



# PSMN6R0-25YLB

N-channel 25 V 6.1 mΩ logic level MOSFET in LPAK using NextPower technology

Rev. 2 — 31 October 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Logic level enhancement mode N-channel MOSFET in LPAK package. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

### 1.2 Features and benefits

- High reliability Power SO8 package, qualified to 175°C
- Low parasitic inductance and resistance
- Optimised for 4.5V Gate drive utilising NextPower Superjunction technology
- Ultra low QG, QGD, & QOSS for high system efficiencies at low and high loads

### 1.3 Applications

- DC-to-DC converters
- Load switching
- Synchronous buck regulator

### 1.4 Quick reference data

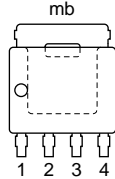
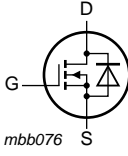
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	-	25	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>	-	-	73	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	58	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}$ ; $I_D = 20\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a>	-	6.7	7.9	mΩ
		$V_{GS} = 10\text{ V}$ ; $I_D = 20\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a>	-	5.1	6.1	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 4.5\text{ V}$ ; $I_D = 20\text{ A}$ ; $V_{DS} = 12\text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	2.6	-	nC
$Q_{G(tot)}$	total gate charge		-	9	-	nC



## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source		
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

**SOT669 (LPAK; Power-SO8)**

## 3. Ordering information

Table 3. Ordering information

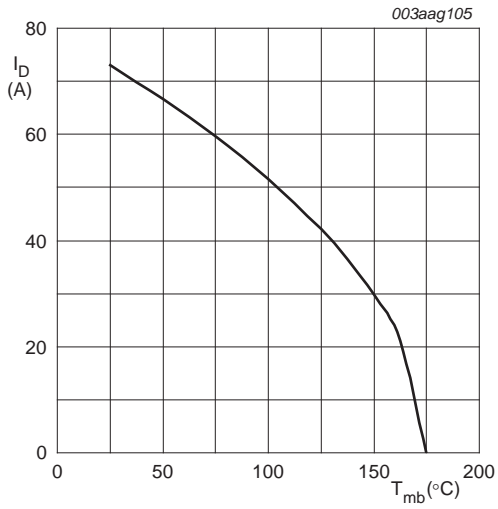
Type number	Package		Version
	Name	Description	
PSMN6R0-25YLB	LPAK; Power-SO8	plastic single-ended surface-mounted package; 4 leads	SOT669

## 4. Limiting values

Table 4. Limiting values

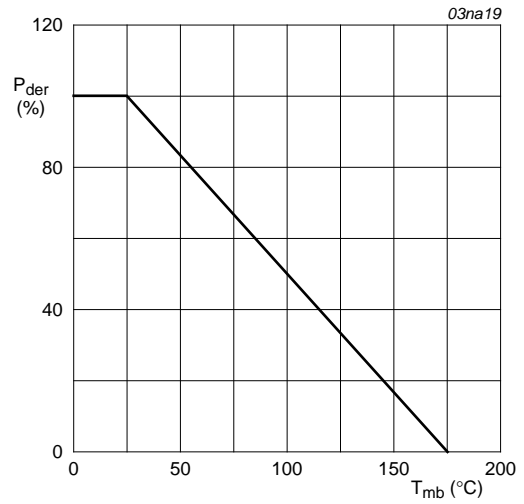
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}$	-	25	V
$V_{DGR}$	drain-gate voltage	$25\text{ °C} \leq T_j \leq 175\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	25	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C};$ see <a href="#">Figure 1</a>	-	73	A
		$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C};$ see <a href="#">Figure 1</a>	-	52	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C};$ see <a href="#">Figure 4</a>	-	292	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	58	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
$T_{slid(M)}$	peak soldering temperature		-	260	°C
$V_{ESD}$	electrostatic discharge voltage	MM (JEDEC JESD22-A115)	220	-	V
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	53	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$	-	292	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 73\text{ A}; V_{sup} \leq 25\text{ V};$ unclamped; $R_{GS} = 50\text{ }\Omega;$ see <a href="#">Figure 3</a>	-	15	mJ



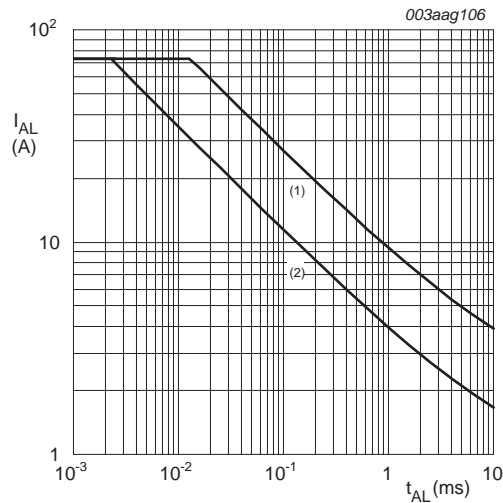
$$V_{GS} \geq 10V$$

Fig 1. Continuous drain current as a function of mounting base temperature



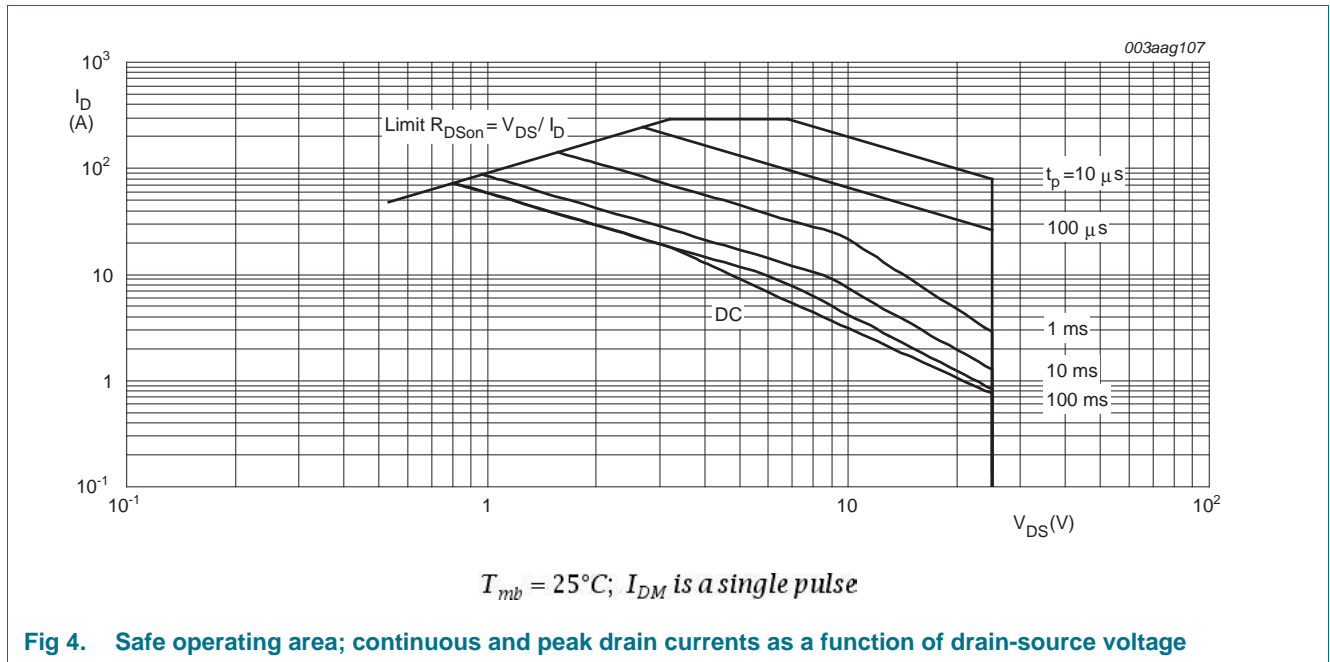
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

Fig 2. Normalized total power dissipation as a function of mounting base temperature



(1)  $T_{j (trnt)} = 25^{\circ}C$ ; (2)  $T_{j (trnt)} = 100^{\circ}C$

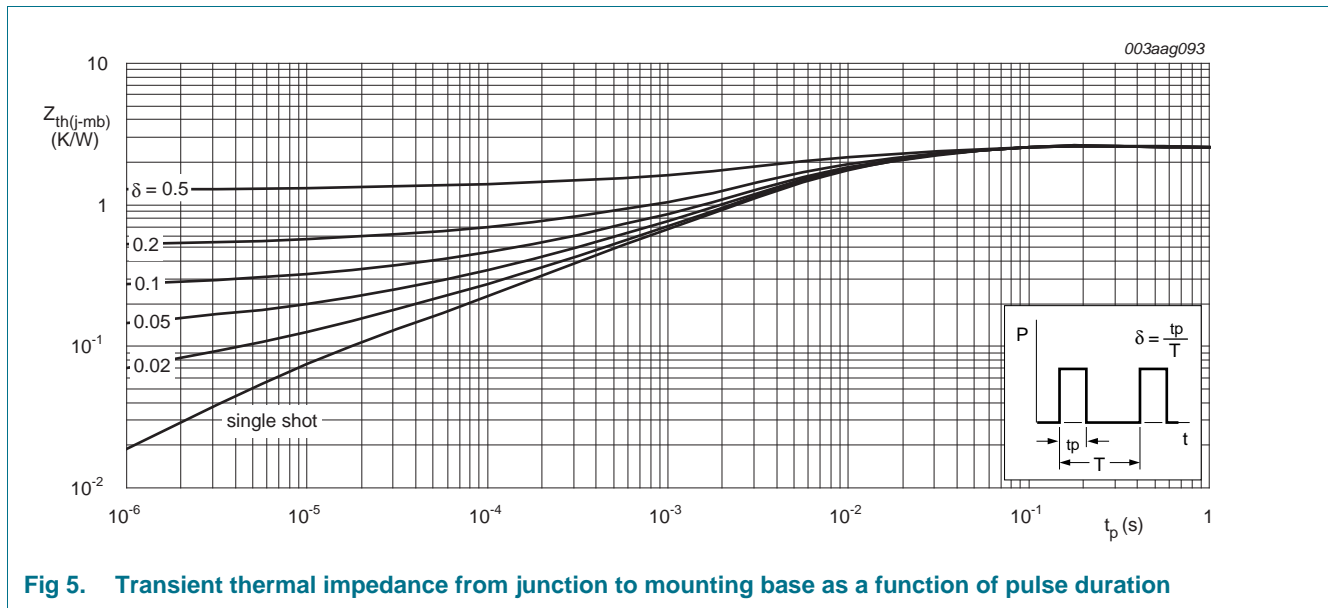
Fig 3. Single pulse avalanche rating; avalanche current as a function of avalanche time



### 5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 5</a>	-	2.35	2.57	K/W



## 6. Characteristics

**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	25	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	22.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	1.05	1.42	1.95	V
		$I_D = 10 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ C$	0.5	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C$	-	-	2.25	V
$I_{DSS}$	drain leakage current	$V_{DS} = 25 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	1	$\mu A$
		$V_{DS} = 25 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 150 \text{ }^\circ C$	-	-	100	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	100	nA
		$V_{GS} = -16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 20 \text{ A}; T_j = 25 \text{ }^\circ C$ ; see <a href="#">Figure 12</a>	-	6.7	7.9	mΩ
		$V_{GS} = 4.5 \text{ V}; I_D = 20 \text{ A}; T_j = 150 \text{ }^\circ C$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	-	13	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 25 \text{ }^\circ C$ ; see <a href="#">Figure 12</a>	-	5.1	6.1	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 20 \text{ A}; T_j = 150 \text{ }^\circ C$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	-	10.1	mΩ
$R_G$	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	1.62	3.24	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 20 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 10 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	19.3	-	nC
		$I_D = 20 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 4.5 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	9	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	17.7	-	nC
$Q_{GS}$	gate-source charge	$I_D = 20 \text{ A}; V_{DS} = 12 \text{ V}; V_{GS} = 4.5 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	2.6	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	1.9	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	0.7	-	nC
$Q_{GD}$	gate-drain charge		-	2.6	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 20 \text{ A}; V_{DS} = 12 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	2.44	-	V
$C_{iss}$	input capacitance	$V_{DS} = 12 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$ ;	-	1099	-	pF
$C_{oss}$	output capacitance	$T_j = 25 \text{ }^\circ C$ ; see <a href="#">Figure 16</a>	-	337	-	pF
$C_{riss}$	reverse transfer capacitance		-	99	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12 \text{ V}; R_L = 0.6 \text{ } \Omega; V_{GS} = 4.5 \text{ V}$ ;	-	16	-	ns
$t_r$	rise time	$R_{G(ext)} = 4.7 \text{ } \Omega$	-	17	-	ns
$t_{d(off)}$	turn-off delay time		-	30	-	ns
$t_f$	fall time		-	9	-	ns

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$Q_{OSS}$	output charge	$V_{GS} = 0\text{ V}; V_{DS} = 12\text{ V}; f = 1\text{ MHz}$	-	6.6	-	nC
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 20\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 17</a>	-	0.85	1.1	V
$t_{rr}$	reverse recovery time	$I_S = 20\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s};$ $V_{GS} = 0\text{ V}; V_{DS} = 12\text{ V}$	-	27	-	ns
$Q_r$	recovered charge	$V_{GS} = 0\text{ V}; V_{DS} = 12\text{ V}$	-	18	-	nC
$t_a$	reverse recovery rise time	$V_{GS} = 0\text{ V}; I_S = 20\text{ A};$ $di_S/dt = -100\text{ A}/\mu\text{s}; V_{DS} = 12\text{ V};$ see <a href="#">Figure 18</a>	-	15	-	ns
$t_b$	reverse recovery fall time	$V_{GS} = 0\text{ V}; I_S = 20\text{ A};$ $di_S/dt = -100\text{ A}/\mu\text{s}; V_{DS} = 12\text{ V};$ see <a href="#">Figure 18</a>	-	12	-	ns

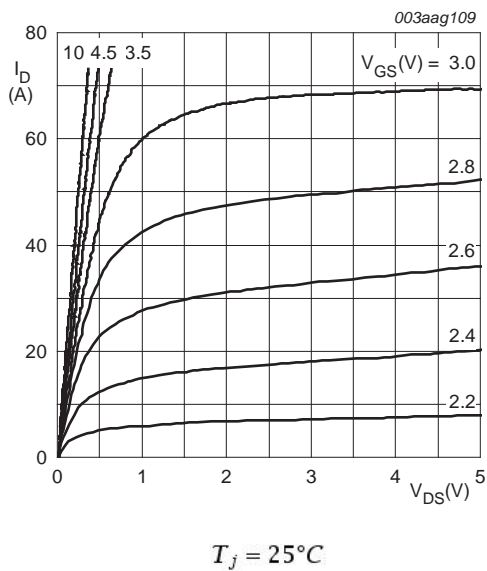


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

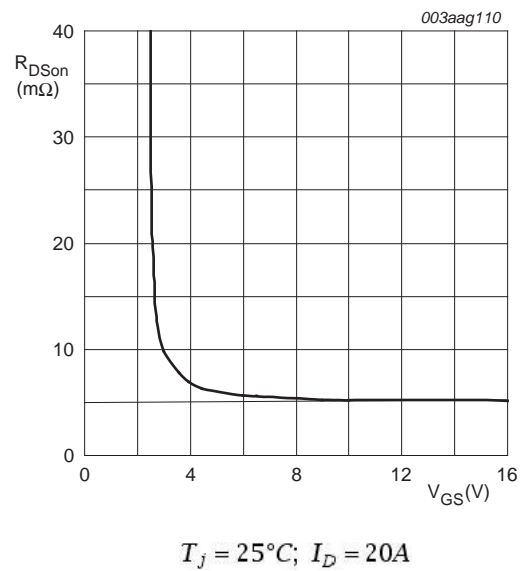
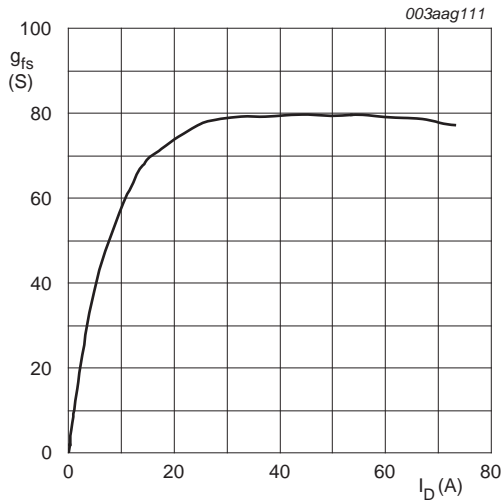
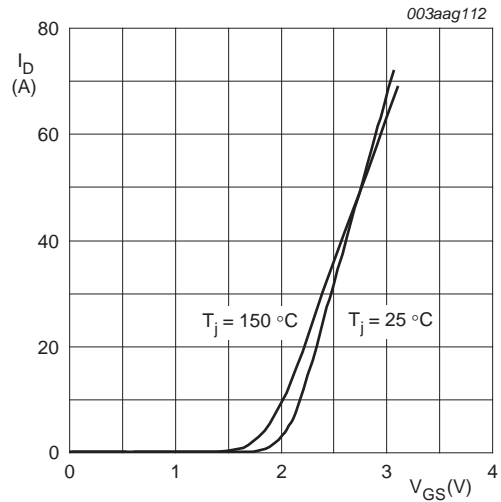


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values



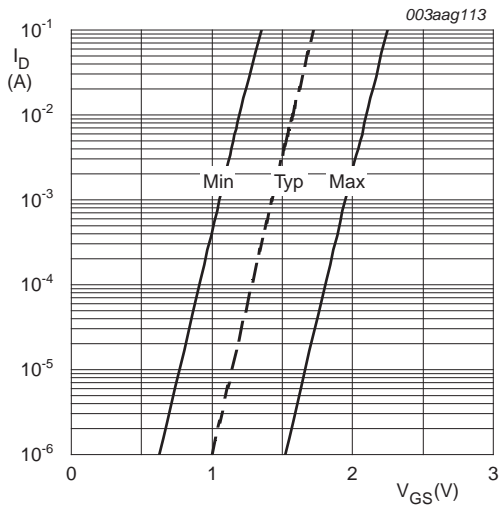
$T_j = 25^\circ\text{C}; V_{DS} = 10\text{V}$

**Fig 8. Forward transconductance as a function of drain current; typical values**



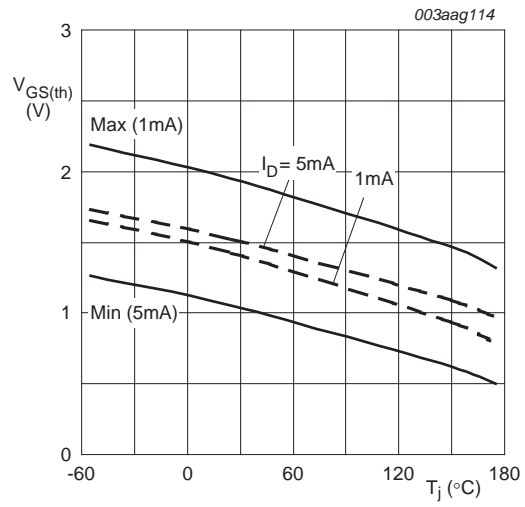
$V_{DS} = 10\text{V}$

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



$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

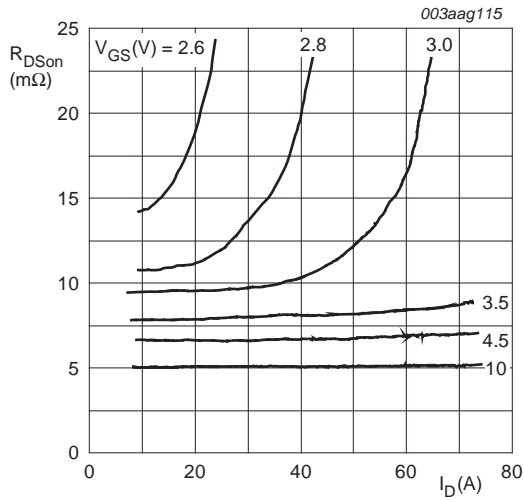
**Fig 10. Sub-threshold drain current as a function of gate-source voltage**



$V_{DS} = V_{GS}$

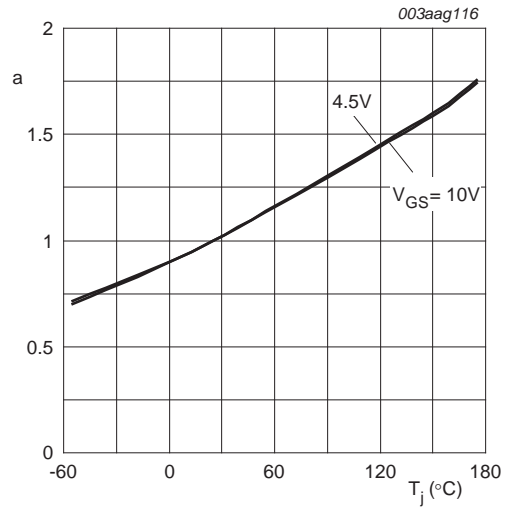
**Fig 11. Gate-source threshold voltage as a function of junction temperature**





$T_j = 25^\circ\text{C}$

Fig 12. Drain-source on-state resistance as a function of drain current; typical values



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

Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature

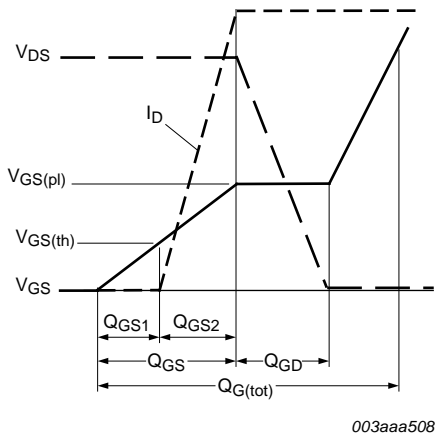
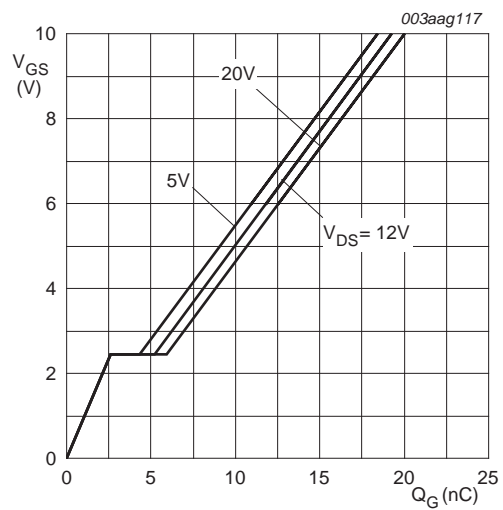
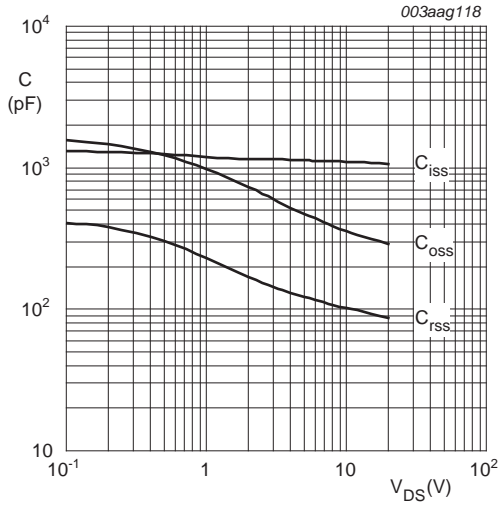


Fig 14. Gate charge waveform definitions



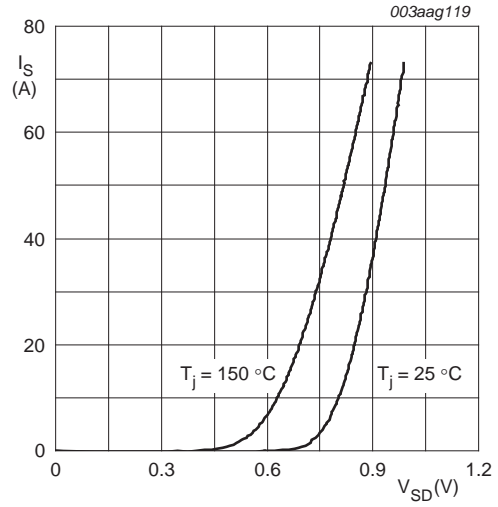
$T_j = 25^\circ\text{C}; I_D = 20\text{A}$

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



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

Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{GS} = 0V$

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

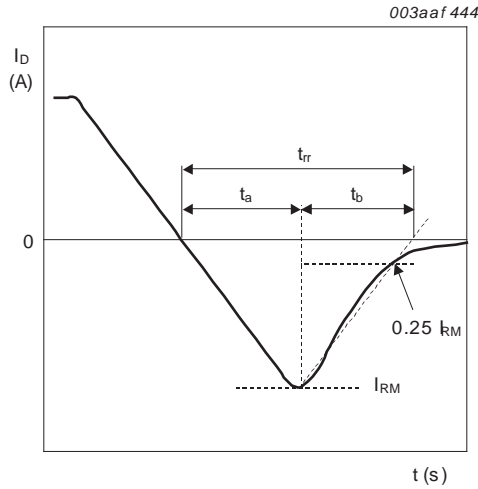


Fig 18. Reverse recovery timing definition

7. Package outline

Plastic single-ended surface-mounted package (LPAK; Power-SO8); 4 leads

SOT669



Fig 19. Package outline SOT669 (LPAK; Power-SO8)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN6R0-25YLB v.2	20111031	Product data sheet	-	PSMN6R0-25YLB v.1
Modifications:	<ul style="list-style-type: none"><li>• Status changed from preliminary to product.</li><li>• Various changes to content.</li></ul>			
PSMN6R0-25YLB v.1	20110908	Preliminary data sheet	-	-

## 9. Legal information

### 9.1 Data sheet status

Document status <a href="#">[1]</a> <a href="#">[2]</a>	Product status <a href="#">[3]</a>	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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