

DATA SHEET

BFG197; BFG197/X; BFG197/XR NPN 7 GHz wideband transistor

Product specification
Supersedes data of November 1992
File under discrete semiconductors, SC14

1995 Sep 13

NPN 7 GHz wideband transistor

BFG197; BFG197/X; BFG197/XR

FEATURES

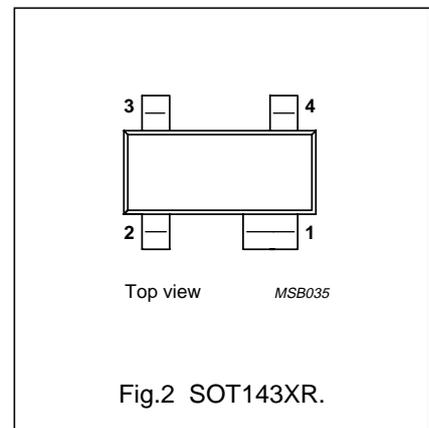
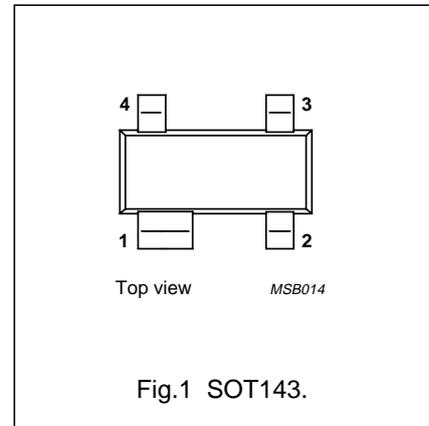
- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG197 is a silicon NPN transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is primarily intended for wideband applications in the GHz range, such as satellite TV systems and repeater amplifiers in fibre-optic systems.

PINNING

| PIN | DESCRIPTION |
|------------------------------|-------------|
| BFG197 (Fig.1) Code: V5 | |
| 1 | collector |
| 2 | base |
| 3 | emitter |
| 4 | emitter |
| BFG197/X (Fig.1) Code: V13 | |
| 1 | collector |
| 2 | emitter |
| 3 | base |
| 4 | emitter |
| BFG197A/XR (Fig.2) Code: V35 | |
| 1 | collector |
| 2 | emitter |
| 3 | base |
| 4 | emitter |



QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------|-------------------------------|--|------|------|------|------|
| V_{CBO} | collector-base voltage | open emitter | – | – | 20 | V |
| V_{CEO} | collector-emitter voltage | open base | – | – | 10 | V |
| I_C | collector current | DC value | – | – | 100 | mA |
| P_{tot} | total power dissipation | up to $T_S = 75\text{ }^\circ\text{C}$; note 1 | – | – | 350 | mW |
| C_{re} | feedback capacitance | $I_C = i_c = 0$; $V_{CB} = 8\text{ V}$; $f = 1\text{ MHz}$ | – | 0.85 | – | pF |
| f_T | transition frequency | $I_C = 50\text{ mA}$; $V_{CE} = 4\text{ V}$; $f = 2\text{ GHz}$ | – | 7.5 | – | GHz |
| G_{UM} | maximum unilateral power gain | $I_C = 50\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; $f = 1\text{ GHz}$ | – | 16 | – | dB |
| | | $I_C = 50\text{ mA}$; $V_{CE} = 6\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; $f = 2\text{ GHz}$ | – | 10 | – | dB |
| F | noise figure | $\Gamma_S = \Gamma_{opt}$; $I_C = 15\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ }^\circ\text{C}$; $f = 1\text{ GHz}$ | – | 1.7 | – | dB |

Note

1. T_S is the temperature at the soldering point of the collector tab.

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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 | – | 10 | V |
| V _{EBO} | emitter-base voltage | open collector | – | 2.5 | V |
| I _C | collector current | DC value, continuous | – | 100 | mA |
| P _{tot} | total power dissipation | up to T _s = 75 °C; note 1 | – | 350 | mW |
| T _{stg} | storage temperature range | | –65 | +150 | °C |
| T _j | junction operating temperature | | – | 175 | °C |

THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | VALUE | UNIT |
|---------------------|--|-------|------|
| R _{th j-s} | from junction to soldering point; note 1 | 290 | 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.

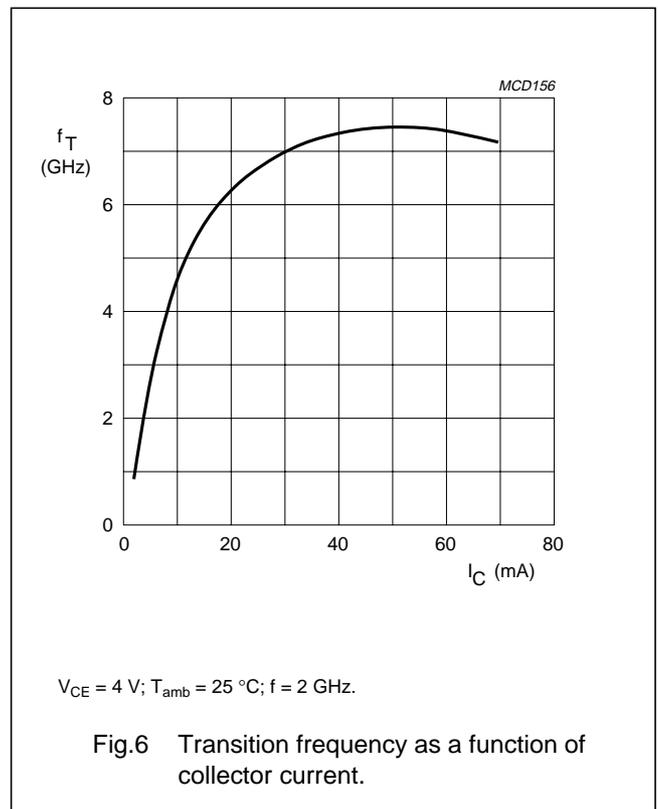
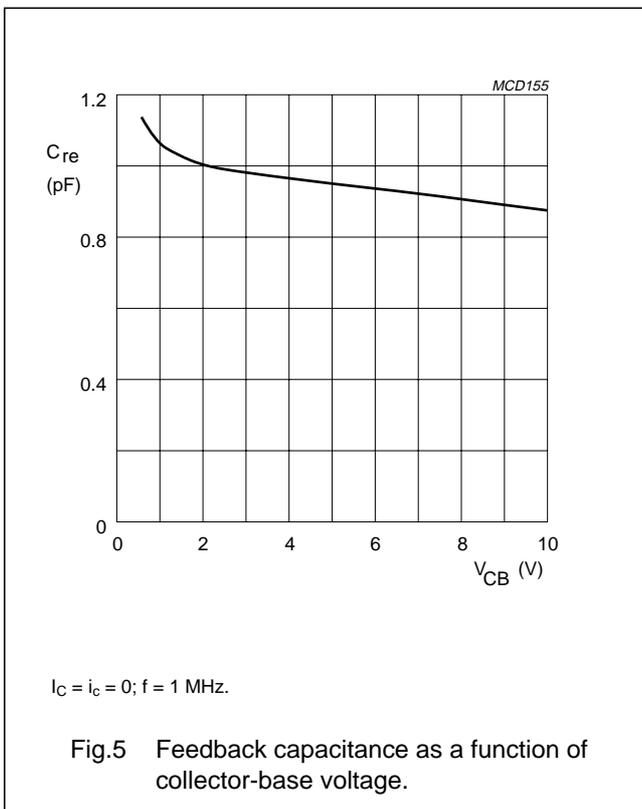
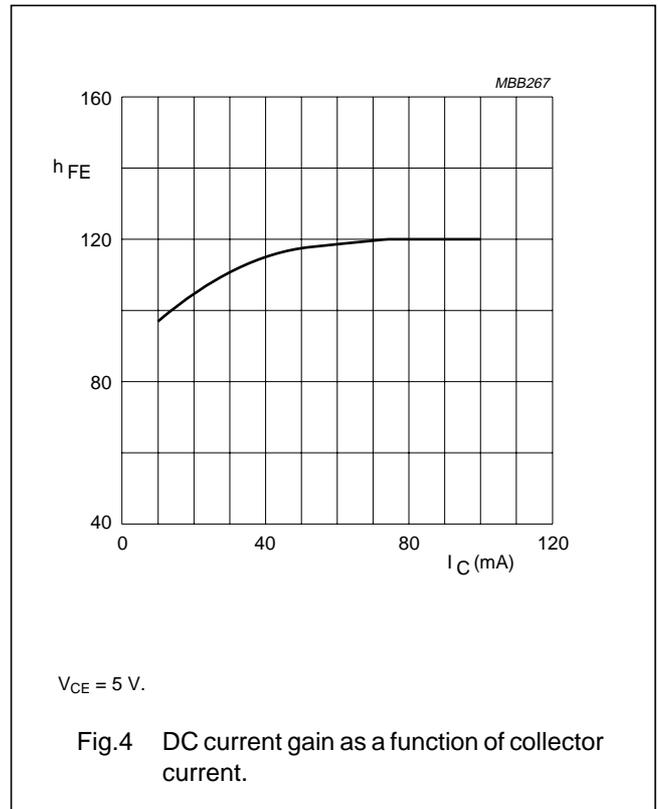
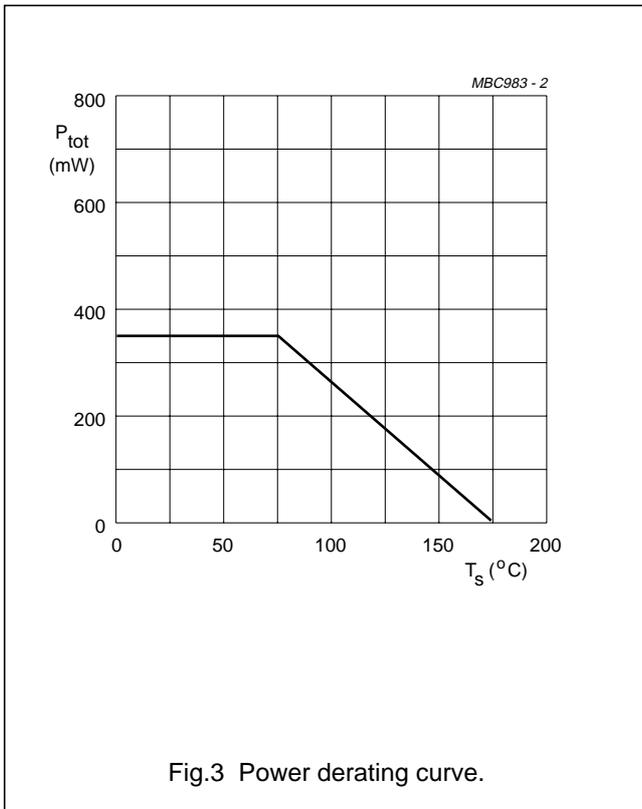
| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|------------------|---|---|------|------|------|------|
| I _{CBO} | collector leakage current | I _E = 0; V _{CB} = 5 V | – | – | 100 | nA |
| h _{FE} | DC current gain | I _C = 50 mA; V _{CE} = 5 V | 40 | 110 | – | |
| C _c | collector capacitance | I _E = i _e = 0; V _{CB} = 8 V; f = 1 MHz | – | 1.5 | – | pF |
| C _e | emitter capacitance | I _C = i _c = 0; V _{EB} = 0.5 V; f = 1 MHz | – | 3.3 | – | pF |
| C _{re} | feedback capacitance | I _C = i _c = 0; V _{CB} = 8 V; f = 1 MHz | – | 0.85 | – | pF |
| f _T | transition frequency | I _C = 50 mA; V _{CE} = 4 V; f = 2 GHz | – | 7.5 | – | GHz |
| G _{UM} | maximum unilateral power gain (note 1) | I _C = 50 mA; V _{CE} = 6 V; T _{amb} = 25 °C; f = 1 GHz | – | 16 | – | dB |
| | | I _C = 50 mA; V _{CE} = 6 V; T _{amb} = 25 °C; f = 2 GHz | – | 10 | – | dB |
| F | noise figure | Γ _s = Γ _{opt} ; I _C = 15 mA; V _{CE} = 8 V; T _{amb} = 25 °C; f = 1 GHz | – | 1.7 | – | dB |
| | | Γ _s = Γ _{opt} ; I _C = 50 mA; V _{CE} = 6 V; T _{amb} = 25 °C; f = 2 GHz | – | 2.3 | – | dB |
| d ₂ | second order intermodulation distortion | V _{CE} = 6 V; V _o = 50 dBmV; | – | –51 | – | dB |

Note

1. G_{UM} is the maximum unilateral power gain, assuming S₁₂ is zero and $G_{UM} = 10 \log \frac{|s_{21}|^2}{(1 - |s_{11}|^2)(1 - |s_{22}|^2)}$ dB.

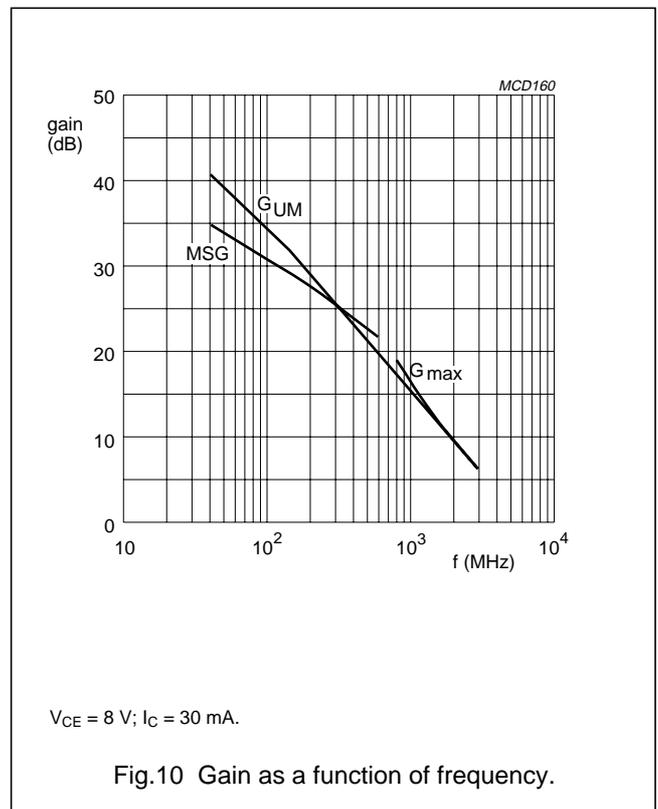
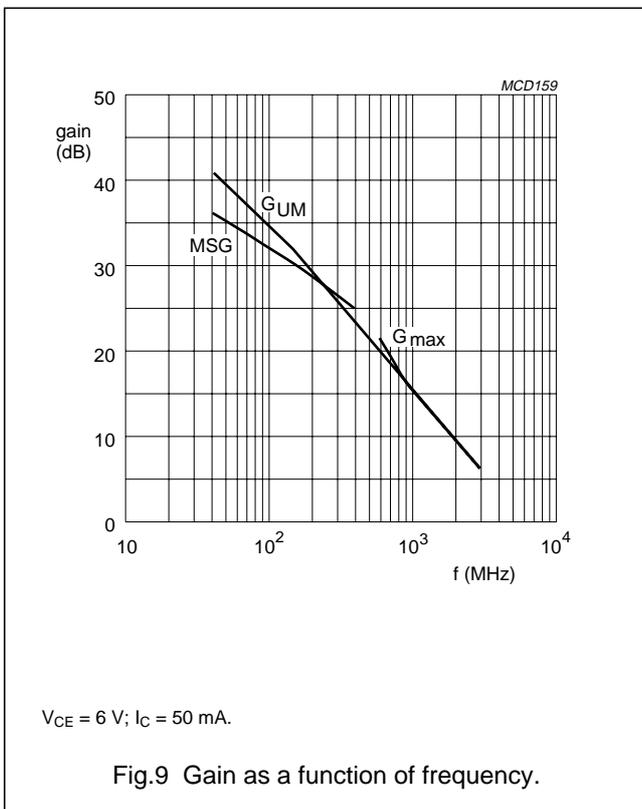
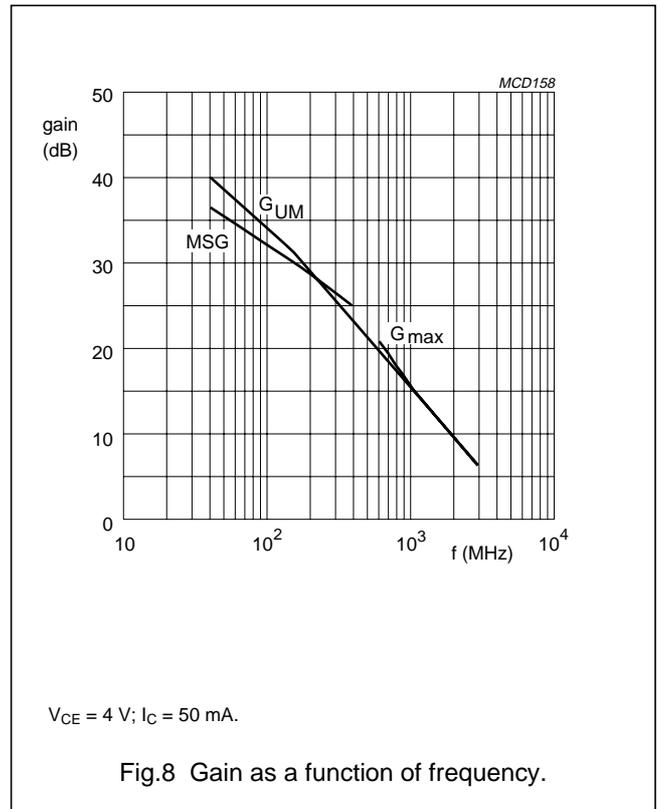
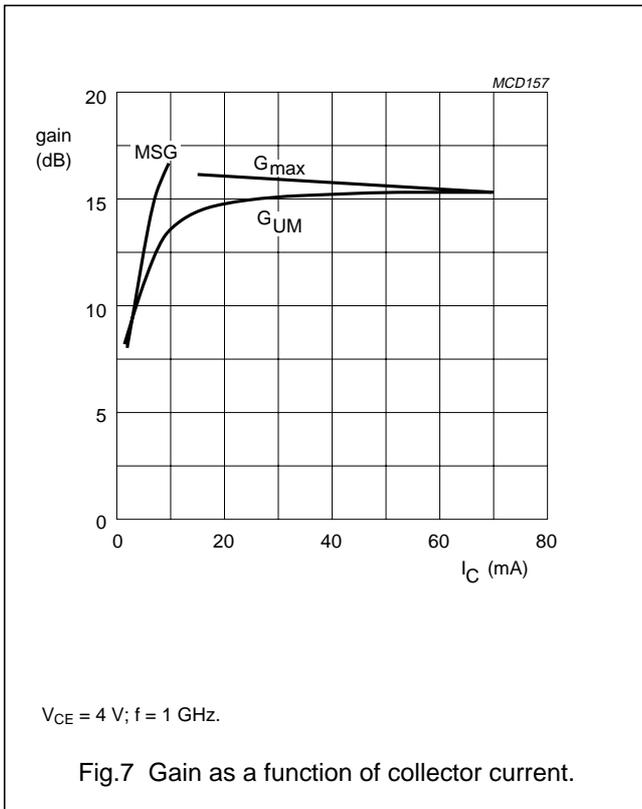
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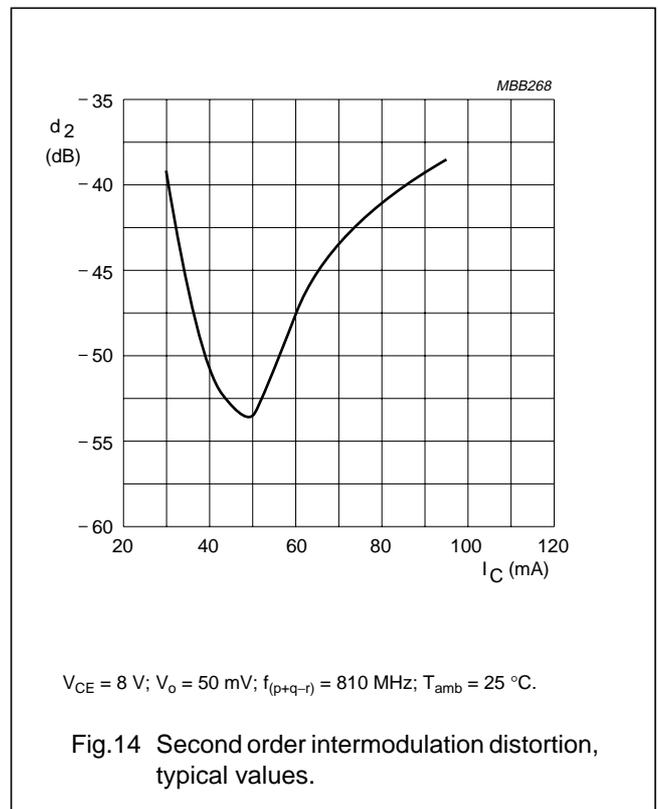
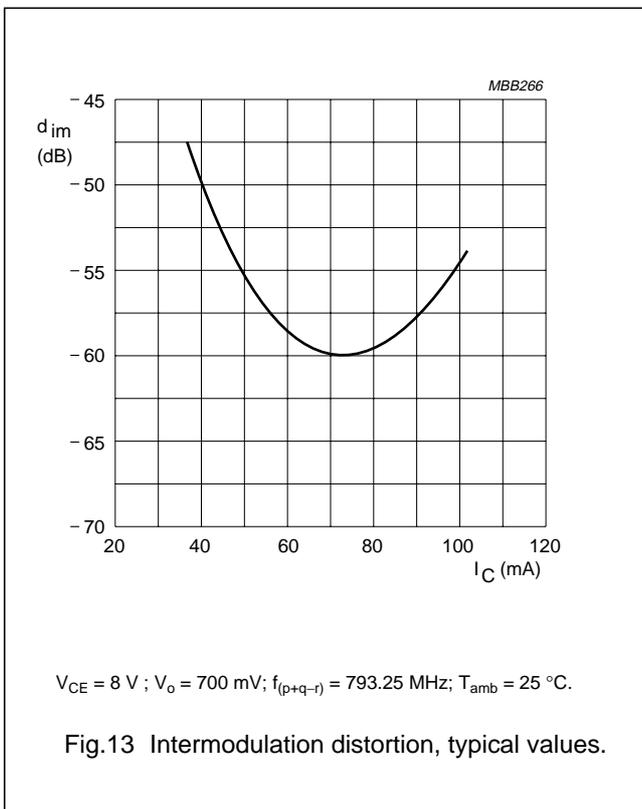
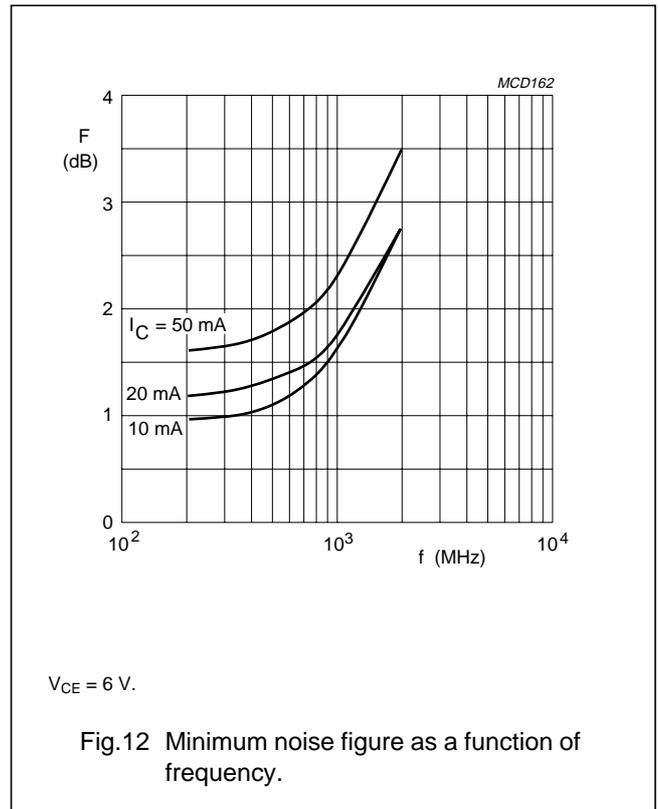
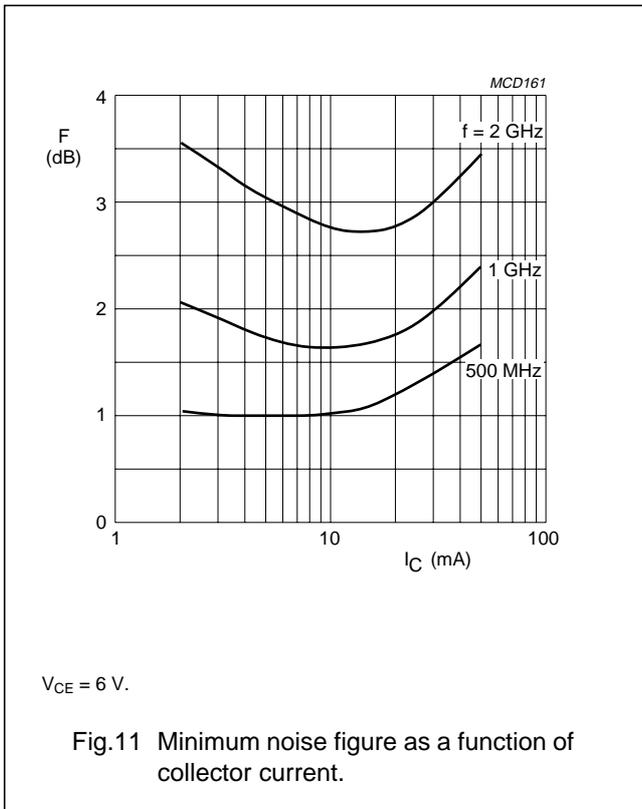
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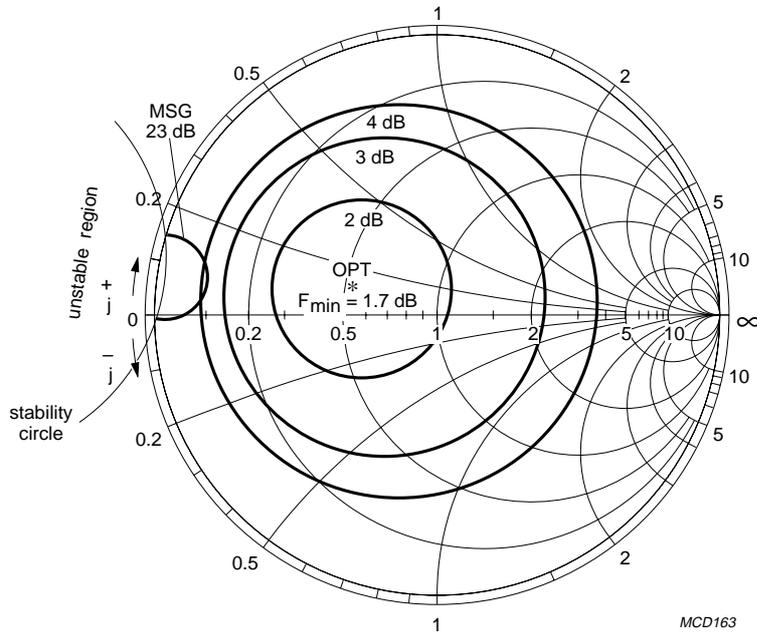
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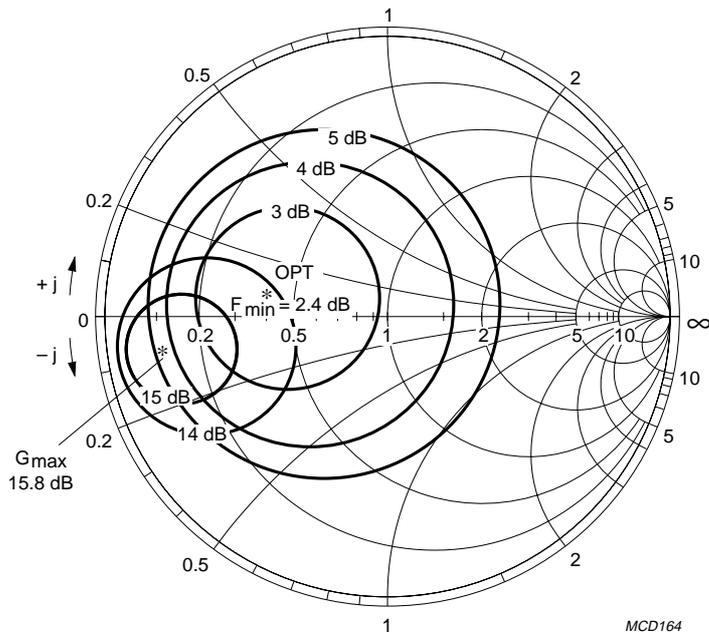
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$Z_0 = 50 \Omega$.
Maximum stable gain = 23 dB.

Fig.15 Noise circle figure.



$Z_0 = 50 \Omega$.

Fig.16 Noise circle figure.

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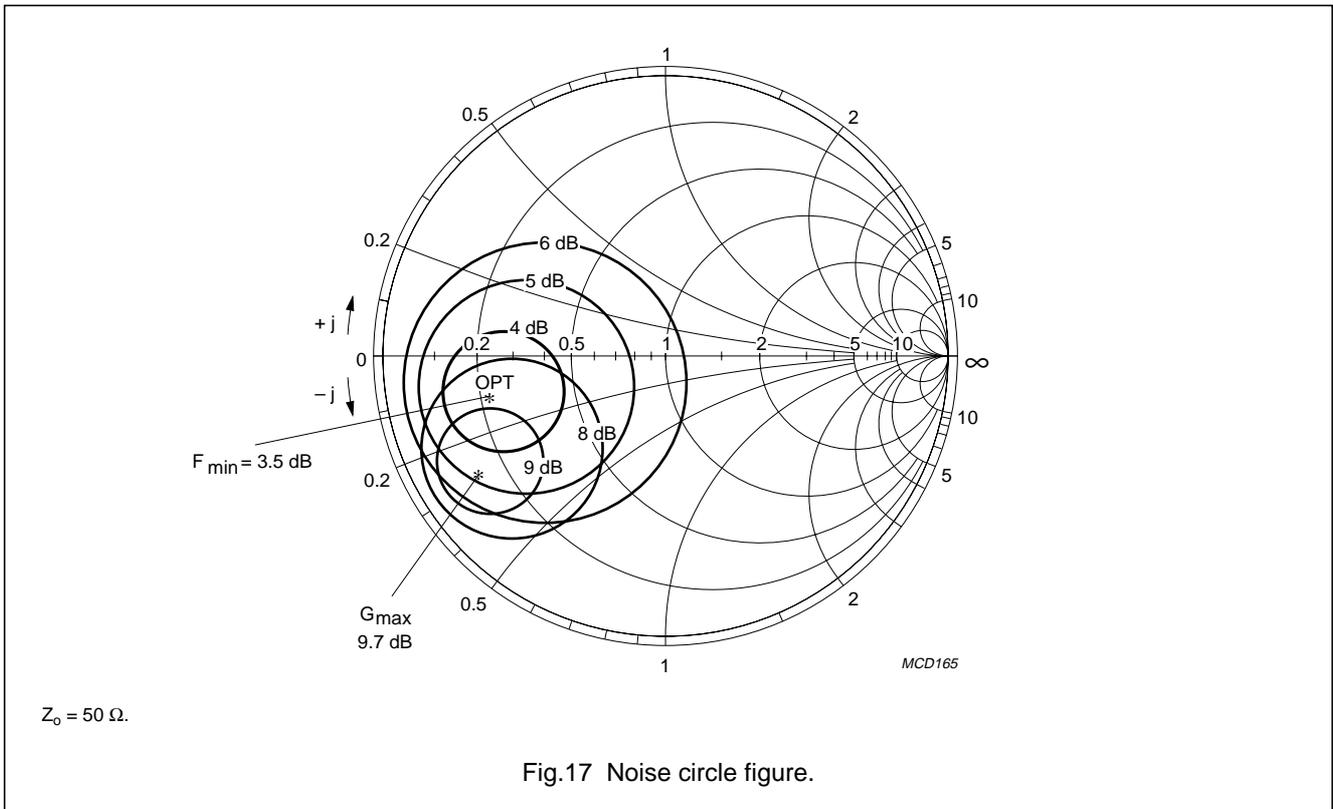


Fig.17 Noise circle figure.

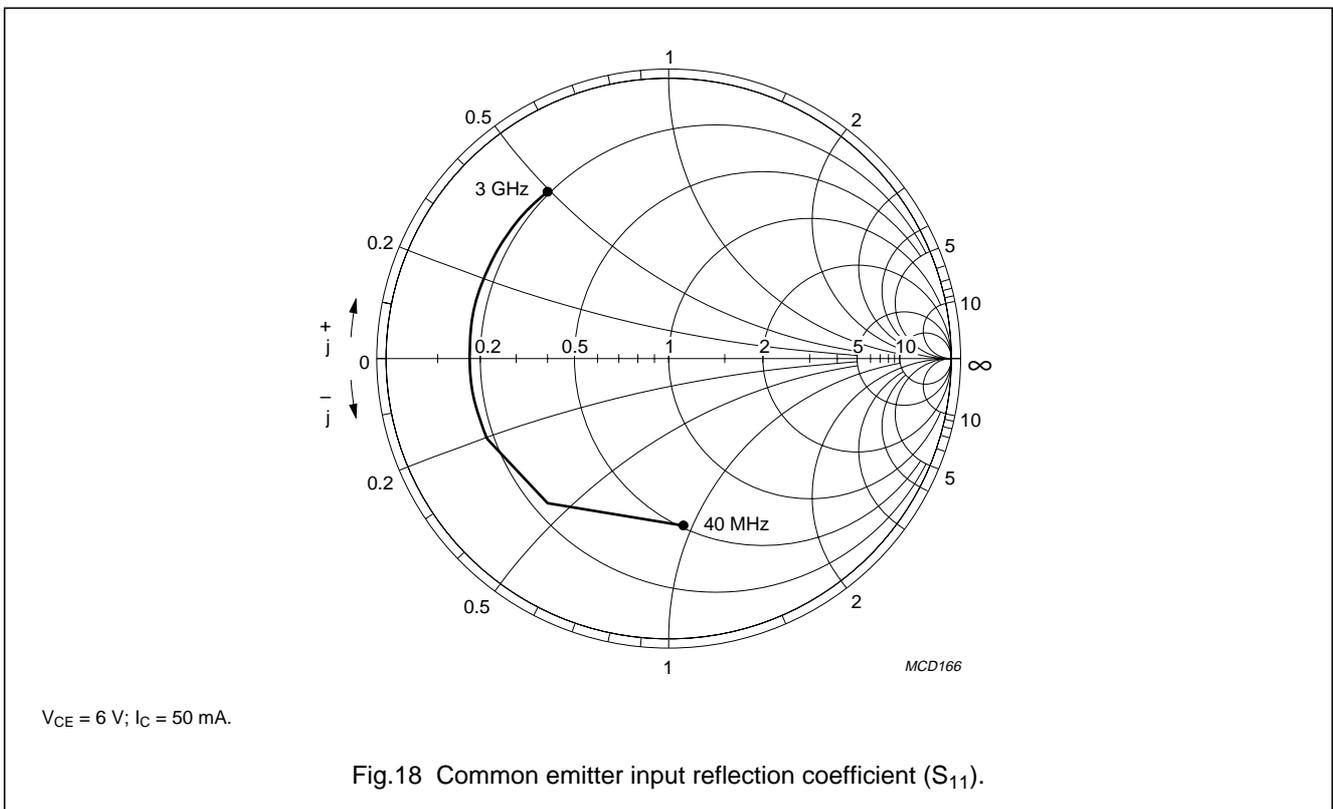
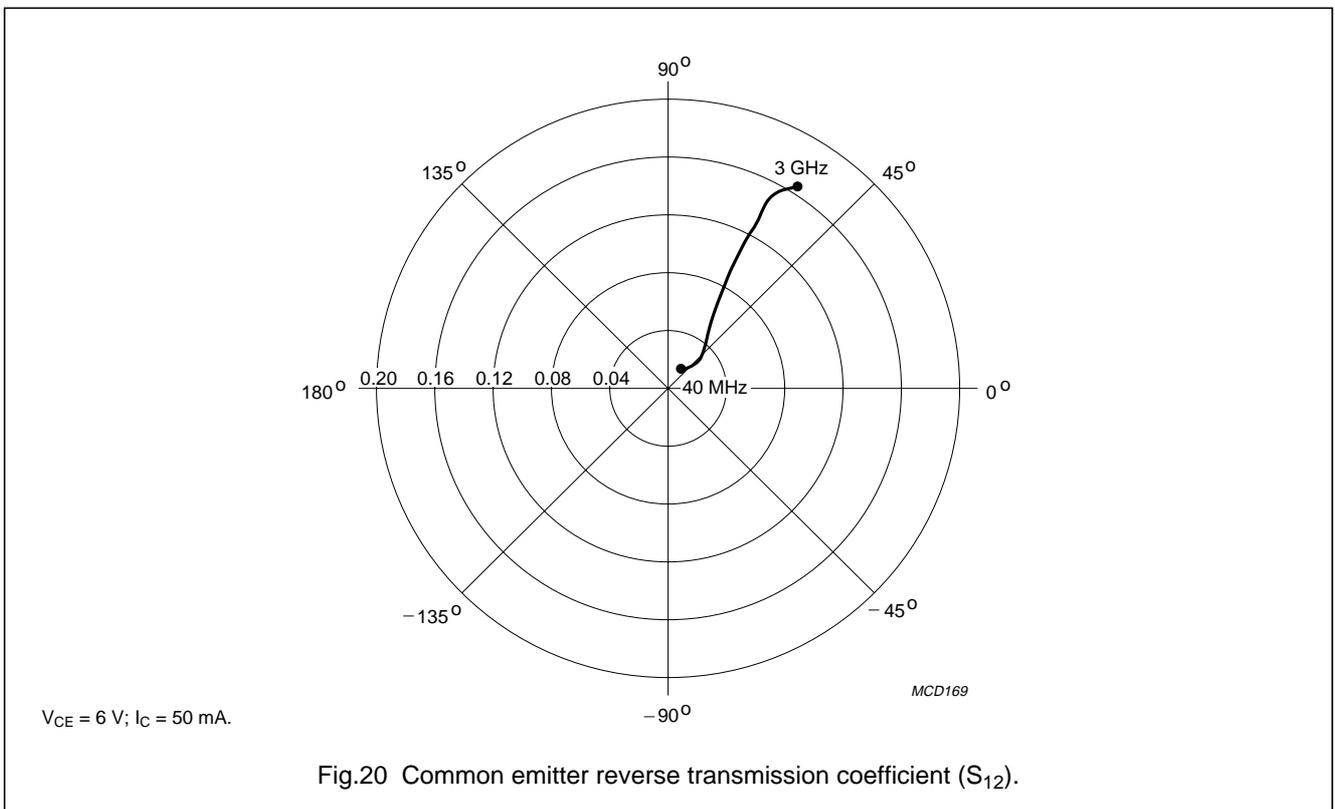
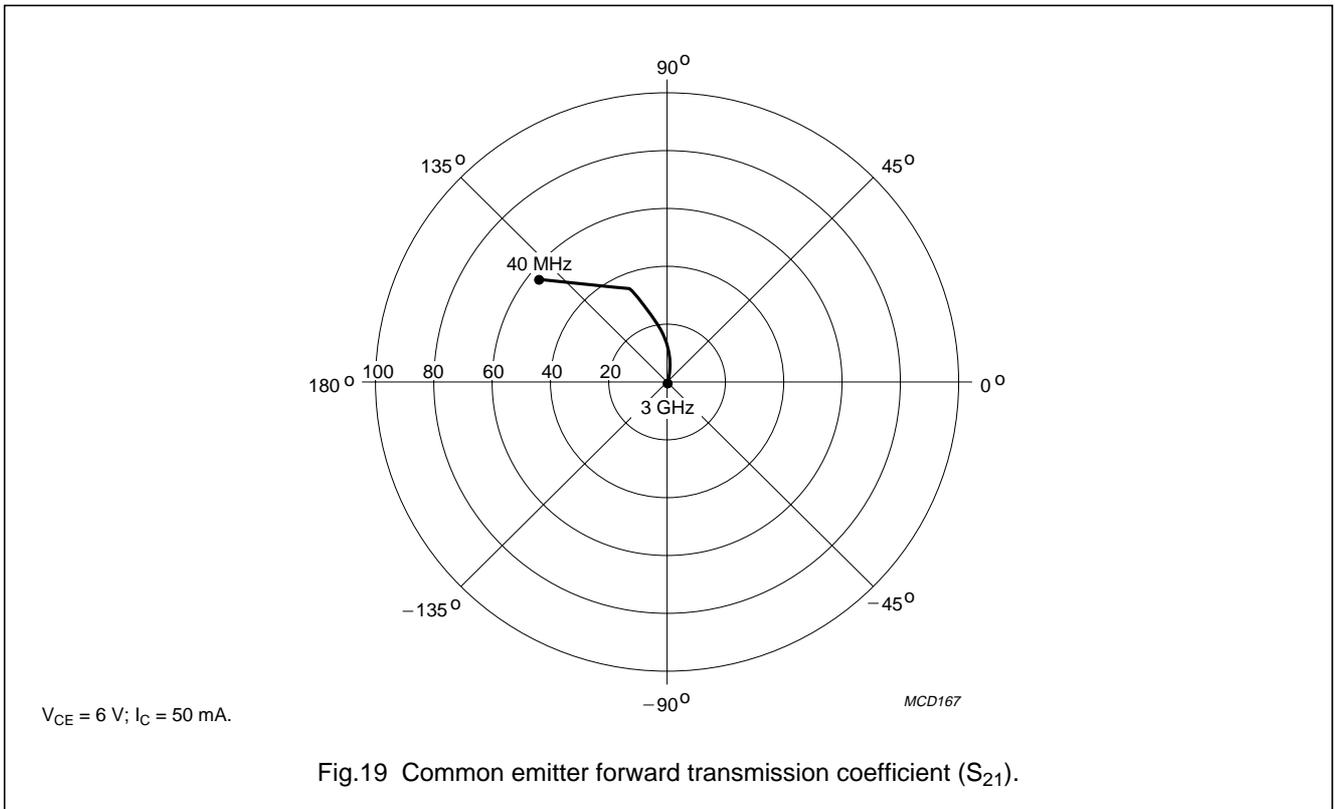


Fig.18 Common emitter input reflection coefficient (S₁₁).

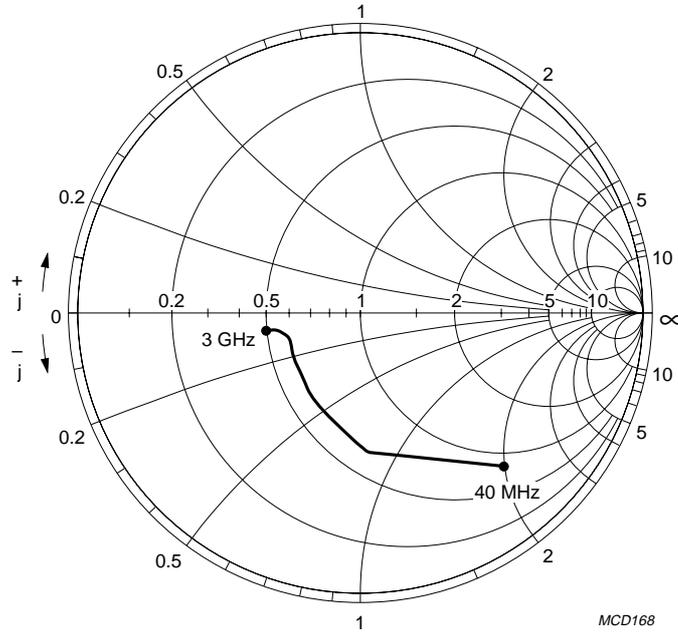
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$V_{CE} = 6\text{ V}; I_C = 50\text{ mA}$.

Fig.21 Common emitter output reflection coefficient (S_{22}).

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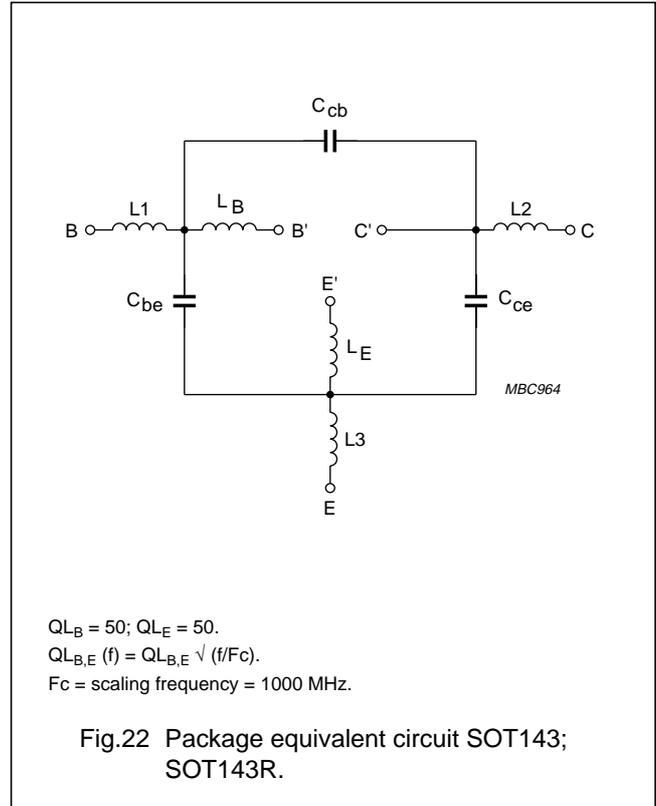
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SPICE parameters for BFQ195 crystal

| SEQUENCE No. | PARAMETER | VALUE | UNIT |
|--------------|-----------|-------|------|
| 1 | IS | 1.972 | fA |
| 2 | BF | 150.0 | – |
| 3 | NF | 990.8 | m |
| 4 | VAF | 54.72 | V |
| 5 | IKF | 30.00 | A |
| 6 | ISE | 47.82 | fA |
| 7 | NE | 1.580 | – |
| 8 | BR | 165.4 | – |
| 9 | NR | 993.9 | m |
| 10 | VAR | 2.351 | V |
| 11 | IKR | 9.967 | A |
| 12 | ISC | 3.510 | aA |
| 13 | NC | 1.124 | – |
| 14 | RB | 5.000 | Ω |
| 15 | IRB | 1.000 | μA |
| 16 | RBM | 5.000 | Ω |
| 17 | RE | 368.1 | mΩ |
| 18 | RC | 937.2 | mΩ |
| 19 (note 1) | XTB | 0.000 | – |
| 20 (note 1) | EG | 1.110 | EV |
| 21 (note 1) | XTI | 3.000 | – |
| 22 | CJE | 3.388 | pF |
| 23 | VJE | 600.0 | mV |
| 24 | MJE | 302.9 | m |
| 25 | TF | 11.06 | ps |
| 26 | XTF | 30.02 | – |
| 27 | VTF | 1.649 | V |
| 28 | ITF | 401.9 | mA |
| 29 | PTF | 0.000 | deg |
| 30 | CJC | 1.190 | pF |
| 31 | VJC | 160.1 | mV |
| 32 | MJC | 89.44 | m |
| 33 | XCJC | 130.0 | m |
| 34 | TR | 2.148 | ns |
| 35 (note 1) | CJS | 0.000 | F |
| 36 (note 1) | VJS | 750.0 | mV |
| 37 (note 1) | MJS | 0.000 | – |
| 38 | FC | 785.9 | m |

Note

1. These parameters have not been extracted, the default values are shown.



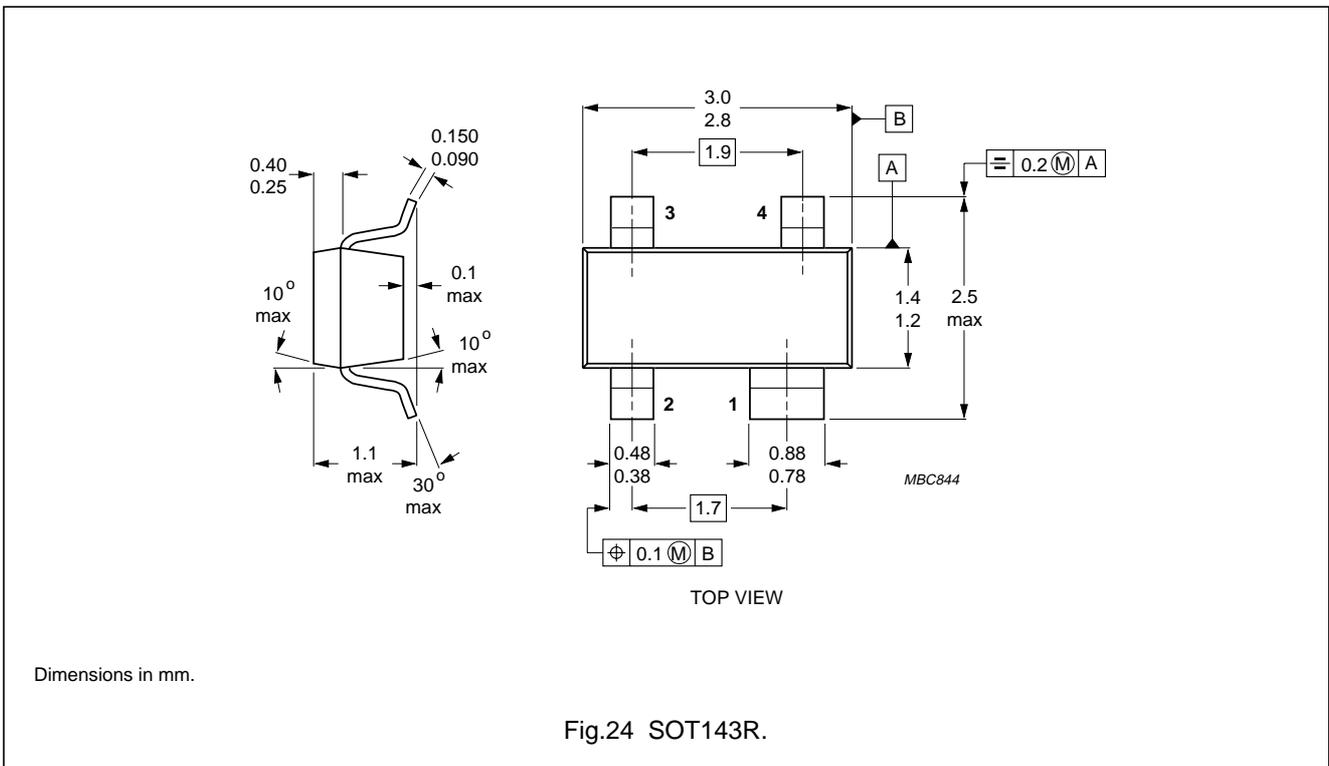
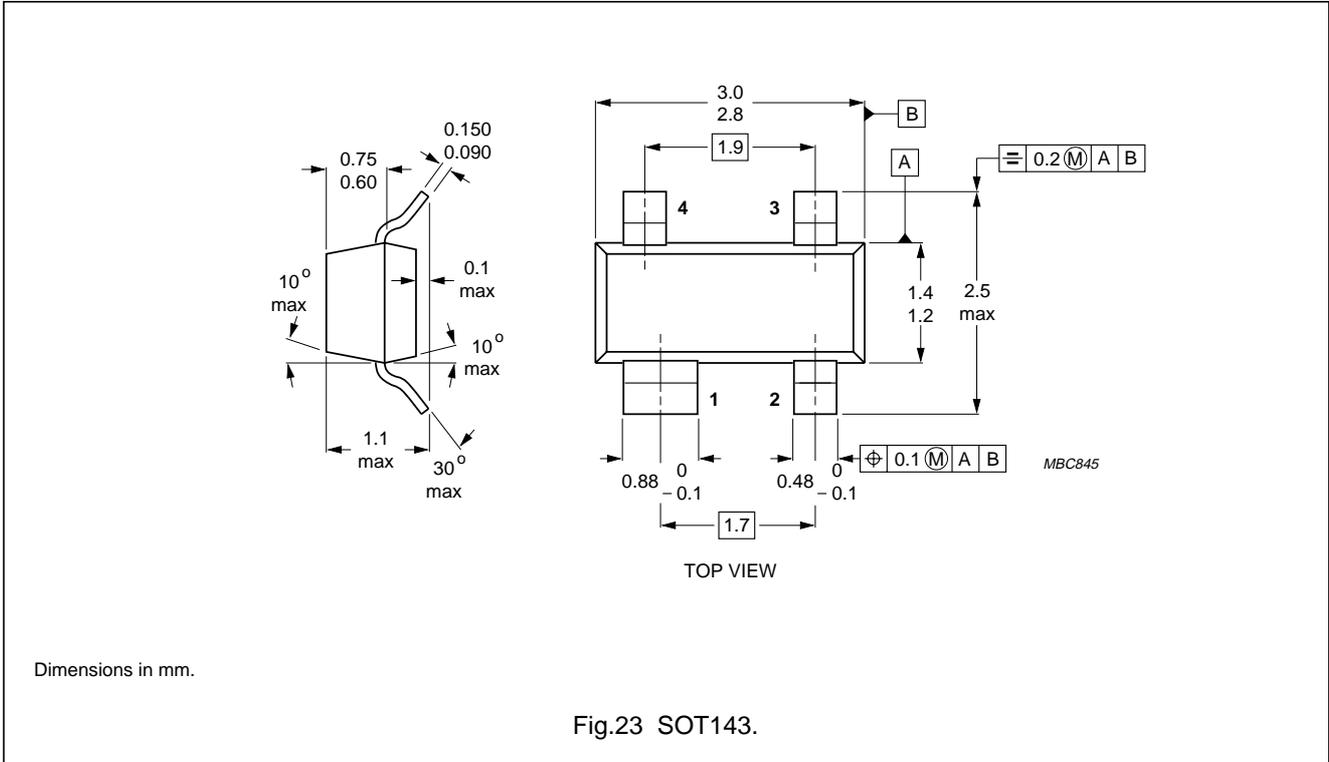
List of components (see Fig.22)

| DESIGNATION | VALUE | UNIT |
|-------------|-------|------|
| C_{be} | 84 | fF |
| C_{cb} | 17 | fF |
| C_{ce} | 191 | fF |
| L1 | 0.12 | nH |
| L2 | 0.21 | nH |
| L3 | 0.06 | nH |
| L_B | 0.95 | nH |
| L_E | 0.40 | nH |

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PACKAGE OUTLINES



NPN 7 GHz wideband transistor

BFG197; BFG197/X;
BFG197/XR**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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