PMCPB5530X

20 V, complementary Trench MOSFET

Rev. 1 — 26 June 2012 **Product data sheet**

1. Product profile

1.1 General description

Complementary N/P-channel enhancement mode Field-Effect Transistor (FET) in a small and leadless ultra thin DFN2020-6 (SOT1118) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

1.2 Features and benefits

- Very fast switching
- 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

1.3 Applications

- Charging switch for portable devices
- DC-to-DC converters
- Small brushless DC motor drive
- Power management in battery-driven portables
- Hard disc and computing power management

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR1 (N-channel), Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 3 A; T_j = 25 °C		-	26	34	mΩ
TR2 (P-channel), Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = -4.5 V; I_D = -3.4 A; T_j = 25 °C		-	55	70	mΩ
TR1 (N-channel)							
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	20	V
V_{GS}	gate-source voltage			-12	-	12	V
I_D	drain current	V_{GS} = 4.5 V; T_{amb} = 25 °C; t ≤ 5 s	[1]	-	-	5.3	A

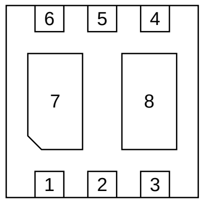
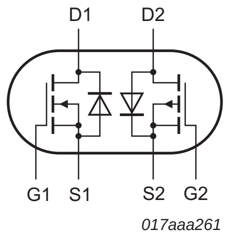
Table 1. Quick reference data *...continued*

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR2 (P-channel)							
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	-20	V
V_{GS}	gate-source voltage			-12	-	12	V
I_D	drain current	V_{GS} = -4.5 V; T_{amb} = 25 °C; t ≤ 5 s	[1]	-	-	-4.5	A

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

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	 Transparent top view **DFN2020-6 (SOT1118)**	
2	G1	gate TR1		
3	D2	drain TR2		
4	S2	source TR2		
5	G2	gate TR2		
6	D1	drain TR1		
7	D1	drain TR1		
8	D2	drain TR2		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMCPB5530X	DFN2020-6	plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals	SOT1118

4. Marking

Table 4. Marking codes

Type number	Marking code
PMCPB5530X	1W

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
TR1 (N-channel)					
V_{DS}	drain-source voltage	T_j = 25 °C	-	20	V
V_{GS}	gate-source voltage		-12	12	V

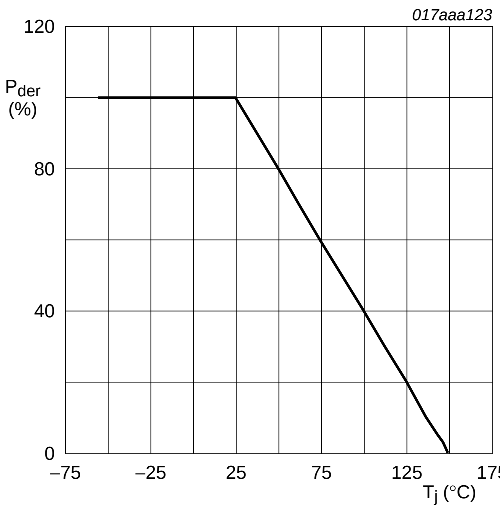
Table 5. Limiting values *...continued*

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

Symbol	Parameter	Conditions		Min	Max	Unit
I_D	drain current	V_{GS} = 4.5 V; T_{amb} = 25 °C; t ≤ 5 s	[1]	-	5.3	A
		V_{GS} = 4.5 V; T_{amb} = 25 °C	[1]	-	4	A
		V_{GS} = 4.5 V; T_{amb} = 100 °C	[1]	-	2.6	A
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; t_p ≤ 10 µs		-	12	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	490	mW
			[1]	-	1170	mW
		T_{sp} = 25 °C		-	8330	mW
TR1 (N-channel), Source-drain diode						
I_S	source current	T_{amb} = 25 °C	[1]	-	1.2	A
TR2 (P-channel)						
V_{DS}	drain-source voltage	T_j = 25 °C		-	-20	V
V_{GS}	gate-source voltage			-12	12	V
I_D	drain current	V_{GS} = -4.5 V; T_{amb} = 25 °C; t ≤ 5 s	[1]	-	-4.5	A
		V_{GS} = -4.5 V; T_{amb} = 25 °C	[1]	-	-3.4	A
		V_{GS} = -4.5 V; T_{amb} = 100 °C	[1]	-	-2.2	A
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; t_p ≤ 10 µs		-	-14	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	490	mW
			[1]	-	1170	mW
		T_{sp} = 25 °C		-	8330	mW
TR2 (P-channel), Source-drain diode						
I_S	source current	T_{amb} = 25 °C	[1]	-	-1.2	A
Per device						
T_j	junction temperature			-55	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C

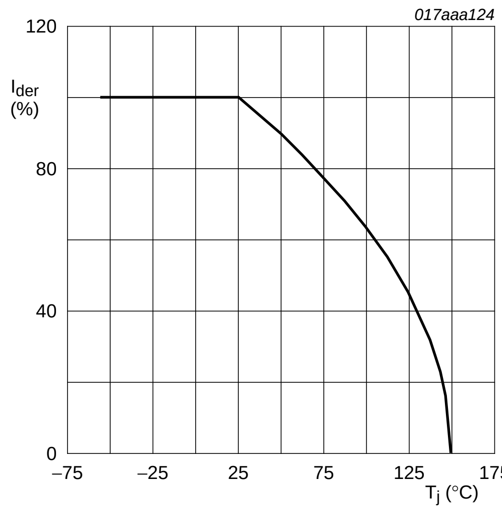
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 6 cm^2.

[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper; tin-plated and standard footprint.



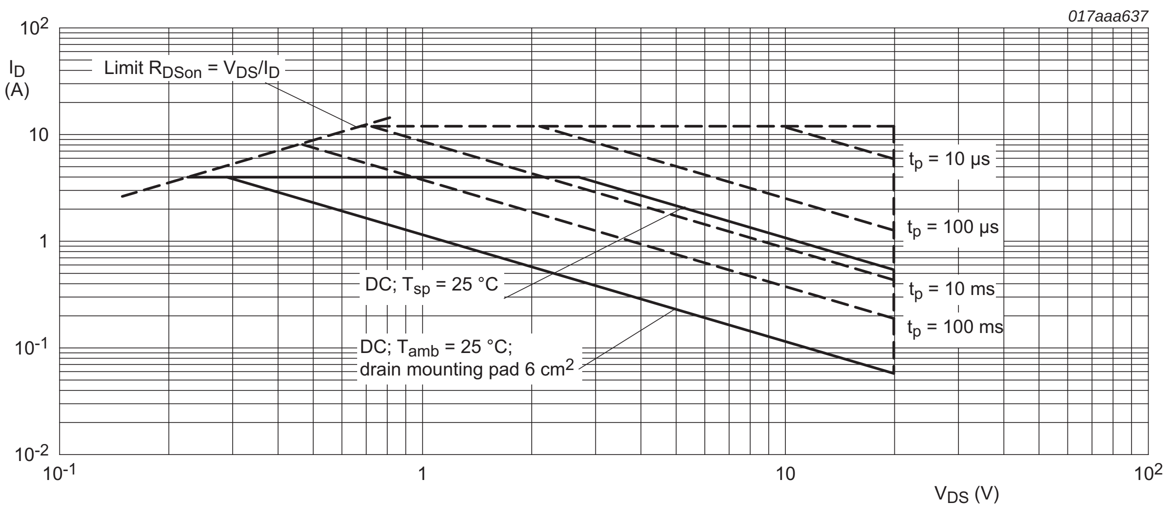
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\ \%$$

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



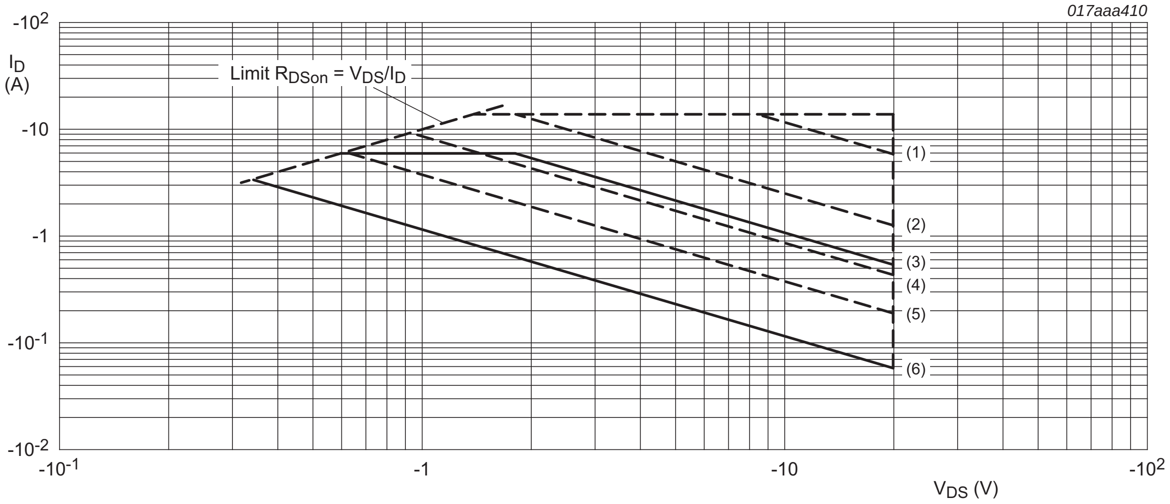
$$I_{der} = \frac{I_D}{I_{D(25^{\circ}C)}} \times 100\ \%$$

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



I_{DM} = single pulse

Fig 3. Safe operating area TR1 (N-channel); junction to ambient; continuous and peak drain currents as a function of drain-source voltage



I_{DM} = single pulse

(1) t_p = 10 µs

(2) t_p = 100 µs

(3) DC; T_{sp} = 25 °C

(4) t_p = 10 ms

(5) t_p = 100 ms

(6) DC; T_{amb} = 25 °C; drain mounting pad 6 cm^2

Fig 4. Safe operating area TR2 (P-channel); junction to ambient; continuous and peak drain currents as a function of drain-source voltage

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
TR1 (N-channel)							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	223	256	K/W
			[2]	-	93	107	K/W
			[3]	-	55	63	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	10	15	K/W
TR2 (P-channel)							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	223	256	K/W
			[2]	-	93	107	K/W
			[3]	-	55	63	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	10	15	K/W

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper; tin-plated and standard footprint.

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

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

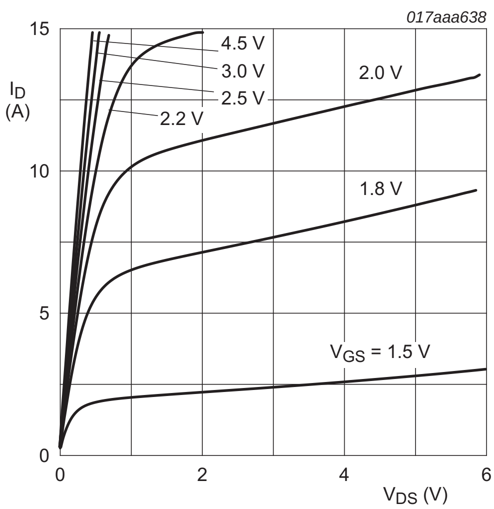
7. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR1 (N-channel), Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C	20	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = 250 µA; V_{DS} = V_{GS}; T_j = 25 °C	0.4	0.65	0.9	V
I_{DSS}	drain leakage current	V_{DS} = 20 V; V_{GS} = 0 V; T_j = 25 °C	-	-	1	µA
		V_{DS} = 20 V; V_{GS} = 0 V; T_j = 150 °C	-	-	11	µA
I_{GSS}	gate leakage current	V_{GS} = 12 V; V_{DS} = 0 V; T_j = 25 °C	-	-	100	nA
		V_{GS} = -12 V; V_{DS} = 0 V; T_j = 25 °C	-	-	100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 3 A; T_j = 25 °C	-	26	34	mΩ
		V_{GS} = 4.5 V; I_D = 3 A; T_j = 150 °C	-	49	63	mΩ
		V_{GS} = 2.5 V; I_D = 1.4 A; T_j = 25 °C	-	33	46	mΩ
		V_{GS} = 1.8 V; I_D = 1.4 A; T_j = 25 °C	-	50	69	mΩ
g_{fs}	transfer conductance	V_{DS} = 5 V; I_D = 3 A; T_j = 25 °C	-	12	-	S
TR1 (N-channel), Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	V_{DS} = 10 V; I_D = 3 A; V_{GS} = 4.5 V; T_j = 25 °C	-	14.4	21.7	nC
Q_{GS}	gate-source charge		-	1.1	-	nC
Q_{GD}	gate-drain charge		-	1.5	-	nC
C_{iss}	input capacitance	V_{DS} = 10 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C	-	660	-	pF
C_{oss}	output capacitance		-	87	-	pF
C_{rss}	reverse transfer capacitance		-	74	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 10 V; I_D = 3 A; V_{GS} = 4.5 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C	-	4	-	ns
t_r	rise time		-	15	-	ns
$t_{d(off)}$	turn-off delay time		-	40	-	ns
t_f	fall time		-	16	-	ns
TR1 (N-channel), Source-drain diode characteristics						
V_{SD}	source-drain voltage	I_S = 1.2 A; V_{GS} = 0 V; T_j = 25 °C	-	0.8	1.2	V
TR2 (P-channel), Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = -250 µA; V_{GS} = 0 V; T_j = 25 °C	-20	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = -250 µA; V_{DS} = V_{GS}; T_j = 25 °C	-0.47	-0.65	-0.9	V
I_{DSS}	drain leakage current	V_{DS} = -20 V; V_{GS} = 0 V; T_j = 25 °C	-	-	-1	µA
		V_{DS} = -20 V; V_{GS} = 0 V; T_j = 150 °C	-	-	-10	µA
I_{GSS}	gate leakage current	V_{GS} = 12 V; V_{DS} = 0 V; T_j = 25 °C	-	-	-100	nA
		V_{GS} = -12 V; V_{DS} = 0 V; T_j = 25 °C	-	-	-100	nA

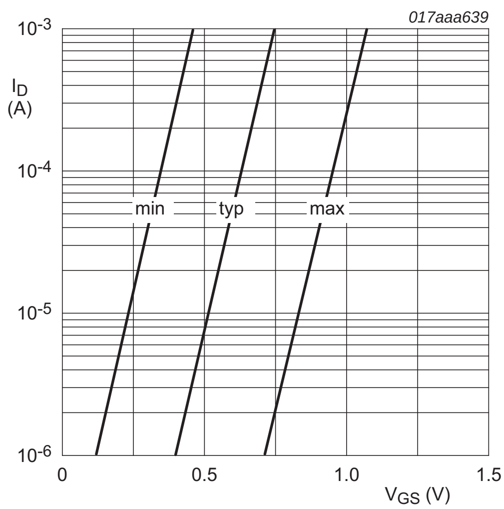
Table 7. Characteristics *...continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R_{DSon}	drain-source on-state resistance	V_{GS} = -4.5 V; I_D = -3.4 A; T_j = 25 °C	-	55	70	mΩ
		V_{GS} = -4.5 V; I_D = -3.4 A; T_j = 150 °C	-	78	99	mΩ
		V_{GS} = -2.5 V; I_D = -3 A; T_j = 25 °C	-	75	90	mΩ
		V_{GS} = -1.8 V; I_D = -1.5 A; T_j = 25 °C	-	110	135	mΩ
g_{fs}	transfer conductance	V_{DS} = -10 V; I_D = -3.4 A; T_j = 25 °C	-	15	-	S
TR2 (P-channel), Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	V_{DS} = -10 V; I_D = -3.4 A; V_{GS} = -5 V; T_j = 25 °C	-	8.1	12.2	nC
Q_{GS}	gate-source charge		-	1.2	-	nC
Q_{GD}	gate-drain charge		-	1.5	-	nC
C_{iss}	input capacitance	V_{DS} = -10 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C	-	785	-	pF
C_{oss}	output capacitance		-	63	-	pF
C_{rss}	reverse transfer capacitance		-	53	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = -10 V; I_D = -3.4 A; V_{GS} = -5 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C	-	4	-	ns
t_r	rise time		-	14	-	ns
$t_{d(off)}$	turn-off delay time		-	40	-	ns
t_f	fall time		-	16	-	ns
TR2 (P-channel), Source-drain diode characteristics						
V_{SD}	source-drain voltage	I_S = -1.2 A; V_{GS} = 0 V; T_j = 25 °C	-	-0.8	-1.2	V



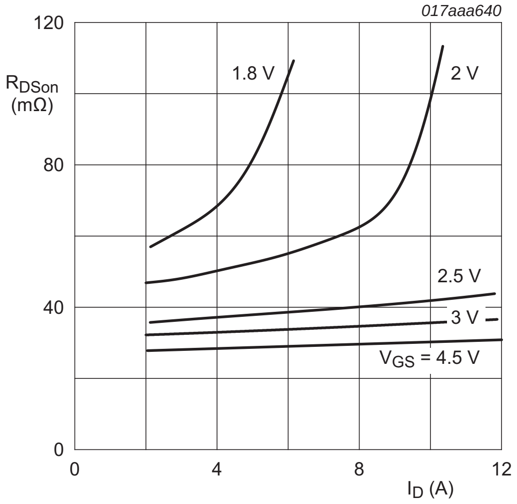
T_j = 25 °C

Fig 5. TR1: Output characteristics: drain current as a function of drain-source voltage; typical values



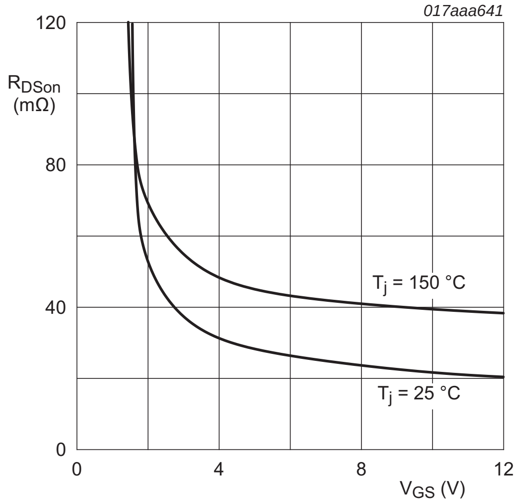
T_j = 25 °C; V_{DS} = 5 V

Fig 6. TR1: Sub-threshold drain current as a function of gate-source voltage



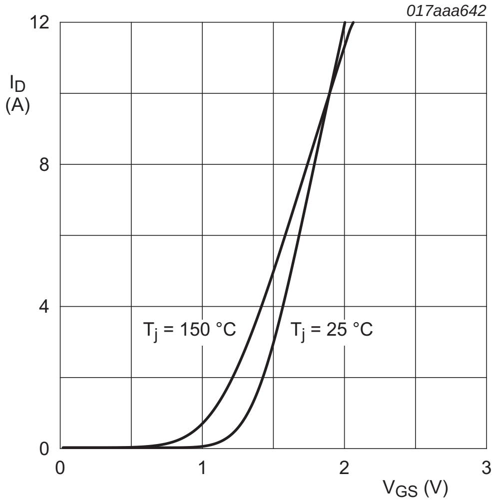
T_j = 25 °C

Fig 7. TR1: Drain-source on-state resistance as a function of drain current; typical values



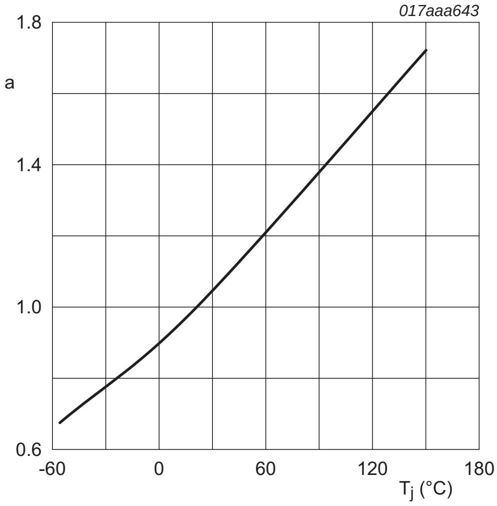
I_D = 2 A

Fig 8. TR1: Drain-source on-state resistance as a function of gate-source voltage; typical values



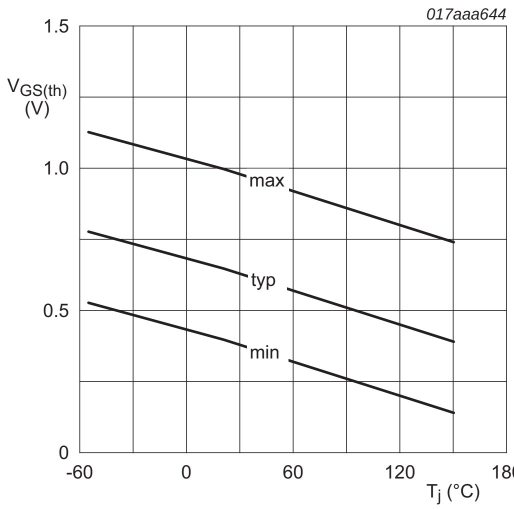
$V_{DS} > I_D \times R_{DSon}$

Fig 9. TR1: Transfer characteristics: drain current as a function of gate-source voltage; typical values



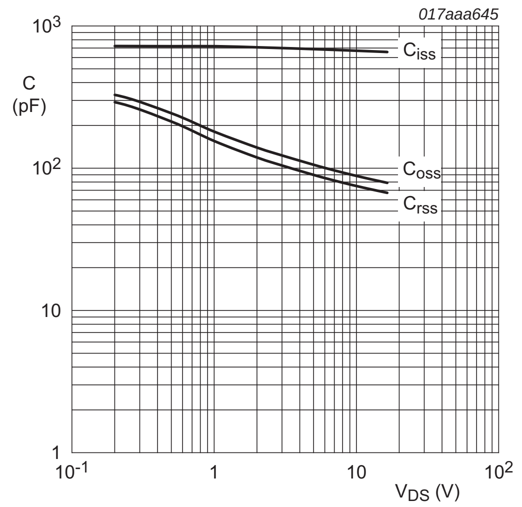
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

Fig 10. TR1: Normalized drain-source on-state resistance as a function of junction temperature; typical values



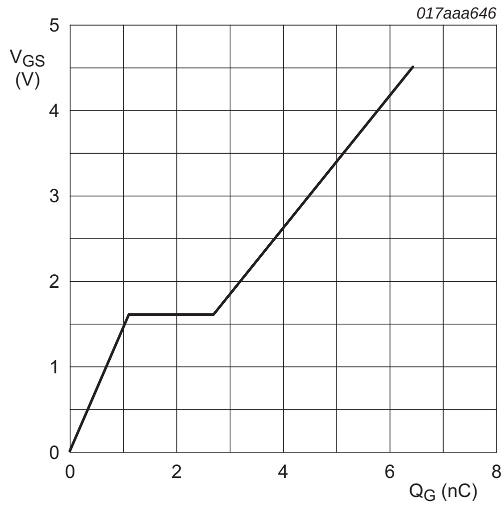
I_D = 0.25 mA; V_{DS} = V_{GS}

Fig 11. TR1: Gate-source threshold voltage as a function of junction temperature



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

Fig 12. TR1: Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



I_D = 3 A; V_{DS} = 10 V; T_{amb} = 25 °C

Fig 13. TR1: Gate-source voltage as a function of gate charge; typical values

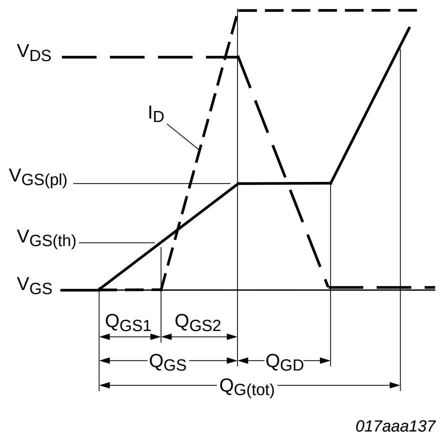
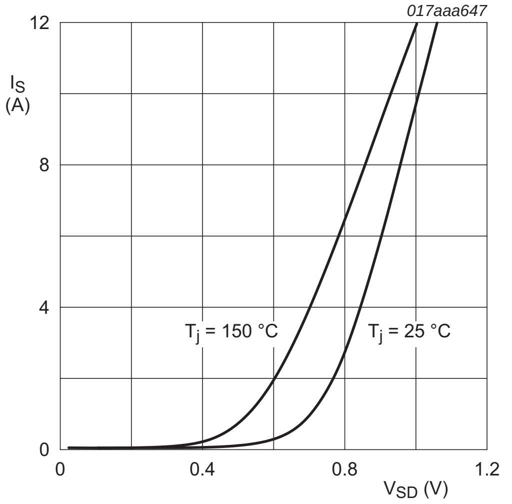
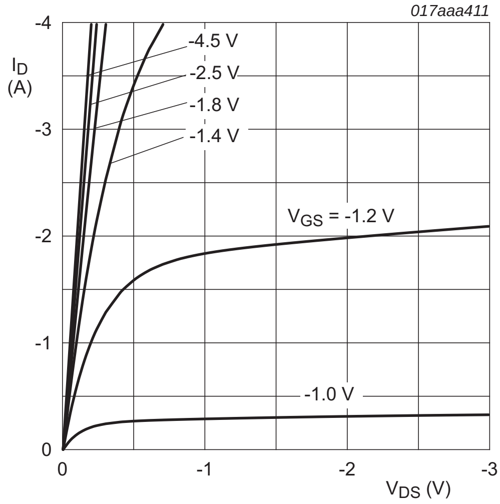


Fig 14. Gate charge waveform definitions



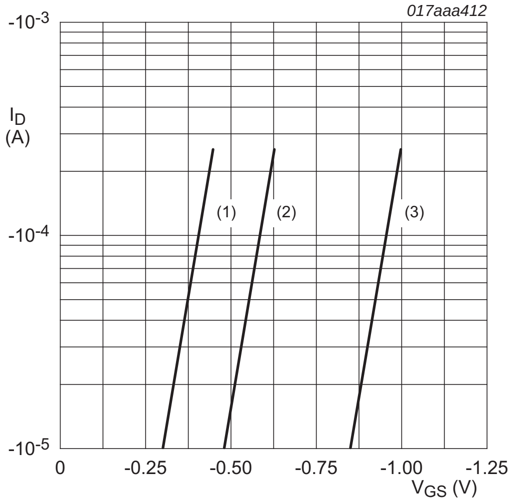
V_{GS} = 0 V

Fig 15. TR1: Source current as a function of source-drain voltage; typical values



T_j = 25 °C

Fig 16. TR2: Output characteristics: drain current as a function of drain-source voltage; typical values



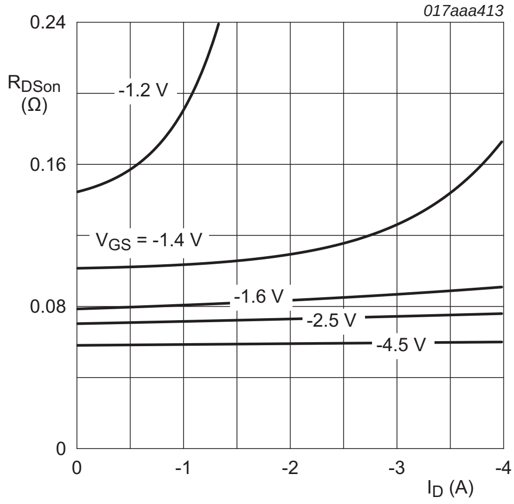
T_j = 25 °C; V_{DS} = −5 V

(1) minimum values

(2) typical values

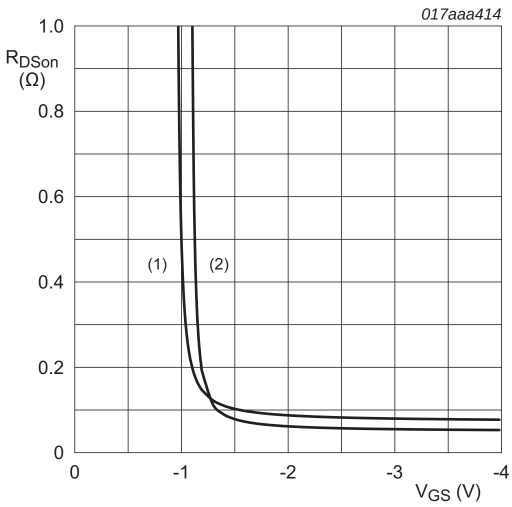
(3) maximum values

Fig 17. TR2: Sub-threshold drain current as a function of gate-source voltage



T_j = 25 °C

Fig 18. TR2: Drain-source on-state resistance as a function of drain current; typical values

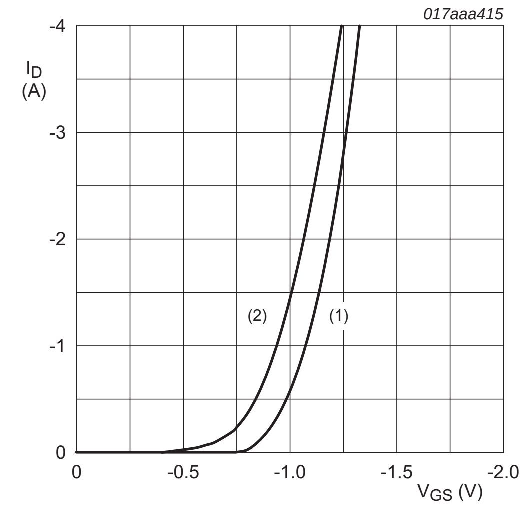


I_D = -1 A

(1) T_j = 150 °C

(2) T_j = 25 °C

Fig 19. TR2: Drain-source on-state resistance as a function of gate-source voltage; typical values

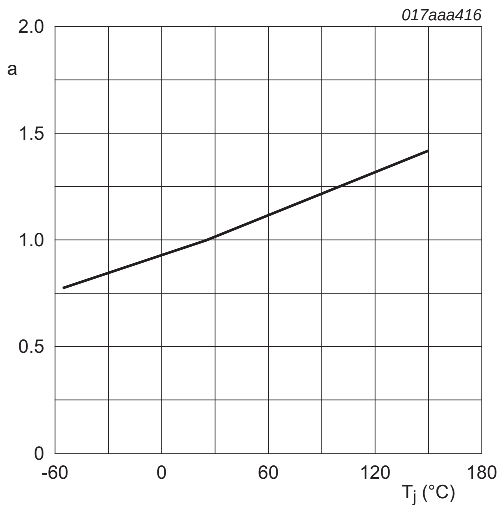


$V_{DS} > I_D \times R_{DSon}$

(1) T_j = 25 °C

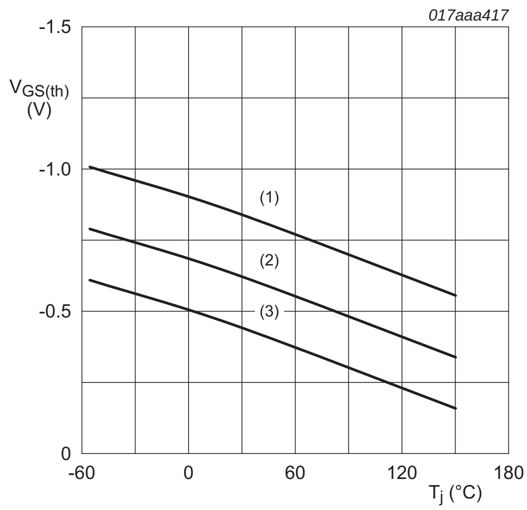
(2) T_j = 150 °C

Fig 20. TR2: Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

Fig 21. TR2: Normalized drain-source on-state resistance as a function of junction temperature; typical values



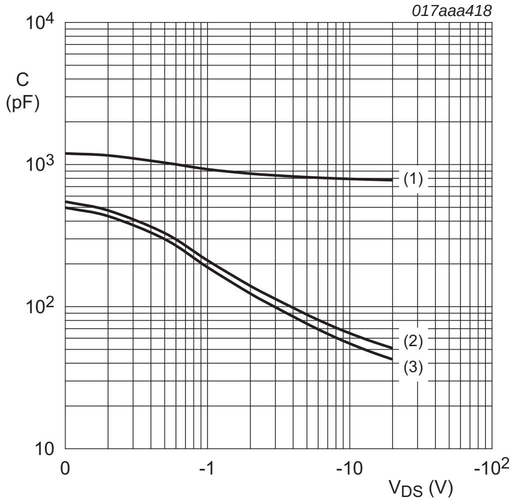
I_D = -0.25 mA; $V_{DS} = V_{GS}$

(1) maximum values

(2) typical values

(3) minimum values

Fig 22. TR2: Gate-source threshold voltage as a function of junction temperature



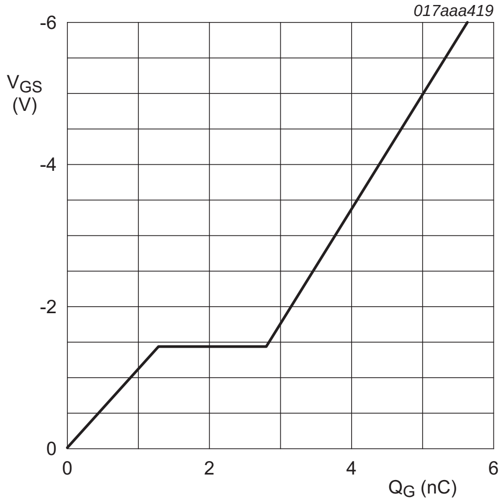
f = 1 MHz; V_{GS} = 0 V

(1) C_{iss}

(2) C_{oss}

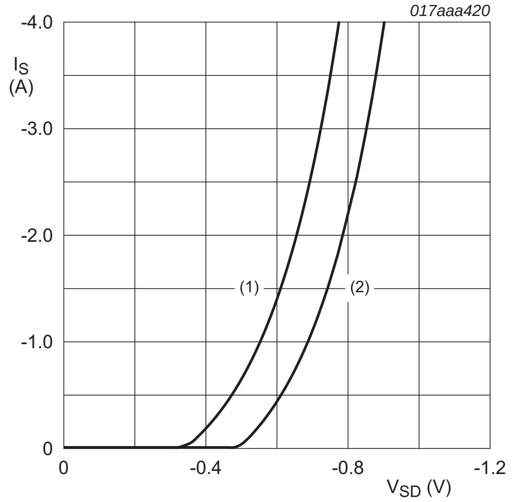
(3) C_{rss}

Fig 23. TR2: Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$I_D = -3.3$ A; $V_{DS} = -10$ V; T_{amb} = 25 °C

Fig 24. TR2: Gate-source voltage as a function of gate charge; typical values



V_{GS} = 0 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

Fig 25. TR2: Source current as a function of source-drain voltage; typical values

8. Test information

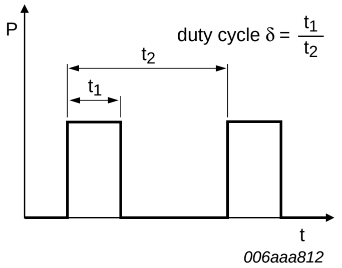


Fig 26. Duty cycle definition

9. Package outline

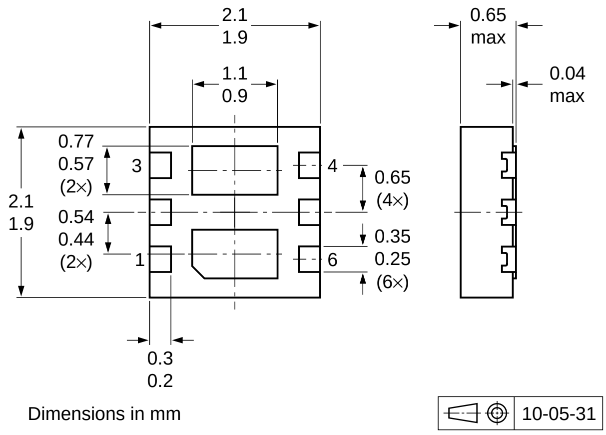


Fig 27. DFN2020-6 (SOT1118)

10. Soldering

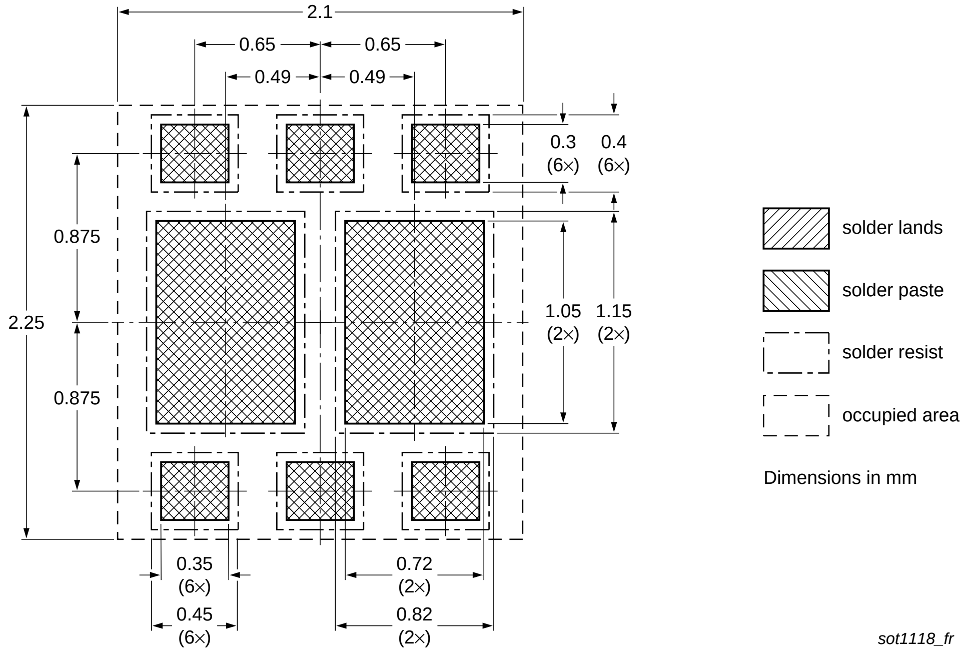


Fig 28. Reflow soldering footprint for SOT1118 (DFN2020-6)

11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMCPB5530X v.1	20120626	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.

[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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