



# PMZB670UPE

20 V, single P-channel Trench MOSFET

Rev. 3 — 23 March 2012

Product data sheet

## 1. Product profile

### 1.1 General description

P-channel enhancement mode Field-Effect Transistor (FET) in a leadless ultra small DFN1006B-3 (SOT883B) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

### 1.2 Features and benefits

- Very fast switching
- Low threshold voltage
- Trench MOSFET technology
- ESD protection up to 2 kV
- Ultra thin package profile of 0.37 mm

### 1.3 Applications

- Relay driver
- High-speed line driver
- High-side loadswitch
- Switching circuits

### 1.4 Quick reference data

Table 1. Quick reference data

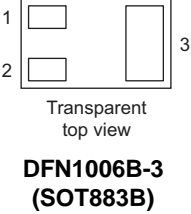
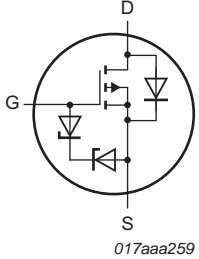
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$	-	-	-20	V
$V_{GS}$	gate-source voltage		-8	-	8	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$	<a href="#">[1]</a>	-	-680	mA
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = -4.5\text{ V}; I_D = -400\text{ mA}; T_j = 25\text{ °C}$	-	0.67	0.85	$\Omega$

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



## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>Transparent top view</p> <p><b>DFN1006B-3 (SOT883B)</b></p>	 <p>017aaa259</p>
2	S	source		
3	D	drain		

## 3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PMZB670UPE	DFN1006B-3	Leadless ultra small plastic package; 3 solder lands; body 1.0 x 0.6 x 0.37 mm	SOT883B

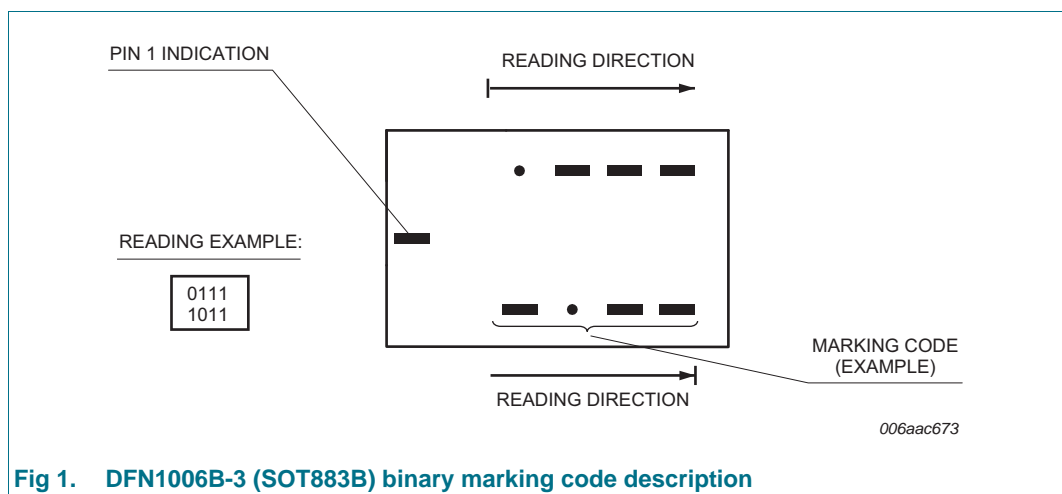
## 4. Marking

Table 4. Marking codes

Type number	Marking code <sup>[1]</sup>
PMZB670UPE	0000 1011

[1] For DFN1006B-3 (SOT883B) binary marking code description see [Figure 1](#).

### 4.1 Binary marking code description



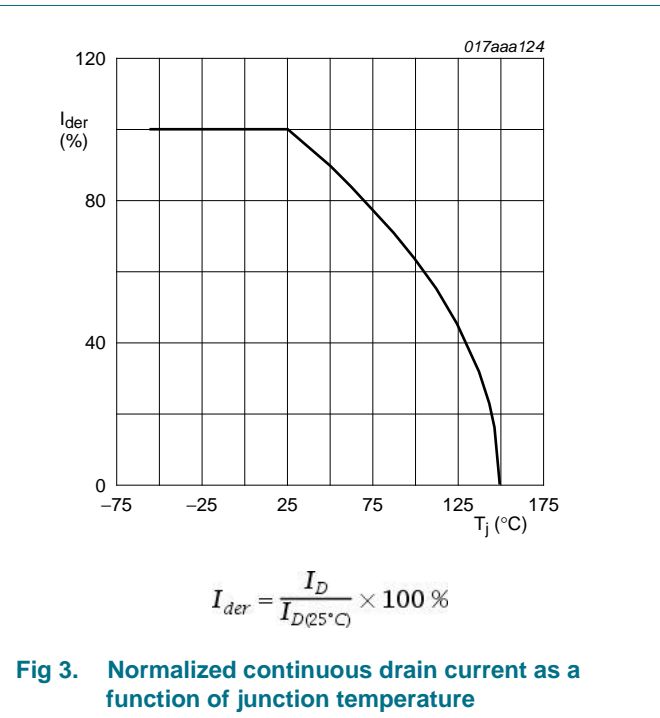
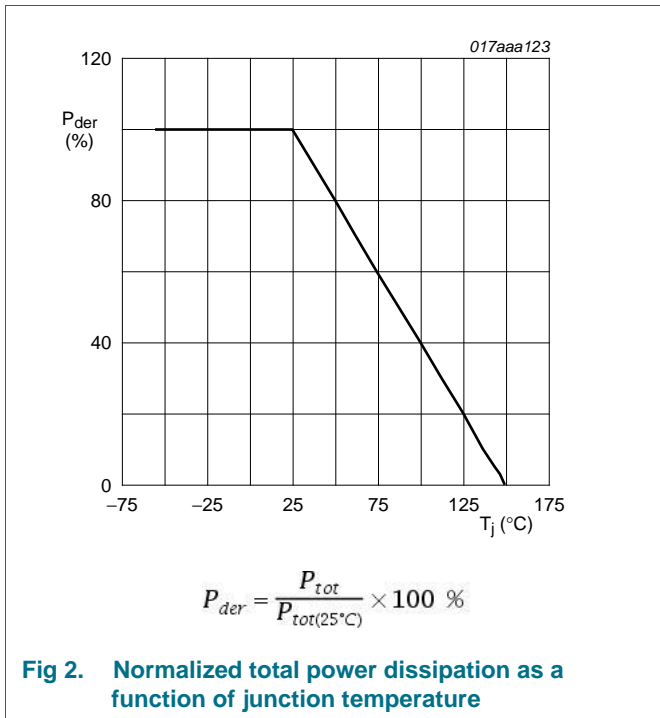
## 5. Limiting values

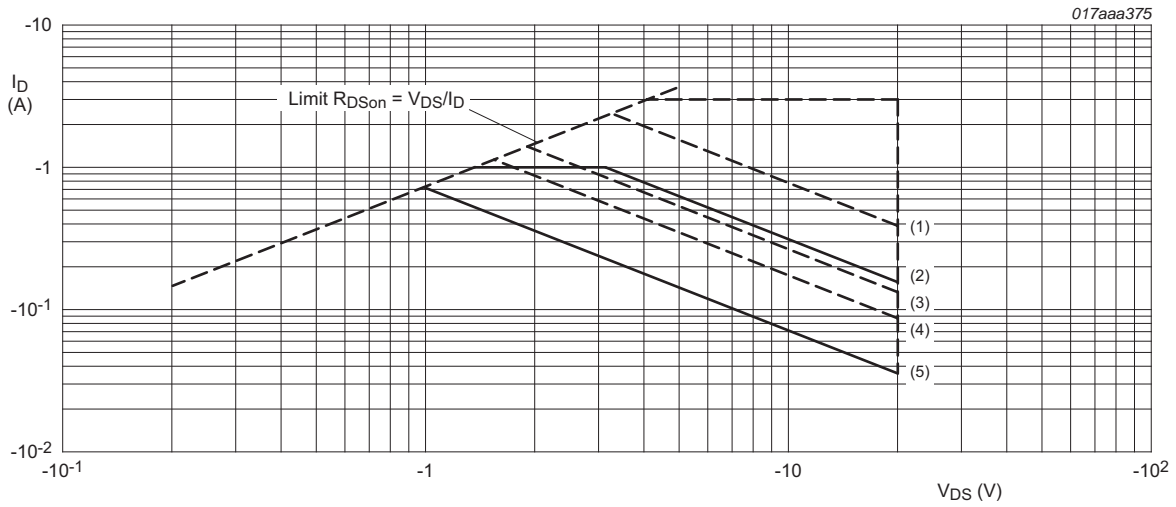
**Table 5. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit	
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> = 25 °C	-	-20	V	
V <sub>GS</sub>	gate-source voltage		-8	8	V	
I <sub>D</sub>	drain current	V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 25 °C	[1]	-	-680	mA
		V <sub>GS</sub> = -4.5 V; T <sub>amb</sub> = 100 °C	[1]	-	-425	mA
I <sub>DM</sub>	peak drain current	T <sub>amb</sub> = 25 °C; single pulse; t <sub>p</sub> ≤ 10 μs	-	-2.7	A	
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = 25 °C	[2]	-	360	mW
			[1]	-	715	mW
		T <sub>sp</sub> = 25 °C		-	2700	mW
T <sub>j</sub>	junction temperature		-55	150	°C	
T <sub>amb</sub>	ambient temperature		-55	150	°C	
T <sub>stg</sub>	storage temperature		-65	150	°C	
<b>Source-drain diode</b>						
I <sub>S</sub>	source current	T <sub>amb</sub> = 25 °C	[1]	-	-680	mA
<b>ESD maximum rating</b>						
V <sub>ESD</sub>	electrostatic discharge voltage	HBM	[3]	-	2000	V

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm<sup>2</sup>.
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.
- [3] Measured between all pins.





$I_{DM}$  = single pulse

(1)  $t_p = 1$  ms

(2) DC;  $T_{sp} = 25$  °C

(3)  $t_p = 10$  ms

(4)  $t_p = 100$  ms

(5) DC;  $T_{amb} = 25$  °C; drain mounting pad  $1$  cm<sup>2</sup>

**Fig 4. 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	
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	305	360	K/W
			[2]	-	150	175	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point		-	-	40	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 1 cm<sup>2</sup>.

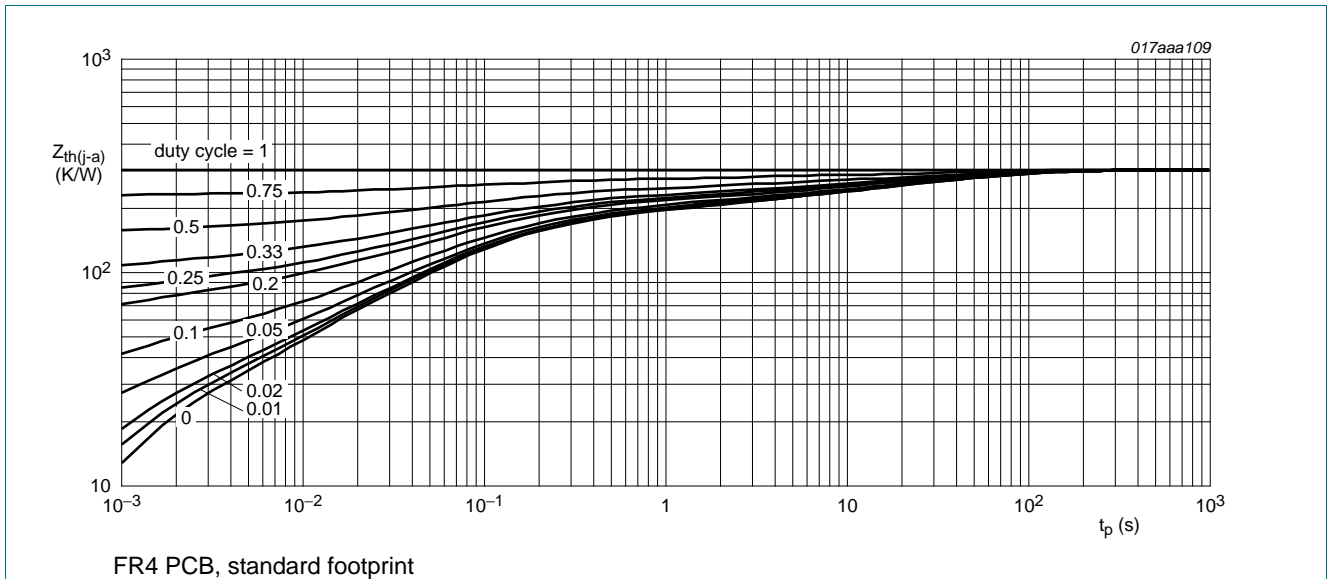


Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

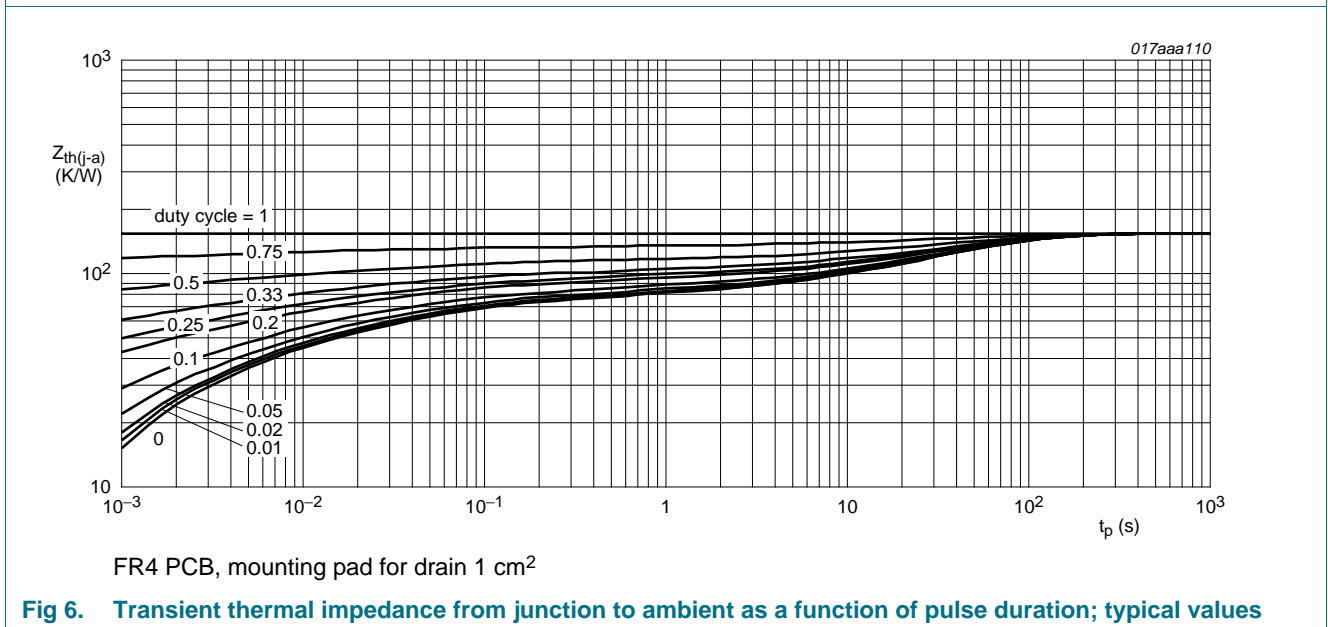
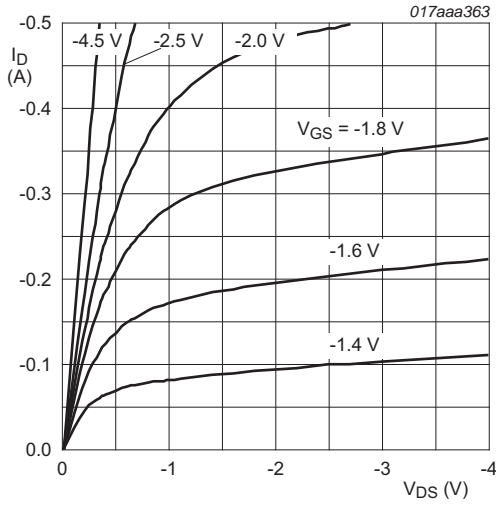


Fig 6. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 7. Characteristics

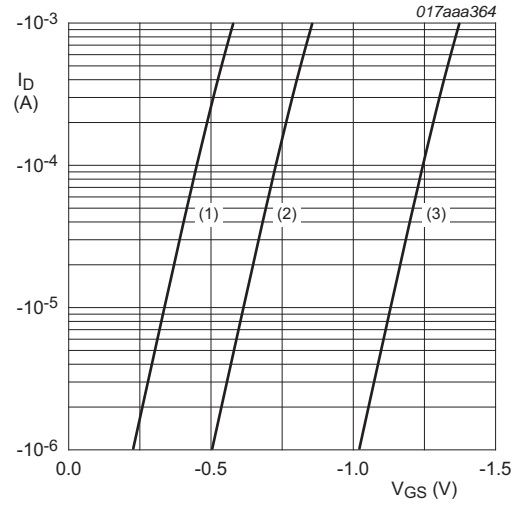
**Table 7. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	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	$I_D = -250 \mu A$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ C$	-0.5	-0.9	-1.3	V
$I_{DSS}$	drain leakage current	$V_{DS} = -20 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-1	$\mu A$
		$V_{DS} = -20 V$ ; $V_{GS} = 0 V$ ; $T_j = 150 \text{ }^\circ C$	-	-	-10	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-2	$\mu A$
		$V_{GS} = -8 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-2	$\mu A$
		$V_{GS} = 4.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-0.5	$\mu A$
		$V_{GS} = -4.5 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	-	-0.5	$\mu A$
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5 V$ ; $I_D = -400 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	0.67	0.85	$\Omega$
		$V_{GS} = -4.5 V$ ; $I_D = -400 \text{ mA}$ ; $T_j = 150 \text{ }^\circ C$	-	1.1	1.4	$\Omega$
		$V_{GS} = -2.5 V$ ; $I_D = -200 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	1.2	1.5	$\Omega$
		$V_{GS} = -1.8 V$ ; $I_D = -10 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	1.8	2.8	$\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = -10 V$ ; $I_D = -200 \text{ mA}$ ; $T_j = 25 \text{ }^\circ C$	-	610	-	mS
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = -10 V$ ; $I_D = -400 \text{ mA}$ ; $V_{GS} = -4.5 V$ ; $T_j = 25 \text{ }^\circ C$	-	0.76	1.14	nC
$Q_{GS}$	gate-source charge		-	0.28	-	nC
$Q_{GD}$	gate-drain charge		-	0.18	-	nC
$C_{iss}$	input capacitance	$V_{DS} = -10 V$ ; $f = 1 \text{ MHz}$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-	58	87	pF
$C_{oss}$	output capacitance		-	21	-	pF
$C_{rss}$	reverse transfer capacitance		-	12	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = -10 V$ ; $R_L = 250 \Omega$ ; $V_{GS} = -4.5 V$ ; $R_{G(ext)} = 6 \Omega$ ; $T_j = 25 \text{ }^\circ C$	-	18	36	ns
$t_r$	rise time		-	30	-	ns
$t_{d(off)}$	turn-off delay time		-	80	160	ns
$t_f$	fall time		-	72	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = -300 \text{ mA}$ ; $V_{GS} = 0 V$ ; $T_j = 25 \text{ }^\circ C$	-0.48	-0.84	-1.2	V



$T_j = 25\text{ °C}$

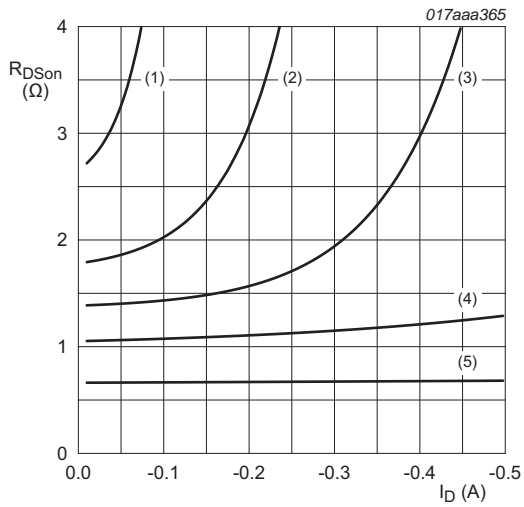
**Fig 7. Output characteristics: drain current as a function of drain-source voltage; typical values**



$T_j = 25\text{ °C}; V_{DS} = -5\text{ V}$

- (1) minimum values
- (2) typical values
- (3) maximum values

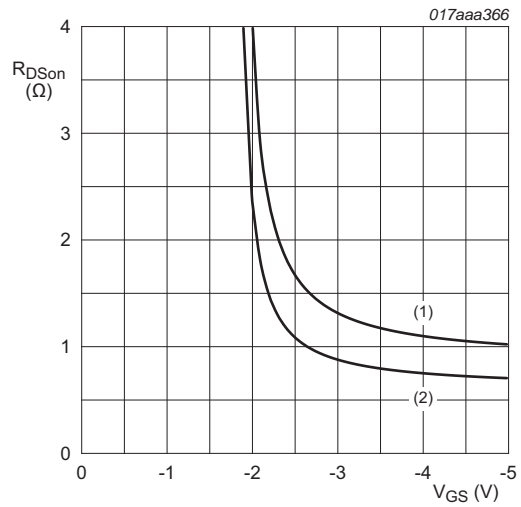
**Fig 8. Sub-threshold drain current as a function of gate-source voltage**



$T_j = 25\text{ °C}$

- (1)  $V_{GS} = -1.5\text{ V}$
- (2)  $V_{GS} = -1.8\text{ V}$
- (3)  $V_{GS} = -2.0\text{ V}$
- (4)  $V_{GS} = -2.5\text{ V}$
- (5)  $V_{GS} = -4.5\text{ V}$

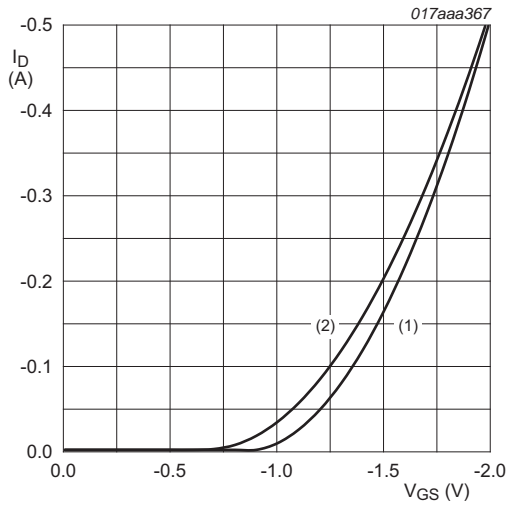
**Fig 9. Drain-source on-state resistance as a function of drain current; typical values**



$I_D = -400\text{ mA}$

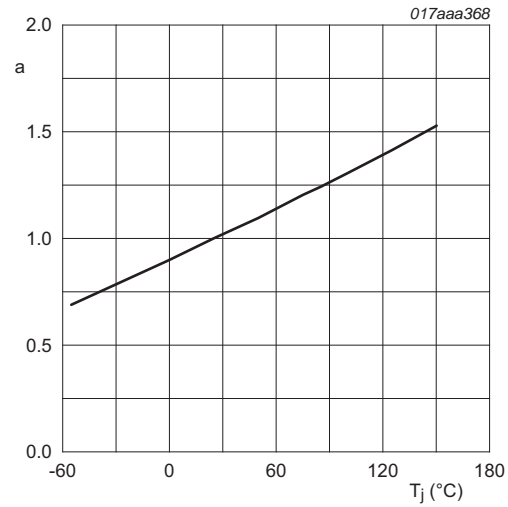
- (1)  $T_j = 150\text{ °C}$
- (2)  $T_j = 25\text{ °C}$

**Fig 10. Drain-source on-state resistance as a function of gate-source voltage; typical values**



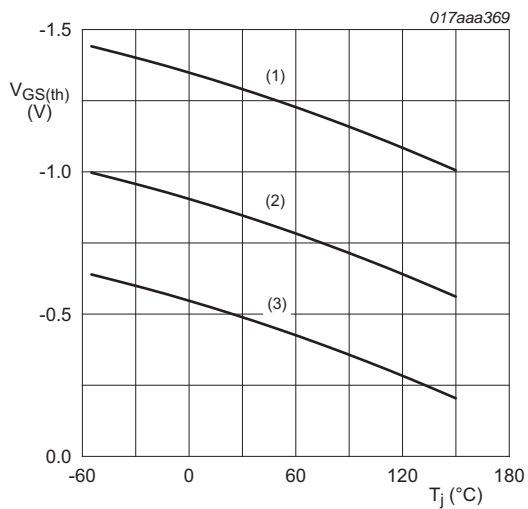
$V_{DS} > I_D \times R_{DS(on)}$   
 (1)  $T_j = 25\text{ °C}$   
 (2)  $T_j = 150\text{ °C}$

Fig 11. Transfer characteristics: drain current as a function of gate-source voltage; typical values



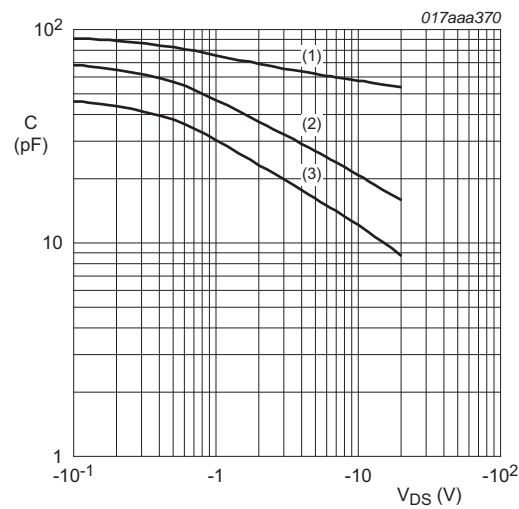
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25\text{ °C})}}$$

Fig 12. 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

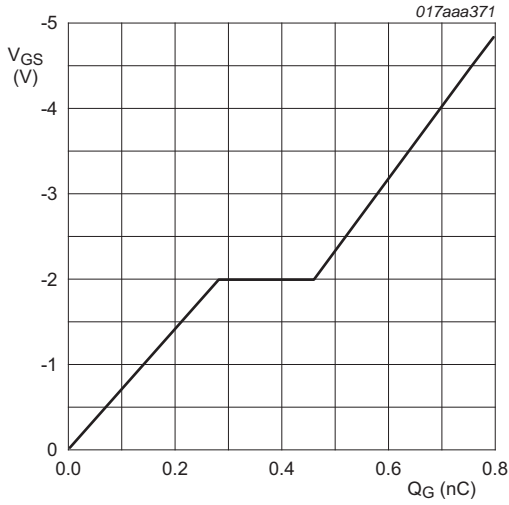
Fig 13. Gate-source threshold voltage as a function of junction temperature



$f = 1\text{ MHz}; V_{GS} = 0\text{ V}$   
 (1)  $C_{iss}$   
 (2)  $C_{oss}$   
 (3)  $C_{rss}$

Fig 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values





$I_D = -0.4$  A;  $V_{DD} = -10$  V;  $T_{amb} = 25$  °C

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

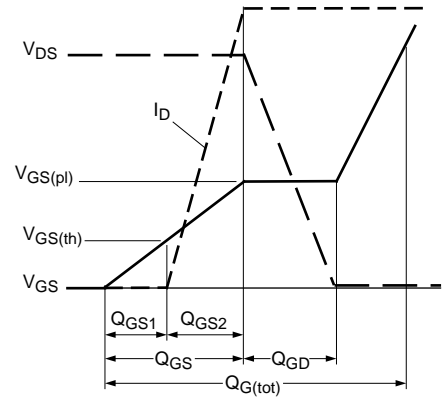
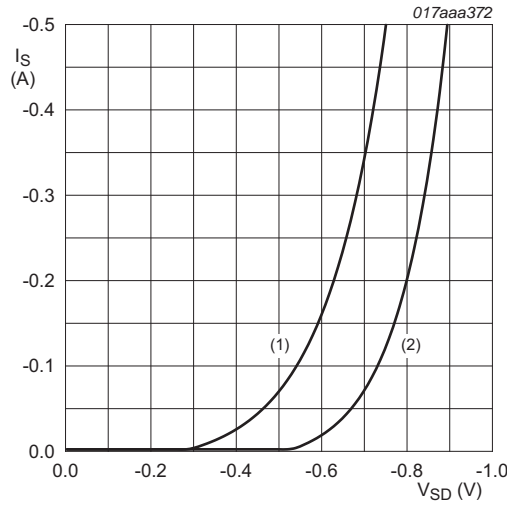


Fig 16. Gate charge waveform definitions



$V_{GS} = 0$  V  
 (1)  $T_{amb} = 150$  °C  
 (2)  $T_{amb} = 25$  °C

Fig 17. Source current as a function of source-drain voltage; typical values

### 8. Test information



Fig 18. Duty cycle definition

### 9. Package outline

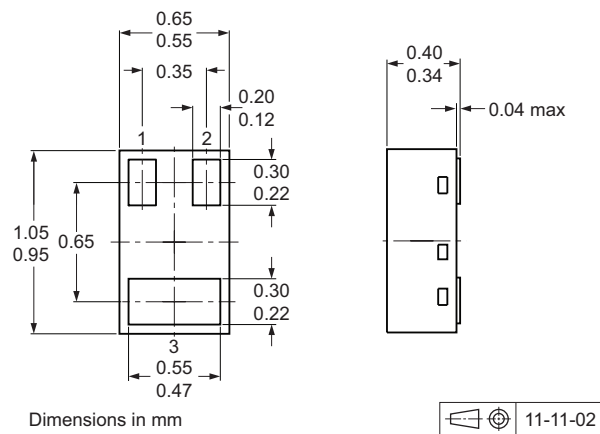


Fig 19. Package outline DFN1006B-3 (SOT883B)

10. Soldering

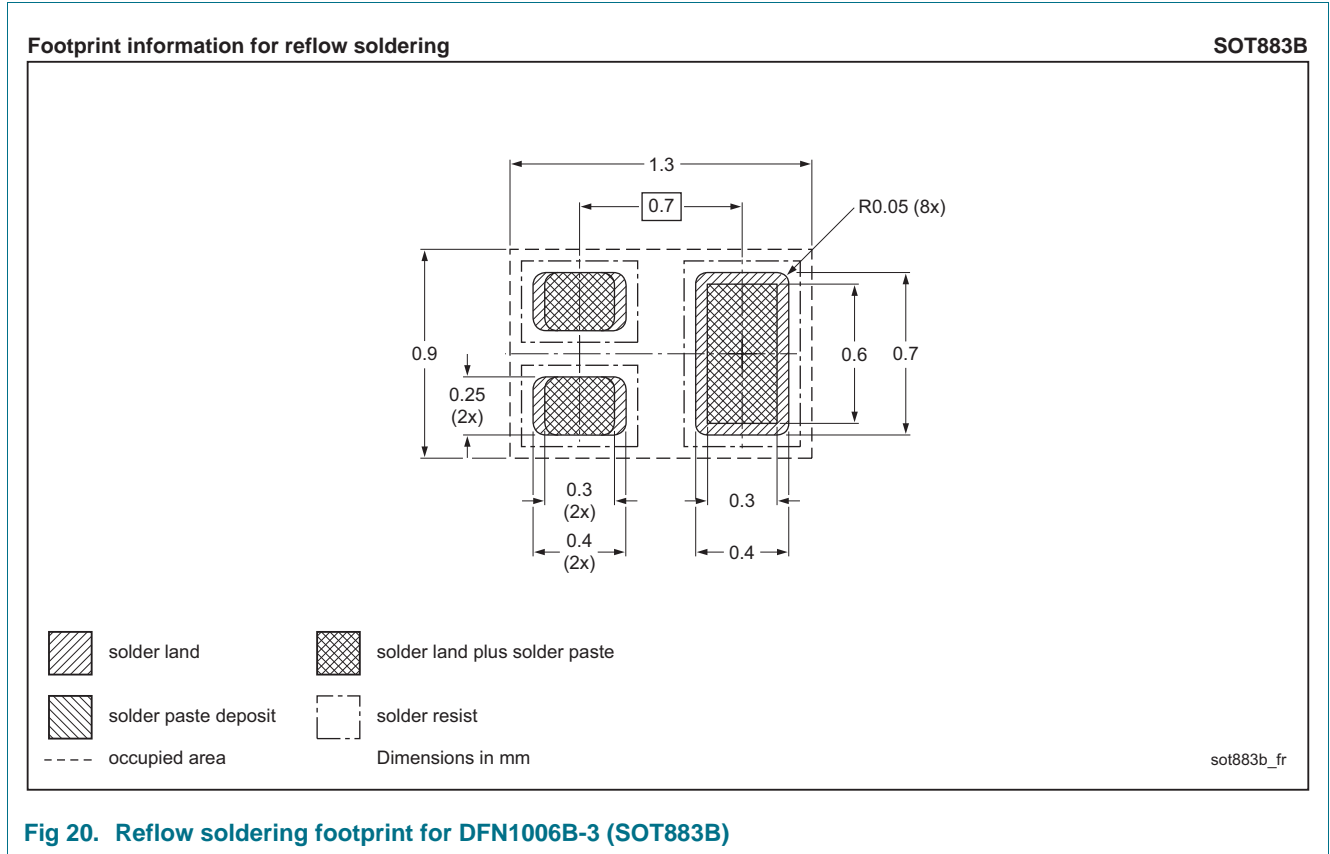


Fig 20. Reflow soldering footprint for DFN1006B-3 (SOT883B)

## 11. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PMZB670UPE v.3	20120323	Product data sheet	-	PMZB670UPE v.2
Modifications:	• <a href="#">1.2 "Features and benefits"</a> is corrected.			
PMZB670UPE v.2	20120207	Product data sheet	-	PMZB670UPE v.1
PMZB670UPE v.1	20120131	Product data sheet	-	-

## 12. Legal information

### 12.1 Data sheet status

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

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

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