

# PMDPB30XN

20 V, dual N-channel Trench MOSFET

6 July 2012

Product data sheet

## 1. Product profile

### 1.1 General description

Dual N-channel enhancement mode Field-Effect Transistor (FET) in a small and leadless ultra thin DFN2020-6 (SOT1118) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

### 1.2 Features and benefits

- Very fast switching
- 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

### 1.3 Applications

- Charging switch for portable devices
- DC-to-DC converters
- Small brushless DC motor drive
- Power management in battery-driven portables
- Hard disc and computing power management

### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol                                         | Parameter                        | Conditions                                                            |     | Min | Typ | Max | Unit |
|------------------------------------------------|----------------------------------|-----------------------------------------------------------------------|-----|-----|-----|-----|------|
| <b>Per transistor</b>                          |                                  |                                                                       |     |     |     |     |      |
| 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] | -   | -   | 5.3 | A    |
| <b>Static characteristics (per transistor)</b> |                                  |                                                                       |     |     |     |     |      |
| R <sub>DS(on)</sub>                            | drain-source on-state resistance | V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 3 A; T <sub>J</sub> = 25 °C |     | -   | 32  | 40  | mΩ   |

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

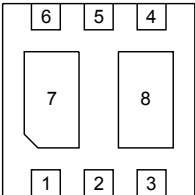
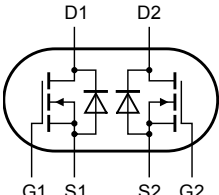


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## 2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline                                                                                                                    | Graphic symbol                                                                                       |
|-----|--------|-------------|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 1   | S1     | source TR1  |  <p>Transparent top view<br/>DFN2020-6 (SOT1118)</p> |  <p>017aaa254</p> |
| 2   | G1     | gate TR1    |                                                                                                                                       |                                                                                                      |
| 3   | D2     | drain TR2   |                                                                                                                                       |                                                                                                      |
| 4   | S2     | source TR2  |                                                                                                                                       |                                                                                                      |
| 5   | G2     | gate TR2    |                                                                                                                                       |                                                                                                      |
| 6   | D1     | drain TR1   |                                                                                                                                       |                                                                                                      |
| 7   | D1     | drain TR1   |                                                                                                                                       |                                                                                                      |
| 8   | D2     | drain TR2   |                                                                                                                                       |                                                                                                      |

## 3. Ordering information

Table 3. Ordering information

| Type number | Package   |                                                                                  |         |
|-------------|-----------|----------------------------------------------------------------------------------|---------|
|             | Name      | Description                                                                      | Version |
| PMDPB30XN   | DFN2020-6 | plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals | SOT1118 |

## 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| PMDPB30XN   | 1V           |

## 5. Limiting values

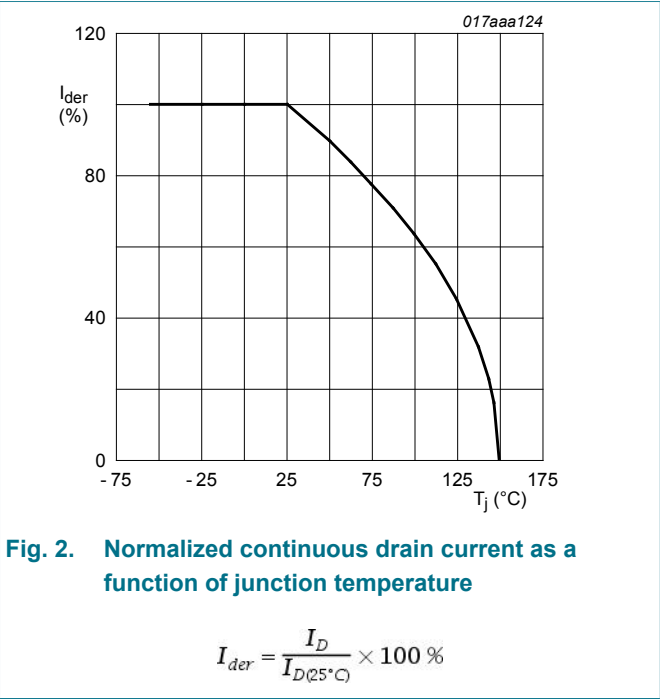
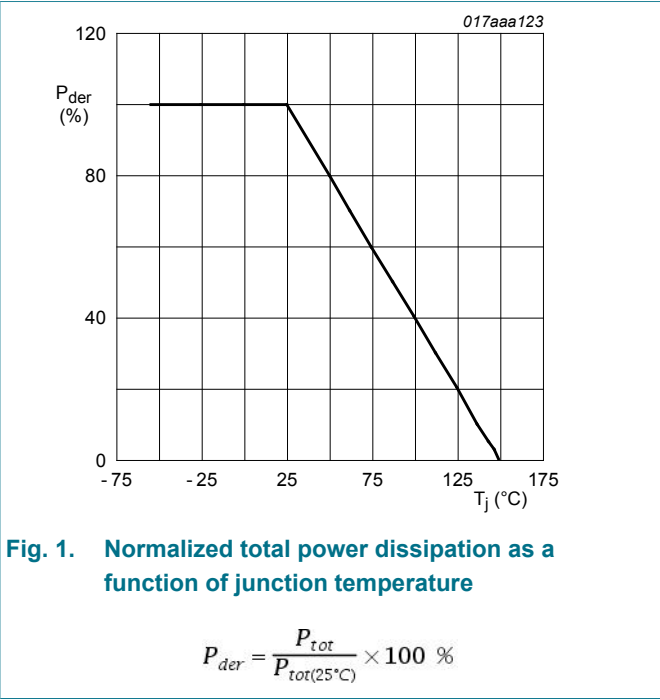
Table 5. Limiting values

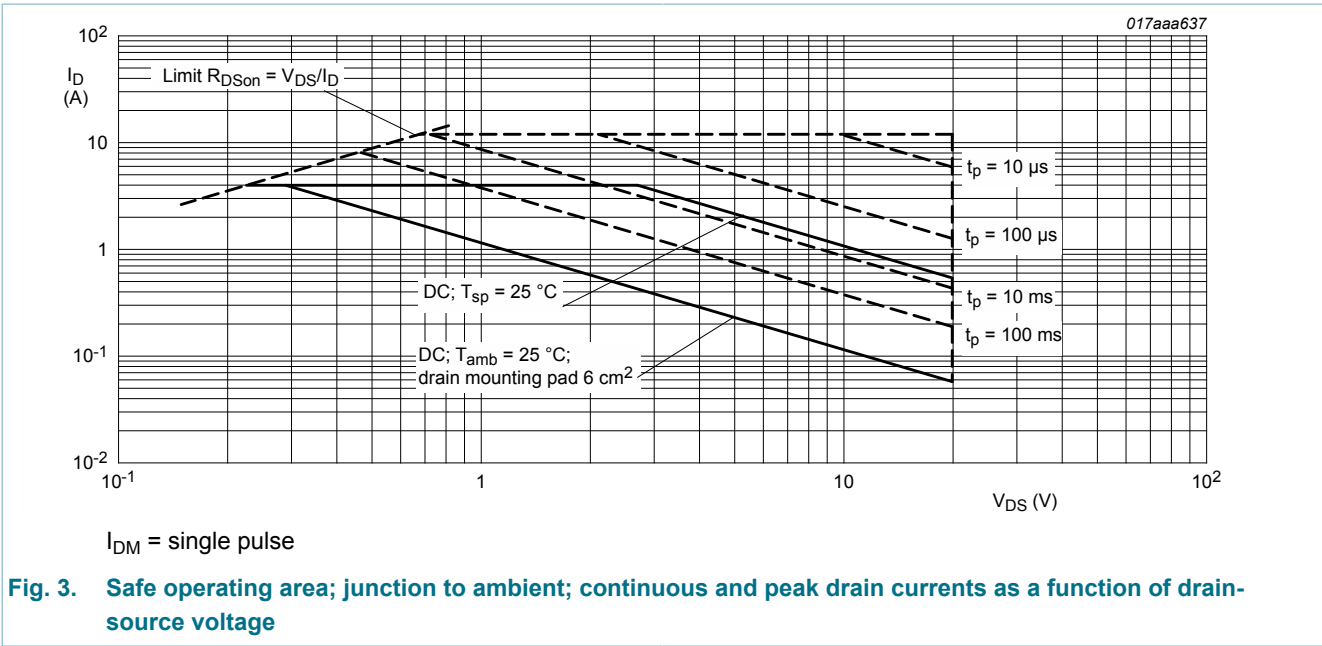
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol                | Parameter            | Conditions                                                                                  |     | Min | Max | Unit |
|-----------------------|----------------------|---------------------------------------------------------------------------------------------|-----|-----|-----|------|
| <b>Per transistor</b> |                      |                                                                                             |     |     |     |      |
| $V_{DS}$              | 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] | -   | 5.3 | A    |
|                       |                      | $V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$                               | [1] | -   | 4   | A    |
|                       |                      | $V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ }^{\circ}\text{C}$                              | [1] | -   | 2.6 | A    |
| $I_{DM}$              | peak drain current   | $T_{amb} = 25\text{ }^{\circ}\text{C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$ |     | -   | 12  | A    |

| Symbol             | Parameter               | Conditions               |     | Min | Max  | Unit |
|--------------------|-------------------------|--------------------------|-----|-----|------|------|
| P <sub>tot</sub>   | total power dissipation | T <sub>amb</sub> = 25 °C | [2] | -   | 490  | mW   |
|                    |                         |                          | [1] | -   | 1170 | mW   |
|                    |                         | T <sub>sp</sub> = 25 °C  |     | -   | 8330 | mW   |
| Source-drain diode |                         |                          |     |     |      |      |
| I <sub>S</sub>     | source current          | T <sub>amb</sub> = 25 °C | [1] | -   | 1.2  | A    |
| Per device         |                         |                          |     |     |      |      |
| 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   |

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



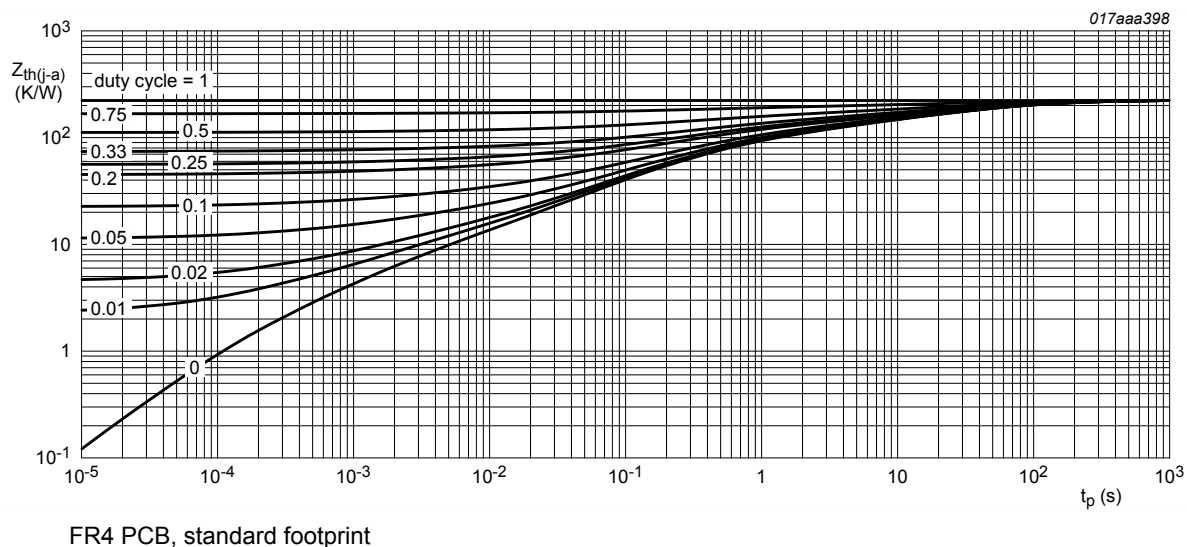


6. Thermal characteristics

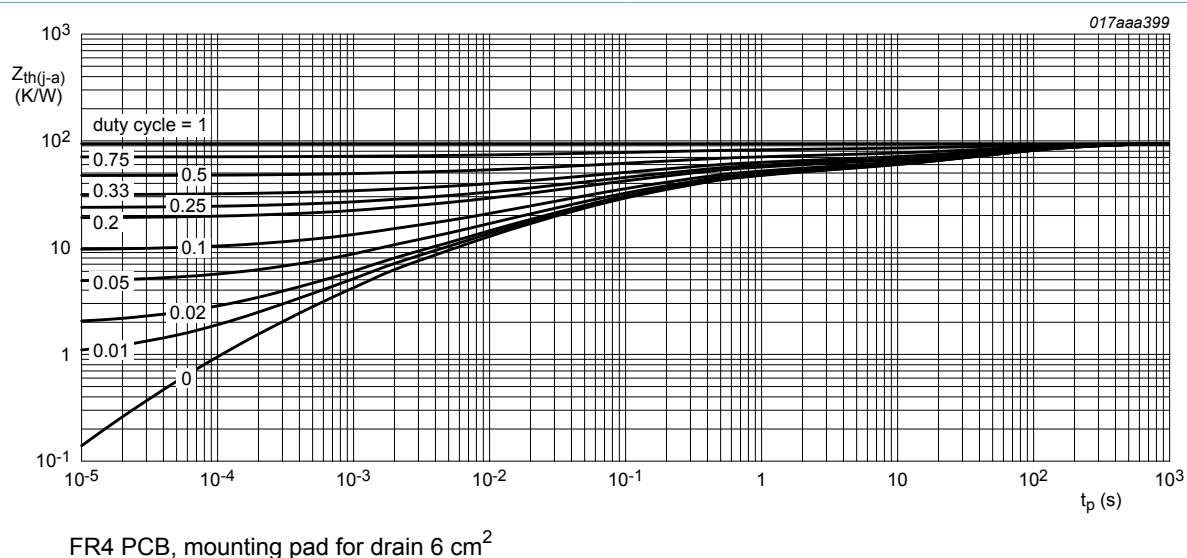
Table 6. Thermal characteristics

| Symbol         | Parameter                                        | Conditions                       |     | Min | Typ | Max | Unit |
|----------------|--------------------------------------------------|----------------------------------|-----|-----|-----|-----|------|
| Per transistor |                                                  |                                  |     |     |     |     |      |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient      | in free air                      | [1] | -   | 223 | 256 | K/W  |
|                |                                                  |                                  | [2] | -   | 93  | 107 | K/W  |
|                |                                                  | in free air; $t \leq 5\text{ s}$ | [2] | -   | 55  | 63  | K/W  |
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point |                                  |     | -   | 10  | 15  | 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  $6\text{ cm}^2$ .



**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**

## 7. Characteristics

### Table 7. Characteristics

| Symbol                                         | Parameter                      | Conditions                                            |  | Min | Typ  | Max | Unit    |
|------------------------------------------------|--------------------------------|-------------------------------------------------------|--|-----|------|-----|---------|
| <b>Static characteristics (per transistor)</b> |                                |                                                       |  |     |      |     |         |
| $V_{(BR)DSS}$                                  | drain-source breakdown voltage | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 ^\circ C$    |  | 20  | -    | -   | V       |
| $V_{GSth}$                                     | gate-source threshold voltage  | $I_D = 250 \mu A; V_{DS} = V_{GS}; T_j = 25 ^\circ C$ |  | 0.4 | 0.65 | 0.9 | V       |
| $I_{DSS}$                                      | drain leakage current          | $V_{DS} = 20 V; V_{GS} = 0 V; T_j = 25 ^\circ C$      |  | -   | -    | 1   | $\mu A$ |
|                                                |                                | $V_{DS} = 20 V; V_{GS} = 0 V; T_j = 150 ^\circ C$     |  | -   | -    | 11  | $\mu A$ |

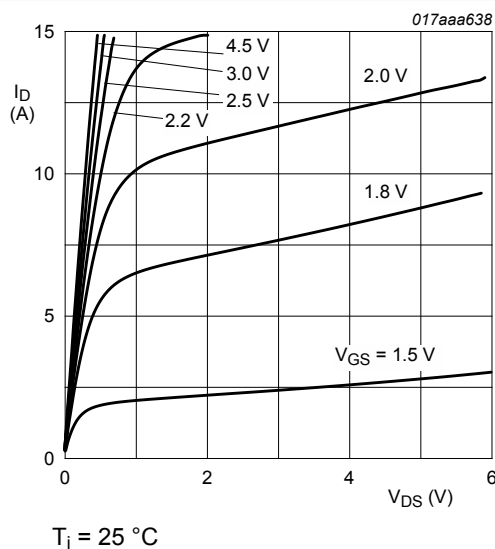
| Symbol       | Parameter                        | Conditions                                                                     | Min | Typ | Max | Unit       |
|--------------|----------------------------------|--------------------------------------------------------------------------------|-----|-----|-----|------------|
| $I_{GSS}$    | gate leakage current             | $V_{GS} = 12\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$  | -   | -   | 100 | nA         |
|              |                                  | $V_{GS} = -12\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$ | -   | -   | 100 | nA         |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 3\text{ A}; T_j = 25\text{ }^{\circ}\text{C}$    | -   | 32  | 40  | m $\Omega$ |
|              |                                  | $V_{GS} = 4.5\text{ V}; I_D = 3\text{ A}; T_j = 150\text{ }^{\circ}\text{C}$   | -   | 55  | 69  | m $\Omega$ |
|              |                                  | $V_{GS} = 2.5\text{ V}; I_D = 1.4\text{ A}; T_j = 25\text{ }^{\circ}\text{C}$  | -   | 40  | 53  | m $\Omega$ |
|              |                                  | $V_{GS} = 1.8\text{ V}; I_D = 1.4\text{ A}; T_j = 25\text{ }^{\circ}\text{C}$  | -   | 60  | 75  | m $\Omega$ |
| $g_{fs}$     | forward transconductance         | $V_{DS} = 5\text{ V}; I_D = 3\text{ A}; T_j = 25\text{ }^{\circ}\text{C}$      | -   | 12  | -   | S          |

**Dynamic characteristics (per transistor)**

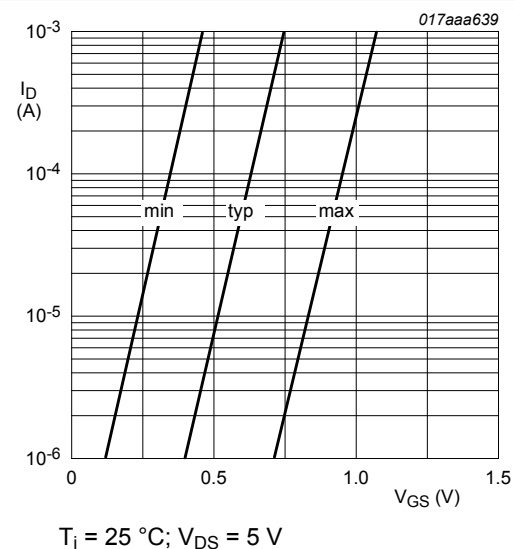
|              |                              |                                                                                                                                 |   |      |      |    |
|--------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---|------|------|----|
| $Q_{G(tot)}$ | total gate charge            | $V_{DS} = 10\text{ V}; I_D = 3\text{ A}; V_{GS} = 4.5\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$                               | - | 14.4 | 21.7 | nC |
| $Q_{GS}$     | gate-source charge           |                                                                                                                                 | - | 1.1  | -    | nC |
| $Q_{GD}$     | gate-drain charge            |                                                                                                                                 | - | 1.5  | -    | nC |
| $C_{iss}$    | input capacitance            | $V_{DS} = 10\text{ V}; f = 1\text{ MHz}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$                                 | - | 660  | -    | pF |
| $C_{oss}$    | output capacitance           |                                                                                                                                 | - | 87   | -    | pF |
| $C_{rss}$    | reverse transfer capacitance |                                                                                                                                 | - | 74   | -    | pF |
| $t_{d(on)}$  | turn-on delay time           | $V_{DS} = 10\text{ V}; I_D = 3\text{ A}; V_{GS} = 4.5\text{ V}; R_{G(ext)} = 6\text{ }\Omega; T_j = 25\text{ }^{\circ}\text{C}$ | - | 4    | -    | ns |
| $t_r$        | rise time                    |                                                                                                                                 | - | 15   | -    | ns |
| $t_{d(off)}$ | turn-off delay time          |                                                                                                                                 | - | 40   | -    | ns |
| $t_f$        | fall time                    |                                                                                                                                 | - | 16   | -    | ns |

**Source-drain diode (per transistor)**

|          |                      |                                                                             |   |     |     |   |
|----------|----------------------|-----------------------------------------------------------------------------|---|-----|-----|---|
| $V_{SD}$ | source-drain voltage | $I_S = 1.2\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^{\circ}\text{C}$ | - | 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**

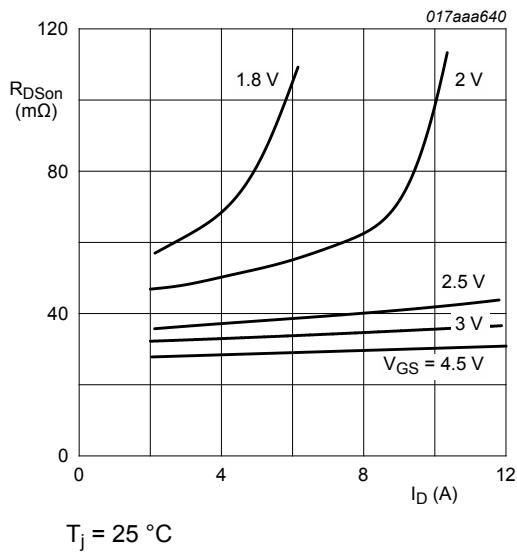


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

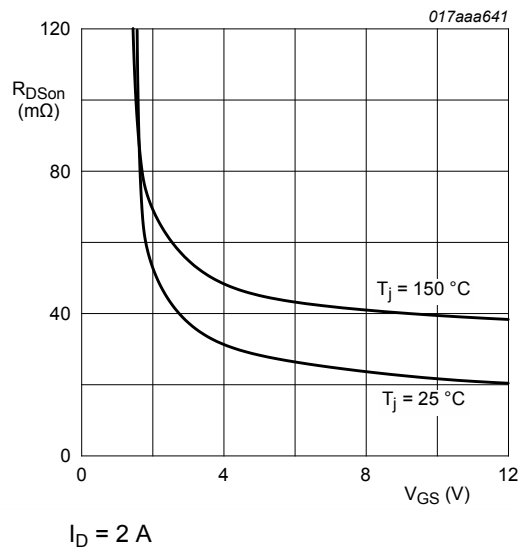


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

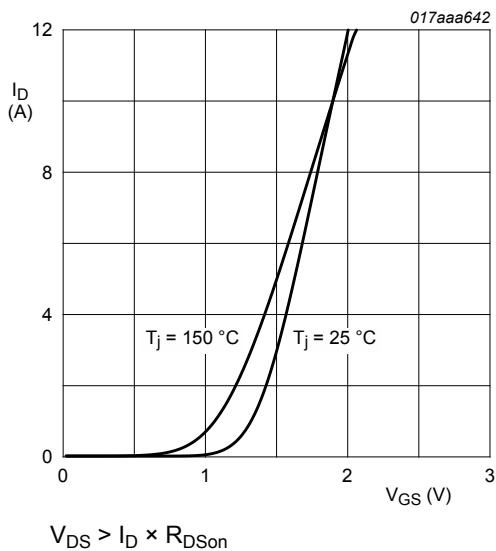


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

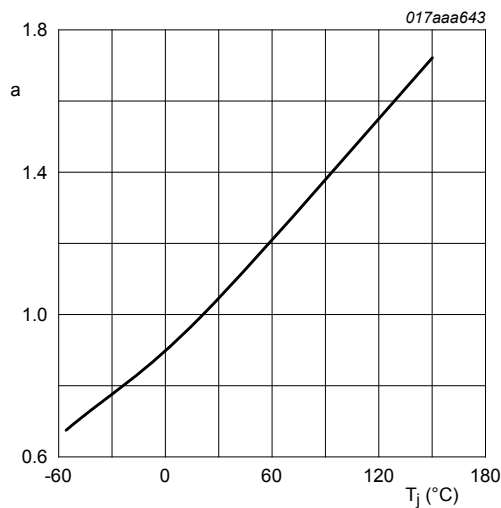


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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

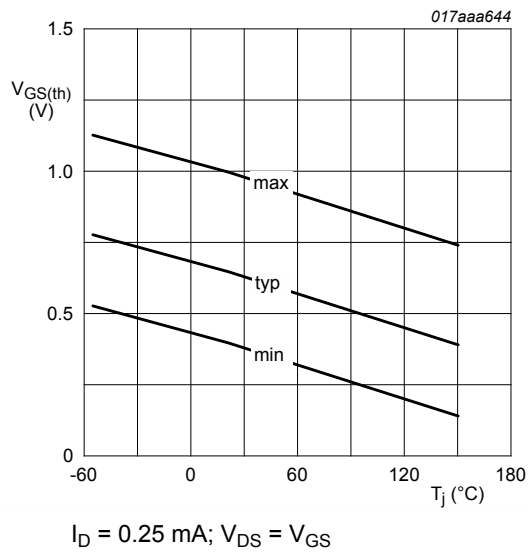


Fig. 12. Gate-source threshold voltage as a function of junction temperature

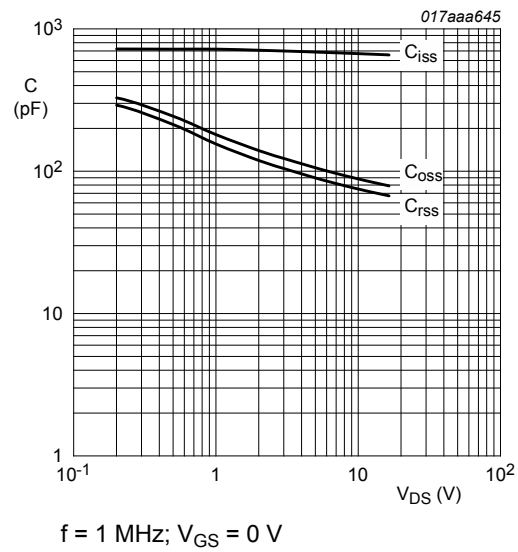


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

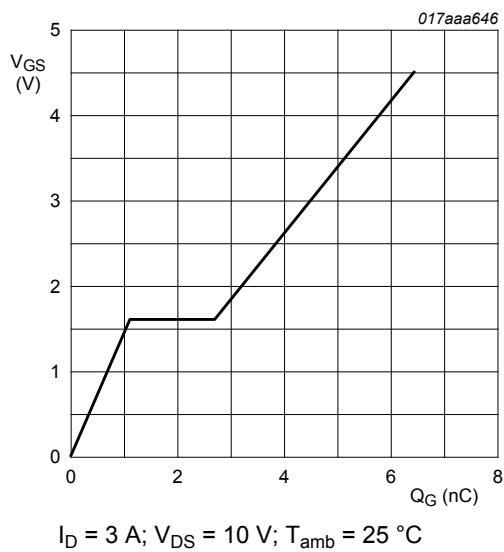


Fig. 14. Gate-source voltage as a function of gate charge; typical values

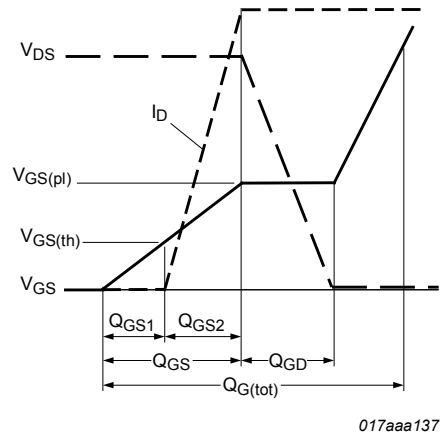
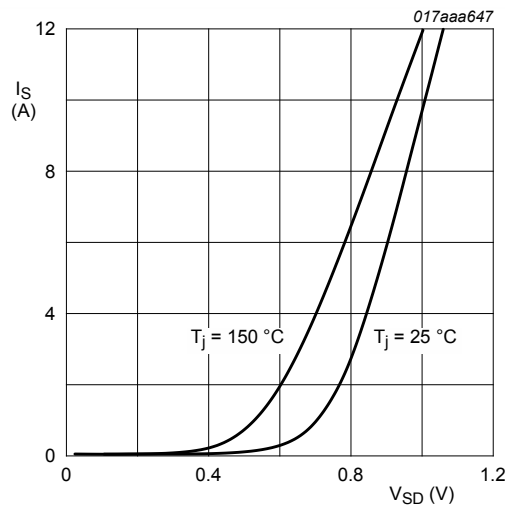


Fig. 15. Gate charge waveform definitions





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

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

8. Test information

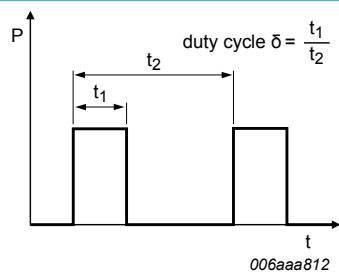


Fig. 17. Duty cycle definition

9. Package outline

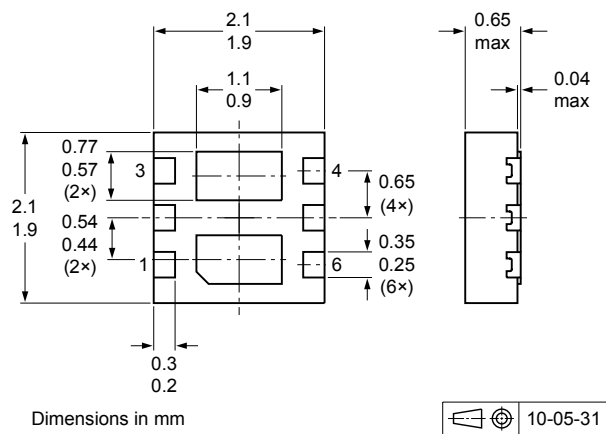
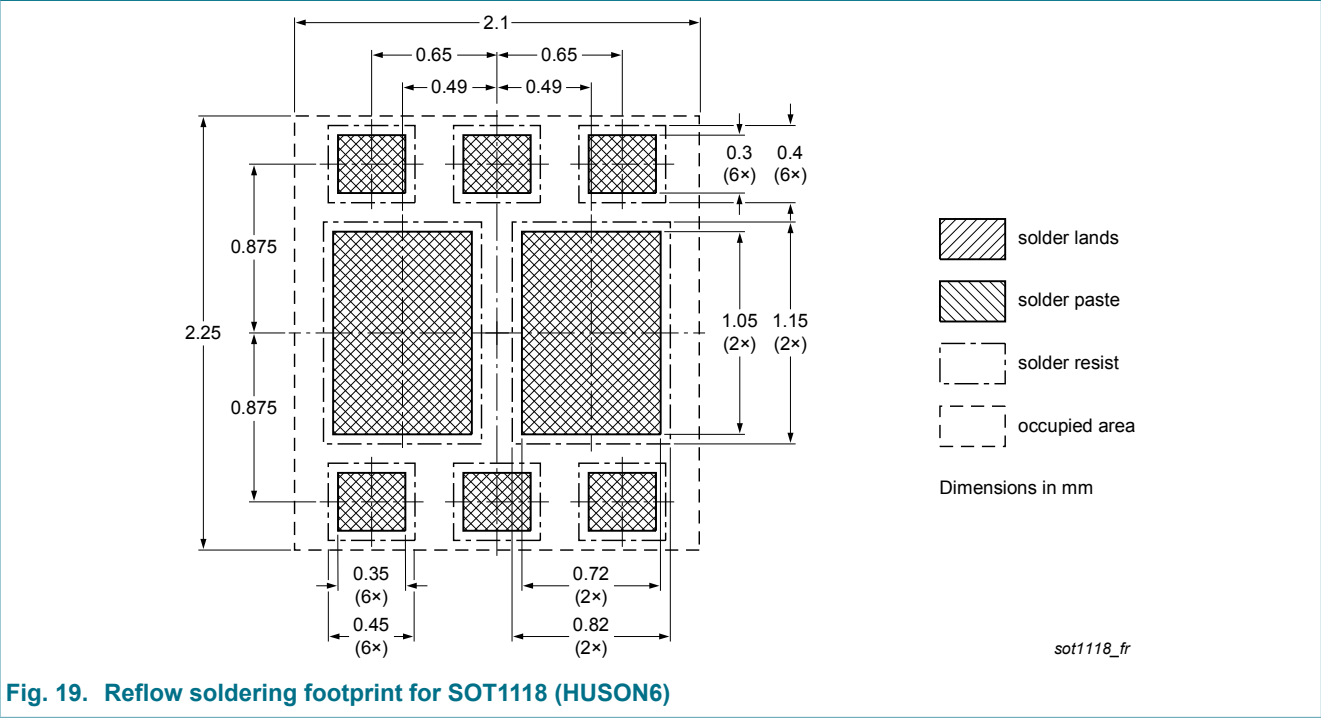


Fig. 18. DFN2020-6 (SOT1118)

10. Soldering



11. Revision history

Table 8. Revision history

| Document ID   | Release date | Document status    | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| PMDPB30XN v.1 | 20120706     | Product data sheet | -             | -          |

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### 12.1 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. |
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| 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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## 13. Contents

|           |                                      |           |
|-----------|--------------------------------------|-----------|
| <b>1</b>  | <b>Product profile .....</b>         | <b>1</b>  |
| 1.1       | General description .....            | 1         |
| 1.2       | Features and benefits .....          | 1         |
| 1.3       | Applications .....                   | 1         |
| 1.4       | Quick reference data .....           | 1         |
| <b>2</b>  | <b>Pinning information .....</b>     | <b>2</b>  |
| <b>3</b>  | <b>Ordering information .....</b>    | <b>2</b>  |
| <b>4</b>  | <b>Marking .....</b>                 | <b>2</b>  |
| <b>5</b>  | <b>Limiting values .....</b>         | <b>2</b>  |
| <b>6</b>  | <b>Thermal characteristics .....</b> | <b>4</b>  |
| <b>7</b>  | <b>Characteristics .....</b>         | <b>5</b>  |
| <b>8</b>  | <b>Test information .....</b>        | <b>9</b>  |
| <b>9</b>  | <b>Package outline .....</b>         | <b>9</b>  |
| <b>10</b> | <b>Soldering .....</b>               | <b>10</b> |
| <b>11</b> | <b>Revision history .....</b>        | <b>10</b> |
| <b>12</b> | <b>Legal information .....</b>       | <b>11</b> |
| 12.1      | Data sheet status .....              | 11        |
| 12.2      | Definitions .....                    | 11        |
| 12.3      | Disclaimers .....                    | 11        |
| 12.4      | Trademarks .....                     | 12        |

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