

PMPB20EN

30 V, N-channel Trench MOSFET

12 July 2018 **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

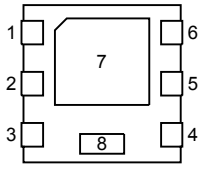
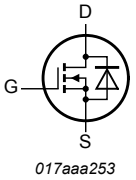
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	30	V
V_{GS}	gate-source voltage			-20	-	20	V
I_D	drain current	V_{GS} = 10 V; T_{amb} = 25 °C; t ≤ 5 s	[1]	-	-	10.4	A
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 7 A; T_j = 25 °C		-	16.5	19.5	mΩ

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

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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 Transparent top view **DFN2020MD-6 (SOT1220)**	 *017aaa253*
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

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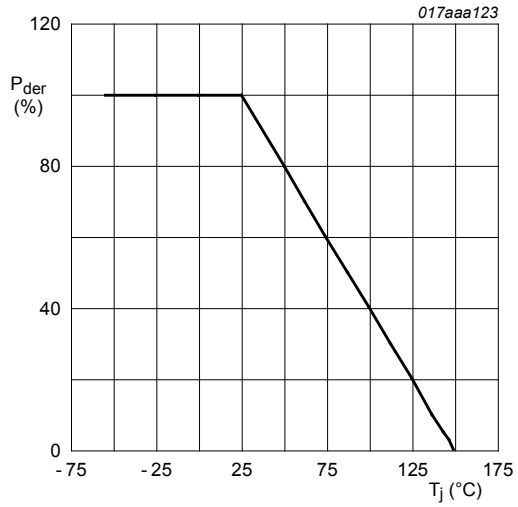
8. Limiting values

Table 5. Limiting values

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

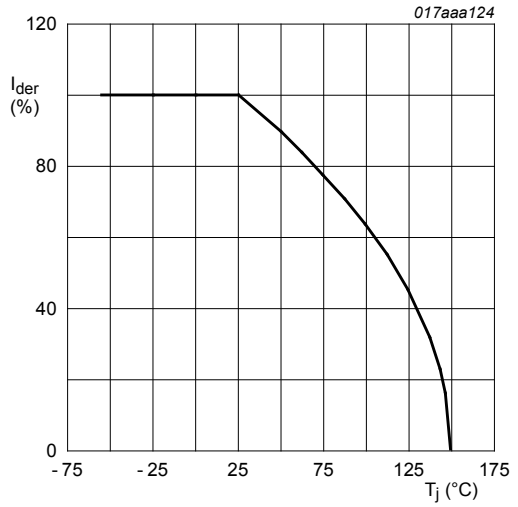
Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	30	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	V_{GS} = 10 V; T_{amb} = 25 °C; t ≤ 5 s	[1]	-	10.4	A
		V_{GS} = 10 V; T_{amb} = 25 °C	[1]	-	7.2	A
		V_{GS} = 10 V; T_{amb} = 100 °C	[1]	-	4.6	A
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; t_p ≤ 10 µs		-	30	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[1]	-	1.7	W
		T_{amb} = 25 °C; t ≤ 5 s	[1]	-	3.5	W
		T_{sp} = 25 °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						
I_S	source current	T_{amb} = 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^2.



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

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

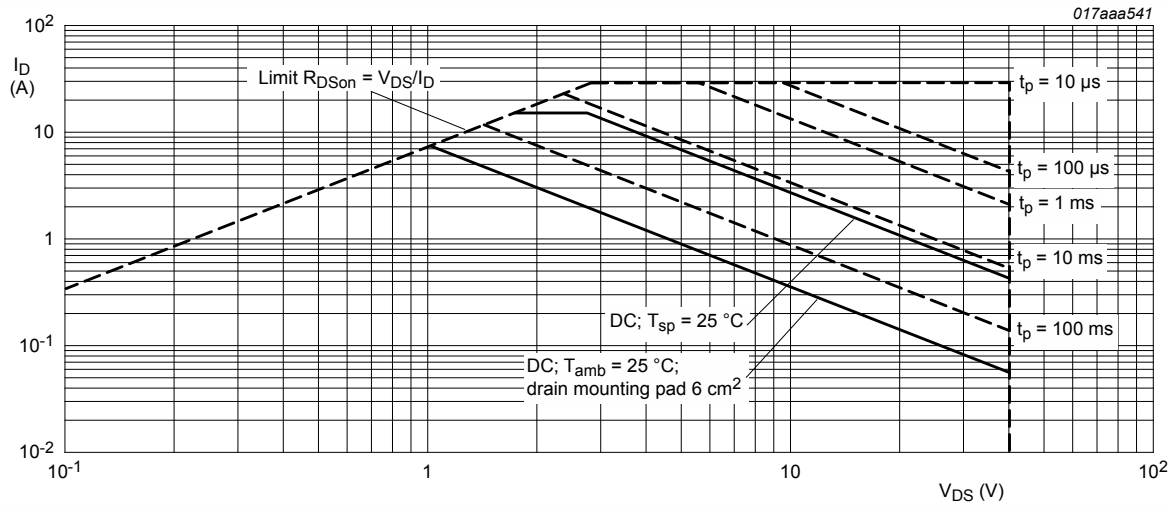


$$I_{der} = \frac{I_D}{I_{D(25°C)}} \times 100\ \%$$

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

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I_{DM} = single pulse

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

9. Thermal characteristics

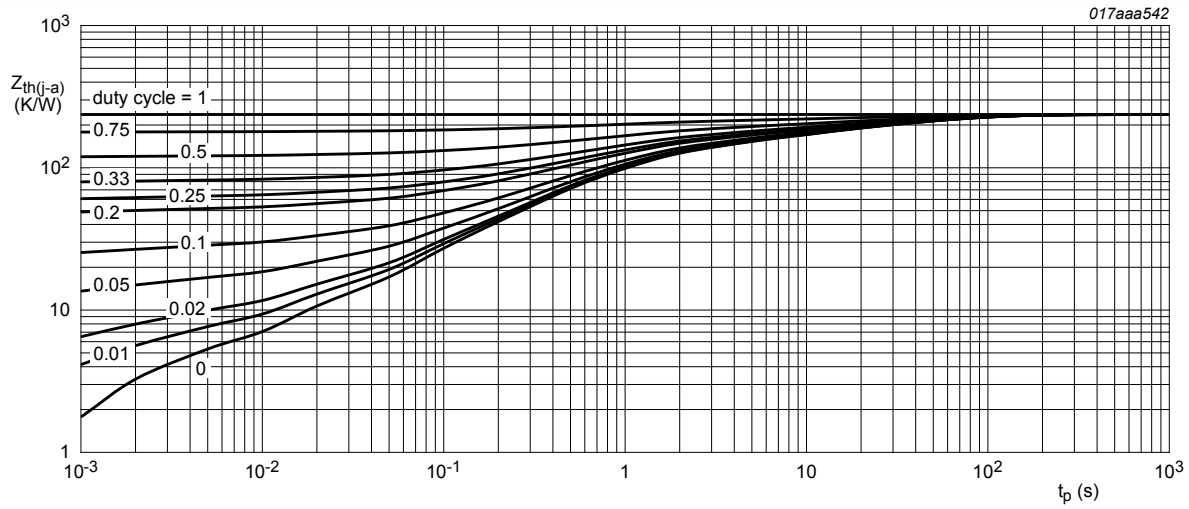
Table 6. Thermal characteristics

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 cm^2.
[3] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm^2, t ≤ 5 s.

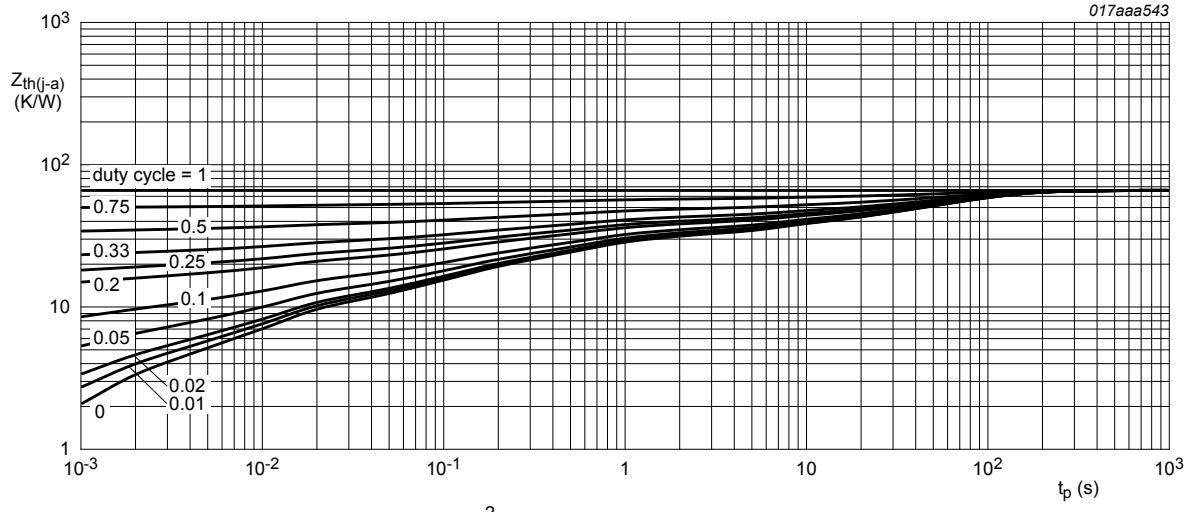
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FR4 PCB, standard footprint

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^2

Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

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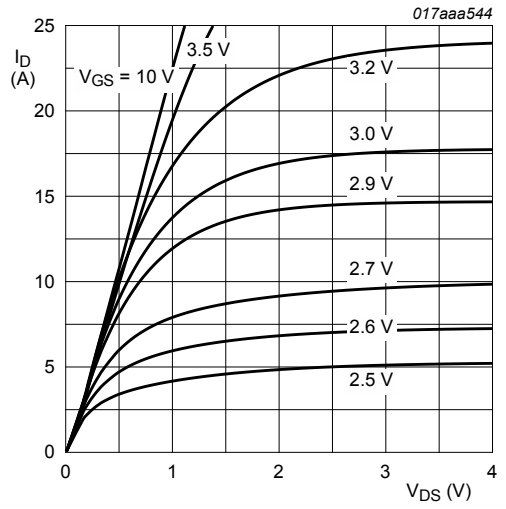
10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		30	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = 250 µA; V_{DS} = V_{GS}; T_j = 25 °C		1	1.5	2	V
I_{DSS}	drain leakage current	V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 °C		-	-	1	µA
		V_{DS} = 30 V; V_{GS} = 0 V; T_j = 150 °C		-	-	20	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	100	nA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	-100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 7 A; T_j = 25 °C		-	16.5	19.5	mΩ
		V_{GS} = 10 V; I_D = 7 A; T_j = 150 °C		-	27	32	mΩ
		V_{GS} = 4.5 V; I_D = 7 A; T_j = 25 °C		-	20.5	24.5	mΩ
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 7 A; T_j = 25 °C		-	40	-	S
R_G	gate resistance	f = 1 MHz		-	1.7	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	V_{DS} = 15 V; I_D = 5 A; V_{GS} = 10 V; T_j = 25 °C		-	7.2	10.8	nC
Q_{GS}	gate-source charge			-	1	-	nC
Q_{GD}	gate-drain charge			-	0.67	-	nC
C_{iss}	input capacitance	V_{DS} = 15 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C		-	435	-	pF
C_{oss}	output capacitance			-	90	-	pF
C_{rss}	reverse transfer capacitance			-	35	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 15 V; I_D = 5 A; V_{GS} = 4.5 V; $R_{G(ext)}$ = 1.7 Ω; T_j = 25 °C		-	9	-	ns
t_r	rise time			-	17	-	ns
$t_{d(off)}$	turn-off delay time			-	9	-	ns
t_f	fall time			-	8	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 2.2 A; V_{GS} = 0 V; T_j = 25 °C		-	0.8	1.2	V

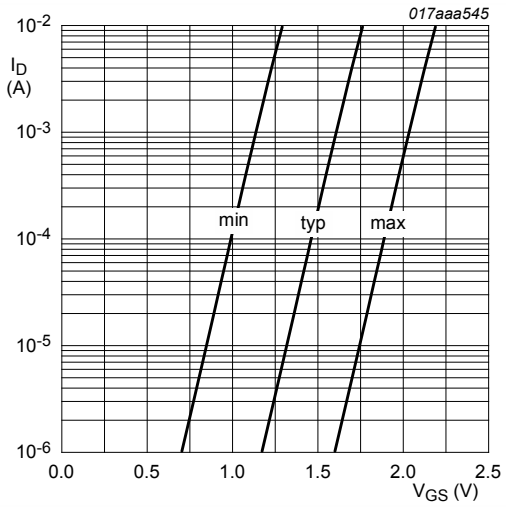
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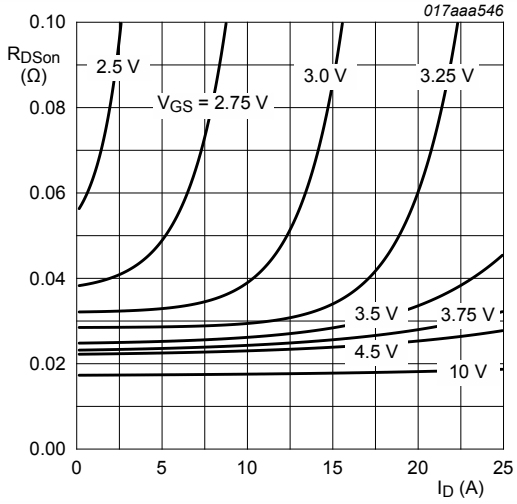
T_j = 25 °C

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



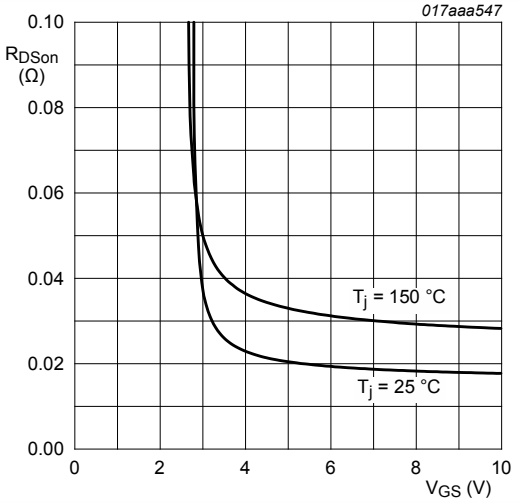
T_j = 25 °C; V_{DS} = 5 V

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



T_j = 25 °C

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

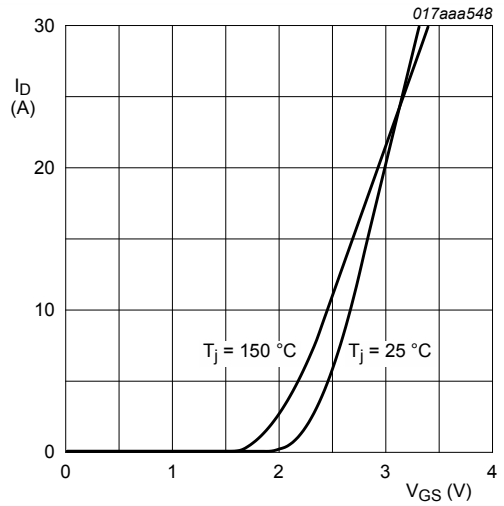


I_D = 8 A

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

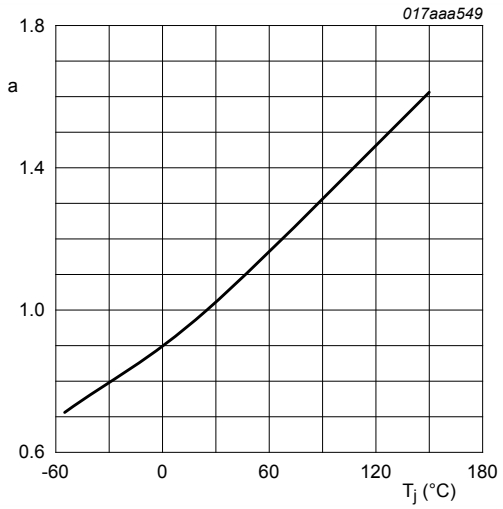
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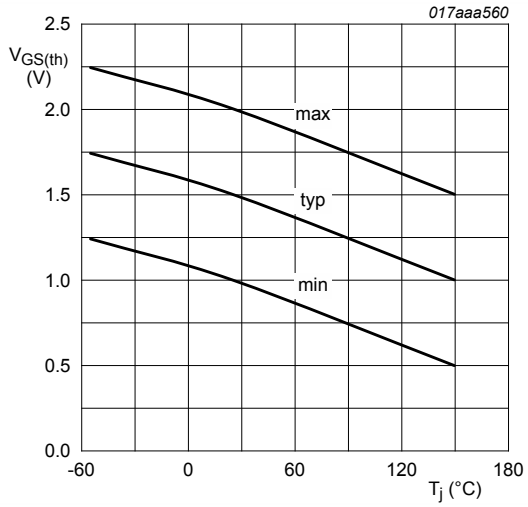
$V_{DS} > I_D \times R_{DSon}$

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



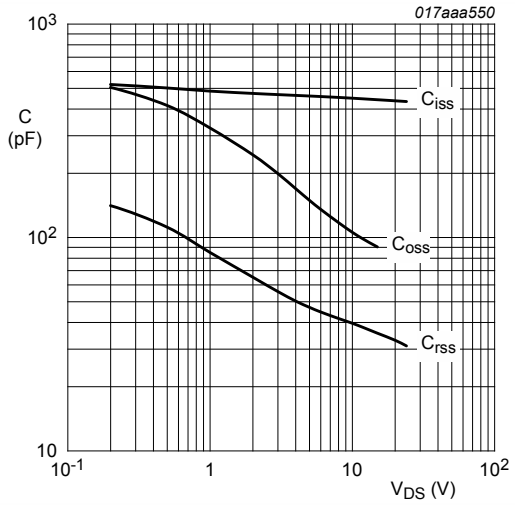
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



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

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

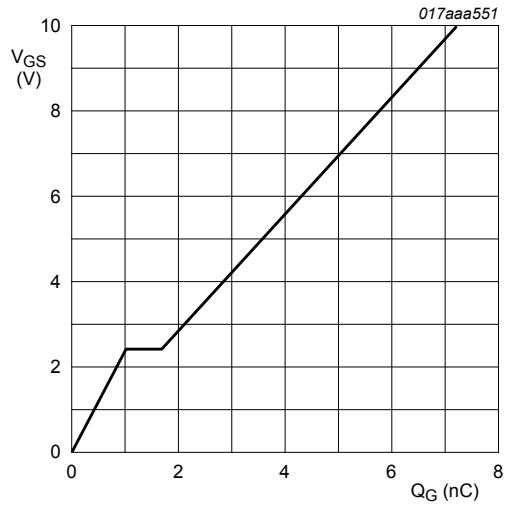


f = 1 MHz; V_{GS} = 0 V

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

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I_D = 5 A; V_{DS} = 15 V; T_{amb} = 25 °C

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

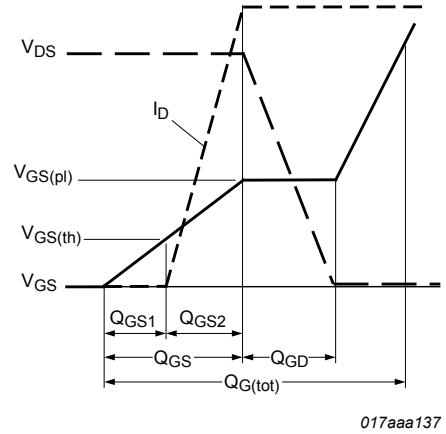
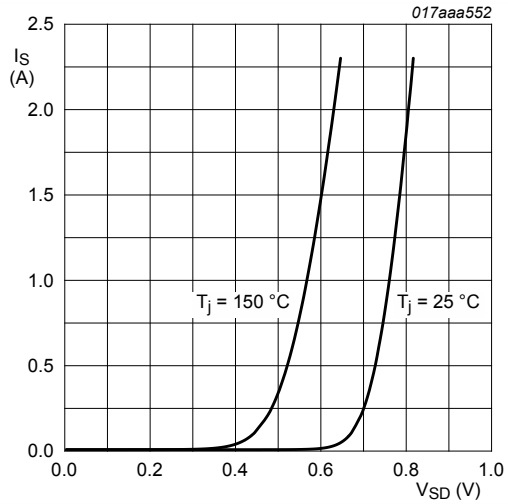


Fig. 15. Gate charge waveform definitions



V_{GS} = 0 V

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

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11. Test information

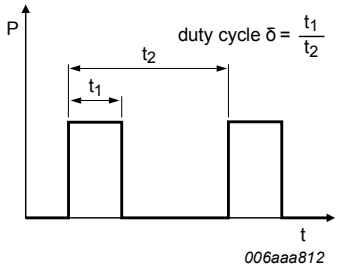


Fig. 17. Duty cycle definition

12. Package outline

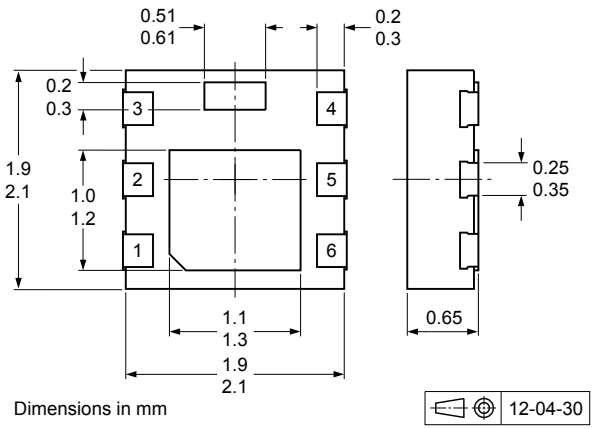


Fig. 18. Package outline DFN2020MD-6 (SOT1220)

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13. Soldering

Footprint information for reflow soldering of DFN2020MD-6 package **SOT1220**

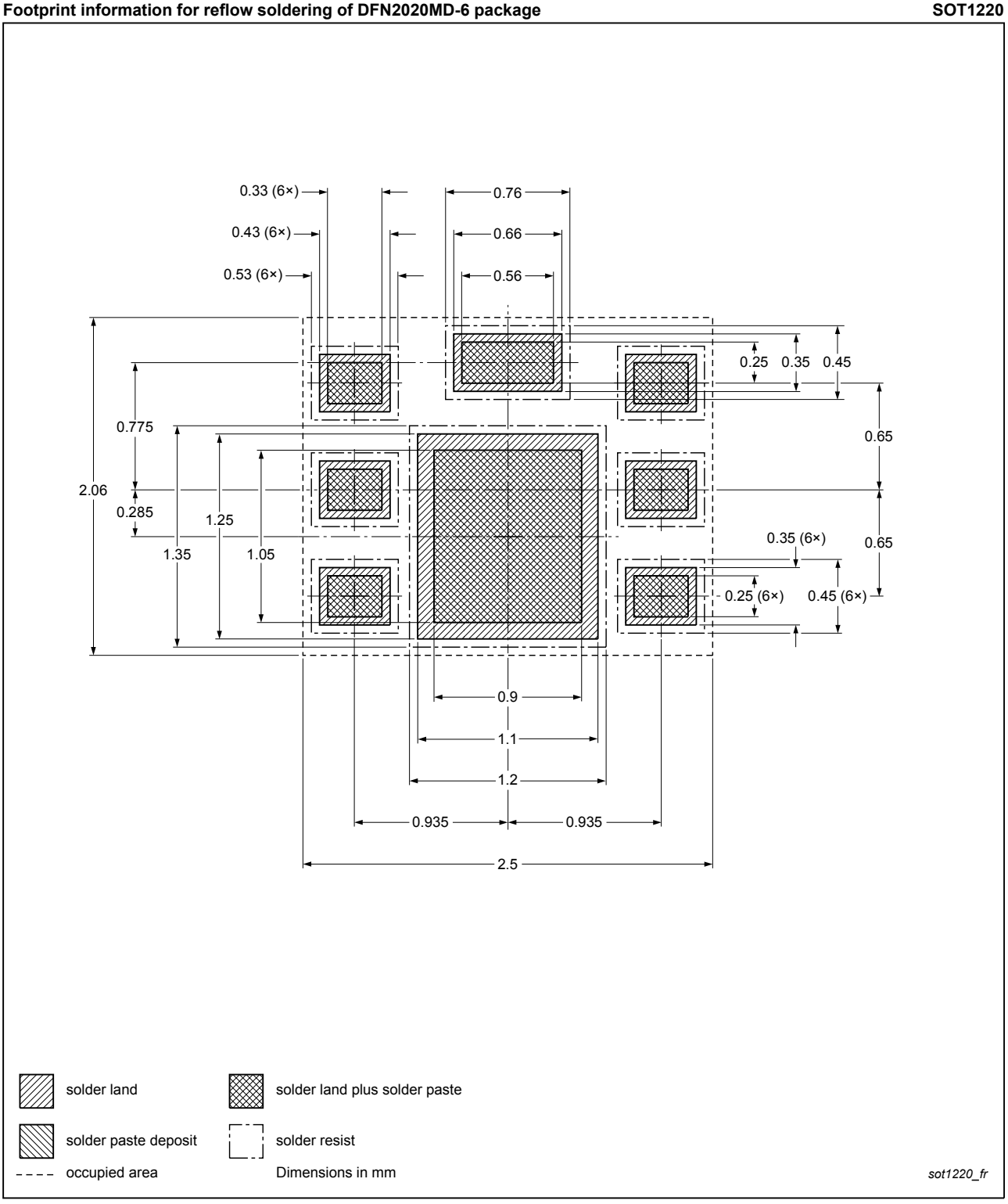


Fig. 19. Reflow soldering footprint for DFN2020MD-6 (SOT1220)

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14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMPB20EN v.3	20180712	Product data sheet	-	PMPB20EN v.2
Modification:	• Adaption of maximum value of I_{GSS} to minus • Adaption of the typical value of g_{fs} according to new wafer fab			
PMPB20EN v.2	20140114	Product data sheet	-	PMPB20EN v.1
PMPB20EN v.1	20120516	Product data sheet	-	-

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15. Legal information

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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