# PTVS24VU1UPA

## 300 W Transient Voltage Suppressor

27 June 2017 Product data sheet

## 1. General description

300 W unidirectional Transient Voltage Suppressor (TVS) in a DFN2020-3 (SOT1061) leadless medium power Surface-Mounted Device (SMD) plastic package, designed for transient overvoltage protection.

## 2. Features and benefits

- Unidirectional protection of one line
- Reverse standoff voltage range: $V_{RWM}$ = 24 V
- Surge current for 8/20 µs pulse: $I_{PPM}$ = 79 A (rated) / $I_{PP}$ = 100 A (average measured)
- Surge current for 10/1000 µs pulse: $I_{PPM}$ = 7.7 A (rated) / $I_{PP}$ = 9.3 A (average measured)
- Reverse current: $I_{RM}$ = 1 nA
- Very low package height: 0.65 mm
- AEC-Q101 qualified

## 3. Applications

- Power supply protection
- Industrial applications
- Power management

## 4. Quick reference data

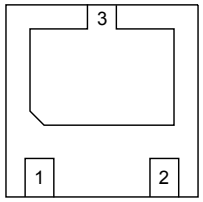
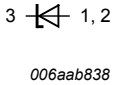
**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RWM}$ | reverse standoff voltage | $T_{amb}$ = 25 °C | | - | - | 24 | V |
| $I_{PPM}$ | rated peak pulse current | $t_p$ = 8/20 µs | [1] [2] | - | - | 79 | A |
| | | $t_p$ = 10/1000 µs | [3] [2] | - | - | 7.7 | A |

[1] In accordance with IEC 61000-4-5 (8/20 µs current waveform).
[2] Measured from pin 1 and 2 to pin 3.
[3] In accordance with IEC 61643-321 (10/1000 µs current waveform).

## 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | A | anode |   Transparent top view **DFN2020-3 (SOT1061)** |   *006aab838* |
| 2 | A | anode | | |
| 3 | K | cathode | | |

## 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PTVS24VU1UPA | DFN2020-3 | plastic, thermal enhanced ultra thin small outline package; 3 terminals; 1.3 mm pitch; 2 mm x 2 mm x 0.65 mm body | SOT1061 |

## 7. Marking

**Table 4. Marking codes**

| Type number | Marking code |
|---|---|
| PTVS24VU1UPA | D6 |

## 8. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| $P_{PPM}$ | rated peak pulse power | $t_p$ = 8/20 µs | [1] [2] | - | 3500 | W |
| | | $t_p$ = 10/1000 µs | [3] [2] | - | 300 | W |
| $I_{PPM}$ | rated peak pulse current | $t_p$ = 8/20 µs | [1] [2] | - | 79 | A |
| | | $t_p$ = 10/1000 µs | [3] [2] | - | 7.7 | A |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | -55 | 150 | °C |
| $T_{stg}$ | storage temperature | | | -65 | 150 | °C |

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| **ESD maximum ratings** | | | | | | |
| $V_{ESD}$ | electrostatic discharge voltage | IEC 61000-4-2; contact discharge | [4] | - | 30 | kV |
| | | IEC 61000-4-2; air discharge | [4] | - | 30 | kV |

[1] In accordance with IEC 61000-4-5 (8/20 µs current waveform).
[2] Measured from pin 1 and 2 to pin 3.
[3] In accordance with IEC 61643-321 (10/1000 µs current waveform).
[4] Device stressed with ten non-repetitive ESD pulses.

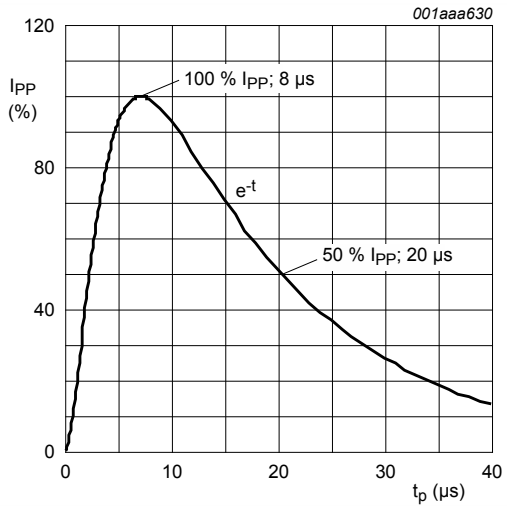



**Fig. 1. 8/20 µs pulse waveform according to IEC 61000-4-5**

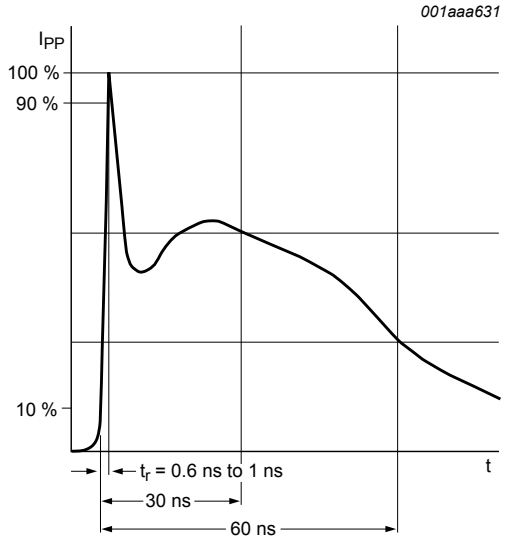



**Fig. 2. ESD pulse waveform according to IEC 61000-4-2**

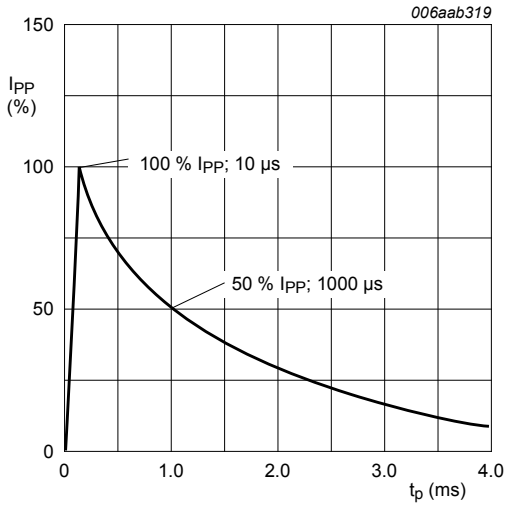



**Fig. 3. 10/1000 µs pulse waveform according to IEC 61643-321**

# 9. Characteristics

**Table 6. Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RWM}$ | reverse standoff voltage | $T_{amb}$ = 25 °C | | - | - | 24 | V |
| $V_{BR}$ | breakdown voltage | $I_R$ = 1 mA; $T_{amb}$ = 25 °C | | 26.7 | 28.1 | 29.5 | V |
| $I_{RM}$ | reverse leakage current | $V_R$ = 24 V; $T_{amb}$ = 25 °C | | - | 1 | 50 | nA |
| $C_d$ | diode capacitance | f = 1 MHz; $V_R$ = 0 V; $T_{amb}$ = 25 °C | | - | 650 | - | pF |
| $V_{CL}$ | clamping voltage | $I_{PPM}$ = 79 A; $t_p$ = 8/20 µs; $T_{amb}$ = 25 °C | [1] [2] | - | 38.5 | 44.2 | V |
| | | $I_{PPM}$ = 7.7 A; $t_p$ = 10/1000 µs; $T_{amb}$ = 25 °C | [3] [2] | - | - | 38.8 | V |

[1] In accordance with IEC 61000-4-5 (8/20 µs current waveform).
[2] Measured from pin 1 and 2 to pin 3.
[3] In accordance with IEC 61643-321 (10/1000 µs current waveform).

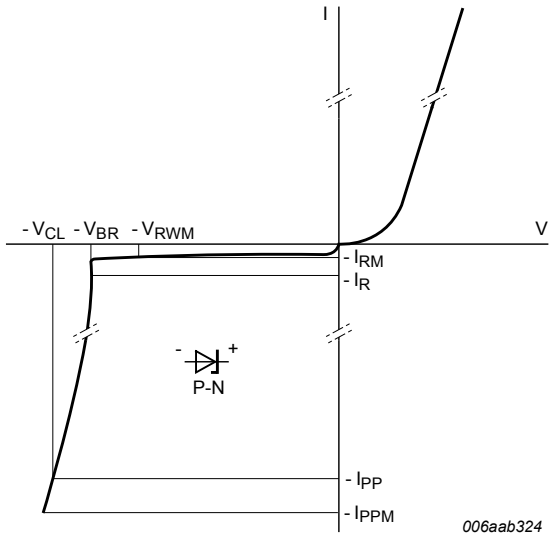



**Fig. 4. V-I characteristics for a unidirectional TVS protection diode**

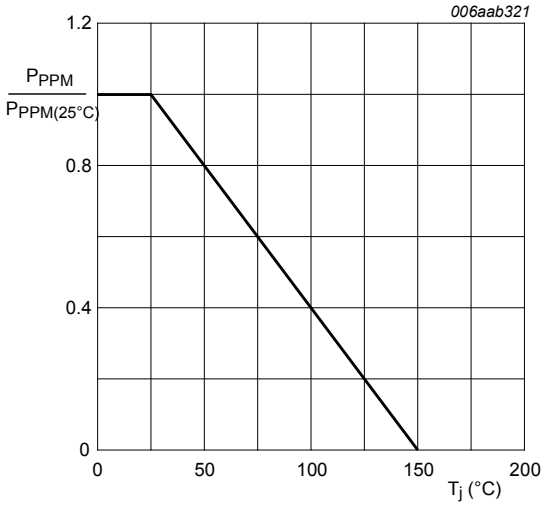
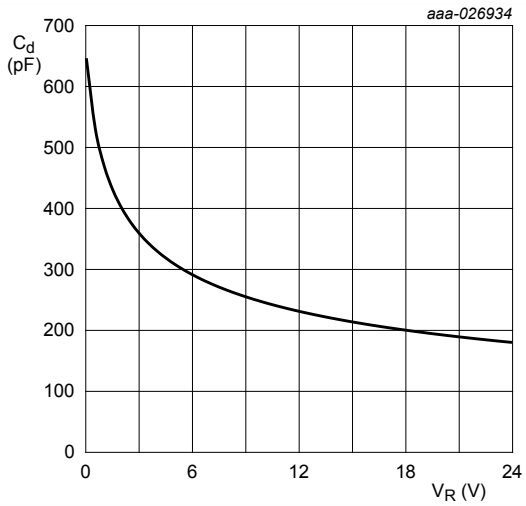



**Fig. 5. Relative variation of rated peak pulse power as a function of junction temperature; typical values**




f = 1 MHz; $T_{amb}$ = 25 °C

**Fig. 6. Diode capacitance as a function of reverse voltage; typical values**

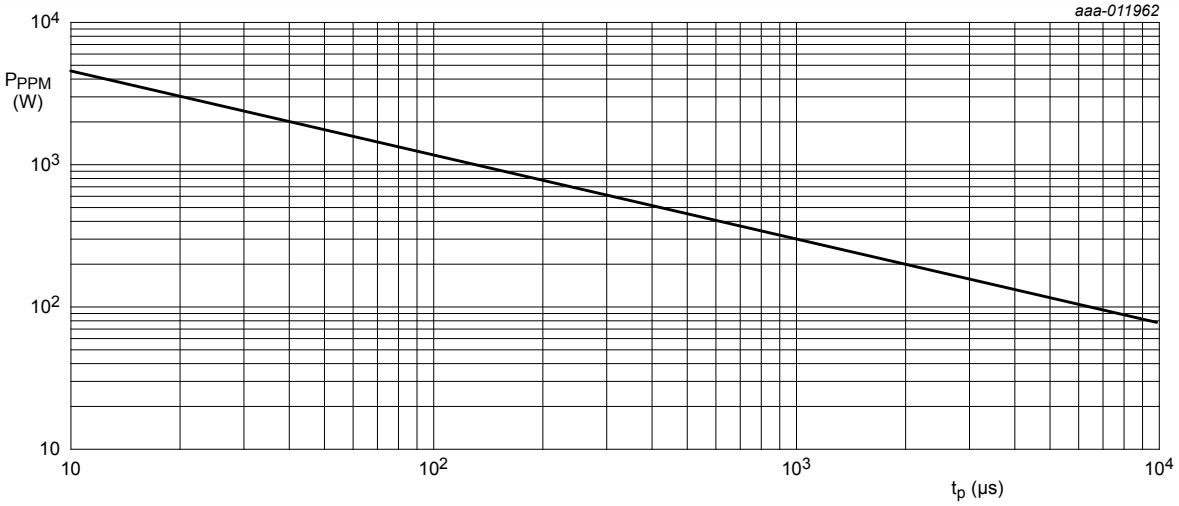
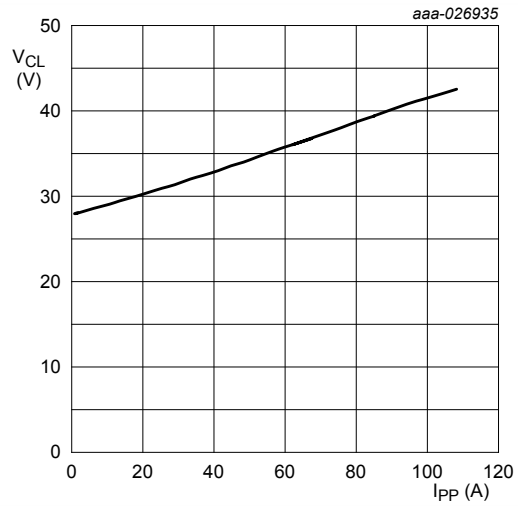
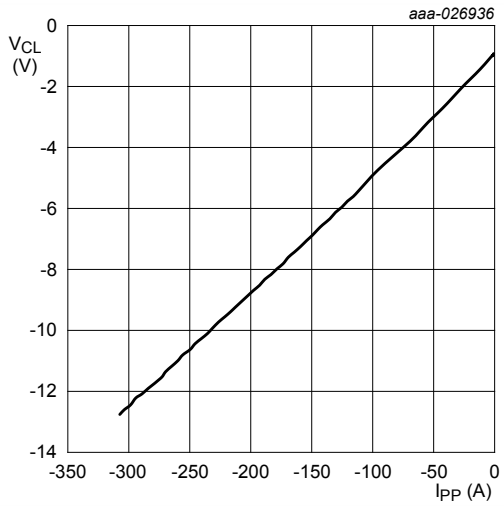



**Fig. 7. Rated peak pulse power as a function of a pulse duration; typical values**



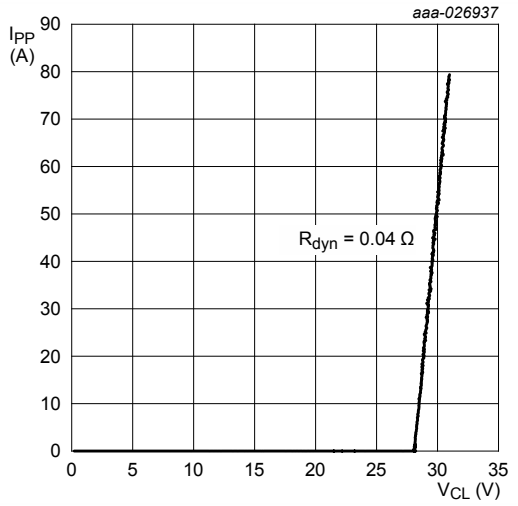

$t_p$ = 8/20 µs; according to IEC 61000-4-5

**Fig. 8. Positive clamping voltage (8/20 µs pulse); typical values**



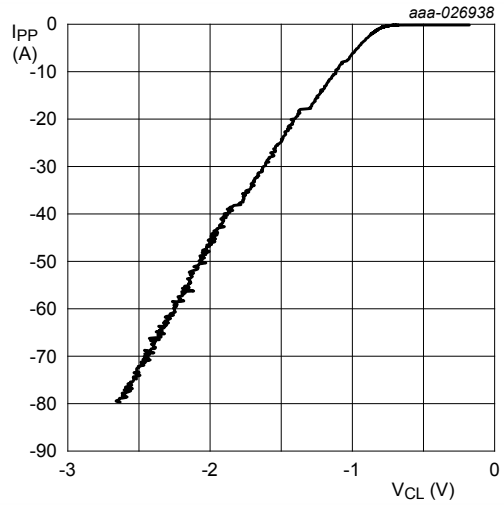

$t_p$ = 8/20 µs; according to IEC 61000-4-5

**Fig. 9. Negative clamping voltage (8/20 µs pulse); typical values**




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

**Fig. 10. Dynamic resistance with positive clamping voltage; typical value**




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

**Fig. 11. Dynamic resistance with negative clamping voltage; typical value**

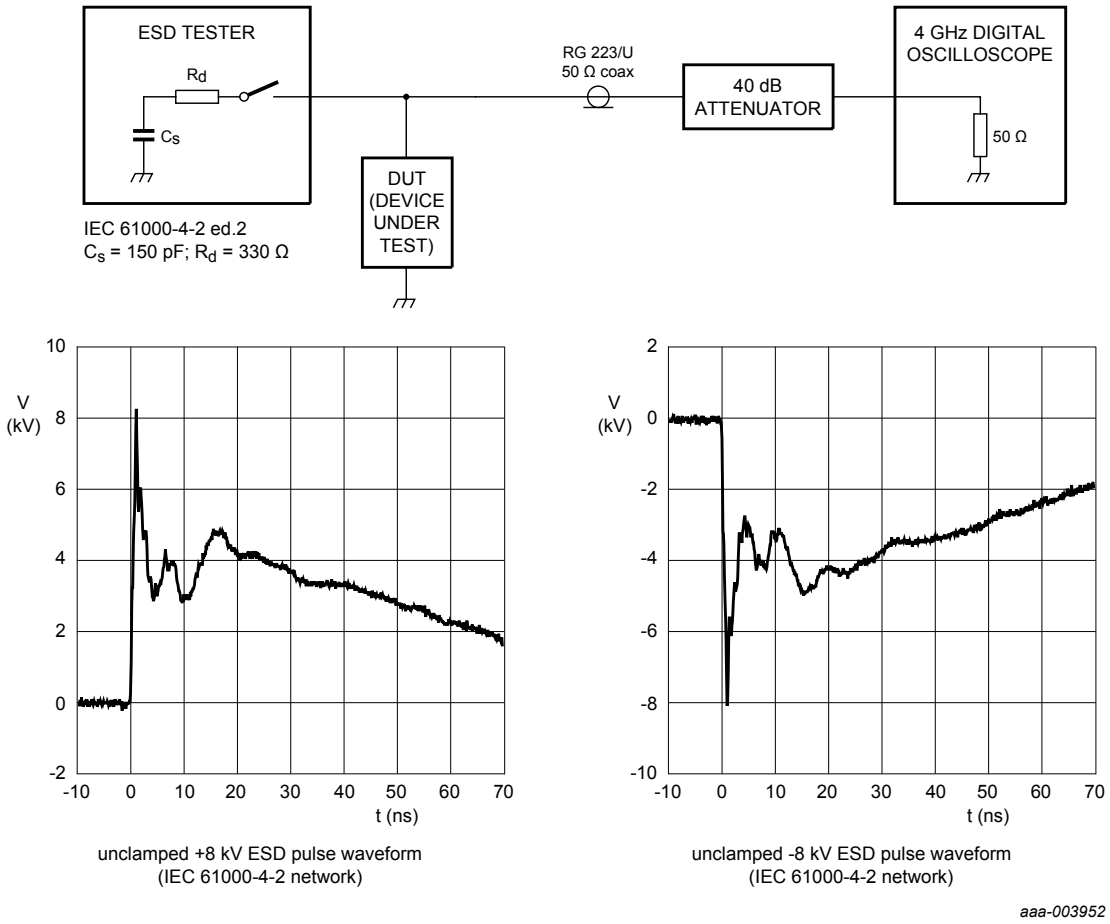



**Fig. 12. ESD clamping test setup and waveforms**

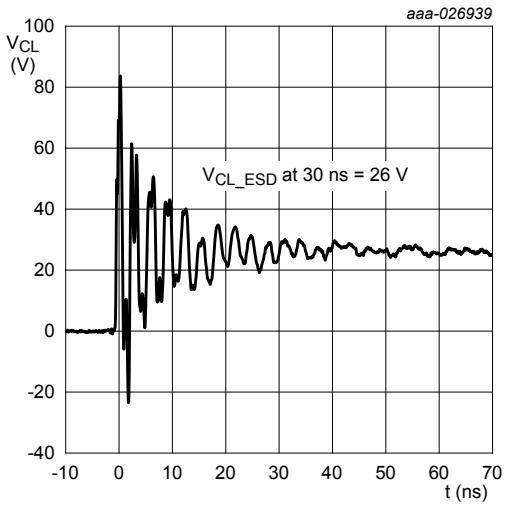



**Fig. 13. Clamped +8 kV pulse waveform (IEC 61000-4-2 network)**

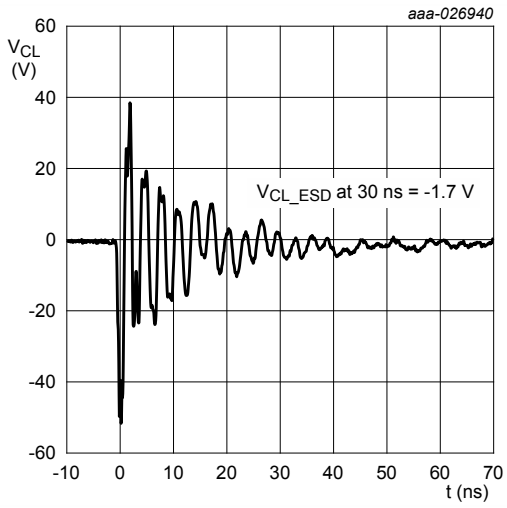



**Fig. 14. Clamped -8 kV pulse waveform (IEC 61000-4-2 network)**

# 10. Application information

The device is designed for the protection of one unidirectional data line from surge pulses and ESD damage. The device is suitable on lines where the signal polarities are either positive or negative with respect to ground.

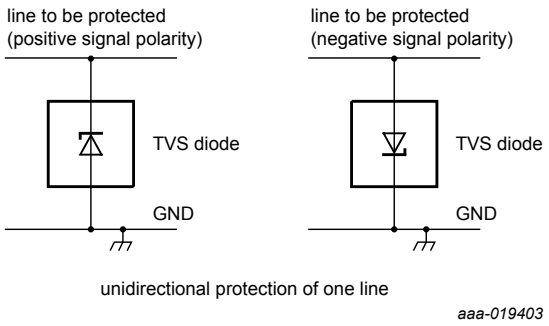



**Fig. 15. Application diagram**

**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.

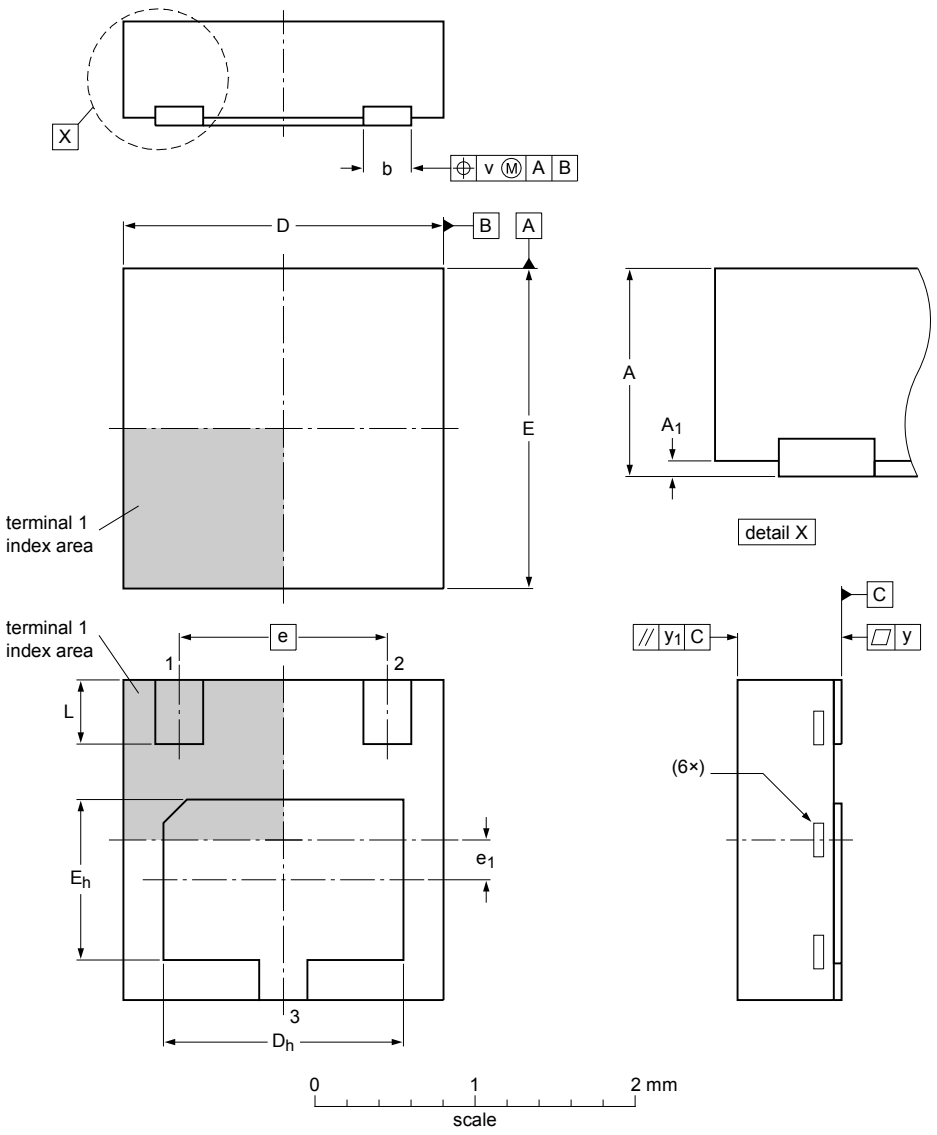
# 11. Test information

## 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

**HUSON3: plastic thermal enhanced ultra thin small outline package; no leads; 3 terminals; body 2 x 2 x 0.65 mm** **SOT1061**




Dimensions

| Unit | | A(1) | A1 | b | D | Dh | E | Eh | e | e1 | L | v | y | y1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 0.65 | 0.04 | 0.35 | 2.1 | 1.6 | 2.1 | 1.1 | | 0.3 | 0.45 | | | |
| | nom | | | | 2.0 | | 2.0 | | 1.3 | | | 0.1 | 0.05 | 0.05 |
| | min | | | 0.25 | 1.9 | 1.4 | 1.9 | 0.9 | | 0.2 | 0.35 | | | |

Note
1. Including plating thickness

sot1061_po

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1061 | | --- | | | | ~~08-02-04~~ 08-10-07 |

**Fig. 16. Package outline DFN2020-3 (SOT1061)**

## 13. Soldering

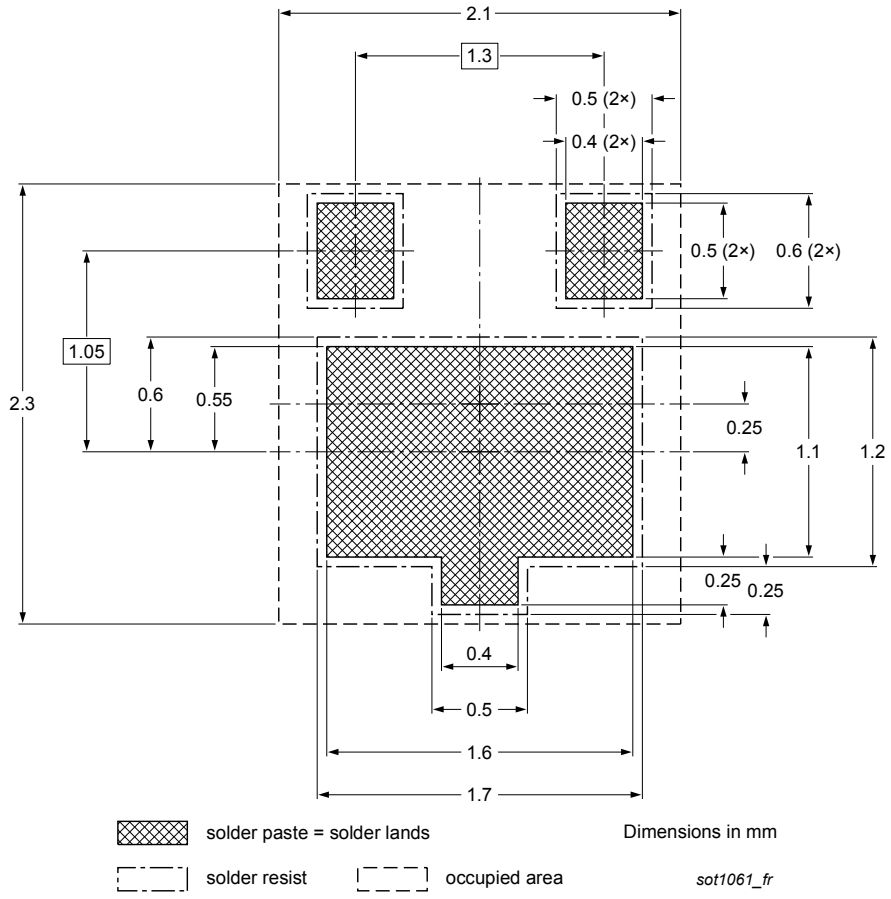



**Fig. 17. Reflow soldering footprint for DFN2020-3 (SOT1061)**

# 14. Revision history

**Table 7. Revision history**

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PTVS24VU1UPA v.1 | 20170627 | Product 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. |
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**Date of release: 27 June 2017**

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