



# PSMN009-100P

N-channel TrenchMOS SiliconMAX standard level FET

Rev. 4 — 27 December 2011

Product data sheet

## 1. Product profile

### 1.1 General description

SiliconMAX standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

### 1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

### 1.3 Applications

- High frequency computer motherboard DC-to-DC convertors
- OR-ing applications

### 1.4 Quick reference data

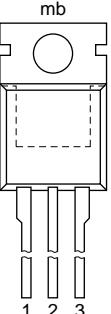
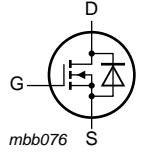
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25 \text{ }^\circ\text{C}; T_j \leq 175 \text{ }^\circ\text{C}$	-	-	100	V
$I_D$	drain current	$T_{mb} = 25 \text{ }^\circ\text{C}; V_{GS} = 10 \text{ V}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>	-	-	75	A
$P_{tot}$	total power dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 2</a>	-	-	230	W
<b>Static characteristics</b>						
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	-	7.5	8.8	$\text{m}\Omega$
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10 \text{ V}; I_D = 75 \text{ A}; V_{DS} = 80 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a>	-	44	-	$\text{nC}$

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## 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

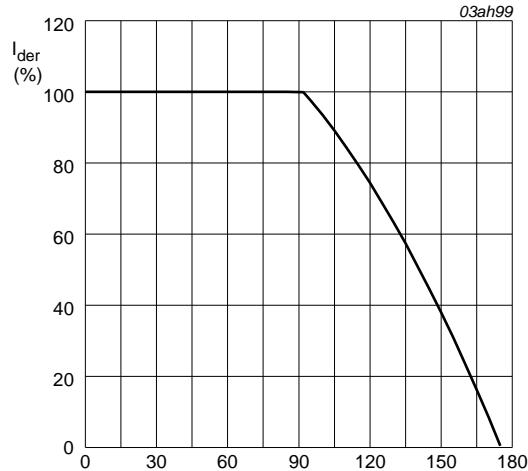
Type number	Package		
	Name	Description	Version
PSMN009-100P	TO-220AB	plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB	SOT78

## 4. Limiting values

**Table 4. Limiting values**

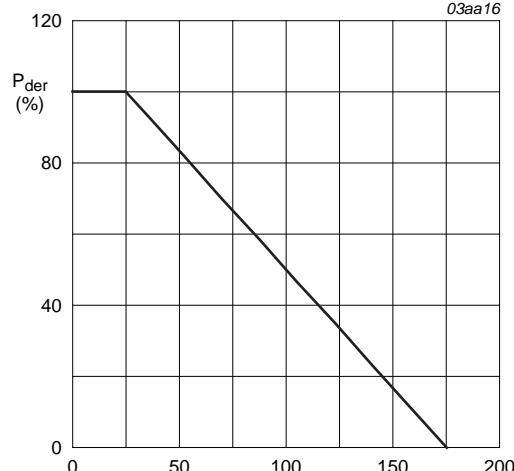
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25^\circ\text{C}; T_{mb} \leq 175^\circ\text{C}$	-	100	V
$V_{DGR}$	drain-gate voltage	$T_j \leq 175^\circ\text{C}; T_{mb} \geq 25^\circ\text{C}; R_{GS} = 20\text{ k}\Omega$	-	100	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$V_{GS} = 10\text{ V}; T_{mb} = 100^\circ\text{C}$ ; see <a href="#">Figure 1</a>	-	65	A
		$V_{GS} = 10\text{ V}; T_{mb} = 25^\circ\text{C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 3</a>	-	75	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>	-	400	A
$P_{tot}$	total power dissipation	$T_{mb} = 25^\circ\text{C}$ ; see <a href="#">Figure 2</a>	-	230	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
$V_{GSM}$	peak gate-source voltage	pulsed; $t_p \leq 50\text{ }\mu\text{s}; T_j \leq 150^\circ\text{C}; \delta = 25\%$	-30	30	V
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25^\circ\text{C}$	-	75	A
$I_{SM}$	peak source current	pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25^\circ\text{C}$	-	400	A
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}; T_{j(init)} = 25^\circ\text{C}; I_D = 35\text{ A}; V_{sup} = 15\text{ V}$ ; unclamped; $t_p = 0.1\text{ ms}; R_{GS} = 50\text{ }\Omega$	-	120	mJ
$I_{DS(AL)S}$	non-repetitive drain-source avalanche current	$V_{GS} = 10\text{ V}; V_{sup} = 15\text{ V}; R_{GS} = 50\text{ }\Omega; T_{j(init)} = 25^\circ\text{C}$ ; unclamped	-	75	A



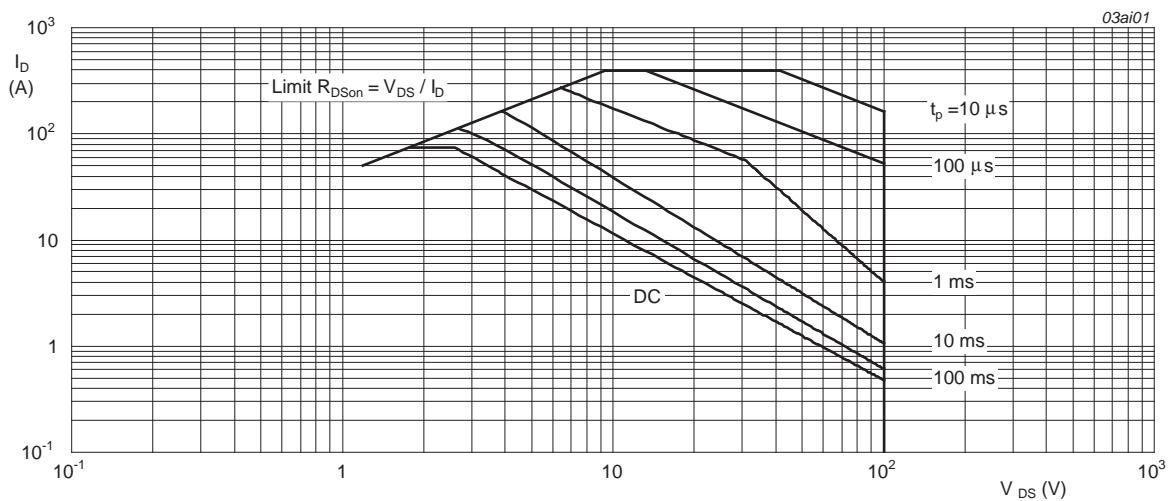
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

**Fig 1. Normalized 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**



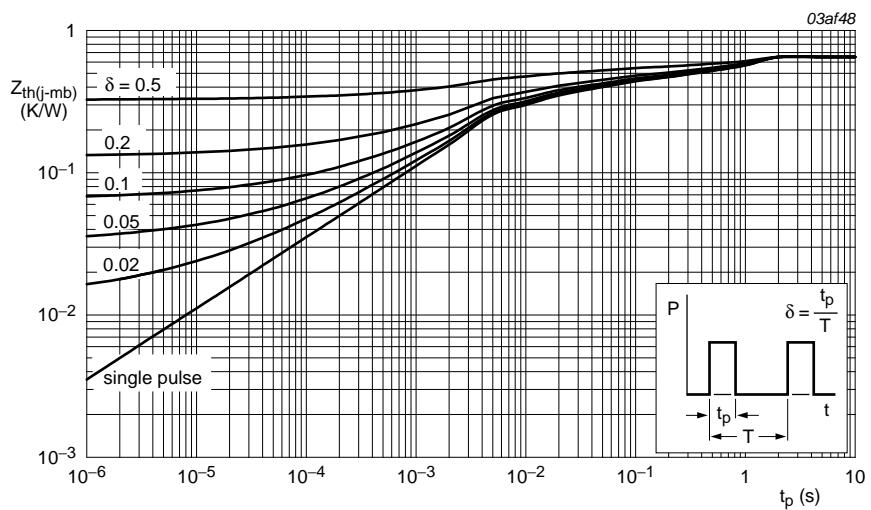
$T_{mb} = 25^\circ C$ ;  $I_{DM}$  is single pulse

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
$R_{th(j\text{-}mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 4</a>	-	-	0.65	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient	vertical in free air	-	60	-	K/W

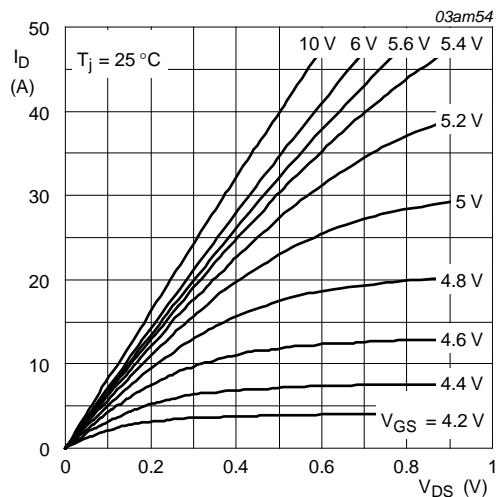


**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**

## 6. Characteristics

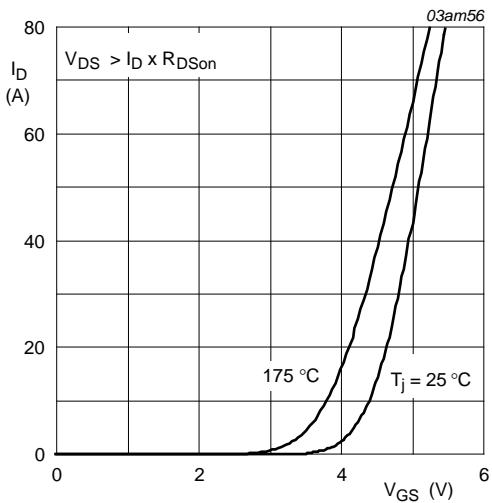
**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	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 <a href="#">Figure 8</a>	1	-	-	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 8</a>	2	3	4	V
		$I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see <a href="#">Figure 8</a>	-	-	4.4	V
$I_{DSS}$	drain leakage current	$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
		$V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	1	$\mu\text{A}$
$I_{GSS}$	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
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	-	20.25	23.8	$\text{m}\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 9</a> ; see <a href="#">Figure 10</a>	-	7.5	8.8	$\text{m}\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(\text{tot})}$	total gate charge	$I_D = 75 \text{ A}; V_{DS} = 80 \text{ V}; V_{GS} = 10 \text{ V};$	-	156	-	nC
$Q_{GS}$	gate-source charge	$T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 11</a>	-	31	-	nC
$Q_{GD}$	gate-drain charge		-	44	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 25 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$	-	8250	-	pF
$C_{oss}$	output capacitance	$T_j = 25 \text{ }^\circ\text{C};$ see <a href="#">Figure 12</a>	-	620	-	pF
$C_{rss}$	reverse transfer capacitance		-	300	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 15 \text{ V}; R_L = 1.25 \Omega; V_{GS} = 10 \text{ V};$	-	38	-	ns
$t_r$	rise time	$R_{G(\text{ext})} = 6 \Omega; T_j = 25 \text{ }^\circ\text{C}; I_D = 12 \text{ A}$	-	59	-	ns
$t_{d(off)}$	turn-off delay time		-	120	-	ns
$t_f$	fall time		-	43	-	ns
<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 13</a>	-	0.8	1.2	V



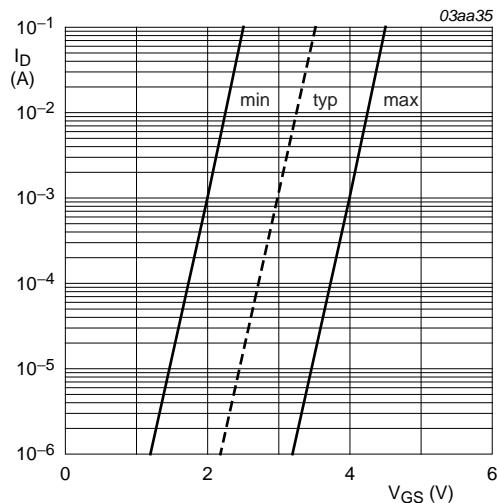
$T_j = 25^\circ C$

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



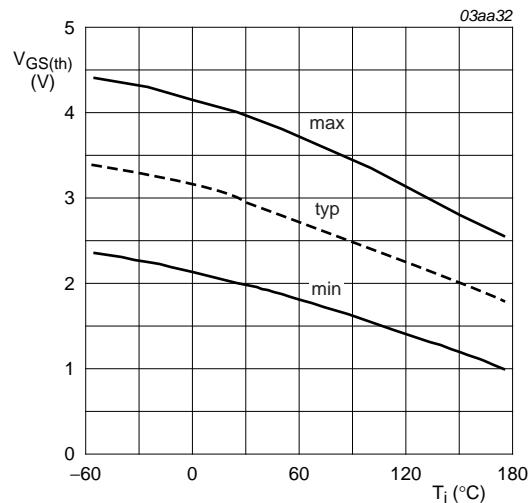
$T_j = 25^\circ C$  and  $175^\circ C$ ;  $V_{DS} > I_D \times R_{DS(on)}$

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



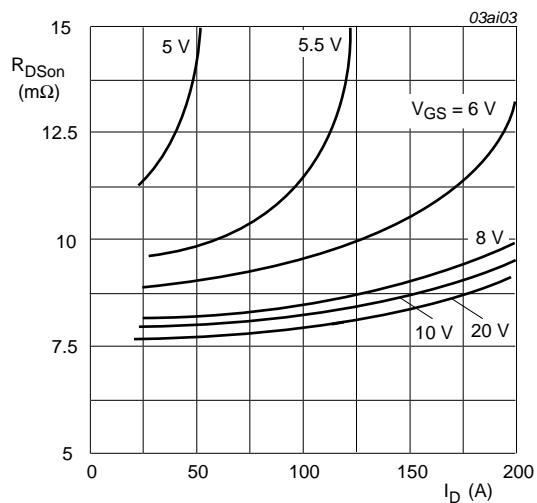
$T_j = 25^\circ C$ ;  $V_{DS} = 5 V$

**Fig 7. Sub-threshold drain current as a function of gate-source voltage**



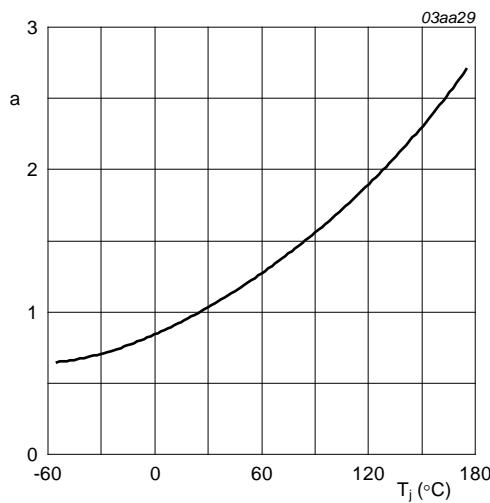
$I_D = 1 mA$ ;  $V_{DS} = V_{GS}$

**Fig 8. Gate-source threshold voltage as a function of junction temperature**



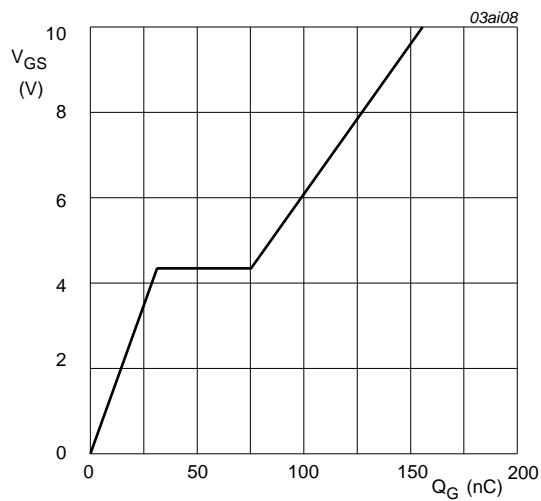
$T_j = 25^\circ C$

**Fig 9. Drain-source on-state resistance as a function of drain current; typical values**



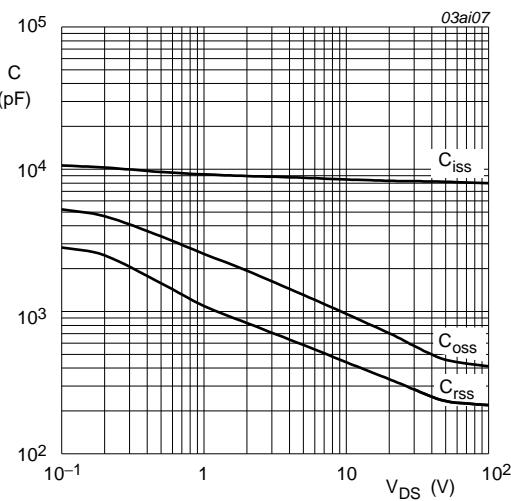
$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^\circ C)}}$$

**Fig 10. Normalized drain-source on-state resistance factor as a function of junction temperature**



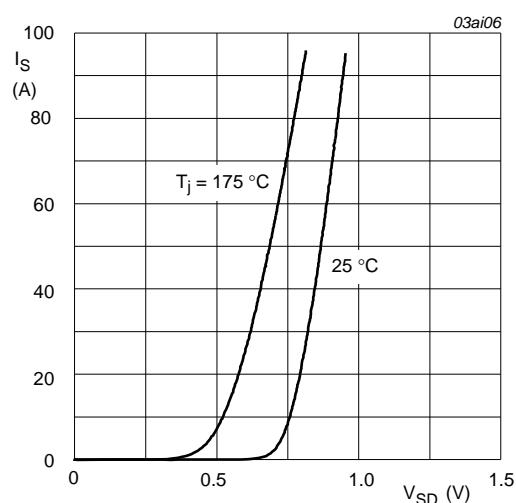
$I_D = 75A; V_{DS} = 80V$

**Fig 11. Gate-source voltage as a function of gate charge; typical values**



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

**Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values**



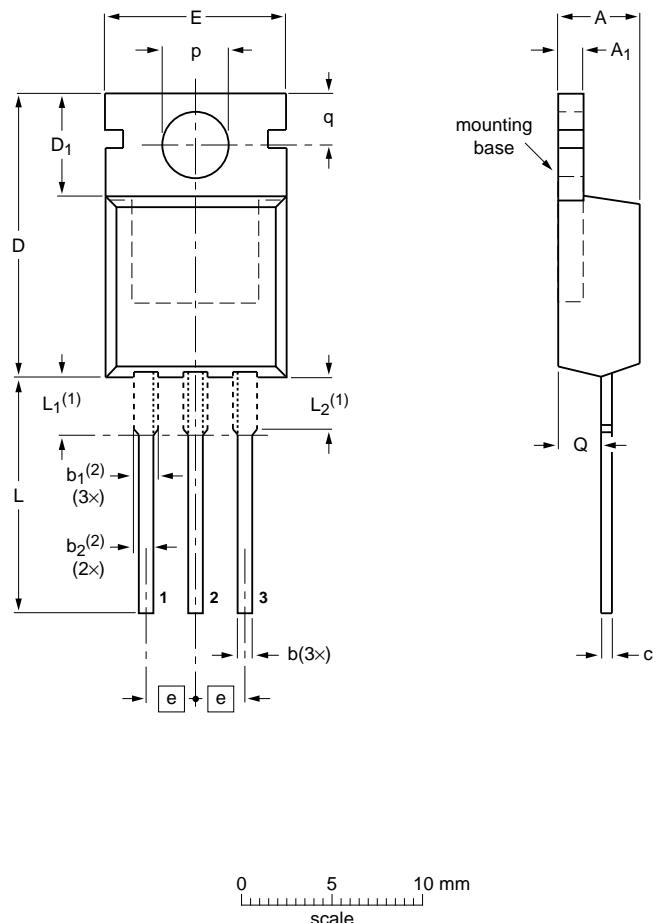
$T_j = 25\text{ }^\circ\text{C}$  and  $175\text{ }^\circ\text{C}$ ;  $V_{GS} = 0\text{V}$

Fig 13. 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	3.0	3.5	2.7	2.2

### Notes

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

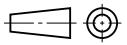
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT78		3-lead TO-220AB	SC-46			08-04-23 08-06-13

Fig 14. Package outline SOT78 (TO-220AB)

## 8. Revision history

**Table 7. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN009-100P v.4	20111227	Product data sheet	-	PSMN009-100P v.3
Modifications:		• Various changes to content.		
PSMN009-100P v.3	20111121	Product data sheet	-	PSMN009-100P v.2

## 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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