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Kind regards,

Team Nexperia



# 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:  $2 \times 2 \times 0.65$  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
<b>MOSFET transistor</b>						
$V_{DS}$	drain-source voltage	$T_{amb} = 25\text{ °C}$	-	-	-20	V
$V_{GS}$	gate-source voltage	$T_{amb} = 25\text{ °C}$	-	-	$\pm 8$	V
$I_D$	drain current	$T_{amb} = 25\text{ °C};$ $V_{GS} = -4.5\text{ V}$	[1] -	-	-3.5	A
$R_{DSon}$	drain-source on-state resistance	$T_j = 25\text{ °C};$ $V_{GS} = -4.5\text{ V};$ $I_D = -1\text{ A}$	[2] -	58	70	m $\Omega$



Table 1. Quick reference data ...continued

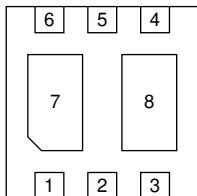
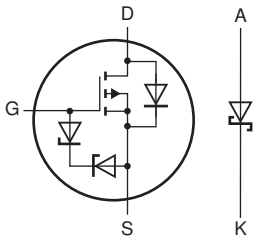
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Schottky diode</b>						
$I_F$	forward current	$T_{sp} \leq 133\text{ °C}$	-	-	2	A
$V_R$	reverse voltage	$T_{amb} = 25\text{ °C}$	-	-	20	V
$V_F$	forward voltage	$T_{amb} = 25\text{ °C};$ $I_F = 1\text{ A}$	-	320	365	mV

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

[2] Pulse test:  $t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.01$ .

## 2. Pinning information

Table 2. Pinning

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

017aaa600

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

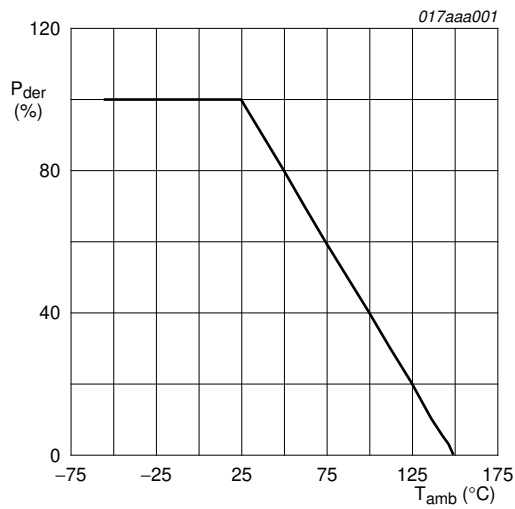
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

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

[3] Measured between all pins.

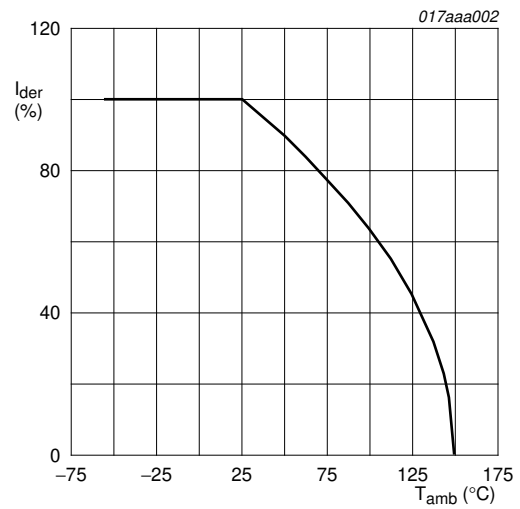
[4]  $T_j = 25\text{ °C}$  prior to surge.

[5] Calculated from square-wave measurements;  $T_j = 25\text{ °C}$  prior to surge.



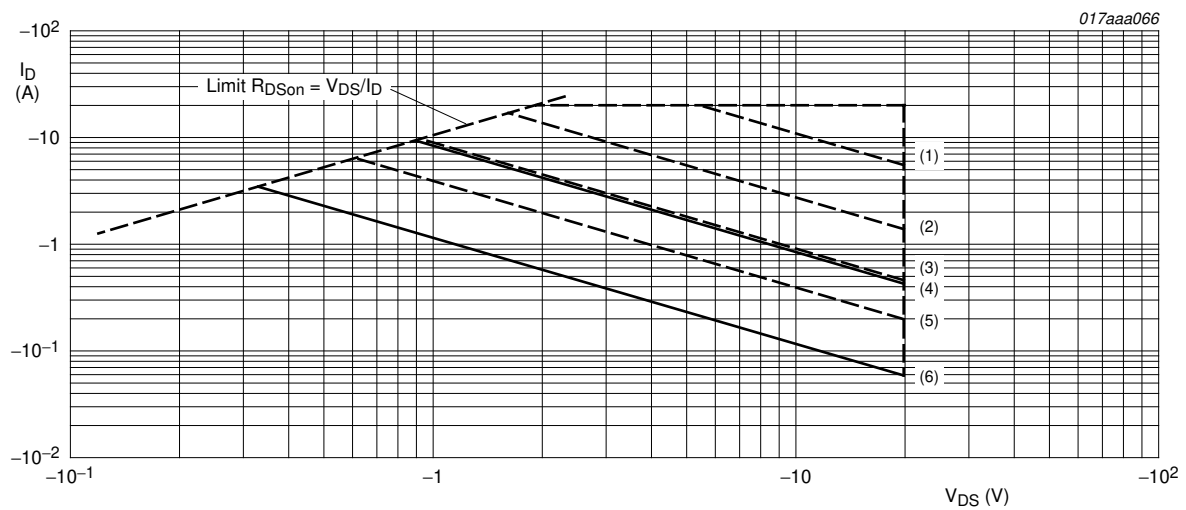
$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100\%$$

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



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

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



- $I_{DM}$  = single pulse
- (1)  $t_p = 100 \mu s$
  - (2)  $t_p = 1 ms$
  - (3)  $t_p = 10 ms$
  - (4) DC;  $T_{sp} = 25^\circ C$
  - (5)  $t_p = 100 ms$
  - (6) DC;  $T_{amb} = 25^\circ C$ ; 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**

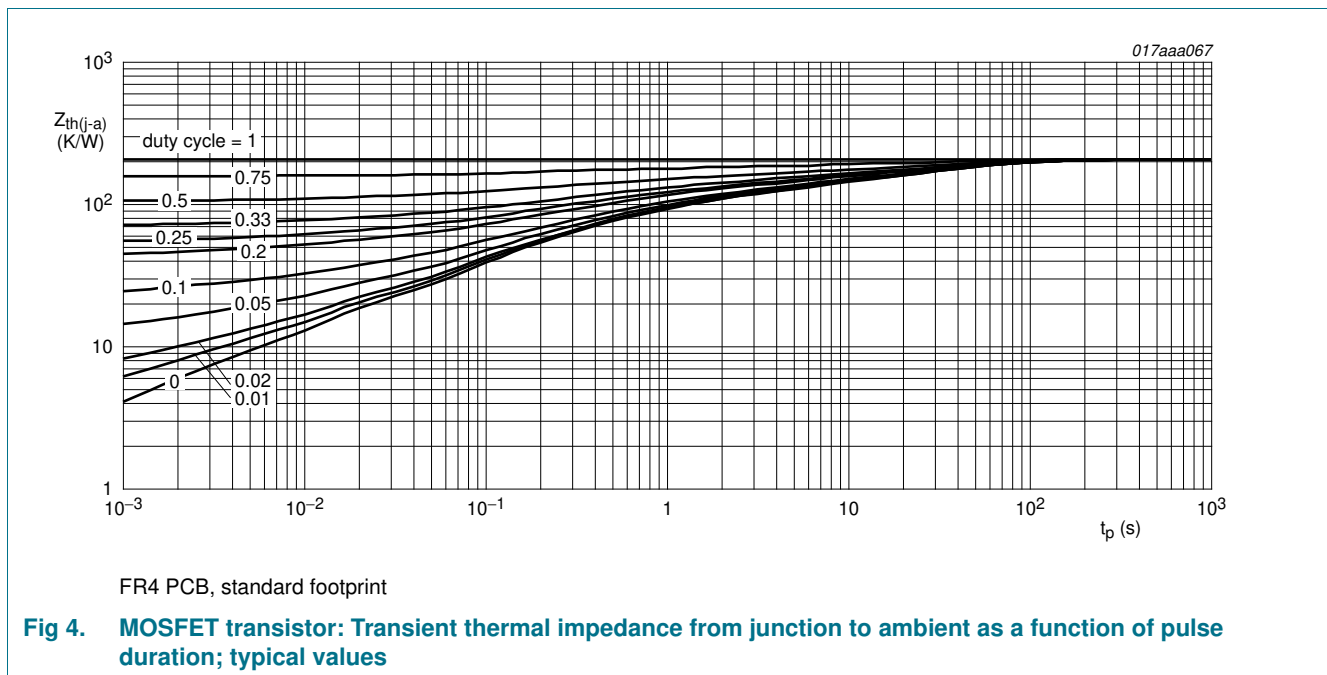
## 6. Thermal characteristics

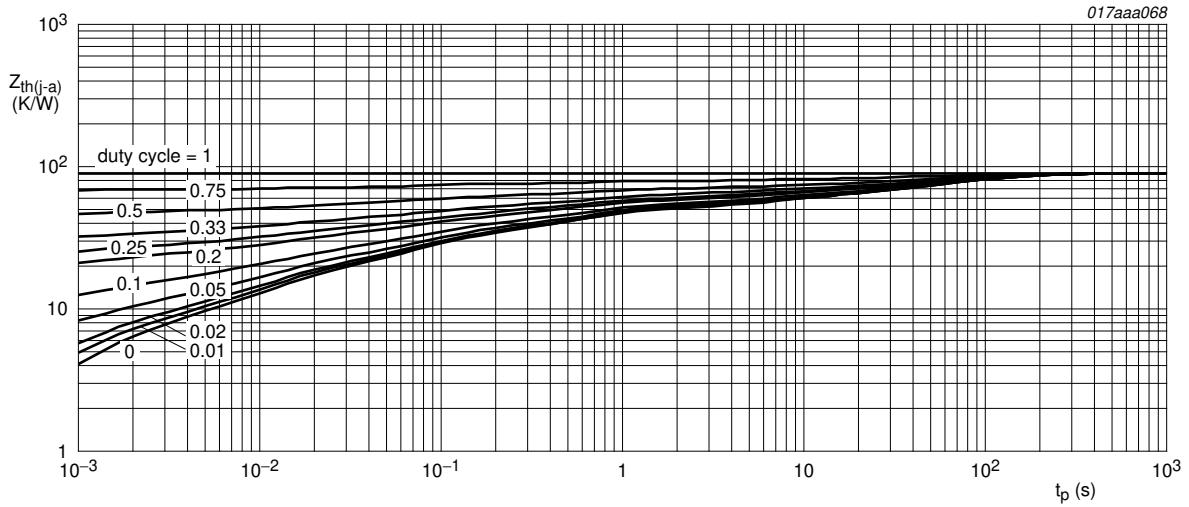
Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>MOSFET transistor</b>						
$R_{th(j-a)}$	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
<b>Schottky diode</b>						
$R_{th(j-a)}$	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.

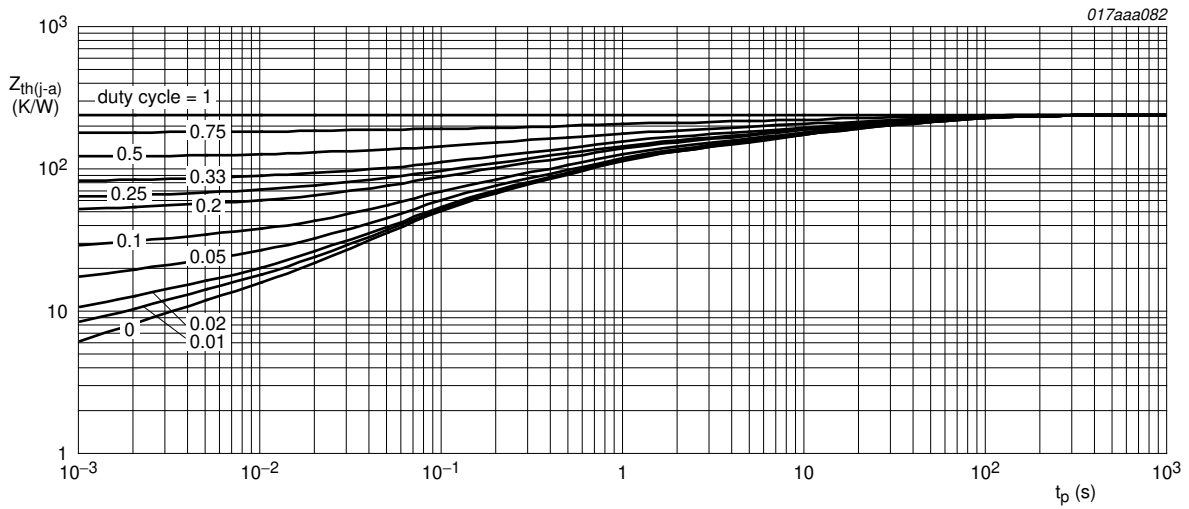
[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.





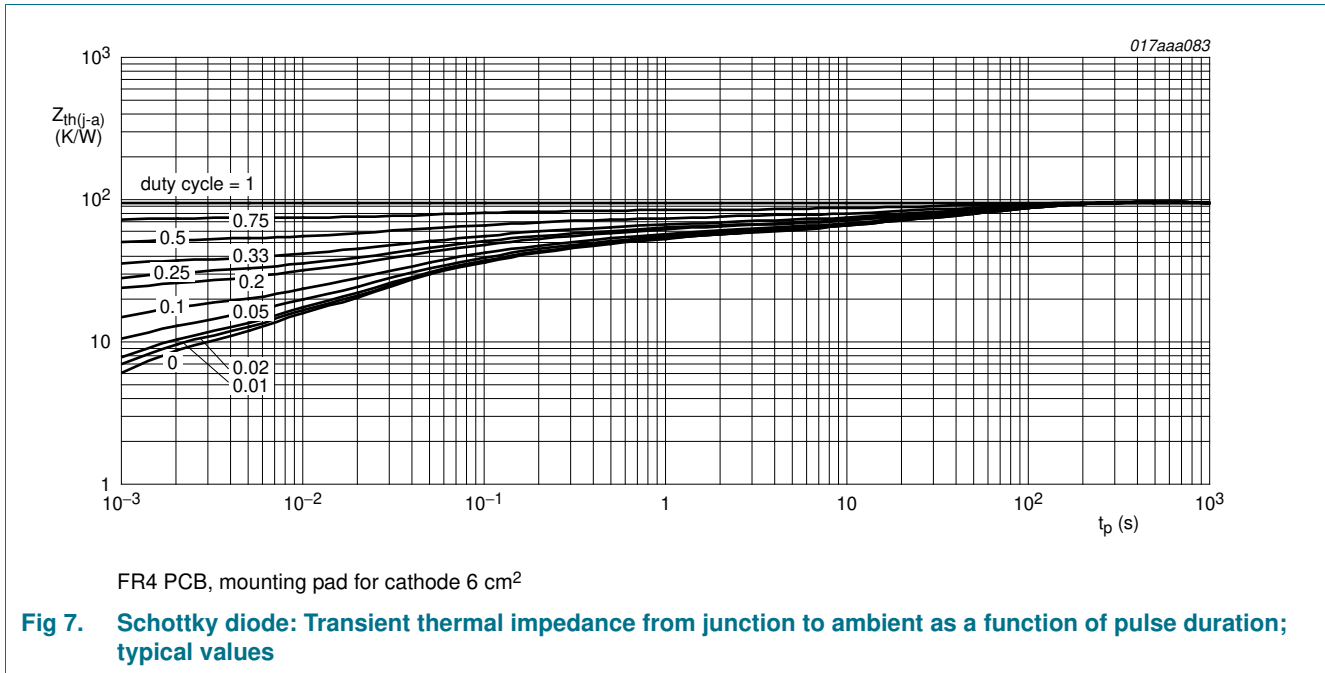
FR4 PCB, mounting pad for drain 6 cm<sup>2</sup>

**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**



## 7. Characteristics

**Table 7. Characteristics**  
*T<sub>j</sub> = 25 °C unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>MOSFET transistor</b>						
<i>Static characteristics</i>						
V <sub>(BR)DSS</sub>	drain-source breakdown voltage	I <sub>D</sub> = -250 μA; V <sub>GS</sub> = 0 V	-20	-	-	V
V <sub>GS(th)</sub>	gate-source threshold voltage	I <sub>D</sub> = -250 μA; V <sub>DS</sub> = V <sub>GS</sub>	-0.4	-0.7	-1	V
I <sub>DSS</sub>	drain leakage current	V <sub>DS</sub> = -16 V; V <sub>GS</sub> = 0 V				
		T <sub>j</sub> = 25 °C	-	-	-1	μA
		T <sub>j</sub> = 150 °C	-	-	-10	μA
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = ±8 V; V <sub>DS</sub> = 0 V	-	1	±10	μA
R <sub>DSon</sub>	drain-source on-state resistance		[1]			
		V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -1 A	-	58	70	mΩ
		V <sub>GS</sub> = -4.5 V; I <sub>D</sub> = -1 A; T <sub>j</sub> = 150 °C	-	80	100	mΩ
		V <sub>GS</sub> = -2.5 V; I <sub>D</sub> = -1 A	-	72	90	mΩ
		V <sub>GS</sub> = -1.8 V; I <sub>D</sub> = -0.5 A	-	100	165	mΩ
g <sub>fs</sub>	forward transconductance	V <sub>DS</sub> = -5 V; I <sub>D</sub> = -1 A	[1]	8	-	S



**Table 7. Characteristics ...continued**  
*T<sub>j</sub> = 25 °C unless otherwise specified.*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Dynamic characteristics</b>						
Q <sub>G(tot)</sub>	total gate charge	I <sub>D</sub> = -3.3 A;	-	4.5	6	nC
Q <sub>GS</sub>	gate-source charge	V <sub>DS</sub> = -10 V;	-	0.8	-	nC
Q <sub>GD</sub>	gate-drain charge	V <sub>GS</sub> = -4.5 V	-	1	-	nC
C <sub>iss</sub>	input capacitance	V <sub>GS</sub> = 0 V; V <sub>DS</sub> = -10 V;	-	380	-	pF
C <sub>oss</sub>	output capacitance	f = 1 MHz	-	72	-	pF
C <sub>rss</sub>	reverse transfer capacitance		-	61	-	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = -15 V; R <sub>L</sub> = 15 Ω;	-	5	-	ns
t <sub>r</sub>	rise time	V <sub>GS</sub> = -10 V; R <sub>G</sub> = 6 Ω	-	10	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	57	-	ns
t <sub>f</sub>	fall time		-	35	-	ns
<b>Source-drain diode</b>						
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = -1.3 A; V <sub>GS</sub> = 0 V	-	-0.75	-1	V
<b>Schottky diode</b>						
V <sub>F</sub>	forward voltage	I <sub>F</sub> = 100 mA	-	225	275	mV
		I <sub>F</sub> = 500 mA	-	285	335	mV
		I <sub>F</sub> = 1 A	-	320	365	mV
I <sub>R</sub>	reverse current	V <sub>R</sub> = 5 V	-	65	220	μA
		V <sub>R</sub> = 5 V; T <sub>j</sub> = 125 °C	-	13	50	mA
		V <sub>R</sub> = 10 V	-	110	400	μA
		V <sub>R</sub> = 20 V	-	230	700	μA
C <sub>d</sub>	diode capacitance	V <sub>R</sub> = 5 V; f = 1 MHz	-	60	70	pF

[1] Pulse test: t<sub>p</sub> ≤ 300 μs; δ ≤ 0.01.

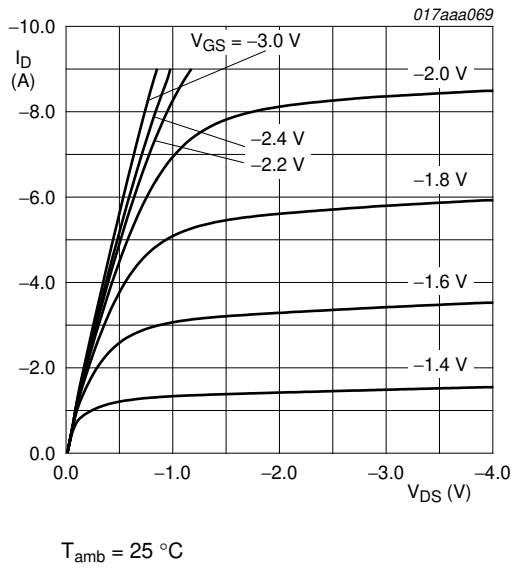


Fig 8. MOSFET transistor: Output characteristics: drain current as a function of drain-source voltage; typical values

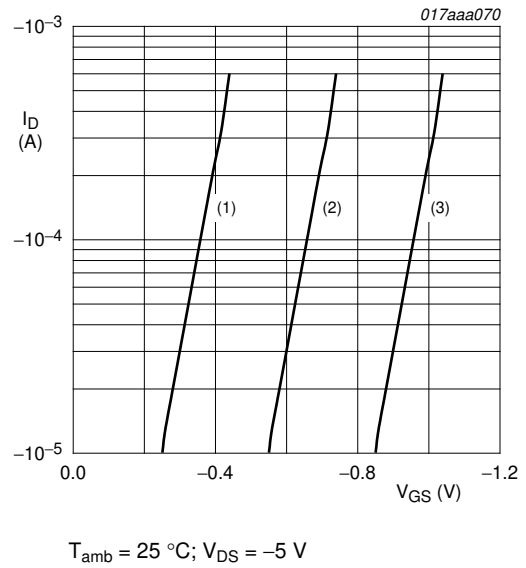
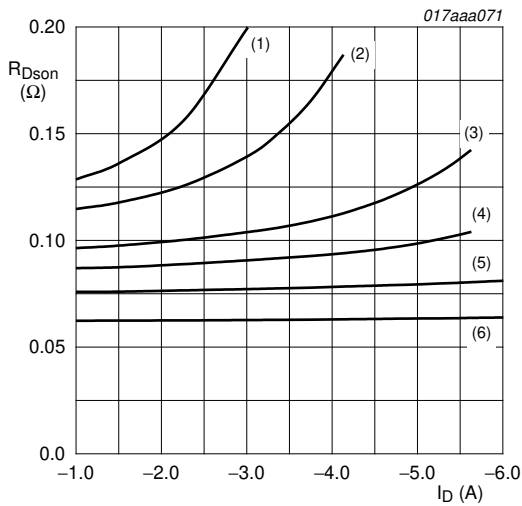
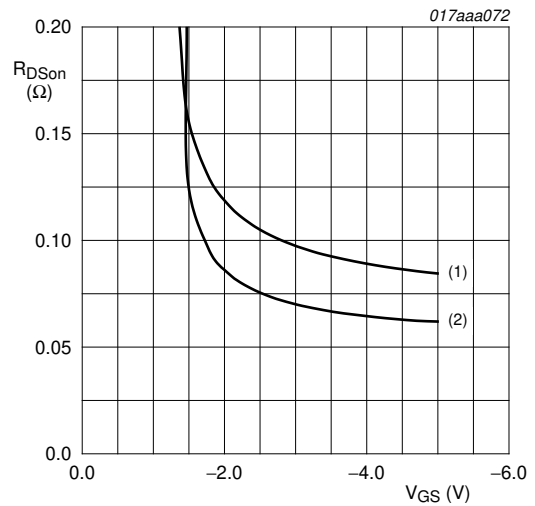


Fig 9. MOSFET transistor: Sub-threshold drain current as a function of gate-source voltage



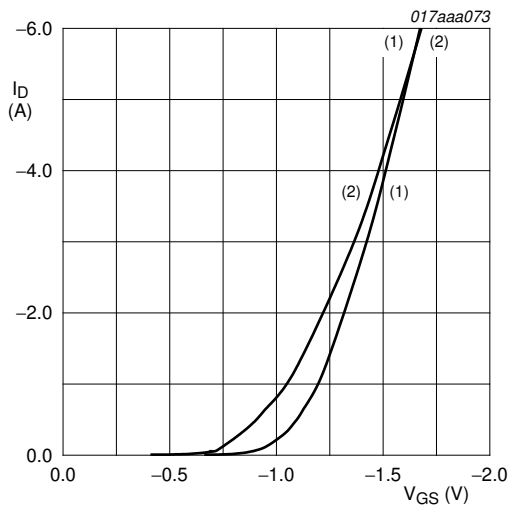
- $T_{amb} = 25\text{ }^\circ\text{C}$
- (1)  $V_{GS} = -1.5\text{ V}$
  - (2)  $V_{GS} = -1.6\text{ V}$
  - (3)  $V_{GS} = -1.8\text{ V}$
  - (4)  $V_{GS} = -2\text{ V}$
  - (5)  $V_{GS} = -2.5\text{ V}$
  - (6)  $V_{GS} = -4.5\text{ V}$

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



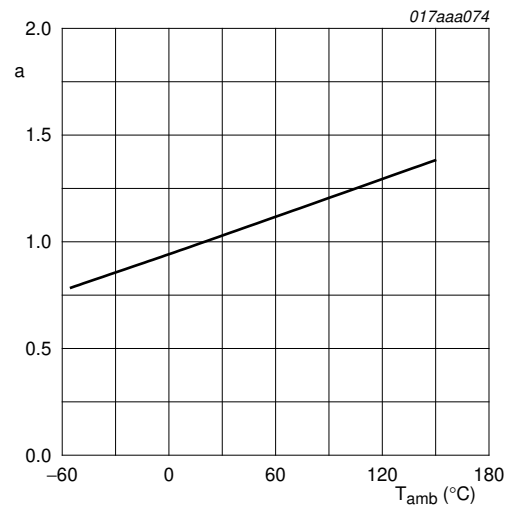
- $I_D = -1\text{ A}$
- (1)  $T_{amb} = 150\text{ }^\circ\text{C}$
  - (2)  $T_{amb} = 25\text{ }^\circ\text{C}$

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



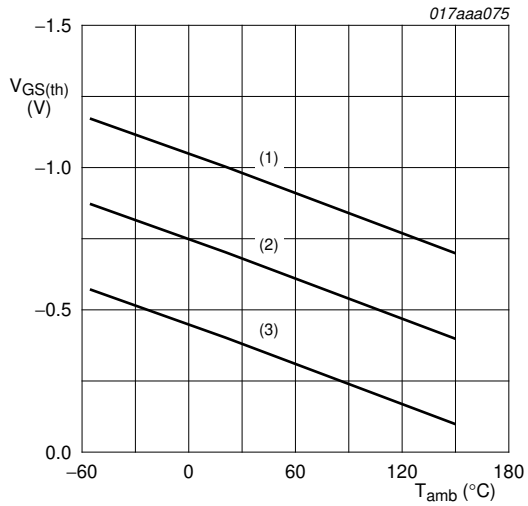
$V_{DS} > I_D \times R_{DSon}$   
 (1)  $T_{amb} = 25\text{ °C}$   
 (2)  $T_{amb} = 150\text{ °C}$

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



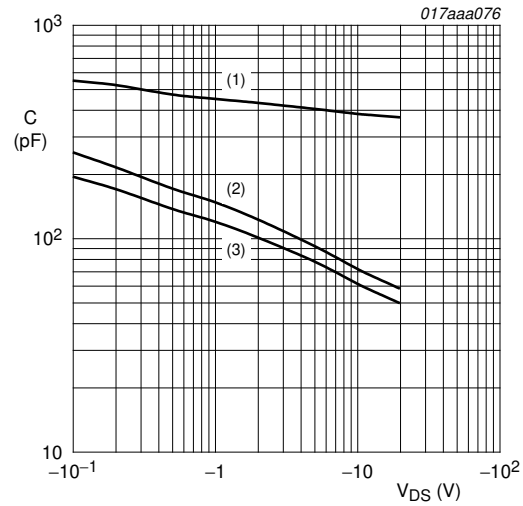
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ C)}}$$

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



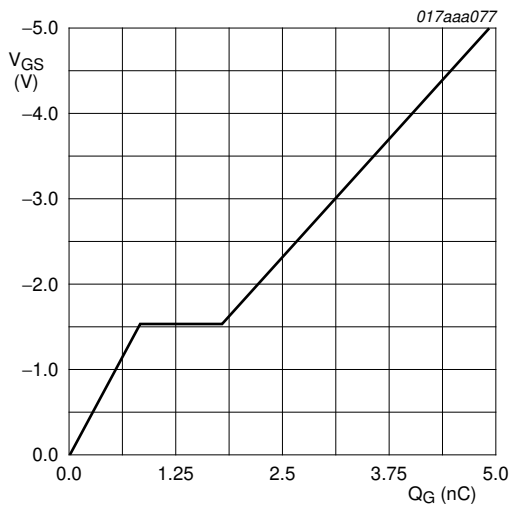
$I_D = -0.25\text{ mA}; V_{DS} = V_{GS}$   
 (1) maximum values  
 (2) typical values  
 (3) minimum values

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



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



$I_D = -3.3 \text{ A}; V_{DS} = -10 \text{ V}; T_{amb} = 25 \text{ }^\circ\text{C}$

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

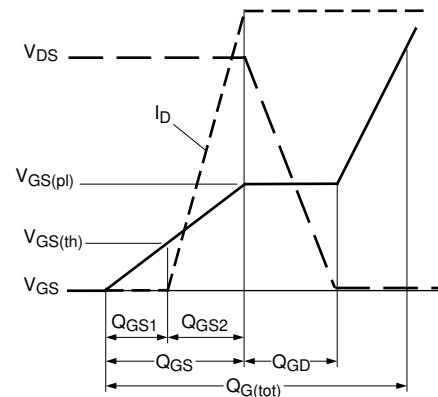
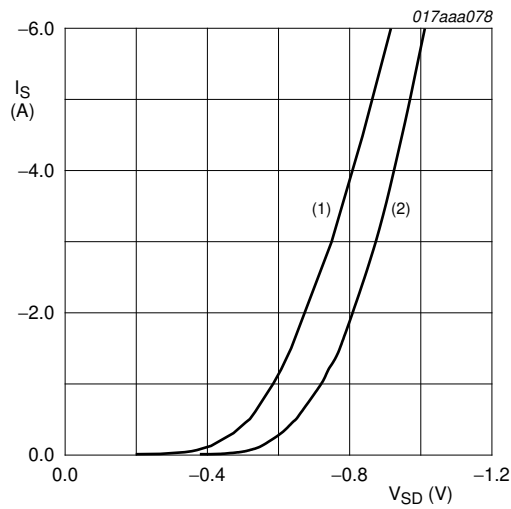


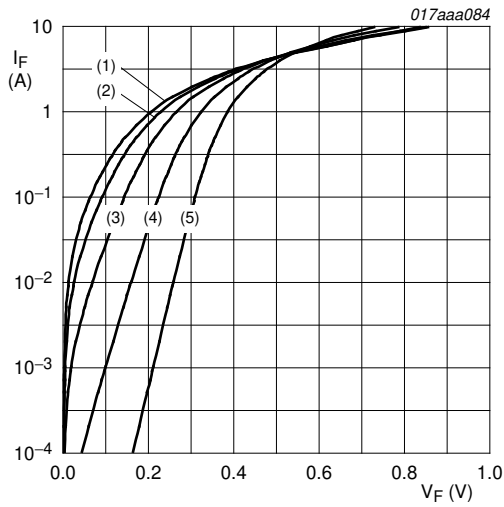
Fig 17. MOSFET transistor: Gate charge waveform definitions



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

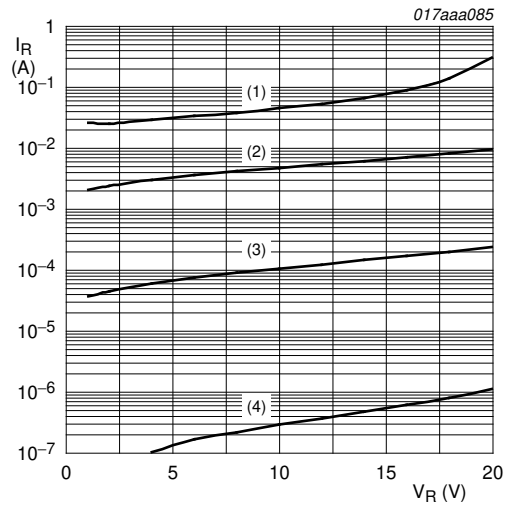
- (1)  $T_{amb} = 150 \text{ }^\circ\text{C}$
- (2)  $T_{amb} = 25 \text{ }^\circ\text{C}$

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



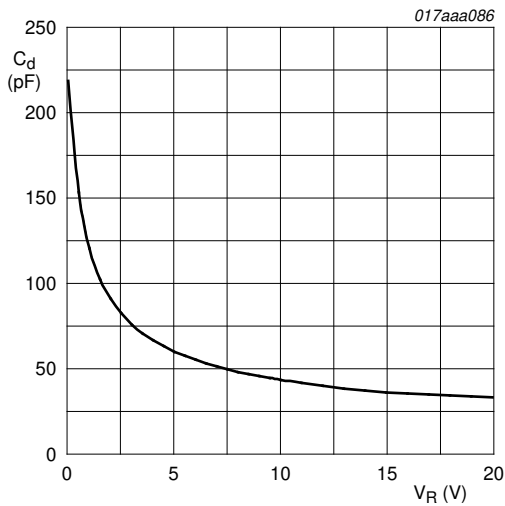
- (1)  $T_j = 150\text{ }^\circ\text{C}$
- (2)  $T_j = 125\text{ }^\circ\text{C}$
- (3)  $T_j = 85\text{ }^\circ\text{C}$
- (4)  $T_j = 25\text{ }^\circ\text{C}$
- (5)  $T_j = -40\text{ }^\circ\text{C}$

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



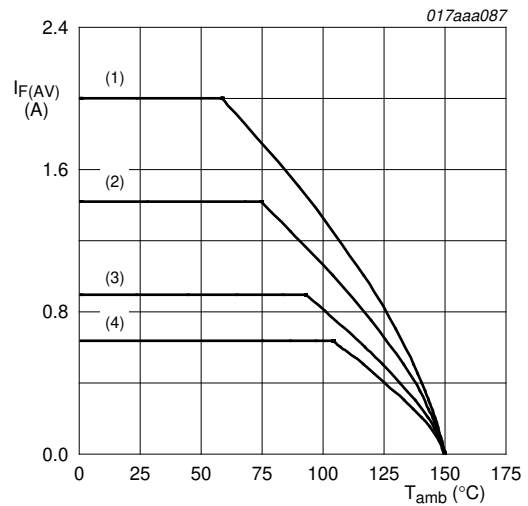
- (1)  $T_j = 125\text{ }^\circ\text{C}$
- (2)  $T_j = 85\text{ }^\circ\text{C}$
- (3)  $T_j = 25\text{ }^\circ\text{C}$
- (4)  $T_j = -40\text{ }^\circ\text{C}$

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



$f = 1\text{ MHz}; T_{amb} = 25\text{ }^\circ\text{C}$

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



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

$T_j = 150\text{ }^\circ\text{C}$

- (1)  $\delta = 1; \text{DC}$
- (2)  $\delta = 0.5; f = 20\text{ kHz}$
- (3)  $\delta = 0.2; f = 20\text{ kHz}$
- (4)  $\delta = 0.1; f = 20\text{ kHz}$

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

## 8. Test information

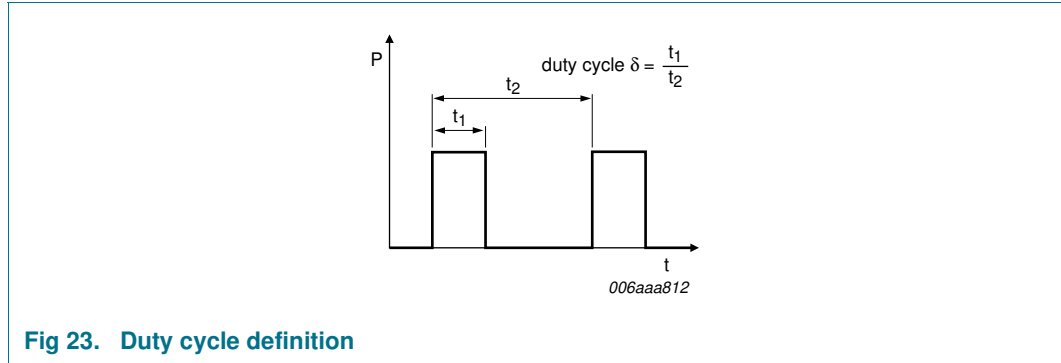


Fig 23. Duty cycle definition

## 9. Package outline

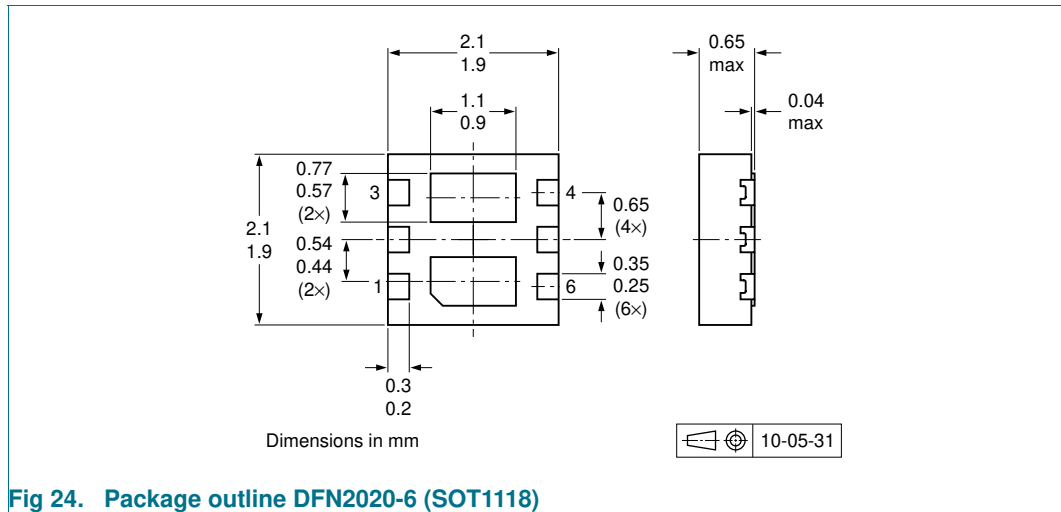


Fig 24. Package outline DFN2020-6 (SOT1118)

10. Soldering

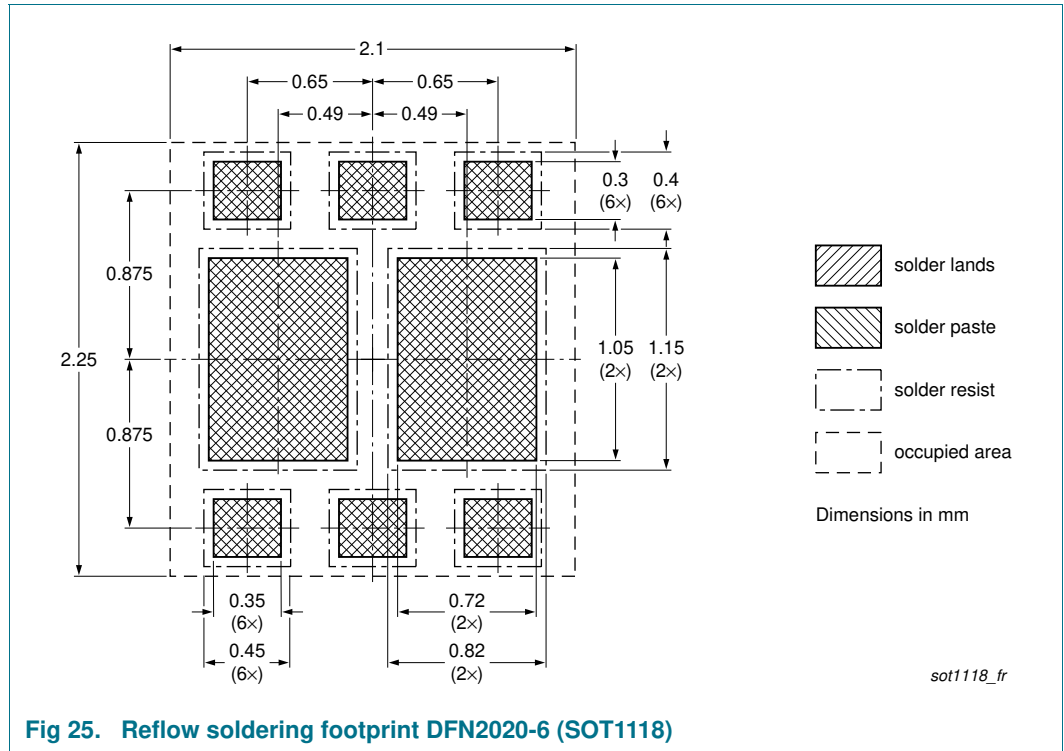


Fig 25. Reflow soldering footprint DFN2020-6 (SOT1118)

## 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:		<ul style="list-style-type: none"><li>• <a href="#">Section 1.1 “General description”</a>: updated</li><li>• <a href="#">Table 2 “Pinning”</a>: graphic symbol drawing updated</li><li>• <a href="#">Figure 24</a>: replaced with minimized package outline drawing</li></ul>		
PMFPB6532UP v.1	20110309	Product data sheet	-	-



## 12. Legal information

### 12.1 Data sheet status

Document status <sup>[1][2]</sup>	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.

[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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