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Kind regards,

Team Nexperia

# PMPB12UN

20 V single N-channel Trench MOSFET

6 July 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

- 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

### 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 <sub>DS</sub>	drain-source voltage	T <sub>J</sub> = 25 °C		-	-	20	V
V <sub>GS</sub>	gate-source voltage			-8	-	8	V
I <sub>D</sub>	drain current	V <sub>GS</sub> = 4.5 V; T <sub>amb</sub> = 25 °C; t ≤ 5 s	[1]	-	-	11.3	A
<b>Static characteristics</b>							
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 7.9 A; T <sub>J</sub> = 25 °C		-	14	18	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>.

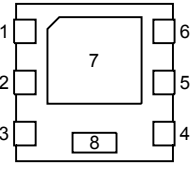
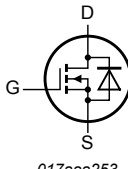


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## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 <p>Transparent top view <b>DFN2020MD-6 (SOT1220)</b></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		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMPB12UN	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
PMPB12UN	1F

## 5. Limiting values

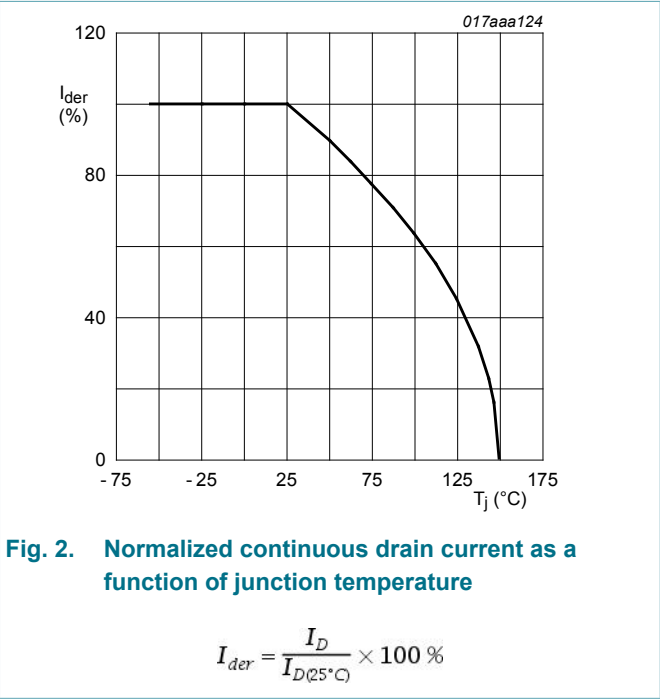
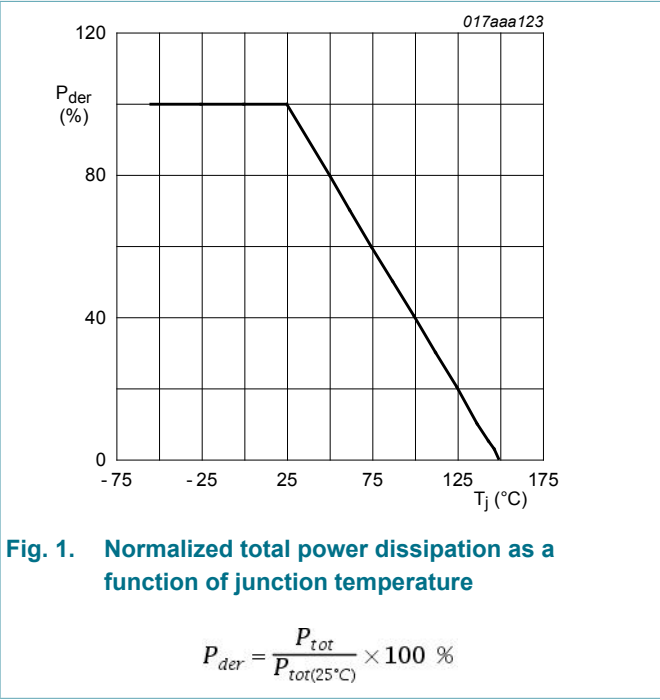
Table 5. Limiting values

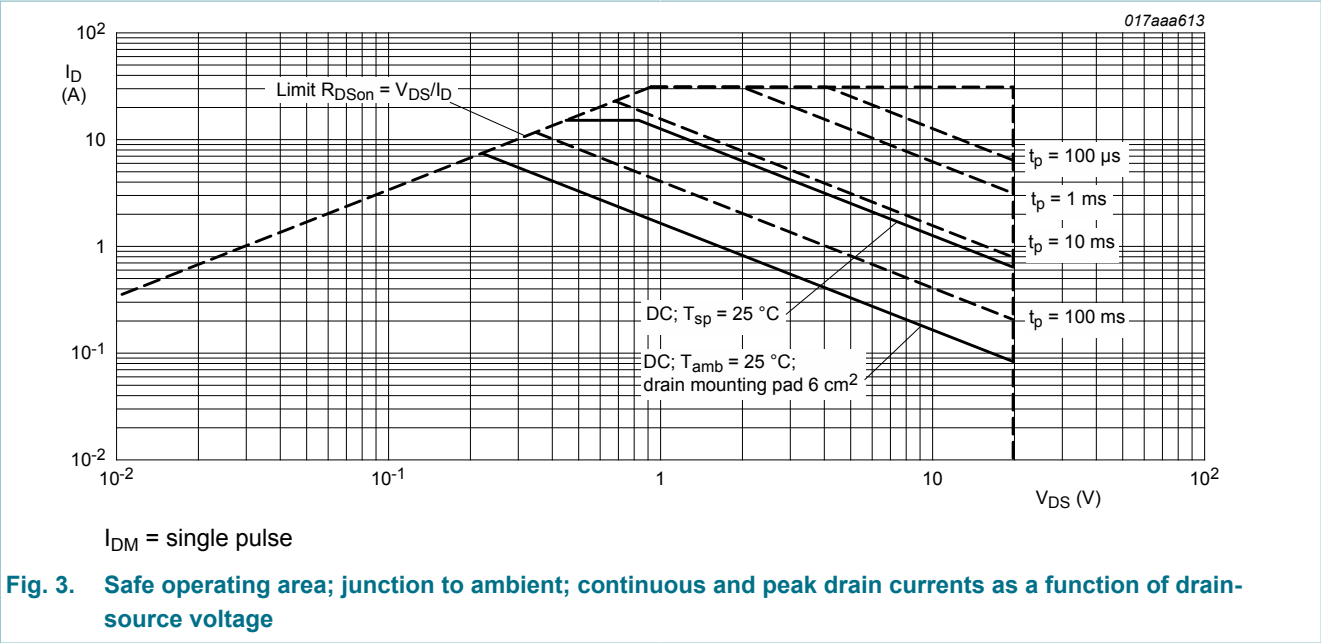
In accordance with the Absolute Maximum Rating System (IEC 60134).

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			-8	8	V
$I_D$	drain current	$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}; t \leq 5\text{ s}$	[1]	-	11.3	A
		$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	7.9	A
		$V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ }^{\circ}\text{C}$	[1]	-	5	A
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ }^{\circ}\text{C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$		-	31	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	1.7	W

Symbol	Parameter	Conditions		Min	Max	Unit
		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
Source-drain diode						
I <sub>S</sub>	source current	T <sub>amb</sub> = 25 °C	[1]	-	1.8	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>.





6. Thermal characteristics

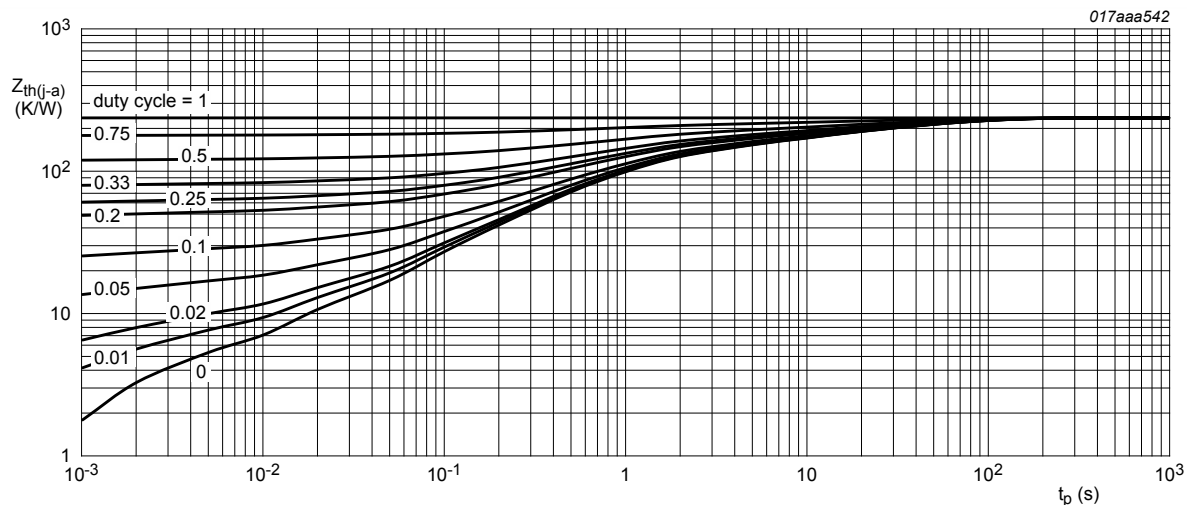
Table 6. Thermal characteristics

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
			[3]	-	33	36	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	5	10	K/W

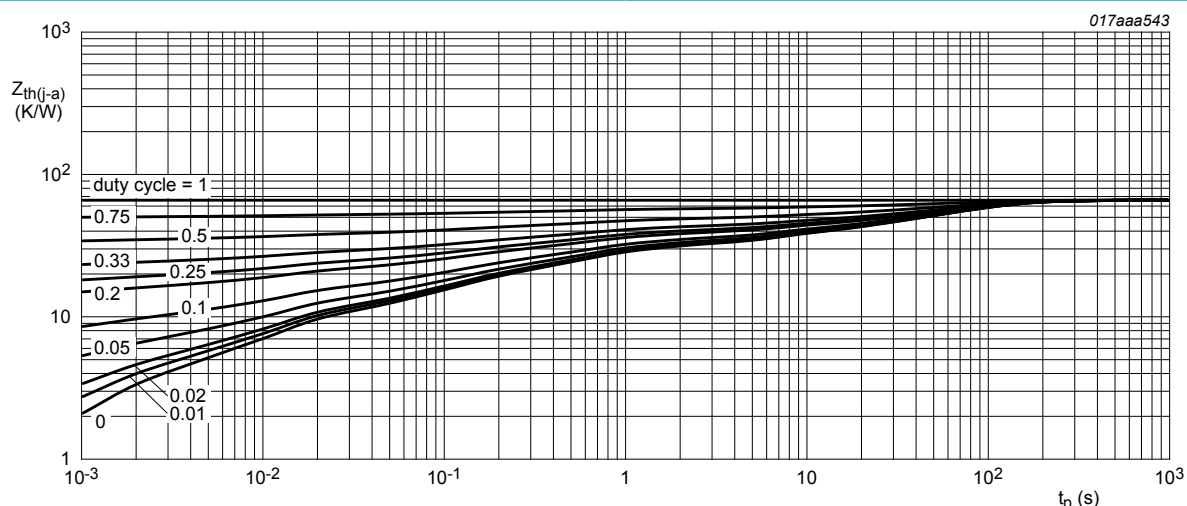
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[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  $6\text{ cm}^2$ ,  $t \leq 5\text{ s}$



**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</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	0.7	1	V
$I_{DSS}$	drain leakage current	$V_{DS} = 20 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 ^\circ C$	-	-	1	$\mu A$
		$V_{DS} = 20 V$ ; $V_{GS} = 0 V$ ; $T_j = 150 ^\circ C$	-	-	100	$\mu A$

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 8 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	100	nA
		V <sub>GS</sub> = -8 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> = 4.5 V; I <sub>D</sub> = 7.9 A; T <sub>j</sub> = 25 °C		-	14	18	mΩ
		V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 7.9 A; T <sub>j</sub> = 150 °C		-	21	27	mΩ
		V <sub>GS</sub> = 2.5 V; I <sub>D</sub> = 3.5 A; T <sub>j</sub> = 25 °C		-	17	23	mΩ
		V <sub>GS</sub> = 1.8 V; I <sub>D</sub> = 3.5 A; T <sub>j</sub> = 25 °C		-	21	33	mΩ
g <sub>fs</sub>	forward transconductance	V <sub>DS</sub> = 10 V; I <sub>D</sub> = 7.9 A; T <sub>j</sub> = 25 °C		-	25	-	S
R <sub>G</sub>	gate resistance	f = 1 MHz		-	1.4	-	Ω
Dynamic characteristics							
Q <sub>G(tot)</sub>	total gate charge	V <sub>DS</sub> = 10 V; I <sub>D</sub> = 6 A; V <sub>GS</sub> = 4.5 V; T <sub>j</sub> = 25 °C		-	8.8	13	nC
Q <sub>GS</sub>	gate-source charge			-	1	-	nC
Q <sub>GD</sub>	gate-drain charge			-	2.2	-	nC
C <sub>iss</sub>	input capacitance	V <sub>DS</sub> = 10 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	886	-	pF
C <sub>oss</sub>	output capacitance			-	233	-	pF
C <sub>rss</sub>	reverse transfer capacitance			-	129	-	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 10 V; I <sub>D</sub> = 6 A; V <sub>GS</sub> = 4.5 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C		-	9	-	ns
t <sub>r</sub>	rise time			-	20	-	ns
t <sub>d(off)</sub>	turn-off delay time			-	26	-	ns
t <sub>f</sub>	fall time			-	26	-	ns
Source-drain diode							
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 1.8 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	0.6	1.2	V

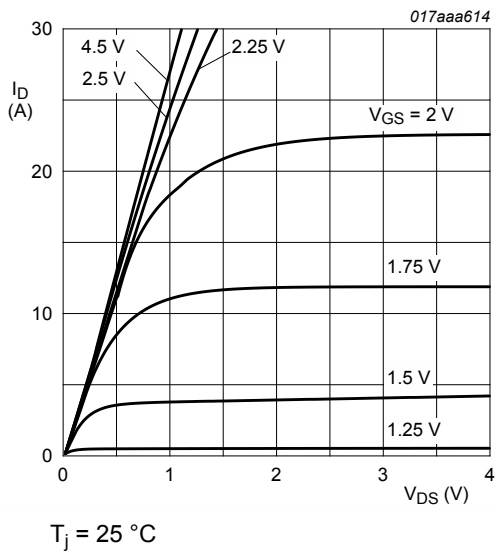


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

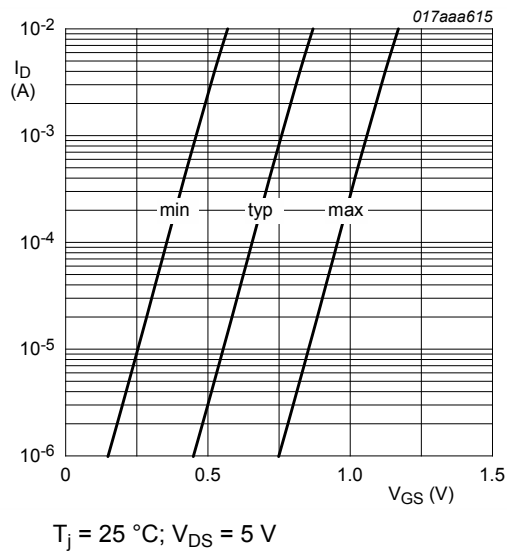


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

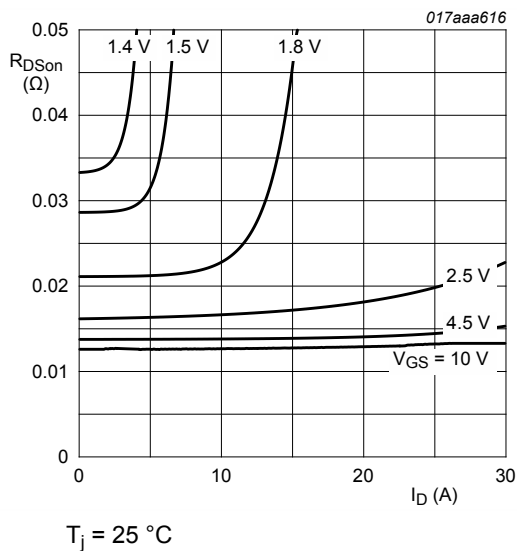


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

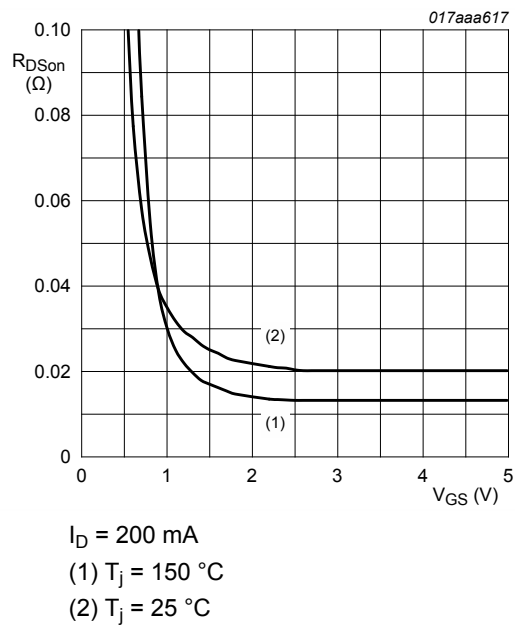


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



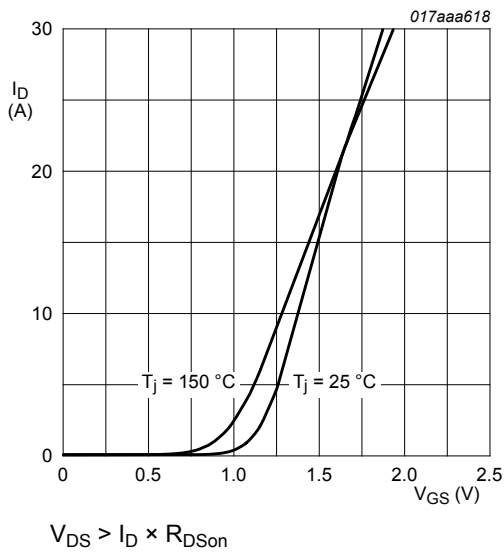


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

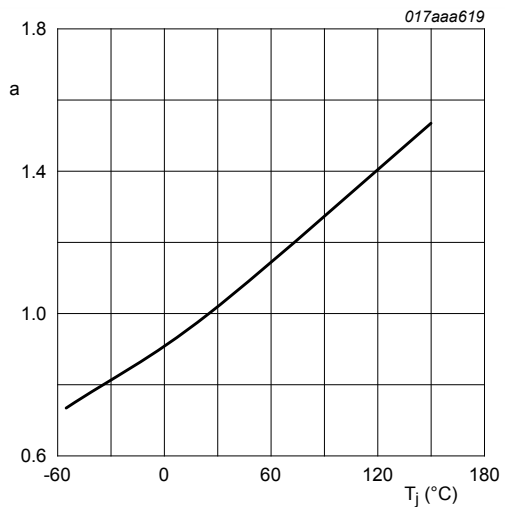


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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

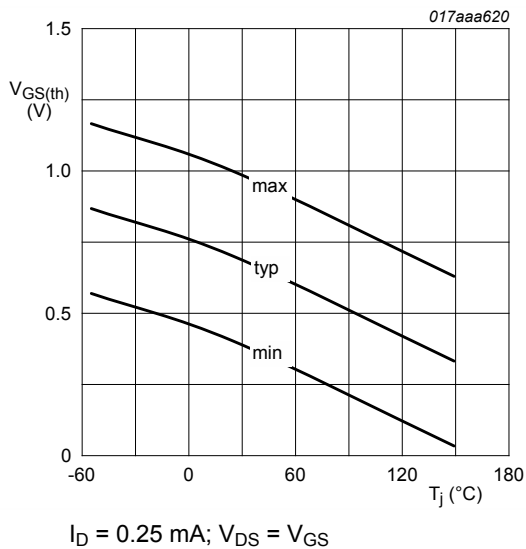


Fig. 12. Gate-source threshold voltage as a function of junction temperature

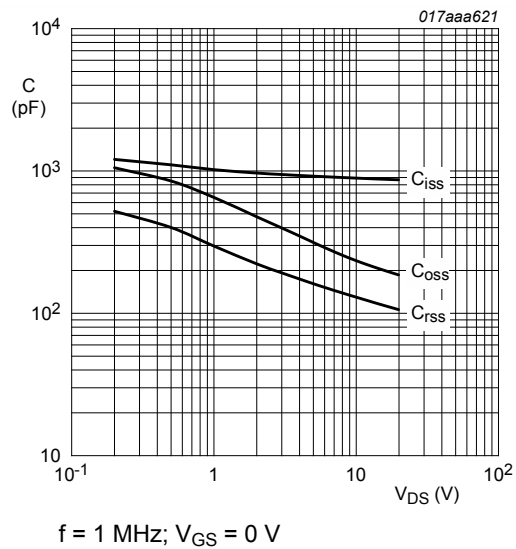


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

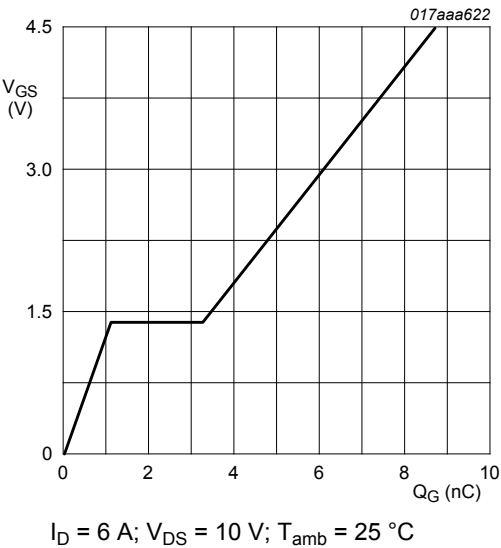


Fig. 14. Gate-source voltage as a function of gate charge; typical values

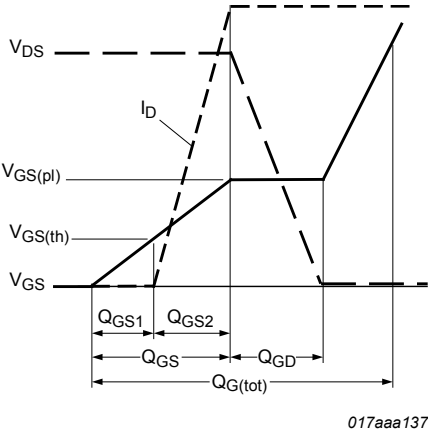


Fig. 15. Gate charge waveform definitions

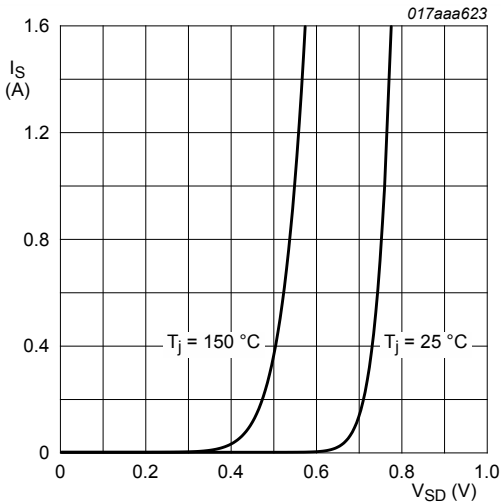


Fig. 16. Source current as a function of source-drain voltage; typical values

8. Test information

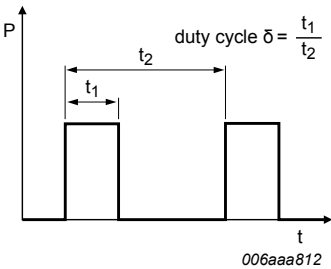


Fig. 17. Duty cycle definition

9. Package outline

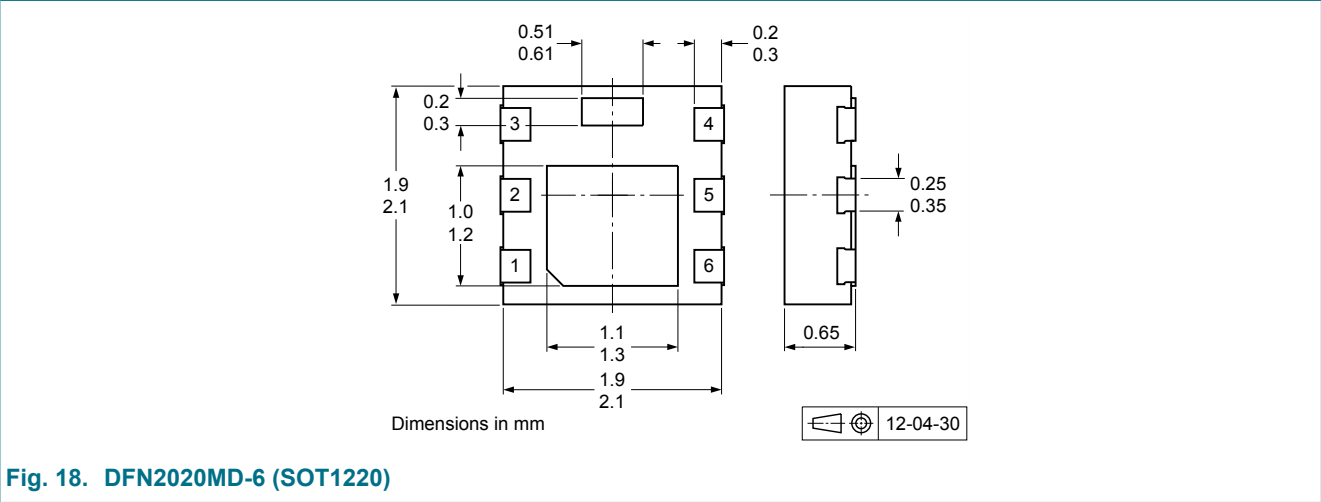


Fig. 18. DFN2020MD-6 (SOT1220)

10. Soldering

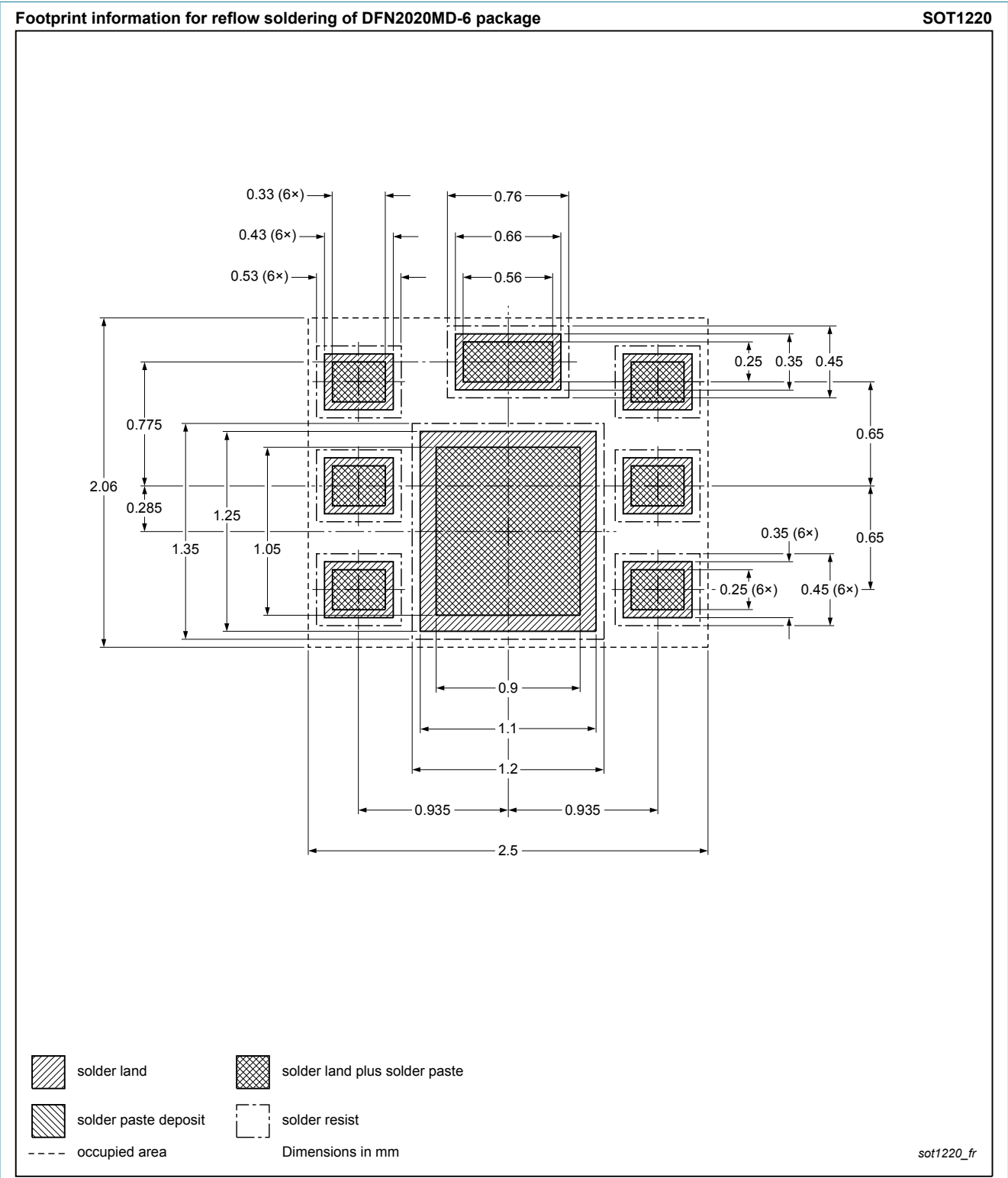


Fig. 19. Reflow soldering footprint for SOT1220 (DFN2020MD-6)

## 11. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMPB12UN v.1	20120706	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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- [2] The term 'short data sheet' is explained in section "Definitions".
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Date of release: 6 July 2012