



# PMV50XP

20 V, P-channel Trench MOSFET

19 November 2014

Product data sheet

## 1. General description

P-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

- Low threshold voltage
- Low on-state resistance
- Trench MOSFET technology
- Enhanced power dissipation capability of 1096 mW

## 3. Applications

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

## 4. Quick reference data

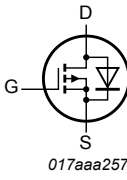
Table 1. Quick reference data

| Symbol                        | Parameter                        | Conditions                                                                              |     | Min | Typ | Max  | Unit       |
|-------------------------------|----------------------------------|-----------------------------------------------------------------------------------------|-----|-----|-----|------|------------|
| $V_{DS}$                      | 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] | -   | -   | -4.4 | A          |
| <b>Static characteristics</b> |                                  |                                                                                         |     |     |     |      |            |
| $R_{DS(on)}$                  | drain-source on-state resistance | $V_{GS} = -4.5\text{ V}$ ; $I_D = -3.6\text{ A}$ ; $T_J = 25\text{ }^{\circ}\text{C}$   |     | -   | 48  | 60   | m $\Omega$ |

[1] Device mounted on an FR4 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        | <br>TO-236AB (SOT23) | <br>017aaa257 |
| 2   | S      | source      |                                                                                                       |                                                                                                  |
| 3   | D      | drain       |                                                                                                       |                                                                                                  |

6. Ordering information

Table 3. Ordering information

| Type number | Package  |                                          |         |
|-------------|----------|------------------------------------------|---------|
|             | Name     | Description                              | Version |
| PMV50XP     | TO-236AB | plastic surface-mounted package; 3 leads | SOT23   |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMV50XP     | %2M          |

[1] % = placeholder for manufacturing site code

## 8. Limiting values

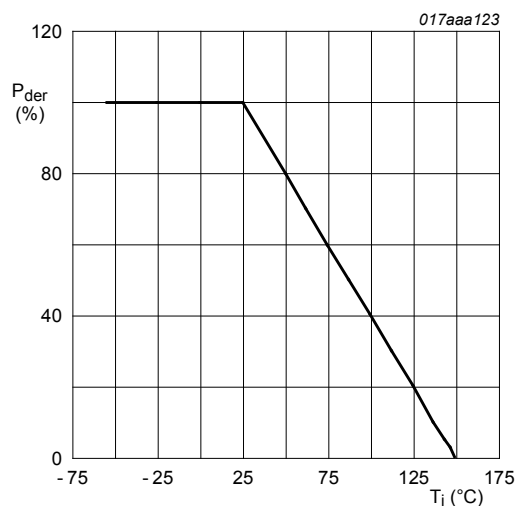
**Table 5. Limiting values**

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

| Symbol                    | Parameter               | Conditions                                                     |     | Min | Max   | Unit |
|---------------------------|-------------------------|----------------------------------------------------------------|-----|-----|-------|------|
| V <sub>DS</sub>           | drain-source voltage    | T <sub>j</sub> = 25 °C                                         |     | -   | -20   | V    |
| V <sub>GS</sub>           | gate-source voltage     |                                                                |     | -12 | 12    | V    |
| I <sub>D</sub>            | drain current           | V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 25 °C; t ≤ 5 s    | [1] | -   | -4.4  | A    |
|                           |                         | V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 25 °C             | [1] | -   | -3.6  | A    |
|                           |                         | V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 100 °C            | [1] | -   | -2.3  | A    |
| I <sub>DM</sub>           | peak drain current      | T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs |     | -   | -14.5 | A    |
| P <sub>tot</sub>          | total power dissipation | T <sub>amb</sub> = 25 °C                                       | [2] | -   | 490   | mW   |
|                           |                         |                                                                | [1] | -   | 1096  | mW   |
|                           |                         | T <sub>sp</sub> = 25 °C                                        |     | -   | 4630  | 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>sp</sub> = 25 °C                                        | [1] | -   | -1    | A    |

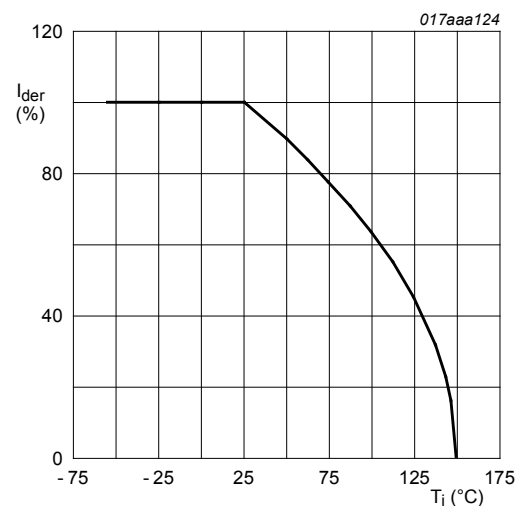
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

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



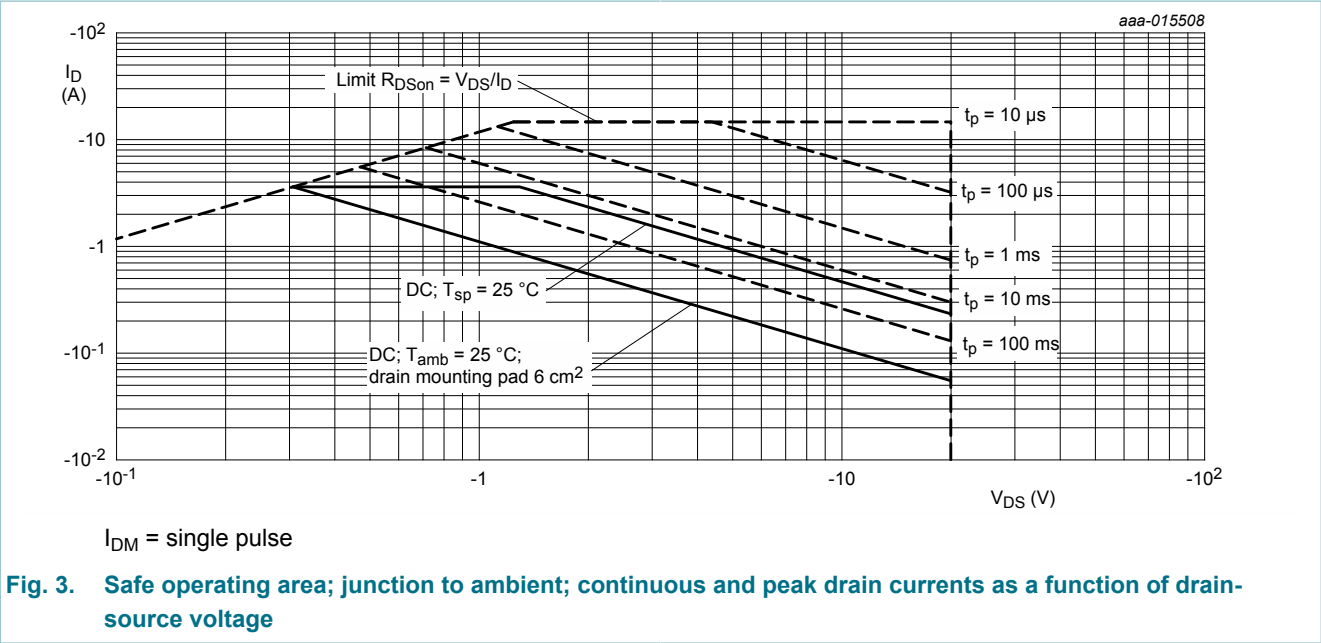
**Fig. 1. Normalized total power dissipation as a function of junction temperature**

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



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

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



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] | -   | 217 | 255 | K/W  |
|                |                                                  |                            | [2] | -   | 97  | 114 | K/W  |
|                |                                                  | in free air; $t \leq 5\ s$ | [2] | -   | 65  | 76  | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |                            |     | -   | 23  | 27  | 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  $6\ cm^2$ .

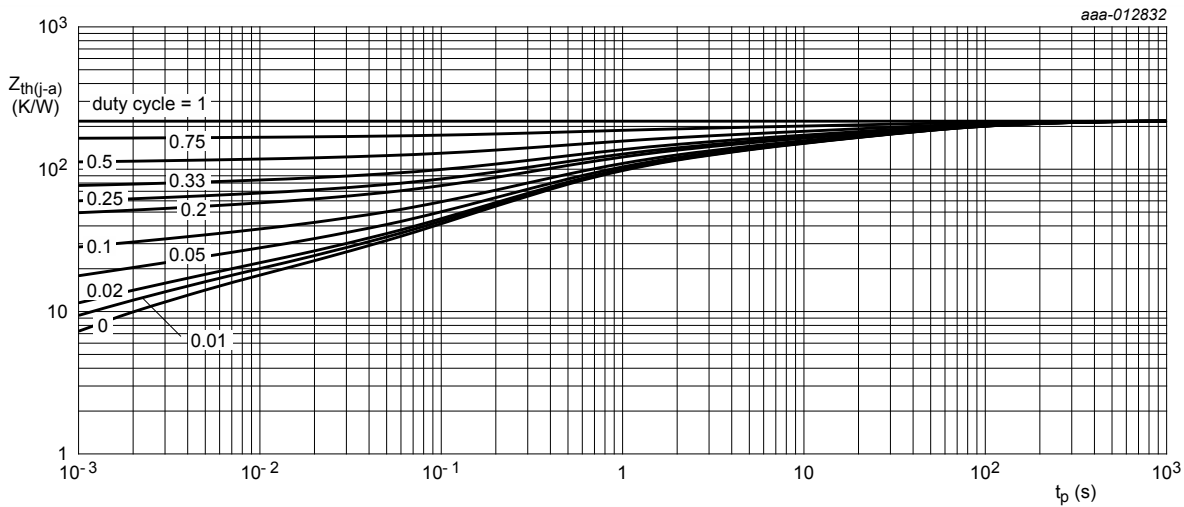


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

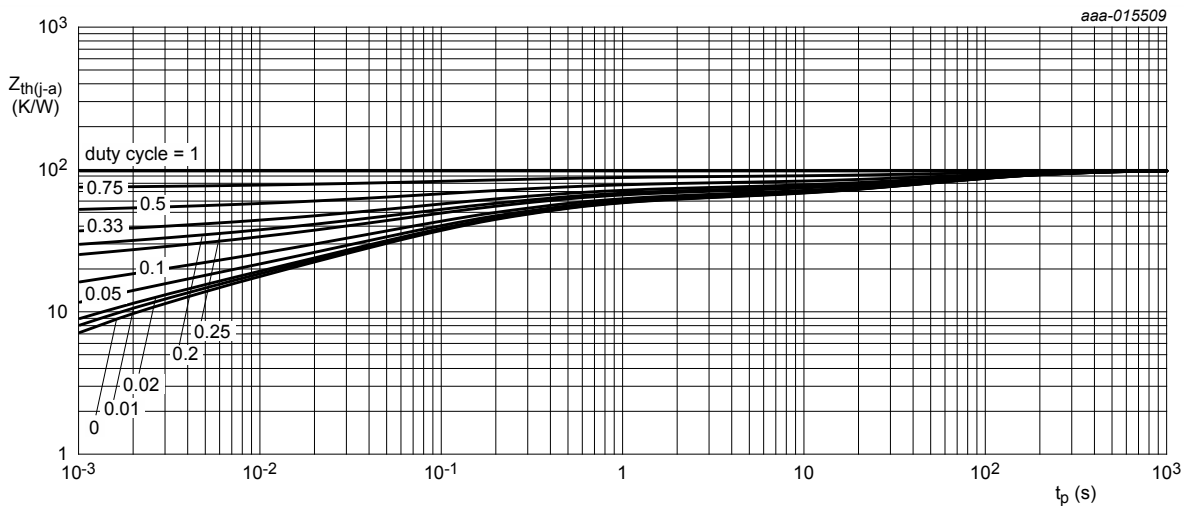


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

| Symbol                  | Parameter                        | Conditions                                                                                                                 |  | Min   | Typ   | Max  | Unit |
|-------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|--|-------|-------|------|------|
| 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                                       |  | -0.47 | -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> = -3.6 A; T <sub>j</sub> = 25 °C                                                  |  | -     | 48    | 60   | mΩ   |
|                         |                                  | V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -3.6 A; T <sub>j</sub> = 150 °C                                                 |  | -     | 68    | 86   | mΩ   |
|                         |                                  | V <sub>GS</sub> = -2.5 V; I <sub>D</sub> = -3.1 A; T <sub>j</sub> = 25 °C                                                  |  | -     | 60    | 80   | mΩ   |
|                         |                                  | V <sub>GS</sub> = -1.8 V; I <sub>D</sub> = -0.8 A; T <sub>j</sub> = 25 °C                                                  |  | -     | 82    | 121  | mΩ   |
|                         |                                  | V <sub>GS</sub> = -1.5 V; I <sub>D</sub> = -0.1 A; T <sub>j</sub> = 25 °C                                                  |  | -     | 116   | 250  | 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                                                     |  | -     | 9     | -    | S    |
| Dynamic characteristics |                                  |                                                                                                                            |  |       |       |      |      |
| Q <sub>G(tot)</sub>     | total gate charge                | V <sub>DS</sub> = -6 V; I <sub>D</sub> = -2.8 A; V <sub>GS</sub> = -4.5 V; T <sub>j</sub> = 25 °C                          |  | -     | 7.7   | 12   | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                                            |  | -     | 1     | -    | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                                            |  | -     | 1.65  | -    | nC   |
| C <sub>iss</sub>        | input capacitance                | V <sub>DS</sub> = -20 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                          |  | -     | 744   | -    | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                                            |  | -     | 65    | -    | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                            |  | -     | 53    | -    | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               | V <sub>DS</sub> = -6 V; V <sub>GS</sub> = -4.5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C; I <sub>D</sub> = -1 A |  | -     | 7     | -    | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                            |  | -     | 18    | -    | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                            |  | -     | 135   | -    | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                            |  | -     | 68    | -    | ns   |
| Source-drain diode      |                                  |                                                                                                                            |  |       |       |      |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = -1 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                       |  | -     | -0.74 | -1.2 | V    |

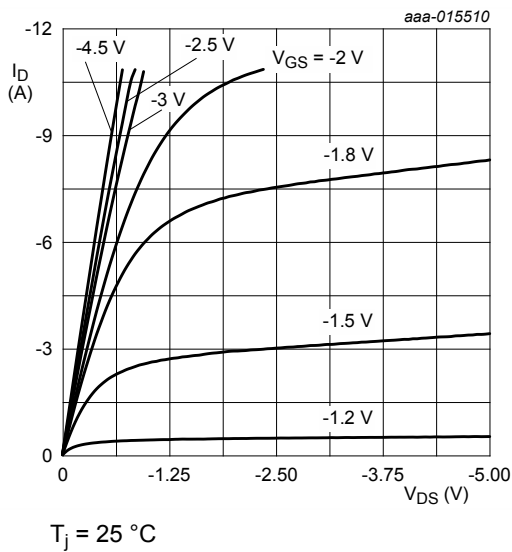


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

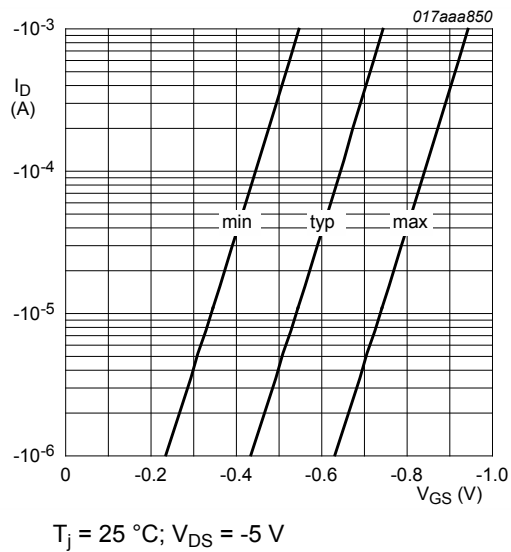


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

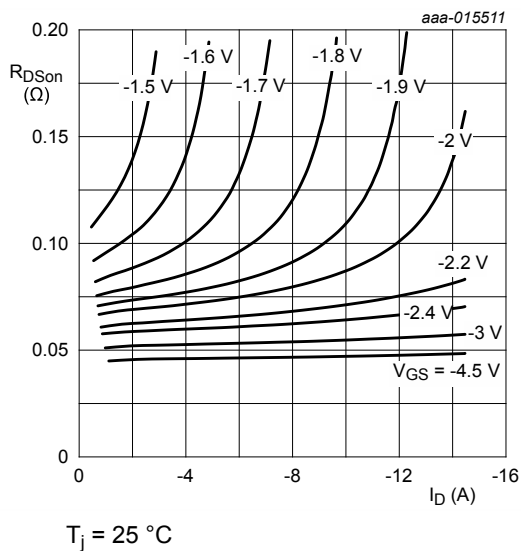


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

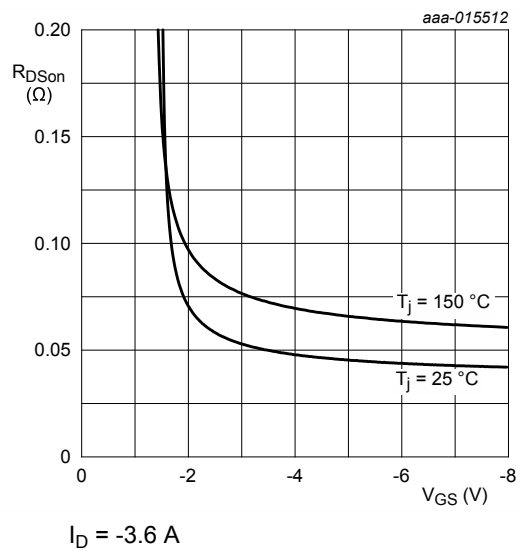


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

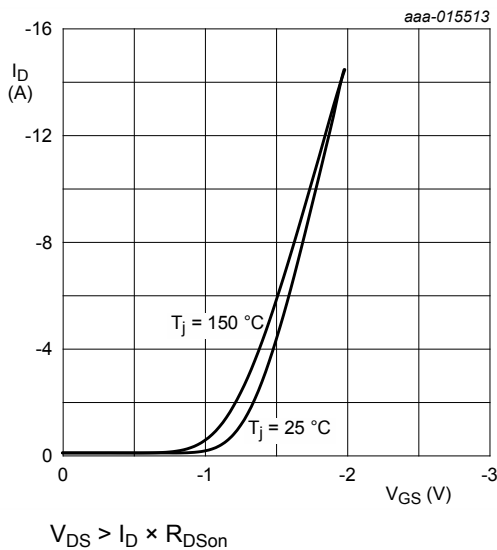


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

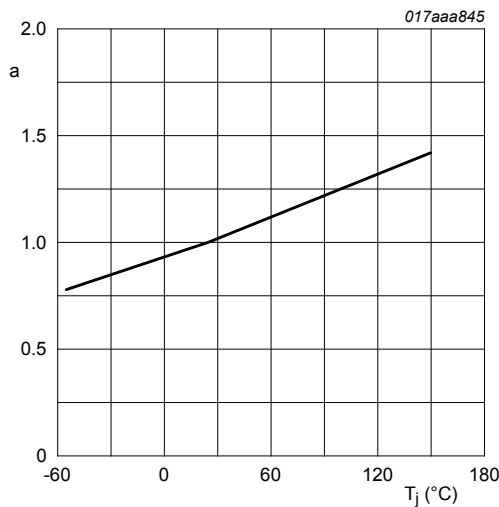


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DSon}}{R_{DSon(25\text{ °C})}}$$

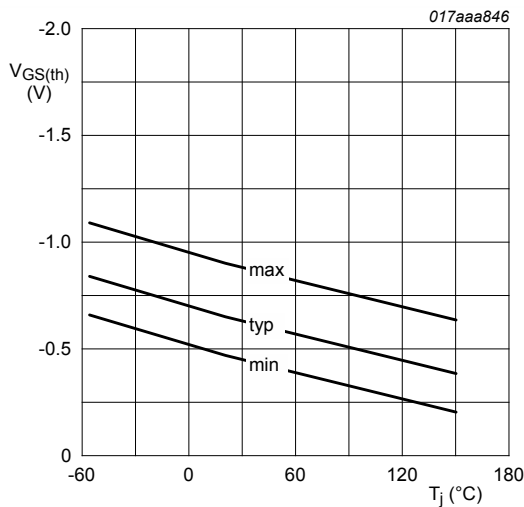


Fig. 12. Gate-source threshold voltage as a function of junction temperature

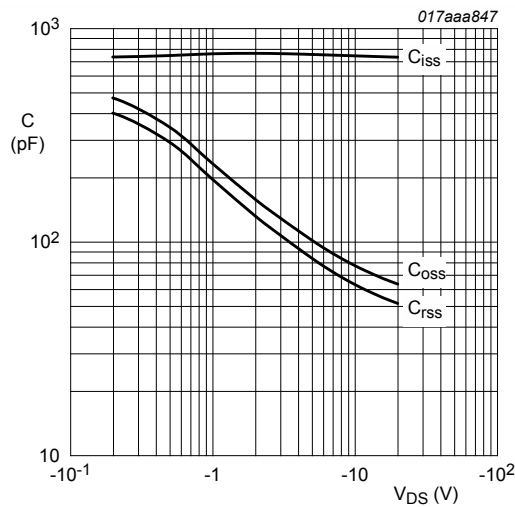


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

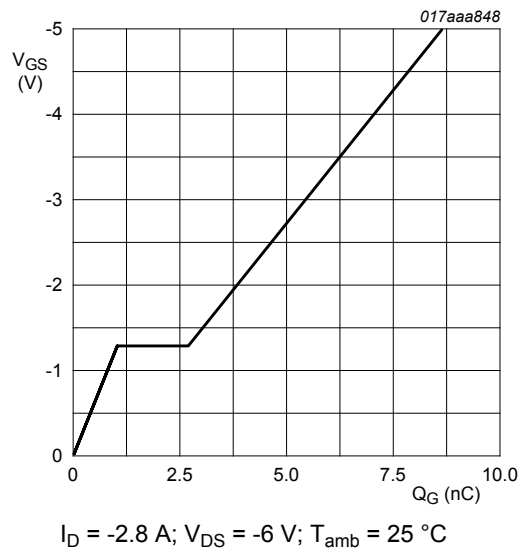


Fig. 14. Gate-source voltage as a function of gate charge; typical values

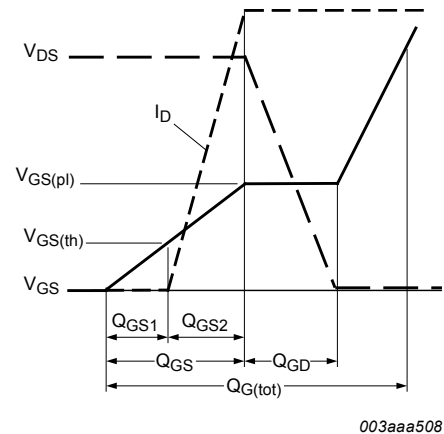
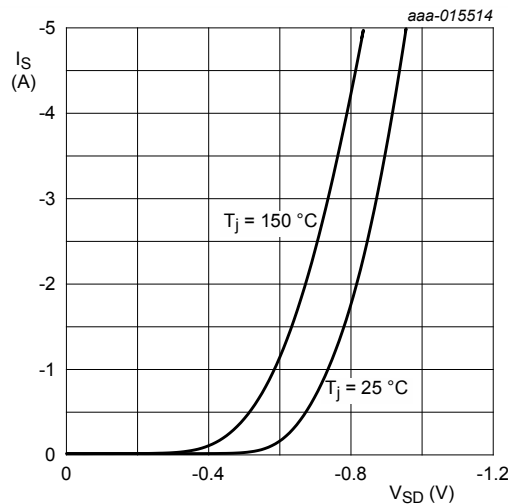


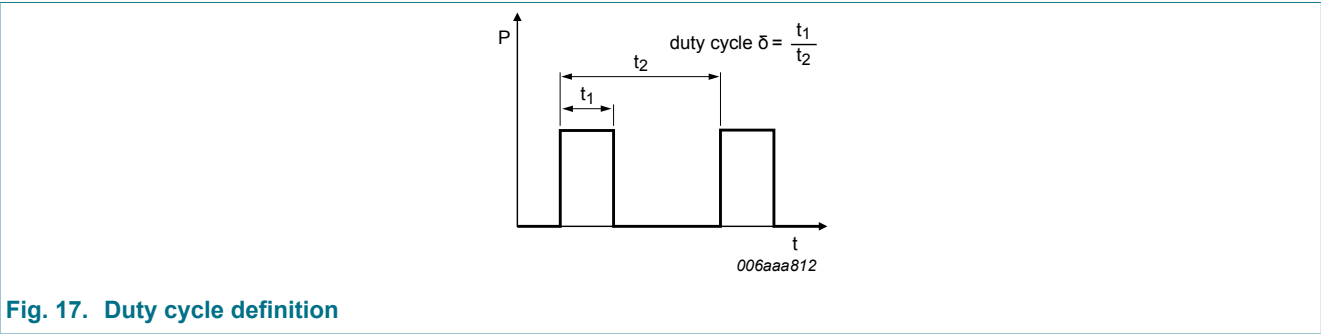
Fig. 15. MOSFET transistor: Gate charge waveform definitions



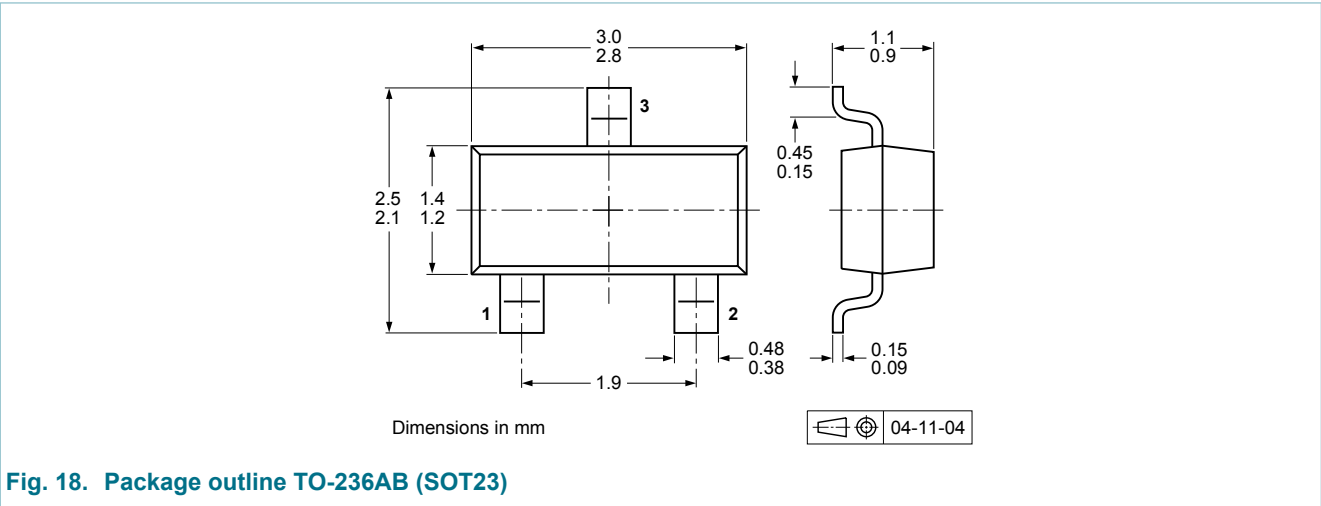
$V_{GS} = 0\text{ V}$   
(1)  $T_j = 150\text{ }^{\circ}\text{C}$   
(2)  $T_j = 25\text{ }^{\circ}\text{C}$

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

11. Test information



12. Package outline



13. Soldering

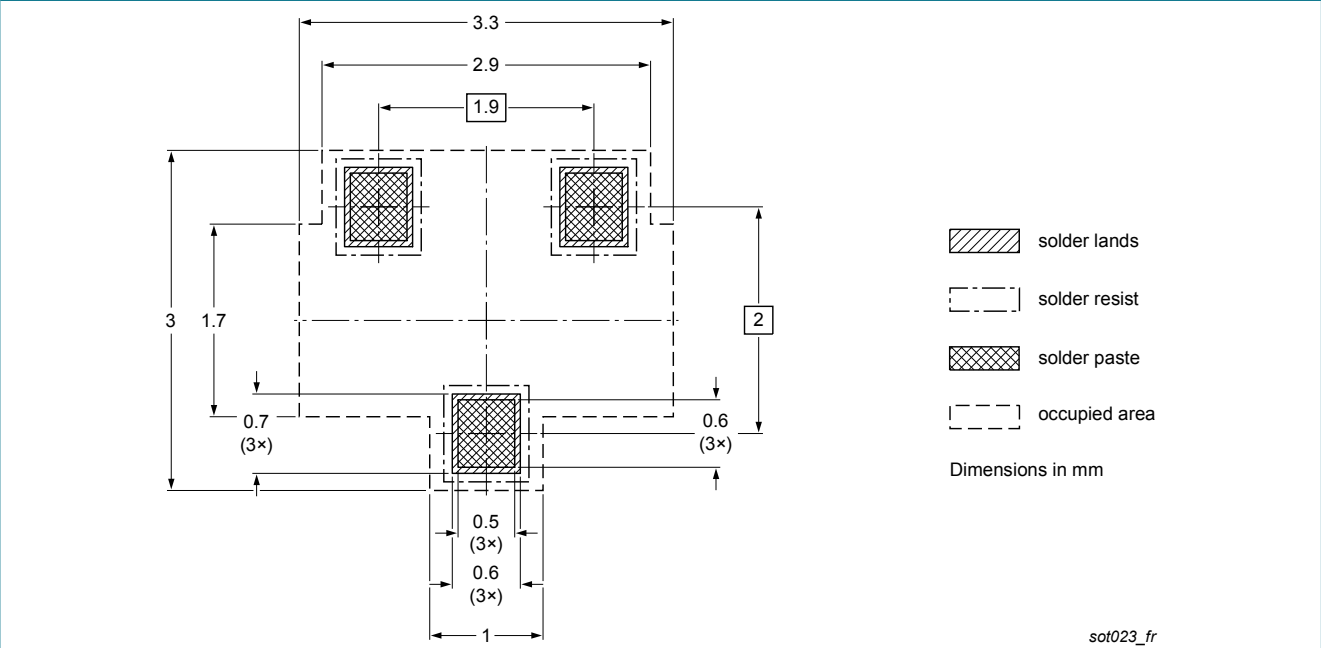


Fig. 19. Reflow soldering footprint for TO-236AB (SOT23)

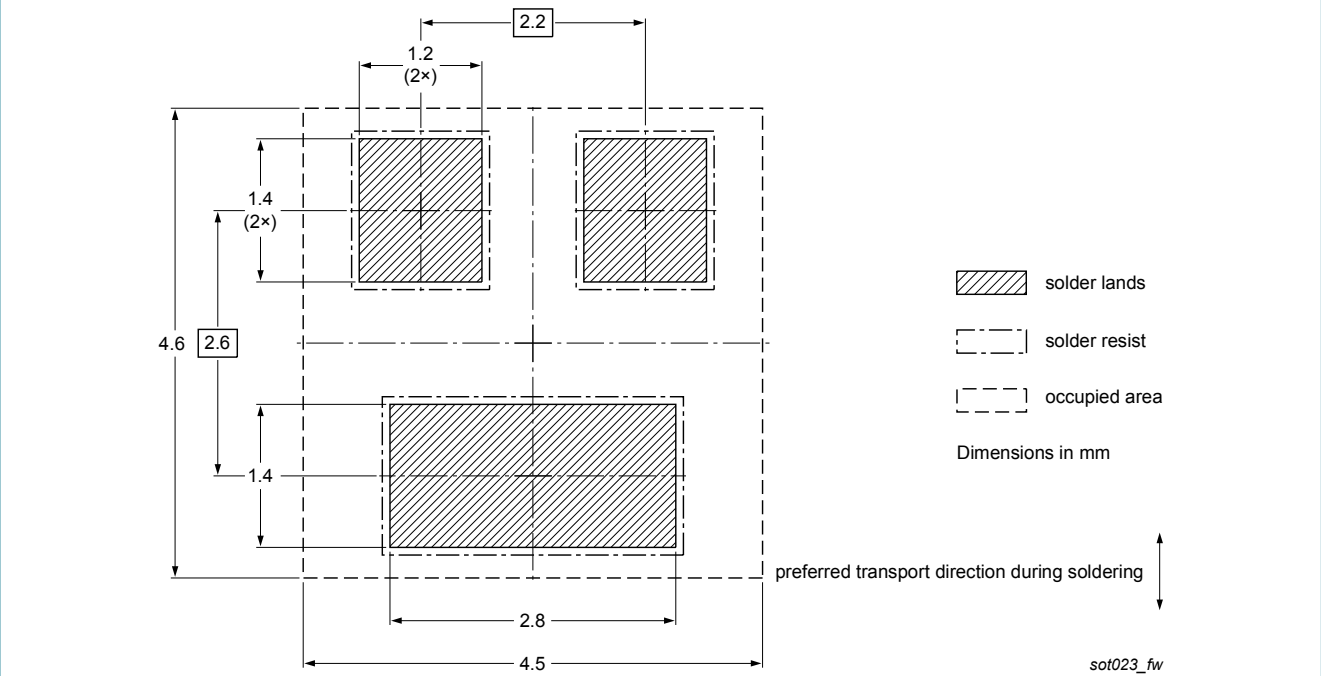


Fig. 20. Wave soldering footprint for TO-236AB (SOT23)

## 14. Revision history

Table 8. Revision history

| Data sheet ID  | Release date                       | Data sheet status  | Change notice | Supersedes  |
|----------------|------------------------------------|--------------------|---------------|-------------|
| PMV50XP v.2    | 20141119                           | Product data sheet | -             | PMV50XP v.1 |
| Modifications: | Table 7: $R_{DSon}$ unit corrected |                    |               |             |
| PMV50XP v.1    | 20141111                           | 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".
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