Protection Device
TVS (Transient Voltage Suppressor)

ESD110-B1 Series
Bi-directional, 18.5 V (AC), 0.3 pF, 0201, 0402, RoHS and Halogen Free compliant

ESD110-B1-02ELS
ESD110-B1-02EL

Data Sheet
Revision 1.4, 2014-10-23
Final
Information
For further information on technology, delivery terms and conditions and prices, please contact the nearest Infineon Technologies Office (www.infineon.com)

Warnings
Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.

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1 Product Overview

1.1 Features

- ESD / transient protection according to:
  - IEC61000-4-2 (ESD): ±15 kV (air), ±12 kV (contact)
  - IEC61000-4-5 (Surge): ±2 A ($t_p = 8 / 20 \mu s$)
- Bi-directional, working voltage up to $V_{RWM} = \pm 18.5 \text{ V (AC)}$
- Ultra-low capacitance: $C_L = 0.3 \text{ pF (typical)}$
- Low clamping voltage: $V_{CL} = 28 \text{ V (typical)}$ at $I_{TLP} = 16 \text{ A}$
- Very low reverse current: $I_R < 1 \text{ nA (typical)}$
- Pb-free (RoHS compliant) and halogen free package

1.2 Application Examples

- ESD Protection of RF signal lines in Near Field Communication (NFC) applications

1.3 Product Description

![Pin Configuration and Schematic Diagram](PinConf_and_SchematicDiag.vsd)

Table 1-1 Part Information

<table>
<thead>
<tr>
<th>Type</th>
<th>Package</th>
<th>Configuration</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD110-B1-02ELS</td>
<td>TSSLP-2-4</td>
<td>1 line, bi-directional</td>
<td>X</td>
</tr>
<tr>
<td>ESD110-B1-02EL</td>
<td>TSLP-2-20</td>
<td>1 line, bi-directional</td>
<td>XX</td>
</tr>
</tbody>
</table>
2  Maximum Ratings

Table 2-1  Maximum Ratings at $T_A = 25$ °C, unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD air discharge</td>
<td>$I'_{ESD}$</td>
<td>±15</td>
<td>kV</td>
</tr>
<tr>
<td>ESD contact discharge</td>
<td>$I'_{ESD}$</td>
<td>±12</td>
<td>kV</td>
</tr>
<tr>
<td>Peak pulse power</td>
<td>$P_{PK}$</td>
<td>58</td>
<td>W</td>
</tr>
<tr>
<td>Peak pulse current</td>
<td>$I_{PP}$</td>
<td>±2</td>
<td>A</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>$T_{OP}$</td>
<td>-40 to 125</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

1) Device is electrically symmetrical
2) $V_{ESD}$ according to IEC61000-4-2
3) Non-repetitive current pulse 8/20µs exponential decay waveform according to IEC61000-4-5

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.

3  Electrical Characteristics at $T_A = 25$ °C, unless otherwise specified

![Diagram of electrical characteristics](image)

Figure 3-1  Definitions of electrical characteristics
# Electrical Characteristics at $T_A = 25 \, ^\circ\text{C}$, unless otherwise specified

## Table 3-1  DC Characteristics at $T_A = 25 \, ^\circ\text{C}$, unless otherwise specified\(^1\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
<th>Note / Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse working voltage</td>
<td>$V_{RWM}$</td>
<td>-18.5</td>
<td>–</td>
<td>18.5 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-15</td>
<td>–</td>
<td>15 V</td>
</tr>
<tr>
<td>Trigger voltage</td>
<td>$V_{IT}$</td>
<td>20</td>
<td>–</td>
<td>– V</td>
</tr>
<tr>
<td>Holding voltage</td>
<td>$V_h$</td>
<td>20</td>
<td>21</td>
<td>26 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>19</td>
<td>– V</td>
</tr>
<tr>
<td>Reverse leakage current</td>
<td>$I_R$</td>
<td>–</td>
<td>&lt;1</td>
<td>30 nA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>10</td>
<td>– nA</td>
</tr>
</tbody>
</table>

1) Device is electrically symmetrical

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
<th>Note / Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line capacitance</td>
<td>$C_L$</td>
<td>0.15</td>
<td>0.3</td>
<td>0.5 pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15</td>
<td>0.3</td>
<td>0.5 pF</td>
</tr>
<tr>
<td>Series inductance</td>
<td>$L_S$</td>
<td>–</td>
<td>0.2</td>
<td>– nH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>0.4</td>
<td>– nH</td>
</tr>
</tbody>
</table>

## Table 3-3  ESD and Surge Characteristics at $T_A = 25 \, ^\circ\text{C}$, unless otherwise specified\(^1\)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
<th>Note / Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clamping voltage(^2)</td>
<td>$V_{CL}$</td>
<td>–</td>
<td>30</td>
<td>35 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>39</td>
<td>44 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>19</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>–</td>
<td>24</td>
<td>29 V</td>
</tr>
<tr>
<td>Dynamic resistance(^2)</td>
<td>$R_{DYN}$</td>
<td>–</td>
<td>0.6</td>
<td>– Ω</td>
</tr>
</tbody>
</table>

1) Device is electrically symmetrical
2) Please refer to Application Note AN210[1]. TLP parameter: $Z_0 = 50 \, \Omega$, $t_p = 100\,\text{ns}$, $t_r = 300\,\text{ps}$
3) Non-repetitive current pulse 8/20μs exponential decay waveform according to IEC61000-4-5
4 Typical Characteristics Diagrams

Typical characteristics diagrams at $T_A = 25^\circ C$, unless otherwise specified

Figure 4-1 Reverse leakage current: $I_R = f(V_R)$

Figure 4-2 Line capacitance: $C_L = f(V_R)$
Figure 4-3  Clamping voltage (ESD): \( V_{CL} = f(t) \), 8 kV positive pulse from pin 1 to pin 2

Figure 4-4  Clamping voltage (ESD): \( V_{CL} = f(t) \), 8 kV negative pulse from pin 1 to pin 2
Figure 4-5  Clamping voltage (ESD): $V_{\text{CL}} = f(t)$, 15 kV positiv pulse from pin 1 to pin 2

Figure 4-6  Clamping voltage (ESD): $V_{\text{CL}} = f(t)$, 15 kV negativ pulse from pin 1 to pin 2
Figure 4-7  Clamping voltage (TLP): $I_{\text{TLP}} = f(V_{\text{TLP}})$ [1], pin 1 to pin 2

$R_{\text{DYN}} = 0.6 \, \Omega$

$R_{\text{DYN}} = 0.6 \, \Omega$
Figure 4-8  Clamping voltage(Surge): $I_{pp} = f(V_{CL})$
Figure 4-9  Insertion loss vs. frequency in a 50 Ω system
5 Application Information

Mobile phone differential antenna

Main PCB/Top shell
- TX+ to EMILP filter
- TX- to GND
- RX to GND
- Antenna matching

Interconnection top/bottom shell “external pads”

Bottom shell
- RF=13.56MHz signal vs. GND <= -18Vp
- +Vsignal vs. -Vsignal < 36V!!
- Caps should be high voltage type to be safe regards the residual ESD peak

Mobile phone single ended antenna

Main PCB/Top shell
- TX+ to EMILP filter
- TX- to GND
- RX to GND
- Antenna matching

Interconnection top/bottom shell “external pads”

Bottom shell
- RF=13.56MHz signal vs. GND <= -18Vp
- Caps should be high voltage type to be safe regards the residual ESD peak

Figure 5-1 Bi-directional ESD / Transient protection for NFC Frontend [3]
6 Package Information

6.1 TSSLP-2-4

Figure 6-1 TSSLP-2-4: Package outline

Figure 6-2 TSSLP-2-4: Footprint

Figure 6-3 TSSLP-2-4: Packing

Figure 6-4 TSSLP-2-4: Marking (example) Table 1-1 “Part Information” on Page 3
6.2 TSLP-2-20

Figure 6-5 TSLP-2-20: Package overview

Figure 6-6 TSLP-2-20: Footprint

Figure 6-7 TSLP-2-20: Packing

Figure 6-8 TSLP-2-20: Marking example Table 1-1 “Part Information” on Page 3
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] Infineon AG - Application Note AN244: Tailored ESD Protection for the NFC Frontend
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Page or Item | Subjects (major changes since previous revision)
Revision 1.4, 2014-10-23
4 | Table 2-1) updated

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