PMFPB6532UP

20 V, 3.5 A / 320 mV V_F P-channel MOSFET-Schottky combination

Rev. 2 — 1 June 2012 Product data sheet

1. Product profile

1.1 General description

Small-signal P-channel enhancement mode Field-Effect Transistor (FET) using Trench MOSFET technology and ultra low V_F Maximum Efficiency General Application (MEGA) Schottky diode combined in a small and leadless ultra thin DFN2020-6 (SOT1118) Surface-Mounted Device (SMD) plastic package.

1.2 Features and benefits

- Trench MOSFET technology
- Integrated ultra low V_F MEGA Schottky diode
- 1 kV ElectroStatic Discharge (ESD) protection
- Small and leadless ultra thin SMD plastic package: 2 × 2 × 0.65 mm
- Exposed drain pad for excellent thermal conduction

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
MOSFET transistor							
V_{DS}	drain-source voltage	T_{amb} = 25 °C		-	-	–20	V
V_{GS}	gate-source voltage	T_{amb} = 25 °C		-	-	±8	V
I_D	drain current	T_{amb} = 25 °C; V_{GS} = –4.5 V	[1]	-	-	–3.5	A
R_{DSon}	drain-source on-state resistance	T_j = 25 °C; V_{GS} = –4.5 V; I_D = –1 A	[2]	-	58	70	mΩ

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

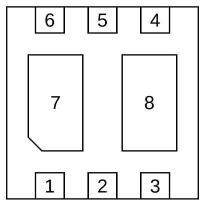
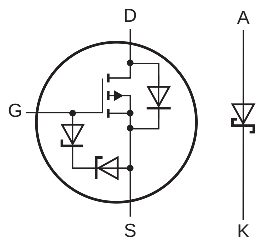
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Schottky diode						
I_F	forward current	$T_{sp} \leq 133$ °C	-	-	2	A
V_R	reverse voltage	$T_{amb} = 25$ °C	-	-	20	V
V_F	forward voltage	$T_{amb} = 25$ °C; $I_F = 1$ A	-	320	365	mV

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

[2] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.01$.

2. Pinning information

Table 2. Pinning

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	A	anode	 Transparent top view	 017aaa600
2	n.c.	not connected		
3	D	drain		
4	S	source		
5	G	gate		
6	K	cathode		
7	K	cathode		
8	D	drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMFPB6532UP	DFN2020-6	plastic thermal enhanced ultra thin small outline package; no leads; 6 terminals; body 2 × 2 × 0.65 mm	SOT1118

4. Marking

Table 4. Marking codes

Type number	Marking code
PMFPB6532UP	1B

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
MOSFET transistor						
V_{DS}	drain-source voltage	T_{amb} = 25 °C		-	–20	V
V_{GS}	gate-source voltage	T_{amb} = 25 °C		-	±8	V
I_D	drain current	V_{GS} = –4.5 V	[1]			
		T_{amb} = 25 °C		-	–3.5	A
		T_{amb} = 100 °C		-	–2.7	A
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; $t_p \leq 10$ µs		-	–20	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	520	mW
			[1]	-	1.25	W
		T_{sp} = 25 °C		-	8.3	W
Source-drain diode						
I_S	source current	T_{amb} = 25 °C	[1]	-	–1.4	A
ESD maximum rating						
V_{ESD}	electrostatic discharge voltage	human body model; C = 100 pF; R = 1.5 kΩ	[3]	-	1000	V
Schottky diode						
V_R	reverse voltage	T_{amb} = 25 °C		-	20	V
I_F	forward current	$T_{sp} \leq 133$ °C		-	2	A
I_{FRM}	repetitive peak forward current	$t_p \leq 1$ ms; $\delta \leq 0.25$; T_{amb} = 25 °C		-	7	A
I_{FSM}	non-repetitive peak forward current	t_p = 8 ms; square wave	[4]	-	18	A
		t_p = 8 ms; half-sine wave	[5]	-	25	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	480	mW
			[1]	-	1190	mW
		T_{sp} = 25 °C		-	8.3	W
Per device						
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			–55	+150	°C
T_{stg}	storage temperature			–65	+150	°C

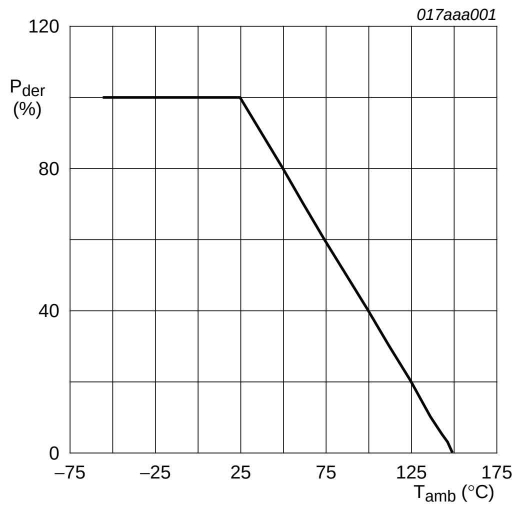
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm^2.

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

[3] Measured between all pins.

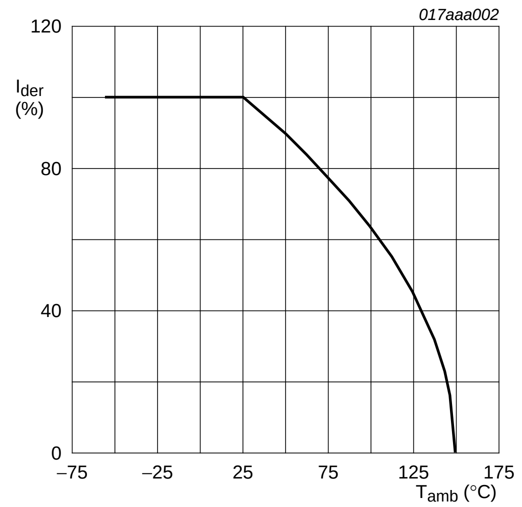
[4] T_j = 25 °C prior to surge.

[5] Calculated from square-wave measurements; T_j = 25 °C prior to surge.



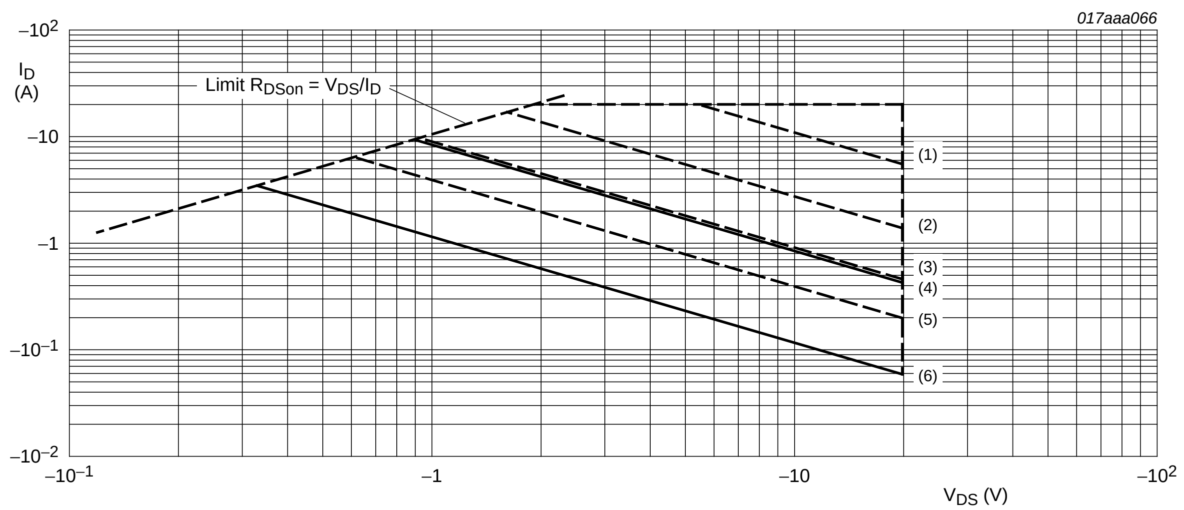
$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\ \%$$

Fig 1. MOSFET transistor: Normalized total power dissipation as a function of ambient temperature



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

Fig 2. MOSFET transistor: Normalized continuous drain current as a function of ambient temperature



I_{DM} = single pulse

(1) t_p = 100 µs

(2) t_p = 1 ms

(3) t_p = 10 ms

(4) DC; T_{sp} = 25 °C

(5) t_p = 100 ms

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

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

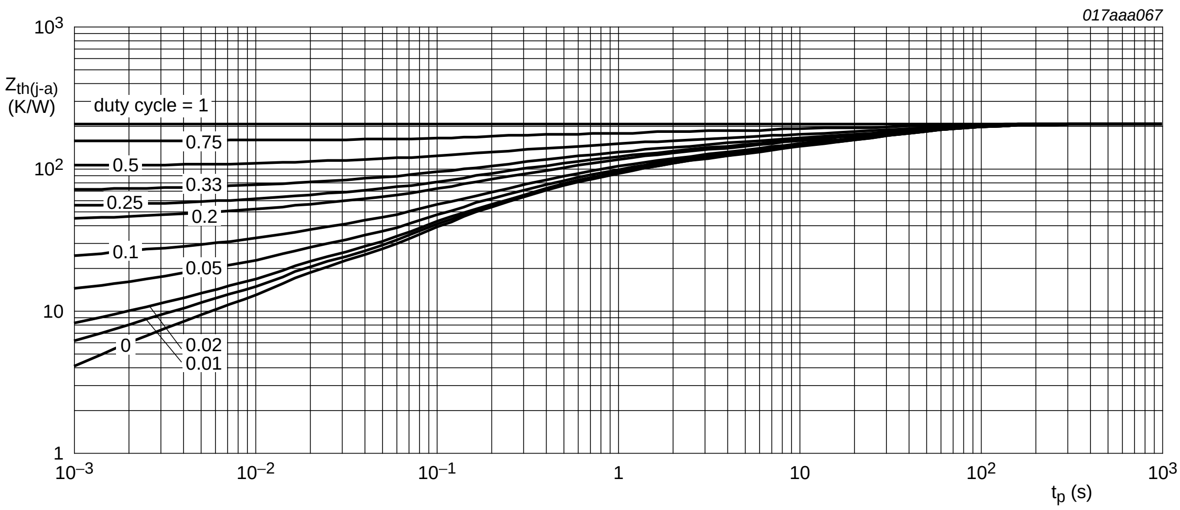
6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
MOSFET transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	240	K/W
			[2]	-	-	100	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	15	K/W
Schottky diode							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	260	K/W
			[2]	-	-	105	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	15	K/W

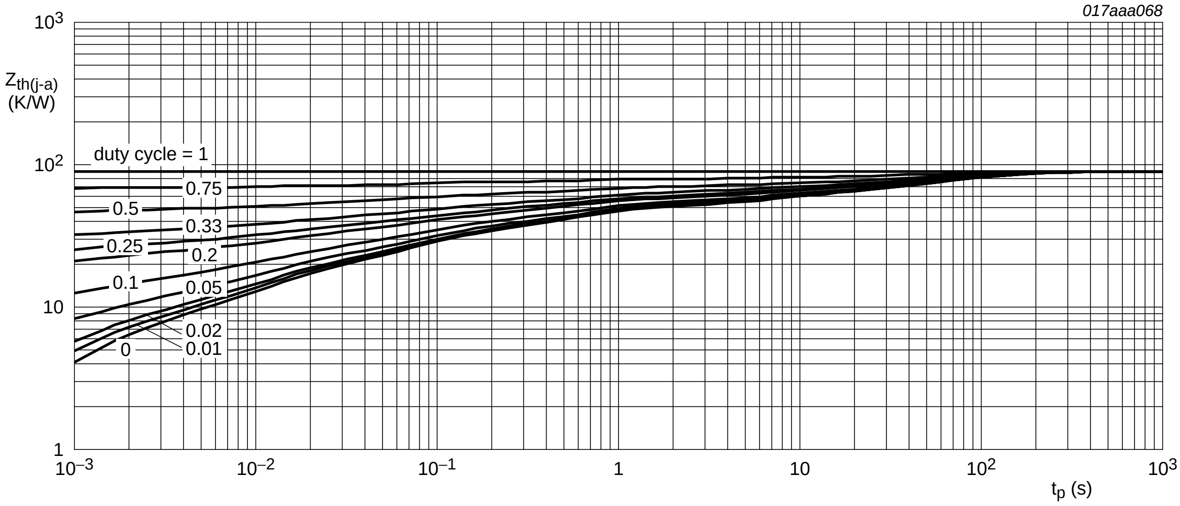
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



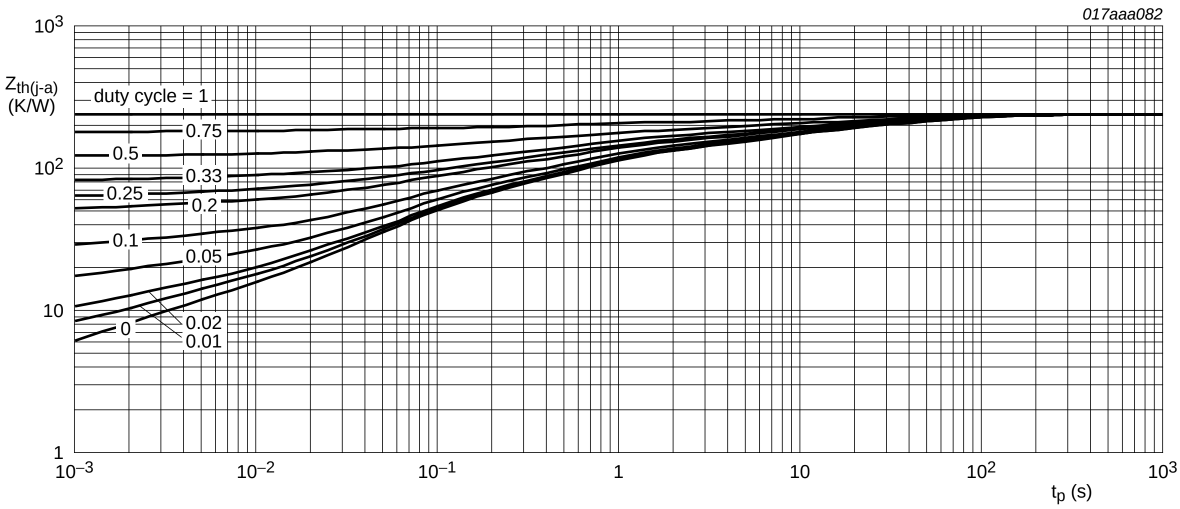
FR4 PCB, standard footprint

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



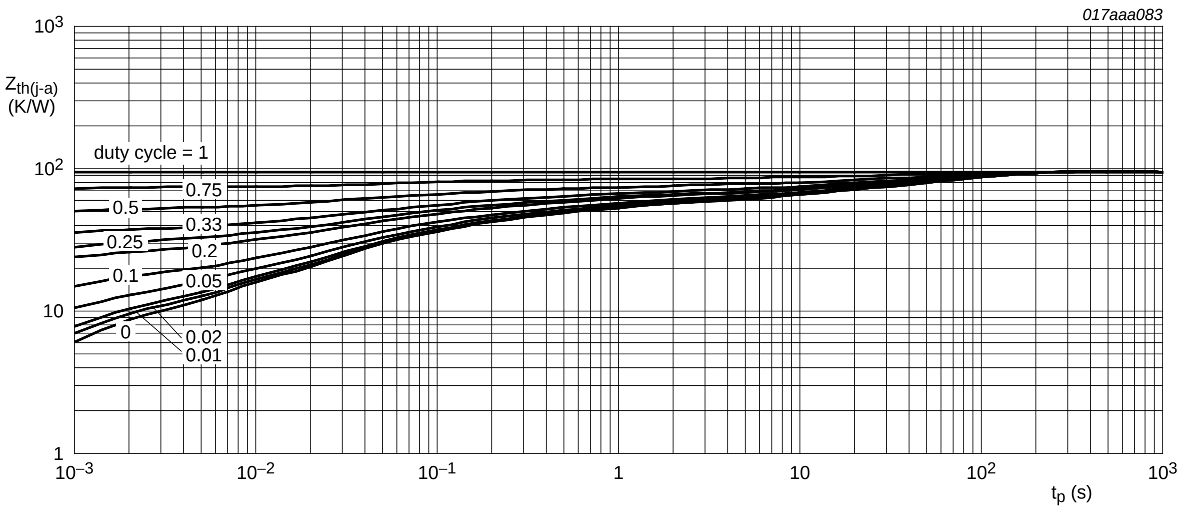
FR4 PCB, mounting pad for drain 6 cm²

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



FR4 PCB, standard footprint

Fig 6. Schottky diode: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



FR4 PCB, mounting pad for cathode 6 cm^2

Fig 7. Schottky diode: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

7. Characteristics

Table 7. Characteristics

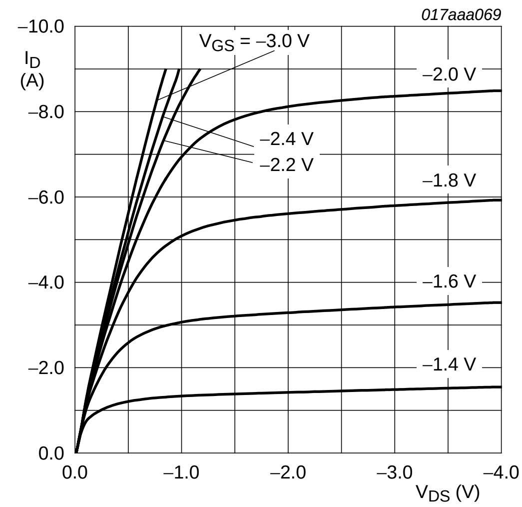
T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
MOSFET transistor						
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = –250 µA; V_{GS} = 0 V	–20	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = –250 µA; V_{DS} = V_{GS}	–0.4	–0.7	–1	V
I_{DSS}	drain leakage current	V_{DS} = –16 V; V_{GS} = 0 V				
		T_j = 25 °C	-	-	–1	µA
		T_j = 150 °C	-	-	–10	µA
I_{GSS}	gate leakage current	V_{GS} = ±8 V; V_{DS} = 0 V	-	1	±10	µA
R_{DSon}	drain-source on-state resistance	[1]				
		V_{GS} = –4.5 V; I_D = –1 A	-	58	70	mΩ
		V_{GS} = –4.5 V; I_D = –1 A; T_j = 150 °C	-	80	100	mΩ
		V_{GS} = –2.5 V; I_D = –1 A	-	72	90	mΩ
		V_{GS} = –1.8 V; I_D = –0.5 A	-	100	165	mΩ
g_{fs}	forward transconductance	V_{DS} = –5 V; I_D = –1 A [1]	-	8	-	S

Table 7. Characteristics *...continued*
T_j = 25 °C unless otherwise specified.

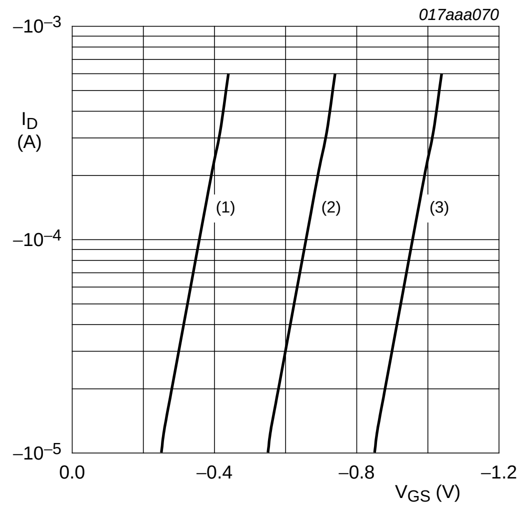
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	I_D = –3.3 A; V_{DS} = –10 V; V_{GS} = –4.5 V	-	4.5	6	nC
Q_{GS}	gate-source charge		-	0.8	-	nC
Q_{GD}	gate-drain charge		-	1	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = –10 V; f = 1 MHz	-	380	-	pF
C_{oss}	output capacitance		-	72	-	pF
C_{rss}	reverse transfer capacitance		-	61	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = –15 V; R_L = 15 Ω; V_{GS} = –10 V; R_G = 6 Ω	-	5	-	ns
t_r	rise time		-	10	-	ns
$t_{d(off)}$	turn-off delay time		-	57	-	ns
t_f	fall time		-	35	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	I_S = –1.3 A; V_{GS} = 0 V	-	–0.75	–1	V
Schottky diode						
V_F	forward voltage	I_F = 100 mA	-	225	275	mV
		I_F = 500 mA	-	285	335	mV
		I_F = 1 A	-	320	365	mV
I_R	reverse current	V_R = 5 V	-	65	220	µA
		V_R = 5 V; T_j = 125 °C	-	13	50	mA
		V_R = 10 V	-	110	400	µA
		V_R = 20 V	-	230	700	µA
C_d	diode capacitance	V_R = 5 V; f = 1 MHz	-	60	70	pF

[1] Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.01$.



T_{amb} = 25 °C

Fig 8. MOSFET transistor: Output characteristics: drain current as a function of drain-source voltage; typical values



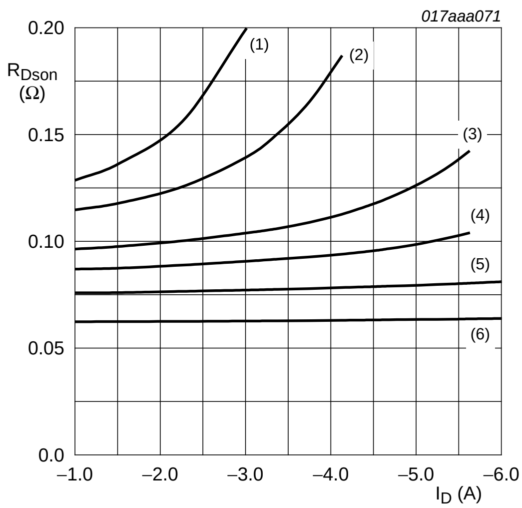
T_{amb} = 25 °C; V_{DS} = −5 V

(1) minimum values

(2) typical values

(3) maximum values

Fig 9. MOSFET transistor: Sub-threshold drain current as a function of gate-source voltage



T_{amb} = 25 °C

(1) V_{GS} = −1.5 V

(2) V_{GS} = −1.6 V

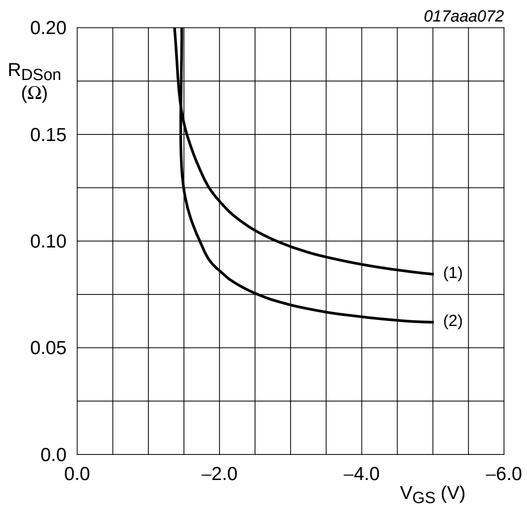
(3) V_{GS} = −1.8 V

(4) V_{GS} = −2 V

(5) V_{GS} = −2.5 V

(6) V_{GS} = −4.5 V

Fig 10. MOSFET transistor: Drain-source on-state resistance as a function of drain current; typical values

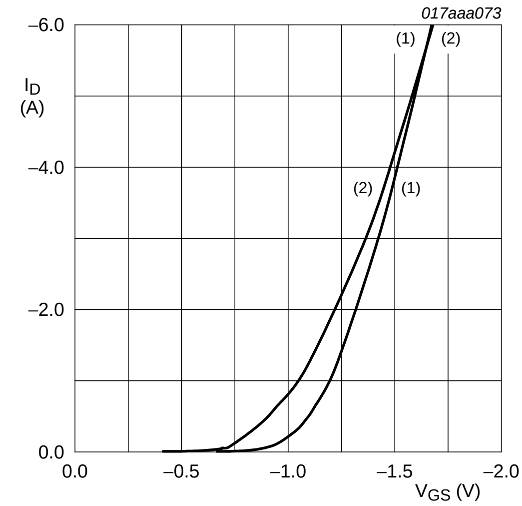


I_D = −1 A

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

Fig 11. MOSFET transistor: Drain-source on-state resistance as a function of gate-source voltage; typical values

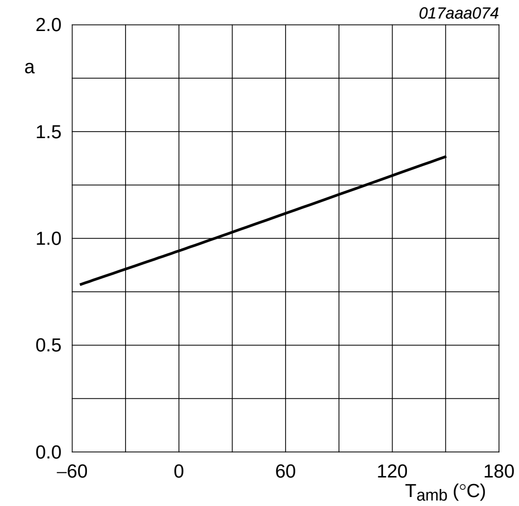


$V_{DS} > I_D \times R_{DSon}$

(1) T_{amb} = 25 °C

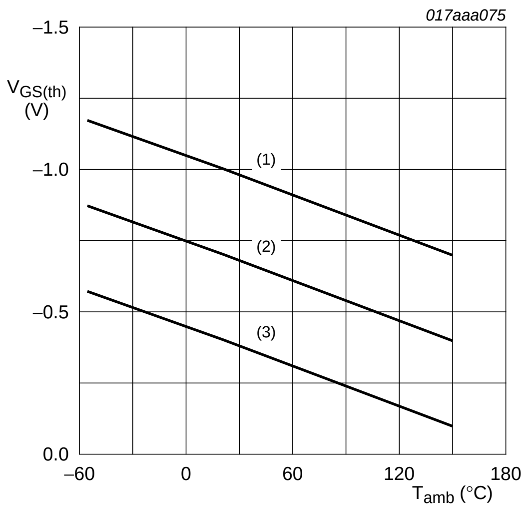
(2) T_{amb} = 150 °C

Fig 12. MOSFET transistor: Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

Fig 13. MOSFET transistor: Normalized drain-source on-state resistance as a function of ambient temperature; typical values



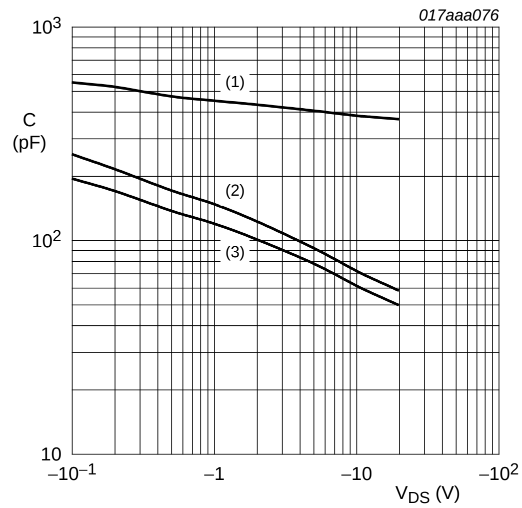
I_D = −0.25 mA; $V_{DS} = V_{GS}$

(1) maximum values

(2) typical values

(3) minimum values

Fig 14. MOSFET transistor: Gate-source threshold voltage as a function of ambient temperature



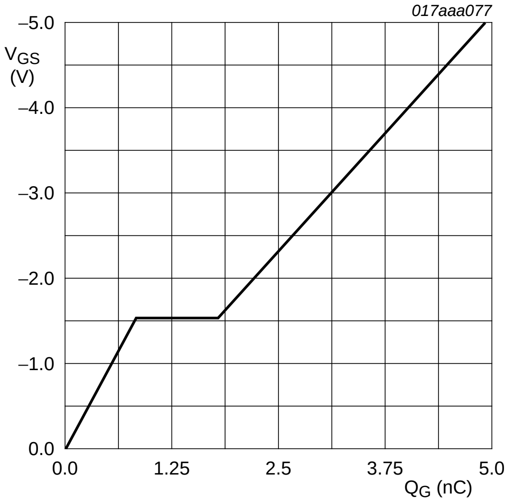
f = 1 MHz; V_{GS} = 0 V

(1) C_{iss}

(2) C_{oss}

(3) C_{rss}

Fig 15. MOSFET transistor: 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 16. MOSFET transistor: Gate-source voltage as a function of gate charge; typical values

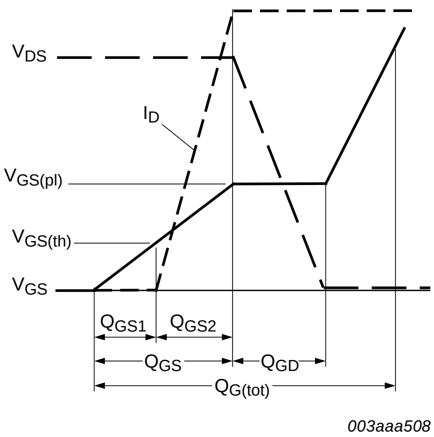
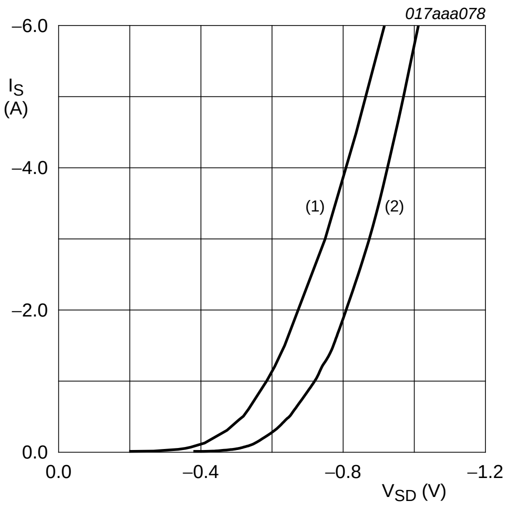


Fig 17. MOSFET transistor: Gate charge waveform definitions

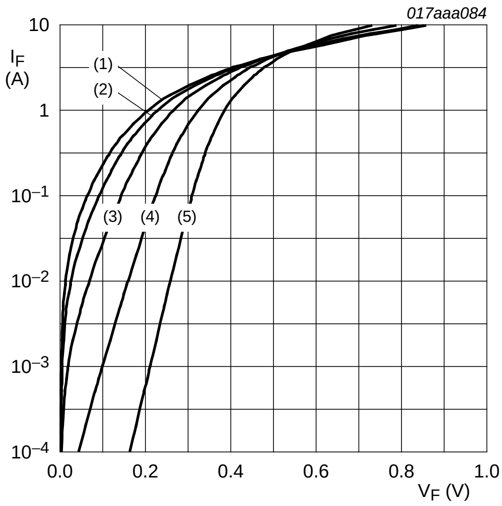


$V_{GS} = 0$ V

(1) $T_{amb} = 150$ °C

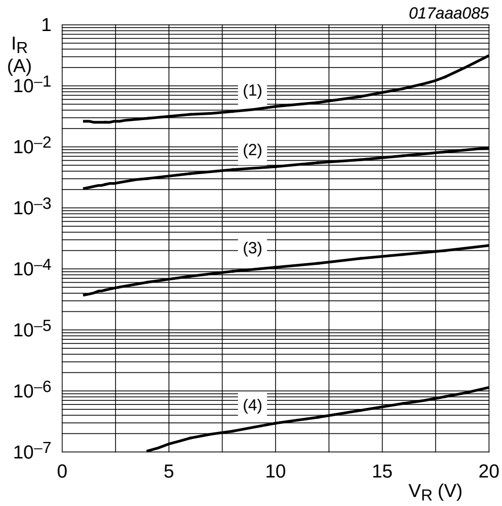
(2) $T_{amb} = 25$ °C

Fig 18. MOSFET transistor: Source current as a function of source-drain voltage; typical values



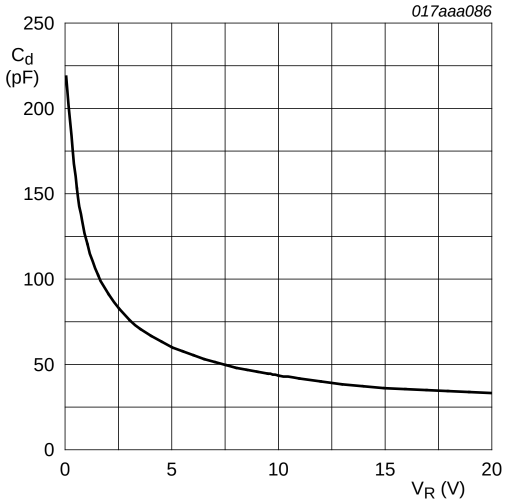
(1) T_j = 150 °C
(2) T_j = 125 °C
(3) T_j = 85 °C
(4) T_j = 25 °C
(5) T_j = –40 °C

Fig 19. Schottky diode: Forward current as a function of forward voltage; typical values



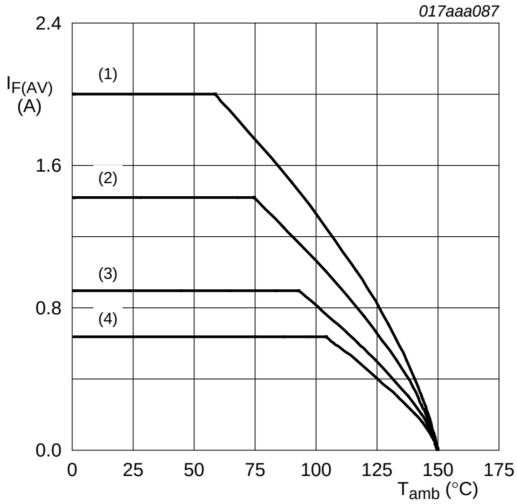
(1) T_j = 125 °C
(2) T_j = 85 °C
(3) T_j = 25 °C
(4) T_j = –40 °C

Fig 20. Schottky diode: Reverse current as a function of reverse voltage; typical values



f = 1 MHz; T_{amb} = 25 °C

Fig 21. Schottky diode: Diode capacitance as a function of reverse voltage; typical values



FR4 PCB, mounting pad for cathode 6 cm^2

T_j = 150 °C

(1) δ = 1; DC
(2) δ = 0.5; f = 20 kHz
(3) δ = 0.2; f = 20 kHz
(4) δ = 0.1; f = 20 kHz

Fig 22. Schottky diode: Average forward current as a function of ambient temperature; typical values

8. Test information

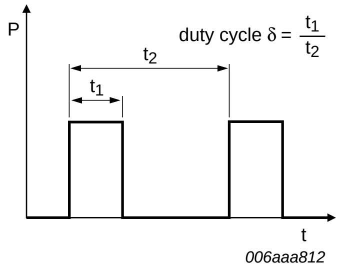


Fig 23. Duty cycle definition

9. Package outline

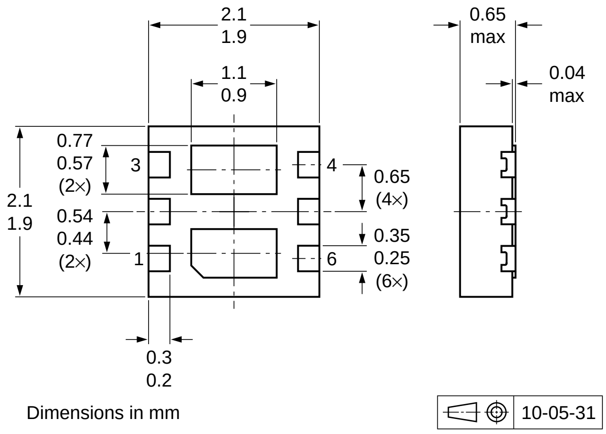


Fig 24. Package outline DFN2020-6 (SOT1118)

10. Soldering

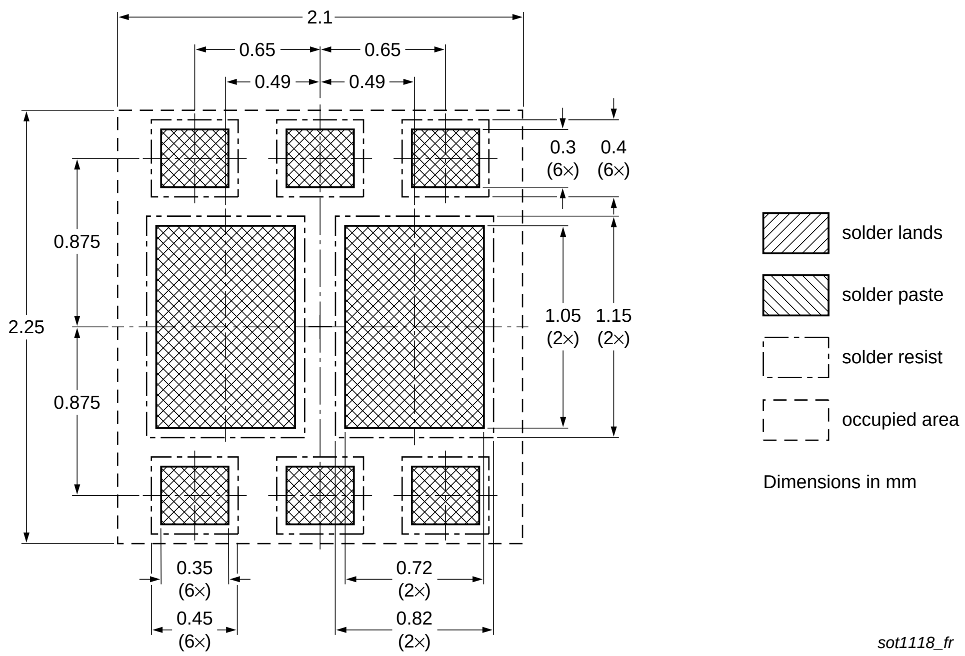


Fig 25. Reflow soldering footprint DFN2020-6 (SOT1118)

11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMFPB6532UP v.2	20120601	Product data sheet	-	PMFPB6532UP v.1
Modifications:	• Section 1.1 "General description": updated • Table 2 "Pinning": graphic symbol drawing updated • Figure 24: replaced with minimized package outline drawing			
PMFPB6532UP v.1	20110309	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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