

Important notice

Dear Customer,

On 7 February 2017 the former NXP Standard Product business became a new company with the tradename **Nexperia**. Nexperia is an industry leading supplier of Discrete, Logic and PowerMOS semiconductors with its focus on the automotive, industrial, computing, consumer and wearable application markets

In data sheets and application notes which still contain NXP or Philips Semiconductors references, use the references to Nexperia, as shown below.

Instead of <http://www.nxp.com>, <http://www.philips.com/> or <http://www.semiconductors.philips.com/>, use <http://www.nexperia.com>

Instead of sales.addresses@www.nxp.com or sales.addresses@www.semiconductors.philips.com, use salesaddresses@nexperia.com (email)

Replace the copyright notice at the bottom of each page or elsewhere in the document, depending on the version, as shown below:

- © NXP N.V. (year). All rights reserved or © Koninklijke Philips Electronics N.V. (year). All rights reserved

Should be replaced with:

- © **Nexperia B.V. (year). All rights reserved.**

If you have any questions related to the data sheet, please contact our nearest sales office via e-mail or telephone (details via salesaddresses@nexperia.com). Thank you for your cooperation and understanding,

Kind regards,

Team Nexperia

PMPB15XN

20 V, single N-channel Trench MOSFET

13 September 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
- 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 portable devices
- Hard disk and computing power management

1.4 Quick reference data

Table 1. Quick reference data

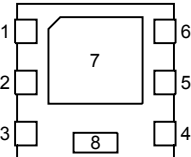
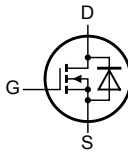
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ °C}$	-	-	20	V
V_{GS}	gate-source voltage		-12	-	12	V
I_D	drain current	$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$	[1]	-	10.4	A
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 7.3\text{ A}; T_j = 25\text{ °C}$	-	18	21	mΩ

[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 DFN2020MD-6 (SOT1220)</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
PMPB15XN	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
PMPB15XN	1J

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			-12	12	V
I_D	drain current	$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; t \leq 5\text{ s}$	[1]	-	10.4	A
		$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	[1]	-	7.3	A
		$V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ }^\circ\text{C}$	[1]	-	4.6	A
I_{DM}	peak drain current	$T_{amb} = 25\text{ }^\circ\text{C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$		-	24	A
P_{tot}	total power dissipation	$T_{amb} = 25\text{ }^\circ\text{C}$	[1]	-	1.7	W

Symbol	Parameter	Conditions		Min	Max	Unit
		$T_{amb} = 25\text{ °C}; t \leq 5\text{ s}$	[1]	-	3.5	W
		$T_{sp} = 25\text{ °C}$		-	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	$T_{amb} = 25\text{ °C}$	[1]	-	2	A

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

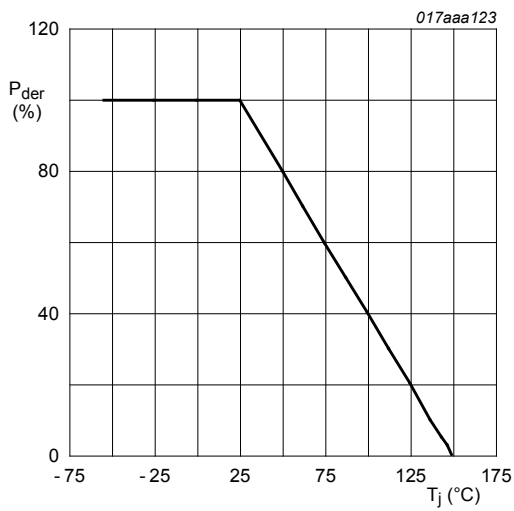


Fig. 1. Normalized total power dissipation as a function of junction temperature

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

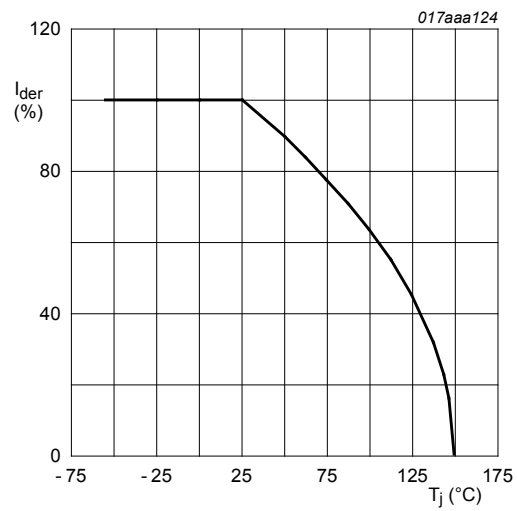
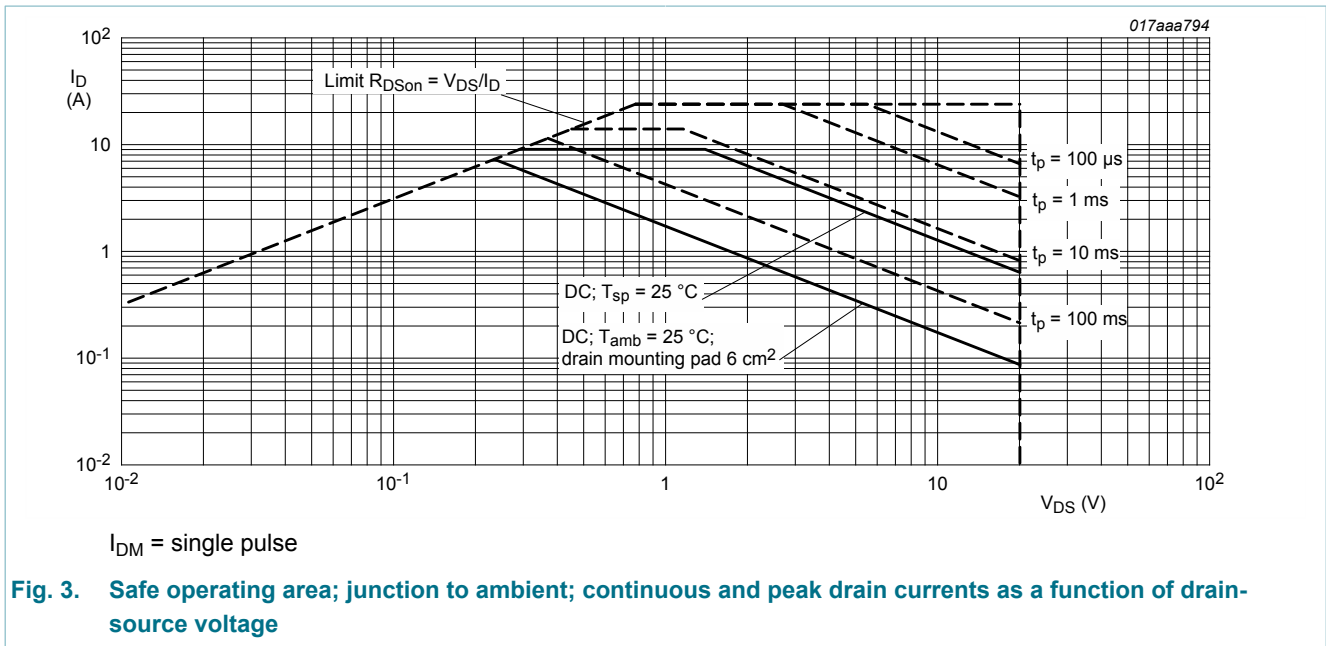


Fig. 2. Normalized continuous drain current as a function of junction temperature

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



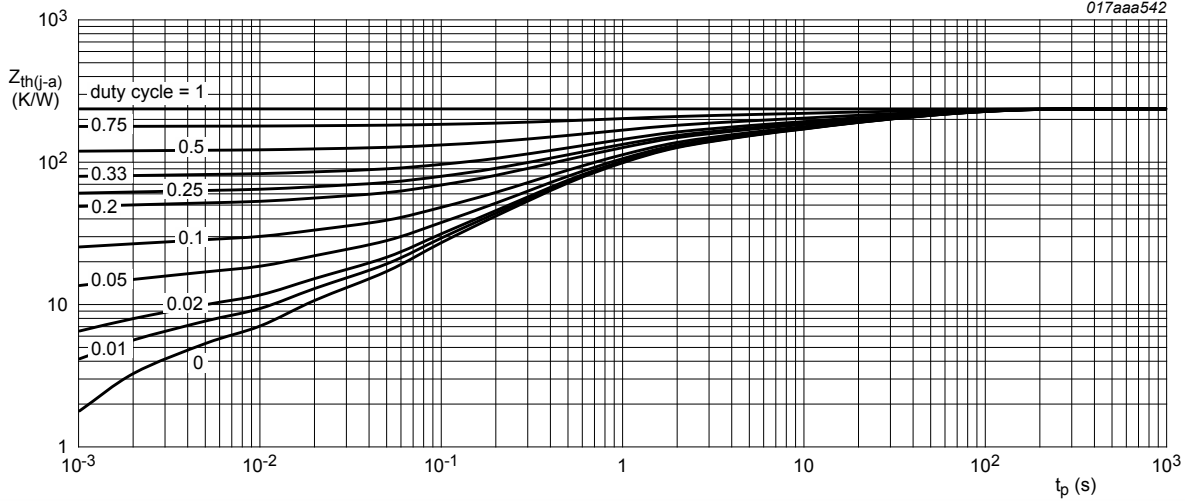
6. Thermal characteristics

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
		in free air; $t \leq 5\text{ s}$	[2]	-	33	36	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	5	10	K/W

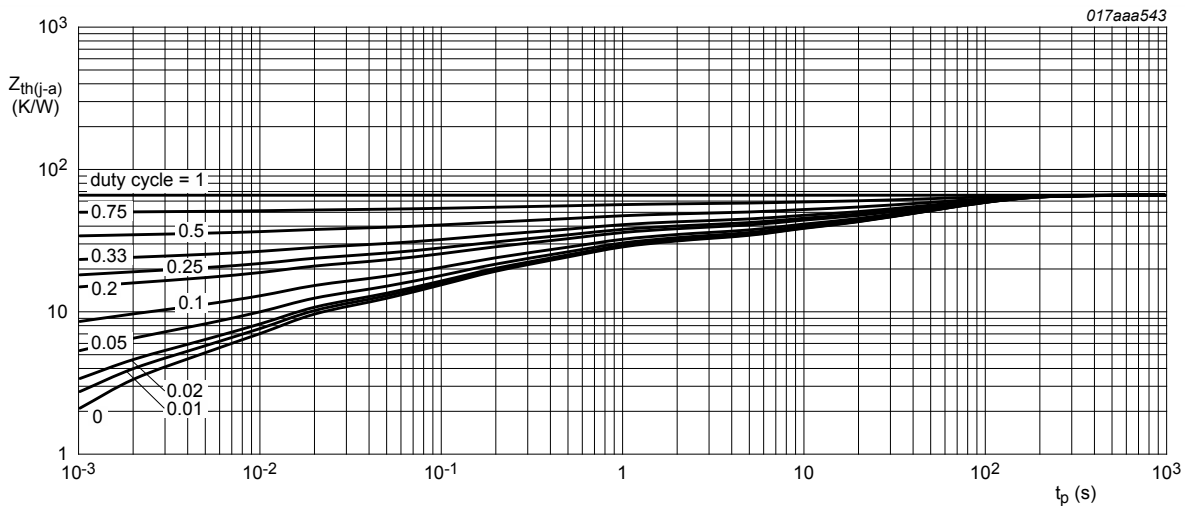
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



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	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	20	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = 250 \mu A; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$	0.4	0.65	0.9	V
I_{DSS}	drain leakage current	$V_{DS} = 20 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	1	μA
I_{GSS}	gate leakage current	$V_{GS} = -12 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	-	-100	nA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		$V_{GS} = 12\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	-	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 7.3\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	18	21	m Ω
		$V_{GS} = 4.5\text{ V}; I_D = 7.3\text{ A}; T_j = 150\text{ }^\circ\text{C}$	-	27	32	m Ω
		$V_{GS} = 2.5\text{ V}; I_D = 6.4\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	21	27	m Ω
		$V_{GS} = 1.8\text{ V}; I_D = 2.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	23	41	m Ω
g_{fs}	forward transconductance	$V_{DS} = 10\text{ V}; I_D = 7.3\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	30	-	S
R_G	gate resistance	$f = 1\text{ MHz}$	-	2	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 10\text{ V}; I_D = 7.3\text{ A}; V_{GS} = 4.5\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	13.4	20.2	nC
Q_{GS}	gate-source charge		-	1.5	-	nC
Q_{GD}	gate-drain charge		-	2.6	-	nC
C_{iss}	input capacitance	$V_{DS} = 10\text{ V}; f = 1\text{ MHz}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	1240	-	pF
C_{oss}	output capacitance		-	145	-	pF
C_{rss}	reverse transfer capacitance		-	125	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 10\text{ V}; I_D = 7.3\text{ A}; V_{GS} = 4.5\text{ V}; R_{G(ext)} = 6\text{ }^\circ\Omega; T_j = 25\text{ }^\circ\text{C}$	-	9	-	ns
t_r	rise time		-	24	-	ns
$t_{d(off)}$	turn-off delay time		-	31	-	ns
t_f	fall time		-	36	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 2\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	0.7	1.2	V

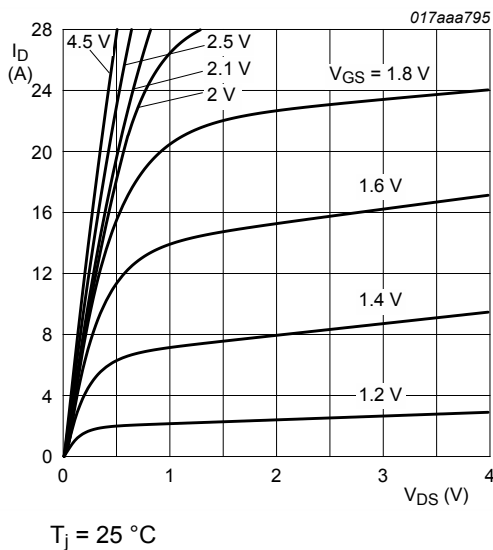


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

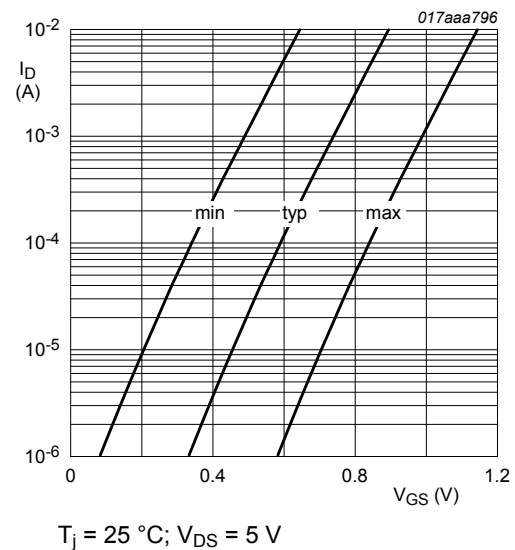


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

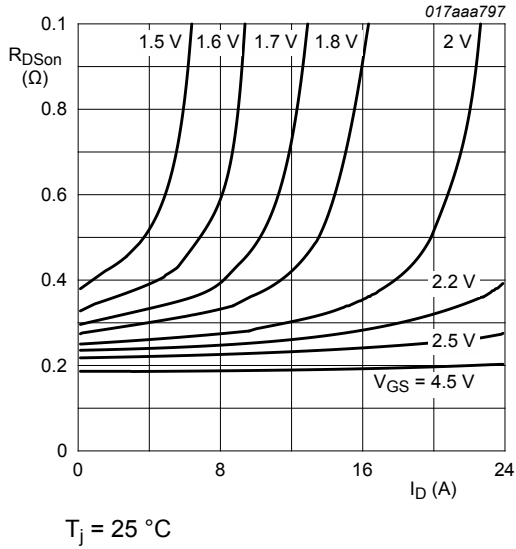


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

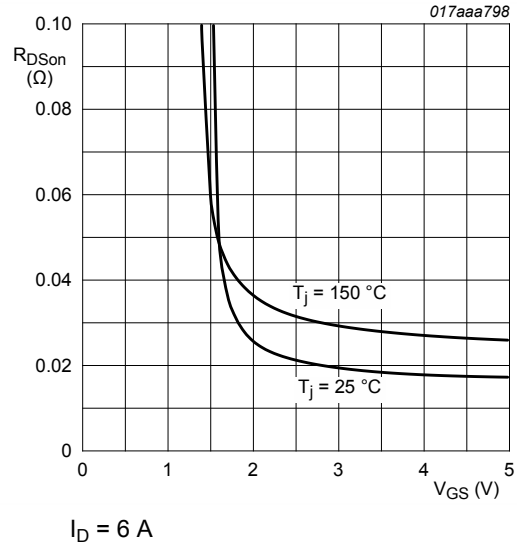


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

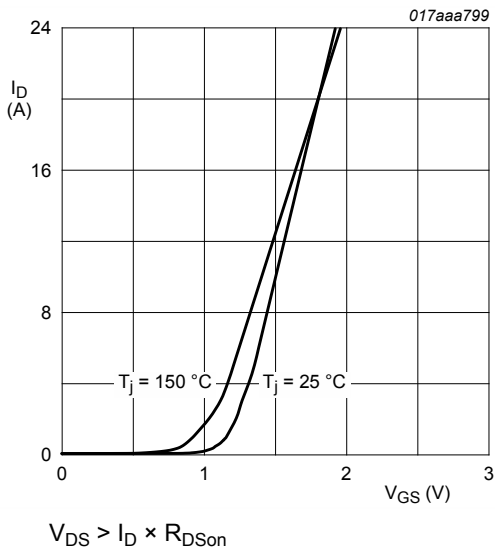


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

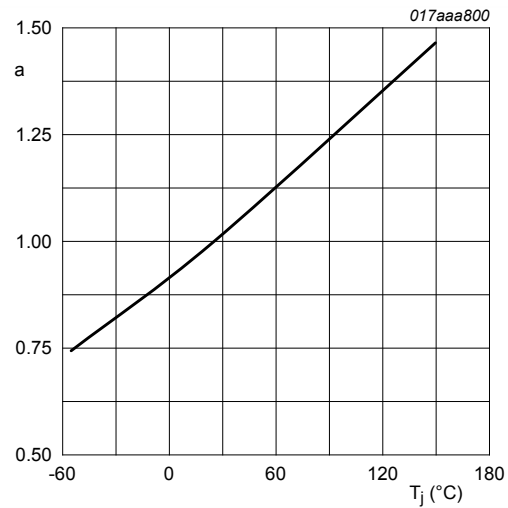


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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

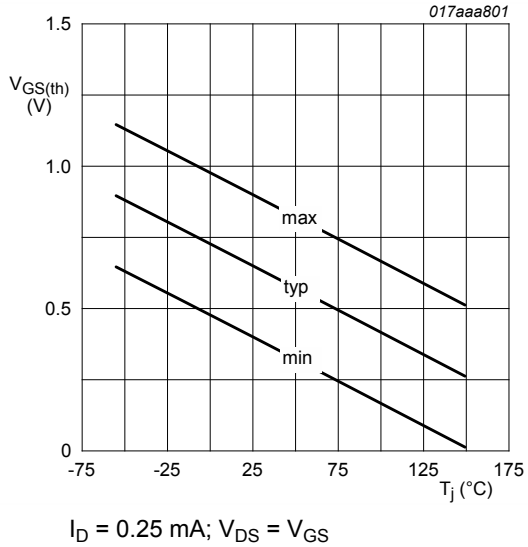


Fig. 12. Gate-source threshold voltage as a function of junction temperature

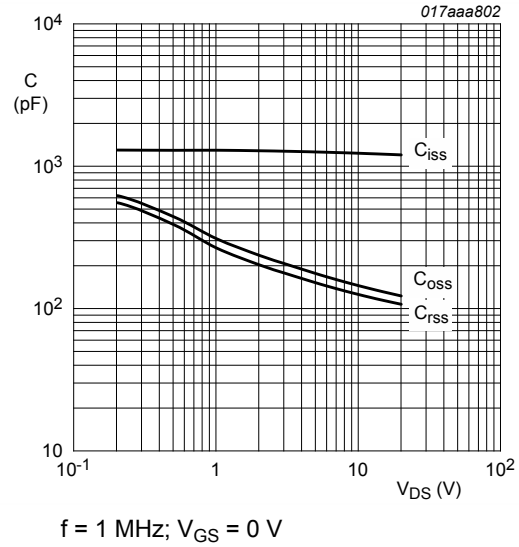


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

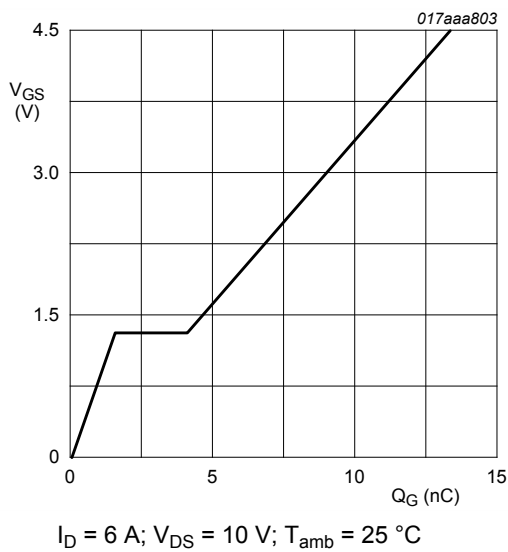


Fig. 14. Gate-source voltage as a function of gate charge; typical values

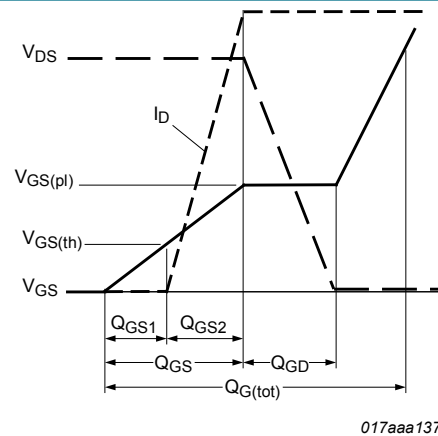
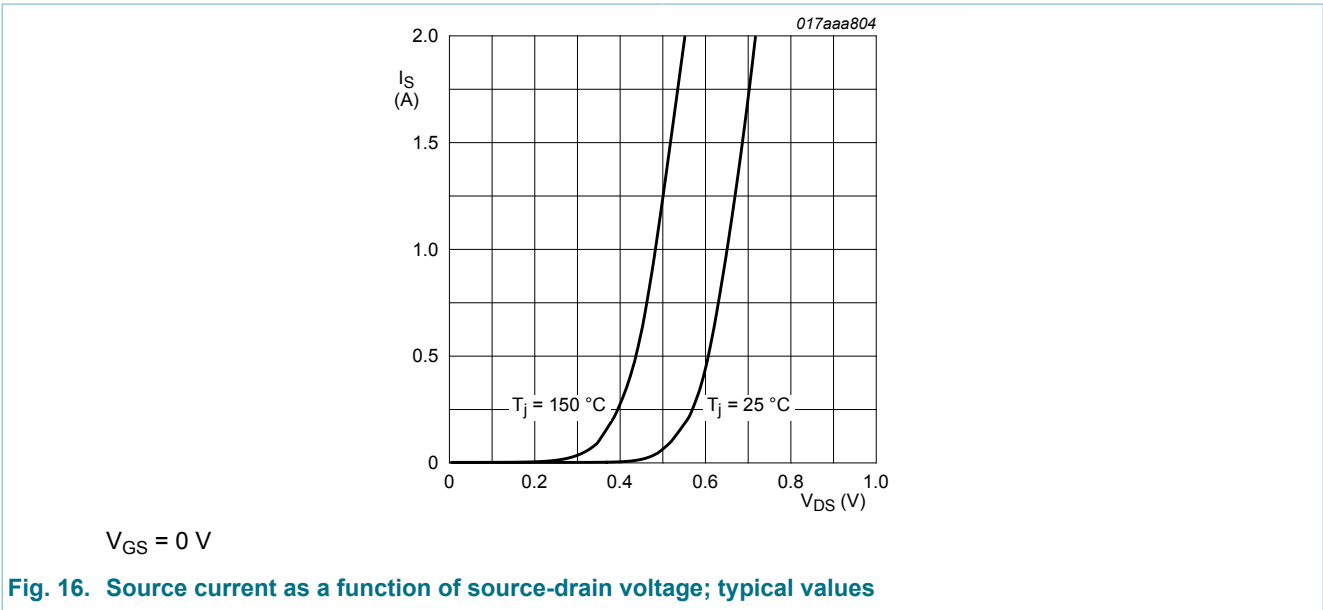
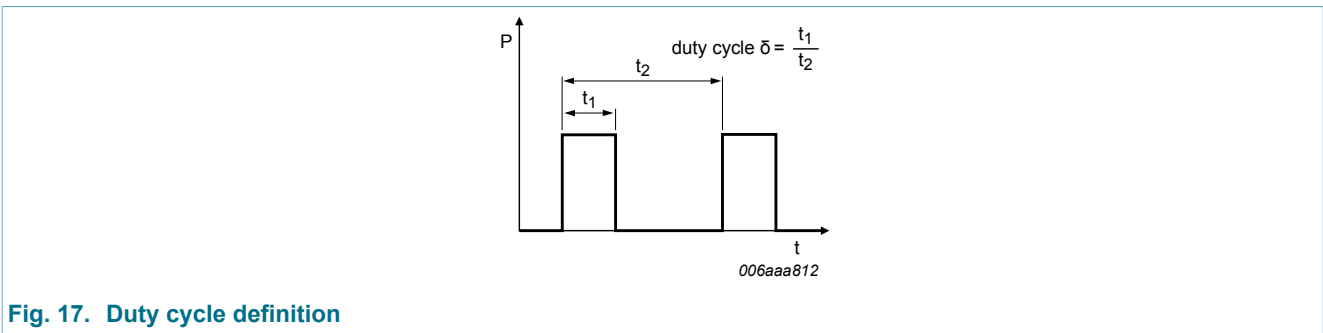


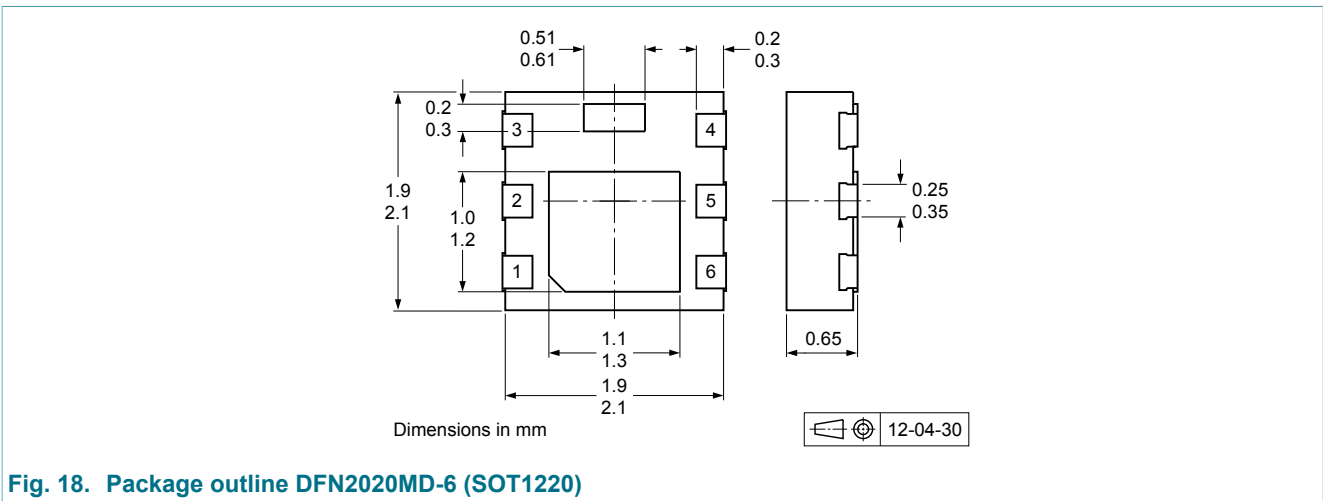
Fig. 15. Gate charge waveform definitions



8. Test information



9. Package outline



10. Soldering

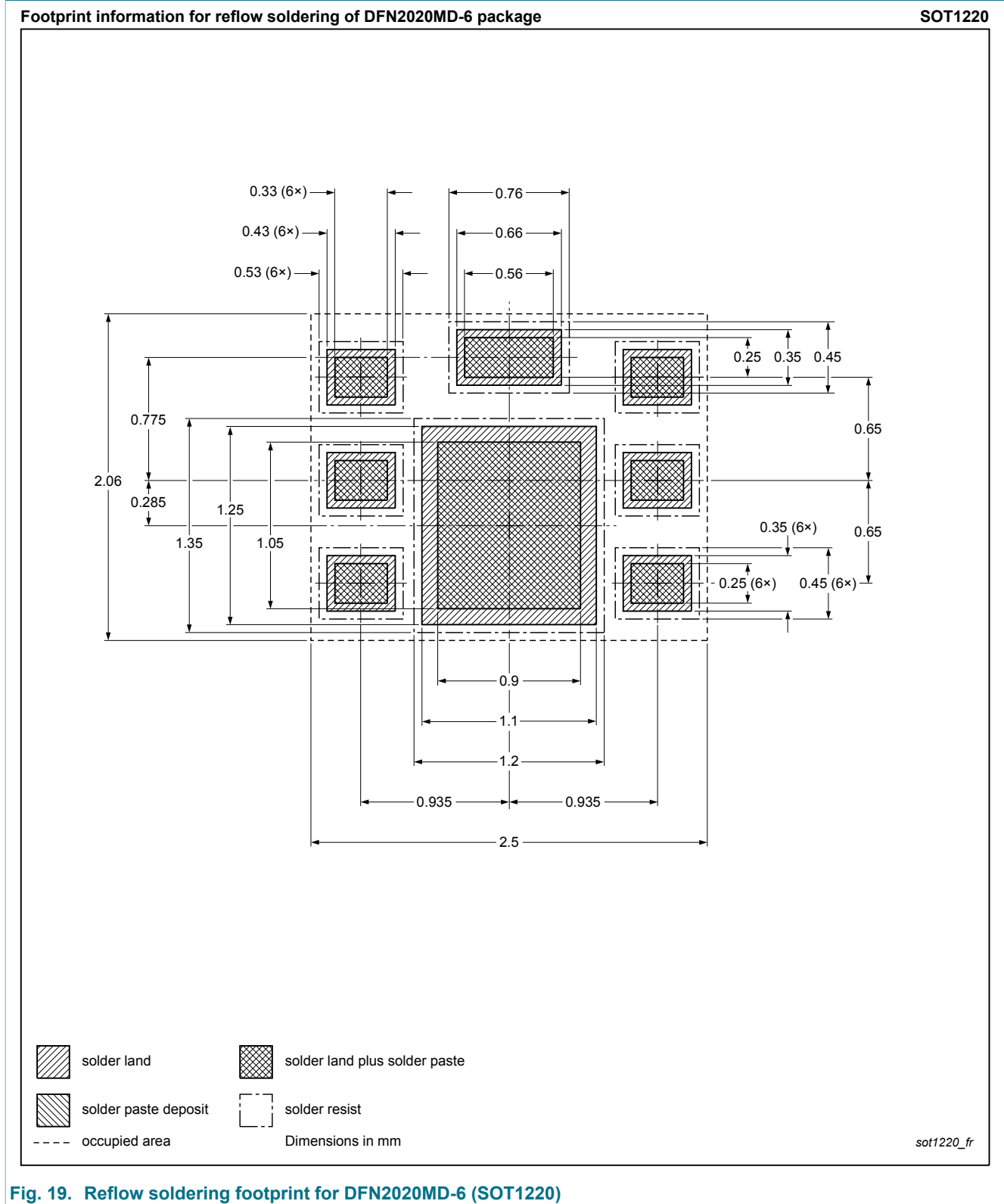


Fig. 19. Reflow soldering footprint for DFN2020MD-6 (SOT1220)

11. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
PMPB15XN v.1	20120913	Product data sheet	-	-

13. Contents

1	Product profile	1
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
1.4	Quick reference data	1
2	Pinning information	2
3	Ordering information	2
4	Marking	2
5	Limiting values	2
6	Thermal characteristics	4
7	Characteristics	5
8	Test information	9
9	Package outline	9
10	Soldering	10
11	Revision history	11
12	Legal information	
12.1	Data sheet status	
12.2	Definitions	
12.3	Disclaimers	
12.4	Trademarks	

© NXP B.V. 2012. All rights reserved

For more information, please visit: <http://www.nxp.com>
For sales office addresses, please send an email to: salesaddresses@nxp.com
Date of release: 13 September 2012
