



# PMZ350UPE

20 V, P-channel Trench MOSFET

14 May 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
- Low threshold voltage
- Very fast switching
- ElectroStatic Discharge (ESD) protection > 1.8 kV HBM
- Leadless ultra small SMD plastic package: 1.0 × 0.6 × 0.48 mm

## 3. Applications

- Relay driver
- High-speed line driver
- High-side loadswitch
- Switching circuits

## 4. Quick reference data

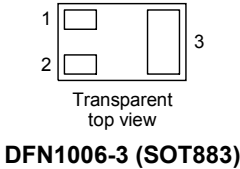
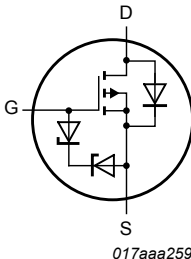
Table 1. Quick reference data

| Symbol                        | Parameter                        | Conditions                                                                |     | Min | Typ | 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; t ≤ 5 s               | [1] | -   | -   | -1.4 | A    |
| <b>Static characteristics</b> |                                  |                                                                           |     |     |     |      |      |
| R <sub>DS(on)</sub>           | drain-source on-state resistance | V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -0.3 A; T <sub>J</sub> = 25 °C |     | -   | 330 | 450  | mΩ   |

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

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

| Type number | Package   |                                                                 |         |
|-------------|-----------|-----------------------------------------------------------------|---------|
|             | Name      | Description                                                     | Version |
| PMZ350UPE   | DFN1006-3 | DFN1006-3: leadless ultra small plastic package; 3 solder lands | SOT883  |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMZ350UPE   | ZP           |

## 8. Limiting values

**Table 5. Limiting values**

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

| Symbol                    | Parameter                       | Conditions                                                                                  |     | Min | 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                   | $V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; t \leq 5\text{ s}$           | [1] | -   | -1.4 | A                  |
|                           |                                 | $V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$                              | [1] | -   | -1   | A                  |
|                           |                                 | $V_{GS} = -4.5\text{ V}; T_{amb} = 100\text{ }^{\circ}\text{C}$                             | [1] | -   | -0.7 | A                  |
| $I_{DM}$                  | peak drain current              | $T_{amb} = 25\text{ }^{\circ}\text{C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$ |     | -   | -2.8 | A                  |
| $P_{tot}$                 | total power dissipation         | $T_{amb} = 25\text{ }^{\circ}\text{C}$                                                      | [2] | -   | 360  | mW                 |
|                           |                                 |                                                                                             | [1] | -   | 715  | mW                 |
|                           |                                 | $T_{sp} = 25\text{ }^{\circ}\text{C}$                                                       |     | -   | 3125 | mW                 |
| $T_j$                     | junction temperature            |                                                                                             |     | -55 | 150  | $^{\circ}\text{C}$ |
| $T_{amb}$                 | ambient temperature             |                                                                                             |     | -55 | 150  | $^{\circ}\text{C}$ |
| $T_{stg}$                 | storage temperature             |                                                                                             |     | -65 | 150  | $^{\circ}\text{C}$ |
| <b>Source-drain diode</b> |                                 |                                                                                             |     |     |      |                    |
| $I_S$                     | source current                  | $T_{amb} = 25\text{ }^{\circ}\text{C}$                                                      | [1] | -   | -0.8 | A                  |
| <b>ESD maximum rating</b> |                                 |                                                                                             |     |     |      |                    |
| $V_{ESD}$                 | electrostatic discharge voltage | HBM                                                                                         | [3] | -   | 1800 | V                  |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain  $1\text{ cm}^2$ .
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [3] Measured between all pins.

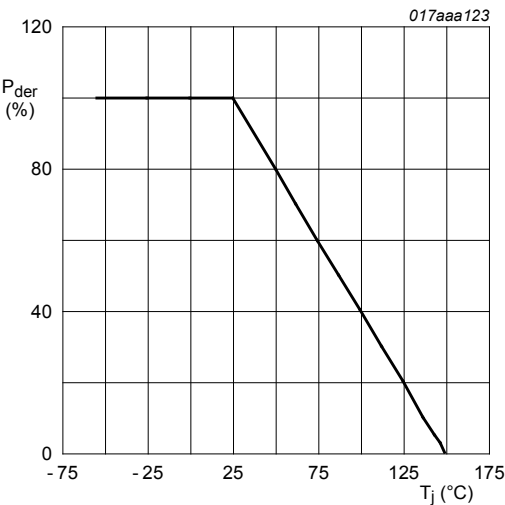


Fig. 1. Normalized total power dissipation as a function of junction temperature

$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100 \%$$

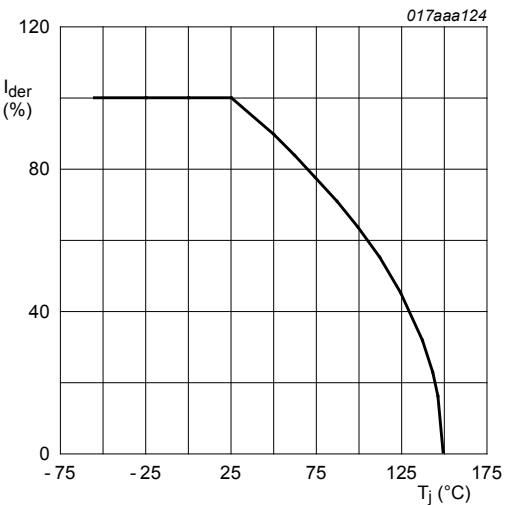


Fig. 2. Normalized continuous drain current as a function of junction temperature

$$I_{der} = \frac{I_D}{I_{D(25^{\circ}\text{C})}} \times 100 \%$$

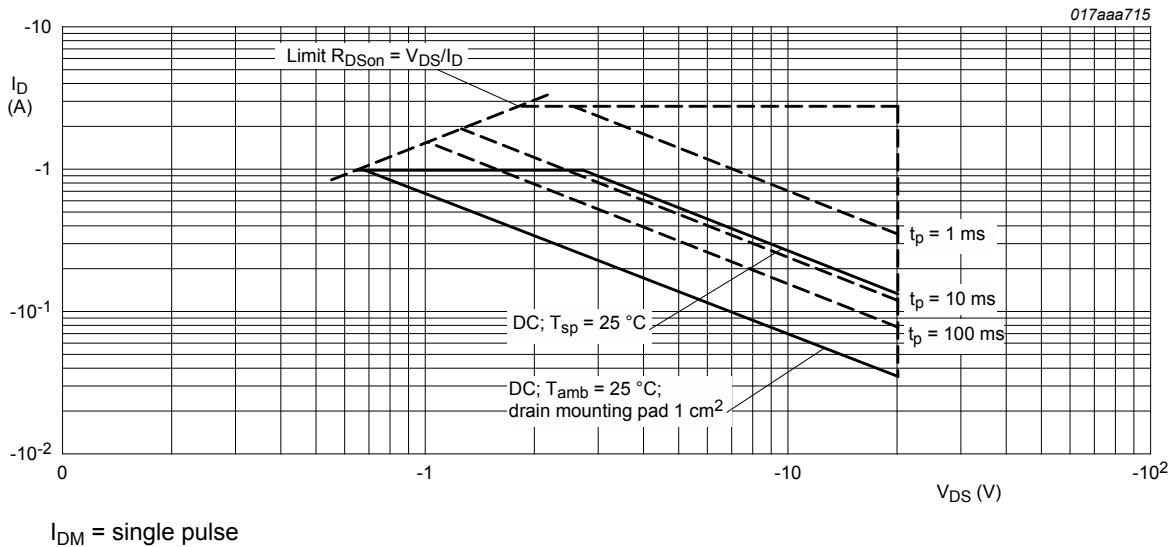


Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

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] | -   | 304 | 350 | K/W  |
|               |                                             |             | [2] | -   | 150 | 175 | K/W  |
|               |                                             |             | [3] | -   | 90  | 103 | K/W  |

| Symbol         | Parameter                                        | Conditions |  | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------|------------|--|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |            |  | -   | 35  | 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 cm<sup>2</sup>.
- [3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm<sup>2</sup>, t ≤ 5 s.

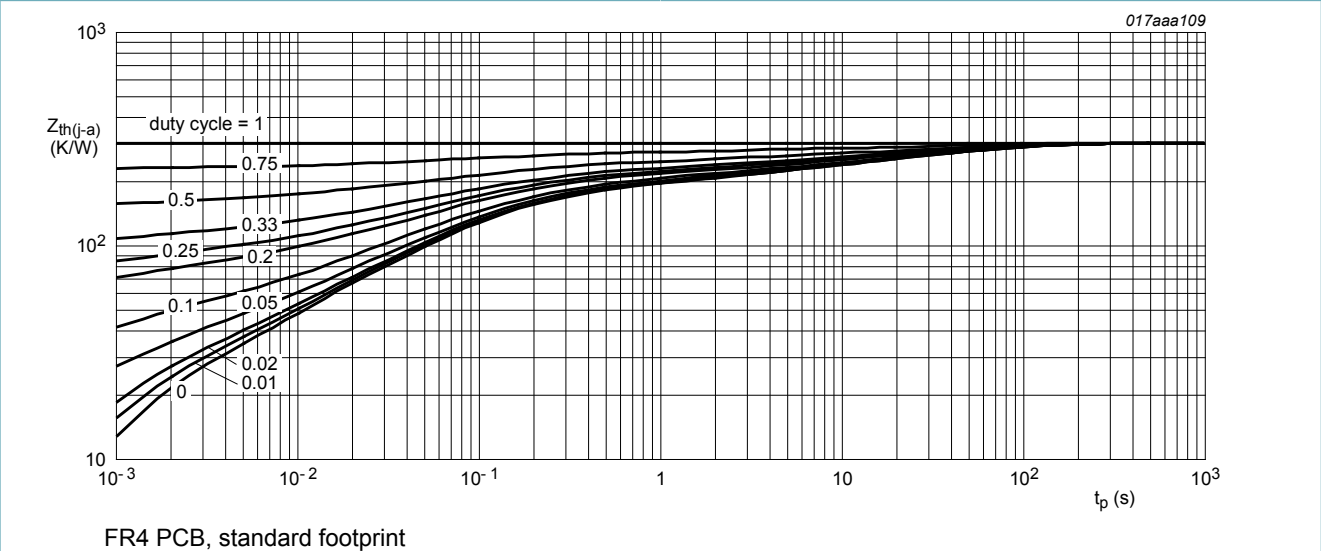


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

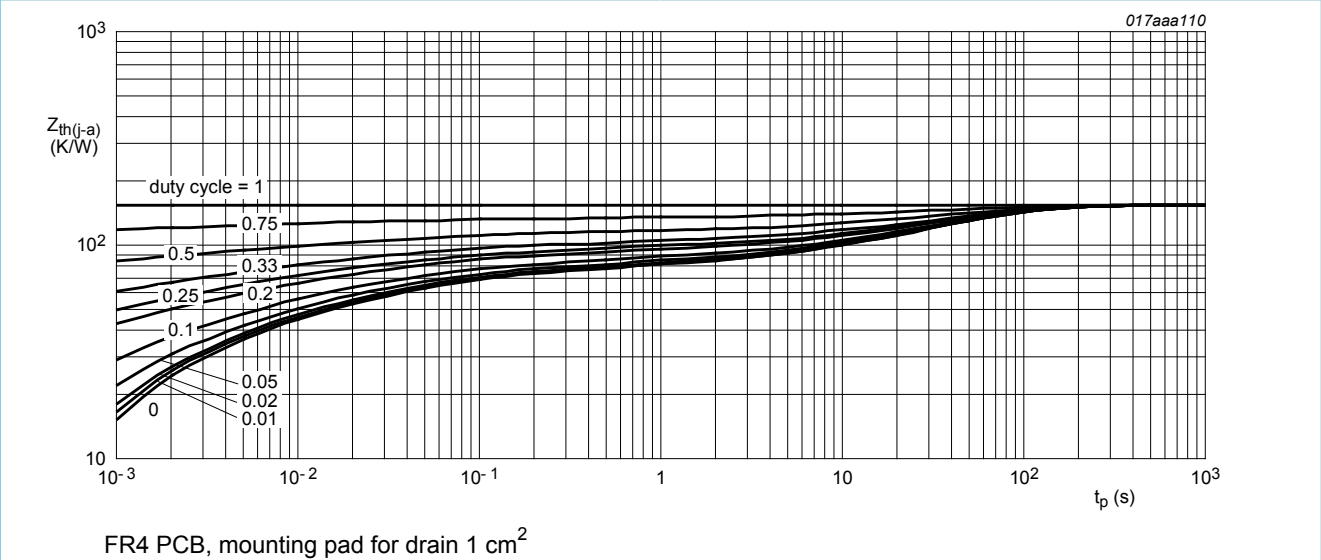


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

| Symbol                  | Parameter                        | Conditions                                                                                         |                                                                                                                               | Min   | Typ  | Max   | Unit |
|-------------------------|----------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------|------|-------|------|
| Static characteristics  |                                  |                                                                                                    |                                                                                                                               |       |      |       |      |
| V <sub>(BR)DSS</sub>    | drain-source breakdown voltage   | I <sub>D</sub> = -250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                            |                                                                                                                               | -20   | -    | -     | V    |
| V <sub>GSth</sub>       | gate-source threshold voltage    | I <sub>D</sub> = -250 μA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C               |                                                                                                                               | -0.45 | -0.7 | -0.95 | V    |
| I <sub>DSS</sub>        | drain leakage current            | V <sub>DS</sub> = -20 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                             |                                                                                                                               | -     | -    | -1    | μA   |
|                         |                                  | V <sub>DS</sub> = -20 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 150 °C                            |                                                                                                                               | -     | -    | -10   | μA   |
| I <sub>GSS</sub>        | gate leakage current             | V <sub>GS</sub> = -8 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                              |                                                                                                                               | -     | -    | -10   | μA   |
|                         |                                  | V <sub>GS</sub> = 8 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                               |                                                                                                                               | -     | -    | 10    | μA   |
| R <sub>DSon</sub>       | drain-source on-state resistance | V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -0.3 A; T <sub>j</sub> = 25 °C                          |                                                                                                                               | -     | 330  | 450   | mΩ   |
|                         |                                  | V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -0.3 A; T <sub>j</sub> = 150 °C                         |                                                                                                                               | -     | 478  | 645   | mΩ   |
|                         |                                  | V <sub>GS</sub> = -2.5 V; I <sub>D</sub> = -0.2 A; T <sub>j</sub> = 25 °C                          |                                                                                                                               | -     | 420  | 645   | mΩ   |
|                         |                                  | V <sub>GS</sub> = -1.8 V; I <sub>D</sub> = -0.1 A; T <sub>j</sub> = 25 °C                          |                                                                                                                               | -     | 520  | 940   | mΩ   |
| g <sub>fs</sub>         | forward transconductance         | V <sub>DS</sub> = -10 V; I <sub>D</sub> = -0.3 A; T <sub>j</sub> = 25 °C                           |                                                                                                                               | -     | 1.4  | -     | S    |
| Dynamic characteristics |                                  |                                                                                                    |                                                                                                                               |       |      |       |      |
| Q <sub>G(tot)</sub>     | total gate charge                | V <sub>DS</sub> = -10 V; I <sub>D</sub> = -0.3 A; V <sub>GS</sub> = -4.5 V; T <sub>j</sub> = 25 °C |                                                                                                                               | -     | 1.3  | 1.9   | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                    |                                                                                                                               | -     | 0.2  | -     | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                    |                                                                                                                               | -     | 0.25 | -     | nC   |
| C <sub>iss</sub>        | input capacitance                | V <sub>DS</sub> = -10 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                  |                                                                                                                               | -     | 127  | -     | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                    |                                                                                                                               | -     | 34   | -     | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                    |                                                                                                                               | -     | 25   | -     | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               |                                                                                                    | V <sub>DS</sub> = -10 V; I <sub>D</sub> = -0.3 A; V <sub>GS</sub> = -4.5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C |       | -    | 4     | -    |
| t <sub>r</sub>          | rise time                        |                                                                                                    |                                                                                                                               | -     | 5    | -     | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                    |                                                                                                                               | -     | 26   | -     | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                    |                                                                                                                               | -     | 9    | -     | ns   |
| Source-drain diode      |                                  |                                                                                                    |                                                                                                                               |       |      |       |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = -0.1 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                             |                                                                                                                               | -     | -0.7 | -1.2  | V    |

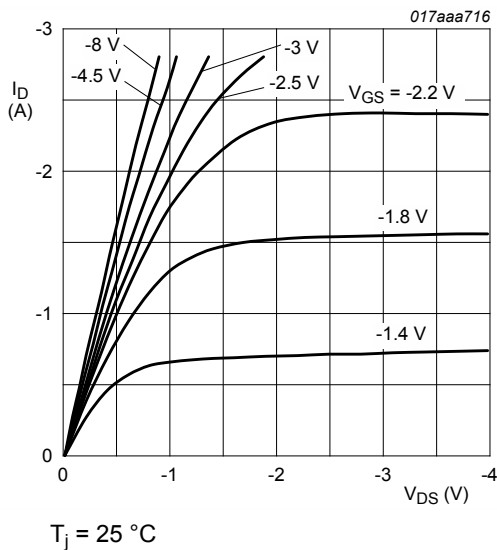


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

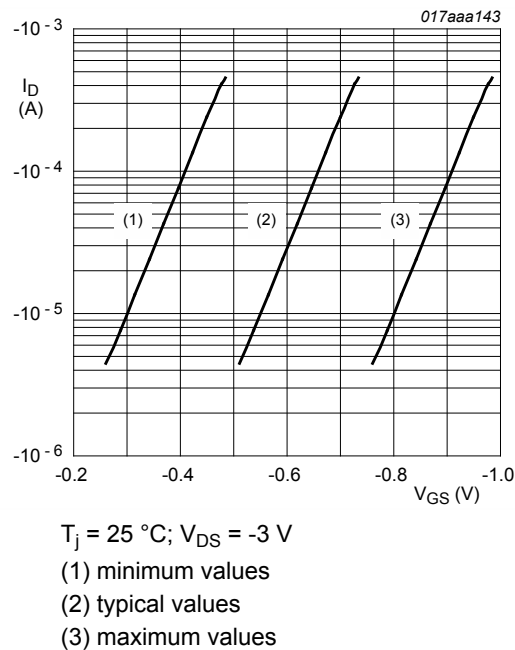


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

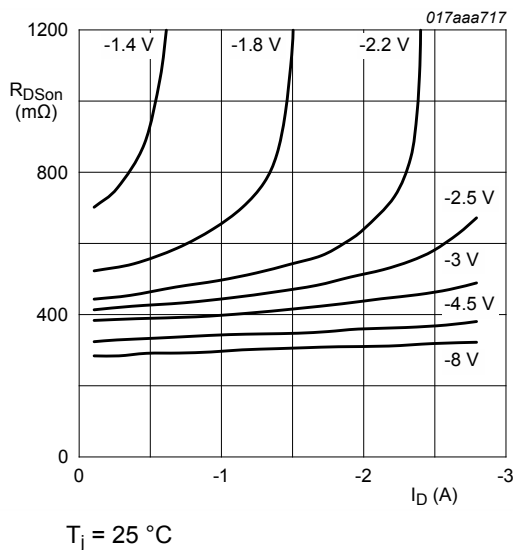


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

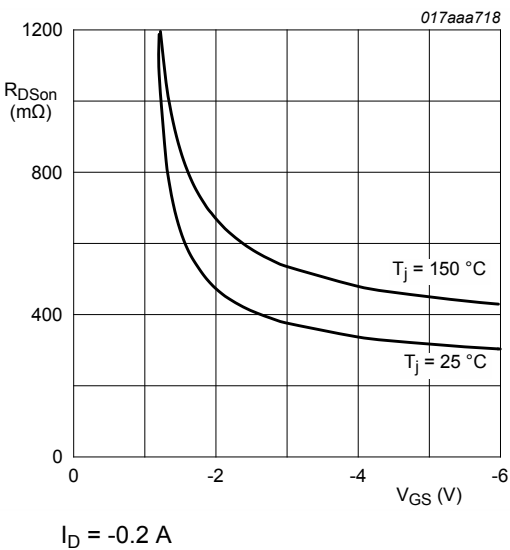


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

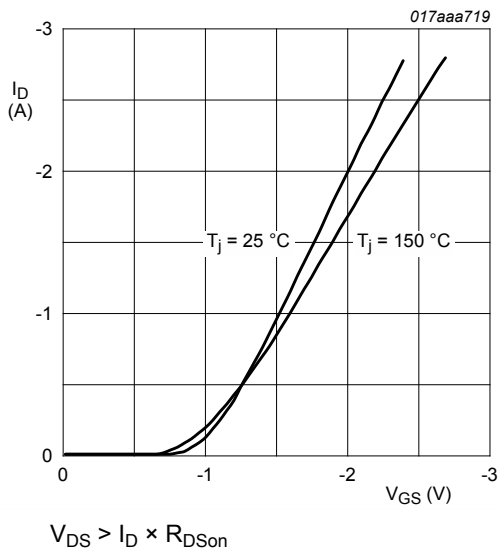


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

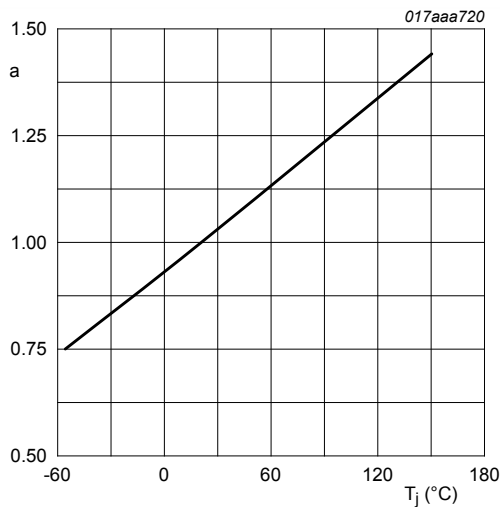


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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

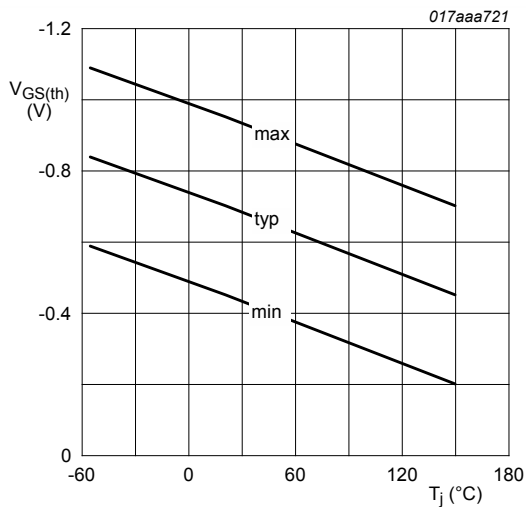


Fig. 12. Gate-source threshold voltage as a function of junction temperature

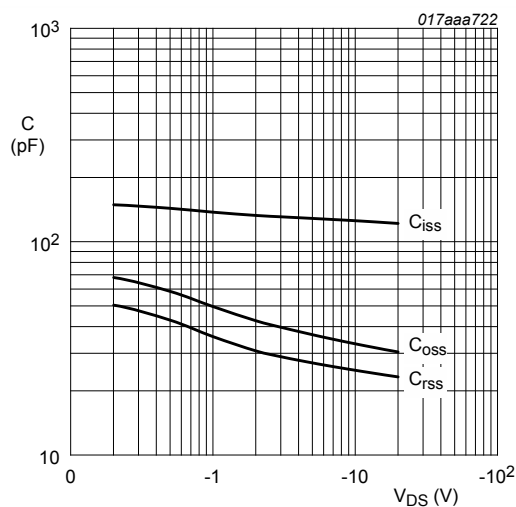


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



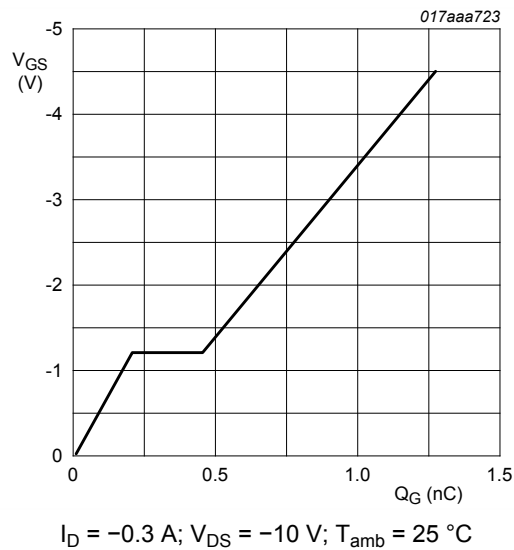


Fig. 14. Gate-source voltage as a function of gate charge; typical values

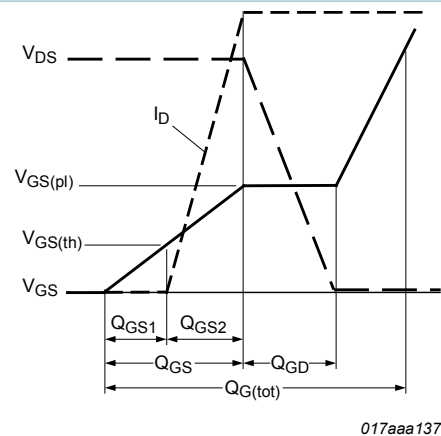


Fig. 15. Gate charge waveform definitions

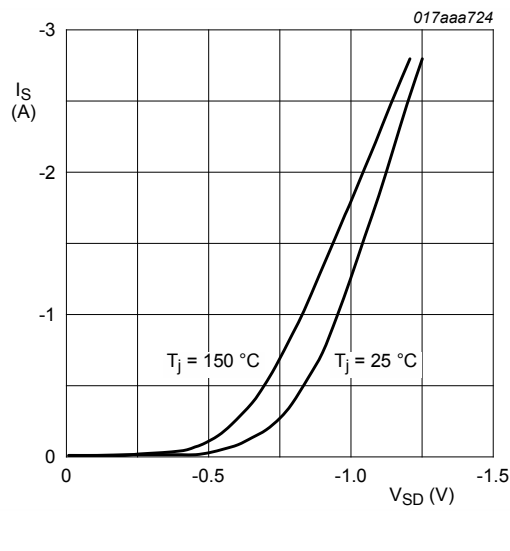


Fig. 16. Source current as a function of source-drain voltage; typical values

## 11. Test information

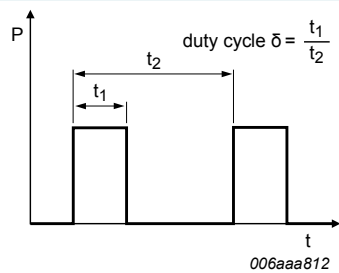
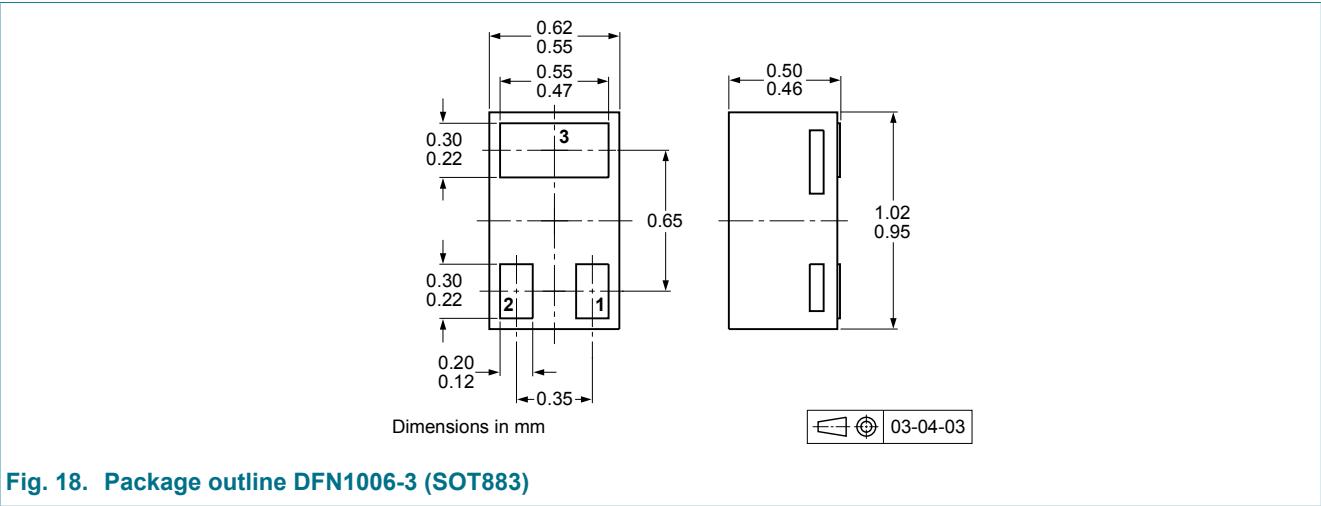
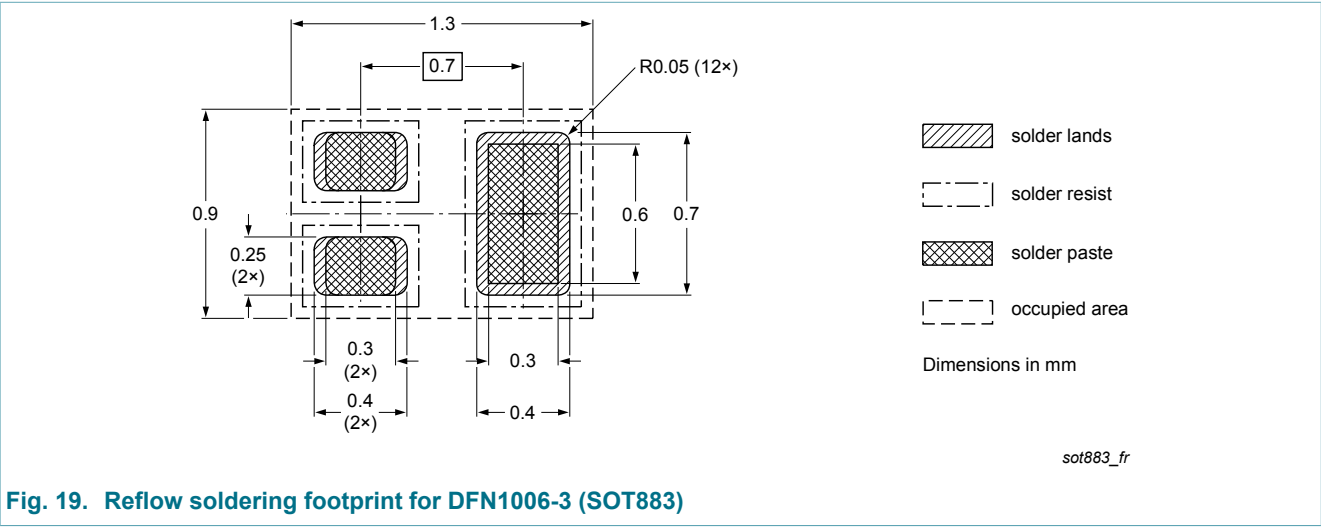


Fig. 17. Duty cycle definition

12. Package outline



13. Soldering



## 14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PMZ350UPE v.1 | 20140514     | Product data sheet | -             | -          |

## 15. Legal information

### 15.1 Data sheet status

| Document status [1][2]         | Product status [3] | Definition                                                                            |
|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
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| 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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Date of release: 14 May 2014