



# PSMN3R5-80PS

N-channel 80 V, 3.5 mΩ standard level MOSFET in TO-220

Rev. 03 — 19 April 2011

Product data sheet

## 1. Product profile

### 1.1 General description

Standard 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 standard level gate drive

### 1.3 Applications

- DC-to-DC converters
- Load switch
- Motor control
- 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	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	-	80	V
$I_D$	drain current	$T_{mb} = 25^\circ\text{C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a>	[1]	-	120	A
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C};$ see <a href="#">Figure 2</a>	-	-	338	W
$T_j$	junction temperature		-55	-	175	°C
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ $T_j = 100^\circ\text{C};$ see <a href="#">Figure 12</a>	-	5	5.8	mΩ
		$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ $T_j = 25^\circ\text{C};$ see <a href="#">Figure 13</a>	[2]	-	3	3.5 mΩ
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 75\text{ A};$	-	27	-	nC
$Q_{G(tot)}$	total gate charge	$V_{DS} = 40\text{ V};$ see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	139	-	nC
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25^\circ\text{C};$ $I_D = 120\text{ A}; V_{sup} \leq 80\text{ V};$ $R_{GS} = 50\text{ }\Omega;$ unclamped	-	-	676	mJ

**nexperia**

[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	drain		

**SOT78 (TO-220AB)**

## 3. Ordering information

**Table 3. Ordering information**

Type number	Package			Version
	Name	Description		
PSMN3R5-80PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB		SOT78

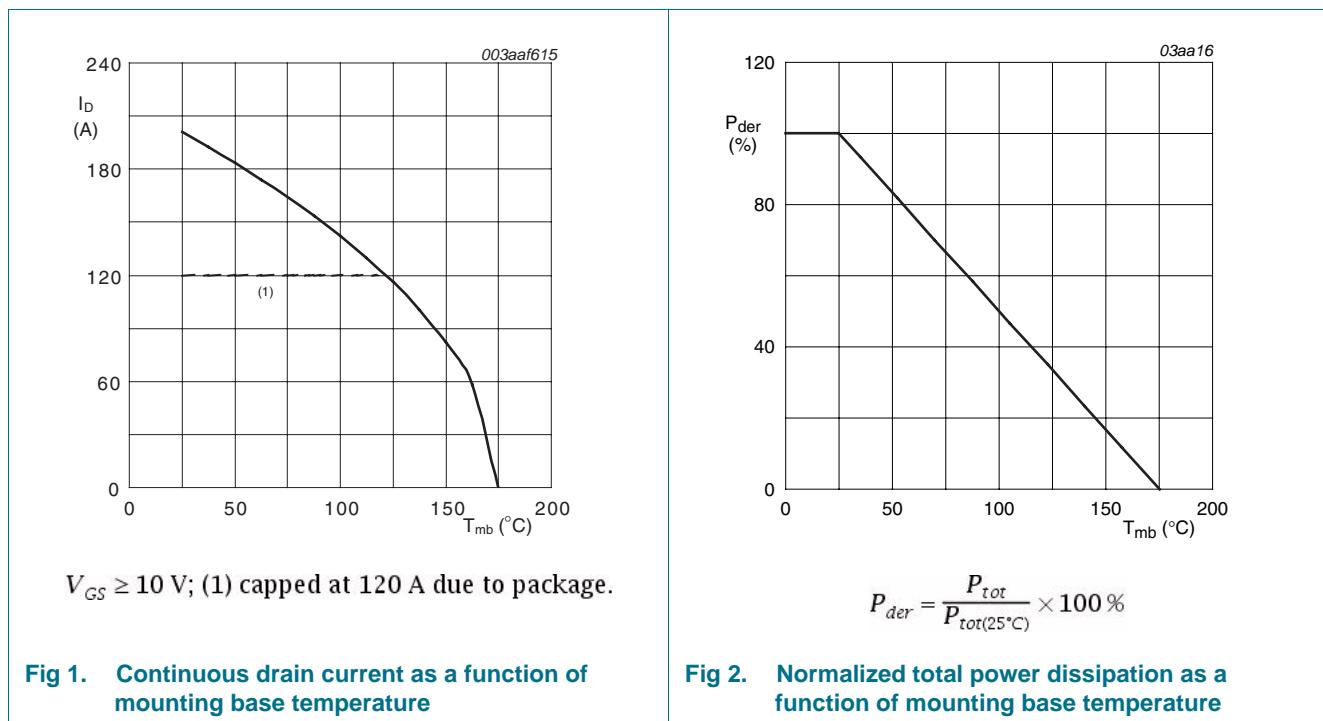
## 4. Limiting values

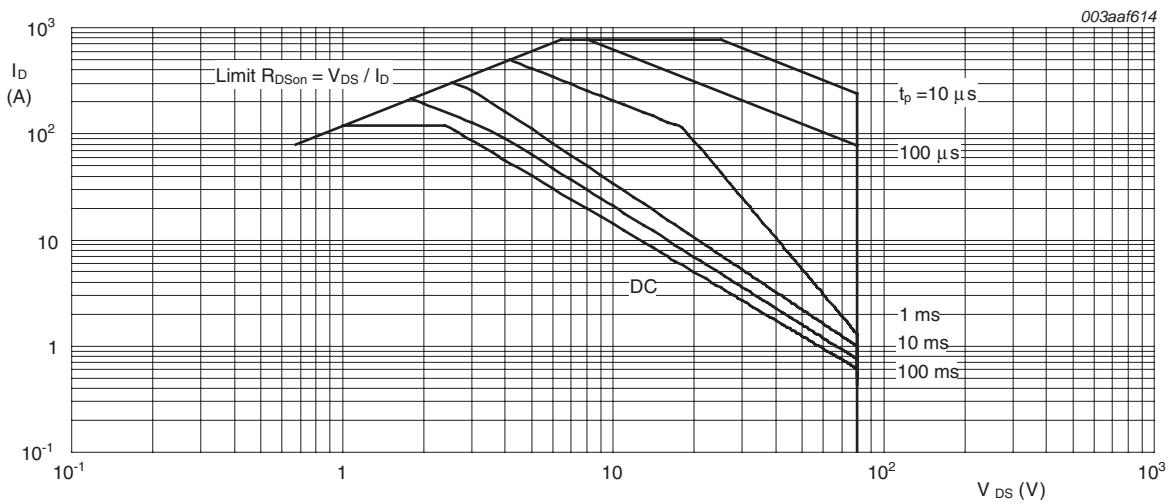
**Table 4. Limiting values**

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

Symbol	Parameter	Conditions	Min	Max	Unit	
$V_{DS}$	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}$	-	80	V	
$V_{DGR}$	drain-gate voltage	$T_j \geq 25^\circ\text{C}; T_j \leq 175^\circ\text{C}; R_{GS} = 20\text{ k}\Omega$	-	80	V	
$V_{GS}$	gate-source voltage		-20	20	V	
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 100^\circ\text{C}$ ; see <a href="#">Figure 1</a>	[1]	-	120	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25^\circ\text{C}$ ; see <a href="#">Figure 1</a>	[1]	-	120	A
$I_{DM}$	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25^\circ\text{C}$ ; see <a href="#">Figure 3</a>	-	803	A	
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C}$ ; see <a href="#">Figure 2</a>	-	338	W	
$T_{stg}$	storage temperature		-55	175	°C	
$T_j$	junction temperature		-55	175	°C	
$T_{sld(M)}$	peak soldering temperature		-	260	°C	
<b>Source-drain diode</b>						
$I_S$	source current	$T_{mb} = 25^\circ\text{C}$	[1]	-	120	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25^\circ\text{C}$	-	803	A	
<b>Avalanche ruggedness</b>						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25^\circ\text{C}; I_D = 120\text{ A}; V_{sup} \leq 80\text{ V}; R_{GS} = 50\text{ }\Omega$ ; unclamped	-	676	mJ	

[1] Continuous current is limited by package.





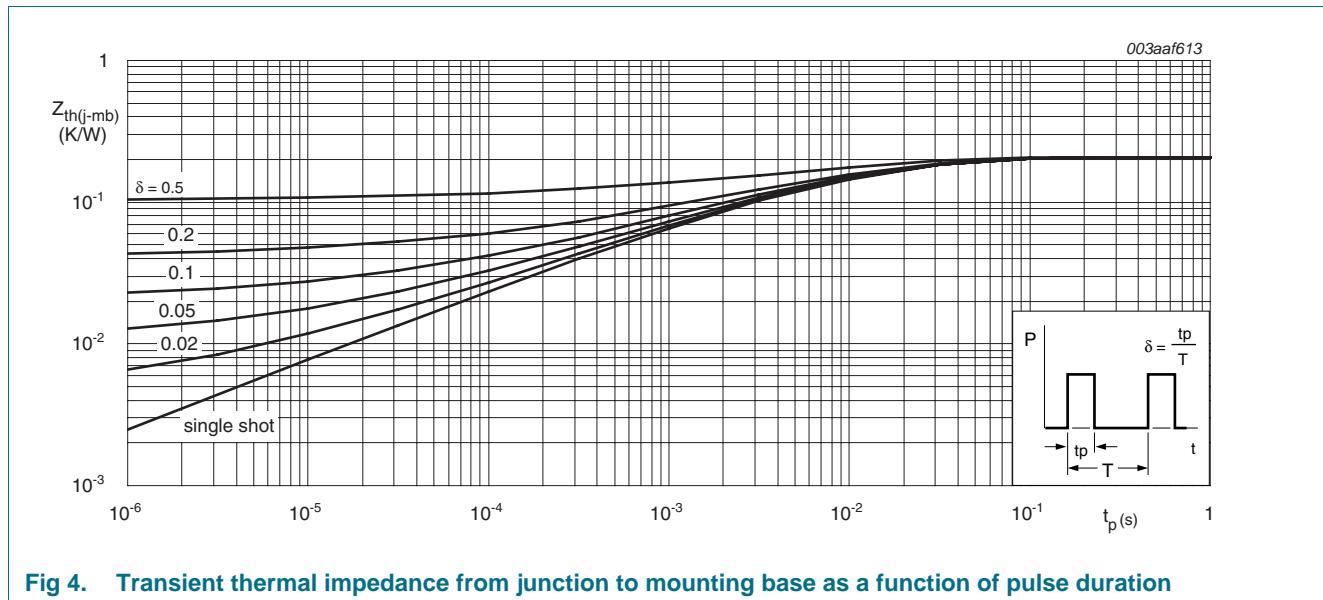
$T_{mb} = 25 \text{ }^{\circ}\text{C}$ ;  $I_{DM}$  is a single pulse; Capped at 120 A due to package

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
$R_{th(j\text{-mb})}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	0.22	0.44	K/W
$R_{th(j\text{-a})}$	thermal resistance from junction to ambient	Vertical in free air	-	60	-	K/W



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

## 6. Characteristics

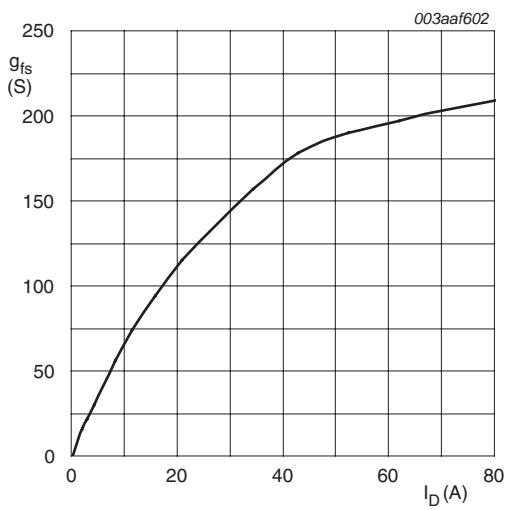
**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55^\circ C$	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	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175^\circ C$ ; see <a href="#">Figure 10</a>	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55^\circ C$ ; see <a href="#">Figure 10</a>	-	-	4.6	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25^\circ C$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	2	3	4	V
$I_{DSS}$	drain leakage current	$V_{DS} = 80 V; V_{GS} = 0 V; T_j = 25^\circ C$	-	0.02	10	$\mu A$
		$V_{DS} = 80 V; V_{GS} = 0 V; T_j = 175^\circ C$	-	-	500	$\mu A$
$I_{GSS}$	gate leakage current	$V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25^\circ C$	-	-	100	nA
		$V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25^\circ C$	-	-	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 V; I_D = 25 A; T_j = 175^\circ C$ ; see <a href="#">Figure 12</a>	-	7.2	8.4	$m\Omega$
		$V_{GS} = 10 V; I_D = 25 A; T_j = 100^\circ C$ ; see <a href="#">Figure 12</a>	-	5	5.8	$m\Omega$
		$V_{GS} = 10 V; I_D = 25 A; T_j = 25^\circ C$ ; <a href="#">[1]</a>	-	3	3.5	$m\Omega$
$R_G$	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	0.9	-	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 0 A; V_{DS} = 0 V; V_{GS} = 10 V$	-	135	-	nC
		$I_D = 75 A; V_{DS} = 40 V; V_{GS} = 10 V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	139	-	nC
$Q_{GS}$	gate-source charge		-	51	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	30	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	21	-	nC
$Q_{GD}$	gate-drain charge		-	27	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25 A; V_{DS} = 40 V$ ; see <a href="#">Figure 14</a> ; see <a href="#">Figure 15</a>	-	5.8	-	V
$C_{iss}$	input capacitance	$V_{DS} = 40 V; V_{GS} = 0 V; f = 1 \text{ MHz}$	-	9961	-	pF
$C_{oss}$	output capacitance	$T_j = 25^\circ C$ ; see <a href="#">Figure 16</a>	-	847	-	pF
$C_{rss}$	reverse transfer capacitance		-	401	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 40 V; R_L = 0.53 \Omega; V_{GS} = 10 V$	-	41	-	ns
$t_r$	rise time	$R_{G(ext)} = 10 \Omega; I_D = 75 A$	-	43	-	ns
$t_{d(off)}$	turn-off delay time		-	109	-	ns
$t_f$	fall time		-	44	-	ns

**Table 6. Characteristics ...continued**

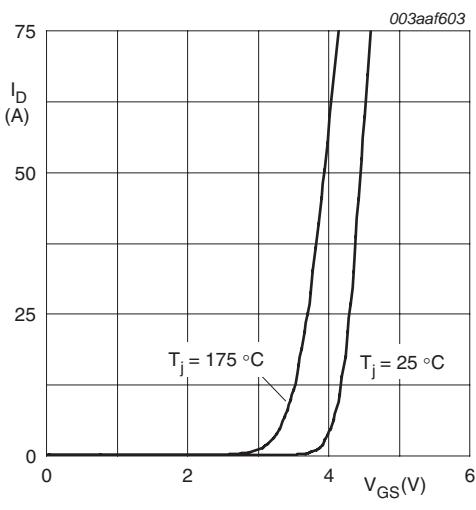
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 17</a>	-	0.8	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 25 \text{ A}; dI_S/dt = 100 \text{ A}/\mu\text{s};$	-	63	-	ns
$Q_r$	recovered charge	$V_{GS} = 0 \text{ V}; V_{DS} = 20 \text{ V}$	-	121	-	nC

[1] Measured 3 mm from package.



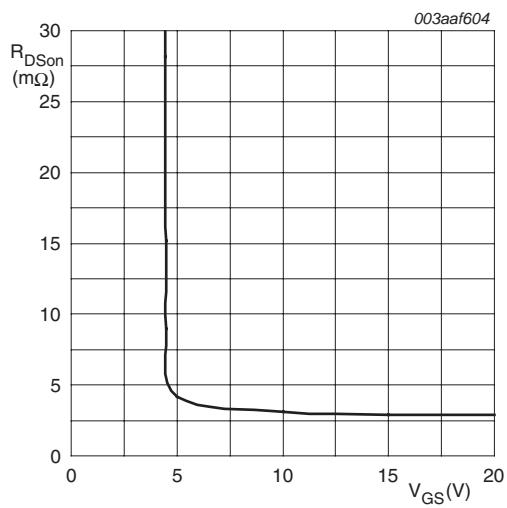
$T_j = 25 \text{ }^\circ\text{C}; V_{DS} = 25 \text{ V}$

**Fig 5. Forward transconductance as a function of drain current; typical values**



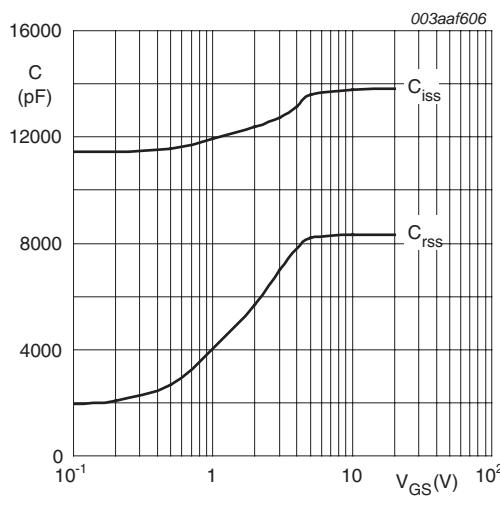
$V_{DS} > I_D \times R_{DSon}$

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



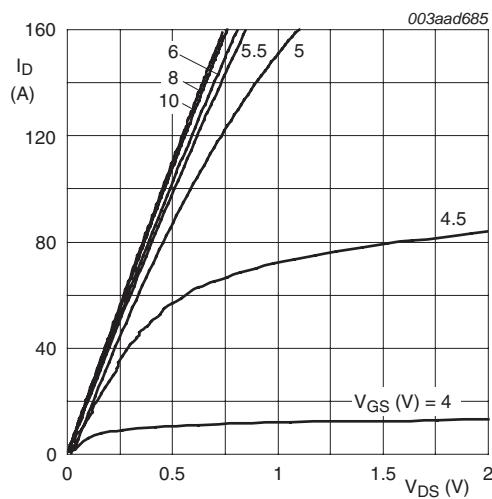
$T_j = 25 \text{ }^\circ\text{C}; I_D = 15 \text{ A}$

**Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values**



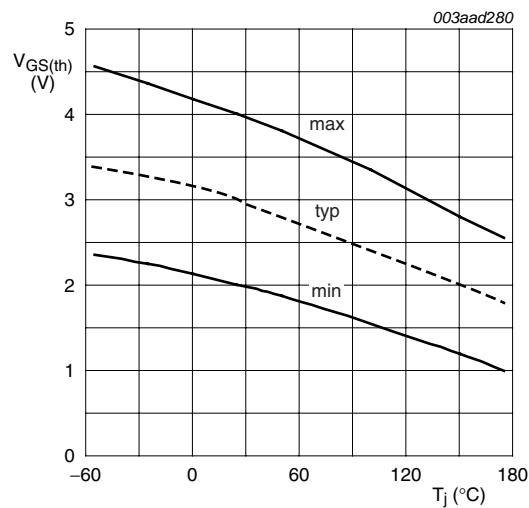
$V_{DS} = 0 \text{ V}; f = 1 \text{ MHz}$

**Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage; typical values**



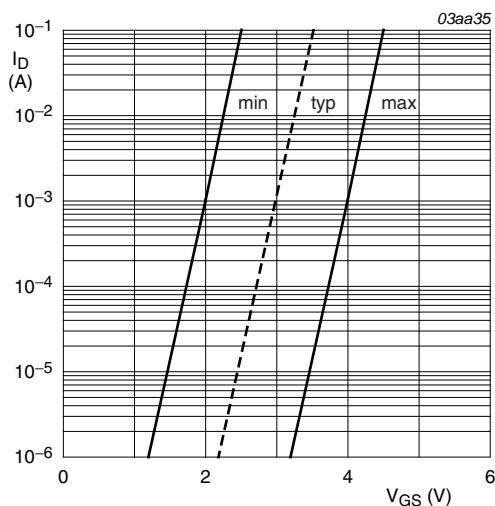
$T_j = 25^\circ\text{C}$ ;  $t_p = 300 \mu\text{s}$

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



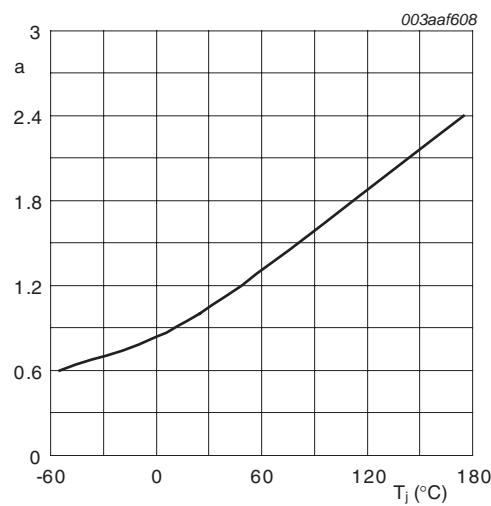
$I_D = 1 \text{ mA}$ ;  $V_{DS} = V_{GS}$

**Fig 10. Gate-source threshold voltage as a function of junction temperature**



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

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



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

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

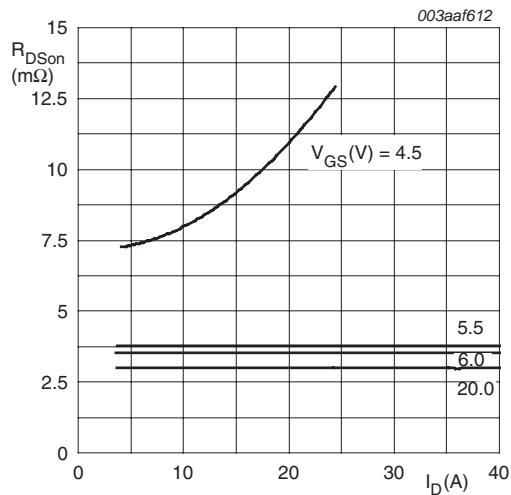


Fig 13. Drain-source on-state resistance as a function of drain current; typical values

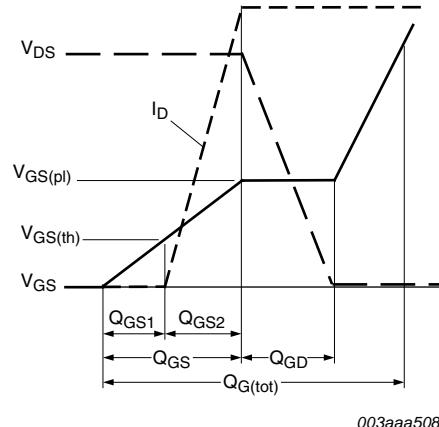
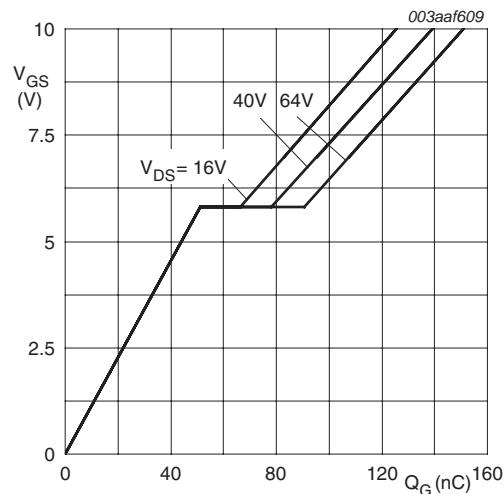
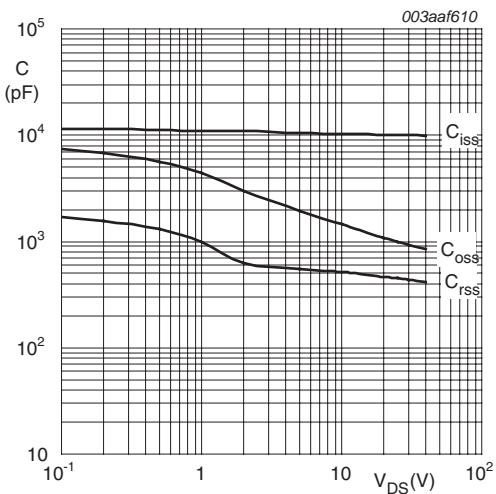


Fig 14. Gate charge waveform definitions



$T_j = 25^\circ\text{C}$ ;  $I_D = 75 \text{ A}$

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

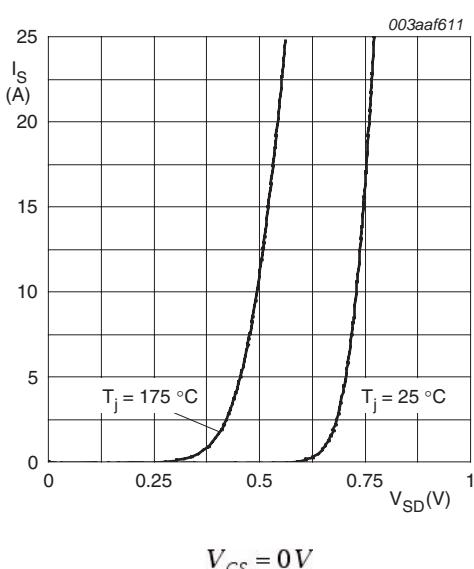
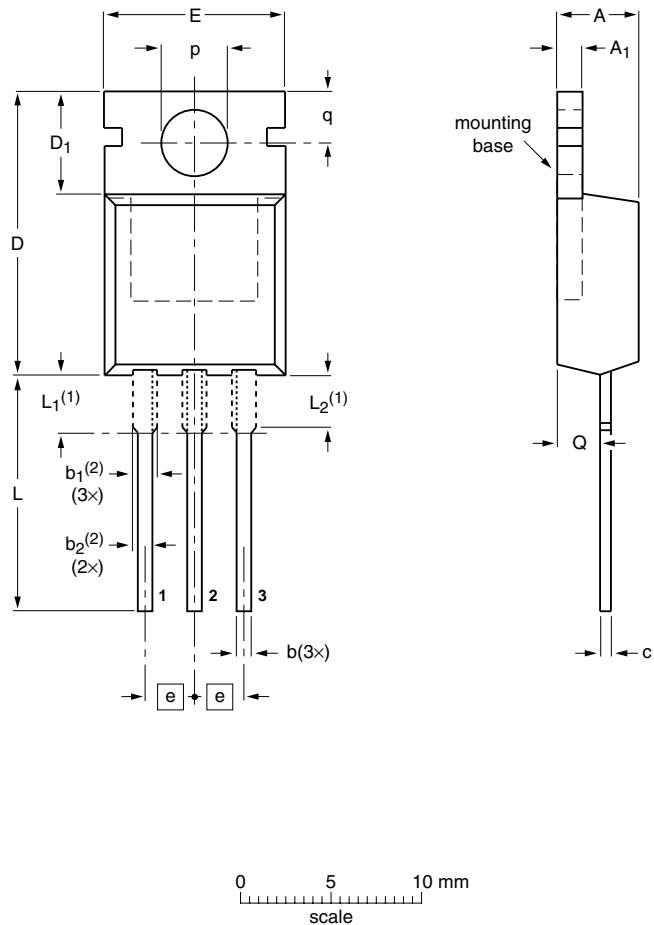


Fig 17. Source current as a function of source-drain voltage; typical values

## 7. Package outline

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

SOT78



### DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b	b <sub>1(2)</sub>	b <sub>2(2)</sub>	c	D	D <sub>1</sub>	E	e	L	L <sub>1(1)</sub>	L <sub>2(1)</sub> max.	p	q	Q
mm	4.7	1.40	0.9	1.6	1.3	0.7	16.0	6.6	10.3	2.54	15.0	3.30	3.0	3.8	3.0	2.6
	4.1	1.25	0.6	1.0	1.0	0.4	15.2	5.9	9.7		12.8	2.79		3.5	2.7	2.2

### Notes

1. Lead shoulder designs may vary.
2. Dimension includes excess dambar.

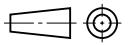
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			08-04-23 08-06-13

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

## 8. Revision history

**Table 7. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN3R5-80PS v.3	20110419	Product data sheet	-	PSMN3R5-80PS v.2
Modifications:		<ul style="list-style-type: none"><li>• Status changed from objective to product.</li><li>• Various changes to content.</li></ul>		
PSMN3R5-80PS v.2	20110304	Objective data sheet	-	PSMN3R5-80PS v.1

## 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".

[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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