

# DATA SHEET

**BFS17A**

**NPN 3 GHz wideband transistor**

Product specification  
File under Discrete Semiconductors, SC14

September 1995

## NPN 3 GHz wideband transistor

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## DESCRIPTION

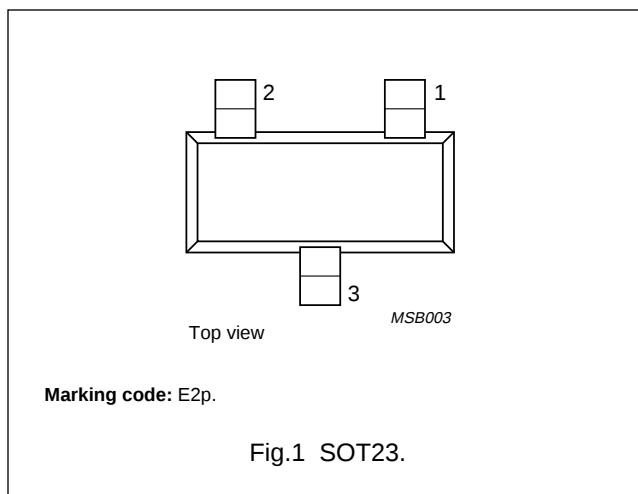
NPN transistor in a plastic SOT23 package.

## APPLICATIONS

- It is intended for RF applications such as oscillators in TV tuners.

## PINNING

| PIN | DESCRIPTION |
|-----|-------------|
| 1   | base        |
| 2   | emitter     |
| 3   | collector   |



## QUICK REFERENCE DATA

| SYMBOL    | PARAMETER                     | CONDITIONS                                                                                                                                                         | TYP. | MAX. | UNIT |
|-----------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|
| $V_{CBO}$ | collector-base voltage        | open emitter                                                                                                                                                       | —    | 25   | V    |
| $V_{CEO}$ | collector-emitter voltage     | open base                                                                                                                                                          | —    | 15   | V    |
| $I_C$     | DC collector current          |                                                                                                                                                                    | —    | 25   | mA   |
| $P_{tot}$ | total power dissipation       | up to $T_s = 70\text{ °C}$ ; note 1                                                                                                                                | —    | 300  | mW   |
| $f_T$     | transition frequency          | $I_C = 25\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$                                                                     | 2.8  | —    | GHz  |
| $G_{UM}$  | maximum unilateral power gain | $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 800\text{ MHz}$                                                                                               | 13.5 | —    | dB   |
| F         | noise figure                  | $I_C = 2\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$                                                                      | 2.5  | —    | dB   |
| $V_O$     | output voltage                | $d_{im} = -60\text{ dB}$ ; $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $R_L = 75\text{ }\Omega$ ; $T_{amb} = 25\text{ °C}$ ; $f_{(p+q-r)} = 793.25\text{ MHz}$ | 150  | —    | mV   |

## LIMITING VALUES

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

| SYMBOL    | PARAMETER                 | CONDITIONS                          | MIN. | MAX. | UNIT |
|-----------|---------------------------|-------------------------------------|------|------|------|
| $V_{CBO}$ | collector-base voltage    | open emitter                        | —    | 25   | V    |
| $V_{CEO}$ | collector-emitter voltage | open base                           | —    | 15   | V    |
| $V_{EBO}$ | emitter-base voltage      | open collector                      | —    | 2.5  | V    |
| $I_C$     | DC collector current      |                                     | —    | 25   | mA   |
| $I_{CM}$  | peak collector current    |                                     | —    | 50   | mA   |
| $P_{tot}$ | total power dissipation   | up to $T_s = 70\text{ °C}$ ; note 1 | —    | 300  | mW   |
| $T_{stg}$ | storage temperature       |                                     | −65  | +150 | °C   |
| $T_j$     | junction temperature      |                                     | —    | 150  | °C   |

## Note to the Quick reference data and the Limiting values

- $T_s$  is the temperature at the soldering point of the collector pin.

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## THERMAL CHARACTERISTICS

| SYMBOL        | PARAMETER                                           | CONDITIONS                          | VALUE | UNIT |
|---------------|-----------------------------------------------------|-------------------------------------|-------|------|
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | up to $T_s = 70\text{ °C}$ ; note 1 | 260   | K/W  |

## Note

- $T_s$  is the temperature at the soldering point of the collector pin.

## CHARACTERISTICS

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

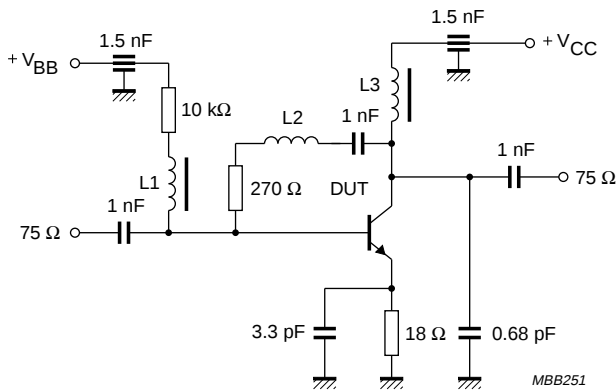
| SYMBOL    | PARAMETER                               | CONDITIONS                                                                                                               | MIN. | TYP. | MAX. | UNIT |
|-----------|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{CBO}$ | collector cut-off current               | $I_E = 0$ ; $V_{CB} = 10\text{ V}$                                                                                       | –    | –    | 50   | nA   |
| $h_{FE}$  | DC current gain                         | $I_C = 2\text{ mA}$ ; $V_{CE} = 1\text{ V}$ ; $T_{amb} = 25\text{ °C}$                                                   | 25   | 90   | –    |      |
|           |                                         | $I_C = 25\text{ mA}$ ; $V_{CE} = 1\text{ V}$ ; $T_{amb} = 25\text{ °C}$                                                  | 25   | 90   | –    |      |
| $f_T$     | transition frequency                    | $I_C = 25\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $f = 500\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$                           | –    | 2.8  | –    | GHz  |
| $C_c$     | collector capacitance                   | $I_E = 0$ ; $V_{CB} = 10\text{ V}$ ; $f = 1\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$                                       | –    | 0.7  | –    | pF   |
| $C_e$     | emitter capacitance                     | $I_C = 0$ ; $V_{EB} = 0.5\text{ V}$ ; $f = 1\text{ MHz}$                                                                 | –    | 1.25 | –    | pF   |
| $C_{re}$  | feedback capacitance                    | $I_C = 0$ ; $V_{CE} = 5\text{ V}$ ; $f = 1\text{ MHz}$                                                                   | –    | 0.6  | –    | pF   |
| $G_{UM}$  | maximum unilateral power gain<br>note 1 | $I_C = 14\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 800\text{ MHz}$                                                     | –    | 13.5 | –    | dB   |
| $F$       | noise figure                            | $I_C = 2\text{ mA}$ ; $V_{CE} = 5\text{ V}$ ; $Z_S = 60\text{ }\Omega$ ; $f = 800\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$ | –    | 2.5  | –    | dB   |
| $V_O$     | output voltage                          | note 2                                                                                                                   | –    | 150  | –    | mV   |

## Notes

- $G_{UM}$  is the maximum unilateral power gain, assuming  $S_{12}$  is zero and  $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$  dB.
- $d_{im} = -60\text{ dB}$  (DIN 45004B);  $I_C = 14\text{ mA}$ ;  $V_{CE} = 10\text{ V}$ ;  $R_L = 75\text{ }\Omega$ ;  $T_{amb} = 25\text{ °C}$ ;  
 $V_p = V_O$ ;  $f_p = 795.25\text{ MHz}$ ;  
 $V_q = V_O - 6\text{ dB}$ ;  $f_q = 803.25\text{ MHz}$ ;  
 $V_r = V_O - 6\text{ dB}$ ;  $f_r = 805.25\text{ MHz}$ ;  
measured at  $f_{(p+q-r)} = 793.25\text{ MHz}$ .

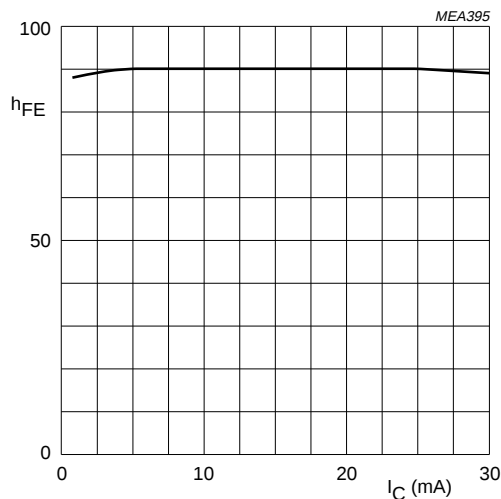
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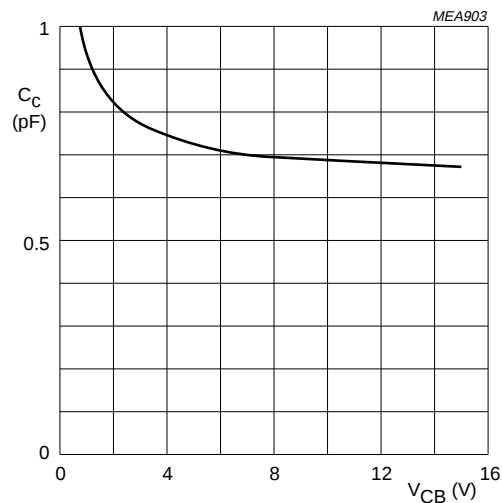
L1 = L3 = 5  $\mu$ H Ferroxcube choke.  
L2 = 3 turns 0.4 mm copper wire; winding pitch 1 mm; internal diameter 3 mm.

Fig.2 Intermodulation distortion and second order intermodulation distortion test circuit.



$V_{CE} = 1$  V;  $T_{amb} = 25$   $^{\circ}$ C.

Fig.3 DC current gain as a function of collector current.

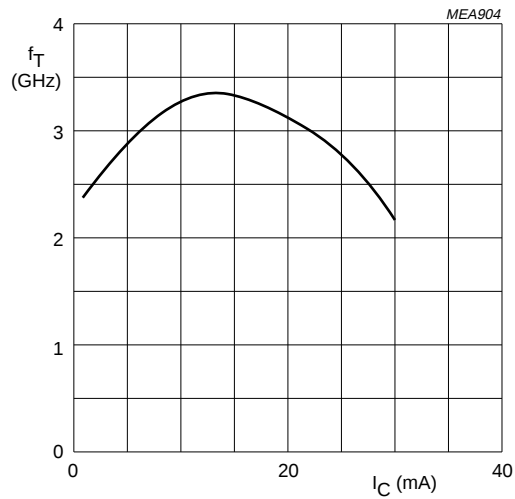


$I_E = 0$ ;  $f = 1$  MHz;  $T_{amb} = 25$   $^{\circ}$ C.

Fig.4 Collector capacitance as a function of collector-base voltage.

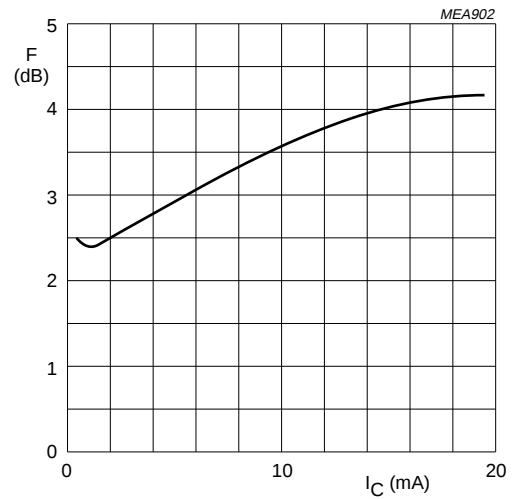
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$V_{CE} = 5$  V;  $f = 500$  MHz;  $T_{amb} = 25$  °C.

Fig.5 Transition frequency as a function of collector current.



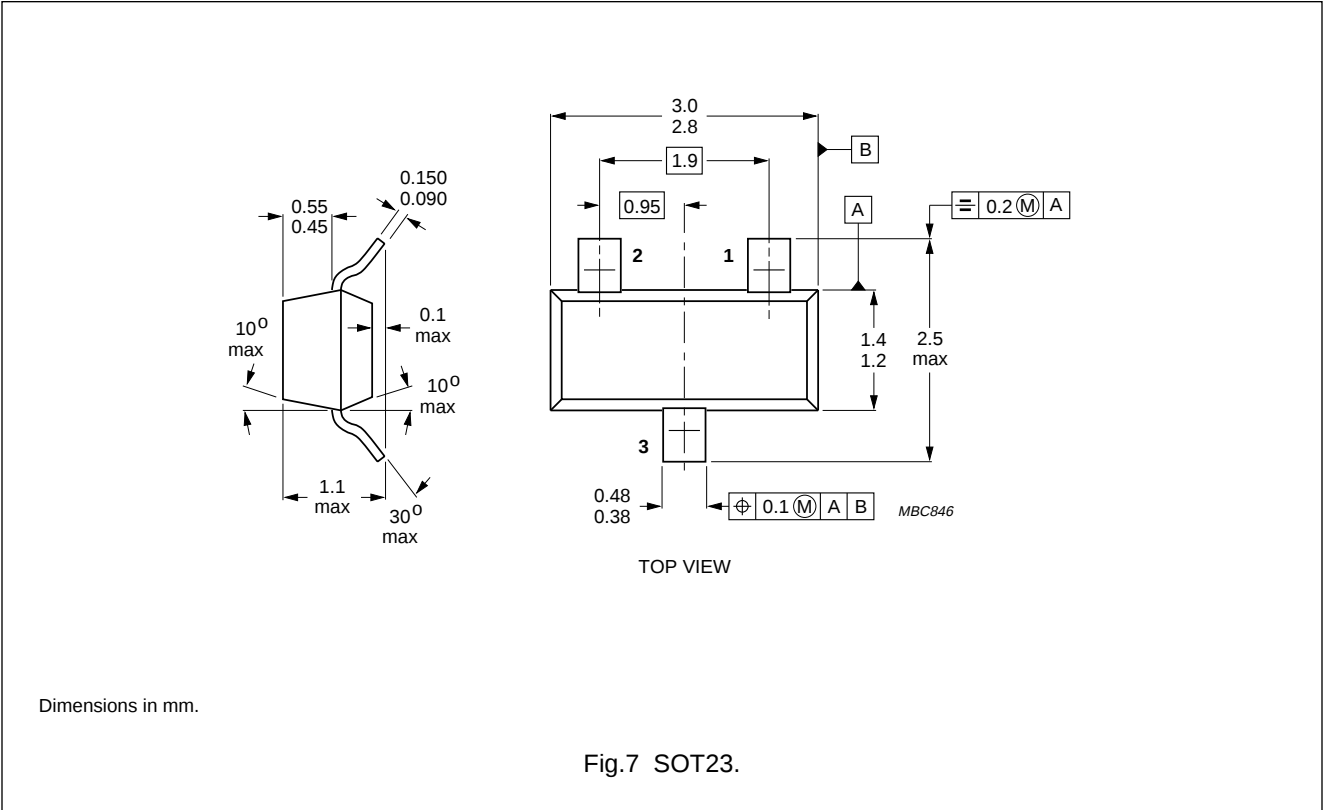
$V_{CE} = 5$  V;  $Z_s = 60$   $\Omega$ ;  $f = 800$  MHz;  $T_{amb} = 25$  °C.

Fig.6 Minimum noise figure as a function of collector current.

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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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