

PSMN9R5-100PS

N-channel 100 V 9.6 m Ω standard level MOSFET in T0220

Rev. 02 — 23 February 2010

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in a TO220 packages 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 switching
- Server power supplies

1.4 Quick reference data

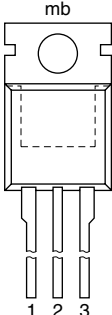
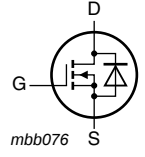
Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{DS}	drain-source voltage	T _j ≥ 25 °C; T _j ≤ 175 °C	-	-	100	V
I _D	drain current	T _{mb} = 25 °C; V _{GS} = 10 V; see Figure 1	-	-	89	A
P _{tot}	total power dissipation	T _{mb} = 25 °C; see Figure 2	-	-	211	W
Dynamic characteristics						
Q _{GD}	gate-drain charge	V _{GS} = 10 V; I _D = 60 A;	-	23	-	nC
Q _{G(tot)}	total gate charge	V _{DS} = 50 V; see Figure 14 and 15	-	82	-	nC
Static characteristics						
R _{DS(on)}	drain-source on-state resistance	V _{GS} = 10 V; I _D = 15 A; T _j = 25 °C; see Figure 13	-	8.16	9.6	m Ω



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
PSMN9R5-100PS	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	$T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$	-	100	V
V_{DGR}	drain-gate voltage	$T_j \leq 175\text{ °C}$; $T_j \geq 25\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$	-	100	V
V_{GS}	gate-source voltage		-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}$; $T_{mb} = 100\text{ °C}$; see Figure 1	-	63	A
		$V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; see Figure 1	-	89	A
I_{DM}	peak drain current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$; see Figure 3	-	355	A
P_{tot}	total power dissipation	$T_{mb} = 25\text{ °C}$; see Figure 2	-	211	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	$T_{mb} = 25\text{ °C}$	-	89	A
I_{SM}	peak source current	$t_p \leq 10\text{ }\mu\text{s}$; pulsed; $T_{mb} = 25\text{ °C}$	-	355	A
Avalanche ruggedness					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 89\text{ A}$; $V_{sup} \leq 100\text{ V}$; unclamped; $R_{GS} = 50\text{ }\Omega$	-	177	mJ

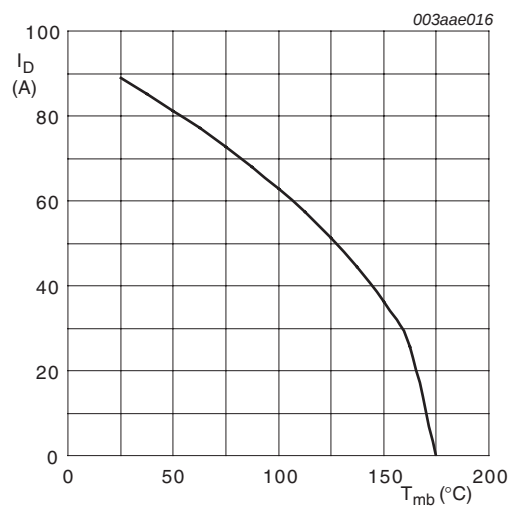
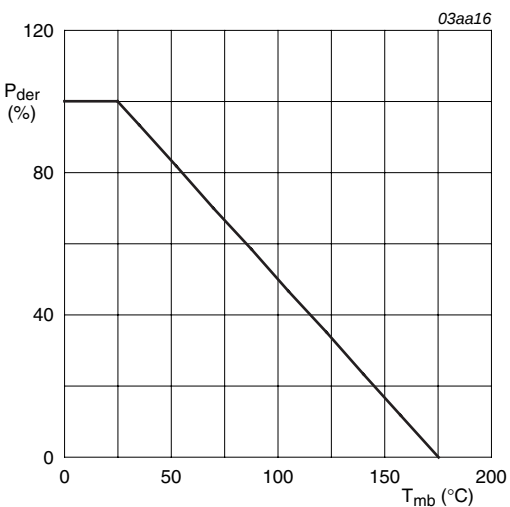
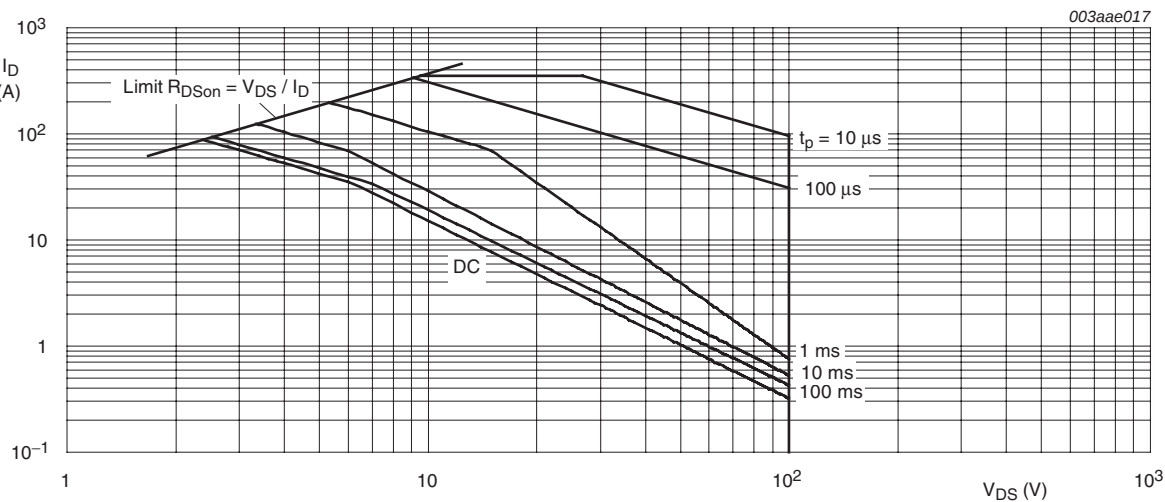


Fig 1. Continuous drain current as a function of mounting base temperature



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

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



$T_{mb} = 25^{\circ}\text{C}; I_{DM}$ is single pulse

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 Figure 4	-	0.38	0.71	K/W

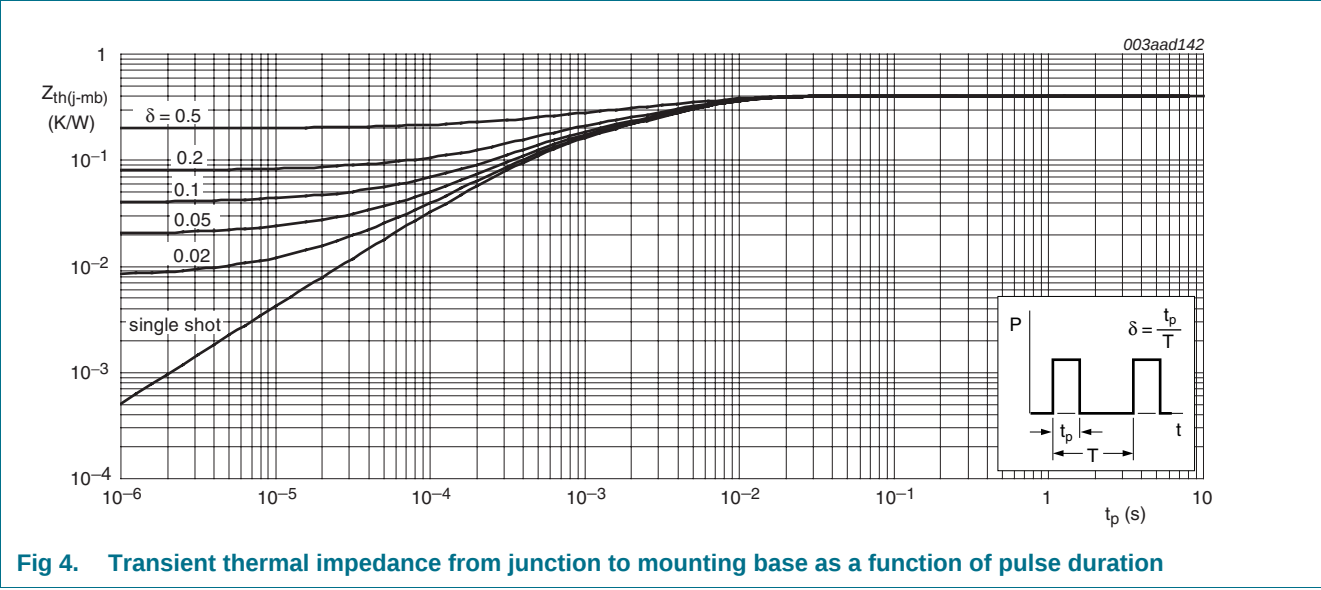


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

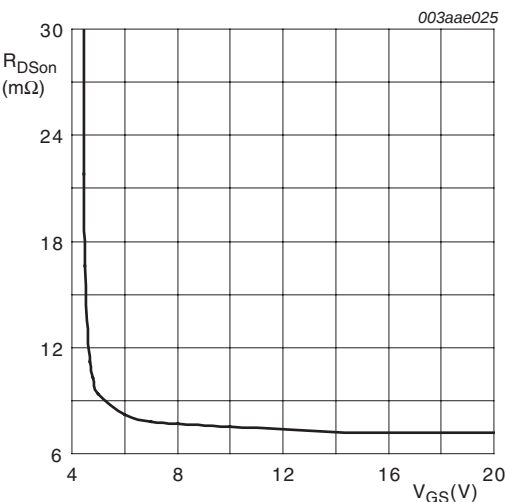
6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_J = -55 \text{ }^{\circ}\text{C}$	90	-	-	V
		$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_J = 25 \text{ }^{\circ}\text{C}$	100	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_J = 175 \text{ }^{\circ}\text{C}$; see Figure 10 and 11	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_J = 25 \text{ }^{\circ}\text{C}$; see Figure 10 and 11	2	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_J = -55 \text{ }^{\circ}\text{C}$; see Figure 10 and 11	-	-	4.8	V
I_{DSS}	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_J = 125 \text{ }^{\circ}\text{C}$	-	-	100	μA
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_J = 25 \text{ }^{\circ}\text{C}$	-	0.02	4	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_J = 25 \text{ }^{\circ}\text{C}$	-	10	100	nA
		$V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_J = 25 \text{ }^{\circ}\text{C}$	-	10	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_J = 100 \text{ }^{\circ}\text{C}$; see Figure 12	-	-	17.3	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_J = 175 \text{ }^{\circ}\text{C}$; see Figure 12	-	23.5	27.4	mΩ
		$V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_J = 25 \text{ }^{\circ}\text{C}$; see Figure 13	-	8.16	9.6	mΩ
R_G	internal gate resistance (AC)	$f = 1 \text{ MHz}$	-	0.7	-	Ω
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$; see Figure 14	-	67	-	nC
		$I_D = 60 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V}$; see Figure 14 and 15	-	82	-	nC
Q_{GS}	gate-source charge		-	21	-	nC
$Q_{GS(th)}$	pre-threshold gate-source charge	$I_D = 60 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 3 \text{ V}$; see Figure 14	-	13.1	-	nC
$Q_{GS(th-pl)}$	post-threshold gate-source charge	$I_D = 60 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V}$; see Figure 14	-	7.8	-	nC
Q_{GD}	gate-drain charge	$I_D = 60 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V}$; see Figure 14 and 15	-	23	-	nC
$V_{GS(pl)}$	gate-source plateau voltage	$V_{DS} = 50 \text{ V}$; see Figure 14 and 15	-	4.5	-	V
C_{iss}	input capacitance	$V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_J = 25 \text{ }^{\circ}\text{C}$; see Figure 16	-	4454	-	pF
C_{oss}	output capacitance		-	302	-	pF
C_{rss}	reverse transfer capacitance		-	185	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 50 \text{ V}; R_L = 0.8 \text{ } \Omega; V_{GS} = 10 \text{ V}; R_{G(ext)} = 4.7 \text{ } \Omega; T_J = 25 \text{ }^{\circ}\text{C}$	-	22	-	ns
t_r	rise time		-	25.2	-	ns
$t_{d(off)}$	turn-off delay time		-	52.2	-	ns
t_f	fall time		-	22.8	-	ns

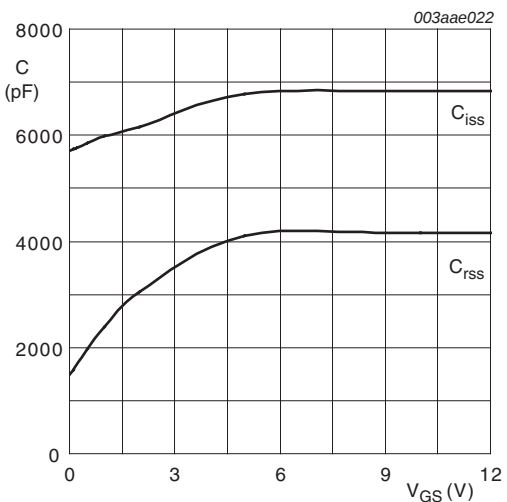
Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V_{SD}	source-drain voltage	$I_S = 15\text{ A}$; $V_{GS} = 0\text{ V}$; $T_j = 25\text{ }^{\circ}\text{C}$; see Figure 17	-	0.85	1.2	V
t_{rr}	reverse recovery time	$I_S = 20\text{ A}$; $di_S/dt = 100\text{ A}/\mu\text{s}$; $V_{GS} = 0\text{ V}$;	-	61.5	-	ns
Q_r	recovered charge	$V_{DS} = 50\text{ V}$	-	157	-	nC



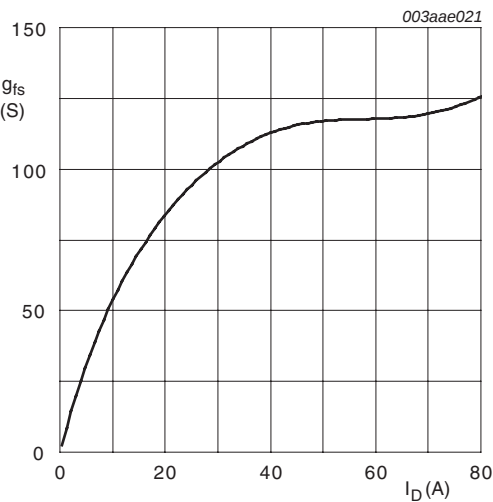
$T_j = 25\text{ }^{\circ}\text{C}$; $I_D = 20\text{ A}$

Fig 5. Drain-source on-state resistance as a function of gate-source voltage; typical values.



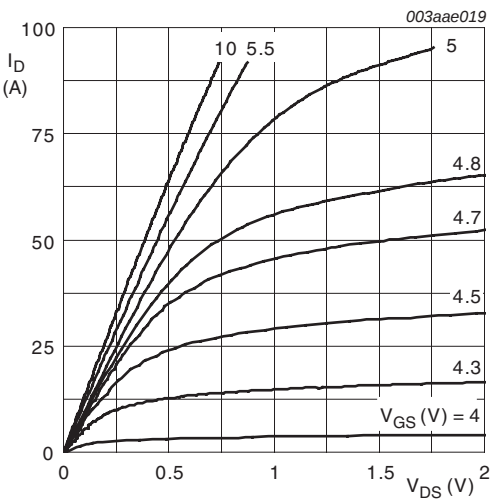
$V_{DS} = 0\text{ V}$; $f = 1\text{ MHz}$

Fig 6. Input and reverse transfer capacitances as a function of gate-source voltage; typical values



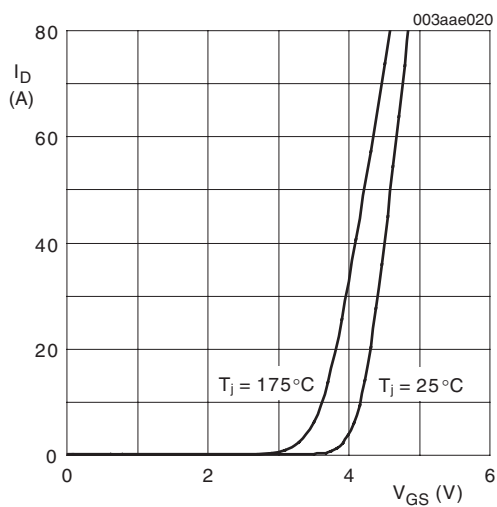
$T_j = 25\text{ }^{\circ}\text{C}$; $V_{DS} = 25\text{ V}$

Fig 7. Forward transconductance as a function of drain current; typical values



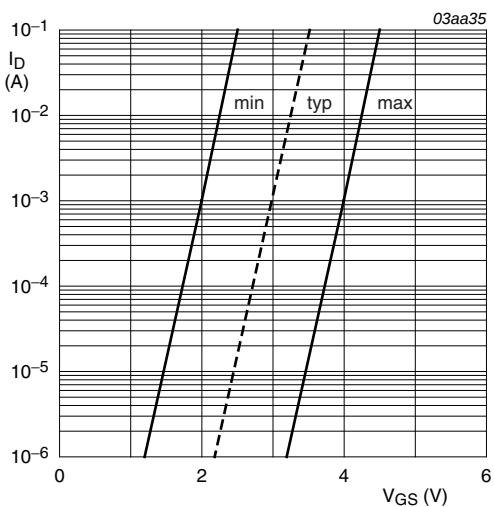
$T_j = 25\text{ }^{\circ}\text{C}$

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



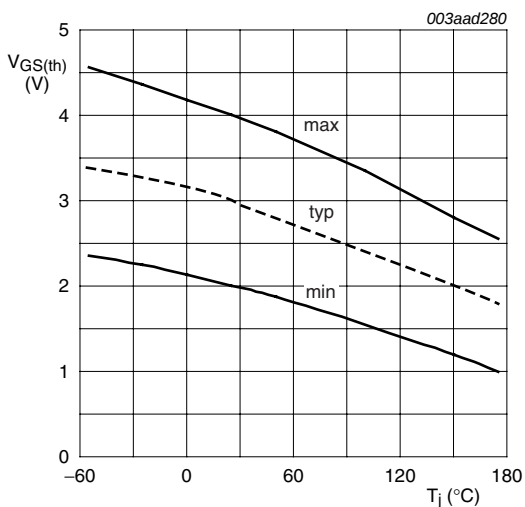
$V_{DS} > I_D \times R_{DSon}$

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



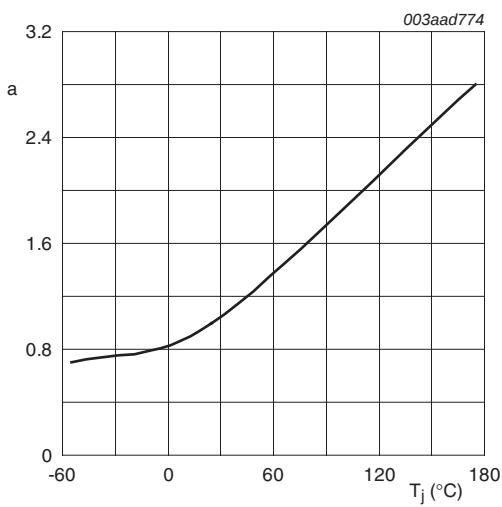
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

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



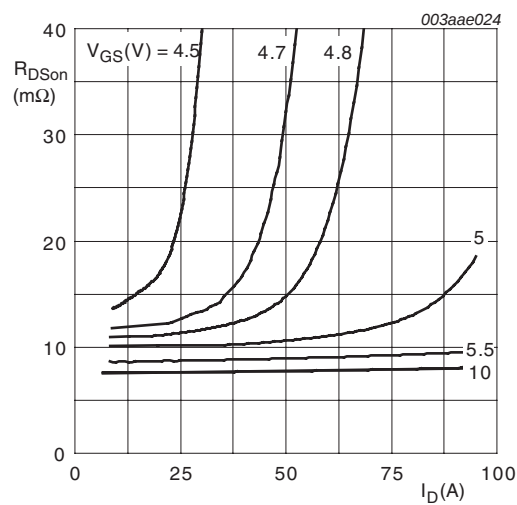
$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

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



$T_j = 25^\circ C$

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

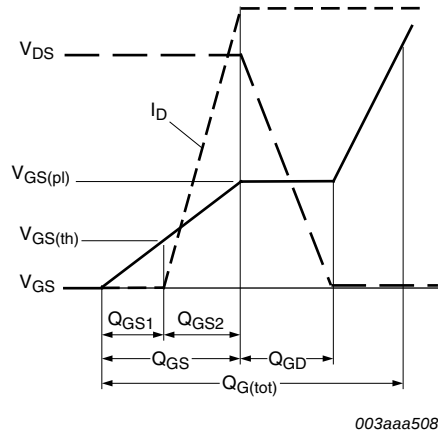
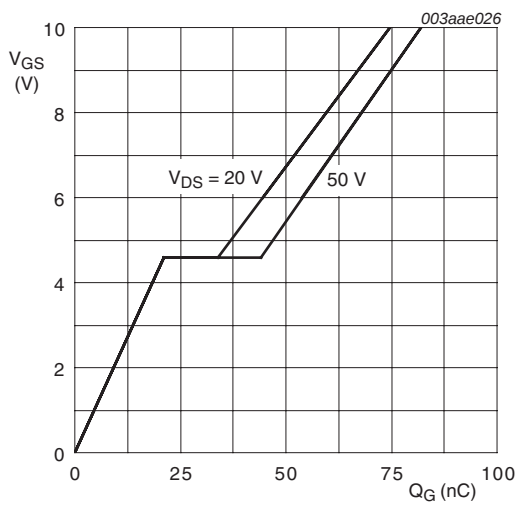
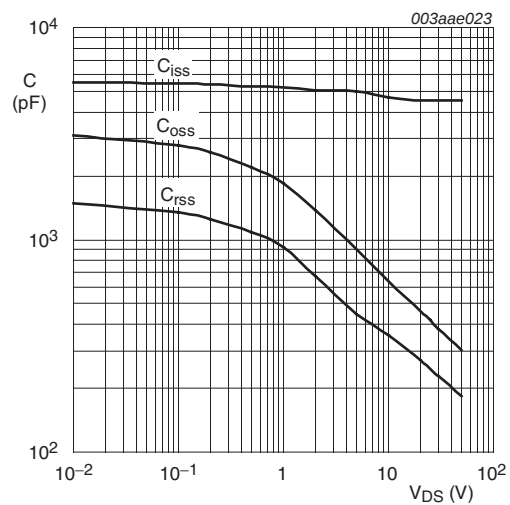


Fig 14. Gate charge waveform definitions



$T_j = 25^\circ C$; $I_D = 60$ A

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



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

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

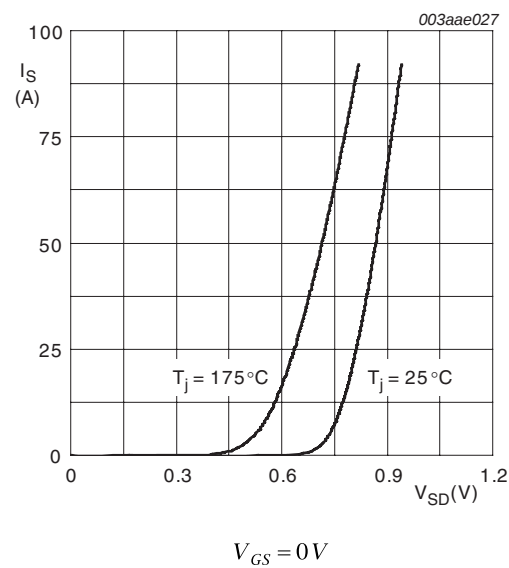


Fig 17. Source current as a function of source-drain voltage; typical values

7. Package outline

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

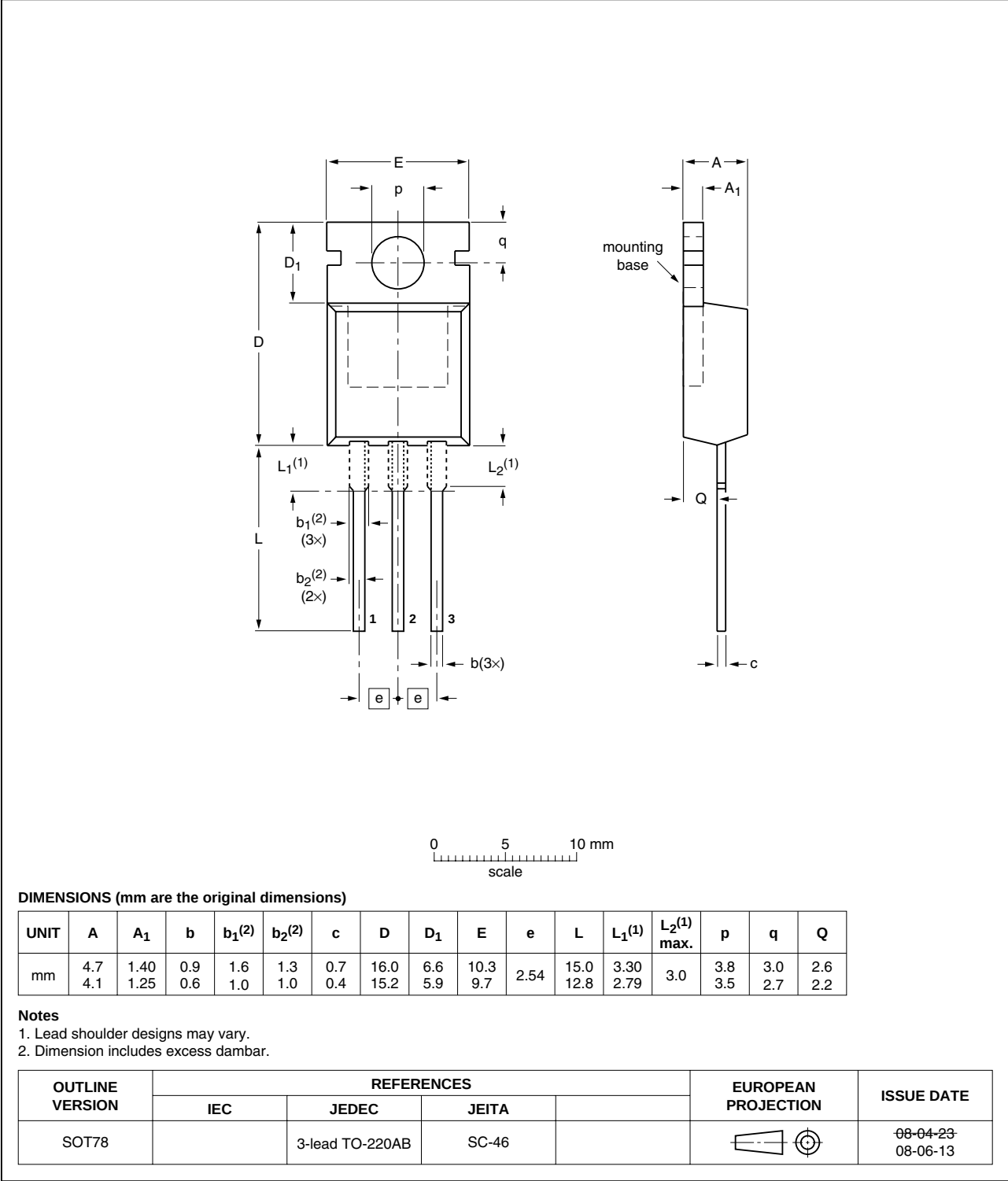


Fig 18. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN9R5-100PS_2	20100223	Product data sheet	-	PSMN9R5-100PS_1
Modifications:	• Various changes to content.			
PSMN9R5-100PS_1	20100122	Objective data sheet	-	-

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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