

PSMN1R6-30PL

N-channel 30 V 1.7 mΩ logic level MOSFET

Rev. 02 — 25 June 2009

Product data sheet

1. Product profile

1.1 General description

Logic level N-channel MOSFET in TO220 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

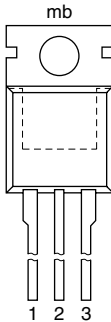
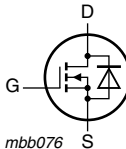
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	-	30	V
I_D	drain current	$T_{mb} = 25\text{ °C}$; $V_{GS} = 10\text{ V}$; see Figure 1 ;	[1]	-	100	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	306	W
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; see Figure 14 ; see Figure 15	-	27	-	nC
$Q_{G(tot)}$	total gate charge	$V_{GS} = 4.5\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 15\text{ V}$; see Figure 14	-	101	-	nC
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$;	[2]	-	1.4	1.7 mΩ

[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;SC-46)	

3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN1R6-30PL	TO-220AB; SC-46	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 ≥ 25 °C; T _j ≤ 175 °C	-	30	V
V _{DGR}	drain-gate voltage	T _j ≥ 25 °C; T _j ≤ 175 °C; R _{GS} = 20 kΩ	-	30	V
V _{GS}	gate-source voltage		-20	20	V
I _D	drain current	V _{GS} = 10 V; T _{mb} = 100 °C; see Figure 1 ; [1]	-	100	A
		V _{GS} = 10 V; T _{mb} = 25 °C; see Figure 1 ; [1]	-	100	A
I _{DM}	peak drain current	t _p ≤ 10 μs; pulsed; T _{mb} = 25 °C; see Figure 3	-	1268	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; see Figure 2	-	306	W
T _{stg}	storage temperature		-55	175	°C
T _j	junction temperature		-55	175	°C

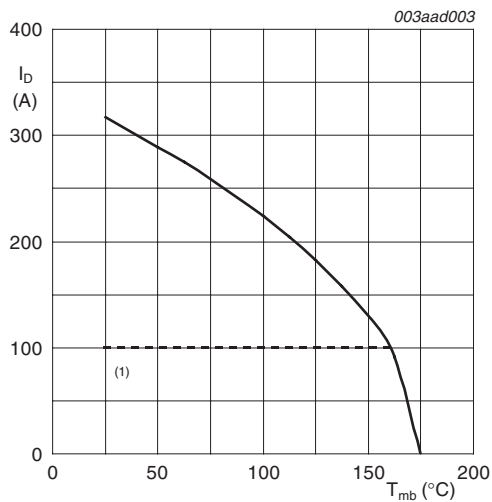
Source-drain diode

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; $T_{mb} = 25\text{ °C}$	-	-	1268	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	-	-	1.7	J
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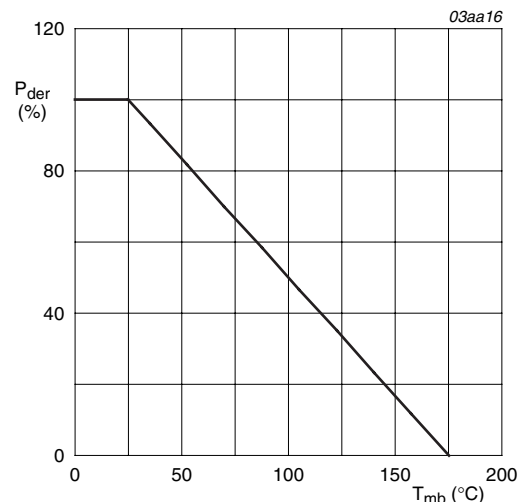
[1] Continuous current is limited by package.



$$V_{GS} \geq 10\text{ V}$$

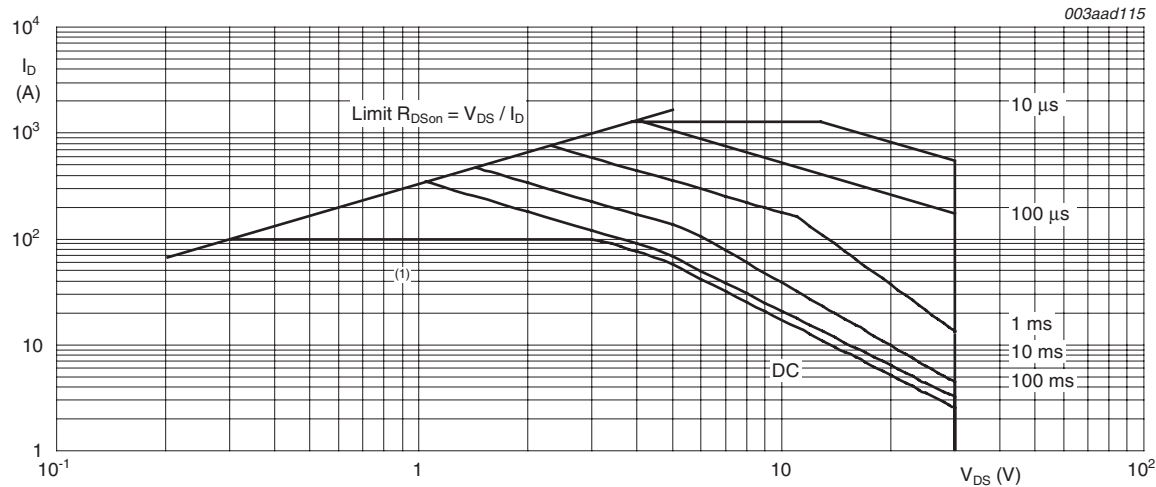
(1) Capped at 100 A due to package.

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



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

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



$T_{mb} = 25\text{ }^{\circ}\text{C}; I_{DM}$ is single pulse
(1) Capped at 100 A due to 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	-	0.22	0.49	K/W

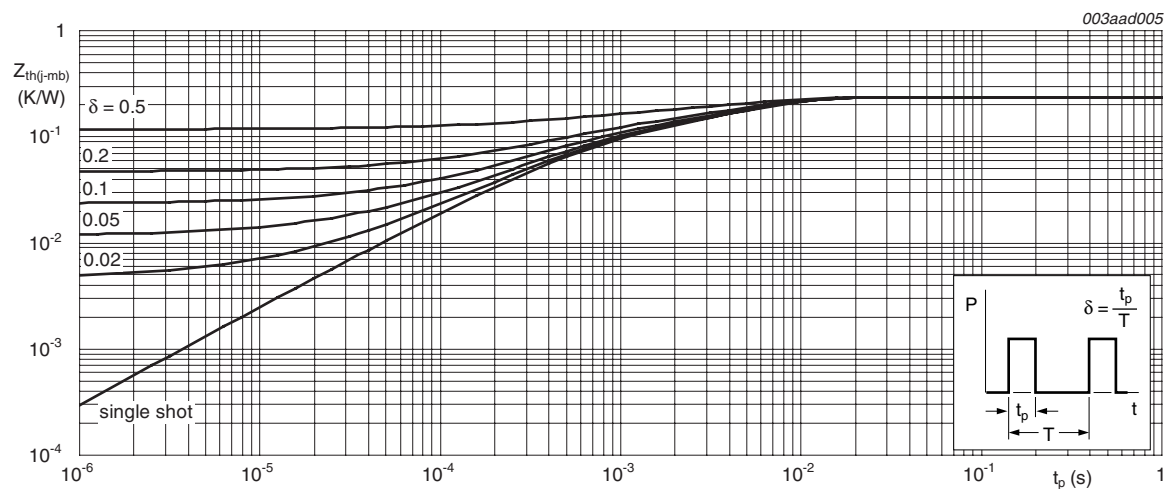


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

6. Characteristics

Table 6. Characteristics

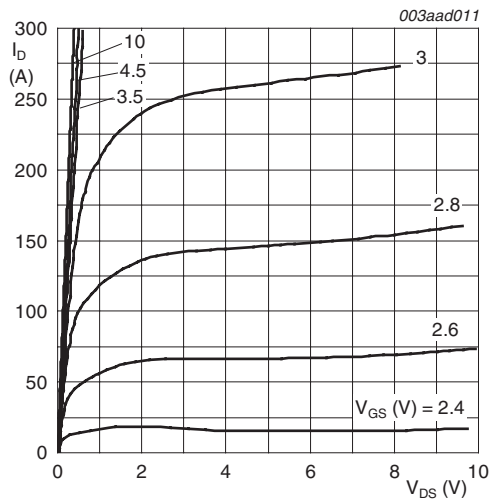
Tested to JEDEC standards where applicable.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$	30	-	-	V
		$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_j = -55 ^\circ C$	27	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_j = 25 ^\circ C$; see Figure 11 ; see Figure 12	1.3	1.7	2.15	V
		$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_j = 175 ^\circ C$; see Figure 12	0.5	-	-	V
		$I_D = 1 mA$; $V_{DS} = V_{GS}$; $T_j = -55 ^\circ C$; see Figure 12	-	-	2.45	V
I_{DSS}	drain leakage current	$V_{DS} = 30 V$; $V_{GS} = 0 V$; $T_j = 25 ^\circ C$	-	-	5	μA
		$V_{DS} = 30 V$; $V_{GS} = 0 V$; $T_j = 125 ^\circ C$	-	-	150	μA
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	$V_{GS} = 4.5 V$; $I_D = 25 A$; $T_j = 25 ^\circ C$	-	1.6	2.1	mΩ
		$V_{GS} = 10 V$; $I_D = 25 A$; $T_j = 100 ^\circ C$; see Figure 13	-	-	2.3	mΩ
		$V_{GS} = 10 V$; $I_D = 25 A$; $T_j = 25 ^\circ C$; [1]	-	1.4	1.7	mΩ
R_G	gate resistance	$f = 1 MHz$	-	0.98	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 25 A$; $V_{DS} = 15 V$; $V_{GS} = 10 V$; see Figure 14 ; see Figure 15	-	212	-	nC
		$I_D = 0 A$; $V_{DS} = 0 V$; $V_{GS} = 10 V$	-	193	-	nC
		$I_D = 25 A$; $V_{DS} = 15 V$; $V_{GS} = 4.5 V$; see Figure 14	-	101	-	nC
Q_{GS}	gate-source charge	$I_D = 25 A$; $V_{DS} = 15 V$; $V_{GS} = 4.5 V$; see Figure 14 ; see Figure 15	-	33	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	$I_D = 25 A$; $V_{DS} = 15 V$; $V_{GS} = 4.5 V$; see Figure 14	-	20	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	13	-	nC
Q_{GD}	gate-drain charge	$I_D = 25 A$; $V_{DS} = 15 V$; $V_{GS} = 4.5 V$; see Figure 14 ; see Figure 15	-	27	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 15 V$; see Figure 14	-	2.5	-	V
C_{iss}	input capacitance	$V_{DS} = 12 V$; $V_{GS} = 0 V$; $f = 1 MHz$;	-	12493	-	pF
C_{oss}	output capacitance	$T_j = 25 ^\circ C$; see Figure 16	-	2486	-	pF
C_{rss}	reverse transfer capacitance		-	1034	-	pF

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

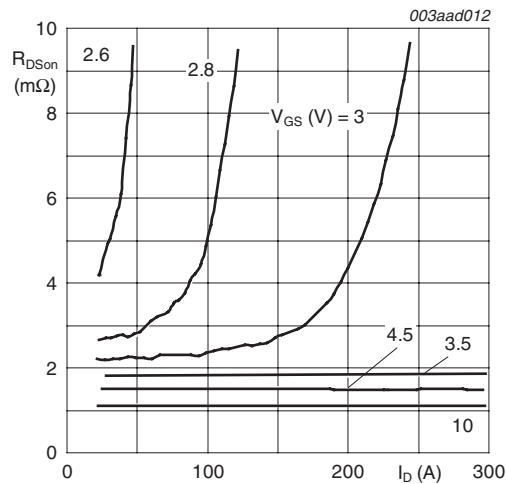
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{d(on)}$	turn-on delay time	$V_{DS} = 12\text{ V}$; $R_L = 0.5\text{ }\Omega$; $V_{GS} = 4.5\text{ V}$; $R_{G(ext)} = 4.7\text{ }\Omega$	-	104	-	ns
t_r	rise time		-	163	-	ns
$t_{d(off)}$	turn-off delay time		-	174	-	ns
t_f	fall time		-	87	-	ns
Source-drain 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	-	0.77	1.2	V
t_{rr}	reverse recovery time	$I_S = 50\text{ A}$; $dI_S/dt = -100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$;	-	64	-	ns
Q_r	recovered charge	$V_{DS} = 15\text{ V}$	-	79	-	nC

[1] Measured 3 mm from package.



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

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



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

Fig 6. Drain-source on-state resistance as a function of drain current; typical values

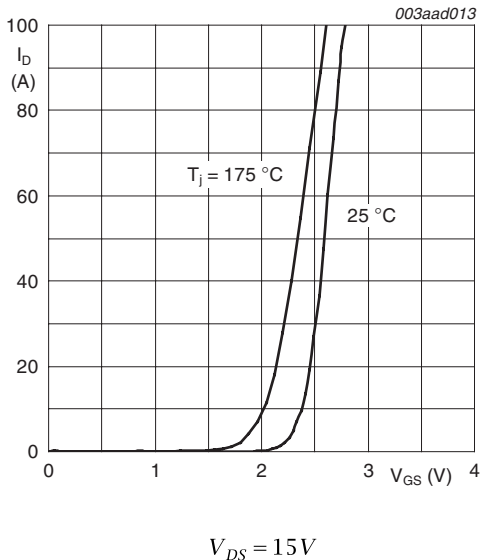


Fig 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

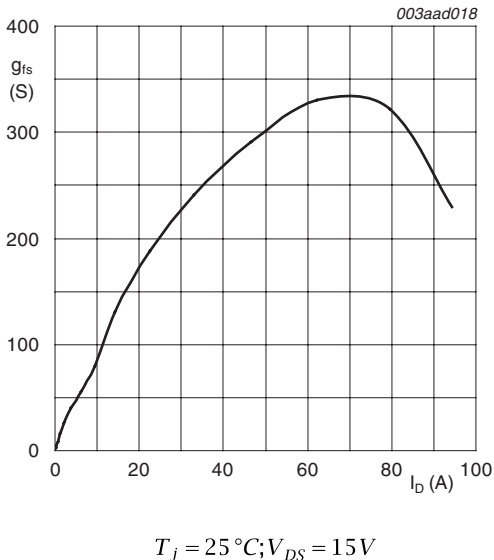


Fig 8. Forward transconductance as a function of drain current; typical values

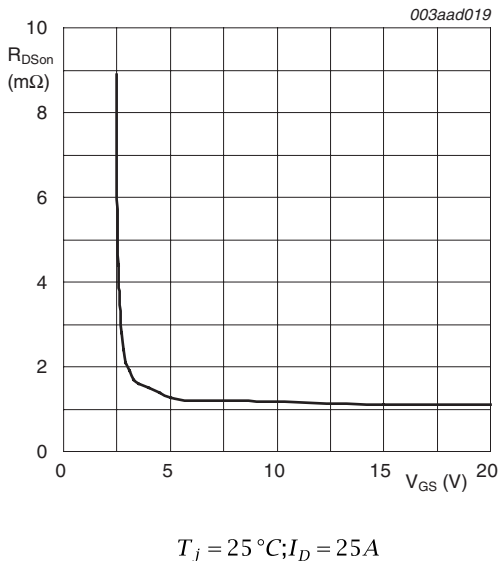


Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

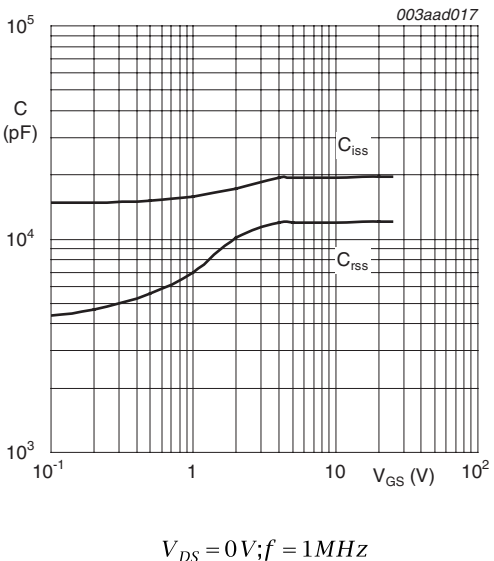


Fig 10. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

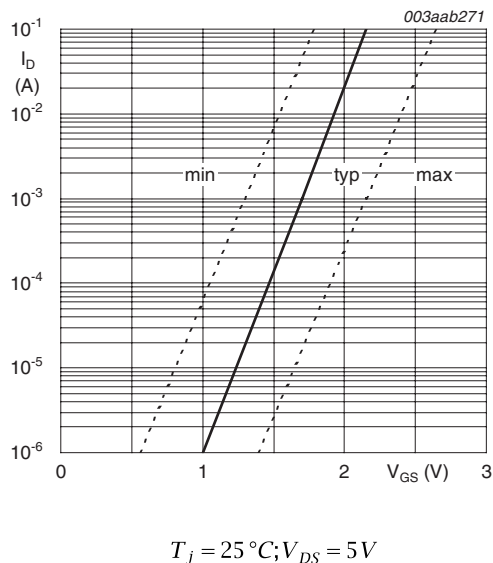


Fig 11. Sub-threshold drain current as a function of gate-source voltage

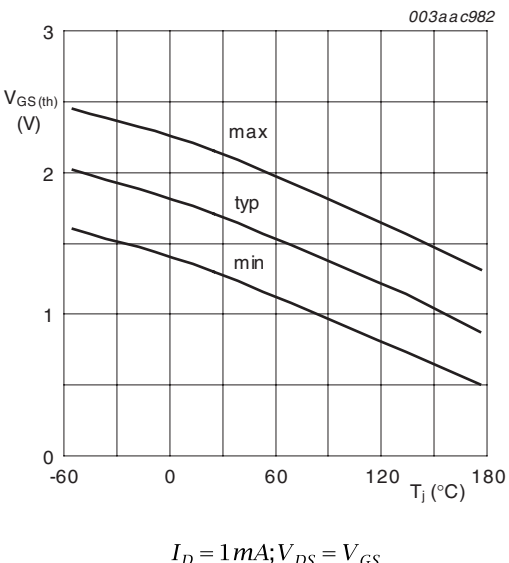


Fig 12. Gate-source threshold voltage as a function of junction temperature

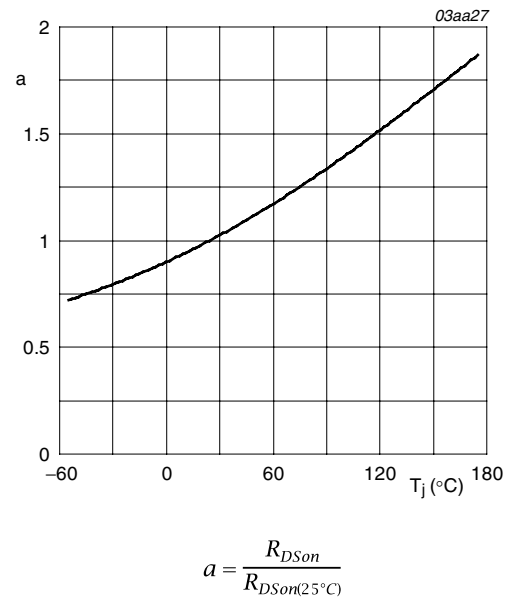


Fig 13. Normalized drain-source on-state resistance factor as a function of junction temperature

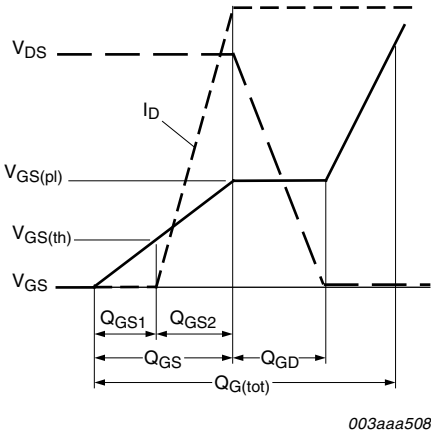


Fig 14. Gate charge waveform definitions

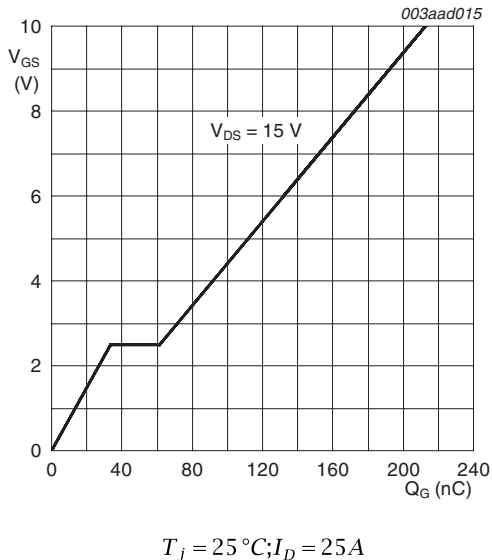


Fig 15. Gate-source voltage as a function of gate charge; typical values

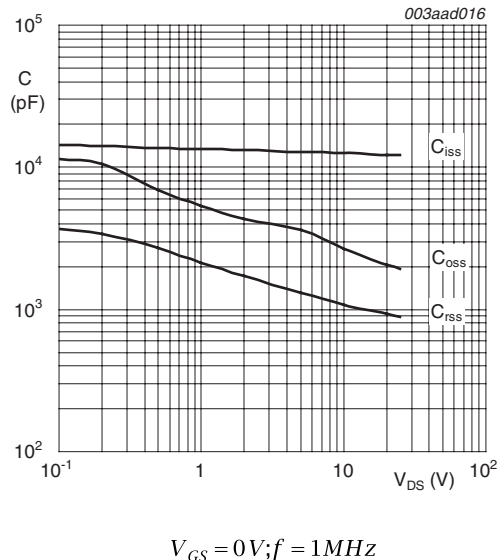


Fig 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

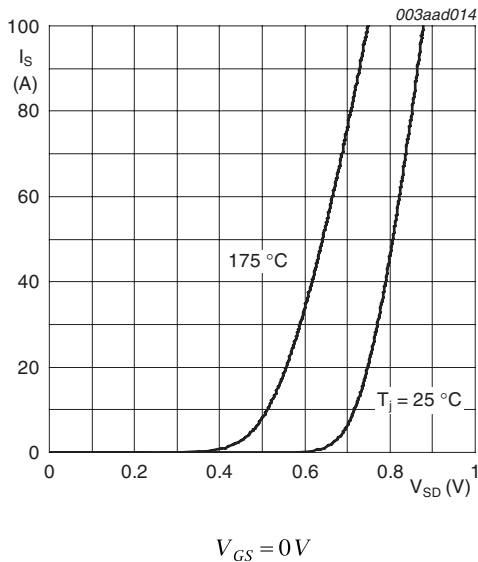


Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB SOT78

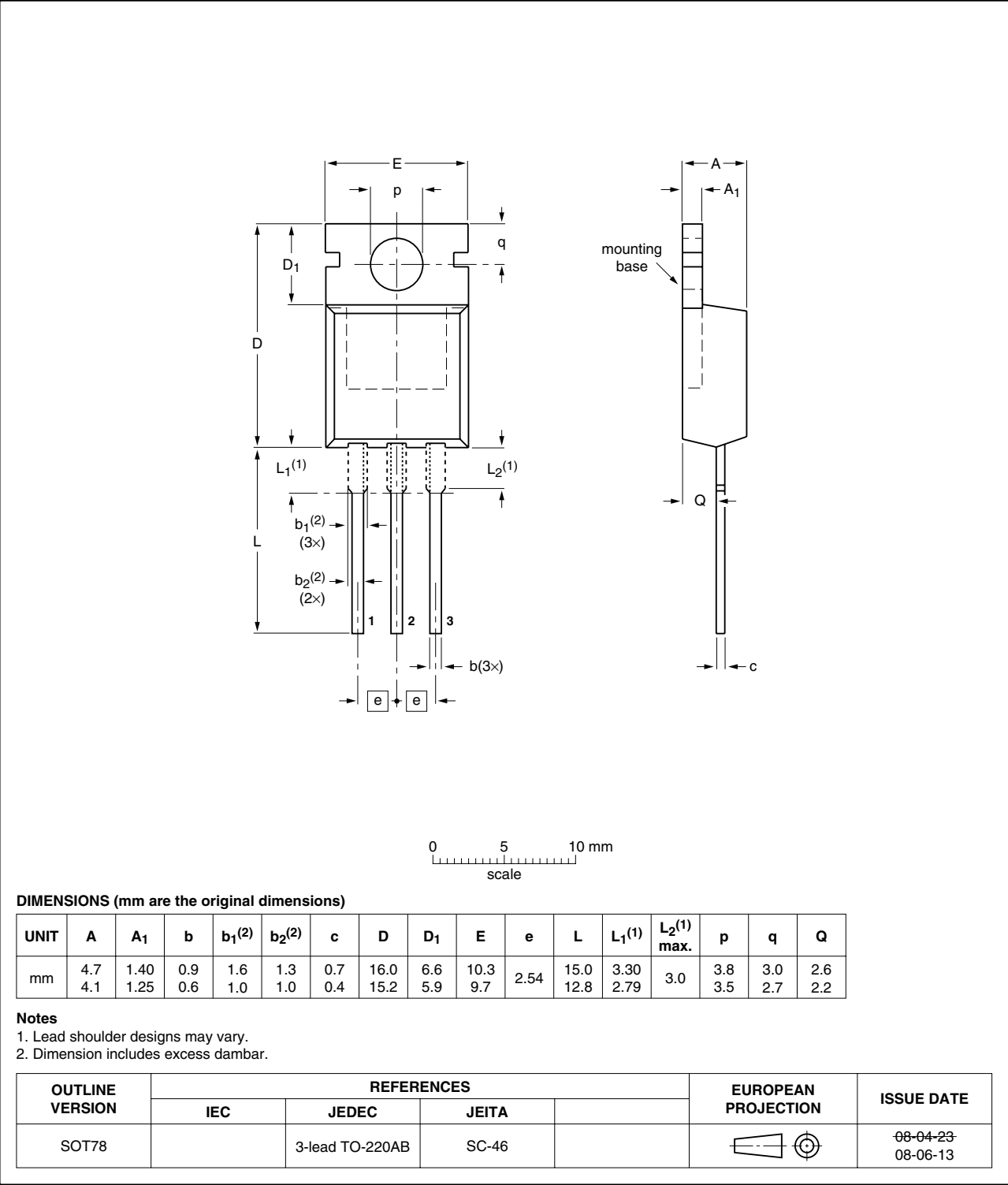


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN1R6-30PL_2	20090625	Product data sheet	-	PSMN1R6-30PL_1
Modifications:	<ul style="list-style-type: none">Data sheet status changed from objective to product.Various content changes.			
PSMN1R6-30PL_1	20090518	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.
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[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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