

# DATA SHEET

**BF991**

N-channel dual-gate MOS-FET

Product specification  
File under Discrete Semiconductors, SC07

April 1991

N-channel dual-gate MOS-FET

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FEATURES

- Protected against excessive input voltage surges by integrated back-to-back diodes between gates and source.

APPLICATIONS

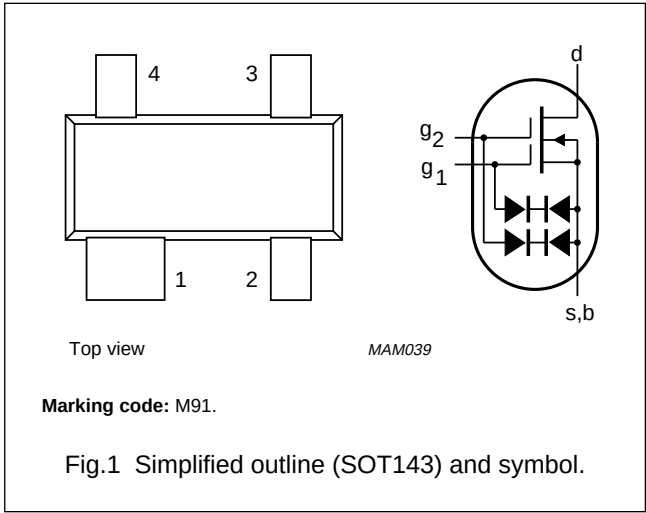
- VHF applications such as:
  - VHF television tuners and FM tuners
  - Professional communication equipment.

PINNING

| PIN | SYMBOL         | DESCRIPTION |
|-----|----------------|-------------|
| 1   | s, b           | source      |
| 2   | d              | drain       |
| 3   | g <sub>2</sub> | gate 2      |
| 4   | g <sub>1</sub> | gate 1      |

DESCRIPTION

Depletion type field-effect transistor in a plastic SOT143 microminiature package with interconnected source and substrate.



QUICK REFERENCE DATA

| SYMBOL      | PARAMETER                   | CONDITIONS                                                                                                               | TYP. | MAX. | UNIT               |
|-------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------|------|------|--------------------|
| $V_{DS}$    | drain-source voltage        |                                                                                                                          | —    | 20   | V                  |
| $I_D$       | drain current               |                                                                                                                          | —    | 20   | mA                 |
| $P_{tot}$   | total power dissipation     | up to $T_{amb} = 60\text{ }^{\circ}\text{C}$                                                                             | —    | 200  | mW                 |
| $T_j$       | junction temperature        |                                                                                                                          | —    | 150  | $^{\circ}\text{C}$ |
| $ Y_{fs} $  | transfer admittance         | $f = 1\text{ kHz}; I_D = 10\text{ mA}; V_{DS} = 10\text{ V}; V_{G2-S} = 4\text{ V}$                                      | 14   | —    | mS                 |
| $C_{ig1-s}$ | input capacitance at gate 1 | $f = 1\text{ MHz}; I_D = 10\text{ mA}; V_{DS} = 10\text{ V}; V_{G2-S} = 4\text{ V}$                                      | 2.1  | —    | pF                 |
| $C_{rs}$    | feedback capacitance        | $f = 1\text{ MHz}; I_D = 10\text{ mA}; V_{DS} = 10\text{ V}; V_{G2-S} = 4\text{ V}$                                      | 20   | —    | fF                 |
| F           | noise figure                | $f = 200\text{ MHz}; G_S = 2\text{ mS}; B_S = B_{Sopt}; I_D = 10\text{ mA}; V_{DS} = 10\text{ V}; V_{G2-S} = 4\text{ V}$ | 1    | 2    | dB                 |

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LIMITING VALUES

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

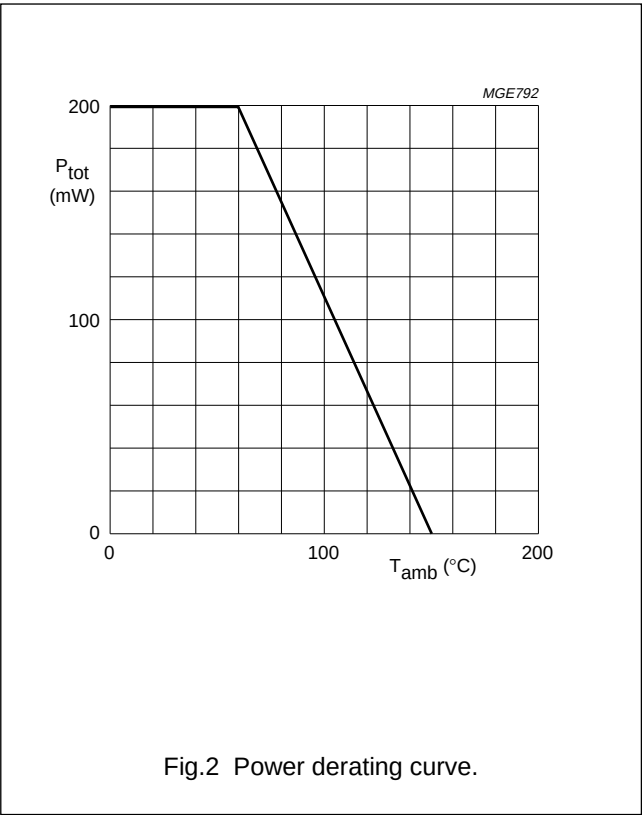
| SYMBOL             | PARAMETER               | CONDITIONS                             | MIN. | MAX. | UNIT |
|--------------------|-------------------------|----------------------------------------|------|------|------|
| V <sub>DS</sub>    | drain-source voltage    |                                        | –    | 20   | V    |
| I <sub>D</sub>     | drain current (DC)      |                                        | –    | 20   | mA   |
| I <sub>D(AV)</sub> | average drain current   |                                        | –    | 20   | mA   |
| I <sub>G1-S</sub>  | gate 1-source current   |                                        | –    | ±10  | mA   |
| I <sub>G2-S</sub>  | gate 2-source current   |                                        | –    | ±10  | mA   |
| P <sub>tot</sub>   | total power dissipation | up to T <sub>amb</sub> = 60 °C; note 1 | –    | 200  | mW   |
| T <sub>stg</sub>   | storage temperature     |                                        | –65  | +150 | °C   |
| T <sub>j</sub>     | junction temperature    |                                        | –    | 150  | °C   |

THERMAL CHARACTERISTICS

| SYMBOL              | PARAMETER                                   | CONDITIONS          | VALUE | UNIT |
|---------------------|---------------------------------------------|---------------------|-------|------|
| R <sub>th j-a</sub> | thermal resistance from junction to ambient | in free air; note 1 | 460   | K/W  |

Note to the Limiting values and the Thermal characteristics

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



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## STATIC CHARACTERISTICS

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

| SYMBOL          | PARAMETER                       | CONDITIONS                                                                 | MIN. | MAX. | UNIT |
|-----------------|---------------------------------|----------------------------------------------------------------------------|------|------|------|
| $I_{G1-SS}$     | gate 1 cut-off current          | $V_{G1-S} = 5\text{ V}; V_{G2-S} = V_{DS} = 0$                             | –    | 50   | nA   |
| $I_{G2-SS}$     | gate 2 cut-off current          | $V_{G2-S} = 5\text{ V}; V_{G1-S} = V_{DS} = 0$                             | –    | 50   | nA   |
| $I_{DSS}$       | drain current                   | $V_{DS} = 10\text{ V}; V_{G1-S} = 0; V_{G2-S} = 4\text{ V}$                | 4    | 25   | mA   |
| $V_{(BR)G1-SS}$ | gate 1-source breakdown voltage | $I_{G1-SS} = 10\text{ mA}; V_{G2-S} = V_{DS} = 0$                          | 6    | 20   | V    |
| $V_{(BR)G2-SS}$ | gate 2-source breakdown voltage | $I_{G2-SS} = 10\text{ mA}; V_{G1-S} = V_{DS} = 0$                          | 6    | 20   | V    |
| $V_{(P)G1-S}$   | gate 1-source cut-off voltage   | $I_D = 20\text{ }\mu\text{A}; V_{DS} = 10\text{ V}; V_{G2-S} = 4\text{ V}$ | –    | –2.5 | V    |
| $V_{(P)G2-S}$   | gate 2-source cut-off voltage   | $I_D = 20\text{ }\mu\text{A}; V_{DS} = 10\text{ V}; V_{G1-S} = 0$          | –    | –2.5 | V    |

## DYNAMIC CHARACTERISTICS

Measuring conditions (common source):  $I_D = 10\text{ mA}; V_{DS} = 10\text{ V}; V_{G2-S} = 4\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$ .

| SYMBOL      | PARAMETER                   | CONDITIONS                                                                                   | MIN. | TYP. | MAX. | UNIT |
|-------------|-----------------------------|----------------------------------------------------------------------------------------------|------|------|------|------|
| $ Y_{fs} $  | transfer admittance         | $f = 1\text{ kHz}$                                                                           | 10   | 14   | –    | mS   |
| $C_{ig1-s}$ | input capacitance at gate 1 | $f = 1\text{ MHz}$                                                                           | –    | 2.1  | –    | pF   |
| $C_{ig2-s}$ | input capacitance at gate 2 | $f = 1\text{ MHz}$                                                                           | –    | 1    | –    | pF   |
| $C_{rs}$    | feedback capacitance        | $f = 1\text{ MHz}$                                                                           | –    | 20   | –    | fF   |
| $C_{os}$    | output capacitance          | $f = 1\text{ MHz}$                                                                           | –    | 1.1  | –    | pF   |
| F           | noise figure                | $f = 100\text{ MHz}; G_S = 1\text{ mS}; B_S = B_{Sopt}$                                      | –    | 0.7  | 1.7  | dB   |
|             |                             | $f = 200\text{ MHz}; G_S = 2\text{ mS}; B_S = B_{Sopt}$                                      | –    | 1    | 2    | dB   |
| $G_{tr}$    | transducer gain; note 1     | $f = 100\text{ MHz}; G_S = 1\text{ mS}; B_S = B_{Sopt}; G_L = 0.5\text{ mS}; B_L = B_{Lopt}$ | –    | 29   | –    | dB   |
|             |                             | $f = 200\text{ MHz}; G_S = 2\text{ mS}; B_S = B_{Sopt}; G_L = 0.5\text{ mS}; B_L = B_{Lopt}$ | –    | 26   | –    | dB   |

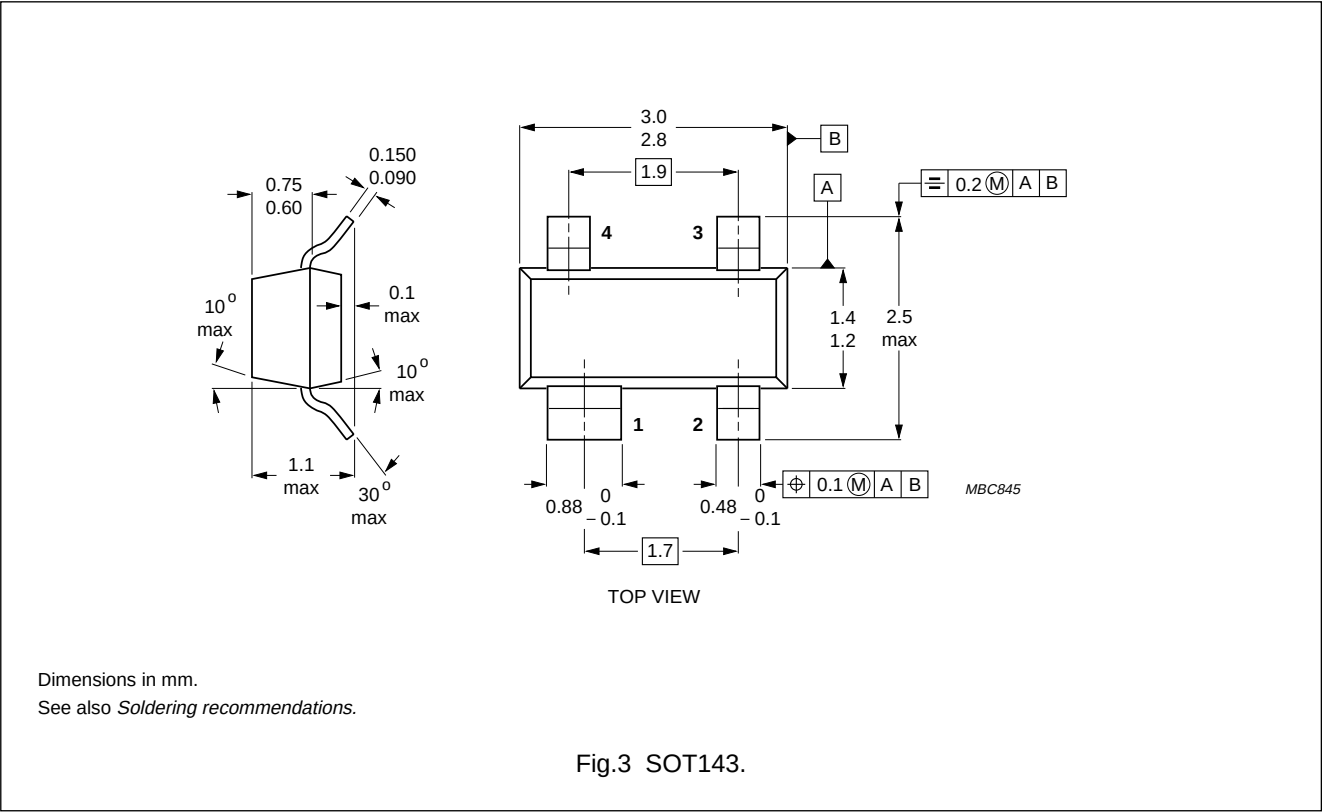
## Note

1. Crystal mounted in a SOT103 package.

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PACKAGE OUTLINE



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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