

# PMPB11EN

## 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	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$	<a href="#">[1]</a>	-	13	A

#### Static characteristics

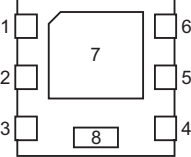
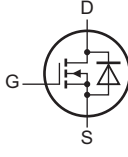
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 9\text{ A}; T_j = 25\text{ °C}$	-	12	14.5	m $\Omega$
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[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.



## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 <p>Transparent top view</p> <p><b>SOT1220 (DFN2020MD-6)</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
PMPB11EN	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
PMPB11EN	1C

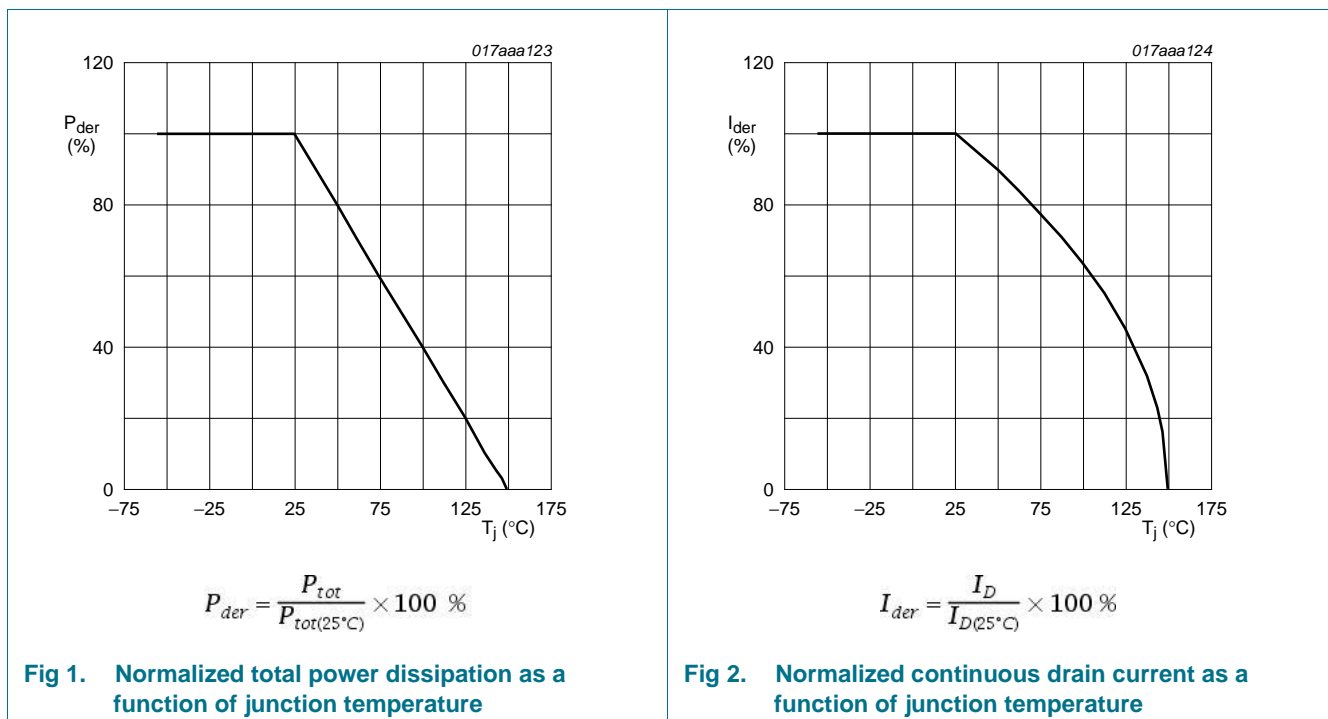
## 5. Limiting values

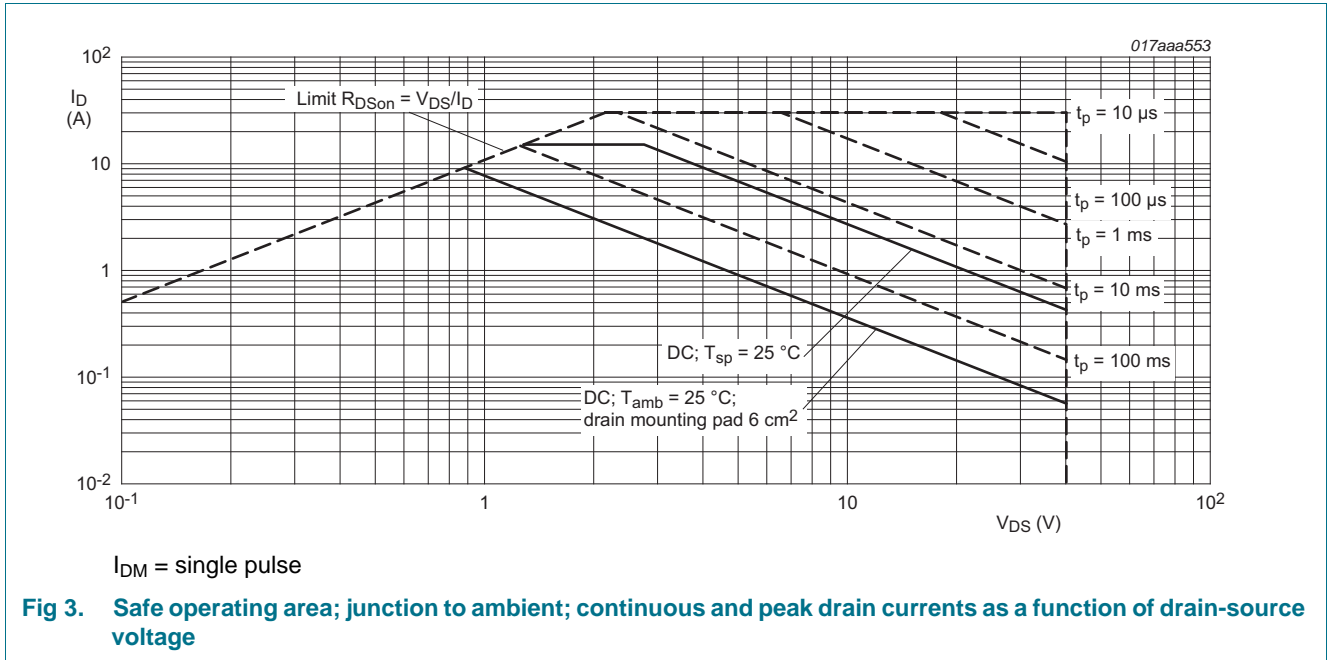
**Table 5. Limiting values**

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]	-	13	A
		V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 25 °C	[1]	-	9	A
		V <sub>GS</sub> = 10 V; T <sub>amb</sub> = 100 °C	[1]	-	5.7	A
I <sub>DM</sub>	peak drain current	T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs	-	34	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>.



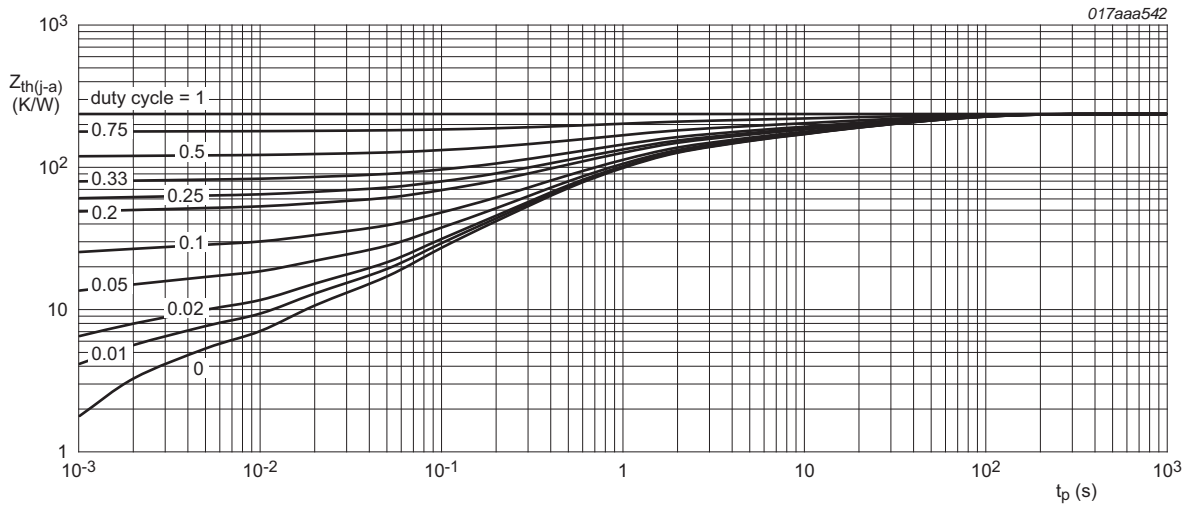


## 6. Thermal characteristics

Table 6. Thermal characteristics

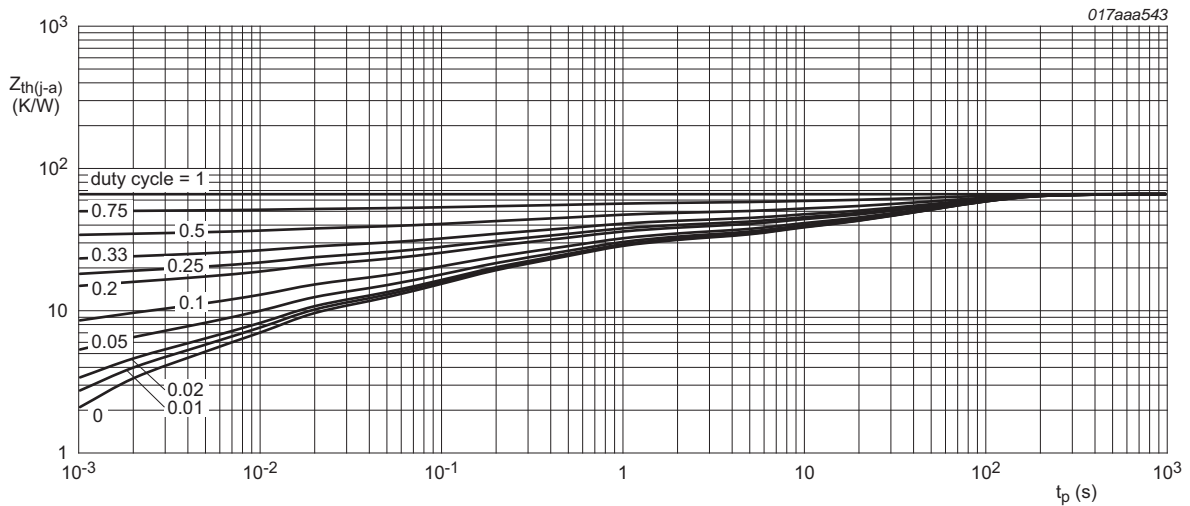
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	235	270	K/W
			[2]	-	67	74	K/W
			[3]	-	33	36	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	5	10	K/W	

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



FR4 PCB, standard footprint

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



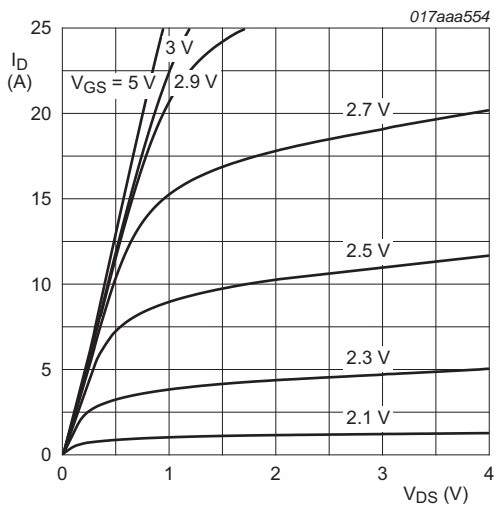
FR4 PCB, mounting pad for drain 6 cm<sup>2</sup>

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

## 7. Characteristics

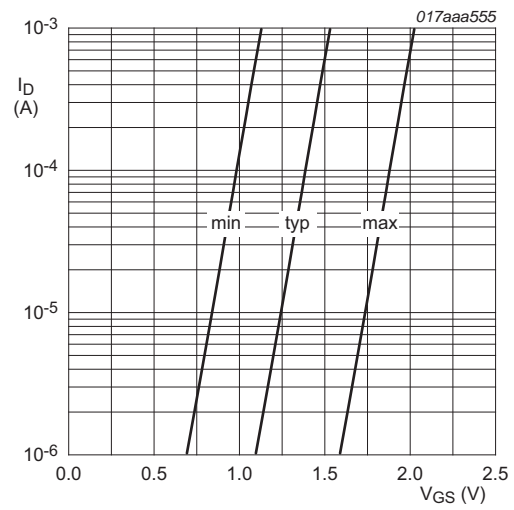
Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	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	$\mu\text{A}$
		$V_{DS} = 30 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 150 \text{ }^\circ\text{C}$	-	-	20	$\mu\text{A}$
$I_{GSS}$	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	$V_{GS} = 10 \text{ V}$ ; $I_D = 9 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	12	14.5	m $\Omega$
		$V_{GS} = 10 \text{ V}$ ; $I_D = 9 \text{ A}$ ; $T_j = 150 \text{ }^\circ\text{C}$	-	18	20.5	m $\Omega$
		$V_{GS} = 4.5 \text{ V}$ ; $I_D = 3.7 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	14	16.5	m $\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = 10 \text{ V}$ ; $I_D = 9 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	20	-	S
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	1.6	-	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 15 \text{ V}$ ; $I_D = 6 \text{ A}$ ; $V_{GS} = 10 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	13.7	20.6	nC
$Q_{GS}$	gate-source charge		-	1.73	-	nC
$Q_{GD}$	gate-drain charge		-	1.71	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 10 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	840	-	pF
$C_{oss}$	output capacitance		-	155	-	pF
$C_{rss}$	reverse transfer capacitance		-	65	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15 \text{ V}$ ; $I_D = 5 \text{ A}$ ; $V_{GS} = 4.5 \text{ V}$ ; $R_{G(ext)} = 6 \text{ } \Omega$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	9	-	ns
$t_r$	rise time		-	10	-	ns
$t_{d(off)}$	turn-off delay time		-	17	-	ns
$t_f$	fall time		-	9	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	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



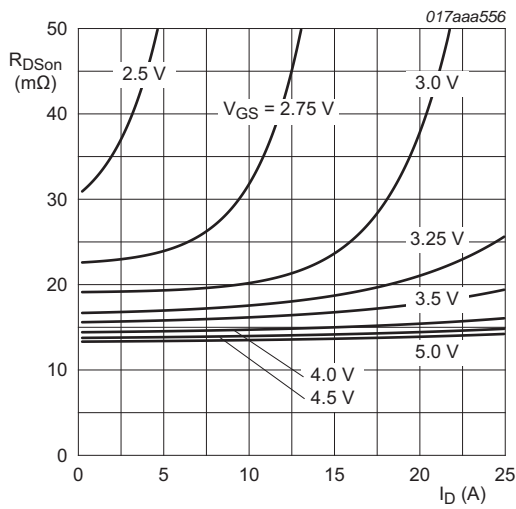
$T_j = 25^\circ\text{C}$

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



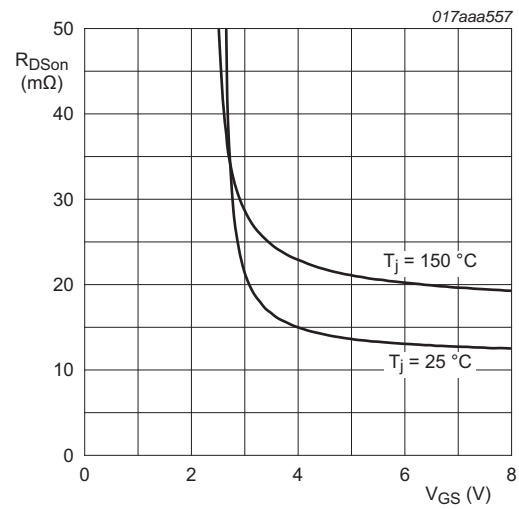
$T_j = 25^\circ\text{C}$ ;  $V_{DS} = 5\text{ V}$

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



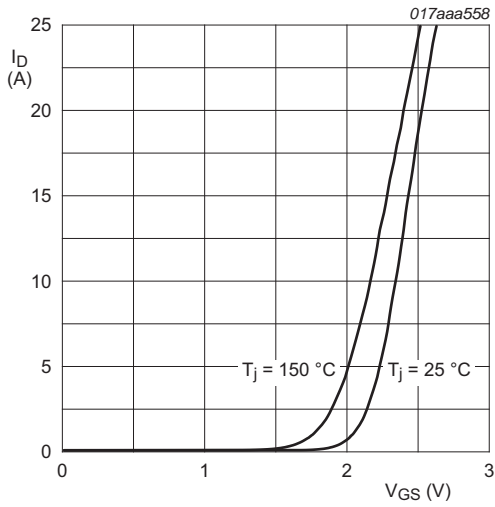
$T_j = 25^\circ\text{C}$

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



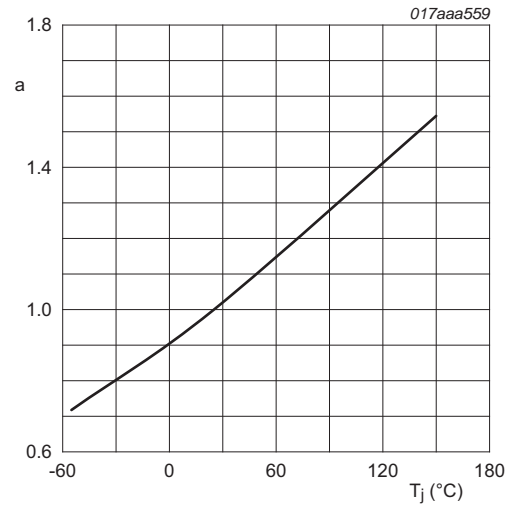
$I_D = 8\text{ A}$

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



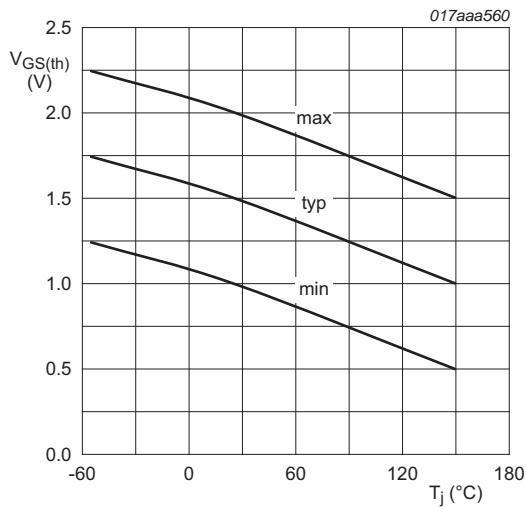
$$V_{DS} > I_D \times R_{DS(on)}$$

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



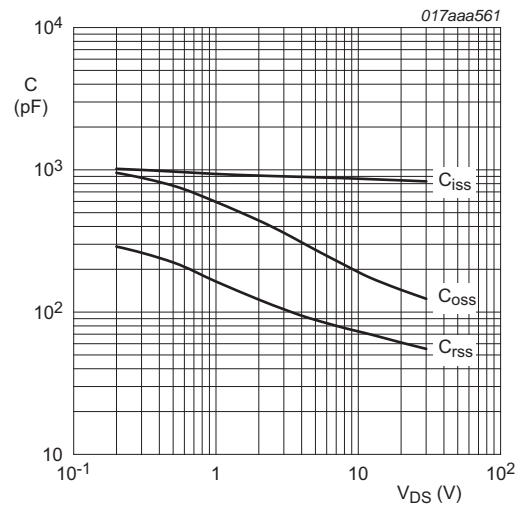
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ C)}}$$

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



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

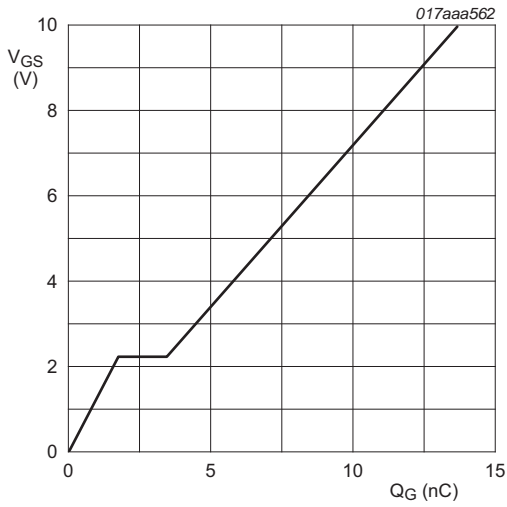
Fig 12. Gate-source threshold voltage as a function of junction temperature



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

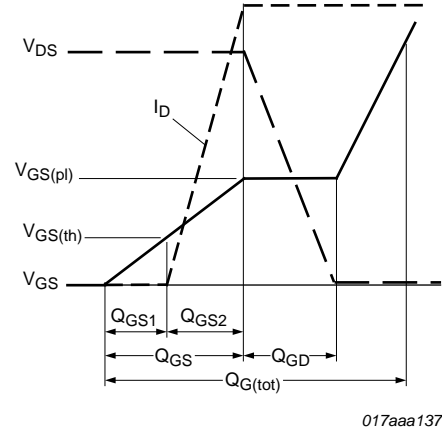
Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



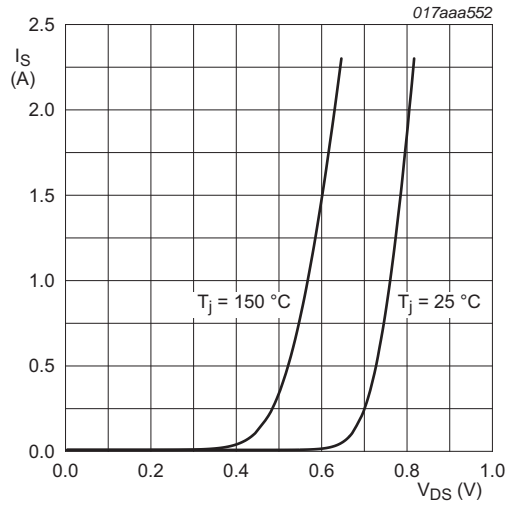


$I_D = 5 \text{ A}; V_{DS} = 15 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

**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

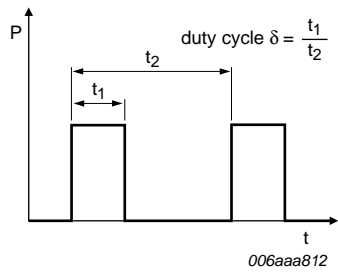


Fig 17. Duty cycle definition

## 9. Package outline

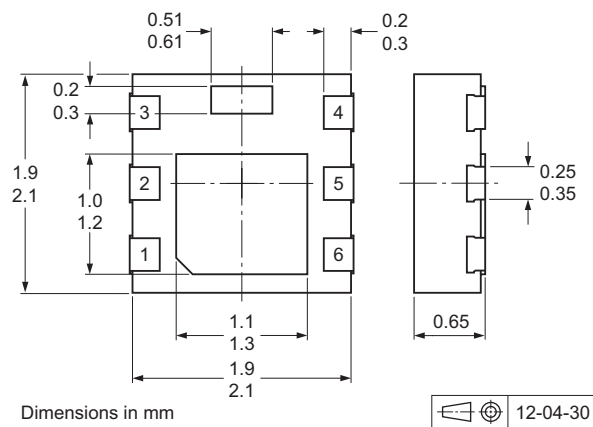


Fig 18. Package outline SOT1220 (DFN2020MD-6)

### 10. Soldering

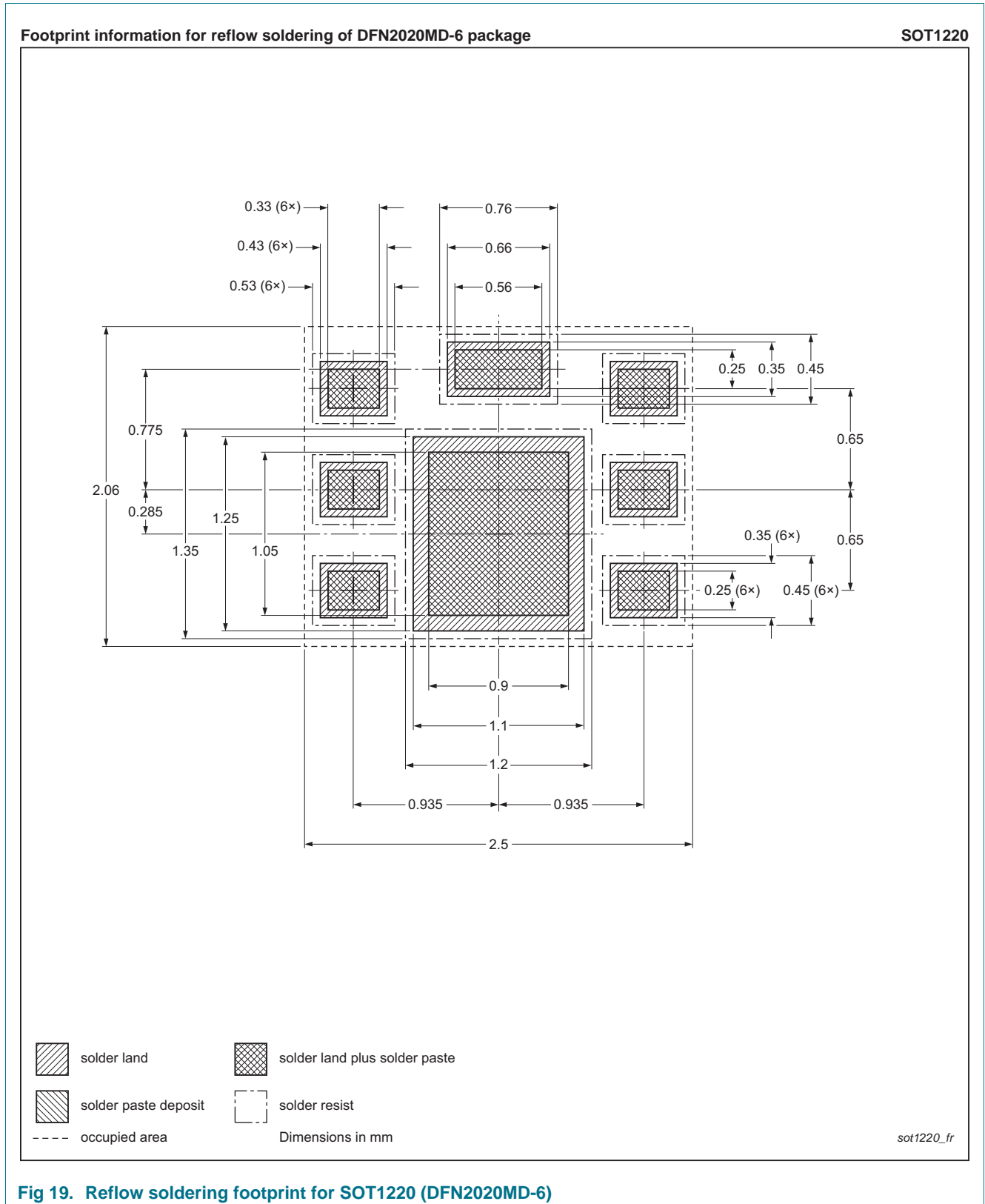


Fig 19. Reflow soldering footprint for SOT1220 (DFN2020MD-6)

## 11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMPB11EN v.1	20120516	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1]</sup> [2]	Product status <sup>[3]</sup>	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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