Ultra low clamping single line bidirectional ESD protection

Features

- Ultra low clamping voltage:
  - 10 V (IEC 61000-4-2 contact discharge 8 kV at 30 ns/16 A TLP)
- Bidirectional and symmetrical device
- High holding voltage for DC line protection
- 0201 package
- ECOPACK2 compliant component
- Complies with IEC 61000-4-2 level 4
  - ±30 kV (air discharge)
  - ±14 kV (contact discharge)

Applications

Where transient over voltage protection in ESD sensitive equipment is required, such as:
- Smartphones, mobile phones and accessories
- Tablets and notebooks
- Portable multimedia devices and accessories
- Wearable, home automation, healthcare
- Highly integrated systems

Description

The ESDZV5H-1BU2 is a bidirectional single line TVS diode designed to protect the data line or other I/O ports against ESD transients.

The device is ideal for applications where reduced line capacitance and board space saving are required.
# Characteristics

### Table 1. Absolute maximum ratings ($T_{\text{amb}} = 25 \, ^\circ\text{C}$)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{PP}}$</td>
<td>Peak pulse voltage</td>
<td>IEC 61000-4-2 contact discharge</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IEC 61000-4-2 air discharge</td>
<td>30</td>
</tr>
<tr>
<td>$P_{\text{PP}}$</td>
<td>Peak pulse power dissipation (8/20 μs)</td>
<td>40</td>
<td>W</td>
</tr>
<tr>
<td>$I_{\text{PP}}$</td>
<td>Peak pulse current (8/20 μs)</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>$T_{\text{j}}$</td>
<td>Operating junction temperature range</td>
<td>-55 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{\text{stg}}$</td>
<td>Storage temperature range</td>
<td>-65 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{\text{L}}$</td>
<td>Maximum lead temperature for soldering during 10 s</td>
<td>260</td>
<td>°C</td>
</tr>
</tbody>
</table>

### Figure 1. Electrical characteristics (definitions)

- $V_{\text{Trig}}$: Trigger voltage
- $V_{\text{CL}}$: Clamping voltage
- $I_{\text{RM}}$: Leakage current at $V_{\text{RM}}$
- $V_{\text{RM}}$: Stand-off voltage
- $I_{\text{PP}}$: Peak pulse current
- $R_{\text{D}}$: Dynamic resistance
- $V_{\text{H}}$: Holding voltage
- $C_{\text{LINE}}$: Input capacitance per line

### Table 2. Electrical characteristics ($T_{\text{amb}} = 25 \, ^\circ\text{C}$)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Test condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{Trig}}$</td>
<td>Higher voltage than $V_{\text{Trig}}$ guarantees the protection turn-on</td>
<td>6.5</td>
<td>10</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{H}}$</td>
<td>Lower voltage than $V_{\text{H}}$ guarantees the protection turn-off</td>
<td>5.5</td>
<td>5.9</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{RM}}$</td>
<td></td>
<td></td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$I_{\text{RM}}$</td>
<td>$V_{\text{RM}} = 5.5 , V$</td>
<td>10</td>
<td>50</td>
<td>nA</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{CL}}$</td>
<td>8 kV contact discharge after 30 ns, IEC 61000-4-2</td>
<td>10</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8/20 μs waveform, $I_{\text{PP}} = 4 , A$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$C_{\text{LINE}}$</td>
<td>$F = 1 , \text{MHz}$, $V_{\text{LINE}} = 0 , V$, $V_{\text{OSC}} = 30 , \text{mV}$</td>
<td>4</td>
<td>5</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>$R_{\text{D}}$</td>
<td>Pulse duration 100 ns</td>
<td>0.18</td>
<td></td>
<td>Ω</td>
<td></td>
</tr>
</tbody>
</table>
1.1 Characteristics (curves)

**Figure 2. Leakage current versus junction temperature**
- Leakage current $I_L$ at $V_{f}$: 5.5 V
- Junction temperature $T_j$ (°C)
- Typical values

**Figure 3. Junction capacitance versus applied voltage**
- Capacitance $C$ (pF)
- Voltage $V_{f}$ (V)
- Frequency $F$ = 1 MHz
- $V_{osc}$ = 30 mV RMS
- $T_j$ = 25 °C

**Figure 4. ESD response to IEC 61000-4-2 (+8 kV contact discharge)**
- Peak clamping voltage
- Clamping voltage at 30 ns
- Clamping voltage at 60 ns
- Clamping voltage at 100 ns

**Figure 5. ESD response to IEC 61000-4-2 (-8 kV contact discharge)**
- Peak clamping voltage
- Clamping voltage at 30 ns
- Clamping voltage at 60 ns
- Clamping voltage at 100 ns

**Figure 6. Positive TLP characteristic**
- TLP current (A)
- Voltage (V)

**Figure 7. Negative TLP characteristic**
- TLP current (A)
- Voltage (V)
Figure 8. S21 attenuation measurement result
2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

2.1 ST0201 package information

Note: The marking codes can be rotated by 90° or 180° to differentiate assembly location. In no case should this product marking be used to orient the component for its placement on a PCB. Only pin 1 mark is to be used for this purpose.
### Table 3. ST0201 package mechanical data

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Dimensions</th>
<th>Millimeters</th>
<th></th>
<th></th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Min.</td>
<td>Typ.</td>
<td>Max.</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0.210</td>
<td>0.240</td>
<td>0.270</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>0.140</td>
<td>0.170</td>
<td>0.200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>0.550</td>
<td>0.580</td>
<td>0.610</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td></td>
<td>0.330</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>0.250</td>
<td>0.280</td>
<td>0.310</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E1</td>
<td>0.170</td>
<td>0.200</td>
<td>0.230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fD</td>
<td></td>
<td>0.040</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fE</td>
<td></td>
<td>0.040</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 10. Marking**

Note: Product marking may be rotated by multiples of 90° for assembly plant differentiation. In no case should this product marking be used to orient the component for its placement on a PCB. Only pin 1 mark is to be used for this purpose.
Figure 11. Tape and reel specification (in mm)

Dot indicates Pin 1

All dimensions in mm

User direction of unreeling
3 Recommendation on PCB assembly

3.1 Footprint

1. Footprint in mm
   a. SMD footprint design is recommended.

![Figure 12. Footprint in mm](image)

3.2 Stencil opening design

1. Reference design
   a. Stencil opening thickness: 75 μm / 3 mils
   b. Stencil aperture ratio: 100%

![Figure 13. Recommended stencil window position in mm](image)

3.3 Solder paste

1. Halide-free flux qualification ROL0 according to ANSI/J-STD-004.
2. "No clean" solder paste is recommended.
3. Offers a high tack force to resist component movement during high speed.
4. Use solder paste with fine particles: powder particle size 20-38 μm.
3.4 Placement

1. Manual positioning is not recommended.
2. It is recommended to use the lead recognition capabilities of the placement system, not the outline centering.
3. Standard tolerance of ±0.05 mm is recommended.
4. 1.0 N placement force is recommended. Too much placement force can lead to squeezed out solder paste and cause solder joints to short. Too low placement force can lead to insufficient contact between package and solder paste that could cause open solder joints or badly centered packages.
5. To improve the package placement accuracy, a bottom side optical control should be performed with a high resolution tool.
6. For assembly, a perfect supporting of the PCB (all the more on flexible PCB) is recommended during solder paste printing, pick and place and reflow soldering by using optimized tools.

3.5 Reflow profile

Figure 14. ST ECOPACK® recommended soldering reflow profile for PCB mounting

Note: Minimize air convection currents in the reflow oven to avoid component movement. Maximum soldering profile corresponds to the latest IPC/JEDEC J-STD-020.
4 Ordering information

Figure 15. Ordering information scheme

ESD | Z | V | 5H | - | 1 | B | U2

- ESD protection
- Z: Ultra low Clamping snapback effect
- V: Very Low Capacitance
- 5: Standoff voltage at 5.5 V max.
- H = Higher holding voltage
- Number of lines
- B = Bi-directional
- Package
- U2 = 0201

Table 4. Ordering information

<table>
<thead>
<tr>
<th>Order code</th>
<th>Marking</th>
<th>Package</th>
<th>Weight</th>
<th>Base qty.</th>
<th>Delivery mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESDZV5H-1BU2</td>
<td>L</td>
<td>0201</td>
<td>0.116 mg</td>
<td>15000</td>
<td>Tape and reel</td>
</tr>
</tbody>
</table>

1. The marking can be rotated by multiples of 90° to differentiate assembly location
## Revision history

**Table 5. Document revision history**

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
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</thead>
<tbody>
<tr>
<td>18-Jul-2017</td>
<td>1</td>
<td>First issue.</td>
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<tr>
<td>05-Jan-2018</td>
<td>2</td>
<td>Updated Figure 11: &quot;Marking&quot;</td>
</tr>
<tr>
<td>10-Sep-2018</td>
<td>3</td>
<td>Updated Table 1. Absolute maximum ratings ($T_{amb} = 25^\circ C$).</td>
</tr>
<tr>
<td>17-Jul-2019</td>
<td>4</td>
<td>Updated Section 3.1 Footprint.</td>
</tr>
<tr>
<td>31-Mar-2020</td>
<td>5</td>
<td>Updated Figure 9 and Table 3.</td>
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