

# DATA SHEET

## **BSD22** MOSFET N-channel depletion switching transistor

Product specification  
File under Discrete Semiconductors, SC07

December 1997

MOSFET N-channel depletion switching transistor

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DESCRIPTION

Symmetrical insulated-gate silicon MOS field-effect transistor of the n-channel depletion mode type. The transistor is sealed in a SOT143 envelope and features a low ON-resistance and low capacitances. The transistor is protected against excessive input voltages by integrated back-to-back diodes between gate and substrate.

Applications:

- analog and/or digital switch
- switch driver
- convertor
- chopper

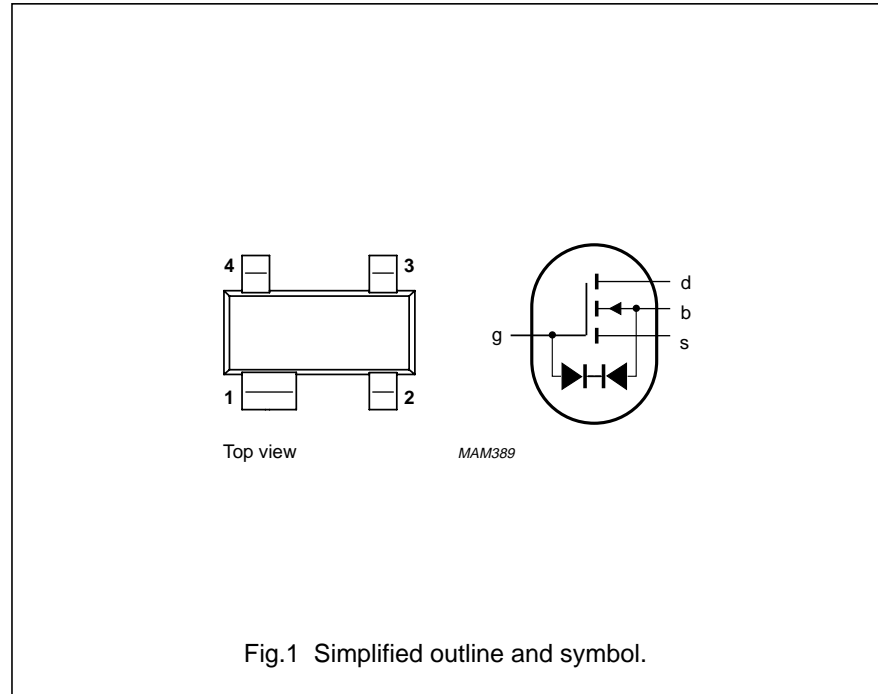
PINNING

- 1 = substrate (b)
- 2 = source
- 3 = drain
- 4 = gate

Note

1. Drain and source are interchangeable

Marking code: M32



QUICK REFERENCE DATA

|   |            |      |      |                  |
|---|------------|------|------|------------------|
| Drain-source voltage  | $V_{DS}$   | max. | 20   | V                |
| Gate-source voltage   | $V_{GS}$   | max. | + 15 | V                |
|   |            |      | - 40 | V                |
| Drain current (DC)  | $I_D$      | max. | 50   | mA               |
| Total power dissipation up to $T_{amb} = 25\text{ }^\circ\text{C}$      | $P_{tot}$  | max. | 230  | mW               |
| Junction temperature  | $T_j$      | max. | 125  | $^\circ\text{C}$ |
| Drain-source ON-resistance  | $R_{DSon}$ | max. | 30   | $\Omega$         |
| $V_{GS} = 10\text{ V}; V_{SB} = 0; I_D = 1\text{ mA}$                   |            |      |      |                  |
| Feed-back capacitance   | $C_{rss}$  | typ. | 0.6  | pF               |
| $V_{GS} = V_{BS} = -5\text{ V}; V_{DS} = 10\text{ V}; f = 1\text{ MHz}$ |            |      |      |                  |

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**RATINGS**

Limiting values in accordance with the Absolute Maximum System (IEC 134)

|  |           |      |              |                  |
|--|-----------|------|--------------|------------------|
| Drain-source voltage   | $V_{DS}$  | max. | 20           | V                |
| Source-drain voltage   | $V_{SD}$  | max. | 20           | V                |
| Drain-substrate voltage  | $V_{DB}$  | max. | 25           | V                |
| Source-substrate voltage   | $V_{SB}$  | max. | 25           | V                |
| Gate-substrate voltage   | $V_{GB}$  | max. | $\pm 15$     | V                |
| Gate-source voltage  | $V_{GS}$  | max. | + 15<br>– 40 | V                |
| Drain current (DC)   | $I_D$     | max. | 50           | mA               |
| Total power dissipation up to $T_{amb} = 25\text{ }^\circ\text{C}^{(1)}$ | $P_{tot}$ | max. | 230          | mW               |
| Storage temperature range  | $T_{stg}$ |      | –65 to + 150 | $^\circ\text{C}$ |
| Junction temperature   | $T_j$     | max. | 125          | $^\circ\text{C}$ |

**THERMAL RESISTANCE**

|   |               |   |     |     |
|---|---------------|---|-----|-----|
| From junction to ambient in free air <sup>(1)</sup> | $R_{th\ j-a}$ | = | 430 | K/W |
|---|---------------|---|-----|-----|

**Note**

1. Device mounted on a ceramic substrate of 8 mm × 10 mm × 0.7 mm.

**CHARACTERISTICS** $T_{amb} = 25\text{ }^\circ\text{C}$  unless otherwise specified

|  |               |              |          |          |
|--|---------------|--------------|----------|----------|
| Drain-source breakdown voltage<br>$V_{GS} = V_{BS} = -5\text{ V}$ ; $I_S = 10\text{ nA}$                       | $V_{(BR)DSX}$ | min.         | 20       | V        |
| Source-drain breakdown voltage<br>$V_{GD} = V_{BD} = -5\text{ V}$ ; $I_D = 10\text{ nA}$                       | $V_{(BR)SDX}$ | min.         | 20       | V        |
| Drain-substrate breakdown voltage<br>$V_{GB} = 0$ ; $I_D = 10\text{ nA}$ ; open source                         | $V_{(BR)DBO}$ | min.         | 25       | V        |
| Source-substrate breakdown voltage<br>$V_{GB} = 0$ ; $I_S = 10\text{ nA}$ ; open drain                         | $V_{(BR)SBO}$ | min.         | 25       | V        |
| Drain-source leakage current<br>$V_{GS} = V_{BS} = -5\text{ V}$ ; $V_{DS} = 10\text{ V}$                       | $I_{DSoff}$   | typ.         | 1.0      | nA       |
| Source-drain leakage current<br>$V_{GD} = V_{BD} = 5\text{ V}$ ; $V_{SD} = 10\text{ V}$                        | $I_{SDoff}$   | typ.         | 1.0      | nA       |
| Gate-substrate leakage current<br>$V_{DB} = V_{SB} = 0$ ; $V_{GB} = \pm 15\text{ V}$                           | $I_{GBS}$     | max.         | 10       | nA       |
| Forward transconductance at $f = 1\text{ kHz}$<br>$V_{DS} = 10\text{ V}$ ; $V_{SB} = 0$ ; $I_D = 20\text{ mA}$ | $g_{fs}$      | min.<br>typ. | 10<br>15 | mS<br>mS |
| Gate-source cut-off voltage<br>$V_{DS} = 10\text{ V}$ ; $V_{SB} = 0$ ;<br>$I_D = 10\text{ }\mu\text{A}$        | $-V_{(P)GS}$  | max.         | 2.0      | V        |

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Drain-source ON-resistance

$I_D = 1 \text{ mA}; V_{SB} = 0;$   
 $V_{GS} = 5 \text{ V}$

|            |      |    |          |
|------------|------|----|----------|
| $R_{DSon}$ | typ. | 25 | $\Omega$ |
|            | max. | 50 | $\Omega$ |

$V_{GS} = 10 \text{ V}$

|            |      |    |          |
|------------|------|----|----------|
| $R_{DSon}$ | typ. | 15 | $\Omega$ |
|            | max. | 30 | $\Omega$ |

Capacitances at  $f = 1 \text{ MHz}$

$V_{GS} = V_{BS} = -5 \text{ V}; V_{DS} = 10 \text{ V}$

Feed-back capacitance

|           |      |     |    |
|-----------|------|-----|----|
| $C_{rss}$ | typ. | 0.6 | pF |
|-----------|------|-----|----|

Input capacitance

|           |      |     |    |
|-----------|------|-----|----|
| $C_{iss}$ | typ. | 1.5 | pF |
|-----------|------|-----|----|

Output capacitance

|           |      |     |    |
|-----------|------|-----|----|
| $C_{oss}$ | typ. | 1.0 | pF |
|-----------|------|-----|----|

Switching times (see Fig.3)

$V_{DD} = 10 \text{ V}; V_i = -5 \text{ V to } +5 \text{ V}$

|           |      |     |    |
|-----------|------|-----|----|
| $t_{on}$  | typ. | 1.0 | ns |
| $t_{off}$ | typ. | 5.0 | ns |

$$C_{iss} = C_{gs} + C_{gd} + C_{gb}$$

$$C_{oss} = C_{gd} + C_{bd}$$

$$C_{rss} = C_{gd}$$

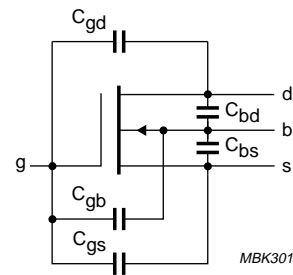


Fig.2 Capacitances model.

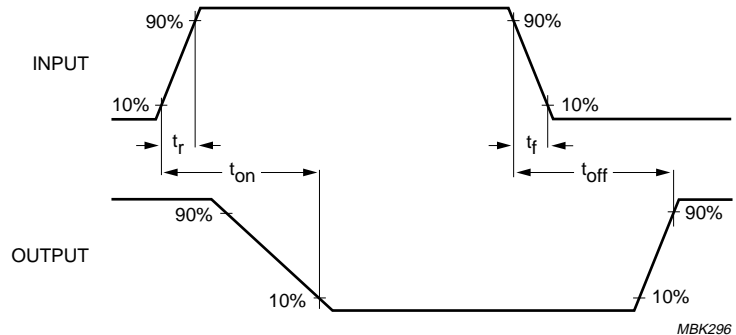
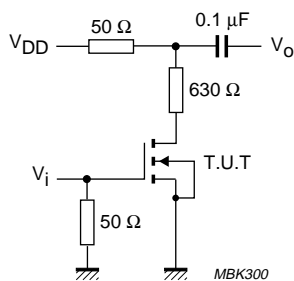


Fig.3 Switching times and input and output waveforms;  $R_i = 50 \Omega; t_r < 0.5 \text{ ns}; t_f < 1.0 \text{ ns}; t_p = 20 \text{ ns}; \delta < 0.01.$

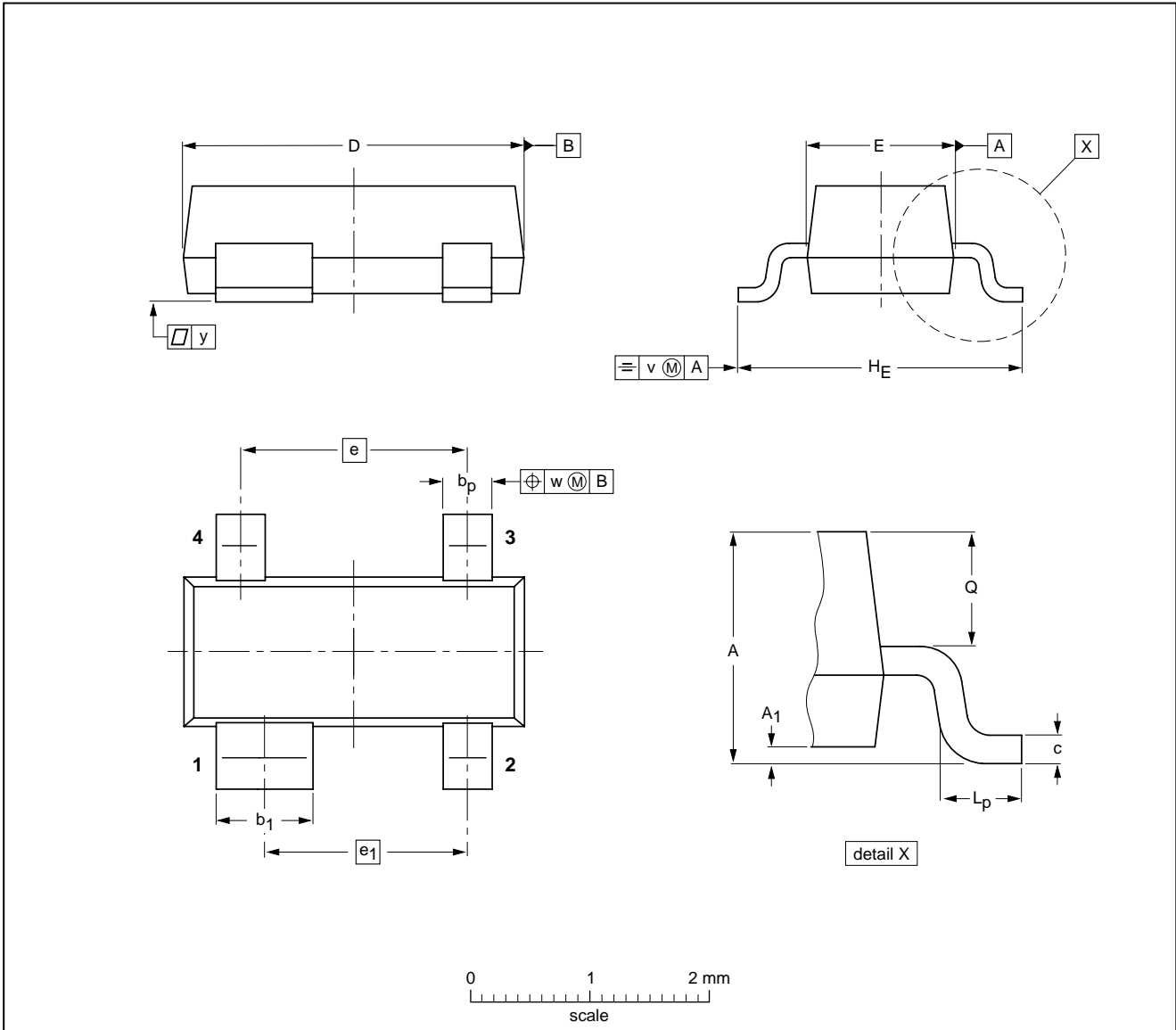
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PACKAGE OUTLINE

Plastic surface mounted package; 4 leads

SOT143B



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub><br>max | b <sub>p</sub> | b <sub>1</sub> | c            | D          | E          | e   | e <sub>1</sub> | H <sub>E</sub> | L <sub>p</sub> | Q            | v   | w   | y   |
|------|------------|-----------------------|----------------|----------------|--------------|------------|------------|-----|----------------|----------------|----------------|--------------|-----|-----|-----|
| mm   | 1.1<br>0.9 | 0.1                   | 0.48<br>0.38   | 0.88<br>0.78   | 0.15<br>0.09 | 3.0<br>2.8 | 1.4<br>1.2 | 1.9 | 1.7            | 2.5<br>2.1     | 0.45<br>0.15   | 0.55<br>0.45 | 0.2 | 0.1 | 0.1 |

| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION | ISSUE DATE |
|--------------------|------------|-------|------|--|------------------------|------------|
|                    | IEC        | JEDEC | EIAJ |  |                        |            |
| SOT143B            |            |       |      |  |                        | 97-02-28   |

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**DEFINITIONS**

| <b>Data sheet status</b>  |  |
|---|--|
| 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.   |
| Short-form specification  | The data in this specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook. |
| <b>Limiting values</b>  |  |
| 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. |  |
| <b>Application information</b>  |  |
| Where application information is given, it is advisory and does not form part of the specification.   |  |

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