

Hipac

High performance passives and actives on chip

BGF137

Integrated Fuse and TVS Protection

BGF137

Data Sheet

Revision 3.1, 2011-08-09
Final

Industrial and Multi-Market

Edition 2011-08-09

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

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Revision History

Page or Item	Subjects (major changes since previous revision)
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Revision 3.1, 2011-08-09

8, 9	Table 3 updated
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Revision 3.0, 2011-06-06

all	Final data sheet
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Revision 2.2, 2011-05-05

4	marking updated
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Last Trademarks Update 2010-06-09

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1 Integrated Fuse and TVS Protection

1.1 Features

- 1 channel integrated fuse and TVS diode
- ESD protection according to IEC61000-4-2 up to 25 kV contact discharge on all IOs
- Wafer Level Package with SnAgCu solder balls
- RoHS and WEEE compliant package
- Very small form factor (0.75 mm x 0.75 mm)
- **Fuse**
 - 2 A fuse
 - Fast fusing time, $t_F < 1$ ms @ 5 A, 25 °C ambient
 - Very low fuse resistance, $R < 50$ mΩ
- **TVS**
 - Very high surge power capability
 - Operation voltage up to 12 V
 - Very accurate breakdown voltage with low temperature coefficient
 - Low clamping voltage

RoHS



1.2 Description

The BGF137 integrates a Fuse and TVS diode and is designed for transient voltage and power overstress suppression. All pins are protected against ESD pulses of ± 25 kV contact discharge according to IEC61000-4-2. The wafer level package is a green package with a size of only 0.75 x 0.75 mm² and a total height of 0.50 mm [2].

2 Product Description

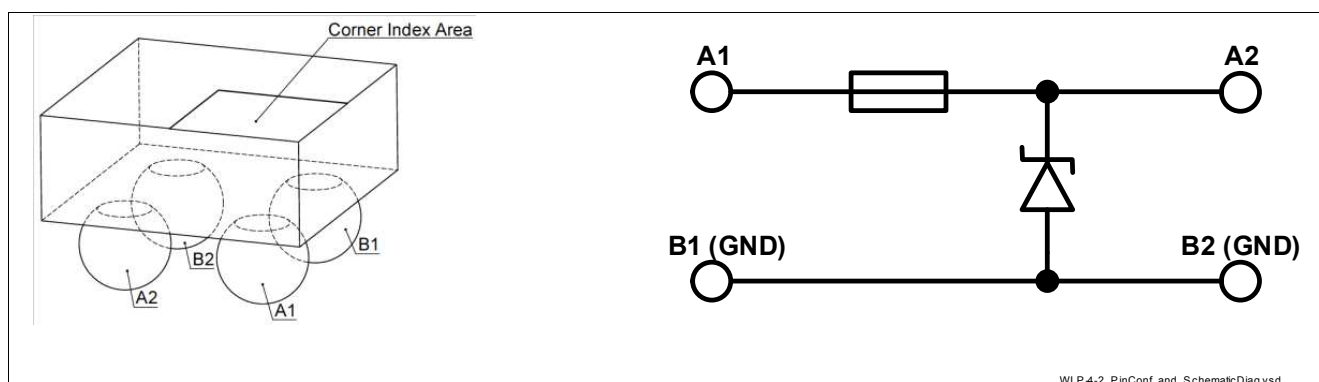


Figure 1 Schematic Diagram and Package Configuration

Table 1 Ordering Information

Type	Package	Chip	Marking code
BGF137	WLP-4-2	N0741	37

3 Characteristics

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

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
Voltage at all pins to GND	V_P	0	–	+12	V
Operating temperature range	T_{OP}	-30	–	+85	$^\circ\text{C}$
Storage temperature	T_{STG}	-55	–	+150	$^\circ\text{C}$
Electrostatic discharge according to IEC61000-4-2 ¹⁾ at all pins	V_{ESD}	-25	–	+25	kV

1) Contact discharge

3.1 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.		
Fuse resistance	R	—	0.045	0.05	Ω	$I = 200\text{mA}$
Fusing time , no current through TVS from Pin A2 to B1/B2 ($I_{A2,B1/B2} = 0\text{ A}$)						$I = 5\text{ A}$, A1 to A2
	t_F	—	1	—	ms	$T_A = 25^\circ\text{C}$
		—	—	100		$T_A = -30^\circ\text{C}$
Fusing time , no current through TVS from Pin A2 to B1/B2 ($I_{A2,B1/B2} = 0\text{ A}$)						$I = 3.2\text{ A}$, A1 to A2
	t_F	—	0.7	—	h	$T_A = 25^\circ\text{C}$
		—	1.2	24		$T_A = 10^\circ\text{C}$, Max. at 100 ppm
		—	7	—		$T_A = -30^\circ\text{C}$
Fuse lifetime , no current through TVS from Pin A2 to B1/B2 ($I_{A2,B1/B2} = 0\text{ A}$)						$I = 2\text{ A}$, A1 to A2
	t_L	—	20000	—	h	$T_A = 25^\circ\text{C}$
		1000	—	—		$T_A = 25^\circ\text{C}$, Min. at 100 ppm
Fuse lifetime , no current through TVS from Pin A2 to B1/B2 ($I_{A2,B1/B2} = 0\text{ A}$)						$I = 1\text{ A}$, A1 to A2
	t_L	—	14×10^6	—	h	$T_A = 25^\circ\text{C}$
Insulation resistance post fusing	R_i	0.1	20	—	$\text{M}\Omega$	5 A forced current, 14 V voltage compliance at A1[2]
Breakdown voltage of TVS diode, current forced from A1 to B1/B2						$I_R = 20\text{ mA}$
	V_{BR}	—	17	—	V	$T_A = 25^\circ\text{C}$
		15.5	—	—		$T_A = -30^\circ\text{C}$

Characteristics

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Leakage current of line to GND						$V_R = 12\text{ V}$
	I_R	—	100	—	nA	$T_A = 85^{\circ}\text{C}$
		—	10	100		$T_A = 25^{\circ}\text{C}$
		—	1	—		$T_A = -30^{\circ}\text{C}$
Forward voltage of TVS diode, current forced from A1 to B1/B2 ¹⁾						$I_F = 850\text{ mA}$
	V_F	—	1.05	1.1	V	$T_A = 25^{\circ}\text{C}$
		—	—	1.15		$T_A = -30^{\circ}\text{C}$

1) To avoid high temperature and possible disassembling of component from the board, DC current operation to be limited to few seconds [2]

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

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Line capacitance to GND	C_L	–	120	–	pF	$V_R = 0\text{ V}, f = 1\text{ MHz}, V_{OSC} = 25\text{ mV}$

Characteristics

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⁾						$I_{PP} = 1\text{ A}$,
	V_{CL}	–	18.9	19.5	V	$T_A = 85^{\circ}\text{C}$ from A2 to GND
		–	17.8	–		$T_A = 25^{\circ}\text{C}$ from A2 to GND
		–	17.0	–		$T_A = -30^{\circ}\text{C}$ from A2 to GND
Clamping voltage ²⁾						
	V_{CL}	–	25.0	–	V	+8 kV
		–	-2.5	–		-8 kV
		–	33.0	–		+15 kV
		–	-4.0	–		-15 kV
Clamping voltage ³⁾						
	V_{CL}	–	18.0	–	V	+8 kV
		–	-1.0	–		-8 kV
		–	22.0	–		+15 kV
		–	-1.6	–		-15 kV
Dynamic resistance ⁴⁾	R_{DYN}	–	0.14	–	Ω	from B1 to A1
		–	0.09	–		from B2 to A2
		–	0.66	–		from A1 to B1
		–	0.60	–		from A2 to B2

1) 8/20 μs pulse waveform according to IEC61000-4-5

2) Clamping voltage after 30 ns according to IEC61000-4-2 (contact)

3) Clamping voltage after 100 ns according to IEC61000-4-2 (contact)

4) TLP parameter: $Z_0 = 50\text{ }\Omega$, $t_p = 100\text{ ns}$, $t_r = 600\text{ ps}$, averaging window: $t_1 = 30\text{ ns}$ to $t_2 = 60\text{ ns}$, extraction of dynamic resistance using least squares fit of TLP characteristic between $IPP1 = 10\text{ A}$ and $IPP2 = 40\text{ A}$. The equivalent stress level VIEC according IEC 61000-4-2 ($R = 330\text{ }\Omega$, $C = 150\text{ pF}$) is calculated at the broad peak of the IEC waveform at $t = 30\text{ ns}$ with 2 A / kV

3.2 Typical Characteristics at $T_A = 25\text{ °C}$, unless otherwise specified

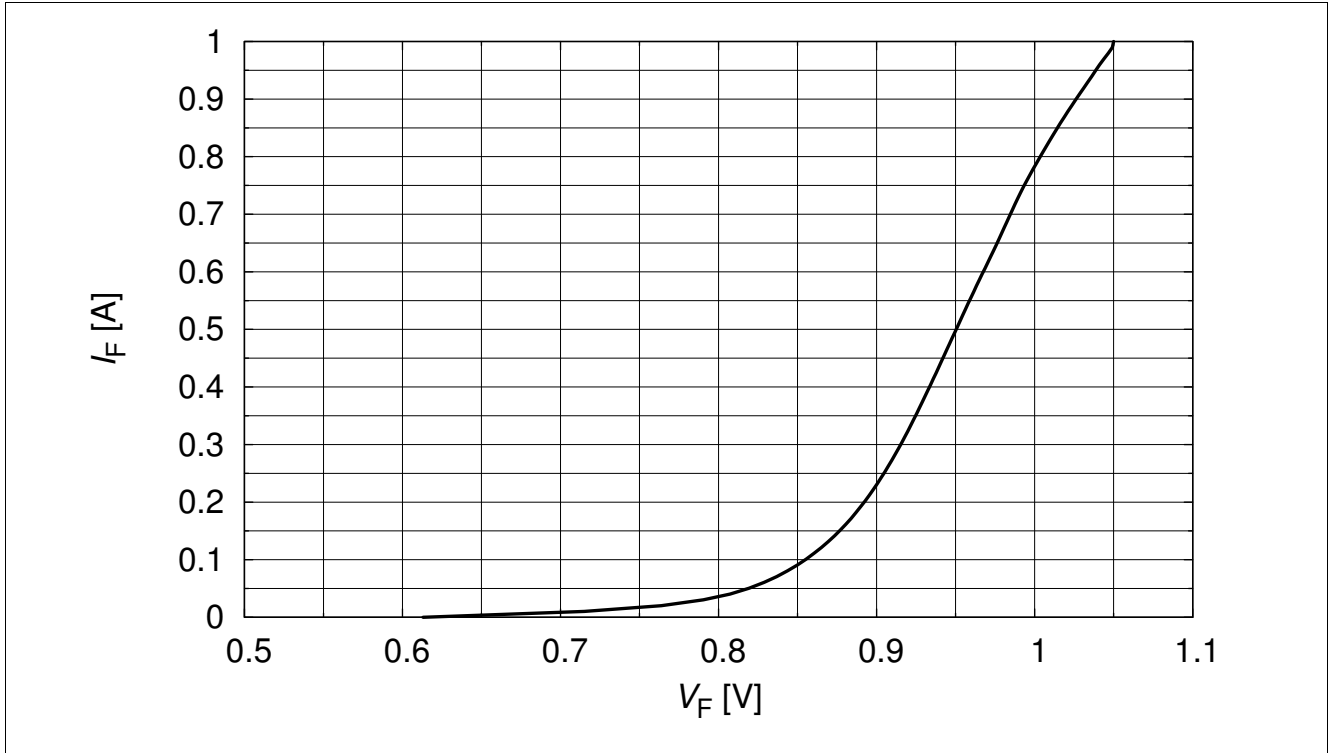


Figure 2 Forward characteristics, $I_F = f(V_F)$

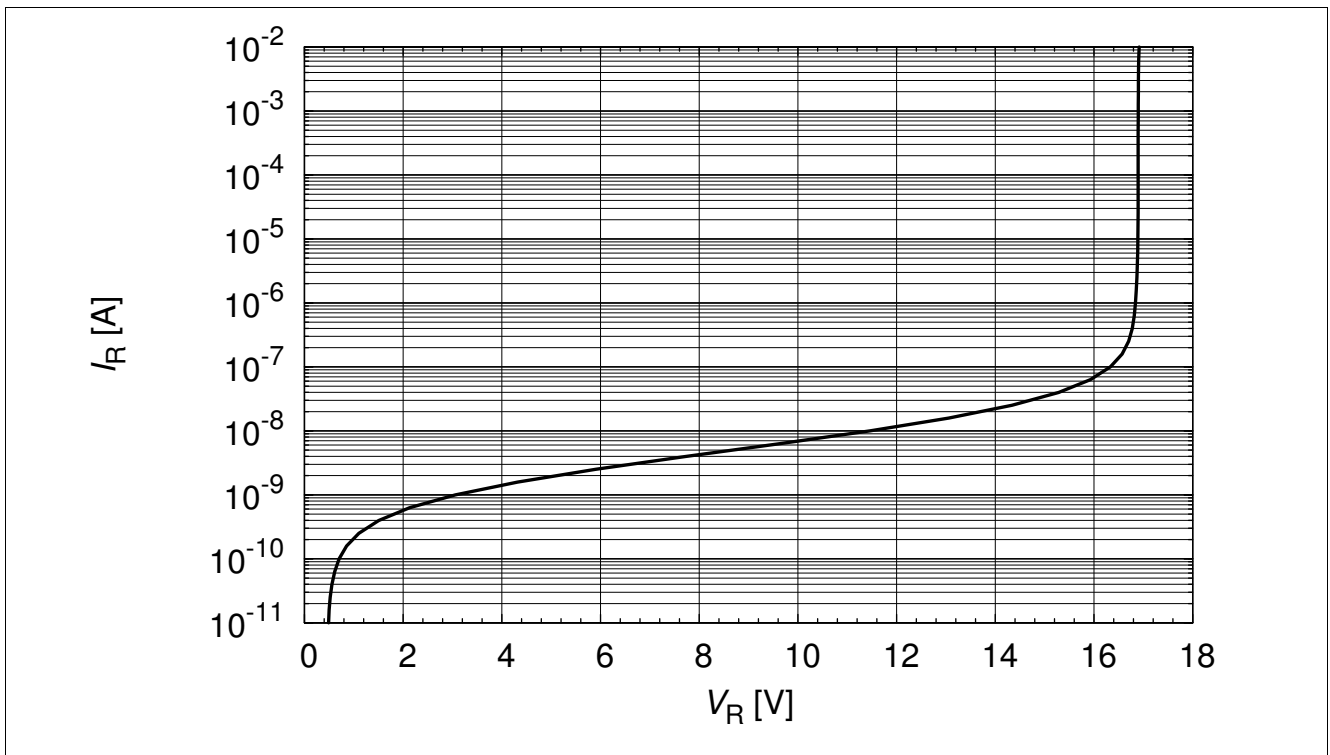


Figure 3 Reverse characteristics, $I_R = f(V_R)$

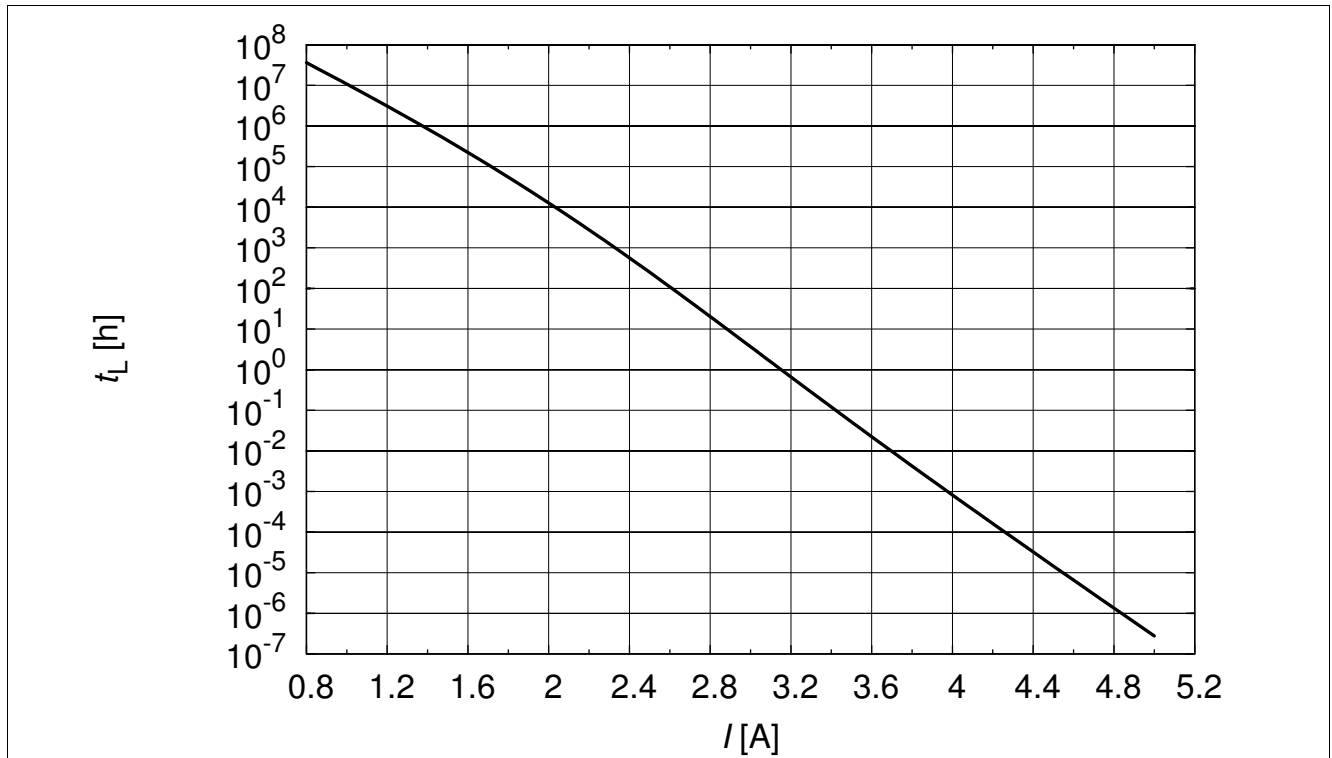


Figure 4 Fuse lifetime, $t_L = f(I)$

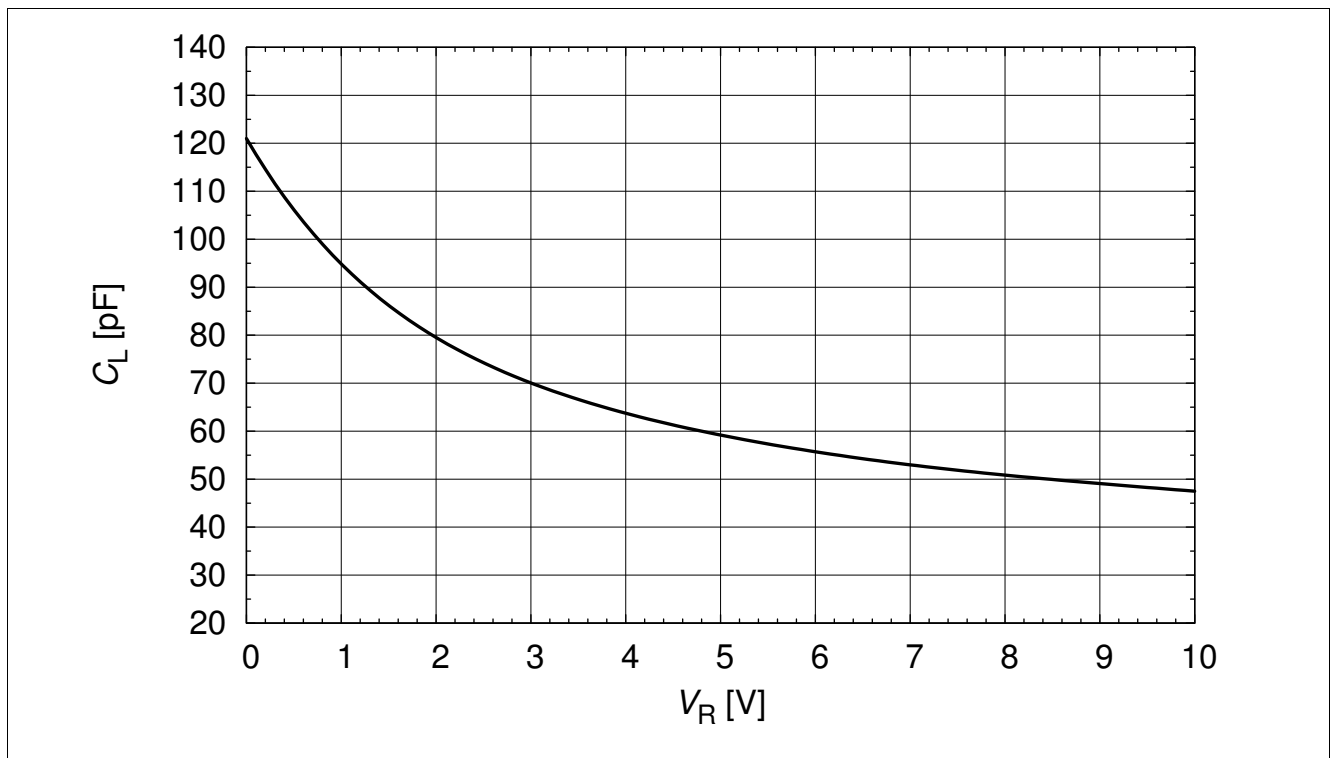


Figure 5 Line capacitance $C_L = f(V_R)$, $f = 1$ MHz

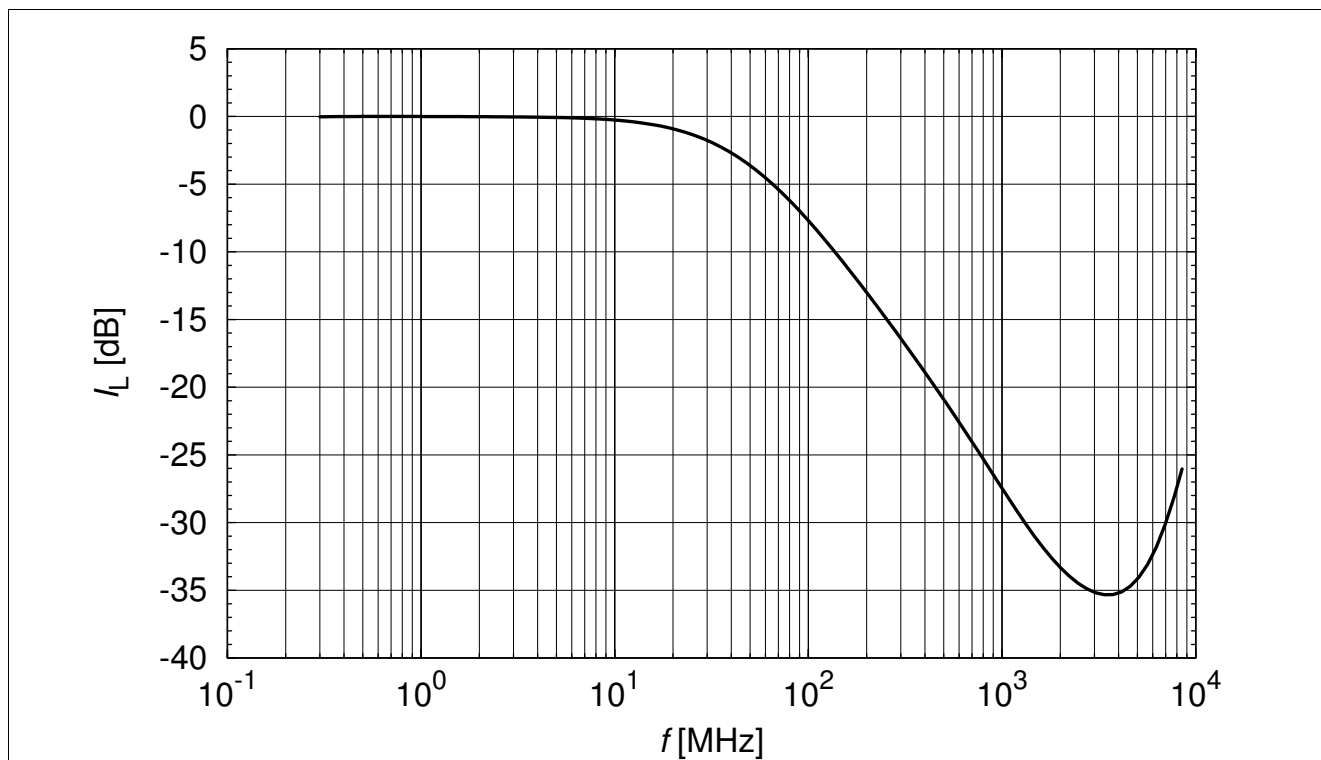


Figure 6 Insertion loss $I_L = f(f)$, $V_R = 0$ V

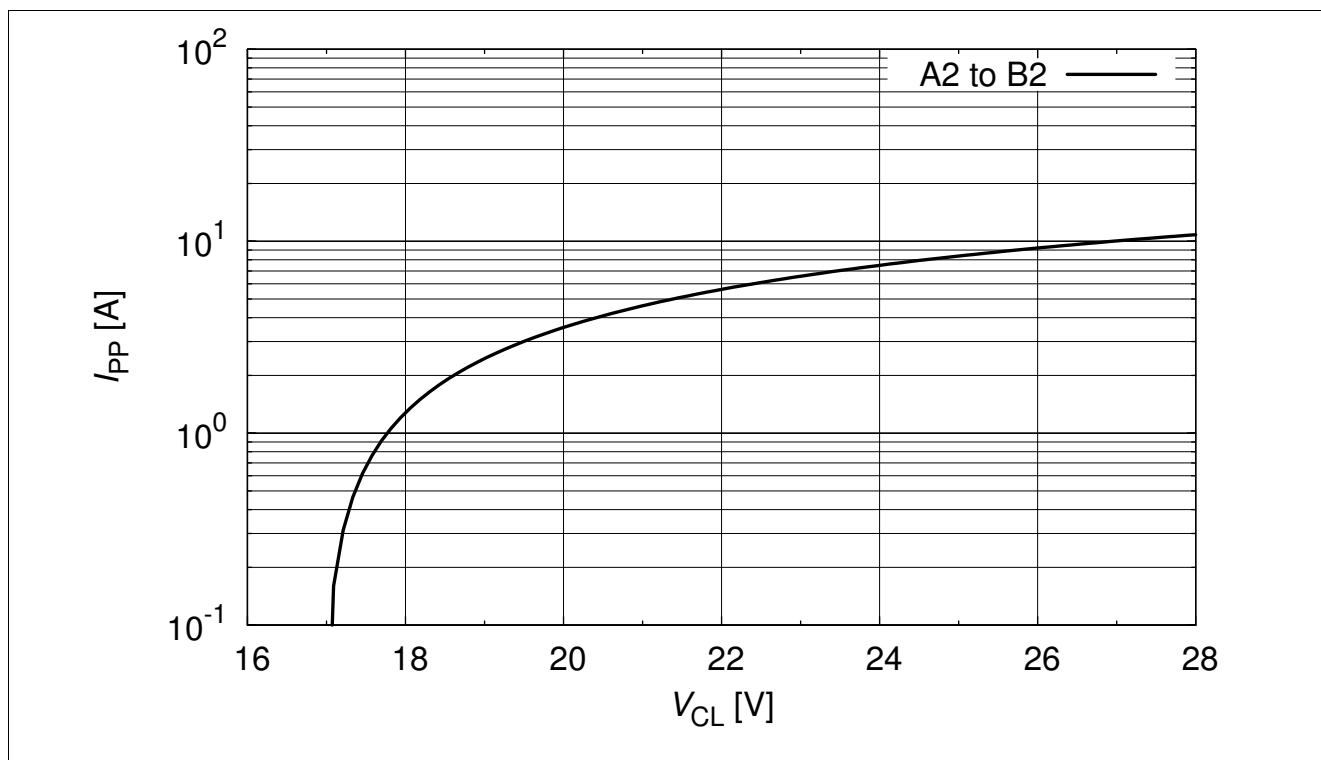


Figure 7 Pulse reverse current (IEC61000-4-5) versus clamping voltage, $I_{PP} = f(V_{CL})$

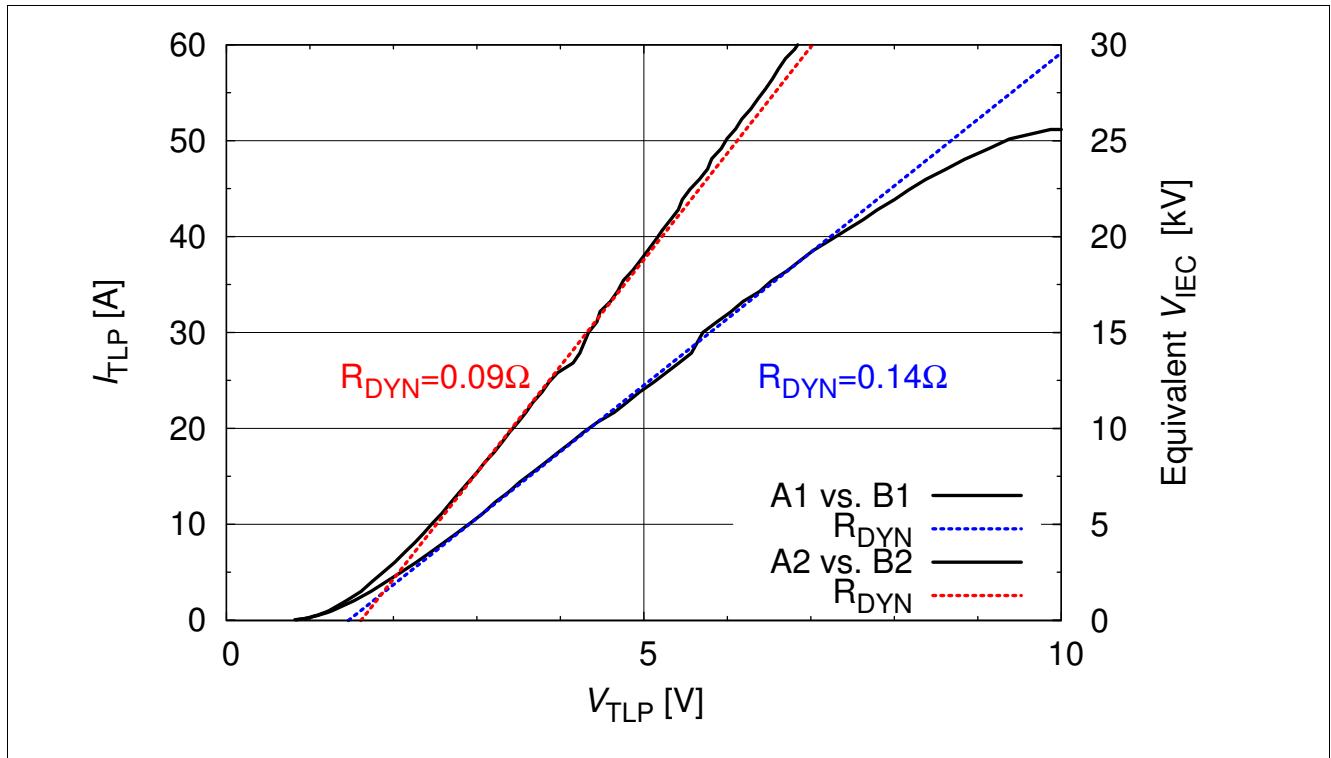


Figure 8 TLP characteristics, negative pulse ^{Note: [1]}

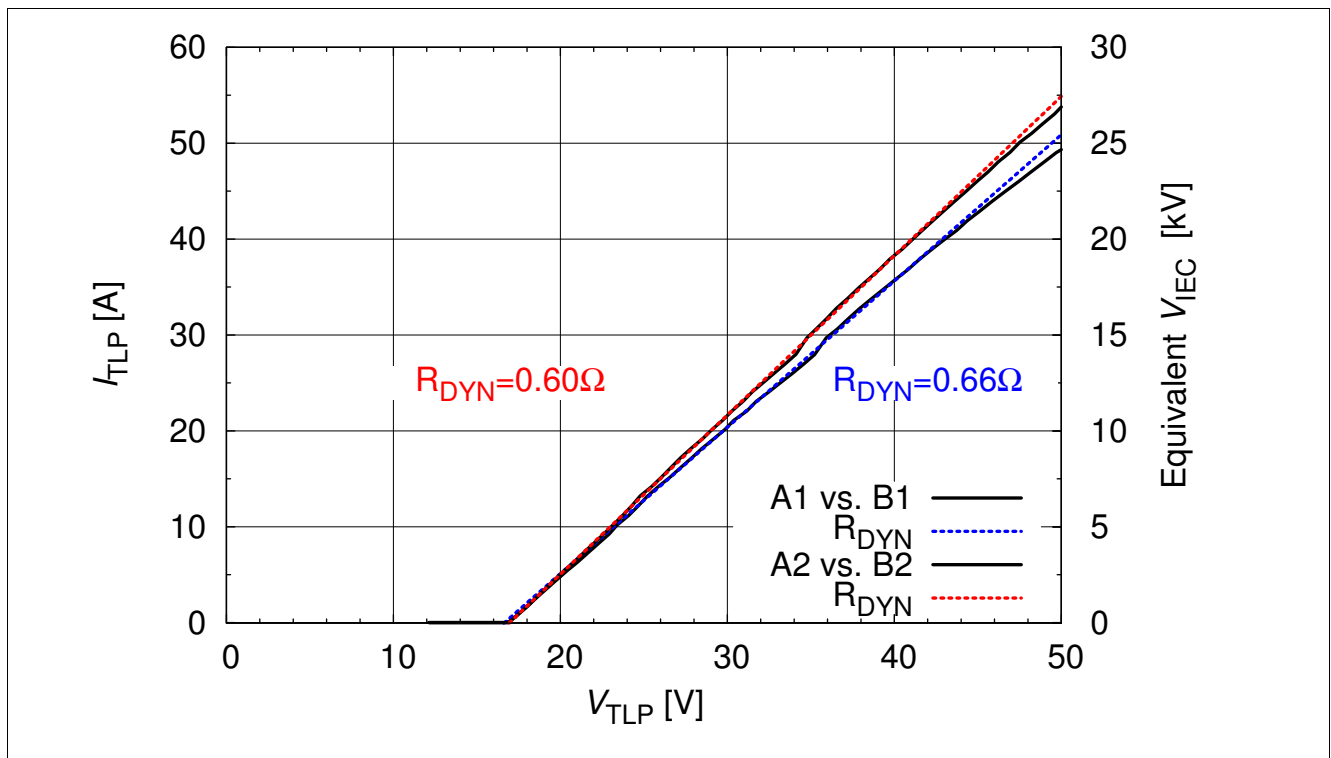


Figure 9 TLP characteristics, positive pulse ^{Note: [1]}

Note: TLP parameter: $Z_0 = 50 \Omega$, $t_p = 100 \text{ ns}$, $t_r = 600 \text{ ps}$, averaging window: $t_1 = 30 \text{ ns}$ to $t_2 = 60 \text{ ns}$, extraction of dynamic resistance using least squares fit of TLP characteristic between $I_{PP1} = 10 \text{ A}$ and $I_{PP2} = 40 \text{ A}$. The equivalent stress level V_{IEC} according IEC 61000-4-2 ($R = 330 \Omega$, $C = 150 \text{ pF}$) is calculated at the broad peak of the IEC waveform at $t = 30 \text{ ns}$ with 2 A/kV

4 Package Information

4.1 WLP-4-2 (in mm)

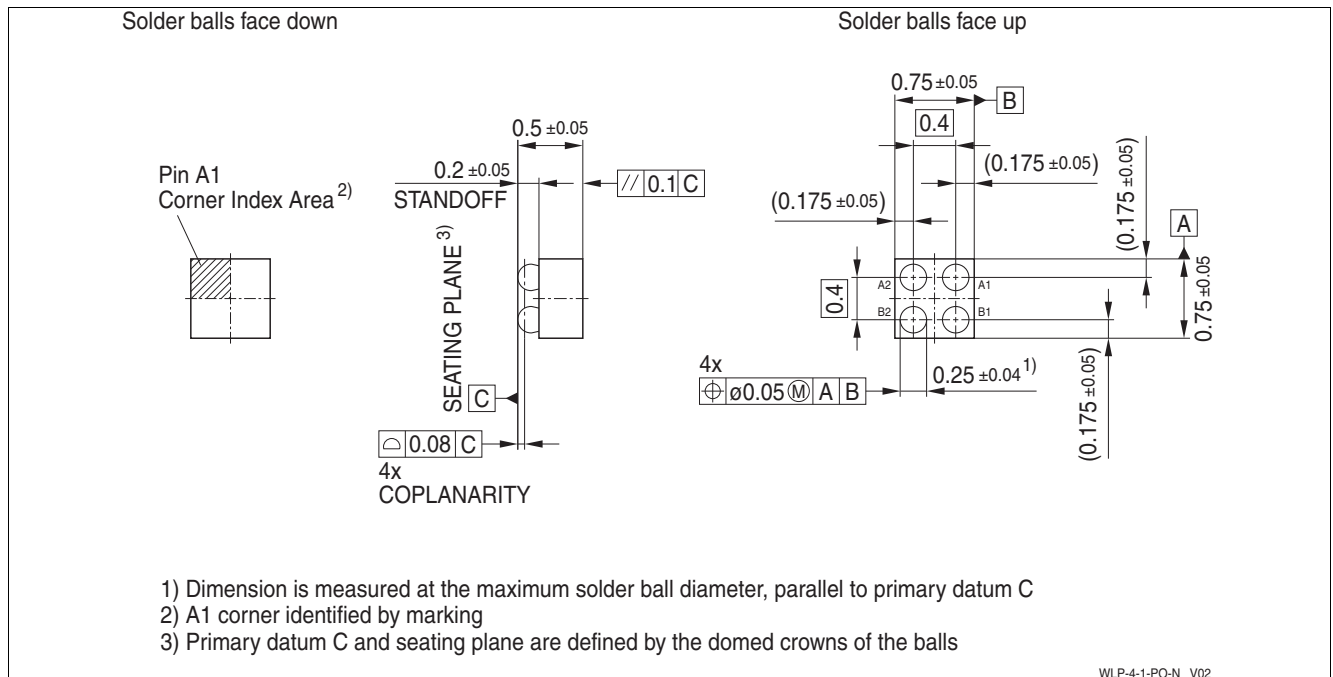


Figure 10 WLP-4-2: Package overview

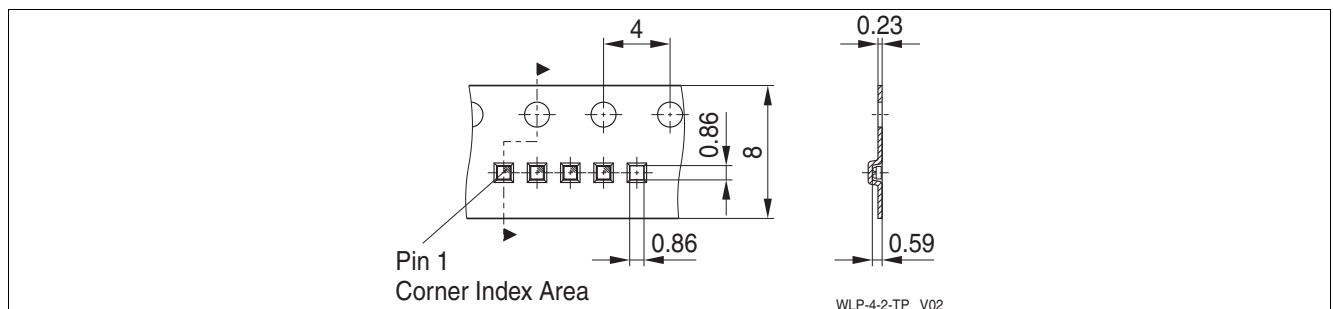


Figure 11 WLP-4-2: Packing

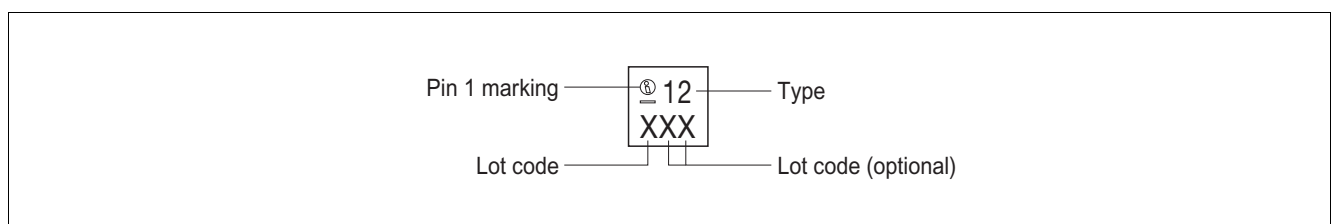


Figure 12 WLP-4-2: Marking (example)

References

- [1] Infineon Technologie AG - **Application Note AN210**: Effective ESD Protection Design at System Level Using VF-TLP Characterization Methodology
- [2] Infineon Technologie AG - **Application Note AN260**: Hipac Protection Devices for EOS and ESD

Terminology

C_L	Line capacitance
ESD	Electrostatic Discharge
IEC	International Electrotechnical Commission
I_{PP}	Peak pulse current
I_R	Reverse current
R	Fuse resistance
R_{DYN}	Dynamic resistance
R_I	Insulation resistance
RoHS	Restriction of Hazardous Substances Directive
T_A	Ambient temperature
t_F	Fusing time
t_L	Fuse lifetime
TLP	Transmission Line Pulse
T_{OP}	Operation temperature
t_r	Pulse rise time
T_{STG}	Storage temperature
V_{CL}	Reverse clamping voltage
V_{ESD}	Electrostatic discharge
V_{FC}	Forward Clamping Voltage
V_{IEC}	Equivalent stress level according IEC61000-4-2 ($R = 330 \Omega$, $C = 150 \text{ pF}$)
V_{OSC}	Oscillator voltage
V_P	Voltage pins
V_R	Reverse voltage
WEEE	Waste Electronic and Electrical Equipment
Z_0	Impedance

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