



# PESD1CAN-U

CAN bus ESD protection diode

Rev. 1 — 27 March 2013

Product data sheet

## 1. Product profile

### 1.1 General description

ElectroStatic Discharge (ESD) protection diode in a very small SOT323 (SC-70 ) Surface-Mounted Device (SMD) plastic package designed to protect two automotive Controller Area Network (CAN) bus lines from the damage caused by ESD and other transients.

### 1.2 Features and benefits

- One very small SOT323 package to protect two CAN bus lines
- Low clamping voltage  $V_{CL} = 35 \text{ V}$  at  $I_{PP} = 1 \text{ A}$
- Typical diode capacitance matching  $\Delta C_d/C_d = 0.1 \%$
- ESD protection up to 23 kV; IEC 61000-4-2, level 4
- IEC 61000-4-5 (surge);  $I_{PPM} = 3 \text{ A}$  at  $t_p = 8/20 \text{ }\mu\text{s}$
- AEC-Q101 qualified

### 1.3 Applications

- CAN bus protection
- Automotive applications

### 1.4 Quick reference data

Table 1. Quick reference data

$T_{amb} = 25 \text{ }^\circ\text{C}$  unless otherwise specified.

| Symbol    | Parameter                | Conditions                                | Min | Typ | Max | Unit |
|-----------|--------------------------|-------------------------------------------|-----|-----|-----|------|
| $V_{RWM}$ | reverse standoff voltage |                                           | -   | -   | 24  | V    |
| $C_d$     | diode capacitance        | $f = 1 \text{ MHz}$ ; $V_R = 0 \text{ V}$ | -   | 9.3 | 12  | pF   |

## 2. Pinning information

Table 2. Pinning

| Pin | Description    | Simplified outline | Graphic symbol |
|-----|----------------|--------------------|----------------|
| 1   | cathode 1      |                    |                |
| 2   | cathode 2      |                    |                |
| 3   | common cathode |                    |                |

006aaa155



### 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                          |         |
|-------------|---------|------------------------------------------|---------|
|             | Name    | Description                              | Version |
| PESD1CAN-U  | SC-70   | plastic surface-mounted package; 3 leads | SOT323  |

### 4. Marking

Table 4. Marking codes

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| PESD1CAN-U  | NB*                         |

[1] \* = placeholder for manufacturing site code.

### 5. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol           | Parameter                | Conditions                    | Min | Max  | Unit |
|------------------|--------------------------|-------------------------------|-----|------|------|
| P <sub>PPM</sub> | rated peak pulse power   | <sup>[1]</sup> <sup>[2]</sup> | -   | 150  | W    |
| I <sub>PPM</sub> | rated peak pulse current | <sup>[1]</sup> <sup>[2]</sup> | -   | 3    | A    |
| T <sub>j</sub>   | junction temperature     |                               | -   | 150  | °C   |
| T <sub>amb</sub> | ambient temperature      |                               | -55 | +150 | °C   |
| T <sub>stg</sub> | storage temperature      |                               | -65 | +150 | °C   |

[1] Device stressed with ten non-repetitive current pulses (8/20 μs exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321).

[2] Measured from pin 1 or 2 to 3.

Table 6. ESD maximum ratings

| Symbol           | Parameter                       | Conditions                                                                | Min | Max | Unit |
|------------------|---------------------------------|---------------------------------------------------------------------------|-----|-----|------|
| V <sub>ESD</sub> | electrostatic discharge voltage | IEC 61000-4-2 (contact discharge) <a href="#">[1]</a> <a href="#">[2]</a> | -   | 23  | kV   |
|                  |                                 | machine model <a href="#">[2]</a>                                         | -   | 400 | V    |
|                  |                                 | MIL-STD-883 (human body model)                                            | -   | 10  | kV   |

[1] Device stressed with ten non-repetitive ESD pulses.

[2] Measured from pin 1 or 2 to 3.

Table 7. ESD standards compliance

| Standard                                 | Conditions                      |
|------------------------------------------|---------------------------------|
| IEC 61000-4-2, level 4 (ESD)             | > 15 kV (air); > 8 kV (contact) |
| MIL-STD-883; class 3B (human body model) | > 8 kV                          |

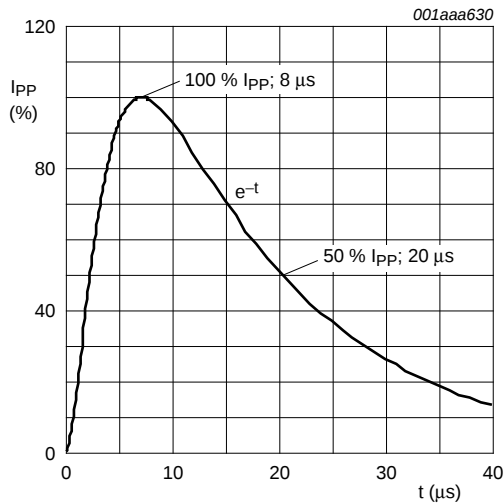


Fig 1. 8/20  $\mu$ s pulse waveform according to IEC 61000-4-5 and IEC 61643-321

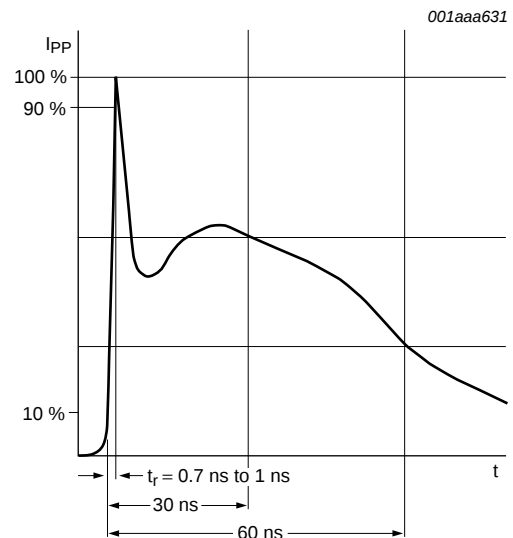


Fig 2. ESD pulse waveform according to IEC 61000-4-2

## 6. Characteristics

Table 8. Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

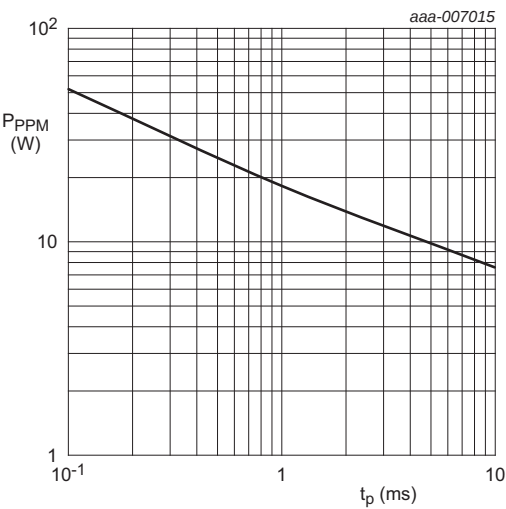
| Symbol           | Parameter                | Conditions                             | Min    | Typ  | Max  | Unit     |
|------------------|--------------------------|----------------------------------------|--------|------|------|----------|
| $V_{RWM}$        | reverse standoff voltage |                                        | -      | -    | 24   | V        |
| $I_{RM}$         | reverse leakage current  | $V_{RWM} = 24\text{ V}$                | -      | 1    | 50   | nA       |
| $V_{BR}$         | breakdown voltage        | $I_R = 5\text{ mA}$                    | 25.4   | 27.8 | 30.3 | V        |
| $V_{CL}$         | clamping voltage         | $I_{PP} = 1\text{ A}$                  | [1][2] | -    | 35   | V        |
|                  |                          | $I_{PPM} = 3\text{ A}$                 | -      | -    | 50   | V        |
| $C_d$            | diode capacitance        | $f = 1\text{ MHz}; V_R = 0\text{ V}$   | -      | 9.3  | 12   | pF       |
|                  |                          | $f = 1\text{ MHz}; V_R = 2.5\text{ V}$ | -      | 7.2  | -    | pF       |
| $\Delta C_d/C_d$ | capacitance matching     | $f = 1\text{ MHz}; V_R = 0\text{ V}$   | [3]    | 0.1  | -    | %        |
|                  |                          | $f = 1\text{ MHz}; V_R = 2.5\text{ V}$ | -      | 0.1  | -    | %        |
| $r_{dyn}$        | dynamic resistance       | $I_R = 10\text{ A}$                    | [2][4] | 1.5  | -    | $\Omega$ |

[1] Device stressed with 8/20  $\mu$ s exponential decay waveform according to IEC 61000-4-5 and IEC 61643-321.

[2] Measured from pin 1 or 2 to 3.

[3]  $\Delta C_d$  is the difference of the capacitance measured between pin 1 and pin 3 and the capacitance measured between pin 2 and pin 3.

[4] Non-repetitive current pulse, Transmission Line Pulse (TLP)  $t_p = 100\text{ ns}$ ; square pulse; ANS/IESD STM5.1-2008.



$T_{amb} = 25\text{ }^{\circ}C$

Fig 3. Rated peak pulse power as a function of square pulse duration; typical values

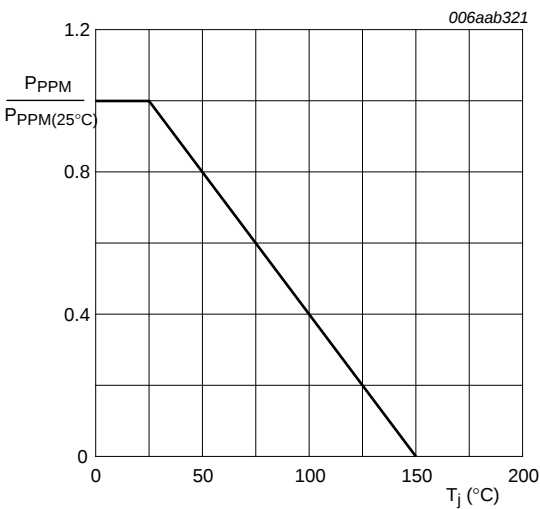
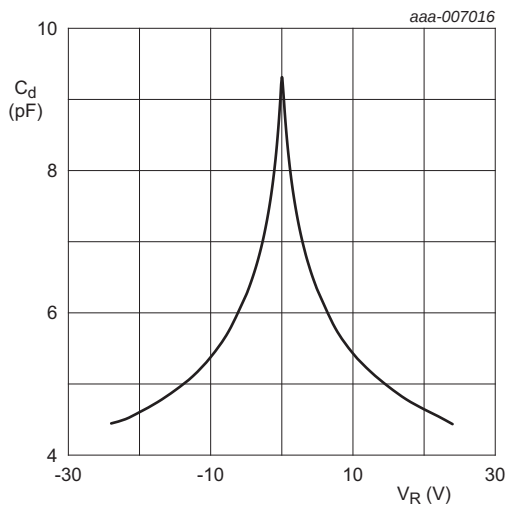


Fig 4. Relative variation of peak pulse power as a function of junction temperature; typical values



$f = 1\text{ MHz}; T_{amb} = 25\text{ }^{\circ}C$

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

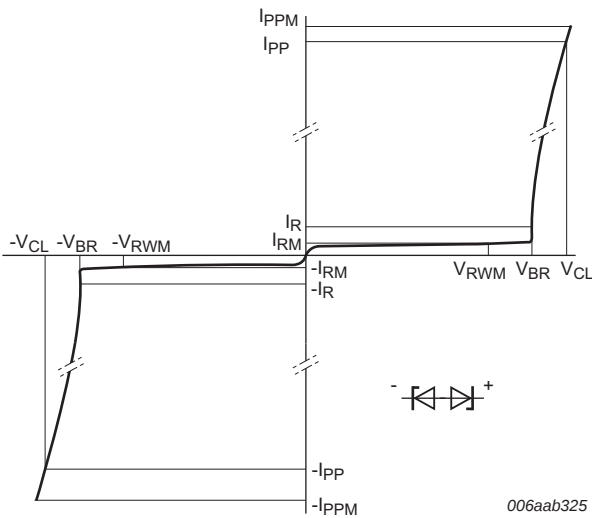


Fig 6. V-I characteristics for a bidirectional ESD protection diode

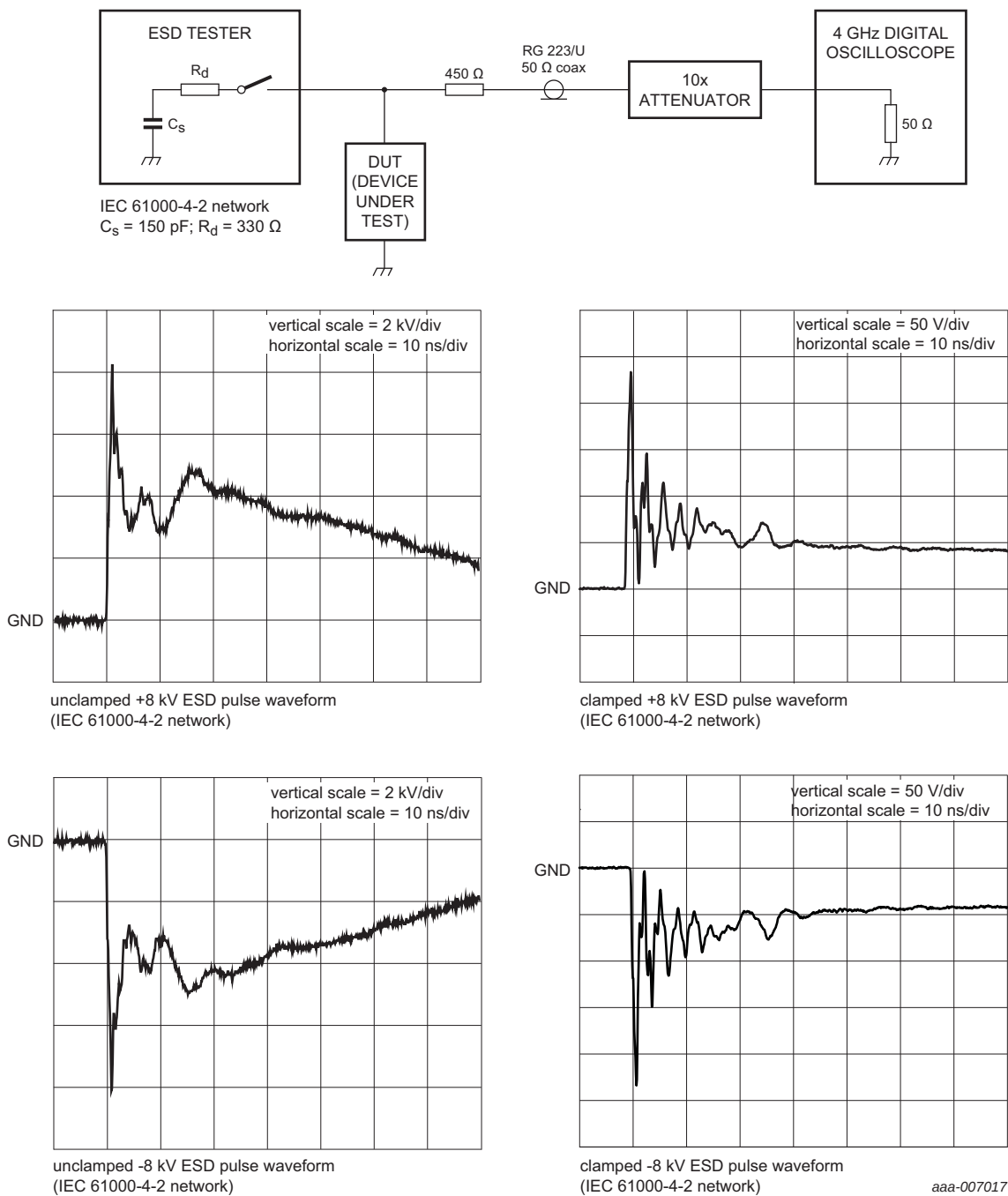


Fig 7. ESD clamping test setup and waveforms

## 7. Application information

The device is designed for the protection of two automotive CAN bus lines from surge pulses and ESD damage. The device is suitable on lines where the signal polarities are both, positive and negative with respect to ground.

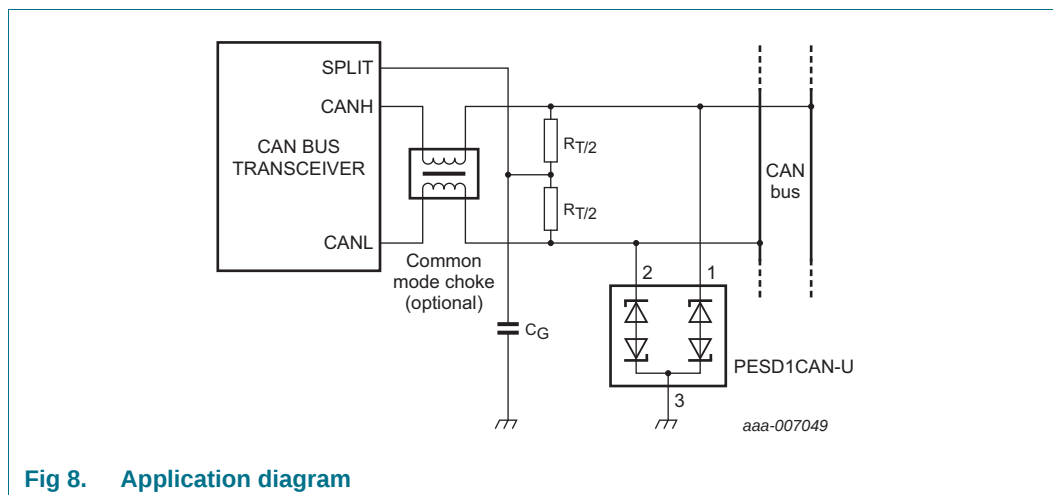


Fig 8. Application diagram

### 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:

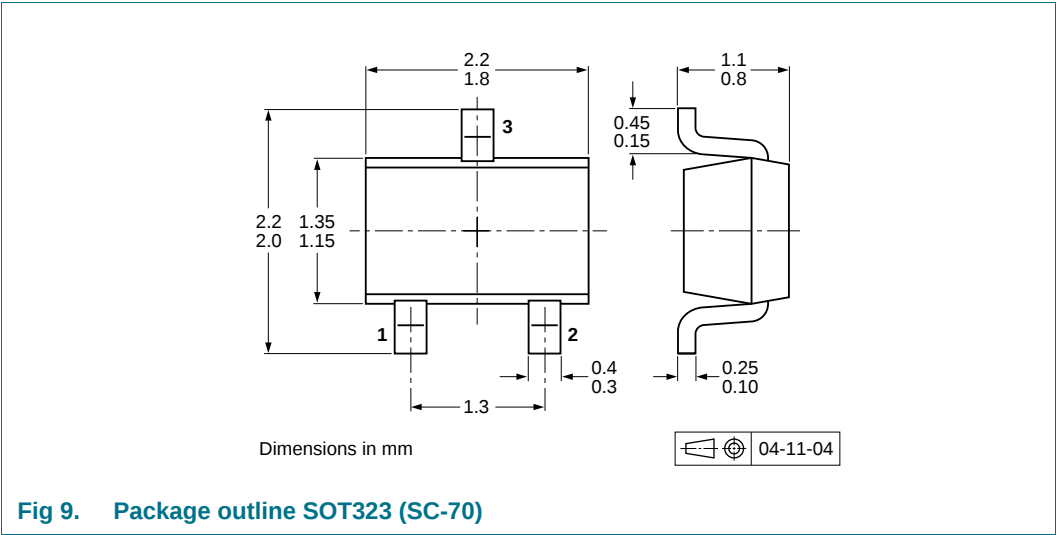
1. Place the device as close to the input terminal or connector as possible.
2. Minimize the path length between the device and the protected line.
3. Keep parallel signal paths to a minimum.
4. Avoid running protected conductors in parallel with unprotected conductors.
5. Minimize all Printed-Circuit 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. Use ground planes whenever possible. For multilayer PCBs, use ground vias.

## 8. Test information

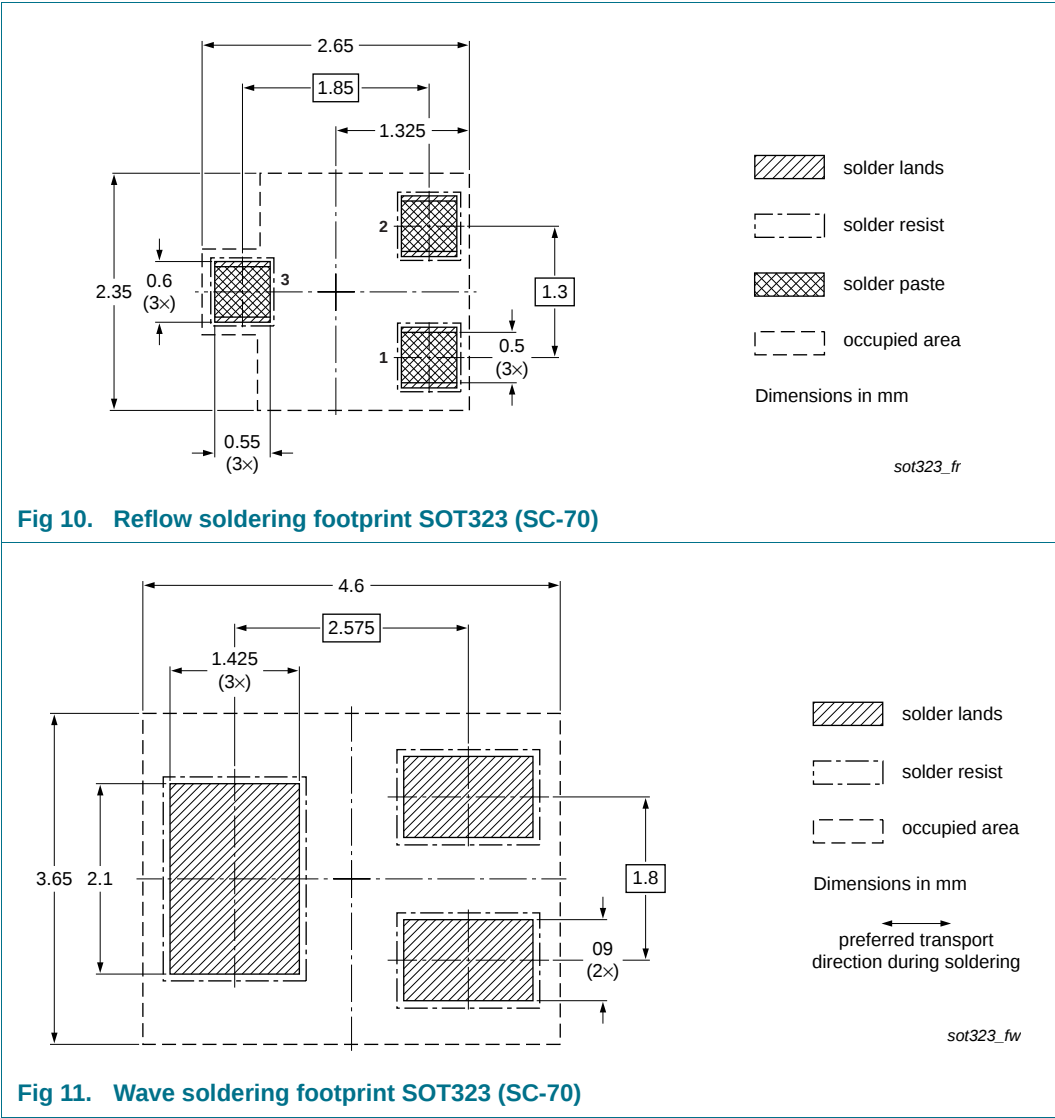
### 8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

9. Package outline



10. Soldering



## 11. Revision history

Table 9. Revision history

| Document ID    | Release date | Data sheet status  | Change notice | Supersedes |
|----------------|--------------|--------------------|---------------|------------|
| PESD1CAN-U v.1 | 20130327     | Product data sheet | -             | -          |

## 12. Legal information

### 12.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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.                                     |

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