

# PSMN025-100D

## N-channel TrenchMOS SiliconMAX standard level FET

Rev. 03 — 20 November 2008

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

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

### 1.3 Applications

- DC-to-DC converters
- Switched-mode power supplies

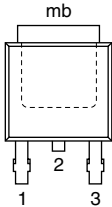
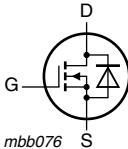
### 1.4 Quick reference data

Table 1. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$	-	-	100	V
$I_D$	drain current	$T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a>	-	-	47	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C};$ see <a href="#">Figure 3</a>	-	-	150	W
<b>Dynamic characteristics</b>						
$Q_{GD}$	gate-drain charge	$V_{GS} = 10\text{ V}; I_D = 45\text{ A};$ $V_{DS} = 80\text{ V}; T_j = 25\text{ °C};$ see <a href="#">Figure 12</a>	-	25	-	nC
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 25\text{ A};$ $T_j = 25\text{ °C};$ see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	-	22	25	mΩ

## 2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p style="text-align: center;"><b>SOT428</b> (SC-63; DPAK)</p>	 <p style="text-align: center;"><i>mbb076</i></p>
2	D	drain <a href="#">[1]</a>		
3	S	source		
mb	D	mounting base; connected to drain		

[1] It is not possible to make connection to pin 2.

## 3. Ordering information

Table 3. Ordering information

Type number	Package		Version
	Name	Description	
PSMN025-100D	SC-63; DPAK	plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)	SOT428

## 4. Limiting values

Table 4. Limiting values

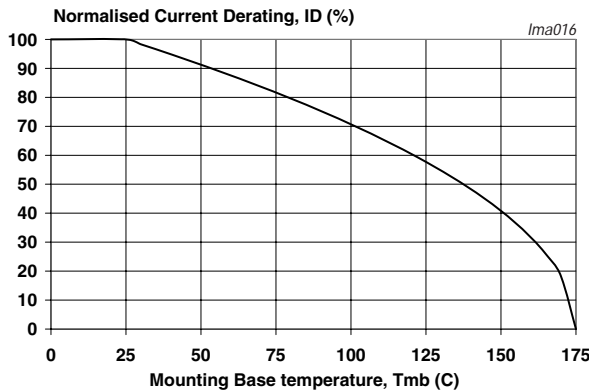
In accordance with the Absolute Maximum Rating System (IEC 60134).

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 <a href="#">Figure 1</a>	-	33	A
		$V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 1</a> ; see <a href="#">Figure 2</a>	-	47	A
$I_{DM}$	peak drain current	pulsed; $T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 2</a>	-	188	A
$P_{tot}$	total power dissipation	$T_{mb} = 25\text{ °C}$ ; see <a href="#">Figure 3</a>	-	150	W
$T_{stg}$	storage temperature		-55	175	°C
$T_j$	junction temperature		-55	175	°C
<b>Source-drain diode</b>					
$I_S$	source current	$T_{mb} = 25\text{ °C}$	-	47	A
$I_{SM}$	peak source current	pulsed; $T_{mb} = 25\text{ °C}$	-	188	A

**Table 4. Limiting values ...continued**

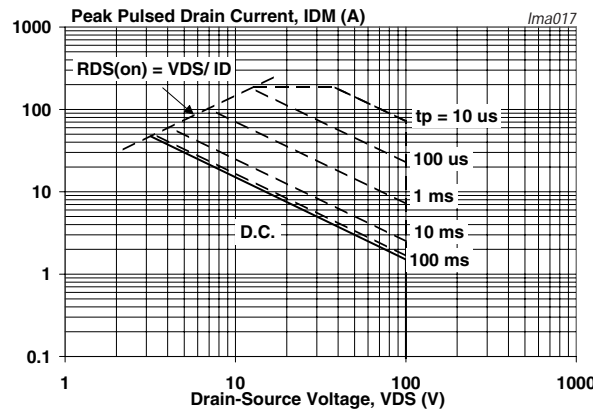
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
<b>Avalanche ruggedness</b>					
$E_{DS(AL)S}$	non-repetitive drain-source avalanche energy	$V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; $I_D = 40\text{ A}$ ; $V_{\text{sup}} \leq 25\text{ V}$ ; unclamped; $t_p = 100\text{ }\mu\text{s}$ ; $R_{GS} = 50\text{ }\Omega$	-	260	mJ
$I_{AS}$	non-repetitive avalanche current	$V_{\text{sup}} \leq 25\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$ ; $R_{GS} = 50\text{ }\Omega$ ; unclamped; see <a href="#">Figure 4</a>	-	47	A



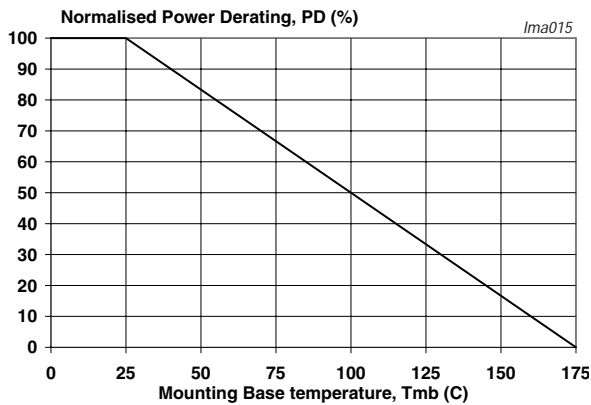
$$V_{GS} \geq 10\text{ V}$$

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



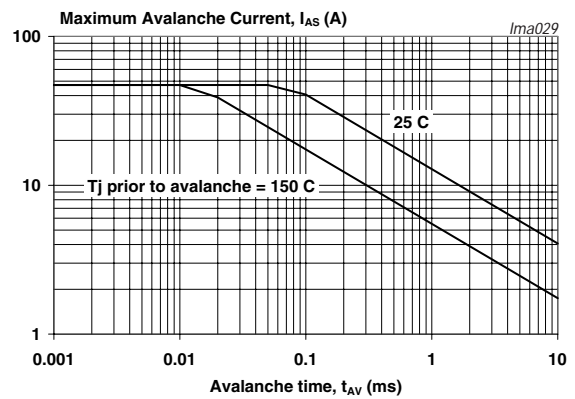
$I_{DM}$  is a single pulse

**Fig 2. Safe operating area; continuous and peak drain currents as a function of drain-source voltage**



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

**Fig 3. Normalized total power dissipation as a function of mounting base temperature**

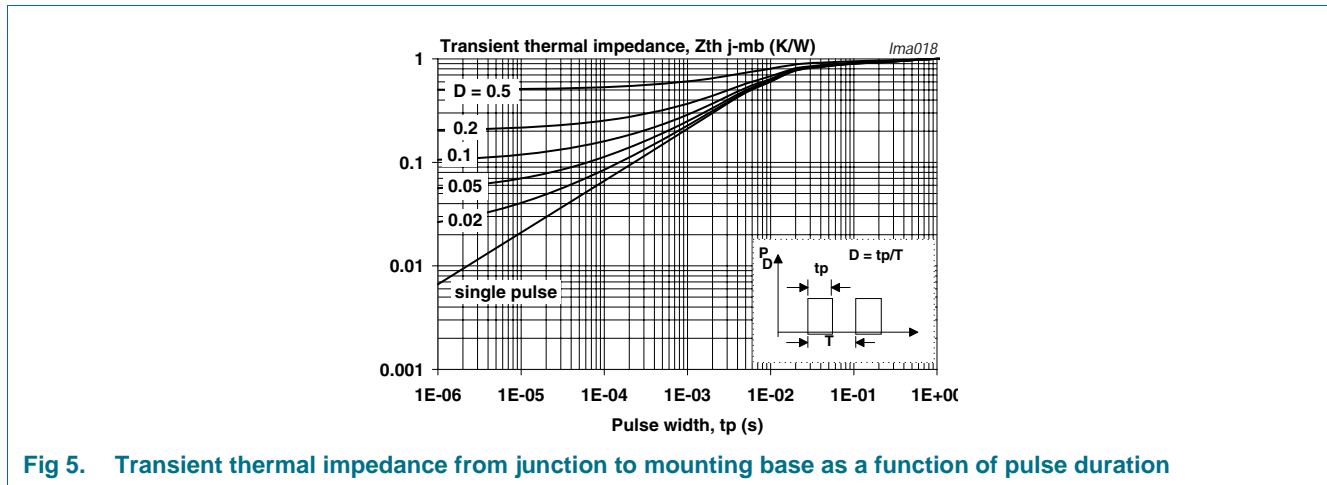


**Fig 4. Maximum permissible non-repetitive avalanche current as a function of avalanche time**

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	SOT428 package; printed-circuit board mounted; minimum footprint	-	50	-	K/W
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	see <a href="#">Figure 5</a>	-	-	1	K/W



**Fig 5. 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	$I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$	89	-	-	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> ; see <a href="#">Figure 9</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>	-	-	6	V
$I_{DSS}$	drain leakage current	$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.05	10	$\mu\text{A}$
		$V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$	-	-	500	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = 10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	100	nA
		$V_{GS} = -10 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	0.02	100	nA
$R_{DS(on)}$	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 10</a>	-	-	68	m $\Omega$
		$V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	-	22	25	m $\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$I_D = 45 \text{ A}; V_{DS} = 80 \text{ V}; V_{GS} = 10 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ ; see <a href="#">Figure 12</a>	-	61	-	nC
$Q_{GS}$	gate-source charge		-	13	-	nC
$Q_{GD}$	gate-drain charge		-	25	-	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 13</a>	-	2600	-	pF
$C_{oss}$	output capacitance		-	340	-	pF
$C_{rss}$	reverse transfer capacitance		-	195	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 50 \text{ V}; R_L = 1.8 \text{ } \Omega; V_{GS} = 10 \text{ V}; R_{G(ext)} = 5.6 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	18	-	ns
$t_r$	rise time		-	72	-	ns
$t_{d(off)}$	turn-off delay time		-	69	-	ns
$t_f$	fall time		-	58	-	ns
$L_D$	internal drain inductance	measured from tab to centre of die; $T_j = 25 \text{ }^\circ\text{C}$	-	3.5	-	nH
$L_S$	internal source inductance	measured from source lead to source bond pad; $T_j = 25 \text{ }^\circ\text{C}$	-	7.5	-	nH
<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 15</a>	-	0.87	1.2	V
$t_{rr}$	reverse recovery time	$I_S = 20 \text{ A}; di_S/dt = -100 \text{ A}/\mu\text{s}; V_{GS} = 0 \text{ V}; V_{DS} = 25 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	82	-	ns
$Q_r$	recovered charge		-	0.26	-	$\mu\text{C}$

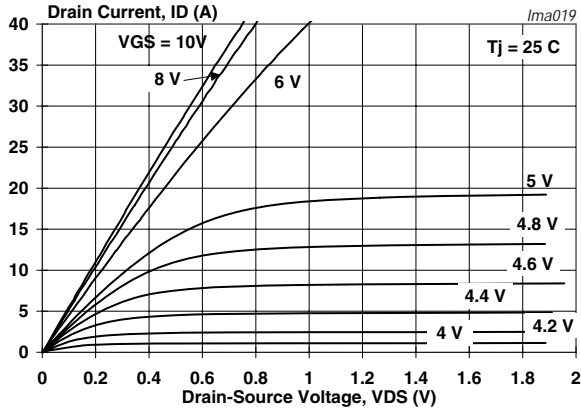


Fig 6. Output characteristics: drain current as a function of drain-source voltage; typical values

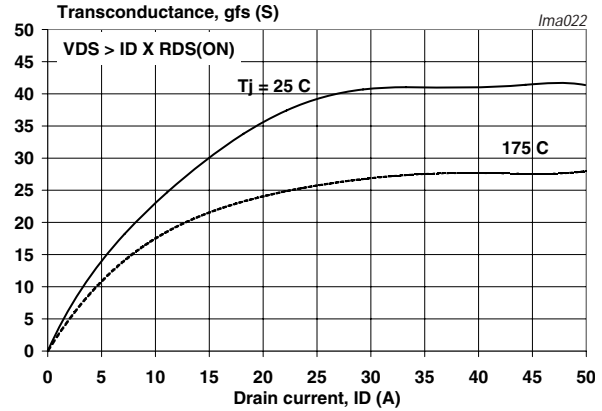


Fig 7. Forward transconductance as a function of drain current; typical values

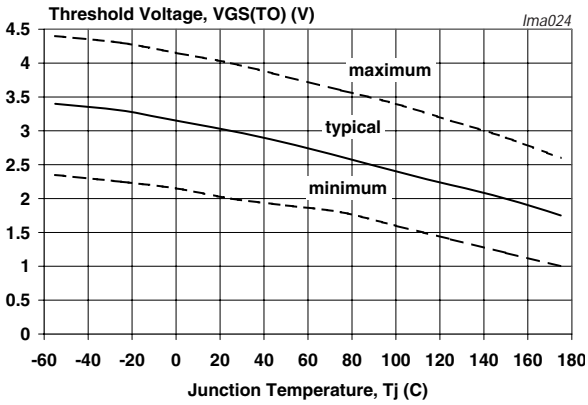


Fig 8. Gate-source threshold voltage as a function of junction temperature

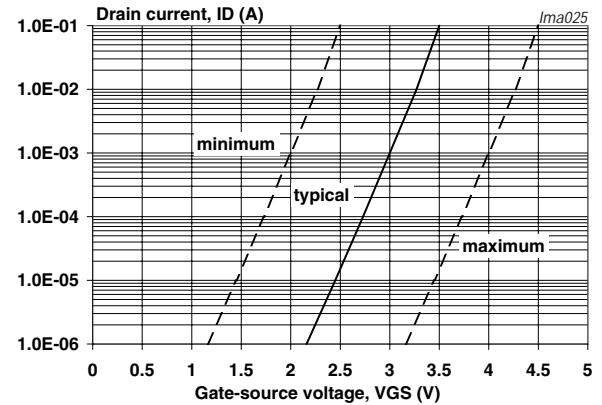


Fig 9. Sub-threshold drain current as a function of gate-source voltage

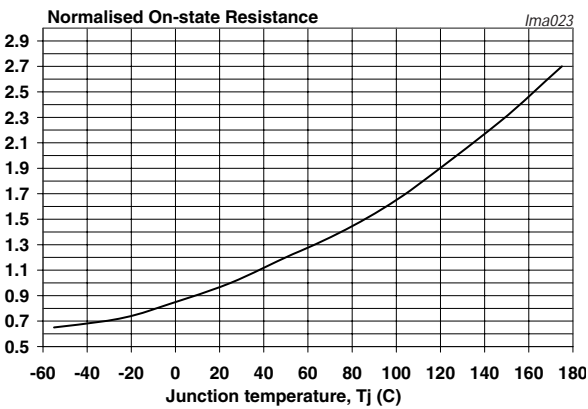


Fig 10. Normalized drain source on-state resistance factor as a function of junction temperature

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

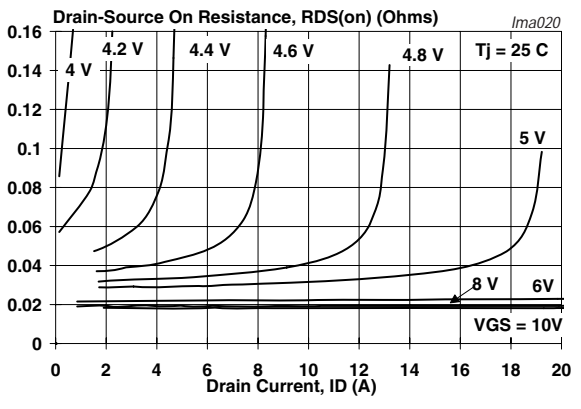


Fig 11. Drain-source on-state resistance as a function of drain current; typical values

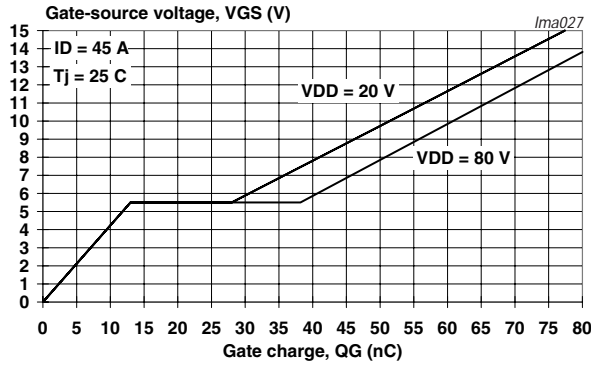


Fig 12. Gate-source voltage as a function of gate charge; typical values

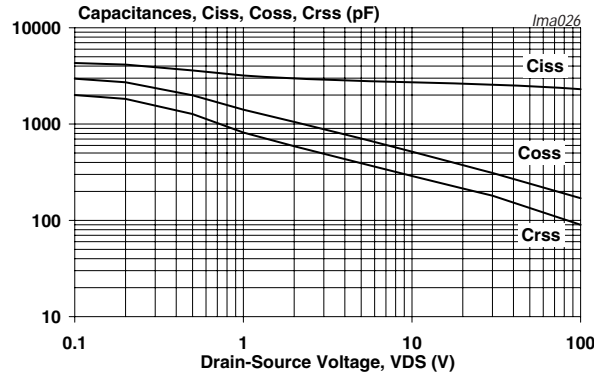


Fig 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

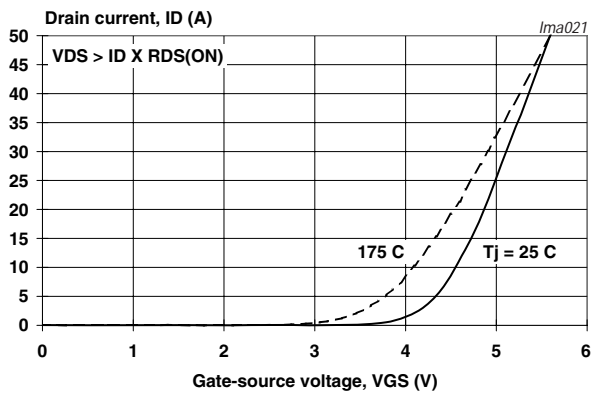


Fig 14. Transfer characteristics: drain current as a function of gate-source voltage; typical values

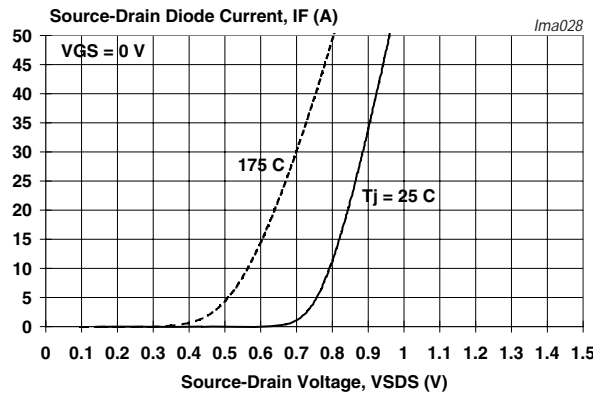


Fig 15. Source current as a function of source-drain voltage; typical values

## 7. Package outline

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)

SOT428

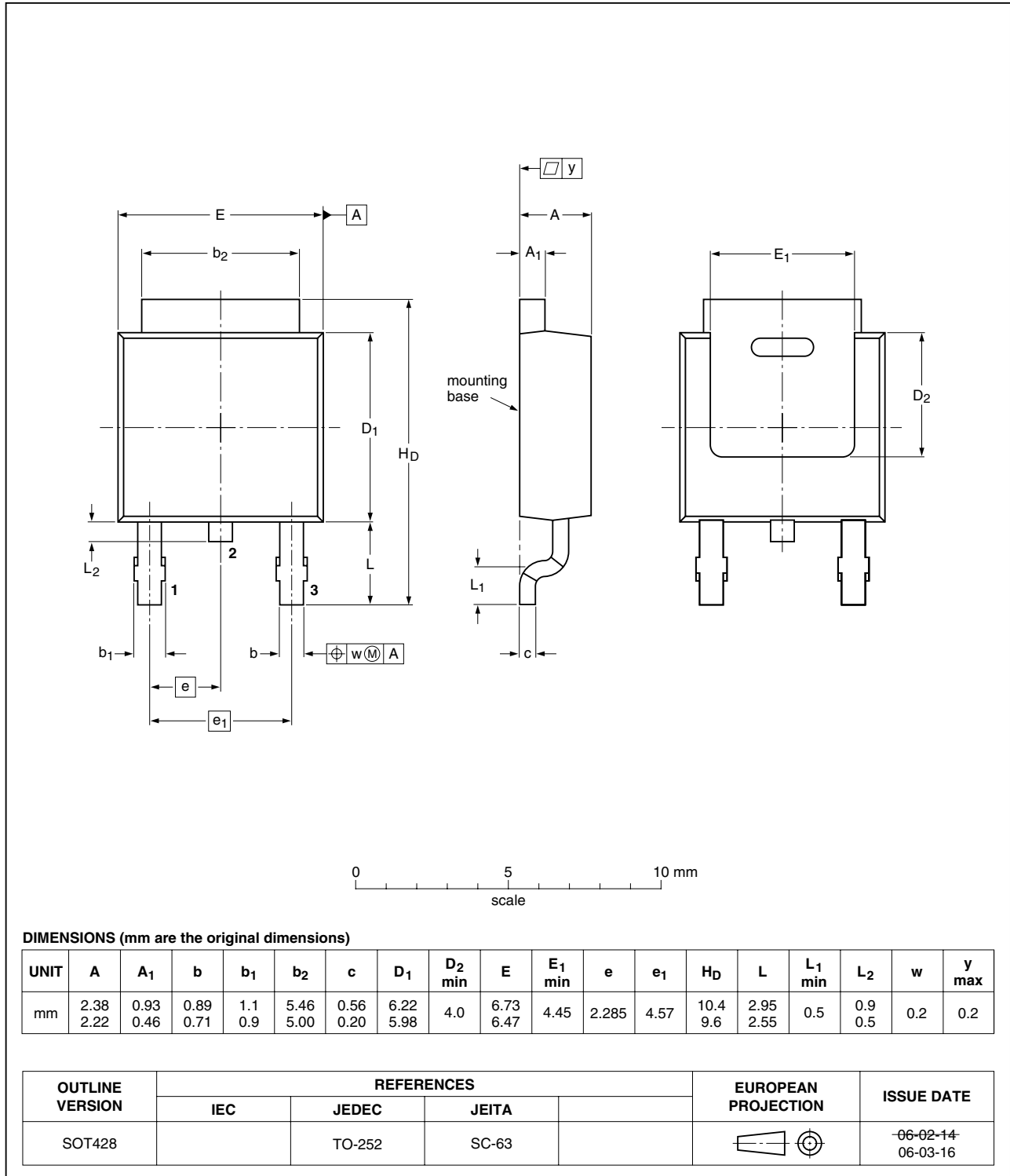


Fig 16. Package outline SOT428 (DPAK)



## 8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PSMN025-100D_3	20081120	Product data sheet	-	PSMN025-100D_2
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>		
PSMN025-100D_2	19990801	Product data sheet	-	PSMN025-100D_1
PSMN025-100D_1	19990201	Objective data sheet	-	-

## 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.nxp.com>.

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