

# PSMN4R0-25YLC

N-channel 25 V 4.5 mΩ logic level MOSFET in LPAK

Rev. 01 — 2 December 2010

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 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
- Power OR-ing
- Server power supplies
- Sync rectifier

### 1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	25	V
$I_D$	drain current	$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	-	-	84	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	61	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>	-	4.5	5.8	mΩ
		$V_{GS} = 10\text{ V}$ ; $I_D = 20\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 12</a>	-	3.5	4.5	mΩ

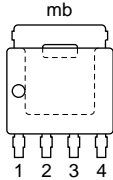
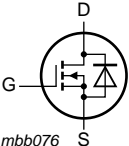


Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
$Q_{GD}$	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>	-	3.5	-	nC
$Q_{G(tot)}$	total gate 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>	-	10.9	-	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)

3. Ordering information

Table 3. Ordering information

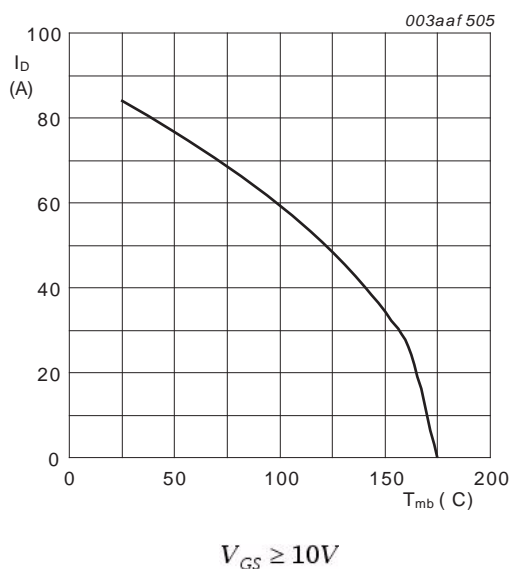
Type number	Package		
	Name	Description	Version
PSMN4R0-25YLC	LPAK	plastic single-ended surface-mounted package (LPAK); 4 leads	SOT669

## 4. Limiting values

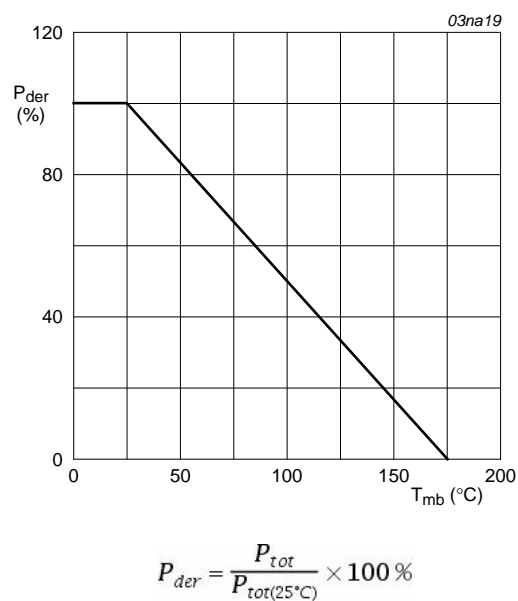
**Table 4. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	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>	-	84	A
		$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$ ; see <a href="#">Figure 1</a>	-	60	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>	-	336	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	61	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
$T_{sld(M)}$	peak soldering temperature		-	260	°C
$V_{ESD}$	electrostatic discharge voltage	MM (JEDEC JESD22-A115)	200	-	V
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	55	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$	-	336	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 84\text{ A}; V_{sup} \leq 25\text{ V}; R_{GS} = 50\text{ }\Omega$ ; unclamped; see <a href="#">Figure 3</a>	-	17.4	mJ



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



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

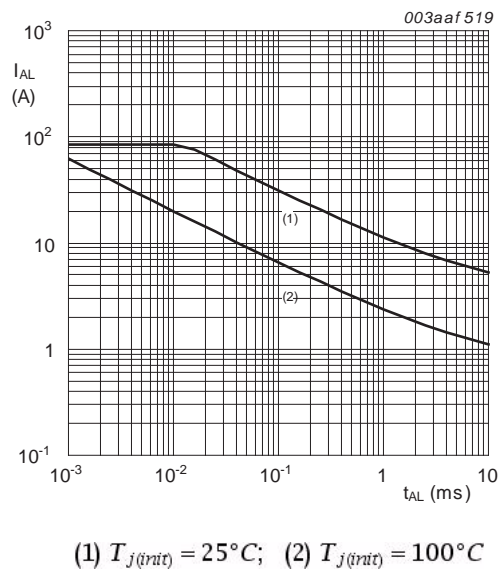


Fig 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

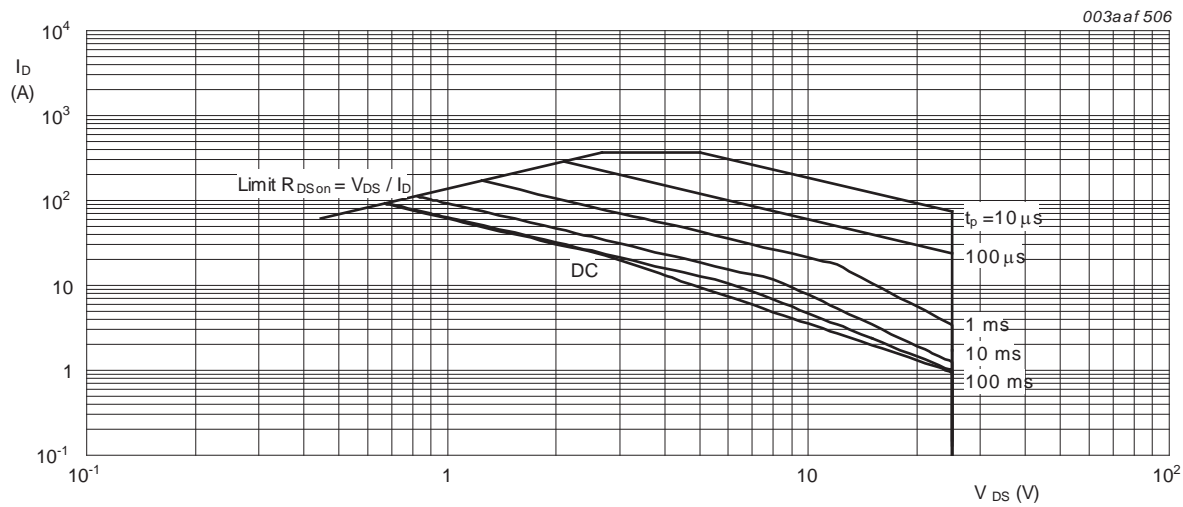


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

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>	-	1.4	2.4	K/W

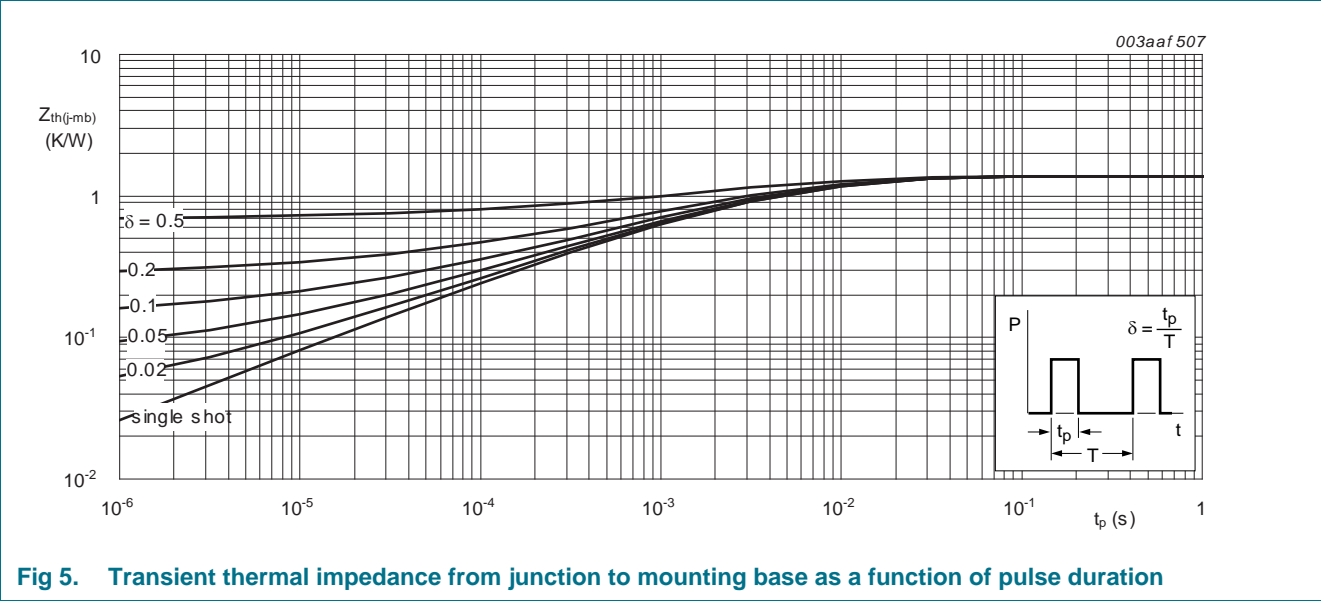


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu A$ ; $V_{GS} = 0\ V$ ; $T_j = 25\ ^\circ C$	25	-	-	V
		$I_D = 250\ \mu A$ ; $V_{GS} = 0\ V$ ; $T_j = -55\ ^\circ C$	22.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ mA$ ; $V_{DS} = V_{GS}$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 10</a>	1.05	1.53	1.95	V
		$I_D = 10\ mA$ ; $V_{DS} = V_{GS}$ ; $T_j = 150\ ^\circ C$ ; see <a href="#">Figure 11</a>	0.5	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ mA$ ; $V_{DS} = V_{GS}$ ; $T_j = -55\ ^\circ C$ ; see <a href="#">Figure 11</a>	-	-	2.25	V
$I_{DSS}$	drain leakage current	$V_{DS} = 25\ V$ ; $V_{GS} = 0\ V$ ; $T_j = 25\ ^\circ C$	-	-	1	$\mu A$
		$V_{DS} = 25\ V$ ; $V_{GS} = 0\ V$ ; $T_j = 150\ ^\circ C$	-	-	100	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = 16\ V$ ; $V_{DS} = 0\ V$ ; $T_j = 25\ ^\circ C$	-	-	100	nA
		$V_{GS} = -16\ V$ ; $V_{DS} = 0\ V$ ; $T_j = 25\ ^\circ C$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\ V$ ; $I_D = 20\ A$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 12</a>	-	4.5	5.8	mΩ
		$V_{GS} = 4.5\ V$ ; $I_D = 20\ A$ ; $T_j = 150\ ^\circ C$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	-	9.85	mΩ
		$V_{GS} = 10\ V$ ; $I_D = 20\ A$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 12</a>	-	3.5	4.5	mΩ
		$V_{GS} = 10\ V$ ; $I_D = 20\ A$ ; $T_j = 150\ ^\circ C$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	-	7.65	mΩ
$R_G$	internal gate resistance (AC)	$f = 1\ MHz$	-	2.1	4.2	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 20\ A$ ; $V_{DS} = 12\ V$ ; $V_{GS} = 10\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	22.8	-	nC
		$I_D = 0\ A$ ; $V_{DS} = 0\ V$ ; $V_{GS} = 10\ V$ ; see <a href="#">Figure 14</a>	-	21.1	-	nC
		$I_D = 20\ A$ ; $V_{DS} = 12\ V$ ; $V_{GS} = 4.5\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	10.9	-	nC
$Q_{GS}$	gate-source charge		-	3.3	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	2.25	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	1.05	-	nC
$Q_{GD}$	gate-drain charge	$I_D = 20\ A$ ; $V_{DS} = 12\ V$ ; $V_{GS} = 4.5\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	3.5	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 12\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	2.58	-	V
$C_{iss}$	input capacitance	$V_{DS} = 12\ V$ ; $V_{GS} = 0\ V$ ; $f = 1\ MHz$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 16</a>	-	1407	-	pF
$C_{oss}$	output capacitance		-	354	-	pF
$C_{rss}$	reverse transfer capacitance		-	119	-	pF

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12\text{ V}; R_L = 0.5\text{ }\Omega; V_{GS} = 4.5\text{ V};$ $R_{G(ext)} = 4.7\text{ }\Omega$	-	15.9	-	ns
$t_r$	rise time		-	17.5	-	ns
$t_{d(off)}$	turn-off delay time		-	24	-	ns
$t_f$	fall time		-	9.9	-	ns
$Q_{oss}$	output charge	$V_{GS} = 0\text{ V}; V_{DS} = 12\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^\circ\text{C}$	-	7.32	-	nC

Source-drain diode

$V_{SD}$	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>	-	0.8	1.1	V
$t_{rr}$	reverse recovery time	$I_S = 20\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s}; V_{GS} = 0\text{ V};$ $V_{DS} = 12\text{ V}$	-	24.5	-	ns
$Q_r$	recovered charge		-	16.1	-	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>	-	14.9	-	ns
$t_b$	reverse recovery fall time		-	9.6	-	ns

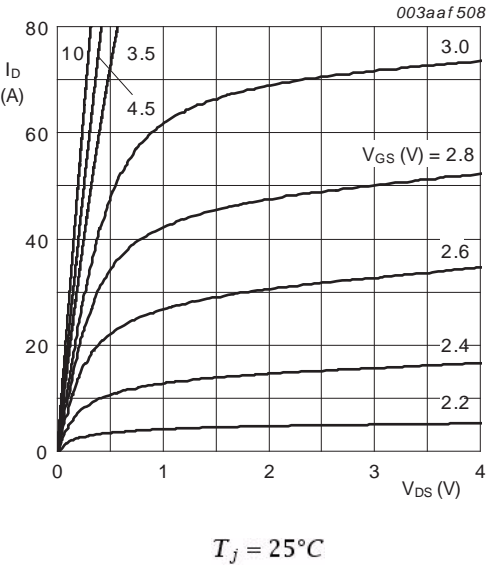


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

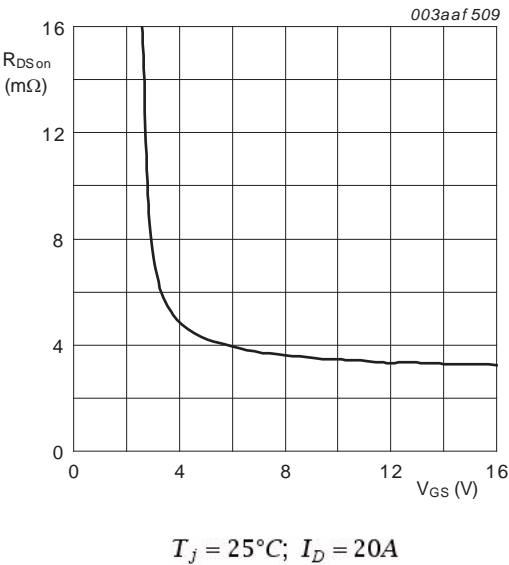
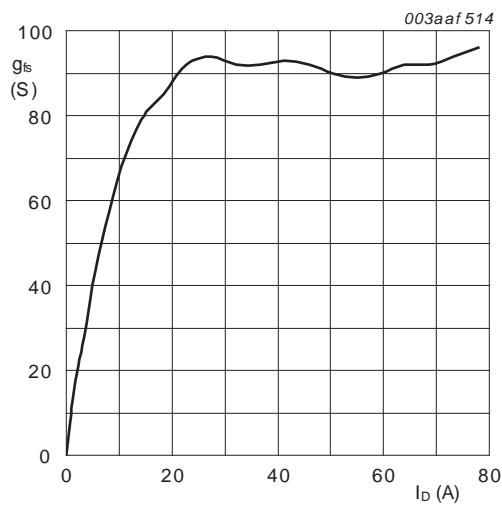
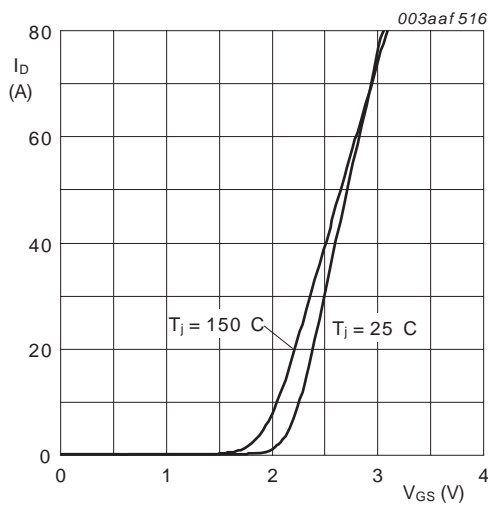


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values



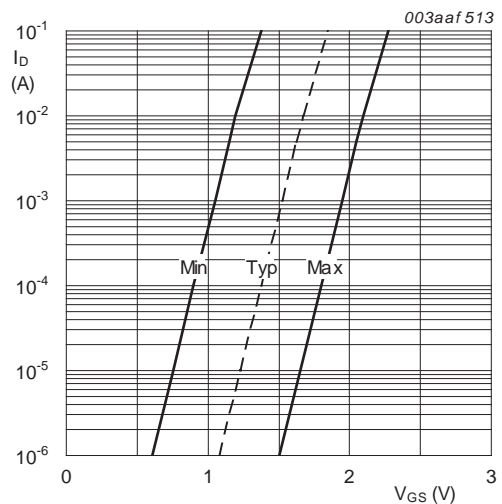
$T_j = 25^\circ\text{C}; V_{DS} = 10\text{V}$

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



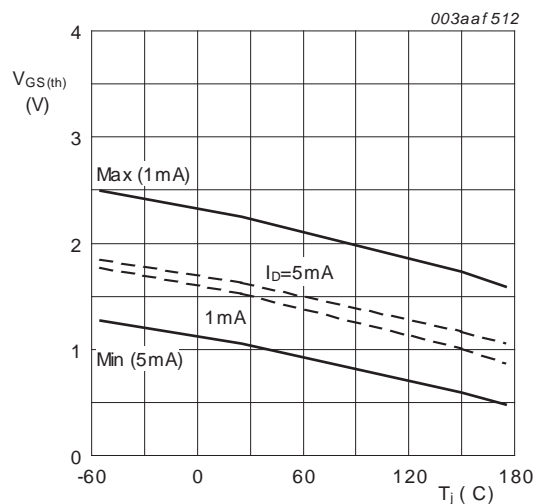
$V_{DS} = 10\text{V}$

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



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

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



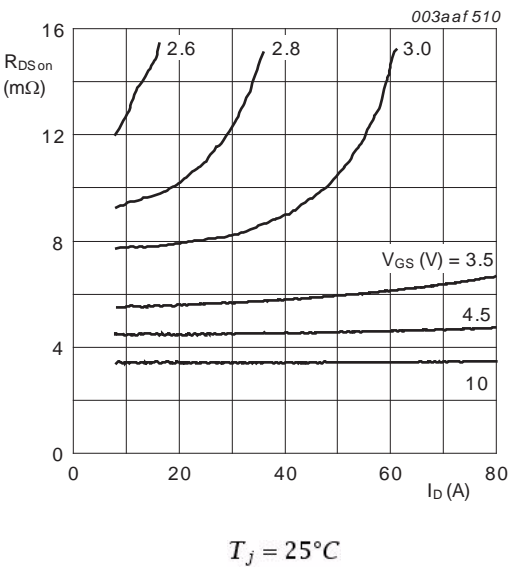


Fig 12. Drain-source on-state resistance as a function of drain current; typical values

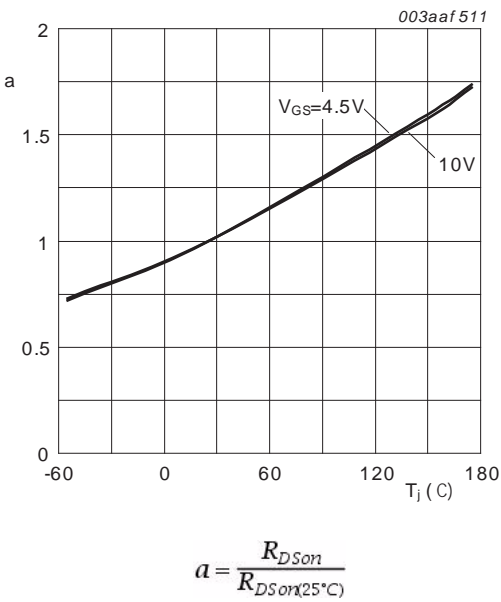


Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature

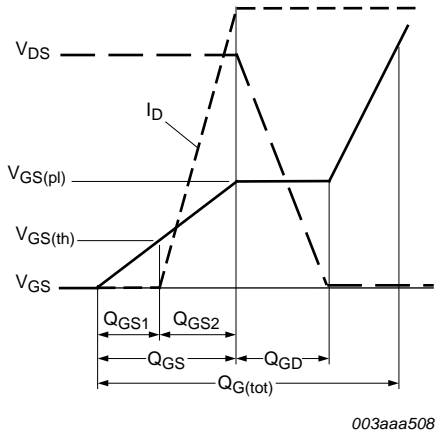


Fig 14. Gate charge waveform definitions

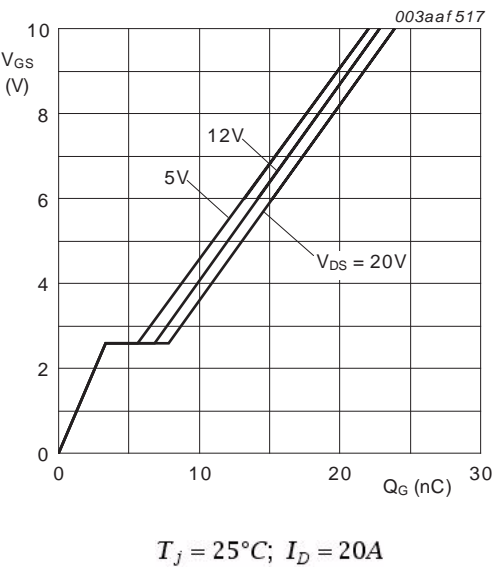


Fig 15. Gate-source voltage as a function of gate charge; typical values

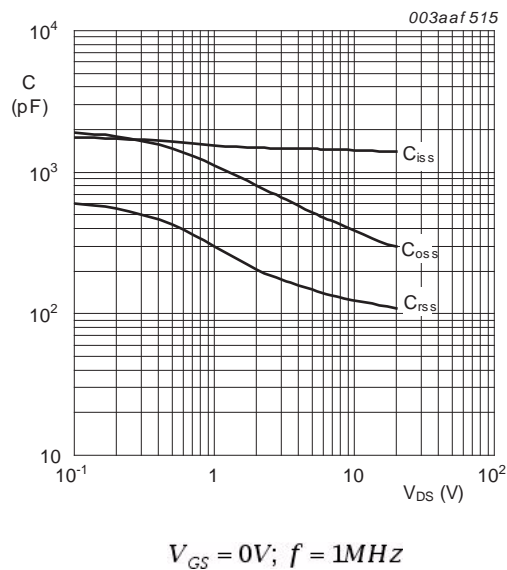


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

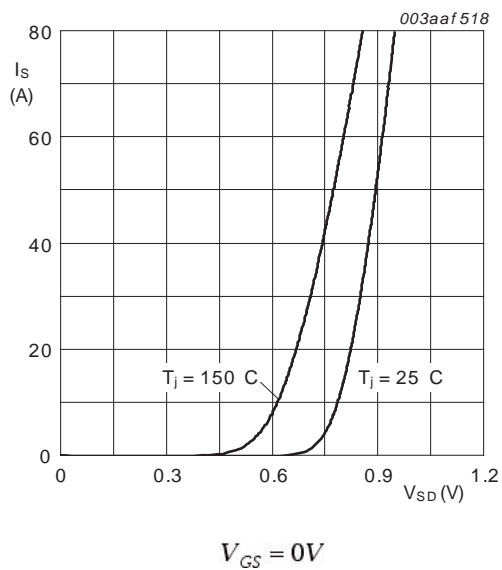


Fig 17. Source current as a function of source-drain voltage; typical values

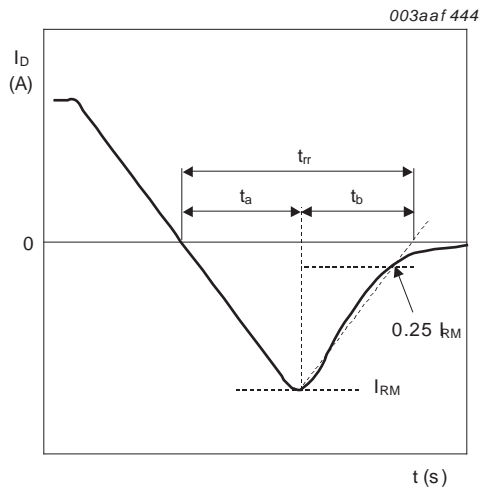


Fig 18. Reverse recovery timing definition

7. Package outline

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

SOT669

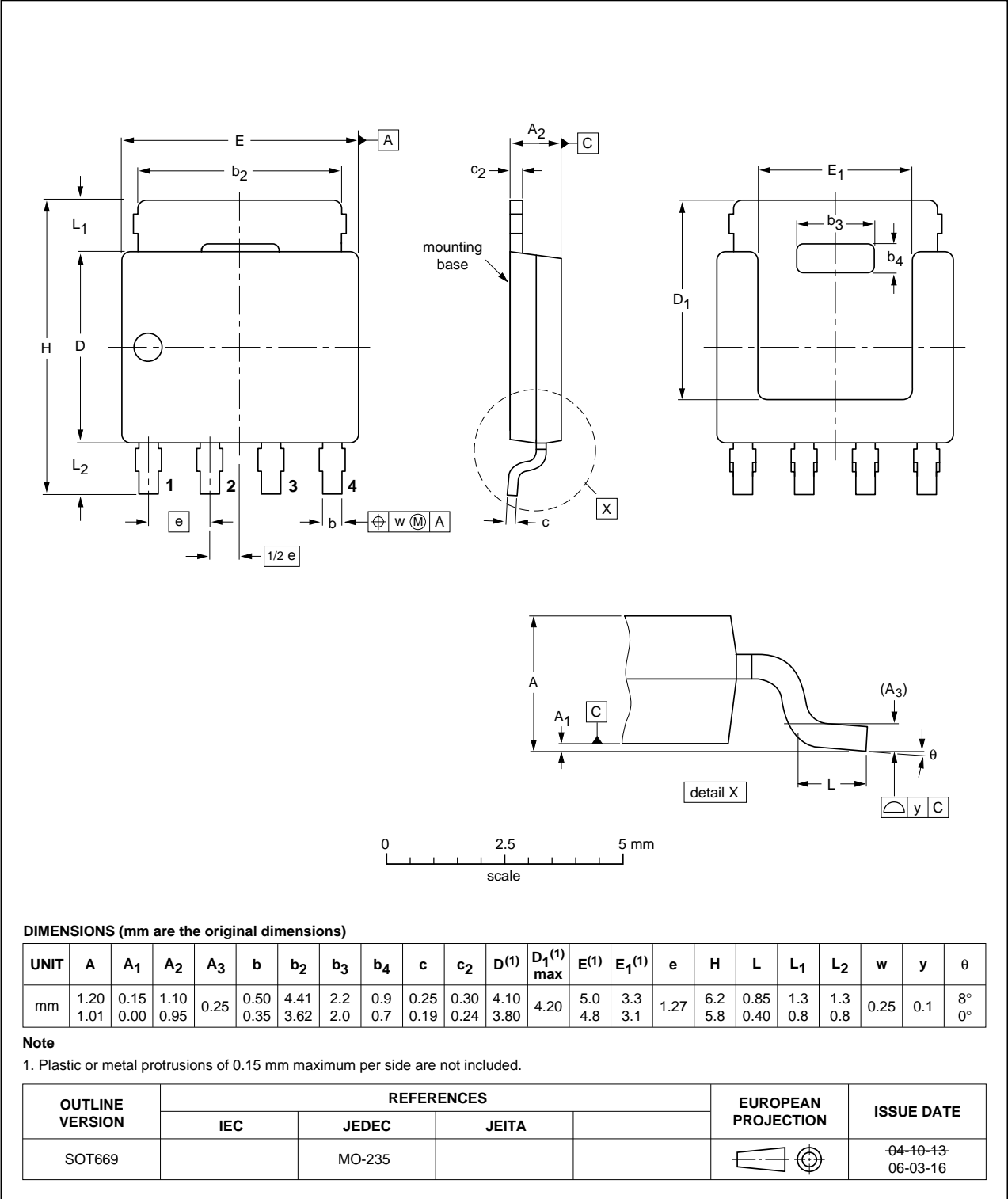


Fig 19. Package outline SOT669 (LPAK)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN4R0-25YLC v.1	20101202	Product data sheet	-	-

## 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".

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## 11. Contents

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<b>1</b>	<b>Product profile</b> . . . . .	<b>1</b>
1.1	General description . . . . .	1
1.2	Features and benefits . . . . .	1
1.3	Applications . . . . .	1
1.4	Quick reference data . . . . .	1
<b>2</b>	<b>Pinning information</b> . . . . .	<b>2</b>
<b>3</b>	<b>Ordering information</b> . . . . .	<b>2</b>
<b>4</b>	<b>Limiting values</b> . . . . .	<b>3</b>
<b>5</b>	<b>Thermal characteristics</b> . . . . .	<b>5</b>
<b>6</b>	<b>Characteristics</b> . . . . .	<b>6</b>
<b>7</b>	<b>Package outline</b> . . . . .	<b>11</b>
<b>8</b>	<b>Revision history</b> . . . . .	<b>12</b>
<b>9</b>	<b>Legal information</b> . . . . .	<b>13</b>
9.1	Data sheet status . . . . .	13
9.2	Definitions . . . . .	13
9.3	Disclaimers . . . . .	13
9.4	Trademarks . . . . .	14
<b>10</b>	<b>Contact information</b> . . . . .	<b>14</b>

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Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

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