

# PSMN1R7-30YL

## N-channel 30 V 1.7 mΩ logic level MOSFET in LPAK

Rev. 04 — 20 April 2010

Product data sheet

## 1. Product profile

### 1.1 General description

Logic level N-channel MOSFET in LPAK package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

### 1.2 Features and benefits

- Advanced TrenchMOS provides low  $R_{DSon}$  and low gate charge
- High efficiency gains in switching power convertors
- Improved mechanical and thermal characteristics
- LPAK provides maximum power density in a Power SO8 package

### 1.3 Applications

- DC-to-DC converters
- Lithium-ion battery protection
- Load switching
- Motor control
- Server power supplies

### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	30	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>	-	-	100	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	109	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 15\text{ A}$ ; $T_j = 100\text{ °C}$ ; see <a href="#">Figure 16</a>	-	-	2.4	mΩ
		$V_{GS} = 10\text{ V}$ ; $I_D = 15\text{ A}$ ; $T_j = 25\text{ °C}$	-	1.29	1.7	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 4.5\text{ V}$ ; $I_D = 10\text{ A}$ ; $V_{DS} = 12\text{ V}$ ; see <a href="#">Figure 17</a> ; see <a href="#">Figure 18</a>	-	8.7	-	nC



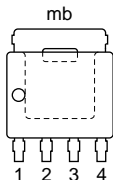
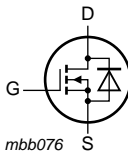
**Table 1. Quick reference data ...continued**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$Q_{G(\text{tot})}$	total gate charge	$V_{GS} = 4.5 \text{ V}; I_D = 10 \text{ A};$ $V_{DS} = 12 \text{ V};$ see <a href="#">Figure 17</a>	-	36.2	-	nC
<b>Avalanche ruggedness</b>						
$E_{DS(\text{AL})R}$	repetitive drain-source avalanche energy	see <a href="#">Figure 3</a>	<a href="#">[2]</a> <a href="#">[3]</a> <a href="#">[4]</a>	-	-	J

- [1] Continuous current is limited by package.
- [2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.
- [3] Repetitive avalanche rating limited by average junction temperature of 170 °C.
- [4] Refer to application note AN10273 for further information.

## 2. Pinning information

**Table 2. Pinning information**

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p style="text-align: center;">SOT669 (LPAK)</p>	 <p style="text-align: center;">mbb076</p>
2	S	source		
3	S	source		
4	G	gate		
mb	D	mounting base; connected to drain		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		
	Name	Description	Version
PSMN1R7-30YL	LPAK	plastic single-ended surface-mounted package (LPAK); 4 leads	SOT669

## 4. Limiting values

**Table 4. Limiting values**

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

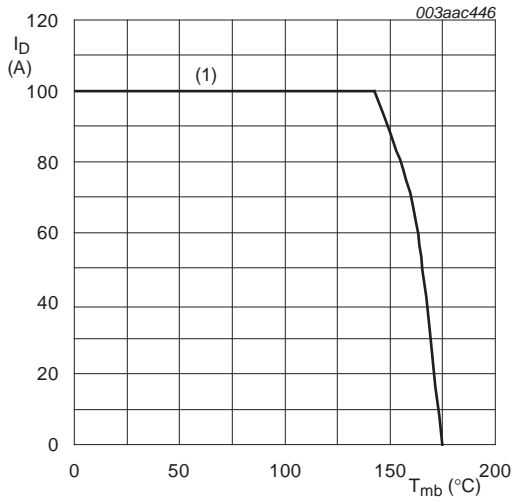
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	30	V
$V_{DGR}$	drain-gate voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	-	30	V
$V_{GS}$	gate-source voltage		-20	-	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$ ; see <a href="#">Figure 1</a> [1]	-	-	100	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> [1]	-	-	100	A
$I_{DM}$	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 4</a>	-	-	790	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	109	W
$T_{stg}$	storage temperature		-55	-	175	°C
$T_j$	junction temperature		-55	-	175	°C
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25\text{ °C}$ [1]	-	-	100	A
$I_{SM}$	peak source current	$t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; $T_{mb} = 25\text{ °C}$	-	-	790	A
<b>Avalanche ruggedness</b>						
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see <a href="#">Figure 3</a> [2][3][4]	-	-	-	J
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 100\text{ A}; V_{sup} \leq 30\text{ V}; R_{GS} = 50\text{ }\Omega$ ; unclamped	-	-	241	mJ

[1] Continuous current is limited by package.

[2] Single-pulse avalanche rating limited by maximum junction temperature of 175 °C.

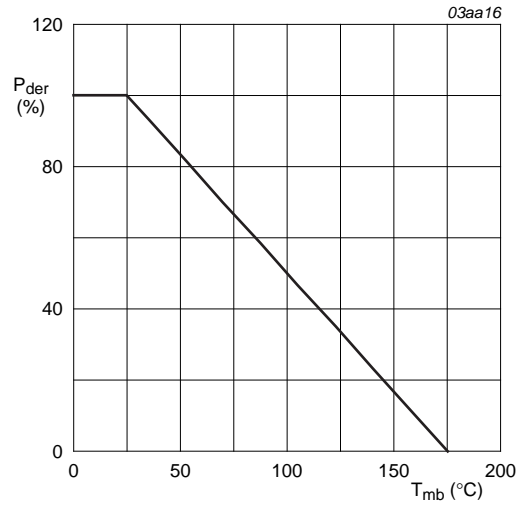
[3] Repetitive avalanche rating limited by average junction temperature of 170 °C.

[4] Refer to application note AN10273 for further information.



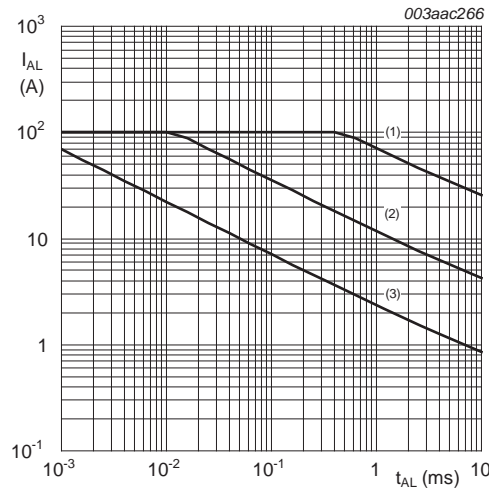
V<sub>GS</sub> ≥ 10 V; (1) Capped at 100 A due to package

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) Single-pulse; T<sub>j</sub> = 25 °C.
- (2) Single-pulse; T<sub>j</sub> = 150 °C.
- (3) Repetitive.

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

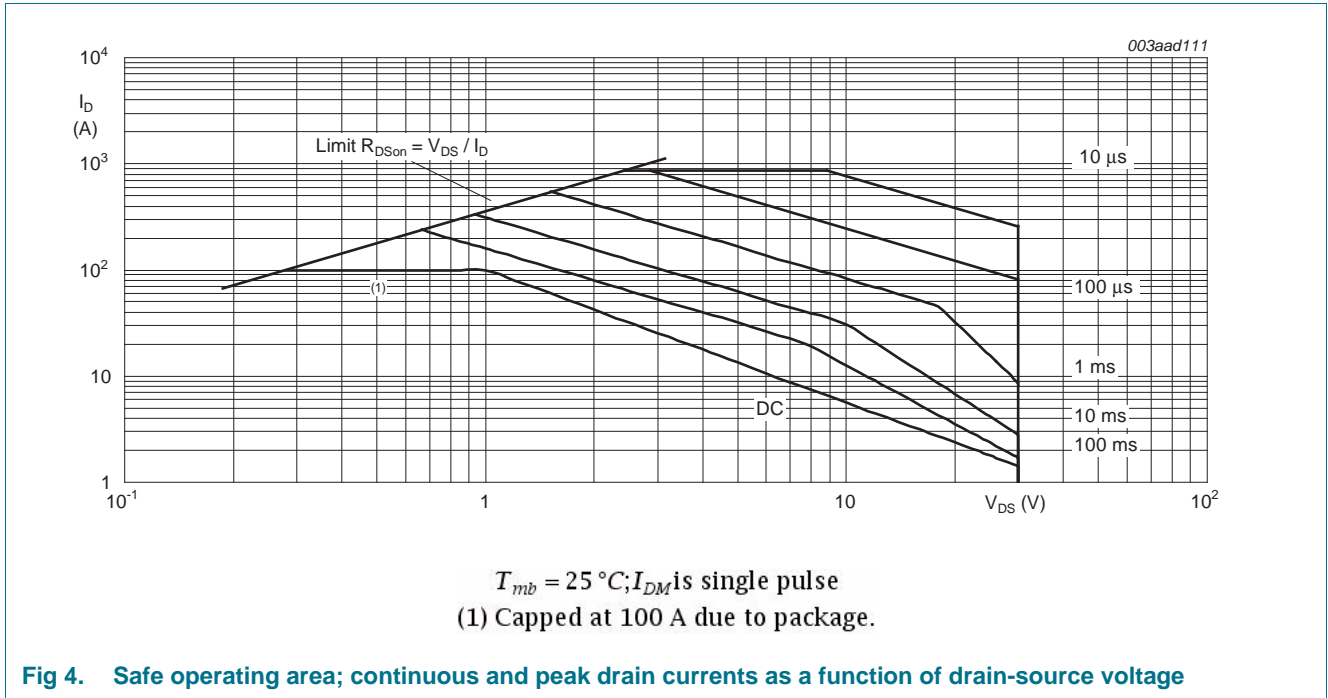


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

## 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>	-	0.5	1.1	K/W

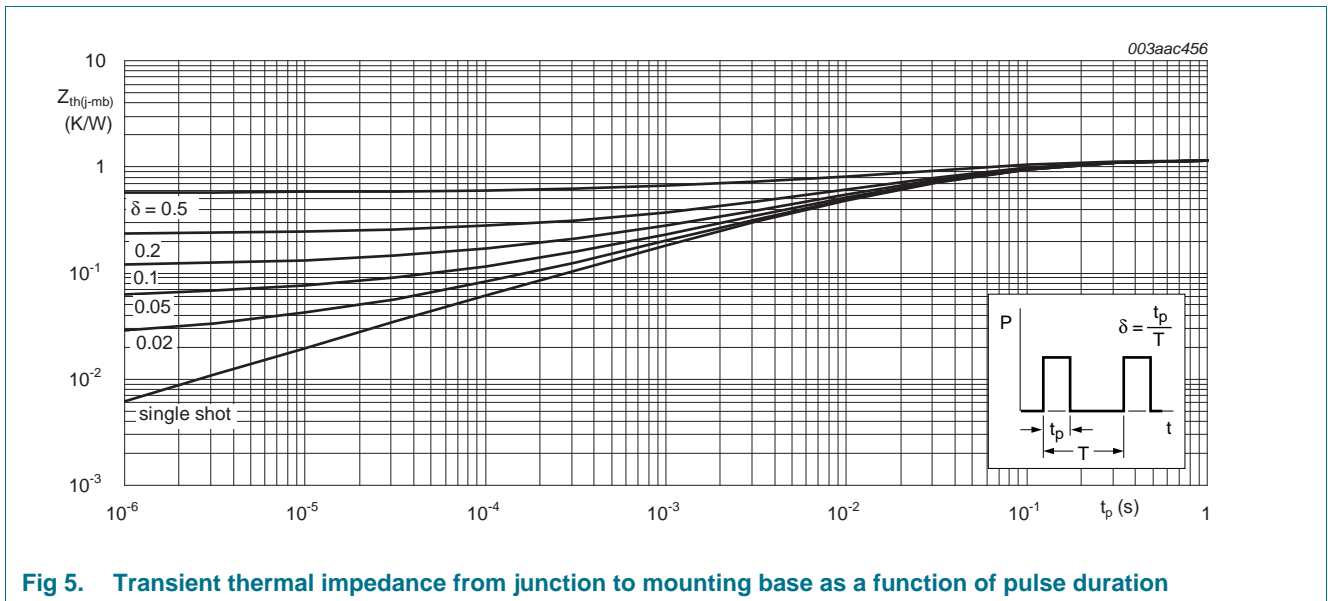


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

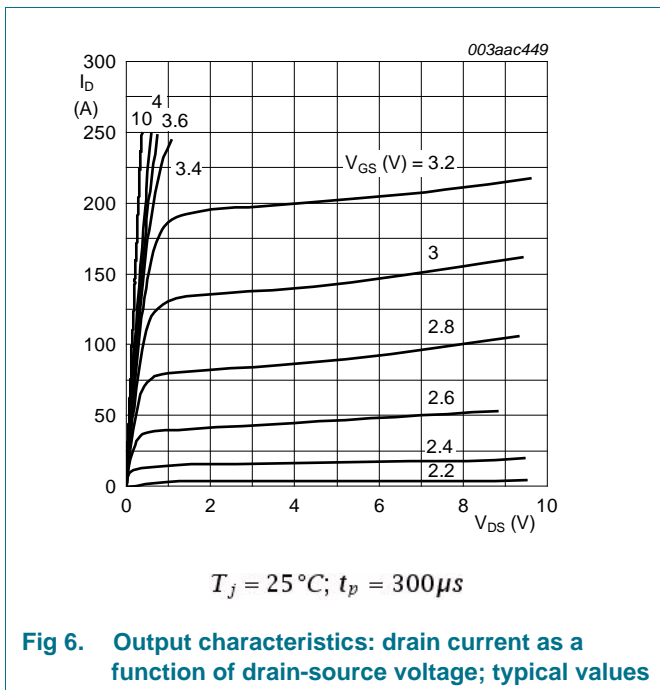
## 6. Characteristics

**Table 6. Characteristics**
*Tested to JEDEC standards where applicable.*

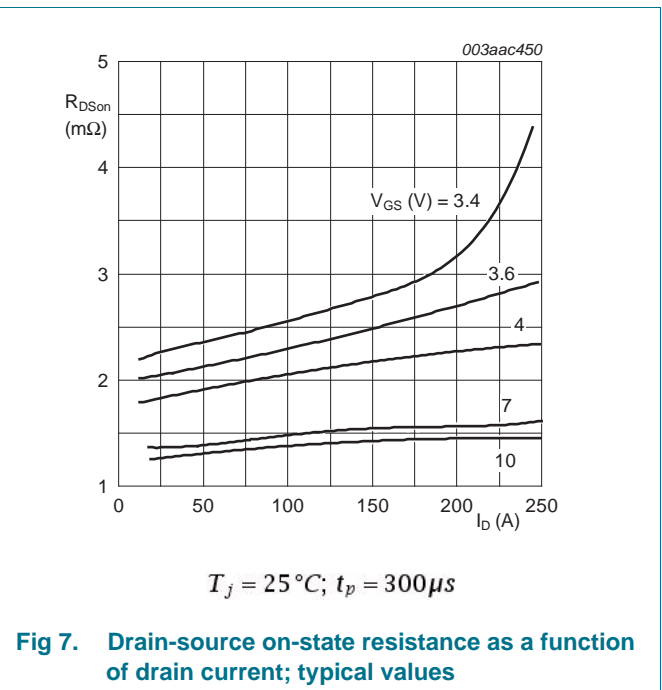
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 20\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C}; t_{av} = 100\text{ ns}$	35	-	-	V
		$I_D = 250\text{ }\mu\text{A}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C}$	30	-	-	V
		$I_D = 250\text{ }\mu\text{A}; V_{GS} = 0\text{ V}; T_j = -55\text{ °C}$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = 25\text{ °C};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	1.3	1.7	2.15	V
		$I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = 150\text{ °C};$ see <a href="#">Figure 15</a>	0.65	-	-	V
		$I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = -55\text{ °C};$ see <a href="#">Figure 15</a>	-	-	2.45	V
$I_{DSS}$	drain leakage current	$V_{DS} = 30\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ °C}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 30\text{ V}; V_{GS} = 0\text{ V}; T_j = 150\text{ °C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ °C}$	-	-	100	nA
		$V_{GS} = -16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ °C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ °C}$	-	1.75	2.09	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 150\text{ °C};$ see <a href="#">Figure 16</a>	-	-	2.8	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 100\text{ °C};$ see <a href="#">Figure 16</a>	-	-	2.4	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ °C}$	-	1.29	1.7	mΩ
$R_G$	gate resistance	$f = 1\text{ MHz}$	-	0.77	1.5	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 10\text{ A}; V_{DS} = 12\text{ V}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 17</a> ; see <a href="#">Figure 18</a>	-	77.9	-	nC
		$I_D = 0\text{ A}; V_{DS} = 0\text{ V}; V_{GS} = 10\text{ V}$	-	70	-	nC
		$I_D = 10\text{ A}; V_{DS} = 12\text{ V}; V_{GS} = 4.5\text{ V};$ see <a href="#">Figure 17</a>	-	36.2	-	nC
$Q_{GS}$	gate-source charge	$I_D = 10\text{ A}; V_{DS} = 12\text{ V}; V_{GS} = 4.5\text{ V};$ see <a href="#">Figure 17</a> ; see <a href="#">Figure 18</a>	-	11.6	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	8	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	3.6	-	nC
$Q_{GD}$	gate-drain charge		-	8.7	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 12\text{ V};$ see <a href="#">Figure 17</a> ; see <a href="#">Figure 18</a>	-	2.34	-	V
$C_{iss}$	input capacitance	$V_{DS} = 12\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ °C};$ see <a href="#">Figure 19</a>	-	5057	-	pF
$C_{oss}$	output capacitance		-	1082	-	pF
$C_{rss}$	reverse transfer capacitance		-	398	-	pF

**Table 6. Characteristics ...continued**  
 Tested to JEDEC standards where applicable.

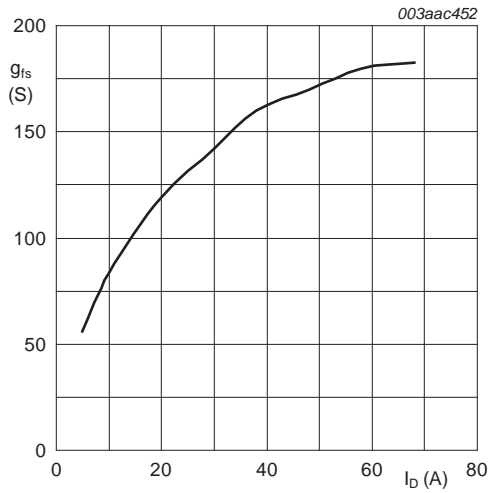
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12\text{ V}; R_L = 0.5\ \Omega; V_{GS} = 4.5\text{ V};$	-	46	-	ns
$t_r$	rise time	$R_{G(ext)} = 4.7\ \Omega$	-	72	-	ns
$t_{d(off)}$	turn-off delay time		-	76	-	ns
$t_f$	fall time		-	34	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 20</a>	-	0.78	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$	-	45	-	ns
$Q_r$	recovered charge	$V_{DS} = 20\text{ V}$	-	56	-	nC



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

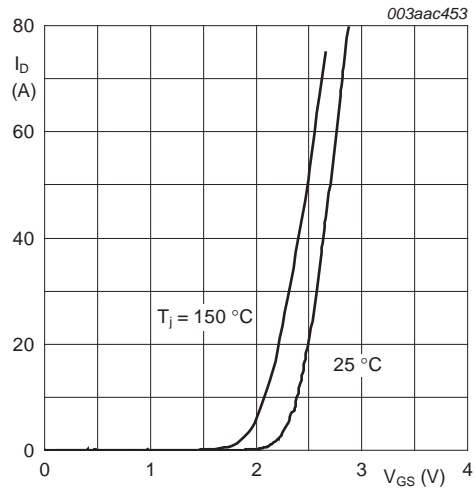


**Fig 7. Drain-source on-state resistance as a function of drain current; typical values**



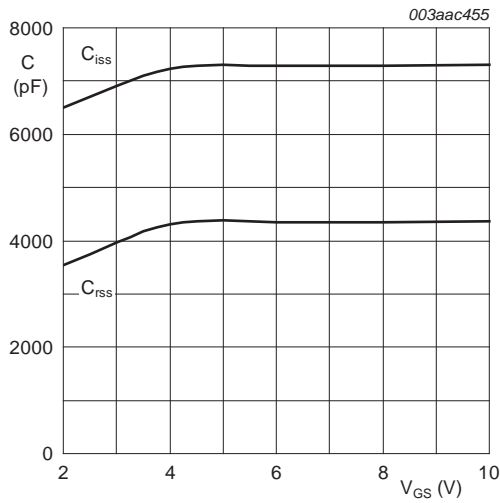
$T_j = 25^\circ\text{C}; V_{DS} = 15\text{V}$

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



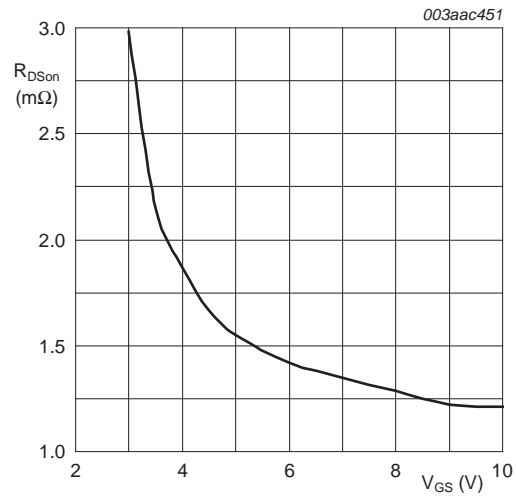
$V_{DS} = 10\text{V}$

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



$V_{DS} = 0\text{V}; f = 1\text{MHz}$

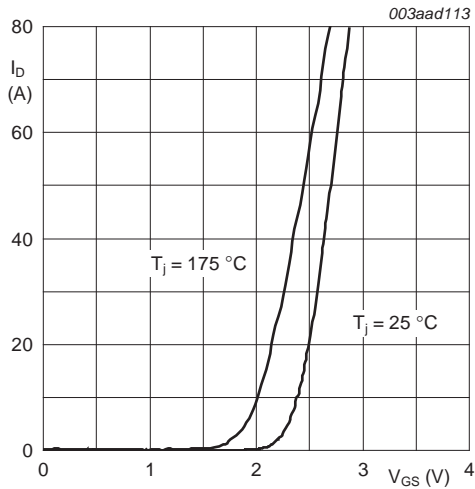
Fig 10. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



$T_j = 25^\circ\text{C}; I_D = 15\text{A}$

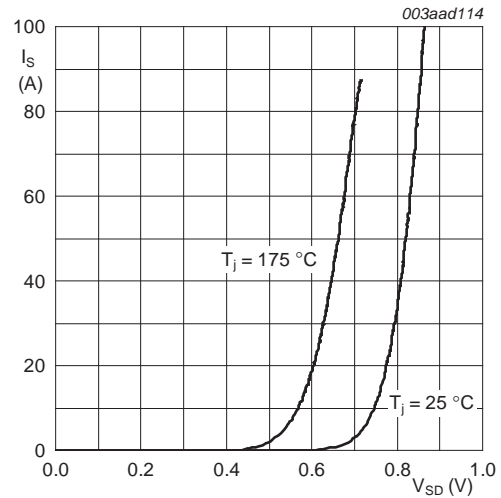
Fig 11. Drain-source on-state resistance as a function of gate-source voltage; typical values





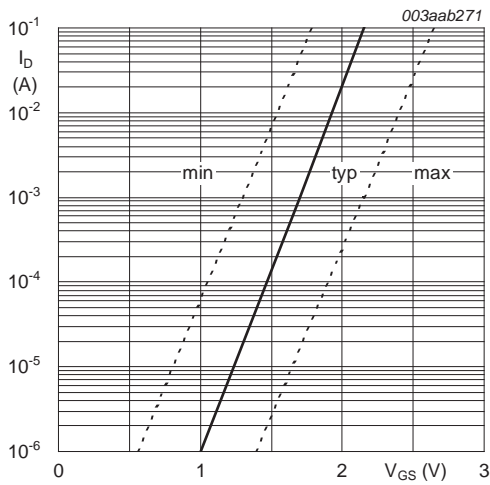
$V_{DS} = 15V$

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



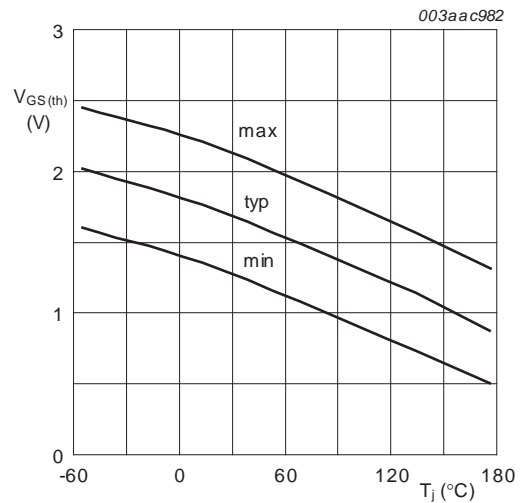
$V_{GS} = 0V$

Fig 13. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values



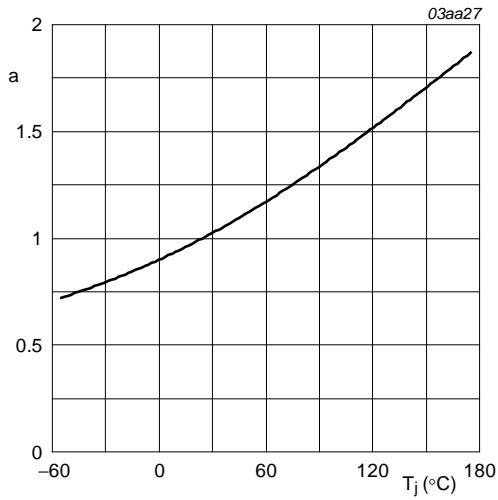
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 5V$

Fig 14. Sub-threshold drain current as a function of gate-source voltage



$I_D = 1mA; V_{DS} = V_{GS}$

Fig 15. Gate-source threshold voltage as a function of junction temperature



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

Fig 16. Normalized drain-source on-state resistance factor as a function of junction temperature

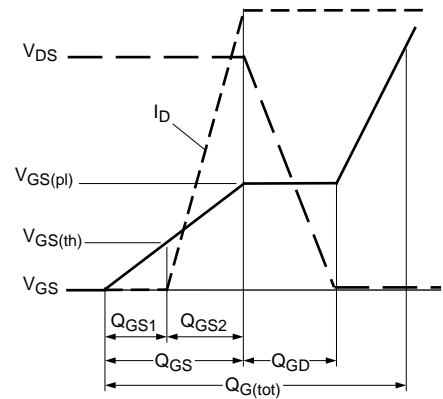
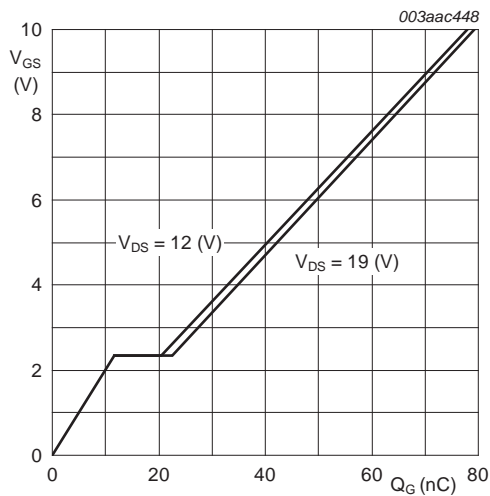
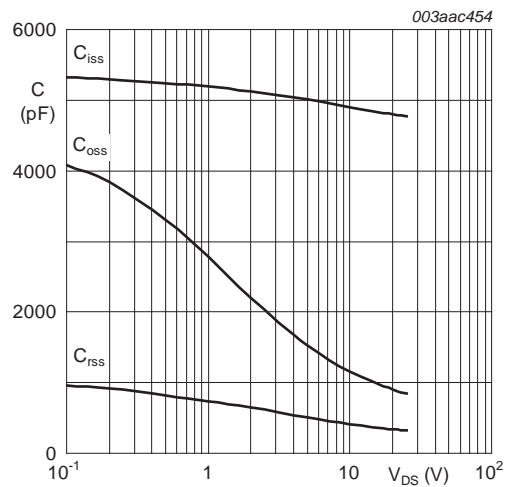


Fig 17. Gate charge waveform definitions



$T_j = 25^{\circ}C; I_D = 10A$

Fig 18. Gate-source voltage as a function of gate charge; typical values



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

Fig 19. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

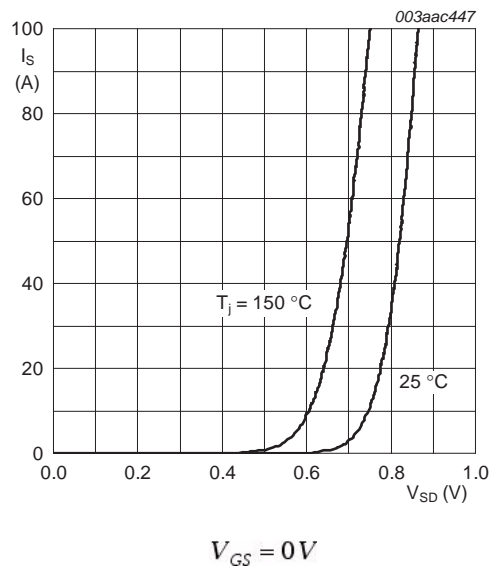


Fig 20. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

SOT669

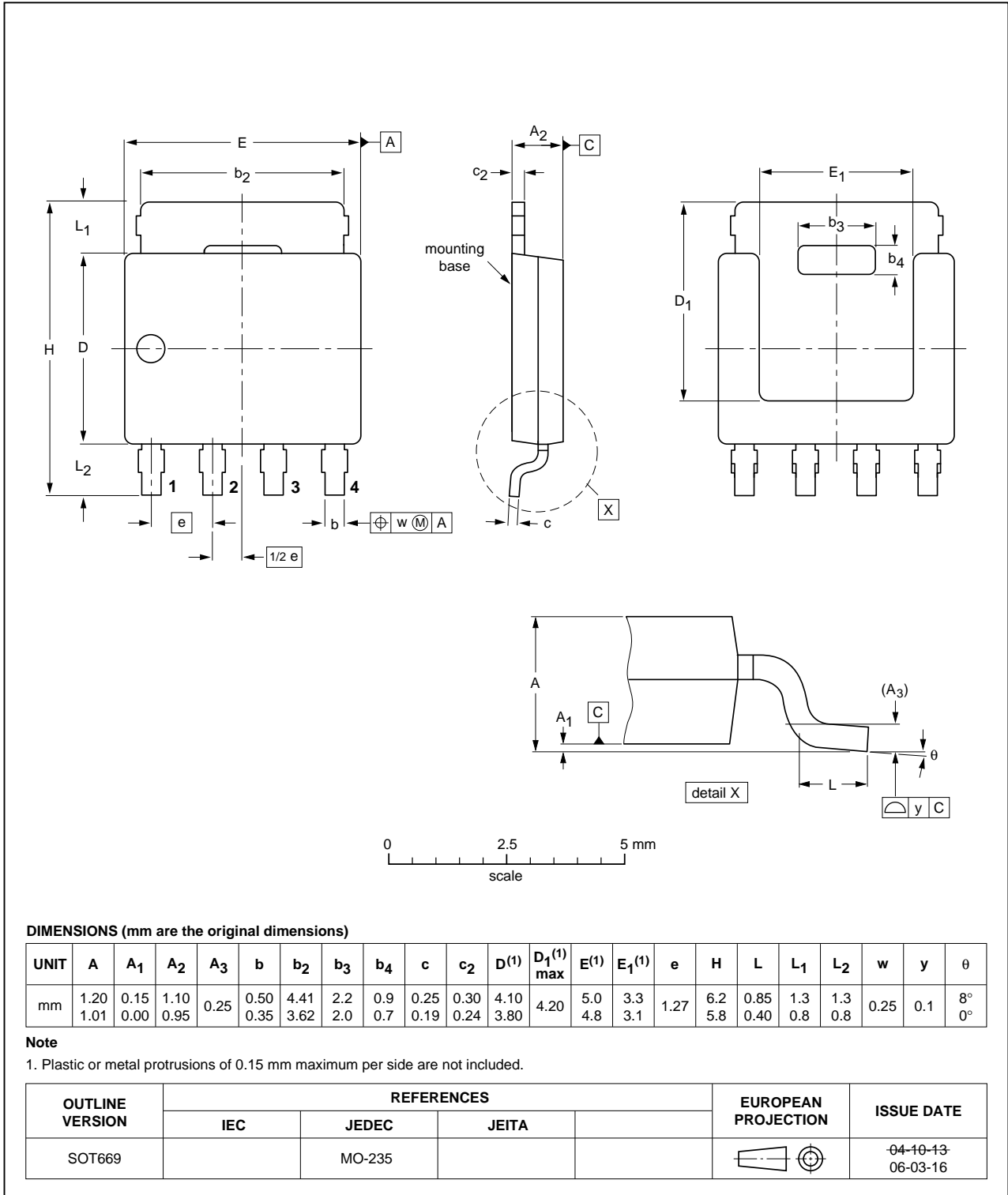


Fig 21. Package outline SOT669 (LPAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN1R7-30YL_4	20100420	Product data sheet	-	PSMN1R7-30YL_3
Modifications:	• Various changes to content.			
PSMN1R7-30YL_3	20100111	Product data sheet	-	PSMN1R7-30YL_2

## 9. Legal information

### 9.1 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".

[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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## 10. Contact information

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