

# DATA SHEET

## **BS107**

N-channel enhancement mode  
vertical D-MOS transistor

Product specification  
File under Discrete Semiconductors, SC13b

April 1995

N-channel enhancement mode vertical  
D-MOS transistor

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FEATURES

- Direct interface to C-MOS, TTL, etc.
- High-speed switching
- No secondary breakdown.

DESCRIPTION

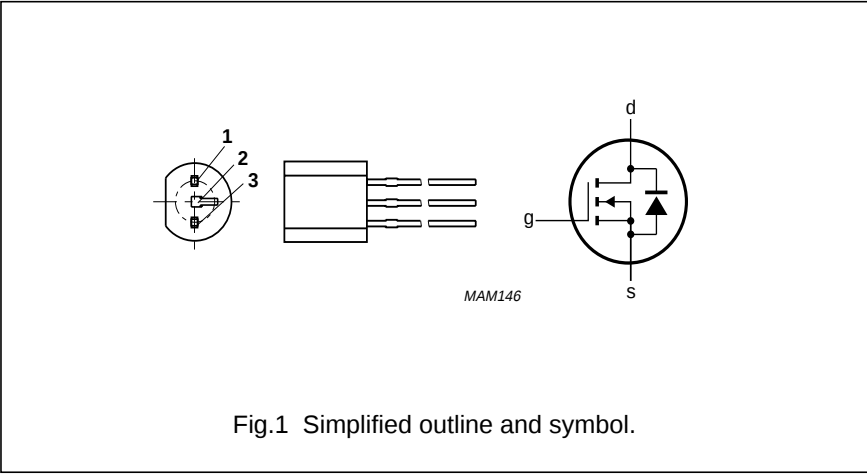
N-channel enhancement mode vertical D-MOS transistor in a TO-92 variant envelope. Intended for use as a line current interruptor in telephone sets and for applications in relay, high-speed and line transformer drivers.

PINNING - TO-92 variant

| PIN | DESCRIPTION |
|-----|-------------|
| 1   | source      |
| 2   | gate        |
| 3   | drain       |

QUICK REFERENCE DATA

| SYMBOL     | PARAMETER                        | MAX. | UNIT     |
|------------|----------------------------------|------|----------|
| $V_{DS}$   | drain-source voltage (DC)        | 200  | V        |
| $V_{GSth}$ | gate-source threshold voltage    | 2.4  | V        |
| $I_D$      | drain current (DC)               | 150  | mA       |
| $R_{DSon}$ | drain-source on-state resistance | 28   | $\Omega$ |



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## LIMITING VALUES

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

| SYMBOL        | PARAMETER                      | CONDITIONS                     | MIN. | MAX. | UNIT |
|---------------|--------------------------------|--------------------------------|------|------|------|
| $V_{DS}$      | drain-source voltage           |                                | –    | 200  | V    |
| $\pm V_{GSO}$ | gate-source voltage            | open drain                     | –    | 20   | V    |
| $I_D$         | drain current                  | DC                             | –    | 150  | mA   |
| $I_{DM}$      | drain current                  | peak                           | –    | 300  | mA   |
| $P_{tot}$     | total power dissipation        | up to $T_{amb} = 25\text{ °C}$ | –    | 830  | mW   |
| $T_{stg}$     | storage temperature range      |                                | –65  | 150  | °C   |
| $T_j$         | operating junction temperature |                                | –    | 150  | °C   |

## THERMAL RESISTANCE

| SYMBOL        | PARAMETER                | MAX. | UNIT |
|---------------|--------------------------|------|------|
| $R_{th\ j-a}$ | from junction to ambient | 150  | K/W  |

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## CHARACTERISTICS

$T_j = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

| SYMBOL                                    | PARAMETER                      | CONDITIONS                                                                            | MIN. | TYP. | MAX. | UNIT          |
|-------------------------------------------|--------------------------------|---------------------------------------------------------------------------------------|------|------|------|---------------|
| $V_{(BR)DSS}$                             | drain-source breakdown voltage | $V_{GS} = 0$<br>$I_D = 10\text{ }\mu\text{A}$                                         | 200  | –    | –    | V             |
| $I_{DSS}$                                 | drain-source leakage current   | $V_{DS} = 130\text{ V}$<br>$V_{GS} = 0$                                               | –    | –    | 30   | nA            |
| $I_{DSX}$                                 | drain-source leakage current   | $V_{DS} = 70\text{ V}$<br>$V_{GS} = 0.2\text{ V}$                                     | –    | –    | 1    | $\mu\text{A}$ |
| $\pm I_{GSS}$                             | gate-source leakage current    | $\pm V_{GS} = 15\text{ V}$<br>$V_{DS} = 0$                                            | –    | –    | 10   | nA            |
| $V_{GS(th)}$                              | gate threshold voltage         | $I_D = 1\text{ mA}$<br>$V_{DS} = V_{GS}$                                              | 0.8  | –    | 2.4  | V             |
| $R_{DS(on)}$                              | drain-source on-resistance     | $I_D = 20\text{ mA}$<br>$V_{GS} = 2.6\text{ V}$                                       | –    | 20   | 28   | $\Omega$      |
| $R_{DS(on)}$                              | drain-source on-resistance     | $I_D = 150\text{ mA}$<br>$V_{GS} = 10\text{ V}$                                       | –    | 14   | –    | $\Omega$      |
| $ Y_{fs} $                                | transfer admittance            | $I_D = 250\text{ mA}$<br>$V_{DS} = 15\text{ V}$                                       | 90   | 180  | –    | mS            |
| $C_{iss}$                                 | input capacitance              | $V_{DS} = 10\text{ V}$<br>$V_{GS} = 0$<br>$f = 1\text{ MHz}$                          | –    | 50   | 65   | pF            |
| $C_{oss}$                                 | output capacitance             | $V_{DS} = 10\text{ V}$<br>$V_{GS} = 0$<br>$f = 1\text{ MHz}$                          | –    | 16   | 25   | pF            |
| $C_{rss}$                                 | feedback capacitance           | $V_{DS} = 10\text{ V}$<br>$V_{GS} = 0$<br>$f = 1\text{ MHz}$                          | –    | 4    | 10   | pF            |
| <b>Switching times (see Figs 2 and 3)</b> |                                |                                                                                       |      |      |      |               |
| $t_{on}$                                  | switching-on time              | $I_D = 250\text{ mA}$<br>$V_{DD} = 50\text{ V}$<br>$V_{GS} = 0\text{ to }10\text{ V}$ | –    | 2    | 10   | ns            |
| $t_{off}$                                 | switching-off time             | $I_D = 250\text{ mA}$<br>$V_{DD} = 50\text{ V}$<br>$V_{GS} = 0\text{ to }10\text{ V}$ | –    | 4    | 20   | ns            |

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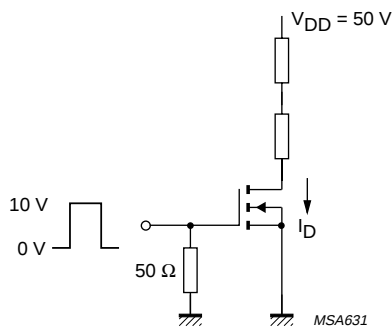


Fig.2 Switching time test circuit.

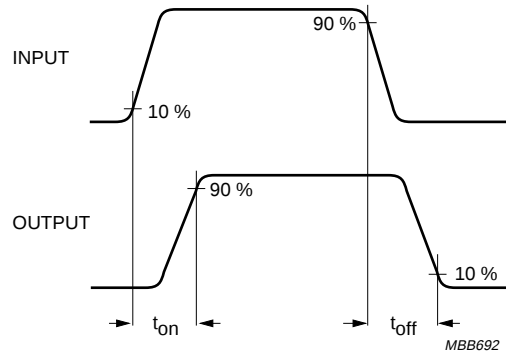


Fig.3 Input and output waveforms.

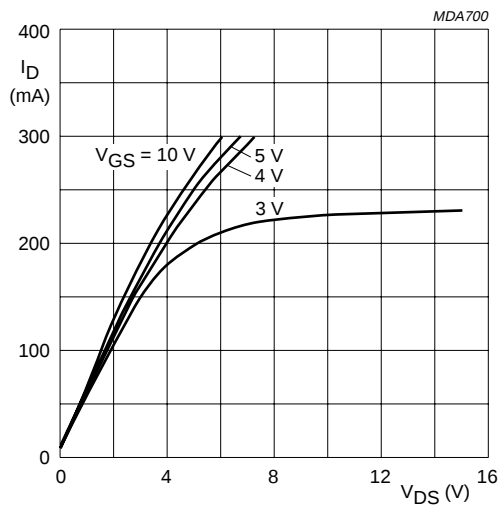


Fig.4 Typical output characteristics;  $T_j = 25\text{ }^{\circ}\text{C}$ .

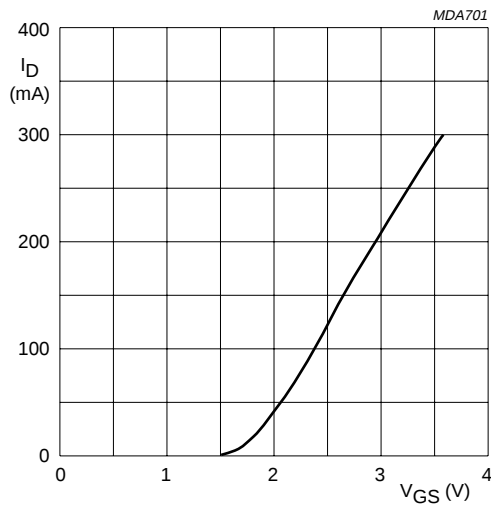


Fig.5 Typical transfer characteristic;  $V_{DS} = 10\text{ V}$ ;  $T_j = 25\text{ }^{\circ}\text{C}$ .

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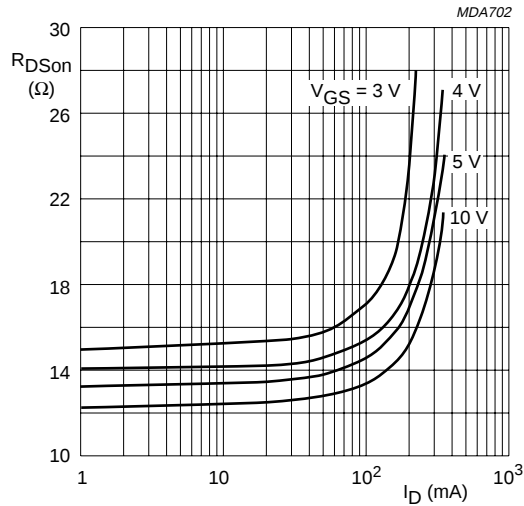


Fig.6 Typical on-resistance as a function of drain current;  $T_j = 25^\circ\text{C}$ .

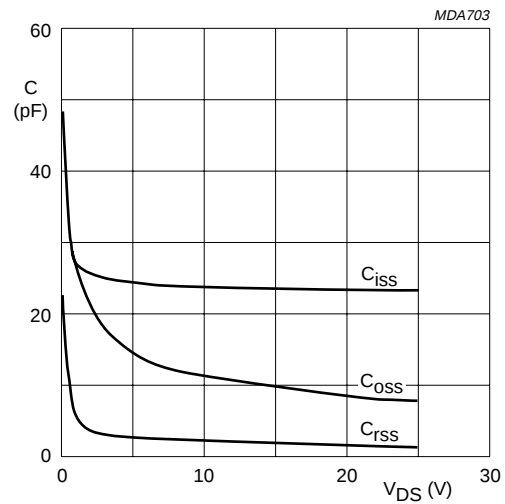
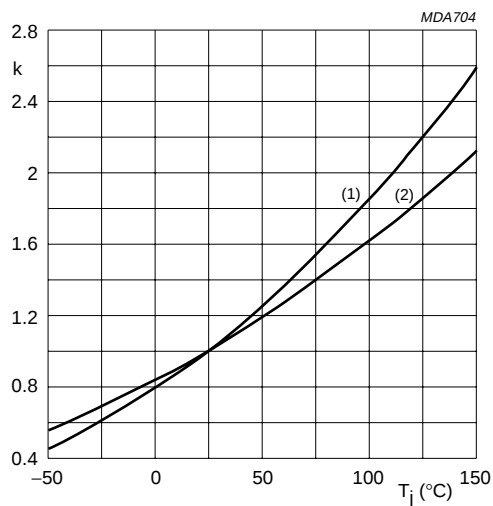


Fig.7 Typical capacitances as a function of drain-source voltage;  $V_{GS} = 0$ ;  $f = 1\text{ MHz}$ ;  $T_j = 25^\circ\text{C}$ .



- (1)  $I_D = 150\text{ mA}$ ;  $V_{GS} = 10\text{ V}$   
(2)  $I_D = 20\text{ mA}$ ;  $V_{GS} = 2.6\text{ V}$

Fig.8 Temperature coefficient of drain-source on-resistance;  $k = \frac{R_{DS(on)} \text{ at } T_j}{R_{DS(on)} \text{ at } 25^\circ\text{C}}$ ; typical  $R_{DS(on)}$  at 150 mA/10 V

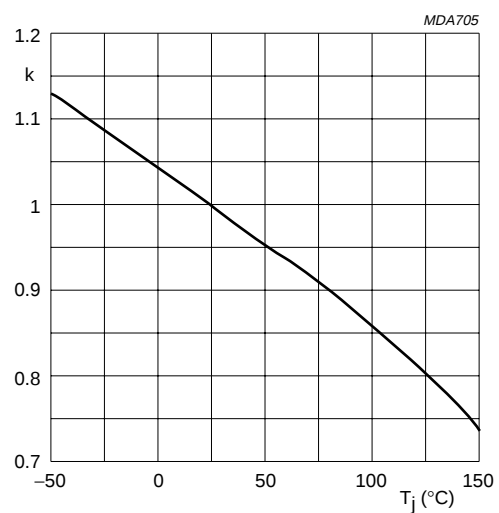


Fig.9 Temperature coefficient of gate-source threshold voltage;  $k = \frac{V_{GS(th)} \text{ at } T_j}{V_{GS(th)} \text{ at } 25^\circ\text{C}}$ ; typical  $V_{GS(th)}$  at 1 mA.

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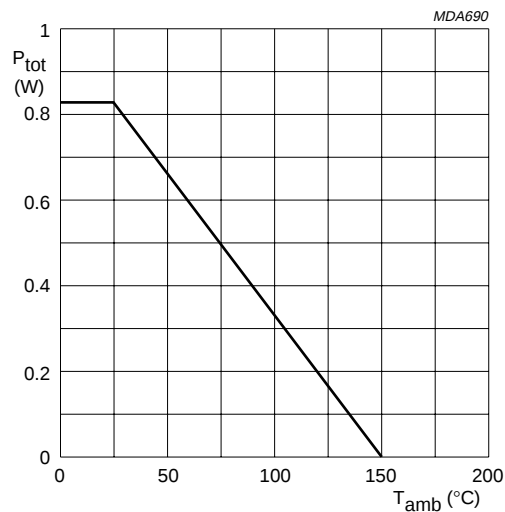


Fig.10 Power derating curve.

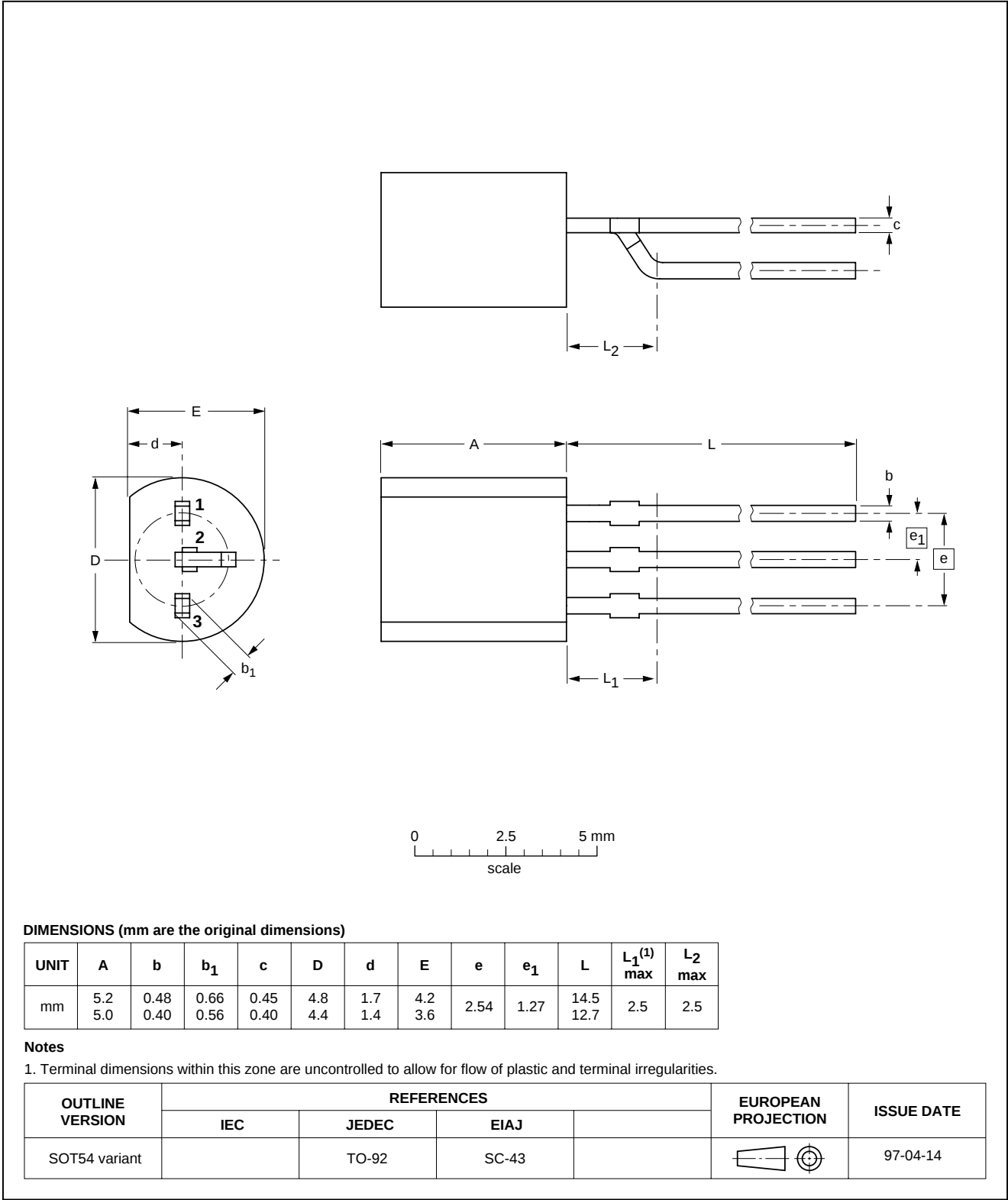
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PACKAGE OUTLINE

Plastic single-ended leaded (through hole) package; 3 leads (on-circle)

SOT54 variant



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## 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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**NOTES**

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