Silicon TVS diodes

- ESD / transient protection of CAN/LIN bus networks power supply lines according to:
  - IEC61000-4-2 (ESD): ±30kV (air / contact)
  - IEC61000-4-4 (EFT): 80 A (5/50 ns)
  - IEC61000-4-5 (surge): 5 A (8/20µs)
  - ISO7637-2: Pulse 1 (max. 50 V), Pulse 2 (max. 125 V), Pulse 3a, b (max.800 V)

- Max. working voltage: 24 V
- Low capacitance: 24 pF typ.
- Low clamping voltage: < 41 V
- Extremely low reverse current: < 1 nA typ.
- Pb-free (RoHS compliant) package

Applications

- Low and High-Speed CAN
- Fault Tolerant CAN
- Industrial control networks
- 12/24 V DC power supply lines

RoHS

ESD24VS2U

<table>
<thead>
<tr>
<th>Type</th>
<th>Package</th>
<th>Configuration</th>
<th>Marking</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD24VS2U</td>
<td>SOT23</td>
<td>2 lines, uni-directional*</td>
<td>EUs</td>
</tr>
</tbody>
</table>

* 1 line, bi-directional between pins 1 and 2, if pin 3 is not connected
Maximum Ratings at $T_A = 25{}^\circ C$, unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD contact discharge$^1$</td>
<td>$V_{ESD}$</td>
<td>30</td>
<td>kV</td>
</tr>
<tr>
<td>Peak pulse current ($t_p = 8 / 20 \mu s$)$^2$</td>
<td>$I_{pp}$</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td>Peak pulse power ($t_p = 8 / 20 \mu s$)$^2$</td>
<td>$P_{pk}$</td>
<td>230</td>
<td>W</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>$T_{op}$</td>
<td>-55...150</td>
<td>$^\circ C$</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td>-65...150</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Values</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>min.</td>
<td>typ.</td>
</tr>
<tr>
<td>Characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse working voltage</td>
<td>$V_{RWM}$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Breakdown voltage</td>
<td>$V_{(BR)}$</td>
<td>26</td>
<td>-</td>
</tr>
<tr>
<td>$I_{(BR)} = 1 \ mA$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse current $V_R = 24 \ V$</td>
<td>$I_R$</td>
<td>-</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Clamping voltage</td>
<td>$V_{CL}$</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>$I_{pp} = 1 \ A, t_p = 8 / 20 \mu s$)$^2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$I_{pp} = 5 \ A, t_p = 8 / 20 \mu s$)$^2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line capacitance$^3$</td>
<td>$C_T$</td>
<td>-</td>
<td>24</td>
</tr>
<tr>
<td>$V_R = 0 \ V, f = 1 \ MHz, (pins 1 to 2, pin 3 n.c.)$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_R = 0 \ V, f = 1 \ MHz, (pins 1 or 2 to 3)$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^1$ $V_{ESD}$ according to IEC61000-4-2. Device stressed with 10 positive / negative ESD pulses.

$^2$I_{pp} according to IEC61000-4-5. Non-repetitive current pulse.

$^3$Total capacitance line to ground (per line)
### Power derating curve $P_{pk} = f(T_A)$

- $P_{pk}$ vs $T_A$

### Clamping voltage, $V_{cl} = f(I_{pp})$

- $V_{cl}$ vs $I_{pp}$
- $t_p = 8 / 20 \mu$s

### Reverse current $I_R = f(V_R)$

- $I_R$ vs $V_R$
- $T_A$ = Parameter, pins 1 / 2 to 3
  - (uni-directional)

### Breakdown voltage $V_{BR} = f(I_R)$

- $V_{BR}$ vs $I_R$
- $T_A$ = Parameter, pins 1 to 2
  - (bi-directional)
Line capacitance $C_T = f(V_R)$

$f = 1\text{MHz}$
**Application example** ESD24VS2U (uni-directional)
12V / 24V DC power supply line protection

The protection diode should be placed very close to the location where the ESD or other transients can occur to keep loops and inductances as small as possible. Pin 3 should be connected directly to a ground plane on the board.

**Application example** ESD24VS2U (bi-directional)
Single Wire CAN and LIN bus protection

Pin 2 (or pin 1) should be connected directly to a ground plane on the board. Pin 3 is not connected.
Clamping voltage according to ISO 7637-2: Pulse 1
Ri = 10 Ohm, td = 2 ms, 5000 pulses

Open circuit voltage: -50 V

With connected diode: -34.8 V
Clamping voltage according to ISO 7637-2: Pulse 2a
Ri = 10 Ohm, td = 2 us, 4000 pulses, 60 min

Open circuit voltage: 125 V

With connected diode: 36.0 V
Clamping voltage according to ISO 7637-2: Pulse 3
Ri = 50 Ohm, td = 100 ns, 10 min

Open circuit voltage: 800 V
With connected diode: 40.0 V

[Graph showing waveforms for open circuit and with diode connected]
Package Outline

Foot Print

1) Lead width can be 0.6 max. in dambar area

Marking Layout (Example)

Standard Packing

Reel ø180 mm = 3.000 Pieces/Reel
Reel ø330 mm = 10.000 Pieces/Reel
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