

PMPB20EN

30 V N-channel Trench MOSFET

Rev. 1 — 16 May 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

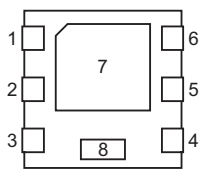
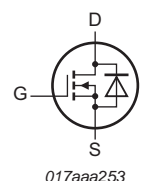
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$	-	-	30	V
V_{GS}	gate-source voltage		-20	-	20	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$	[1]	-	10.4	A
Static characteristics						
R_{DSon}	drain-source on-state resistance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

[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

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 <p>Transparent top view</p> <p>SOT1220 (DFN2020MD-6)</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
PMPB20EN	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
PMPB20EN	1B

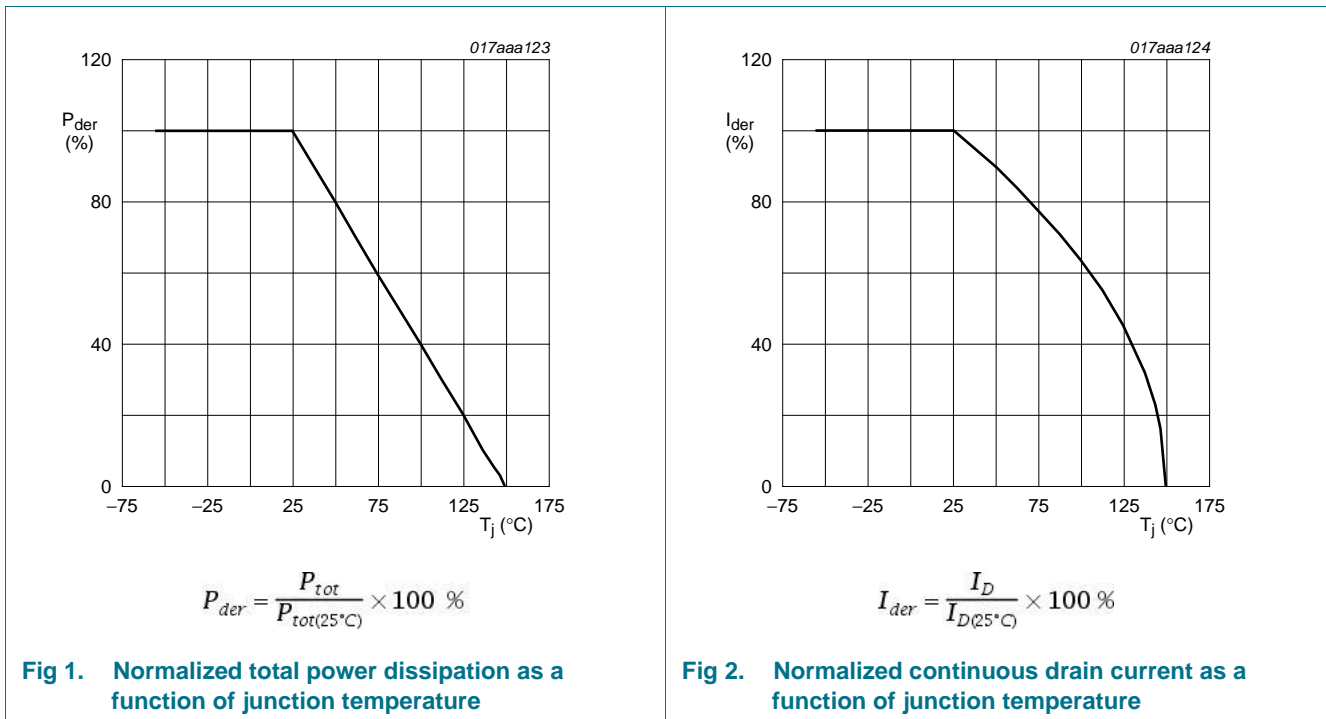
5. Limiting values

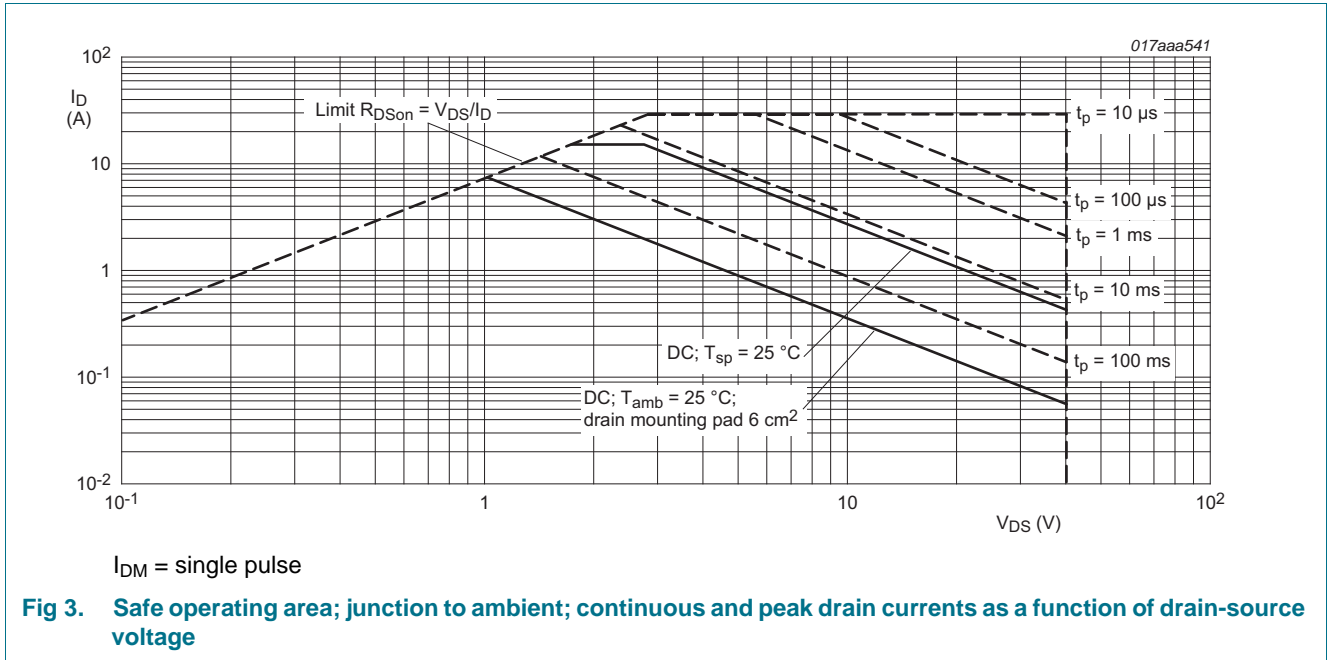
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit	
V _{DS}	drain-source voltage	T _j = 25 °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 cm².



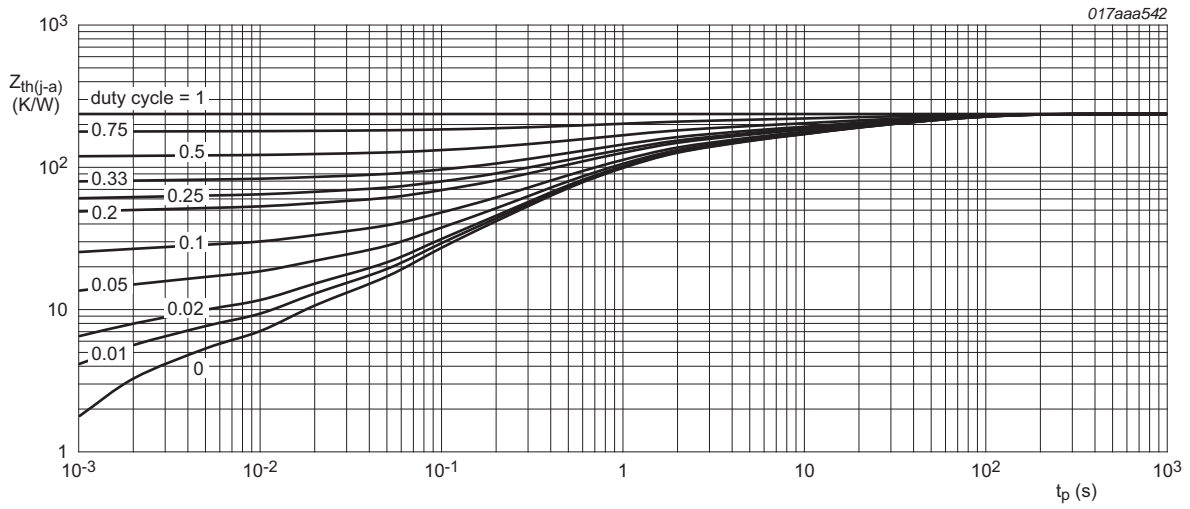


6. Thermal characteristics

Table 6. Thermal characteristics

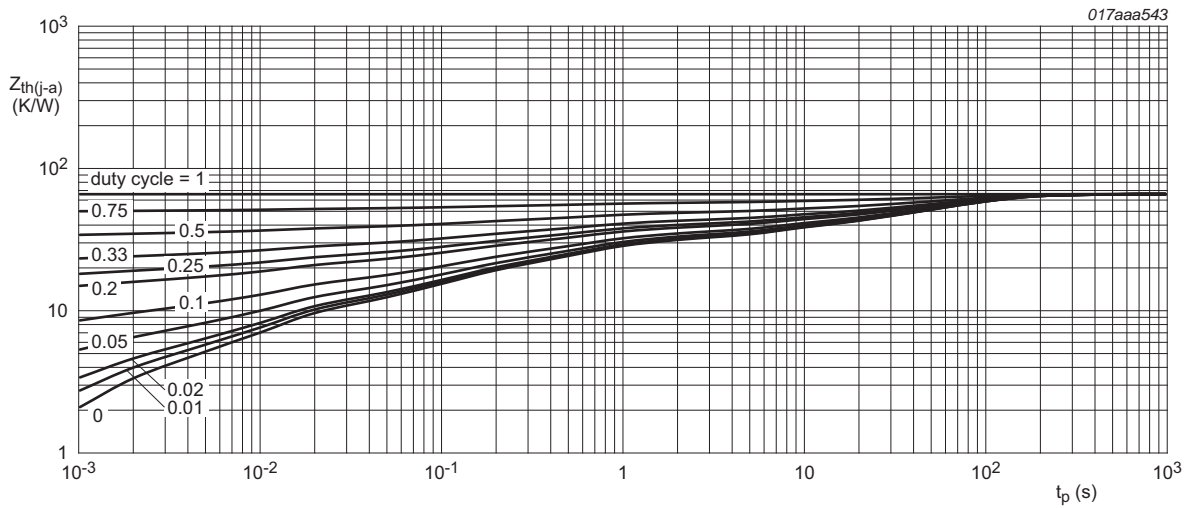
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	235	270	K/W
			[2]	-	67	74	K/W
			[3]	-	33	36	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	5	10	K/W	

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



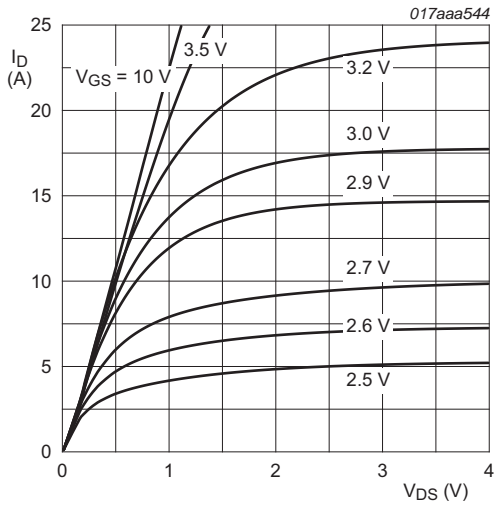
FR4 PCB, mounting pad for drain 6 cm²

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

7. Characteristics

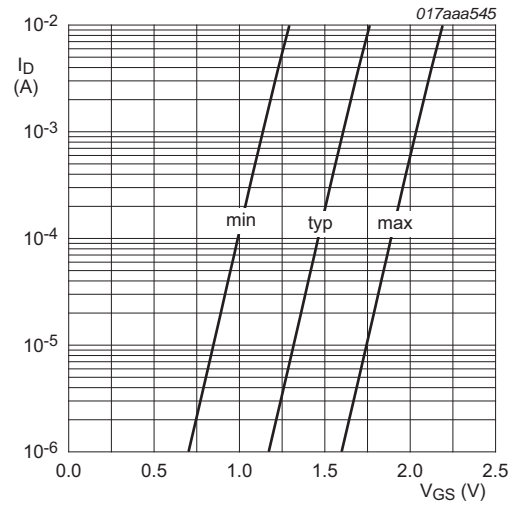
Table 7. Characteristics

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



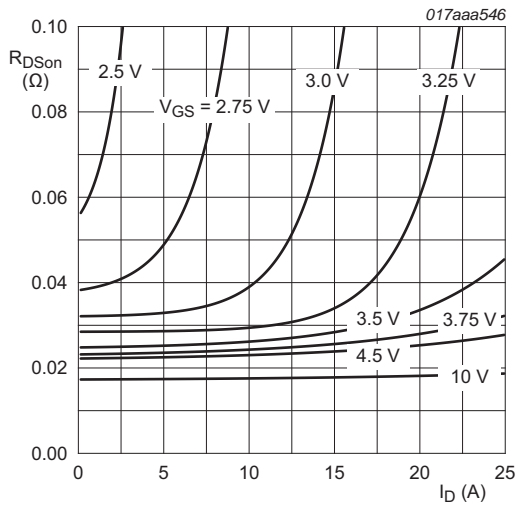
$T_j = 25\text{ }^\circ\text{C}$

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



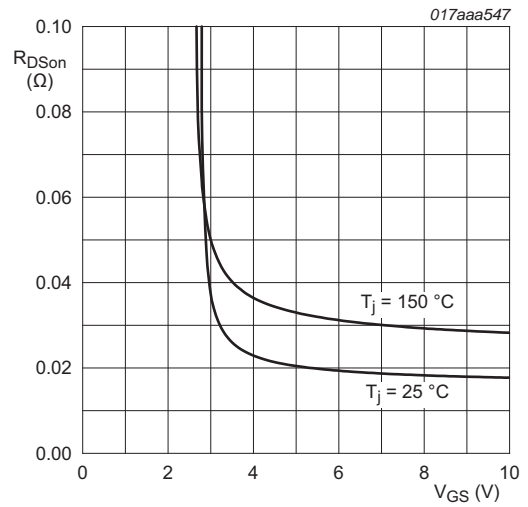
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 5\text{ V}$

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



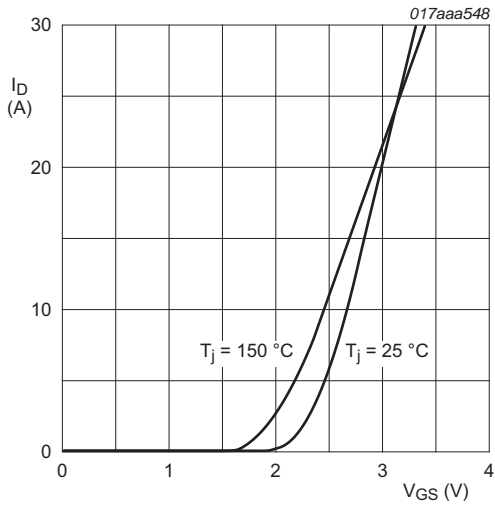
$T_j = 25\text{ }^\circ\text{C}$

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



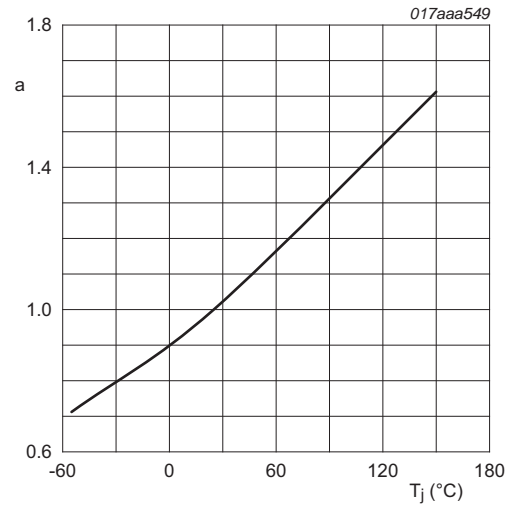
$I_D = 8\text{ A}$

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



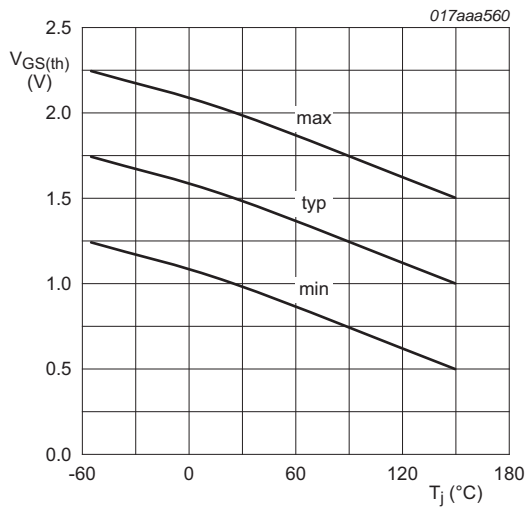
$$V_{DS} > I_D \times R_{DS(on)}$$

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



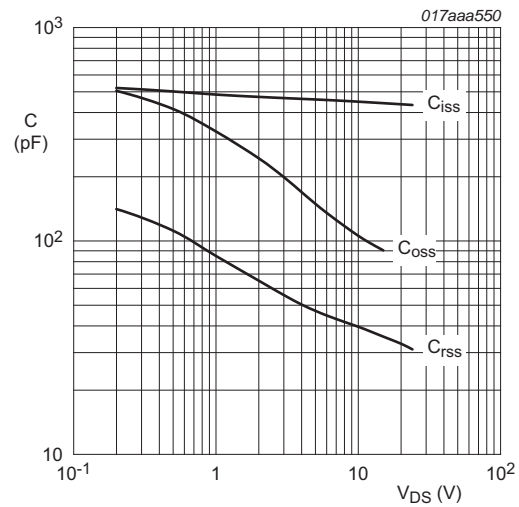
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ C)}}$$

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



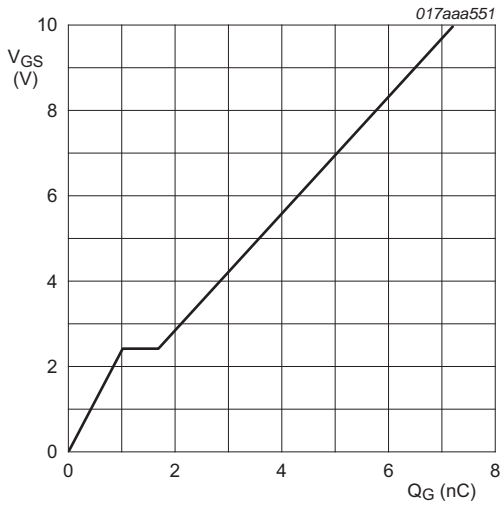
$$I_D = 0.25 \text{ mA}; V_{DS} = V_{GS}$$

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



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

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



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

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

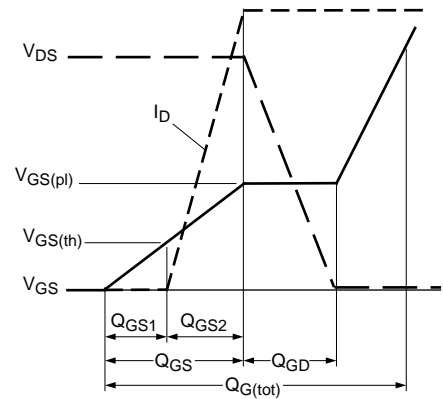
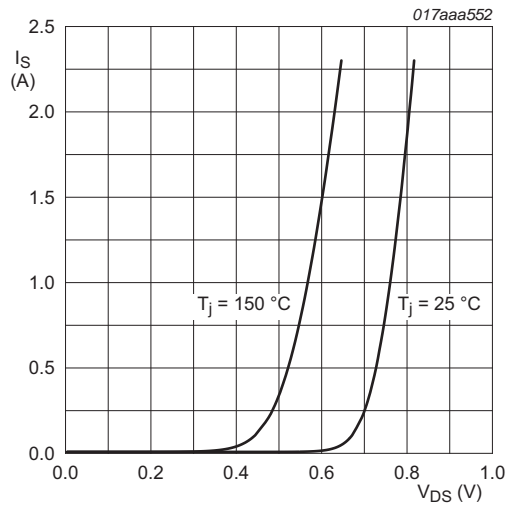


Fig 15. Gate charge waveform definitions



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

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

8. Test information



Fig 17. Duty cycle definition

9. Package outline

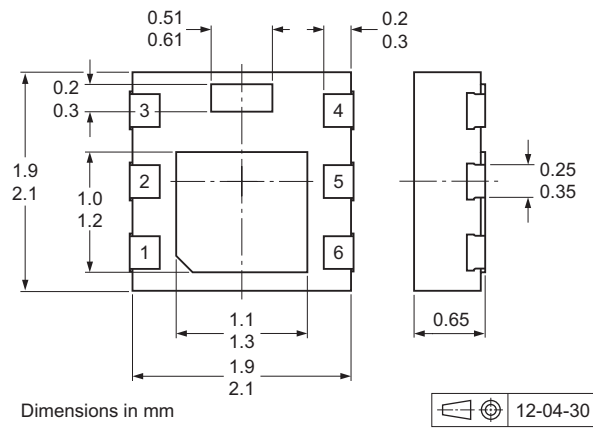


Fig 18. Package outline SOT1220 (DFN2020MD-6)

10. Soldering

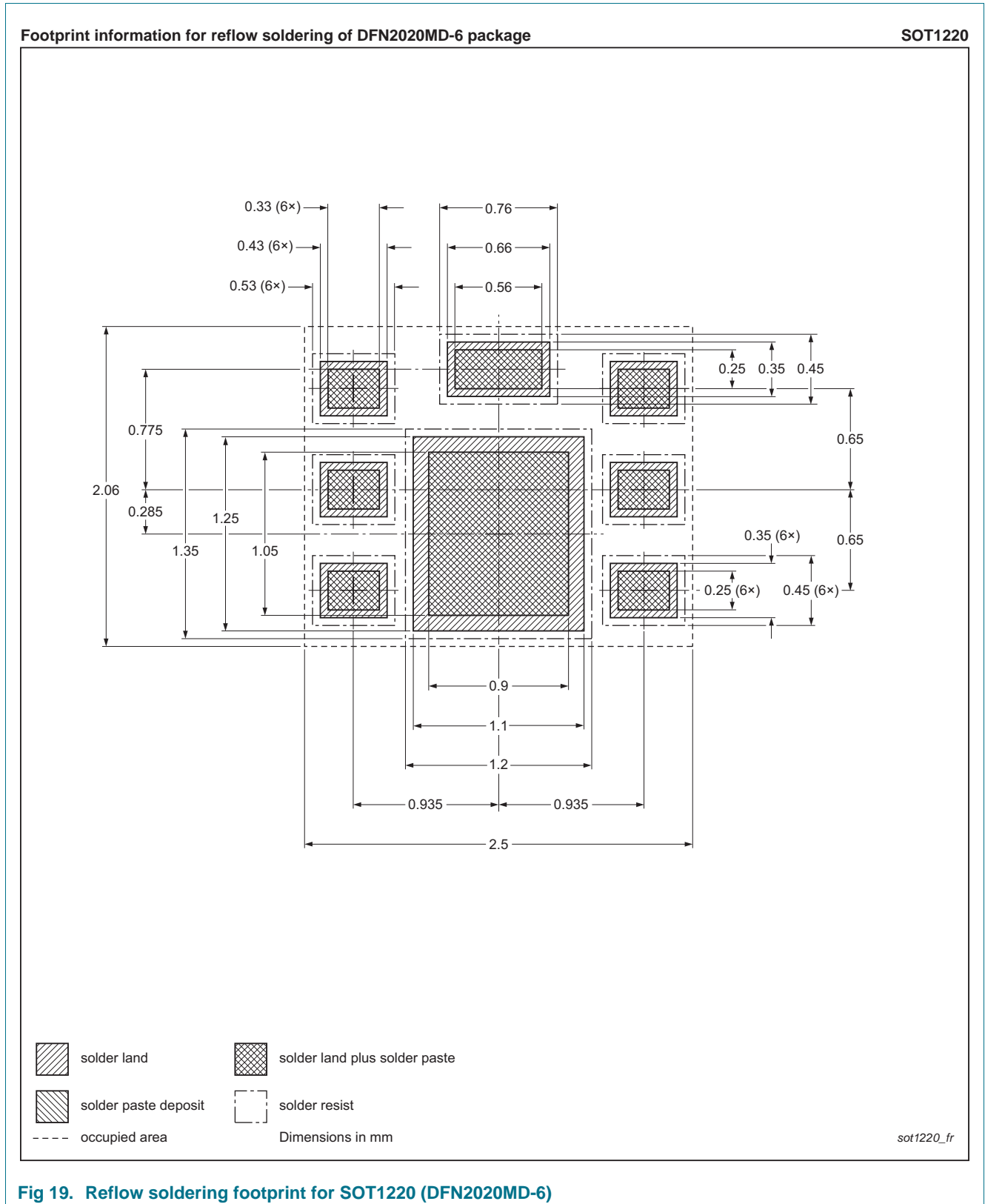


Fig 19. Reflow soldering footprint for SOT1220 (DFN2020MD-6)

11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMPB20EN v.1	20120516	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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