



# PMZ950UPE

20 V, P-channel Trench MOSFET

10 July 2014

Product data sheet

## 1. General description

P-channel enhancement mode Field-Effect Transistor (FET) in a leadless ultra small DFN1006-3 (SOT883) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Trench MOSFET technology
- Leadless ultra small and ultra thin SMD plastic package: 1.0 × 0.6 × 0.48 mm
- ElectroStatic Discharge (ESD) protection > 1 kV HBM
- Drain-source on-state resistance  $R_{DSon} = 1.02 \Omega$

## 3. Applications

- Relay driver
- High-speed line driver
- High-side load switch
- Switching circuits

## 4. Quick reference data

Table 1. Quick reference data

| Symbol                        | Parameter                        | Conditions  | Min | Typ  | Max  | Unit     |
|-------------------------------|----------------------------------|---|-----|------|------|----------|
| $V_{DS}$                      | drain-source voltage             | $T_j = 25 \text{ }^\circ\text{C}$   | -   | -    | -20  | V        |
| $V_{GS}$                      | gate-source voltage              |   | -8  | -    | 8    | V        |
| $I_D$                         | drain current                    | $V_{GS} = -4.5 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$                    | [1] | -    | -500 | mA       |
| <b>Static characteristics</b> |                                  |   |     |      |      |          |
| $R_{DSon}$                    | drain-source on-state resistance | $V_{GS} = -4.5 \text{ V}; I_D = -500 \text{ mA}; T_j = 25 \text{ }^\circ\text{C}$ | -   | 1.02 | 1.4  | $\Omega$ |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 1 cm<sup>2</sup>.

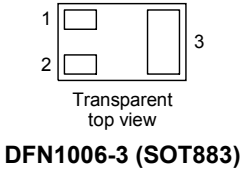
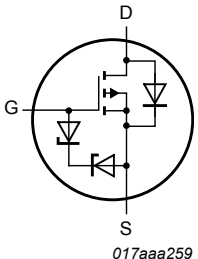


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## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline   | Graphic symbol   |
|-----|--------|-------------|--|--|
| 1   | G      | gate        |  <p>Transparent top view<br/>DFN1006-3 (SOT883)</p> |  <p>017aaa259</p> |
| 2   | S      | source      |  |  |
| 3   | D      | drain       |  |  |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package   |   |         |
|-------------|-----------|---|---------|
|             | Name      | Description   | Version |
| PMZ950UPE   | DFN1006-3 | DFN1006-3: leadless ultra small plastic package; 3 solder lands | SOT883  |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMZ950UPE   | ZT           |

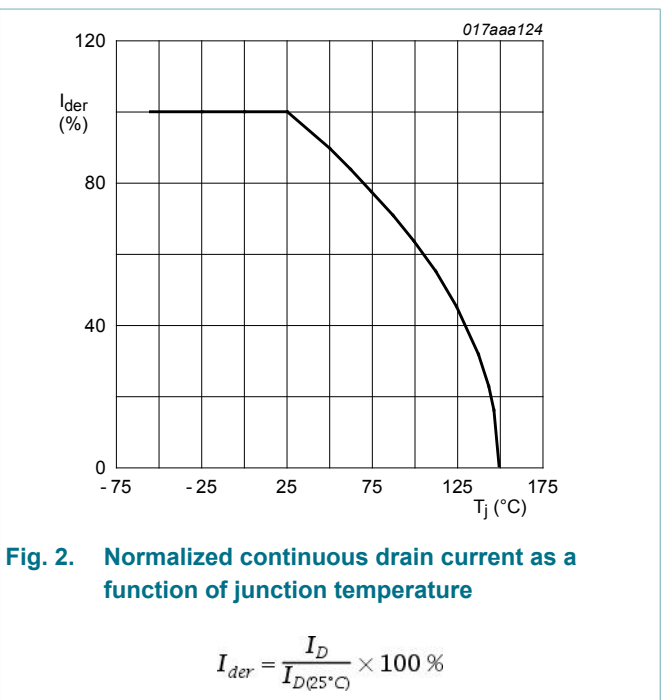
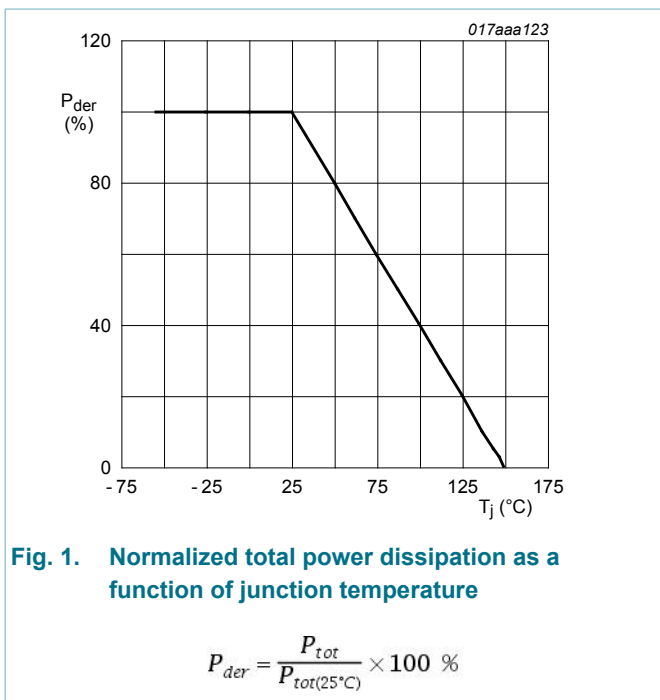
## 8. Limiting values

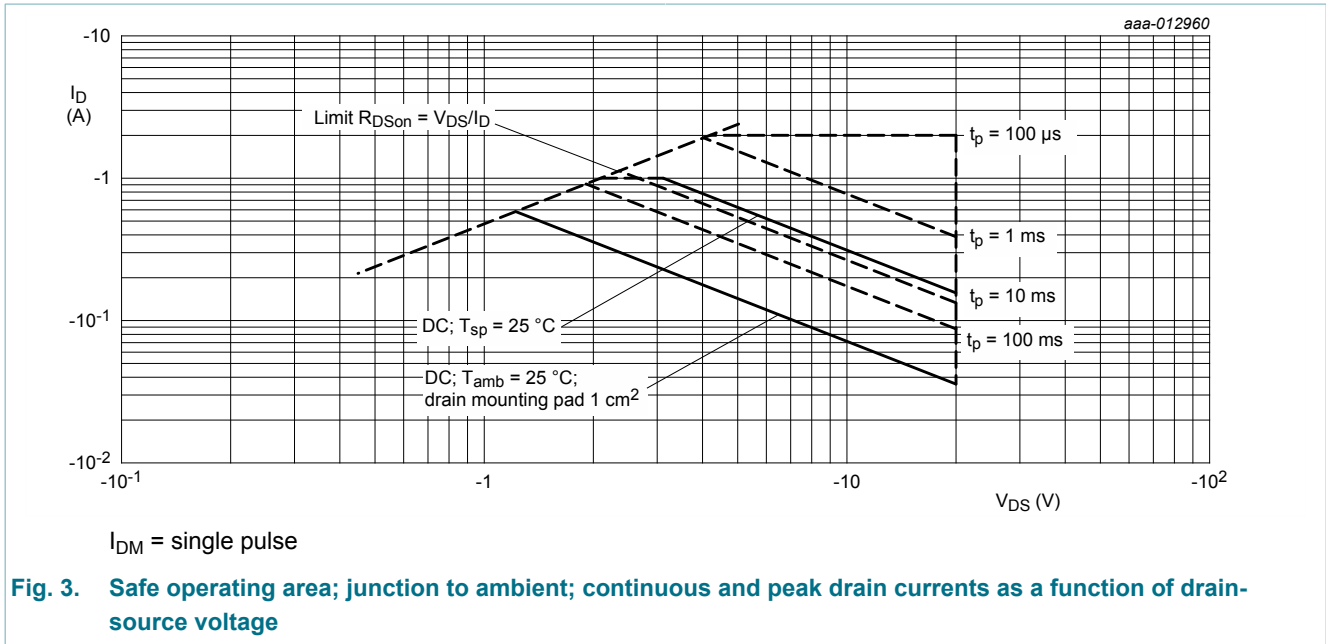
**Table 5. Limiting values**

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

| Symbol                    | Parameter               | Conditions   |     | Min | Max  | Unit |
|---------------------------|-------------------------|--|-----|-----|------|------|
| V <sub>DS</sub>           | drain-source voltage    | T <sub>j</sub> = 25 °C   |     | -   | -20  | V    |
| V <sub>GS</sub>           | gate-source voltage     |  |     | -8  | 8    | V    |
| I <sub>D</sub>            | drain current           | V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 25 °C             | [1] | -   | -500 | mA   |
|                           |                         | V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 100 °C            | [1] | -   | -300 | mA   |
| I <sub>DM</sub>           | peak drain current      | T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs |     | -   | -2   | A    |
| P <sub>tot</sub>          | total power dissipation | T <sub>amb</sub> = 25 °C                                       | [2] | -   | 360  | mW   |
|                           |                         |  | [1] | -   | 715  | mW   |
|                           |                         | T <sub>sp</sub> = 25 °C  |     | -   | 2700 | mW   |
| T <sub>j</sub>            | junction temperature    |  |     | -55 | 150  | °C   |
| T <sub>amb</sub>          | ambient temperature     |  |     | -55 | 150  | °C   |
| T <sub>stg</sub>          | storage temperature     |  |     | -65 | 150  | °C   |
| <b>Source-drain diode</b> |                         |  |     |     |      |      |
| I <sub>S</sub>            | source current          | T <sub>amb</sub> = 25 °C                                       | [1] | -   | -350 | mA   |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 1 cm<sup>2</sup>.
- [2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.





## 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter  | Conditions  |     | Min | Typ | Max | Unit |
|----------------|--|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air | [1] | -   | 305 | 360 | K/W  |
|                |  |             | [2] | -   | 150 | 175 | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |             |     | -   | -   | 40  | K/W  |

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain  $1 \text{ cm}^2$ .

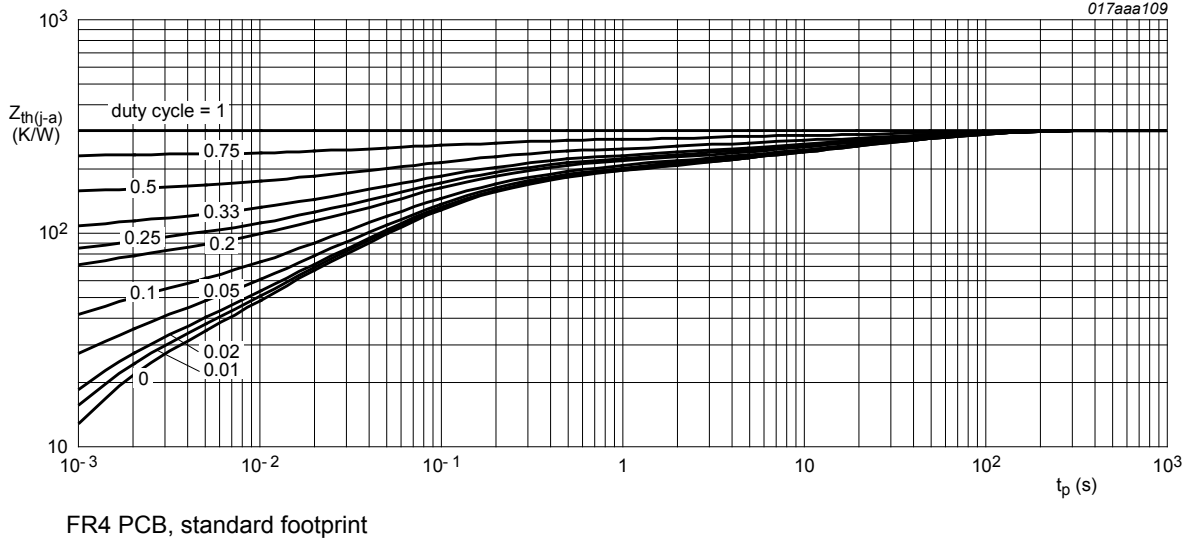


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

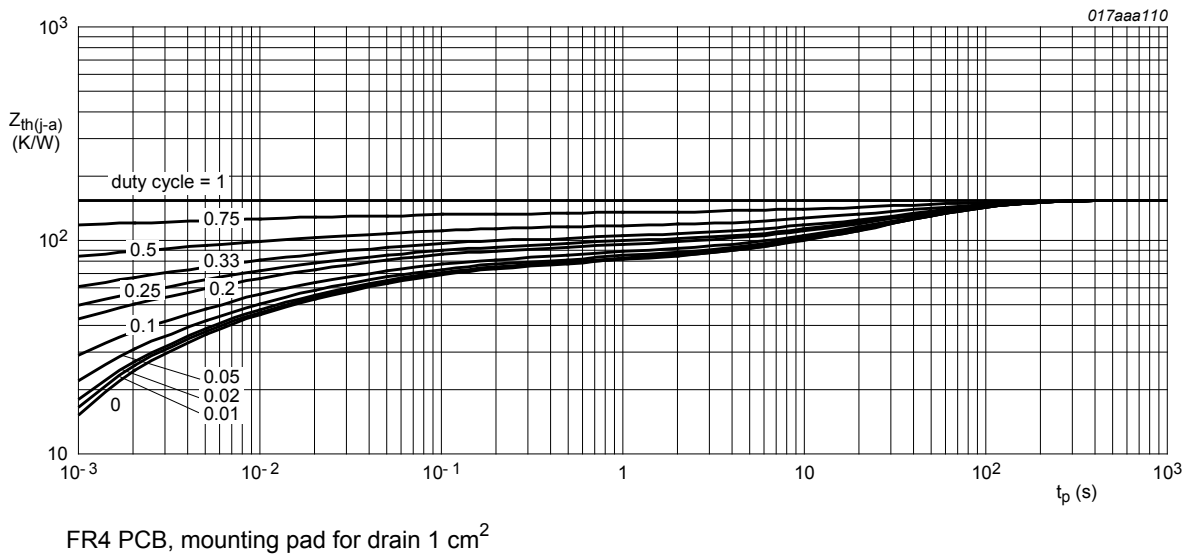
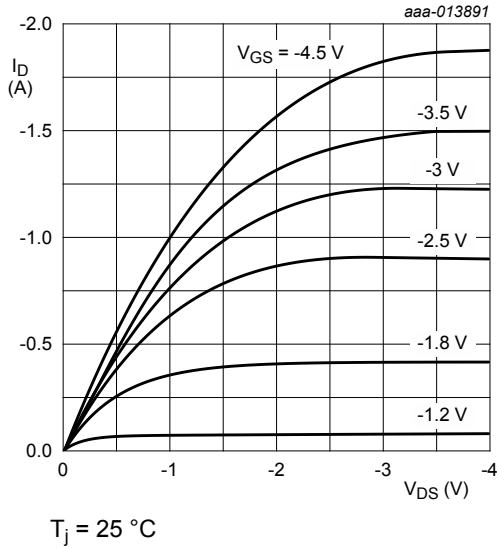


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

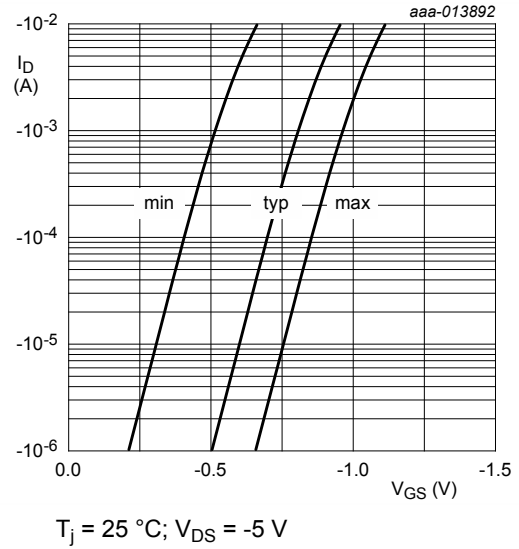
## 10. Characteristics

Table 7. Characteristics

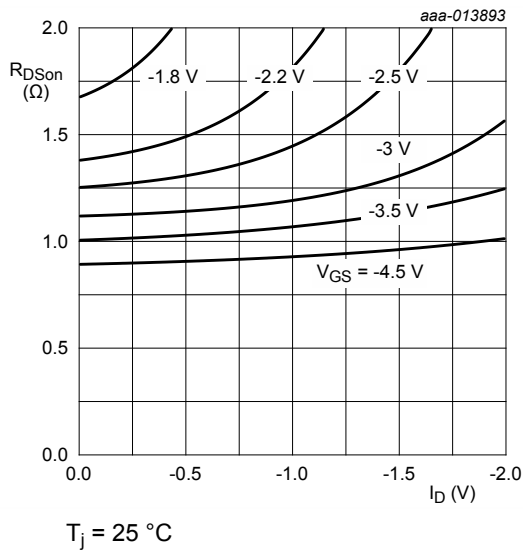
| Symbol                         | Parameter                        | Conditions   | Min   | Typ  | Max   | Unit     |
|--------------------------------|----------------------------------|--|-------|------|-------|----------|
| <b>Static characteristics</b>  |                                  |  |       |      |       |          |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage   | $I_D = -250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$  | -20   | -    | -     | V        |
| $V_{GSth}$                     | gate-source threshold voltage    | $I_D = -250 \mu A; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$   | -0.45 | -0.7 | -0.95 | V        |
| $I_{DSS}$                      | drain leakage current            | $V_{DS} = -20 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$  | -     | -    | -1    | $\mu A$  |
|                                |                                  | $V_{DS} = -20 V; V_{GS} = 0 V; T_j = 150 \text{ }^\circ C$   | -     | -    | -10   | $\mu A$  |
| $I_{GSS}$                      | gate leakage current             | $V_{GS} = 8 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$  | -     | -    | 10    | $\mu A$  |
|                                |                                  | $V_{GS} = -8 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$   | -     | -    | -10   | $\mu A$  |
|                                |                                  | $V_{GS} = -4.5 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$   | -     | -    | -1    | $\mu A$  |
|                                |                                  | $V_{GS} = 4.5 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$  | -     | -    | 1     | $\mu A$  |
| $R_{DSon}$                     | drain-source on-state resistance | $V_{GS} = -4.5 V; I_D = -500 \text{ mA}; T_j = 25 \text{ }^\circ C$  | -     | 1.02 | 1.4   | $\Omega$ |
|                                |                                  | $V_{GS} = -4.5 V; I_D = -500 \text{ mA}; T_j = 150 \text{ }^\circ C$   | -     | 1.54 | 2.1   | $\Omega$ |
|                                |                                  | $V_{GS} = -2.5 V; I_D = -200 \text{ mA}; T_j = 25 \text{ }^\circ C$  | -     | 1.27 | 2.2   | $\Omega$ |
|                                |                                  | $V_{GS} = -1.8 V; I_D = -40 \text{ mA}; T_j = 25 \text{ }^\circ C$   | -     | 1.7  | 3.3   | $\Omega$ |
|                                |                                  | $V_{GS} = -1.5 V; I_D = -10 \text{ mA}; T_j = 25 \text{ }^\circ C$   | -     | 2.3  | 5     | $\Omega$ |
|                                |                                  | $V_{GS} = -1.2 V; I_D = -1 \text{ mA}; T_j = 25 \text{ }^\circ C$  | -     | 3.5  | -     | $\Omega$ |
| $g_{fs}$                       | forward transconductance         | $V_{DS} = -10 V; I_D = -500 \text{ mA}; T_j = 25 \text{ }^\circ C$   | -     | 480  | -     | mS       |
| <b>Dynamic characteristics</b> |                                  |  |       |      |       |          |
| $Q_{G(tot)}$                   | total gate charge                | $V_{DS} = -10 V; I_D = -450 \text{ mA};$<br>$V_{GS} = -4.5 V; T_j = 25 \text{ }^\circ C$   | -     | 1.19 | 2.1   | nC       |
| $Q_{GS}$                       | gate-source charge               |  | -     | 0.17 | -     | nC       |
| $Q_{GD}$                       | gate-drain charge                |  | -     | 0.1  | -     | nC       |
| $C_{iss}$                      | input capacitance                | $V_{DS} = -10 V; f = 1 \text{ MHz}; V_{GS} = 0 V;$<br>$T_j = 25 \text{ }^\circ C$  | -     | 43   | -     | pF       |
| $C_{oss}$                      | output capacitance               |  | -     | 14   | -     | pF       |
| $C_{rss}$                      | reverse transfer capacitance     |  | -     | 8    | -     | pF       |
| $t_{d(on)}$                    | turn-on delay time               | $V_{DS} = -10 V; I_D = -0.45 \text{ A}; R_L = 22 \text{ } \Omega;$<br>$V_{GS} = -4.5 V; R_{G(ext)} = 6 \text{ } \Omega; T_j = 25 \text{ }^\circ C$ | -     | 2.3  | -     | ns       |
| $t_r$                          | rise time                        |  | -     | 5    | -     | ns       |
| $t_{d(off)}$                   | turn-off delay time              |  | -     | 13.5 | -     | ns       |
| $t_f$                          | fall time                        |  | -     | 6    | -     | ns       |
| <b>Source-drain diode</b>      |                                  |  |       |      |       |          |
| $V_{SD}$                       | source-drain voltage             | $I_S = -115 \text{ mA}; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$   | -     | -0.7 | -1.2  | V        |



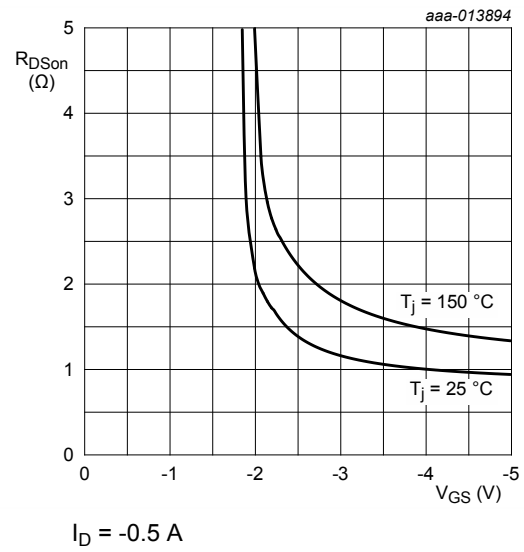
**Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



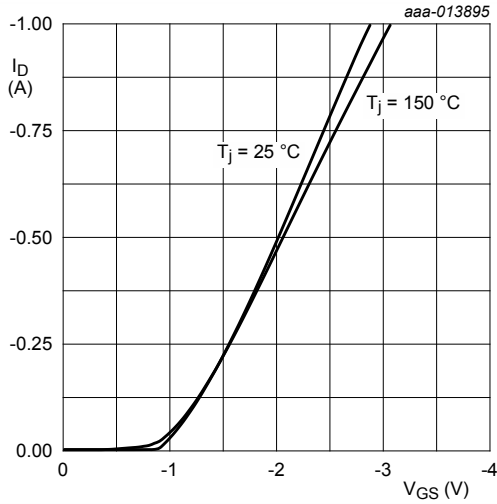
**Fig. 7. Sub-threshold drain current as a function of gate-source voltage**



**Fig. 8. Drain-source on-state resistance as a function of drain current; typical values**



**Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values**



$$V_{DS} > I_D \times R_{DS(on)}$$

Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

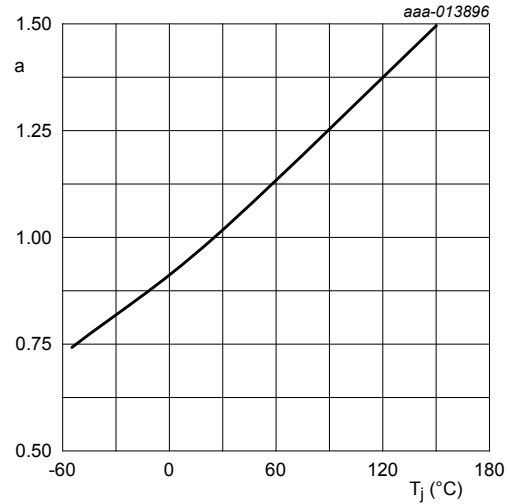
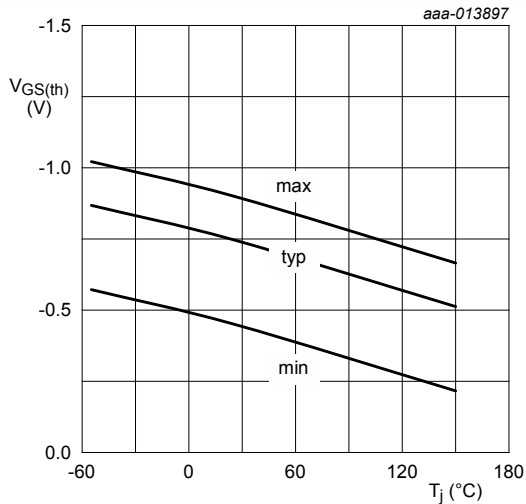


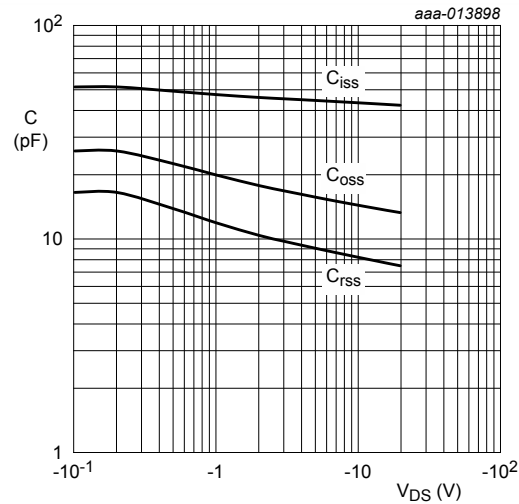
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ C)}}$$



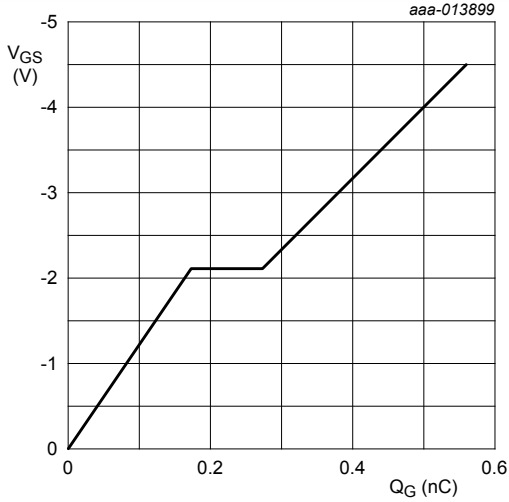
$$I_D = -0.25 \text{ mA}; V_{DS} = V_{GS}$$

Fig. 12. Gate-source threshold voltage as a function of junction temperature



$$f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}$$

Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$I_D = -0.45$  A;  $V_{DS} = -10$  V;  $T_{amb} = 25$  °C

Fig. 14. Gate-source voltage as a function of gate charge; typical values

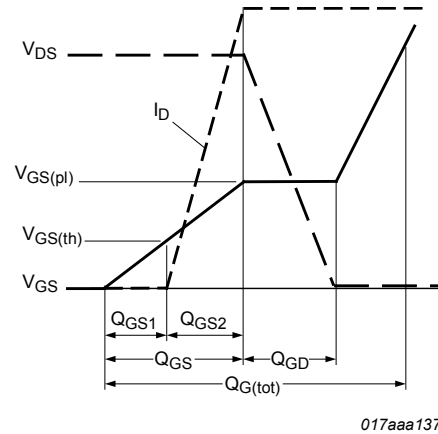
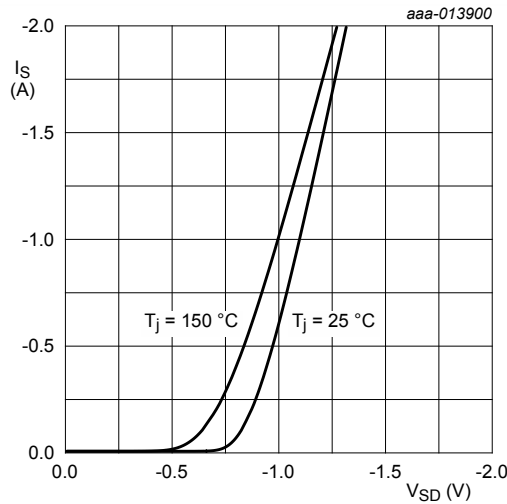


Fig. 15. MOSFET transistor: Gate charge waveform definitions



$V_{GS} = 0$  V

Fig. 16. Source current as a function of source-drain voltage; typical values

## 11. Test information

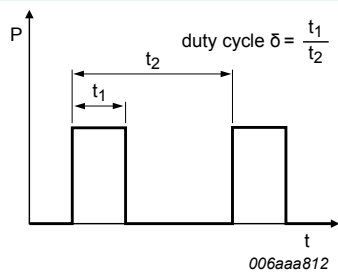
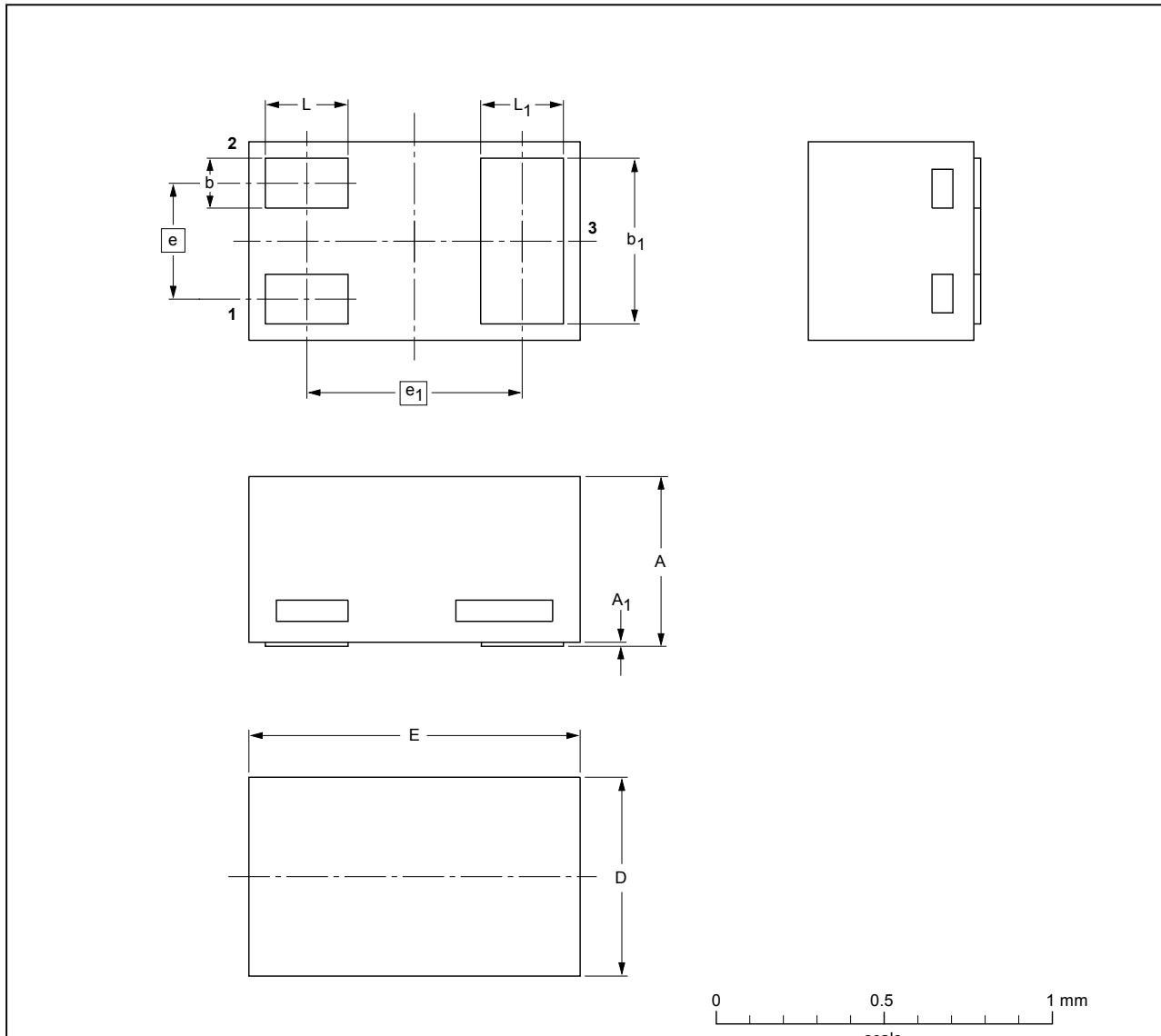


Fig. 17. Duty cycle definition

## 12. Package outline

Leadless ultra small plastic package; 3 solder lands; body 1.0 x 0.6 x 0.5 mm

SOT883



**DIMENSIONS** (mm are the original dimensions)

| UNIT | A <sup>(1)</sup> | A <sub>1</sub><br>max. | b            | b <sub>1</sub> | D            | E            | e    | e <sub>1</sub> | L            | L <sub>1</sub> |
|------|------------------|------------------------|--------------|----------------|--------------|--------------|------|----------------|--------------|----------------|
| mm   | 0.50<br>0.46     | 0.03                   | 0.20<br>0.12 | 0.55<br>0.47   | 0.62<br>0.55 | 1.02<br>0.95 | 0.35 | 0.65           | 0.30<br>0.22 | 0.30<br>0.22   |

**Note**

1. Including plating thickness

| OUTLINE<br>VERSION | REFERENCES |       |        |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|-------|--------|--|------------------------|----------------------|
|                    | IEC        | JEDEC | JEITA  |  |                        |                      |
| SOT883             |            |       | SC-101 |  |                        | 03-02-05<br>03-04-03 |

Fig. 18. Package outline DFN1006-3 (SOT883)

### 13. Soldering

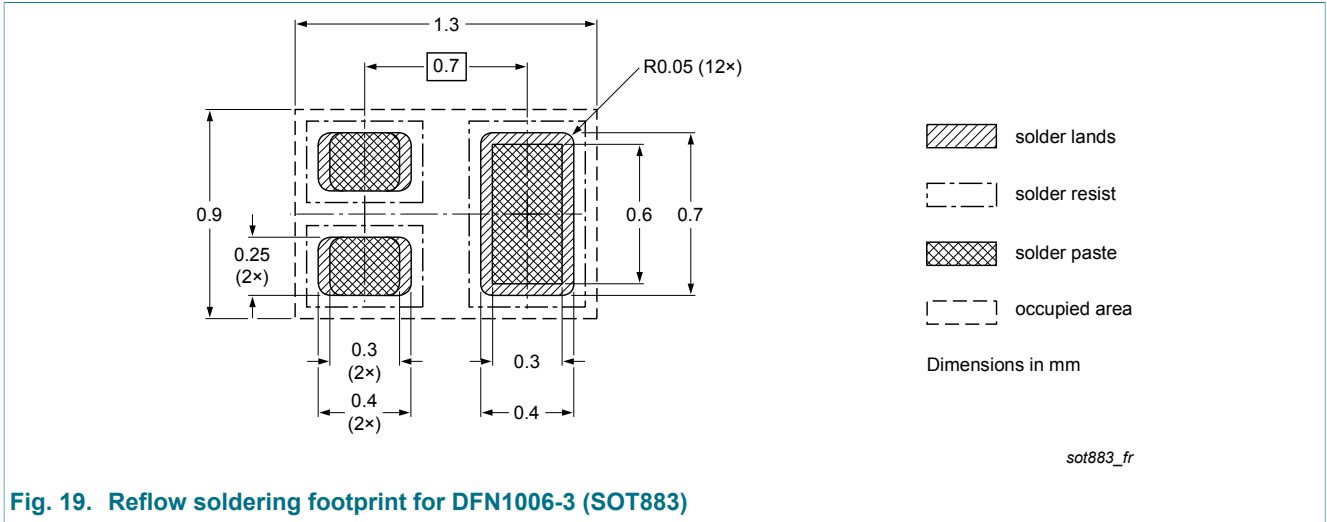


Fig. 19. Reflow soldering footprint for DFN1006-3 (SOT883)

## 14. Revision history

Table 8. Revision history

| Data sheet ID  | Release date   | Data sheet status  | Change notice | Supersedes    |
|----------------|--|--------------------|---------------|---------------|
| PMZ950UPE v.2  | 20140710   | Product data sheet | -             | PMZ950UPE v.1 |
| Modifications: | <ul style="list-style-type: none"><li>Editorial update of figures 6 - 14 and 16.</li></ul> |                    |               |               |
| PMZ950UPE v.1  | 20140508   | Product data sheet | -             | -             |

## 15. Legal information

### 15.1 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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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