



# THE DATASHEET OF PMV20XNER





# PMV20XNE

30 V, N-channel Trench MOSFET

10 November 2014

Product data sheet

## 1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Trench MOSFET technology
- Low threshold voltage
- Enhanced power dissipation capability of 1200 mW
- ElectroStatic Discharge (ESD) protection: 2 kV HBM

## 3. Applications

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

## 4. Quick reference data

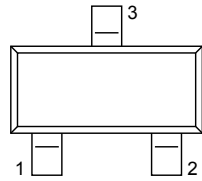
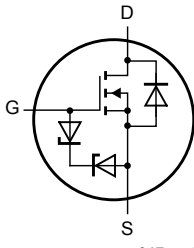
Table 1. Quick reference data

| Symbol                        | Parameter                        | Conditions   | Min | Typ | Max | Unit       |
|-------------------------------|----------------------------------|--|-----|-----|-----|------------|
| $V_{DS}$                      | drain-source voltage             | $T_j = 25\text{ °C}$   | -   | -   | 30  | V          |
| $V_{GS}$                      | gate-source voltage              |  | -12 | -   | 12  | V          |
| $I_D$                         | drain current                    | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$ | [1] | -   | 7.2 | A          |
| <b>Static characteristics</b> |                                  |  |     |     |     |            |
| $R_{DS(on)}$                  | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 5.7\text{ A}; T_j = 25\text{ °C}$    | -   | 19  | 23  | m $\Omega$ |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline  | Graphic symbol   |
|-----|--------|-------------|---|--|
| 1   | G      | gate        |  <p>TO-236AB (SOT23)</p> |  <p>017aaa255</p> |
| 2   | S      | source      |   |  |
| 3   | D      | drain       |   |  |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package  |  |         |
|-------------|----------|--|---------|
|             | Name     | Description                              | Version |
| PMV20XNE    | TO-236AB | plastic surface-mounted package; 3 leads | SOT23   |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMV20XNE    | %G9          |

[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 |
|---------------------------|-------------------------|--|-----|-----|------|------|
| $V_{DS}$                  | drain-source voltage    | $T_j = 25\text{ °C}$   |     | -   | 30   | V    |
| $V_{GS}$                  | gate-source voltage     |  |     | -12 | 12   | V    |
| $I_D$                     | drain current           | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$       | [1] | -   | 7.2  | A    |
|                           |                         | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}$                          | [1] | -   | 5.7  | A    |
|                           |                         | $V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ °C}$                         | [1] | -   | 3.6  | A    |
| $I_{DM}$                  | peak drain current      | $T_{amb} = 25\text{ °C};$ single pulse; $t_p \leq 10\text{ }\mu\text{s}$ |     | -   | 24   | A    |
| $P_{tot}$                 | total power dissipation | $T_{amb} = 25\text{ °C}$   | [2] | -   | 510  | mW   |
|                           |                         |  | [1] | -   | 1200 | mW   |
|                           |                         | $T_{sp} = 25\text{ °C}$  |     | -   | 6940 | mW   |
| $T_j$                     | junction temperature    |  |     | -55 | 150  | °C   |
| $T_{amb}$                 | ambient temperature     |  |     | -55 | 150  | °C   |
| $T_{stg}$                 | storage temperature     |  |     | -65 | 150  | °C   |
| <b>Source-drain diode</b> |                         |  |     |     |      |      |
| $I_S$                     | source current          | $T_{amb} = 25\text{ °C}$   | [1] | -   | 1.2  | A    |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain  $6\text{ cm}^2$ .
- [2] Device mounted on an FR4 Printed Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.



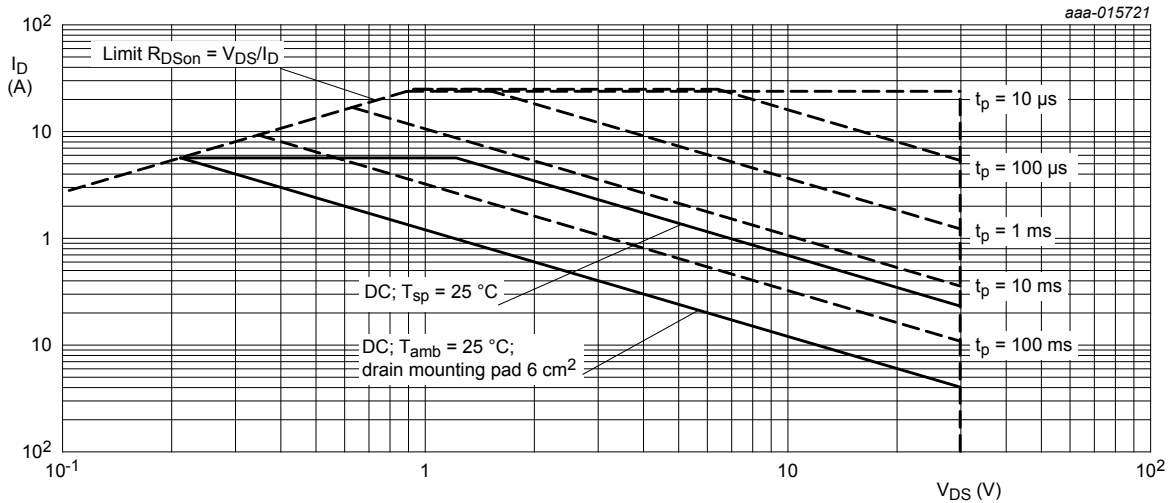
Fig. 1. Normalized total power dissipation as a function of junction temperature

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



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

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



I<sub>DM</sub> = single pulse

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 <sub>th(j-a)</sub> | thermal resistance from junction to ambient | in free air          | [1] | -   | 208 | 245 | K/W  |
|                      |   |                      | [2] | -   | 88  | 104 | K/W  |
|                      |   | in free air; t ≤ 5 s | [2] | -   | 55  | 65  | K/W  |

| Symbol         | Parameter  | Conditions | Min | Typ | Max | Unit |
|----------------|--|------------|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |            | -   | 13  | 18  | K/W  |

- [1] Device mounted on an FR4 Printed-Circuit Board (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 6 cm<sup>2</sup>.

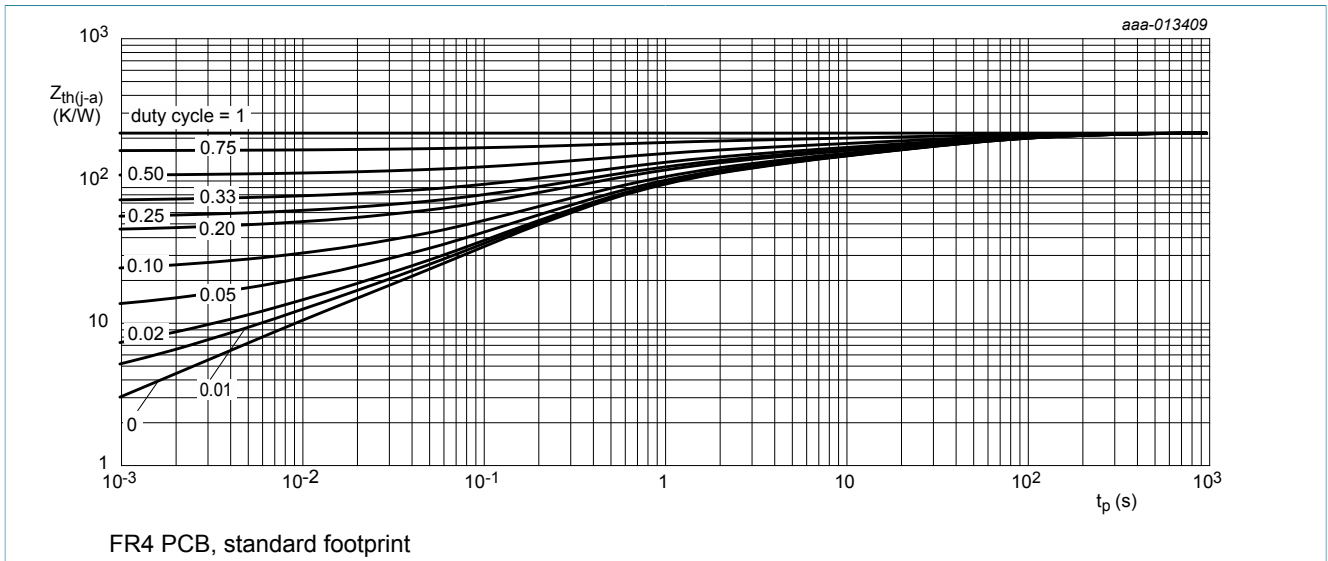


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

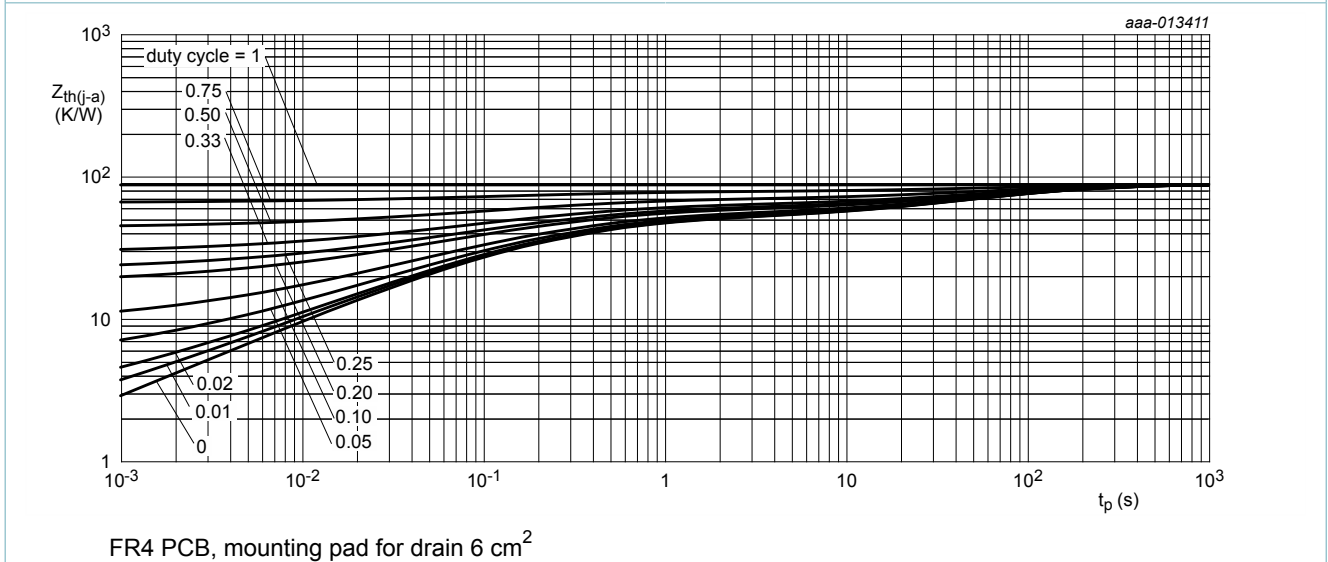
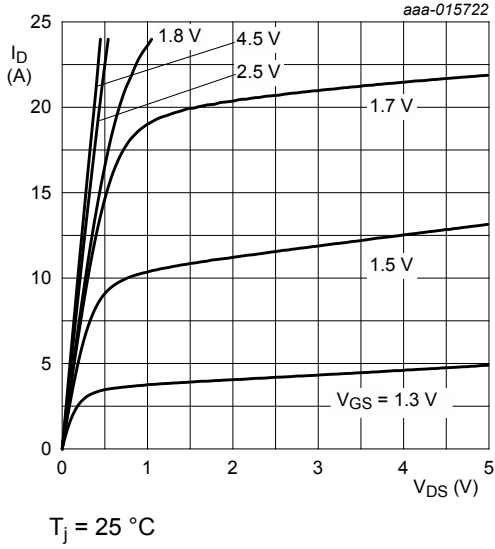


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

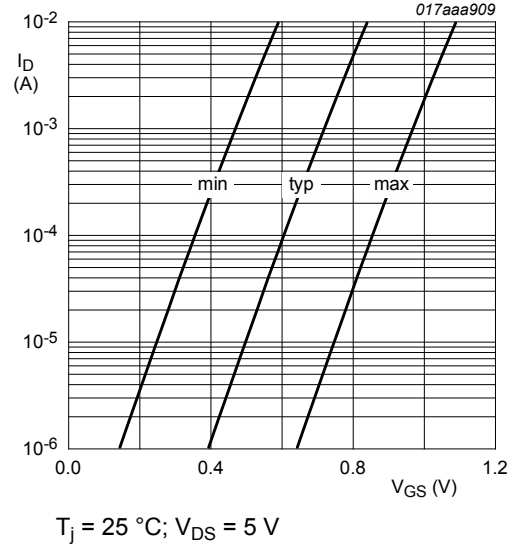
## 10. Characteristics

Table 7. Characteristics

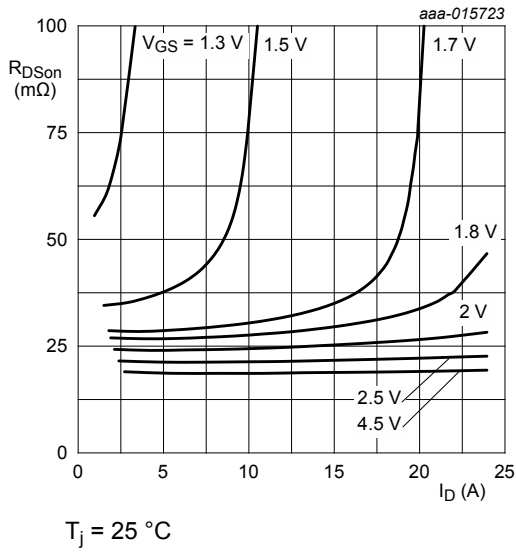
| Symbol                         | Parameter                        | Conditions  | Min | Typ  | Max  | Unit          |
|--------------------------------|----------------------------------|---|-----|------|------|---------------|
| <b>Static characteristics</b>  |                                  |   |     |      |      |               |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage   | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$  | 30  | -    | -    | V             |
| $V_{GSth}$                     | gate-source threshold voltage    | $I_D = 250 \mu\text{A}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C}$   | 0.4 | 0.65 | 0.9  | V             |
| $I_{DSS}$                      | drain leakage current            | $V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$  | -   | -    | 1    | $\mu\text{A}$ |
| $I_{GSS}$                      | gate leakage current             | $V_{GS} = 8 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$   | -   | -    | 10   | $\mu\text{A}$ |
|                                |                                  | $V_{GS} = -8 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$  | -   | -    | -10  | $\mu\text{A}$ |
| $R_{DSon}$                     | drain-source on-state resistance | $V_{GS} = 4.5 \text{ V}; I_D = 5.7 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$  | -   | 19   | 23   | m $\Omega$    |
|                                |                                  | $V_{GS} = 4.5 \text{ V}; I_D = 5.7 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$   | -   | 31   | 37   | m $\Omega$    |
|                                |                                  | $V_{GS} = 2.5 \text{ V}; I_D = 5 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$  | -   | 22   | 30   | m $\Omega$    |
|                                |                                  | $V_{GS} = 1.8 \text{ V}; I_D = 1.9 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$  | -   | 27   | 38   | m $\Omega$    |
| $g_{fs}$                       | forward transconductance         | $V_{DS} = 10 \text{ V}; I_D = 2 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$   | -   | 11   | -    | S             |
| $R_G$                          | gate resistance                  | $f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}$  | -   | 1.8  | -    | $\Omega$      |
| <b>Dynamic characteristics</b> |                                  |   |     |      |      |               |
| $Q_{G(tot)}$                   | total gate charge                | $V_{DS} = 10 \text{ V}; I_D = 5 \text{ A}; V_{GS} = 4.5 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$                                 | -   | 12.4 | 18.6 | nC            |
| $Q_{GS}$                       | gate-source charge               |   | -   | 1.2  | -    | nC            |
| $Q_{GD}$                       | gate-drain charge                |   | -   | 2.1  | -    | nC            |
| $C_{iss}$                      | input capacitance                | $V_{DS} = 15 \text{ V}; f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$                                   | -   | 1150 | -    | pF            |
| $C_{oss}$                      | output capacitance               |   | -   | 110  | -    | pF            |
| $C_{rss}$                      | reverse transfer capacitance     |   | -   | 85   | -    | pF            |
| $t_{d(on)}$                    | turn-on delay time               | $V_{DS} = 15 \text{ V}; I_D = 5 \text{ A}; V_{GS} = 4.5 \text{ V}; R_{G(ext)} = 6 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | -   | 8    | -    | ns            |
| $t_r$                          | rise time                        |   | -   | 17   | -    | ns            |
| $t_{d(off)}$                   | turn-off delay time              |   | -   | 33   | -    | ns            |
| $t_f$                          | fall time                        |   | -   | 32   | -    | ns            |
| <b>Source-drain diode</b>      |                                  |   |     |      |      |               |
| $V_{SD}$                       | source-drain voltage             | $I_S = 1.2 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$  | -   | 0.7  | 1.2  | V             |



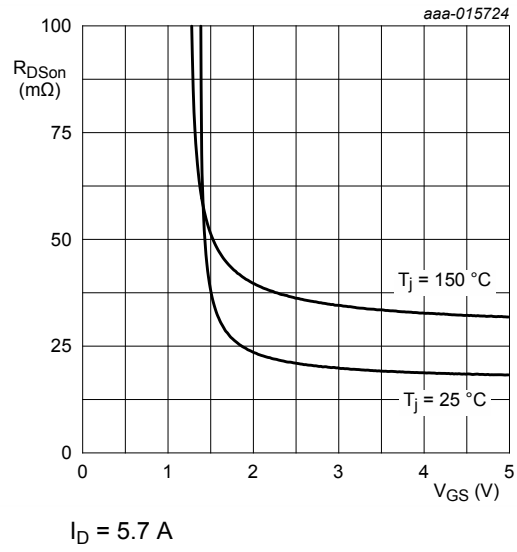
**Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values**



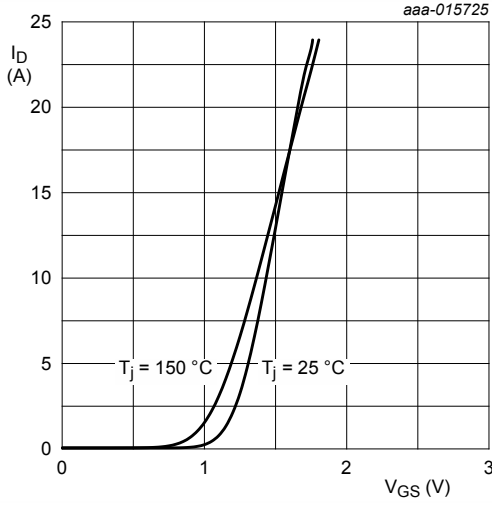
**Fig. 7. Subthreshold drain current as a function of gate-source voltage**



**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**



$$V_{DS} > I_D \times R_{DSon}$$

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

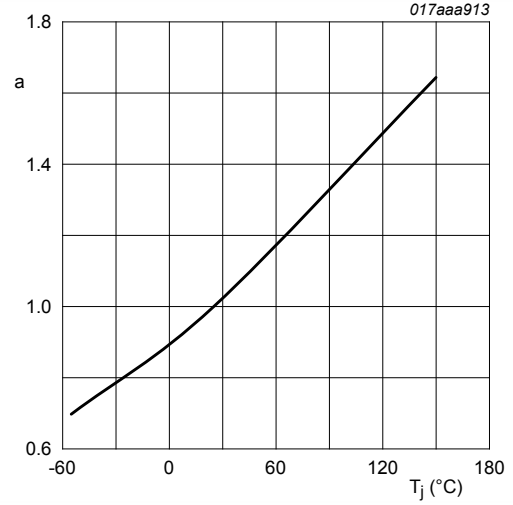
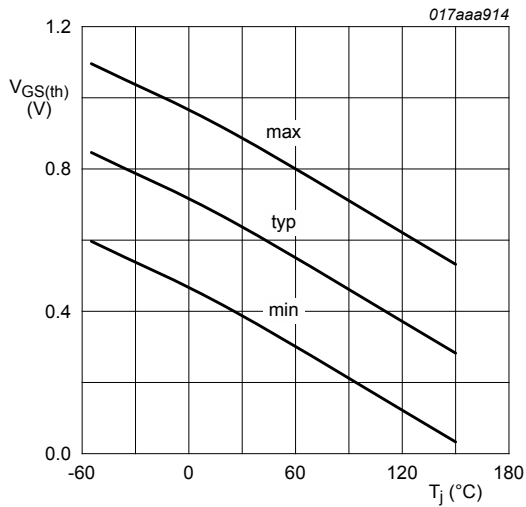


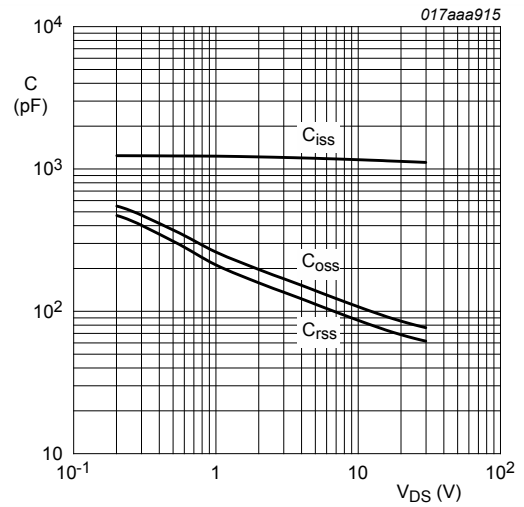
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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



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

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

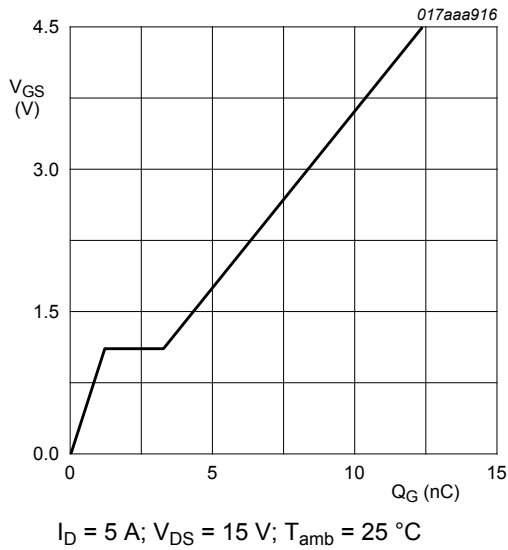


Fig. 14. Gate-source voltage as a function of gate charge; typical values

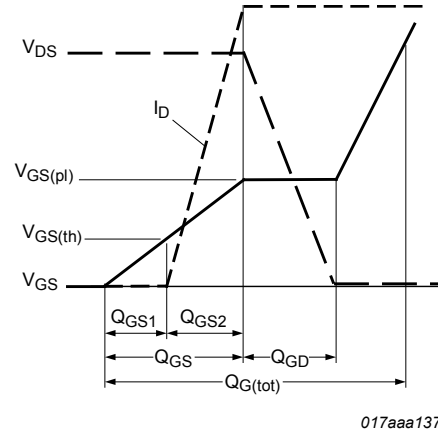
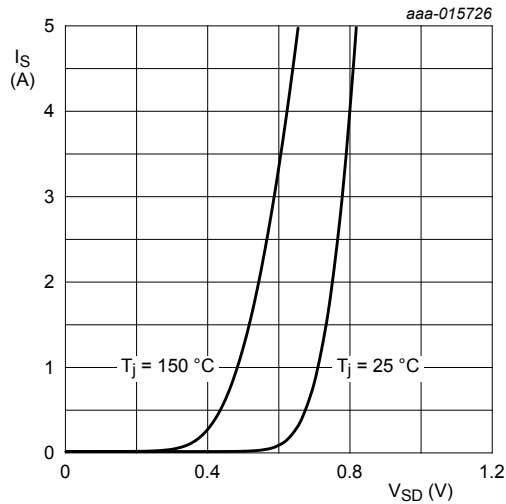


Fig. 15. MOSFET transistor: Gate charge waveform definitions



$V_{GS} = 0 \text{ V}$

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

## 11. Test information

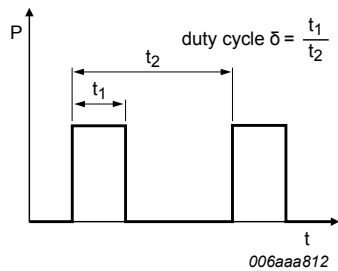


Fig. 17. Duty cycle definition

## 12. Package outline

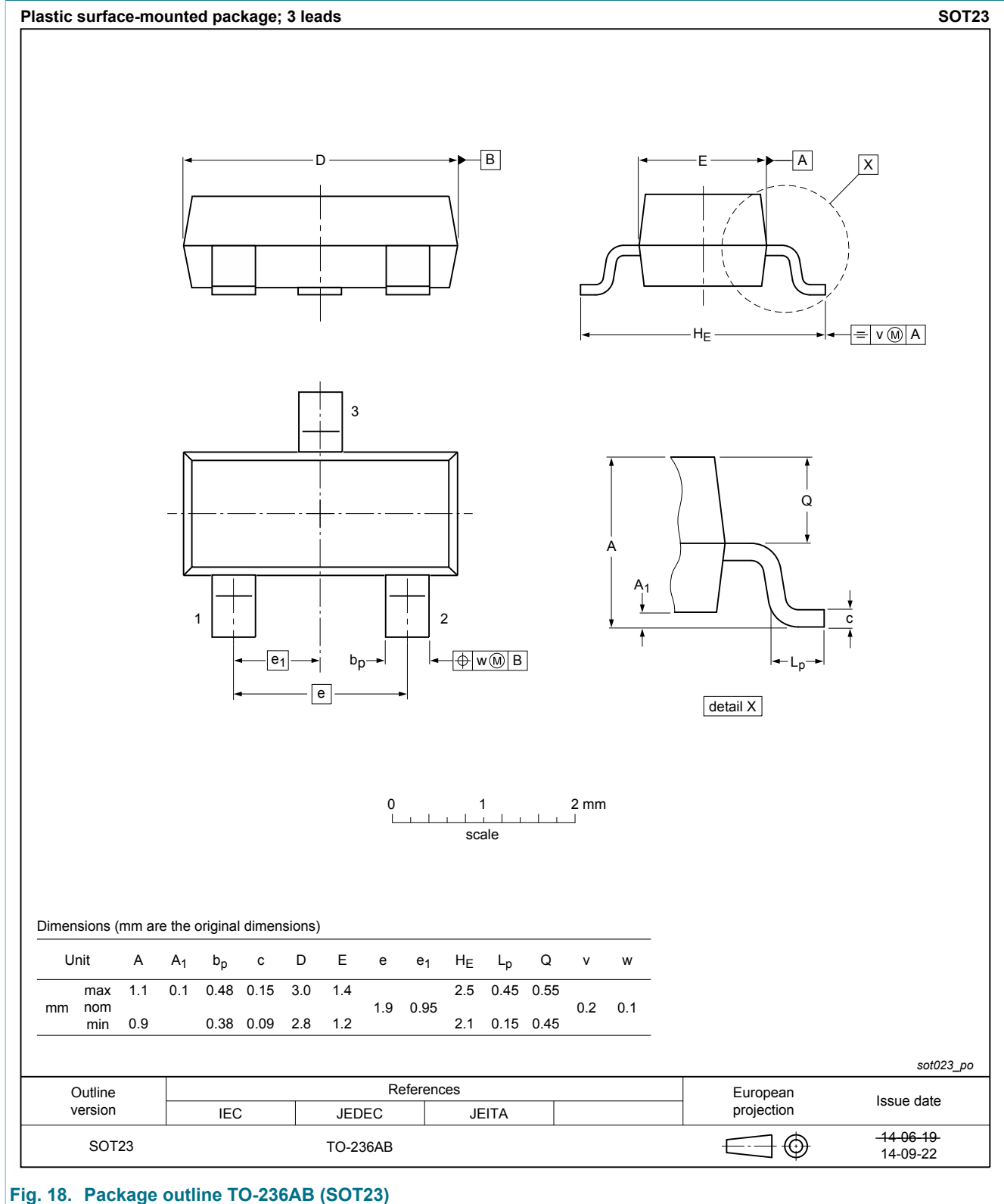


Fig. 18. Package outline TO-236AB (SOT23)

### 13. Soldering

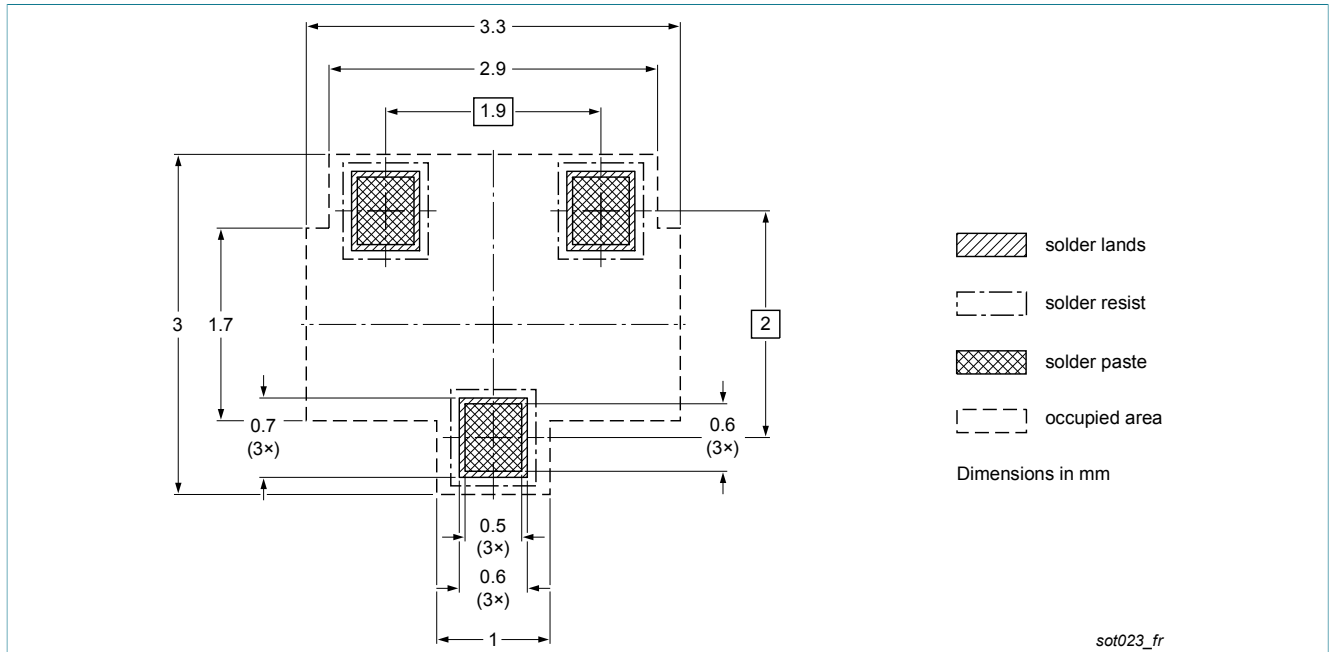


Fig. 19. Reflow soldering footprint for TO-236AB (SOT23)

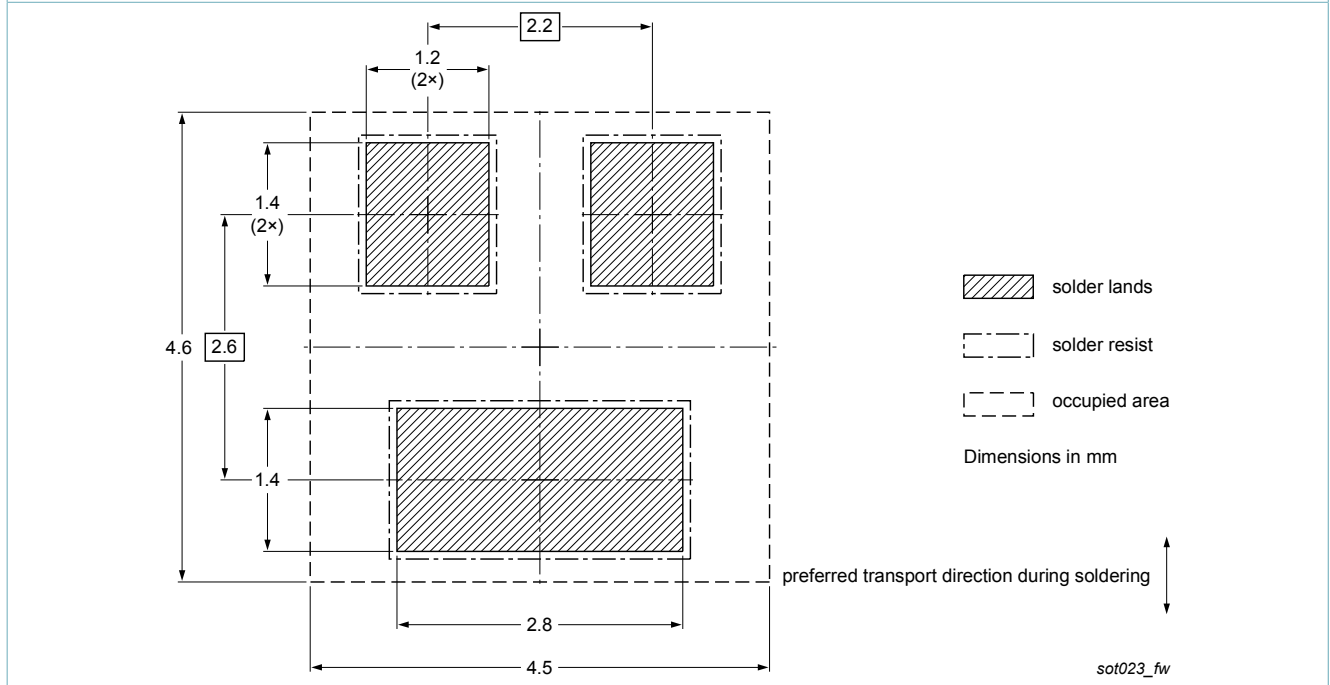


Fig. 20. Wave soldering footprint for TO-236AB (SOT23)

## 14. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PMV20XNE v.1  | 20141110     | 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.                                     |

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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 10 November 2014

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