

# DATA SHEET

## **BF510 to 513**

N-channel silicon field-effect  
transistors

Product specification

December 1997



N-channel silicon field-effect transistors

BF510 to 513

DESCRIPTION

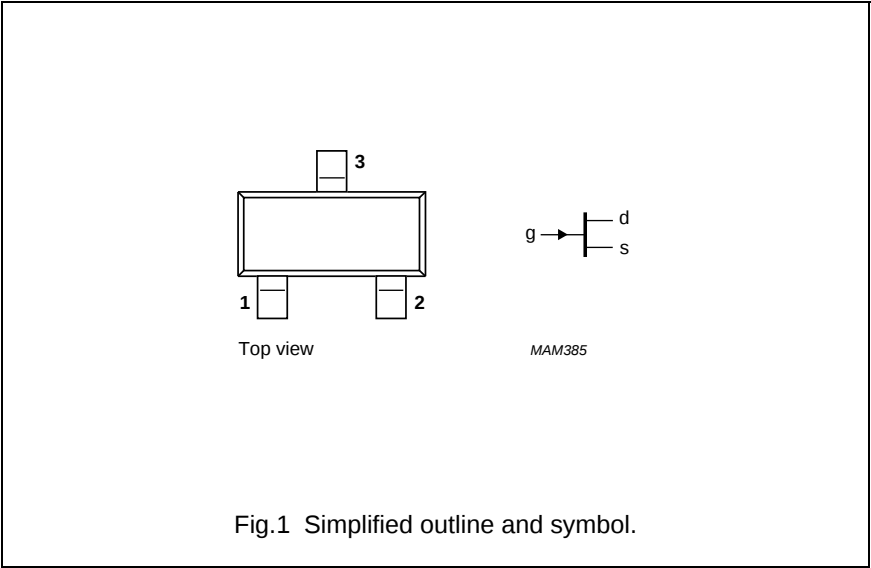
Asymmetrical N-channel planar epitaxial junction field-effect transistors in the miniature plastic envelope intended for applications up to the v.h.f. range in hybrid thick and thin-film circuits. Special features are the low feedback capacitance and the low noise figure. These features make the product very suitable for applications such as the r.f. stages in f.m. portables (BF510), car radios (BF511) and mains radios (BF512) or the mixer stage (BF513).

MARKING CODE

- BF510 = S6p
- BF511 = S7p
- BF512 = S8p
- BF513 = S9p

PINNING - SOT23

- 1 = gate
- 2 = drain
- 3 = source



QUICK REFERENCE DATA

|                                                                                                          |            |      |              |            |            |            |    |
|----------------------------------------------------------------------------------------------------------|------------|------|--------------|------------|------------|------------|----|
| Drain-source voltage                                                                                     | $V_{DS}$   | max. | 20           |            |            |            | V  |
| Drain current (DC or average)                                                                            | $I_D$      | max. | 30           |            |            |            | mA |
| Total power dissipation<br>up to $T_{amb} = 40\text{ }^{\circ}\text{C}$                                  | $P_{tot}$  | max. | 250          |            |            |            | mW |
|                                                                                                          |            |      | <b>BF510</b> | <b>511</b> | <b>512</b> | <b>513</b> |    |
| Drain current                                                                                            | $I_{DSS}$  | $>$  | 0.7          | 2.5        | 6          | 10         | mA |
| $V_{DS} = 10\text{ V}; V_{GS} = 0$                                                                       | $I_{DSS}$  | $<$  | 3.0          | 7.0        | 12         | 18         | mA |
| Transfer admittance (common source)<br>$V_{DS} = 10\text{ V}; V_{GS} = 0; f = 1\text{ kHz}$              | $ y_{fs} $ | $>$  | 2.5          | 4          | 6          | 7          | mS |
| Feedback capacitance<br>$V_{DS} = 10\text{ V}; V_{GS} = 0$                                               | $C_{rs}$   | typ. | 0.3          | 0.3        | –          | –          | pF |
| $V_{DS} = 10\text{ V}; I_D = 5\text{ mA}$                                                                | $C_{rs}$   | typ. | –            | –          | 0.3        | 0.3        | pF |
| Noise figure at optimum source admittance<br>$G_S = 1\text{ mS}; -B_S = 3\text{ mS}; f = 100\text{ MHz}$ | F          | typ. | 1.5          | 1.5        | –          | –          | dB |
| $V_{DS} = 10\text{ V}; I_D = 5\text{ mA}$                                                                | F          | typ. | –            | –          | 1.5        | 1.5        | dB |

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**RATINGS**

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

|                                                                               |           |              |                        |
|-------------------------------------------------------------------------------|-----------|--------------|------------------------|
| Drain-source voltage                                                          | $V_{DS}$  | max.         | 20 V                   |
| Drain-gate voltage (open source)                                              | $V_{DGO}$ | max.         | 20 V                   |
| Drain current (DC or average)                                                 | $I_D$     | max.         | 30 mA                  |
| Gate current                                                                  | $\pm I_G$ | max.         | 10 mA                  |
| Total power dissipation up to $T_{amb} = 40\text{ }^{\circ}\text{C}$ (note 1) | $P_{tot}$ | max.         | 250 mW                 |
| Storage temperature range                                                     | $T_{stg}$ | –65 to + 150 | $^{\circ}\text{C}$     |
| Junction temperature                                                          | $T_j$     | max.         | 150 $^{\circ}\text{C}$ |

**THERMAL RESISTANCE**

|                                   |               |   |         |
|-----------------------------------|---------------|---|---------|
| From junction to ambient (note 1) | $R_{th\ j-a}$ | = | 430 K/W |
|-----------------------------------|---------------|---|---------|

**Note**

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

**STATIC CHARACTERISTICS** $T_{amb} = 25\text{ }^{\circ}\text{C}$ 

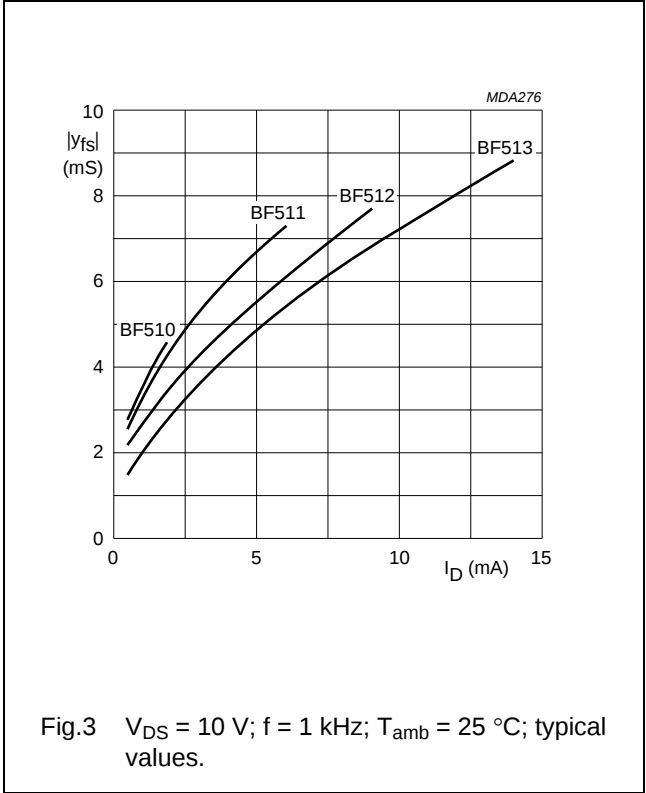
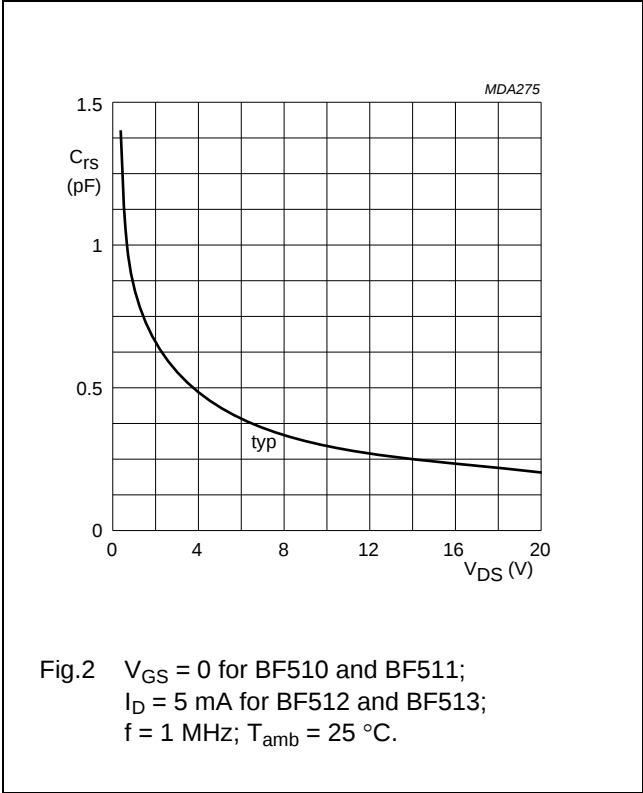
|                                                        |                |      | BF510 | 511 | 512 | 513   |
|--------------------------------------------------------|----------------|------|-------|-----|-----|-------|
| Gate cut-off current                                   |                |      |       |     |     |       |
| – $V_{GS} = 0.2\text{ V}$ ; $V_{DS} = 0$               | $-I_{GSS}$     | <    | 10    | 10  | 10  | 10 nA |
| Gate-drain breakdown voltage                           |                |      |       |     |     |       |
| $I_S = 0$ ; $-I_D = 10\text{ }\mu\text{A}$             | $-V_{(BR)GDO}$ | >    | 20    | 20  | 20  | 20 V  |
| Drain current                                          |                |      |       |     |     |       |
| $V_{DS} = 10\text{ V}$ ; $V_{GS} = 0$                  | $I_{DSS}$      | >    | 0.7   | 2.5 | 6   | 10 mA |
|                                                        |                | <    | 3.0   | 7.0 | 12  | 18 mA |
| Gate-source cut-off voltage                            |                |      |       |     |     |       |
| $I_D = 10\text{ }\mu\text{A}$ ; $V_{DS} = 10\text{ V}$ | $-V_{(P)GS}$   | typ. | 0.8   | 1.5 | 2.2 | 3 V   |

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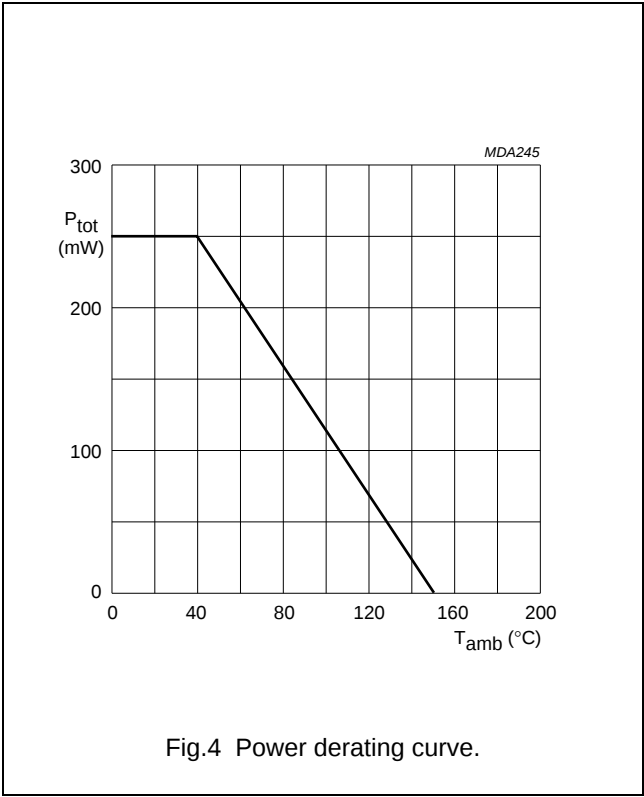
DYNAMIC CHARACTERISTICS

|                                                  |            |      |                                                                                                     |     |     |                   |
|--------------------------------------------------|------------|------|-----------------------------------------------------------------------------------------------------|-----|-----|-------------------|
| <b>Measuring conditions (common source):</b>     |            |      | $V_{DS} = 10\text{ V}; V_{GS} = 0; T_{amb} = 25\text{ }^{\circ}\text{C}$ for BF510 and BF511        |     |     |                   |
|                                                  |            |      | $V_{DS} = 10\text{ V}; I_D = 5\text{ mA}; T_{amb} = 25\text{ }^{\circ}\text{C}$ for BF512 and BF513 |     |     |                   |
| <b>y-parameters (common source)</b>              |            |      | BF510                                                                                               | 511 | 512 | 513               |
| Input capacitance at $f = 1\text{ MHz}$          | $C_{is}$   | <    | 5                                                                                                   | 5   | 5   | 5 pF              |
| Input conductance at $f = 100\text{ MHz}$        | $g_{is}$   | typ. | 100                                                                                                 | 90  | 60  | 50 $\mu\text{S}$  |
| Feedback capacitance at $f = 1\text{ MHz}$       | $C_{rs}$   | typ. | 0.4                                                                                                 | 0.4 | 0.4 | 0.4 pF            |
|                                                  |            | <    | 0.5                                                                                                 | 0.5 | 0.5 | 0.5 pF            |
| Transfer admittance at $f = 1\text{ kHz}$        | $ y_{fs} $ | >    | 2.5                                                                                                 | 4.0 | 4.0 | 3.5 mS            |
| $V_{GS} = 0$ instead of $I_D = 5\text{ mA}$      | $ y_{fs} $ | >    | –                                                                                                   | –   | 6.0 | 7.0 mS            |
| Transfer admittance at $f = 100\text{ MHz}$      | $ y_{fs} $ | typ. | 3.5                                                                                                 | 5.5 | 5.0 | 5.0 mS            |
| Output capacitance at $f = 1\text{ MHz}$         | $C_{os}$   | <    | 3                                                                                                   | 3   | 3   | 3 pF              |
| Output conductance at $f = 1\text{ MHz}$         | $g_{os}$   | <    | 60                                                                                                  | 80  | 100 | 120 $\mu\text{S}$ |
| Output conductance at $f = 100\text{ MHz}$       | $g_{os}$   | typ. | 35                                                                                                  | 55  | 70  | 90 $\mu\text{S}$  |
| <b>Noise figure</b> at optimum source admittance |            |      |                                                                                                     |     |     |                   |
| $G_S = 1\text{ mS}; -B_S = 3\text{ mS};$         |            |      |                                                                                                     |     |     |                   |
| $f = 100\text{ MHz}$                             | F          | typ. | 1.5                                                                                                 | 1.5 | 1.5 | 1.5 dB            |



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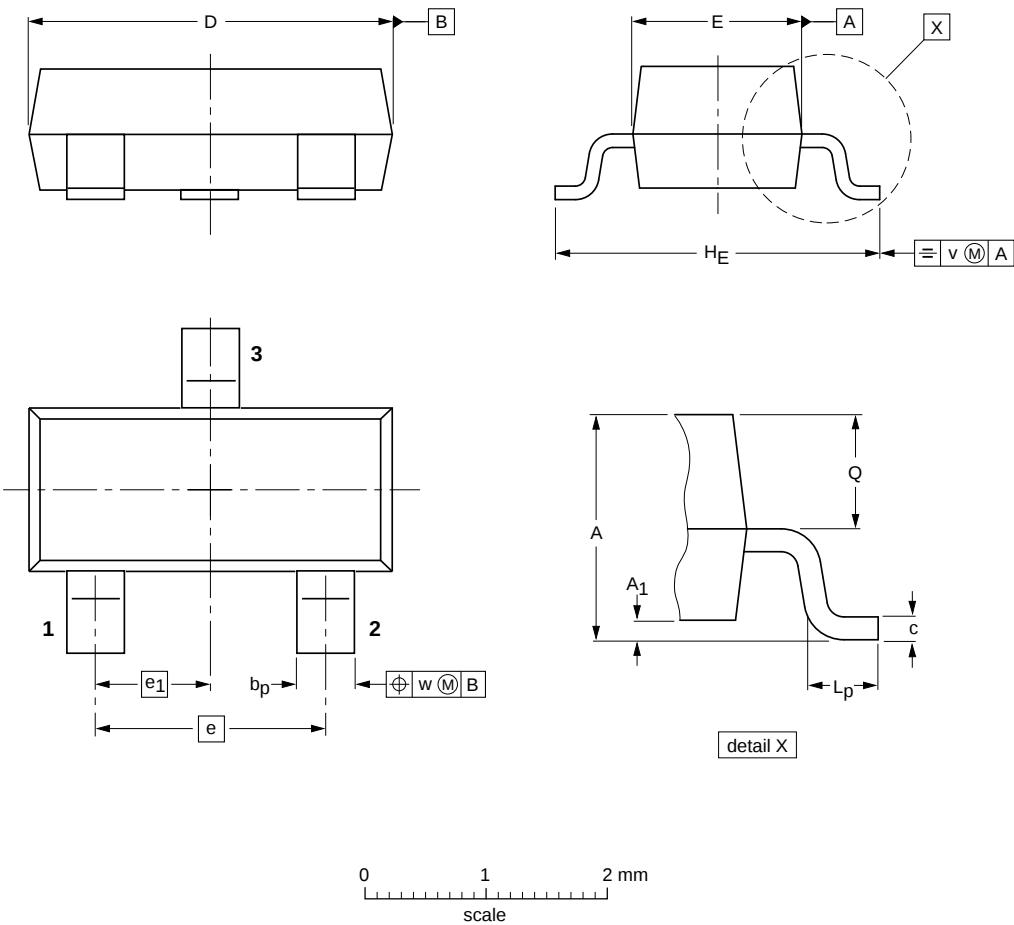
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PACKAGE OUTLINE

Plastic surface-mounted package; 3 leads

SOT23



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub><br>max. | b <sub>p</sub> | c            | D          | E          | e   | e <sub>1</sub> | H <sub>E</sub> | L <sub>p</sub> | Q            | v   | w   |
|------|------------|------------------------|----------------|--------------|------------|------------|-----|----------------|----------------|----------------|--------------|-----|-----|
| mm   | 1.1<br>0.9 | 0.1                    | 0.48<br>0.38   | 0.15<br>0.09 | 3.0<br>2.8 | 1.4<br>1.2 | 1.9 | 0.95           | 2.5<br>2.1     | 0.45<br>0.15   | 0.55<br>0.45 | 0.2 | 0.1 |

| OUTLINE<br>VERSION | REFERENCES |          |       |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE                      |
|--------------------|------------|----------|-------|--|---------------------------------------------------------------------------------------|---------------------------------|
|                    | IEC        | JEDEC    | JEITA |  |                                                                                       |                                 |
| SOT23              |            | TO-236AB |       |  |  | <del>04-11-04</del><br>06-03-16 |

## N-channel silicon field-effect transistors

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## DATA SHEET STATUS

| DOCUMENT STATUS <sup>(1)</sup> | PRODUCT STATUS <sup>(2)</sup> | DEFINITION                                                                            |
|--------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective data sheet           | Development                   | This document contains data from the objective specification for product development. |
| Preliminary data sheet         | Qualification                 | This document contains data from the preliminary specification.                       |
| Product data sheet             | Production                    | This document contains the product specification.                                     |

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