

BSH111

N-channel enhancement mode field-effect transistor

Rev. 02 — 26 April 2002

Product data

1. Description

N-channel enhancement mode field-effect transistor in a plastic package using TrenchMOS™ technology.

Product availability:

BSH111 in SOT23.

2. Features

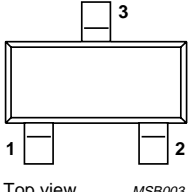
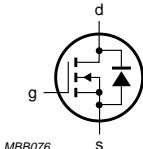
- TrenchMOS™ technology
- Very fast switching
- Low threshold voltage
- Subminiature surface mount package.

3. Applications

- Battery management
- High speed switch
- Logic level translator.

4. Pinning information

Table 1: Pinning - SOT23, simplified outline and symbol

Pin	Description	Simplified outline	Symbol
1	gate (g)	 <p>Top view MSB003</p> <p>SOT23</p>	 <p>MBB076</p>
2	source (s)		
3	drain (d)		

5. Quick reference data

Table 2: Quick reference data

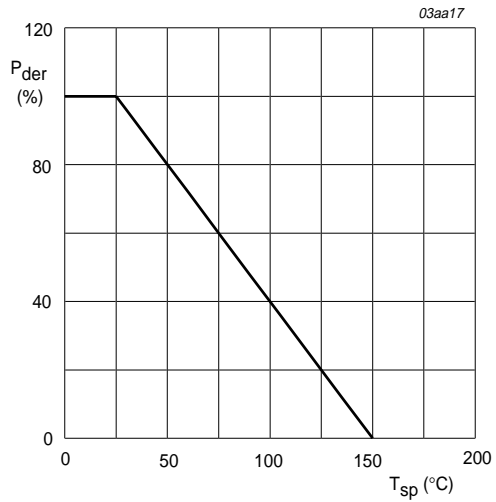
Symbol	Parameter	Conditions	Typ	Max	Unit
V_{DS}	drain-source voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	55	V
I_D	drain current (DC)	$T_{sp} = 25\text{ °C}; V_{GS} = 4.5\text{ V}$	-	335	mA
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C}$	-	0.83	W
T_j	junction temperature		-	150	°C
R_{DSon}	drain-source on-state resistance	$V_{GS} = 4.5\text{ V}; I_D = 500\text{ mA}$	2.3	4.0	Ω
		$V_{GS} = 2.5\text{ V}; I_D = 75\text{ mA}$	2.4	5.0	Ω
		$V_{GS} = 1.8\text{ V}; I_D = 75\text{ mA}$	3.1	8.0	Ω

6. Limiting values

Table 3: Limiting values

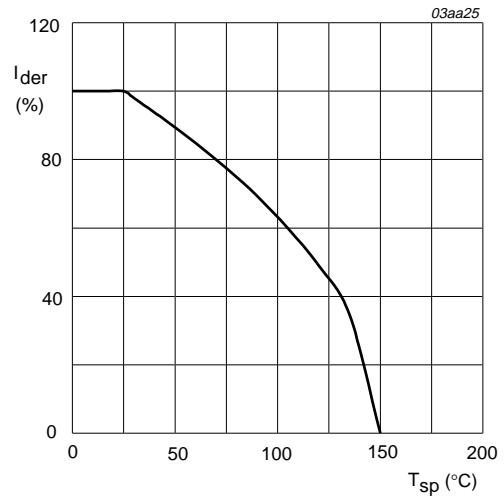
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	55	V
V_{DGR}	drain-gate voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}; R_{GS} = 20\text{ k}\Omega$	-	55	V
V_{GS}	gate-source voltage		-	± 10	V
I_D	drain current (DC)	$T_{sp} = 25\text{ °C}; V_{GS} = 4.5\text{ V};$ Figure 2 and 3	-	335	mA
		$T_{sp} = 100\text{ °C}; V_{GS} = 4.5\text{ V};$ Figure 2	-	212	mA
I_{DM}	peak drain current	$T_{sp} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s};$ Figure 3	-	1.3	A
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C};$ Figure 1	-	0.83	W
T_{stg}	storage temperature		-65	+150	°C
T_j	junction temperature		-65	+150	°C
Source-drain diode					
I_S	source (diode forward) current (DC)	$T_{sp} = 25\text{ °C}$	-	335	mA
I_{SM}	peak source (diode forward) current	$T_{sp} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s}$	-	1.3	A



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

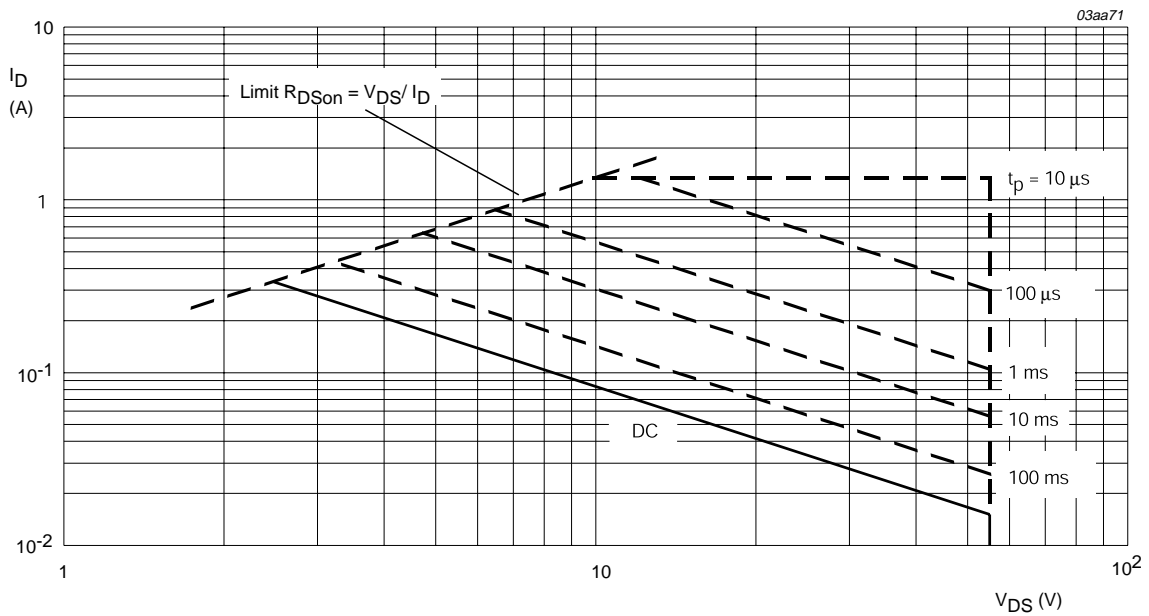
Fig 1. Normalized total power dissipation as a function of solder point temperature.



$$V_{GS} \geq 4.5 \text{ V}$$

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

Fig 2. Normalized continuous drain current as a function of solder point temperature.



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

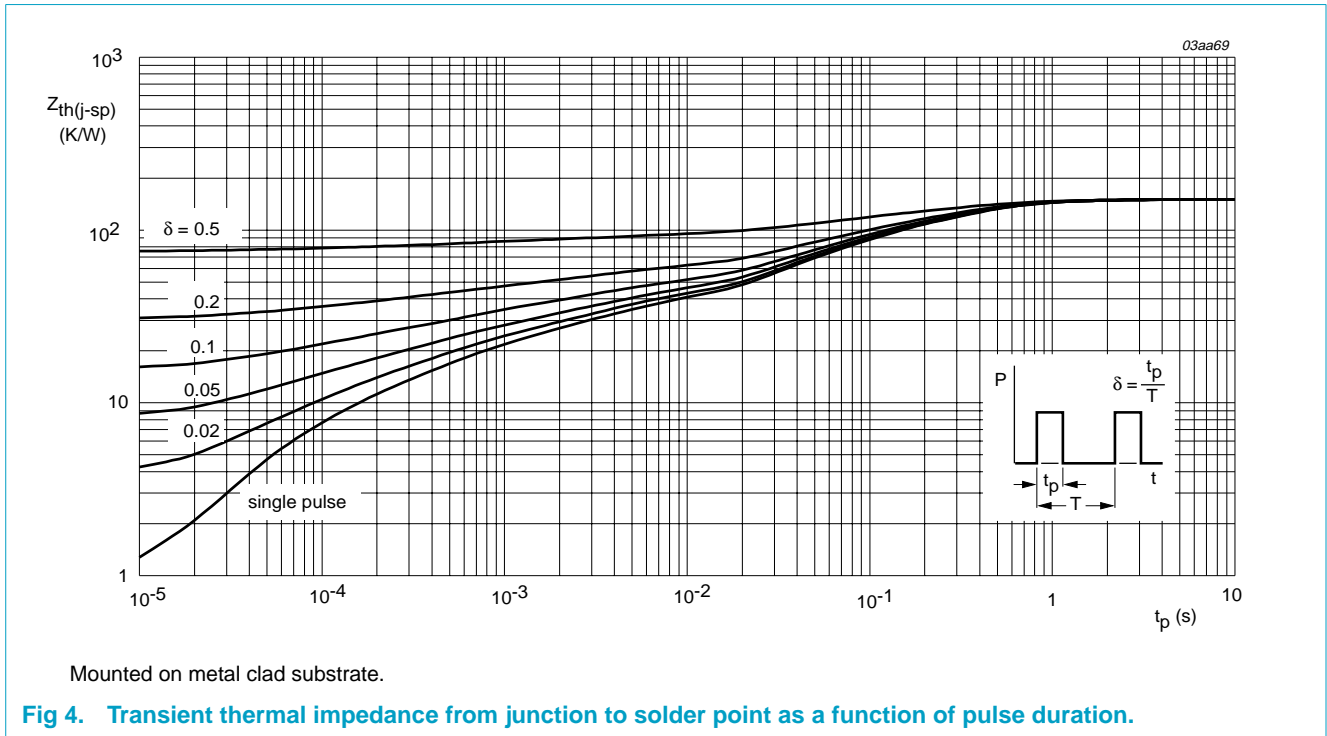
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

7. Thermal characteristics

Table 4: Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	mounted on metal clad substrate; Figure 4	-	-	150	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	minimum footprint; mounted on printed circuit board	-	350	-	K/W

7.1 Transient thermal impedance



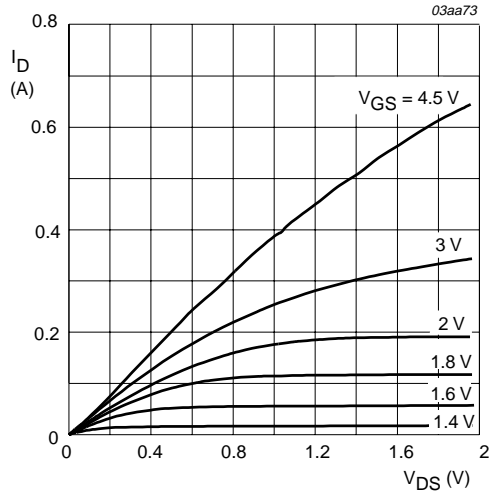
8. Characteristics

Table 5: Characteristics
 $T_j = 25\text{ °C}$ unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 10\text{ }\mu\text{A}$; $V_{GS} = 0\text{ V}$					
		$T_j = 25\text{ °C}$	55	75	-	V	
		$T_j = -55\text{ °C}$	50	-	-	V	
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 1\text{ mA}$; $V_{DS} = V_{GS}$; Figure 9					
		$T_j = 25\text{ °C}$	0.4	1.0	1.3	V	
		$T_j = 150\text{ °C}$	0.3	-	-	V	
		$T_j = -55\text{ °C}$	-	-	2.5	V	
I_{DSS}	drain-source leakage current	$V_{DS} = 44\text{ V}$; $V_{GS} = 0\text{ V}$					
		$T_j = 25\text{ °C}$	-	0.01	1.0	μA	
		$T_j = 150\text{ °C}$	-	-	10	μA	
I_{GSS}	gate-source leakage current	$V_{GS} = \pm 8\text{ V}$; $V_{DS} = 0\text{ V}$	-	10	100	nA	
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 2.5\text{ V}$; $I_D = 75\text{ mA}$; Figure 7 and 8					
		$T_j = 25\text{ °C}$	-	2.4	5	Ω	
		$T_j = 150\text{ °C}$	-	-	7.4	Ω	
		$V_{GS} = 4.5\text{ V}$; $I_D = 500\text{ mA}$; Figure 7 and 8					
		$T_j = 25\text{ °C}$	-	2.3	4	Ω	
		$V_{GS} = 1.8\text{ V}$; $I_D = 75\text{ mA}$; Figure 7 and 8					
$T_j = 25\text{ °C}$	-	3.1	8	Ω			
Dynamic characteristics							
g_{fs}	forward transconductance	$V_{DS} = 10\text{ V}$; $I_D = 200\text{ mA}$; Figure 11	100	380	-	mS	
$Q_{g(tot)}$	total gate charge	$I_D = 0.5\text{ A}$; $V_{DS} = 44\text{ V}$;	-	1.0	-	nC	
Q_{gs}	gate-source charge	$V_{GS} = 8\text{ V}$; Figure 14	-	0.05	-	nC	
Q_{gd}	gate-drain (Miller) charge		-	0.5	-	nC	
C_{iss}	input capacitance	$V_{GS} = 0\text{ V}$; $V_{DS} = 10\text{ V}$;	-	17	40	pF	
C_{oss}	output capacitance	$f = 1\text{ MHz}$; Figure 12	-	7	30	pF	
C_{rss}	reverse transfer capacitance		-	4	10	pF	
t_{on}	turn-on time	$V_{DD} = 50\text{ V}$; $R_D = 250\text{ }\Omega$;	-	4	10	ns	
t_{off}	turn-off time	$V_{GS} = 10\text{ V}$; $R_G = 50\text{ }\Omega$; $R_{GS} = 50\text{ }\Omega$	-	11	15	ns	

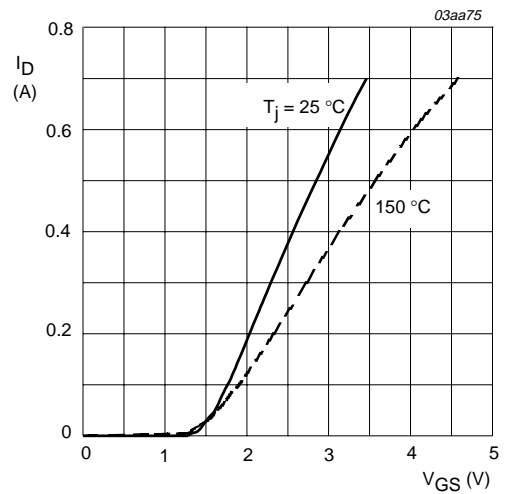
Table 5: Characteristics...continued*T_j = 25 °C unless otherwise specified*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Source-drain diode						
V _{SD}	source-drain (diode forward) voltage	I _S = 300 mA; V _{GS} = 0 V; Figure 13	-	0.95	1.5	V
t _{rr}	reverse recovery time	I _S = 300 mA;	-	30	-	ns
Q _r	recovered charge	dI _S /dt = -100 A/μs; V _{GS} = 0 V; V _{DS} = 25 V	-	30	-	nC



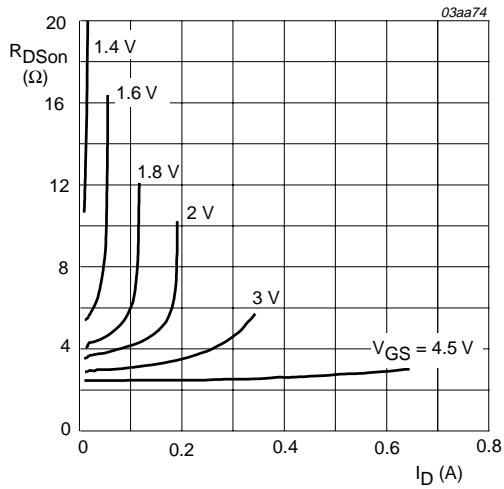
$T_j = 25\text{ }^\circ\text{C}$

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



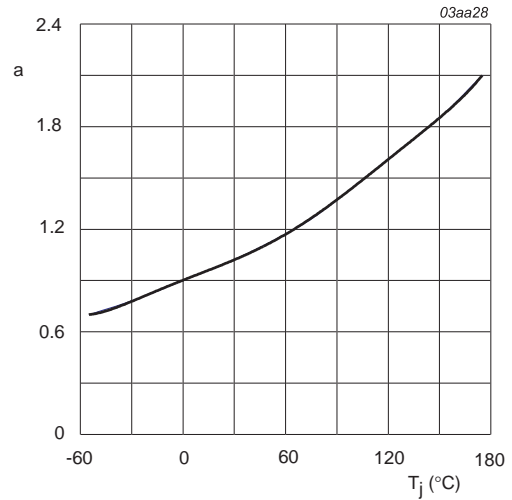
$T_j = 25\text{ }^\circ\text{C}$ and $150\text{ }^\circ\text{C}$; $V_{DS} > I_D \times R_{DSon}$

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



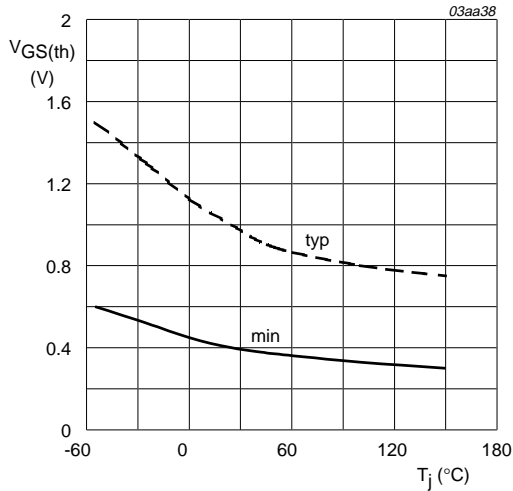
$T_j = 25\text{ }^\circ\text{C}$

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



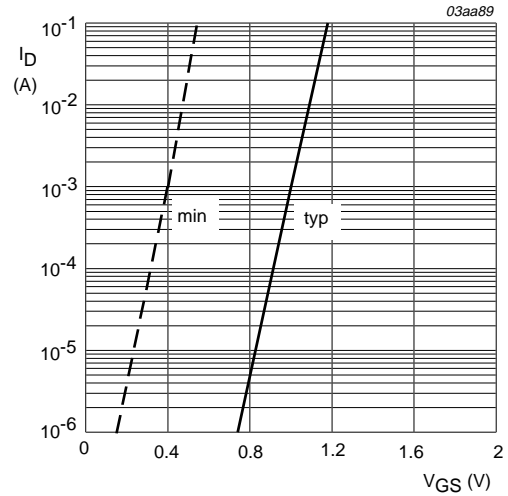
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.



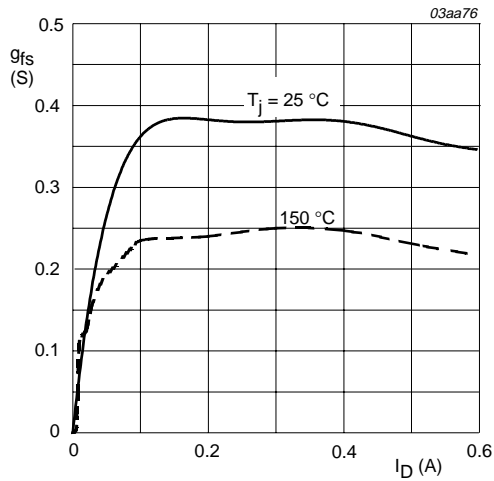
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

Fig 9. Gate-source threshold voltage as a function of junction temperature.



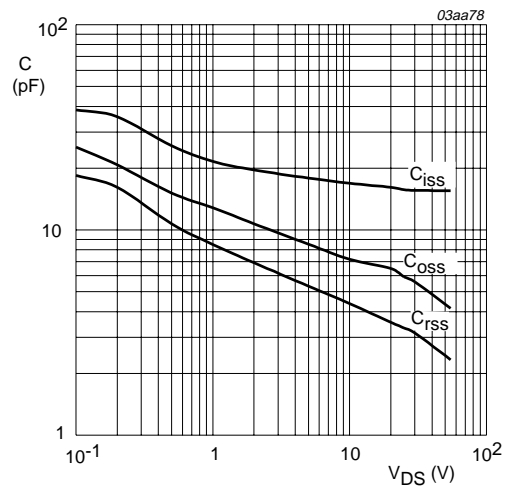
$T_J = 25 \text{ }^\circ\text{C}; V_{DS} = 5 \text{ V}$

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



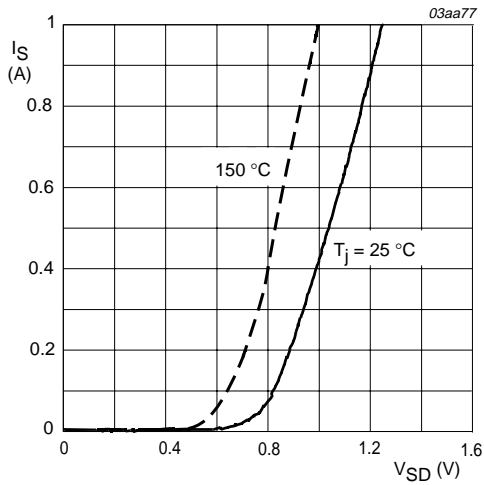
$T_J = 25 \text{ }^\circ\text{C and } 150 \text{ }^\circ\text{C}; V_{DS} > I_D \times R_{DS(on)}$

Fig 11. Forward transconductance as a function of drain current; typical values.



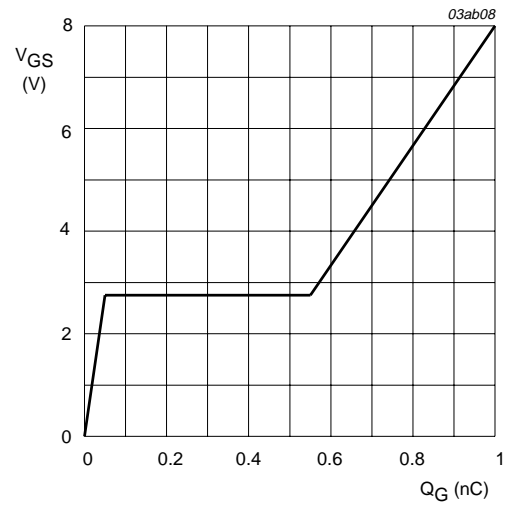
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

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



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

Fig 13. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.



$I_D = 0.5\text{ A}$; $V_{DS} = 44\text{ V}$

Fig 14. Gate-source voltage as a function of gate charge; typical values.

9. Package outline

Plastic surface mounted package; 3 leads

SOT23

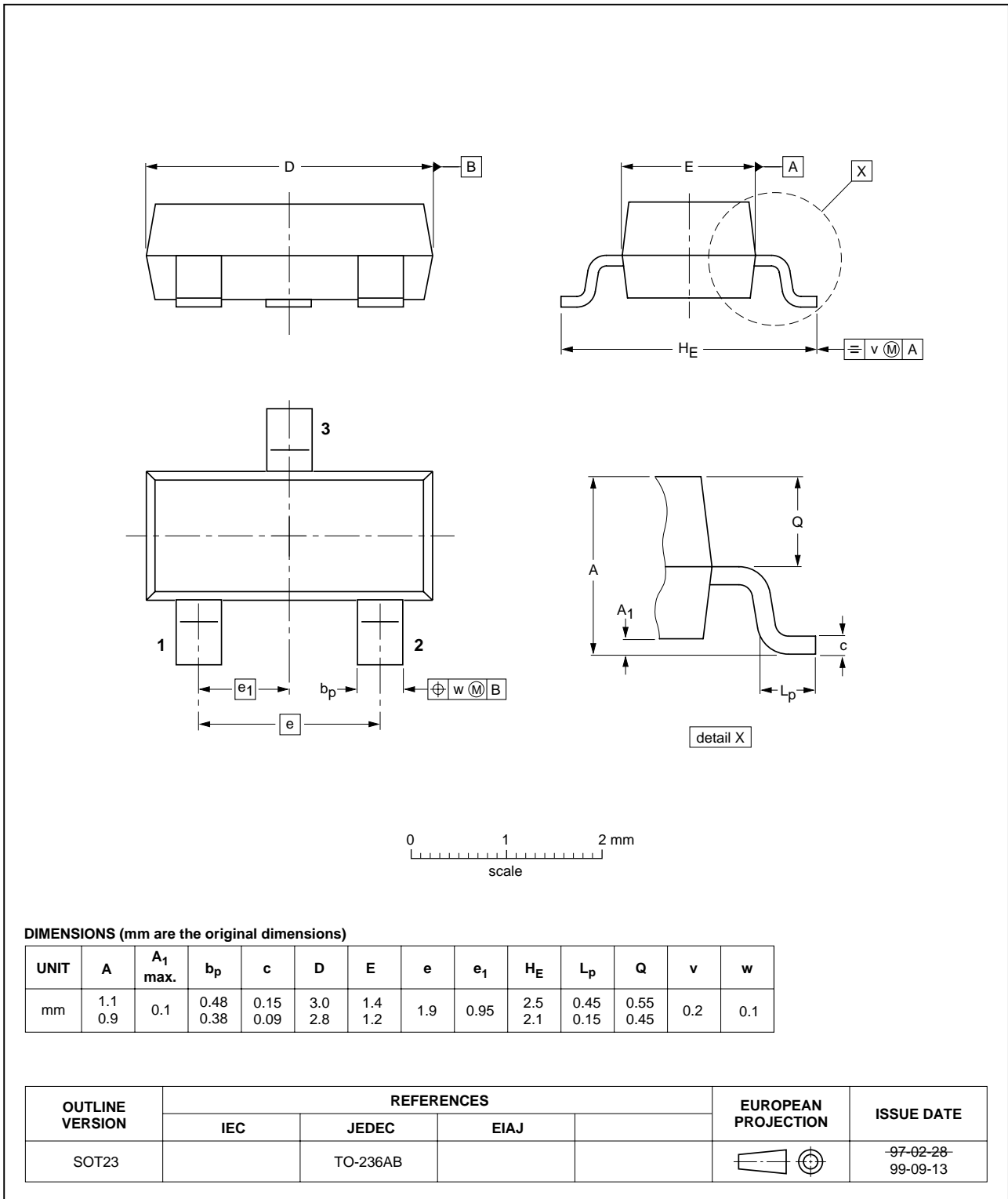


Fig 15. SOT23.

10. Revision history

Table 6: Revision history

Rev	Date	CPCN	Description
02	20020426	-	Product data (9397 750 09629) Modifications • V_{GS} data updated.
01	20000807	-	Product specification; initial version.

11. Data sheet status

Data sheet status ^[1]	Product status ^[2]	Definition
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

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