



# PSMN3R4-30PL

N-channel 30 V 3.4 mΩ logic level MOSFET

Rev. 01 — 2 November 2010

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 data

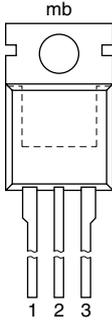
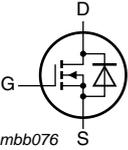
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	30	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	<a href="#">[1]</a> -	-	100	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	-	114	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 10\text{ A};$ $T_j = 25\text{ °C};$ see <a href="#">Figure 13</a>	-	3.5	4.1	mΩ
		$V_{GS} = 10\text{ V}; I_D = 10\text{ A};$ $T_j = 25\text{ °C};$ see <a href="#">Figure 13</a>	<a href="#">[2]</a> -	2.8	3.4	mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 4.5\text{ V}; I_D = 25\text{ A};$ $V_{DS} = 15\text{ V};$ see <a href="#">Figure 14</a> ;	-	8	-	nC
$Q_{G(tot)}$	total gate charge	see <a href="#">Figure 15</a>	-	31	-	nC
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ $I_D = 100\text{ A}; V_{sup} \leq 30\text{ V};$ $R_{GS} = 50\text{ Ω};$ unclamped	-	-	200	mJ

[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
PSMN3R4-30PL	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

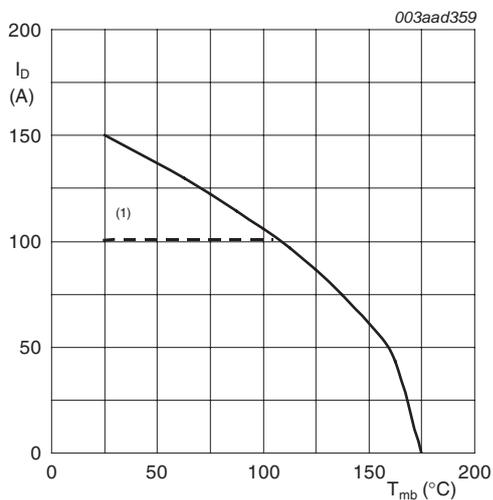
## 4. Limiting values

**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 <a href="#">Figure 1</a>	[1]	100	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a>	[1]	100	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 3</a>	-	609	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	114	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	[1]	100	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$	-	609	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 100\text{ A}; V_{sup} \leq 30\text{ V}; R_{GS} = 50\text{ }\Omega$ ; unclamped	-	200	mJ

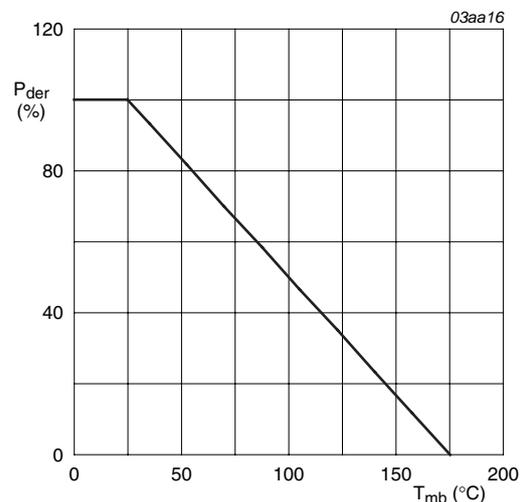
[1] Continuous current is limited by package.



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

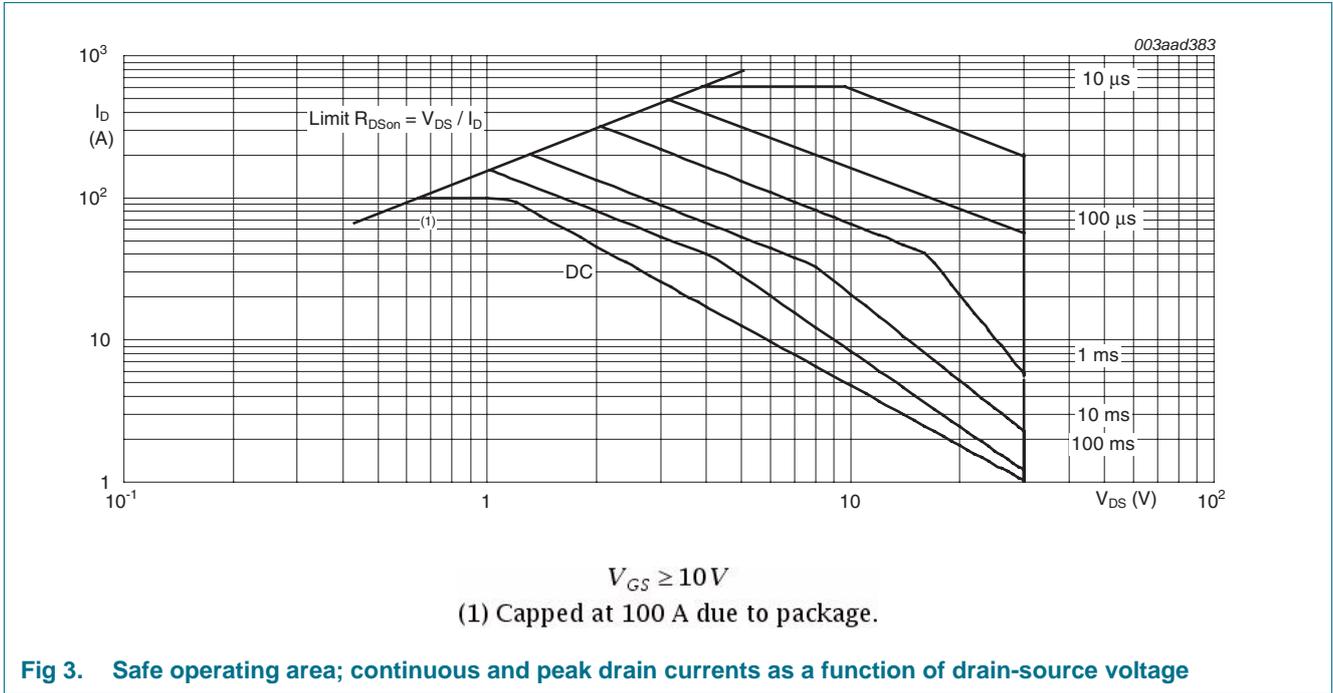
(1) Capped at 100 A due to package.

**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**



### 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 4</a>	-	0.65	1	K/W

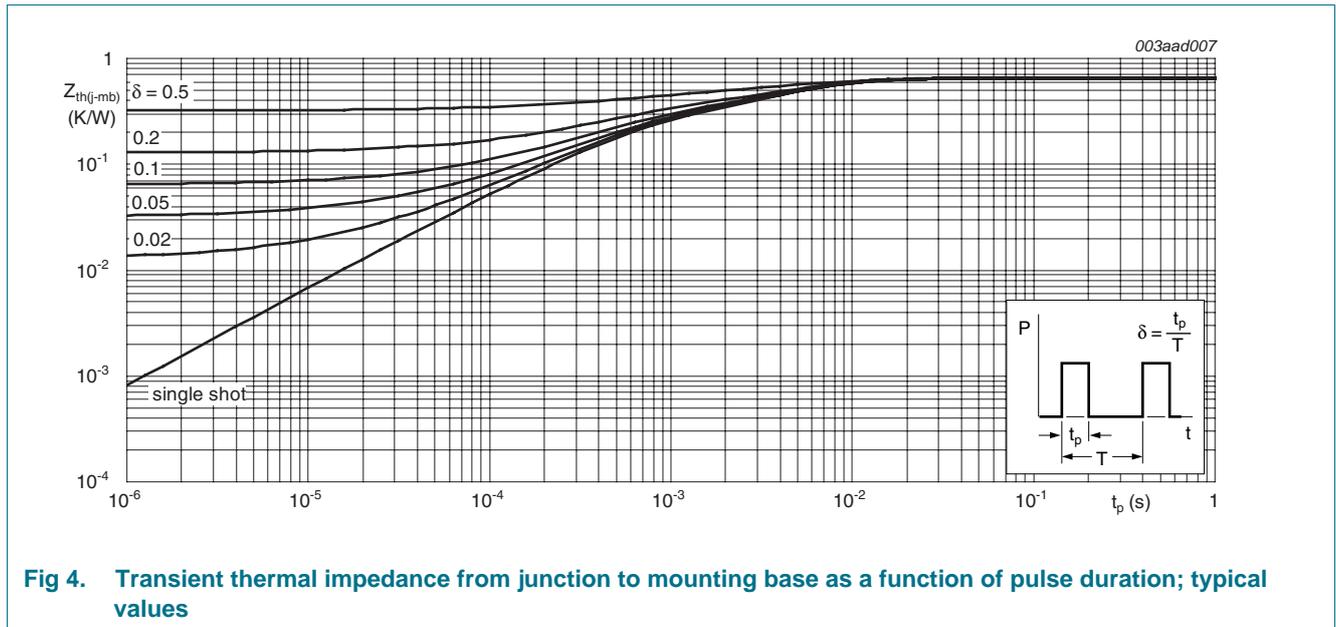


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration; typical values

## 6. Characteristics

**Table 6. Characteristics**

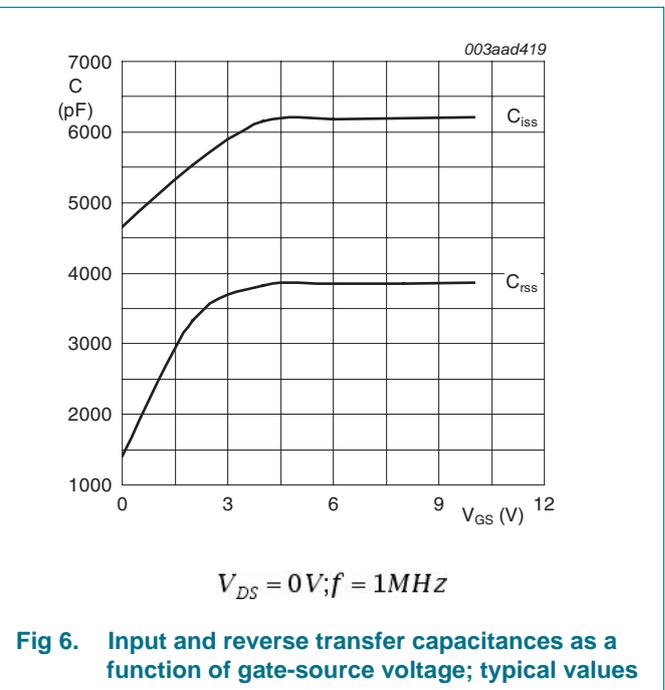
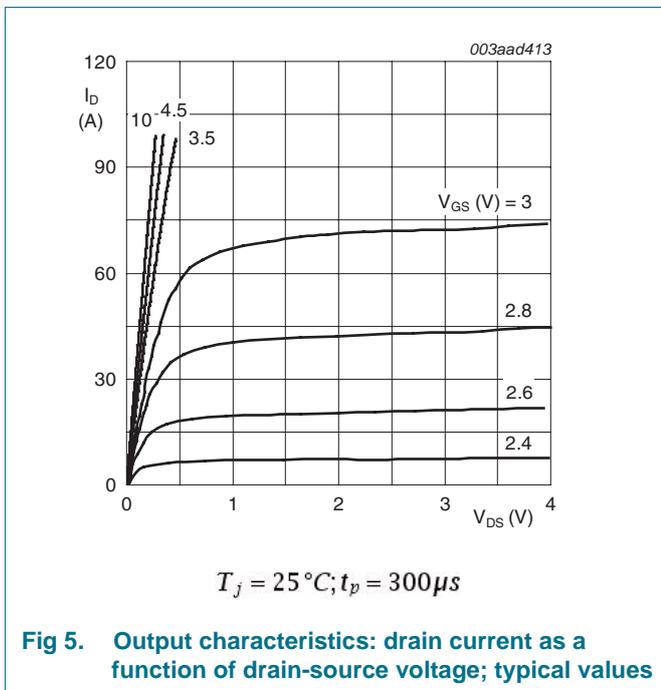
Tested to JEDEC standards where applicable.

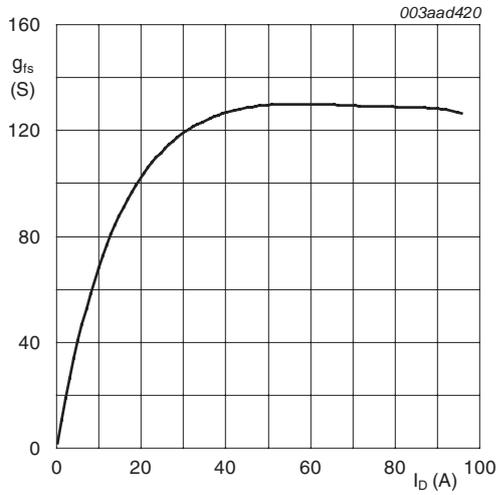
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	30	-	-	V
		$I_D = 250 \mu\text{A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = -55 \text{ }^\circ\text{C}$	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 <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	1.3	1.7	2.15	V
		$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a>	0.5	-	-	V
		$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = -55 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a>	-	-	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	5	$\mu\text{A}$
		$V_{DS} = 30 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 125 \text{ }^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	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	$V_{GS} = 10 \text{ V}$ ; $I_D = 10 \text{ A}$ ; $T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	-	6.46	mΩ
		$V_{GS} = 4.5 \text{ V}$ ; $I_D = 10 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 13</a>	-	3.5	4.1	mΩ
		$V_{GS} = 10 \text{ V}$ ; $I_D = 10 \text{ A}$ ; $T_j = 100 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	-	6.1	mΩ
		$V_{GS} = 4.5 \text{ V}$ ; $I_D = 10 \text{ A}$ ; $T_j = 175 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	-	7.79	mΩ
		$V_{GS} = 10 \text{ V}$ ; $I_D = 10 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 13</a>	<a href="#">11</a>	-	2.8	3.4
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	1	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}$ ; $V_{DS} = 15 \text{ V}$ ; $V_{GS} = 10 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	64	-	nC
		$I_D = 0 \text{ A}$ ; $V_{DS} = 0 \text{ V}$ ; $V_{GS} = 10 \text{ V}$	-	58	-	nC
		$I_D = 25 \text{ A}$ ; $V_{DS} = 15 \text{ V}$ ; $V_{GS} = 4.5 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	31	-	nC
$Q_{GS}$	gate-source charge		-	12	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	6.2	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	5.8	-	nC
$Q_{GD}$	gate-drain charge		-	8	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 15 \text{ V}$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	2.8	-	V
$C_{iss}$	input capacitance	$V_{DS} = 12 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $f = 1 \text{ MHz}$ ;	-	3907	-	pF
$C_{oss}$	output capacitance	$T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 16</a>	-	822	-	pF
$C_{rss}$	reverse transfer capacitance		-	356	-	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	$V_{DS} = 12\text{ V}; R_L = 0.5\ \Omega;$	-	40	-	ns
$t_r$	rise time	$V_{GS} = 4.5\text{ V}; R_{G(ext)} = 4.7\ \Omega$	-	73	-	ns
$t_{d(off)}$	turn-off delay time		-	59	-	ns
$t_f$	fall time		-	28	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 10\text{ A}; V_{GS} = 0\text{ V}; T_j = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 17</a>	-	0.7	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25\text{ A}; dI_S/dt = -100\text{ A}/\mu\text{s};$	-	36	-	ns
$Q_r$	recovered charge	$V_{GS} = 0\text{ V}; V_{DS} = 12\text{ V}$	-	28	-	nC

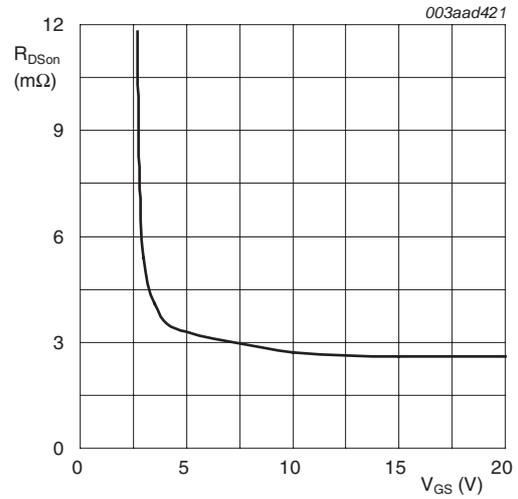
[1] Measured 3 mm from package.





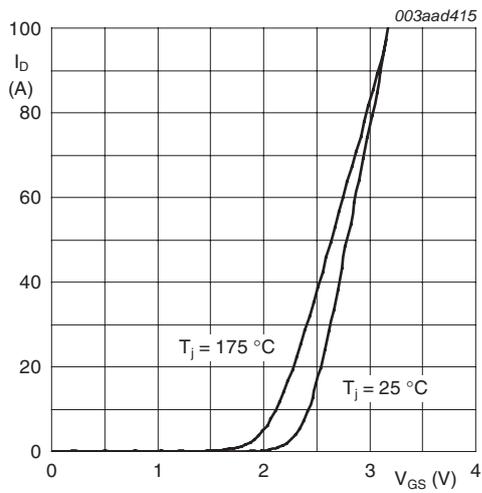
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 15\text{ V}$

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



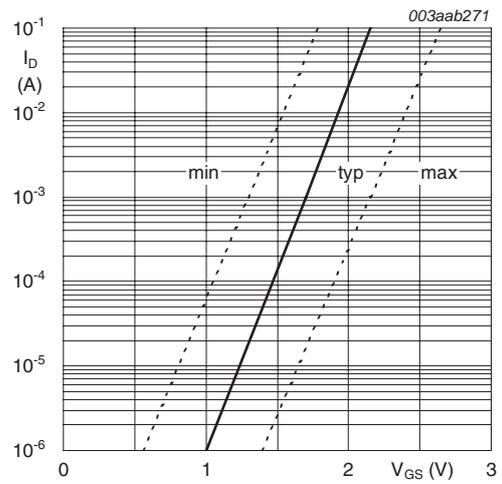
$T_j = 25\text{ }^\circ\text{C}; I_D = 25\text{ A}$

Fig 8. Drain-source on-state resistance as a function of gate-source voltage; typical values



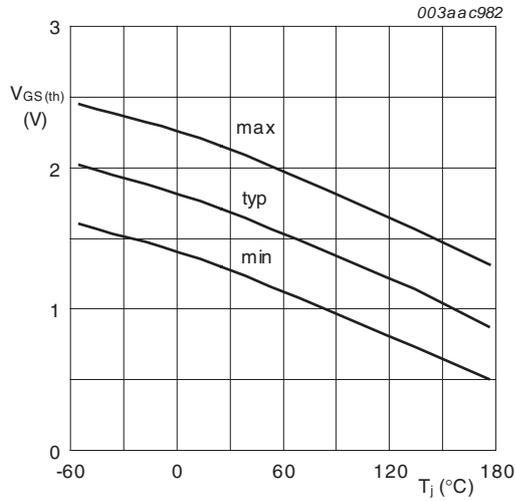
$V_{DS} = 15\text{ V}$

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



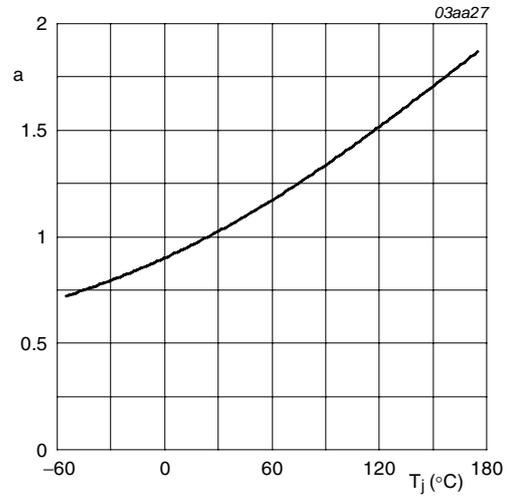
$T_j = 25\text{ }^\circ\text{C}; V_{DS} = 5\text{ V}$

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



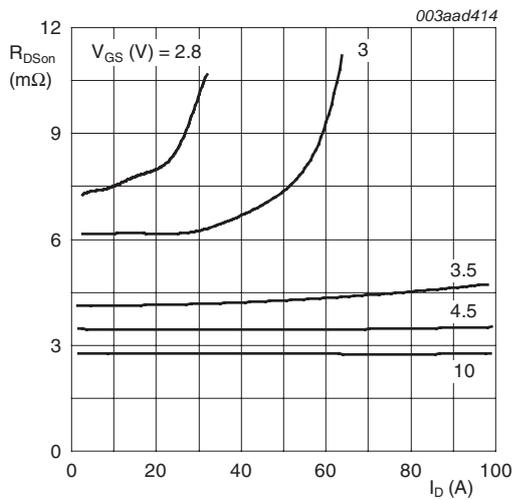
$$I_D = 1\text{mA}; V_{DS} = V_{GS}$$

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



$$a = \frac{R_{DS(on)}}{R_{DS(on)@25^\circ\text{C}}}$$

Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature



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

Fig 13. Drain-source on-state resistance as a function of drain current; typical values

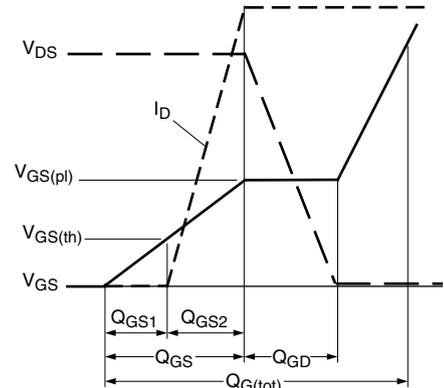
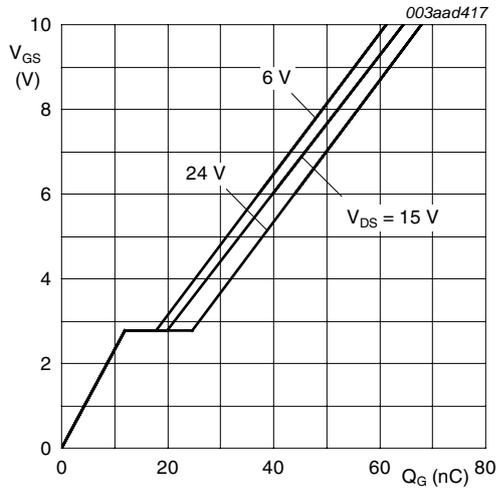
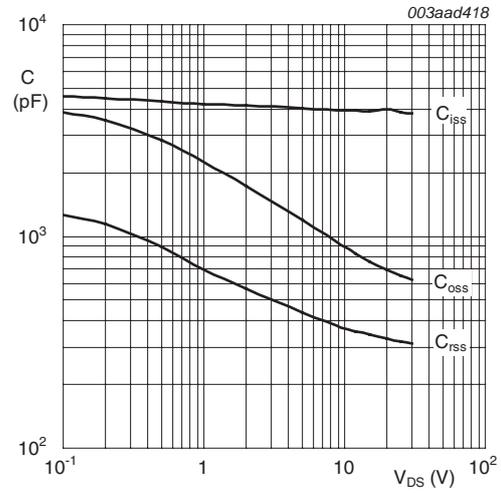


Fig 14. Gate charge waveform definitions



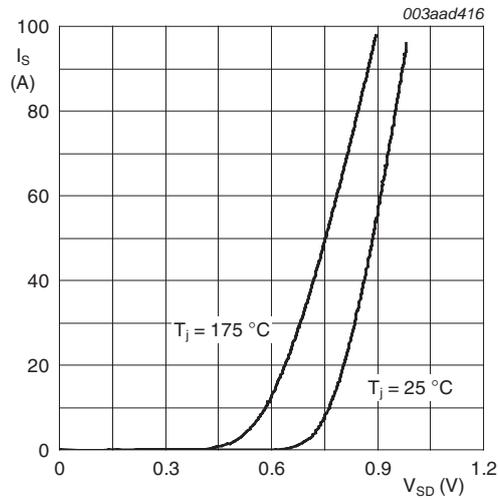
$T_j = 25\text{ }^\circ\text{C}; I_D = 25\text{ A}$

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

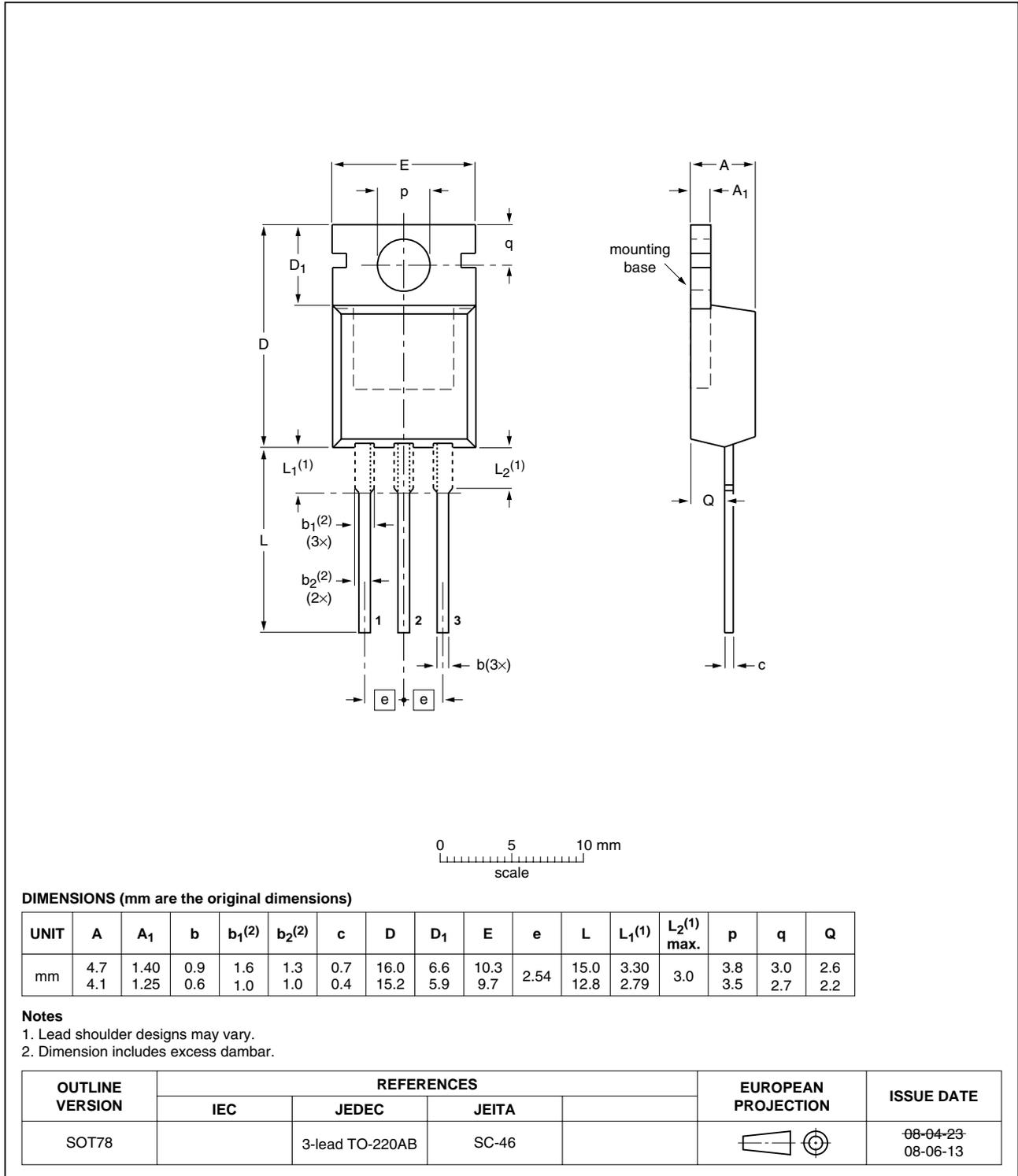


Fig 18. Package outline SOT78 (TO-220AB)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN3R4-30PL v.1	20101102	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.

[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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