



THE DATASHEET OF PMV250EPEAR





PMV250EPEA

40 V, P-channel Trench MOSFET

20 June 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

- Logic-level compatible
- Very fast switching
- Trench MOSFET technology
- 1 kV ESD protected
- AEC-Q101 qualified

3. Applications

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

4. Quick reference data

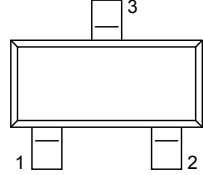
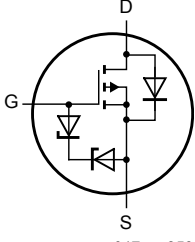
Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|----------------------------------|--|-----|-----|------|------------|
| V_{DS} | drain-source voltage | $T_j = 25\text{ °C}$ | - | - | -40 | V |
| V_{GS} | gate-source voltage | | -20 | - | 20 | V |
| I_D | drain current | $V_{GS} = -10\text{ V}; T_{amb} = 25\text{ °C}$ | [1] | - | -1.5 | A |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = -10\text{ V}; I_D = -1.3\text{ A}; T_j = 25\text{ °C}$ | - | 180 | 240 | m Ω |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm².

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-------------|---|--|
| 1 | G | gate |  <p>TO-236AB (SOT23)</p> |  <p>017aaa259</p> |
| 2 | S | source | | |
| 3 | D | drain | | |

6. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|-------------|----------|--|---------|
| | Name | Description | Version |
| PMV250EPEA | TO-236AB | plastic surface-mounted package; 3 leads | SOT23 |

7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMV250EPEA | %JY |

[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 | $T_j = 25\text{ °C}$ | | - | -40 | V |
| V_{GS} | gate-source voltage | | | -20 | 20 | V |
| I_D | drain current | $V_{GS} = -10\text{ V}; T_{amb} = 25\text{ °C}$ | [1] | - | -1.5 | A |
| | | $V_{GS} = -10\text{ V}; T_{amb} = 100\text{ °C}$ | [1] | - | -1 | A |
| I_{DM} | peak drain current | $T_{amb} = 25\text{ °C};$ single pulse; $t_p \leq 10\text{ }\mu\text{s}$ | | - | -6 | A |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $T_{j(\text{init})} = 25\text{ °C}; I_D = -0.26\text{ A};$ DUT in avalanche (unclamped) | | - | 5.5 | mJ |
| P_{tot} | total power dissipation | $T_{amb} = 25\text{ °C}$ | [2] | - | 480 | mW |
| | | | [1] | - | 890 | mW |
| | | $T_{sp} = 25\text{ °C}$ | | - | 6250 | mW |
| T_j | junction temperature | | | -55 | 150 | °C |
| T_{amb} | ambient temperature | | | -55 | 150 | °C |
| T_{stg} | storage temperature | | | -65 | 150 | °C |
| Source-drain diode | | | | | | |
| I_S | source current | $T_{amb} = 25\text{ °C}$ | [1] | - | -0.9 | A |
| ESD maximum rating | | | | | | |
| V_{ESD} | electrostatic discharge voltage | HBM | [3] | - | 1000 | V |

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

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

[3] Measured between all pins.



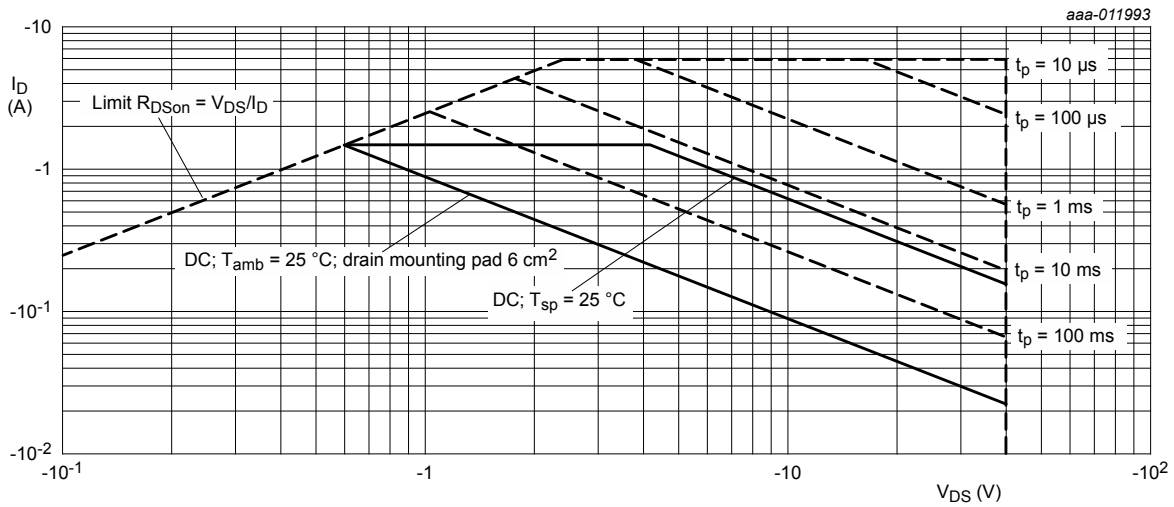
Fig. 1. Normalized total power dissipation as a function of junction temperature

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



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

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



I_{DM} = 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 |
|---------------|---|-------------|-----|-----|-----|-----|------|
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | 230 | 260 | K/W |
| | | | [2] | - | 120 | 140 | K/W |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|--|------------|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | | - | 15 | 20 | 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 cm².

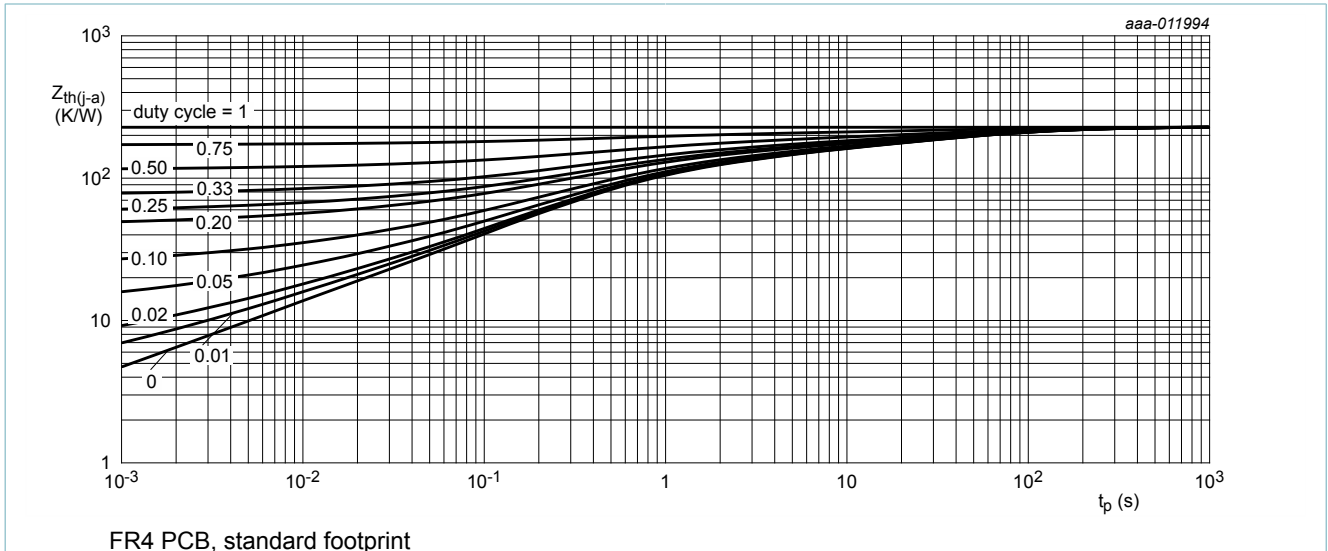


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

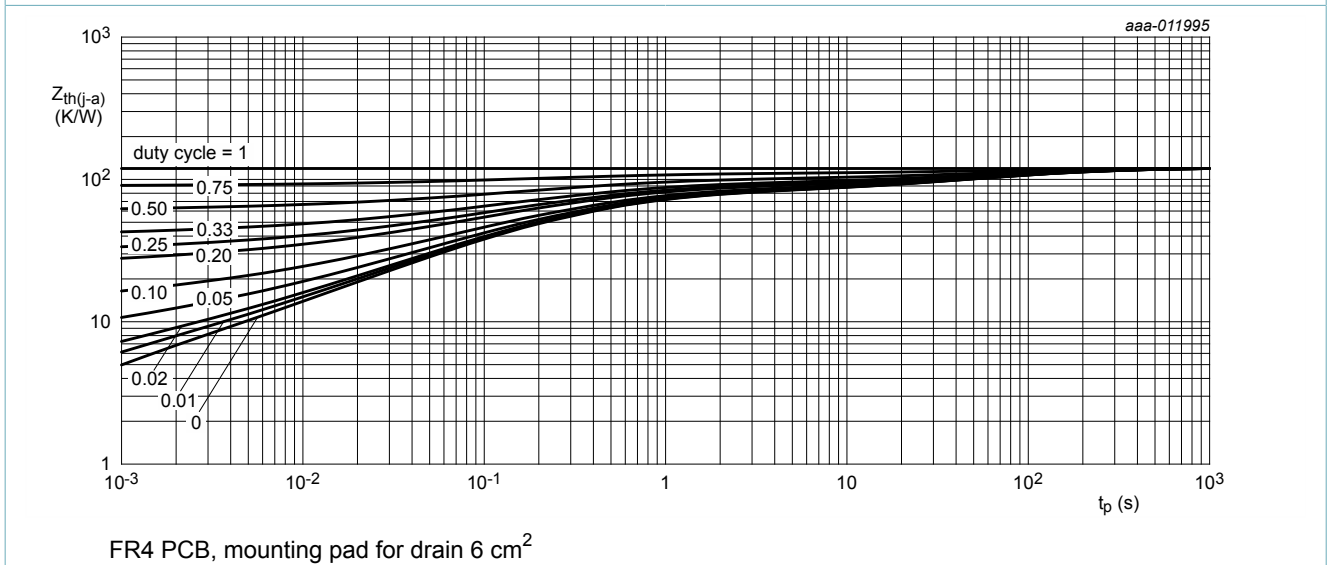


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|-----|------|------|------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = -250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$ | -40 | - | - | V |
| V_{GSth} | gate-source threshold voltage | $I_D = -250 \mu A$; $V_{DS} = V_{GS}$; $T_j = 25 \text{ }^\circ C$ | -1 | -1.7 | -2.5 | V |
| I_{DSS} | drain leakage current | $V_{DS} = -40 V$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$ | - | - | -1 | μA |
| | | $V_{DS} = -40 V$; $V_{GS} = 0 V$; $T_j = 150 \text{ }^\circ C$ | - | - | -20 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 20 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$ | - | - | 10 | μA |
| | | $V_{GS} = -20 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$ | - | - | -10 | μA |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = -10 V$; $I_D = -1.3 A$; $T_j = 25 \text{ }^\circ C$ | - | 180 | 240 | m Ω |
| | | $V_{GS} = -10 V$; $I_D = -1.3 A$; $T_j = 150 \text{ }^\circ C$ | - | 300 | 400 | m Ω |
| | | $V_{GS} = -4.5 V$; $I_D = -0.8 A$; $T_j = 25 \text{ }^\circ C$ | - | 220 | 300 | m Ω |
| g_{fs} | forward transconductance | $V_{DS} = -5 V$; $I_D = -2 A$; $T_j = 25 \text{ }^\circ C$ | - | 4.5 | - | S |
| R_G | gate resistance | $f = 1 \text{ MHz}$ | - | 19 | - | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $V_{DS} = -20 V$; $I_D = -1.3 A$; $V_{GS} = -10 V$; $T_j = 25 \text{ }^\circ C$ | - | 4.7 | 6 | nC |
| Q_{GS} | gate-source charge | | - | 0.8 | - | nC |
| Q_{GD} | gate-drain charge | | - | 0.7 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = -20 V$; $f = 1 \text{ MHz}$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$ | - | 293 | 450 | pF |
| C_{oss} | output capacitance | | - | 35 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 20 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = -20 V$; $I_D = -1.3 A$; $V_{GS} = -10 V$; $R_{G(ext)} = 15 \text{ } \Omega$; $T_j = 25 \text{ }^\circ C$ | - | 4 | 6 | ns |
| t_r | rise time | | - | 6 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 26 | 39 | ns |
| t_f | fall time | | - | 14 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = -0.86 A$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$ | - | -0.8 | -1.2 | V |

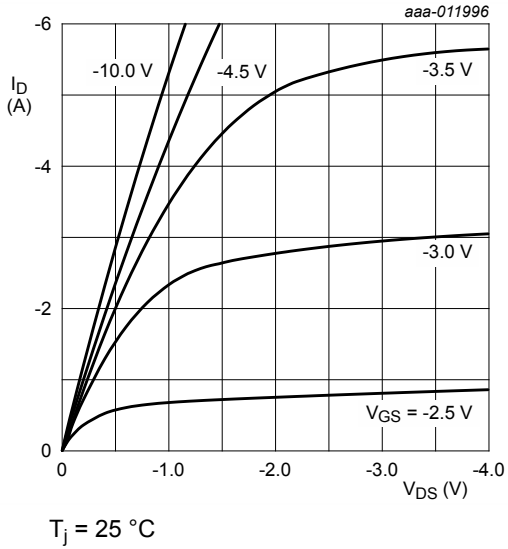


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

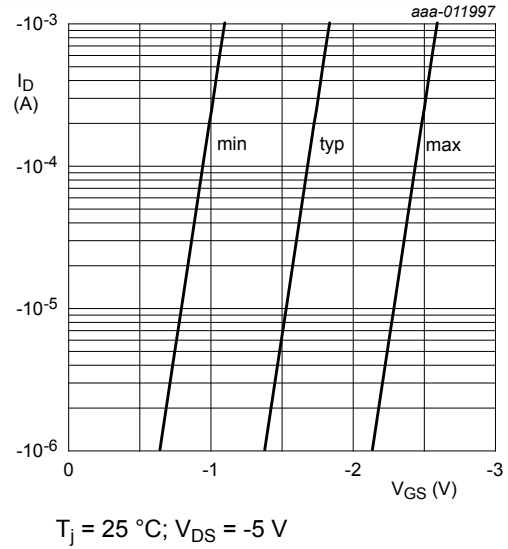


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

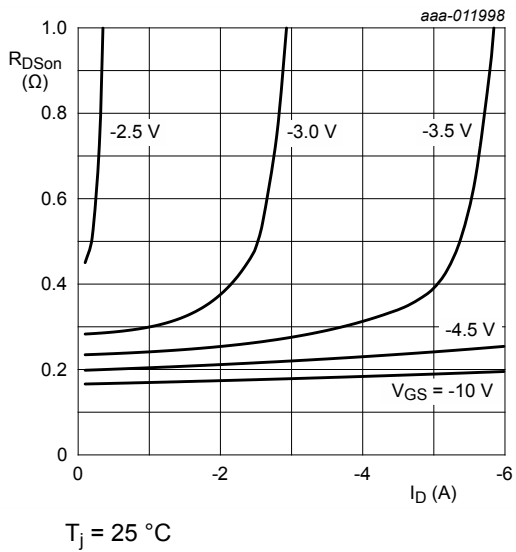


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

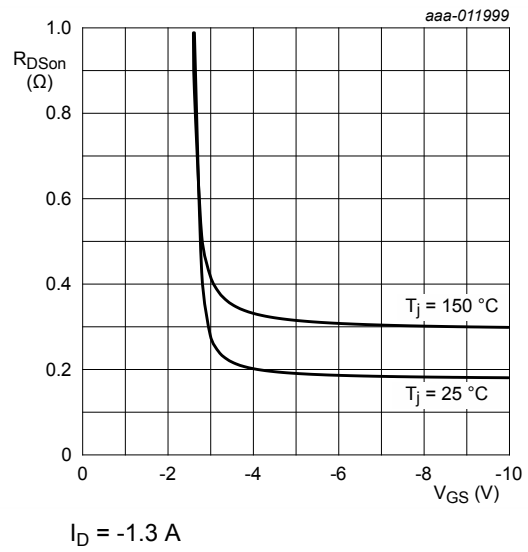
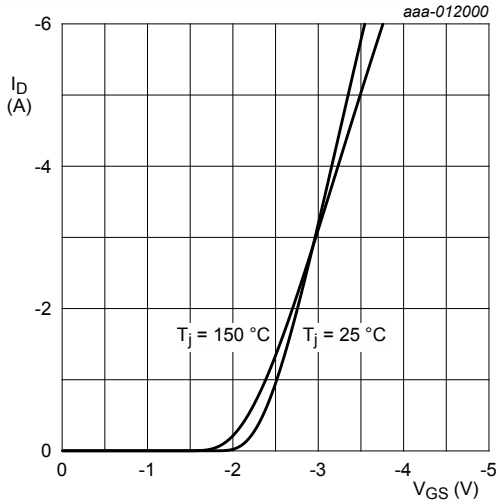


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



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

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

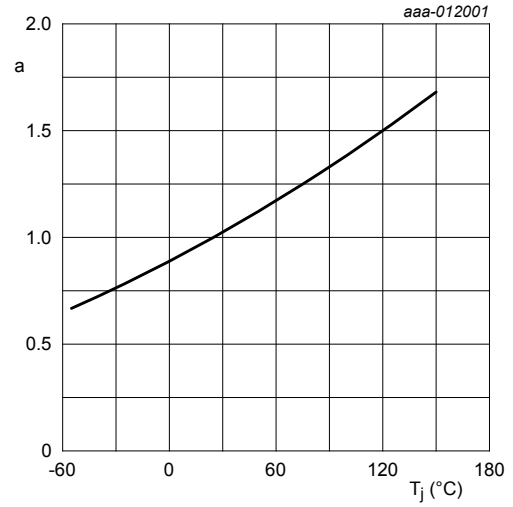
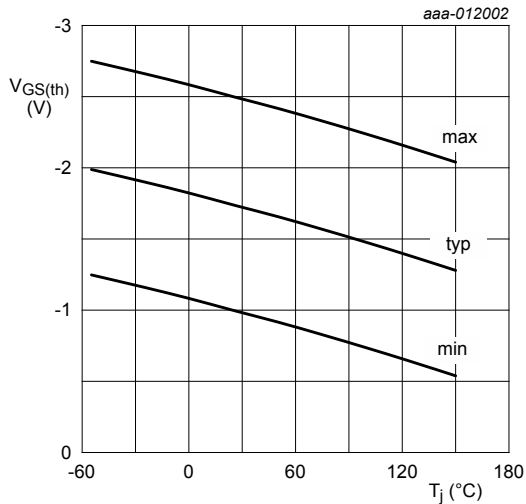


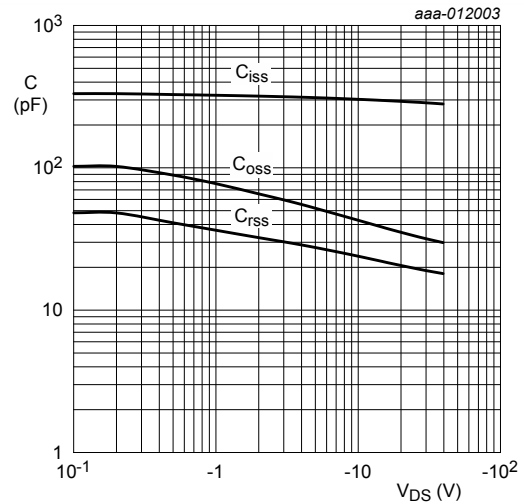
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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



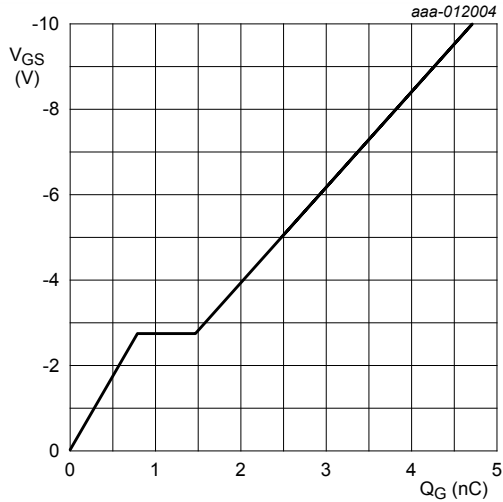
$$I_D = -0.25 \text{ mA}; V_{DS} = V_{GS}$$

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



$I_D = -1.3 \text{ A}; V_{DS} = -20 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

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

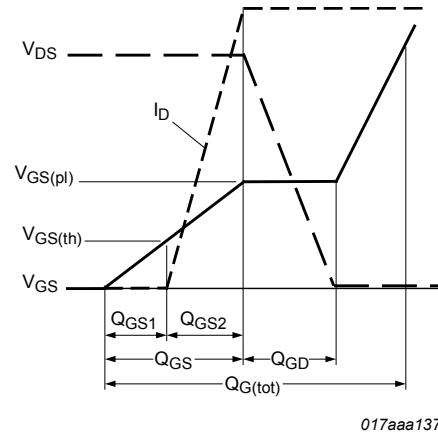
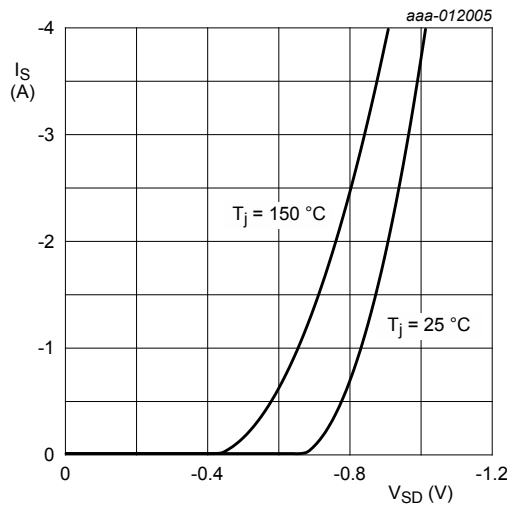


Fig. 15. MOSFET transistor: Gate charge waveform definitions



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

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

11. Test information

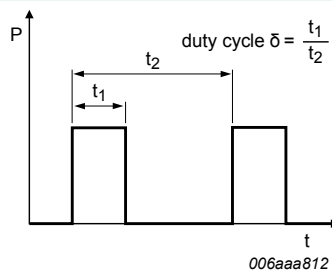


Fig. 17. Duty cycle definition

11.1 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

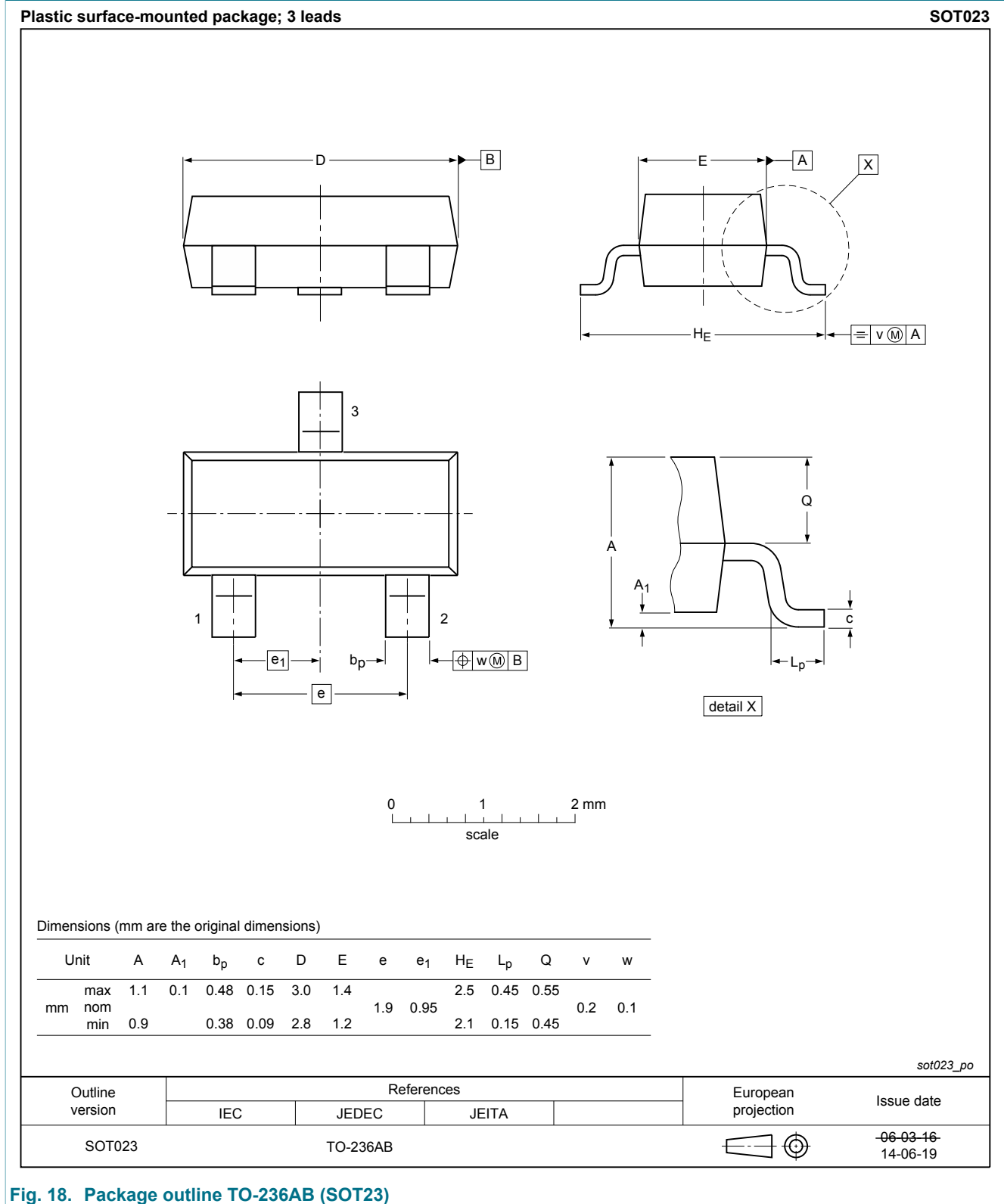


Fig. 18. Package outline TO-236AB (SOT23)

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 |
|---------------------------------------|--------------|------------------------|---------------|----------------|
| PMV250EPEA v.3 | 20140620 | Product data sheet | - | PMV250EPEA v.2 |
| Modification: Soldering chapter added | | | | |
| PMV250EPEA v.2 | 20140612 | Product data sheet | - | PMV250EPEA v.1 |
| PMV250EPEA v.1 | 20140312 | Preliminary 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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