

# TVS Diodes

Transient Voltage Suppressor Diodes

## TVS3V3L4U

Low Capacitance ESD / Transient / Surge Protection Array

TVS3V3L4U

## Data Sheet

Revision 2.4, 2013-02-06  
Final

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**Revision History: Rev. 2.3 2012-01-11**

| Page or Item | Subjects (major changes since previous revision) |
|--------------|--------------------------------------------------|
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**Revision 2.4, 2013-02-06**

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Last Trademarks Update 2010-06-09

# 1 Low Capacitance ESD / Transient / Surge Protection Array

## 1.1 Features

- ESD/Transient/Surge protection according to:  
**IEC61000-4-2 (ESD):  $\pm 30$  kV air/contact discharge**  
**IEC61000-4-4 (EFT):  $\pm 80$  A (5/50 ns)**  
**IEC61000-4-5 (Surge):  $\pm 20$  A (8/20  $\mu$ s)**
- Reverse working voltage maximum:  $V_{RWM} = 3.3$  V
- Low leakage current:  $I_R < 50$  nA
- Low capacitance:  $C_L = 2$  pF typ. (I/O to GND), 1 pF typ. (I/O to I/O)**
- Low clamping voltage:  $V_{CL} = 7.7$  V typ. @ 20 A (8/20  $\mu$ s)
- Pb-free (RoHS compliant) package



## 1.2 Application Examples

- 10/100/1000 Ethernet
- 4 lines uni-directional (Pin 2 to GND)
- 2 lines bi-directional (Pin 2 n.c.)

## 1.3 Product Description

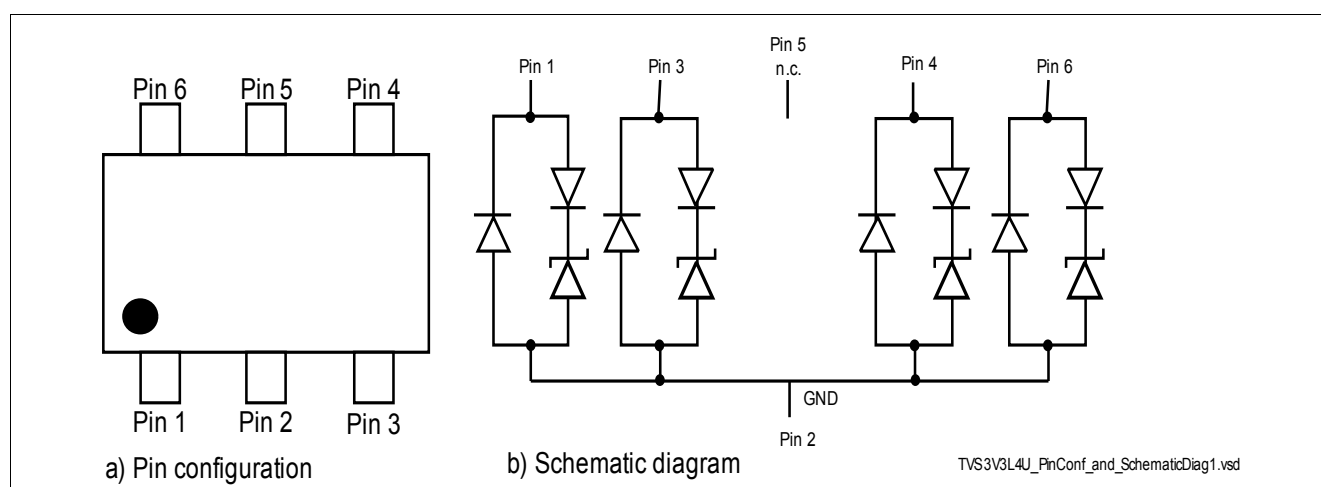


Figure 1-1 Pin configuration and Schematic diagram

Table 1-1 Ordering Information

| Type      | Package | Configuration                                      | Marking code |
|-----------|---------|----------------------------------------------------|--------------|
| TVS3V3L4U | SC74    | 4 lines, uni-directional or 2 lines, bidirectional | E1s          |

## 2 Electrical Characteristics

### 2.1 Maximum Ratings

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

| Parameter                                                                                                | Symbol           | Values     |        |             | Unit               |
|----------------------------------------------------------------------------------------------------------|------------------|------------|--------|-------------|--------------------|
|                                                                                                          |                  | Min.       | Typ.   | Max.        |                    |
| ESD discharge <sup>1)</sup><br>air<br>contact                                                            | $V_{\text{ESD}}$ | -30<br>-30 | —<br>— | 30<br>30    | kV                 |
| Peak pulse current ( $t_P = 8/20\text{ }\mu\text{s}$ ) <sup>2)</sup>                                     | $I_{\text{PP}}$  | -20        | —      | 20          | A                  |
| Peak pulse power<br>$t_P = 8/20\text{ }\mu\text{s}$ <sup>2)</sup><br>$t_P = 100\text{ ns}$ <sup>3)</sup> | $P_{\text{PK}}$  | —<br>—     | —<br>— | 154<br>1044 | W                  |
| Operating temperature                                                                                    | $T_{\text{OP}}$  | -55        | —      | 125         | $^{\circ}\text{C}$ |
| Storage temperature                                                                                      | $T_{\text{stg}}$ | -55        | —      | 150         | $^{\circ}\text{C}$ |

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

2)  $I_{\text{PP}}$  according to IEC61000-4-5.  $P_{\text{PK}}$  is calculated by  $I_{\text{PP}} \times V_{\text{CL}}$ .

3) Please refer to AN210[1].  $P_{\text{PK}}$  is calculated by  $I_{\text{TLP}} \times V_{\text{CL}}$ .

**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.**

## 2.2 DC Characteristics

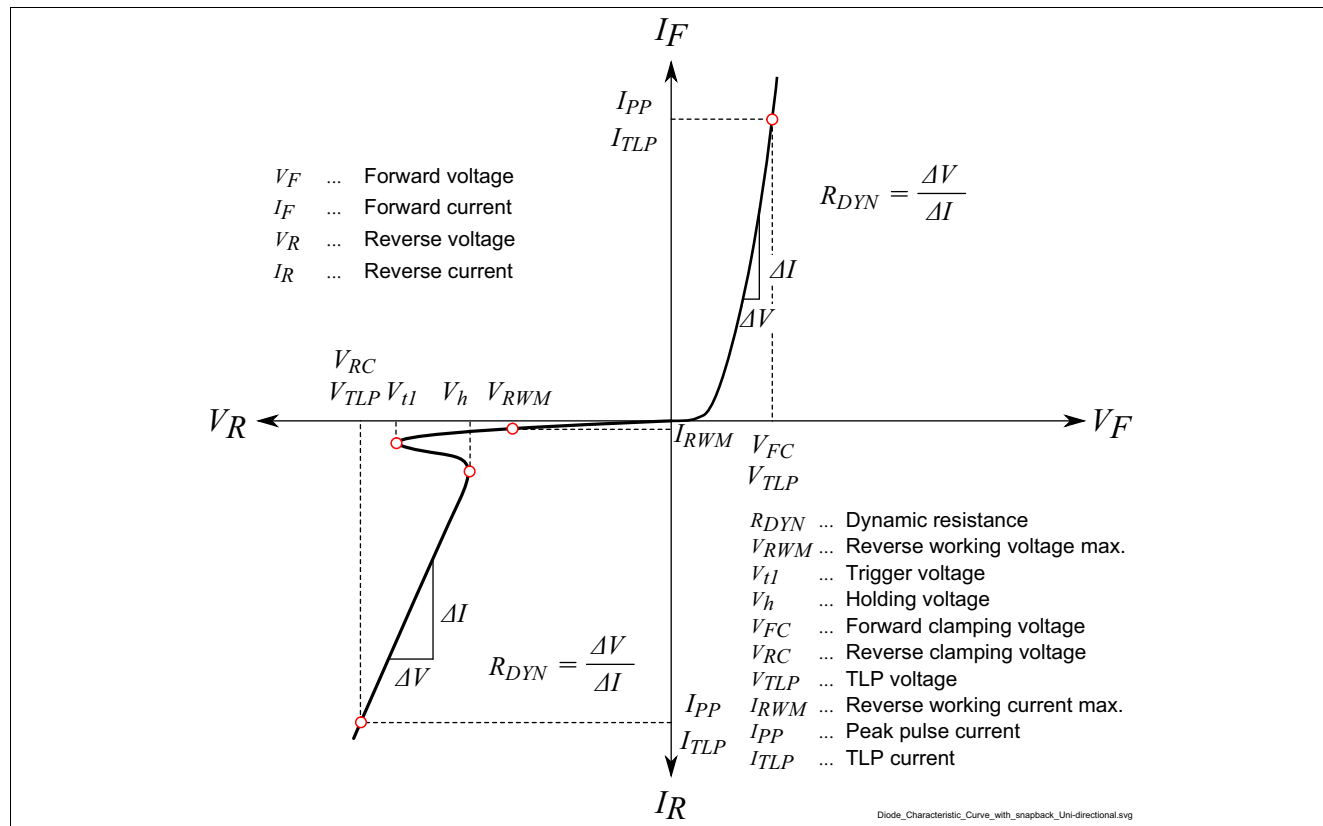


Figure 2-1 Definitions of electrical characteristics

Table 2-2 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 | $V_{RWM}$ | —      | —    | 3.3  | V    |                       |
| Reverse current         | $I_R$     | —      | —    | 50   | nA   | $V_R = 3.3\text{ V}$  |

## 2.3 RF Characteristics

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

| Parameter        | Symbol | Values |      |      | Unit | Note / Test Condition                   |
|------------------|--------|--------|------|------|------|-----------------------------------------|
|                  |        | Min.   | Typ. | Max. |      |                                         |
| Line capacitance | $C_L$  |        |      |      | pF   | $V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ |
| I/O to GND       |        | —      | 2    | 3    |      |                                         |
| I/O to I/O       |        | —      | 1    | —    |      |                                         |

## 2.4 ESD Characteristics

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

| Parameter                                            | Symbol    | Values |      |      | Unit     | Note / Test Condition                                    |
|------------------------------------------------------|-----------|--------|------|------|----------|----------------------------------------------------------|
|                                                      |           | Min.   | Typ. | Max. |          |                                                          |
| Reverse clamping voltage <sup>1)</sup><br>I/O to GND | $V_{CL}$  | —      | 4.2  | —    | V        | $t_p = 8/20\text{ }\mu\text{s}$<br>$I_{PP} = 1\text{ A}$ |
| I/O to GND                                           |           | —      | 4.9  | —    |          | $I_{PP} = 5\text{ A}$                                    |
| I/O to GND                                           |           | —      | 5.8  | —    |          | $I_{PP} = 10\text{ A}$                                   |
| I/O to GND                                           |           | —      | 6.7  | —    |          | $I_{PP} = 15\text{ A}$                                   |
| I/O to GND                                           |           | —      | 7.7  | —    |          | $I_{PP} = 20\text{ A}$                                   |
| Reverse clamping voltage <sup>2)</sup><br>I/O to GND |           | —      | 5.8  | —    |          | $t_p = 100\text{ ns}$<br>$I_{PP} = 16\text{ A}_{PP}$     |
| Forward clamping voltage <sup>1)</sup><br>GND to I/O | $V_{FC}$  | —      | 1.1  | —    | V        | $t_p = 8/20\text{ }\mu\text{s}$<br>$I_{PP} = 1\text{ A}$ |
| GND to I/O                                           |           | —      | 4    | —    |          | $I_{PP} = 20\text{ A}$                                   |
| Forward clamping voltage <sup>2)</sup><br>GND to I/O |           | —      | 3.1  | —    |          | $t_p = 100\text{ ns}$<br>$I_{PP} = 16\text{ A}$          |
| Dynamic resistance <sup>1)</sup><br>I/O to GND       | $R_{DYN}$ | —      | 0.15 | —    | $\Omega$ | $t_p = 8/20\text{ }\mu\text{s}$                          |
| Dynamic resistance <sup>2)</sup><br>I/O to GND       |           | —      | 0.09 | —    |          | $t_p = 100\text{ ns}$                                    |

1)  $I_{PP}$  according to IEC61000-4-5

2) Please refer to Application Note AN210 [1]. TLP parameter:  $Z_0 = 50\text{ }\Omega$ ,  $t_p = 100\text{ ns}$ ,  $t_r = 300\text{ ps}$ , 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  $I_{PP1} = 10\text{ A}$  and  $I_{PP2} = 40\text{ A}$ .

### 3 Typical Characteristic

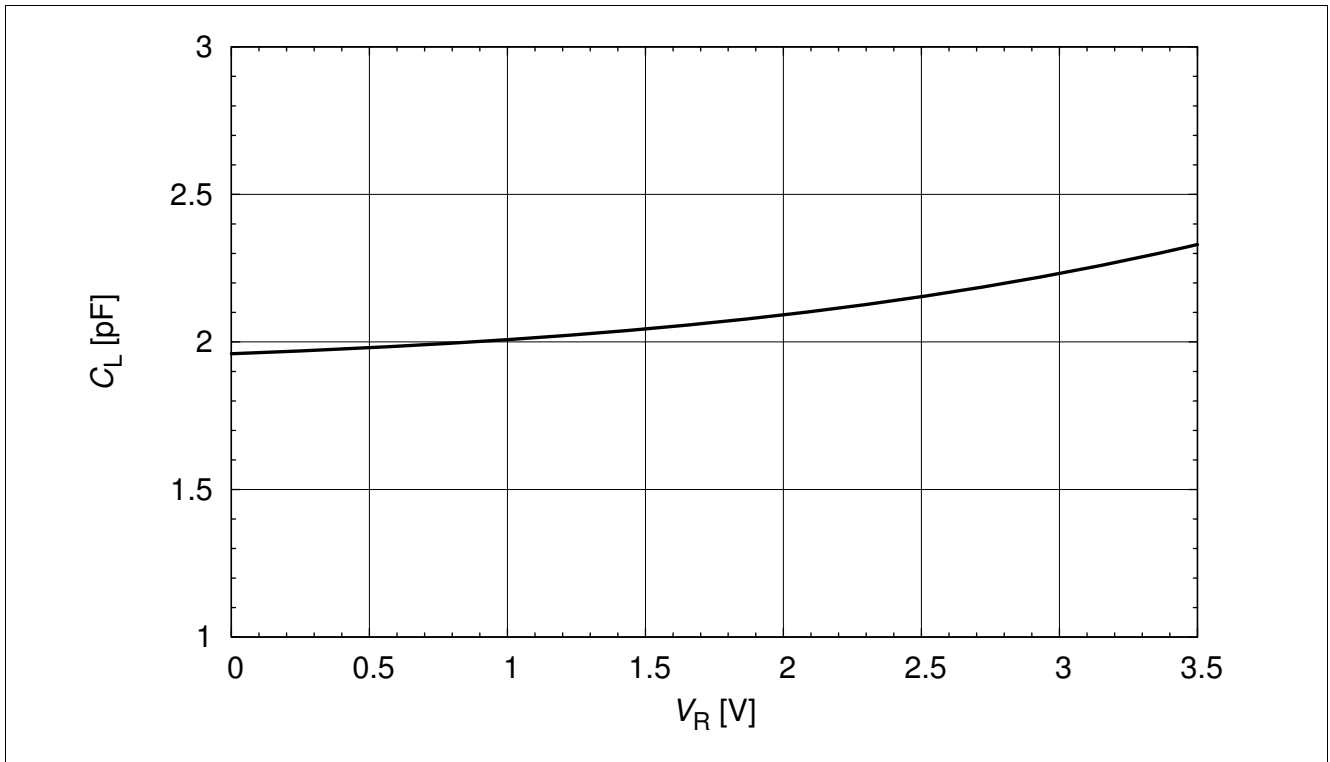


Figure 3-1 Line capacitance  $C_L = f(V_R)$

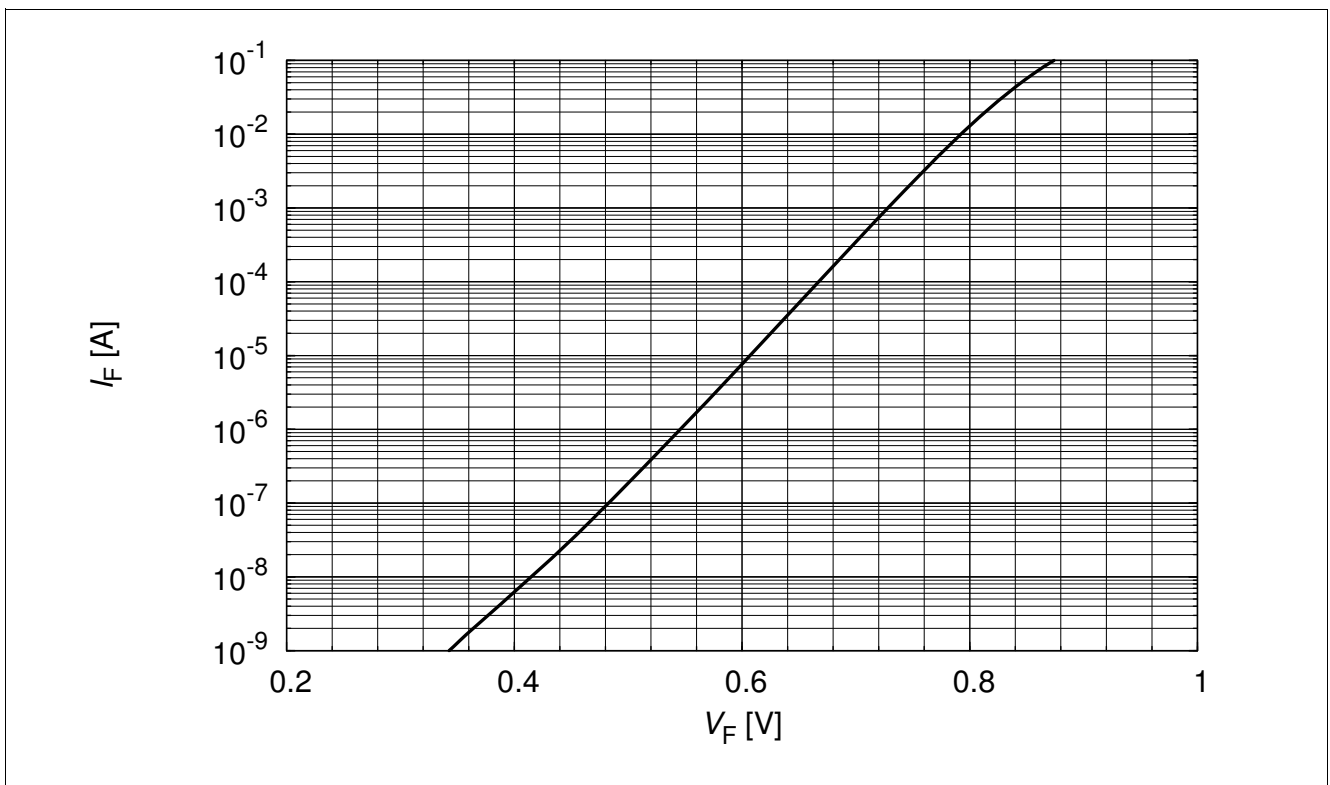


Figure 3-2 Forward characteristic,  $I_F = f(V_F)$

# Typical Characteristic

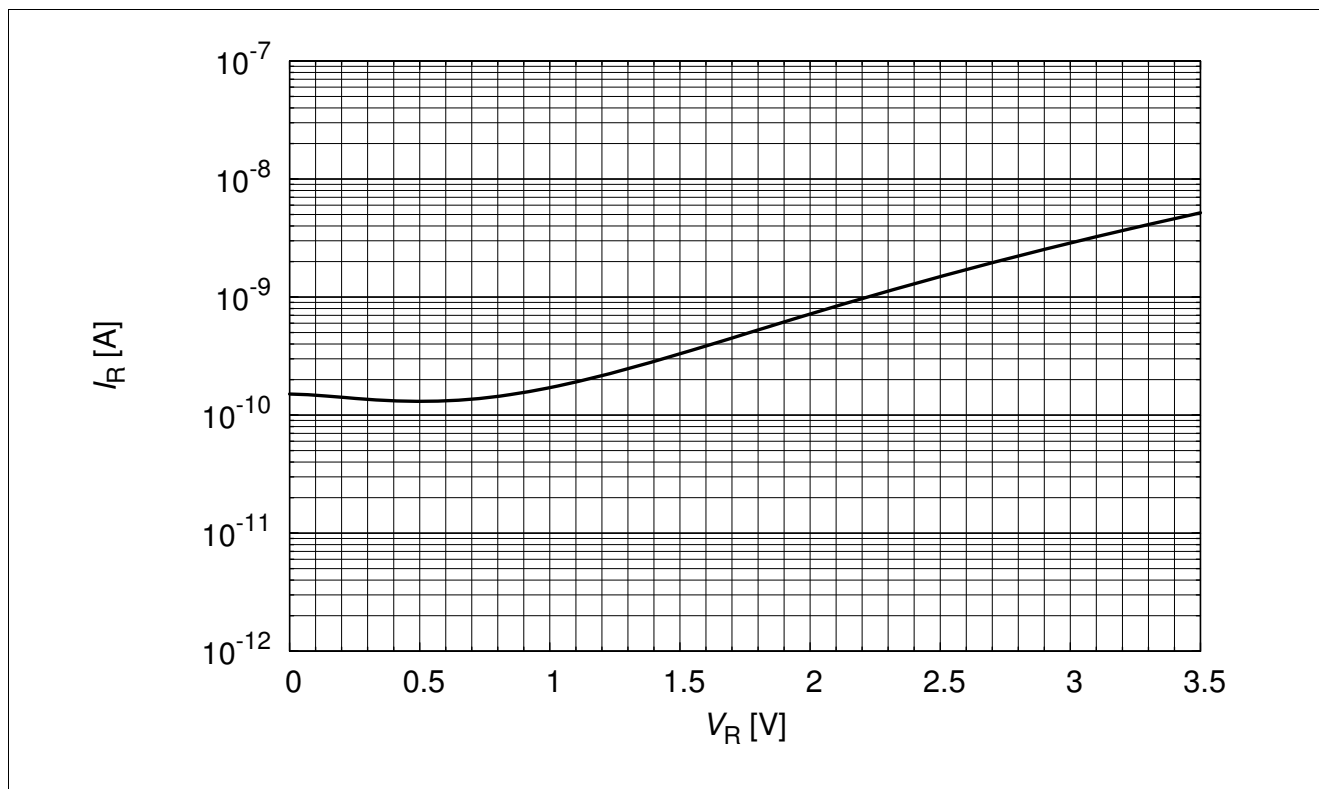


Figure 3-3 Reverse current,  $I_R = f(V_R)$

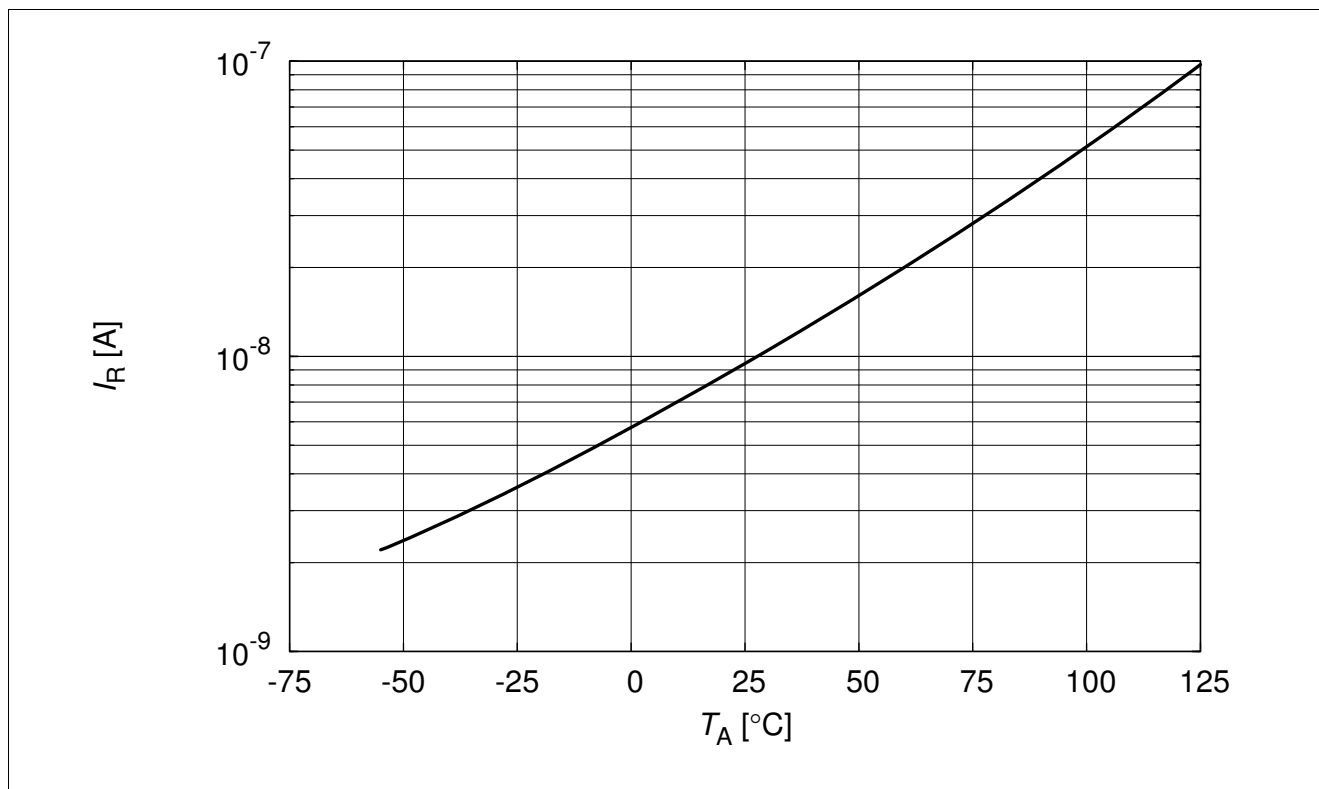


Figure 3-4 Reverse current  $I_R = f(T_A)$ ,  $V_R = 3.3$  V

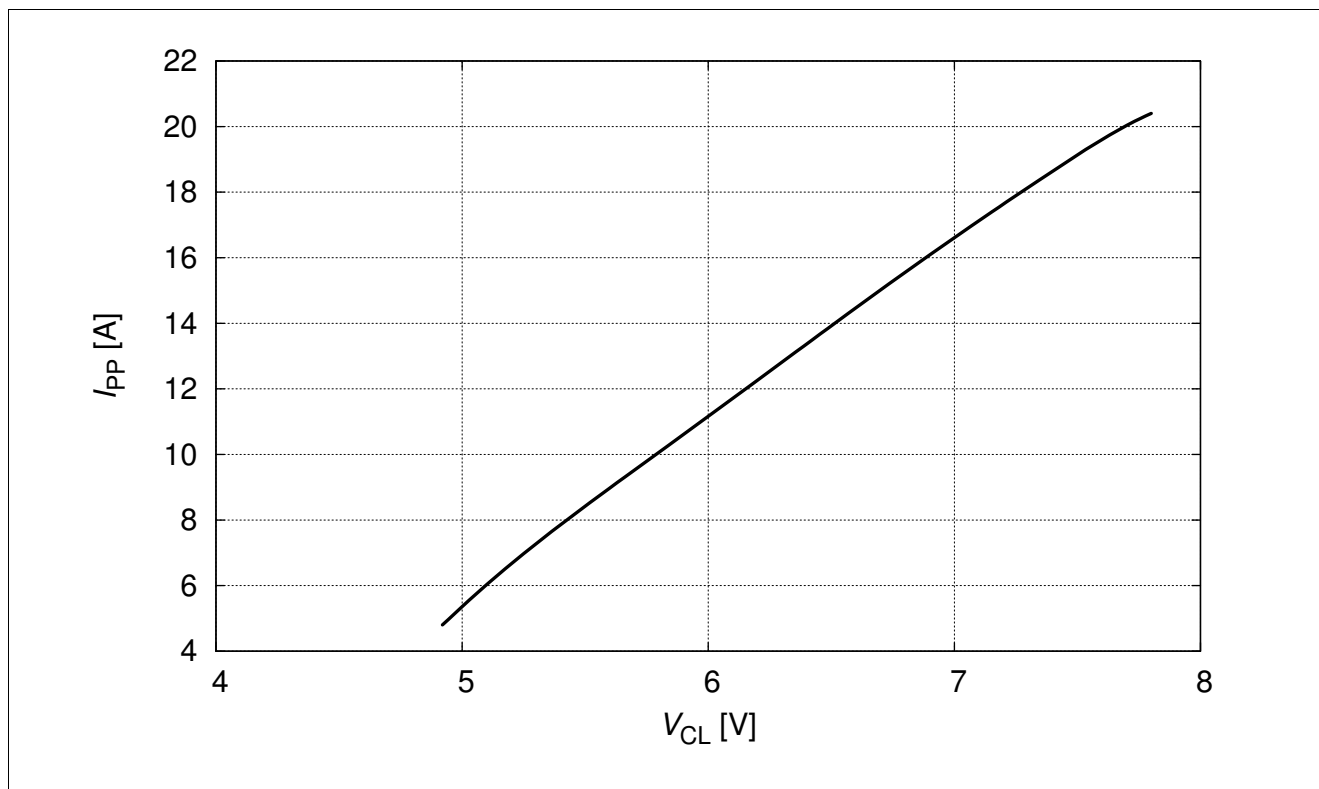


Figure 3-5 Pulse reverse current (IEC61000-4-5) versus clamping voltage,  $I_{PP} = f(V_{CL})$

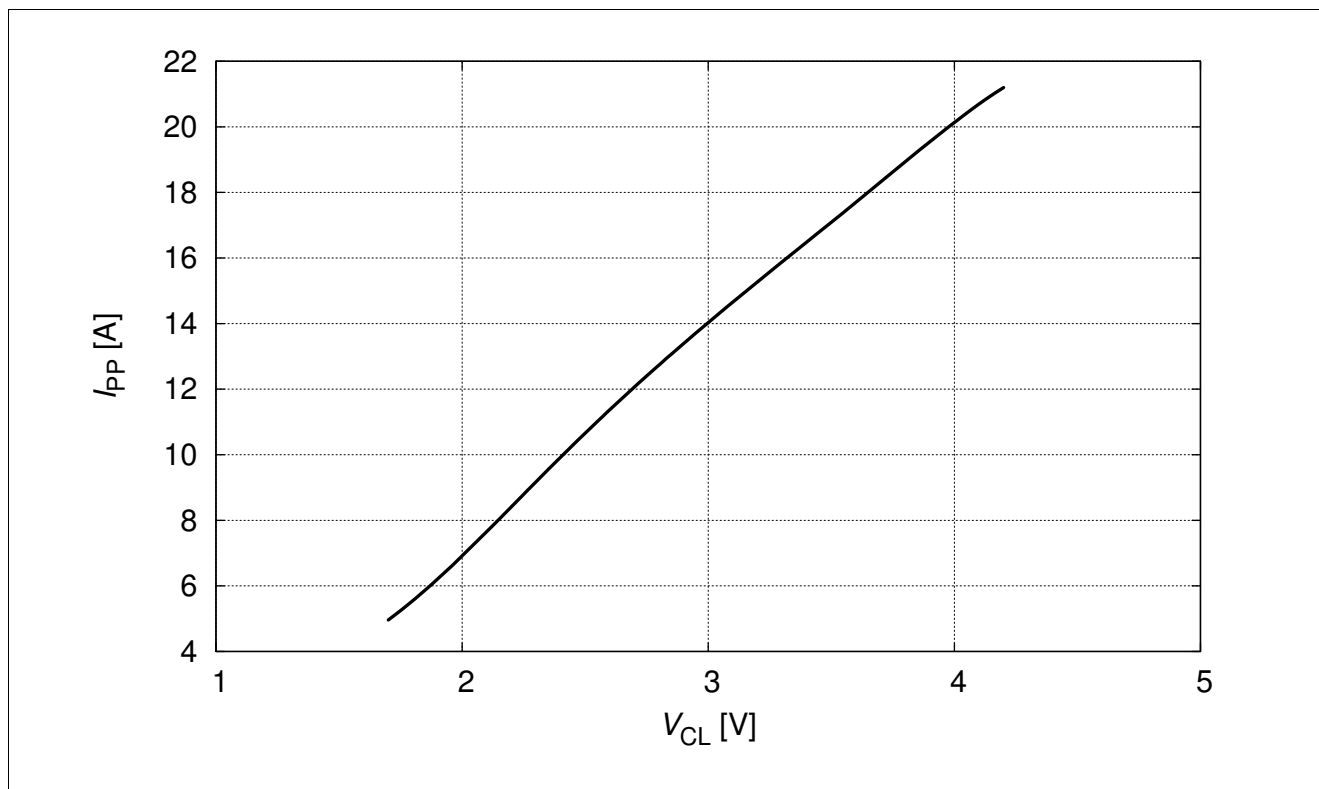


Figure 3-6 Pulse forward current (IEC61000-4-5) versus clamping voltage,  $I_{PP} = f(V_{CL})$

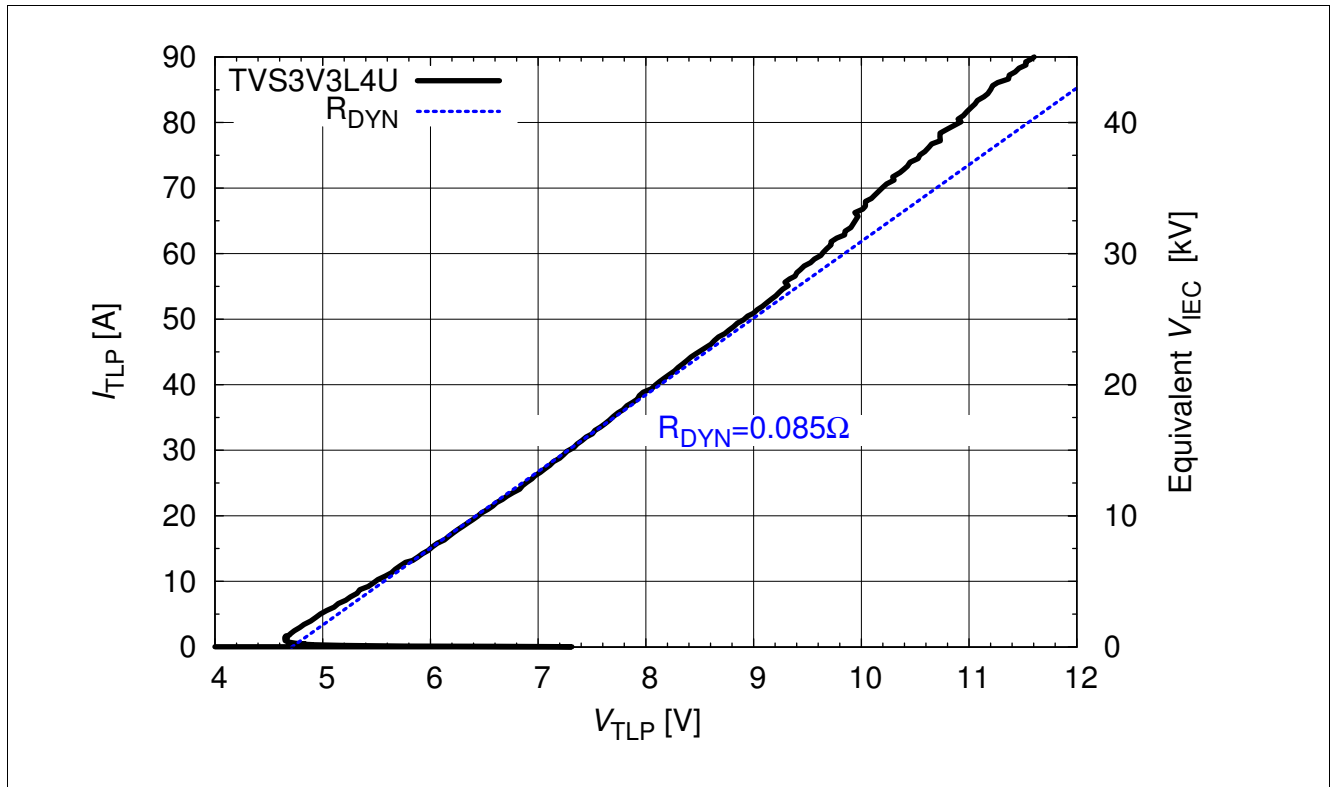


Figure 3-7 TLP characteristics, reverse pulse

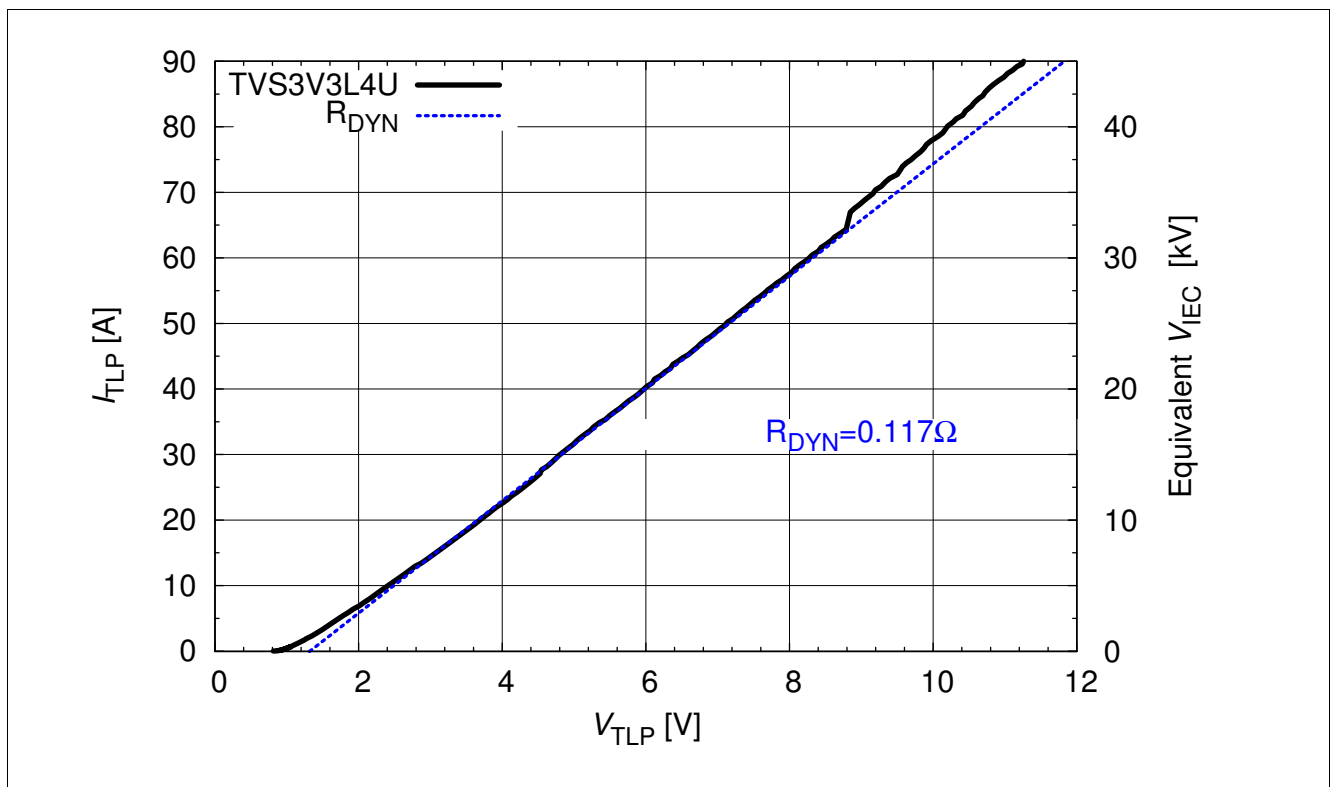


Figure 3-8 TLP characteristics, forward pulse

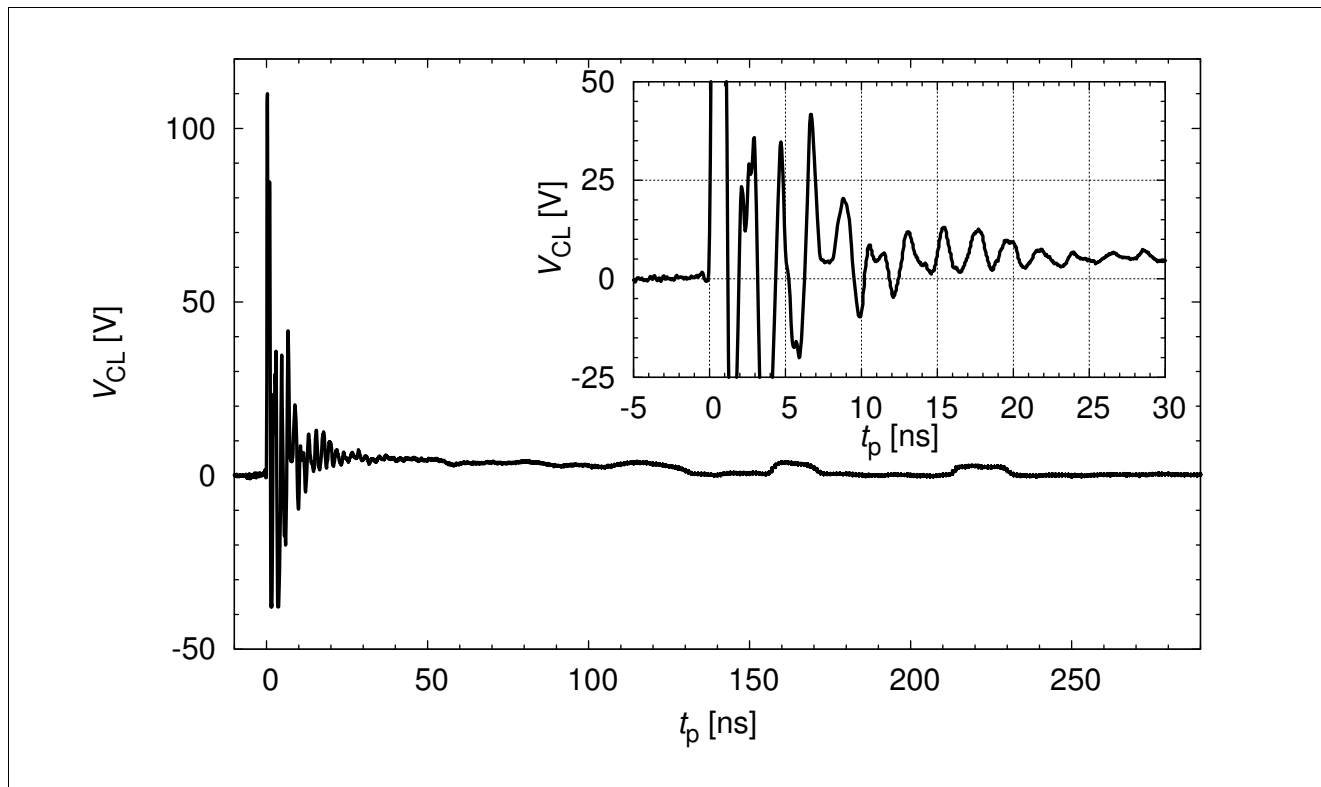


Figure 3-9 Clamping voltage at +8 kV contact discharge according IEC61000-4-2 ( $R = 330 \, \Omega$ ,  $C = 150 \, \text{pF}$ )

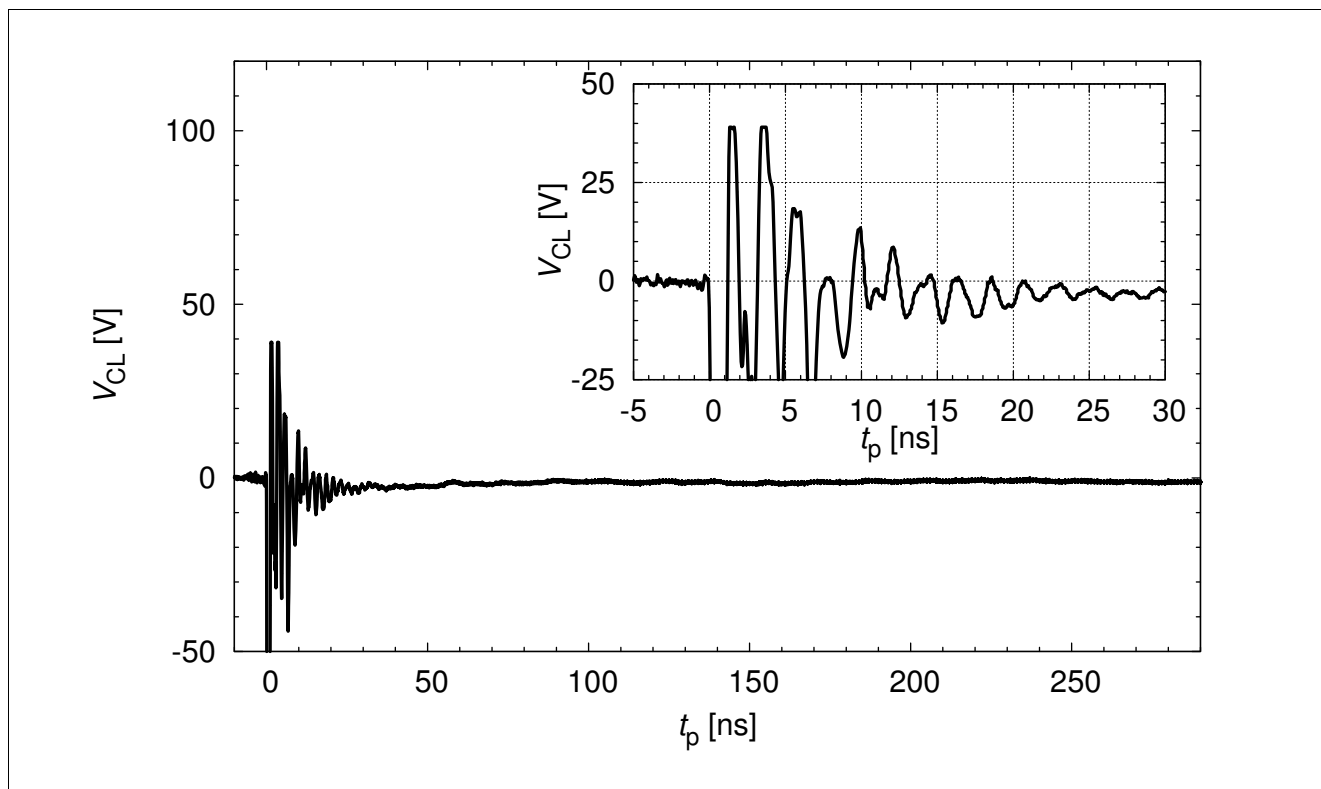


Figure 3-10 Clamping voltage at -8 kV contact discharge according IEC61000-4-2 ( $R = 330 \, \Omega$ ,  $C = 150 \, \text{pF}$ )

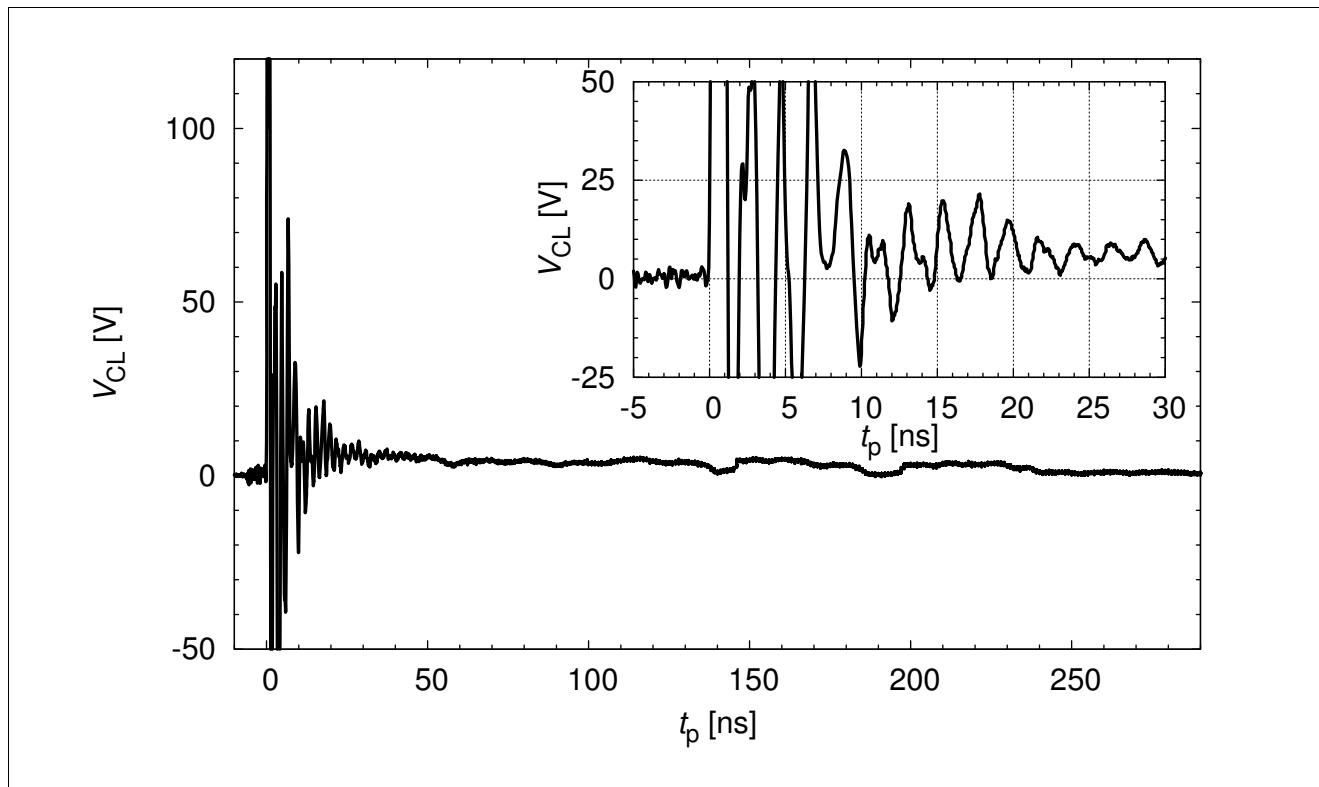


Figure 3-11 Clamping voltage at +15 kV contact discharge according IEC61000-4-2 ( $R = 330 \, \Omega$ ,  $C = 150 \, \text{pF}$ )

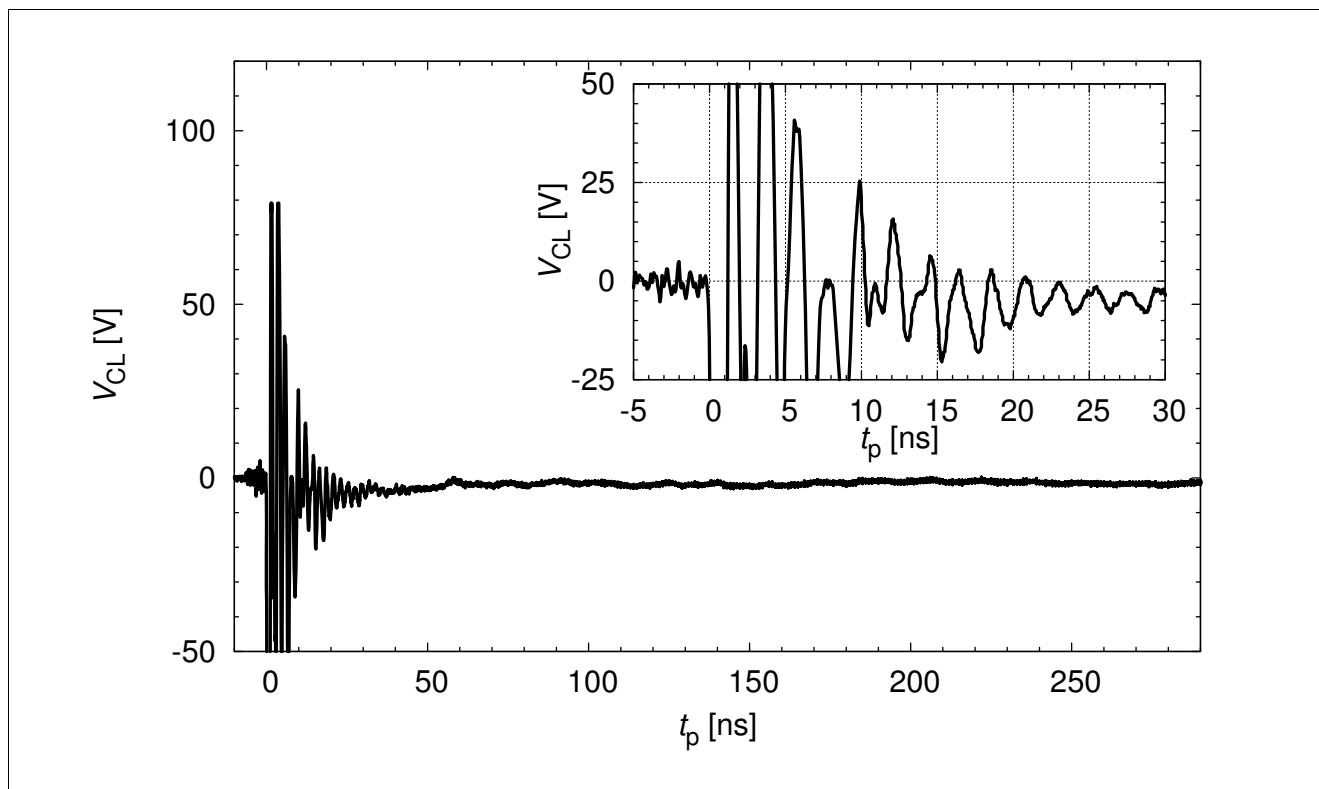


Figure 3-12 Clamping voltage at -15 kV contact discharge according IEC61000-4-2 ( $R = 330 \, \Omega$ ,  $C = 150 \, \text{pF}$ )

## 4 Package Information

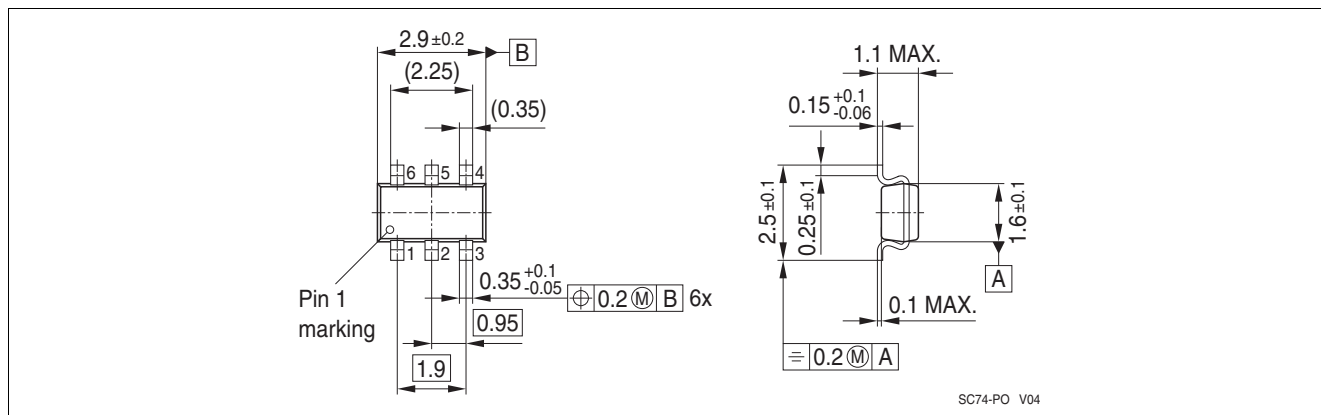


Figure 4-1 SC74 Package outline

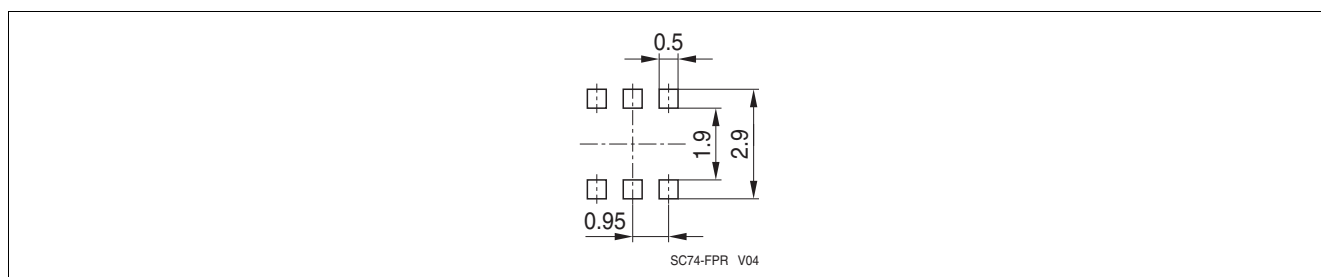


Figure 4-2 SC74 Footprint (Reflow Soldering)

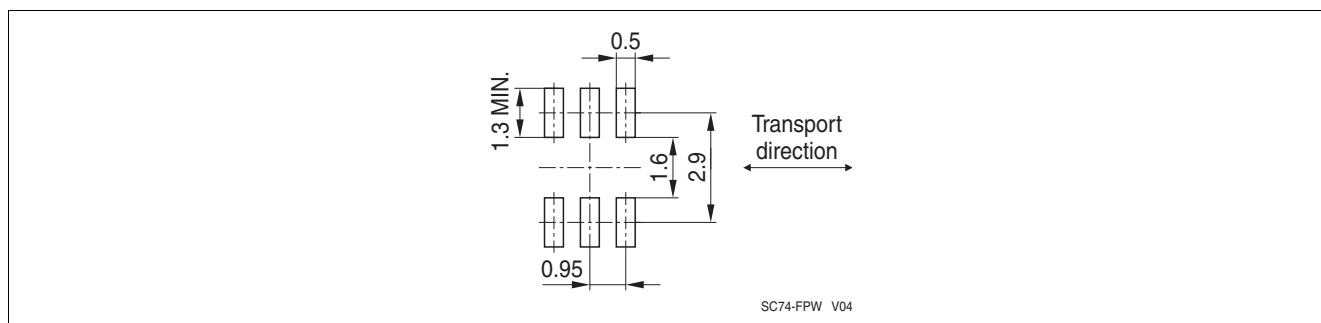


Figure 4-3 SC74 Footprint (Reflow Soldering)

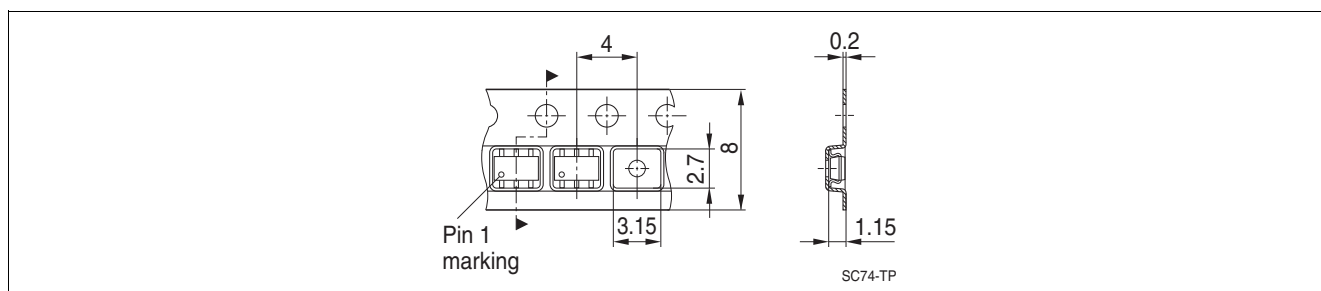


Figure 4-4 SC74 Packing

## 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

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