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Team Nexperia



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 175C. 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

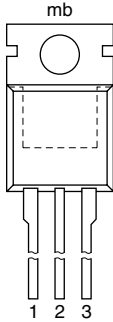
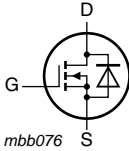
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DS}	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	80	V
I_D	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ [1] see Figure 1	-	-	120	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C};$ see Figure 2	-	-	338	W
T_j	junction temperature		-55	-	175	°C
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ $T_j = 100\text{ °C};$ see Figure 12	-	5	5.8	mΩ
		$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ [2] $T_j = 25\text{ °C};$ see Figure 13	-	3	3.5	mΩ
Dynamic characteristics						
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 Figure 14 ; see Figure 15	-	139	-	nC
Avalanche ruggedness						
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C};$ $I_D = 120\text{ A}; V_{sup} \leq 80\text{ V};$ $R_{GS} = 50\text{ Ω};$ 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
PSMN3R5-80PS	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

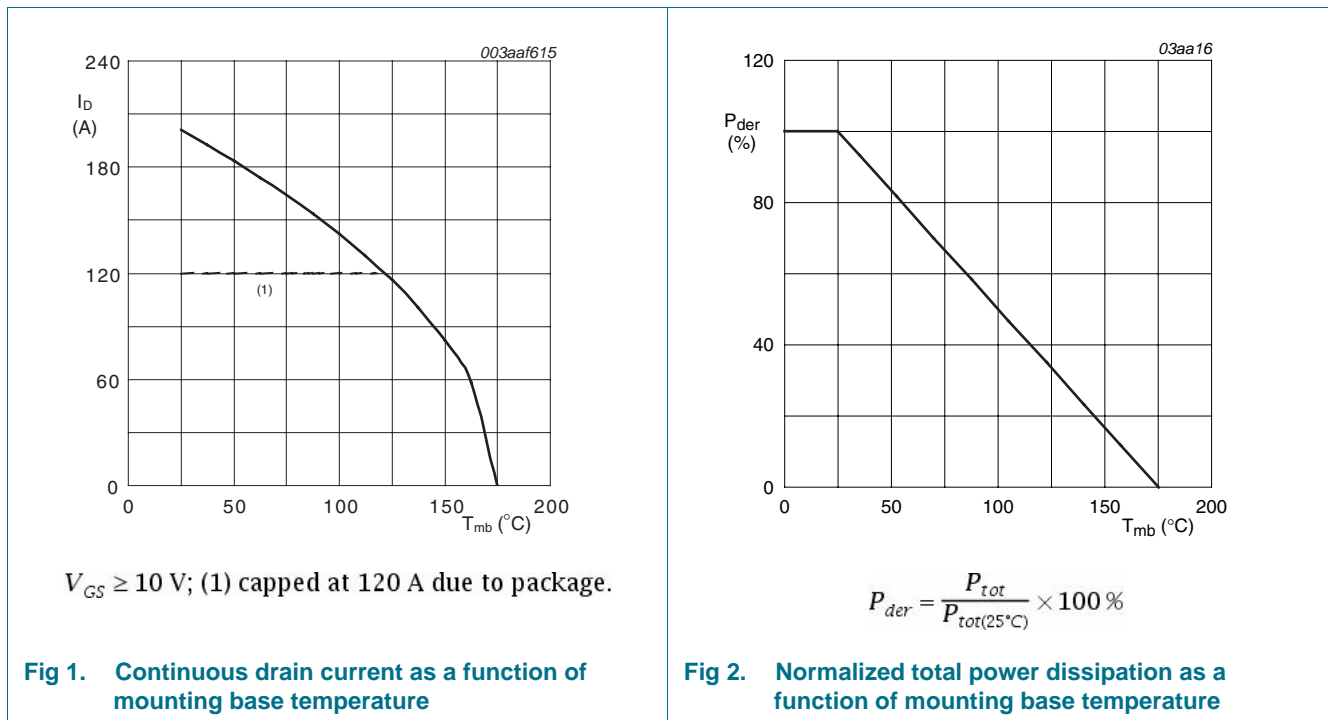
4. Limiting values

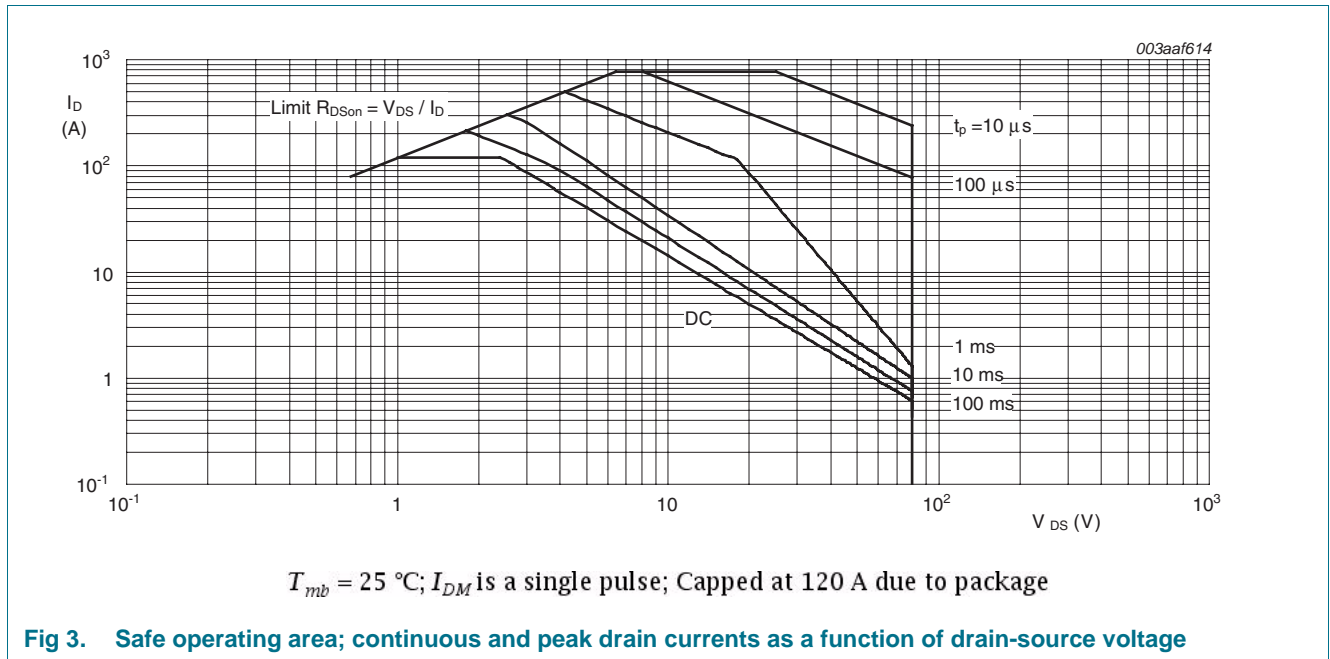
Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V _{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 175 °C	-	80	V
V _{DGR}	drain-gate voltage	T _j ≥ 25 °C; T _j ≤ 175 °C; R _{GS} = 20 kΩ	-	80	V
V _{GS}	gate-source voltage		-20	20	V
I _D	drain current	V _{GS} = 10 V; T _{mb} = 100 °C; see Figure 1 ^[1]	-	120	A
		V _{GS} = 10 V; T _{mb} = 25 °C; see Figure 1 ^[1]	-	120	A
I _{DM}	peak drain current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C; see Figure 3	-	803	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; see Figure 2	-	338	W
T _{stg}	storage temperature		-55	175	°C
T _j	junction temperature		-55	175	°C
T _{sld(M)}	peak soldering temperature		-	260	°C
Source-drain diode					
I _S	source current	T _{mb} = 25 °C	^[1] -	120	A
I _{SM}	peak source current	pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C	-	803	A
Avalanche ruggedness					
E _{DS(AL)S}	non-repetitive drain-source avalanche energy	V _{GS} = 10 V; T _{j(init)} = 25 °C; I _D = 120 A; V _{sup} ≤ 80 V; R _{GS} = 50 Ω; unclamped	-	676	mJ

[1] Continuous current is limited by package.





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	-	0.22	0.44	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	Vertical in free air	-	60	-	K/W

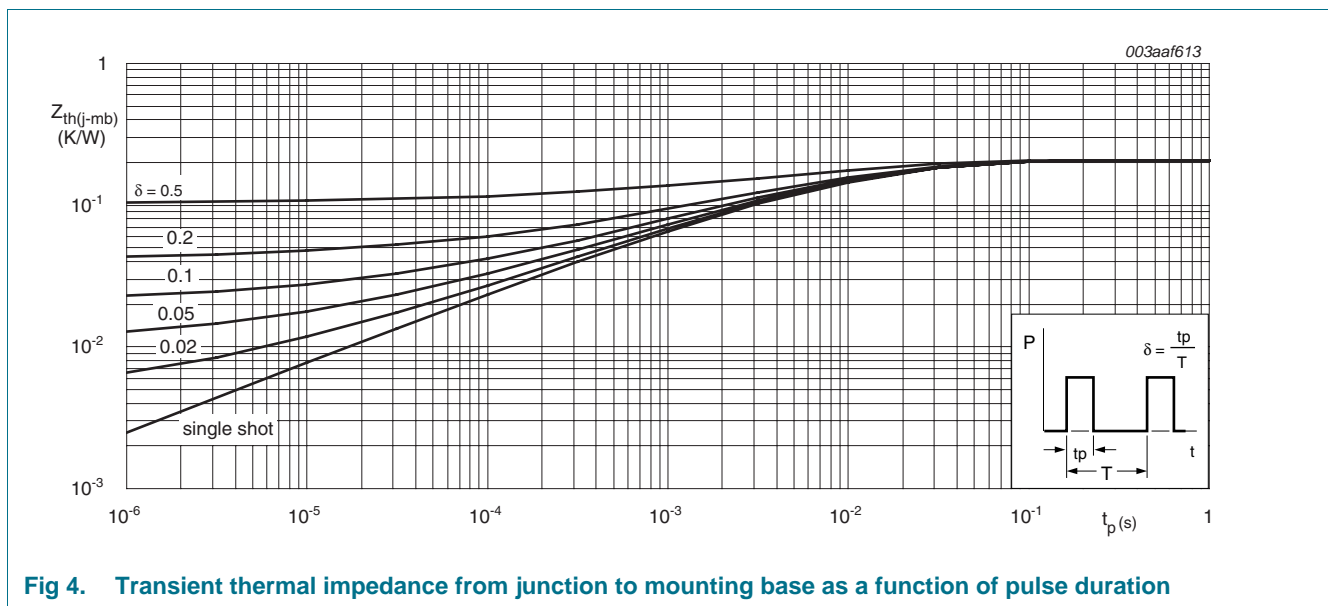


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 250 μA; V _{GS} = 0 V; T _j = -55 °C	73	-	-	V
		I _D = 250 μA; V _{GS} = 0 V; T _j = 25 °C	80	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 175 °C; see Figure 10	1	-	-	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = -55 °C; see Figure 10	-	-	4.6	V
		I _D = 1 mA; V _{DS} = V _{GS} ; T _j = 25 °C; see Figure 10 ; see Figure 11	2	3	4	V
I _{DSS}	drain leakage current	V _{DS} = 80 V; V _{GS} = 0 V; T _j = 25 °C	-	0.02	10	μA
		V _{DS} = 80 V; V _{GS} = 0 V; T _j = 175 °C	-	-	500	μA
I _{GSS}	gate leakage current	V _{GS} = -20 V; V _{DS} = 0 V; T _j = 25 °C	-	-	100	nA
		V _{GS} = 20 V; V _{DS} = 0 V; T _j = 25 °C	-	-	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 25 A; T _j = 175 °C; see Figure 12	-	7.2	8.4	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 100 °C; see Figure 12	-	5	5.8	mΩ
		V _{GS} = 10 V; I _D = 25 A; T _j = 25 °C; see Figure 13	[1]	-	3	3.5
R _G	internal gate resistance (AC)	f = 1 MHz	-	0.9	-	Ω
Dynamic characteristics						
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 Figure 14 ; see Figure 15	-	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 Figure 14 ; see Figure 15	-	5.8	-	V
C _{iss}	input capacitance	V _{DS} = 40 V; V _{GS} = 0 V; f = 1 MHz; T _j = 25 °C; see Figure 16	-	9961	-	pF
C _{oss}	output capacitance		-	847	-	pF
C _{rss}	reverse transfer capacitance		-	401	-	pF
t _{d(on)}	turn-on delay time	V _{DS} = 40 V; R _L = 0.53 Ω; V _{GS} = 10 V; R _{G(ext)} = 10 Ω; I _D = 75 A	-	41	-	ns
t _r	rise time		-	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
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	-	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.

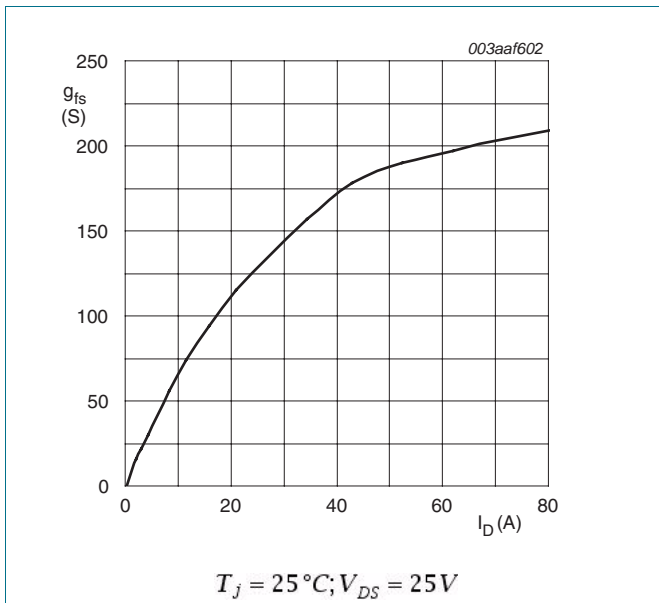


Fig 5. Forward transconductance as a function of drain current; typical values

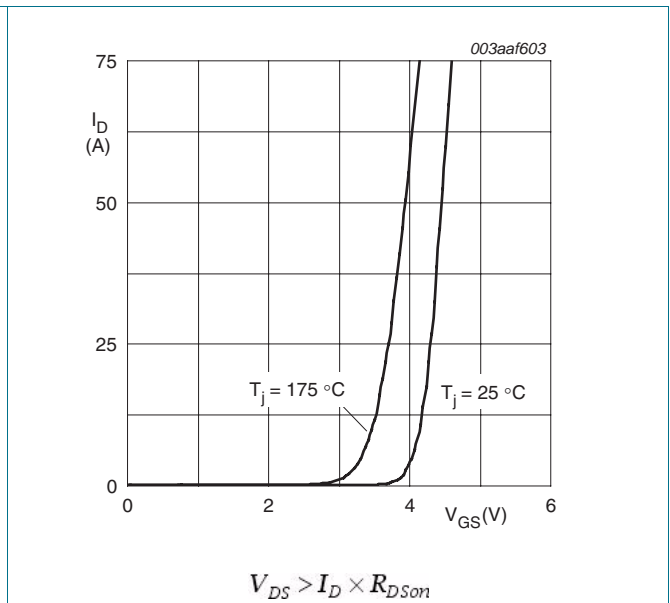


Fig 6. Transfer characteristics: drain current as a function of gate-source voltage; typical values

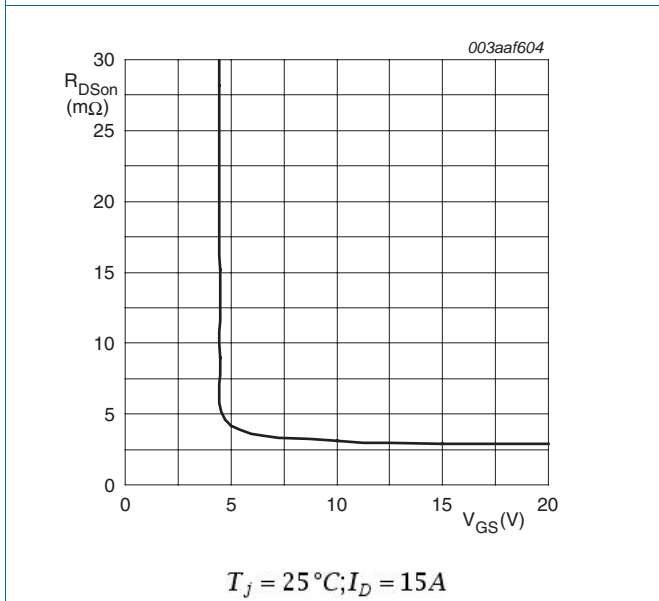


Fig 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

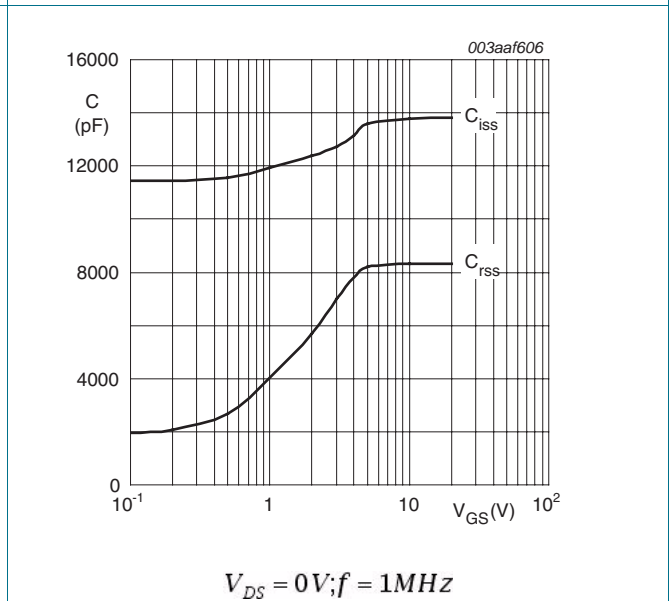
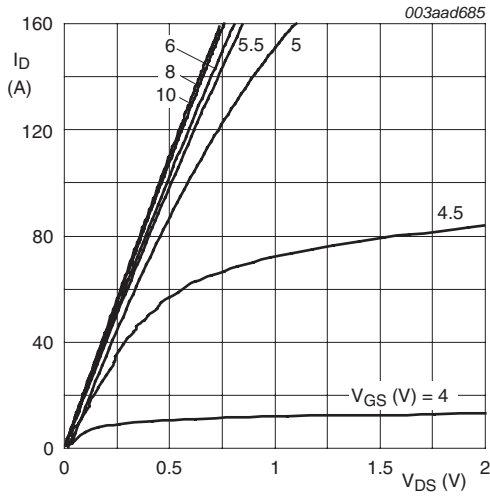
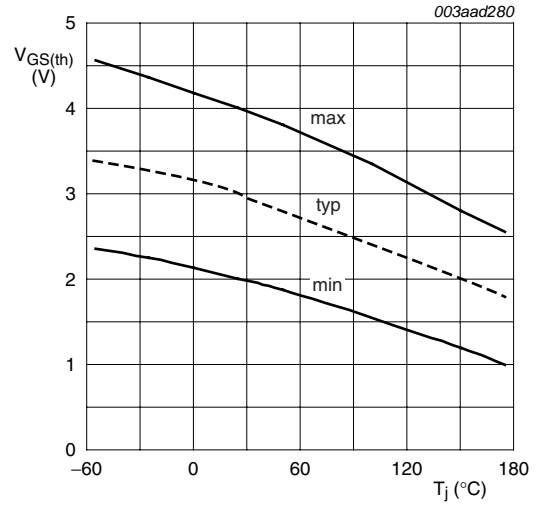


Fig 8. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



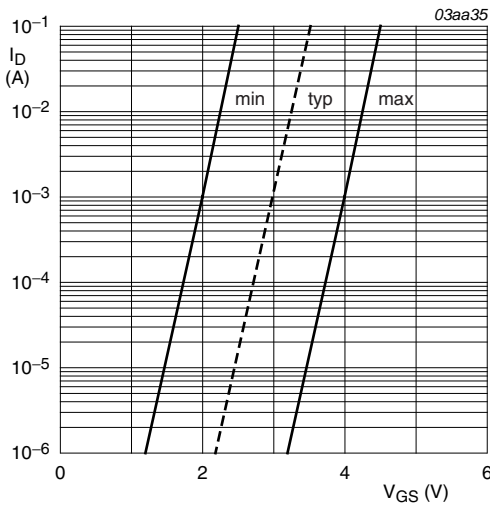
$T_j = 25\text{ }^\circ\text{C}; t_p = 300\text{ }\mu\text{s}$

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



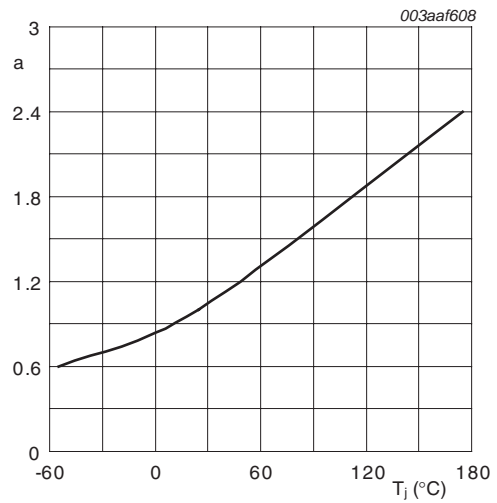
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

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



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

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

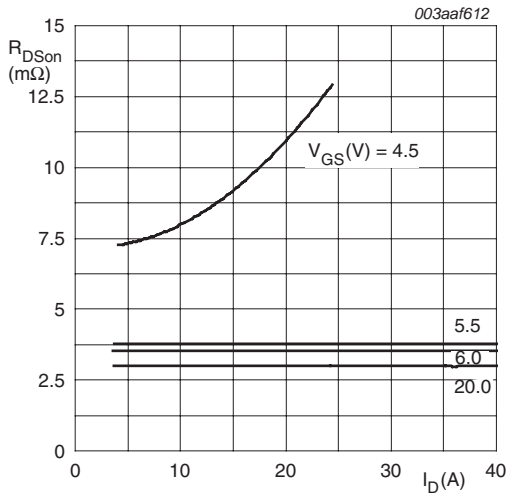


Fig 13. Drain-source on-state resistance as a function of drain current; typical values

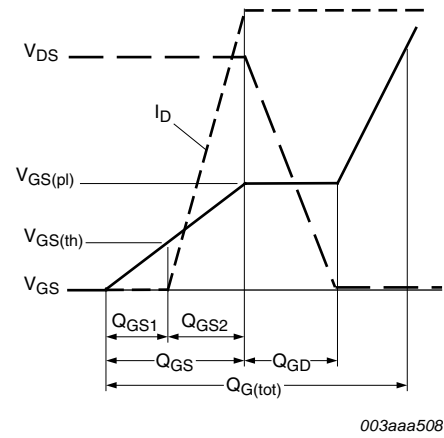
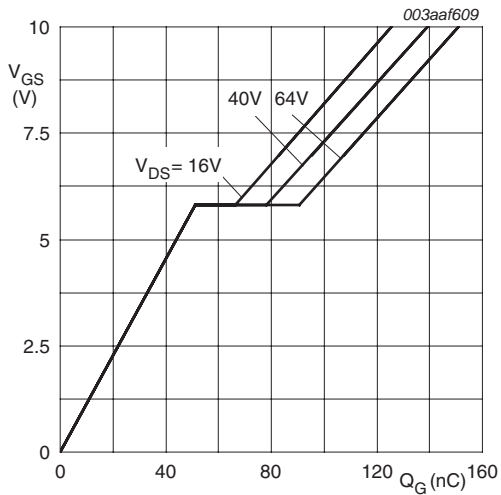
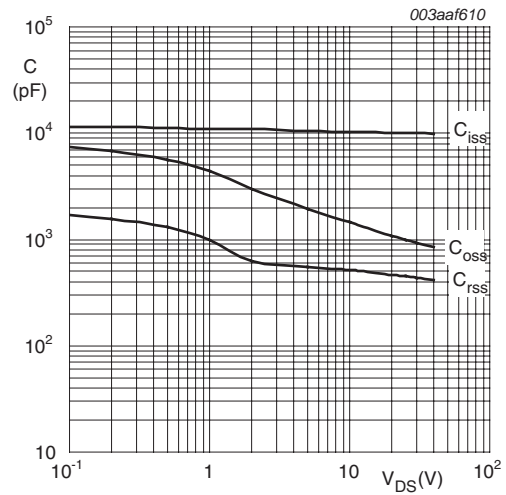


Fig 14. Gate charge waveform definitions



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

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

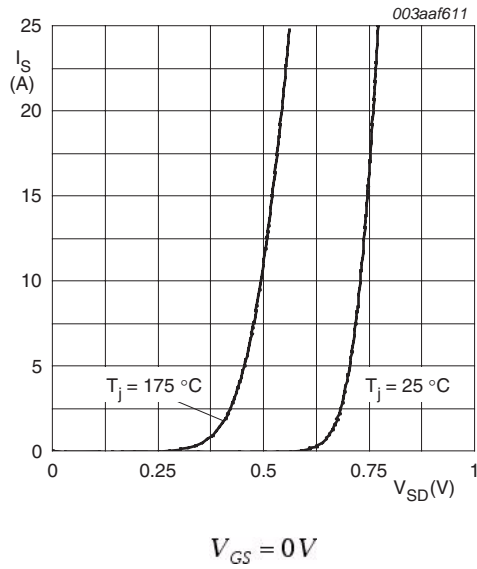


Fig 17. Source current as a function of source-drain voltage; typical values

7. Package outline

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

SOT78

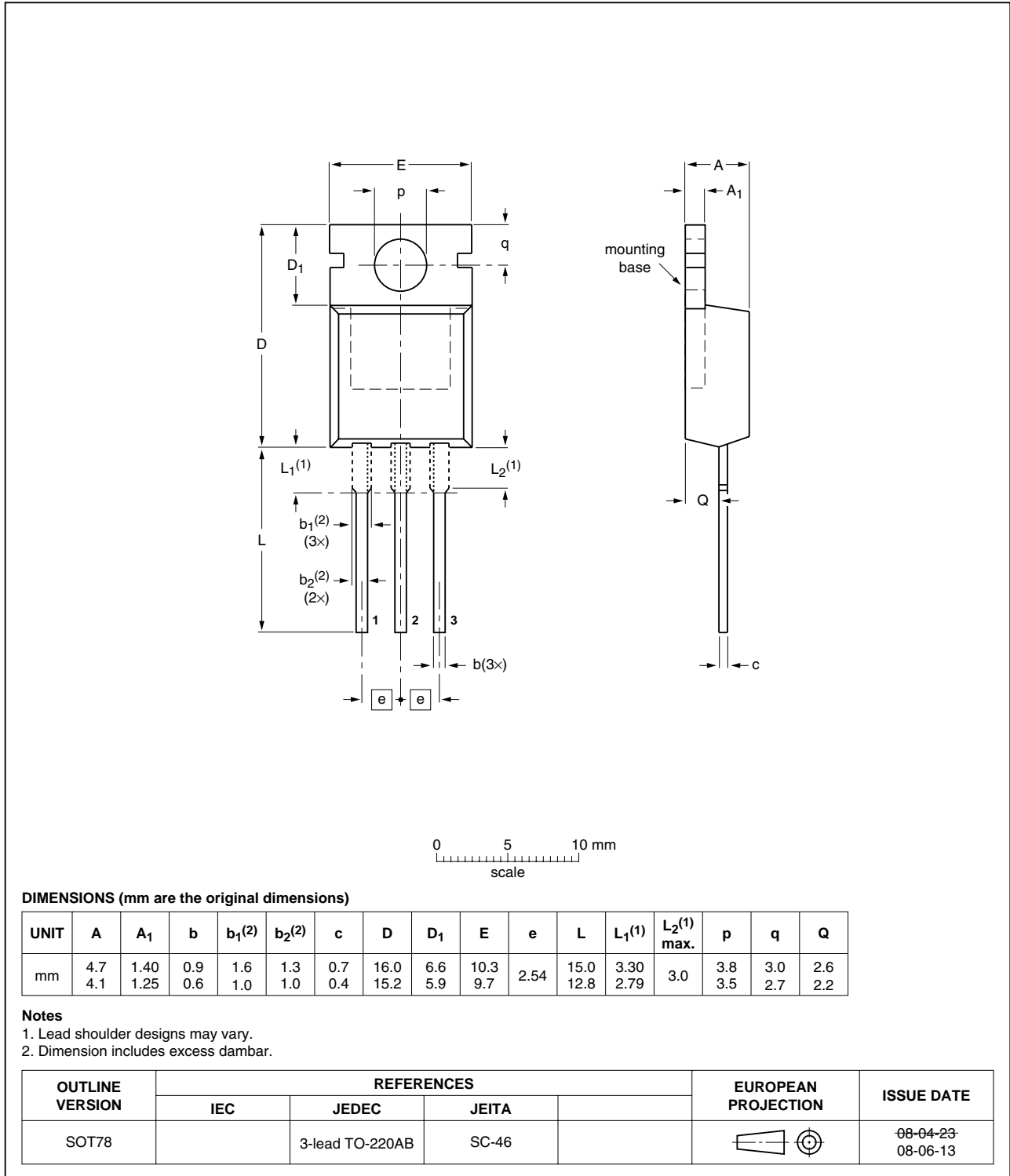


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

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

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