

# PSMN4R3-30PL

N-channel 30 V 4.3 mΩ logic level MOSFET

Rev. 01 — 16 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

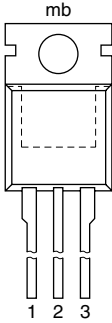
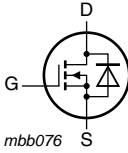
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$	-	-	30	V	
$I_D$	drain current	$T_{mb} = 25\text{ °C}$ ; $V_{GS} = 10\text{ V}$ ; see <a href="#">Figure 1</a>	[1]	-	100	A	
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	103	W	
<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> ; see <a href="#">Figure 15</a>	-	5	-	nC	
<b>Static characteristics</b>							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 15\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 13</a>	[2]	-	3.5	4.3	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	 <p style="text-align: center;"><b>SOT78</b> (TO-220AB; SC-46)</p>	 <p style="text-align: center;"><i>mbb076</i></p>
2	D	drain		
3	S	source		
mb	D	mounting base; connected to drain		

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package		Version
	Name	Description	
PSMN4R3-30PL	TO-220AB;	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead	SOT78
	SC-46		

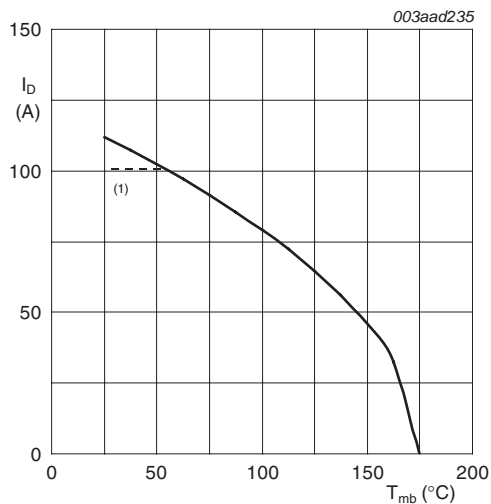
## 4. Limiting values

**Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

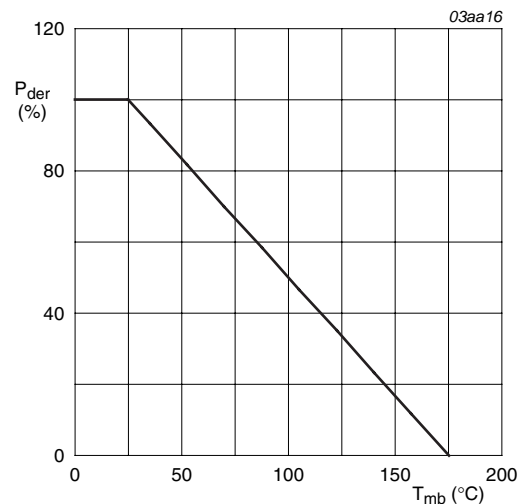
Symbol	Parameter	Conditions	Min	Max	Unit	
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C	-	30	V	
V <sub>DGR</sub>	drain-gate voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C; R <sub>GS</sub> = 20 kΩ	-	30	V	
V <sub>GS</sub>	gate-source voltage		-20	20	V	
I <sub>D</sub>	drain current	V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 100 °C; see <a href="#">Figure 1</a>	[1]	-	80	A
		V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 1</a>	[1]	-	100	A
I <sub>DM</sub>	peak drain current	t <sub>p</sub> ≤ 10 μs; pulsed; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 3</a>	-	465	A	
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <a href="#">Figure 2</a>	-	103	W	
T <sub>stg</sub>	storage temperature		-55	175	°C	
T <sub>j</sub>	junction temperature		-55	175	°C	
<b>Source-drain diode</b>						
I <sub>S</sub>	source current	T <sub>mb</sub> = 25 °C	[1]	-	100	A
I <sub>SM</sub>	peak source current	t <sub>p</sub> ≤ 10 μs; pulsed; T <sub>mb</sub> = 25 °C	-	465	A	
<b>Avalanche ruggedness</b>						
E <sub>DS(AL)S</sub>	non-repetitive drain-source avalanche energy	V <sub>GS</sub> = 10 V; T <sub>j(init)</sub> = 25 °C; I <sub>D</sub> = 100 A; V <sub>sup</sub> ≤ 30 V; R <sub>GS</sub> = 50 Ω; unclamped	-	74	mJ	

[1] Continuous current is limited by package.



V<sub>GS</sub> ≥ 5 V(1) Capped at 100A 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**

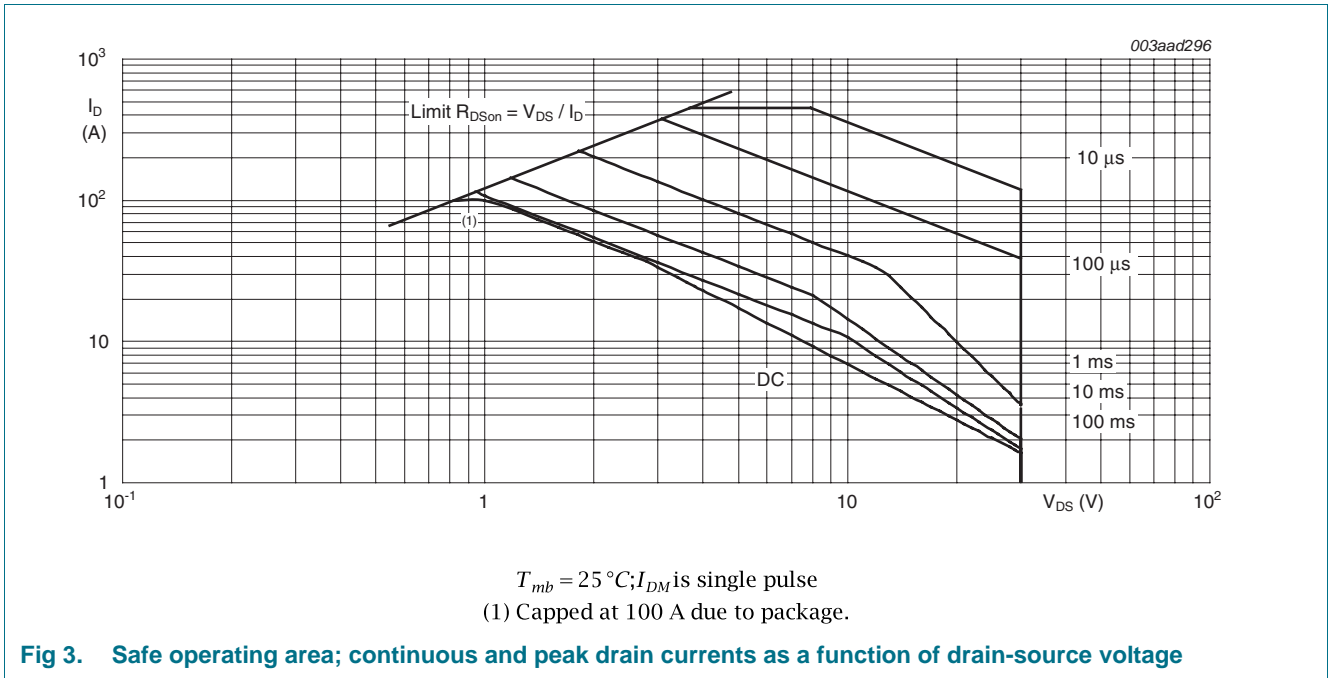


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

## 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 <a href="#">Figure 4</a>	-	1	1.5	K/W

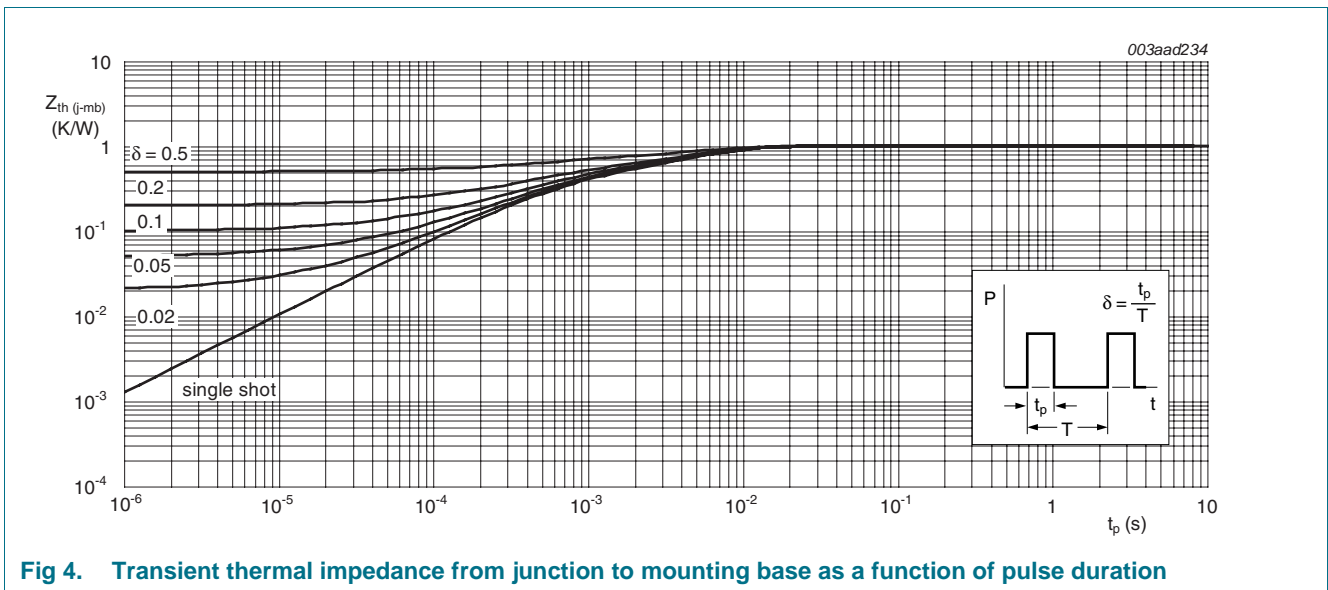


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 6. Characteristics

**Table 6. Characteristics**

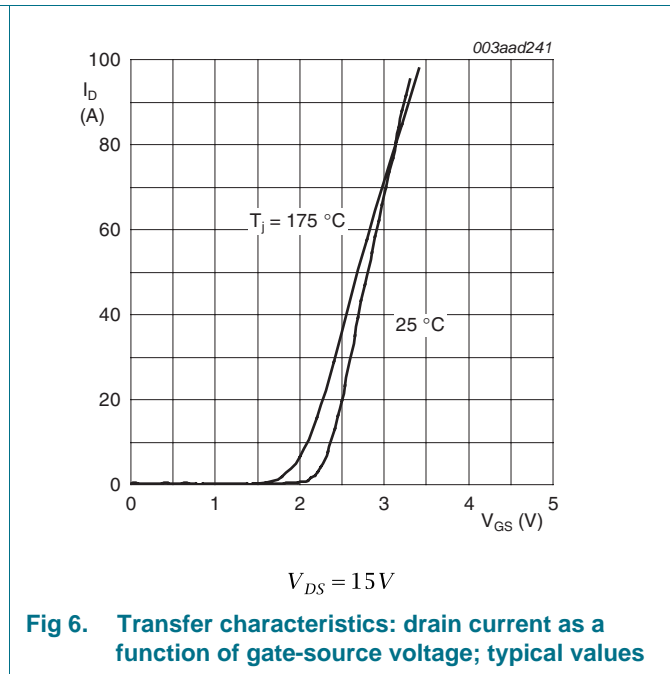
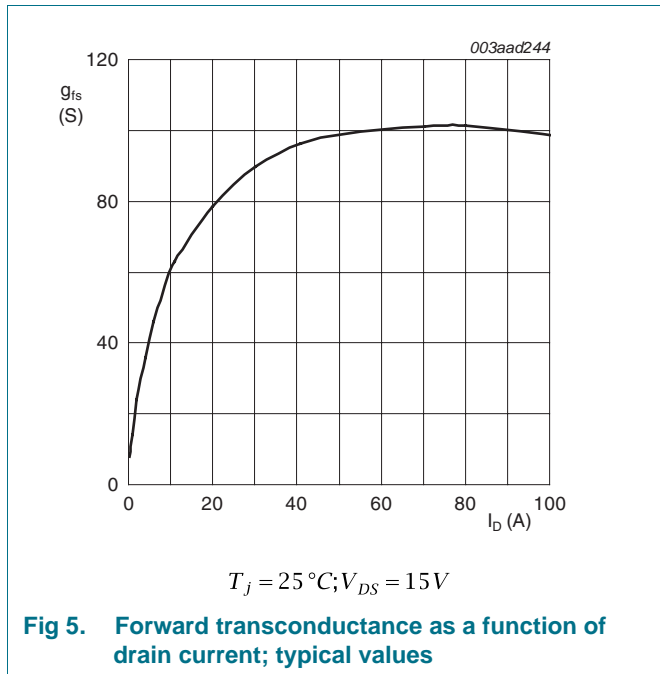
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	30	-	-	V
		$I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	27	-	-	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	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$	-	-	40	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 16 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	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	$V_{GS} = 4.5 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	[2]	-	4.5	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 \text{ }^\circ\text{C};$ see <a href="#">Figure 12</a> ; see <a href="#">Figure 13</a>	-	-	6	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 13</a> ;	[2]	-	3.5	4.3
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	1	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	19	-	nC
		$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 10 \text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	41.5	-	nC
$Q_{GS}$	gate-source charge	$I_D = 25 \text{ A}; V_{DS} = 15 \text{ V}; V_{GS} = 4.5 \text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	8	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	4	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	4	-	nC
$Q_{GD}$	gate-drain charge		-	5	-	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>	-	2.7	-	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 <a href="#">Figure 16</a>	-	2400	-	pF
$C_{oss}$	output capacitance		-	500	-	pF
$C_{rss}$	reverse transfer capacitance		-	240	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 20 \text{ V}; R_L = 0.5 \text{ } \Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 5.6 \text{ } \Omega$	-	28	-	ns
$t_r$	rise time		-	58	-	ns
$t_{d(off)}$	turn-off delay time		-	44	-	ns
$t_f$	fall time		-	21	-	ns

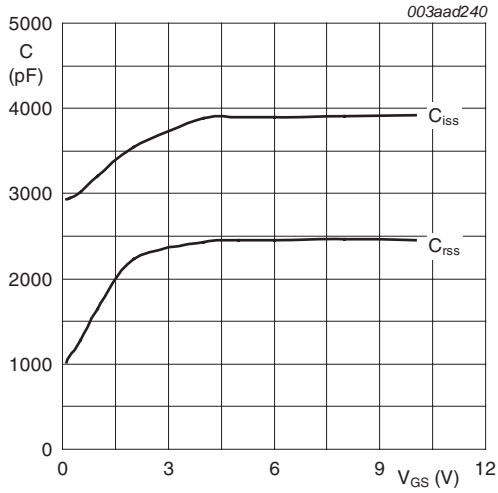
Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 17</a>	-	0.81	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20\text{ A}$ ; $di_S/dt = -100\text{ A}/\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ;	-	35	-	ns
$Q_r$	recovered charge	$V_{DS} = 30\text{ V}$	-	30	-	nC

[1] Tested to JEDEC standards where applicable.

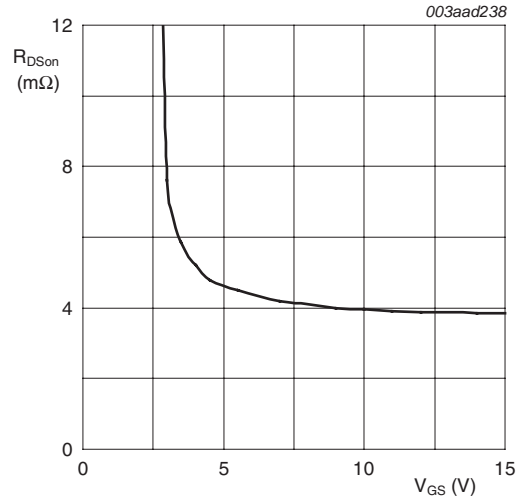
[2] Measured 3 mm from package.





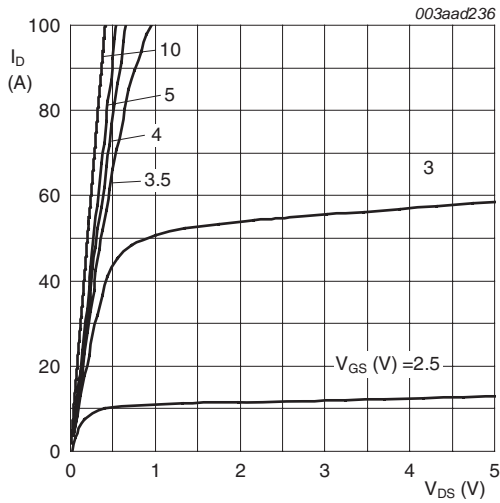
$V_{DS} = 0V; f = 1MHz$

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



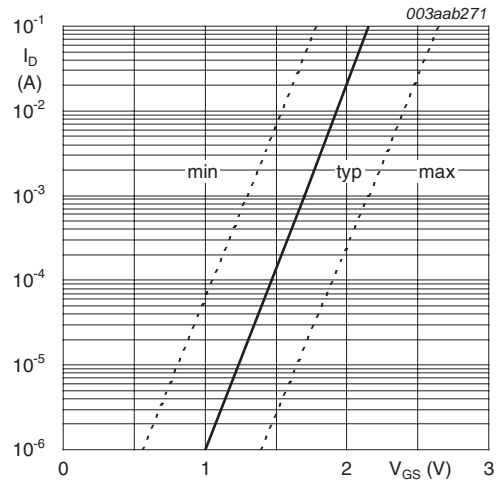
$T_j = 25^\circ C; I_D = 15A$

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



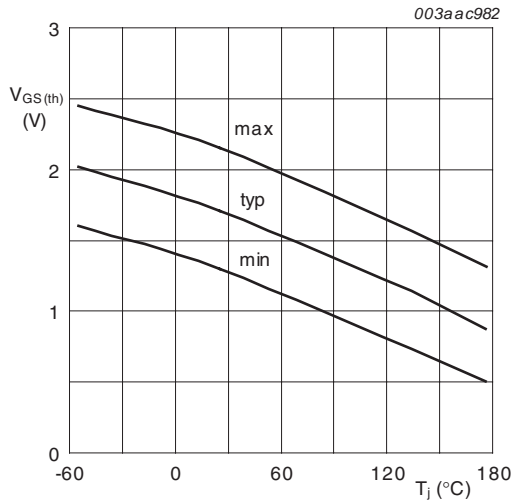
$T_j = 25^\circ C; t_p = 300 \mu s$

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



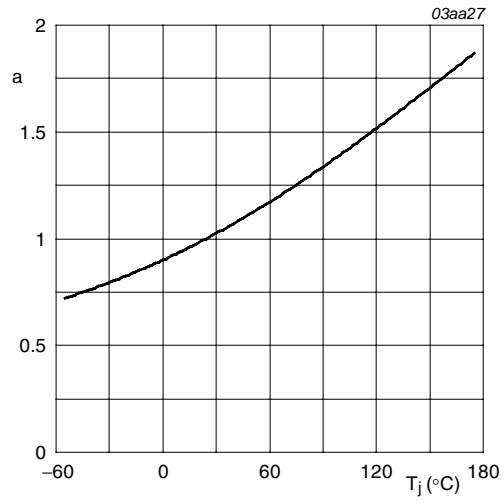
$T_j = 25^\circ C; V_{DS} = 5V$

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



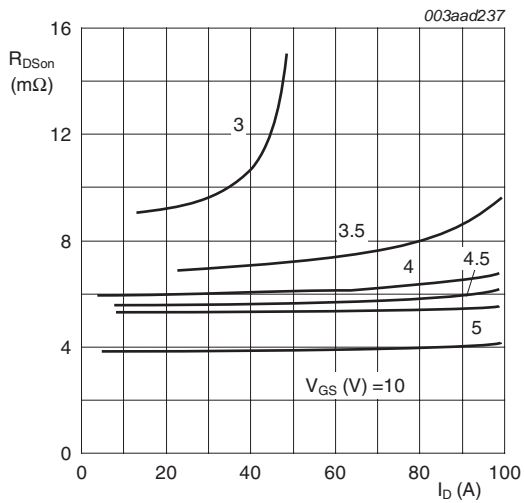
$$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$$

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



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

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

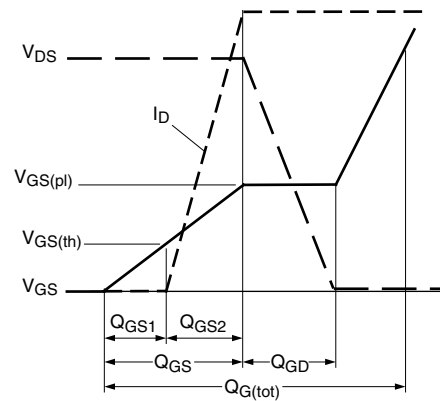
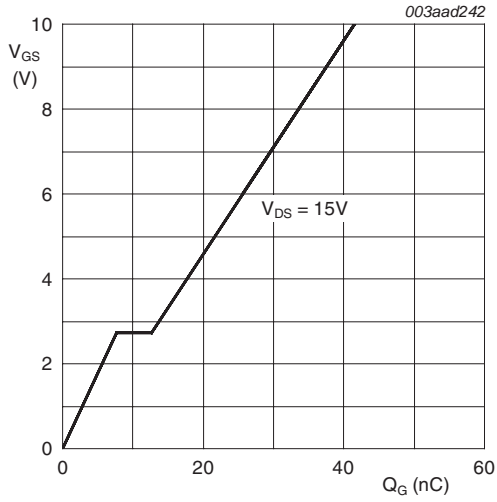


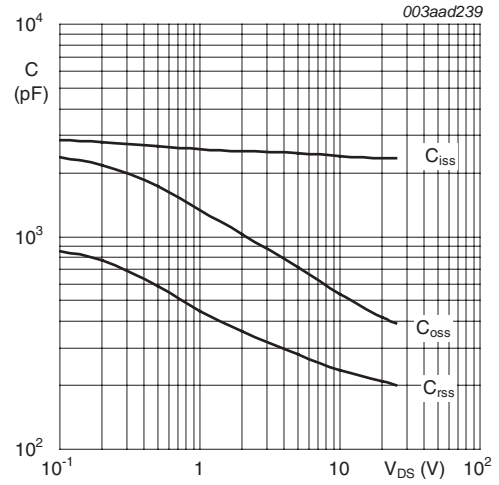
Fig 14. Gate charge waveform definitions





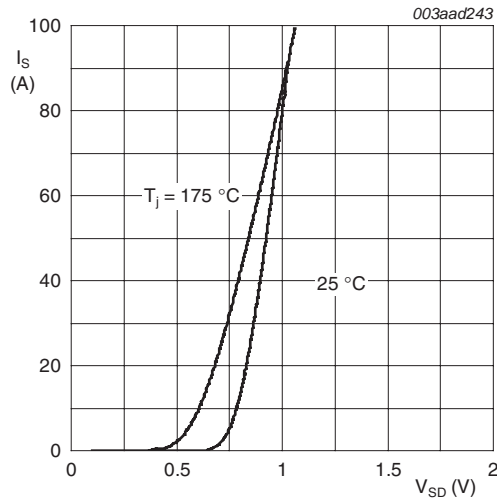
$T_j = 25^\circ C; I_D = 25A$

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



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

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



$V_{GS} = 0V$

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

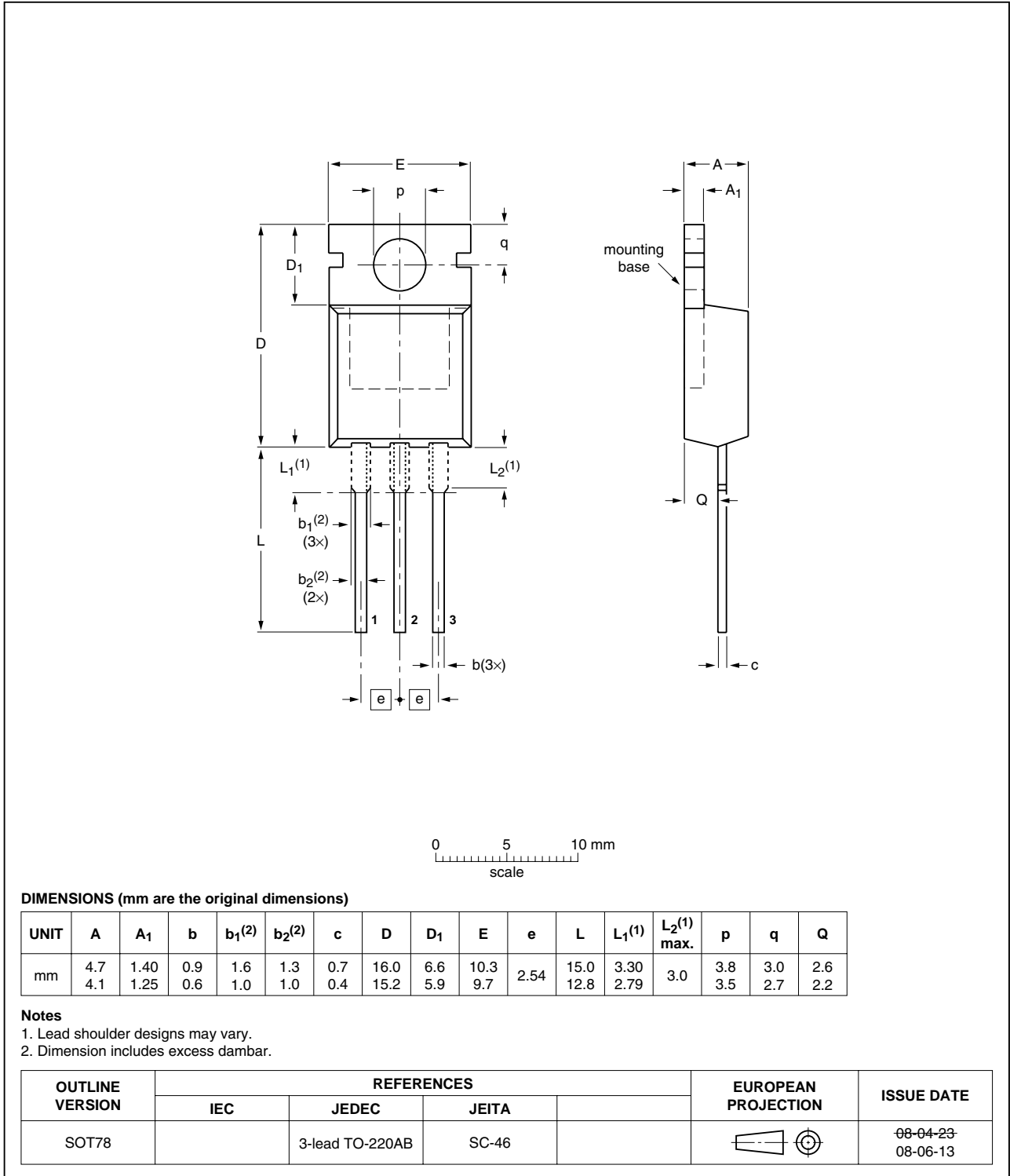


Fig 18. Package outline SOT78 (TO-220AB)

## 8. Revision history

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Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN4R3-30PL_1	20090616	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.

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[2] The term 'short data sheet' is explained in section "Definitions".

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