DATA SHEET

BSP030
N-channel enhancement mode vertical D-MOS transistor

Product specification
Supersedes data of 1997 Jan 20
File under Discrete Semiconductors, SC07

1997 Mar 13

Philips Semiconductors

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N-channel enhancement mode vertical D-MOS transistor

BSP030

FEATURES

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

APPLICATIONS

- Motor and actuator drivers
- Power management
- Synchronized rectification.

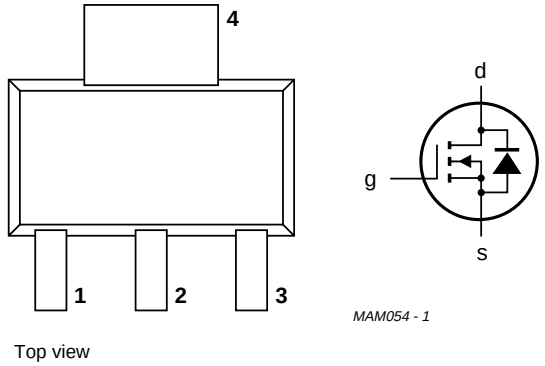
DESCRIPTION

N-channel enhancement mode vertical D-MOS transistor in a 4-pin plastic SOT223 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



Top view

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	V
V_{GS}	gate-source voltage (DC)		–	±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)	T_s = 100 °C	–	10	A
R_{DSon}	drain-source on-state resistance	I_D = 5 A; V_{GS} = 10 V	–	0.03	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_{GS}	gate-source voltage (DC)		–	±20	V
I_D	drain current (DC)	T_s = 100 °C; note 1	–	10	A
I_{DM}	peak drain current	note 2	–	40	A
P_{tot}	total power dissipation	T_s = 100 °C	–	5	W
		T_{amb} = 25 °C; note 3	–	3.3	W
		T_{amb} = 25 °C; note 4	–	1.25	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–65	+150	°C
Source-drain diode					
I_S	source current (DC)	T_s = 100 °C	–	5	A
I_{SM}	peak pulsed source current	note 2	–	20	A

Notes

1. T_s is the temperature at the soldering point of the drain lead.
2. Pulse width and duty cycle limited by maximum junction temperature.
3. Value based on printed-circuit board with a $R_{th\ a\text{-}tp}$ (ambient to tie-point) of 27.5 K/W.
4. Value based on printed-circuit board with a $R_{th\ a\text{-}tp}$ (ambient to tie-point) of 90 K/W.

THERMAL CHARACTERISTICS

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

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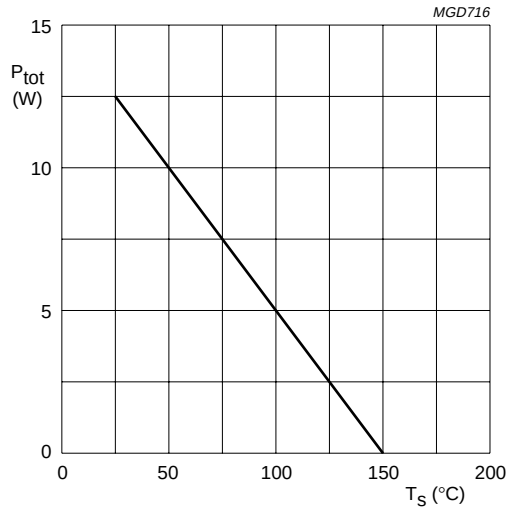
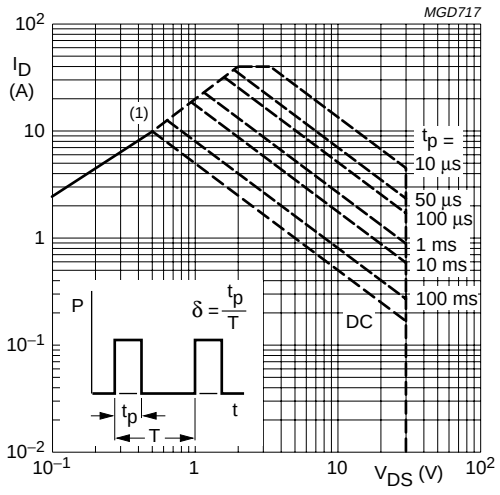


Fig.2 Power derating curve.



$\delta = 0.01$; $T_s = 100$ °C.

(1) R_{DSon} limitation.

Fig.3 SOAR.

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	–	–	500	nA
I_{GSS}	gate leakage current	V_{GS} = ±20 V; V_{DS} = 0	–	–	±100	nA
R_{DSon}	drain-source on-state resistance	V_{GS} = 4.5 V; I_D = 2.5 A	–	–	0.05	Ω
		V_{GS} = 10 V; I_D = 5 A	–	–	0.03	Ω
C_{iss}	input capacitance	V_{GS} = 0; V_{DS} = 24 V; f = 1 MHz	–	750	–	pF
C_{oss}	output capacitance	V_{GS} = 0; V_{DS} = 24 V; f = 1 MHz	–	450	–	pF
C_{rss}	reverse transfer capacitance	V_{GS} = 0; V_{DS} = 24 V; f = 1 MHz	–	200	–	pF
Q_g	total gate charge	V_{GS} = 10 V; V_{DD} = 15 V; I_D = 5 A; T_{amb} = 25 °C	–	28	–	nC
Q_{gs}	gate-source charge	V_{GS} = 10 V; V_{DD} = 15 V; I_D = 5 A; T_{amb} = 25 °C	–	2.5	–	nC
Q_{gd}	gate-drain charge	V_{GS} = 10 V; V_{DD} = 15 V; I_D = 5 A; T_{amb} = 25 °C	–	10.5	–	nC
$t_{d(on)}$	turn-on delay time	V_{GS} = 0 to 10 V; V_{DD} = 15 V; I_D = 1 A; R_L = 15 Ω; R_{gen} = 6 Ω	–	14	–	ns
t_f	fall time	V_{GS} = 0 to 10 V; V_{DD} = 15 V; I_D = 1 A; R_L = 15 Ω; R_{gen} = 6 Ω	–	18	–	ns
t_{on}	turn-on switching time	V_{GS} = 0 to 10 V; V_{DD} = 15 V; I_D = 1 A; R_L = 15 Ω; R_{gen} = 6 Ω	–	32	60	ns
$t_{d(off)}$	turn-off delay time	V_{GS} = 10 to 0 V; V_{DD} = 15 V; I_D = 1 A; R_L = 15 Ω; R_{gen} = 6 Ω	–	29	–	ns
t_r	rise time	V_{GS} = 10 to 0 V; V_{DD} = 15 V; I_D = 1 A; R_L = 15 Ω; R_{gen} = 6 Ω	–	33	–	ns
t_{off}	turn-off switching time	V_{GS} = 10 to 0 V; V_{DD} = 15 V; I_D = 1 A; R_L = 15 Ω; R_{gen} = 6 Ω	–	62	150	ns
Source-drain diode						
V_{SD}	source-drain diode forward voltage	V_{GD} = 0; I_S = 1.25 A	–	–	1	V
t_{rr}	reverse recovery time	I_S = 1.25 A; di/dt = –100 A/μs	–	70	–	ns

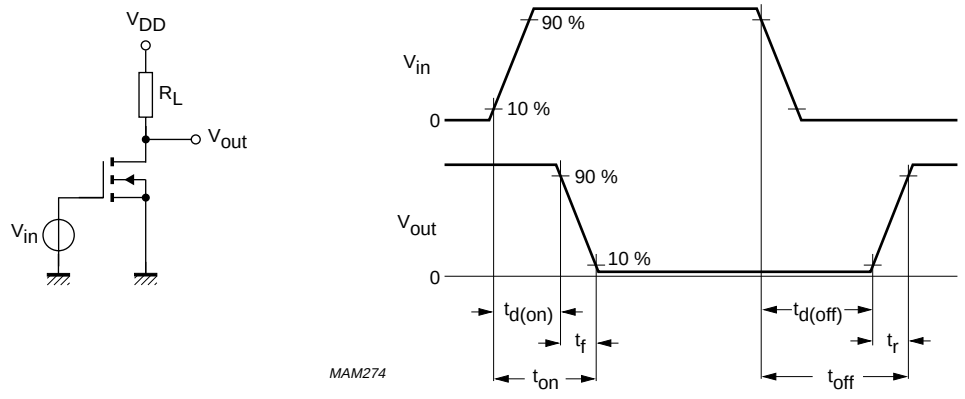


Fig.4 Switching time test circuit; input and output waveforms.

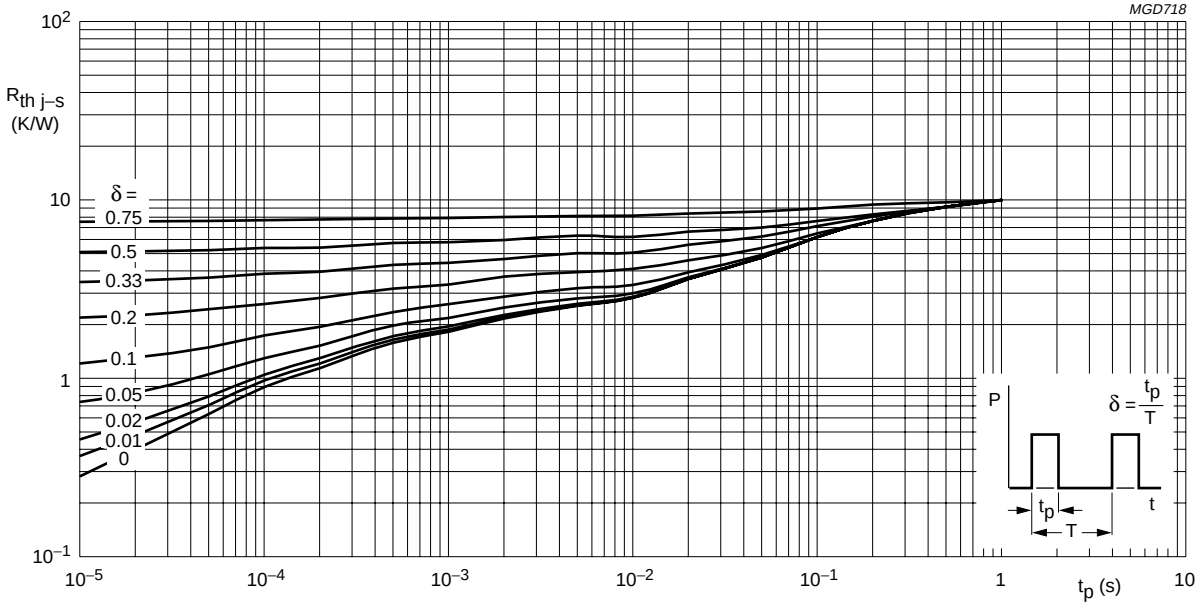
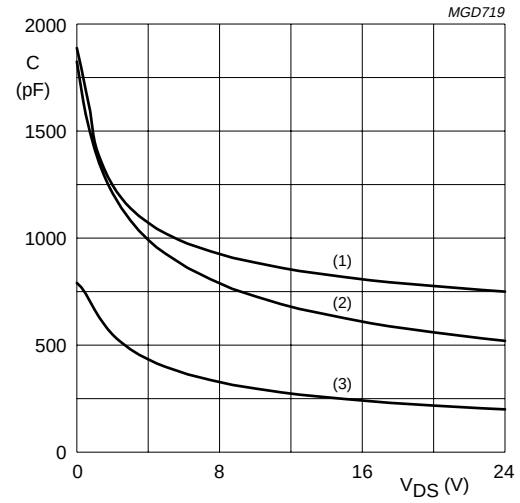
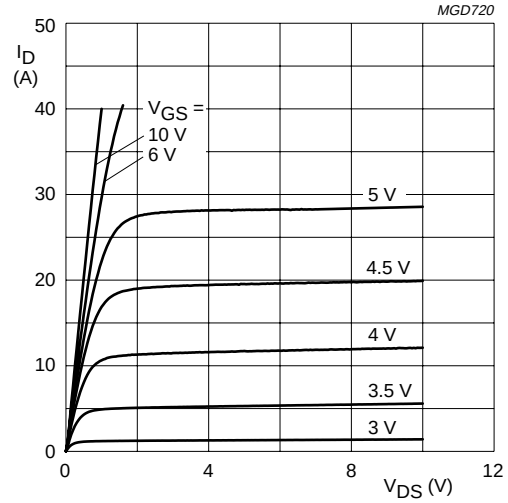


Fig.5 Transient thermal resistance from junction to soldering point as a function of pulse time; typical values.



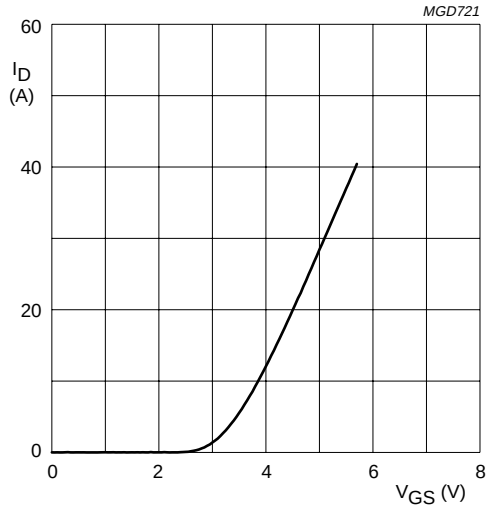
V_{GS} = 0; f = 1 MHz; T_j = 25 °C.
(1) C_{iss}.
(2) C_{oss}.
(3) C_{rss}.

Fig.6 Capacitance as a function of drain-source voltage; typical values.



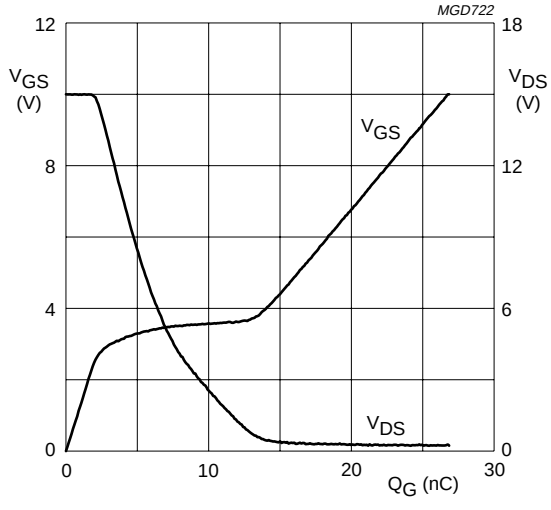
T_{amb} = 25 °C; t_p = 80 µs; δ = 0.

Fig.7 Output characteristics; typical values.



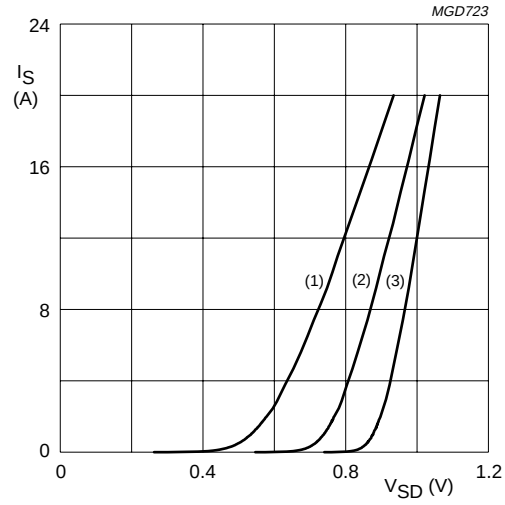
V_{DS} = 10 V; T_{amb} = 25 °C; t_p = 80 µs; δ = 0.

Fig.8 Transfer characteristics; typical values.



V_{DD} = 12.5 V; I_D = 5 A; T_{amb} = 25 °C.

Fig.9 Gate-source voltage and drain-source voltage as a function of total gate charge; typical values.



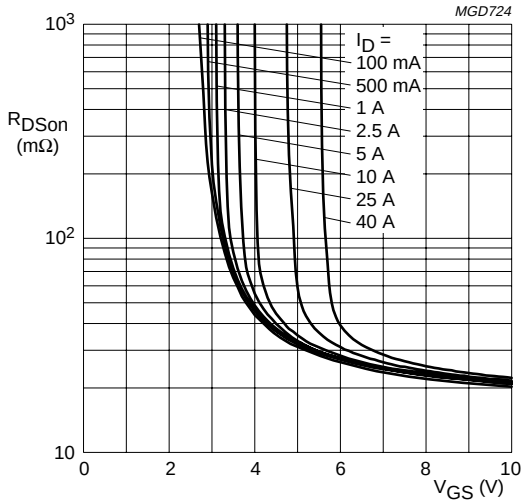
V_{GD} = 0.

(1) T_{amb} = 150 °C; t_p = 80 μs; δ = 0.

(2) T_{amb}= 25 °C; t_p = 80 μs; δ = 0.

(3) T_{amb}= –65 °C; t_p = 80 μs; δ = 0.

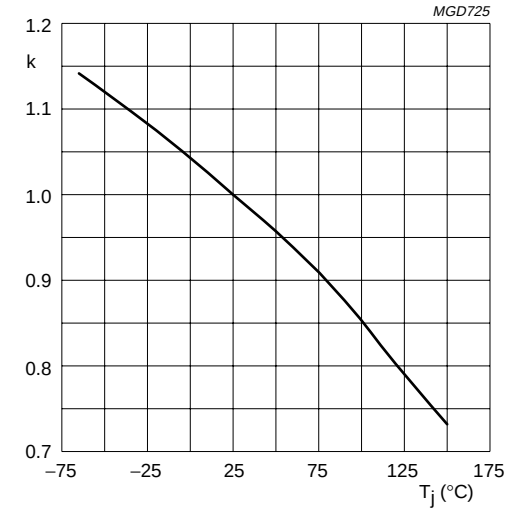
Fig.10 Source current as a function of source-drain diode forward voltage; typical values.



T_{amb} = 25 °C; t_p = 80 μs; δ = 0.

$V_{DS} \geq I_D \times R_{DSon}$.

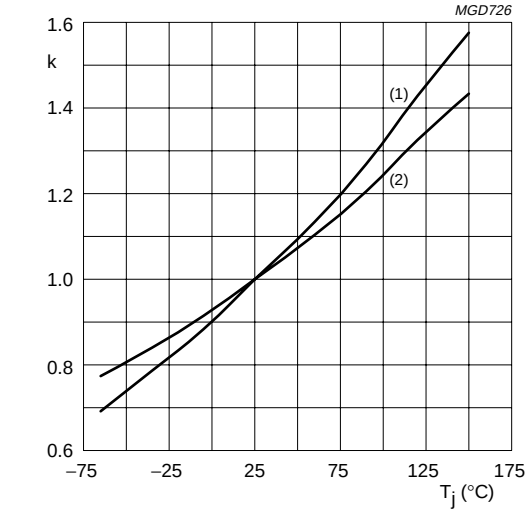
Fig.11 Drain-source on-state resistance as a function of gate-source voltage; typical values.



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

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

Fig.12 Temperature coefficient of gate-source threshold voltage as a function of junction temperature; typical values.



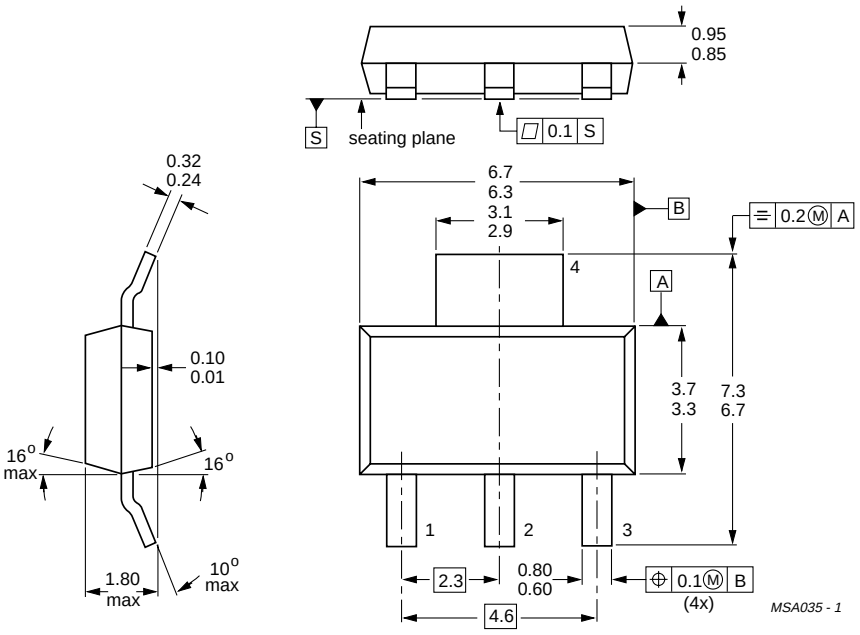
$$k = \frac{R_{DSon} \text{ at } T_j}{R_{DSon} \text{ at } 25\ °C}$$

(1) R_{DSon} at V_{GS} = 10 V; I_D = 5 A.

(2) R_{DSon} at V_{GS} = 4.5 V; I_D = 2.5 A.

Fig.13 Temperature coefficient of drain-source on-state resistance as a function of junction temperature; typical values.

PACKAGE OUTLINE



Dimensions in mm.

Fig.14 SOT223.

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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