1. Product profile

1.1 General description

P-channel enhancement mode Field-Effect Transistor (FET) in a leadless medium power DFN2020MD-6 (SOT1220) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

1.2 Features and benefits

- 2.3 kV ESD protected
- Small and leadless ultra thin SMD plastic package: 2 x 2 x 0.65 mm
- Exposed drain pad for excellent thermal conduction
- Tin-plated 100 % solderable side pads for optical solder inspection

1.3 Applications

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

1.4 Quick reference data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_DS</td>
<td>drain-source voltage</td>
<td>T_j = 25 °C</td>
<td>-</td>
<td>-</td>
<td>-20</td>
<td>V</td>
</tr>
<tr>
<td>V_GS</td>
<td>gate-source voltage</td>
<td>-12</td>
<td>-</td>
<td>12</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I_D</td>
<td>drain current</td>
<td>V_GS = -4.5 V; T_amb = 25 °C</td>
<td>[1]</td>
<td>-</td>
<td>-5</td>
<td>A</td>
</tr>
<tr>
<td>R_DSon</td>
<td>drain-source on-state resistance</td>
<td>V_GS = -4.5 V; I_D = -5 A; T_j = 25 °C</td>
<td>-</td>
<td>28</td>
<td>32.5</td>
<td>mΩ</td>
</tr>
</tbody>
</table>

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

Table 2. Pinning information

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D</td>
<td>drain</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>drain</td>
</tr>
<tr>
<td>3</td>
<td>G</td>
<td>gate</td>
</tr>
<tr>
<td>4</td>
<td>S</td>
<td>source</td>
</tr>
<tr>
<td>5</td>
<td>D</td>
<td>drain</td>
</tr>
<tr>
<td>6</td>
<td>D</td>
<td>drain</td>
</tr>
<tr>
<td>7</td>
<td>D</td>
<td>drain</td>
</tr>
<tr>
<td>8</td>
<td>S</td>
<td>source</td>
</tr>
</tbody>
</table>

3. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMPB29XPE</td>
<td>DFN2020MD-6</td>
<td>plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals</td>
<td>SOT1220</td>
</tr>
</tbody>
</table>

4. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMPB29XPE</td>
<td>1T</td>
</tr>
</tbody>
</table>

5. Limiting values

Table 5. Limiting values

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{DS}</td>
<td>drain-source voltage</td>
<td>( T_j = 25 ) °C</td>
<td>-</td>
<td>-20</td>
<td>V</td>
</tr>
<tr>
<td>V_{GS}</td>
<td>gate-source voltage</td>
<td></td>
<td>-12</td>
<td>12</td>
<td>V</td>
</tr>
<tr>
<td>I_D</td>
<td>drain current</td>
<td>( V_{ GS } = -4.5 ) V; ( T_{amb} = 25 ) °C</td>
<td>[1]</td>
<td>-5</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{ GS } = -4.5 ) V; ( T_{amb} = 100 ) °C</td>
<td>[1]</td>
<td>-3.2</td>
<td>A</td>
</tr>
<tr>
<td>I_{DM}</td>
<td>peak drain current</td>
<td>( T_{amb} = 25 ) °C; single pulse; ( t_p \leq 10 ) µs</td>
<td>-</td>
<td>-12</td>
<td>A</td>
</tr>
<tr>
<td>P_{tot}</td>
<td>total power dissipation</td>
<td>( T_{amb} = 25 ) °C</td>
<td>[1]</td>
<td>1.7</td>
<td>W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( T_{amb} = 25 ) °C; ( t \leq 5 ) s</td>
<td>[1]</td>
<td>3.5</td>
<td>W</td>
</tr>
</tbody>
</table>
### Symbol | Parameter | Conditions | Min | Max | Unit
---|---|---|---|---|---
- | | \( T_{sp} = 25 \, ^\circ C \) | - | 12.5 | W
\( T_j \) | junction temperature | -55 | 150 | °C
\( T_{amb} \) | ambient temperature | -55 | 150 | °C
\( T_{stg} \) | storage temperature | -65 | 150 | °C

**Source-drain diode**

| Symbol | Parameter | Conditions | Min | Max | Unit |
---|---|---|---|---|---|
\( I_S \) | source current | \( T_{amb} = 25 \, ^\circ C \) (1) | - | -1.8 | A

**ESD maximum rating**

| Symbol | Parameter | Conditions | Min | Max | Unit |
---|---|---|---|---|---|
\( V_{ESD} \) | electrostatic discharge voltage | HBM | - | 2300 | V

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


---

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

\[
P_{\text{der}} = \frac{P_{T_{amb} = 25\,^\circ C}}{P_{T_{amb} = 25\,^\circ C}} \times 100 \, \%
\]

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

\[
I_{\text{der}} = \frac{I_D}{I_{D_{T_{amb} = 25\,^\circ C}}} \times 100 \, \%
\]
6. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{\text{th(j-a)}}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td>-</td>
<td>235</td>
<td>270</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{\text{th(j-a)}}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air; $t \leq 5$ s</td>
<td>-</td>
<td>67</td>
<td>74</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{\text{th(j-sp)}}$</td>
<td>thermal resistance from junction to solder point</td>
<td>-</td>
<td>33</td>
<td>36</td>
<td>K/W</td>
<td></td>
</tr>
</tbody>
</table>


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

Table 7. Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{BR,\text{DSS}}$</td>
<td>drain-source breakdown voltage</td>
<td>$I_D = -250 \mu A; V_{GS} = 0 \text{ V}; T_J = 25 \text{ °C}$</td>
<td>-20</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_{GSth}$</td>
<td>gate-source threshold voltage</td>
<td>$I_D = -250 \mu A; V_{DS} = V_{GS}; T_J = 25 \text{ °C}$</td>
<td>-0.47</td>
<td>-0.68</td>
<td>-0.9</td>
<td>V</td>
</tr>
<tr>
<td>$I_{DSS}$</td>
<td>drain leakage current</td>
<td>$V_{DS} = -20 \text{ V}; V_{GS} = 0 \text{ V}; T_J = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>-1</td>
<td>µA</td>
</tr>
<tr>
<td>$I_{GSS}$</td>
<td>gate leakage current</td>
<td>$V_{GS} = -8 \text{ V}; V_{DS} = 0 \text{ V}; T_J = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>-10</td>
<td>µA</td>
</tr>
</tbody>
</table>

FR4 PCB, standard footprint

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

FR4 PCB, mounting pad for drain 6 cm²

Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
## Symbol | Parameter | Conditions | Min | Typ | Max | Unit
--- | --- | --- | --- | --- | --- | ---
$V_{GS} = 8 \, \text{V}; \, V_{DS} = 0 \, \text{V}; \, T_j = 25 \, ^\circ\text{C}$ | - | - | 10 | $\mu\text{A}$

### Dynamic characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit
--- | --- | --- | --- | --- | --- | ---
$q_{gs}$ | forward transconductance | $V_{DS} = -10 \, \text{V}; \, I_D = -5 \, \text{A}; \, T_j = 25 \, ^\circ\text{C}$ | - | 20 | - | $\text{S}$
$R_G$ | gate resistance | $f = 1 \, \text{MHz}$ | - | 5.3 | - | $\Omega$

### Source-drain diode

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit
--- | --- | --- | --- | --- | --- | ---
$V_{SD}$ | source-drain voltage | $I_S = -1.8 \, \text{A}; \, V_{GS} = 0 \, \text{V}; \, T_j = 25 \, ^\circ\text{C}$ | - | -0.7 | -1.2 | $\text{V}$
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

\[ a = \frac{R_{DSon}}{R_{DSon@TC}} \]
Fig. 12. Gate-source threshold voltage as a function of junction temperature

\[ V_{GS(\text{th})} \] (V)

\[ T_j \] (°C)

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

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

\[ f = 1 \text{ MHz}; V_{GS} = 0 \text{ V} \]

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

\[ I_D = -5 \text{ A}; V_{DS} = -10 \text{ V}; T_{\text{amb}} = 25 \text{ °C} \]

Fig. 15. MOSFET transistor: Gate charge waveform definitions
8. Test information

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

9. Package outline

Fig. 17. Duty cycle definition

Fig. 18. Package outline DFN2020MD-6 (SOT1220)
10. Soldering

Footprint information for reflow soldering of DFN2020MD-6 package

Fig. 19. Reflow soldering footprint for DFN2020MD-6 (SOT1220)
11. Revision history

Table 8. Revision history

<table>
<thead>
<tr>
<th>Data sheet ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<tbody>
<tr>
<td>PMPB29XPE v.1</td>
<td>20121205</td>
<td>Product data sheet</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
12. Legal information

12.1 Data sheet status

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective [short] data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
</tr>
<tr>
<td>Preliminary [short] data sheet</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Product [short] data sheet</td>
<td>Production</td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

[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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