DATA SHEET

BSP250
P-channel enhancement mode vertical D-MOS transistor

Product specification
Supersedes data of November 1994
File under Discrete Semiconductors, SC13b

1997 Jun 20

Philips Semiconductors

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P-channel enhancement mode vertical D-MOS transistor

BSP250

FEATURES

- High-speed switching
- No secondary breakdown
- Very low on-resistance.

APPLICATIONS

- Low-loss motor and actuator drivers
- Power switching.

DESCRIPTION

P-channel enhancement mode vertical D-MOS transistor in a SOT223 plastic SMD package.

CAUTION
The device is supplied in an antistatic package. The gate-source input must be protected against static discharge during transport or handling.

PINNING - SOT223

PIN	SYMBOL	DESCRIPTION
1	g	gate
2	d	drain
3	s	source
4	d	drain

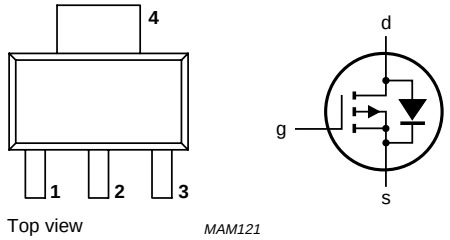


Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage (DC)		–	–30	V
V_{SD}	source-drain diode forward voltage	I_S = –1.25 A	–	–1.6	V
V_{GSO}	gate-source voltage (DC)	open drain	–	±20	V
V_{GSth}	gate-source threshold voltage	I_D = –1 mA; V_{DS} = V_{GS}	–1	–2.8	V
I_D	drain current (DC)		–	–3	A
R_{DSon}	drain-source on-state resistance	I_D = –1 A; V_{GS} = –10 V	–	0.25	Ω
P_{tot}	total power dissipation	T_s = 100 °C	–	5	W

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DS}	drain-source voltage (DC)		–	–30	V
V_{GSO}	gate-source voltage (DC)	open drain	–	±20	V
I_D	drain current (DC)	$T_s \leq 100$ °C	–	–3	A
I_{DM}	peak drain current	note 1	–	–12	A
P_{tot}	total power dissipation	$T_s = 100$ °C	–	5	W
		$T_{amb} = 25$ °C; note 2	–	1.65	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C
Source-drain diode					
I_S	source current (DC)	$T_s \leq 100$ °C	–	–1.5	A
I_{SM}	peak pulsed source current	note 1	–	–6	A

Notes

1. Pulse width and duty cycle limited by maximum junction temperature.
2. Device mounted on an epoxy printed-circuit board, 40 × 40 × 1.5 mm; mounting pad for drain lead minimum 6 cm^2.

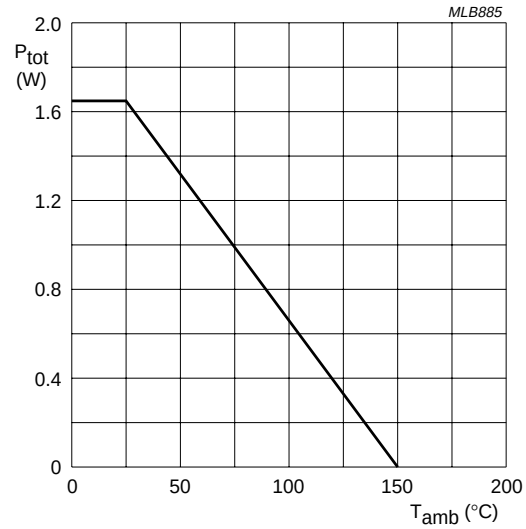
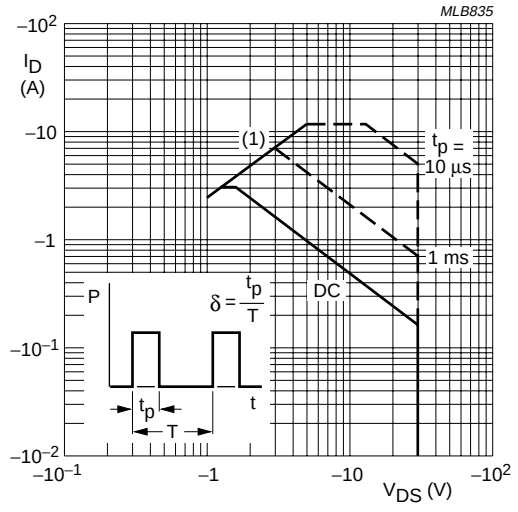


Fig.2 Power derating curve.



δ = 0.01.
Soldering point temperature $T_s = 100$ °C.
(1) R_{DSon} limitation.

Fig.3 SOAR.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	note 1	75	K/W
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point		10	K/W

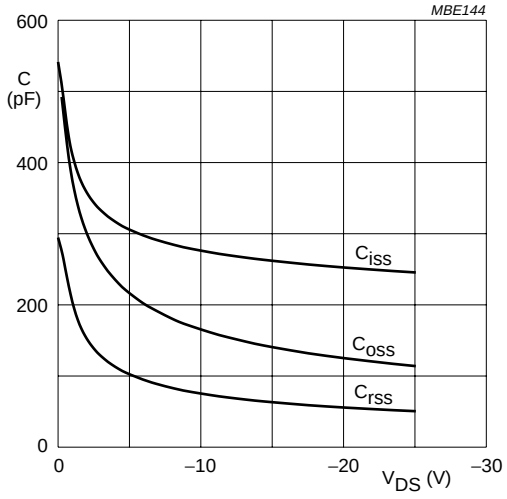
Note

1. Device mounted on an epoxy printed-circuit board, $40 \times 40 \times 1.5$ mm; mounting pad for drain lead minimum 6 cm^2.

CHARACTERISTICS

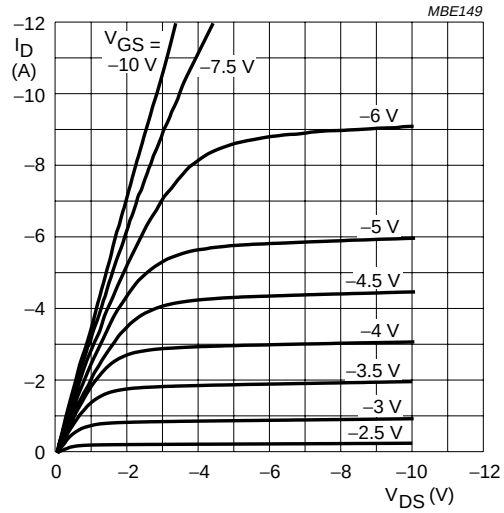
T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	drain-source breakdown voltage	V_{GS} = 0; I_D = –10 μA	–30	–	–	V
V_{GSth}	gate-source threshold voltage	V_{GS} = V_{DS}; I_D = –1 mA	–1	–	–2.8	V
I_{DSS}	drain-source leakage current	V_{GS} = 0; V_{DS} = –24 V	–	–	–100	nA
I_{GSS}	gate leakage current	V_{GS} = ±20 V; V_{DS} = 0	–	–	±100	nA
I_{Don}	on-state drain current	V_{GS} = –10 V; V_{DS} = –1 V	–3	–	–	A
		V_{GS} = –4.5 V; V_{DS} = –5 V	–1	–	–	A
R_{DSon}	drain-source on-state resistance	V_{GS} = –4.5 V; I_D = –0.5 A	–	0.33	0.4	Ω
		V_{GS} = –10 V; I_D = –1 A	–	0.22	0.25	Ω
$\lvert y_{fs} \rvert$	forward transfer admittance	V_{DS} = –20 V; I_D = –1 A	1	2	–	S
C_{iss}	input capacitance	V_{GS} = 0; V_{DS} = –20 V; f = 1 MHz	–	250	–	pF
C_{oss}	output capacitance	V_{GS} = 0; V_{DS} = –20 V; f = 1 MHz	–	140	–	pF
C_{rss}	reverse transfer capacitance	V_{GS} = 0; V_{DS} = –20 V; f = 1 MHz	–	50	–	pF
Q_G	total gate charge	V_{GS} = –10 V; V_{DS} = –15 V; I_D = –2.3 A	–	10	25	nC
Q_{GS}	gate-source charge	V_{GS} = –10 V; V_{DS} = –15 V; I_D = –2.3 A	–	1	–	nC
Q_{GD}	gate-drain charge	V_{GS} = –10 V; V_{DS} = –15 V; I_D = –2.3 A	–	3	–	nC
Switching times						
t_{on}	turn-on time	V_{GS} = 0 to –10 V; V_{DD} = –20 V; I_D = –1 A; R_L = 20 Ω	–	20	80	ns
t_{off}	turn-off time	V_{GS} = –10 to 0 V; V_{DD} = –20 V; I_D = –1 A; R_L = 20 Ω	–	50	140	ns
Source-drain diode						
V_{SD}	source-drain diode forward voltage	V_{GD} = 0; I_S = –1.25 A	–	–	–1.6	V
t_{rr}	reverse recovery time	I_S = –1.25 A; di/dt = 100 A/μs	–	150	200	ns



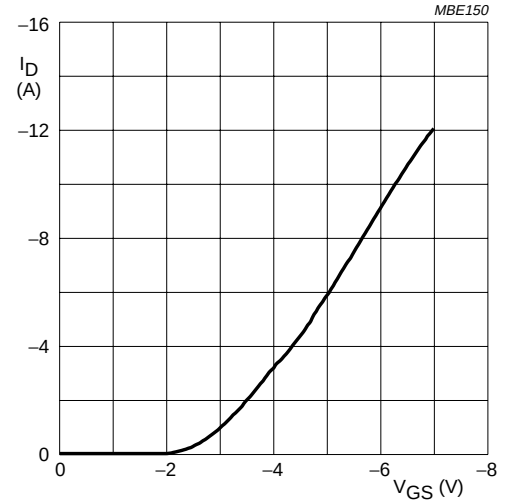
V_{GS} = 0.
T_j = 25 °C.

Fig.4 Capacitance as a function of drain source voltage; typical values.



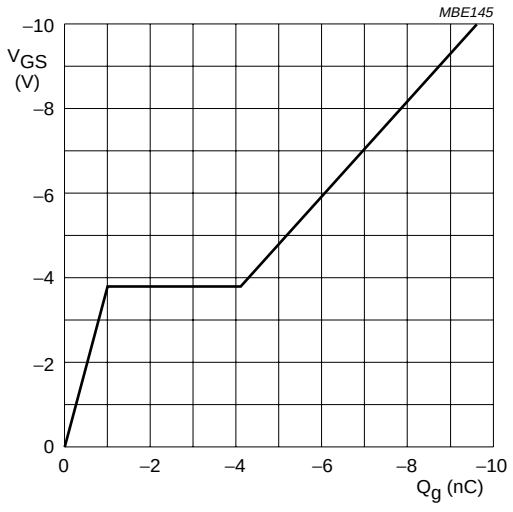
T_j = 25 °C.

Fig.5 Output characteristics; typical values.



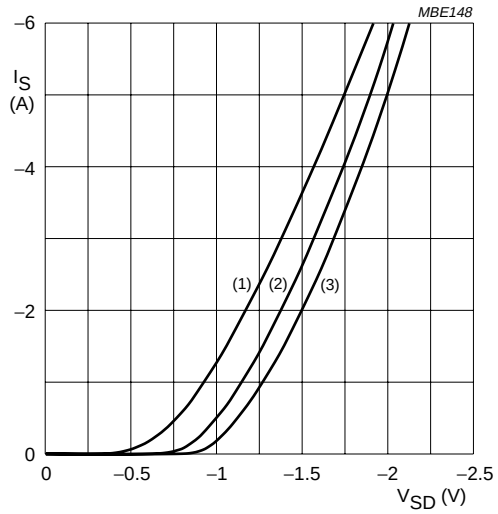
V_{DS} = −10 V.
T_j = 25 °C.

Fig.6 Transfer characteristic, typical values.



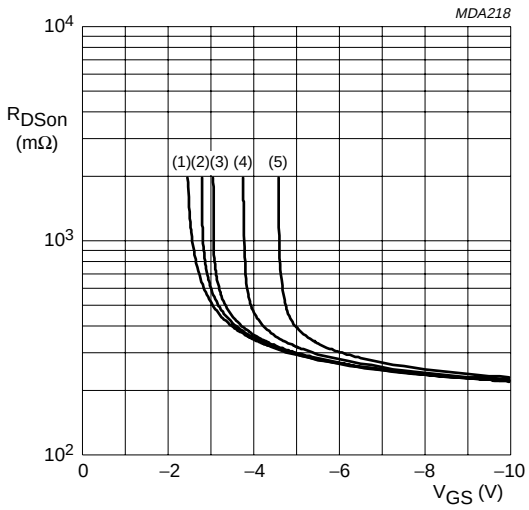
V_{DD} = −15 V.
I_D = −3 A.

Fig.7 Gate-source voltage as a function of total gate charge.



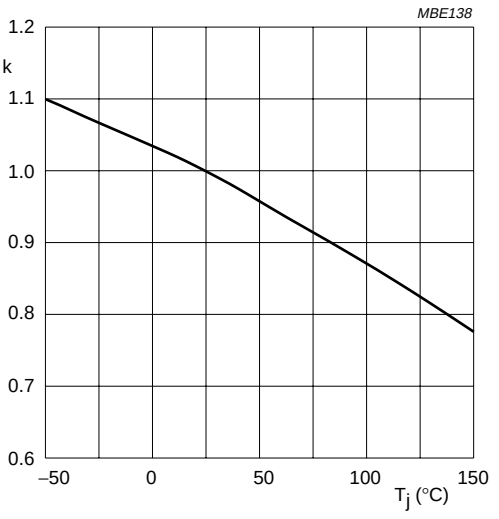
V_{GD} = 0.
(1) T_j = 150 °C.
(2) T_j = 25 °C.
(3) T_j = −55 °C.

Fig.8 Source current as a function of source-drain diode forward voltage.



$-V_{DS} \geq -I_D \times R_{DSon}$; T_j = 25 °C.
(1) I_D = −0.1 A.
(2) I_D = −0.5 A.
(3) I_D = −1 A.
(4) I_D = −3 A.
(5) I_D = −6 A.

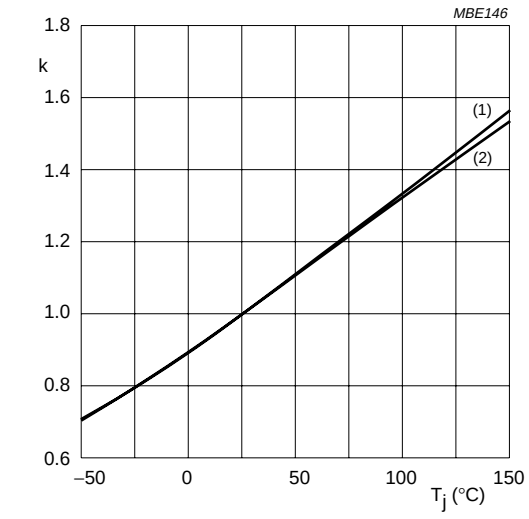
Fig.9 Drain-source on-state resistance as a function of gate-source voltage; typical values.



$$k = \frac{V_{GSth} \text{ at } T_j}{V_{GSth} \text{ at } 25°C}$$

Typical V_{GSth} at I_D = −1 mA; V_{DS} = V_{GS} = V_{GSth}.

Fig.10 Temperature coefficient of gate-source threshold voltage.



$$k = \frac{R_{DSon} \text{ at } T_j}{R_{DSon} \text{ at } 25\ °C}$$

Typical R_{DSon} at:
(1) I_D = −1 A; V_{GS} = −10 V.
(2) I_D = −0.5 A; V_{GS} = −4.5 V.

Fig.11 Temperature coefficient of drain-source on-resistance.

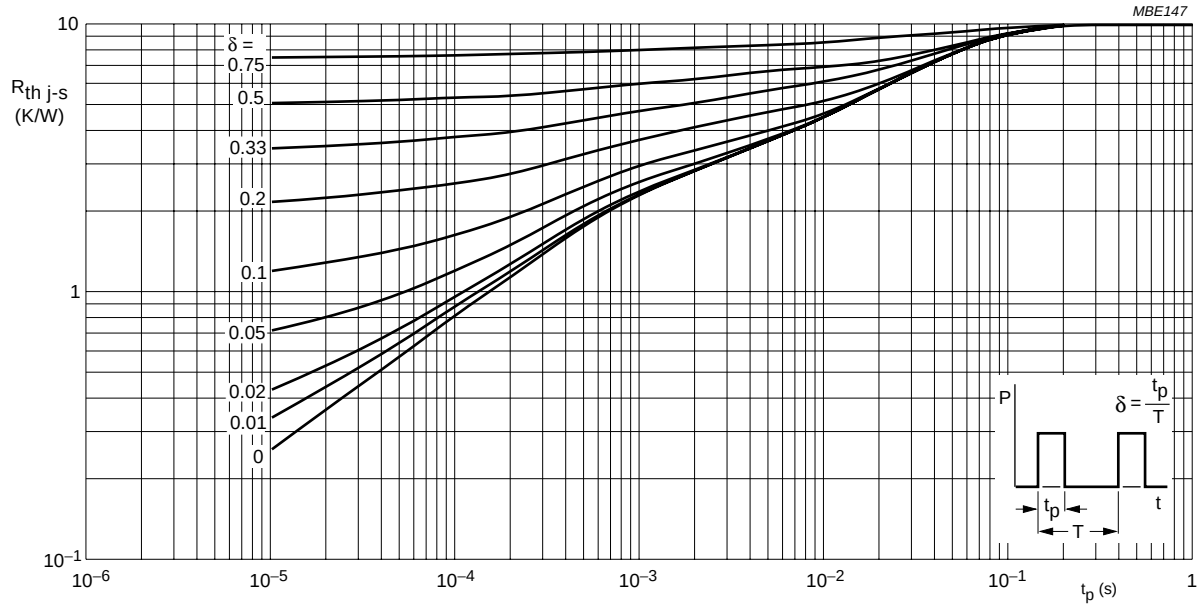
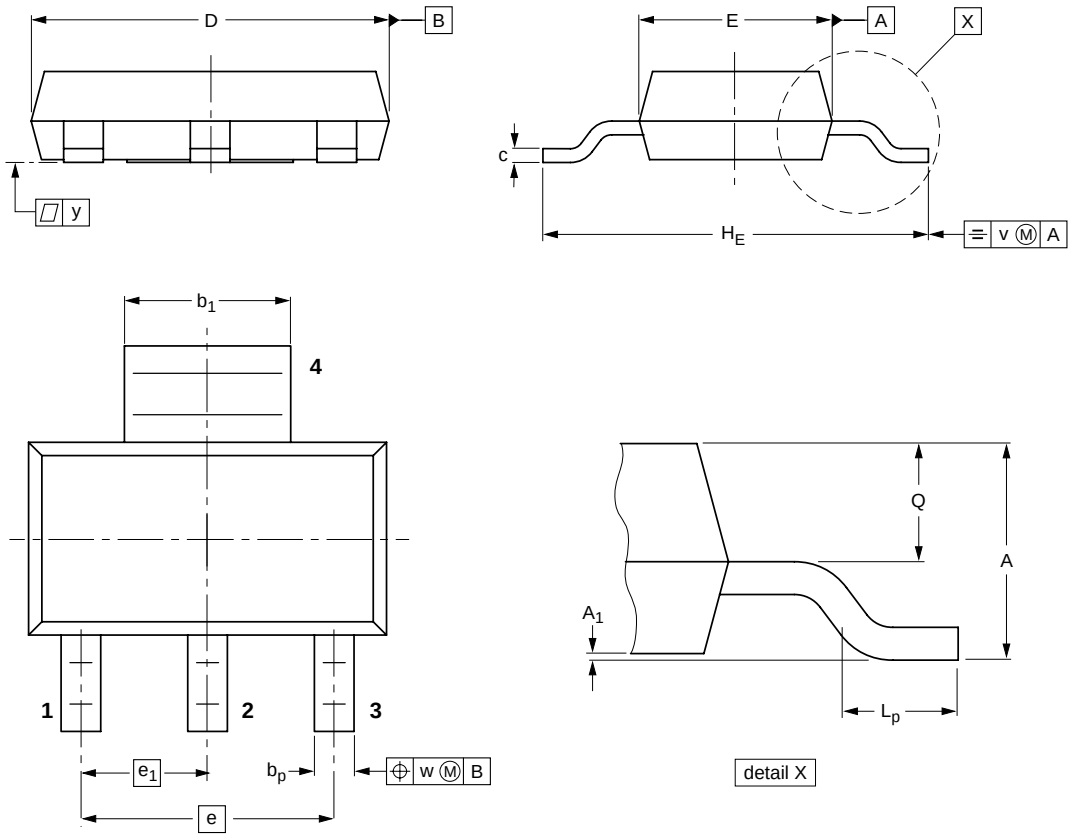


Fig.12 Transient thermal resistance from junction to soldering point as a function of pulse time; typical values.

PACKAGE OUTLINE

Plastic surface mounted package; collector pad for good heat transfer; 4 leads **SOT223**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.8 1.5	0.10 0.01	0.80 0.60	3.1 2.9	0.32 0.22	6.7 6.3	3.7 3.3	4.6	2.3	7.3 6.7	1.1 0.7	0.95 0.85	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT223						~~96-11-11~~ 97-02-28

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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