

1 Bi-directional Femto Farad Capacitance TVS Diode

1.1 Features

- ESD/Transient protection of RF and ultra-high speed signal lines according to:
 - IEC61000-4-2: ± 10 kV (contact)
- Extremely low capacitance $C_L = 0.09$ pF (typical) at $f = 1$ GHz
- Maximum working voltage: $V_{RWM} = \pm 15$ V
- Very low reverse current: $I_R < 0.1$ nA (typ.)
- Very low series inductance down to 0.2 nH typical (TSSLP-2-4)
- Extremely small form factor down to $0.62 \times 0.32 \times 0.31$ mm³
- Pb-free package (RoHS compliant)



1.2 Application Examples [4]

- ESD protection in RF applications
- Tailored for connectivity applications
- WLAN, GPS antenna, DVB T/H, Bluetooth Class 1 and 2
- Automated Meter Reading

1.3 Product Description

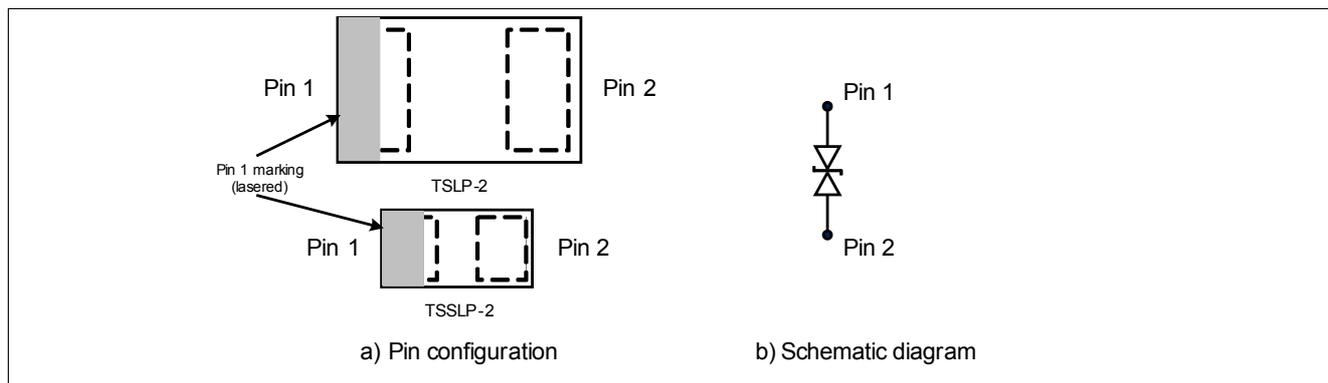


Figure 1 Pin configuration and Schematic diagram

Table 1 Ordering Information

Type	Package	Configuration	Marking code
ESD103-B1-02ELS	TSSLP-2-4	1 line, bi-directional	<u>V</u>
ESD103-B1-02EL	TSLP-2-20	1 line, bi-directional	V

2 Characteristics

Table 2 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}	-10	–	10	kV
Operating temperature	T_{OP}	-55	–	125	$^\circ\text{C}$
Storage temperature	T_{stg}	-65	–	150	$^\circ\text{C}$

1) V_{ESD} according to IEC61000-4-2 ($R = 330\ \Omega$, $C = 150\ \text{pF}$ discharge network)

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.

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

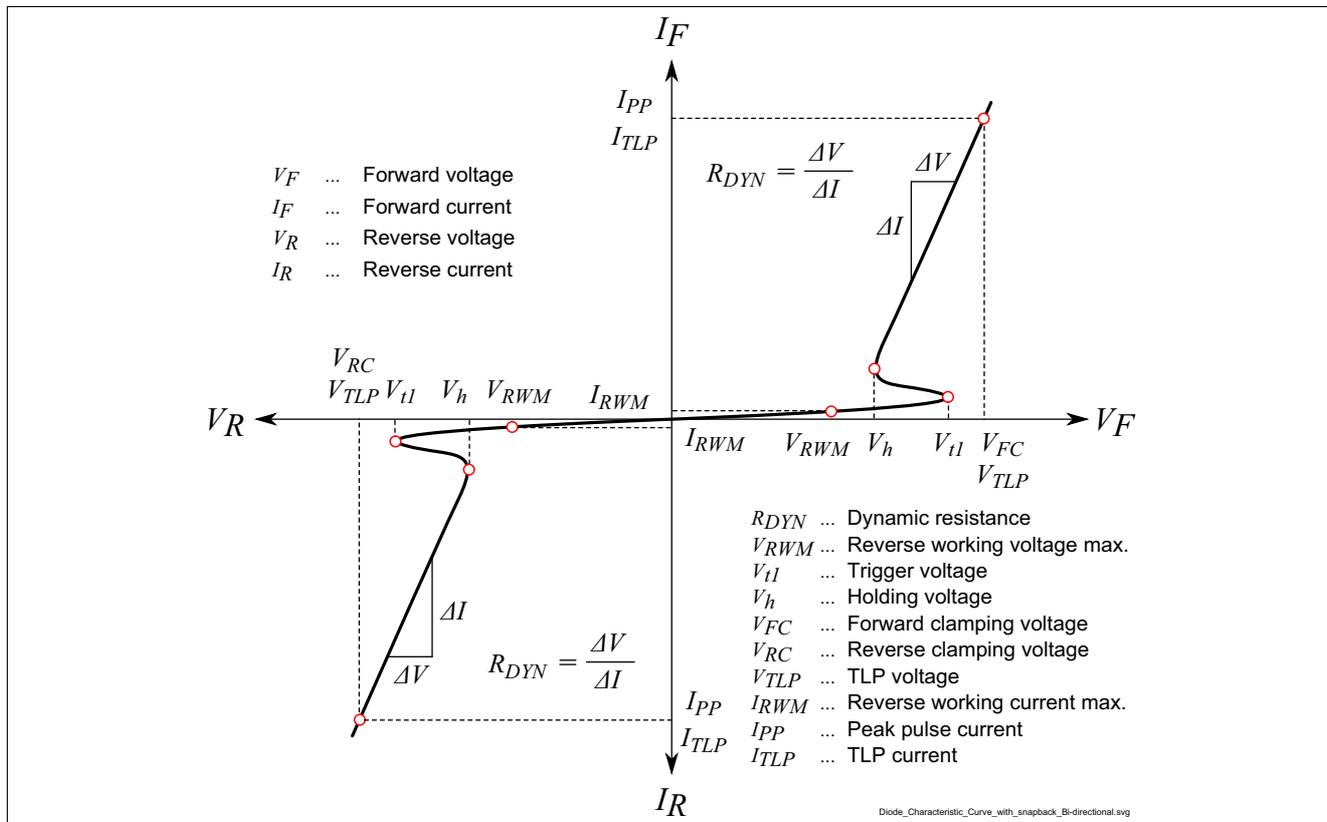


Figure 2 Definitions of electrical characteristics

Characteristics

Table 3 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}	-15	–	15	V	
Trigger voltage	V_{Trig}	–	21	–	V	$I_{BR} = 1\text{ mA}$, from Pin 1 to Pin 2
		–	21	–		$I_{BR} = 1\text{ mA}$, from Pin 2 to Pin 1
Reverse current	I_R	–	<0.1	50	nA	$V_R = 15\text{ V}$

Table 4 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	–	0.13	0.2	pF	$V_R = 0\text{ V}$, $f = 1\text{ MHz}$
		–	0.09	–		$V_R = 0\text{ V}$, $f = 1\text{ GHz}$
Series inductance	L_S	–	0.2	–	nH	ESD103-B1-02ELS ESD103-B1-02EL
		–	0.4	–		

Table 5 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 ¹⁾	V_{CL}	–	20	–	V	$I_{TLP} = 1\text{ A}$
		–	36	–		$I_{TLP} = 8\text{ A}$
		–	48	–		$I_{TLP} = 16\text{ A}$
Dynamic resistance ¹⁾	R_{DYN}	–	1.8	–	Ω	$t_p = 100\text{ ns}$

1) ANSI/ESD STM5.5.1 - Electrostatic Discharge Sensitive Testing using Transmission Line Pulse (TLP) Model. TLP conditions: $Z_0 = 50\ \Omega$, $t_p = 100\text{ ns}$, $t_r = 0.6\text{ ns}$, I_{TLP} and V_{TLP} averaging window: $t_1 = 30\text{ ns}$ to $t_2 = 60\text{ ns}$, extraction of dynamic resistance using least squares fit of TLP characteristic between $I_{TLP1} = 2\text{ A}$ and $I_{TLP2} = 14.1\text{ A}$. Please refer to Application Note AN210[1].

3 Typical Characteristics

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

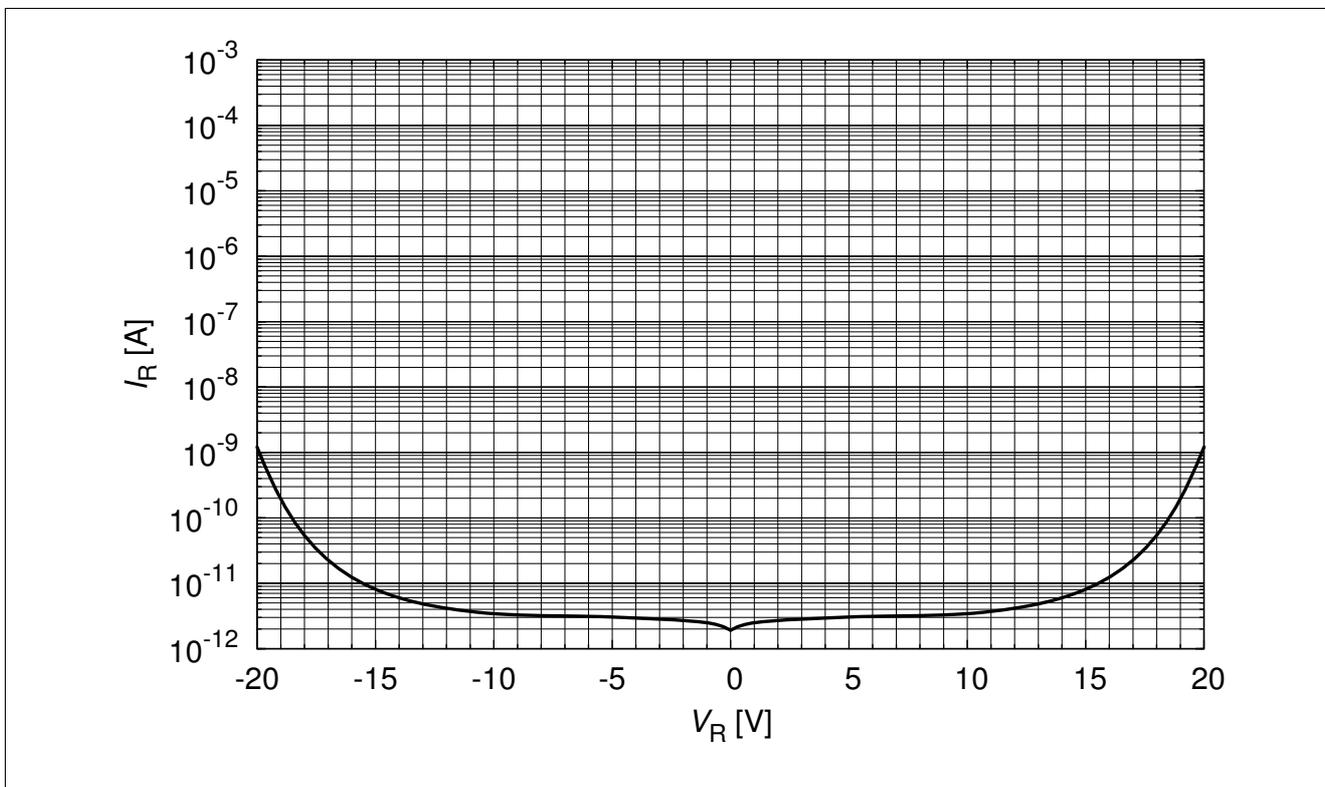


Figure 3 Reverse current $I_R = f(V_R)$

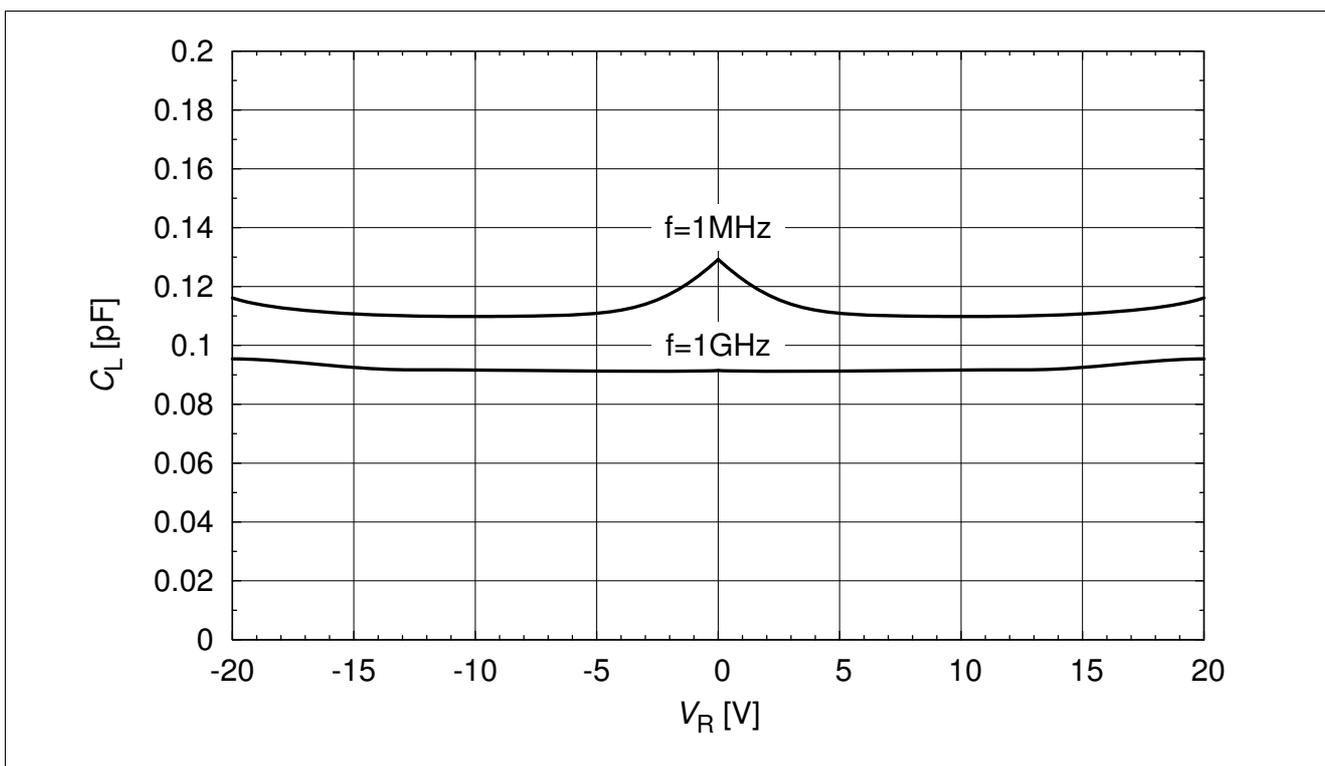


Figure 4 Line capacitance $C_L = f(V_R)$, $f = 1\text{ MHz}$

Typical Characteristics

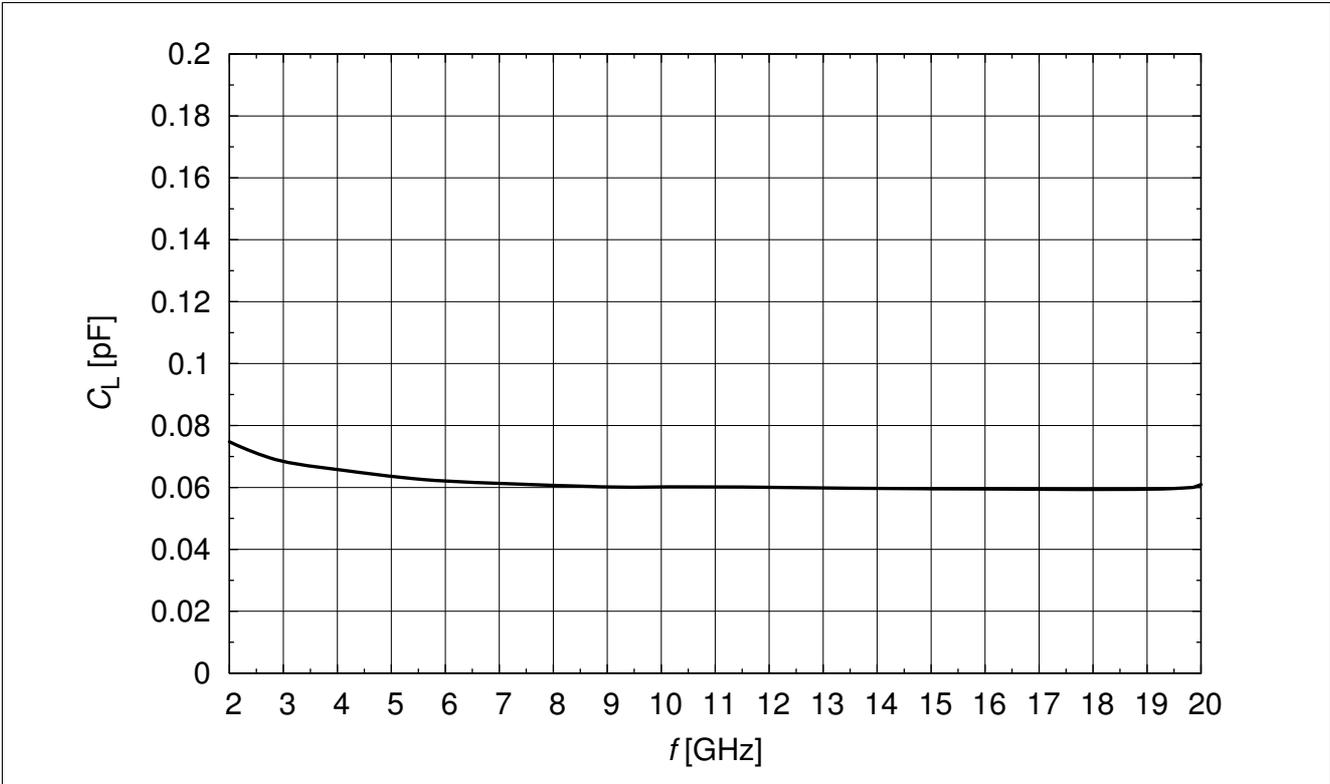


Figure 5 Line capacitance: $C_L = f(f)$, $V_R = 0\text{ V}$

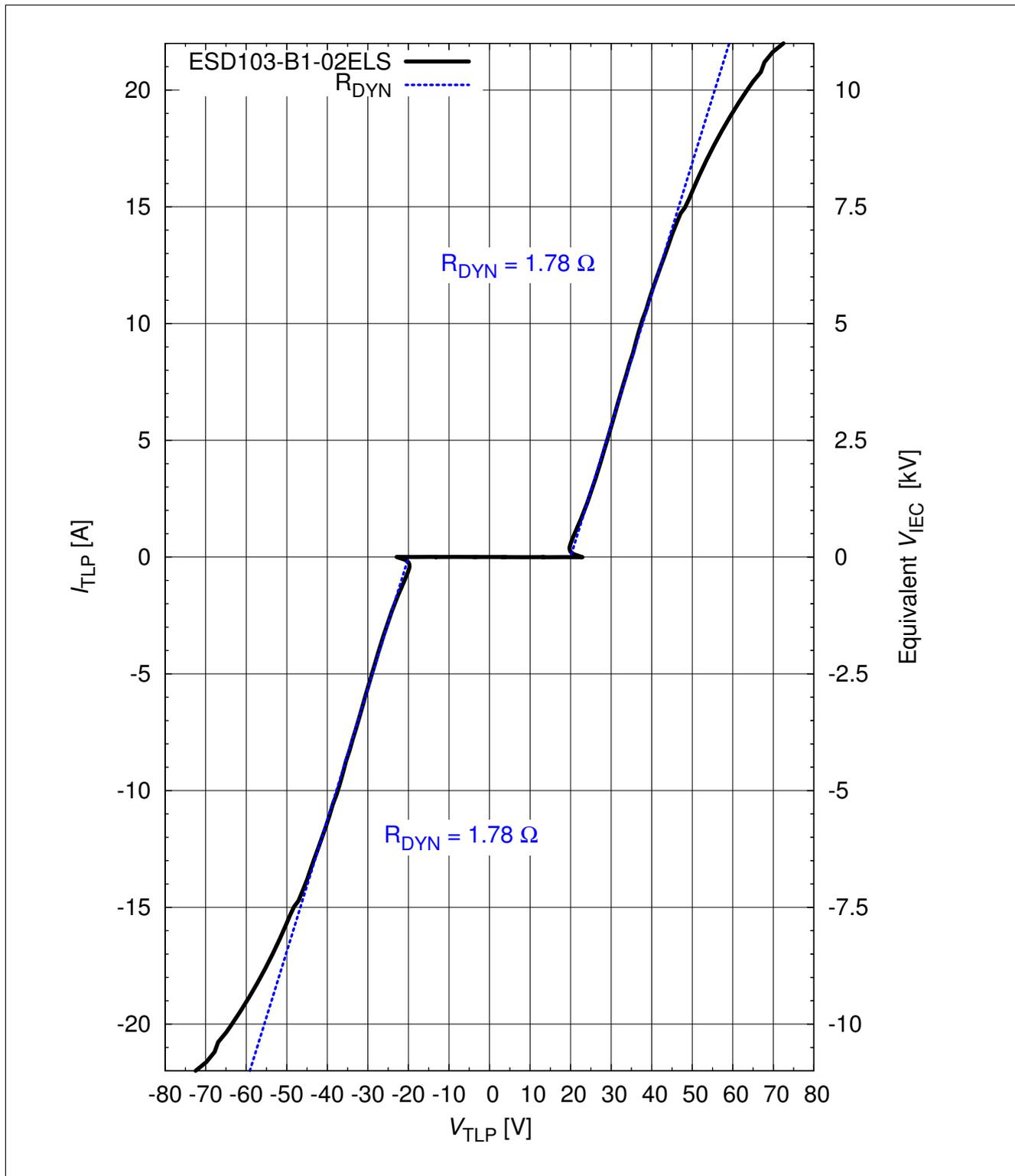


Figure 6 Clamping voltage (TLP): $I_{TLP} = f(V_{TLP})$ according ANSI/ESDSTM5.5.1-Electrostatic Discharge Sensitivity Testing using Transmission Line Pulse (TLP) Model. TLP conditions: $Z_0 = 50 \Omega$, $t_p = 100 \text{ ns}$, $t_r = 0.6 \text{ ns}$, I_{TLP} and V_{TLP} average window: $t_1 = 30 \text{ ns}$ to $t_2 = 60 \text{ ns}$, extraction of dynamic resistance using squares fit to TLP characteristics between $I_{TLP1} = 2 \text{ A}$ and $I_{TLP2} = 14.1 \text{ A}$. Please refer to Application Note AN210[1]

Typical Characteristics

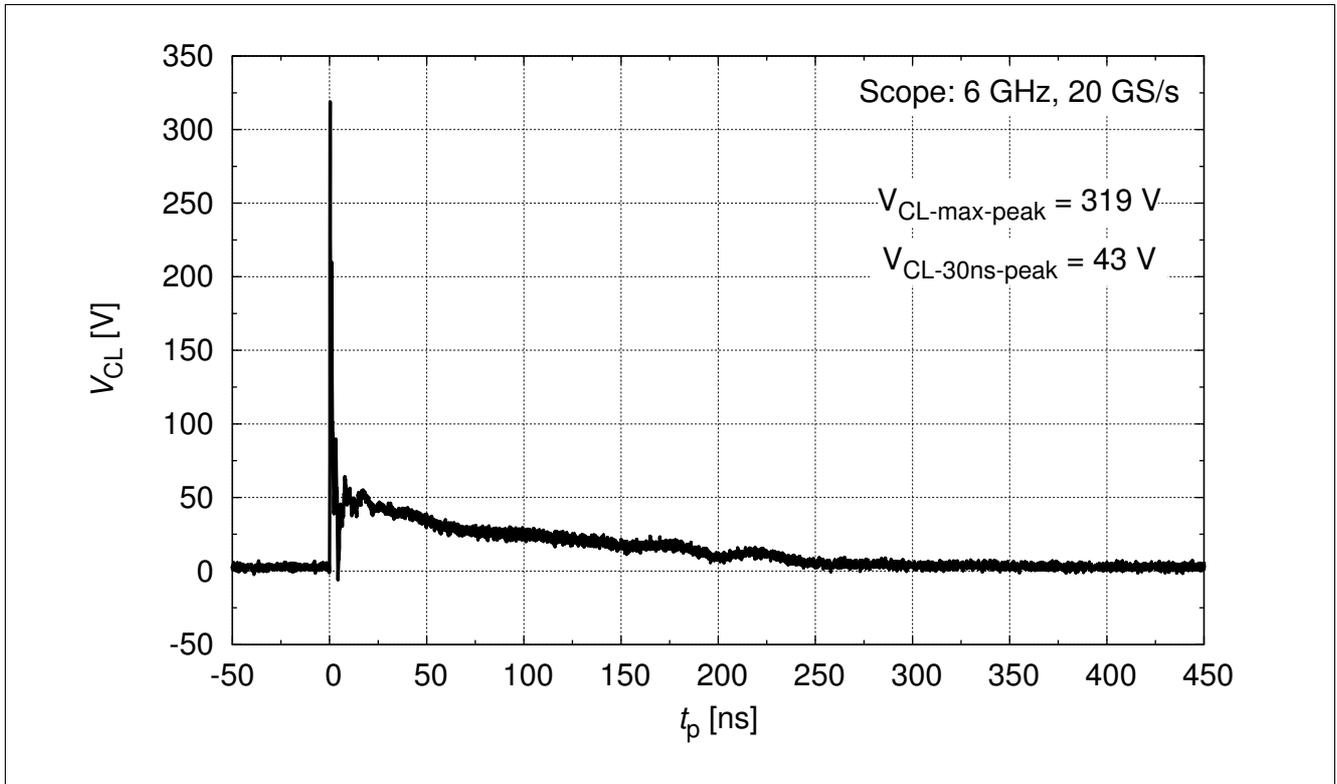


Figure 7 Clamping voltage at +8 kV discharge according IEC61000-4-2 ($R = 330 \Omega$, $C = 150 \text{ pF}$)

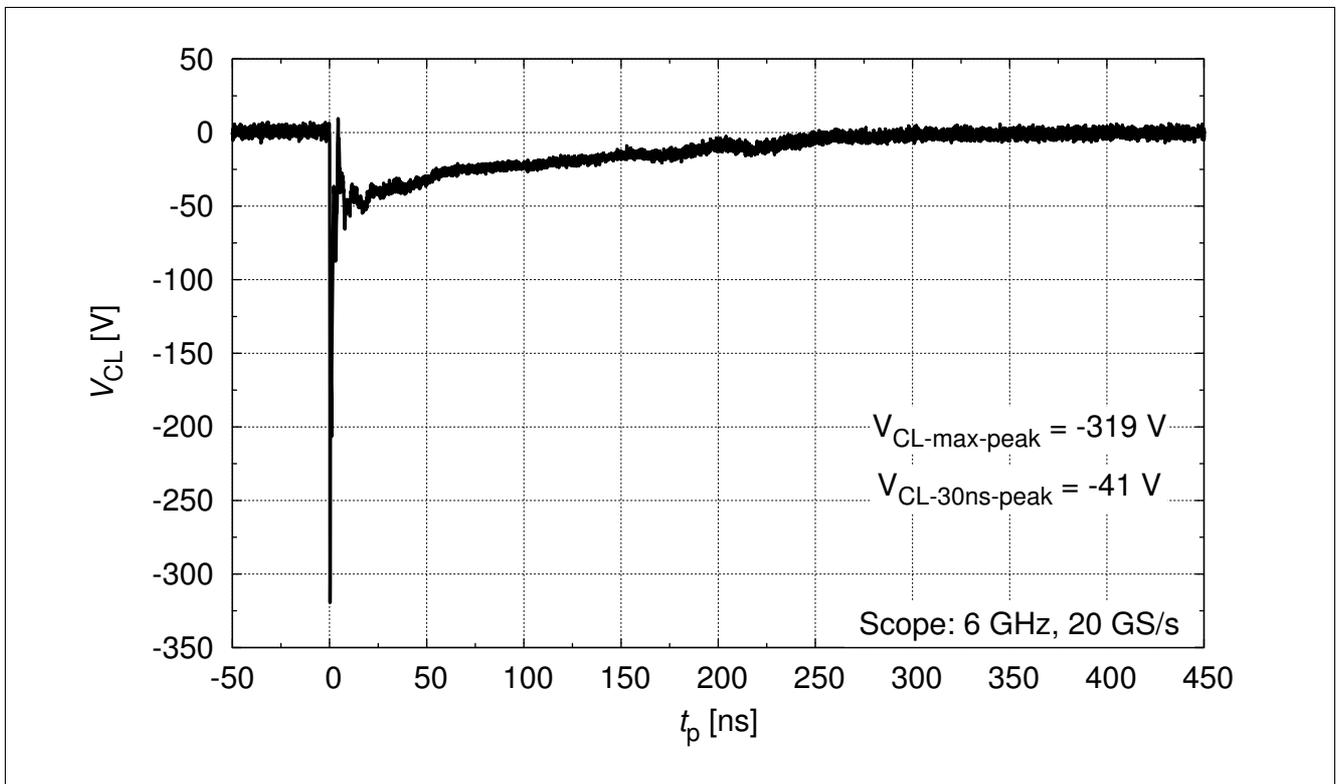


Figure 8 Clamping voltage at -8 kV discharge according IEC61000-4-2 ($R = 330 \Omega$, $C = 150 \text{ pF}$)

4 Package Information

4.1 TSSLP-2-4 [2]

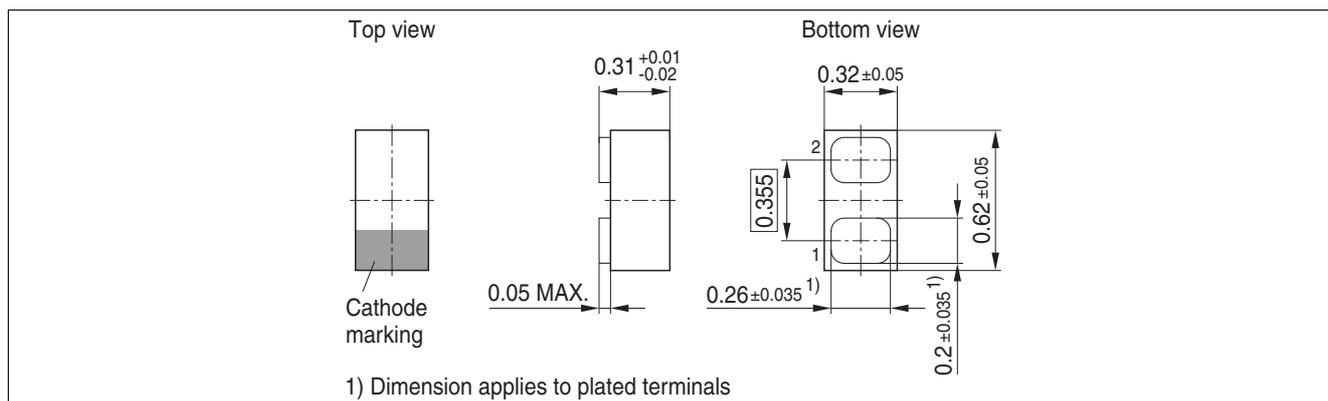


Figure 9 TSSLP-2-4 Package outline

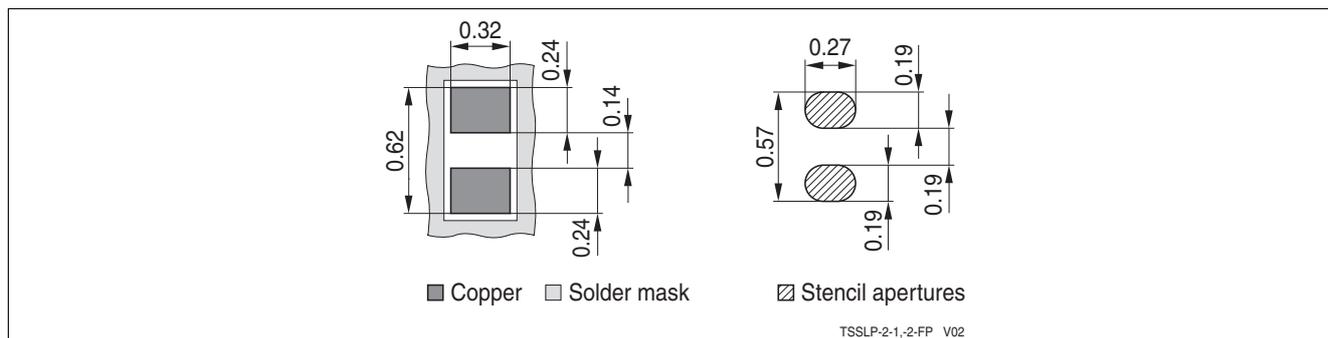


Figure 10 TSSLP-2-4 Footprint

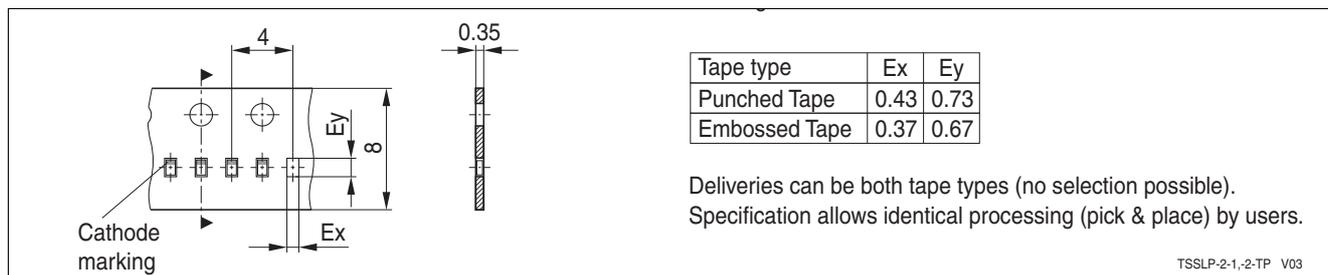


Figure 11 TSSLP-2-4 Packing

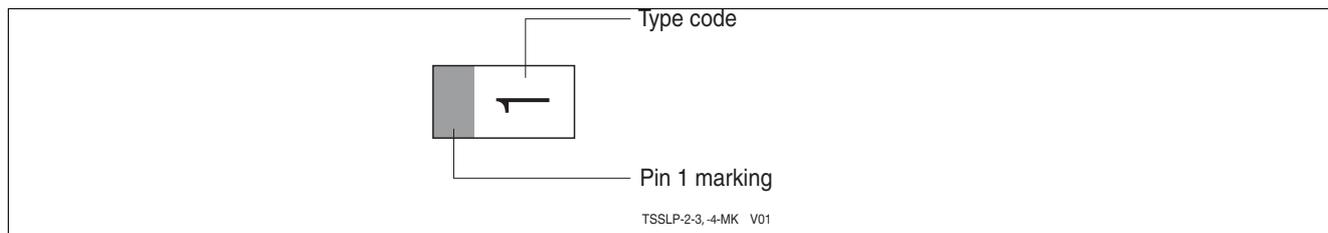


Figure 12 TSSLP-2-4 Marking (example)

4.2 TSLP-2-20 [2]

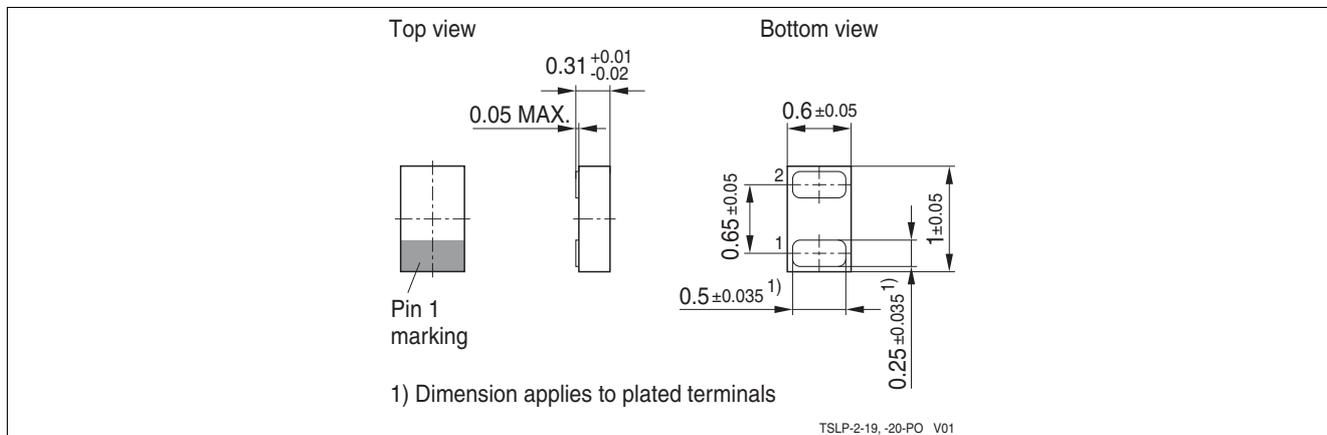


Figure 13 TSLP-2-20 Package outline

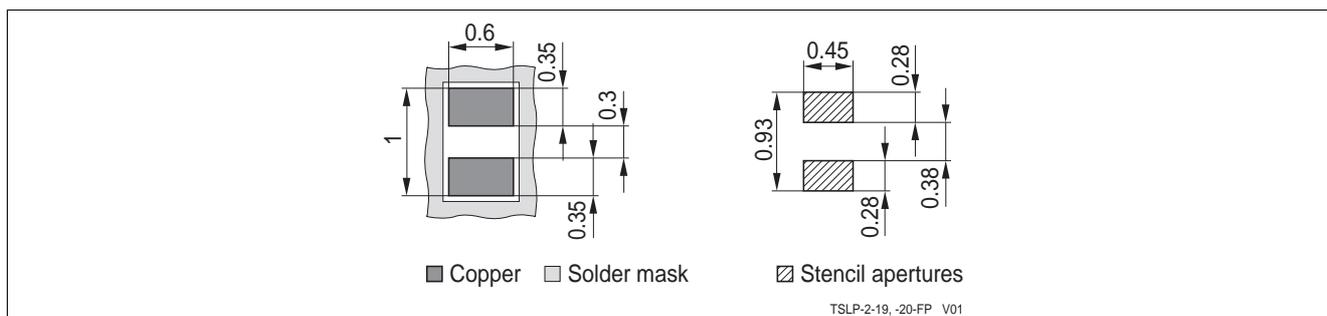


Figure 14 TSLP-2-20 Footprint

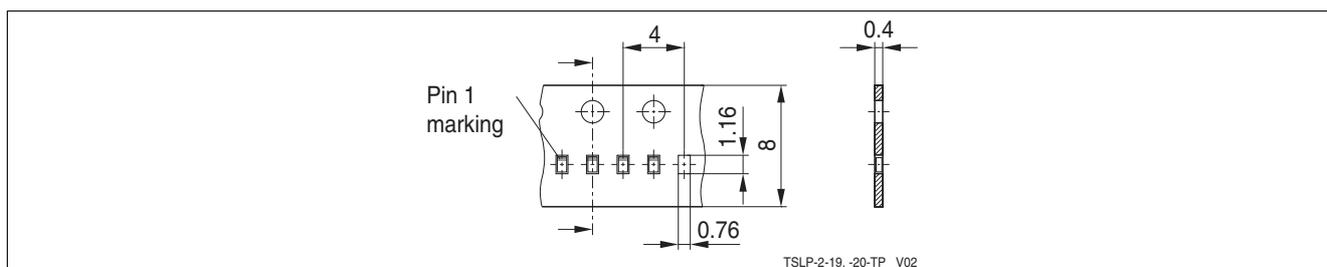


Figure 15 TSLP-2-20 Packing

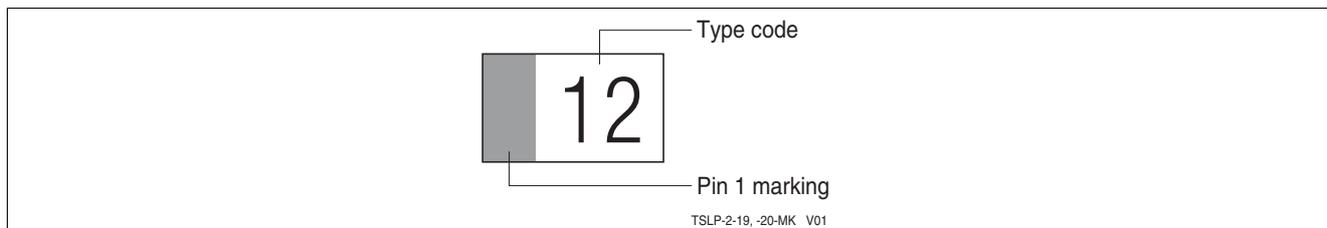


Figure 16 TSLP-2-20 Marking (example)

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
- [3] Tero, Ranta, Juha Ellä, Helena Pohjonen: Antenna Switch Linearity Requirements for GSM/WCDMA Mobile Phone Front-Ends. Nokia Technology Platforms, P.O.Box 86, FIN-24101 SALO.
- [4] Infineon AC - Application Note AN327: ESD101-B1 / ESD103-B1, Bi-directional Ultra Low Capacitance Transient Voltage Suppression Diodes for High Power RF Applications.

Revision History: Revision 1.2, 2013-07-22

Page or Item	Subjects (major changes since previous revision)
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Revision 1.3, 2014-06-12

6	Table 5) updated

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