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TVS Diode

Transient Voltage Suppressor Diode

ESD5V3U4U-HDMI

Uni-directional Ultra-low Capacitance ESD / Transient Protection Array

ESD5V3U4U-HDMI

Data Sheet

Revision 1.1, 2012-07-03
Final

Edition 2012-07-03

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

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Revision History Revision 1.0, 2012-06-30

Page or Item	Subjects (major changes since previous revision)
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Revision 1.1, 2012-07-03

7	Figure 2-1

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Last Trademarks Update 2010-10-26

1 Uni-directional Ultra-low Capacitance ESD / Transient Protection Array

1.1 Features

- ESD / Transient protection of high speed data lines exceeding:
 - IEC61000-4-2 (ESD): ± 20 kV (air / contact)
 - IEC61000-4-4 (EFT): 2.5 kV / 50 A (5/50 ns)
 - IEC61000-4-5 (surge): 3 A (8/20 μ s)
- Maximum working voltage: $V_R = 5.3$ V
- Very low reverse current: $I_R < 1$ nA typ.
- Extremely low capacitance: 0.4 pF typ. (I/O to GND)
- Four-lines protection array with pad pitch = 0.5 mm
- Flow-through design for optimal PCB layout of differential lines
- Pb-free package (RoHS compliant) and halogen free package



1.2 Application Examples

- Protection of high speed digital interfaces like:
- HDMI 1.3, HDMI 1.4a, MHL, DisplayPort, S-ATA, DVI, MIPI, MDDI
- USB2.0, 10/100/1000 Ethernet, FireWire

2 Product Description

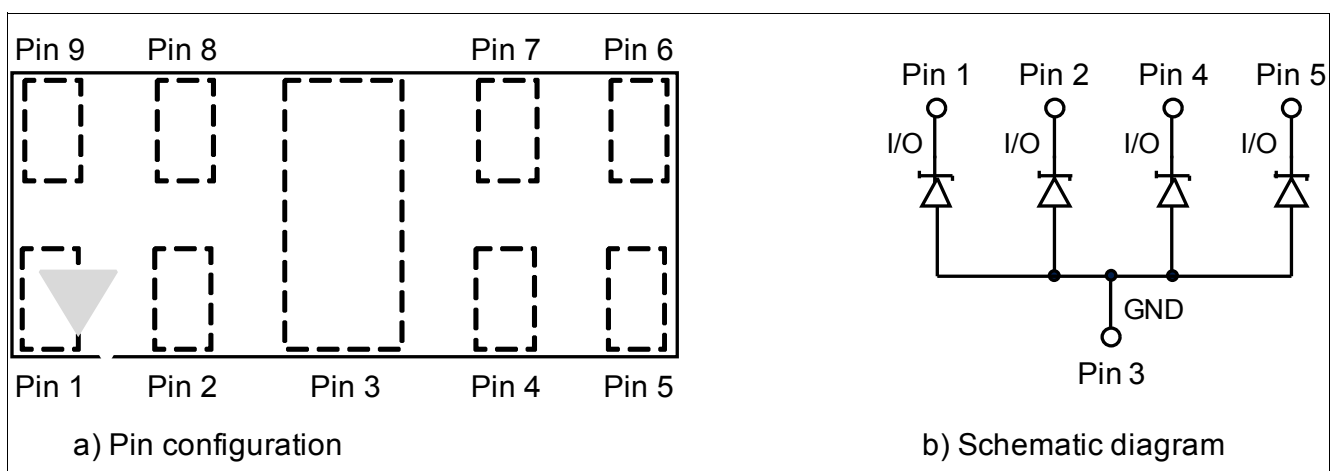


Figure 2-1 Pin Configuration and Schematic Diagram

Table 2-1 Ordering information

Type	Package	Configuration	Marking code
ESD5V3U4U-HDMI	PG-TSLP-9-1	4 lines, uni-directional	Z1

3 Characteristics

Table 3-1 Maximum Rating at $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		Min.	Typ.	Max.	
ESD (air / contact) discharge ¹⁾	V_{ESD}	–	–	20	kV
Peak pulse current ($t_p = 8/20\ \mu\text{s}$) ²⁾	I_{PP}	–	–	3	A
Operating temperature range	T_{OP}	-40	–	125	$^\circ\text{C}$
Storage temperature	T_{stg}	-65	–	150	$^\circ\text{C}$

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

2) I_{PP} according to IEC61000-4-5

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

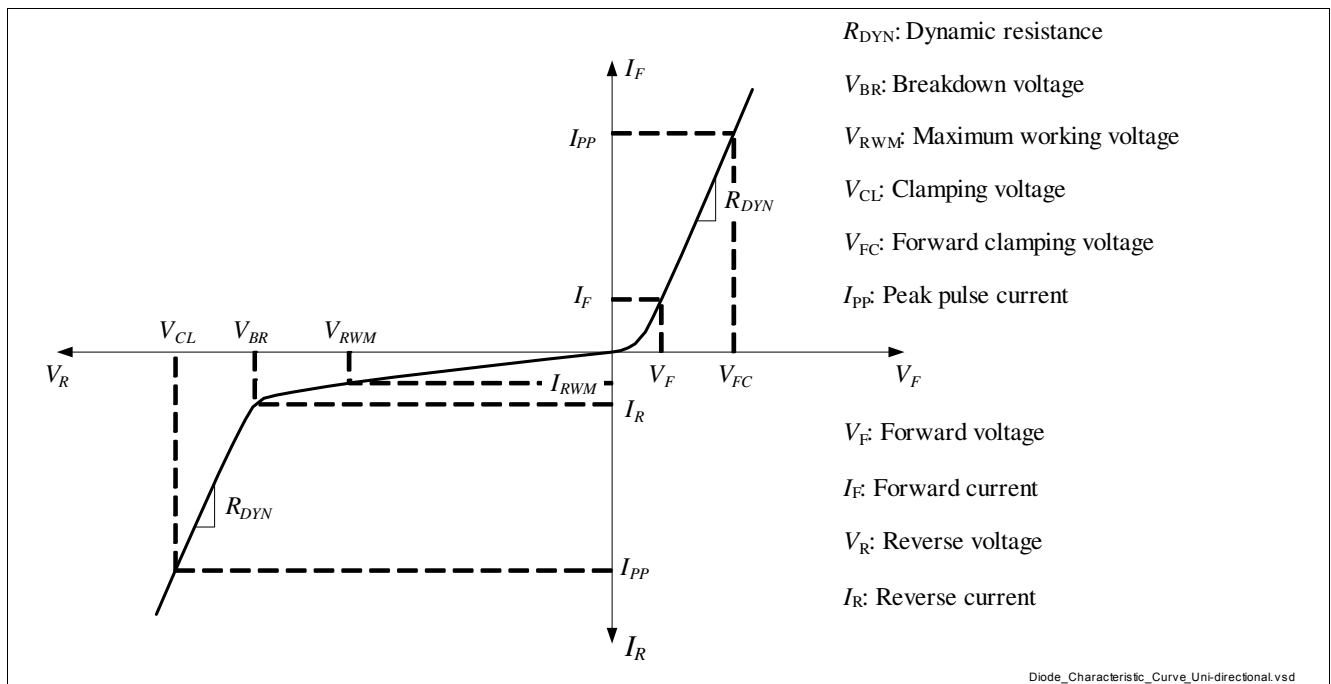


Figure 3-1 Definitions of Electrical Characteristics

Table 3-2 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}	–	–	5.3	V	
Breakdown voltage	V_{BR}	6	–	–	V	$I_{BR} = 1\text{ mA}$ (I/O to GND)
Reverse current	I_R	–	<1	50	nA	$V_R = 5.3\text{ V}$ (I/O to GND)

Table 3-3 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 ¹⁾	C_L	–	0.4	0.6	pF	$V_R = 0\text{ V}$, $f = 1\text{ MHz}$ (I/O to GND)
Line capacitance ¹⁾	C_L	–	0.2	0.3	pF	$V_R = 0\text{ V}$, $f = 1\text{ MHz}$ (I/O to I/O)

1) Total capacitance line to ground

Table 3-4 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}	–	19	–	V	$I_{PP} = 16\text{ A}$ (I/O to GND)
		–	28	–	V	$I_{PP} = 30\text{ A}$ (I/O to GND)
Forward clamping voltage ¹⁾	V_{FC}	–	10	–	V	$I_{PP} = 16\text{ A}$ (GND to I/O)
		–	17	–	V	$I_{PP} = 30\text{ A}$ (GND to I/O)
Dynamic resistance ¹⁾	R_{DYN}	–	0.6	–	Ω	I/O to GND
		–	0.5	–		GND to I/O

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 characteristic between $I_{PP1} = 10\text{ A}$ and $I_{PP2} = 40\text{ A}$.

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

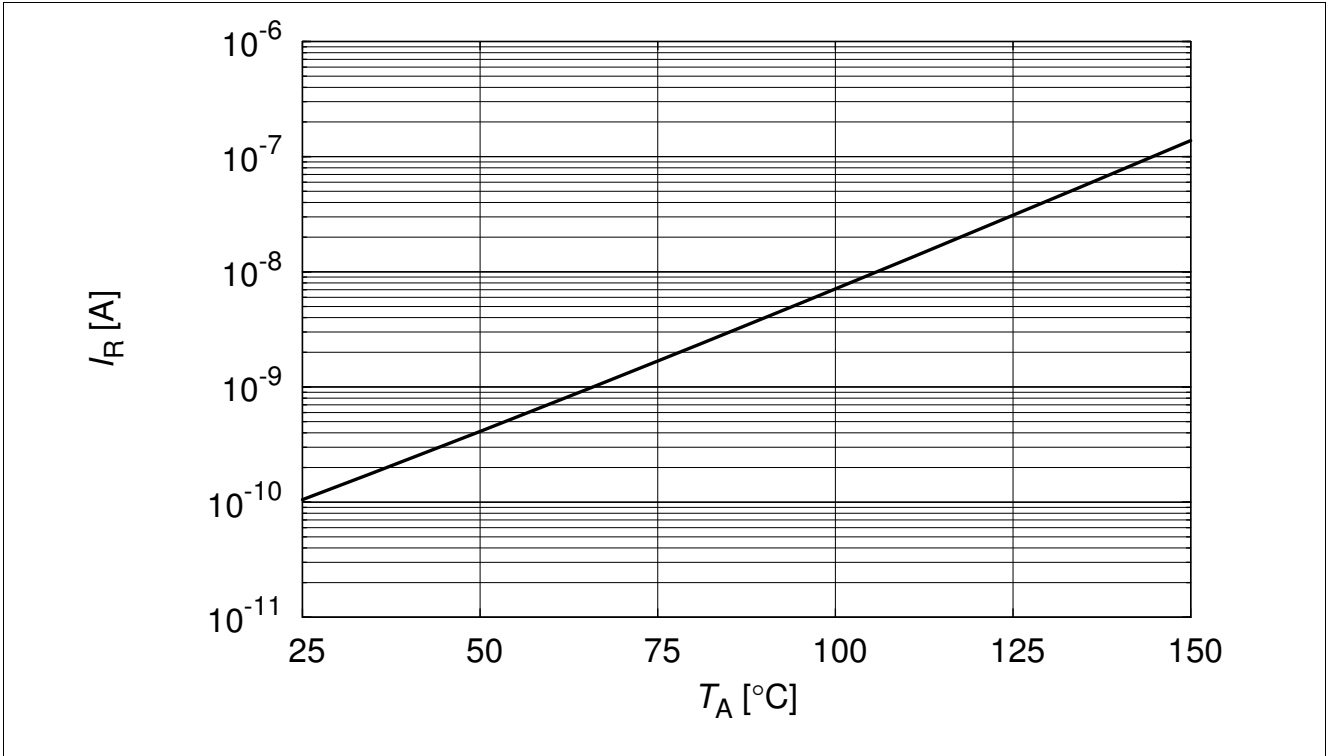


Figure 3-2 Reverse current: $I_R = f(T_A)$, $V_R = 5.3\text{ V}$, (I/O to GND)

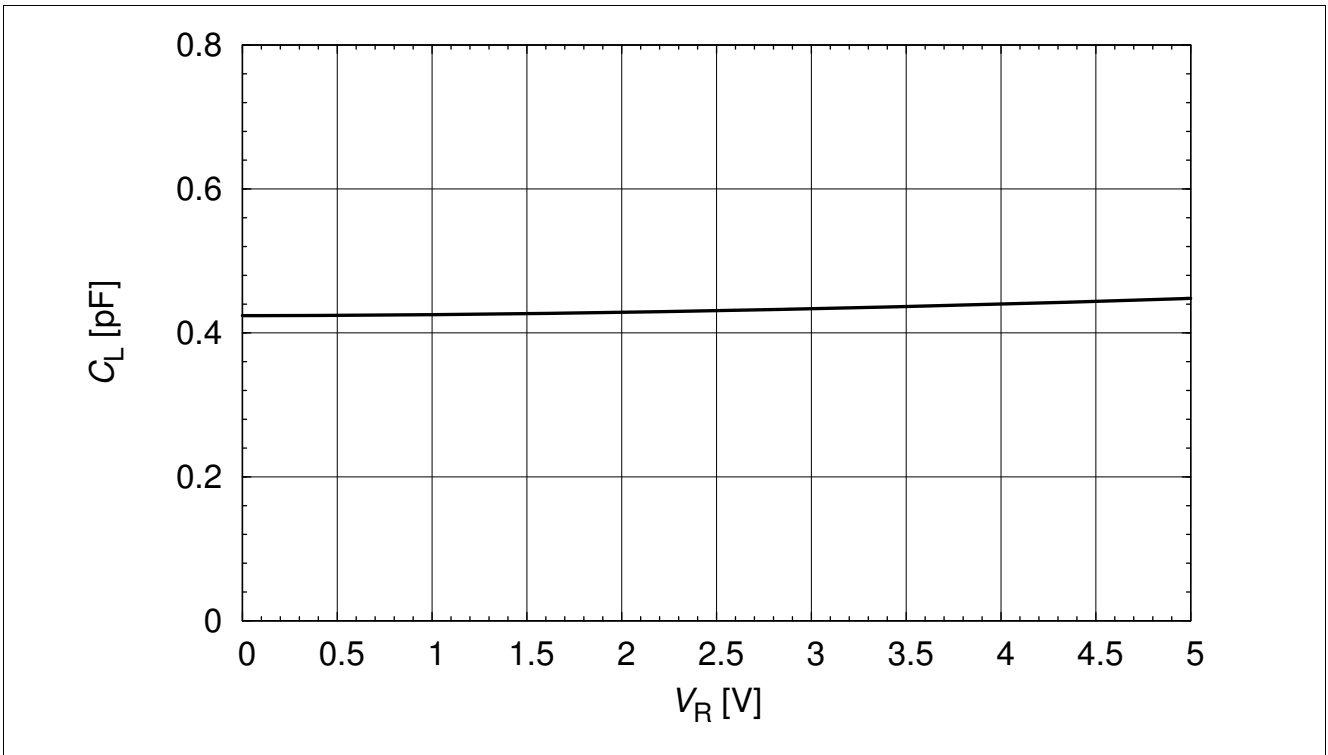


Figure 3-3 Diode capacitance: $C_L = f(V_R)$, (I/O to GND)

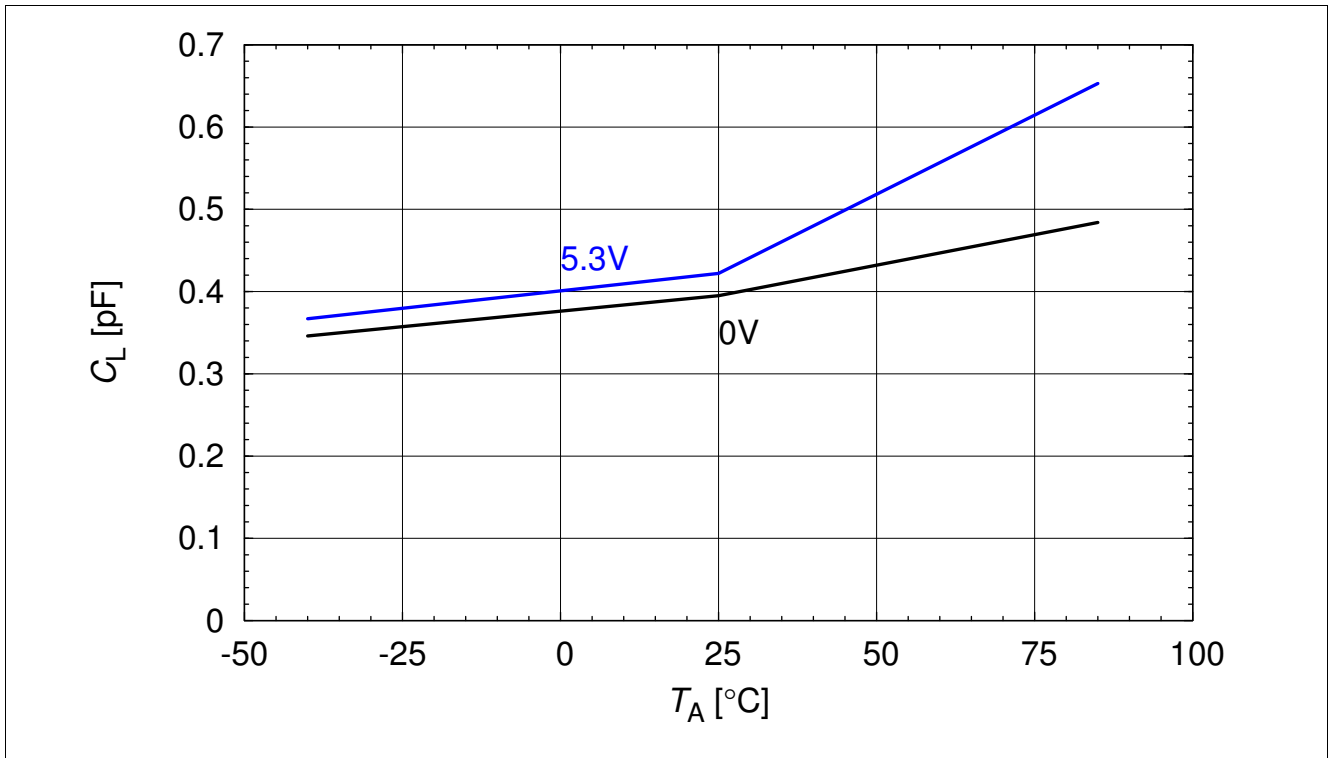


Figure 3-4 Line capacitance: $C_L = f(T_A)$

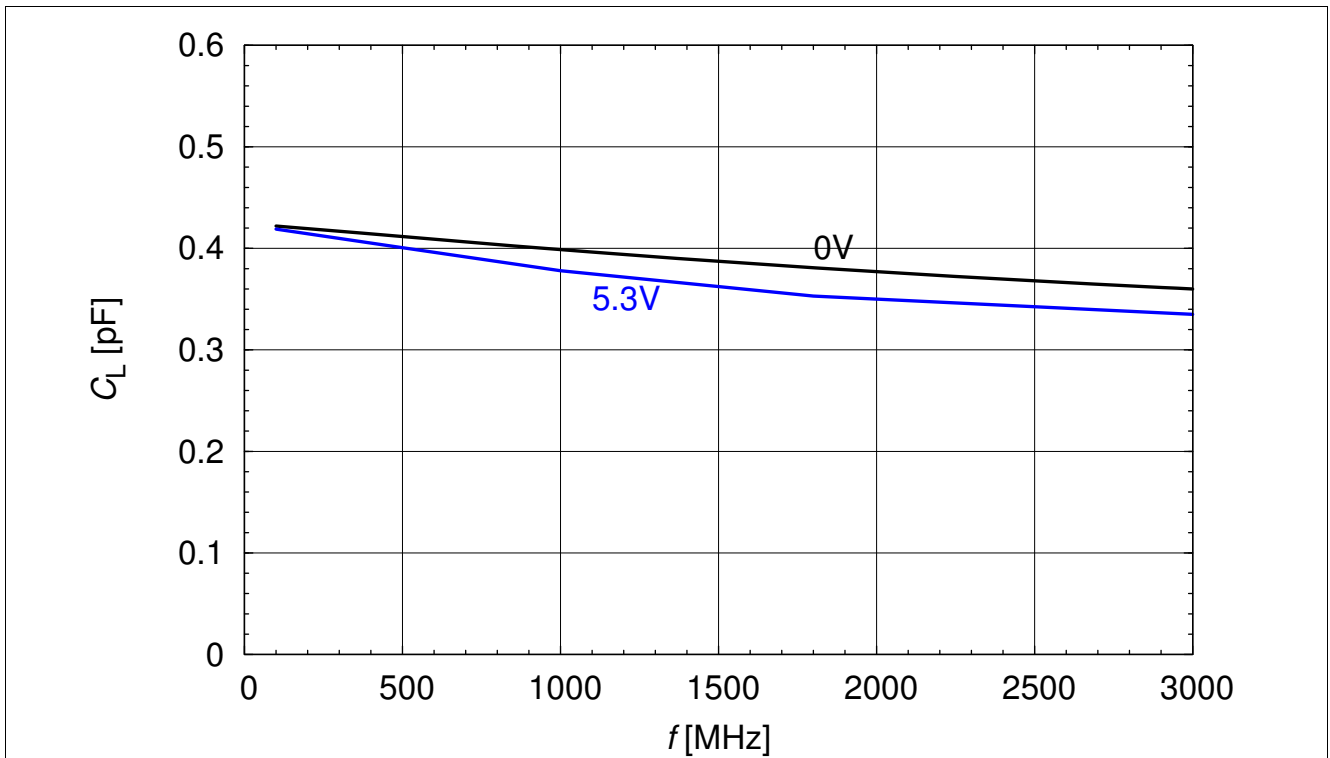


Figure 3-5 Line capacitance: $C_L = f(f)$, (I/O to GND)

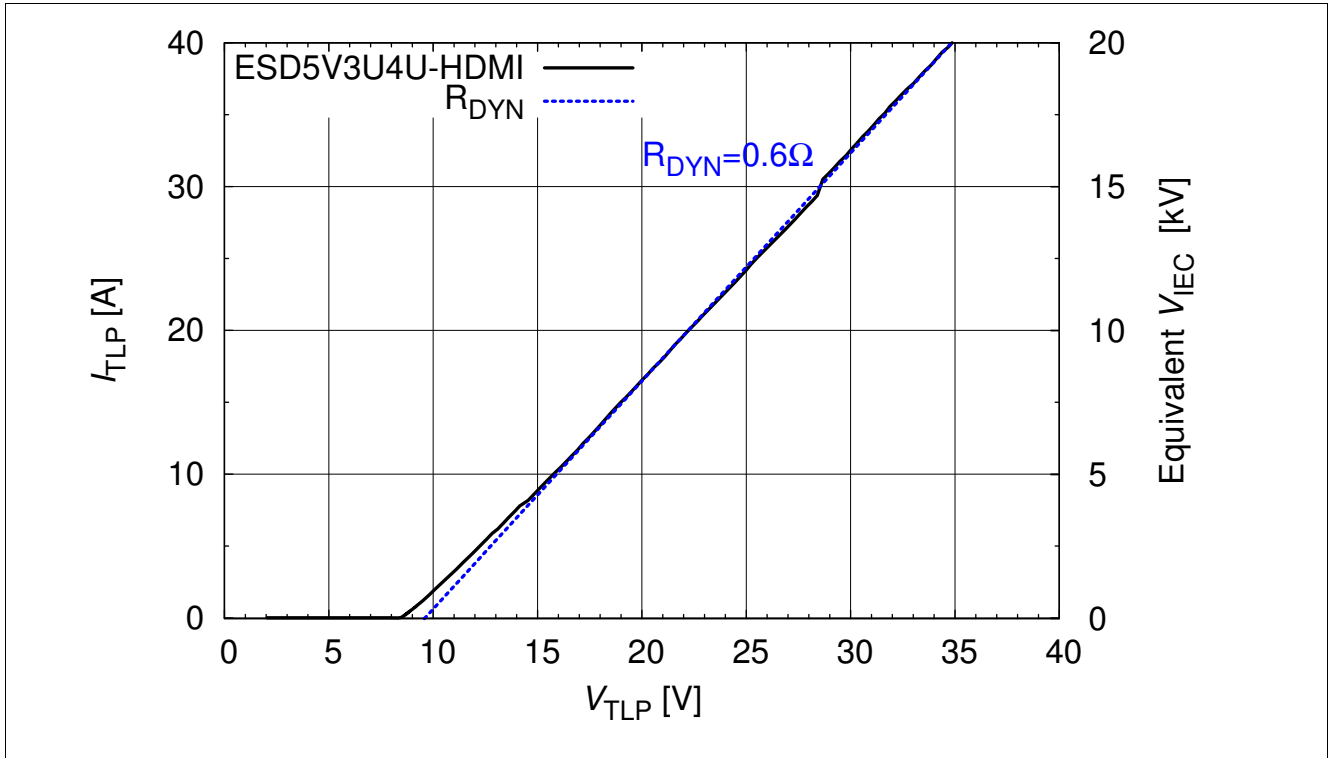


Figure 3-6 Forward clamping voltage: $I_{TLP} = f(V_{TLP})$, (GND to I/O) [1]

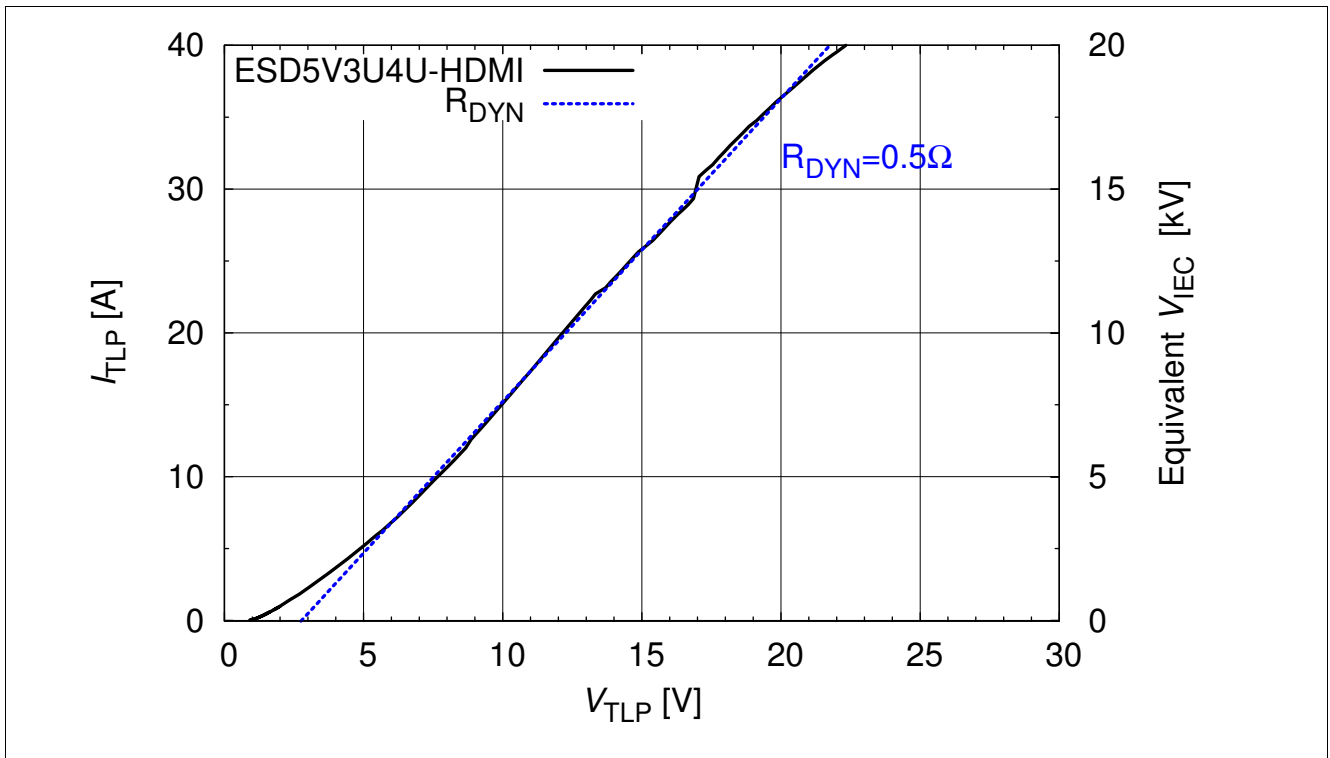


Figure 3-7 Reverse clamping voltage: $I_{TLP} = f(V_{TLP})$, (I/O to GND) [1]

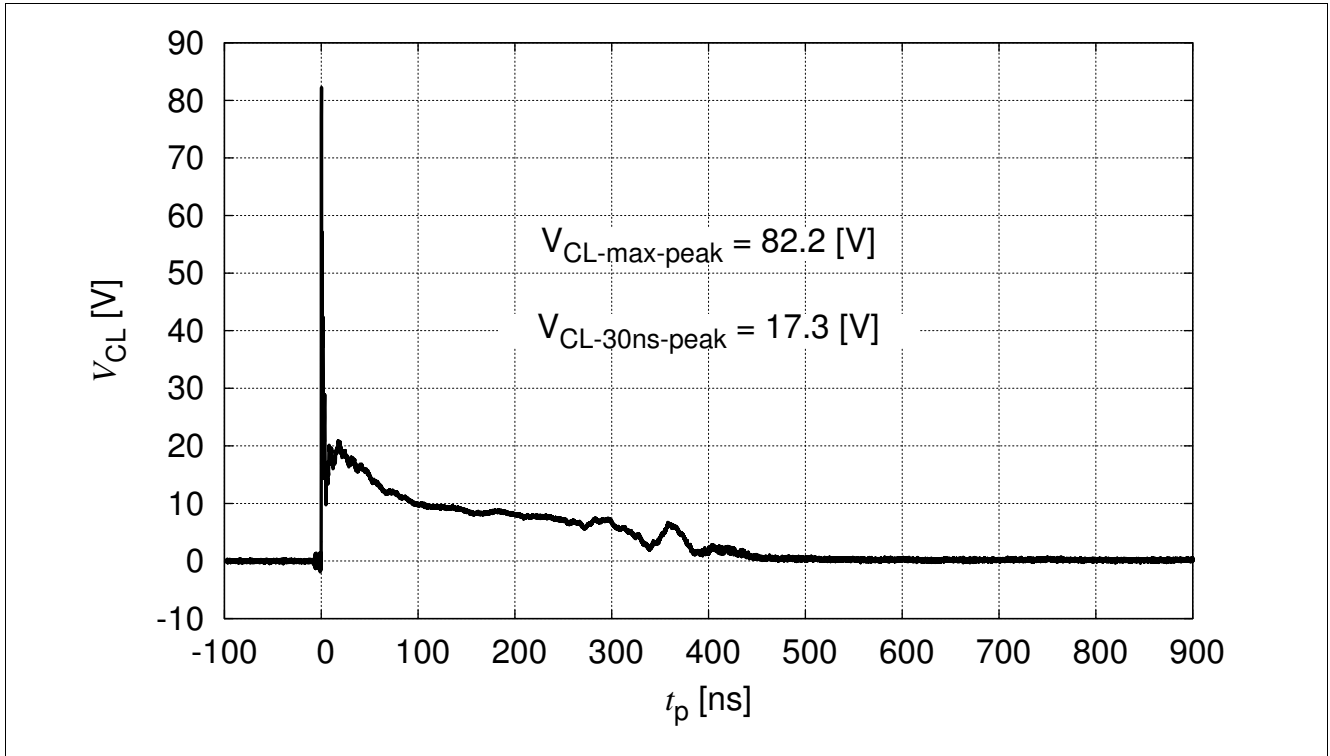


Figure 3-8 IEC61000-4-2 $V_{CL} = f(t)$, 8 kV positive pulse, (I/O to GND)

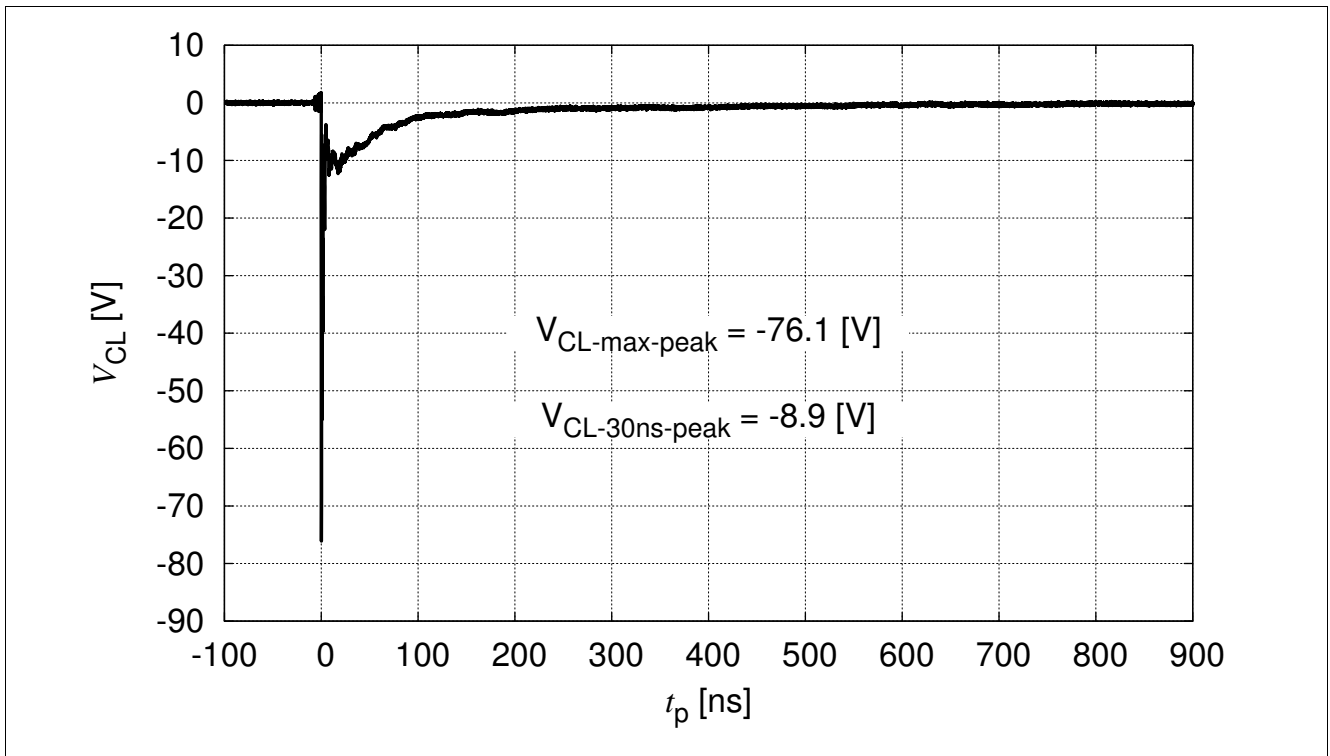


Figure 3-9 IEC61000-4-2 $V_{CL} = f(t)$, 8 kV negative pulse, (I/O to GND)

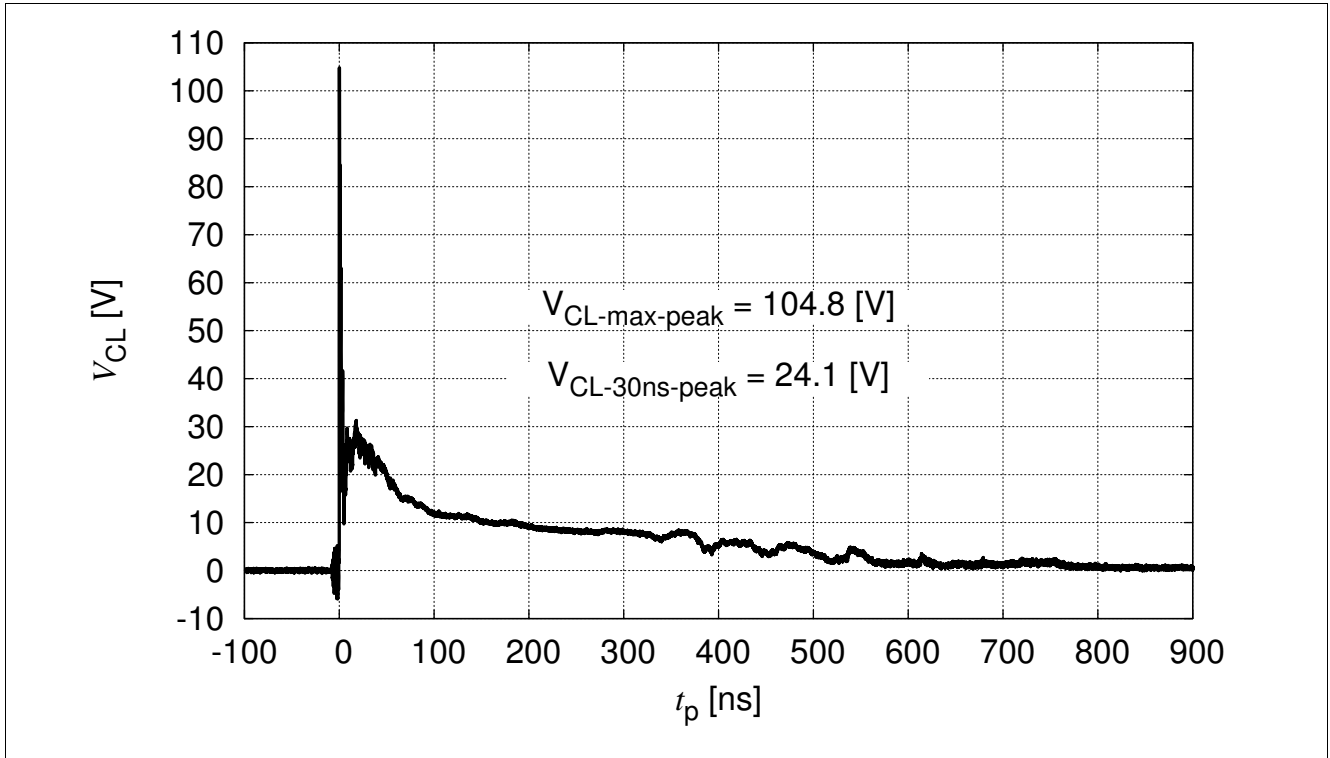


Figure 3-10 IEC61000-4-2 $V_{CL} = f(t)$, 15 kV positive pulse, (I/O to GND)

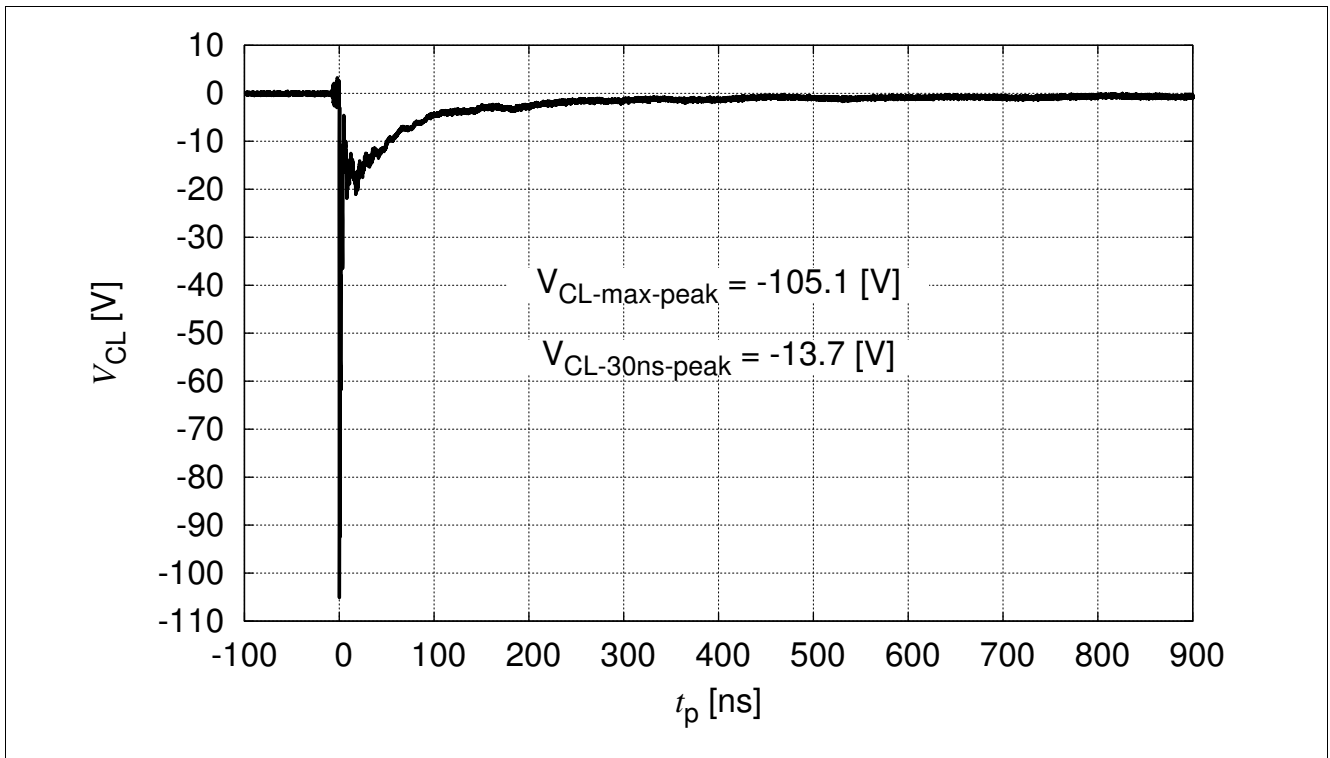


Figure 3-11 IEC61000-4-2 $V_{CL} = f(t)$, 15 kV negative pulse, (I/O to GND)

4 Application Information

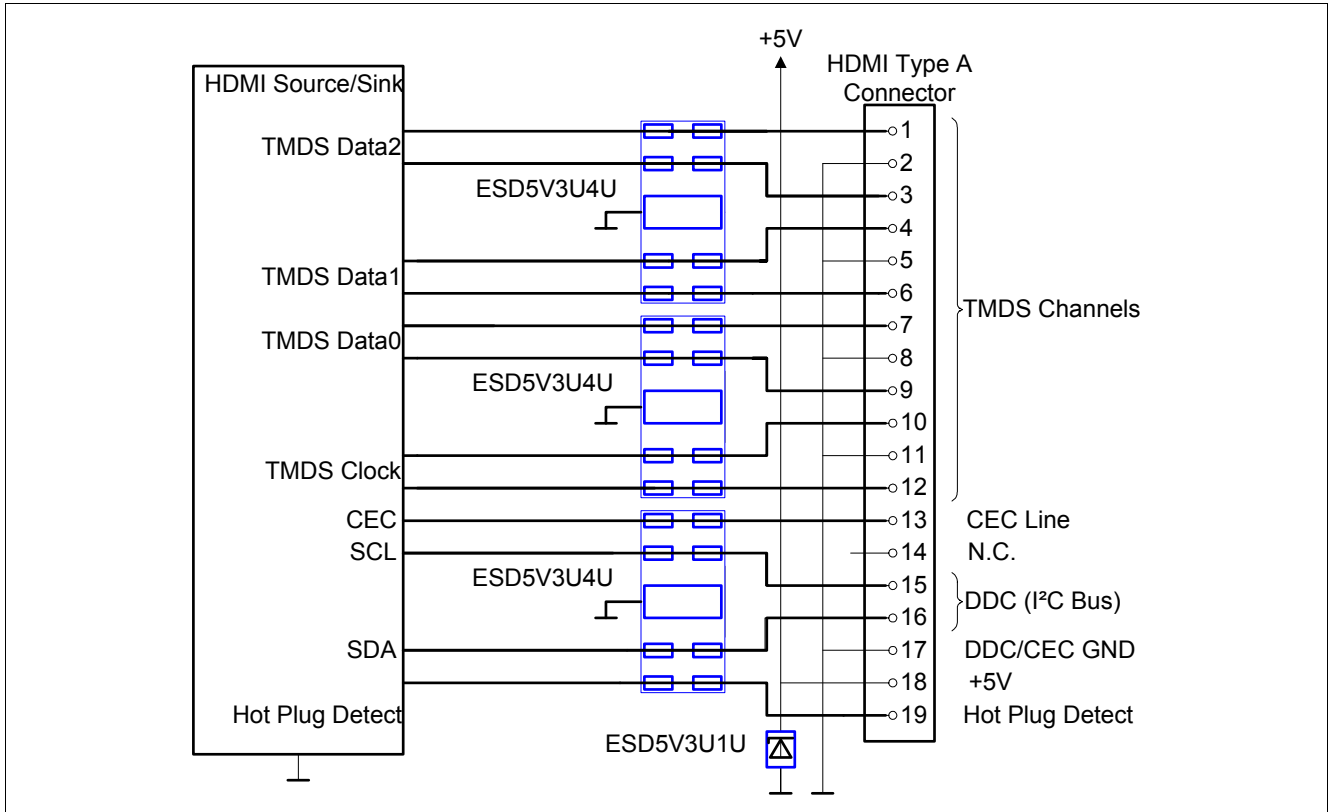


Figure 4-1 4 lines, uni-directional ESD5V3U4U-HDMI

For protection on the 5 V supply rail please refer to ESD5V3U1U- TVS diode data sheet.

5 Ordering Information Scheme (Examples)

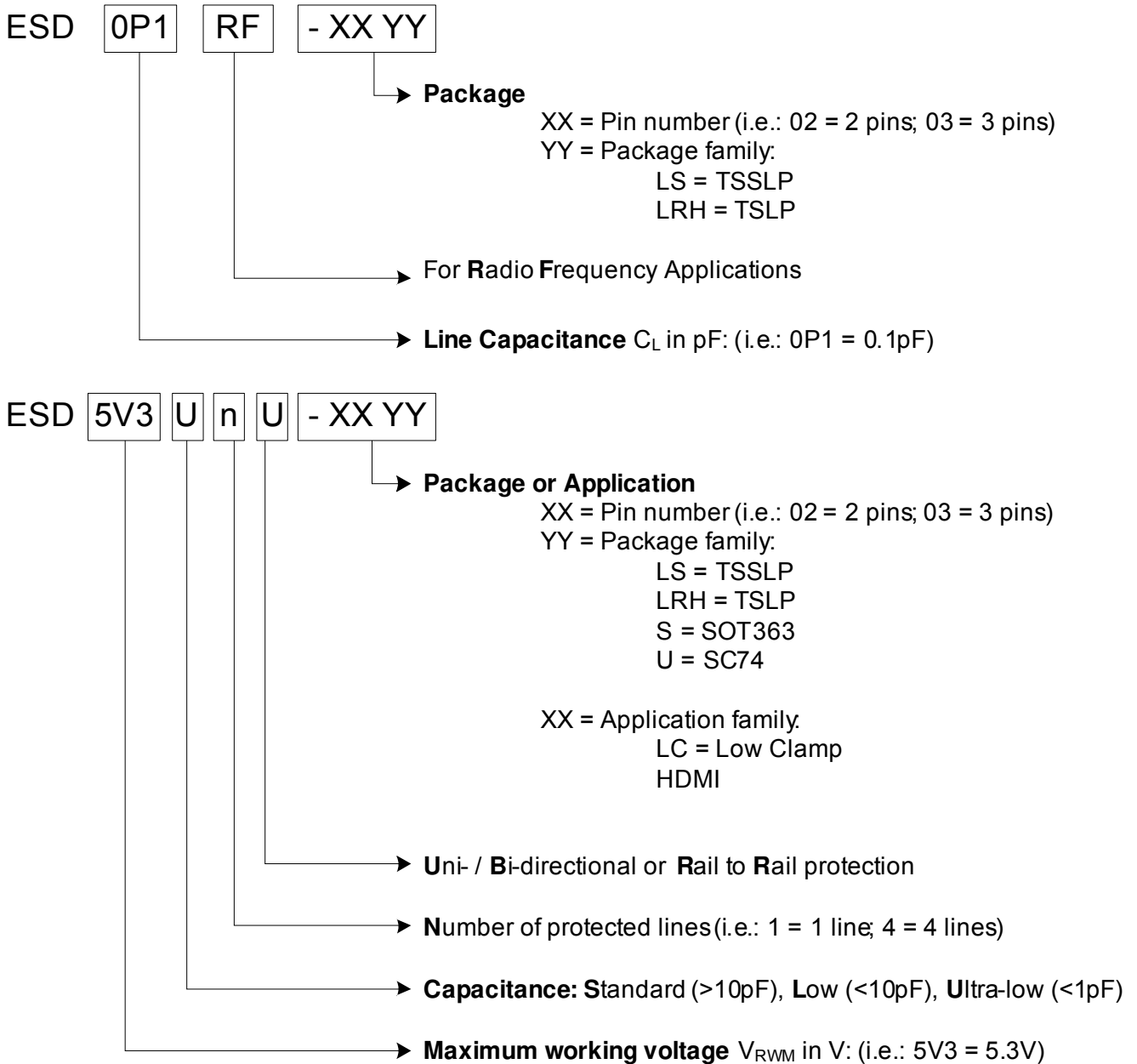


Figure 5-1 Ordering information scheme

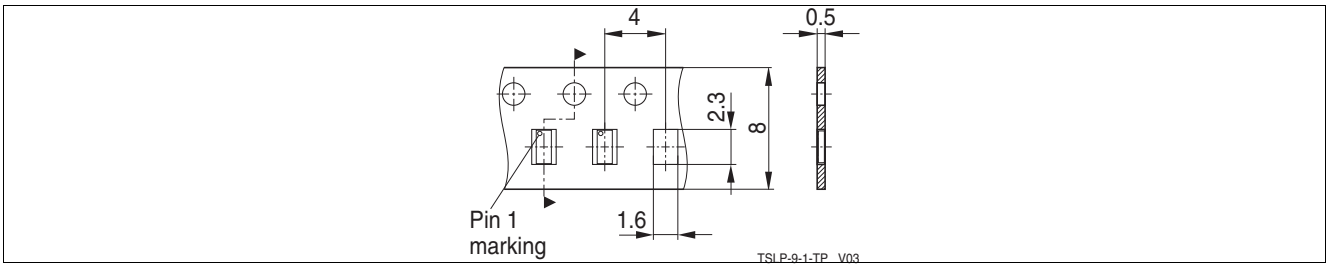


Figure 6-3 PG-TSLP-9-1: Packing

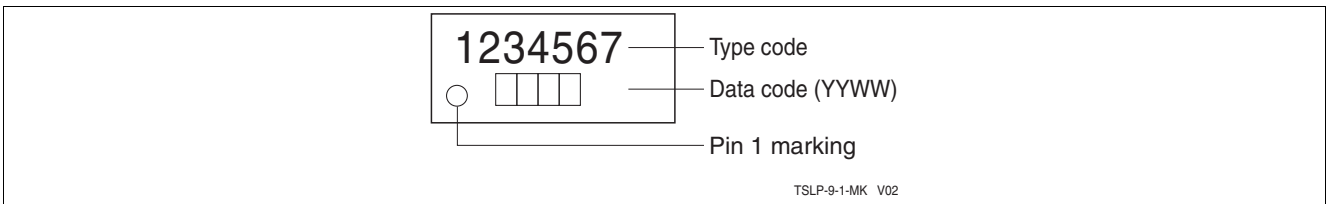


Figure 6-4 PG-TSLP-9-1: Marking (example)

References

- [1] Infineon AG - **Application Note AN210**: Effective ESD Protection Design at System Level Using VF-TLP Characterization Methodology

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