



PSMN9R0-30KL

N-channel 30 V 9 mΩ logic-level MOSFET in SO8

Rev. 01 — 14 April 2011

Objective data sheet

1. Product profile

1.1 General description

Logic level N-channel enhancement mode MOSFET in SO8 package qualified to 150 °C. This product is designed and qualified for use in a wide range of industrial, communications and power supply equipment

1.2 Features and benefits

- High efficiency due to low switching and conduction losses
- High performance replacement for legacy SO8 designs
- Suitable for logic level gate drive
- Suitable for wave and reflow soldering

1.3 Applications

- DC-to-DC converters
- Li-ion battery applications
- Load switching
- Portable equipment

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 150\text{ °C}$	-	-	30	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1	-	-	16	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	4	W
T_j	junction temperature		-55	-	150	°C

Static characteristics

$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}$; $I_D = 5\text{ A}$; $T_j = 25\text{ °C}$; see Figure 12	-	11.1	13	mΩ
		$V_{GS} = 10\text{ V}$; $I_D = 5\text{ A}$; $T_j = 25\text{ °C}$; see Figure 12	-	7.7	9	mΩ

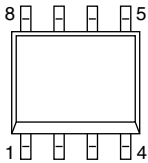
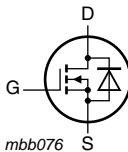


Table 1. Quick reference data ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 5\text{ A};$	-	3.2	-	nC
$Q_{G(\text{tot})}$	total gate charge	$V_{DS} = 15\text{ V};$ see Figure 14 ; see Figure 15	-	19.2	-	nC
		$V_{GS} = 4.5\text{ V}; I_D = 5\text{ A};$ $V_{DS} = 15\text{ V};$ see Figure 14 ; see Figure 15	-	9.3	-	nC
Avalanche ruggedness						
$E_{DS(\text{AL})S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ }^\circ\text{C};$ $I_D = 16\text{ A}; V_{\text{sup}} \leq 30\text{ V};$ unclamped; $R_{GS} = 50\text{ } \Omega$	-	-	77	mJ

2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>SOT96-1 (SO8)</p>	 <p><i>mbb076</i></p>
2	S	source		
3	S	source		
4	G	gate		
5	D	drain		
6	D	drain		
7	D	drain		
8	D	drain		

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN9R0-30KL	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

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	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}$	-	30	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ °C}; T_j \leq 150\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	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	-	11	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C};$ see Figure 1	-	16	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C};$ see Figure 3	-	64	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C};$ see Figure 2	-	4	W
T_{stg}	storage temperature		-55	150	°C
T_j	junction temperature		-55	150	°C
$T_{sld(M)}$	peak soldering temperature		-	260	°C
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ °C}$	-	16	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$	-	64	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 16\text{ A};$ $V_{sup} \leq 30\text{ V};$ unclamped; $R_{GS} = 50\text{ }\Omega$	-	77	mJ

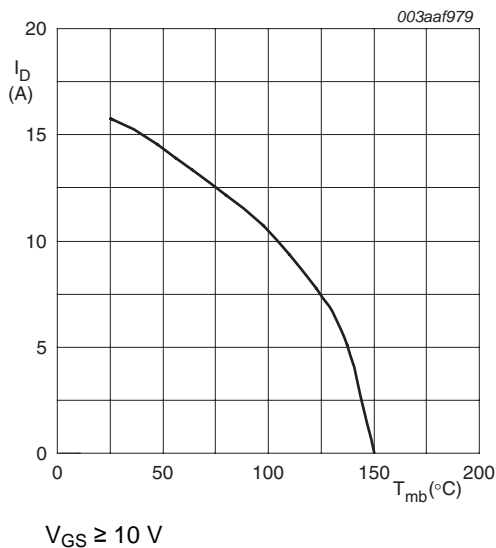
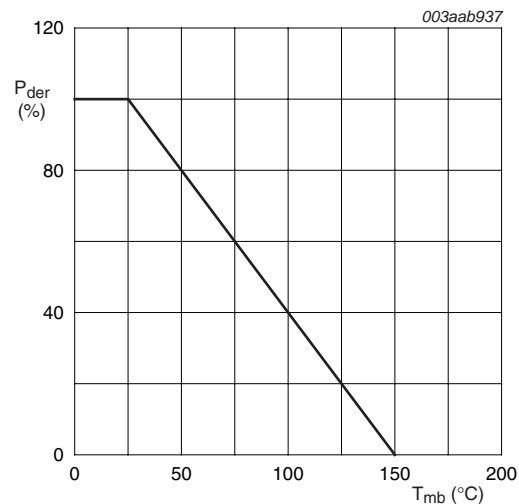
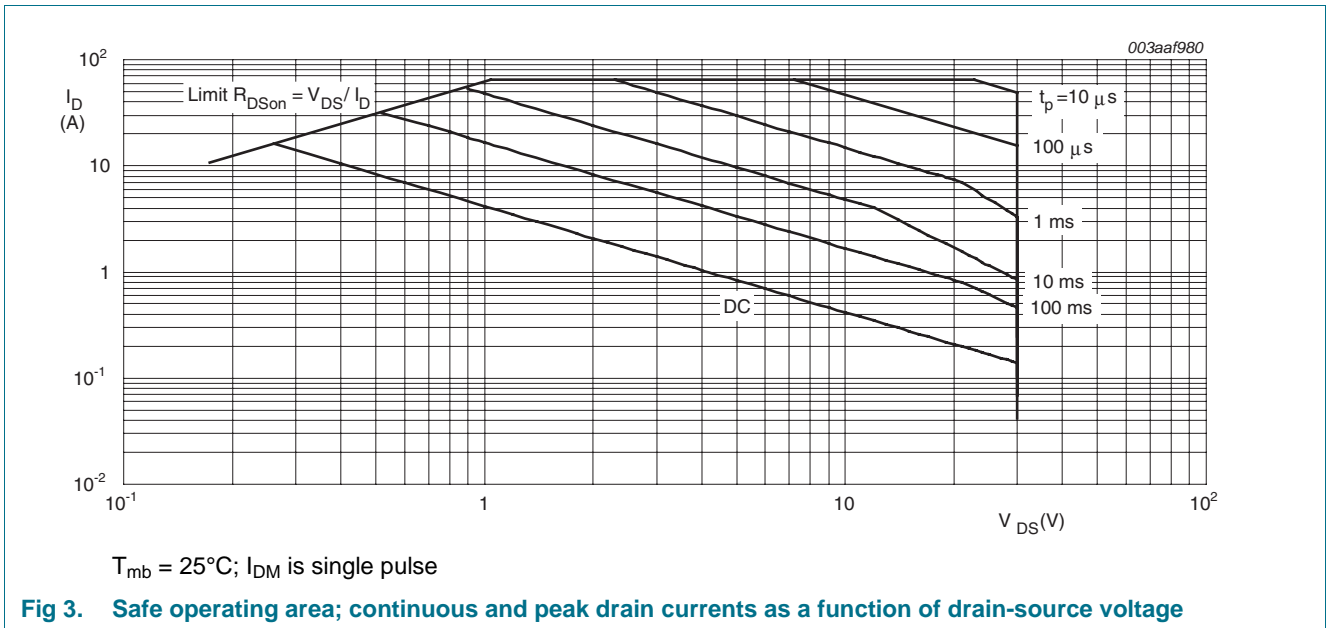


Fig 1. Continuous drain current as a function of mounting base temperature



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

Fig 2. Normalized total power dissipation as a function of solder point temperature



5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	see Figure 4	-	24	30	K/W

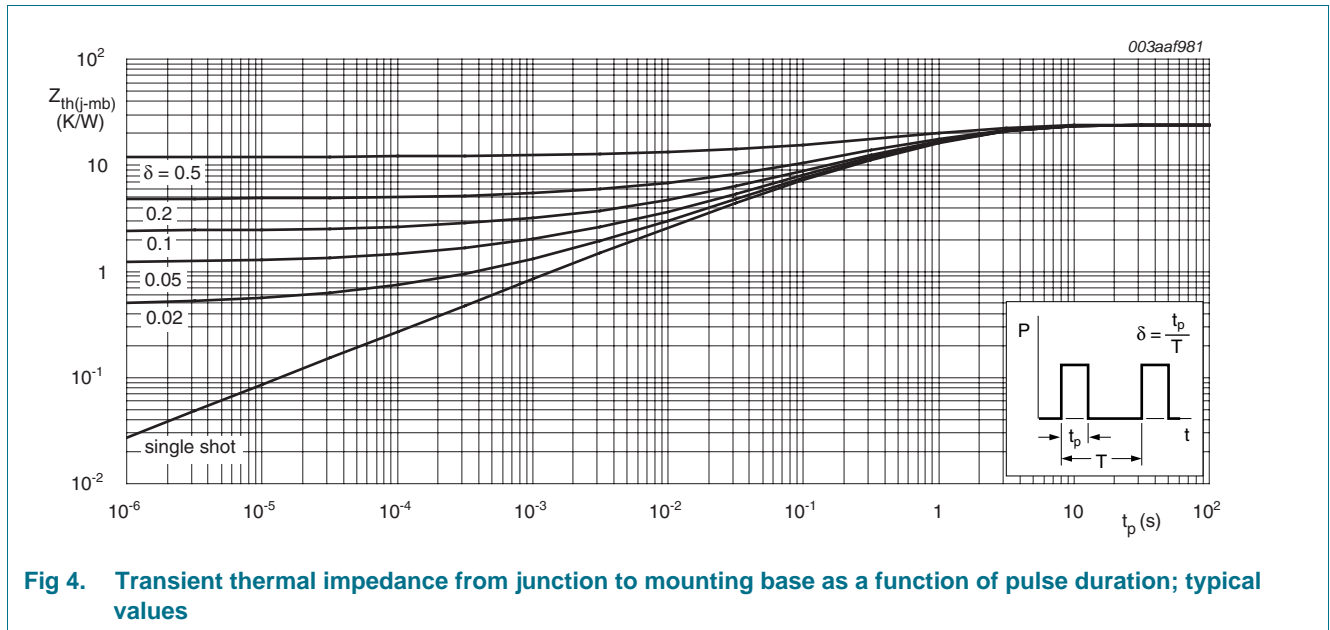


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

6. Characteristics

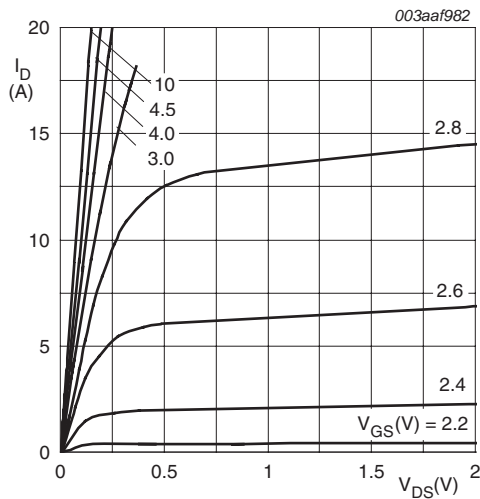
Table 6. Characteristics

Tested to JEDEC standards where applicable.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$	27	-	-	V
		$I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	30	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C$; see Figure 10 ; see Figure 11	1.3	1.7	2.15	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C$; see Figure 11	-	-	2.55	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 150 \text{ }^\circ C$; see Figure 11	0.5	-	-	V
I_{DSS}	drain leakage current	$V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$	-	0.1	1	μA
		$V_{DS} = 30 V; V_{GS} = 0 V; T_j = 125 \text{ }^\circ C$	-	-	50	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	2	100	nA
		$V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 \text{ }^\circ C$	-	2	100	nA
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5 V; I_D = 5 A; T_j = 25 \text{ }^\circ C$; see Figure 12	-	11.1	13	mΩ
		$V_{GS} = 10 V; I_D = 5 A; T_j = 100 \text{ }^\circ C$; see Figure 12 ; see Figure 13	-	-	12.4	mΩ
		$V_{GS} = 10 V; I_D = 5 A; T_j = 150 \text{ }^\circ C$; see Figure 12 ; see Figure 13	-	13.8	16.2	mΩ
		$V_{GS} = 10 V; I_D = 5 A; T_j = 25 \text{ }^\circ C$; see Figure 12	-	7.7	9	mΩ
R_G	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	1.34	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 5 A; V_{DS} = 15 V; V_{GS} = 10 V$; see Figure 14 ; see Figure 15	-	19.2	-	nC
		$I_D = 5 A; V_{DS} = 15 V; V_{GS} = 4.5 V$; see Figure 14 ; see Figure 15	-	9.3	-	nC
		$I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V$	-	16.9	-	nC
Q_{GS}	gate-source charge	$I_D = 5 A; V_{DS} = 15 V; V_{GS} = 10 V$; see Figure 14 ; see Figure 15	-	2.5	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	1.8	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	0.7	-	nC
Q_{GD}	gate-drain charge		-	3.2	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 5 A; V_{DS} = 15 V$; see Figure 14 ; see Figure 15	-	2.5	-	V
C_{iss}	input capacitance	$V_{DS} = 15 V; V_{GS} = 0 V; f = 1 \text{ MHz}$;	-	1128	-	pF
C_{oss}	output capacitance	$T_j = 25 \text{ }^\circ C$; see Figure 16	-	220	-	pF
C_{rss}	reverse transfer capacitance		-	105	-	pF

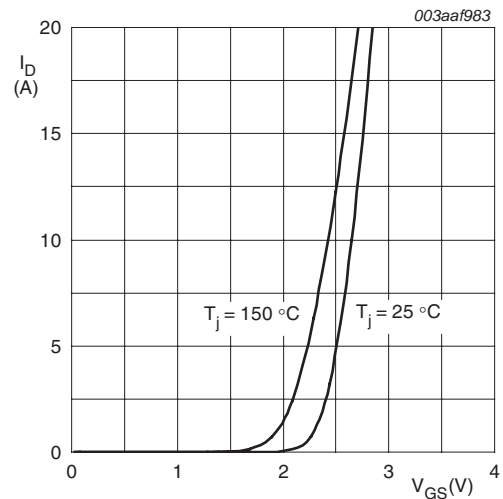
Table 6. Characteristics ...continued
Tested to JEDEC standards where applicable.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15\text{ V}; R_L = 0.5\ \Omega; V_{GS} = 10\text{ V};$	-	15	-	ns
t_r	rise time	$R_{G(ext)} = 4.7\ \Omega; T_j = 25\text{ }^\circ\text{C}$	-	27	-	ns
$t_{d(off)}$	turn-off delay time		-	17	-	ns
t_f	fall time		-	8	-	ns
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 5\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see Figure 17	-	0.79	1.2	V
t_{rr}	reverse recovery time	$I_S = 5\text{ A}; di_S/dt = 100\text{ A}/\mu\text{s};$	-	20	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}; V_{DS} = 15\text{ V}$	-	14	-	nC



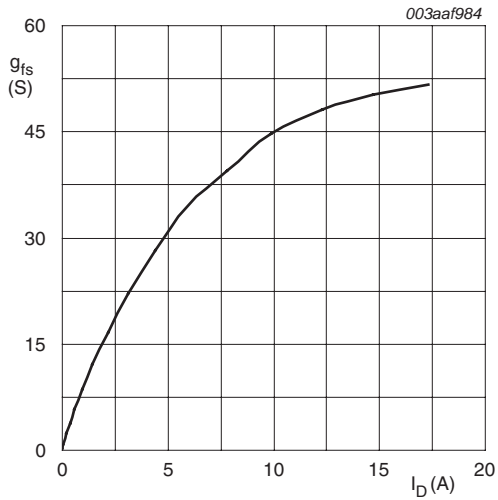
$T_j = 25^\circ\text{C}$

Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values



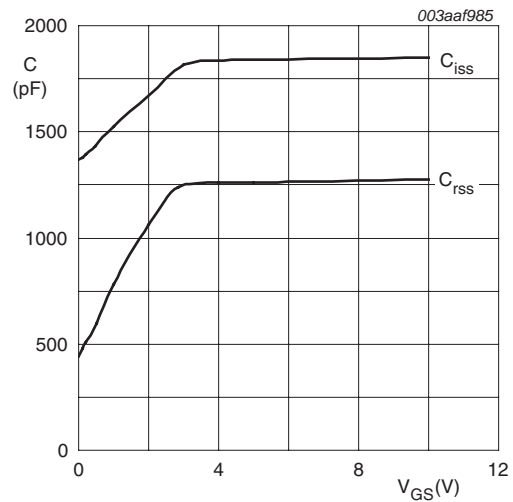
$V_{DS} = 10\text{ V}$

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



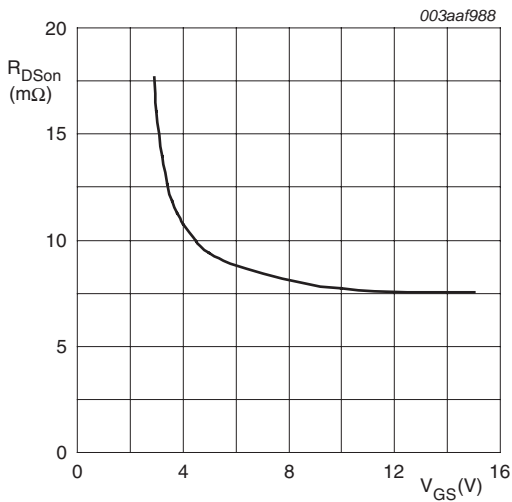
$T_j = 25^\circ\text{C}; V_{DS} = 10\text{ V}$

Fig 7. Forward transconductance as a function of drain current; typical values



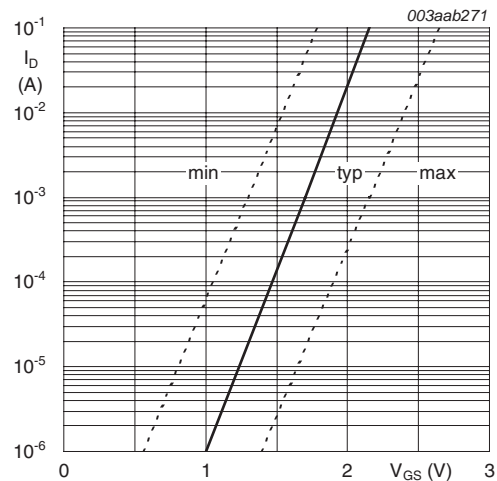
$V_{DS} = 0\text{ V}; f = 1\text{ MHz}$

Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



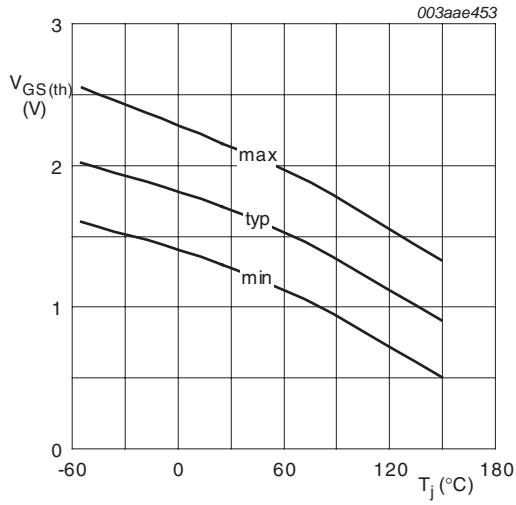
$T_j = 25^\circ\text{C}; I_D = 5\text{ A}$

Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



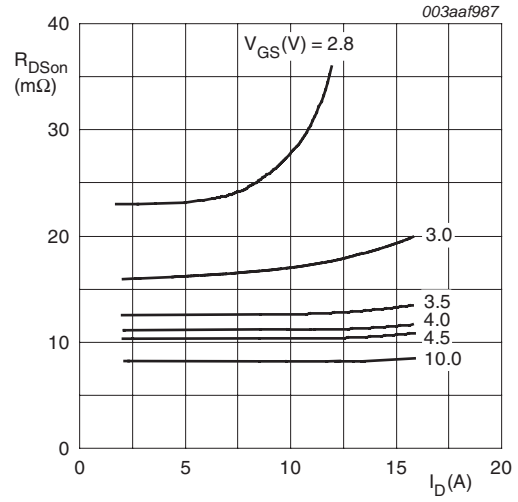
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{ V}$

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



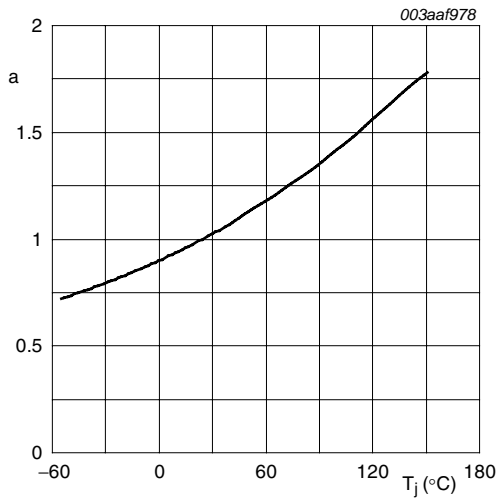
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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

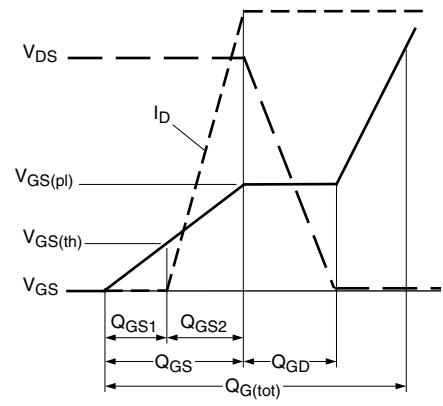
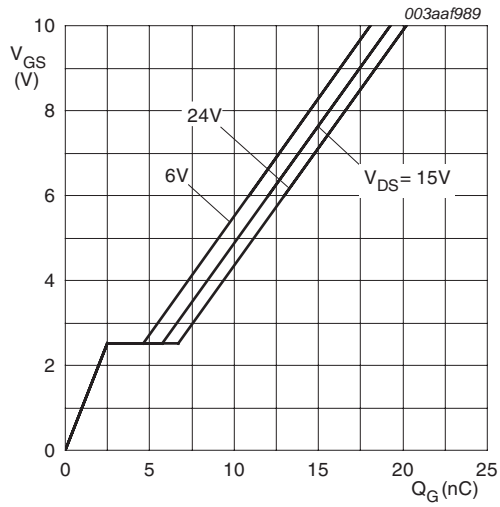
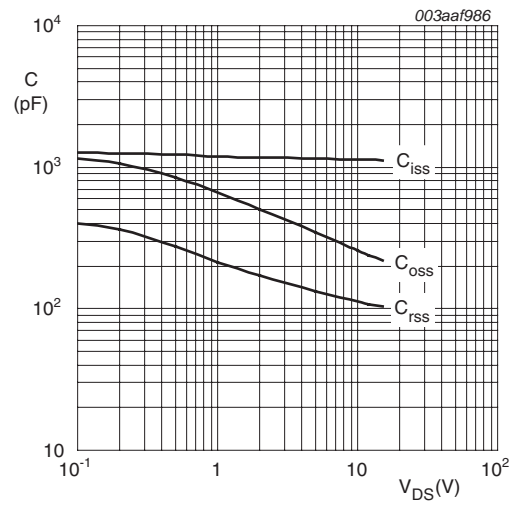


Fig 14. Gate charge waveform definitions



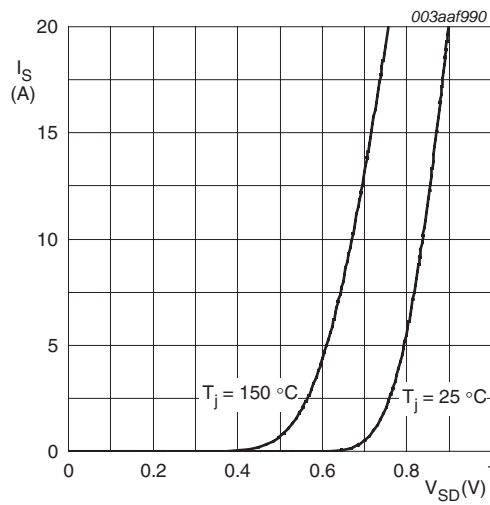
$T_j = 25^\circ\text{C}$ and $I_D = 5\text{ A}$

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



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

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



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

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

7. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

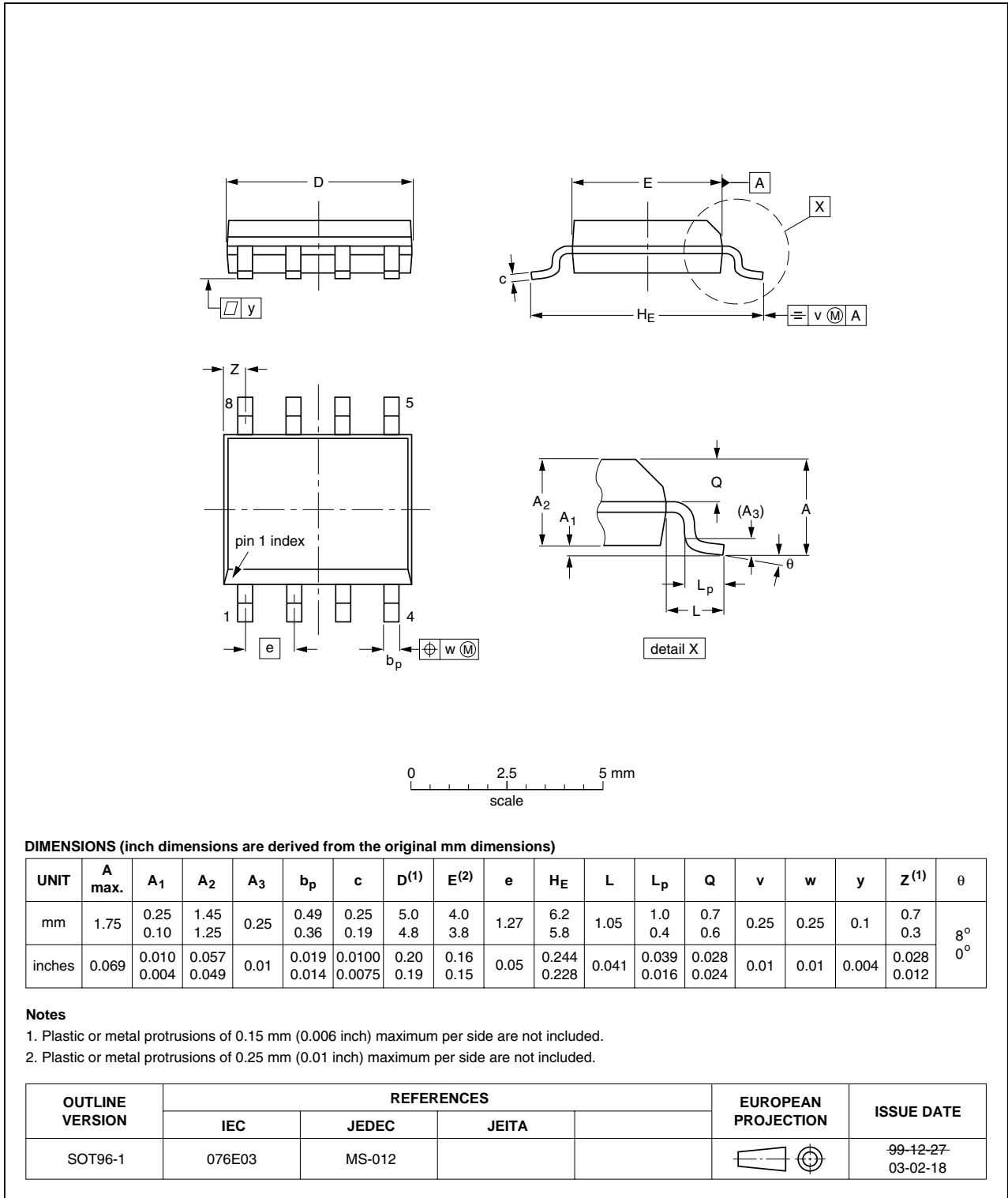


Fig 18. Package outline SOT96-1 (SO8)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN9R0-30KL v.1	20110414	Objective 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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11. Contents

1 Product profile1

1.1 General description1

1.2 Features and benefits1

1.3 Applications1

1.4 Quick reference data1

2 Pinning information2

3 Ordering information2

4 Limiting values3

5 Thermal characteristics5

6 Characteristics6

7 Package outline11

8 Revision history12

9 Legal information13

9.1 Data sheet status13

9.2 Definitions13

9.3 Disclaimers13

9.4 Trademarks14

10 Contact information14

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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