

# PMPB10XNE

20 V, single N-channel Trench MOSFET

30 November 2012

Product data sheet

## 1. Product profile

### 1.1 General description

N-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

- 2.2 kV ESD protection
- 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 portables
- Hard disk and computing power management

### 1.4 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		-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]	-	12.9	A
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}$ ; $I_D = 9\text{ A}$ ; $T_J = 25\text{ }^{\circ}\text{C}$	-	10	14	m $\Omega$

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

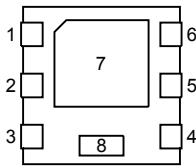
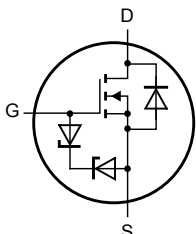


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## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 <p>Transparent top view <b>DFN2020MD-6 (SOT1220)</b></p>	 <p>017aaa255</p>
2	D	drain		
3	G	gate		
4	S	source		
5	D	drain		
6	D	drain		
7	D	drain		
8	S	source		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMPB10XNE	DFN2020MD-6	plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals	SOT1220

## 4. Marking

Table 4. Marking codes

Type number	Marking code
PMPB10XNE	1H

## 5. Limiting values

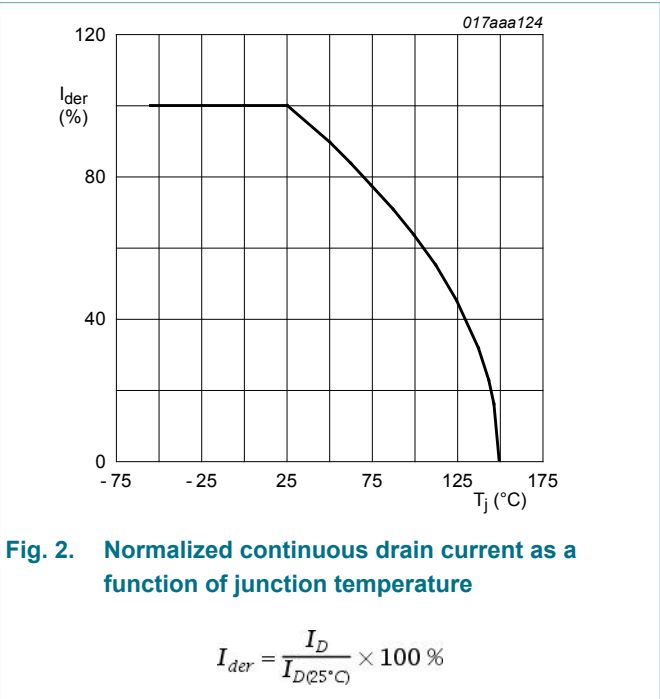
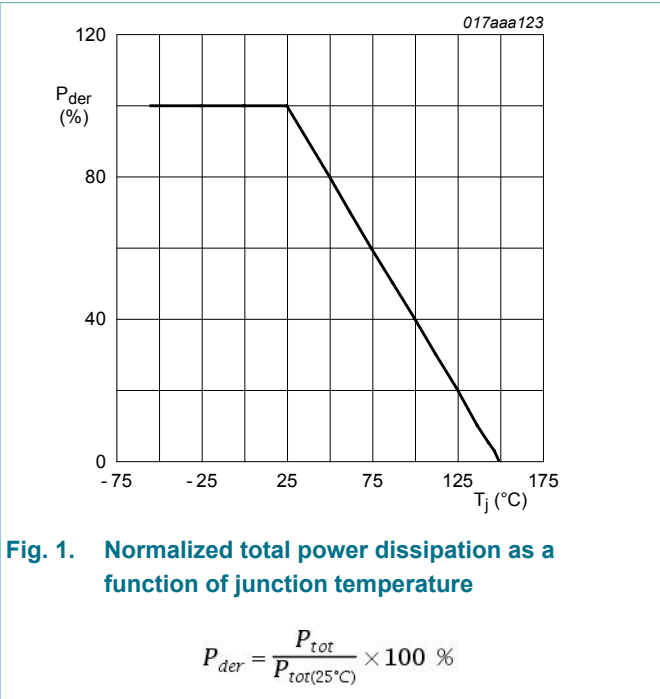
Table 5. Limiting values

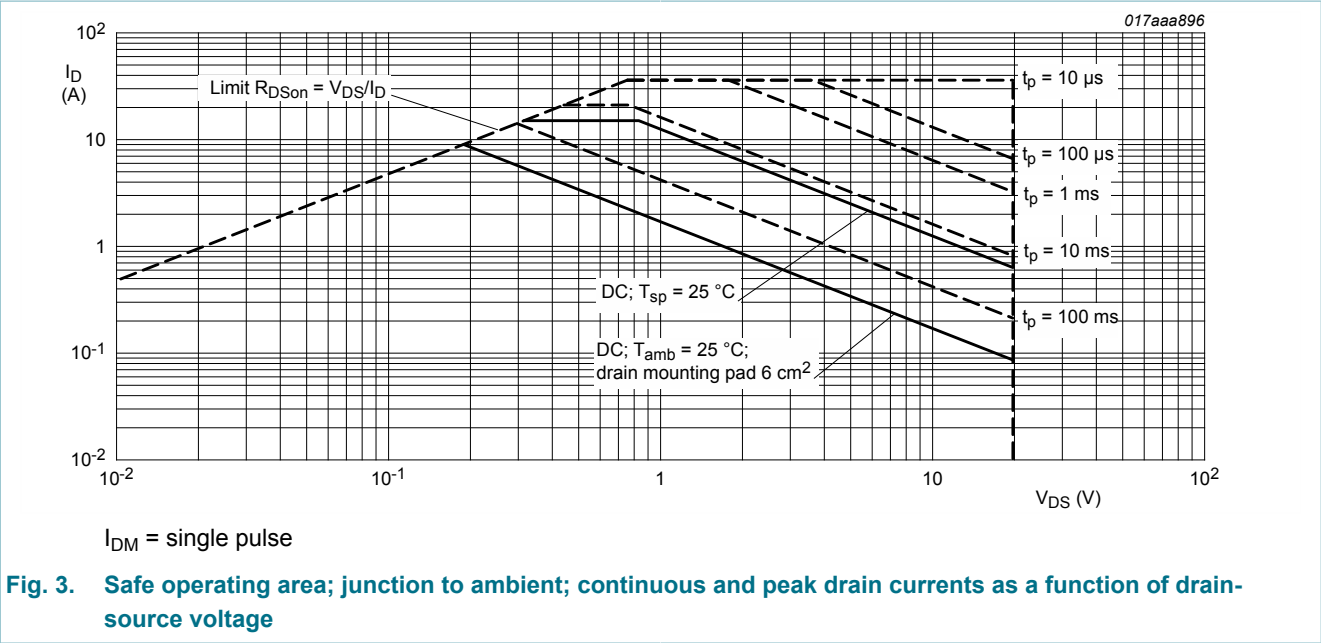
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ }^{\circ}\text{C}$		-	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]	-	12.9	A
		$V_{GS} = 4.5\text{ V}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	9	A
		$V_{GS} = 4.5\text{ V}$ ; $T_{amb} = 100\text{ }^{\circ}\text{C}$	[1]	-	5.7	A
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ }^{\circ}\text{C}$ ; single pulse; $t_p \leq 10\text{ }\mu\text{s}$		-	36	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	1.7	W

Symbol	Parameter	Conditions		Min	Max	Unit
		$T_{amb} = 25\text{ }^{\circ}\text{C}; t \leq 5\text{ s}$	[1]	-	3.5	W
		$T_{sp} = 25\text{ }^{\circ}\text{C}$		-	12.5	W
$T_j$	junction temperature			-55	150	$^{\circ}\text{C}$
$T_{amb}$	ambient temperature			-55	150	$^{\circ}\text{C}$
$T_{stg}$	storage temperature			-65	150	$^{\circ}\text{C}$
Source-drain diode						
$I_S$	source current	$T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	2	A
ESD maximum rating						
$V_{ESD}$	electrostatic discharge voltage	HBM	[2]	-	2200	V

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.
- [2] Measured between all pins.



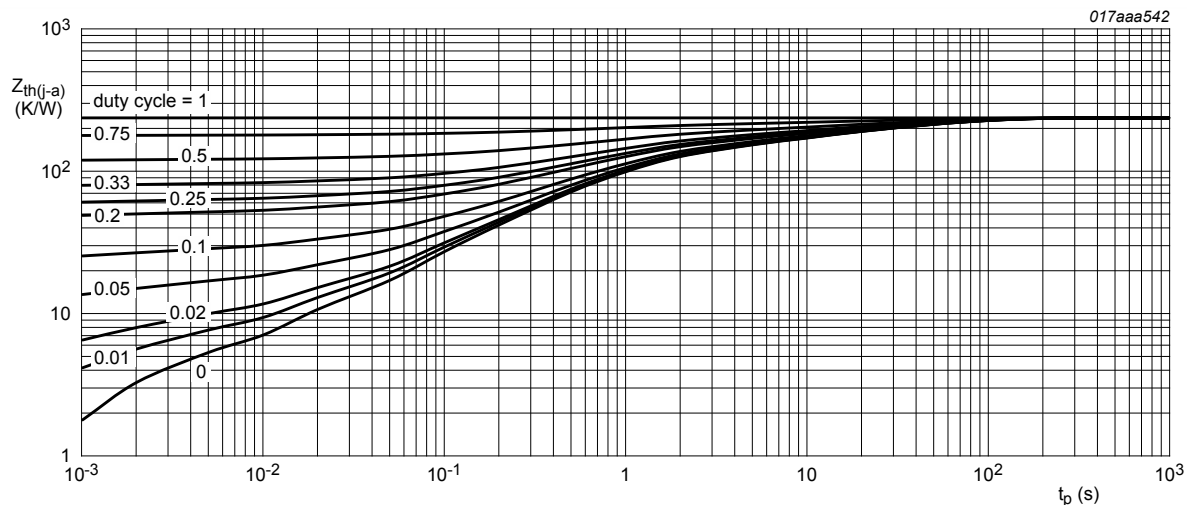


6. Thermal characteristics

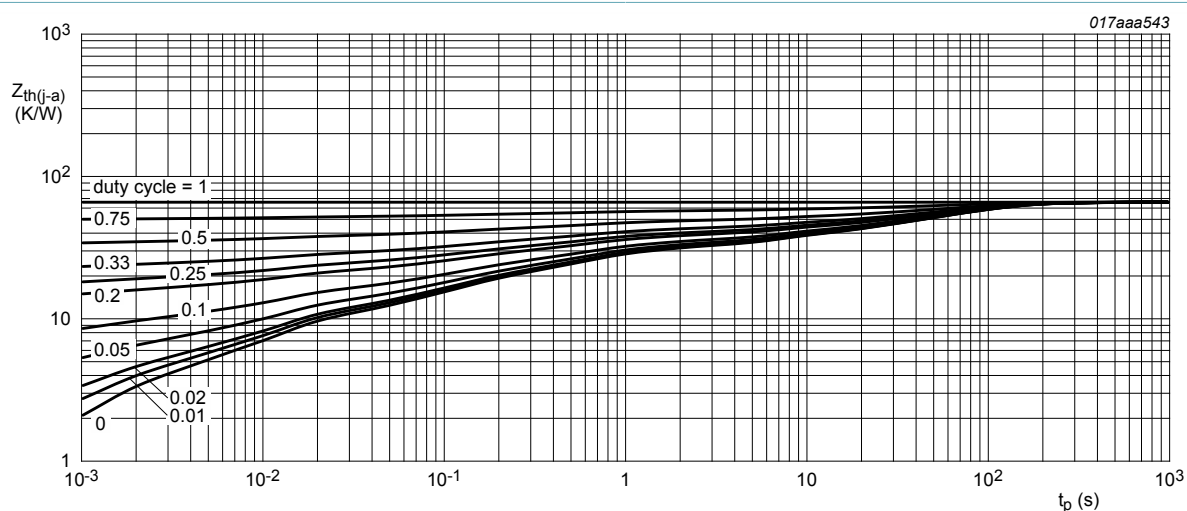
Table 6. Thermal characteristics

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]	-	67	74	K/W
		in free air; $t \leq 5\text{ s}$	[2]	-	33	36	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	5	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, mounting pad for drain  $6\text{ cm}^2$ .



FR4 PCB, standard footprint

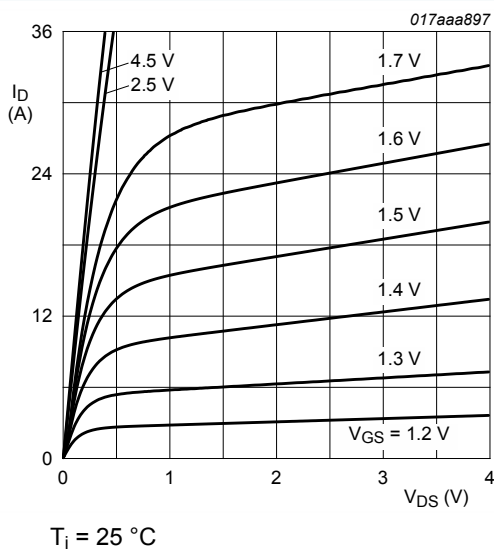
**Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

FR4 PCB, mounting pad for drain 6 cm<sup>2</sup>
**Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

## 7. Characteristics

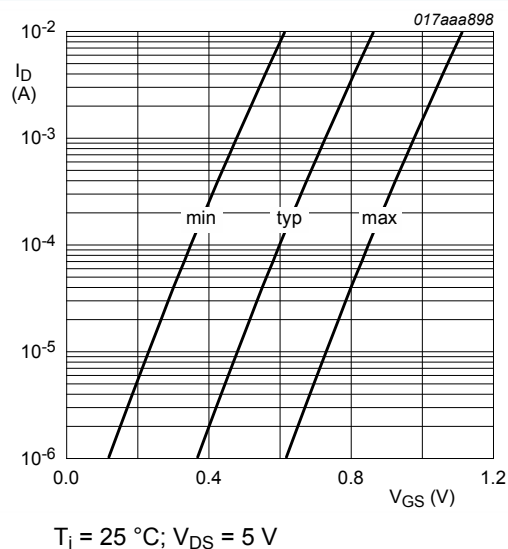
**Table 7. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</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	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 ^\circ C$	-	-	10	$\mu A$

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
		$V_{GS} = -8 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^{\circ}\text{C}$		-	-	-10	$\mu\text{A}$
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 9 \text{ A}; T_j = 25 \text{ }^{\circ}\text{C}$		-	10	14	$\text{m}\Omega$
		$V_{GS} = 4.5 \text{ V}; I_D = 9 \text{ A}; T_j = 150 \text{ }^{\circ}\text{C}$		-	15	21	$\text{m}\Omega$
		$V_{GS} = 2.5 \text{ V}; I_D = 8 \text{ A}; T_j = 25 \text{ }^{\circ}\text{C}$		-	12	18	$\text{m}\Omega$
		$V_{GS} = 1.8 \text{ V}; I_D = 3.7 \text{ A}; T_j = 25 \text{ }^{\circ}\text{C}$		-	16	25	$\text{m}\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = 10 \text{ V}; I_D = 9 \text{ A}; T_j = 25 \text{ }^{\circ}\text{C}$		-	60	-	S
$R_G$	gate resistance	$f = 1 \text{ MHz}$		-	2	-	$\Omega$
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	$V_{DS} = 10 \text{ V}; I_D = 6 \text{ A}; V_{GS} = 4.5 \text{ V}; T_j = 25 \text{ }^{\circ}\text{C}$		-	23	34	nC
$Q_{GS}$	gate-source charge			-	2.6	-	nC
$Q_{GD}$	gate-drain charge			-	4.5	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 10 \text{ V}; f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^{\circ}\text{C}$		-	2175	-	pF
$C_{oss}$	output capacitance			-	235	-	pF
$C_{rss}$	reverse transfer capacitance			-	205	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 10 \text{ V}; I_D = 6 \text{ A}; V_{GS} = 4.5 \text{ V}; R_{G(ext)} = 6 \text{ }\Omega; T_j = 25 \text{ }^{\circ}\text{C}$		-	13	-	ns
$t_r$	rise time			-	35	-	ns
$t_{d(off)}$	turn-off delay time			-	54	-	ns
$t_f$	fall time			-	50	-	ns
Source-drain diode							
$V_{SD}$	source-drain voltage	$I_S = 2 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^{\circ}\text{C}$		-	0.6	1.2	V



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



**Fig. 7. Subthreshold drain current as a function of gate-source voltage**

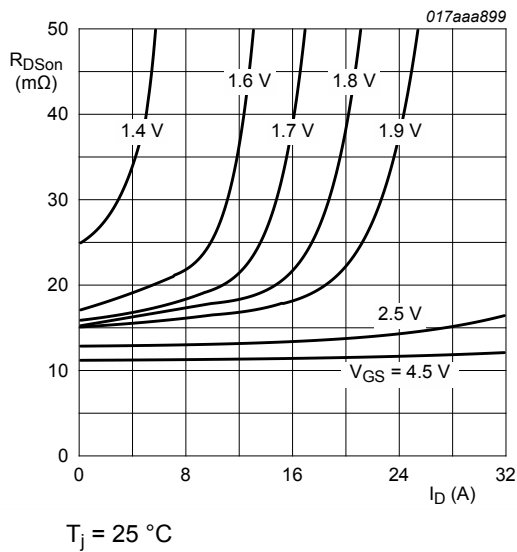


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

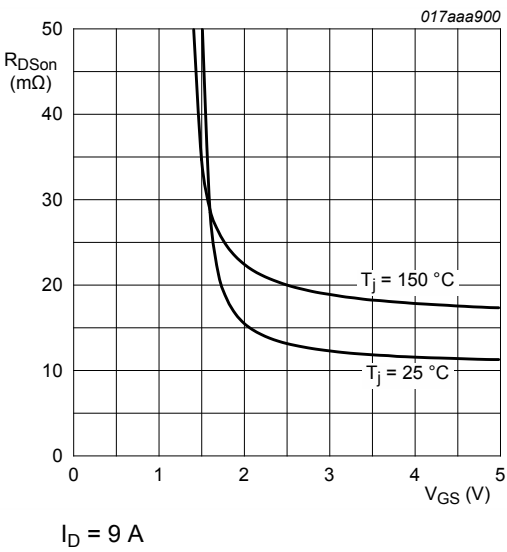


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

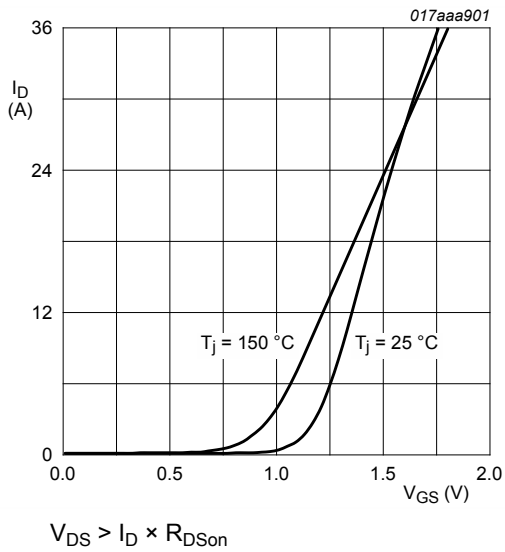


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

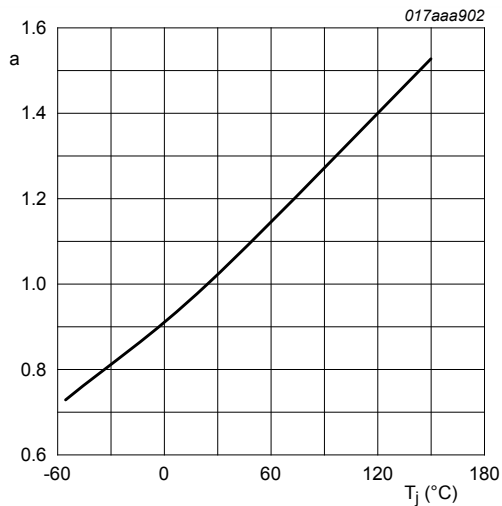


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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

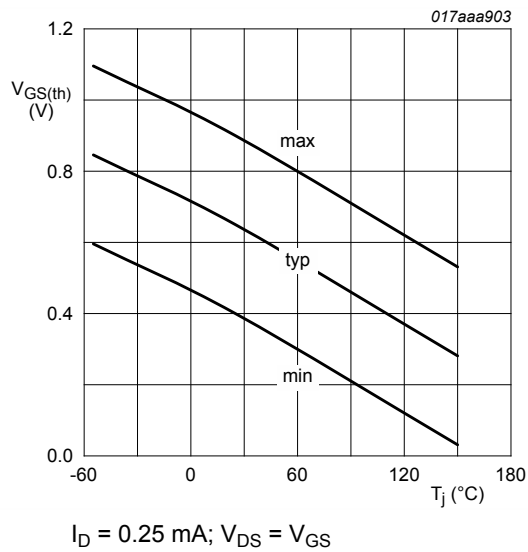


Fig. 12. Gate-source threshold voltage as a function of junction temperature

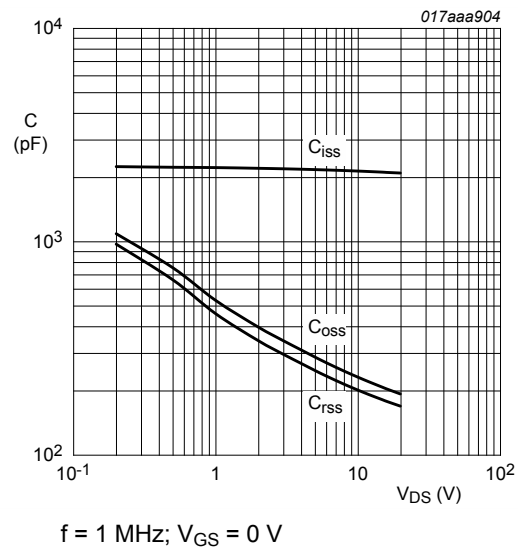


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

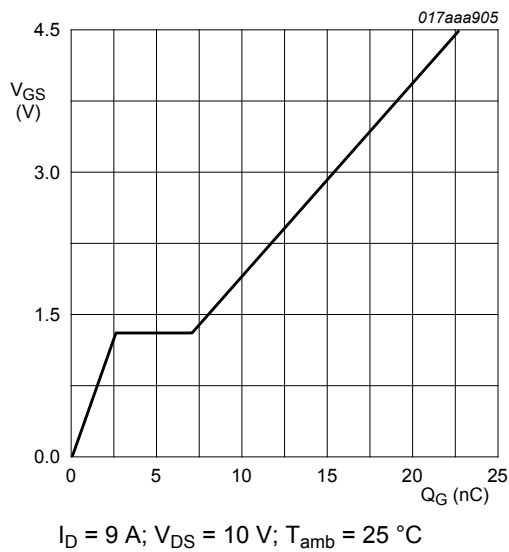


Fig. 14. Gate-source voltage as a function of gate charge; typical values

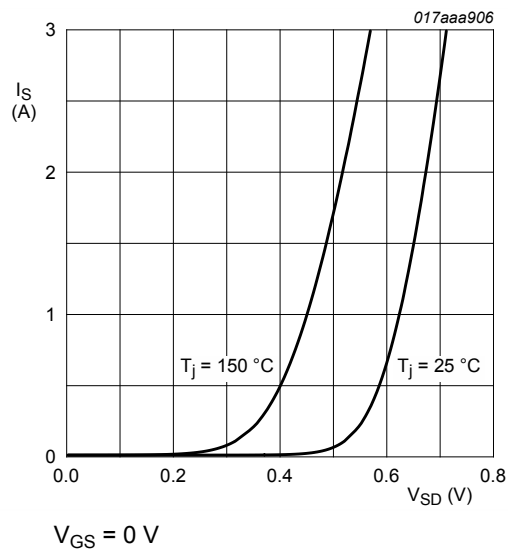
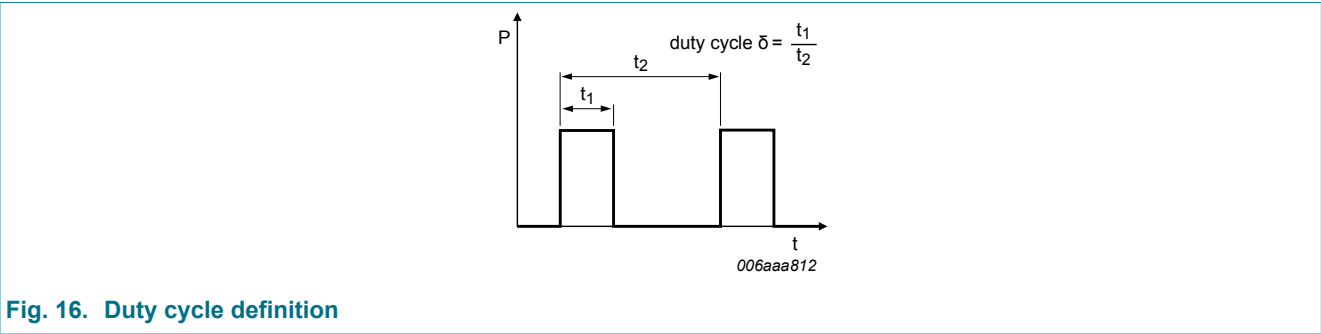
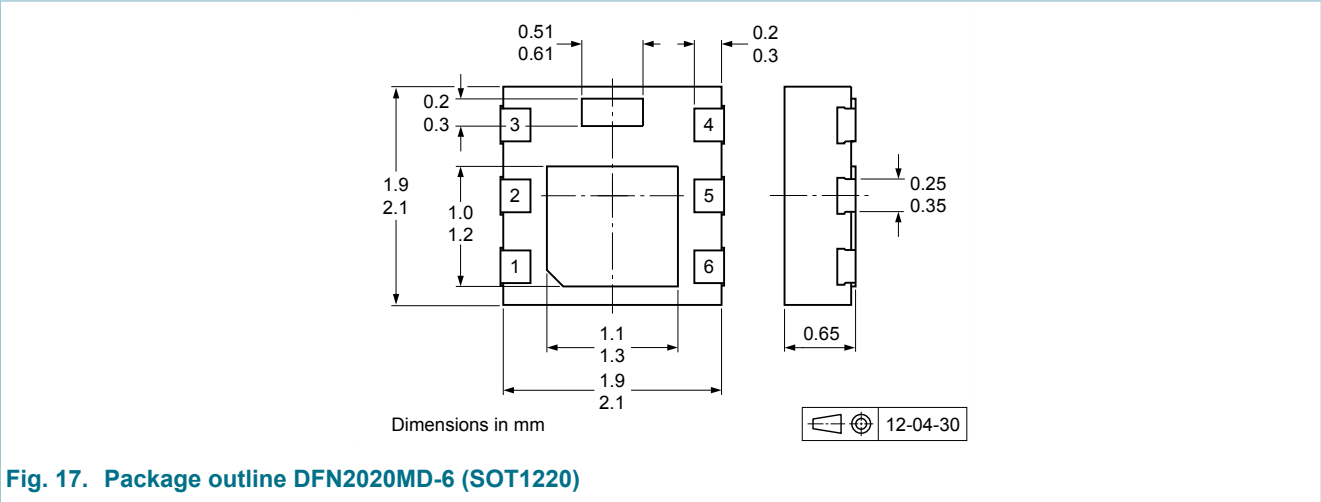


Fig. 15. Source current as a function of source-drain voltage; typical values

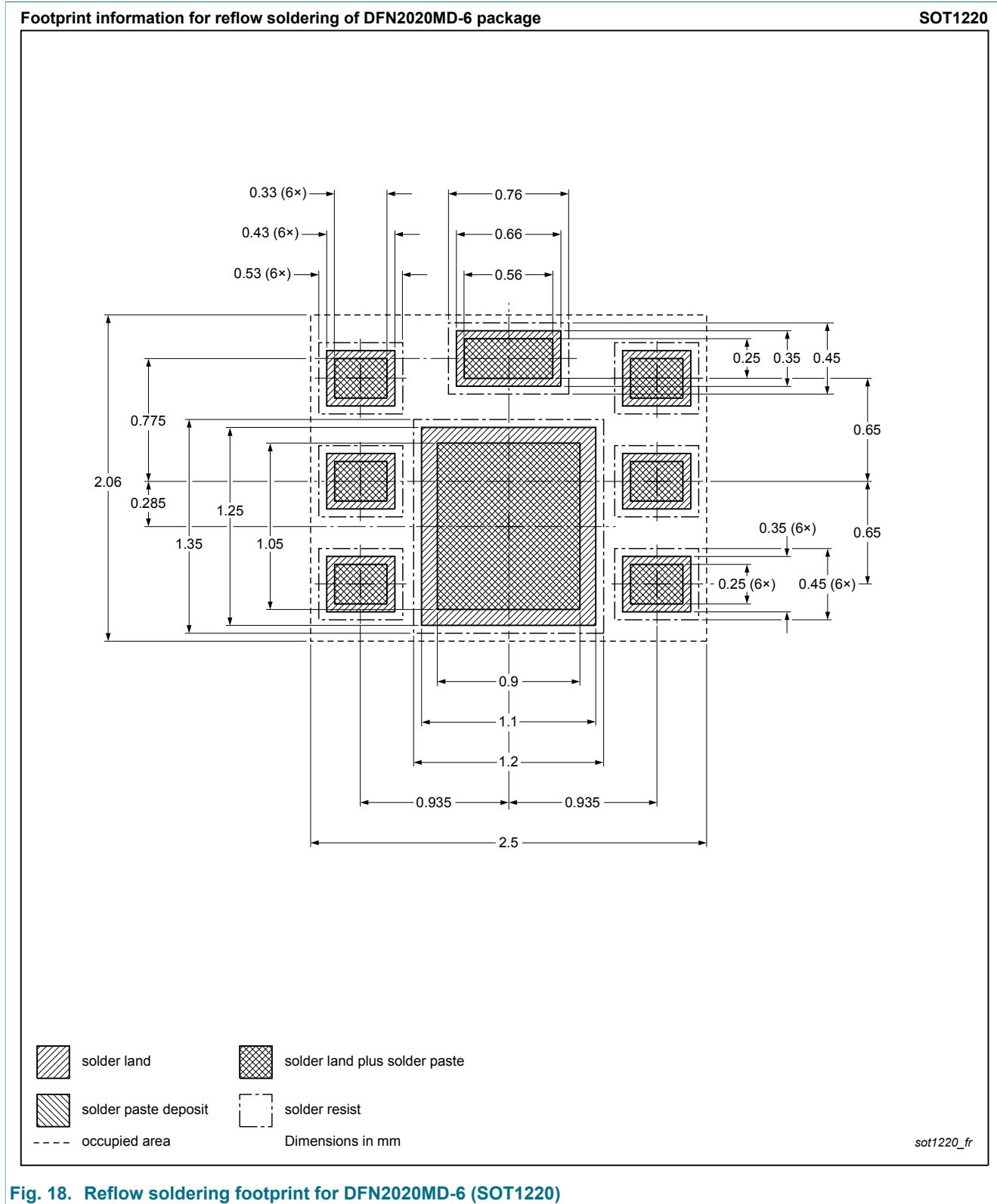
8. Test information



9. Package outline



## 10. Soldering



**Fig. 18. Reflow soldering footprint for DFN2020MD-6 (SOT1220)**

## 11. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMPB10XNE v.1	20121130	Product data sheet	-	-

## 12. Legal information

### 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.
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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## 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>11</b>
<b>12</b>	<b>Legal information .....</b>	<b>12</b>
12.1	Data sheet status .....	12
12.2	Definitions .....	12
12.3	Disclaimers .....	12
12.4	Trademarks .....	13

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