



# PESD2CANFD27V-U

ESD protection for In-vehicle networks

11 August 2020

Product data sheet

## 1. General description

ESD protection device in a small SOT323 (SC-70) Surface-Mounted Device (SMD) plastic package designed to protect two automotive In-vehicle network bus lines from the damage caused by ElectroStatic discharge (ESD) and other transients

## 2. Features and benefits

- Reverse stand-off voltage:  $V_{RWM} = 27\text{ V}$
- Low clamping voltage:  $V_{CL} = 33\text{ V}$  at  $I_{PP} = 1\text{ A}$
- ESD protection up to 20 kV (IEC 61000-4-2)
- Low capacitance:  $C_d = 6\text{ pF}$
- ESD protection up to 20 kV (ISO 10605;  $C = 150\text{ pF}$ ;  $R = 330\ \Omega$ )
- High temperature capability:  $T_j = 175\text{ }^\circ\text{C}$
- AEC-Q101 qualified

## 3. Applications

ESD protection for In-vehicle network lines in automotive environments

- CAN-FD
- CAN
- FlexRay
- SENT

## 4. Quick reference data

Table 1. Quick reference data

| Symbol    | Parameter                | Conditions  |         | Min | Typ | Max | Unit |
|-----------|--------------------------|---|---------|-----|-----|-----|------|
| $V_{RWM}$ | reverse standoff voltage | $T_{amb} = 25\text{ }^\circ\text{C}$  |         | -   | -   | 27  | V    |
| $I_{PPM}$ | rated peak pulse current | $t_p = 8/20\ \mu\text{s}$   | [1] [2] | -   | -   | 2.5 | A    |
| $V_{CL}$  | clamping voltage         | $I_{PPM} = 1\text{ A}$ ; $t_p = 8/20\ \mu\text{s}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ | [3] [2] | -   | 33  | 44  | V    |

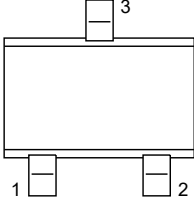
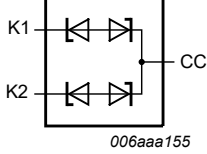
[1] According to IEC 61000-4-5.

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

[3] Device stressed with 8/20  $\mu\text{s}$  exponential decay waveform according to IEC 61000-4-5.

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description       | Simplified outline  | Graphic symbol  |
|-----|--------|-------------------|---|---|
| 1   | K1     | cathode (diode 1) |  <p>SC-70 (SOT323)</p> |  |
| 2   | K2     | cathode (diode 2) |   |   |
| 3   | CC     | common cathode    |   |   |

## 6. Ordering information

Table 3. Ordering information

| Type number     | Package |  |         |
|-----------------|---------|--|---------|
|                 | Name    | Description  | Version |
| PESD2CANFD27V-U | SC-70   | plastic, surface-mounted package; 3 leads; 1.3 mm pitch; 2 mm x 1.25 mm x 0.95 mm body | SOT323  |

## 7. Marking

Table 4. Marking codes

| Type number     | Marking code[1] |
|-----------------|-----------------|
| PESD2CANFD27V-U | Z3%             |

[1] % = placeholder for manufacturing site code

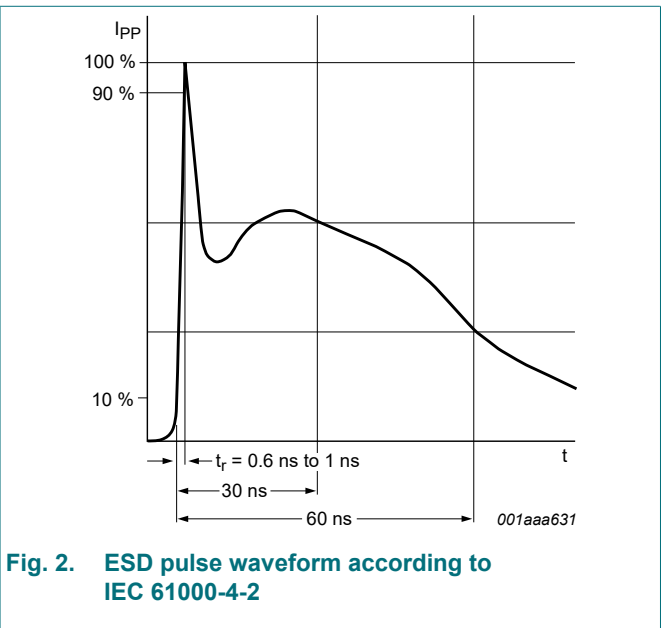
## 8. Limiting values

**Table 5. Limiting values**

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

| Symbol                     | Parameter                       | Conditions   |         | Min | Max | Unit |
|----------------------------|---------------------------------|--|---------|-----|-----|------|
| $I_{PPM}$                  | rated peak pulse current        | $t_p = 8/20 \mu s$   | [1] [2] | -   | 2.5 | A    |
| $T_j$                      | junction temperature            |  |         | -   | 175 | °C   |
| $T_{amb}$                  | ambient temperature             |  |         | -55 | 175 | °C   |
| $T_{stg}$                  | storage temperature             |  |         | -65 | 175 | °C   |
| <b>ESD maximum ratings</b> |                                 |  |         |     |     |      |
| $V_{ESD}$                  | electrostatic discharge voltage | IEC 61000-4-2; contact discharge                           | [2] [3] | -   | 20  | kV   |
|                            |                                 | ISO 10605; contact discharge; C = 330 pF, R = 330 $\Omega$ | [2] [3] | -   | 17  | kV   |
|                            |                                 | ISO 10605; contact discharge; C = 150 pF, R = 330 $\Omega$ | [2] [3] | -   | 20  | kV   |

- [1] According to IEC 61000-4-5.
- [2] Measured from pin 1 or 2 to pin 3.
- [3] Device stressed with ten non-repetitive ESD pulses.



### 9. Characteristics

Table 6. Characteristics

| Symbol           | Parameter                  | Conditions  |         | Min | Typ | Max | Unit     |
|------------------|----------------------------|---|---------|-----|-----|-----|----------|
| $V_{RWM}$        | reverse standoff voltage   | $T_{amb} = 25\text{ }^{\circ}\text{C}$  |         | -   | -   | 27  | V        |
| $V_{BR}$         | breakdown voltage          | $I_R = 10\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$                                  | [1]     | 28  | -   | 38  | V        |
| $I_{RM}$         | reverse leakage current    | $V_{RWM} = 27\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$                               | [1]     | -   | 1   | 50  | nA       |
| $C_d$            | diode capacitance          | $f = 1\text{ MHz}; V_R = 2.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$                | [1]     | -   | 5.2 | 6   | pF       |
|                  |                            | $f = 1\text{ MHz}; V_R = -2.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$               | [1]     | -   | 5.2 | 6   | pF       |
| $\Delta C_d/C_d$ | diode capacitance matching | $f = 1\text{ MHz}; V_R = 2.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$                | [2]     | -   | 0.5 | -   | %        |
|                  |                            | $f = 1\text{ MHz}; V_R = -2.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$               | [2]     | -   | 0.5 | -   | %        |
| $V_{CL}$         | clamping voltage           | $I_{PPM} = 1\text{ A}; t_p = 8/20\text{ }\mu\text{s}; T_{amb} = 25\text{ }^{\circ}\text{C}$ | [3] [1] | -   | 33  | 44  | V        |
| $R_{dyn}$        | dynamic resistance         | $I_R = 10\text{ A}; T_{amb} = 25\text{ }^{\circ}\text{C}$                                   | [4] [1] | -   | 0.8 | -   | $\Omega$ |

- [1] Measured from pin 1 or 2 to pin 3.
- [2]  $\Delta C_d$  is the difference of the capacitance measured between pin 1 and pin 3 and the capacitance measured between pin 2 and pin 3.
- [3] Device stressed with 8/20  $\mu\text{s}$  exponential decay waveform according to IEC 61000-4-5.
- [4] Non-repetitive current pulse, Transmission Line Pulse (TLP); square pulse; ANSI / ESD STM5.5.1-2008

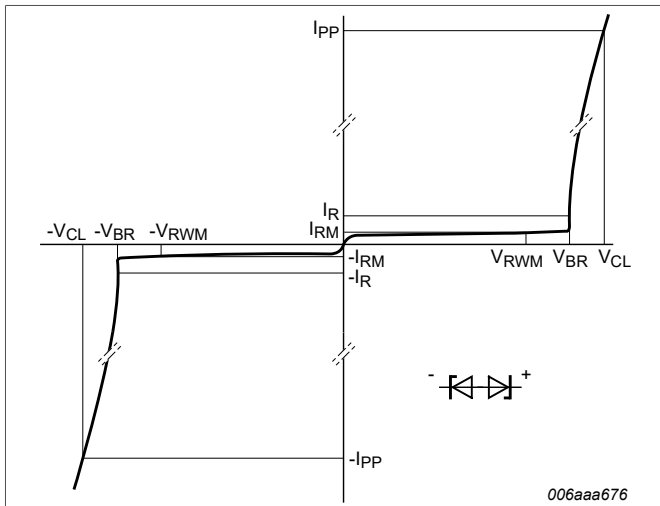


Fig. 3. V-I characteristics for a bidirectional ESD protection diode

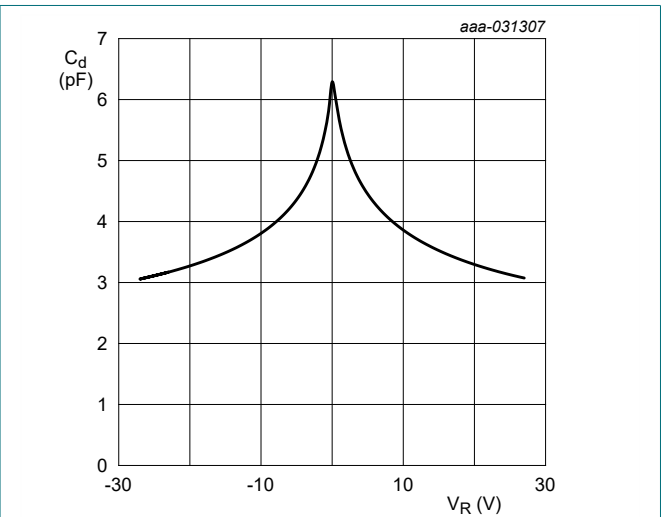
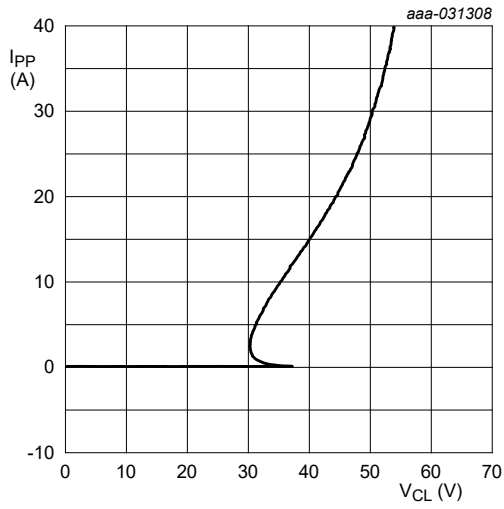
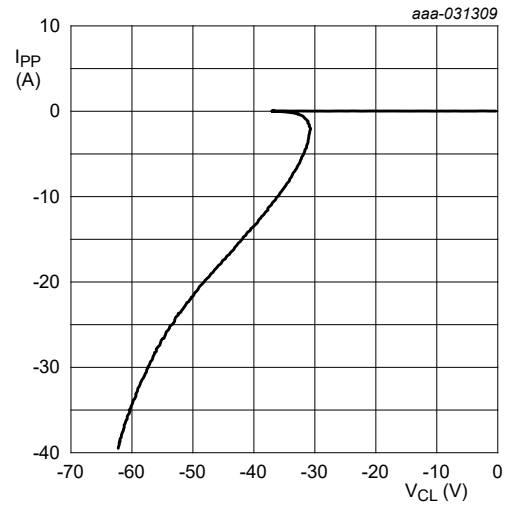


Fig. 4. Diode capacitance as a function of reverse voltage; typical values



$t_p = 100$  ns; Transmission Line Pulse (TLP)

Fig. 5. Positive clamping voltage (TLP); typical values



$t_p = 100$  ns; Transmission Line Pulse (TLP)

Fig. 6. Negative clamping voltage (TLP); typical values

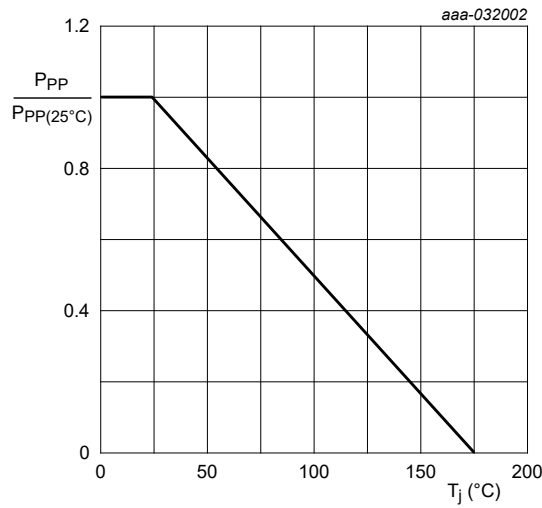


Fig. 7. Relative variation of peak pulse power as a function of junction temperature; typical values



Fig. 8. ESD clamping test setup and waveforms

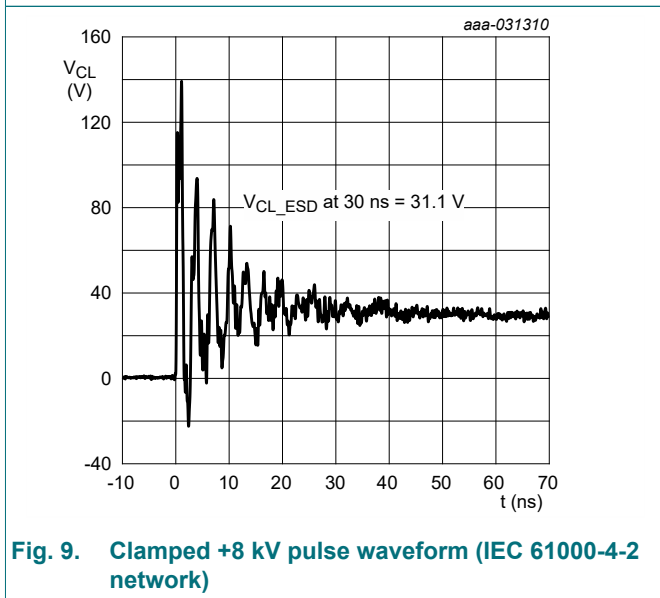


Fig. 9. Clamped +8 kV pulse waveform (IEC 61000-4-2 network)

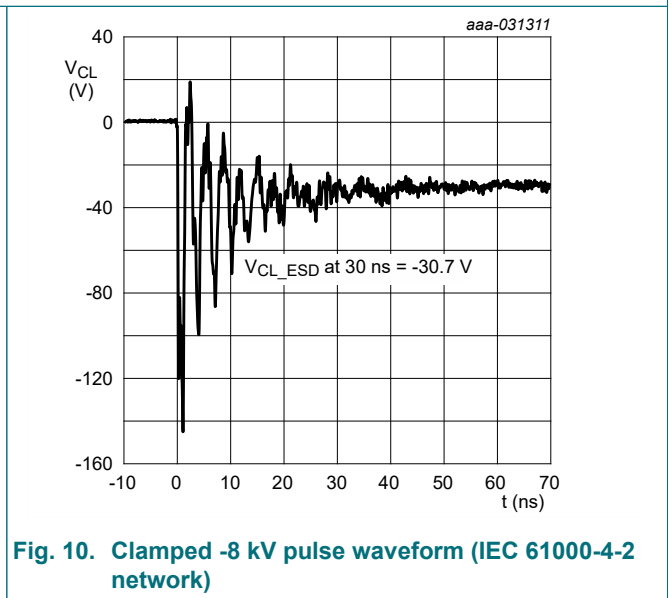


Fig. 10. Clamped -8 kV pulse waveform (IEC 61000-4-2 network)

## 10. Application information

The device is designed for the protection of two automotive in-vehicle bus lines, e.g. CAN (FD), from the damage caused by ESD and surge pulses.

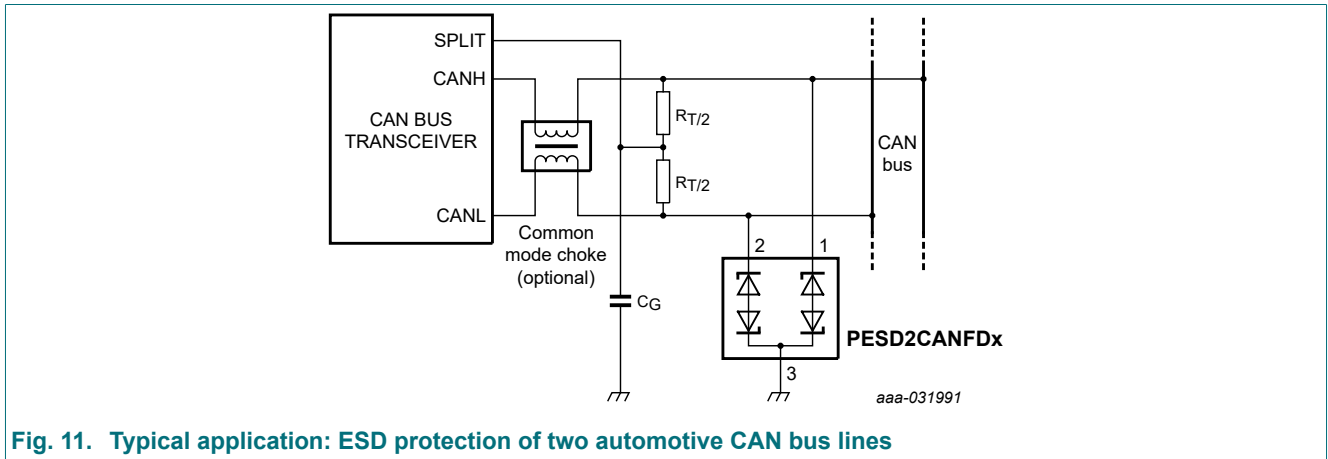


Fig. 11. Typical application: ESD protection of two automotive CAN bus lines

### 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 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.

## 11. Test information

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### 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.



## 12. Package outline

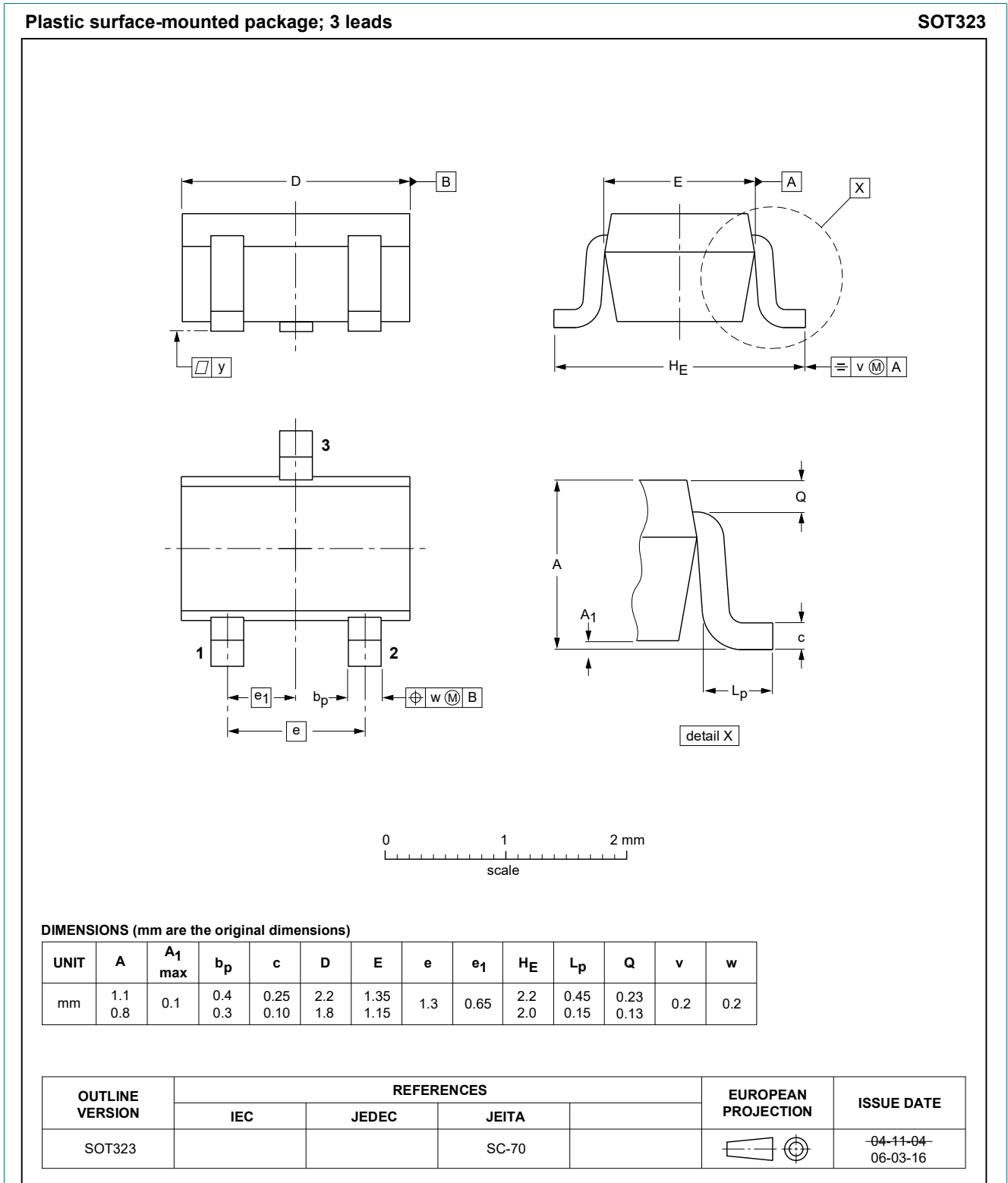


Fig. 12. Package outline SC-70 (SOT323)

### 13. Soldering

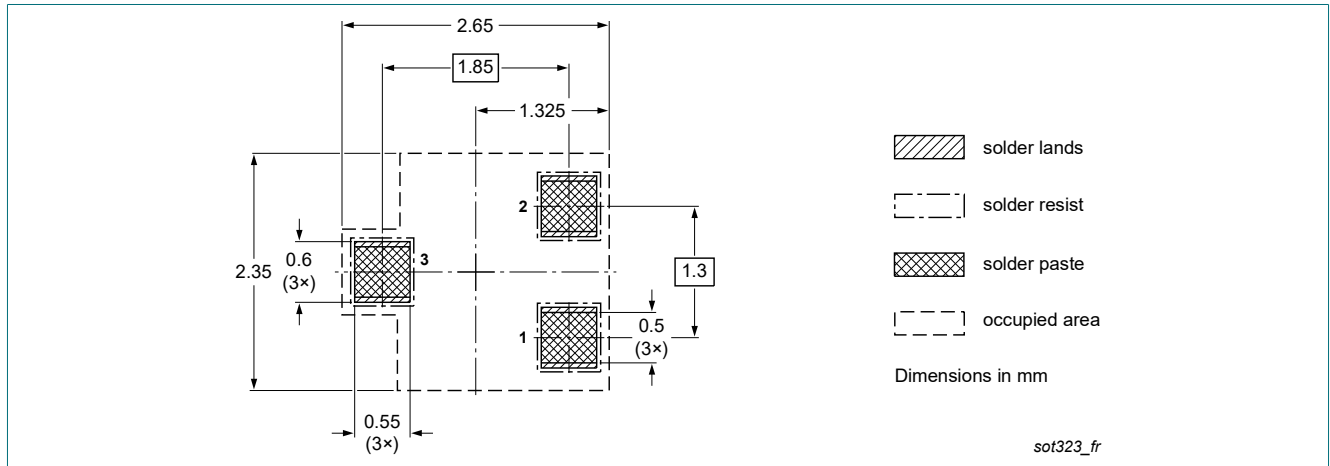


Fig. 13. Reflow soldering footprint for SC-70 (SOT323)

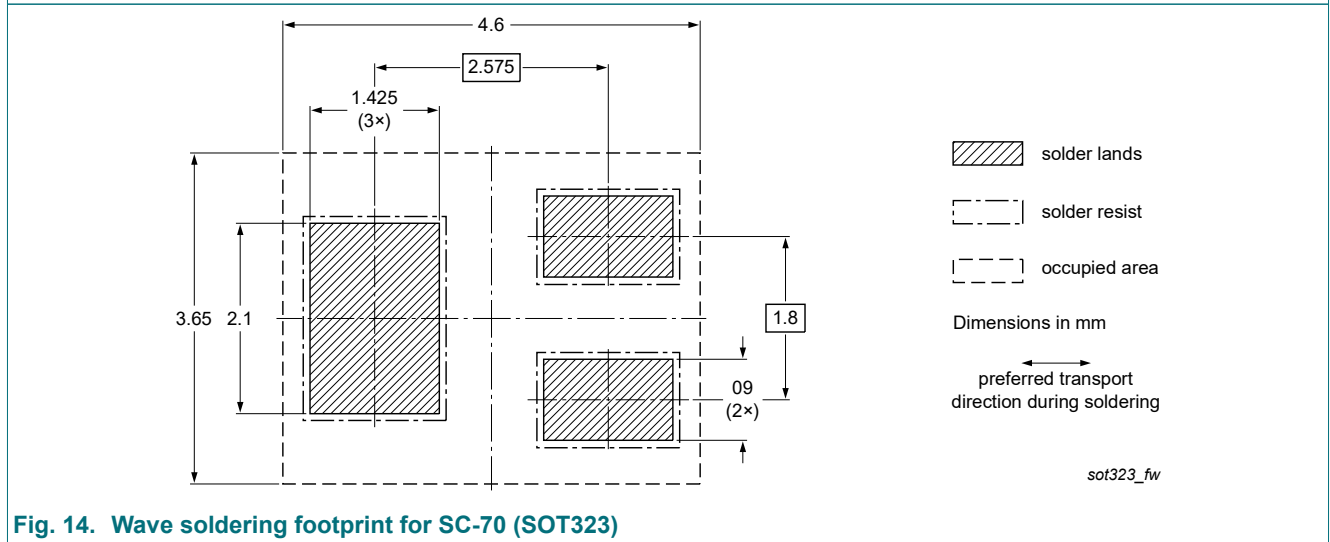


Fig. 14. Wave soldering footprint for SC-70 (SOT323)

## 14. Revision history

**Table 7. Revision history**

| Data sheet ID       | Release date   | Data sheet status    | Change notice | Supersedes          |
|---------------------|--|----------------------|---------------|---------------------|
| PESD2CANFD27V-U v.3 | 20200811   | Product data sheet   | -             | PESD2CANFD27V-U v.2 |
| Modifications:      | <ul style="list-style-type: none"><li>• Chapter "Features and benefits": Description adapted.</li><li>• Chapter "Characteristics": Corrected Fig. 7 to match the temperature range.</li><li>• Chapter "Application information" added.</li></ul> |                      |               |                     |
| PESD2CANFD27V-U v.2 | 20200416   | Product data sheet   | -             | PESD2CANFD27V-U v.1 |
| PESD2CANFD27V-U v.1 | 20190801   | Objective data sheet | -             | -                   |

## 15. Legal information

### Data sheet status

| Document status [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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