PESD2CAN
CAN bus ESD protection diode
Rev. 01 - 22 December 2006
Product data sheet

## 1. Product profile

### 1.1 General description

PESD2CAN in a small SOT23 Surface-Mounted Device (SMD) plastic package designed to protect two automotive Controller Area Network (CAN) bus lines from the damage caused by ElectroStatic Discharge (ESD) and other transients.

### 1.2 Features

- Due to the integrated diode structure only one small SOT23 package is needed to protect two CAN bus lines
- Max. peak pulse power: $\mathrm{P}_{\mathrm{PP}}=230 \mathrm{~W}$ at $\mathrm{t}_{\mathrm{p}}=8 / 20 \mu \mathrm{~s}$
- Low clamping voltage: $\mathrm{V}_{\mathrm{CL}}=41 \mathrm{~V}$ at $\mathrm{I}_{\mathrm{PP}}=5 \mathrm{~A}$
- Ultra low leakage current: $\mathrm{I}_{\mathrm{RM}}<1 \mathrm{nA}$
- ESD protection up to 30 kV
- IEC 61000-4-2, level 4 (ESD)
- IEC 61000-4-5 (surge); $I_{\text {PP }}=5$ A at $t_{p}=8 / 20 \mu \mathrm{~s}$
- Small SMD plastic package


### 1.3 Applications

- CAN bus protection
- Automotive applications


### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Per diode |  |  |  |  |  |  |
| $\mathrm{V}_{\mathrm{RWM}}$ | reverse standoff voltage |  | - | - | 24 | V |
| $\mathrm{C}_{\mathrm{d}}$ | diode capacitance | $\mathrm{f}=1 \mathrm{MHz} ; \mathrm{V}_{\mathrm{R}}=0 \mathrm{~V}$ | - | 25 | 30 | pF |

## 2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline | Symbol |
| :--- | :--- | :--- | :--- |
| 1 | cathode 1 |  |  |
| 2 | cathode 2 |  |  |
| 3 | common cathode |  |  |

## 3. Ordering information

Table 3. Ordering information

| Type number | Package |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
|  | Name | Description | Version |  |
| PESD2CAN | - | plastic surface-mounted package; 3 leads | SOT23 |  |

4. Marking

Table 4. Marking codes

| Type number | Marking code[1] |
| :--- | :--- |
| PESD2CAN | $6 R^{*}$ |
| $[1] \quad{ }^{*}=-:$ made in Hong Kong |  |
| $\quad *=p:$ made in Hong Kong |  |
| $\quad *=$ t: made in Malaysia |  |
| $\quad$ * $=$ W: made in China |  |

## 5. Limiting values

Table 5. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Per diode |  |  |  |  |  |
| $P_{\text {PP }}$ | peak pulse power | $t_{p}=8 / 20 \mu \mathrm{~s}$ | $\underline{[1][2]}-$ | 230 | W |
| $\mathrm{I}_{\mathrm{PP}}$ | peak pulse current | $\mathrm{t}_{\mathrm{p}}=8 / 20 \mu \mathrm{~s}$ | $\underline{[1][2]}-$ | 5 | A |
| Per device |  |  |  |  |  |
| $\mathrm{T}_{\mathrm{j}}$ | junction temperature |  | - | 150 | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{T}_{\text {amb }}$ | ambient temperature |  | -65 | +150 | ${ }^{\circ} \mathrm{C}$ |
| $\mathrm{T}_{\text {stg }}$ | storage temperature |  | -65 | +150 | ${ }^{\circ} \mathrm{C}$ |

[^0]Table 6. ESD maximum ratings

| Symbol | Parameter | Conditions | Min | Max | Unit |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Per diode | electrostatic discharge voltage | IEC 61000-4-2 <br> (contact discharge) | $\underline{[1][2]}-$ | 30 | kV |
| VESD | machine model | $\underline{[2]}-$ | 400 | V |  |
| MIL-STD-883 (human <br> body model) | $\underline{[1][2]}-$ | 16 | kV |  |  |

[1] Device stressed with ten non-repetitive ESD pulses.
[2] Measured from pin 1 to 3 or 2 to 3.

Table 7. ESD standards compliance

Standard Conditions
Per diode
IEC 61000-4-2; level 4 (ESD) $\quad>15 \mathrm{kV}$ (air); >8 kV (contact)

MIL-STD-883; class 3 (human body model) $>4$ kV


Fig 1. $8 / 20 \mu \mathrm{~s}$ pulse waveform according to IEC 61000-4-5


Fig 2. ESD pulse waveform according to IEC 61000-4-2

## 6. Characteristics

Table 8. Characteristics
$T_{a m b}=25^{\circ} \mathrm{C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Per diode |  |  |  |  |  |  |
| $\mathrm{V}_{\mathrm{RWM}}$ | reverse standoff voltage |  | - | - | 24 | V |
| $\mathrm{I}_{\mathrm{RM}}$ | reverse leakage current | $\mathrm{V}_{\mathrm{RWM}}=24 \mathrm{~V}$ | - | $<1$ | 10 | nA |
| $\mathrm{V}_{\mathrm{BR}}$ | breakdown voltage | $\mathrm{I}_{\mathrm{R}}=1 \mathrm{~mA}$ | 26.2 | 28 | 30.3 | V |
| $\mathrm{C}_{\mathrm{d}}$ | diode capacitance | $\mathrm{f}=1 \mathrm{MHz} ; \mathrm{V}_{\mathrm{R}}=0 \mathrm{~V}$ | - | 25 | 30 | pF |
| $\mathrm{V}_{\mathrm{CL}}$ | clamping voltage | $\mathrm{I}_{\mathrm{PP}}=1 \mathrm{~A}$ | $\underline{[1][2]}-$ | - | 34 | V |
|  |  | $\underline{\mathrm{I}_{\mathrm{PP}}=5 \mathrm{~A}}$ | $\underline{[1][2]}-$ | - | 41 | V |
| $\mathrm{r}_{\text {dif }}$ | differential resistance | $\mathrm{I}_{\mathrm{R}}=1 \mathrm{~mA}$ | - | - | 300 | $\Omega$ |

[1] Non-repetitive current pulse $8 / 20 \mu$ s exponential decay waveform according to IEC 61000-4-5.
[2] Measured from pin 1 to 3 or 2 to 3.


Fig 3. Peak pulse current as a function of clamping voltage; typical values


Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values

$\mathrm{f}=1 \mathrm{MHz}$
(1) $\mathrm{T}_{\mathrm{amb}}=150^{\circ} \mathrm{C}$
(2) $\mathrm{T}_{\mathrm{amb}}=125^{\circ} \mathrm{C}$
(3) $\mathrm{T}_{\mathrm{amb}}=85^{\circ} \mathrm{C}$
(4) $\mathrm{T}_{\mathrm{amb}}=25^{\circ} \mathrm{C}$
(5) $\mathrm{T}_{\mathrm{amb}}=-40^{\circ} \mathrm{C}$

Fig 5. Diode capacitance as a function of reverse voltage; typical values

$\mathrm{T}_{\mathrm{amb}}=150^{\circ} \mathrm{C}$
$\mathrm{I}_{\mathrm{R}}$ is less than 1 nA at $-55^{\circ} \mathrm{C}$ and $25^{\circ} \mathrm{C}$.
Fig 7. Reverse voltage as a function of reverse leakage current; typical values

(1) $\mathrm{T}_{\mathrm{amb}}=-55^{\circ} \mathrm{C}$
(2) $\mathrm{T}_{\mathrm{amb}}=25^{\circ} \mathrm{C}$
(3) $\mathrm{T}_{\mathrm{amb}}=150^{\circ} \mathrm{C}$

Fig 6. Reverse current as a function of reverse voltage; typical values


Fig 8. V-I characteristics for a bidirectional ESD protection diode


unclamped +8 kV ESD pulse waveform (IEC 61000-4-2 network)

unclamped -8 kV ESD pulse waveform (IEC 61000-4-2 network)

clamped +8 kV ESD pulse waveform (IEC 61000-4-2 network), Pin 1 to 3

clamped -8 kV ESD voltage waveform (IEC 61000-4-2 network), Pin 1 to 3

006aaa941

Fig 9. ESD clamping test setup and waveforms

## 7. Application information

The PESD2CAN is designed for the protection of two automotive CAN bus lines from the damage caused by ESD and surge pulses. The PESD2CAN can be used for both, high-speed CAN bus and fault-tolerant CAN bus protection. The PESD2CAN provides a surge capability of up to 230 W per line for an $8 / 20 \mu \mathrm{~s}$ waveform.


Fig 10. Typical application: ESD protection of two automotive CAN bus lines

## Circuit board layout and protection device placement:

Circuit board layout is critical for the suppression of ESD, Electrical Fast Transient (EFT) and surge transients. The following guidelines are recommended:

1. Place the PESD2CAN as close to the input terminal or connector as possible.
2. The path length between the PESD2CAN and the protected line should be minimized.
3. Keep parallel signal paths to a minimum.
4. Avoid running protection conductors in parallel with unprotected conductors.
5. Minimize all Printed-Circuit Board (PCB) conductive loops including power and ground loops.
6. Minimize the length of the transient return path to ground.
7. Avoid using shared transient return paths to a common ground point.
8. Ground planes should be used whenever possible. For multilayer PCBs, use ground vias.

## 8. Package outline



Fig 11. Package outline SOT23 (TO-236AB)

## 9. Packing information

Table 9. Packing methods
The indicated -xxx are the last three digits of the 12NC ordering code.[1]

| Type number | Package | Description | Packing quantity |  |
| :--- | :--- | :--- | :--- | :--- |
|  |  |  | $\mathbf{3 0 0 0}$ | $\mathbf{1 0 0 0 0}$ |
| PESD2CAN | SOT23 | 4 mm pitch, 8 mm tape and reel | -215 | -235 |

[1] For further information and the availability of packing methods, see Section 12.

## 10. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
| :--- | :--- | :--- | :--- | :--- |
| PESD2CAN_1 | 20061222 | Product data sheet | - | - |

## 11. Legal information

### 11.1 Data sheet status

| Document status $[\underline{[1][2]}$ | Product status $[3]$ | Definition |
| :--- | :--- | :--- |
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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## 12. Contact information

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[^0]:    [1] Non-repetitive current pulse $8 / 20 \mu$ s exponential decay waveform according to IEC 61000-4-5.
    [2] Measured from pin 1 to 3 or 2 to 3.

