

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

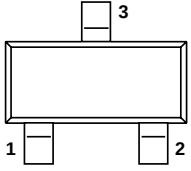
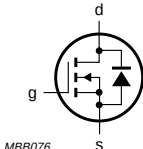
- TrenchMOS™ technology
- Very fast switching
- Low threshold voltage
- Subminiature surface mount package.

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)	 Top view MSB003 SOT23	 MBB076
2	source (s)		
3	drain (d)		

5. Quick reference data

Table 2: Quick reference data

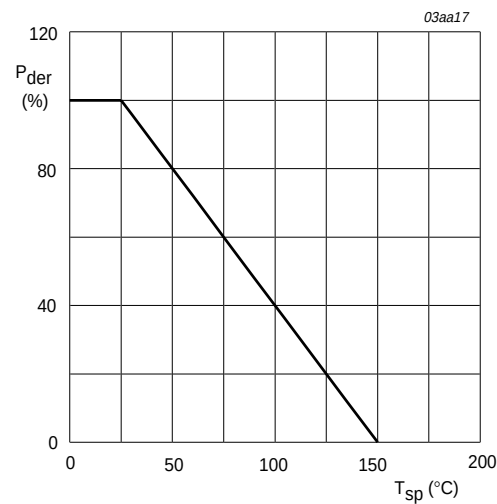
Symbol	Parameter	Conditions	Typ	Max	Unit
V_{DS}	drain-source voltage (DC)	$25\text{ °C} \leq T_j \leq 150\text{ °C}$	-	55	V
I_D	drain current (DC)	$T_{sp} = 25\text{ °C}; V_{GS} = 4.5\text{ V}$	-	335	mA
P_{tot}	total power dissipation	$T_{sp} = 25\text{ °C}$	-	0.83	W
T_j	junction temperature		-	150	°C
$R_{DS(on)}$	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

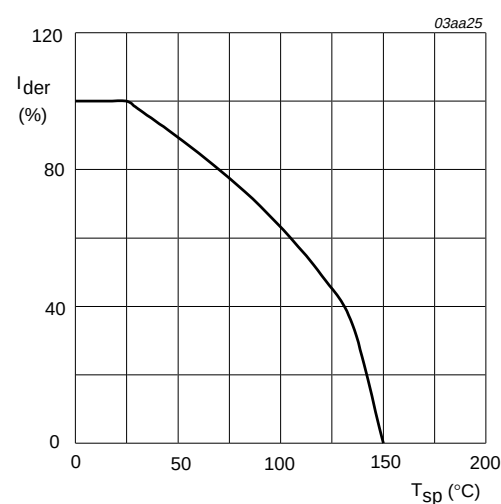
In accordance with the Absolute Maximum Rating System (IEC 60134).

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



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

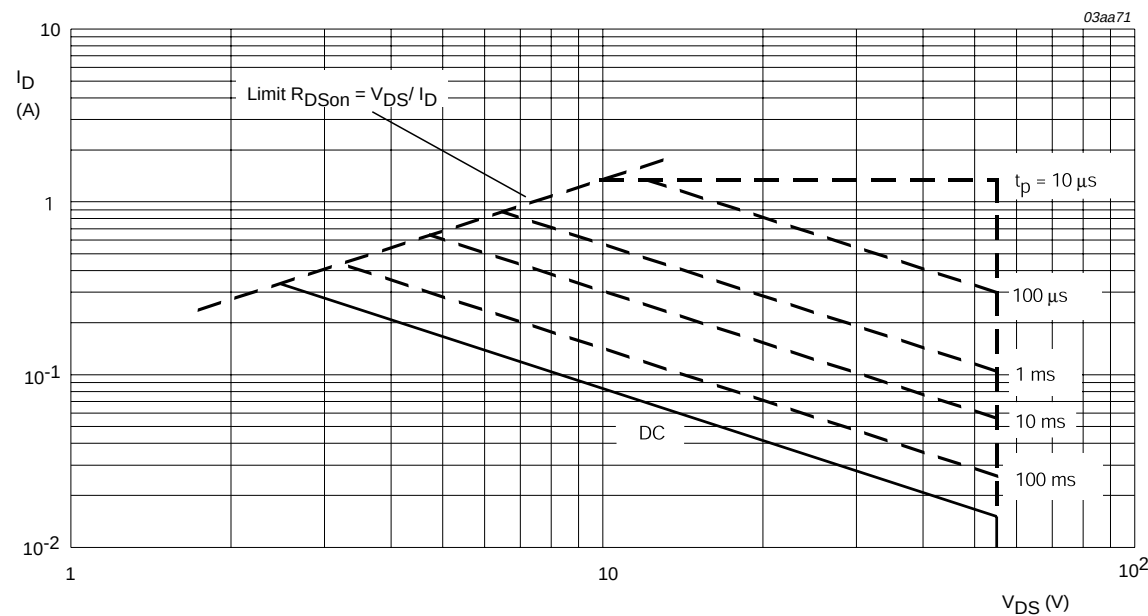
Fig 1. Normalized total power dissipation as a function of solder point temperature.



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

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

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



$T_{sp} = 25$ °C; I_{DM} is single pulse.

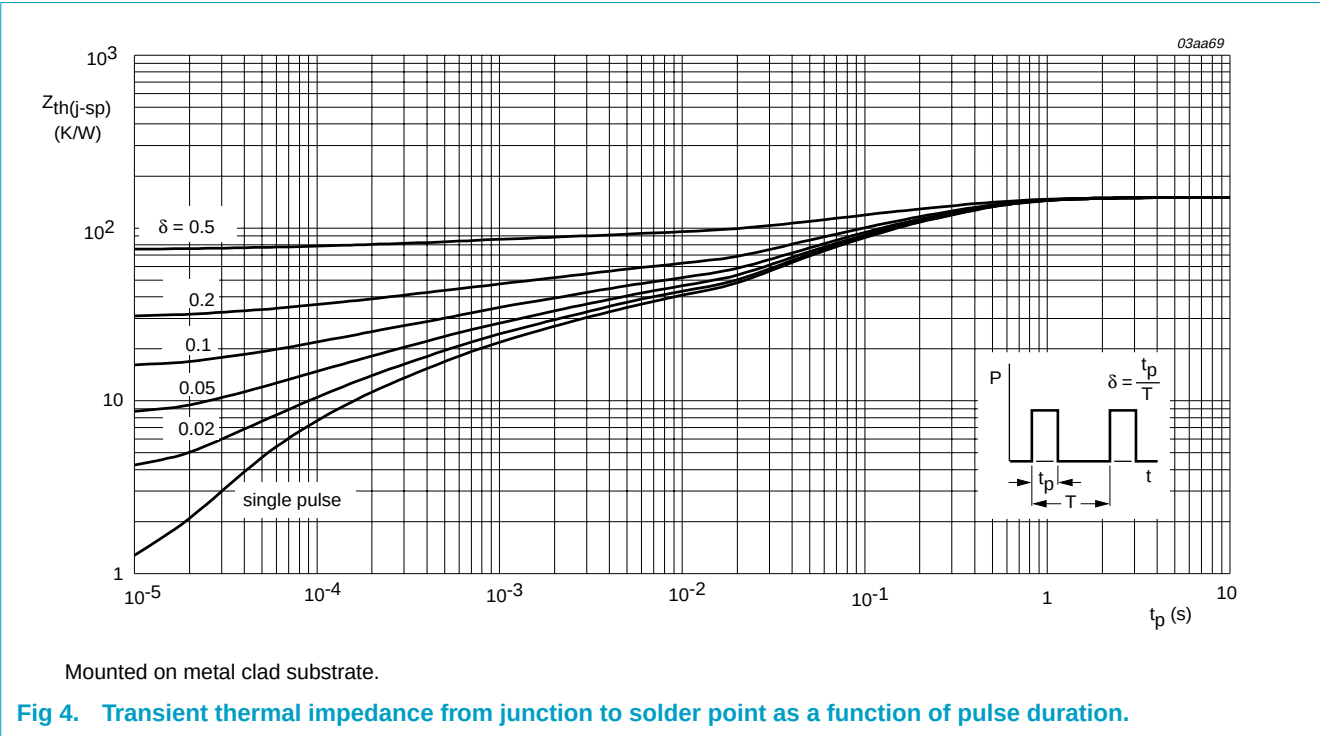
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

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

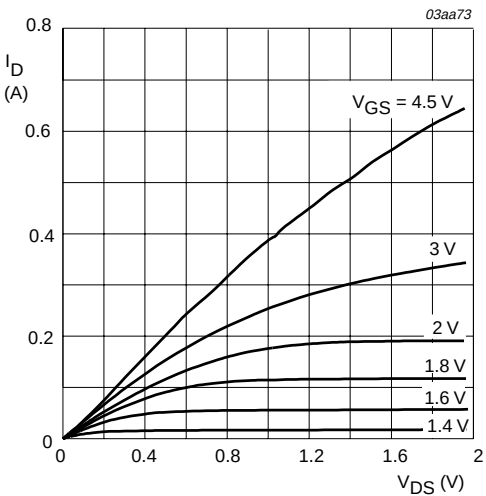
Table 5: Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
V _{(BR)DSS}	drain-source breakdown voltage	I _D = 10 μA; V _{GS} = 0 V				
		T _J = 25 °C	55	75	-	V
		T _J = −55 °C	50	-	-	V
V _{GS(th)}	gate-source threshold voltage	I _D = 1 mA; V _{DS} = V _{GS} ; Figure 9				
		T _J = 25 °C	0.4	1.0	1.3	V
		T _J = 150 °C	0.3	-	-	V
		T _J = −55 °C	-	-	2.5	V
I _{DSS}	drain-source leakage current	V _{DS} = 44 V; V _{GS} = 0 V				
		T _J = 25 °C	-	0.01	1.0	μA
		T _J = 150 °C	-	-	10	μA
I _{GSS}	gate-source leakage current	V _{GS} = ±8 V; V _{DS} = 0 V	-	10	100	nA
R _{DSon}	drain-source on-state resistance	V _{GS} = 2.5 V; I _D = 75 mA; Figure 7 and 8				
		T _J = 25 °C	-	2.4	5	Ω
		T _J = 150 °C	-	-	7.4	Ω
		V _{GS} = 4.5 V; I _D = 500 mA; Figure 7 and 8				
		T _J = 25 °C	-	2.3	4	Ω
		V _{GS} = 1.8 V; I _D = 75 mA; Figure 7 and 8				
		T _J = 25 °C	-	3.1	8	Ω
Dynamic characteristics						
g _{fs}	forward transconductance	V _{DS} = 10 V; I _D = 200 mA; Figure 11	100	380	-	mS
Q _{g(tot)}	total gate charge	I _D = 0.5 A; V _{DS} = 44 V;	-	1.0	-	nC
Q _{gs}	gate-source charge	V _{GS} = 8 V; Figure 14	-	0.05	-	nC
Q _{gd}	gate-drain (Miller) charge		-	0.5	-	nC
C _{iss}	input capacitance	V _{GS} = 0 V; V _{DS} = 10 V;	-	17	40	pF
C _{oss}	output capacitance	f = 1 MHz; Figure 12	-	7	30	pF
C _{rss}	reverse transfer capacitance		-	4	10	pF
t _{on}	turn-on time	V _{DD} = 50 V; R _D = 250 Ω;	-	4	10	ns
t _{off}	turn-off time	V _{GS} = 10 V; R _G = 50 Ω; R _{GS} = 50 Ω	-	11	15	ns

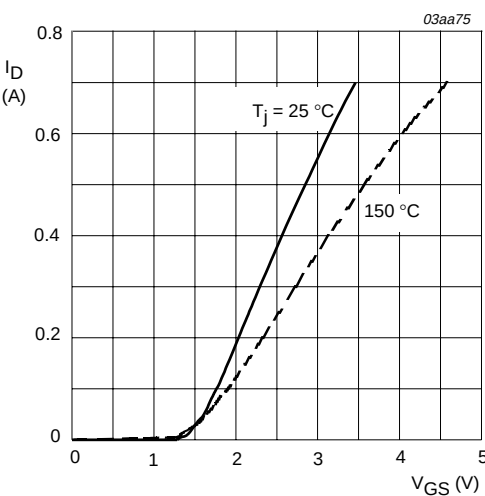
Table 5: Characteristics...continued
T_j = 25 °C unless otherwise specified

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



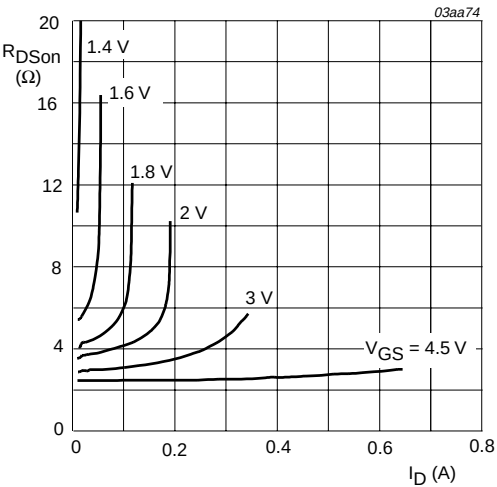
$T_j = 25^\circ\text{C}$

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



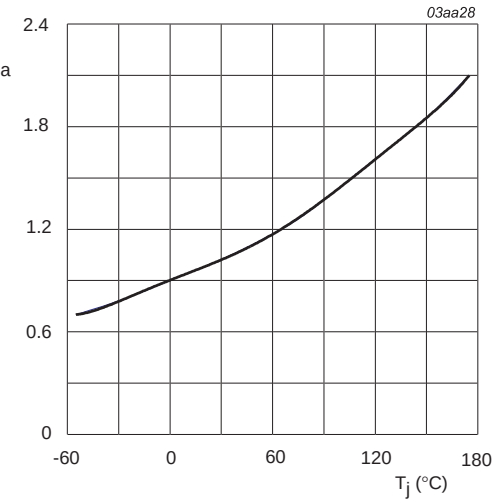
$T_j = 25^\circ\text{C}$ and 150°C ; $V_{DS} > I_D \times R_{DSon}$

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



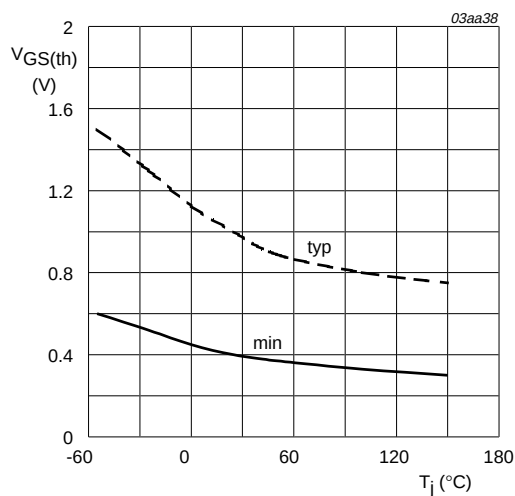
$T_j = 25^\circ\text{C}$

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



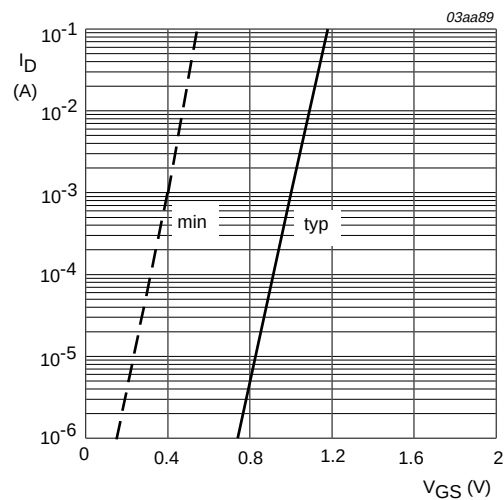
$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

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



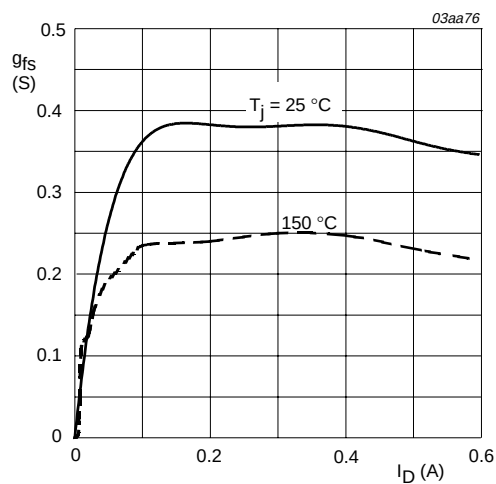
$I_D = 1 \text{ mA}$; $V_{DS} = V_{GS}$

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



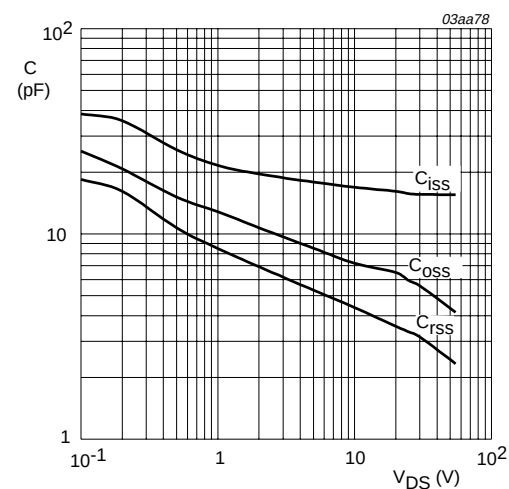
$T_J = 25 \text{ }^\circ\text{C}$; $V_{DS} = 5 \text{ V}$

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



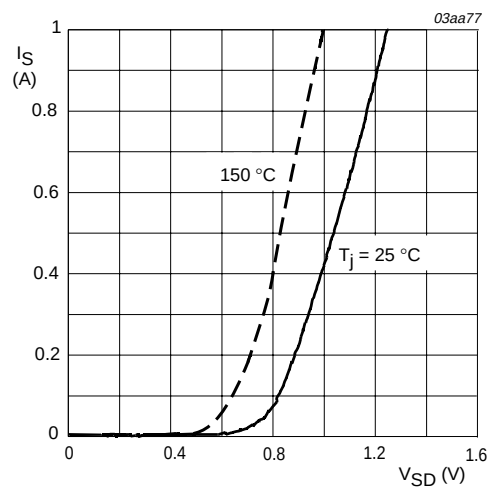
$T_J = 25 \text{ }^\circ\text{C}$ and $150 \text{ }^\circ\text{C}$; $V_{DS} > I_D \times R_{DS(on)}$

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



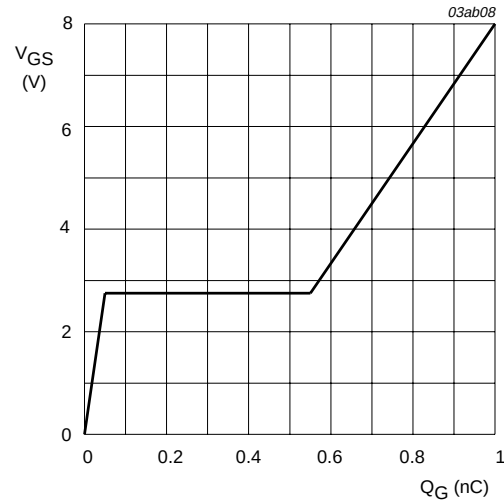
$V_{GS} = 0 \text{ V}$; $f = 1 \text{ MHz}$

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



$T_j = 25\text{ °C}$ 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

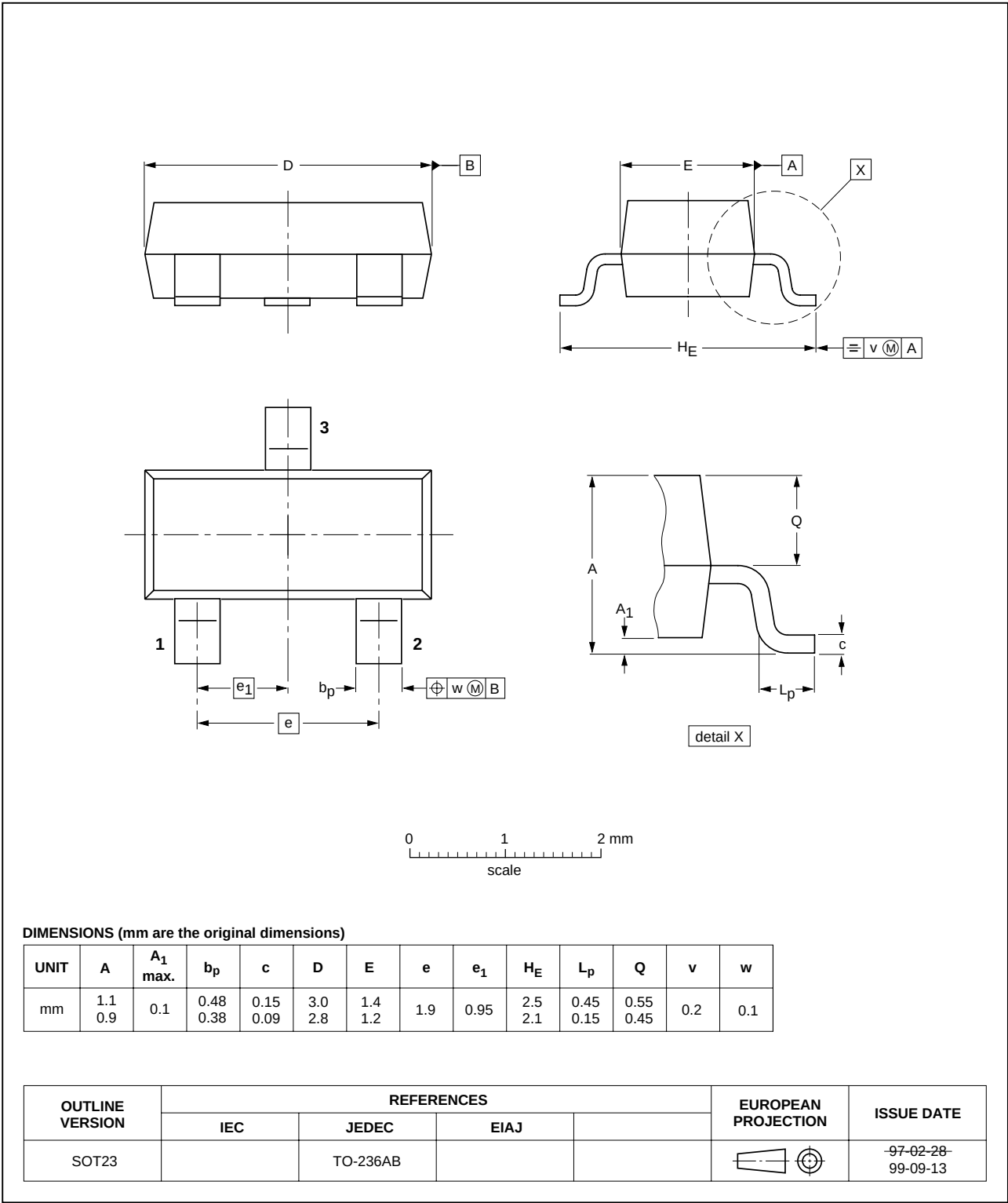


Fig 15. SOT23.

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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