

# TVS Diodes

Transient Voltage Suppressor Diodes

## BGF120A

Dual Channel Ultra-Low Capacitance ESD Diode

## Datasheet

Rev. 1.4, 2012-09-17  
Final

Power Management & Multimarket

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**Revision History Rev.1.3, 2012-08-01**

Page or Item	Subjects (major changes since previous revision)
Rev. 1.4, 2012-09-17	
12	Package outline updated

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Last Trademarks Update 2011-11-11

## 1 BGF120A Dual Channel Ultra-Low Capacitance ESD Diode

### 1.1 Features

- ESD /transient protection of high-speed data and RF antenna lines exceeding:
  - IEC61000-4-2 (ESD): 18 kV (contact)
- Max. reverse working voltage: 5.3 V
- Ultra-low capacitance:
  - < 0.75 pF (max.) in bi-directional configuration
  - < 1.5 pF (max.) in uni-directional configuration
- Very low reverse current: < 1 nA (typ.)
- Small leadless plastic package with 0.75 mm x 0.75 mm size (typ.) and 0.66 mm height (max.)
- 400  $\mu$ m pad pitch and 40  $\mu$ m Sn solder depot on pads
- RoHS and WEEE compliant package

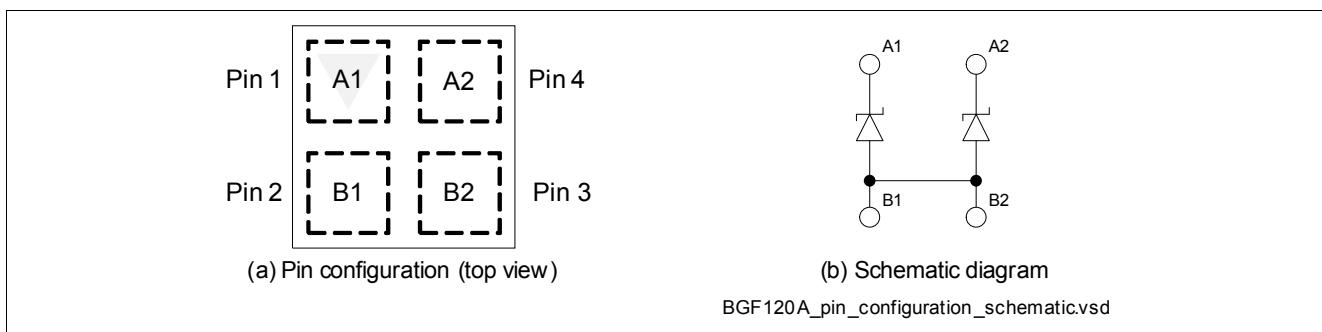


### 1.2 Application

- USB 2.0, 10/100/1000 Ethernet, Firewire, DVI, HDMI, S-ATA
- RF antenna protection e.g. GPS, FM radio, mobile TV

### 1.3 Description

The BGF120A can be used for 2 lines uni-directional or 1 line bi-directional ESD and surge protection up to 20 kV contact discharge according to IEC61000-4-2. The capacitance of the device is less than 0.75 pF (max.) in bi-directional configuration and less than 1.5 pF (max.) in uni-directional configuration. Maximum reverse working voltage is 5.3 V (uni-directional) or  $\pm$ 5.3 V (bi-directional). The reverse leakage current is less than 1 nA (typ.). The leadless plastic package has 0.75 mm x 0.75 mm typical size and maximum height of 0.66 mm. The pads have 400  $\mu$ m pitch and offer 40  $\mu$ m Sn for high reliability soldering



**Figure 1-1 Pin Configuration and Schematic Diagram**

Type	Package	Configuration	Marking code
BGF120A	TSLP-4-8	2 lines, uni-directional <sup>1)</sup>	A

1) Or 1 line, bi-directional between A1 and A2, if B1, B2 are not connected

## 2 Electrical Characteristics

**Table 2-1 Maximum Ratings  $T_A = 25^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Operating temperature range	$T_{OP}$	-40	-	+125	°C	
Storage temperature range	$T_{STG}$	-65	-	+150	°C	
Contact discharge <sup>1)</sup>	$V_{ESD}$	-	-	18	kV	

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

**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.**

**Table 2-2 DC Electrical Characteristics  $T_A = 25^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Reverse working voltage	$V_{RWM}$	-	-	5.3	V	
Breakdown voltage	$V_{BR}$	6	-	-	V	$I_{BR} = 1 \text{ mA}$
Reverse current	$I_R$	-	<1	50	nA	$V_R = 5.3\text{V}$

**Table 2-3 DC Electrical Characteristics  $T_A = 25^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Line capacitance <sup>1)</sup> A1 or A2 to B1/B2 A1 to A2, B1/B2 n.c.	$C_L$	-	-	1.5 0.75	pF	$V_R = 0 \text{ V}, f = 1 \text{ MHz}$
Series inductance per diode	$L_S$	-	0.25	-	nH	

1) Total capacitance line to ground

## Electrical Characteristics

**Table 2-4 ESD Characteristics at  $T_A = 25^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Reverse clamping voltage <sup>1)</sup> A1 or A2 vs B1, B2 A1 or A2 vs B1, B2	$V_{CL}$	-	22	-	V	$I_{TLP} = 16 \text{ A}$ ,
		-	31	-		$I_{TLP} = 30 \text{ A}$ ,
Forward clamping voltage <sup>1)</sup> A1 or A2 vs B1, B2 A1 or A2 vs B1, B2	$V_{FC}$	-	-14	-	V	$I_{TLP} = -16 \text{ A}$ ,
		-	-20	-		$I_{TLP} = -30 \text{ A}$ ,
Dynamic resistance <sup>1)</sup> positive pulse A1 or A2 vs. B1, B2 negative pulse A1 or A2 vs B1, B2	$R_{DYN}$	-	0.7	-	$\Omega$	
		-	0.5	-		

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  $I_{PP1} = 10 \text{ A}$  and  $I_{PP2} = 30 \text{ A}$ . Please refer to Application Note AN210[1].

### 3 Typical Characteristics

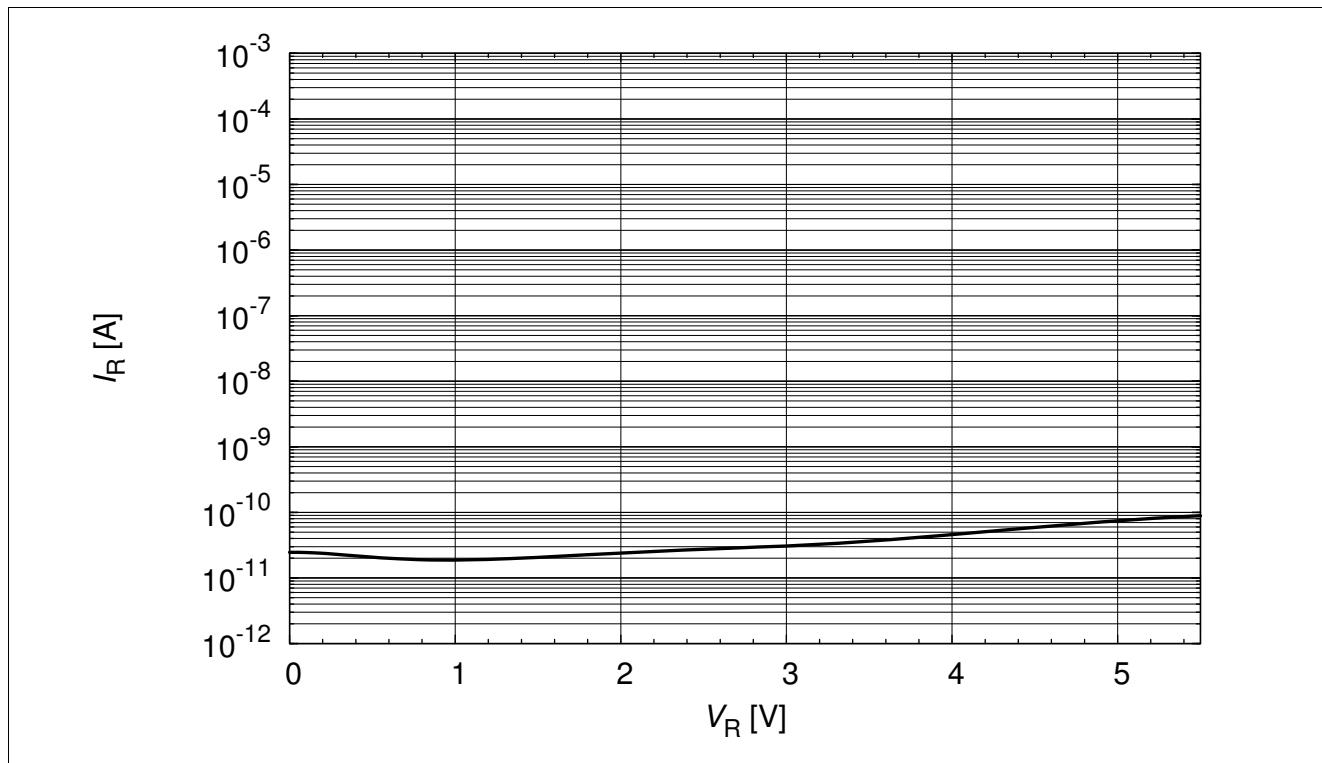


Figure 3-1 Reverse current  $I_R = f(V_R)$

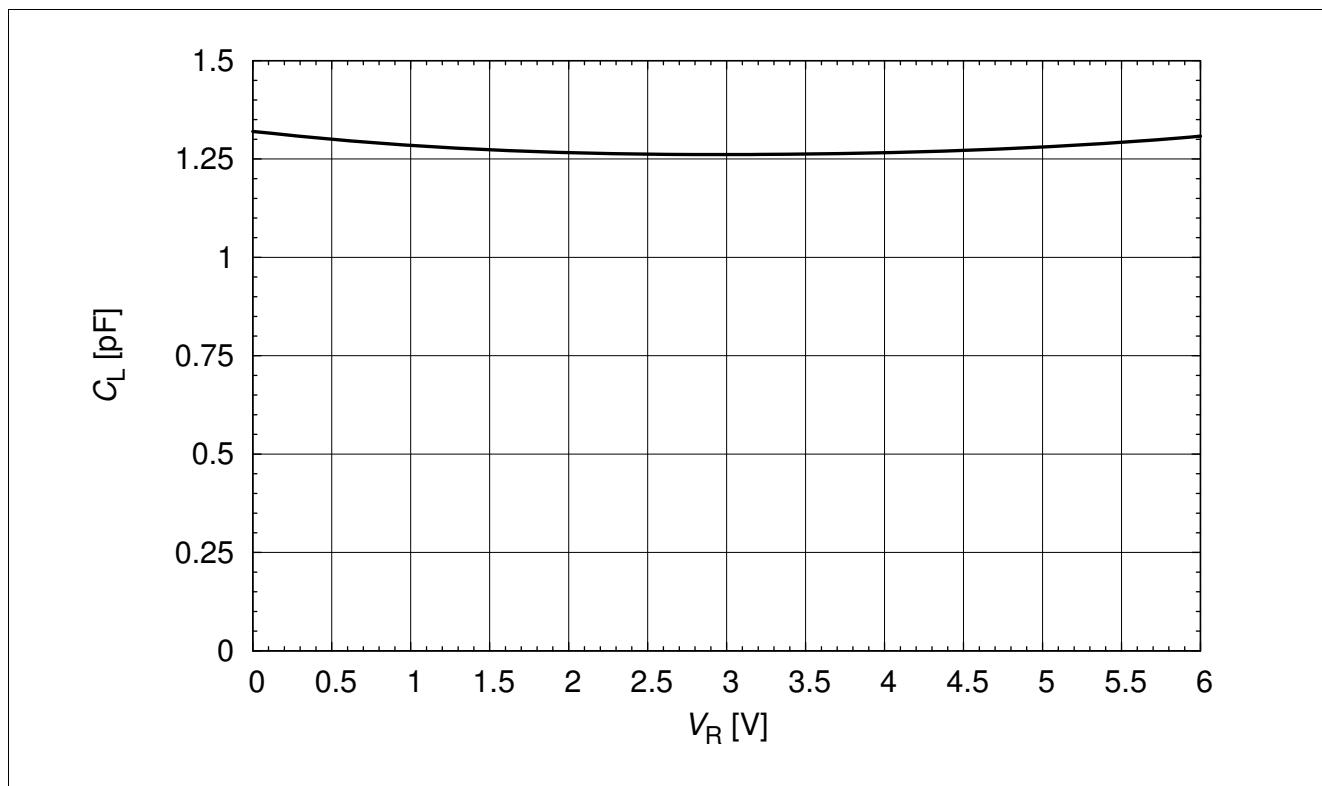
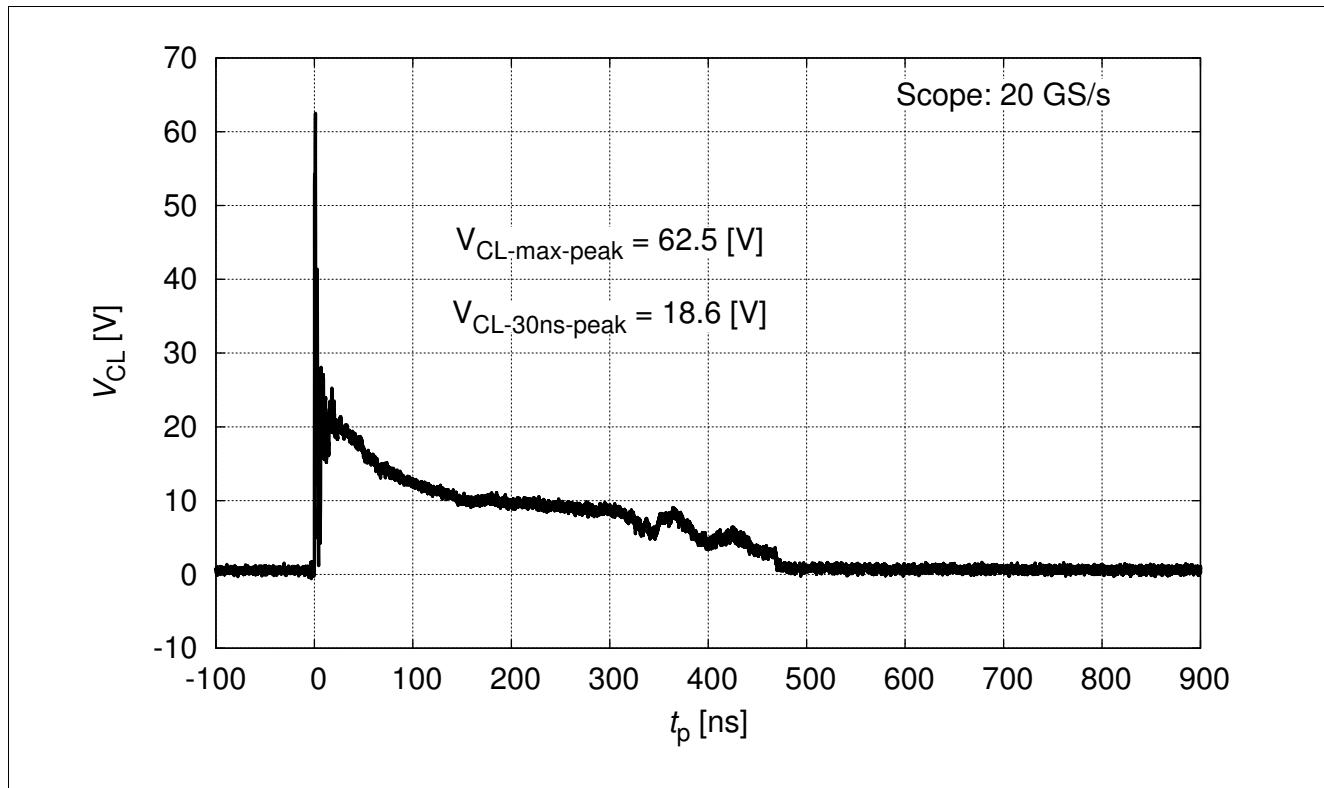
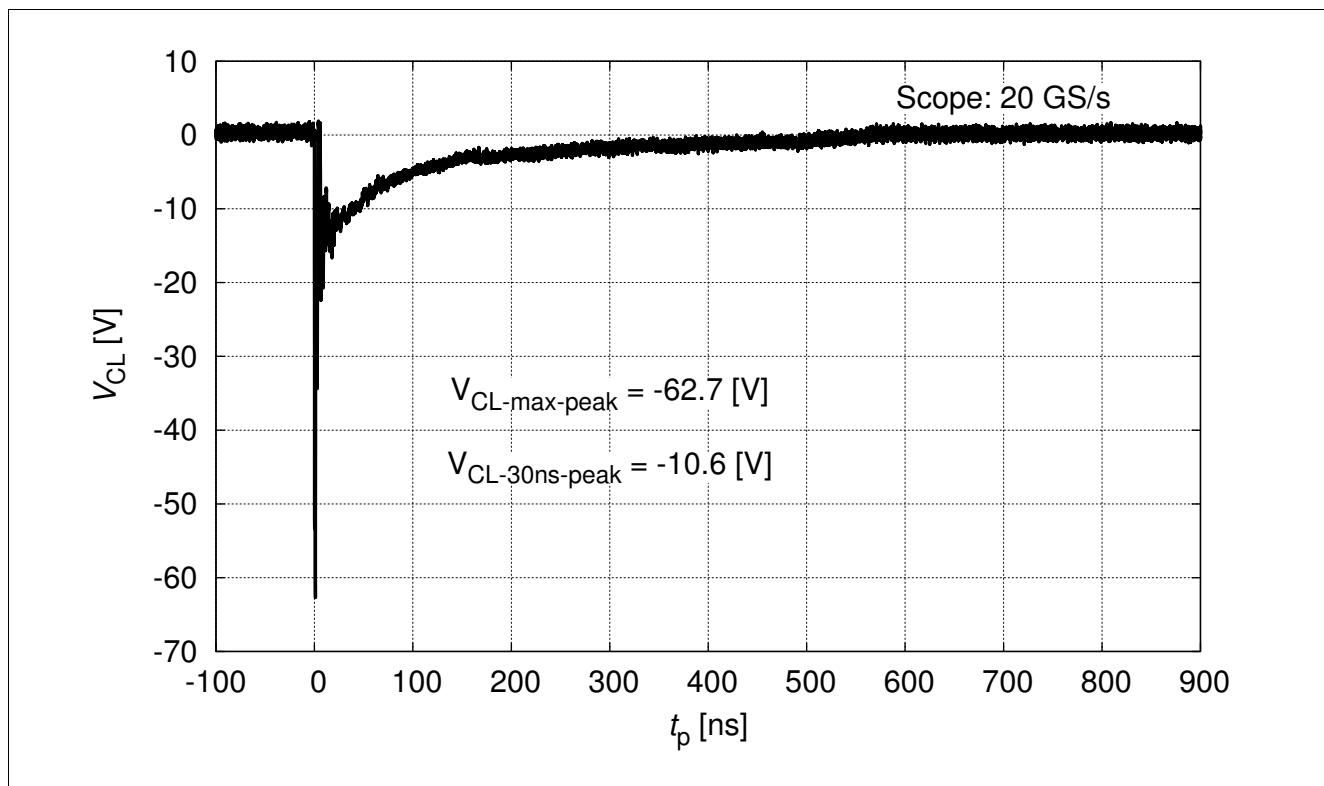


Figure 3-2 Capacitance A1vs. B1, A2 vs. B2,  $C_{L(A1,B1)} = C_{L(A2,B2)} = f(V_R)$

**Typical Characteristics**


**Figure 3-3 Clamping voltage at +8 kV discharge according to IEC61000-4-2 ( $R = 330 \Omega$ ,  $C = 150 \text{ pF}$ )**



**Figure 3-4 Clamping voltage at -8 kV discharge according to IEC61000-4-2 ( $R = 330 \Omega$ ,  $C = 150 \text{ pF}$ )**

## Typical Characteristics

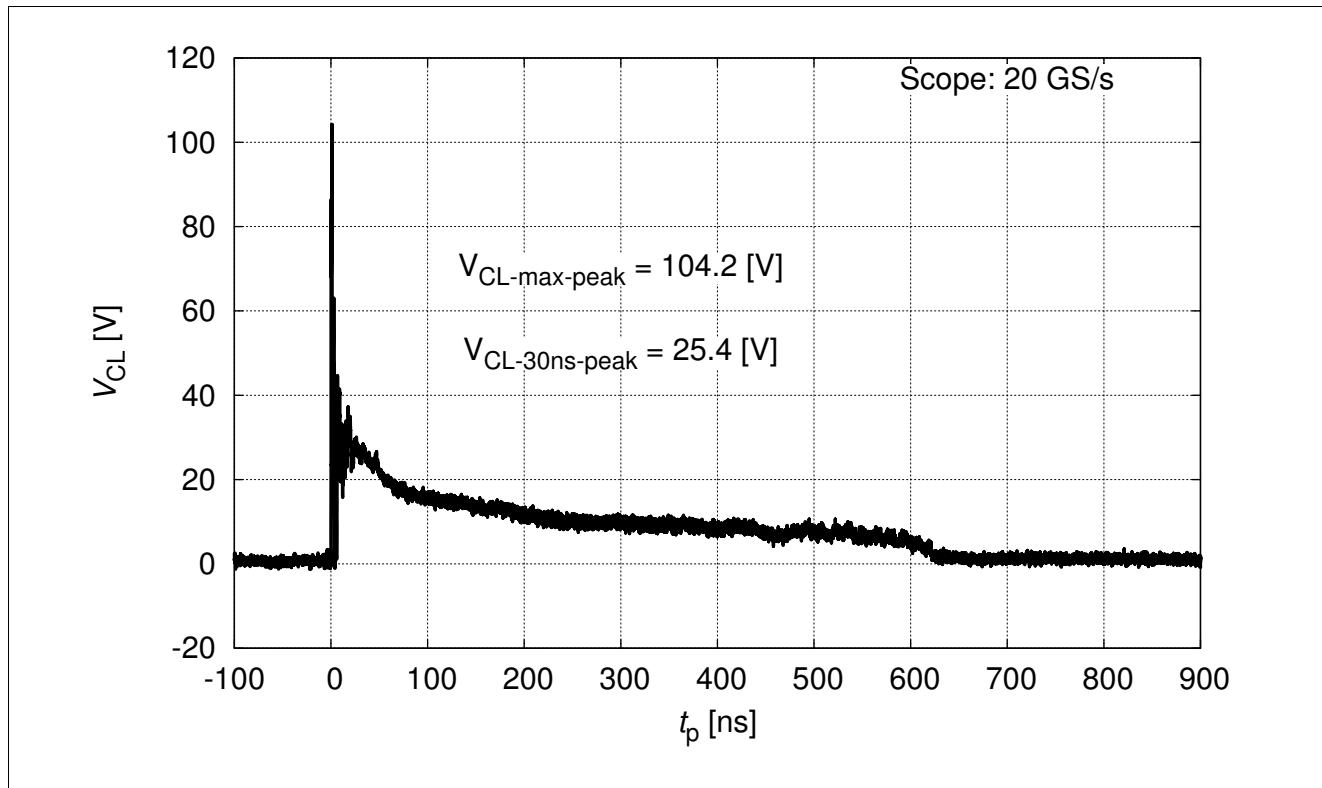


Figure 3-5 Clamping voltage at +15 kV discharge according IEC61000-4-2 ( $R = 330 \Omega$ ,  $C = 150 \text{ pF}$ )

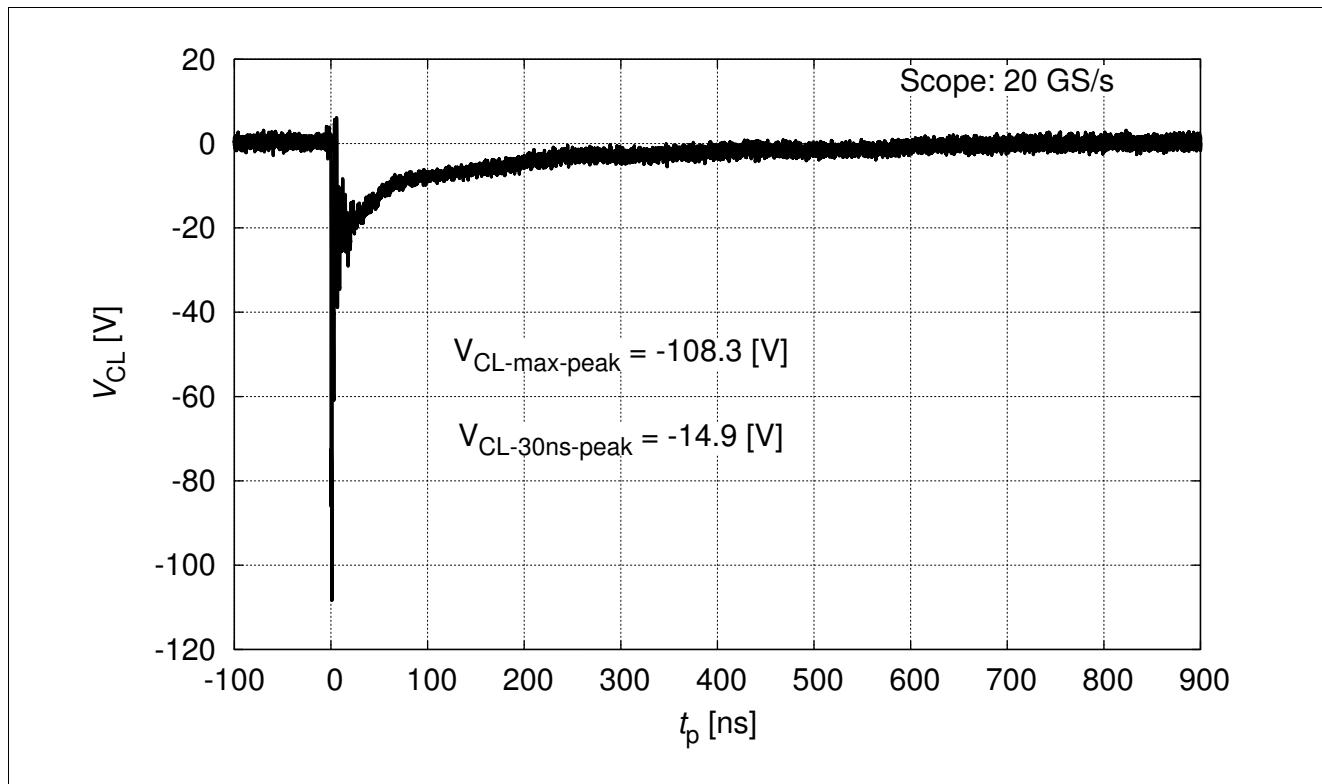
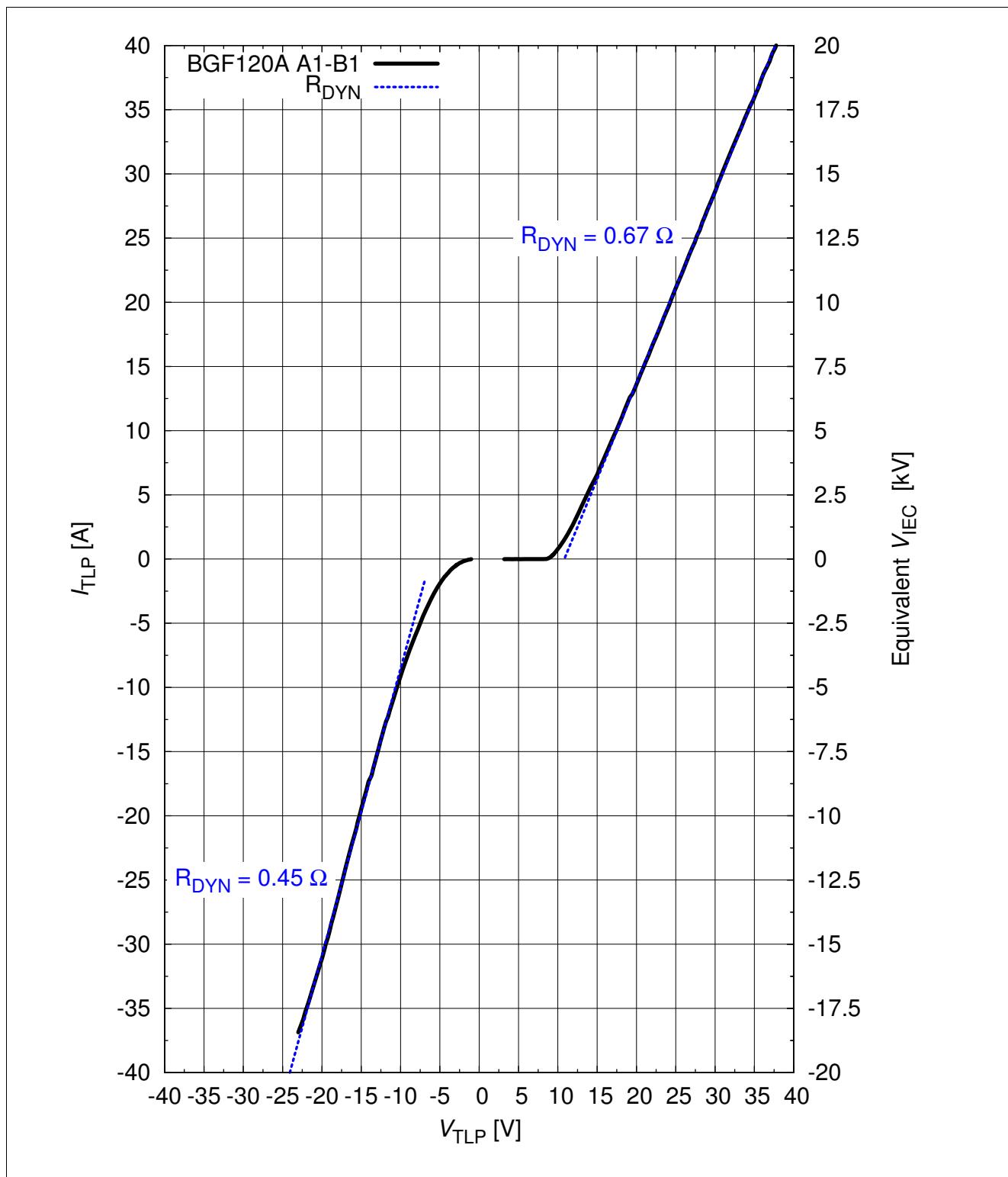


Figure 3-6 Clamping voltage at -15 kV discharge according IEC61000-4-2 ( $R = 330 \Omega$ ,  $C = 150 \text{ pF}$ )

## Typical Characteristics



**Figure 3-7 Clamping voltage (TLP):  $I_{TLP} = f(V_{TLP})$  according ANSI/ESD STM5.5.1- 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  $V_{TLP}$  averaging window:  $t_1 = 30 \text{ ns}$  to  $t_2 = 60 \text{ ns}$ , extraction of dynamic resistance using squares fit to ELP characteristic between  $I_{TLP1} = 10 \text{ A}$  and  $I_{TLP2} = 30 \text{ A}$ . Please refer to Application Note AN210 [1]**

## 4 Application and Signal Routing

### Application example for high-speed data line protection (uni-directional)

This low parasitic capacitance dual channel TVS diode array can be used either in a 2 channel uni-directional configuration or in a single channel bi-directional configuration. Due to the low capacitance and low inductance the configurations are perfect fit for ultra high-speed interfaces, such as USB2.0/3.0, S-ATA, DVI or HDMI ports.

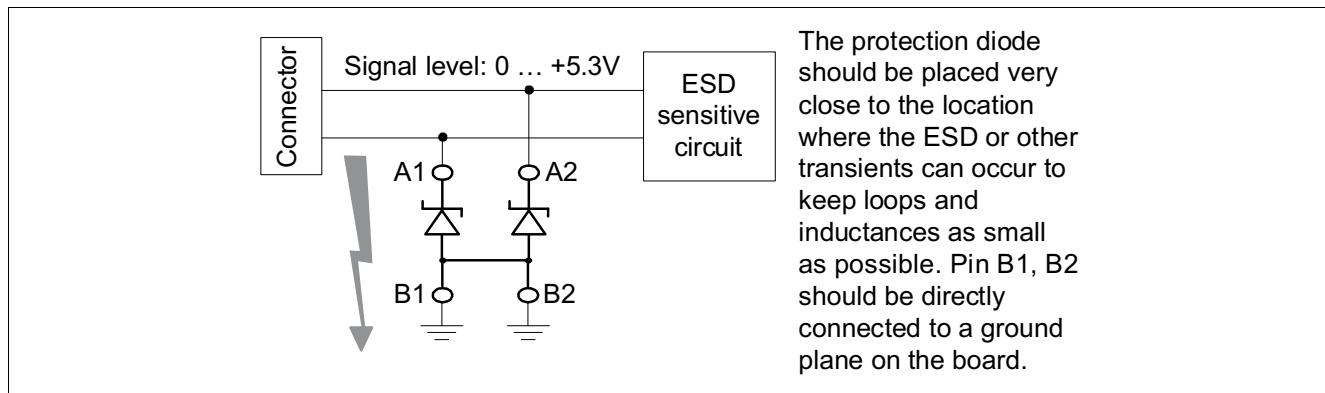


Figure 4-1 Application example for high-speed data line protection (uni-directional)

### Application example for RF antenna line (bi-directional)

Connecting pin A1(A2) to the signal line and A2(A1) to GND and leaving pin B1/B2 floating even further reduces the parasitics to 0.75 pF only and correspondingly enable the user to add reliable ESD protection to RF antennas in e.g. GPS, FM radio or mobile TV applications without influence of the RF circuitry.

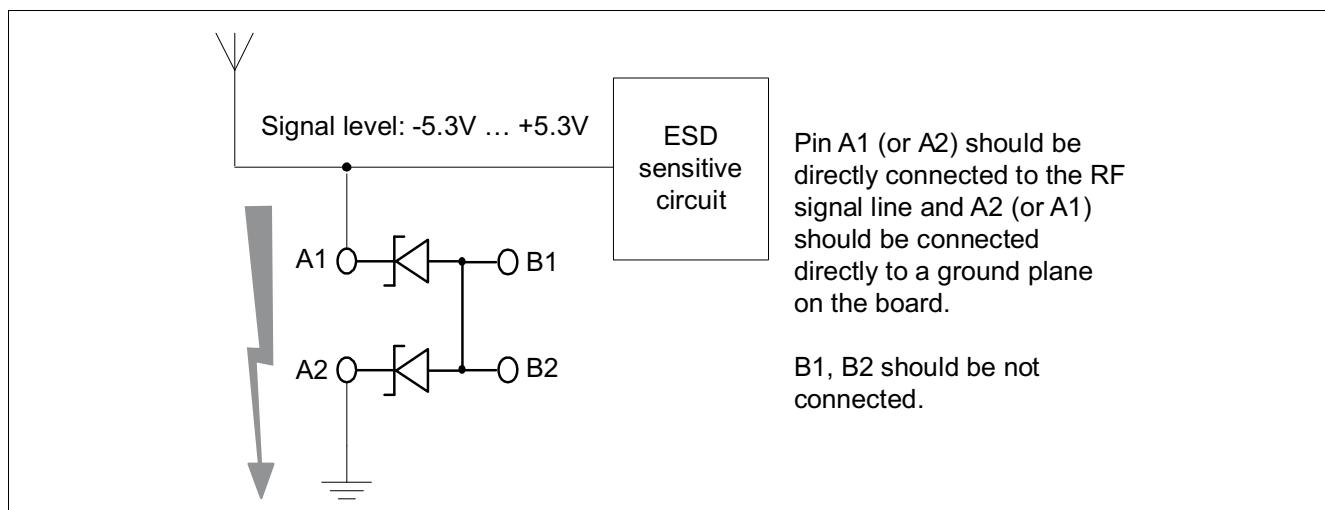
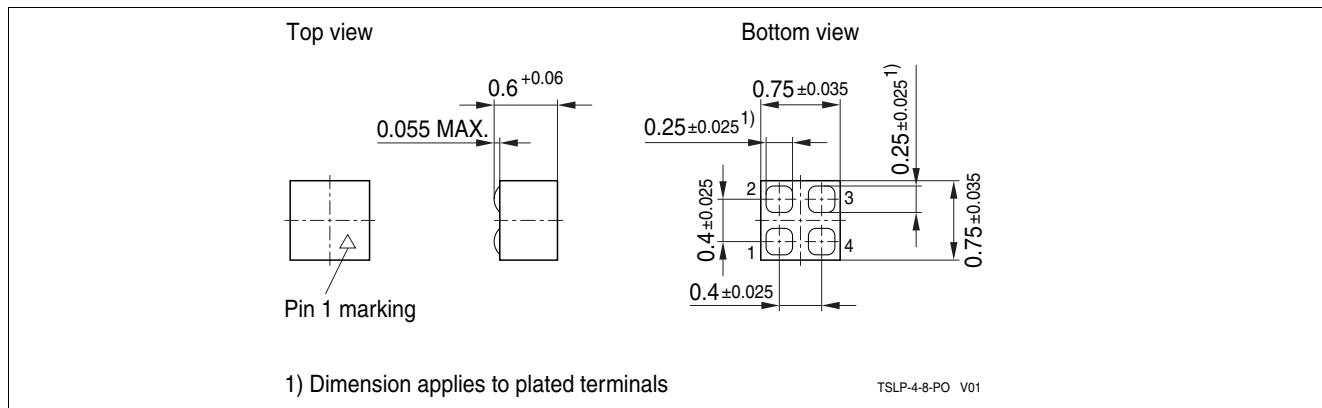
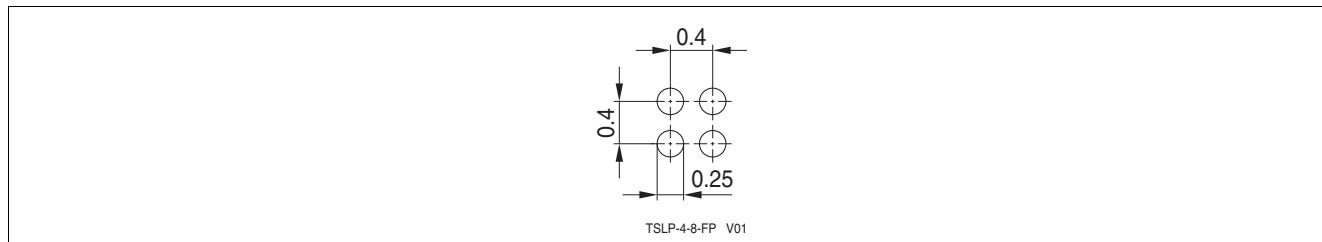


Figure 4-2 Application example for RF antenna line (bi-directional)

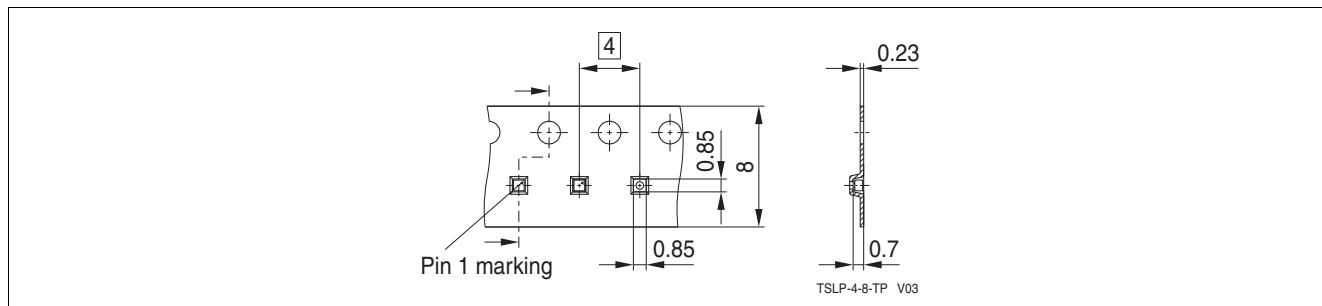
## 5 Package



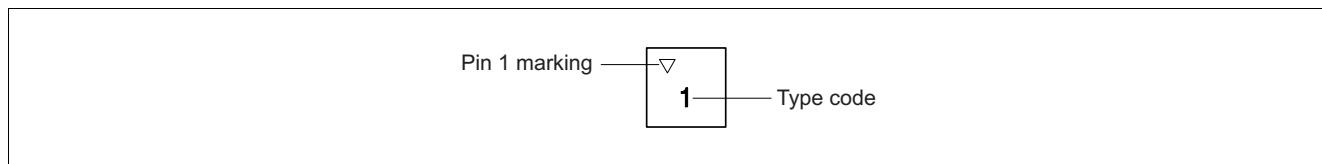
**Figure 5-1 Package outline for TSLP-4-8 (dimension in mm)**



**Figure 5-2 Package footprint for TSLP-4-8 (dimension in mm)**



**Figure 5-3 Tape and Reel Information for TSLP-4-8 (dimension in mm)**



**Figure 5-4 Marking (example) for TSLP-4-8**

## References

- [1] Infineon Technologies AG, "Effective ESD Protection Design at System Level Using VF-TLP Characterization Methodology", Application Note 210, RF and Protection Devices, April 22, 2010, Rev.1.0
- [2] Infineon Technologies AG, "Recommendation for PCB Assembly of Infineon TSLP and TSSLP Packages".

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