



# PMV16XN

20 V, N-channel Trench MOSFET

11 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
- Very fast switching
- Enhanced power dissipation capability of 1200 mW

## 3. Applications

- LED driver
- Power management
- 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             | $T_J = 25\text{ }^{\circ}\text{C}$                                               |     | -   | -   | 20  | V          |
| $V_{GS}$                      | gate-source voltage              |                                                                                  |     | -12 | -   | 12  | V          |
| $I_D$                         | drain current                    | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; t \leq 5\text{ s}$ | [1] | -   | -   | 8.6 | A          |
| <b>Static characteristics</b> |                                  |                                                                                  |     |     |     |     |            |
| $R_{DS(on)}$                  | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 6.8\text{ A}; T_J = 25\text{ }^{\circ}\text{C}$    |     | -   | 16  | 20  | m $\Omega$ |

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

## 5. Pinning information

Table 2. Pinning information

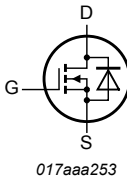
| Pin | Symbol | Description | Simplified outline                                                                                    | Graphic symbol                                                                                   |
|-----|--------|-------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 1   | G      | gate        | <br>TO-236AB (SOT23) | <br>017aaa253 |
| 2   | S      | source      |                                                                                                       |                                                                                                  |
| 3   | D      | drain       |                                                                                                       |                                                                                                  |

Table 3. Ordering information

| Type number | Package  |                                          |         |
|-------------|----------|------------------------------------------|---------|
|             | Name     | Description                              | Version |
| PMV16XN     | TO-236AB | plastic surface-mounted package; 3 leads | SOT23   |

## 6. Marking

Table 4. Marking codes

| Type number | Marking code<br>[1] |
|-------------|---------------------|
| PMV16XN     | %BZ                 |

[1] % = placeholder for manufacturing site code

## 7. 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     |                                                                                             |     | -12 | 12   | V                  |
| $I_D$                     | drain current           | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; t \leq 5\text{ s}$            | [1] | -   | 8.6  | A                  |
|                           |                         | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$                               | [1] | -   | 6.8  | A                  |
|                           |                         | $V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ }^{\circ}\text{C}$                              | [1] | -   | 4.3  | A                  |
| $I_{DM}$                  | peak drain current      | $T_{amb} = 25\text{ }^{\circ}\text{C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$ |     | -   | 27   | A                  |
| $P_{tot}$                 | total power dissipation | $T_{amb} = 25\text{ }^{\circ}\text{C}$                                                      | [2] | -   | 510  | mW                 |
|                           |                         |                                                                                             | [1] | -   | 1200 | mW                 |
|                           |                         | $T_{sp} = 25\text{ }^{\circ}\text{C}$                                                       |     | -   | 6940 | 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] | -   | 1.2  | A                  |

- [1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and 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.

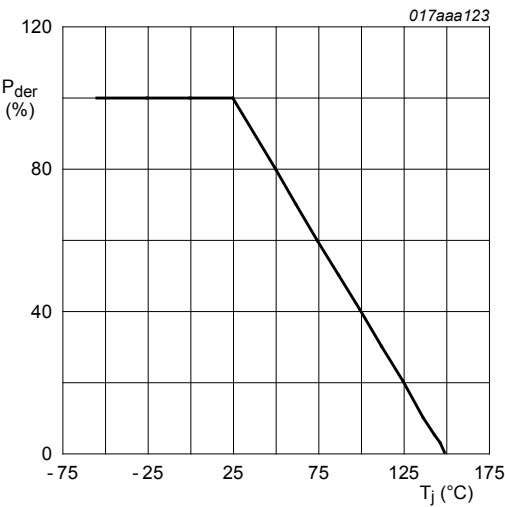


Fig. 1. Normalized total power dissipation as a function of junction temperature

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

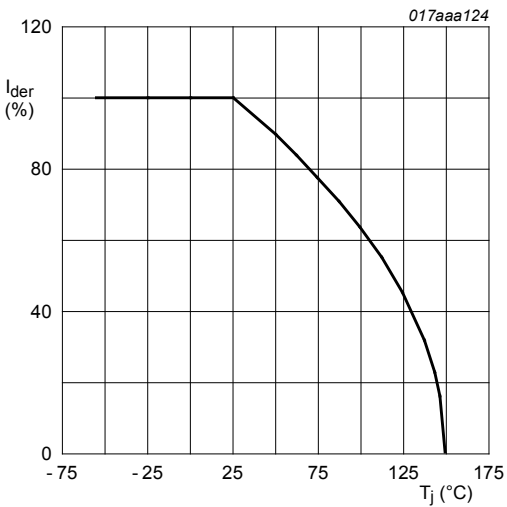


Fig. 2. Normalized continuous drain current as a function of junction temperature

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

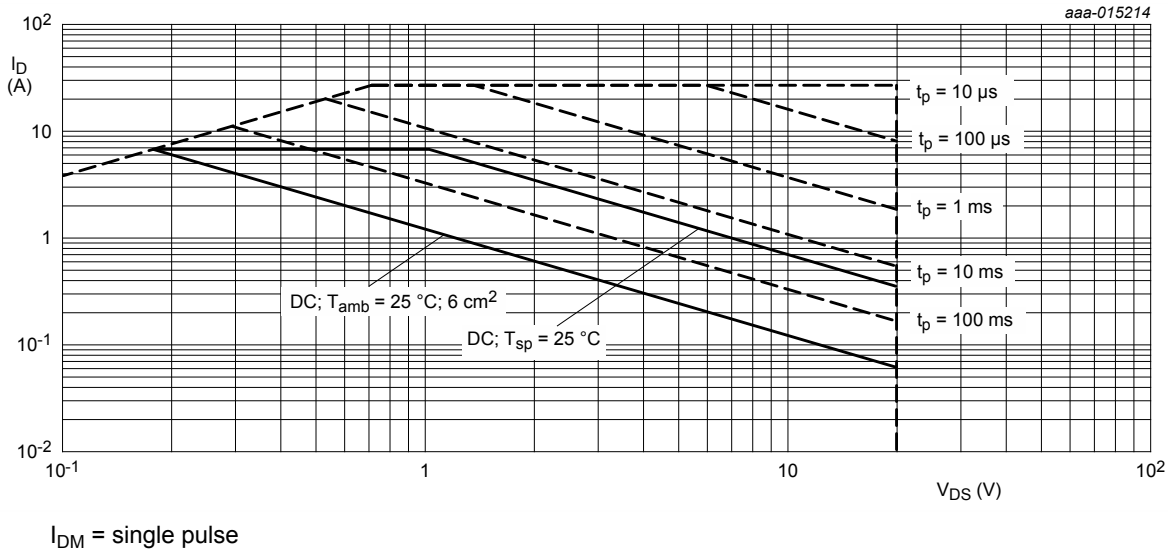


Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

8. 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] | -   | 208 | 245 | K/W  |
|               |                                             |                      | [2] | -   | 88  | 104 | K/W  |
|               |                                             | $t \leq 5 \text{ s}$ | [2] | -   | 55  | 65  | K/W  |

| Symbol         | Parameter                                              | Conditions |  | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------------|------------|--|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance<br>from junction to solder<br>point |            |  | -   | 13  | 18  | 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 and mounting pad for drain 6 cm<sup>2</sup>.

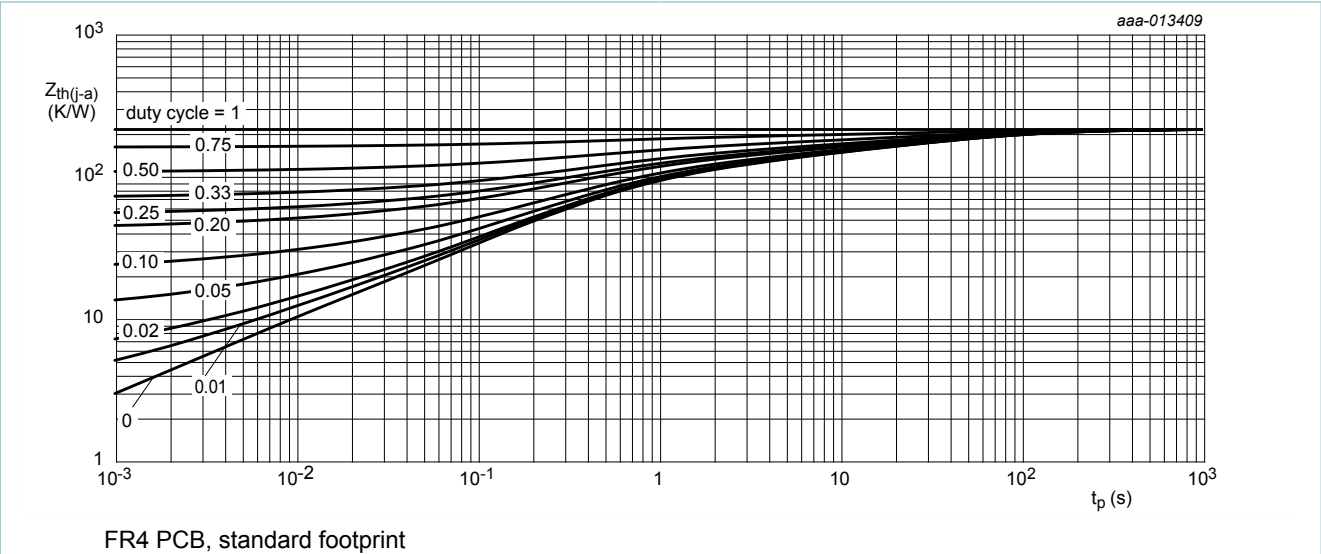


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

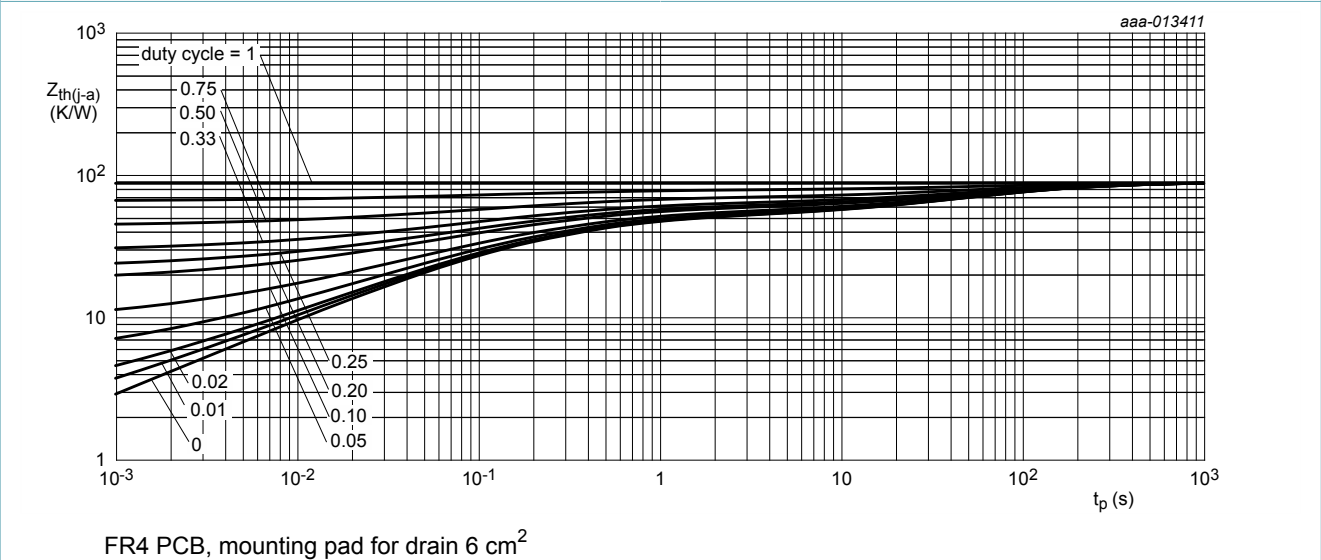


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 9. 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                                        |  | 0.4 | 0.65 | 0.9  | 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   |
| I <sub>GSS</sub>        | gate leakage current             | V <sub>GS</sub> = 12 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                      |  | -   | -    | 100  | nA   |
|                         |                                  | V <sub>GS</sub> = -12 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                     |  | -   | -    | -100 | nA   |
| R <sub>DSon</sub>       | drain-source on-state resistance | V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 6.8 A; T <sub>j</sub> = 25 °C                                                    |  | -   | 16   | 20   | mΩ   |
|                         |                                  | V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 6.8 A; T <sub>j</sub> = 150 °C                                                   |  | -   | 23   | 29   | mΩ   |
|                         |                                  | V <sub>GS</sub> = 2.5 V; I <sub>D</sub> = 6.0 A; T <sub>j</sub> = 25 °C                                                    |  | -   | 18   | 24   | mΩ   |
|                         |                                  | V <sub>GS</sub> = 1.8 V; I <sub>D</sub> = 2.1 A; T <sub>j</sub> = 25 °C                                                    |  | -   | 22   | 33   | mΩ   |
| g <sub>fs</sub>         | forward transconductance         | V <sub>DS</sub> = 10 V; I <sub>D</sub> = 2 A; T <sub>j</sub> = 25 °C                                                       |  | -   | 12   | -    | S    |
| R <sub>G</sub>          | gate resistance                  | f = 1 MHz                                                                                                                  |  | -   | 2    | -    | Ω    |
| Dynamic characteristics |                                  |                                                                                                                            |  |     |      |      |      |
| Q <sub>G(tot)</sub>     | total gate charge                | V <sub>DS</sub> = 10 V; I <sub>D</sub> = 7.3 A; V <sub>GS</sub> = 4.5 V; T <sub>j</sub> = 25 °C                            |  | -   | 13.4 | 20.2 | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                                            |  | -   | 1.5  | -    | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                                            |  | -   | 2.6  | -    | 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                                           |  | -   | 1240 | -    | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                                            |  | -   | 145  | -    | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                            |  | -   | 125  | -    | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               | V <sub>DS</sub> = 10 V; I <sub>D</sub> = 7.3 A; V <sub>GS</sub> = 4.5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C |  | -   | 9    | -    | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                            |  | -   | 24   | -    | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                            |  | -   | 31   | -    | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                            |  | -   | 36   | -    | ns   |
| Source-drain diode      |                                  |                                                                                                                            |  |     |      |      |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = 1.2 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                      |  | -   | 0.65 | 1.2  | V    |

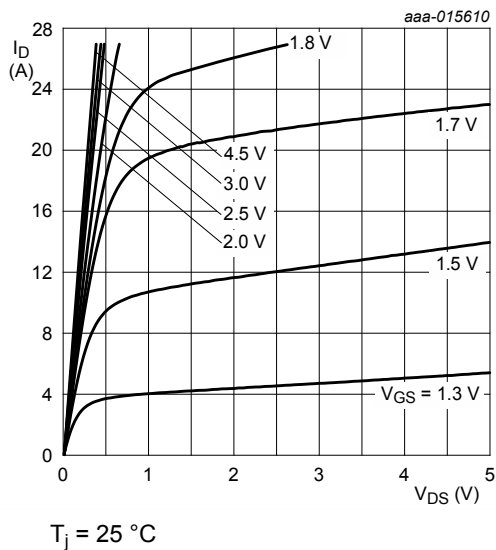


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

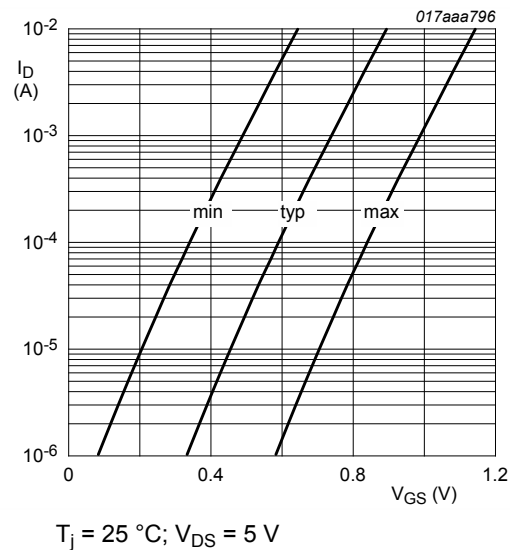


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

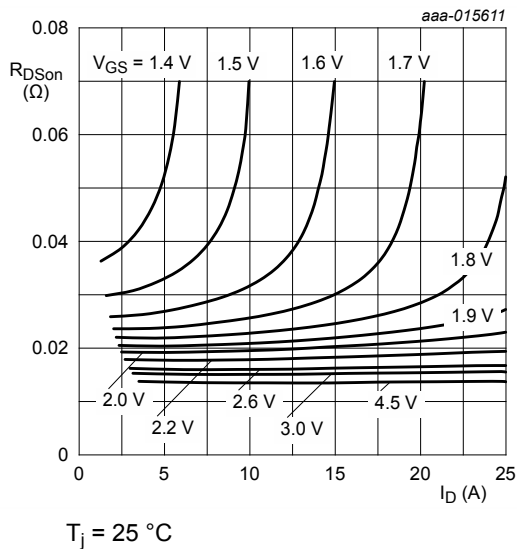


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

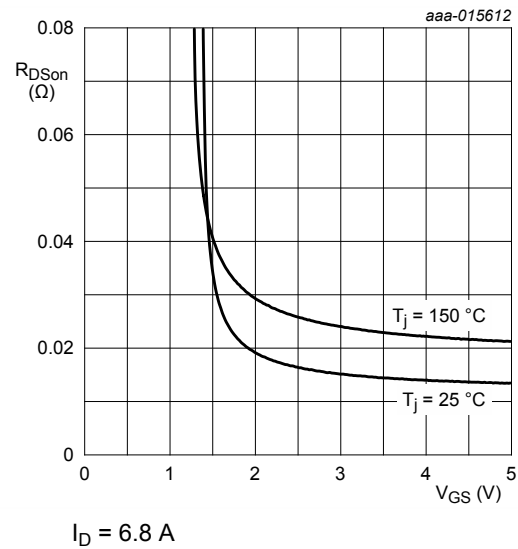


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

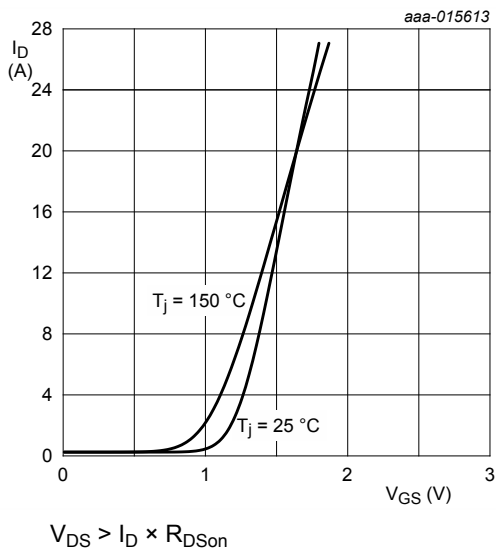


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

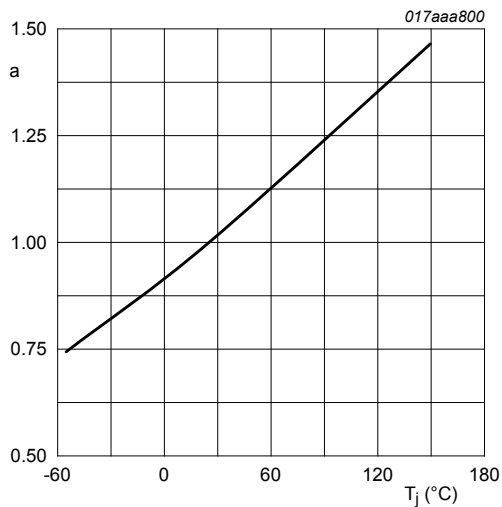


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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

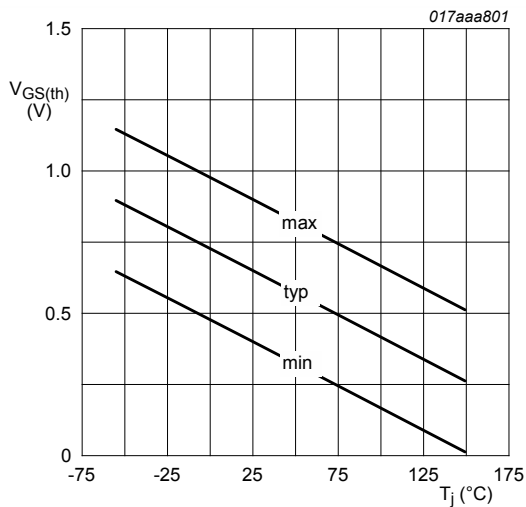


Fig. 12. Gate-source threshold voltage as a function of junction temperature

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

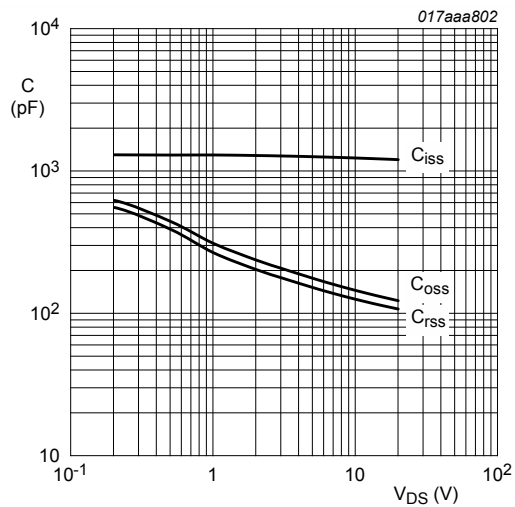


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

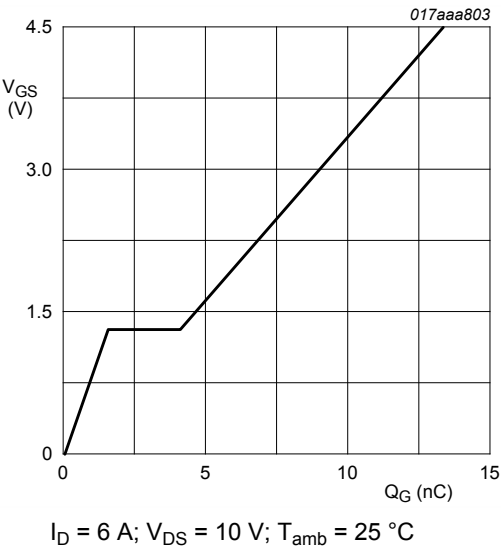


Fig. 14. Gate-source voltage as a function of gate charge; typical values

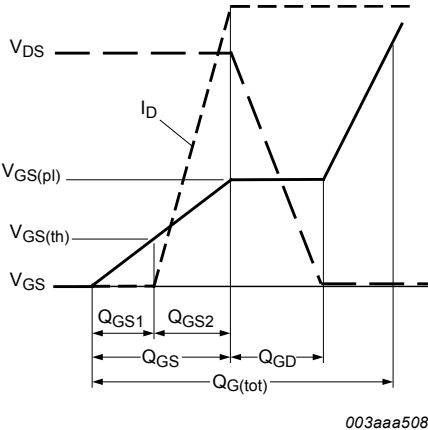


Fig. 15. MOSFET transistor: Gate charge waveform definitions

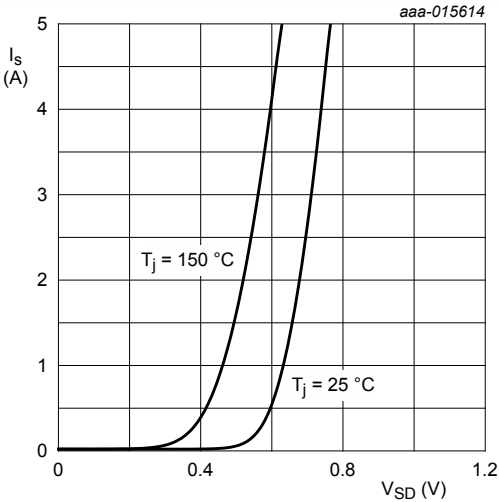


Fig. 16. Source current as a function of source-drain voltage; typical values

10. Test information

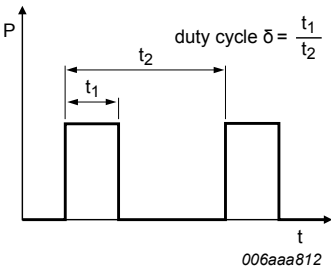


Fig. 17. Duty cycle definition

11. Package outline

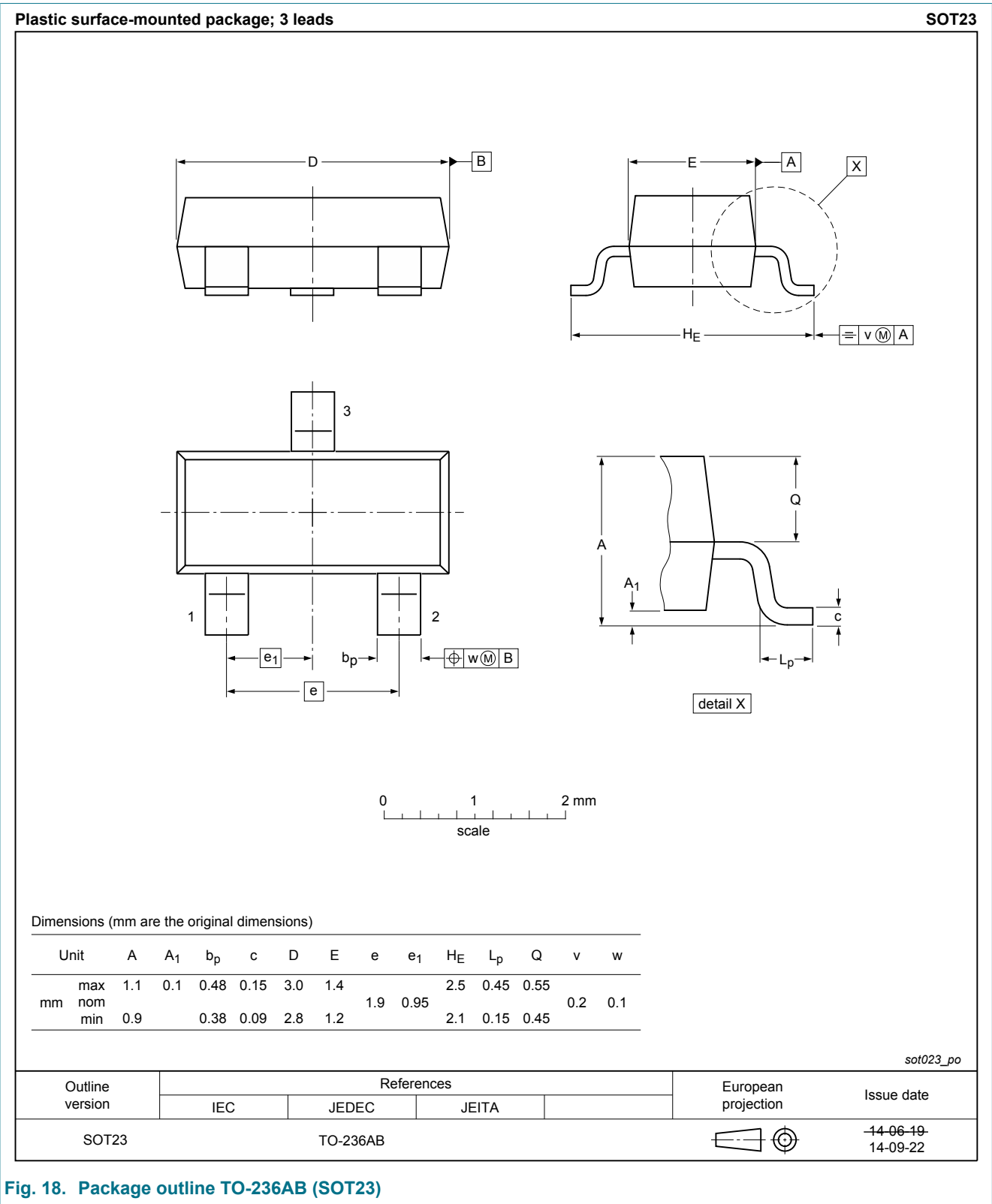


Fig. 18. Package outline TO-236AB (SOT23)

12. Soldering

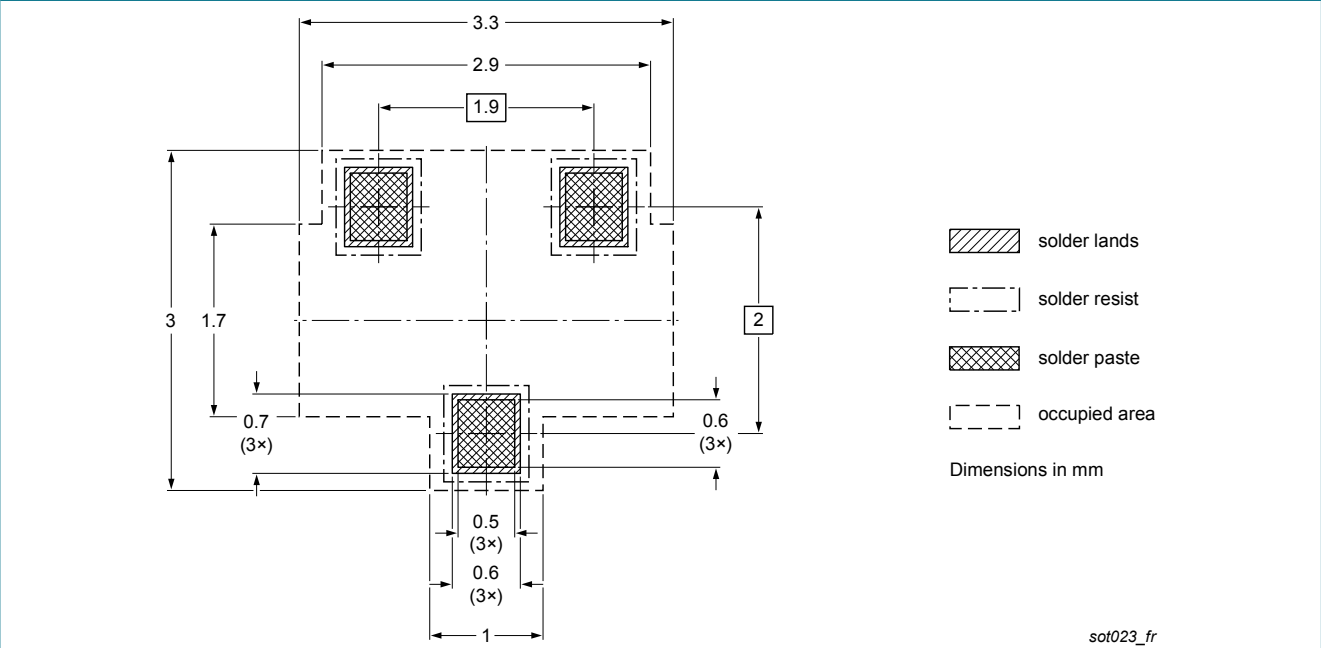


Fig. 19. Reflow soldering footprint for TO-236AB (SOT23)

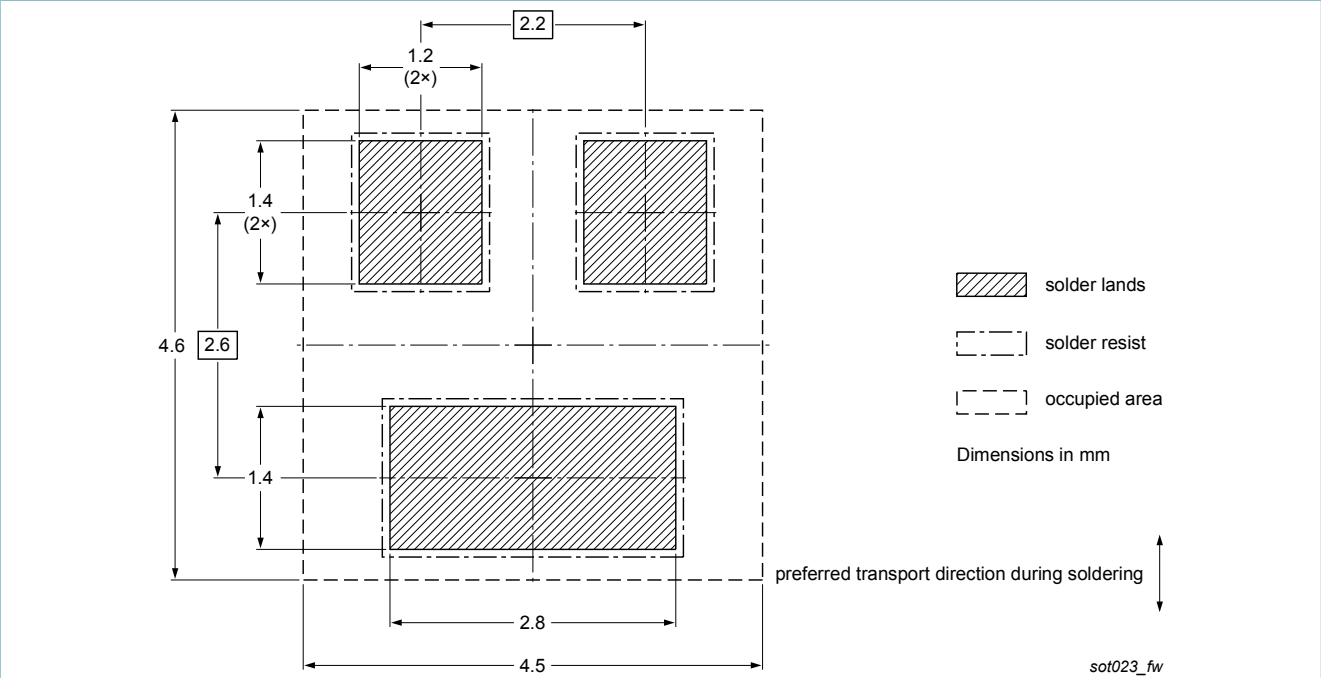


Fig. 20. Wave soldering footprint for TO-236AB (SOT23)

## 13. Revision history

Table 8. Revision history

| Data sheet ID | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PMV16XN v.1   | 20141111     | Product data sheet | -             | -          |

## 14. Legal information

### 14.1 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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