



# PSMN012-25YLC

N-channel 25 V 12.6 mΩ logic level MOSFET in LPAK using NextPower technology

Rev. 1 — 25 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

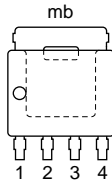
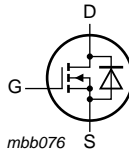
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>DS</sub>	drain-source voltage	25 °C ≤ T <sub>j</sub> ≤ 175 °C	-	-	25	V
I <sub>D</sub>	drain current	T <sub>mb</sub> = 25 °C; V <sub>GS</sub> = 10 V; see <a href="#">Figure 1</a>	-	-	33	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <a href="#">Figure 2</a>	-	-	26	W
T <sub>j</sub>	junction temperature		-55	-	175	°C
Static characteristics						
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 10 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 12</a>	-	14.1	16.6	mΩ
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 10 A; T <sub>j</sub> = 25 °C; see <a href="#">Figure 12</a>	-	10.7	12.6	mΩ
Dynamic characteristics						
Q <sub>GD</sub>	gate-drain charge	V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 10 A; V <sub>DS</sub> = 12 V; see <a href="#">Figure 14</a> ;	-	1.22	-	nC
Q <sub>G(tot)</sub>	total gate charge	see <a href="#">Figure 15</a>	-	3.8	-	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

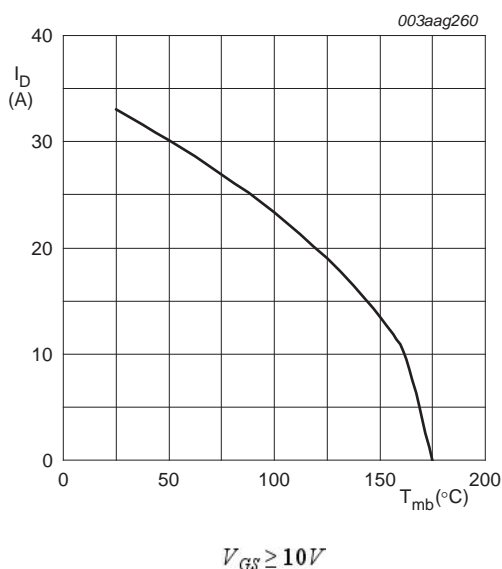
Type number	Package		
	Name	Description	Version
PSMN012-25YLC	LPAK; Power-SO8	plastic single-ended surface-mounted package; 4 leads	SOT669

## 4. Limiting values

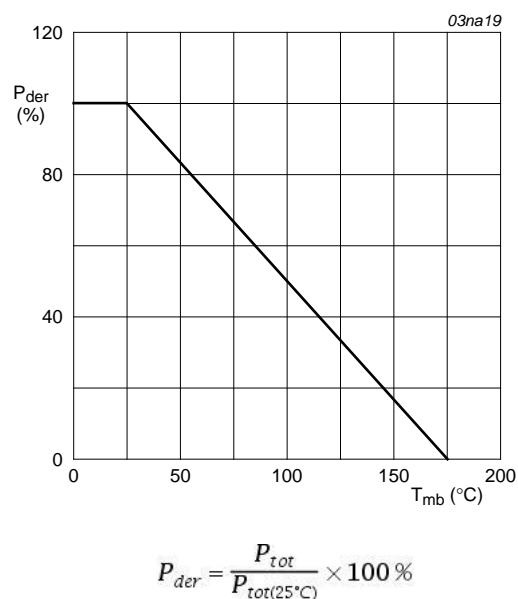
**Table 4. Limiting values**

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>	-	33	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ °C}$ ; see <a href="#">Figure 1</a>	-	24	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>	-	134	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	26	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)	100	-	V
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	23	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$	-	134	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 33\text{ A}$ ; $V_{sup} \leq 25\text{ V}$ ; unclamped; $R_{GS} = 50\text{ }\Omega$ ; see <a href="#">Figure 3</a>	-	8	mJ



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



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

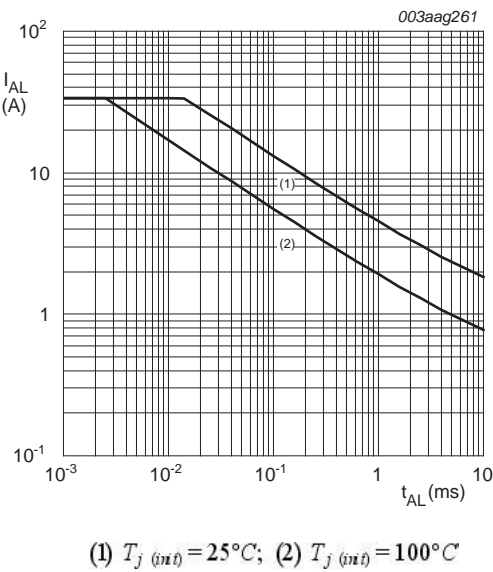


Fig 3. Single pulse avalanche rating; avalanche current as a function of avalanche time

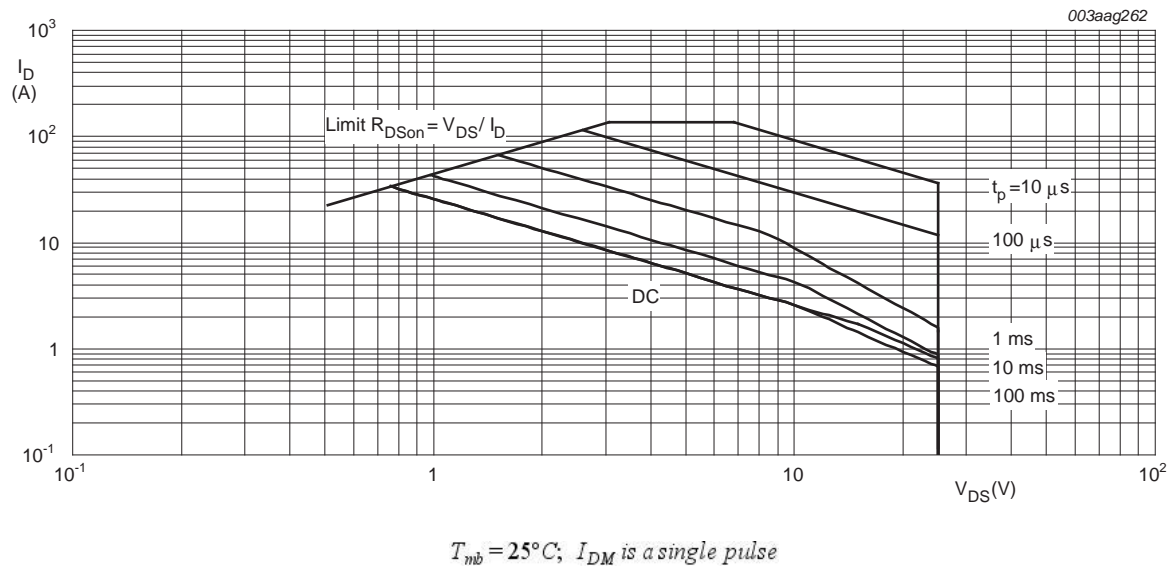


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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>	-	5.66	5.83	K/W

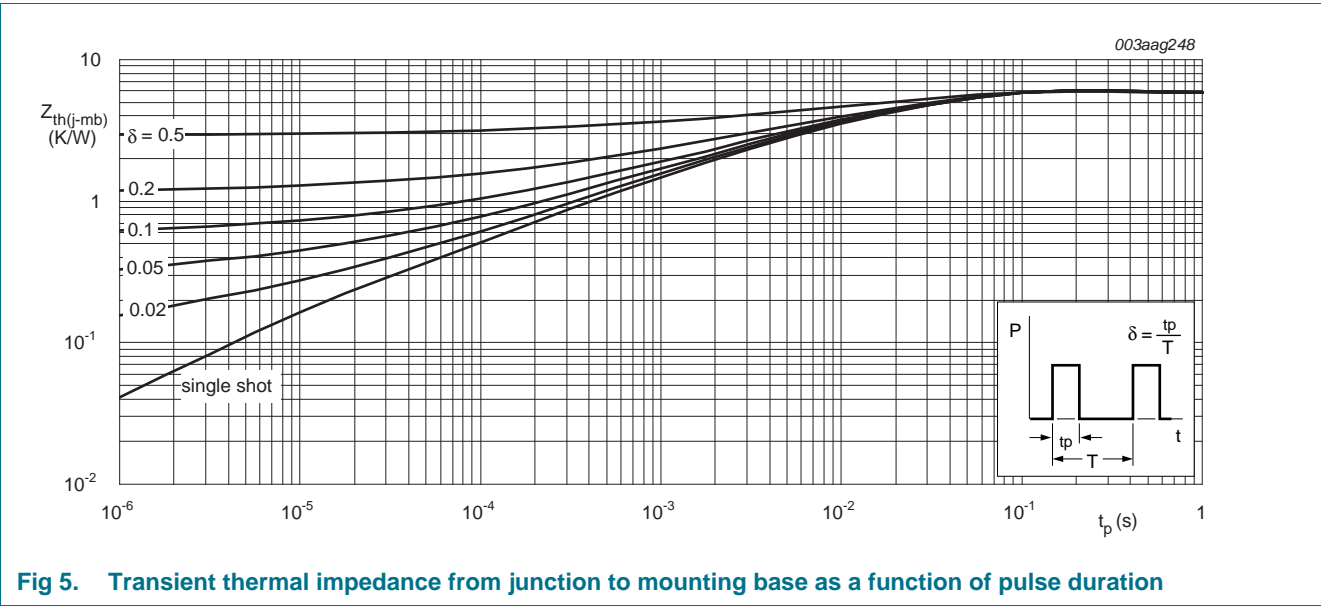


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 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> ; see <a href="#">Figure 11</a>	1.05	1.66	1.95	V
		$I_D = 10\ mA$ ; $V_{DS} = V_{GS}$ ; $T_j = 150\ ^\circ C$	0.5	-	-	V
		$I_D = 1\ mA$ ; $V_{DS} = V_{GS}$ ; $T_j = -55\ ^\circ C$	-	-	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	$V_{GS} = 4.5\ V$ ; $I_D = 10\ A$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 12</a>	-	14.1	16.6	mΩ
		$V_{GS} = 4.5\ V$ ; $I_D = 10\ A$ ; $T_j = 150\ ^\circ C$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	-	26.3	mΩ
		$V_{GS} = 10\ V$ ; $I_D = 10\ A$ ; $T_j = 25\ ^\circ C$ ; see <a href="#">Figure 12</a>	-	10.7	12.6	mΩ
		$V_{GS} = 10\ V$ ; $I_D = 10\ A$ ; $T_j = 150\ ^\circ C$ ; see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	-	20.1	mΩ
$R_G$	internal gate resistance (AC)	$f = 1\ MHz$	-	2.12	4.24	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 10\ A$ ; $V_{DS} = 12\ V$ ; $V_{GS} = 10\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	8.3	-	nC
		$I_D = 10\ A$ ; $V_{DS} = 12\ V$ ; $V_{GS} = 4.5\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	3.8	-	nC
		$I_D = 0\ A$ ; $V_{DS} = 0\ V$ ; $V_{GS} = 10\ V$	-	7.7	-	nC
$Q_{GS}$	gate-source charge	$I_D = 10\ A$ ; $V_{DS} = 12\ V$ ; $V_{GS} = 4.5\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	1.23	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	0.86	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	0.37	-	nC
$Q_{GD}$	gate-drain charge		-	1.22	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 10\ A$ ; $V_{DS} = 12\ V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	2.71	-	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>	-	528	-	pF
$C_{oss}$	output capacitance		-	145	-	pF
$C_{rss}$	reverse transfer capacitance		-	43	-	pF

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 12 V; R <sub>L</sub> = 0.6 Ω; V <sub>GS</sub> = 4.5 V; R <sub>G(ext)</sub> = 4.7 Ω	-	11.7	-	ns
t <sub>r</sub>	rise time		-	9.4	-	ns
t <sub>d(off)</sub>	turn-off delay time		-	14.4	-	ns
t <sub>f</sub>	fall time		-	5.6	-	ns
Q <sub>oss</sub>	output charge	V <sub>GS</sub> = 0 V; V <sub>DS</sub> = 12 V; f = 1 MHz; T <sub>j</sub> = 25 °C	-	3.3	-	nC

Source-drain diode

V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 10 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; see <a href="#">Figure 17</a>	-	0.85	1.1	V
t <sub>rr</sub>	reverse recovery time	I <sub>S</sub> = 10 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V;	-	14.7	-	ns
Q <sub>r</sub>	recovered charge	V <sub>DS</sub> = 12 V	-	4.6	-	nC
t <sub>a</sub>	reverse recovery rise time	V <sub>GS</sub> = 0 V; I <sub>S</sub> = 10 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>DS</sub> = 12 V; see <a href="#">Figure 18</a>	-	8.2	-	ns
t <sub>b</sub>	reverse recovery fall time		-	6.5	-	ns

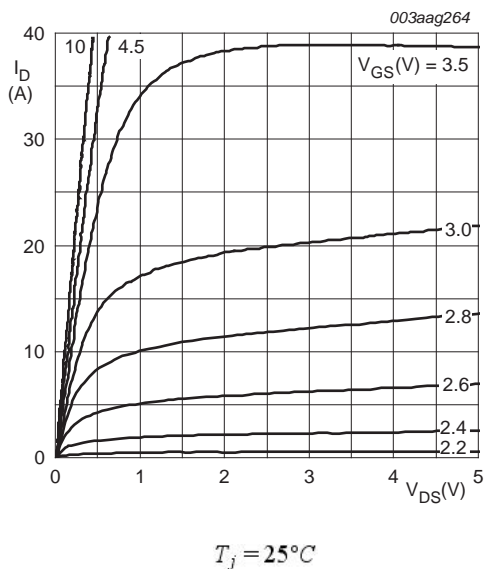


Fig 6. Output characteristics; drain current as a function of drain-source voltage; typical values

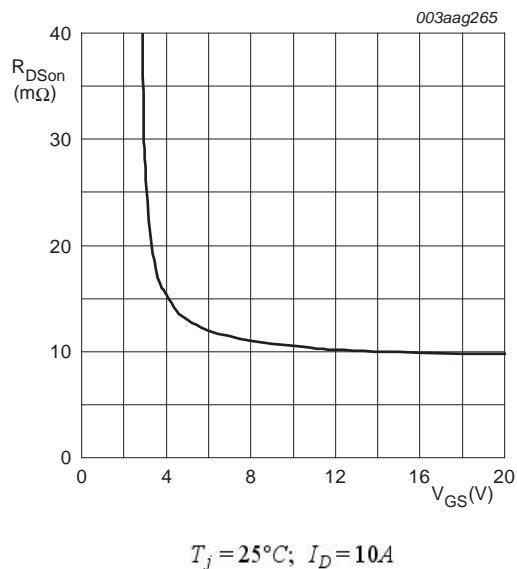
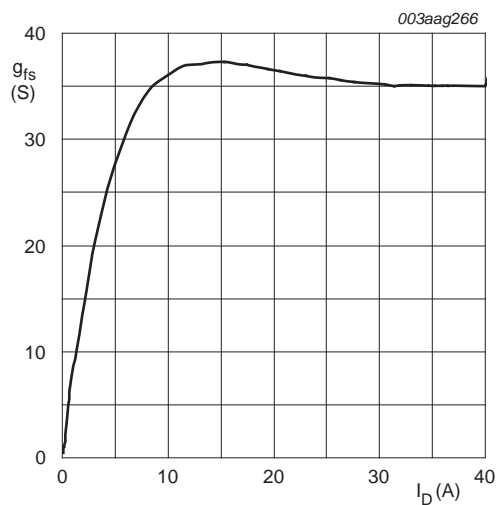
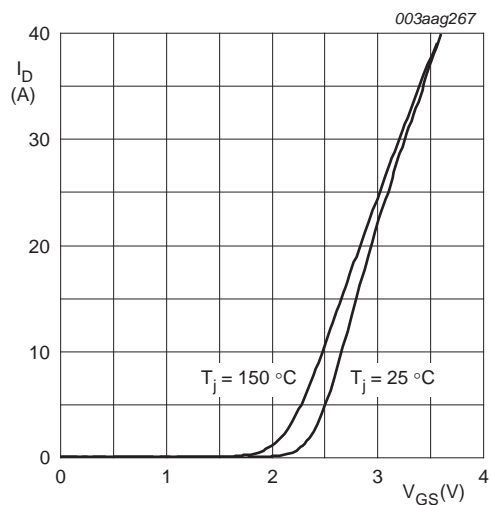


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values



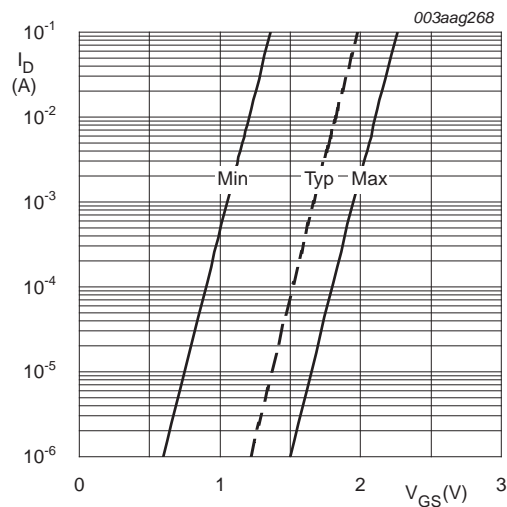
$T_j = 25^\circ\text{C}; V_{DS} = 10\text{V}$

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



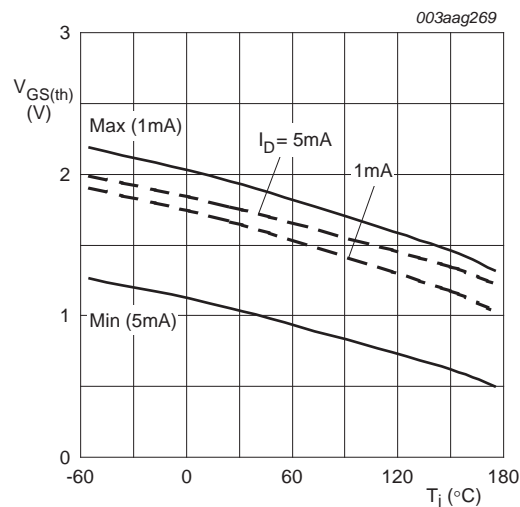
$V_{DS} = 10\text{V}$

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



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

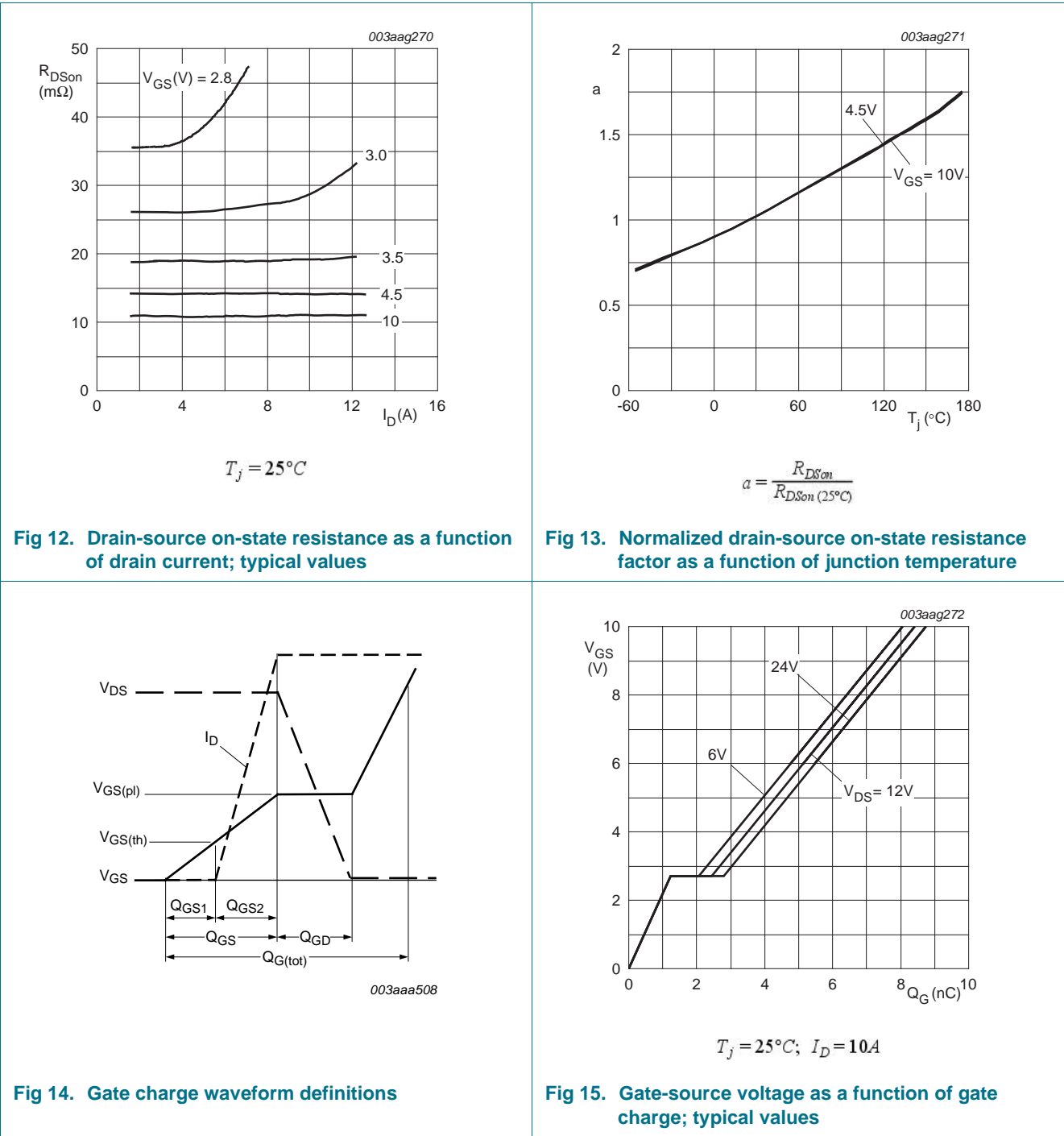
Fig 10. Sub-threshold drain current as a function of gate-source voltage



$V_{DS} = V_{GS}$

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





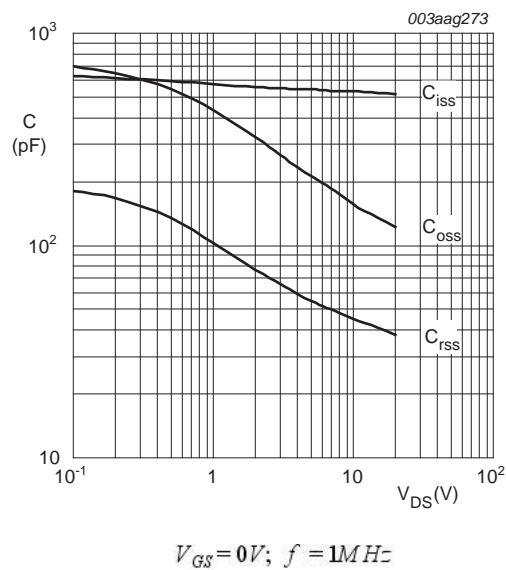


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

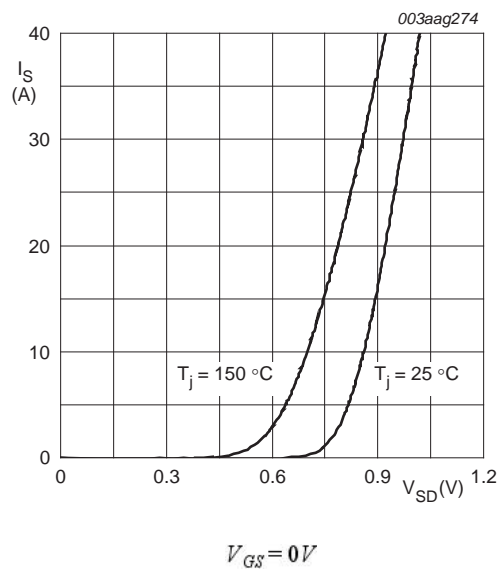


Fig 17. Source current as a function of source-drain voltage; typical values

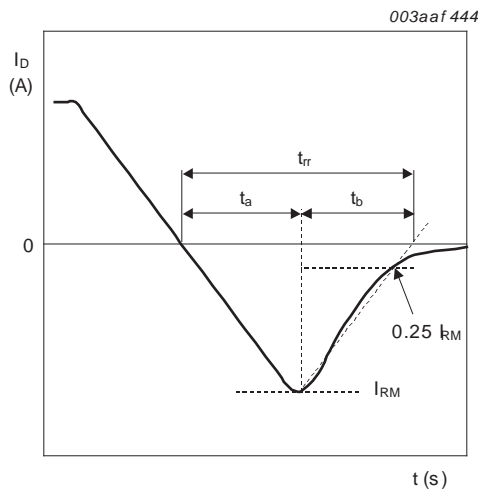


Fig 18. Reverse recovery timing definition

7. Package outline

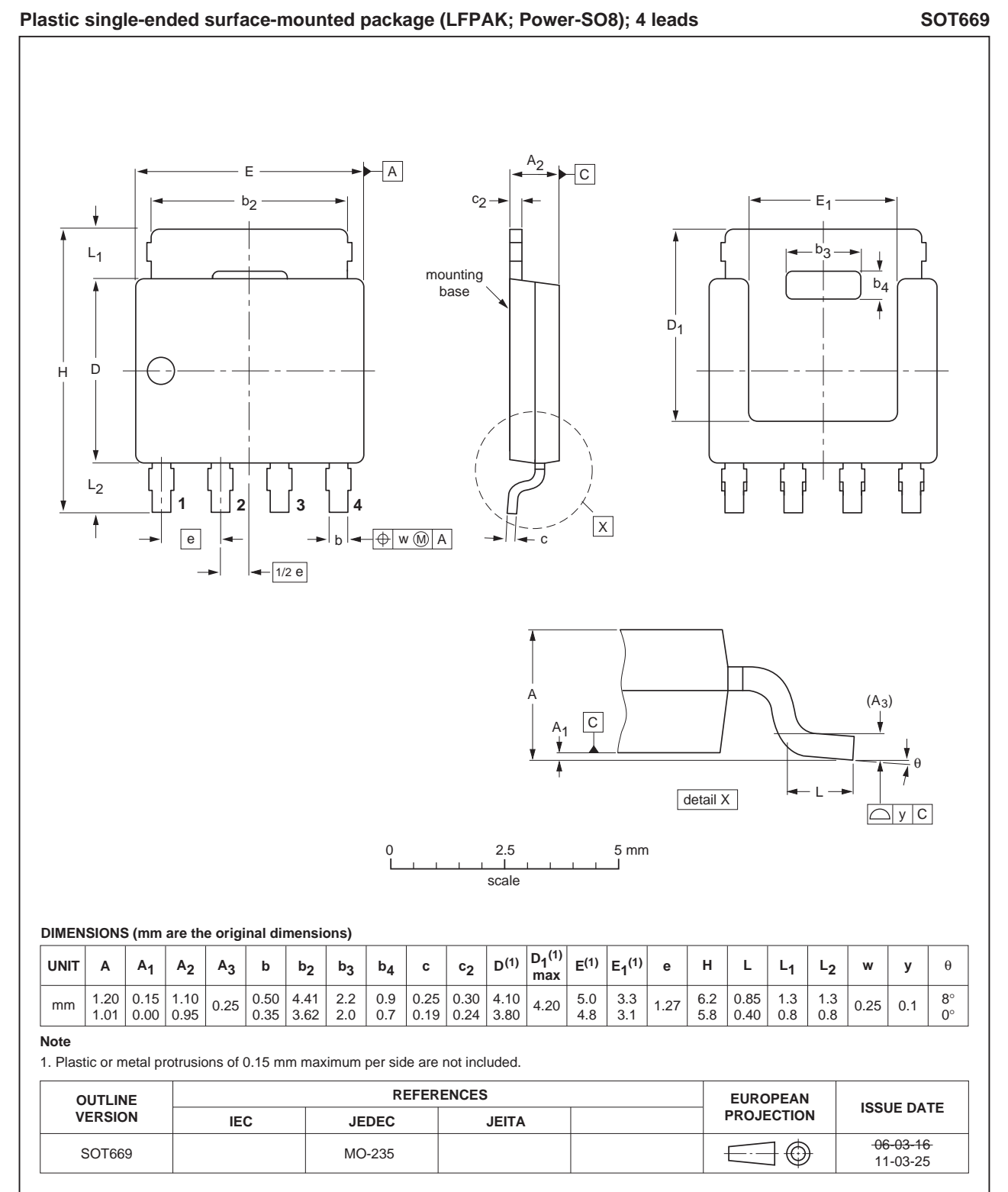


Fig 19. Package outline SOT669 (LPAK; Power-SO8)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN012-25YLC v.1	20111025	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.

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