



PSMN4R3-80PS

N-channel 80 V, 4.3 mΩ standard level MOSFET in TO220

Rev. 03 — 18 April 2011

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

1.3 Applications

- DC-to-DC converters
- Motor control
- Load switch
- 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 Figure 1	[1]	-	120	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	-	306	W
T_j	junction temperature		-55	-	175	°C

Static characteristics

$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ °C}$; see Figure 13	[2]	-	3.7	4.3	mΩ
		$V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 100\text{ °C}$; see Figure 12	[2]	-	6.1	7.1	mΩ



Table 1. Quick reference data ...continued

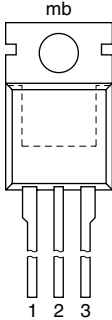
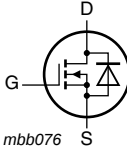
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
Q_{GD}	gate-drain charge	$V_{GS} = 10\text{ V}$; $I_D = 75\text{ A}$;	-	28.4	-	nC
$Q_{G(tot)}$	total gate charge	$V_{DS} = 40\text{ V}$; see Figure 14 ; see Figure 15	-	111	-	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(init)} = 25\text{ °C}$; $I_D = 120\text{ A}$; $V_{sup} \leq 80\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	-	676	mJ

[1] Continuous current is limited by package

[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		
	Name	Description	Version
PSMN4R3-80PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

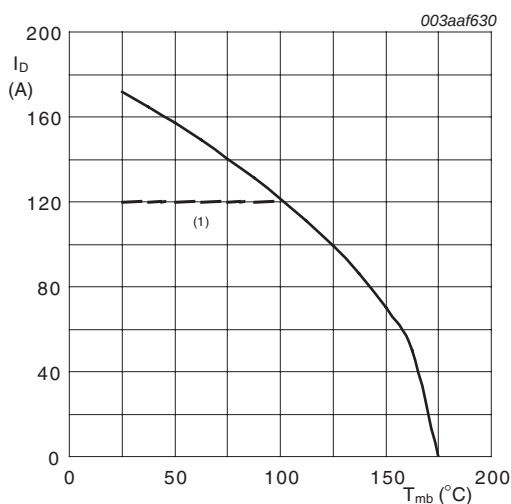
4. Limiting values

Table 4. Limiting values

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

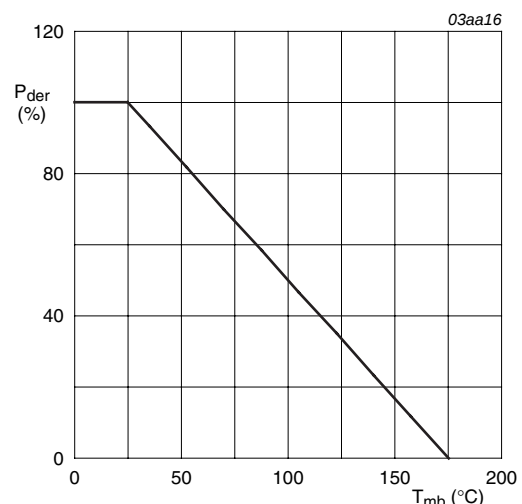
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$; $T_j \leq 175\text{ }^{\circ}\text{C}$	-	80	V
V_{DGR}	drain-gate voltage	$T_j \geq 25\text{ }^{\circ}\text{C}$; $T_j \leq 175\text{ }^{\circ}\text{C}$; $R_{GS} = 20\text{ k}\Omega$	-	80	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ }^{\circ}\text{C}$; see Figure 1 ^[1]	-	120	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 1 ^[1]	-	120	A
I_{DM}	peak drain current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 3	-	688	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ }^{\circ}\text{C}$; see Figure 2	-	306	W
T_{stg}	storage temperature		-55	175	$^{\circ}\text{C}$
T_j	junction temperature		-55	175	$^{\circ}\text{C}$
$T_{sld(M)}$	peak soldering temperature		-	260	$^{\circ}\text{C}$
Source-drain diode					
I_S	source current	$T_{mb} = 25\text{ }^{\circ}\text{C}$ ^[1]	-	120	A
I_{SM}	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}$; $T_{mb} = 25\text{ }^{\circ}\text{C}$	-	688	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$; $I_D = 120\text{ A}$; $V_{sup} \leq 80\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped	-	676	mJ

[1] Continuous current is limited by package



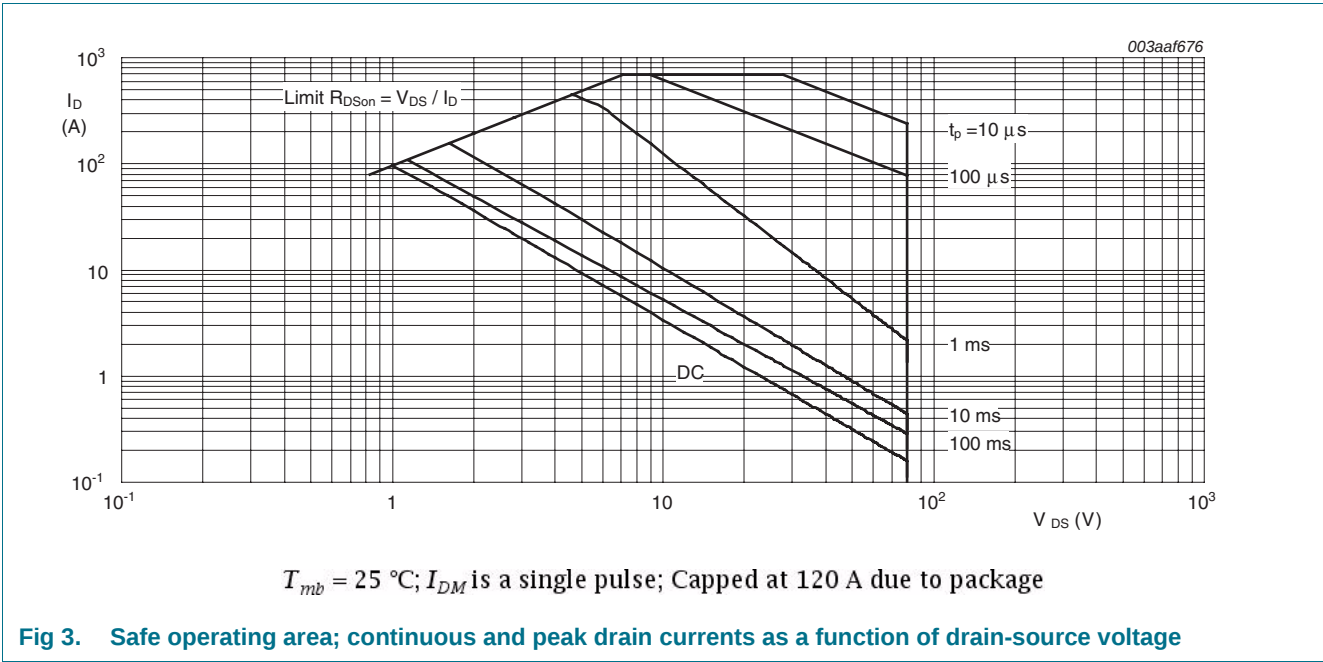
$V_{GS} \geq 10\text{ V}$; (1) capped at 120 A due to package.

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



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

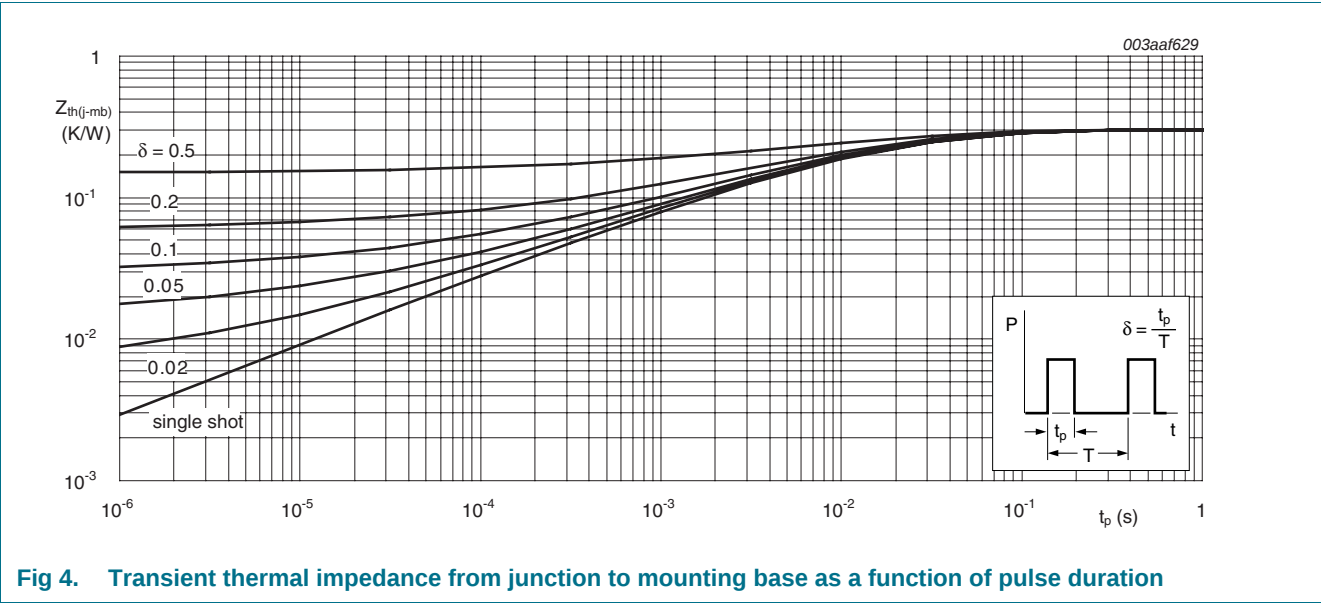
Fig 2. Normalized total power dissipation as a function of mounting base temperature



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	-	0.3	0.49	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Vertical in free air	-	60	-	K/W



6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\ \mu\text{A}; V_{GS} = 0\ \text{V}; T_j = -55\ ^\circ\text{C}$	73	-	-	V
		$I_D = 250\ \mu\text{A}; V_{GS} = 0\ \text{V}; T_j = 25\ ^\circ\text{C}$	80	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\ \text{mA}; V_{DS} = V_{GS}; T_j = 175\ ^\circ\text{C};$ see Figure 10	1	-	-	V
		$I_D = 1\ \text{mA}; V_{DS} = V_{GS}; T_j = -55\ ^\circ\text{C};$ see Figure 10	-	-	4.6	V
		$I_D = 1\ \text{mA}; V_{DS} = V_{GS}; T_j = 25\ ^\circ\text{C};$ see Figure 10 ; see Figure 11	2	3	4	V
I_{DSS}	drain leakage current	$V_{DS} = 80\ \text{V}; V_{GS} = 0\ \text{V}; T_j = 25\ ^\circ\text{C}$	-	0.02	10	μA
		$V_{DS} = 80\ \text{V}; V_{GS} = 0\ \text{V}; T_j = 175\ ^\circ\text{C}$	-	-	500	μA
I_{GSS}	gate leakage current	$V_{GS} = -20\ \text{V}; V_{DS} = 0\ \text{V}; T_j = 25\ ^\circ\text{C}$	-	-	100	nA
		$V_{GS} = 20\ \text{V}; V_{DS} = 0\ \text{V}; T_j = 25\ ^\circ\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\ \text{V}; I_D = 25\ \text{A}; T_j = 175\ ^\circ\text{C};$ see Figure 12	[1]	-	8.9	10.3 mΩ
		$V_{GS} = 10\ \text{V}; I_D = 25\ \text{A}; T_j = 25\ ^\circ\text{C};$ see Figure 13	[1]	-	3.7	4.3 mΩ
		$V_{GS} = 10\ \text{V}; I_D = 25\ \text{A}; T_j = 100\ ^\circ\text{C};$ see Figure 12	[1]	-	6.1	7.1 mΩ
R_G	internal gate resistance (AC)	$f = 1\ \text{MHz}$	-	0.9	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 0\ \text{A}; V_{DS} = 0\ \text{V}; V_{GS} = 10\ \text{V}$	-	104	-	nC
		$I_D = 75\ \text{A}; V_{DS} = 40\ \text{V}; V_{GS} = 10\ \text{V};$ see Figure 14 ; see Figure 15	-	111	-	nC
Q_{GS}	gate-source charge		-	38	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge		-	24.1	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge		-	14.1	-	nC
Q_{GD}	gate-drain charge		-	28.4	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$I_D = 25\ \text{A}; V_{DS} = 40\ \text{V};$ see Figure 14 ; see Figure 15	-	6.1	-	V
C_{iss}	input capacitance	$V_{DS} = 40\ \text{V}; V_{GS} = 0\ \text{V}; f = 1\ \text{MHz};$ $T_j = 25\ ^\circ\text{C};$ see Figure 16	-	8161	-	pF
C_{oss}	output capacitance		-	701	-	pF
C_{rss}	reverse transfer capacitance		-	337	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 40\ \text{V}; R_L = 0.53\ \Omega; V_{GS} = 10\ \text{V};$ $R_{G(ext)} = 4.7\ \Omega; I_D = 75\ \text{A}$	-	38	-	ns
t_r	rise time		-	29	-	ns
$t_{d(off)}$	turn-off delay time		-	94	-	ns
t_f	fall time		-	33	-	ns

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 25\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ °C}$; see Figure 17	-	-	1.2	V
t_{rr}	reverse recovery time	$I_S = 25\text{ A}$; $di_S/dt = 100\text{ A/}\mu\text{s}$;	-	59	-	ns
Q_r	recovered charge	$V_{GS} = 0\text{ V}$; $V_{DS} = 20\text{ V}$	-	109	-	nC

[1] Measured 3 mm from package.

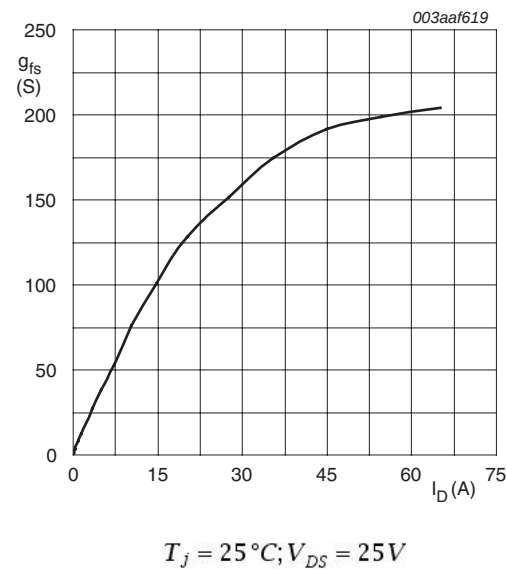


Fig 5. Forward transconductance as a function of drain current; typical values

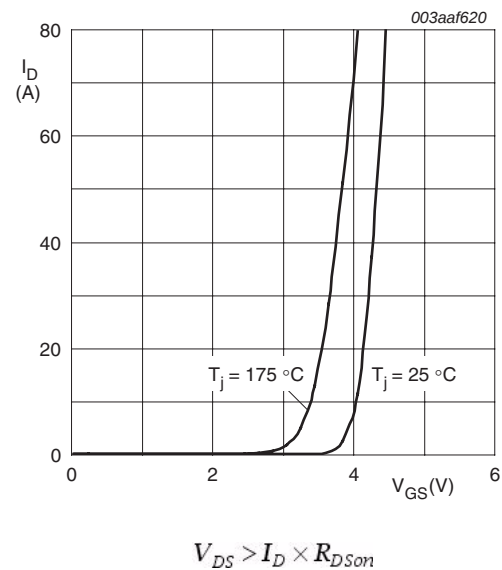


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

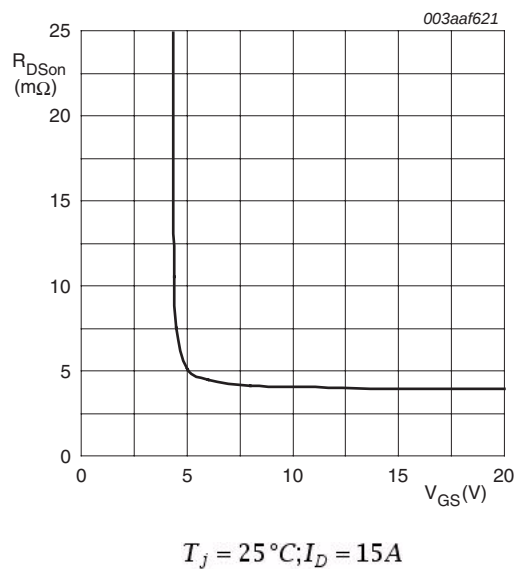


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

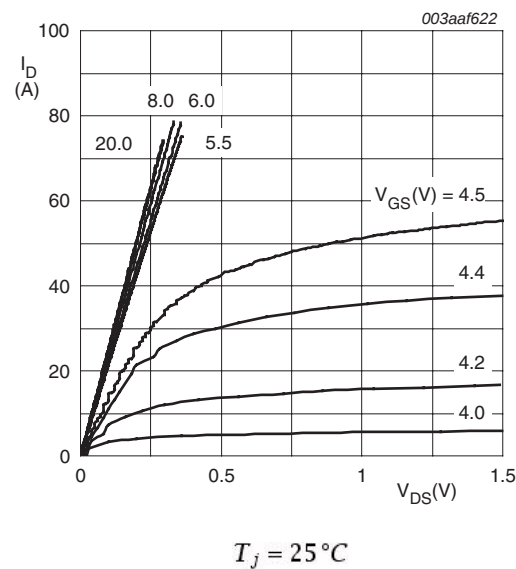
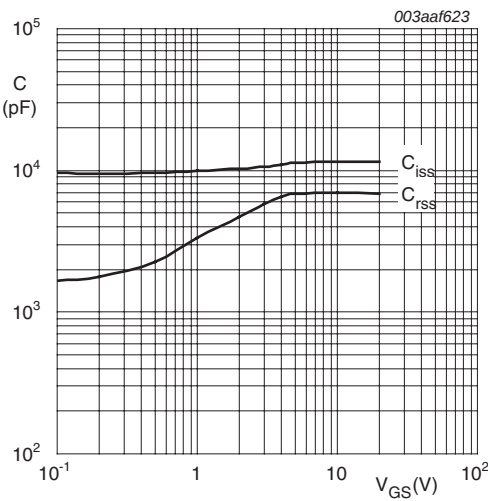
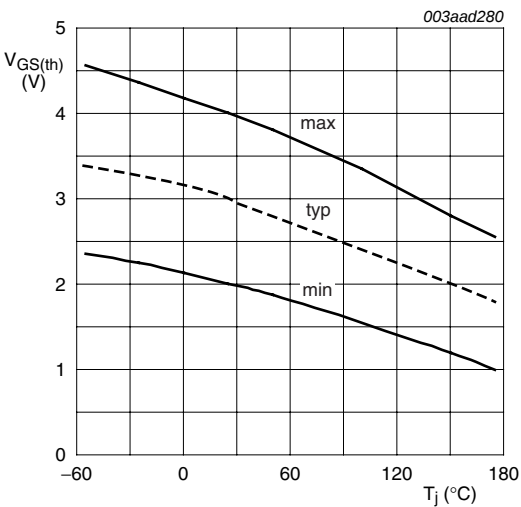


Fig 8. Output characteristics: drain current as a function of drain-source voltage; typical values



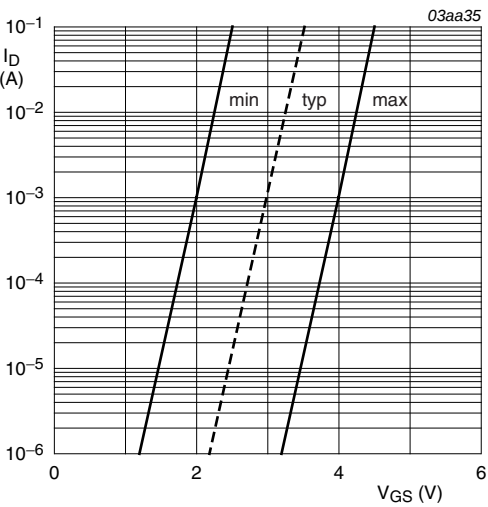
$V_{DS} = 0V; f = 1MHz$

Fig 9. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



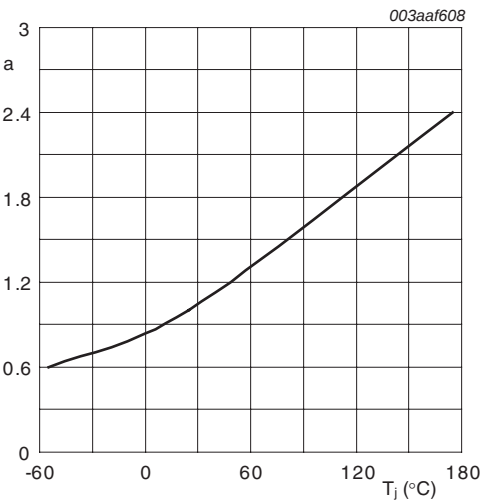
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

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



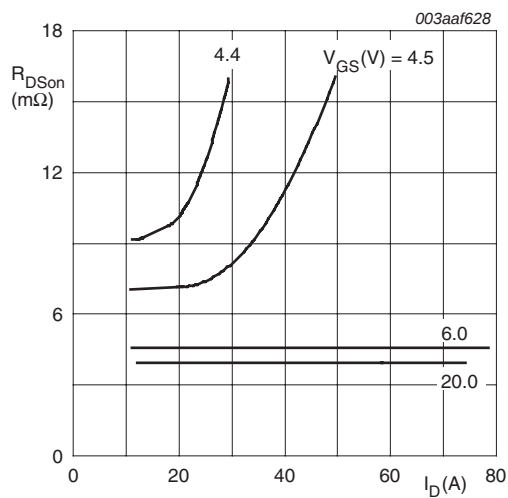
$T_j = 25^\circ C; V_{DS} = 5V$

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



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

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



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

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

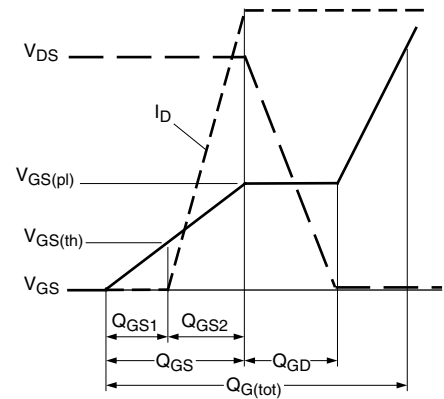
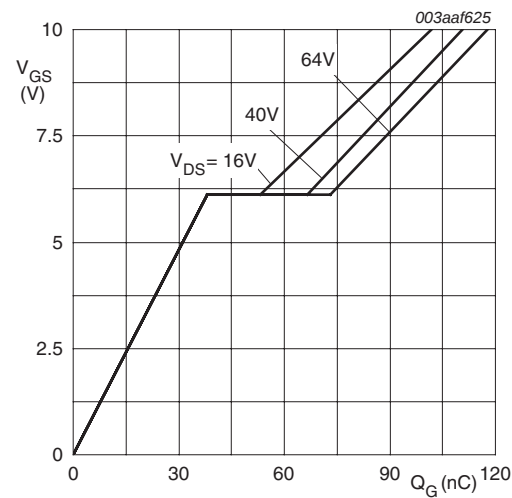
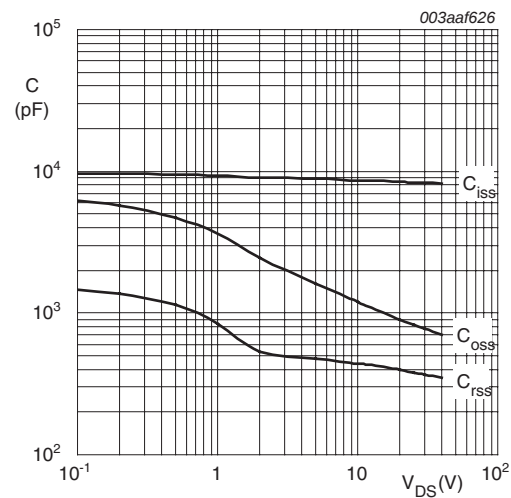


Fig 14. Gate charge waveform definitions



$I_D = 75A$

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

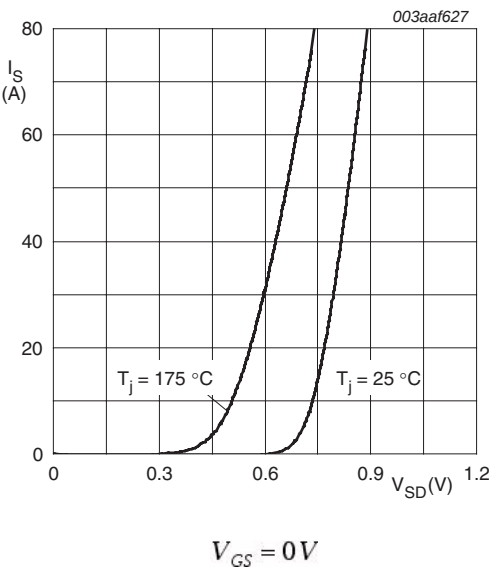


Fig 17. Source current as a function of source-drain voltage; typical values

7. Package outline

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

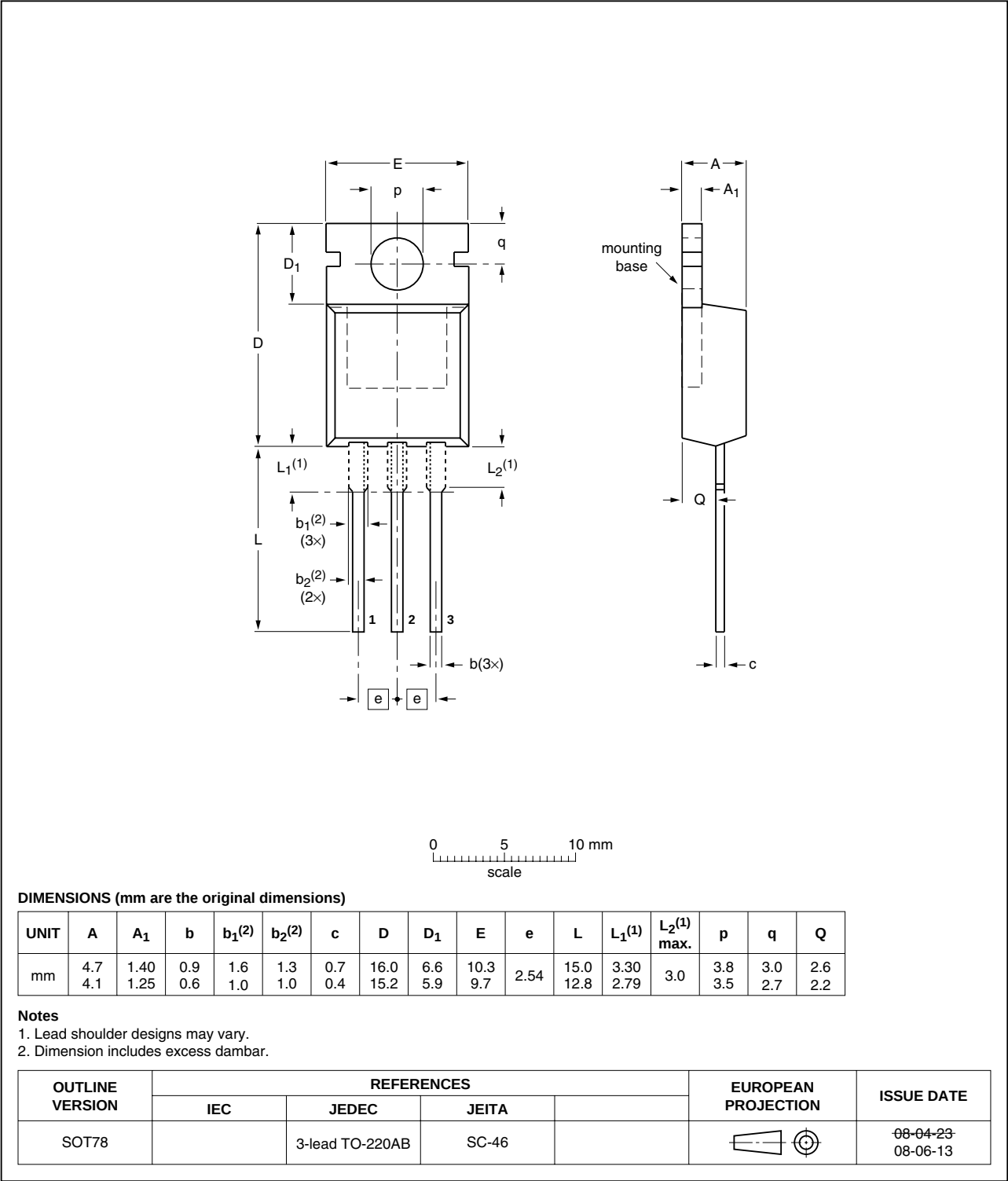


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN4R3-80PS v.3	20110418	Product data sheet	-	PSMN4R3-80PS v.2
Modifications:	• Status changed from objective to product. • Various changes to content.			
PSMN4R3-80PS v.2	20110309	Objective data sheet	-	PSMN4R3-80PS 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".

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