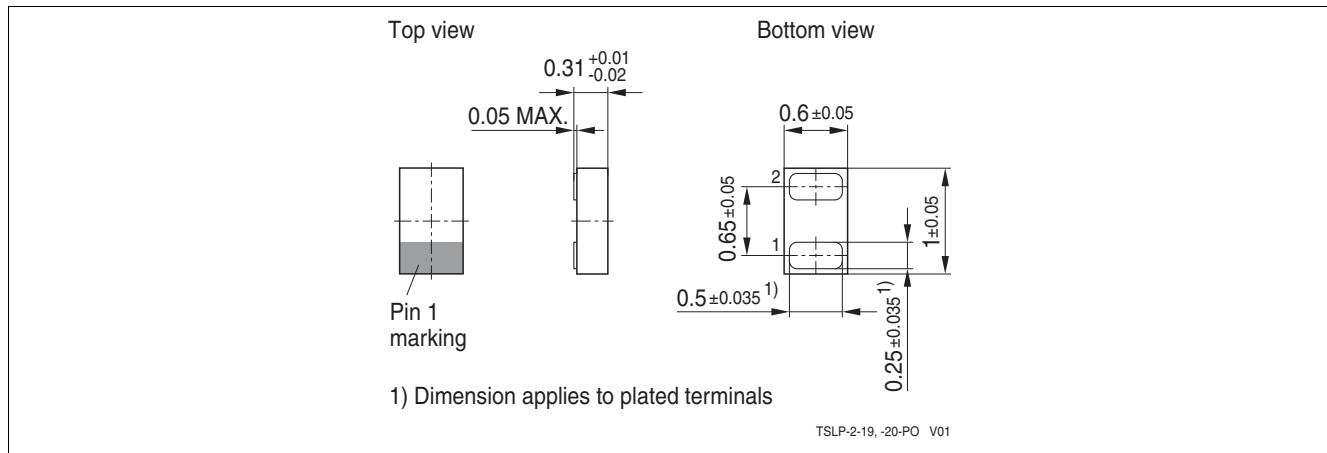


**Figure 12 TSSLP-2-3: Packing**

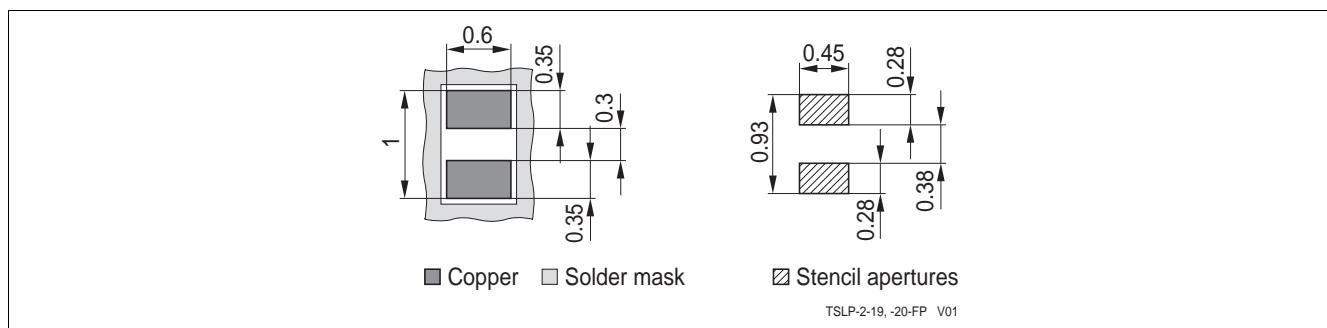


**Figure 13 TSSLP-2-3: Marking (example)**

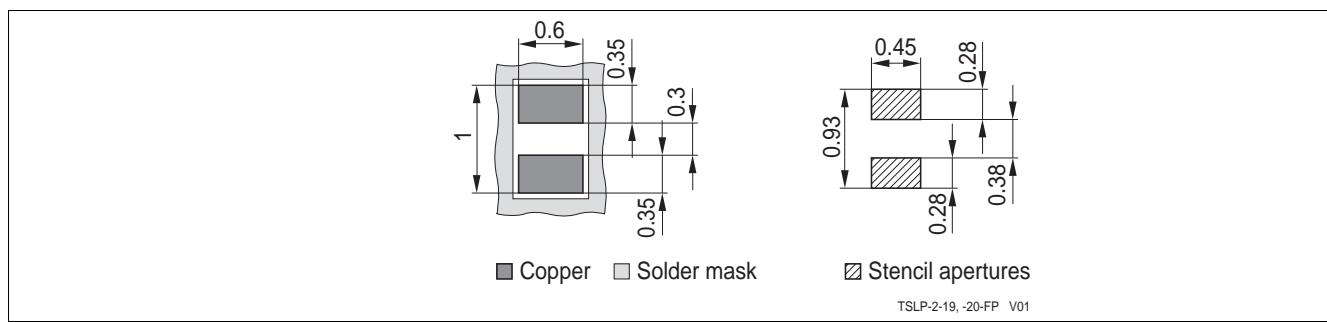
## 5.2 TSLP-2-19 (mm)<sup>[3]</sup>



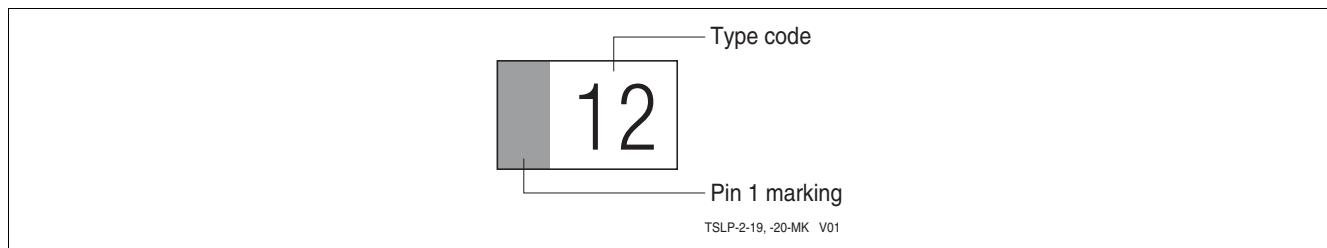
**Figure 14 TSLP-2-19: Package Overview**



**Figure 15 TSLP-2-19: Footprint**



**Figure 16 TSLP-2-19: Packing**



**Figure 17 TSLP-2-19: Marking (example)**

## References

- [1] Infineon AG - **Application Note AN210**: Effective ESD Protection Design at System Level Using VF-TLP
- [2] Infineon AG - **Application Note AN140**: ESD Protection for Digital High-Speed Interfaces (HDMI, FireWire, ...) using ESD5V3U1U)
- [3] Infineon AG - Recommendations for PCB Assembly of Infineon TSLP and TSSLP Package

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**Revision History: Rev.09, 2014-06-20**

Page or Item	Subjects (major changes since previous revision)
<b>Revision 1.0, 2014-10-30</b>	
All	Status change to Final

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