



PMPB20SNA

40 V, N-channel Trench MOSFET

19 July 2017

Preliminary 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

- Extended temperature range $T_j = 175\text{ °C}$
- Small and leadless ultra thin SMD plastic package: 2 x 2 x 0.65 mm
- Tin-plated 100 % solderable side pads for optical solder inspection
- Trench MOSFET technology
- AEC-Q101 qualified

3. Applications

- Relay driver
- High-speed line driver
- Low-side load switch
- Switching circuits

4. Quick reference data

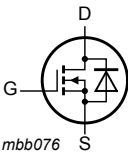
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$		-	-	40	V
V_{GS}	gate-source voltage			-20	-	20	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-	8	A
Static characteristics							
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 8\text{ A}; T_j = 25\text{ °C}$		-	18	25	mΩ

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm².

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	D	drain	 Transparent top view DFN2020MD-6 (SOT1220)	
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
PMPB20SNA	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
PMPB20SNA	4C

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		-	40	V
V _{GS}	gate-source voltage			-20	20	V
I _D	drain current	V _{GS} = 10 V; T _{amb} = 25 °C	[1]	-	8	A
		V _{GS} = 10 V; T _{amb} = 100 °C	[1]	-	5.1	A
I _{DM}	peak drain current	T _{amb} = 25 °C; single pulse; t _p ≤ 10 μs		-	32	A
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	T _{j(init)} = 25 °C; I _D = 1.35 A; DUT in avalanche (unclamped)		-	28.4	mJ
P _{tot}	total power dissipation	T _{amb} = 25 °C	[1]	-	2.27	W
		T _{sp} = 25 °C		-	15	W
T _j	junction temperature			-55	175	°C
T _{amb}	ambient temperature			-55	175	°C
T _{stg}	storage temperature			-65	175	°C
Source-drain diode						
I _S	source current	T _{amb} = 25 °C	[1]	-	2.3	A
ESD maximum rating						
V _{ESD}	electrostatic discharge voltage	HBM	[2]	-	500	V

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm².

[2] Measured between all pins.

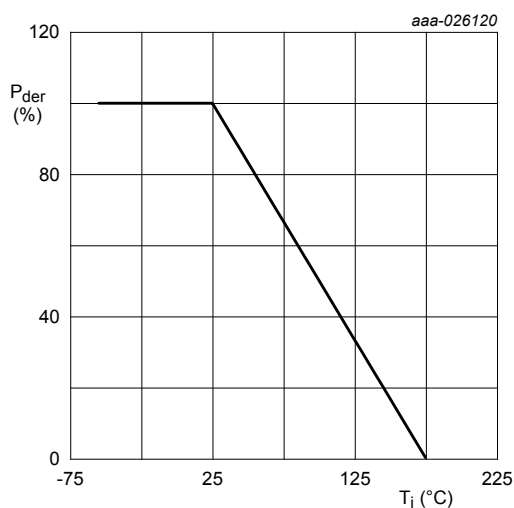


Fig. 1. Normalized total power dissipation as a function of junction temperature

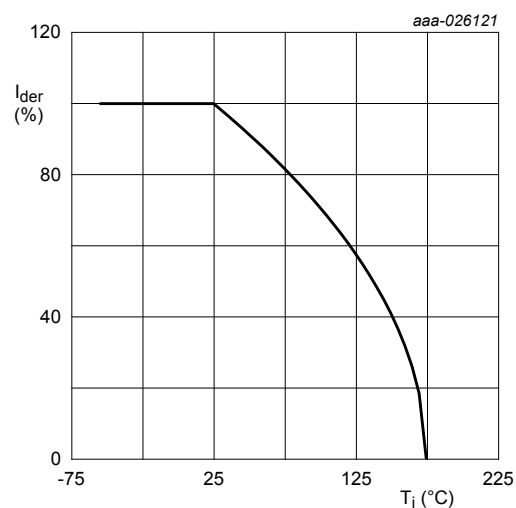


Fig. 2. Normalized continuous drain current as a function of junction temperature

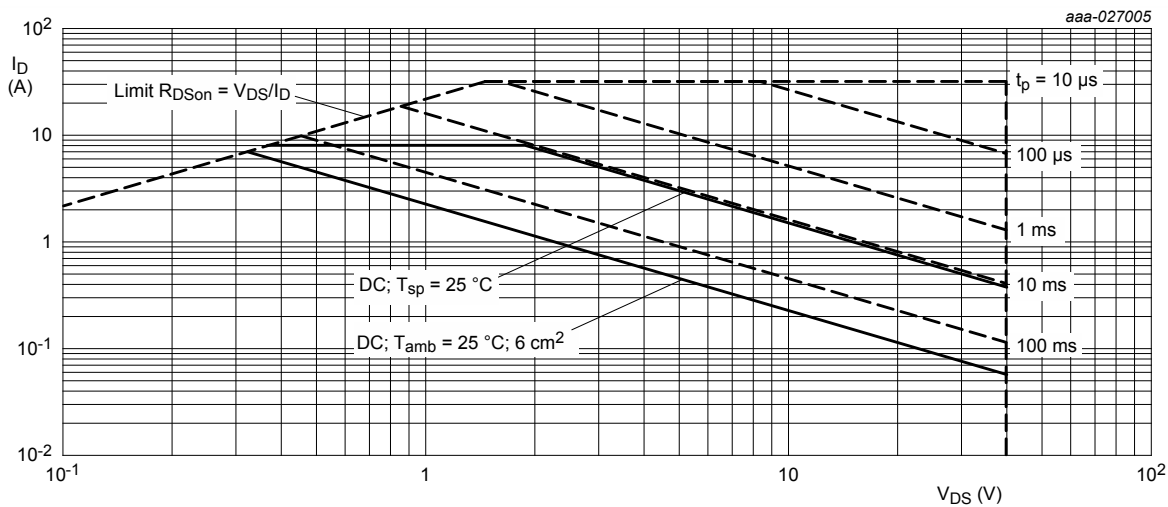


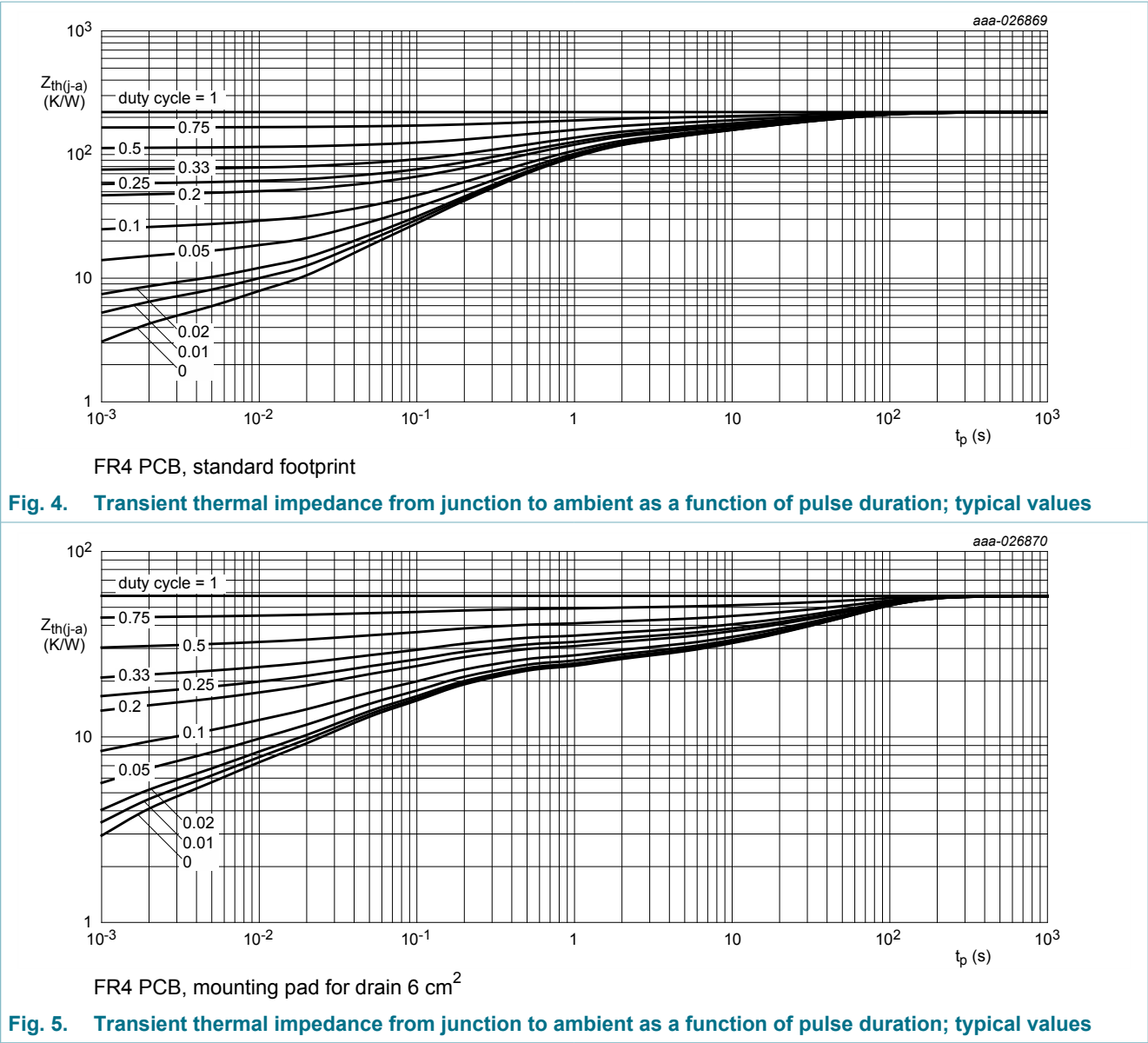
Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

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]	-	223	256	K/W
			[2]	-	57	66	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 cm².



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		40	-	-	V
V _{GSth}	gate-source threshold voltage	I _D = 250 μA; V _{DS} = V _{GS} ; T _j = 25 °C		2.4	3	4	V
I _{DSS}	drain leakage current	V _{DS} = 40 V; V _{GS} = 0 V; T _j = 25 °C		-	-	1	μA
I _{GSS}	gate leakage current	V _{GS} = 15 V; V _{DS} = 0 V; T _j = 25 °C		-	-	100	nA
		V _{GS} = -15 V; V _{DS} = 0 V; T _j = 25 °C		-	-	-100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 8 A; T _j = 25 °C		-	18	25	mΩ
		V _{GS} = 10 V; I _D = 8 A; T _j = 175 °C		-	33	46	mΩ
g _{fs}	forward transconductance	V _{DS} = 10 V; I _D = 8 A; T _j = 25 °C		-	26	-	S
R _G	gate resistance	f = 1 MHz		-	1.7	-	Ω
Dynamic characteristics							
Q _{G(tot)}	total gate charge	V _{DS} = 20 V; I _D = 7 A; V _{GS} = 10 V; T _j = 25 °C		-	8.6	13	nC
Q _{GS}	gate-source charge			-	1.8	-	nC
Q _{GD}	gate-drain charge			-	2.6	-	nC
C _{iss}	input capacitance	V _{DS} = 20 V; f = 1 MHz; V _{GS} = 0 V; T _j = 25 °C		-	460	-	pF
C _{oss}	output capacitance			-	105	-	pF
C _{rss}	reverse transfer capacitance			-	64	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 20 V; I _D = 7 A; V _{GS} = 10 V; R _{G(ext)} = 6 Ω; T _j = 25 °C		-	3	-	ns
t _r	rise time			-	6	-	ns
t _{d(off)}	turn-off delay time			-	8	-	ns
t _f	fall time			-	4	-	ns
Source-drain diode							
V _{SD}	source-drain voltage	I _S = 2.3 A; V _{GS} = 0 V; T _j = 25 °C		-	0.8	1.2	V
t _{rr}	reverse recovery time	I _S = 2.3 A; dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 20 V; T _j = 25 °C		-	14.3	-	ns
Q _r	recovered charge			-	6.1	-	nC

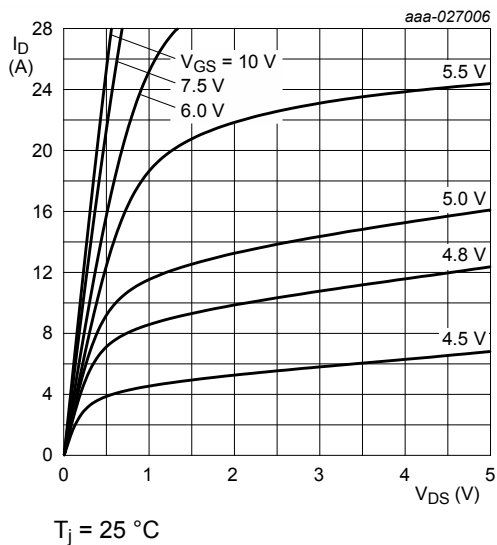


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

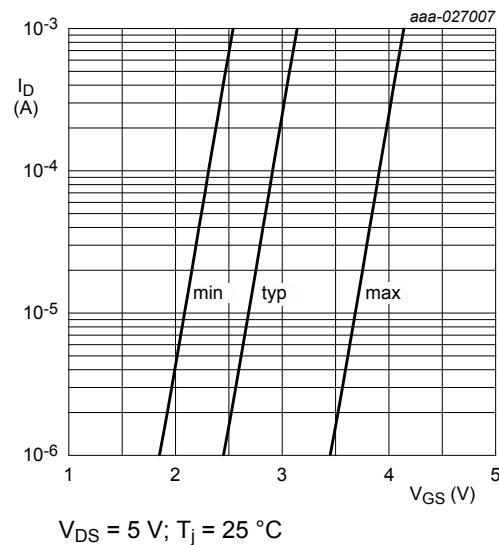


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

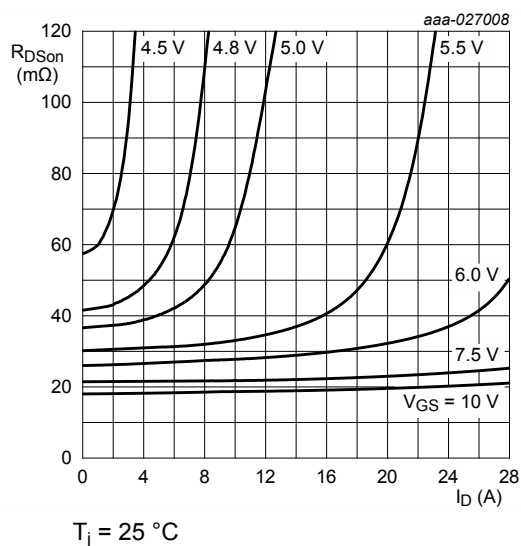


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

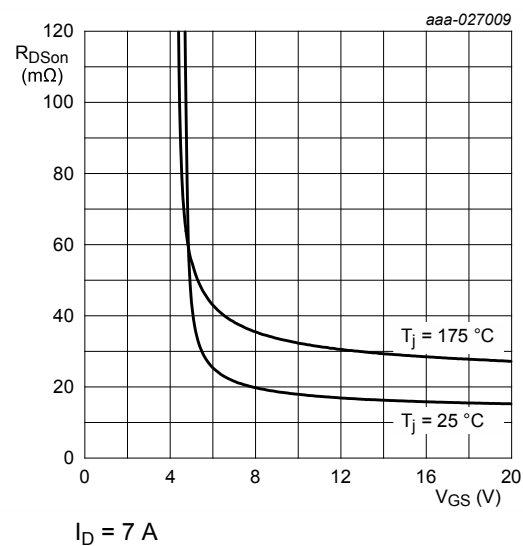


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

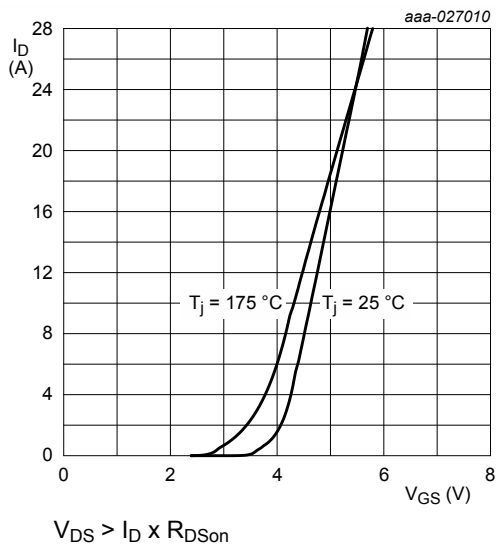


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

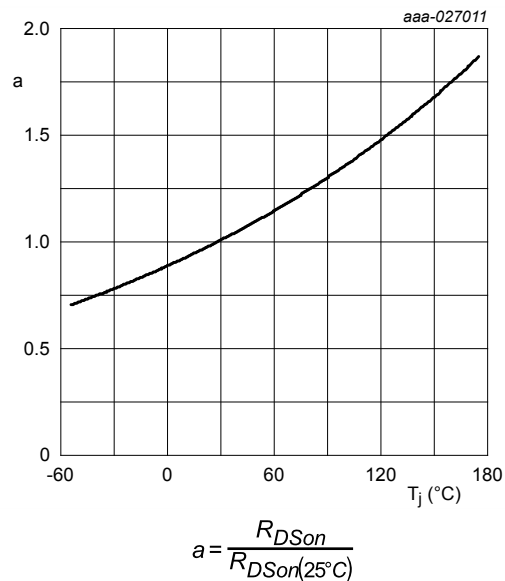


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

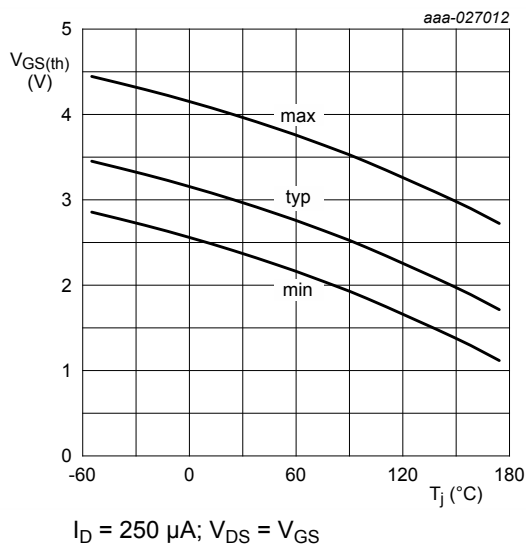


Fig. 12. Gate-source threshold voltage as a function of junction temperature

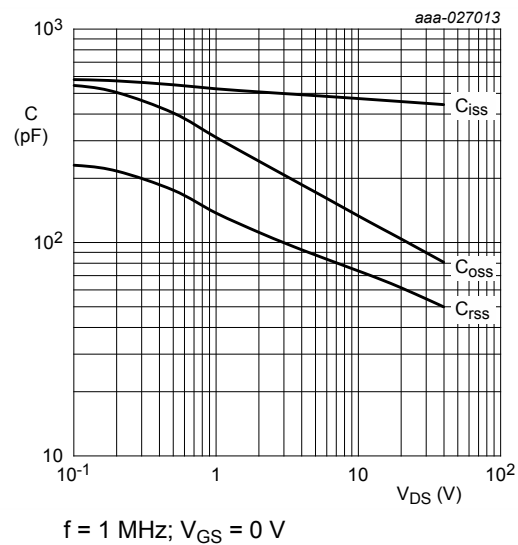
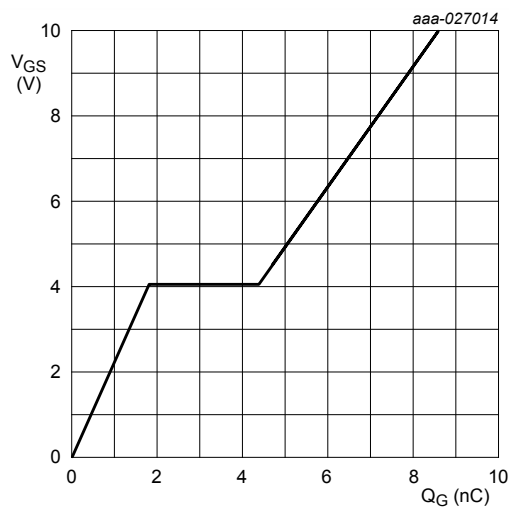


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{DS} = 20\text{ V}$; $I_D = 7\text{ A}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$

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

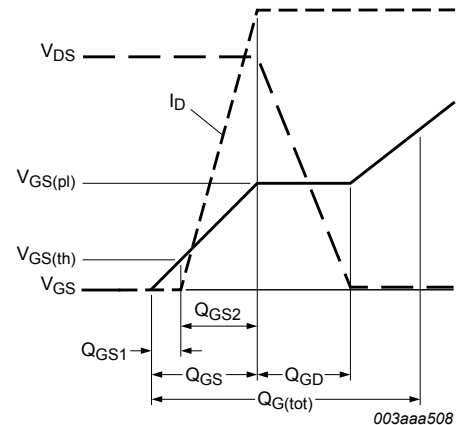
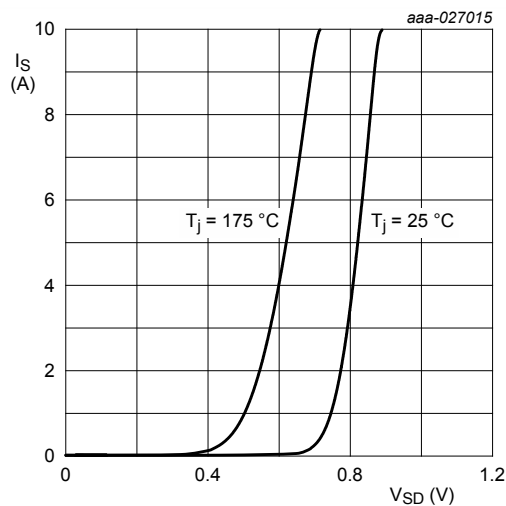


Fig. 15. Gate charge waveform definitions



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

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

11. Test information

Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - *Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

12. Package outline

DFN2020MD-6: plastic thermal enhanced ultra thin small outline package; no leads;
6 terminals; body 2 x 2 x 0.65 mm

SOT1220

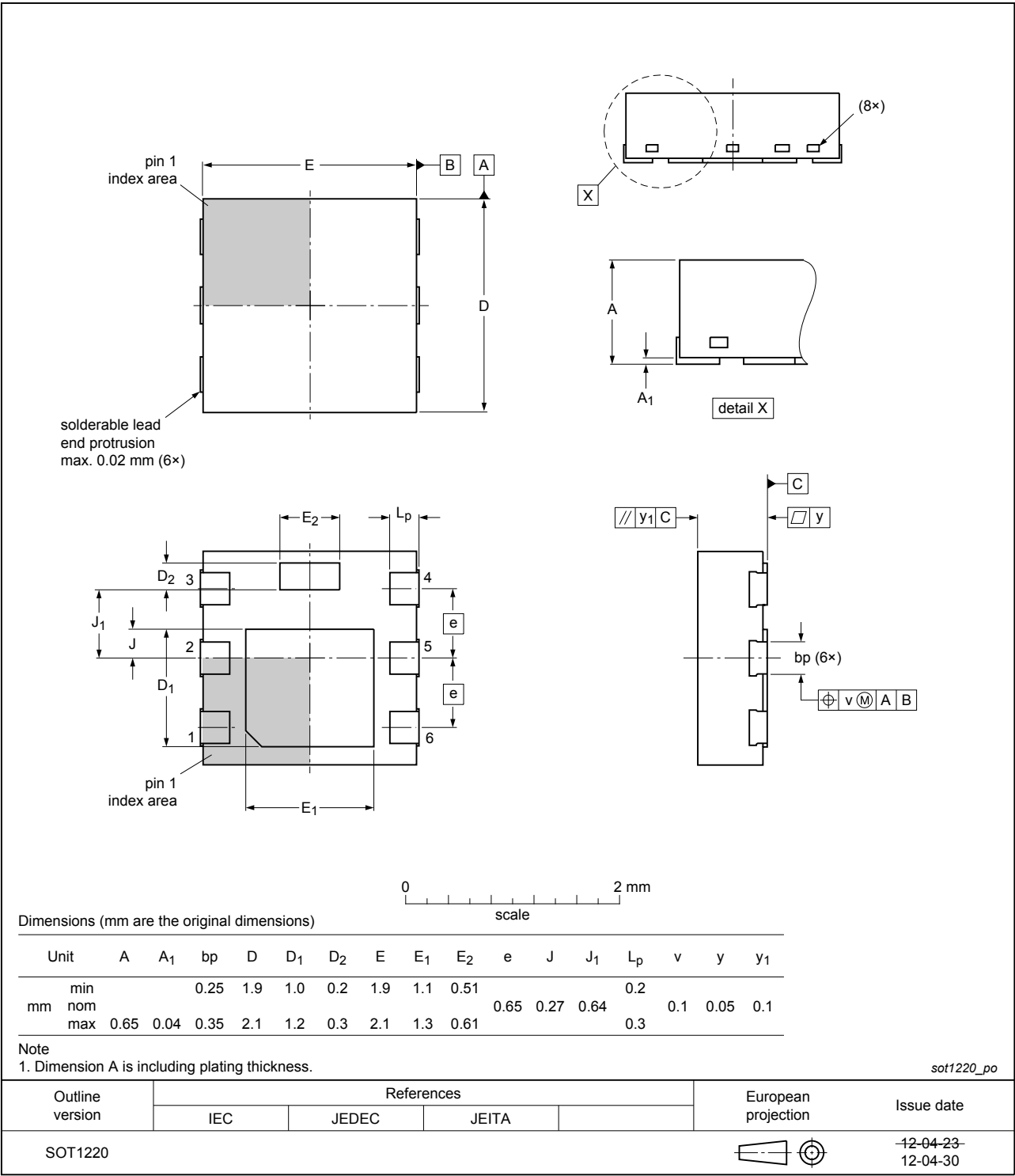
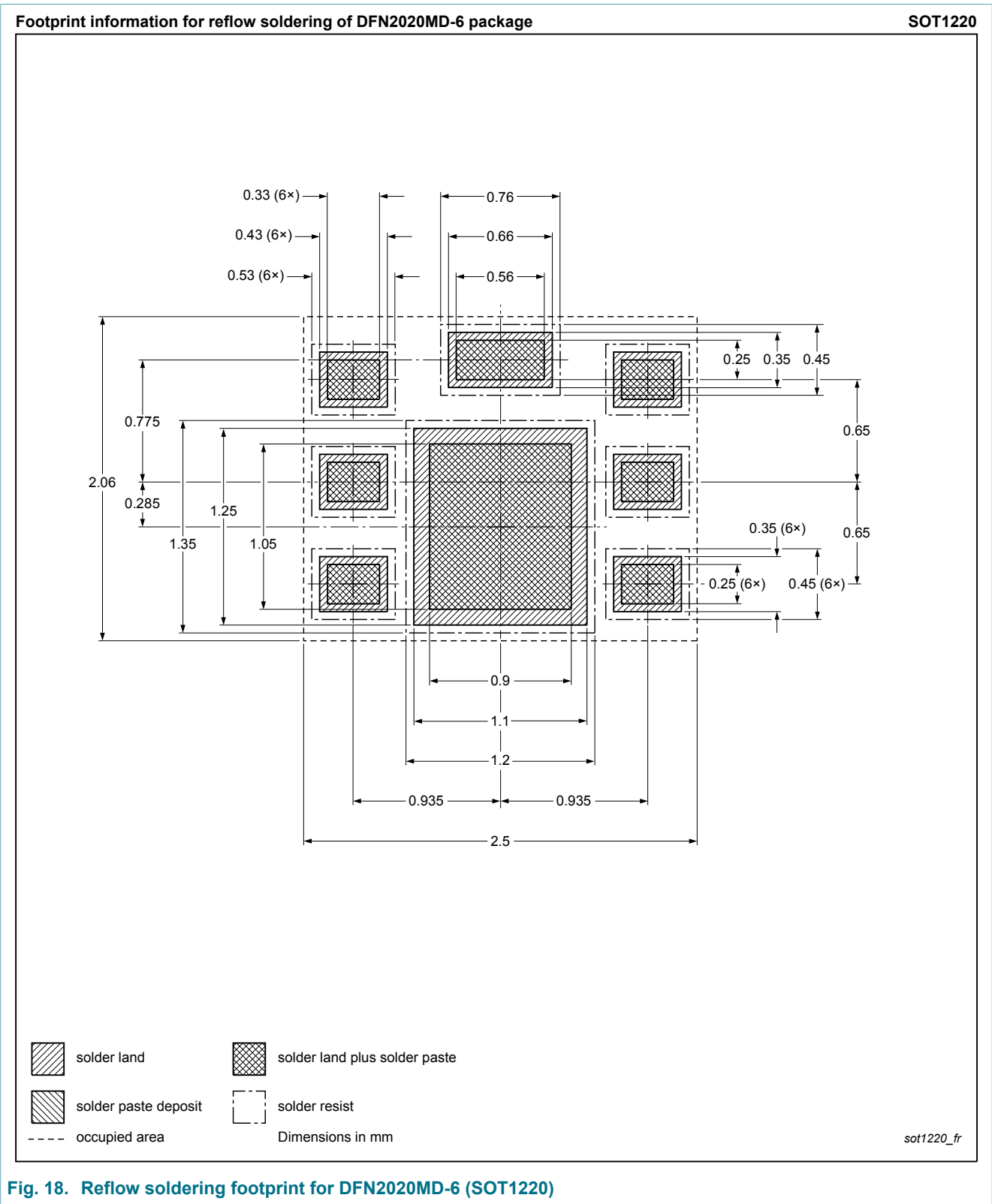


Fig. 17. Package outline DFN2020MD-6 (SOT1220)

13. Soldering



14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMPB20SNA v.1	20170719	Preliminary data sheet	-	-

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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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