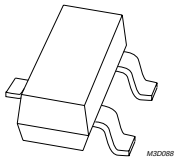


BSH111

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

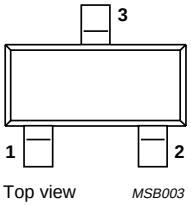
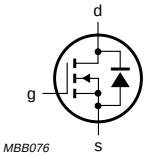
- TrenchMOS™ technology
- Very fast switching
- Low threshold voltage
- Subminiature surface mount package.

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)		
2	source (s)		
3	drain (d)		

SOT23

5. Quick reference data

Table 2: Quick reference data

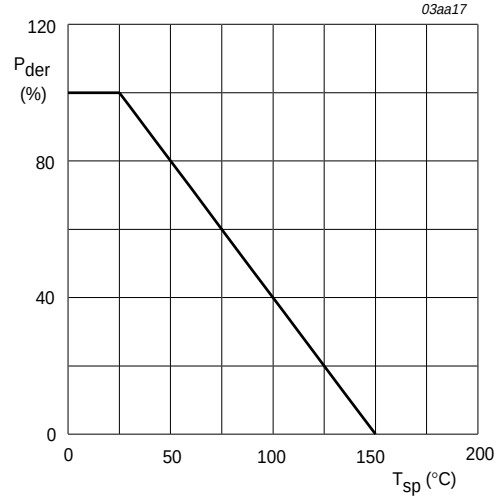
Symbol	Parameter	Conditions	Typ	Max	Unit
V_{DS}	drain-source voltage (DC)	25 °C ≤ T_j ≤ 150 °C	-	55	V
I_D	drain current (DC)	T_{sp} = 25 °C; V_{GS} = 4.5 V	-	335	mA
P_{tot}	total power dissipation	T_{sp} = 25 °C	-	0.83	W
T_j	junction temperature		-	150	°C
R_{DSon}	drain-source on-state resistance	V_{GS}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

6. Limiting values

Table 3: Limiting values

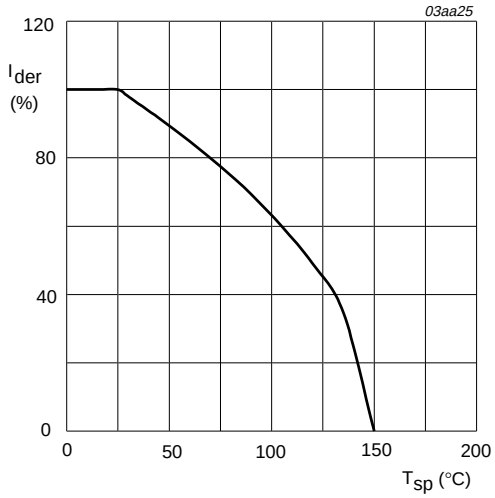
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage (DC)	25 °C ≤ T_j ≤ 150 °C	-	55	V
V_{DGR}	drain-gate voltage (DC)	25 °C ≤ T_j ≤ 150 °C; R_{GS} = 20 kΩ	-	55	V
V_{GS}	gate-source voltage		-	±10	V
I_D	drain current (DC)	T_{sp} = 25 °C; V_{GS} = 4.5 V; Figure 2 and 3	-	335	mA
		T_{sp} = 100 °C; V_{GS} = 4.5 V; Figure 2	-	212	mA
I_{DM}	peak drain current	T_{sp} = 25 °C; pulsed; t_p ≤ 10 µs; Figure 3	-	1.3	A
P_{tot}	total power dissipation	T_{sp} = 25 °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 °C	-	335	mA
I_{SM}	peak source (diode forward) current	T_{sp} = 25 °C; pulsed; t_p ≤ 10 µs	-	1.3	A



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

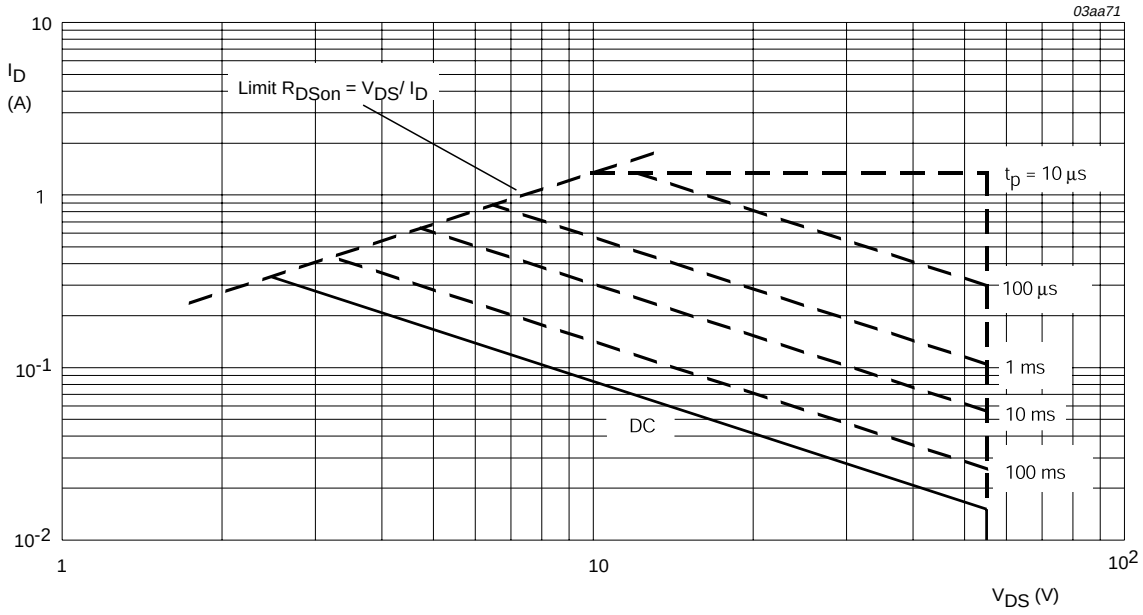
Fig 1. Normalized total power dissipation as a function of solder point temperature.



$V_{GS} \geq 4.5$ 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.

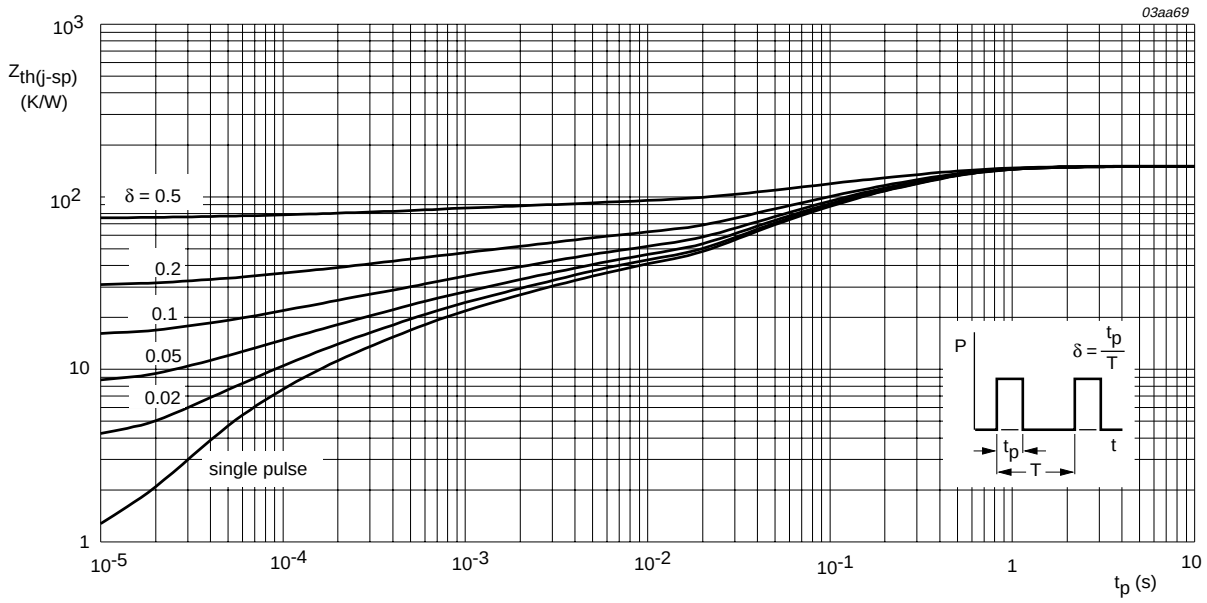
Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage.

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



Mounted on metal clad substrate.

Fig 4. Transient thermal impedance from junction to solder point as a function of pulse duration.

8. Characteristics

Table 5: Characteristics

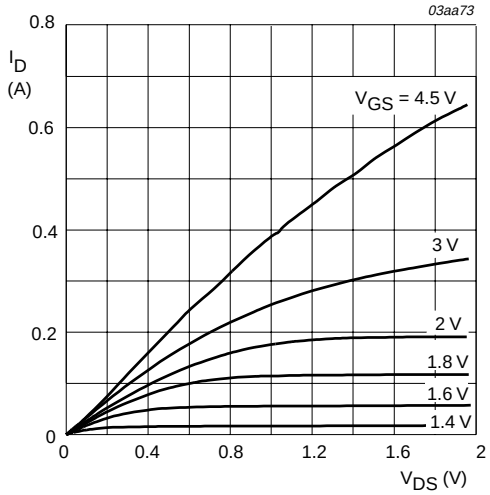
T_j = 25 °C unless otherwise specified

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; V_{GS} = 8 V; Figure 14	-	1.0	-	nC
Q_{gs}	gate-source charge		-	0.05	-	nC
Q_{gd}	gate-drain (Miller) charge		-	0.5	-	nC
C_{iss}	input capacitance	V_{GS} = 0 V; V_{DS} = 10 V; f = 1 MHz; Figure 12	-	17	40	pF
C_{oss}	output capacitance		-	7	30	pF
C_{rss}	reverse transfer capacitance		-	4	10	pF
t_{on}	turn-on time	V_{DD} = 50 V; R_D = 250 Ω; V_{GS} = 10 V; R_G = 50 Ω; R_{GS} = 50 Ω	-	4	10	ns
t_{off}	turn-off time		-	11	15	ns

Table 5: Characteristics *...continued*

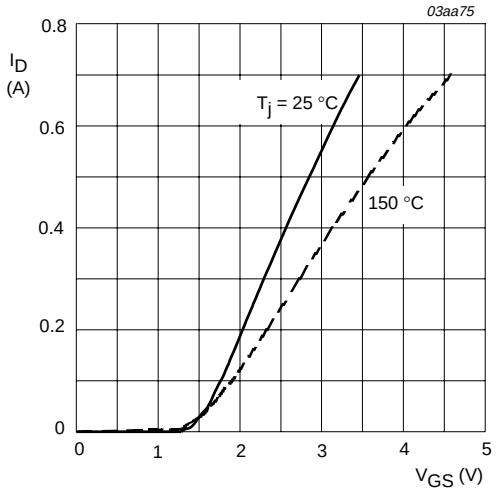
T_j = 25 °C unless otherwise specified

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; dI_S/dt = –100 A/µs; V_{GS} = 0 V; V_{DS} = 25 V	-	30	-	ns
Q_r	recovered charge		-	30	-	nC



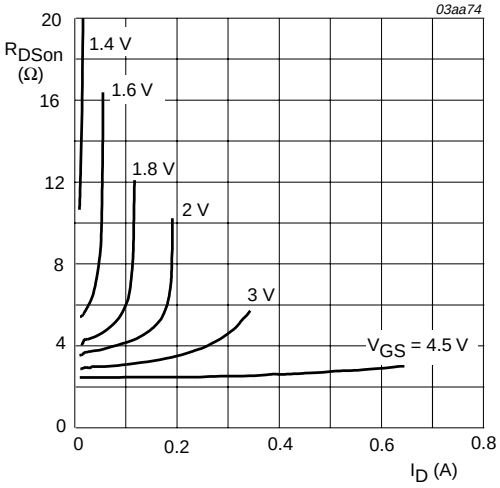
T_j = 25 °C

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



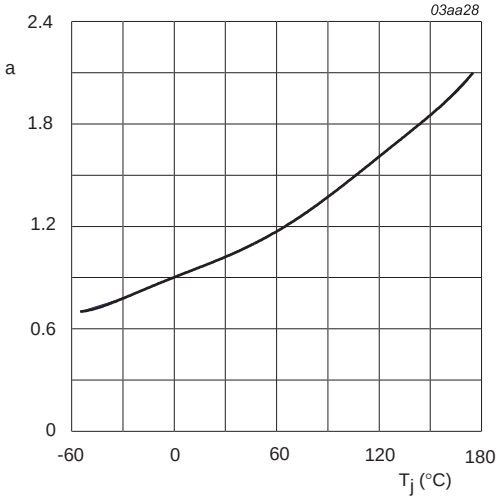
T_j = 25 °C and 150 °C; $V_{DS} > I_D \times R_{DSon}$

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



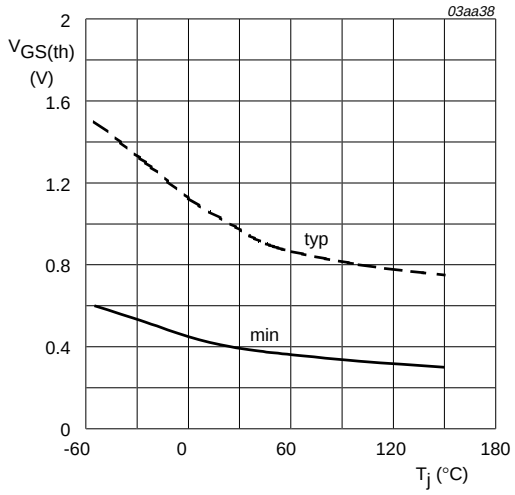
T_j = 25 °C

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



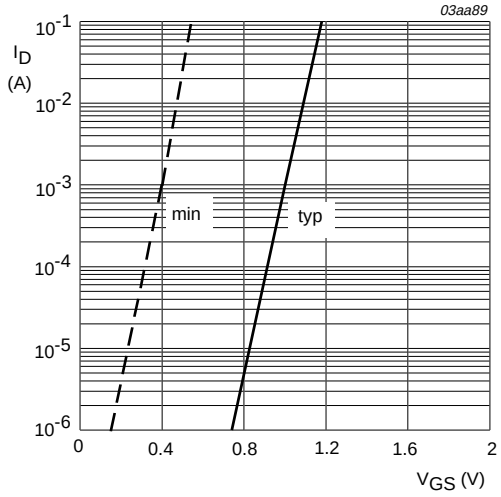
$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



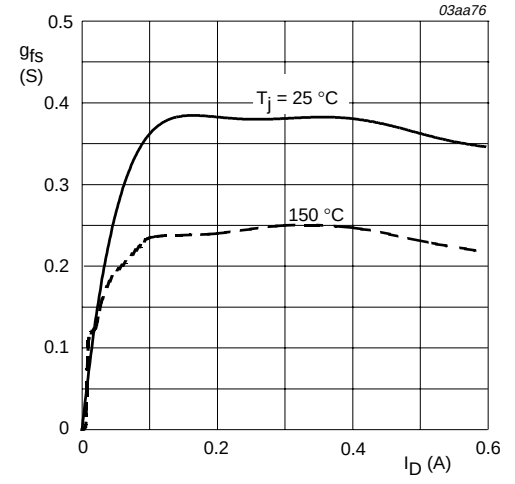
I_D = 1 mA; V_{DS} = V_{GS}

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



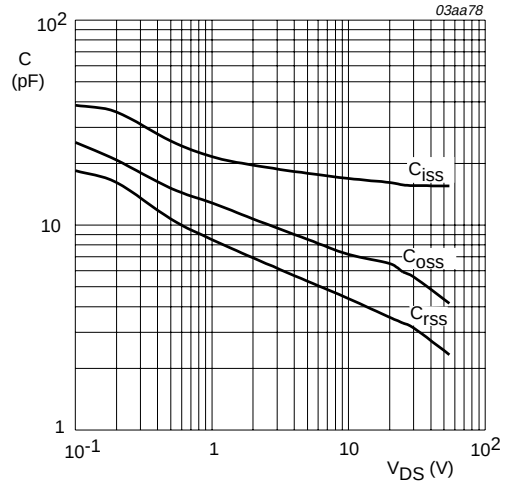
T_j = 25 °C; V_{DS} = 5 V

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



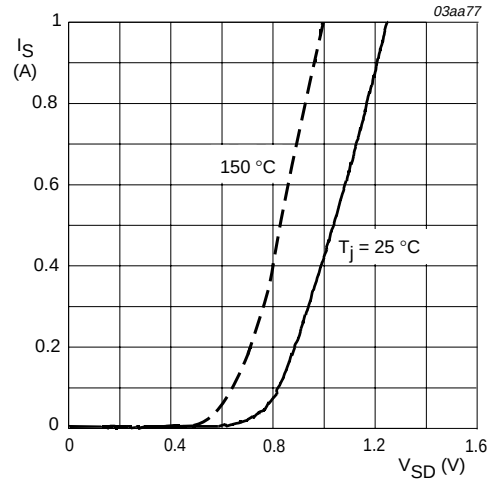
T_j = 25 °C and 150 °C; V_{DS} > I_D × R_{DSon}

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



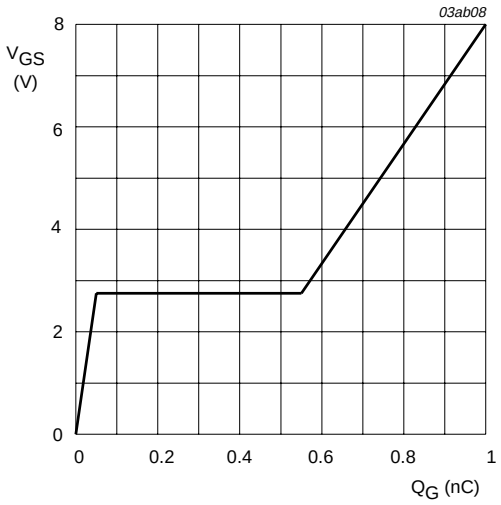
V_{GS} = 0 V; f = 1 MHz

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



T_j = 25 °C and 150 °C; V_{GS} = 0 V

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

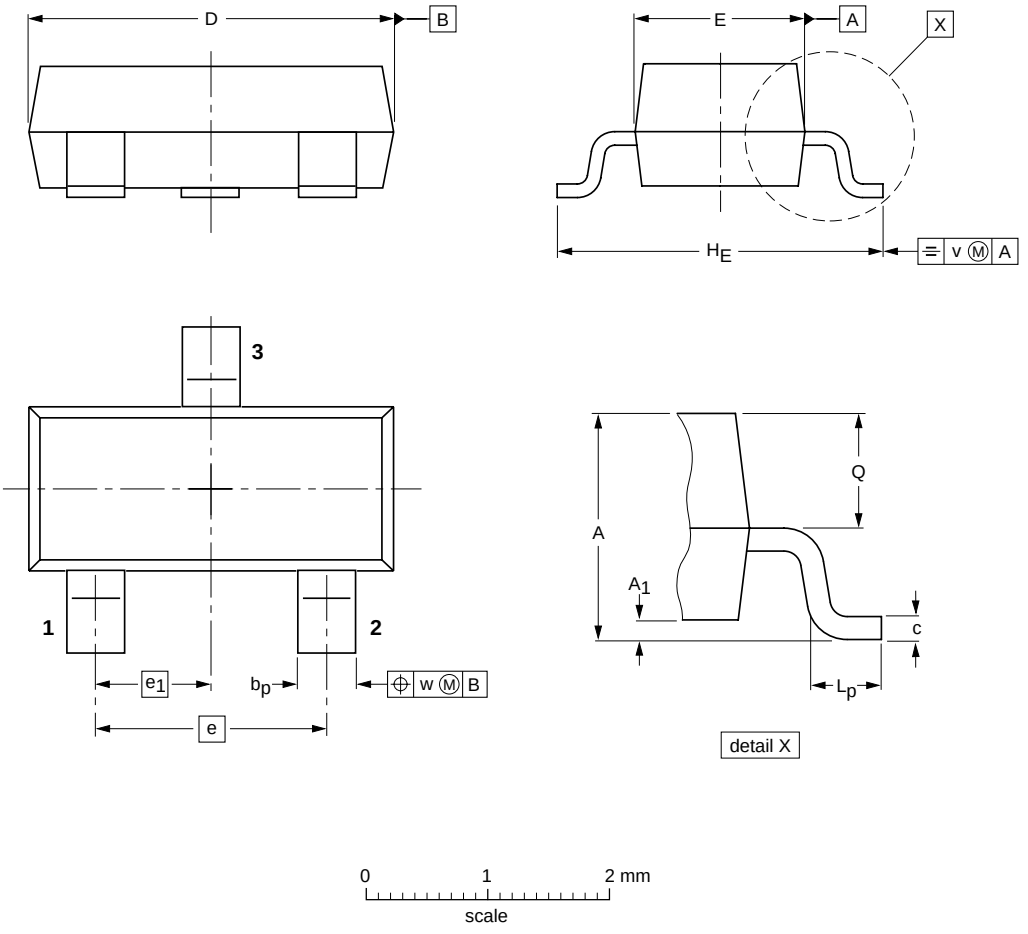


I_D = 0.5 A; V_{DS} = 44 V

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

9. Package outline

Plastic surface mounted package; 3 leads **SOT23**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max.	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT23		TO-236AB				~~97-02-28~~ 99-09-13

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.**