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Kind regards,

Team Nexperia



# PMPB20EN

## 30 V N-channel Trench MOSFET

14 January 2014

Product data sheet

### 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.

### 2. Features and benefits

- Trench MOSFET technology
- Very fast switching
- 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

### 3. Applications

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

### 4. Quick reference data

Table 1. Quick reference data

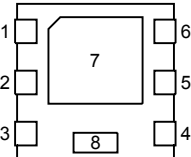
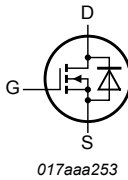
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ }^{\circ}\text{C}$		-	-	30	V
$V_{GS}$	gate-source voltage			-20	-	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; t \leq 5\text{ s}$	[1]	-	-	10.4	A
<b>Static characteristics</b>							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 7\text{ A}; T_j = 25\text{ }^{\circ}\text{C}$		-	16.5	19.5	m $\Omega$

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, 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 DFN2020MD-6 (SOT1220)</p>	 <p>017aaa253</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
PMPB20EN	DFN2020MD-6	DFN2020MD-6: plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals	SOT1220

## 7. Marking

Table 4. Marking codes

Type number	Marking code
PMPB20EN	1B



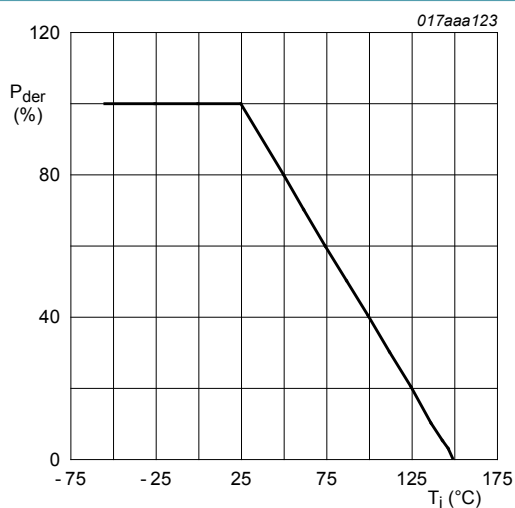
## 8. Limiting values

**Table 5. Limiting values**

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

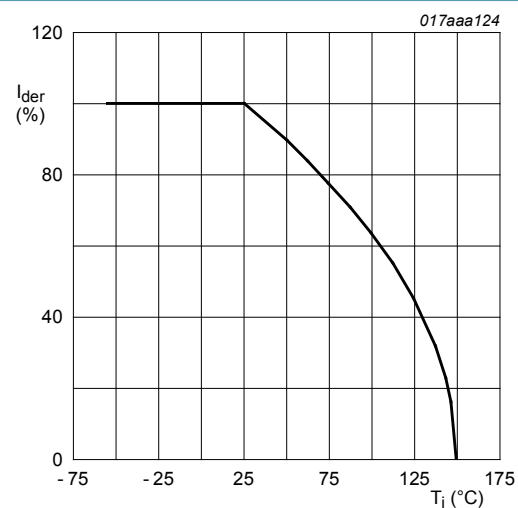
Symbol	Parameter	Conditions		Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> = 25 °C		-	30	V
V <sub>GS</sub>	gate-source voltage			-20	20	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 25 °C; t ≤ 5 s	[1]	-	10.4	A
		V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 25 °C	[1]	-	7.2	A
		V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 100 °C	[1]	-	4.6	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	[1]	-	1.7	W
		T <sub>amb</sub> = 25 °C; t ≤ 5 s	[1]	-	3.5	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]	-	2.2	A

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



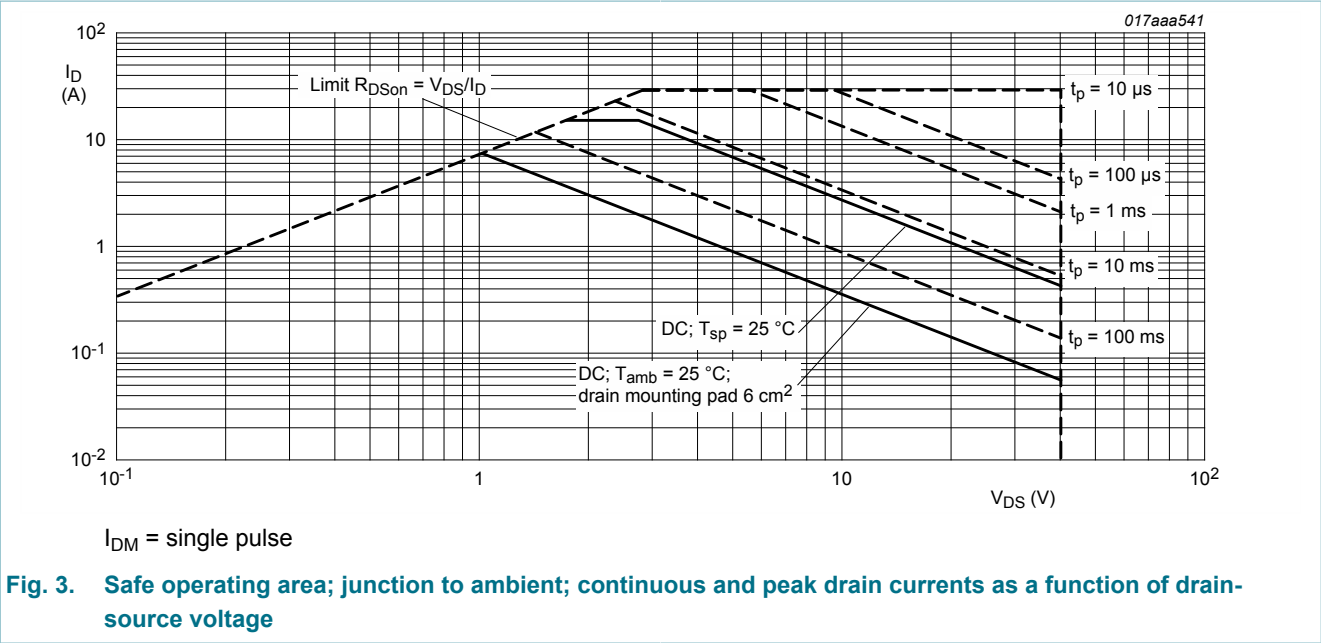
**Fig. 1. Normalized total power dissipation as a function of junction temperature**

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



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

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



9. Thermal characteristics

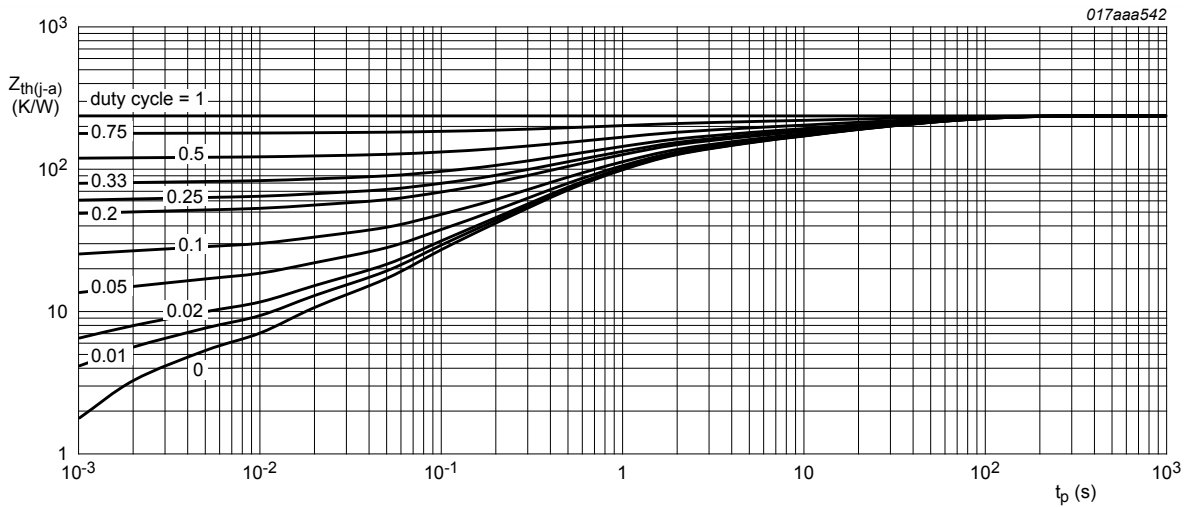
Table 6. Thermal characteristics

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]	-	67	74	K/W
			[3]	-	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.

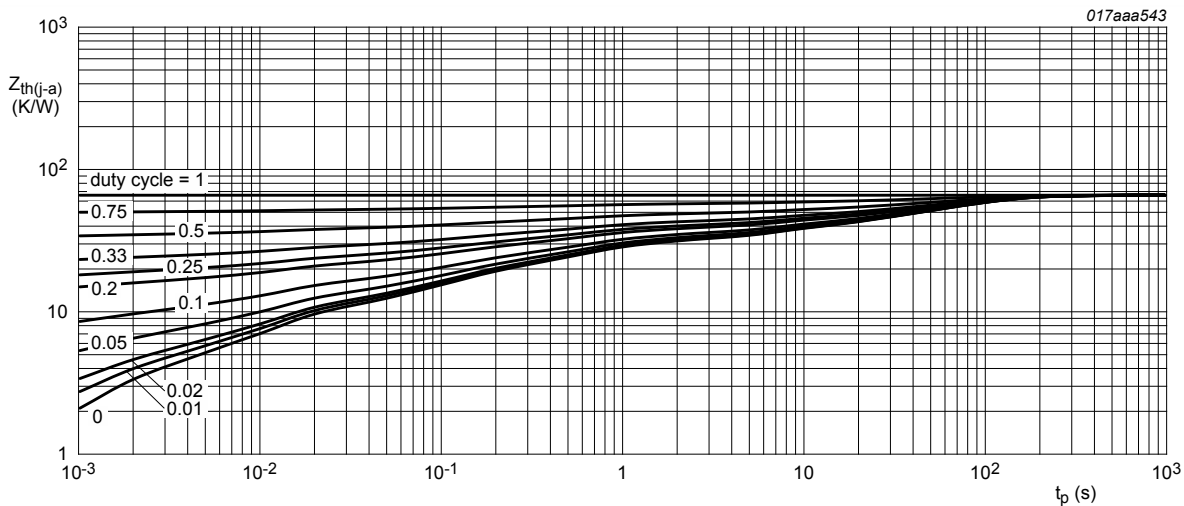
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain  $6\text{ cm}^2$ .

[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain  $6\text{ cm}^2$ ,  $t \leq 5\text{ s}$



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

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		30	-	-	V
V <sub>GSth</sub>	gate-source threshold voltage	I <sub>D</sub> = 250 μA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>j</sub> = 25 °C		1	1.5	2	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = 30 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	1	μA
		V <sub>DS</sub> = 30 V; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 150 °C		-	-	20	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	100	nA
		V <sub>GS</sub> = -20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	100	nA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 7 A; T <sub>j</sub> = 25 °C		-	16.5	19.5	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 7 A; T <sub>j</sub> = 150 °C		-	27	32	mΩ
		V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 7 A; T <sub>j</sub> = 25 °C		-	20.5	24.5	mΩ
g <sub>fs</sub>	forward transconductance	V <sub>DS</sub> = 10 V; I <sub>D</sub> = 7 A; T <sub>j</sub> = 25 °C		-	8	-	S
R <sub>G</sub>	gate resistance	f = 1 MHz		-	1.7	-	Ω
Dynamic characteristics							
Q <sub>G(tot)</sub>	total gate charge	V <sub>DS</sub> = 15 V; I <sub>D</sub> = 5 A; V <sub>GS</sub> = 10 V; T <sub>j</sub> = 25 °C		-	7.2	10.8	nC
Q <sub>GS</sub>	gate-source charge			-	1	-	nC
Q <sub>GD</sub>	gate-drain charge			-	0.67	-	nC
C <sub>iss</sub>	input capacitance	V <sub>DS</sub> = 15 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	435	-	pF
C <sub>oss</sub>	output capacitance			-	90	-	pF
C <sub>rss</sub>	reverse transfer capacitance			-	35	-	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 15 V; I <sub>D</sub> = 5 A; V <sub>GS</sub> = 4.5 V; R <sub>G(ext)</sub> = 1.7 Ω; T <sub>j</sub> = 25 °C		-	9	-	ns
t <sub>r</sub>	rise time			-	17	-	ns
t <sub>d(off)</sub>	turn-off delay time			-	9	-	ns
t <sub>f</sub>	fall time			-	8	-	ns
Source-drain diode							
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 2.2 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	0.8	1.2	V



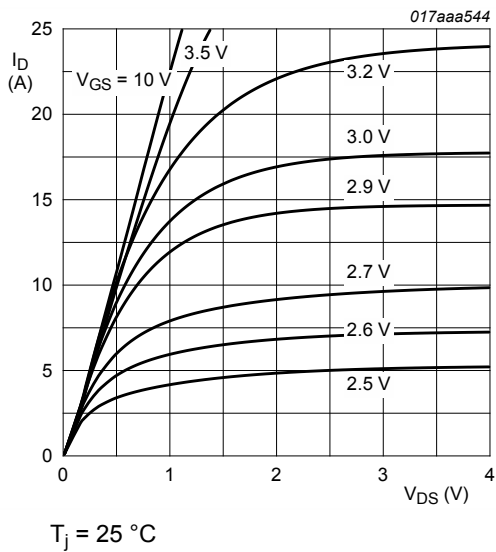


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

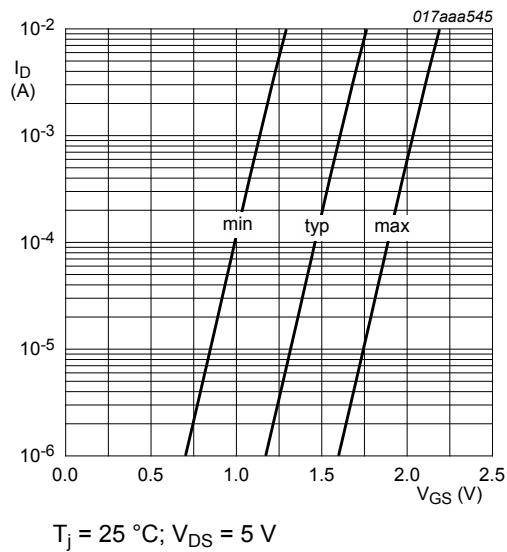


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

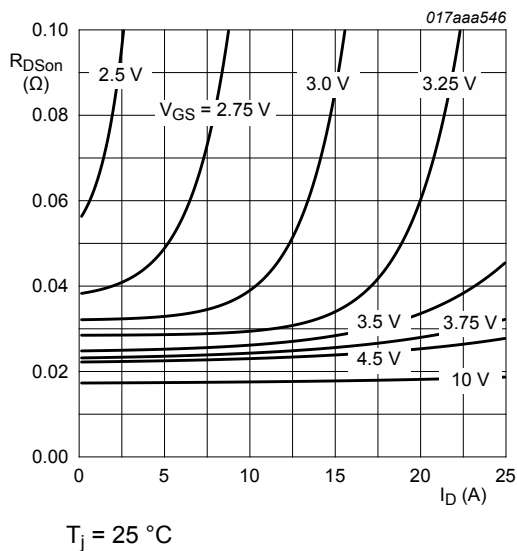


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

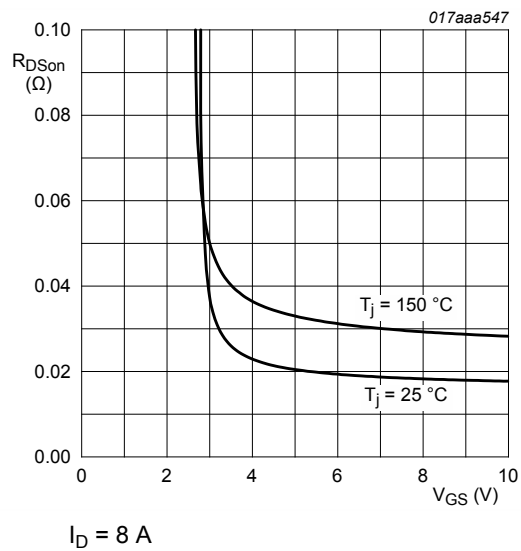


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

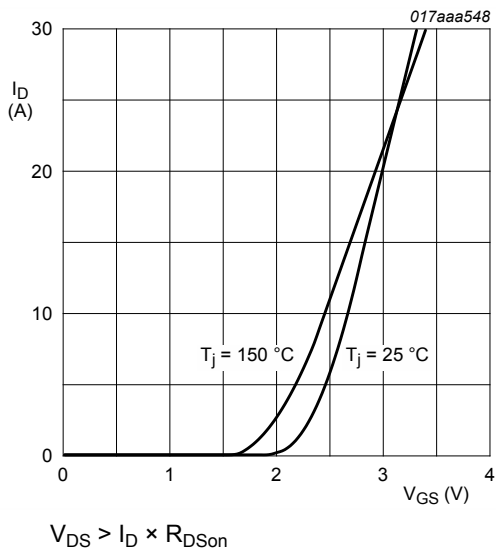


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

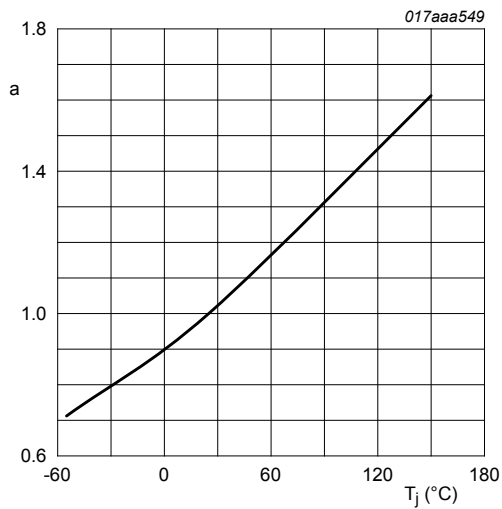


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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

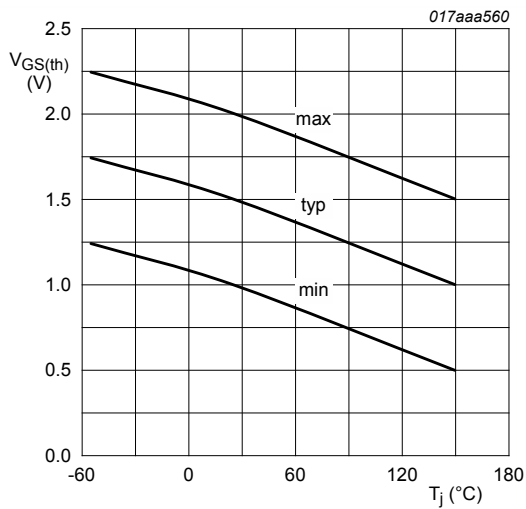


Fig. 12. Gate-source threshold voltage as a function of junction temperature

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

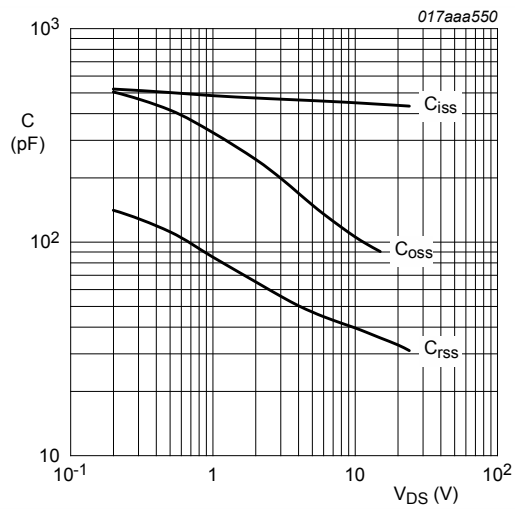
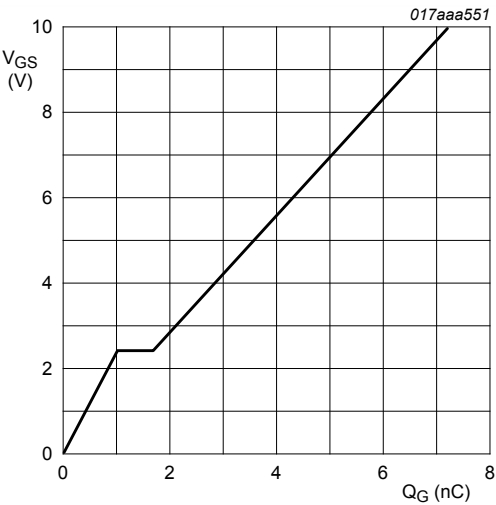


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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



$I_D = 5\text{ A}$ ;  $V_{DS} = 15\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$

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

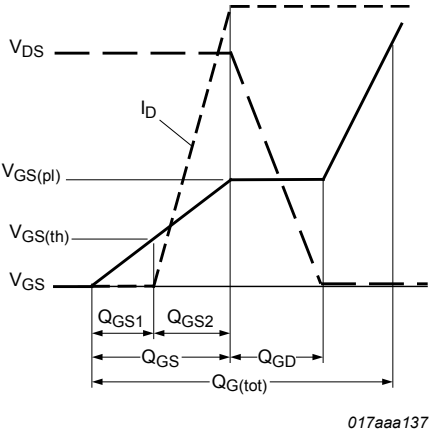
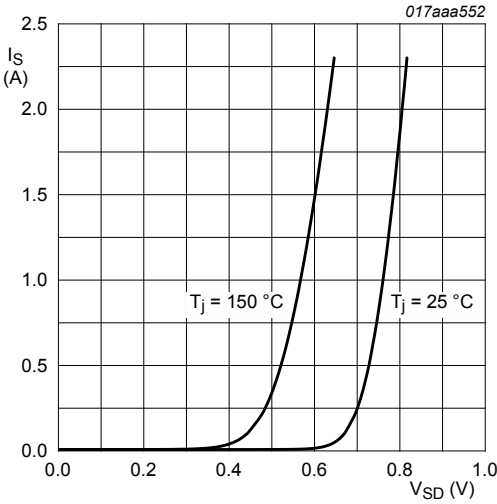


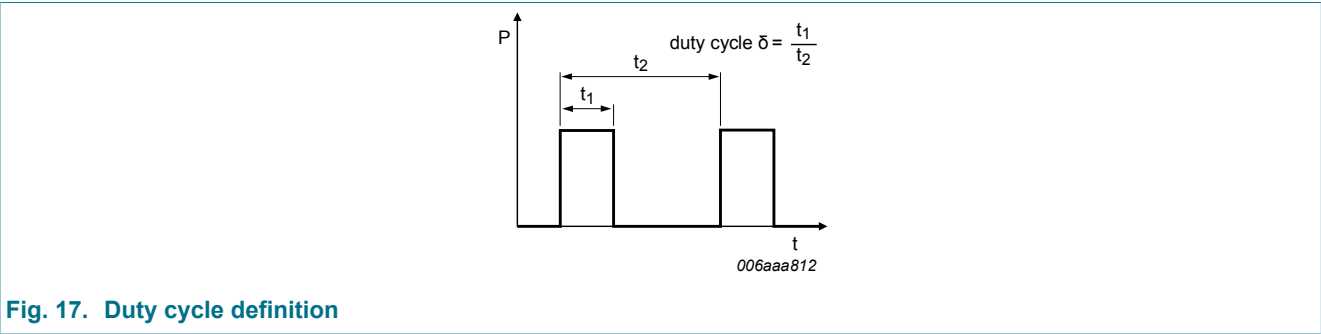
Fig. 15. Gate charge waveform definitions



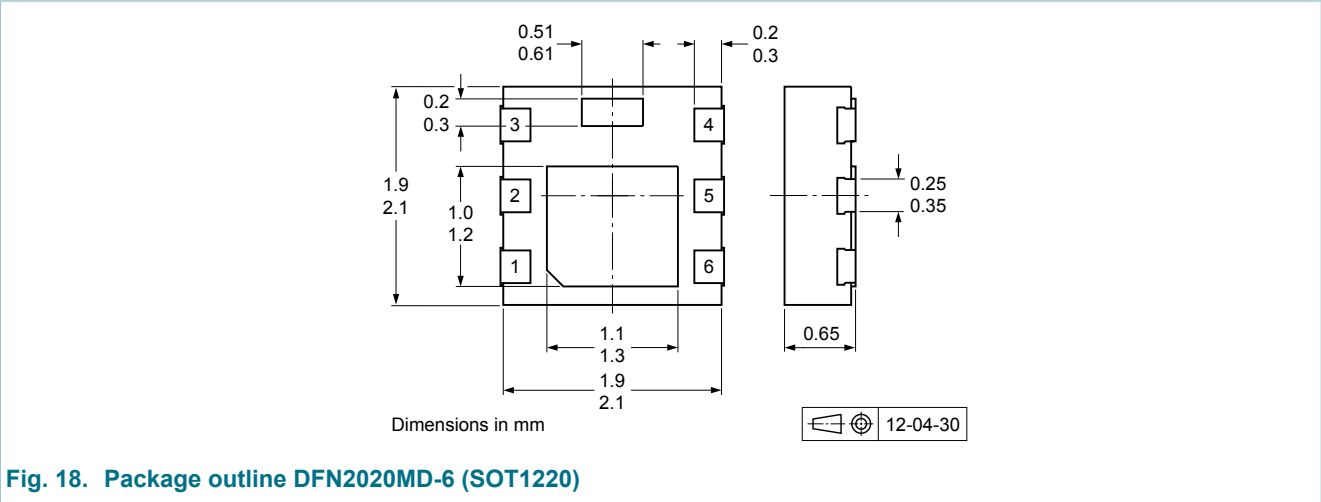
$V_{GS} = 0\text{ V}$

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

11. Test information



12. Package outline



13. Soldering

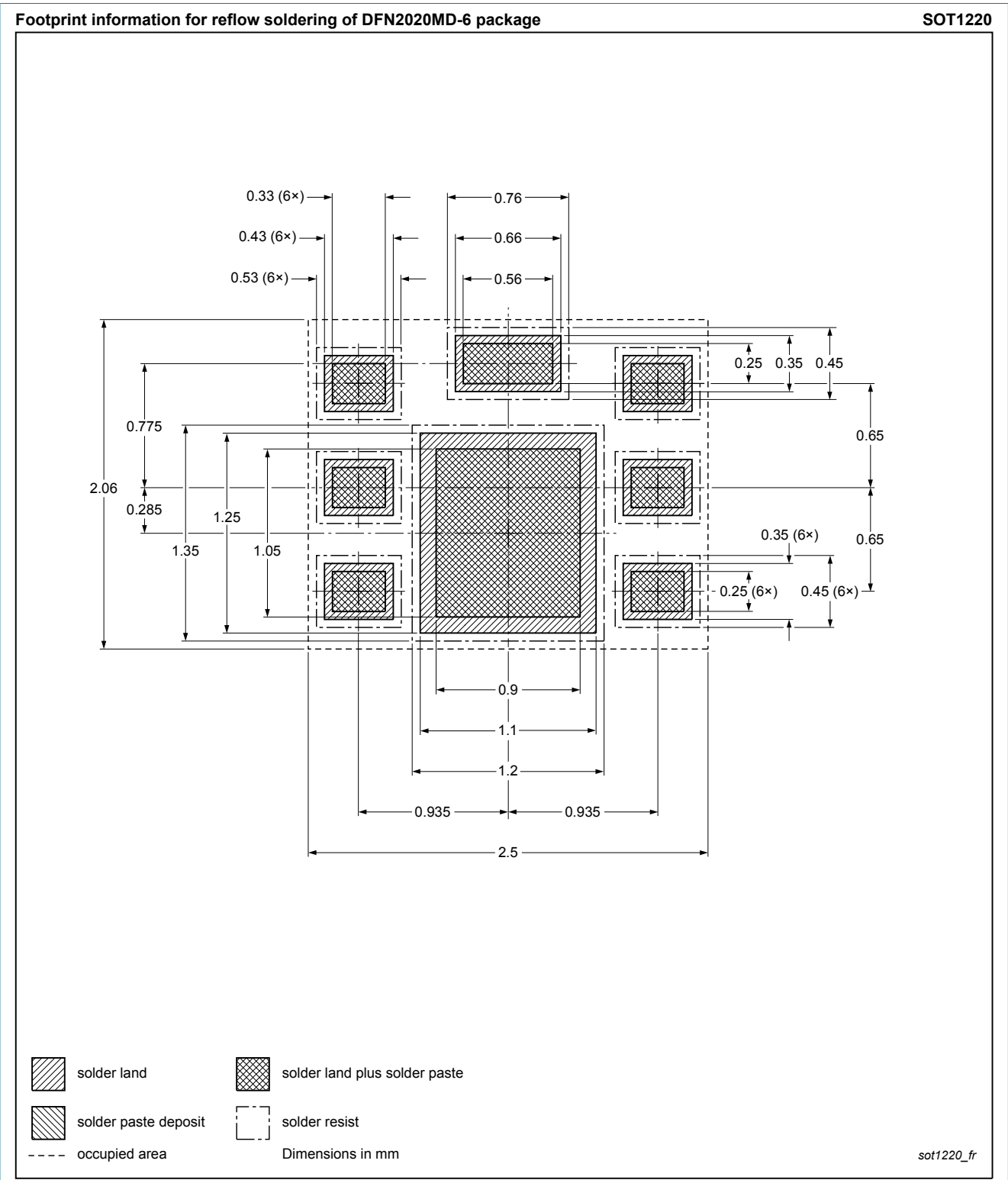


Fig. 19. Reflow soldering footprint for DFN2020MD-6 (SOT1220)

## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMPB20EN v.2	20140114	Product data sheet	-	PMPB20EN v.1
Modifications:	<ul style="list-style-type: none"><li>Table 7: parameter value of <math>V_{DS}</math> corrected from 10 V to 15 V in capacitance condition.</li><li>Figure 16: <math>V_{SD}</math> parameter corrected.</li></ul>			
PMPB20EN v.1	20120516	Product 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.

- [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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