



# PMV15UNEA

20 V, N-channel Trench MOSFET

12 August 2024

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

- Low threshold voltage
- Extended temperature range  $T_j = 175\text{ °C}$
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection > 500 V HBM (class H1B)
- AEC-Q101 qualified

## 3. Applications

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

## 4. Quick reference data

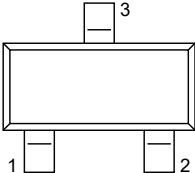
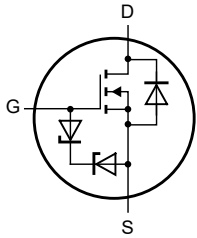
Table 1. Quick reference data

| Symbol                        | Parameter                        | Conditions                                                    |     | Min | Typ | Max | Unit |
|-------------------------------|----------------------------------|---------------------------------------------------------------|-----|-----|-----|-----|------|
| $V_{DS}$                      | drain-source voltage             | $T_j = 25\text{ °C}$                                          |     | -   | -   | 20  | V    |
| $V_{GS}$                      | gate-source voltage              |                                                               |     | -8  | -   | 8   | V    |
| $I_D$                         | drain current                    | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}$               | [1] | -   | -   | 7   | A    |
| <b>Static characteristics</b> |                                  |                                                               |     |     |     |     |      |
| $R_{DSon}$                    | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 7\text{ A}; T_j = 25\text{ °C}$ |     | -   | 15  | 19  | mΩ   |

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

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline                                                                         | Graphic symbol                                                                                   |
|-----|--------|-------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 1   | G      | gate        | <br>SOT23 | <br>017aaa255 |
| 2   | S      | source      |                                                                                            |                                                                                                  |
| 3   | D      | drain       |                                                                                            |                                                                                                  |

6. Ordering information

Table 3. Ordering information

| Type number | Package |                                                                                          |         |
|-------------|---------|------------------------------------------------------------------------------------------|---------|
|             | Name    | Description                                                                              | Version |
| PMV15UNEA   | SOT23   | plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body | SOT23   |

7. Marking

Table 4. Marking codes

| Type number | Marking code[1] |
|-------------|-----------------|
| PMV15UNEA   | %GN             |

[1] % = placeholder for manufacturing site code

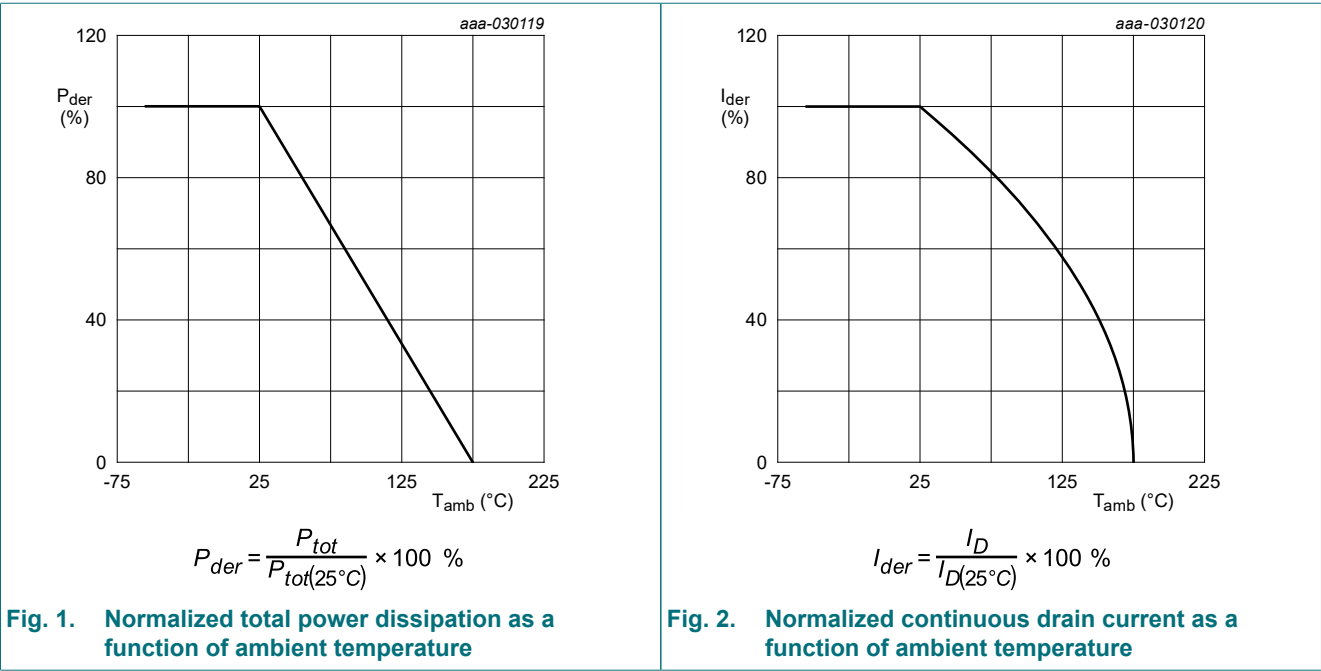
8. Limiting values

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                          |                                                                                       |     | -8  | 8   | V    |
| I <sub>D</sub>       | drain current                                | V <sub>GS</sub> = 4.5 V; T <sub>amb</sub> = 25 °C                                     | [1] | -   | 7   | A    |
|                      |                                              | V <sub>GS</sub> = 4.5 V; T <sub>amb</sub> = 100 °C                                    | [1] | -   | 4.4 | A    |
| I <sub>DM</sub>      | peak drain current                           | T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs                        |     | -   | 28  | A    |
| P <sub>tot</sub>     | total power dissipation                      | T <sub>amb</sub> = 25 °C                                                              | [2] | -   | 610 | mW   |
|                      |                                              |                                                                                       | [1] | -   | 1.4 | W    |
|                      |                                              | T <sub>sp</sub> = 25 °C                                                               |     | -   | 8.3 | W    |
| T <sub>j</sub>       | junction temperature                         |                                                                                       |     | -55 | 175 | °C   |
| T <sub>amb</sub>     | ambient temperature                          |                                                                                       |     | -55 | 175 | °C   |
| T <sub>stg</sub>     | storage temperature                          |                                                                                       |     | -65 | 175 | °C   |
| Source-drain diode   |                                              |                                                                                       |     |     |     |      |
| I <sub>S</sub>       | source current                               | T <sub>amb</sub> = 25 °C                                                              | [1] | -   | 1.4 | A    |
| ESD maximum rating   |                                              |                                                                                       |     |     |     |      |
| V <sub>ESD</sub>     | electrostatic discharge voltage              | HBM                                                                                   | [3] | -   | 500 | V    |
| Avalanche ruggedness |                                              |                                                                                       |     |     |     |      |
| E <sub>DS(AL)S</sub> | non-repetitive drain-source avalanche energy | T <sub>j(initial)</sub> = 25 °C; I <sub>D</sub> = 1.5 A; DUT in avalanche (unclamped) |     | -   | 14  | mJ   |

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



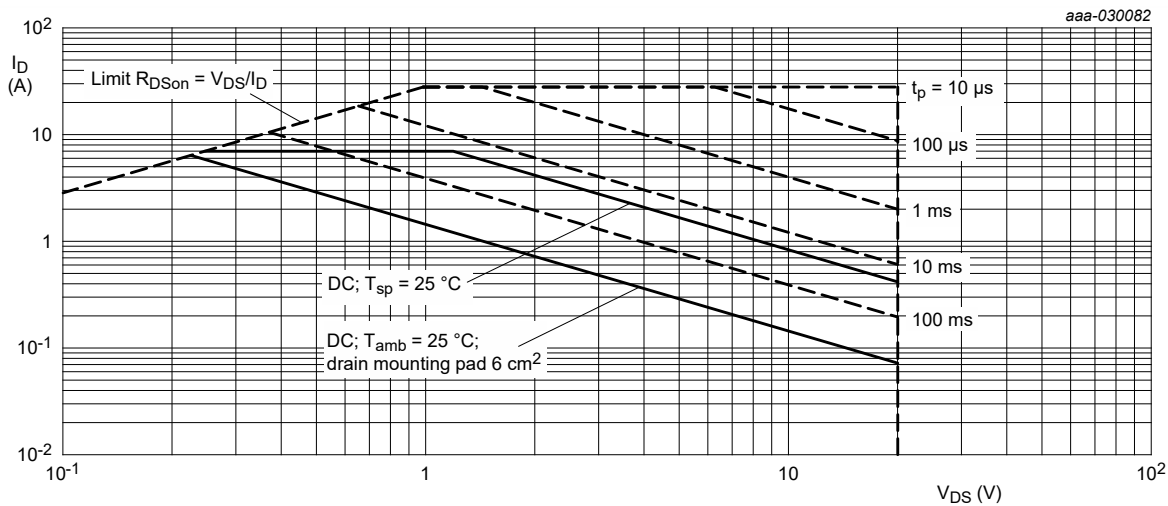


Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

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] | -   | 208 | 245 | K/W  |
|                |                                                  |             | [2] | -   | 88  | 104 | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder 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>.

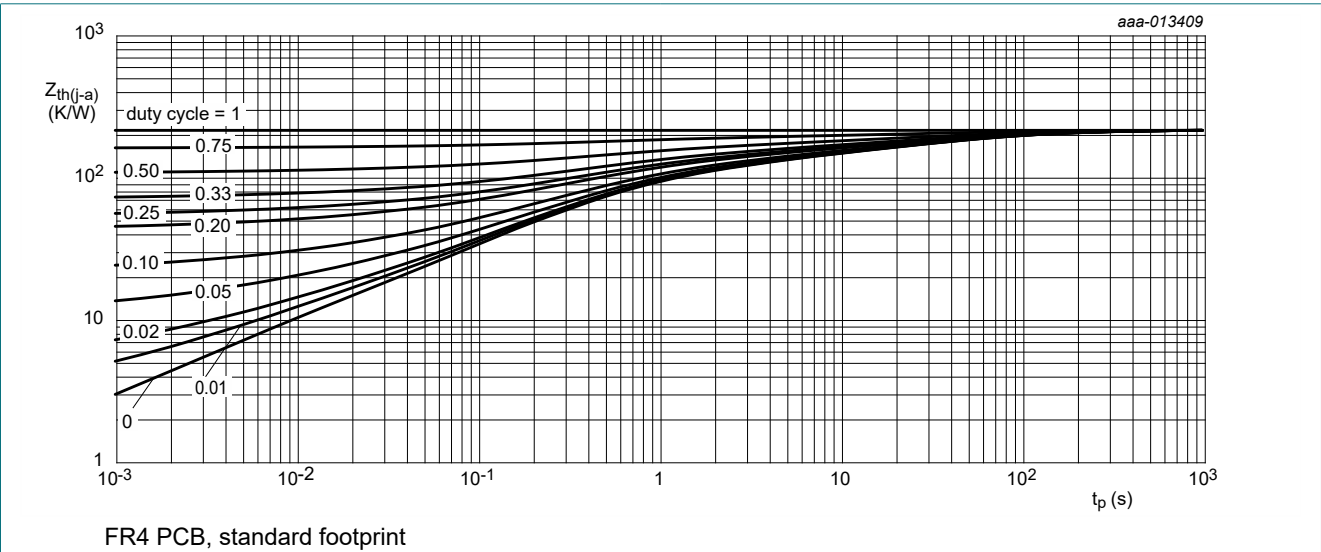


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

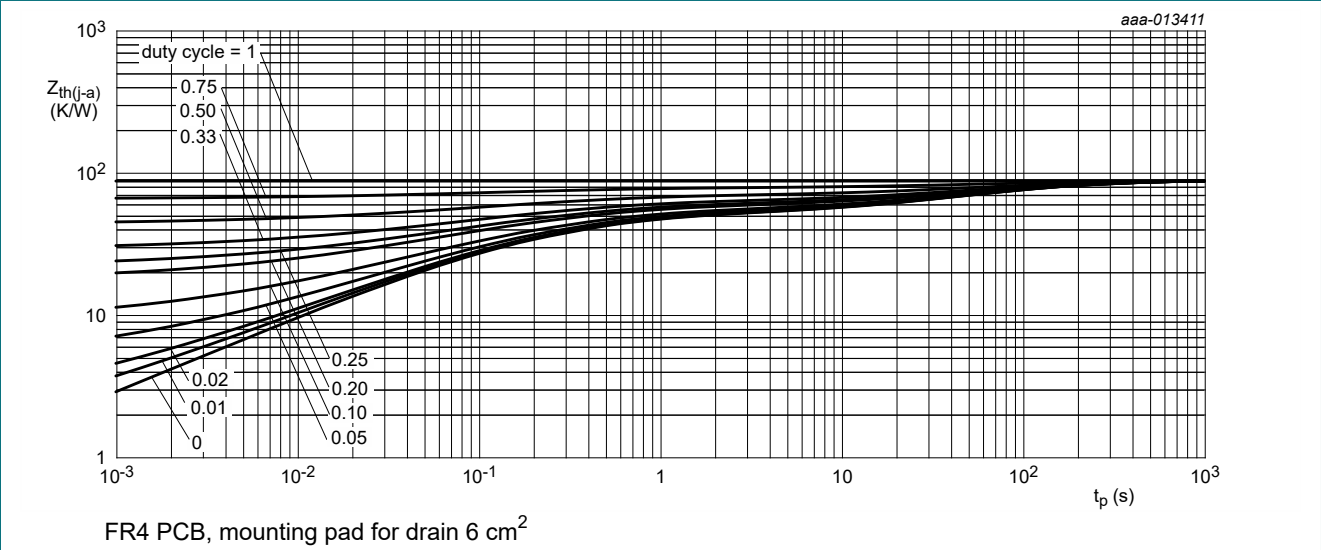


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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                                            |  | 0.4 | 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> = 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> = 7 A; T <sub>j</sub> = 25 °C                                                          |  | -   | 15   | 19  | mΩ   |
|                         |                                  | V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 7 A; T <sub>j</sub> = 175 °C                                                         |  | -   | 28   | 35  | mΩ   |
|                         |                                  | V <sub>GS</sub> = 2.5 V; I <sub>D</sub> = 5.7 A; T <sub>j</sub> = 25 °C                                                        |  | -   | 18   | 24  | mΩ   |
|                         |                                  | V <sub>GS</sub> = 1.8 V; I <sub>D</sub> = 2 A; T <sub>j</sub> = 25 °C                                                          |  | -   | 23   | 36  | mΩ   |
| g <sub>fs</sub>         | forward transconductance         | V <sub>DS</sub> = 10 V; I <sub>D</sub> = 7 A; T <sub>j</sub> = 25 °C                                                           |  | -   | 50   | -   | 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> = 6 A; V <sub>GS</sub> = 4.5 V; T <sub>j</sub> = 25 °C                                  |  | -   | 11   | 17  | nC   |
| Q <sub>GS</sub>         | gate-source charge               |                                                                                                                                |  | -   | 1.3  | -   | nC   |
| Q <sub>GD</sub>         | gate-drain charge                |                                                                                                                                |  | -   | 2.1  | -   | 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                                               |  | -   | 1220 | -   | pF   |
| C <sub>oss</sub>        | output capacitance               |                                                                                                                                |  | -   | 124  | -   | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance     |                                                                                                                                |  | -   | 102  | -   | pF   |
| t <sub>d(on)</sub>      | turn-on delay time               | V <sub>DS</sub> = 10 V; I <sub>D</sub> = 6 A; V <sub>GS</sub> = 4.5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C       |  | -   | 10   | -   | ns   |
| t <sub>r</sub>          | rise time                        |                                                                                                                                |  | -   | 24   | -   | ns   |
| t <sub>d(off)</sub>     | turn-off delay time              |                                                                                                                                |  | -   | 32   | -   | ns   |
| t <sub>f</sub>          | fall time                        |                                                                                                                                |  | -   | 34   | -   | ns   |
| Source-drain diode      |                                  |                                                                                                                                |  |     |      |     |      |
| V <sub>SD</sub>         | source-drain voltage             | I <sub>S</sub> = 1.4 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C                                                          |  | -   | 0.7  | 1.2 | V    |
| t <sub>rr</sub>         | reverse recovery time            | I <sub>S</sub> = 1.5 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 10 V; T <sub>j</sub> = 25 °C |  | -   | 10   | -   | ns   |
| Q <sub>r</sub>          | recovered charge                 |                                                                                                                                |  | -   | 2    | -   | nC   |

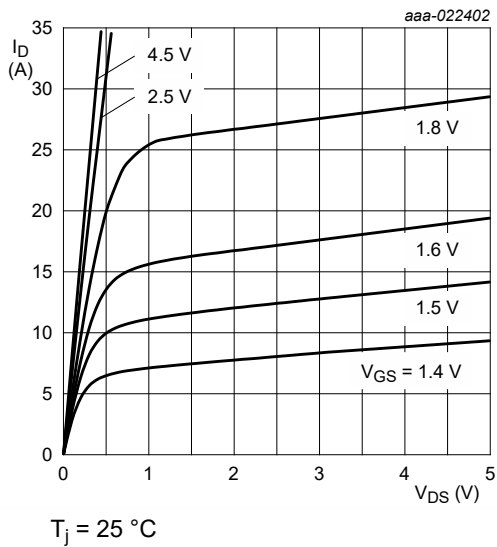


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

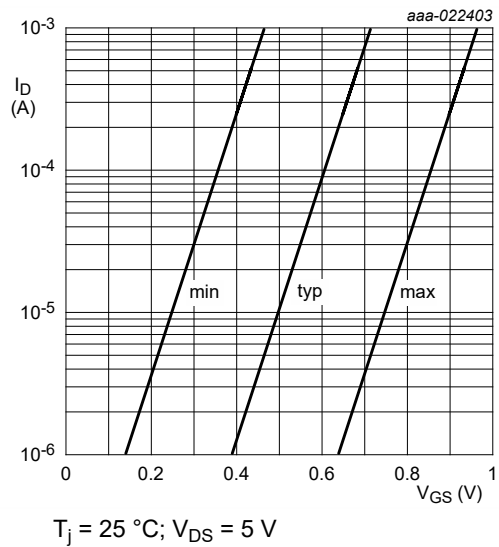


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

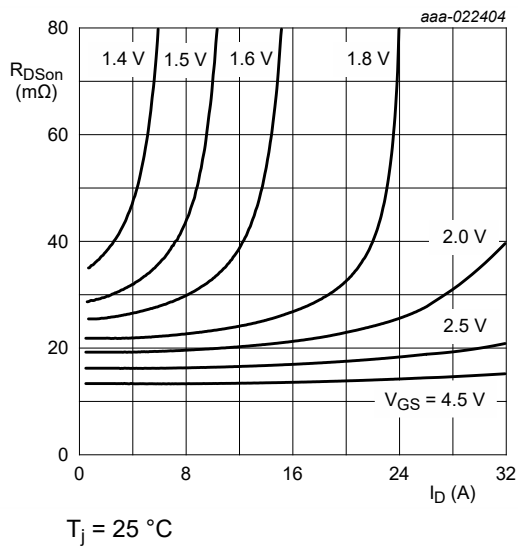


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

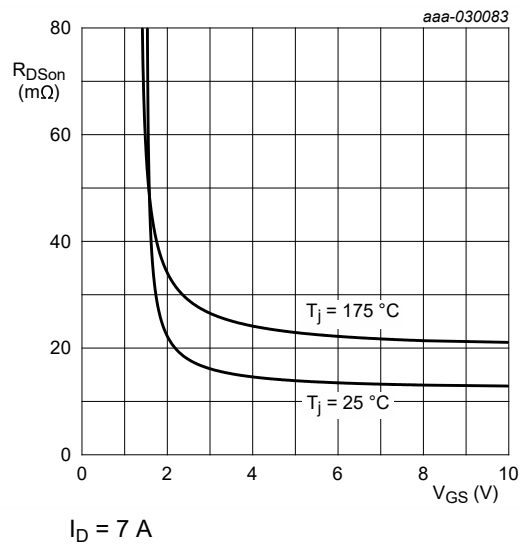


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

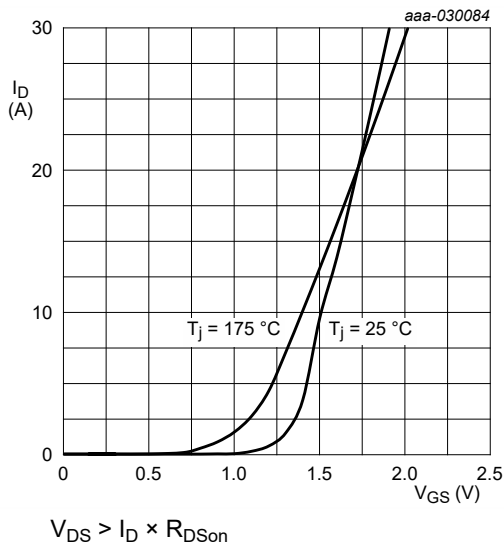


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

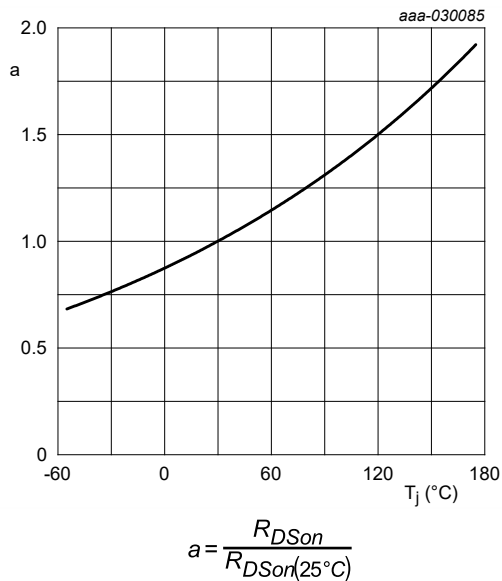


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

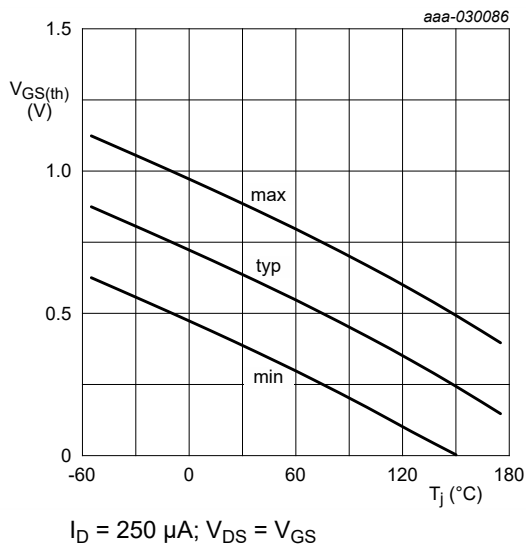


Fig. 12. Gate-source threshold voltage as a function of junction temperature

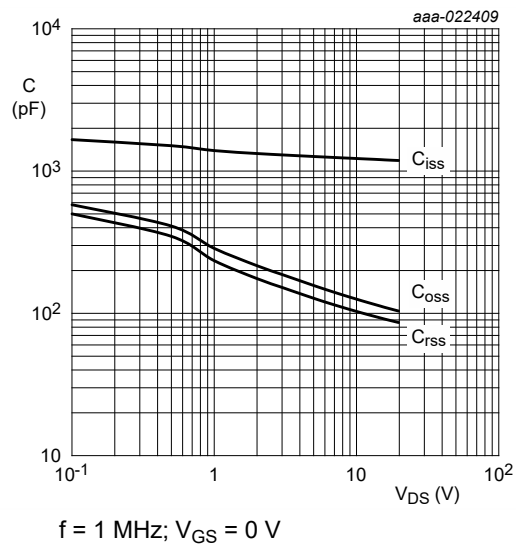


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

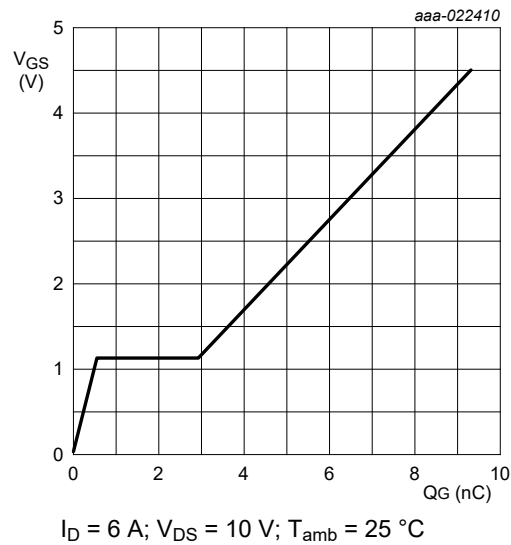


Fig. 14. Gate-source voltage as a function of gate charge; typical values

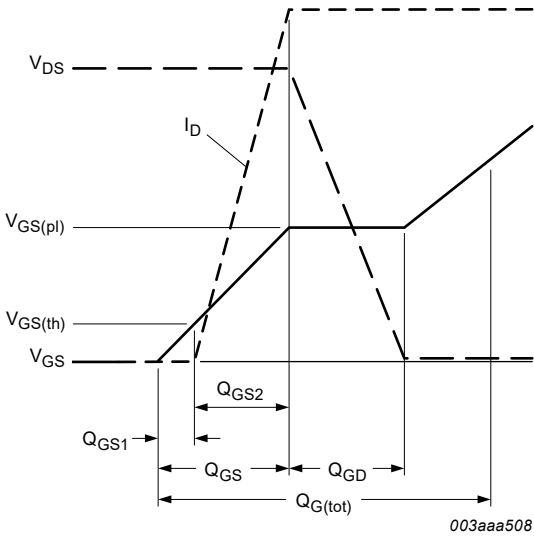


Fig. 15. Gate charge waveform definitions

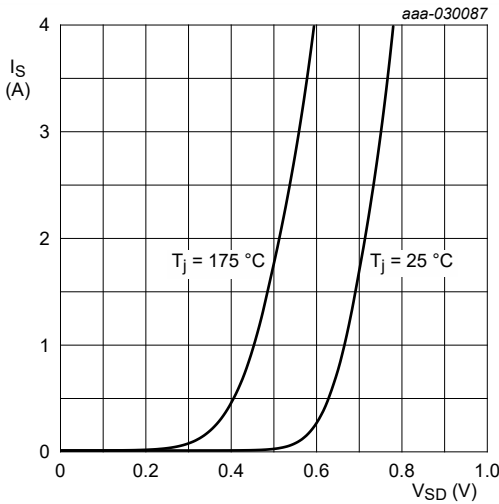


Fig. 16. Source current as a function of source-drain voltage; typical values

## 11. Test information

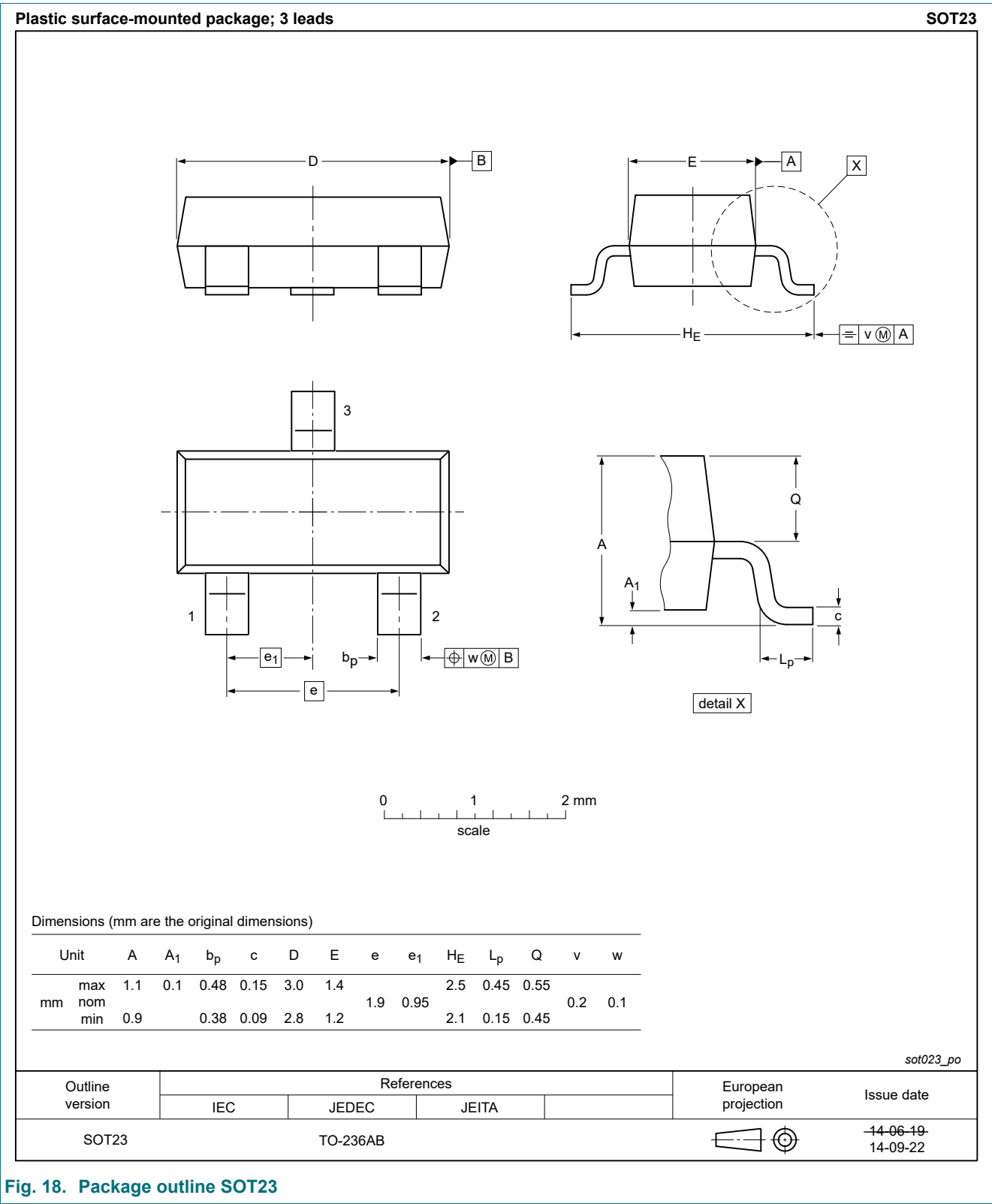


Fig. 17. Duty cycle definition

### Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

12. Package outline



13. Soldering



Fig. 19. Reflow soldering footprint for SOT23

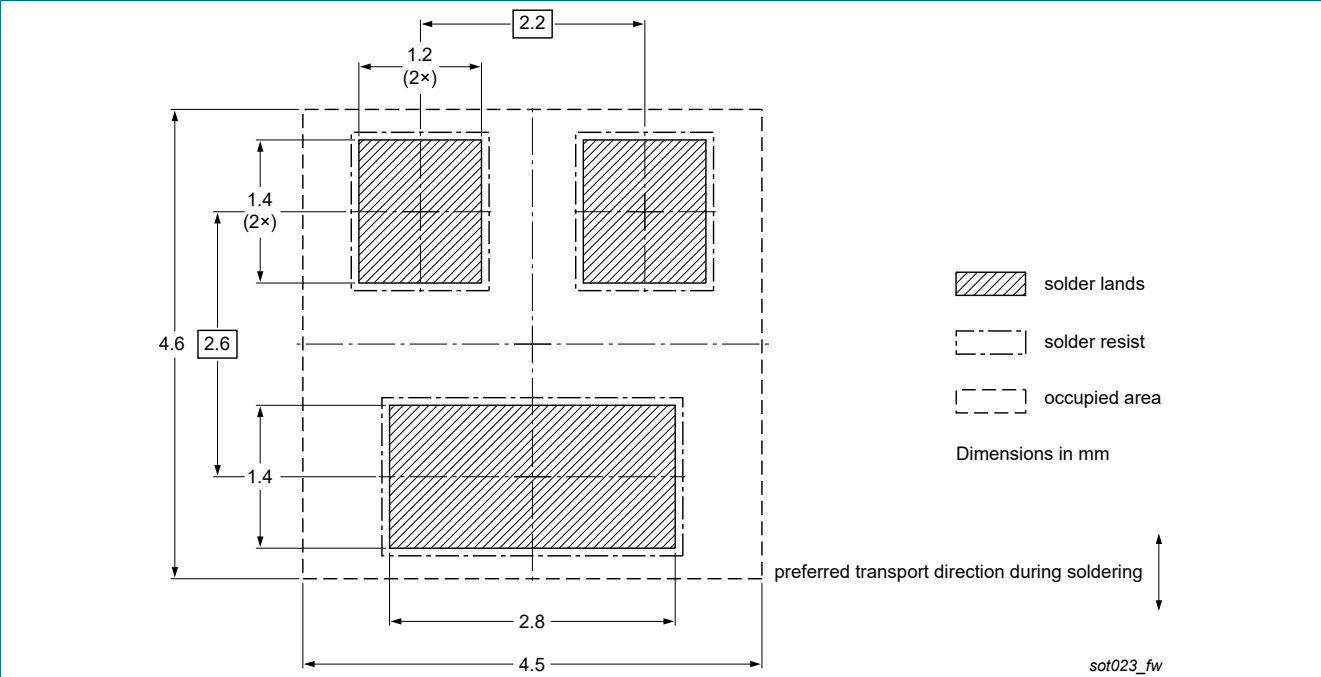


Fig. 20. Wave soldering footprint for SOT23

## 14. Revision history

Table 8. Revision history

| Data sheet ID  | Release date                                                               | Data sheet status  | Change notice | Supersedes    |
|----------------|----------------------------------------------------------------------------|--------------------|---------------|---------------|
| PMV15UNEA v.2  | 20240812                                                                   | Product data sheet | -             | PMV15UNEA v.1 |
| Modifications: | • Chapter "Characteristics": Fig. 16, label of the vertical axis corrected |                    |               |               |
| PMV15UNEA v.1  | 20190906                                                                   | Product data sheet | -             | -             |

## 15. Legal information

### 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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For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

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