



# PMPB19R0UPE

20 V, P-channel Trench MOSFET

24 February 2022

Product data sheet

## 1. General description

P-channel enhancement mode Field-Effect Transistor (FET) in a leadless medium power DFN2020M-6 (SOT1220-2) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

## 2. Features and benefits

- Low threshold voltage
- Trench MOSFET technology
- Small and leadless ultra thin SMD plastic package: 2 x 2 x 0.65 mm
- Exposed drain pad for excellent thermal conduction
- ElectroStatic Discharge (ESD) protection > 2000 V HBM (class H2)

## 3. Applications

- Charging switch for portable devices
- DC-to-DC converters
- Power management in battery-driven portable devices
- Hard disk and computing power management

## 4. Quick reference data

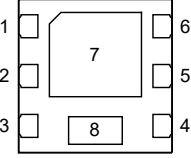
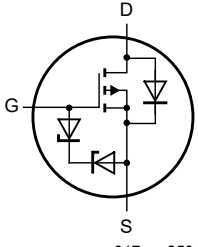
Table 1. Quick reference data

| 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              |   | -10 | -   | 10  | V          |
| $I_D$                         | drain current                    | $V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; t \leq 5\text{ s}$ | [1] | -   | -11 | A          |
| <b>Static characteristics</b> |                                  |   |     |     |     |            |
| $R_{DSon}$                    | drain-source on-state resistance | $V_{GS} = -4.5\text{ V}; I_D = -7.6\text{ A}; T_j = 25\text{ }^\circ\text{C}$   | -   | 17  | 21  | 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   | D      | drain       |  <p>Transparent top view<br/><b>DFN2020M-6 (SOT1220-2)</b></p> |  <p>017aaa259</p> |
| 2   | D      | drain       |   |  |
| 3   | G      | gate        |   |  |
| 4   | S      | source      |   |  |
| 5   | D      | drain       |   |  |
| 6   | D      | drain       |   |  |
| 7   | D      | drain       |   |  |
| 8   | S      | source      |   |  |

## 6. Ordering information

Table 3. Ordering information

| Type number | Package    |  |           |
|-------------|------------|--|-----------|
|             | Name       | Description  | Version   |
| PMPB19R0UPE | DFN2020M-6 | plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals; body 2 x 2 x 0.65 mm | SOT1220-2 |

## 7. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMPB19R0UPE | ZR           |

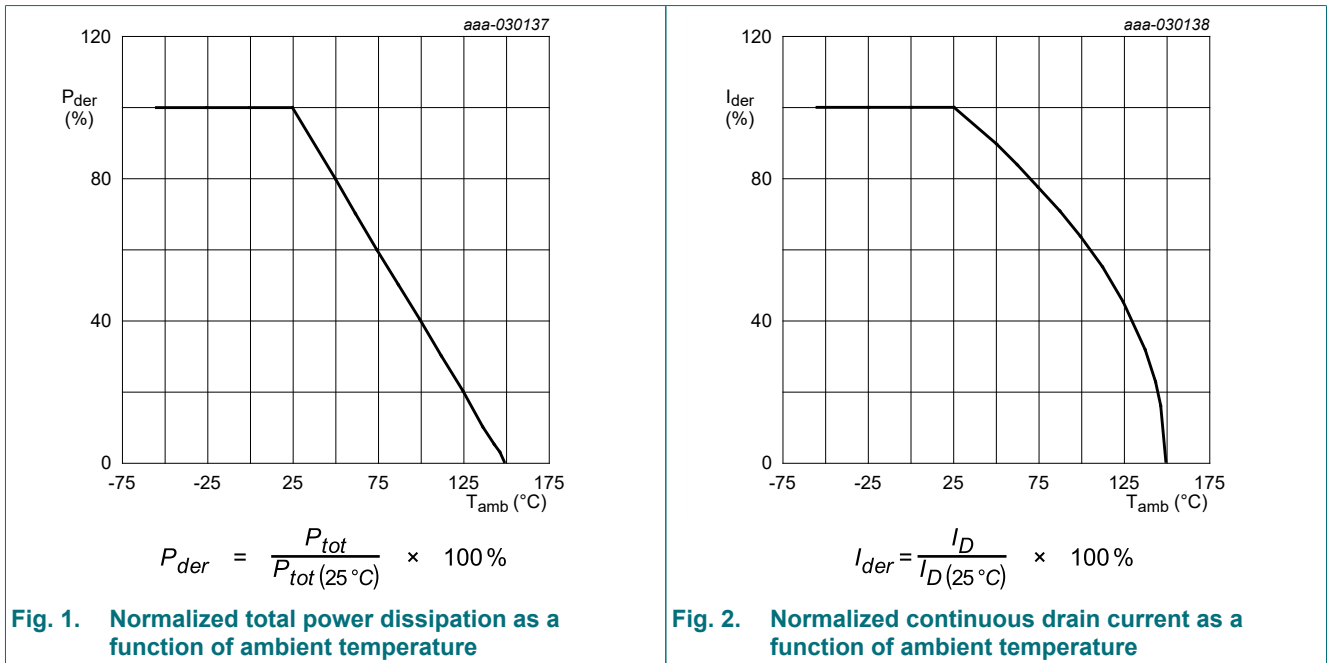
## 8. Limiting values

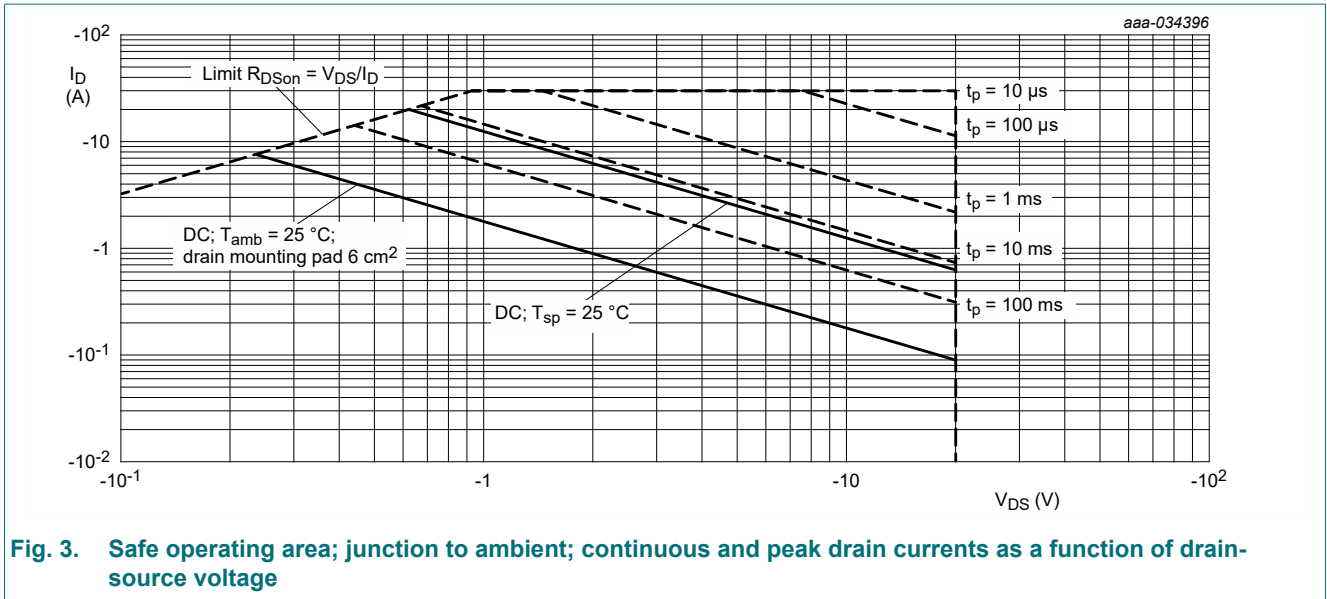
**Table 5. Limiting values**

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     |  |     | -10 | 10   | V    |
| I <sub>D</sub>            | drain current           | V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 25 °C; t ≤ 5 s    | [1] | -   | -11  | A    |
|                           |                         | V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 25 °C             | [1] | -   | -7.6 | A    |
|                           |                         | V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 100 °C            | [1] | -   | -4.8 | A    |
| I <sub>DM</sub>           | peak drain current      | T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs |     | -   | -30  | A    |
| P <sub>tot</sub>          | total power dissipation | T <sub>amb</sub> = 25 °C; t ≤ 5 s                              | [1] | -   | 3.5  | W    |
|                           |                         | T <sub>amb</sub> = 25 °C                                       | [1] | -   | 1.8  | W    |
|                           |                         | T <sub>sp</sub> = 25 °C  |     | -   | 12.5 | W    |
| 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>amb</sub> = 25 °C                                       | [1] | -   | -1.7 | A    |

[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>.





## 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] | -   | 235 | 270 | K/W  |
|                |  |                           | [2] | -   | 61  | 70  | K/W  |
|                |  | in free air; $t \leq 5$ s | [2] | -   | 33  | 36  | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |                           |     | -   | 7   | 10  | 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>.

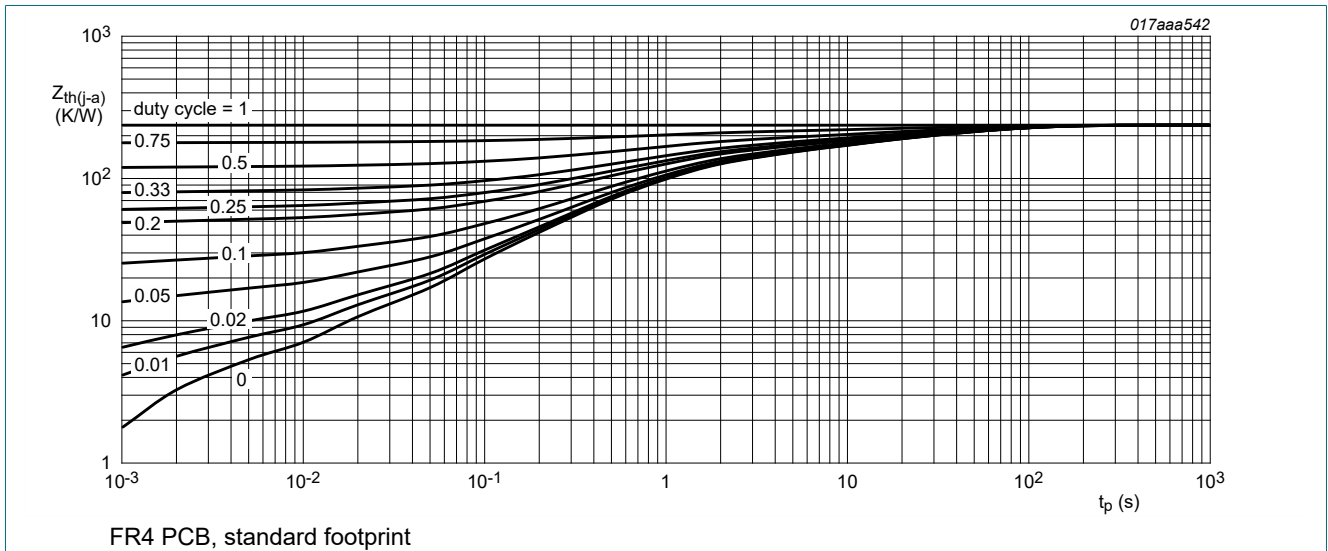


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

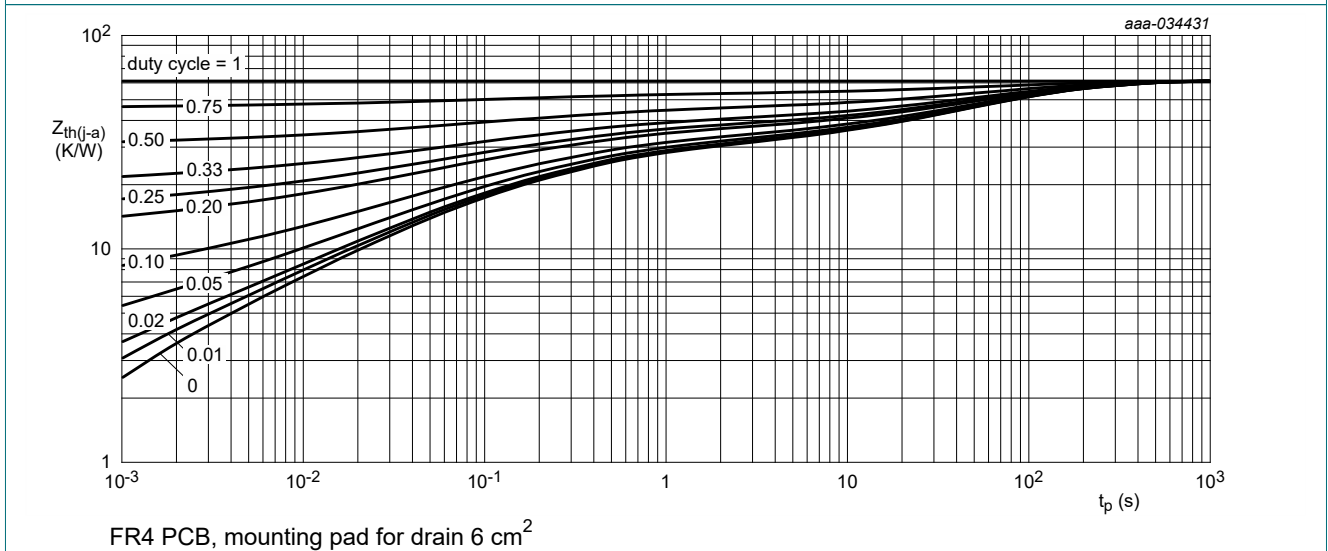


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

| Symbol                         | Parameter                        | Conditions   | Min  | Typ  | Max  | Unit       |
|--------------------------------|----------------------------------|--|------|------|------|------------|
| <b>Static characteristics</b>  |                                  |  |      |      |      |            |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage   | $I_D = -250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | -20  | -    | -    | V          |
| $V_{GSth}$                     | gate-source threshold voltage    | $I_D = -250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$   | -0.4 | -0.6 | -0.9 | V          |
| $I_{DSS}$                      | drain leakage current            | $V_{DS} = -20 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | -    | -    | -1   | $\mu A$    |
| $I_{GSS}$                      | gate leakage current             | $V_{GS} = -8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$   | -    | -    | -10  | $\mu A$    |
|                                |                                  | $V_{GS} = 8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | -    | -    | 10   | $\mu A$    |
|                                |                                  | $V_{GS} = -4.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$   | -    | -    | -2   | $\mu A$    |
|                                |                                  | $V_{GS} = 4.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | -    | -    | 2    | $\mu A$    |
| $R_{DSon}$                     | drain-source on-state resistance | $V_{GS} = -4.5 V$ ; $I_D = -7.6 A$ ; $T_j = 25 \text{ }^\circ C$   | -    | 17   | 21   | m $\Omega$ |
|                                |                                  | $V_{GS} = -4.5 V$ ; $I_D = -7.6 A$ ; $T_j = 150 \text{ }^\circ C$  | -    | 25   | 31   | m $\Omega$ |
|                                |                                  | $V_{GS} = -2.5 V$ ; $I_D = -6.3 A$ ; $T_j = 25 \text{ }^\circ C$   | -    | 24   | 30   | m $\Omega$ |
|                                |                                  | $V_{GS} = -1.8 V$ ; $I_D = -1 A$ ; $T_j = 25 \text{ }^\circ C$   | -    | 34   | 52   | m $\Omega$ |
|                                |                                  | $V_{GS} = -1.5 V$ ; $I_D = -0.1 A$ ; $T_j = 25 \text{ }^\circ C$   | -    | 50   | 110  | m $\Omega$ |
| $g_{fs}$                       | forward transconductance         | $V_{DS} = -10 V$ ; $I_D = -7.6 A$ ; $T_j = 25 \text{ }^\circ C$  | -    | 17   | -    | S          |
| $R_G$                          | gate resistance                  | $f = 1 \text{ MHz}$  | -    | 8    | -    | $\Omega$   |
| <b>Dynamic characteristics</b> |                                  |  |      |      |      |            |
| $Q_{G(tot)}$                   | total gate charge                | $V_{DS} = -10 V$ ; $I_D = -7.4 A$ ; $V_{GS} = -4.5 V$ ;<br>$T_j = 25 \text{ }^\circ C$                           | -    | 16   | 24   | nC         |
| $Q_{GS}$                       | gate-source charge               |  | -    | 1.8  | -    | nC         |
| $Q_{GD}$                       | gate-drain charge                |  | -    | 5.1  | -    | nC         |
| $C_{iss}$                      | input capacitance                | $V_{DS} = -10 V$ ; $f = 1 \text{ MHz}$ ; $V_{GS} = 0 V$ ;<br>$T_j = 25 \text{ }^\circ C$                         | -    | 1275 | -    | pF         |
| $C_{oss}$                      | output capacitance               |  | -    | 191  | -    | pF         |
| $C_{rss}$                      | reverse transfer capacitance     |  | -    | 171  | -    | pF         |
| $t_{d(on)}$                    | turn-on delay time               | $V_{DS} = -10 V$ ; $I_D = -7.2 A$ ; $V_{GS} = -4.5 V$ ;<br>$R_{G(ext)} = 6 \Omega$ ; $T_j = 25 \text{ }^\circ C$ | -    | 4    | -    | ns         |
| $t_r$                          | rise time                        |  | -    | 19   | -    | ns         |
| $t_{d(off)}$                   | turn-off delay time              |  | -    | 62   | -    | ns         |
| $t_f$                          | fall time                        |  | -    | 36   | -    | ns         |
| <b>Source-drain diode</b>      |                                  |  |      |      |      |            |
| $V_{SD}$                       | source-drain voltage             | $I_S = -1.7 A$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$  | -    | -0.7 | -1.2 | V          |

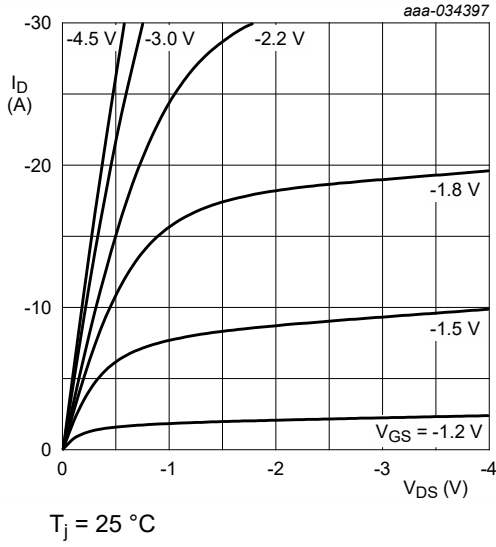


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

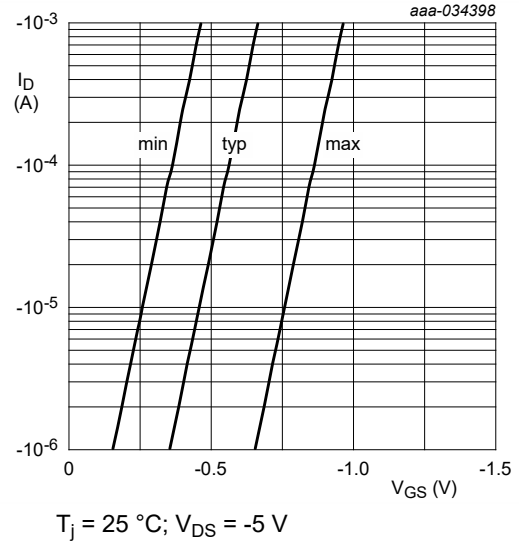


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

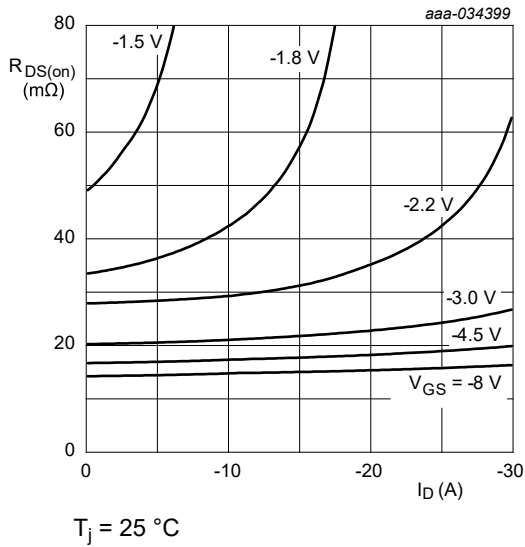


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

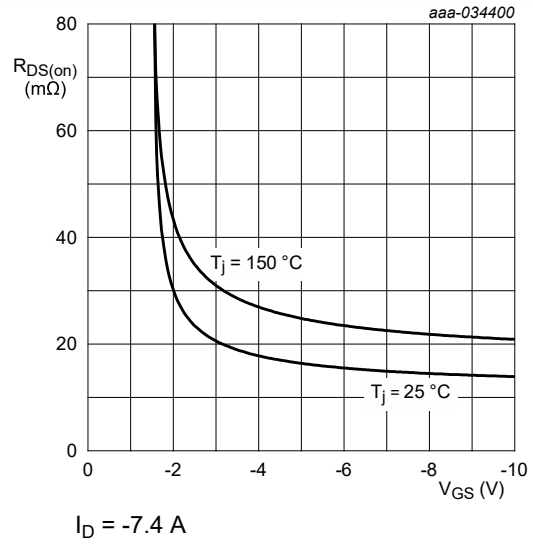


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

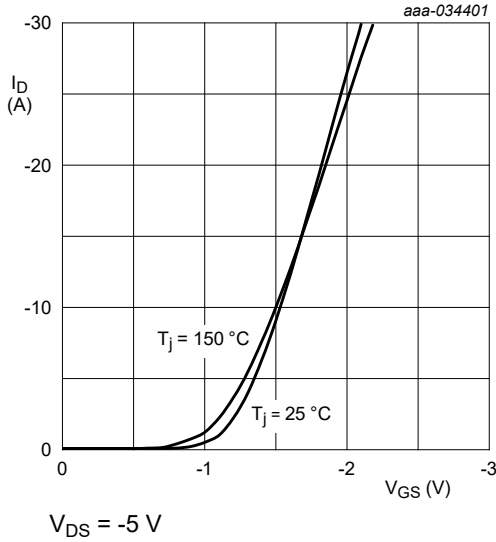
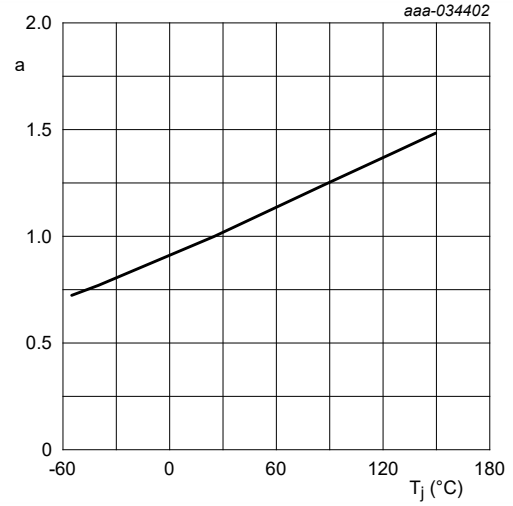


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

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

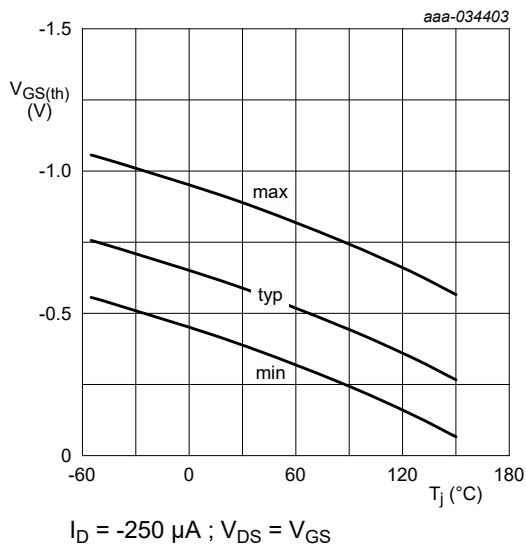


Fig. 12. Gate-source threshold voltage as a function of junction temperature

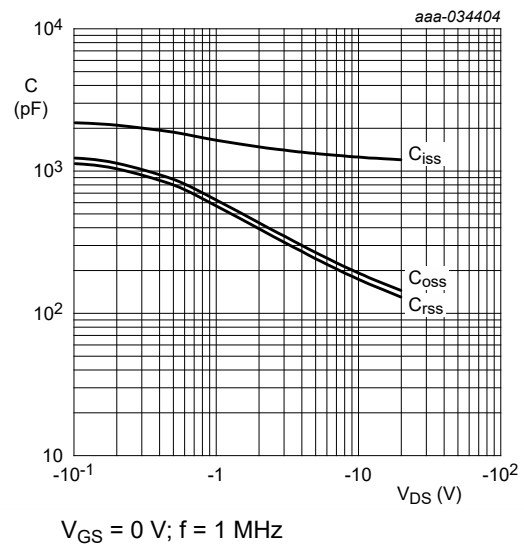
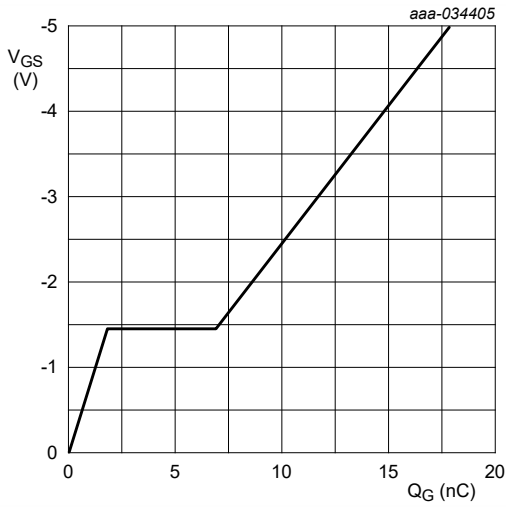


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



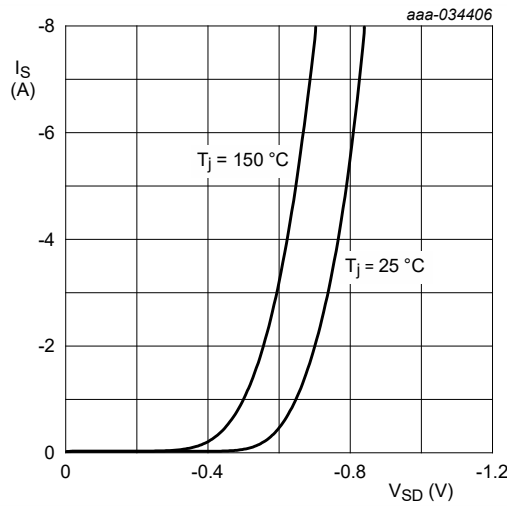


$V_{DS} = -10\text{ V}; I_D = -7.4\text{ A}; T_j = 25\text{ }^\circ\text{C}$

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



Fig. 15. 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

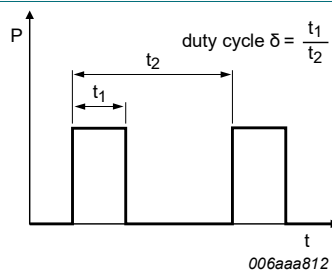
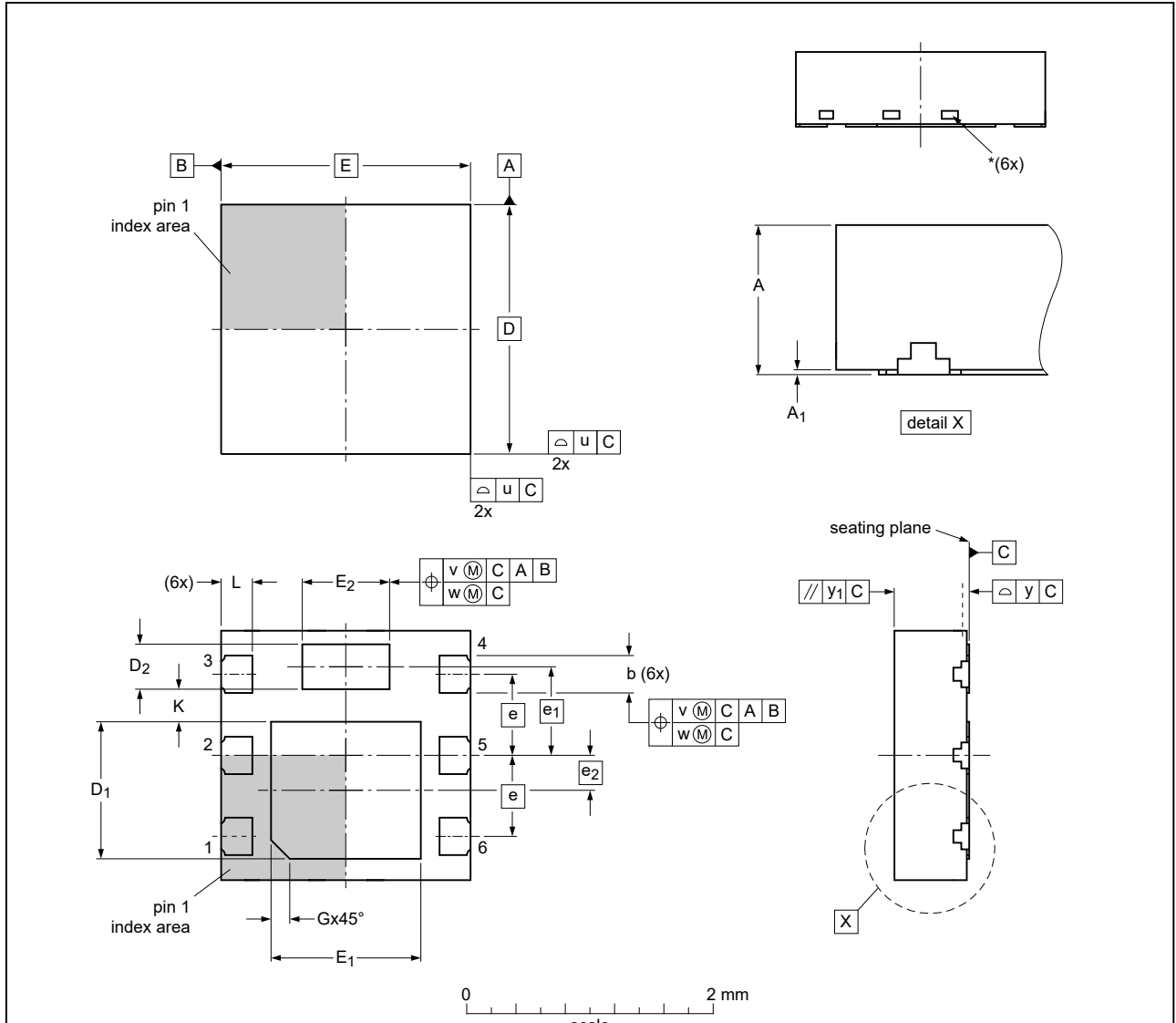


Fig. 17. Duty cycle definition

12. Package outline

DFN2020M-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals; body 2 x 2 x 0.65 mm

SOT1220-2



Dimensions (mm are the original dimensions)

| Unit | A    | A <sub>1</sub> | b    | D    | D <sub>1</sub> | D <sub>2</sub> | E    | E <sub>1</sub> | E <sub>2</sub> | e   | e <sub>1</sub> | e <sub>2</sub> | G    | K          | L    | u    | v   | w    | y    | y <sub>1</sub> |
|------|------|----------------|------|------|----------------|----------------|------|----------------|----------------|-----|----------------|----------------|------|------------|------|------|-----|------|------|----------------|
| min  | 0.55 | 0              | 0.25 | 1.0  | 0.31           | 1.1            | 0.6  |                |                |     |                |                |      | 0.2        | 0.20 |      |     |      |      |                |
| mm   | nom  | 0.60           | 0.02 | 0.30 | 2              | 1.1            | 0.36 | 2              | 1.2            | 0.7 | 0.65           | 0.71           | 0.28 | 0.15 (ref) | 0.25 | 0.05 | 0.1 | 0.05 | 0.05 | 0.05           |
|      | max  | 0.65           | 0.04 | 0.35 | 1.2            | 0.41           | 1.3  | 0.8            |                |     |                |                |      |            | 0.30 |      |     |      |      |                |

Note

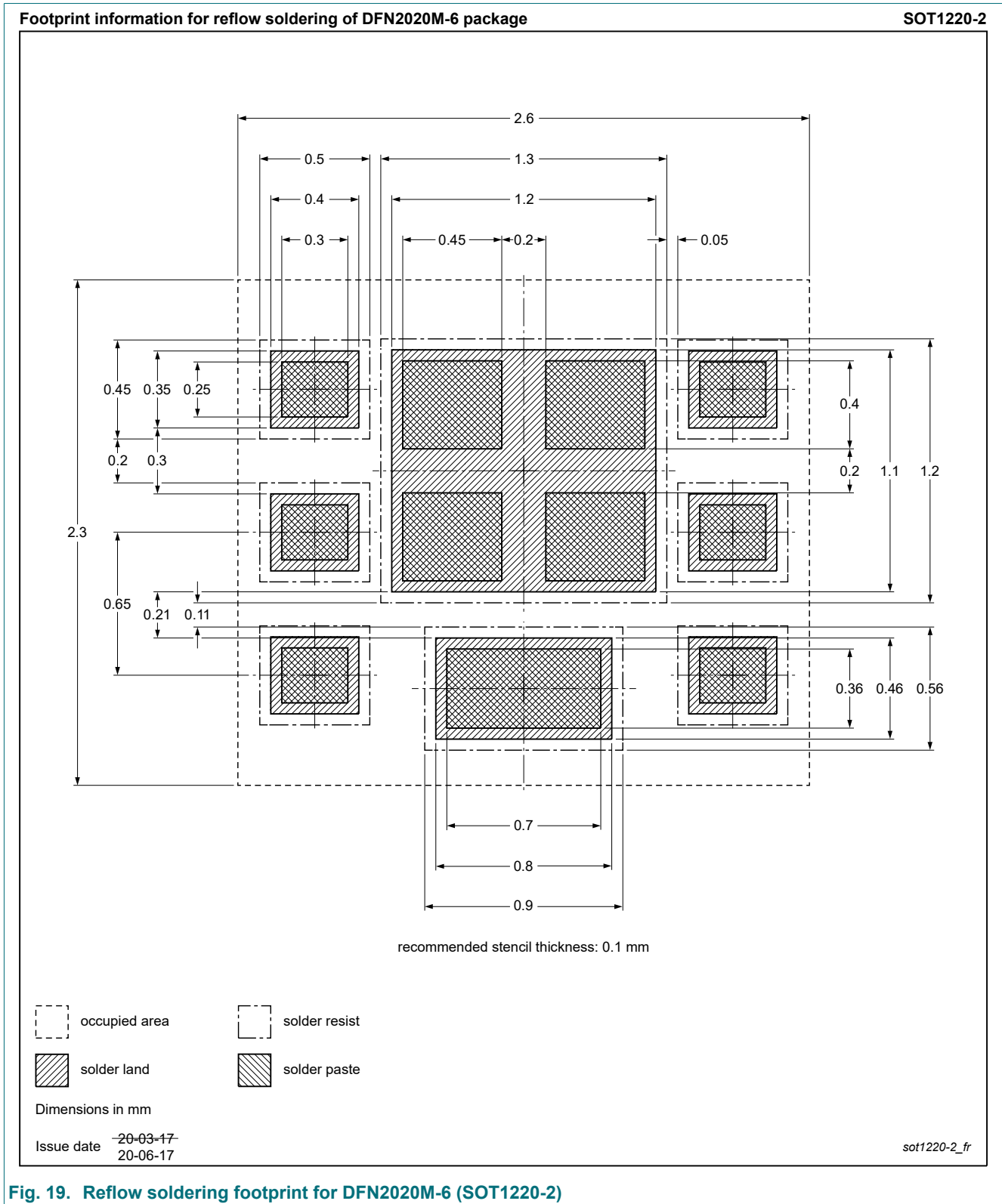
1. Dimension A is including plating thickness.
2. \* Visible depend upon used manufacturing technology.

sot1220-2\_po

| Outline version | References |       |       |  | European projection | Issue date             |
|-----------------|------------|-------|-------|--|---------------------|------------------------|
|                 | IEC        | JEDEC | JEITA |  |                     |                        |
| SOT1220-2       |            | ---   |       |  |                     | -20-03-31-<br>20-04-01 |

Fig. 18. Package outline DFN2020M-6 (SOT1220-2)

### 13. Soldering



**Fig. 19. Reflow soldering footprint for DFN2020M-6 (SOT1220-2)**

### 14. Revision history

Table 8. Revision history

| Data sheet ID   | Release date | Data sheet status  | Change notice | Supersedes |
|-----------------|--------------|--------------------|---------------|------------|
| PMPB19R0UPE v.1 | 20220224     | 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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