

PSMN1R8-30PL

N-channel 30 V, 1.8 mΩ logic level MOSFET in TO-220

Rev. 02 — 2 November 2010

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel MOSFET in TO-220 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

- High efficiency due to low switching and conduction losses
- Suitable for logic level gate drive sources

1.3 Applications

- DC-to-DC converters
- Motor control
- Load switching
- 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 Figure 1	[1]	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	270	W
T_j	junction temperature		-55	-	175	°C
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 13 ; see Figure 12	[2]	-	1.6	1.8 mΩ
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$;	-	22	-	nC
$Q_{G(tot)}$	total gate charge	$V_{DS} = 15\text{ V}$; see Figure 14 ; see Figure 15	-	83	-	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	-	-	1.1	J

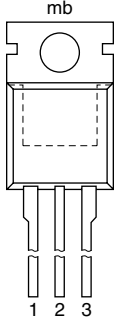
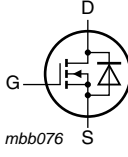
[1] Continuous current is limited by package.

[2] Measured 3 mm from package.



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

SOT78 (TO-220AB)

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PSMN1R8-30PL	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

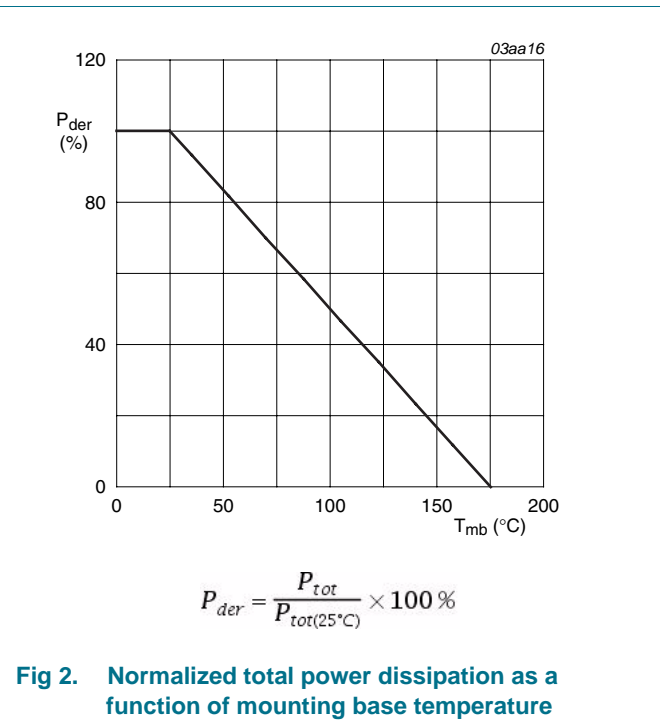
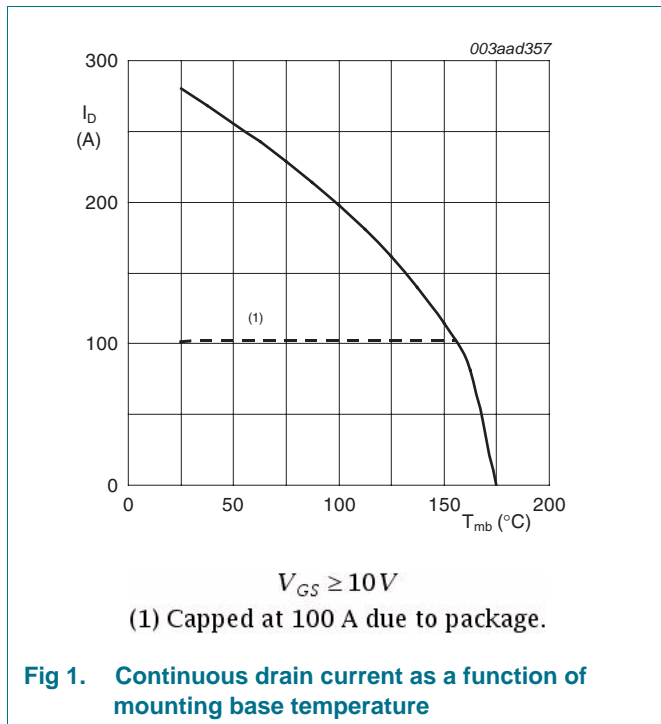
4. Limiting values

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	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	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	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$; see Figure 3	-	1120	A	
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	270	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	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ °C}$	-	1120	A	
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 100\text{ A}; V_{sup} \leq 30\text{ V}; R_{GS} = 50\text{ }\Omega$; unclamped	-	1.1	J	

[1] Continuous current is limited by package.



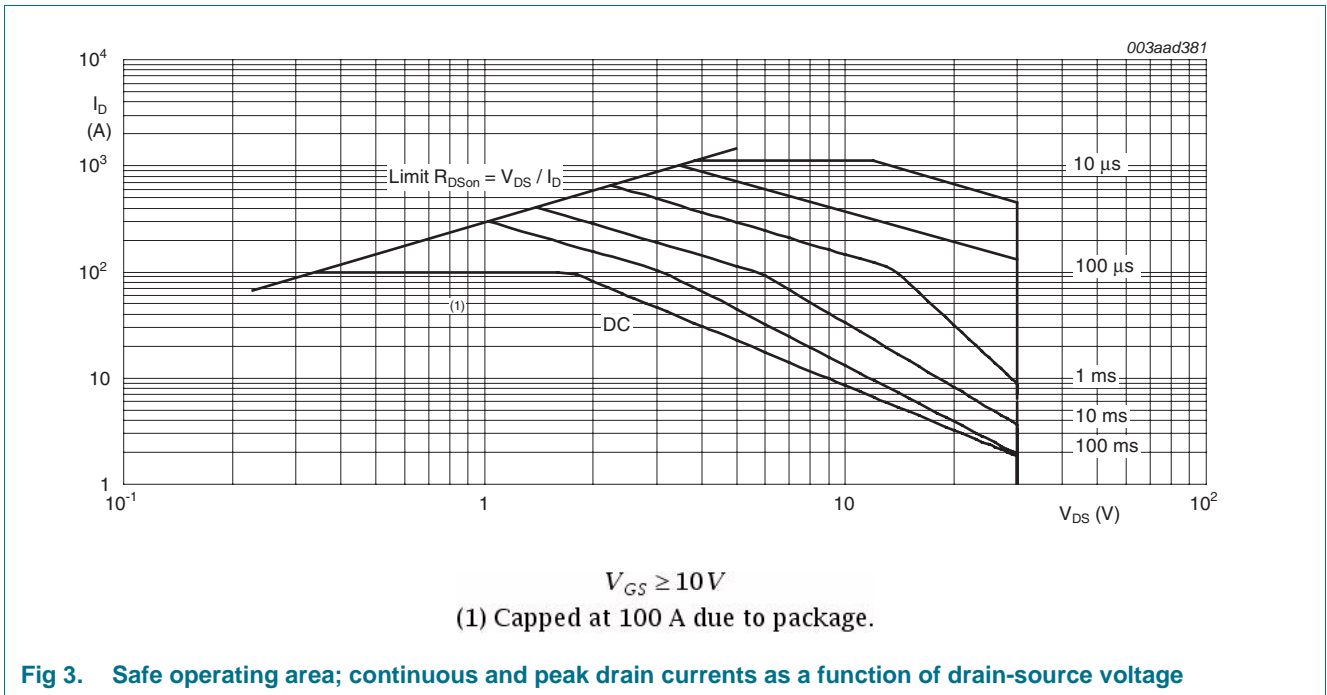


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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 4	-	0.3	0.56	K/W

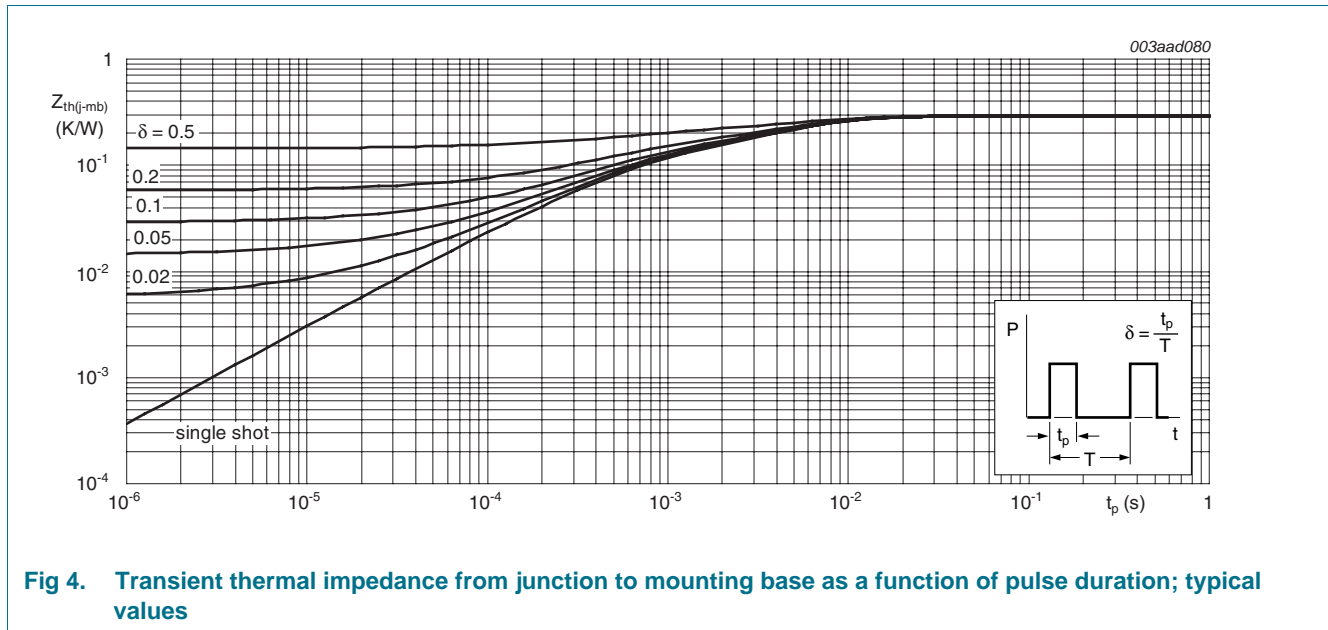


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

6. Characteristics

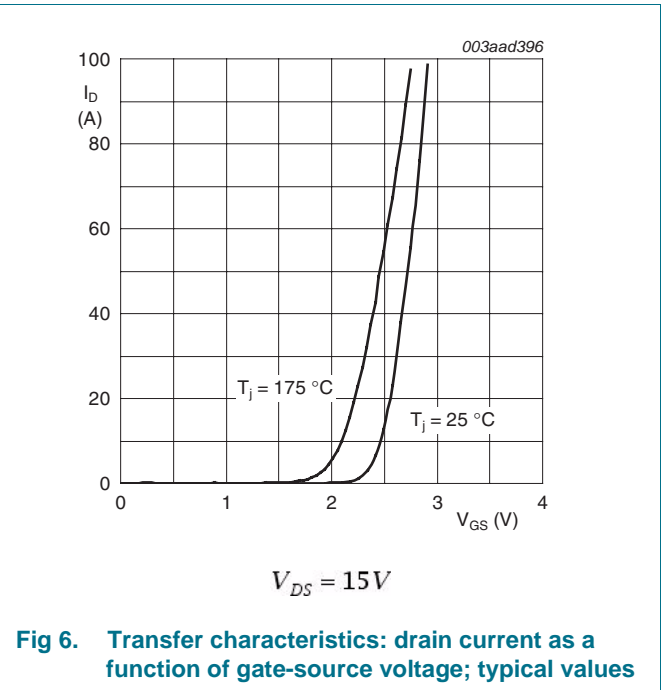
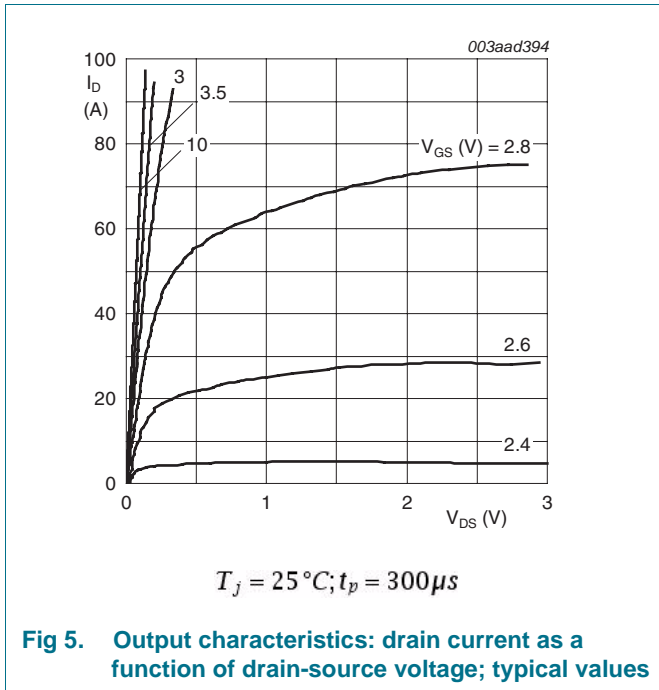
Table 6. Characteristics
Tested to JEDEC standards where applicable.

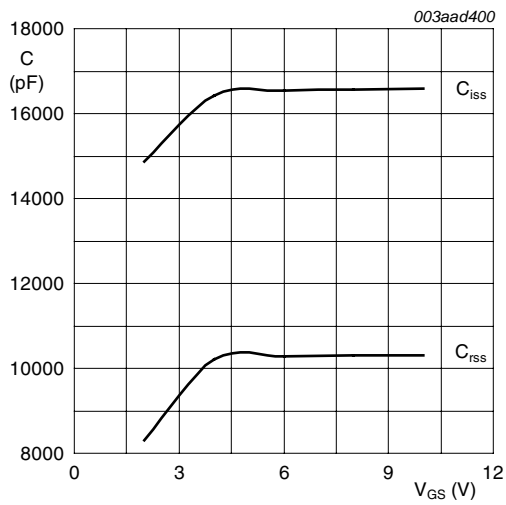
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	30	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 10 ; see Figure 11	1.3	1.7	2.15	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 11	0.5	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 11	-	-	2.45	V
I_{DSS}	drain leakage current	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.3	4	μA
		$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$	-	-	200	μA
I_{GSS}	gate leakage current	$V_{GS} = 16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	10	100	nA
		$V_{GS} = -16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 12	-	1.8	2.3	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 13	-	-	3.42	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see Figure 13	-	-	2.4	mΩ
		$V_{GS} = 4.5 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 13	-	-	4.73	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 ; see Figure 12	11	-	1.6	1.8
R_G	gate resistance	$f = 1 \text{ MHz}$	-	1	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 10 \text{ V};$ see Figure 14 ; see Figure 15	-	170	-	nC
		$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$	-	158	-	nC
		$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ see Figure 14 ; see Figure 15	-	83	-	nC
Q_{GS}	gate-source charge		-	29	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	17	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	12	-	nC
Q_{GD}	gate-drain charge		-	22	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 15 \text{ V};$ see Figure 14 ; see Figure 15	-	2.6	-	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 16	-	10180	-	pF
C_{oss}	output capacitance		-	2000	-	pF
C_{rss}	reverse transfer capacitance		-	872	-	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	$V_{DS} = 12\text{ V}; R_L = 0.5\ \Omega; V_{GS} = 4.5\text{ V};$	-	92	-	ns
t_r	rise time	$R_{G(ext)} = 4.7\ \Omega$	-	156	-	ns
$t_{d(off)}$	turn-off delay time		-	135	-	ns
t_f	fall time		-	69	-	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 17	-	0.7	1.2	V
t_{rr}	reverse recovery time	$I_S = 30\text{ A}; di_S/dt = -100\text{ A}/\mu\text{s};$	-	64	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}; V_{DS} = 12\text{ V}$	-	60	-	nC

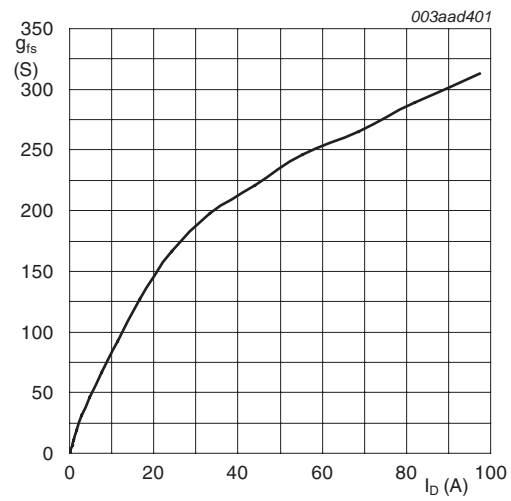
[1] Measured 3 mm from package.





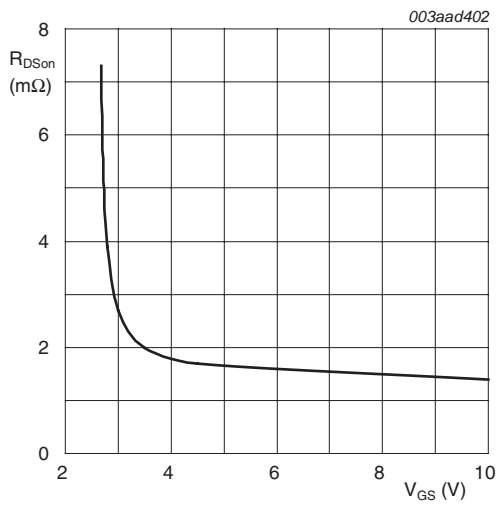
$V_{DS} = 0V; f = 1MHz$

Fig 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



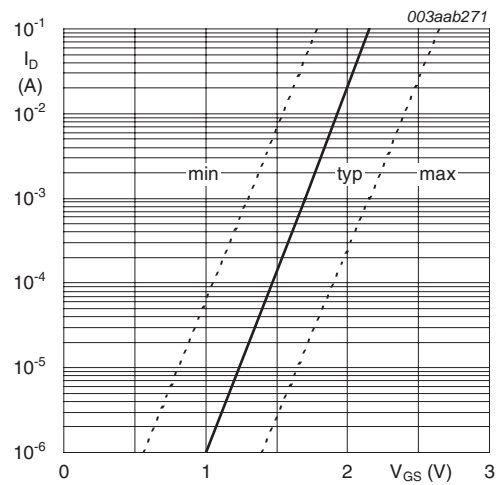
$T_j = 25^\circ C; V_{DS} = 15V$

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



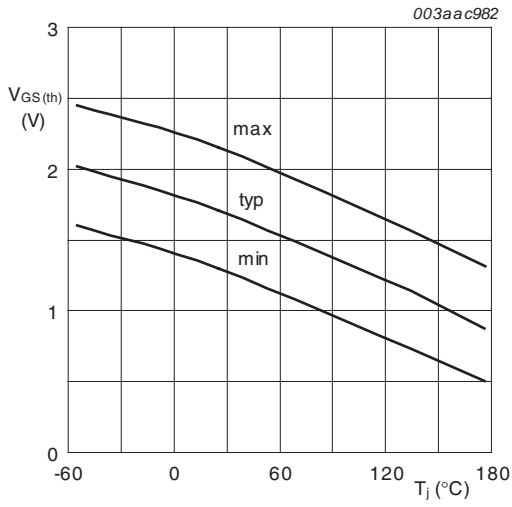
$T_j = 25^\circ C; I_D = 25A$

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



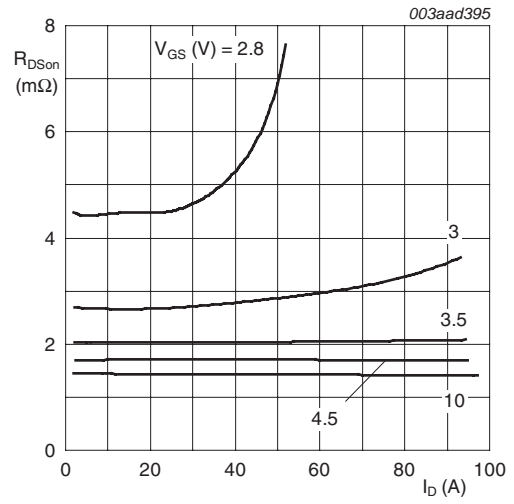
$T_j = 25^\circ C; V_{DS} = 5V$

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



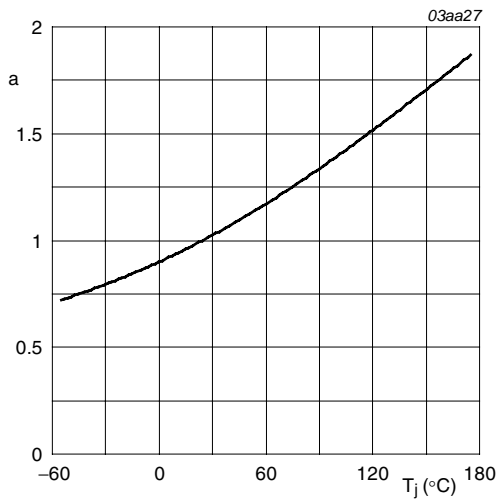
$$I_D = 1\text{mA}; V_{DS} = V_{GS}$$

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



$$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$$

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



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

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

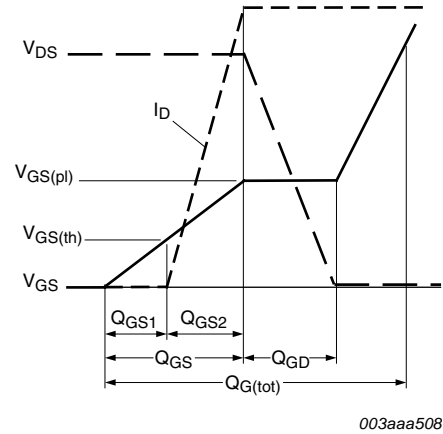
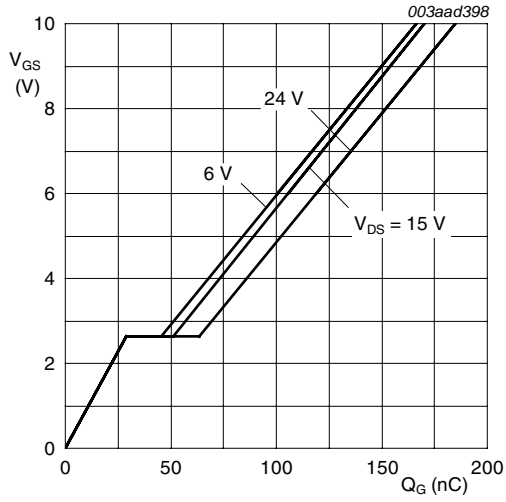
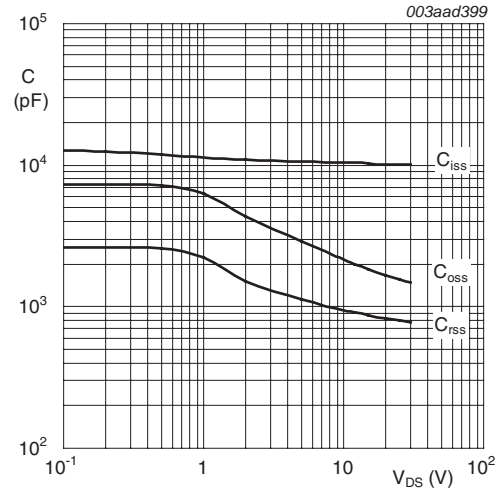


Fig 14. Gate charge waveform definitions



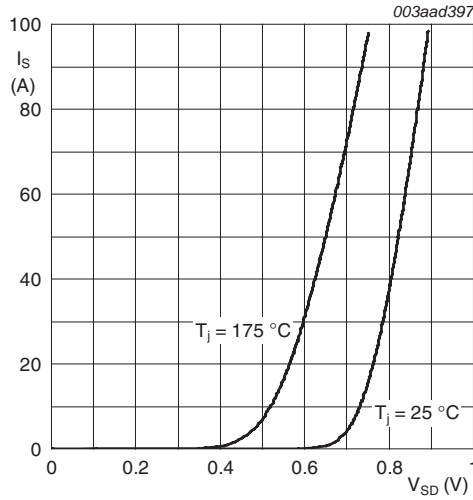
$T_j = 25\text{ }^\circ\text{C}; I_D = 25\text{ A}$

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

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78

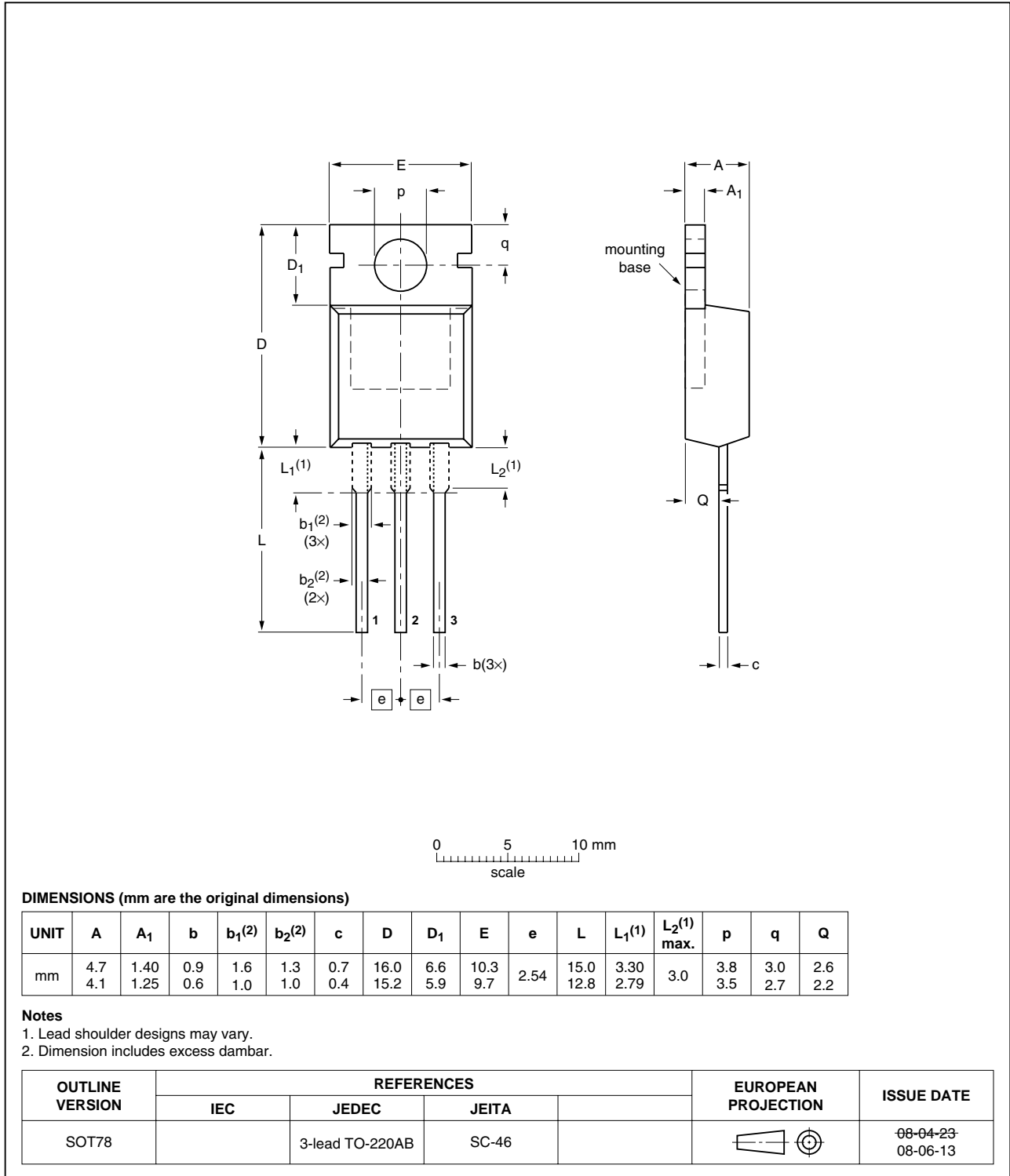


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN1R8-30PL v.2	20101102	Product data sheet	-	PSMN1R8-30PL v.1
Modifications:	<ul style="list-style-type: none">• Status changed from objective to product.• Various changes to content.			
PSMN1R8-30PL v.1	20100218	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 profile	1
1.1	General description	1
1.2	Features and benefits	1
1.3	Applications	1
1.4	Quick reference data	1
2	Pinning information	2
3	Ordering information	2
4	Limiting values	3
5	Thermal characteristics	5
6	Characteristics	6
7	Package outline	11
8	Revision history	12
9	Legal information	13
9.1	Data sheet status	13
9.2	Definitions	13
9.3	Disclaimers	13
9.4	Trademarks	14
10	Contact information	14

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