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# DATA SHEET

## BFG31
## PNP 5 GHz wideband transistor

Product specification
Supersedes data of November 1992

1995 Sep 12

# PNP 5 GHz wideband transistor BFG31

## FEATURES

- High output voltage capability
- High gain bandwidth product
- Good thermal stability
- Gold metallization ensures excellent reliability.

## PINNING

| PIN | DESCRIPTION |
|---|---|
| 1 | emitter |
| 2 | base |
| 3 | emitter |
| 4 | collector |

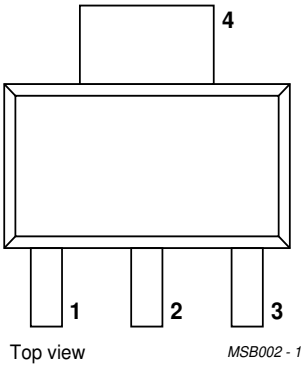



Fig.1 SOT223.

## DESCRIPTION

PNP planar epitaxial transistor mounted in a plastic SOT223 envelope.

It is intended for wideband amplifier applications.

NPN complement is the BFG97.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{CEO}$ | collector-emitter voltage | open base | – | – | −15 | V |
| $I_C$ | DC collector current | | – | – | −100 | mA |
| $P_{tot}$ | total power dissipation | up to $T_s$ = 135 °C ; note 1 | – | – | 1 | W |
| $h_{FE}$ | DC current gain | $I_C$ = −70 mA; $V_{CE}$ = −10 V; $T_{amb}$ = 25 °C | 25 | – | – | |
| $f_T$ | transition frequency | $I_C$ = −70 mA; $V_{CE}$ = −10 V; f = 500 MHz; $T_{amb}$ = 25 °C | – | 5.0 | – | GHz |
| $G_{UM}$ | maximum unilateral power gain | $I_C$ = −70 mA; $V_{CE}$ = −10 V; f = 800 MHz; $T_{amb}$ = 25 °C | – | 12 | – | dB |
| $V_o$ | output voltage | $I_C$ = −100 mA; $V_{CE}$ = −10 V; $R_L$ = 75 Ω; $T_{amb}$ = 25 °C | – | 600 | – | mV |

## LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | −20 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | – | −15 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | −3 | V |
| $I_C$ | DC collector current | | – | −100 | mA |
| $P_{tot}$ | total power dissipation | up to $T_s$ = 135 °C; note 1 | – | 1 | W |
| $T_{stg}$ | storage temperature | | −65 | 150 | °C |
| $T_j$ | junction temperature | | – | 175 | °C |

**Note**

1. $T_s$ is the temperature at the soldering point of the collector tab.

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | THERMAL RESISTANCE |
|---|---|---|---|
| $R_{th\ j\text{-}s}$ | thermal resistance from junction to soldering point | up to $T_s$ = 135 °C; note 1 | 40 K/W |

**Note**

1. $T_s$ is the temperature at the soldering point of the collector tab.

## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | open emitter; $I_C$ = −10 mA | −20 | – | – | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | open base; $I_C$ = −10 mA | −18 | – | – | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | open collector; $I_E$ = −0.1 mA | −3 | – | – | V |
| $I_{CBO}$ | collector cut-off current | $I_E$ = 0; $V_{CB}$ = −10 V | – | – | −1 | μA |
| $h_{FE}$ | DC current gain | $I_C$ = −70 mA; $V_{CE}$ = −10 V; $T_{amb}$ = 25 °C | 25 | – | – | |
| $C_{cb}$ | collector-base capacitance | $I_C$ = 0; $V_{CB}$ = −10 V; f = 1 MHz; | – | 1.8 | – | pF |
| $C_{eb}$ | emitter-base capacitance | $I_C$ = 0; $V_{EB}$ = −10 V; f = 1 MHz | – | 5 | – | pF |
| $C_{re}$ | feedback capacitance | $I_C$ = 0; $V_{CE}$ = −10 V; f = 1 MHz; $T_{amb}$ = 25 °C | – | 1.6 | – | pF |
| $f_T$ | transition frequency | $I_C$ = −70 mA; $V_{CE}$ = −10 V; f = 500 MHz; $T_{amb}$ = 25 °C | – | 5 | – | GHz |
| $G_{UM}$ | maximum unilateral power gain; note 1 | $I_C$ = −70 mA; $V_{CE}$ = −10 V; f = 500 MHz; $T_{amb}$ = 25 °C | – | 16 | – | dB |
| | | $I_C$ = −70 mA; $V_{CE}$ = −10 V; f = 800 MHz; $T_{amb}$ = 25 °C | – | 12 | – | dB |
| $V_o$ | output voltage | note 2 | – | 600 | – | mV |
| $V_o$ | output voltage | note 3 | – | 550 | – | mV |

**Notes**

1. $G_{UM}$ 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.
2. $d_{im}$ = −60 dB; $I_C$ = −70 mA; $V_{CE}$ = −10 V; $R_L$ = 75 Ω; $T_{amb}$ = 25 °C;
   $V_p = V_o$ at $d_{im}$ = −60 dB; $f_p$ = 850.25 MHz;
   $V_q = V_o$ −6 dB; $f_q$ = 858.25 MHz;
   $V_r = V_o$ −6 dB; $f_r$ = 860.25 MHz;
   measured at $f_{(p+q-r)}$ = 848.25 MHz.
3. $d_{im}$ = −60 dB (DIN 45004B); $I_C$ = −70 mA; $V_{CE}$ = −10 V; $R_L$ = 75 Ω; $T_{amb}$ = 25 °C;
   $V_p = V_o$ = at $d_{im}$ = −60 dB; $f_p$ = 445.25 MHz;
   $V_q = V_o$ −6 dB; $f_q$ = 453.25 MHz;
   $V_r = V_o$ −6 dB; $f_r$ = 455.25 MHz;
   measured at $f_{(p+q-r)}$ = 443.25 MHz.

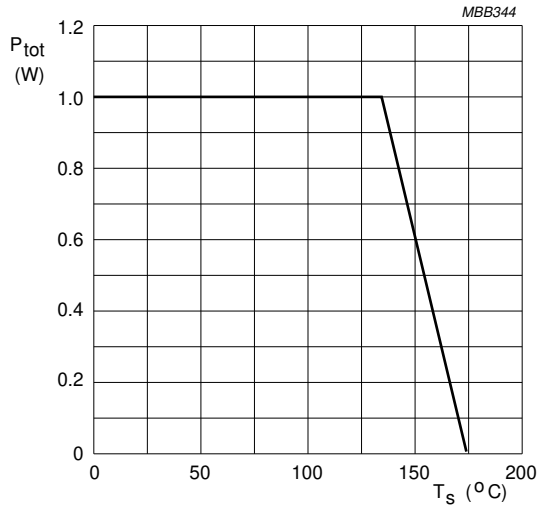
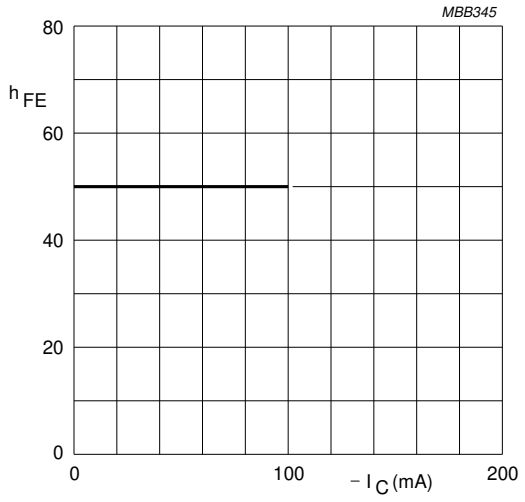
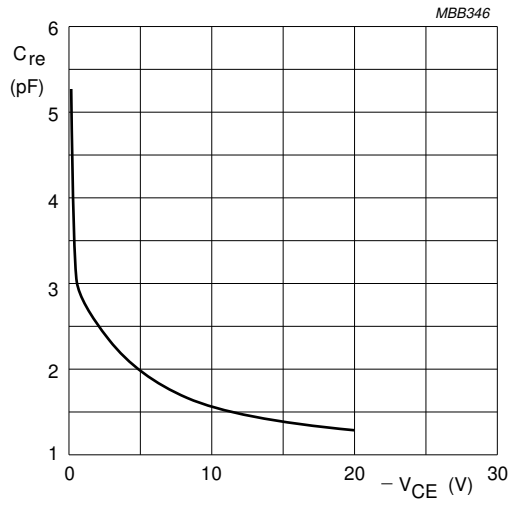



Fig.2 Power derating curve.



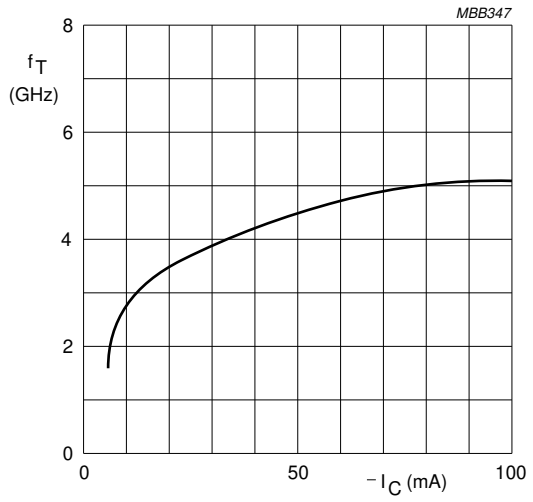

$V_{CE}$ = –10 V; $T_{amb}$ = 25 °C.

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



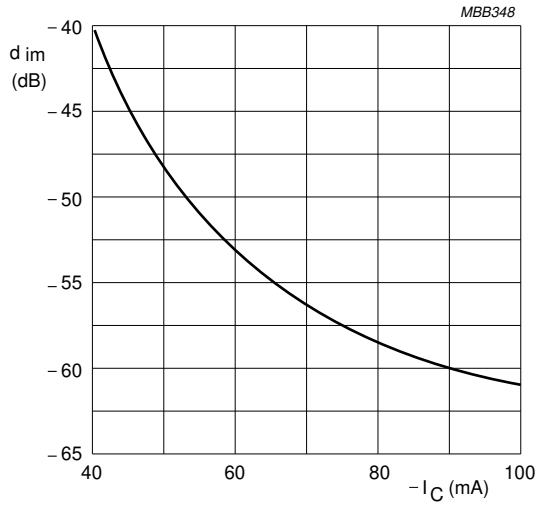

f = 1 MHz; $T_{amb}$ = 25 °C

Fig.4 Feedback capacitance as a function of collector-emitter voltage.



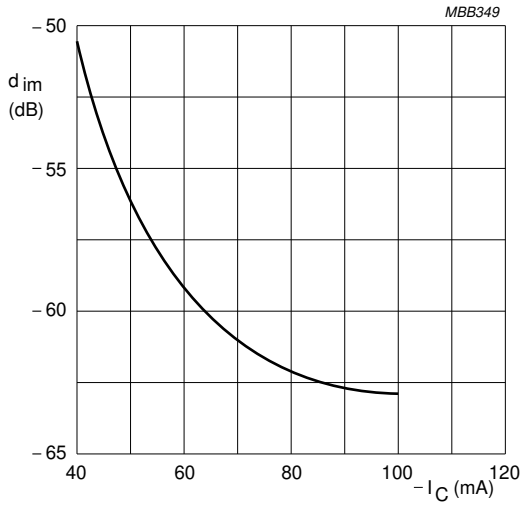

$V_{CE}$ = –10 V; $T_{amb}$ = 25 °C.

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



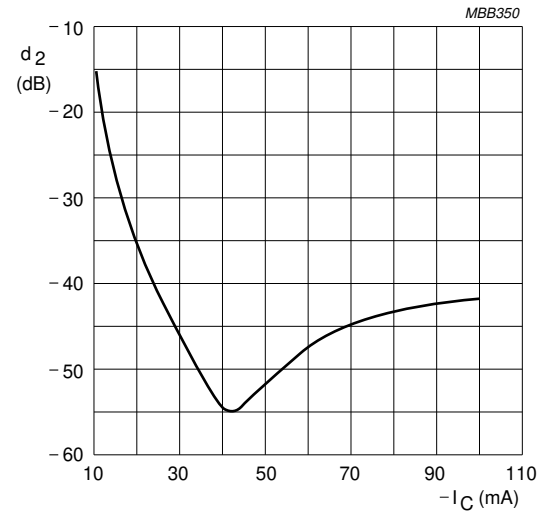

$V_{CE}$ = −10 V; $V_o$ = 650 mV; $T_{amb}$ = 25 °C;
$f_{(p+q-r)}$ = 443.25 MHz.

Fig.6 Intermodulation distortion as a function of collector current.



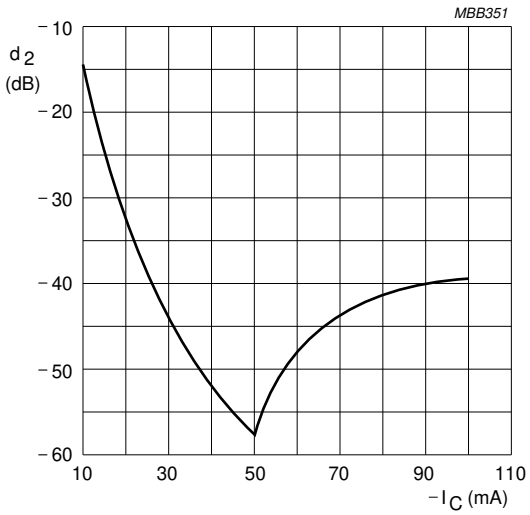

$V_{CE}$ = −10 V; $V_o$ = 550 mV; $T_{amb}$ = 25 °C;
$f_{(p+q-r)}$ = 848.25 MHz.

Fig.7 Intermodulation distortion as a function of collector current.




$V_{CE}$ = −10 V; $V_o$ = 50 dBmV; $T_{amb}$ = 25 °C;
$f_{(p+q)}$ = 450 MHz.

Fig.8 Second order intermodulation distortion as a function of collector current.

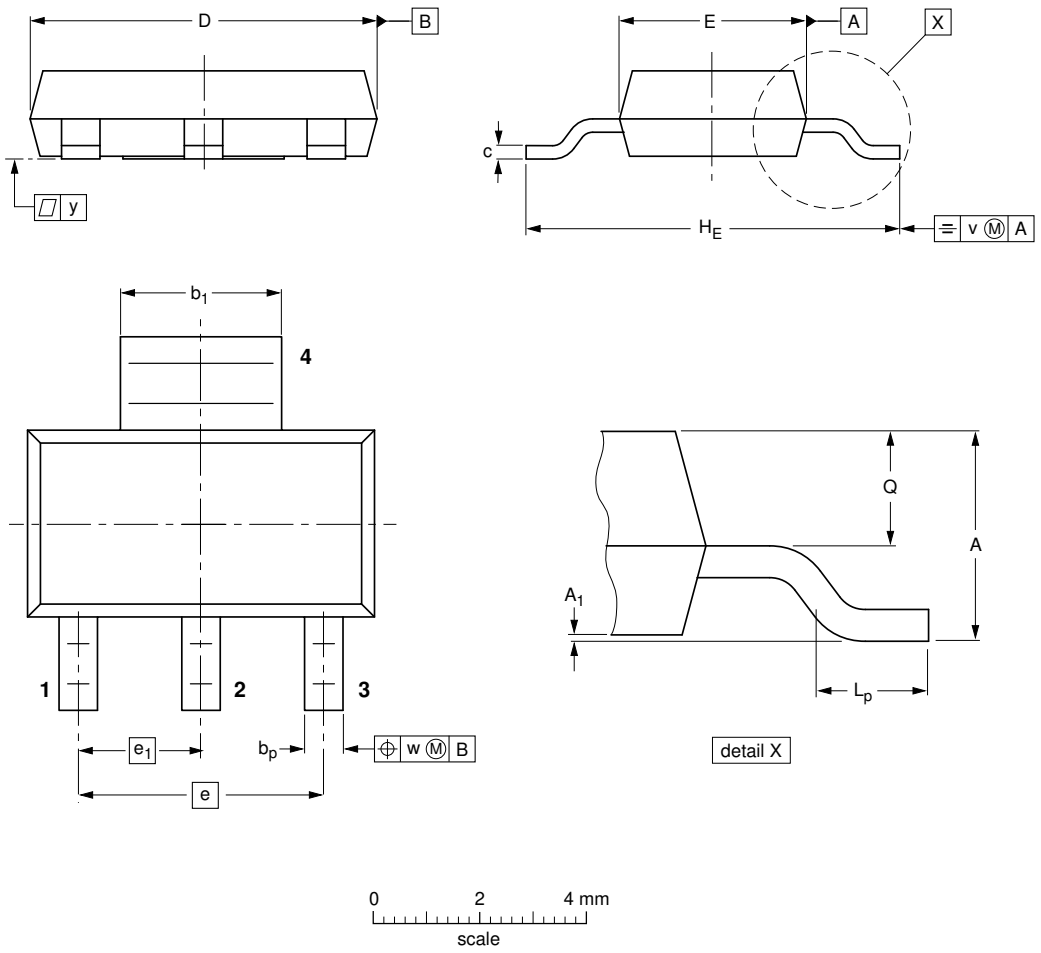



$V_{CE}$ = −10 V; $V_o$ = 50 dBmV; $T_{amb}$ = 25 °C;
$f_{(p+q)}$ = 810 MHz.

Fig.9 Second order intermodulation distortion as a function of collector current.

## PACKAGE OUTLINE

**Plastic surface-mounted package with increased heatsink; 4 leads** **SOT223**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $A_1$ | $b_p$ | $b_1$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | Q | v | w | y |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.8<br>1.5 | 0.10<br>0.01 | 0.80<br>0.60 | 3.1<br>2.9 | 0.32<br>0.22 | 6.7<br>6.3 | 3.7<br>3.3 | 4.6 | 2.3 | 7.3<br>6.7 | 1.1<br>0.7 | 0.95<br>0.85 | 0.2 | 0.1 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT223 | | | SC-73 | | | ~~04-11-10~~<br>06-03-16 |

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|---|---|---|
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| Preliminary data sheet | Qualification | This document contains data from the preliminary specification. |
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