

# PSMN038-100K

## N-channel TrenchMOS SiliconMAX standard level FET

Rev. 02 — 25 November 2009

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

- Computer motherboards
- DC-to-DC convertors
- Switched-mode power supplies

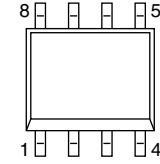
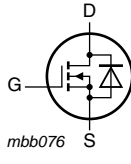
### 1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 150\text{ °C}$	-	-	100	V
$I_D$	drain current	$T_{sp} = 80\text{ °C}$ ; see <a href="#">Figure 1</a> and <a href="#">3</a>	-	-	6.3	A
$P_{tot}$	total power dissipation	$T_{sp} = 80\text{ °C}$ ; see <a href="#">Figure 2</a>	-	-	3.5	W
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}$ ; $I_D = 6.3\text{ A}$ ; $V_{DS} = 50\text{ V}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 11</a>	-	16	21.5	nC
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}$ ; $I_D = 5.2\text{ A}$ ; $T_j = 25\text{ °C}$ ; see <a href="#">Figure 9</a> and <a href="#">10</a>	-	33	38	m $\Omega$

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S	source	 <p>SOT96-1 (SO8)</p>	
2	S	source		
3	S	source		
4	G	gate		
5	D	drain		
6	D	drain		
7	D	drain		
8	D	drain		

## 3. Ordering information

Table 3. Ordering information

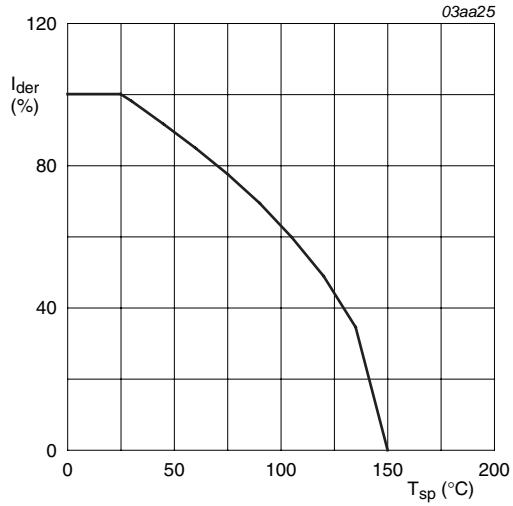
Type number	Package		
	Name	Description	Version
PSMN038-100K	SO8	plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

## 4. Limiting values

Table 4. Limiting values

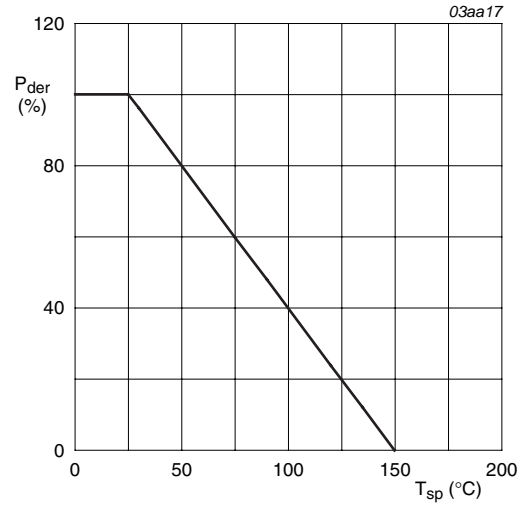
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}$ ; $T_j \leq 150\text{ °C}$	-	100	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$T_{sp} = 80\text{ °C}$ ; see <a href="#">Figure 1</a> and <a href="#">3</a>	-	6.3	A
$I_{DM}$	peak drain current	$T_{sp} = 25\text{ °C}$ ; $t_p \leq 10\text{ }\mu\text{s}$ ; pulsed; see <a href="#">Figure 3</a>	-	50	A
$P_{tot}$	total power dissipation	$T_{sp} = 80\text{ °C}$ ; see <a href="#">Figure 2</a>	-	3.5	W
$T_{stg}$	storage temperature		-55	150	°C
$T_j$	junction temperature		-55	150	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{sp} = 80\text{ °C}$	-	3.1	A
$I_{SM}$	peak source current	$T_{sp} = 25\text{ °C}$ ; $t_p \leq 10\text{ }\mu\text{s}$ ; pulsed	-	50	A



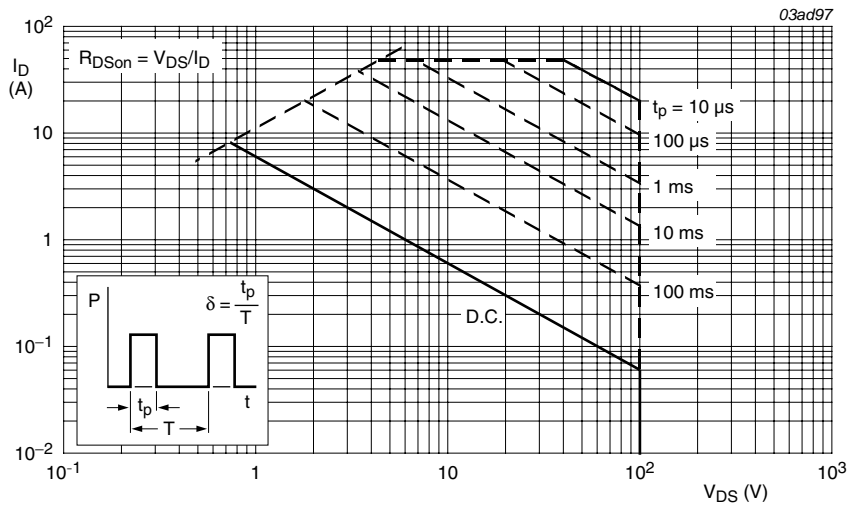
$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

Fig 1. Normalized continuous drain current as a function of solder point temperature



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

Fig 2. Normalized total power dissipation as a function of solder point temperature



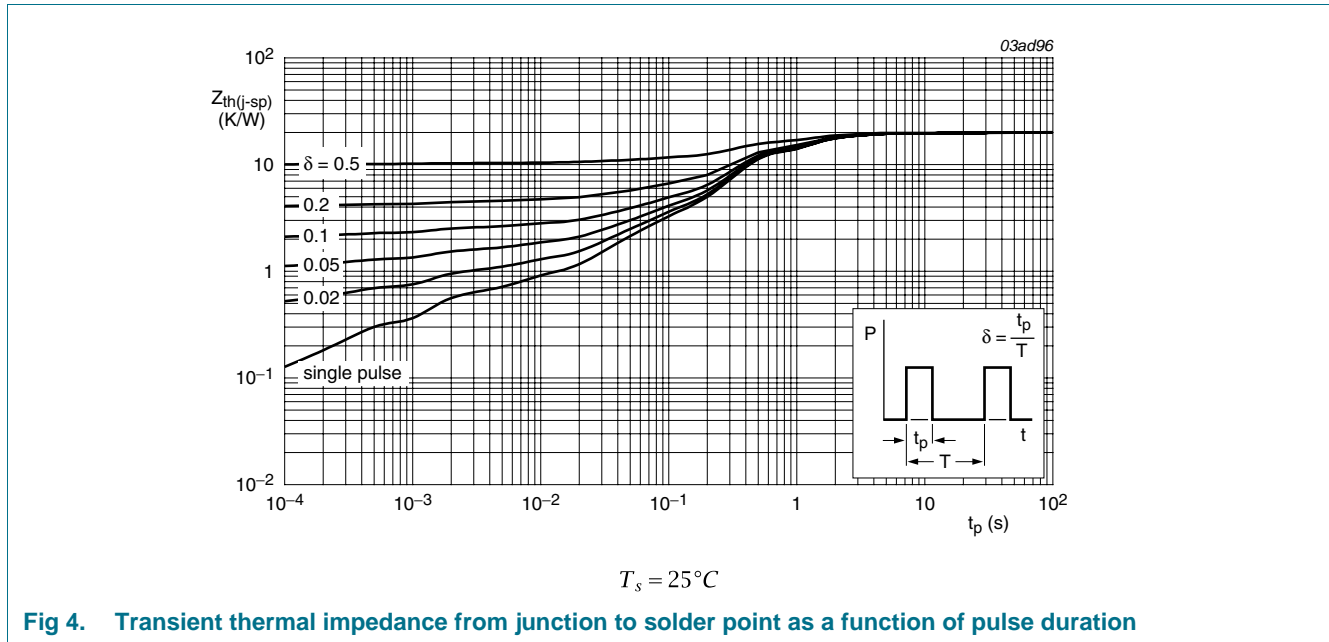
$T_{sp} = 25^\circ\text{C}; I_{DM}$  is single pulse

Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

### 5. Thermal characteristics

**Table 5. Thermal characteristics**

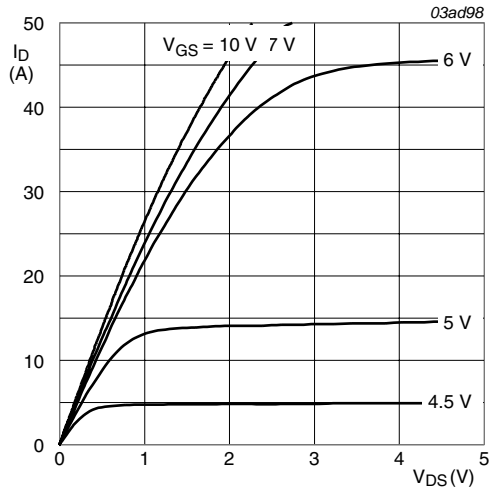
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	mounted on a metal clad substrate; see <a href="#">Figure 4</a>	-	-	20	K/W



## 6. Characteristics

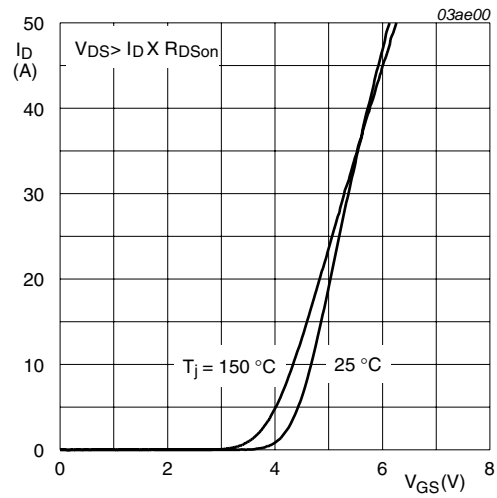
**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu\text{A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	100	130	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 150 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a>	1.2	-	-	V
		$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = -55 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a>	-	-	6	V
		$I_D = 1 \text{ mA}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a>	2	-	4	V
$I_{DSS}$	drain leakage current	$V_{DS} = 100 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 150 \text{ }^\circ\text{C}$	-	-	0.5	mA
		$V_{DS} = 80 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	1	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 20 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
		$V_{GS} = -20 \text{ V}$ ; $V_{DS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10 \text{ V}$ ; $I_D = 5.2 \text{ A}$ ; $T_j = 150 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a> and <a href="#">10</a>	-	76	88	m $\Omega$
		$V_{GS} = 10 \text{ V}$ ; $I_D = 5.2 \text{ A}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 9</a> and <a href="#">10</a>	-	33	38	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 6.3 \text{ A}$ ; $V_{DS} = 50 \text{ V}$ ; $V_{GS} = 10 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 11</a>	-	43	-	nC
$Q_{GS}$	gate-source charge		-	6.5	-	nC
$Q_{GD}$	gate-drain charge		-	16	21.5	nC
$C_{iss}$	input capacitance	$V_{DS} = 25 \text{ V}$ ; $V_{GS} = 0 \text{ V}$ ; $f = 1 \text{ MHz}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	1740	-	pF
$C_{oss}$	output capacitance		-	220	-	pF
$C_{rss}$	reverse transfer capacitance		-	135	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 50 \text{ V}$ ; $R_L = 50 \text{ } \Omega$ ; $V_{GS} = 10 \text{ V}$ ; $R_{G(ext)} = 6 \text{ } \Omega$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; $I_D = 1 \text{ A}$	-	15	30	ns
$t_r$	rise time		-	13	25	ns
$t_{d(off)}$	turn-off delay time		-	50	80	ns
$t_f$	fall time		-	25	40	ns
$g_{fs}$	transfer conductance	$V_{DS} = 15 \text{ V}$ ; $I_D = 6.3 \text{ A}$ ; see <a href="#">Figure 13</a>	-	20	-	S
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = 2.3 \text{ A}$ ; $V_{GS} = 0 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 14</a>	-	0.7	1.1	V
$t_{rr}$	reverse recovery time	$I_S = 6.3 \text{ A}$ ; $di_S/dt = -100 \text{ A}/\mu\text{s}$ ; $V_{GS} = 0 \text{ V}$ ; $V_{DS} = 25 \text{ V}$ ; $T_j = 25 \text{ }^\circ\text{C}$	-	85	-	ns
$Q_r$	recovered charge		-	0.3	-	$\mu\text{C}$



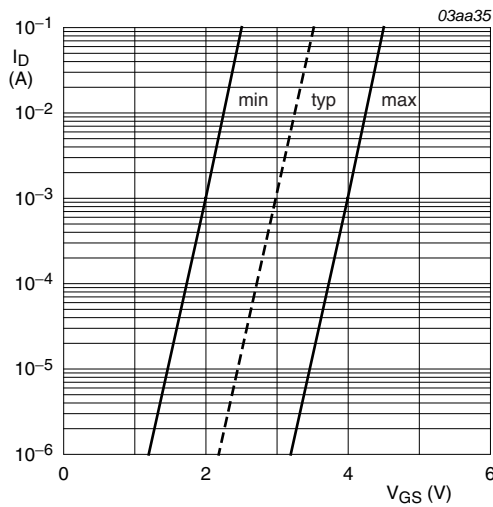
$T_j = 25^\circ\text{C}$

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



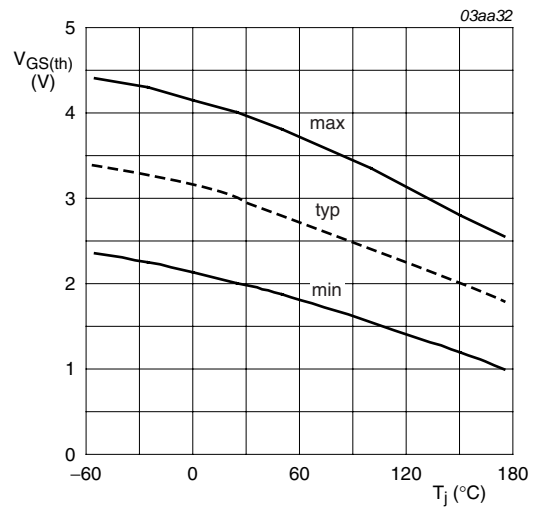
$T_j = 25^\circ\text{C}$  and  $150^\circ\text{C}$ ;  $V_{DS} > I_D \times R_{DSon}$

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



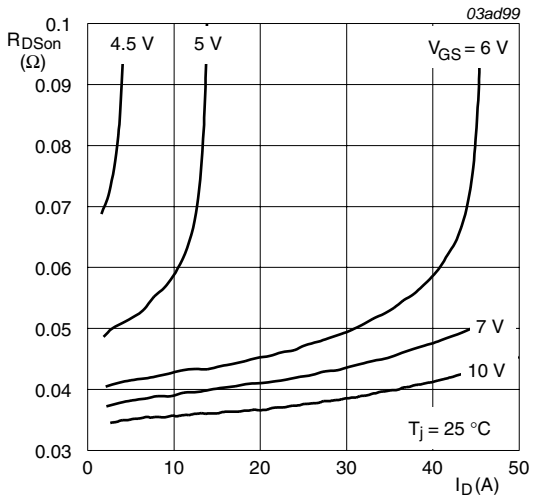
$T_j = 25^\circ\text{C}$ ;  $V_{DS} = 5\text{V}$

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



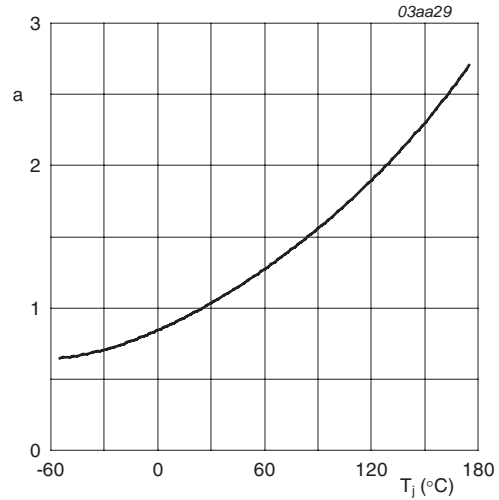
$I_D = 1\text{mA}$ ;  $V_{DS} = V_{GS}$

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



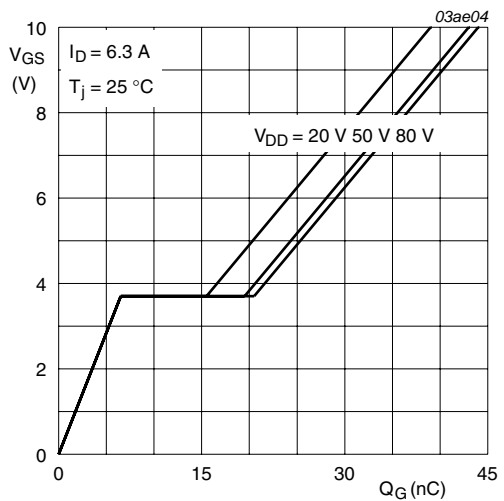
$T_j = 25^\circ\text{C}$

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



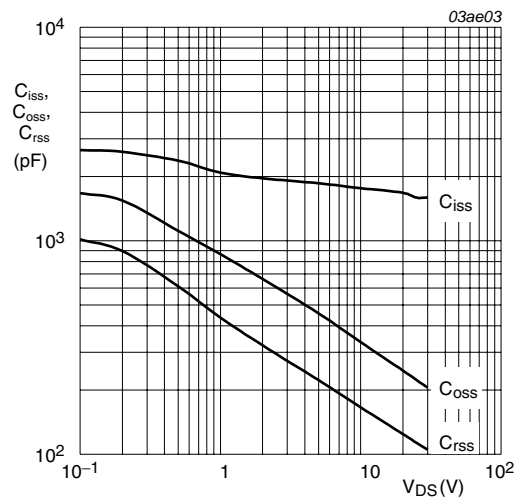
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

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



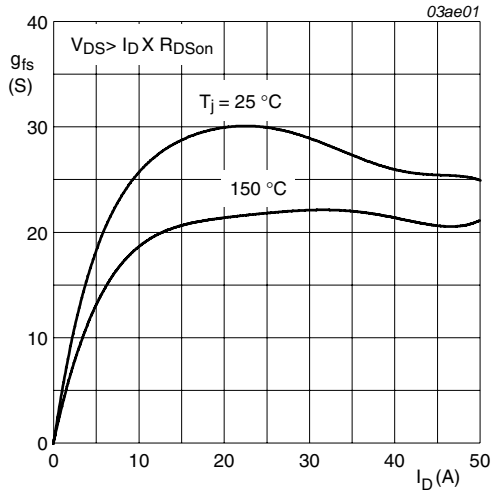
$I_D = 6.3\text{ A}; V_{DS} = 20\text{ V}, 50\text{ V and } 80\text{ V}$

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



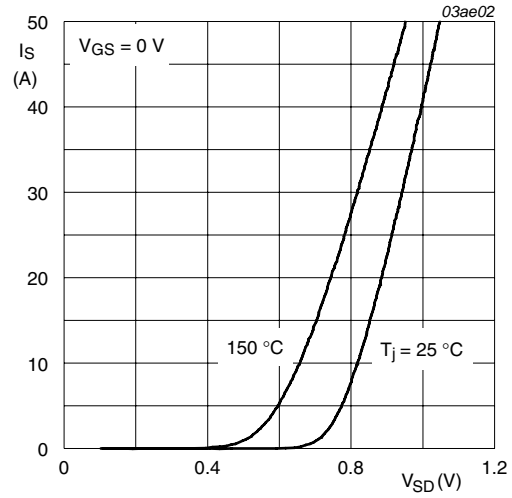
$V_{GS} = 0\text{ V}; f = 1\text{ MHz}$

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  $150\text{ }^\circ\text{C}$ ;  $V_{DS} > I_D \times R_{DSon}$

**Fig 13. Forward transconductance as a function of drain current; typical values**



$T_j = 25\text{ }^\circ\text{C}$  and  $150\text{ }^\circ\text{C}$ ;  $V_{GS} = 0\text{ V}$

**Fig 14. Source current as a function of source-drain voltage; typical values**



7. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

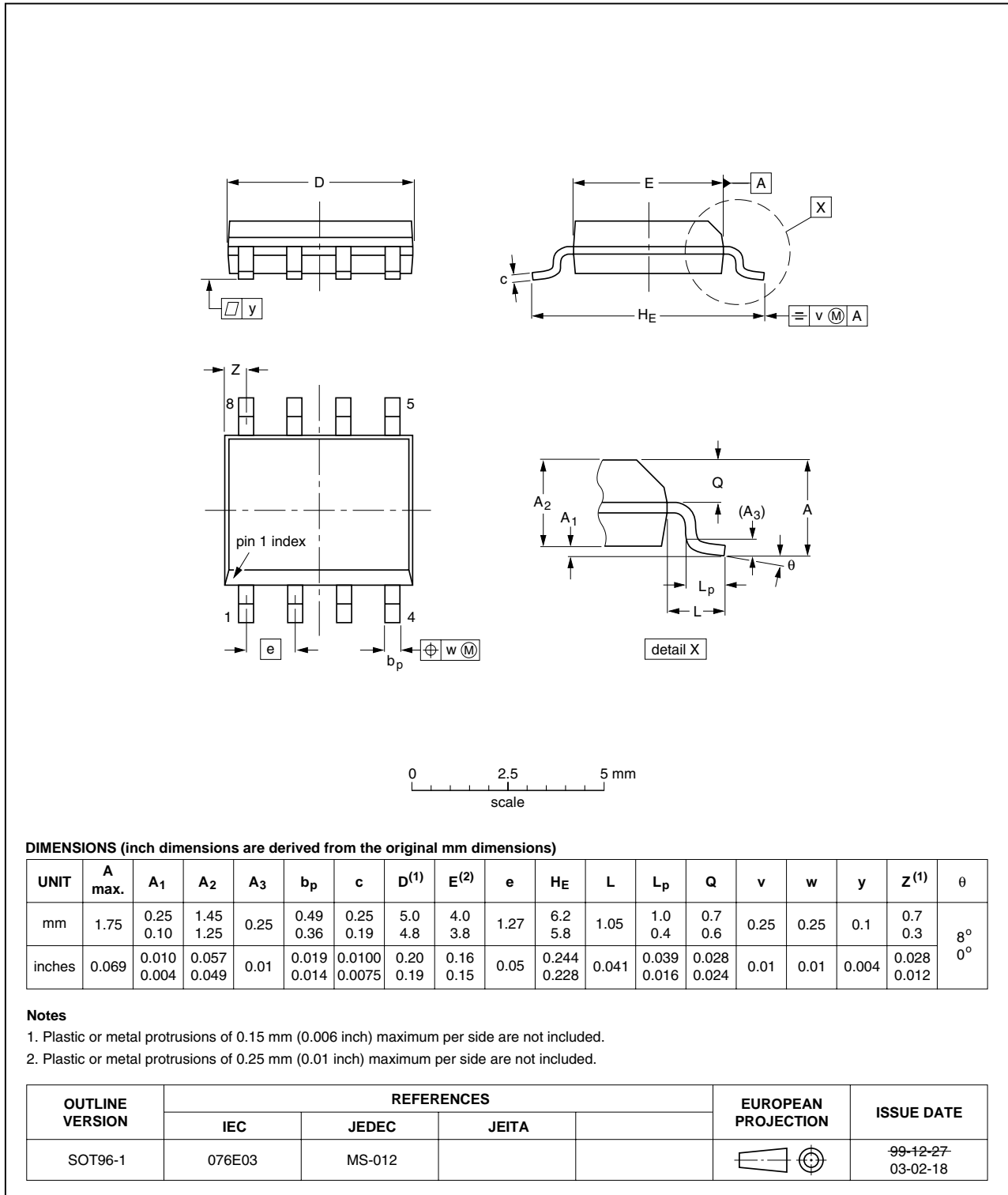


Fig 15. Package outline SOT96-1 (SO8)

## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN038-100K_2	20091125	Product data sheet	-	PSMN038-100K-01
Modifications:				
				<ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li></ul>
PSMN038-100K-01	20010116	Product specification	-	-

## 9. Legal information

### 9.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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