



# PSMN6R5-80PS

N-channel 80 V 6.9 mΩ standard level MOSFET in TO220

Rev. 02 — 1 November 2010

Product data sheet

## 1. Product profile

### 1.1 General description

Standard 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 standard 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

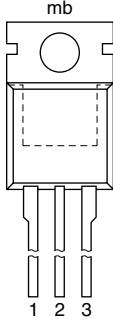
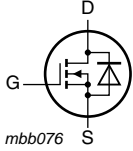
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	80	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	[1]	-	100	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 2</a>	-	-	210	W
$T_j$	junction temperature		-55	-	175	°C
<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]	-	5.9	6.9 mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$	-	16	-	nC
$Q_{G(tot)}$	total gate charge	$V_{DS} = 40\text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	71	-	nC
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ $I_D = 49\text{ A}; V_{sup} \leq 80\text{ V};$ $R_{GS} = 50\text{ Ω};$ unclamped	-	-	700	mJ

[1] Continuous current rating 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

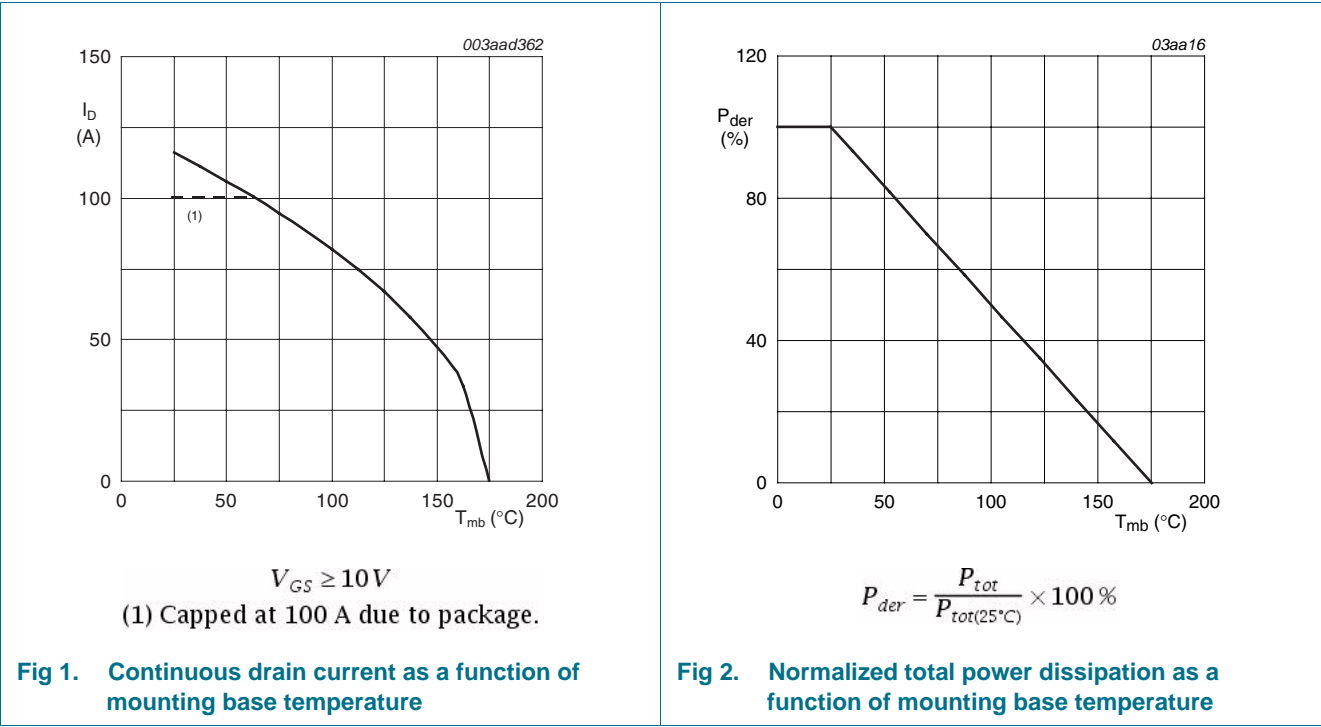
Type number	Package		
	Name	Description	Version
PSMN6R5-80PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

4. Limiting values

Table 4. Limiting values  
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>DS</sub>	drain-source voltage	T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C	-	80	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	-	80	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>	-	82	A
		V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 1</a> <sup>[1]</sup>	-	100	A
I <sub>DM</sub>	peak drain current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C; see <a href="#">Figure 3</a>	-	470	A
P <sub>tot</sub>	total power dissipation	T <sub>mb</sub> = 25 °C; see <a href="#">Figure 2</a>	-	210	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	-	100	A
I <sub>SM</sub>	peak source current	pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C	-	470	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> = 49 A; V <sub>sup</sub> ≤ 80 V; R <sub>GS</sub> = 50 Ω; unclamped	-	700	mJ

[1] Continuous current rating is limited by package.



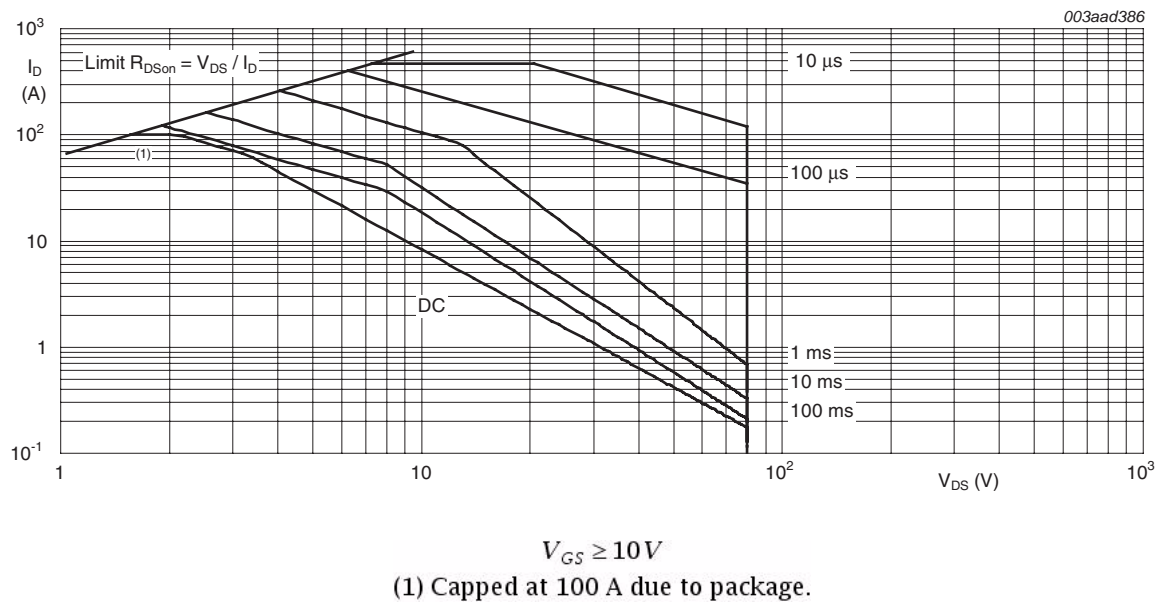


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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 <a href="#">Figure 4</a>	-	0.4	0.7	K/W

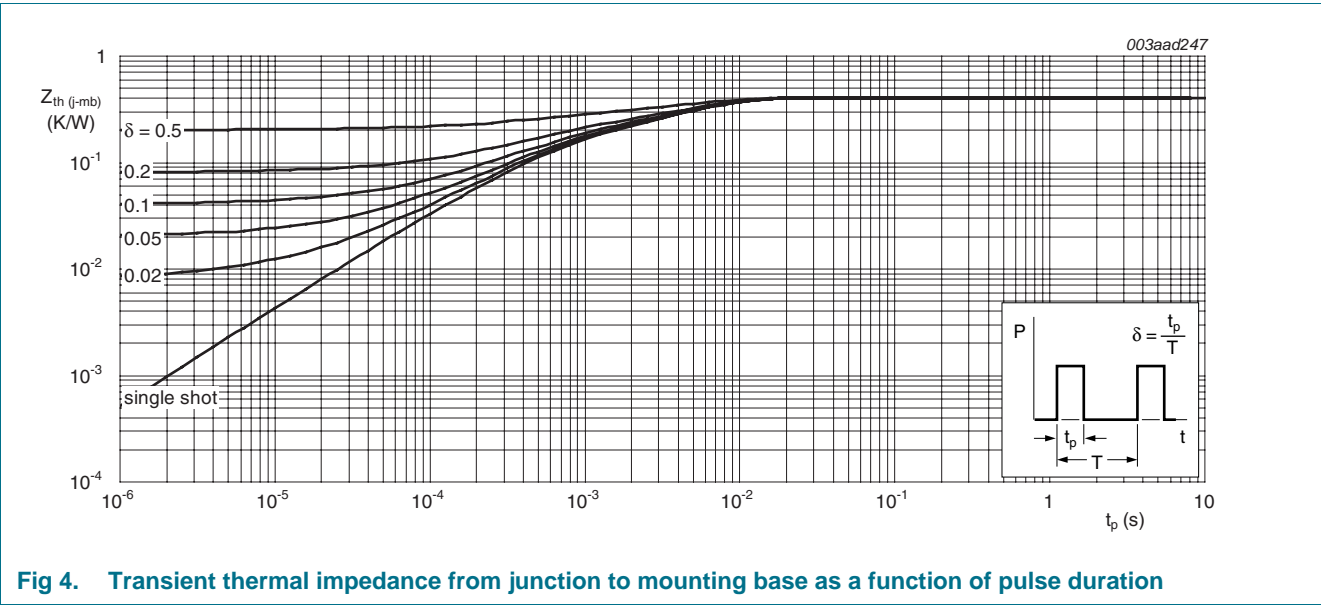


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 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	$I_D = 250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = -55 ^\circ C$	73	-	-	V
		$I_D = 250 \mu A$ ; $V_{GS} = 0 V$ ; $T_j = 25 ^\circ C$	80	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 mA$ ; $V_{DS} = V_{GS}$ ; $T_j = 175 ^\circ C$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	1	-	-	V
		$I_D = 1 mA$ ; $V_{DS} = V_{GS}$ ; $T_j = -55 ^\circ C$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	-	-	4.6	V
		$I_D = 1 mA$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 ^\circ C$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	2.3	3	4	V
$I_{DSS}$	drain leakage current	$V_{DS} = 80 V$ ; $V_{GS} = 0 V$ ; $T_j = 25 ^\circ C$	-	0.3	10	$\mu A$
		$V_{DS} = 80 V$ ; $V_{GS} = 0 V$ ; $T_j = 125 ^\circ C$	-	-	150	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = -20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 ^\circ C$	-	10	100	nA
		$V_{GS} = 20 V$ ; $V_{DS} = 0 V$ ; $T_j = 25 ^\circ C$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 V$ ; $I_D = 15 A$ ; $T_j = 100 ^\circ C$ ; see <a href="#">Figure 12</a>	-	-	11.5	mΩ
		$V_{GS} = 10 V$ ; $I_D = 15 A$ ; $T_j = 175 ^\circ C$ ; see <a href="#">Figure 12</a>	-	-	16.56	mΩ
		$V_{GS} = 10 V$ ; $I_D = 15 A$ ; $T_j = 25 ^\circ C$ ; see <a href="#">Figure 13</a>	<a href="#">[1]</a> -	5.9	6.9	mΩ
$R_G$	internal gate resistance (AC)	$f = 1 MHz$	-	0.75	-	Ω
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 0 A$ ; $V_{DS} = 0 V$ ; $V_{GS} = 10 V$	-	61	-	nC
		$I_D = 25 A$ ; $V_{DS} = 40 V$ ; $V_{GS} = 10 V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	71	-	nC
$Q_{GS}$	gate-source charge		-	19	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	13.2	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	5.8	-	nC
$Q_{GD}$	gate-drain charge		-	16	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25 A$ ; $V_{DS} = 40 V$ ; see <a href="#">Figure 15</a>	-	4.3	-	V
$C_{iss}$	input capacitance	$V_{DS} = 40 V$ ; $V_{GS} = 0 V$ ; $f = 1 MHz$ ;	-	4461	-	pF
$C_{oss}$	output capacitance	$T_j = 25 ^\circ C$ ; see <a href="#">Figure 16</a>	-	410	-	pF
$C_{rss}$	reverse transfer capacitance		-	214	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 40 V$ ; $R_L = 0.5 \Omega$ ; $V_{GS} = 10 V$ ;	-	26	-	ns
$t_r$	rise time	$R_{G(ext)} = 4.7 \Omega$	-	24	-	ns
$t_{d(off)}$	turn-off delay time		-	57	-	ns
$t_f$	fall time		-	22	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 15 A$ ; $V_{GS} = 0 V$ ; $T_j = 25 ^\circ C$ ; see <a href="#">Figure 17</a>	-	0.79	1.2	V

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$t_{rr}$	reverse recovery time	$I_S = 25\text{ A}$ ; $dI_S/dt = 100\text{ A}/\mu\text{s}$ ;	-	48	-	ns
$Q_r$	recovered charge	$V_{GS} = 0\text{ V}$ ; $V_{DS} = 40\text{ V}$	-	82	-	nC

[1] Measured 3 mm from package.

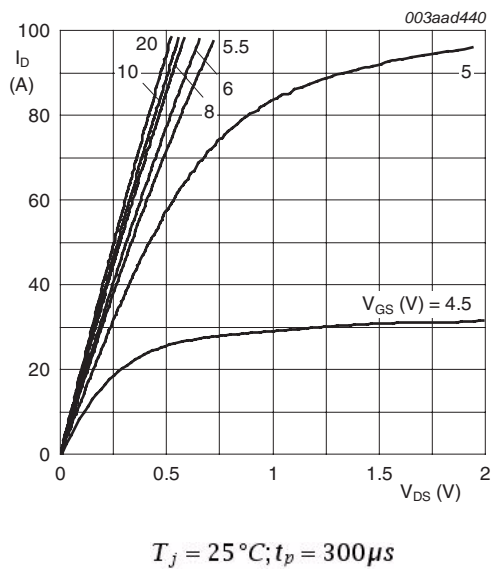


Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

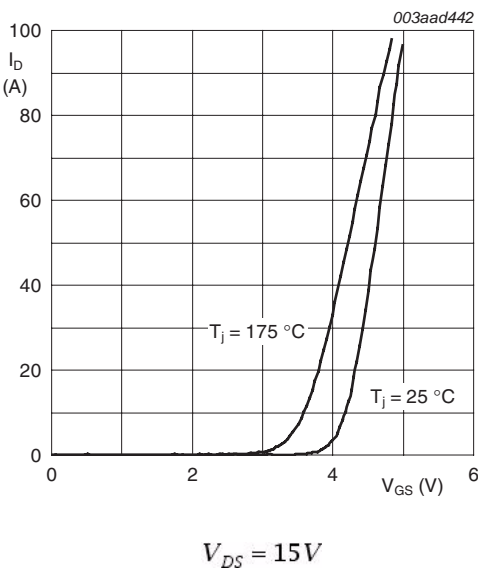


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

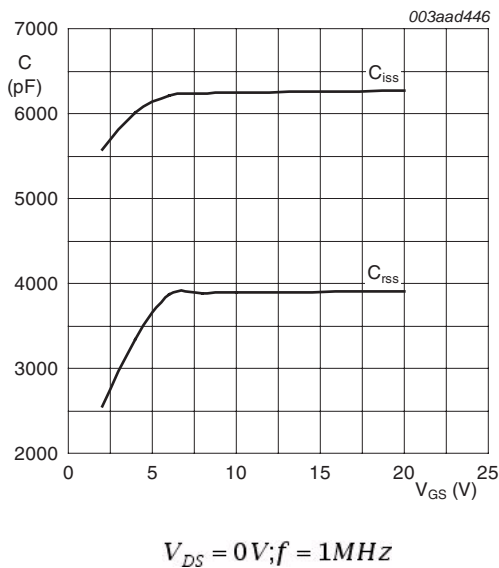


Fig 7. Input and reverse transfer capacitances as a function of gate-source voltage; typical values

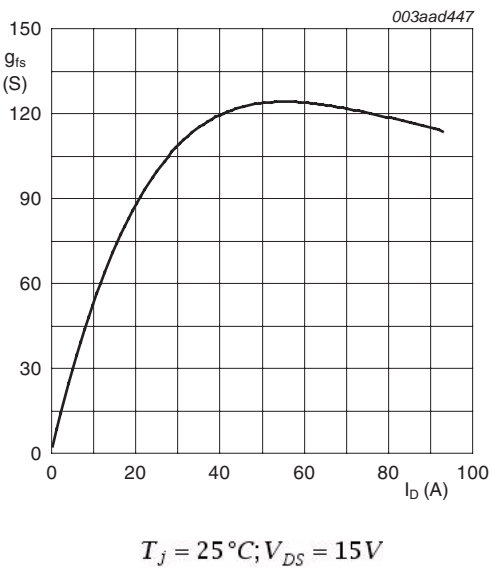


Fig 8. Forward transconductance as a function of drain current; typical values

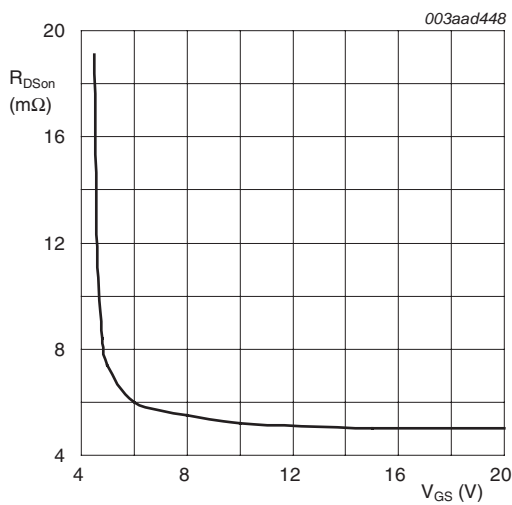


Fig 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

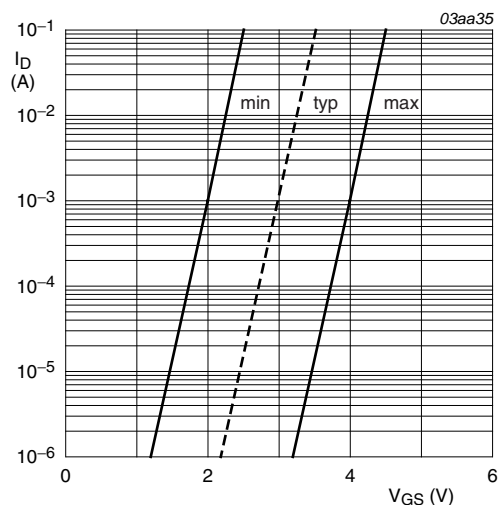


Fig 10. Sub-threshold drain current as a function of gate-source voltage

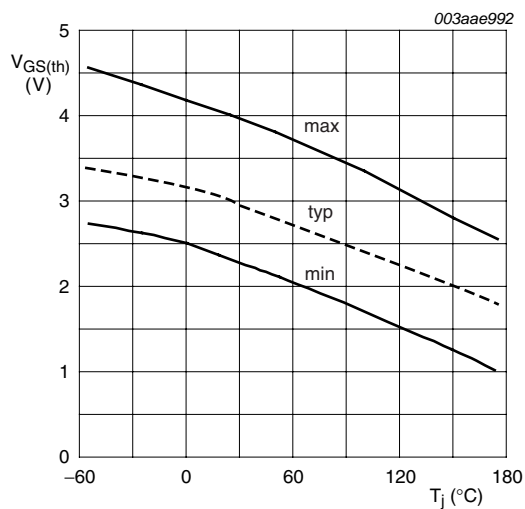


Fig 11. Gate-source threshold voltage as a function of junction temperature

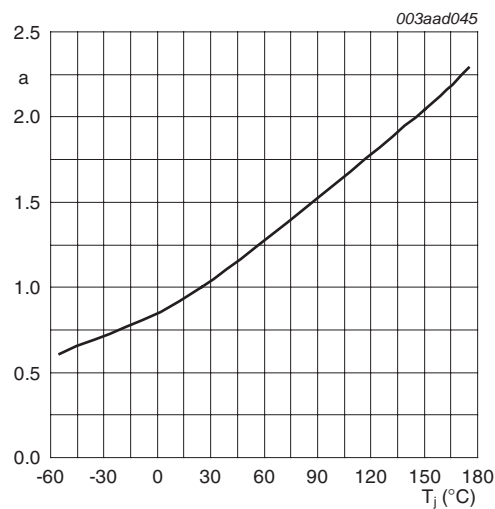
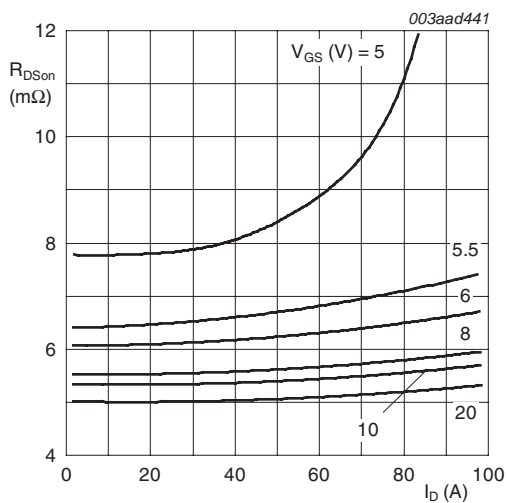


Fig 12. Normalized drain-source on-state resistance factor as a function of junction temperature





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

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

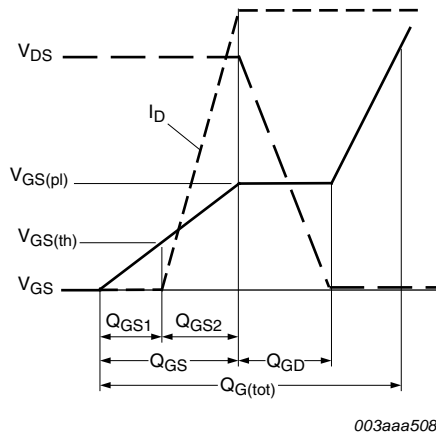
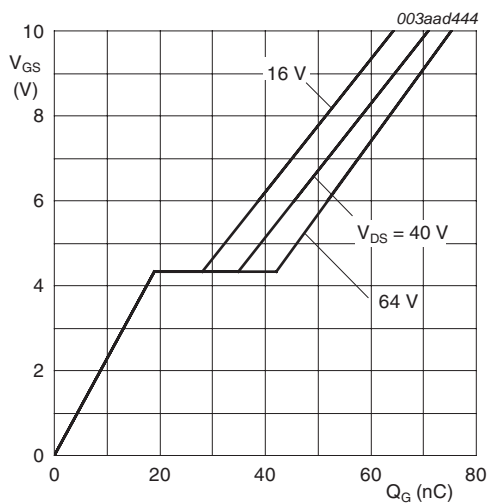
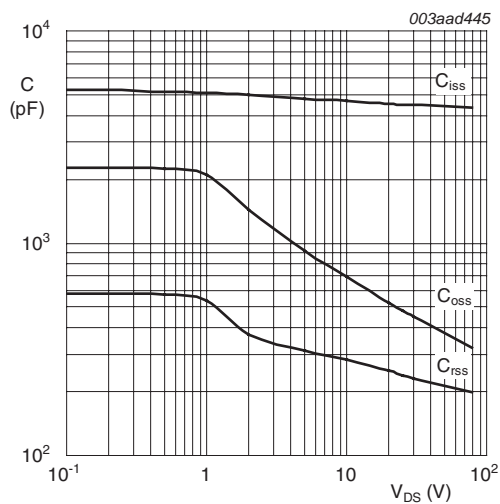


Fig 14. Gate charge waveform definitions



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

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

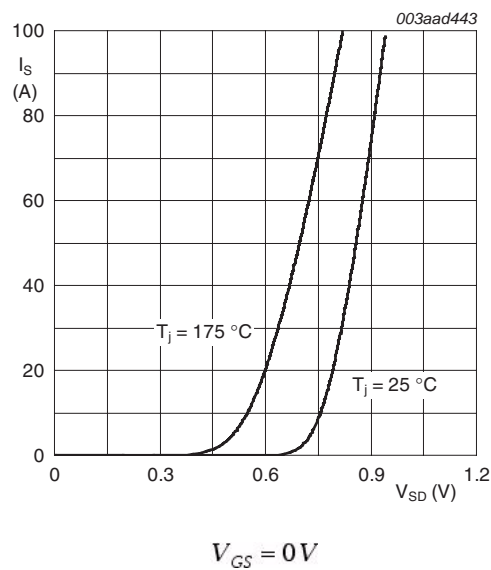


Fig 17. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values

7. Package outline

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

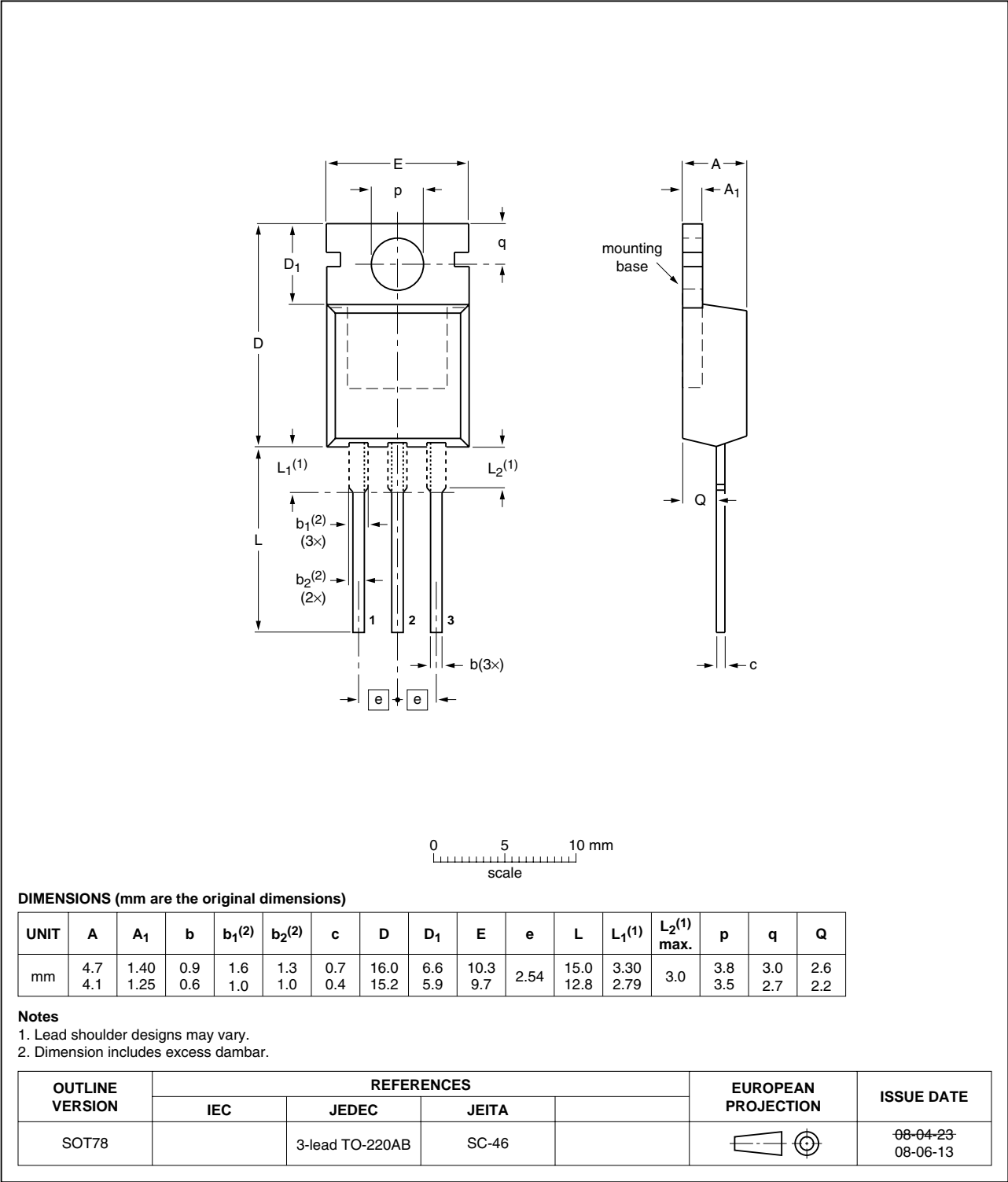


Fig 18. Package outline SOT78 (TO-220AB)

## 8. Revision history

**Table 7.** Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN6R5-80PS v.2	20101101	Product data sheet	-	PSMN6R5-80PS v.1
Modifications:	<ul style="list-style-type: none"><li>• Status changed from objective to product.</li><li>• Various changes to content.</li></ul>			
PSMN6R5-80PS v.1	20100309	Objective 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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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