

PSMN1R5-30YL

N-channel 30 V 1.5 mΩ logic level MOSFET in LPAK

Rev. 01 — 9 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 [1] Figure 1	-	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C};$ see Figure 2	-	-	109	W
T_j	junction temperature		-55	-	175	°C
Static characteristics						
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 15\text{ A};$ $T_j = 100\text{ °C};$ see Figure 14	-	-	2.4	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A};$ $T_j = 25\text{ °C}$	-	1.3	1.5	mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 4.5\text{ V}; I_D = 10\text{ A};$ $V_{DS} = 12\text{ V};$ see Figure 15 ; see Figure 16	-	8.7	-	nC



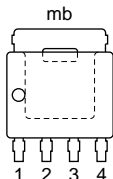
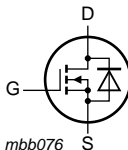
Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$Q_{G(tot)}$	total gate charge	$V_{GS} = 4.5\text{ V}; I_D = 10\text{ A};$ $V_{DS} = 12\text{ V};$ see Figure 15	-	36.2	-	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ $I_D = 100\text{ A}; V_{sup} \leq 30\text{ V};$ $R_{GS} = 50\text{ }\Omega;$ unclamped	-	-	241	mJ

[1] Continuous current is limited by package.

2. 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
PSMN1R5-30YL	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).

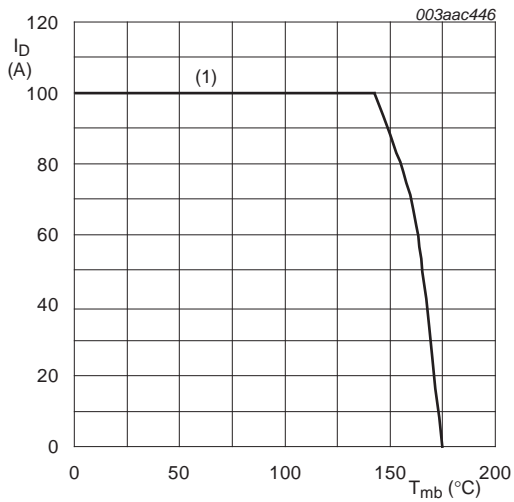
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	30	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	-	30	V
V_{GS}	gate-source voltage		-20	-	20	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C}$; see Figure 1 [1]	-	-	100	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$; see Figure 1 [1]	-	-	100	A
I_{DM}	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$; see Figure 4	-	-	790	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	109	W
T_{stg}	storage temperature		-55	-	175	°C
T_j	junction temperature		-55	-	175	°C
Source-drain diode						
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
Avalanche ruggedness						
$E_{DS(AL)R}$	repetitive drain-source avalanche energy	see Figure 3 [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.

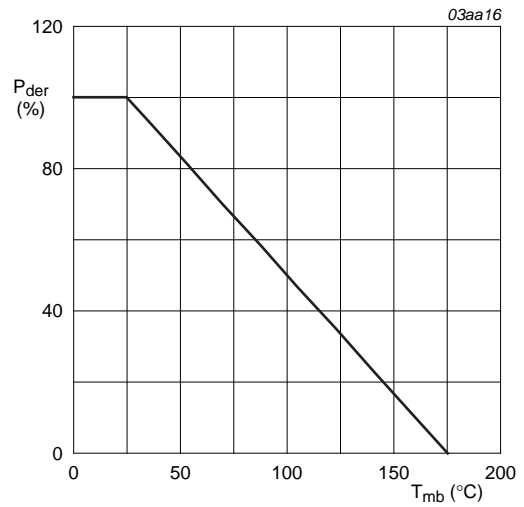
[3] Repetitive avalanche rating limited by average junction temperature of 170 °C.

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



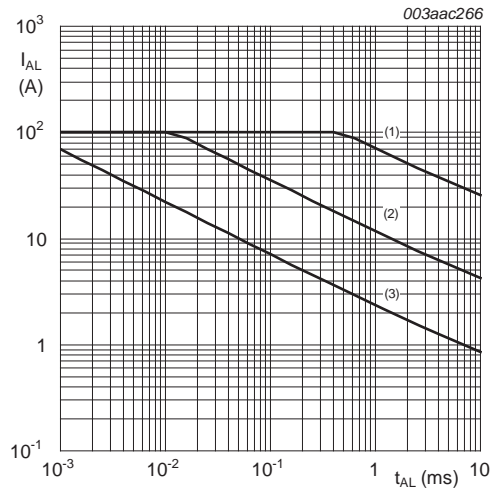
V_{GS} ≥ 10 V; (1) Capped at 100 A due to package

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



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

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



- (1) Single-pulse; T_j = 25 °C.
- (2) Single-pulse; T_j = 175 °C.
- (3) Repetitive.

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

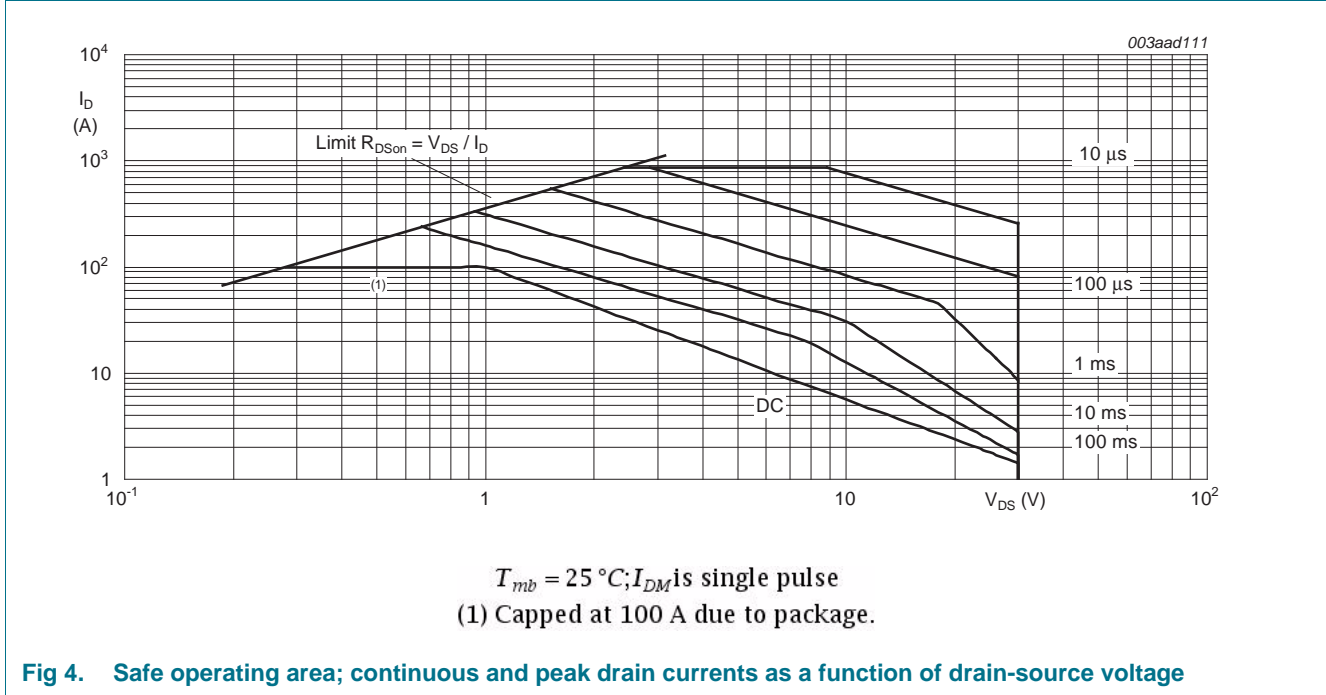


Fig 4. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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 Figure 5	-	0.5	1.1	K/W

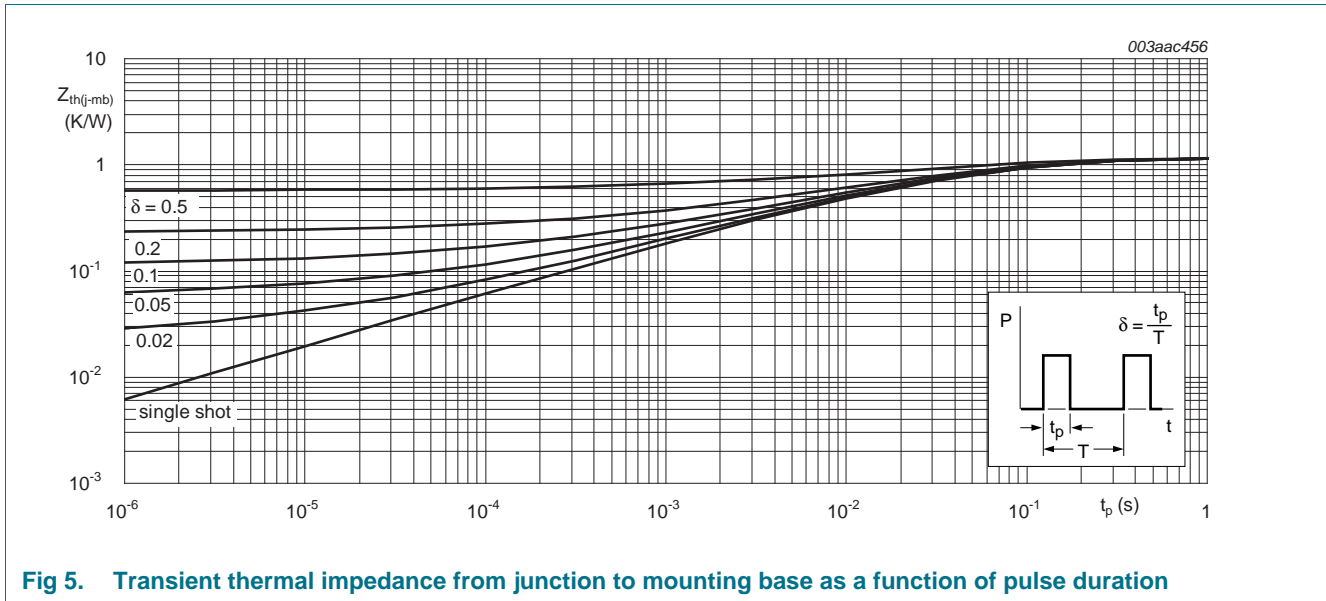


Fig 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics
Tested to JEDEC standards where applicable.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 20\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}; t_{av} = 100\text{ ns}$	35	-	-	V
		$I_D = 250\text{ }\mu\text{A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	30	-	-	V
		$I_D = 250\text{ }\mu\text{A}; V_{GS} = 0\text{ V}; T_j = -55\text{ }^\circ\text{C}$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = 25\text{ }^\circ\text{C};$ see Figure 12 ; see Figure 13	1.3	1.7	2.15	V
		$I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = 150\text{ }^\circ\text{C};$ see Figure 13	0.65	-	-	V
		$I_D = 1\text{ mA}; V_{DS} = V_{GS}; T_j = -55\text{ }^\circ\text{C};$ see Figure 13	-	-	2.45	V
I_{DSS}	drain leakage current	$V_{DS} = 30\text{ V}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	-	1	μA
		$V_{DS} = 30\text{ V}; V_{GS} = 0\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	-	100	μA
I_{GSS}	gate leakage current	$V_{GS} = 16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	-	100	nA
		$V_{GS} = -16\text{ V}; V_{DS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	1.8	1.9	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 150\text{ }^\circ\text{C};$ see Figure 14	-	-	2.8	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 100\text{ }^\circ\text{C};$ see Figure 14	-	-	2.4	mΩ
		$V_{GS} = 10\text{ V}; I_D = 15\text{ A}; T_j = 25\text{ }^\circ\text{C}$	-	1.3	1.5	mΩ
R_G	gate resistance	$f = 1\text{ MHz}$	-	0.77	1.5	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 10\text{ A}; V_{DS} = 12\text{ V}; V_{GS} = 10\text{ V};$ see Figure 15 ; see Figure 16	-	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 Figure 15	-	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 Figure 15 ; see Figure 16	-	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 Figure 15 ; see Figure 16	-	2.34	-	V
C_{iss}	input capacitance	$V_{DS} = 12\text{ V}; V_{GS} = 0\text{ V}; f = 1\text{ MHz};$ $T_j = 25\text{ }^\circ\text{C};$ see Figure 17	-	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
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see Figure 18	-	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

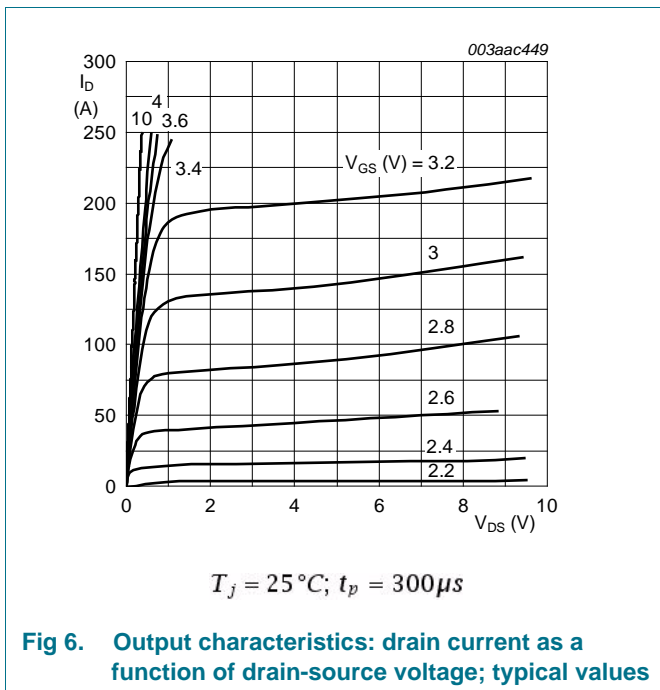


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

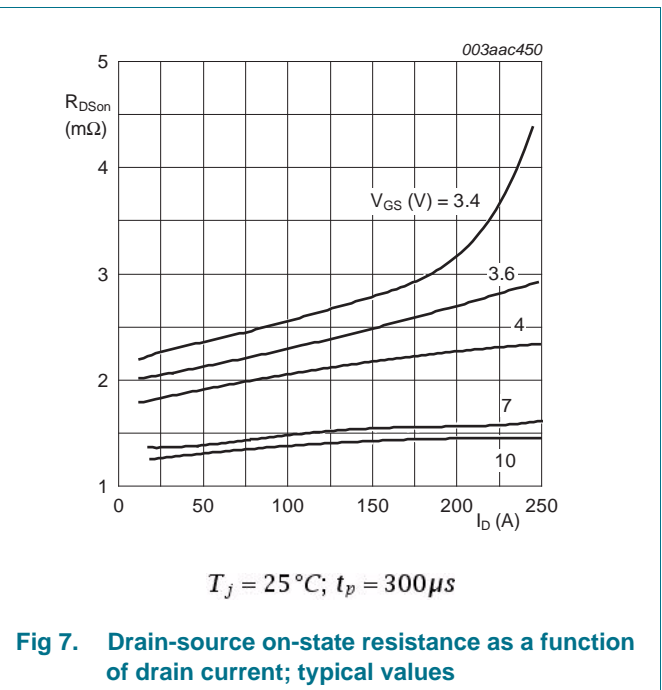
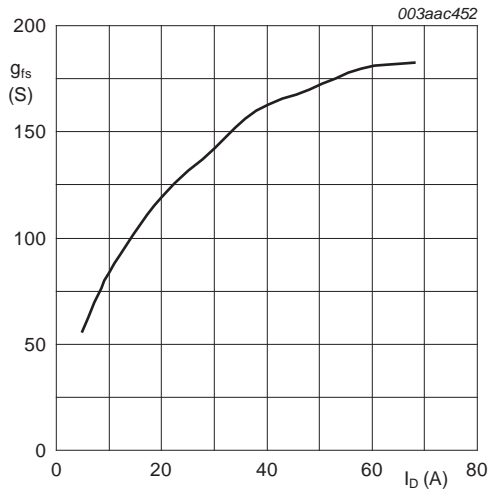
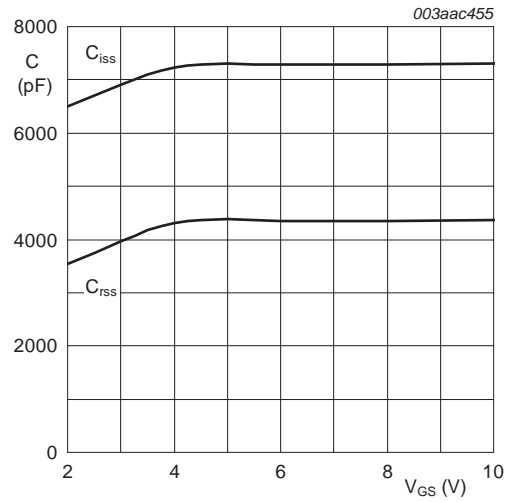


Fig 7. Drain-source on-state resistance as a function of drain current; typical values



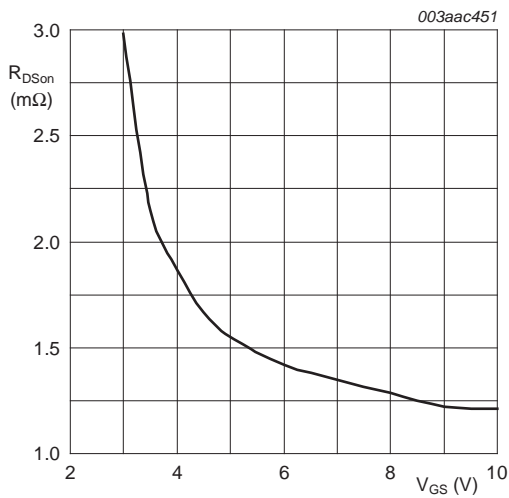
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 15\text{ V}$

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



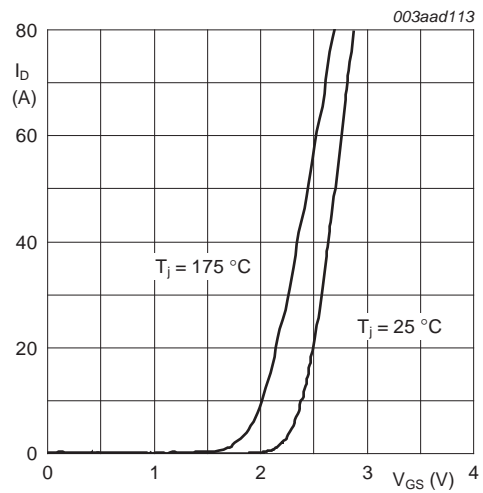
$V_{DS} = 0\text{ V}; f = 1\text{ MHz}$

Fig 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



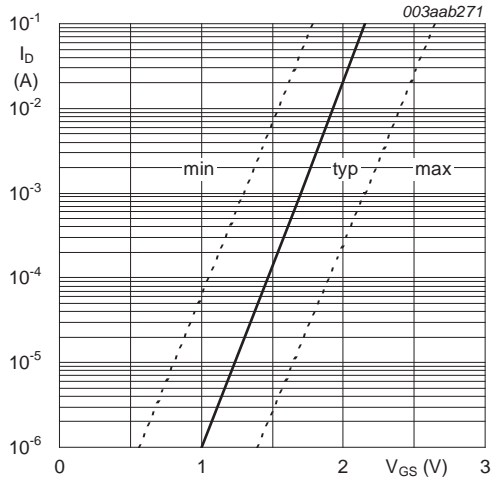
$T_j = 25\text{ }^\circ\text{C}; I_D = 15\text{ A}$

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



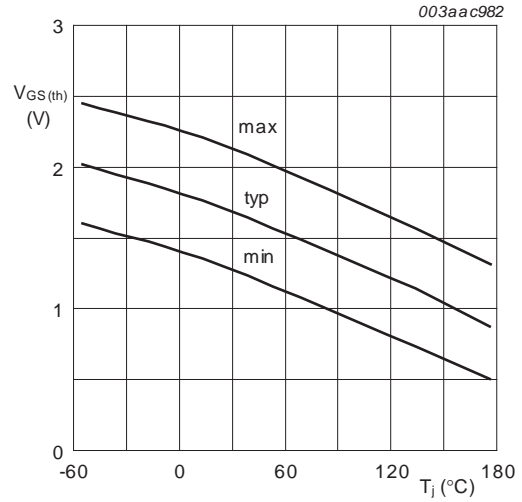
$V_{DS} = 15\text{ V}$

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



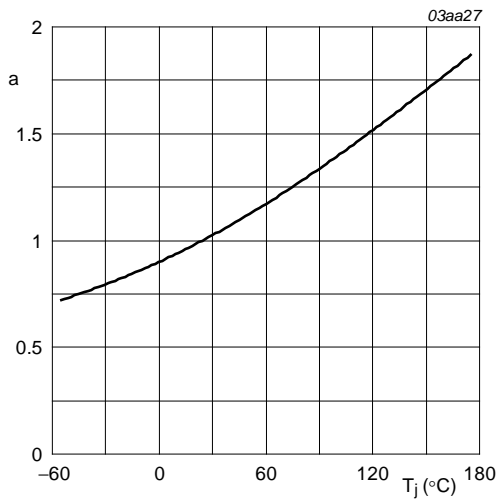
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

Fig 12. Sub-threshold drain current as a function of gate-source voltage



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

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



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

Fig 14. Normalized drain-source on-state resistance factor as a function of junction temperature

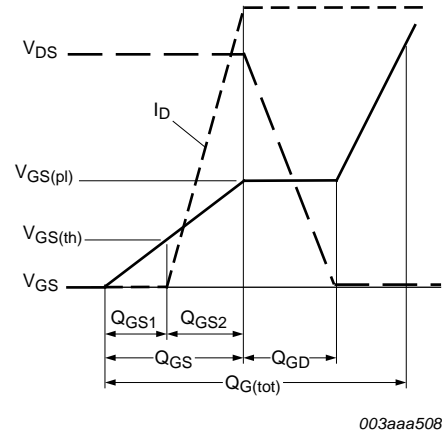
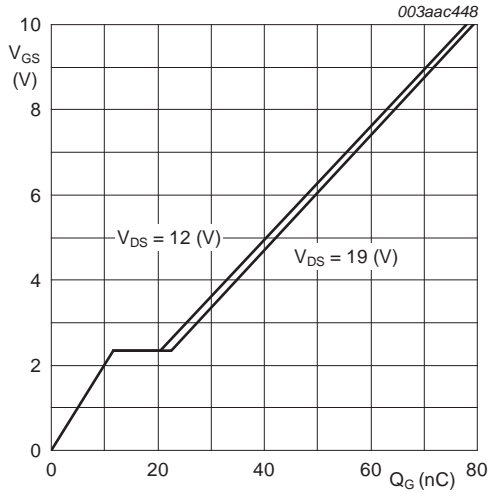
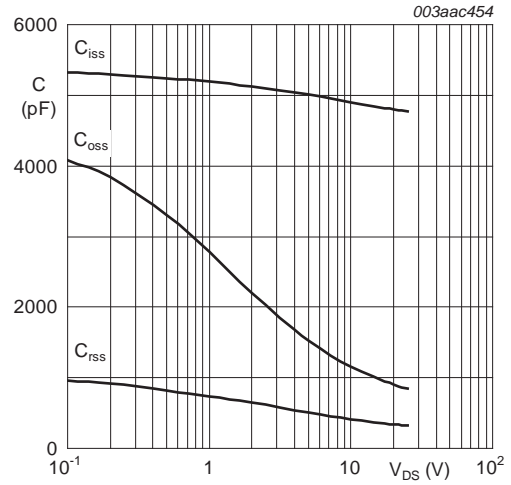


Fig 15. Gate charge waveform definitions



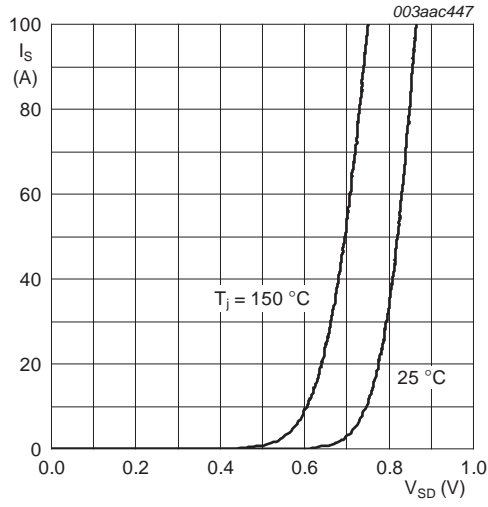
$T_j = 25^\circ\text{C}; I_D = 10\text{A}$

Fig 16. Gate-source voltage as a function of gate charge; typical values



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

Fig 17. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



$V_{GS} = 0\text{V}$

Fig 18. 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

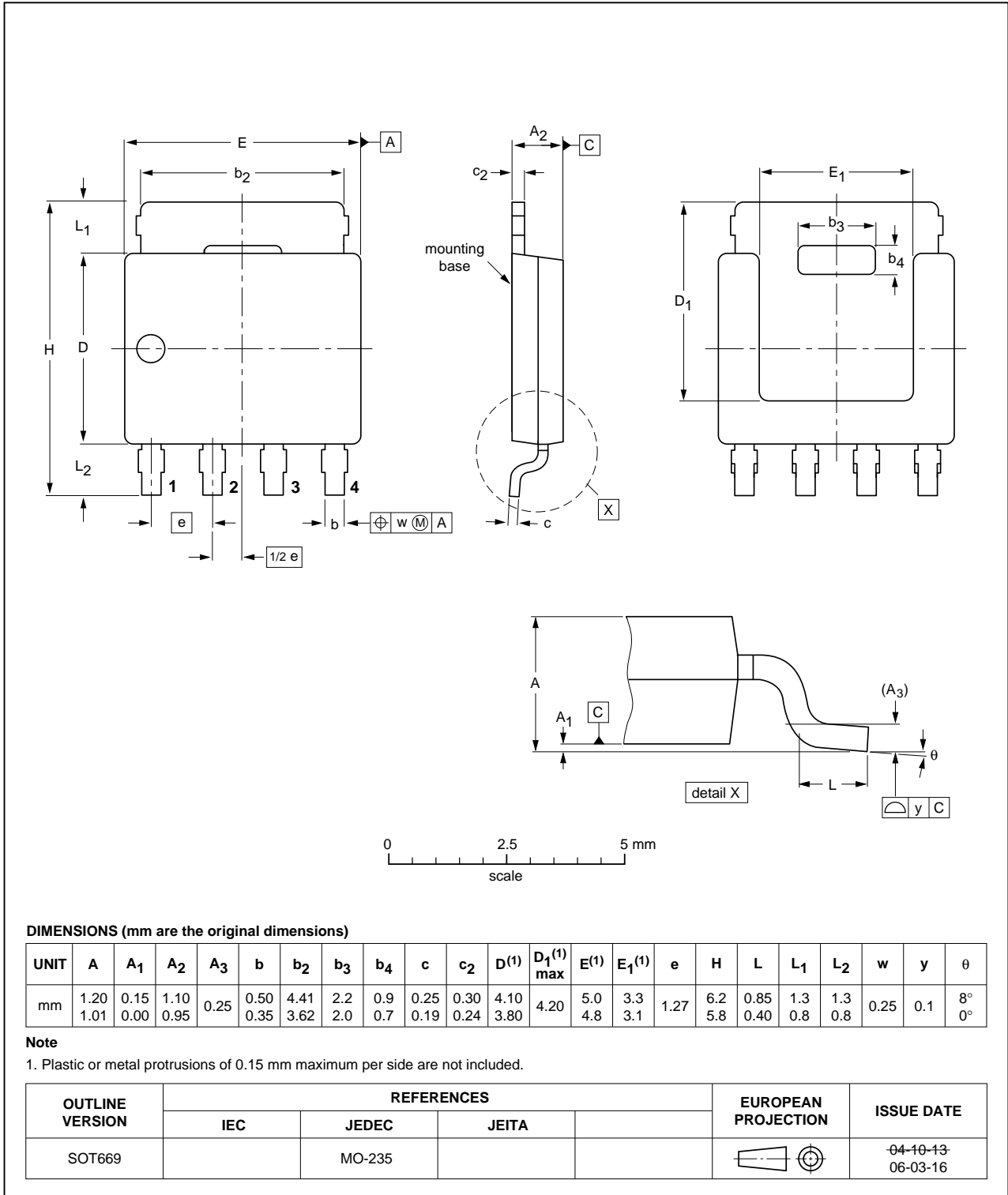


Fig 19. Package outline SOT669 (LPAK)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN1R5-30YL_1	20100409	Product data sheet	-	-

9. Legal information

9.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	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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