

# DATA SHEET

## **BFG67; BFG67/X; BFG67/XR** NPN 8 GHz wideband transistors

Product specification  
Supersedes data of September 1995

1998 Oct 02

## NPN 8 GHz wideband transistors

## BFG67; BFG67/X; BFG67/XR

## FEATURES

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

## APPLICATIONS

Wideband applications in the GHz range, such as satellite TV tuners and portable RF communications equipment.

## DESCRIPTION

NPN silicon transistor in a 4-pin, dual-emitter SOT143B plastic package. Available with in-line emitter pinning (BFG67) and cross emitter pinning (BFG67/X). Version with reverse pinning (BFG67/XR) also available on request.

## MARKING

| TYPE NUMBER      | CODE |
|------------------|------|
| BFG67 (Fig.1)    | V3   |
| BFG67/X (Fig.1)  | V12  |
| BFG67/XR (Fig.2) | V26  |

## PINNING

| PIN | DESCRIPTION |           |           |
|-----|-------------|-----------|-----------|
|     | BFG67       | BFG67/X   | BFG67/XR  |
| 1   | collector   | collector | collector |
| 2   | base        | emitter   | emitter   |
| 3   | emitter     | base      | base      |
| 4   | emitter     | emitter   | emitter   |

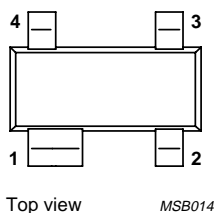


Fig.1 Simplified outline SOT143B.

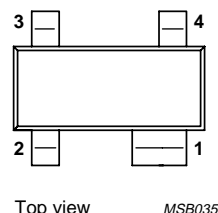


Fig.2 Simplified outline SOT143R.

## QUICK REFERENCE DATA

| SYMBOL    | PARAMETER                     | CONDITIONS  | TYP. | MAX. | UNIT |
|-----------|-------------------------------|---|------|------|------|
| $V_{CE0}$ | collector-emitter voltage     | open base   | —    | 10   | V    |
| $I_C$     | collector current (DC)        |   | —    | 50   | mA   |
| $P_{tot}$ | total power dissipation       | $T_s \leq 65\text{ }^{\circ}\text{C}$   | —    | 300  | mW   |
| $C_{re}$  | feedback capacitance          | $I_C = i_c = 0$ ; $V_{CB} = 8\text{ V}$ ; $f = 1\text{ MHz}$  | 0.5  | —    | pF   |
| $f_T$     | transition frequency          | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 500\text{ MHz}$   | 8    | —    | GHz  |
| $G_{UM}$  | maximum unilateral power gain | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; $f = 1\text{ GHz}$                            | 17   | —    | dB   |
| F         | noise figure                  | $\Gamma_s = \Gamma_{opt}$ ; $I_C = 5\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; $f = 1\text{ GHz}$ | 1.3  | —    | dB   |
|           |                               | $\Gamma_s = \Gamma_{opt}$ ; $I_C = 5\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $T_{amb} = 25\text{ }^{\circ}\text{C}$ ; $f = 2\text{ GHz}$ | 2.2  | —    | dB   |

NPN 8 GHz wideband transistors

BFG67; BFG67/X; BFG67/XR

LIMITING VALUES

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

| SYMBOL           | PARAMETER                 | CONDITIONS                                | MIN. | MAX. | UNIT |
|------------------|---------------------------|---|------|------|------|
| V <sub>CBO</sub> | collector-base voltage    | open emitter                              | –    | 20   | V    |
| V <sub>CEO</sub> | collector-emitter voltage | open base                                 | –    | 10   | V    |
| V <sub>EBO</sub> | emitter-base voltage      | open collector                            | –    | 2.5  | V    |
| I <sub>C</sub>   | collector current (DC)    |   | –    | 50   | mA   |
| P <sub>tot</sub> | total power dissipation   | T <sub>s</sub> ≤ 65 °C; see Fig.3; note 1 | –    | 380  | mW   |
| T <sub>stg</sub> | storage temperature range |   | –65  | 150  | °C   |
| T <sub>j</sub>   | junction temperature      |   | –    | 175  | °C   |

Note

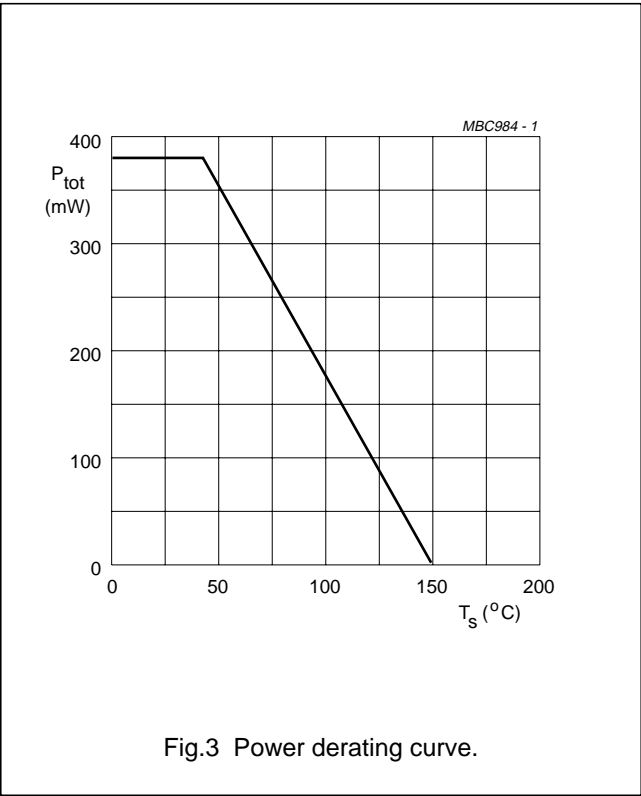
1. T<sub>s</sub> is the temperature at the soldering point of the collector pin.

THERMAL CHARACTERISTICS

| SYMBOL              | PARAMETER   | CONDITIONS | VALUE | UNIT |
|---------------------|---|------------|-------|------|
| R <sub>th j-s</sub> | thermal resistance from junction to soldering point | note 1     | 290   | K/W  |

Note

1. T<sub>s</sub> is the temperature at the soldering point of the collector pin.



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## CHARACTERISTICS

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

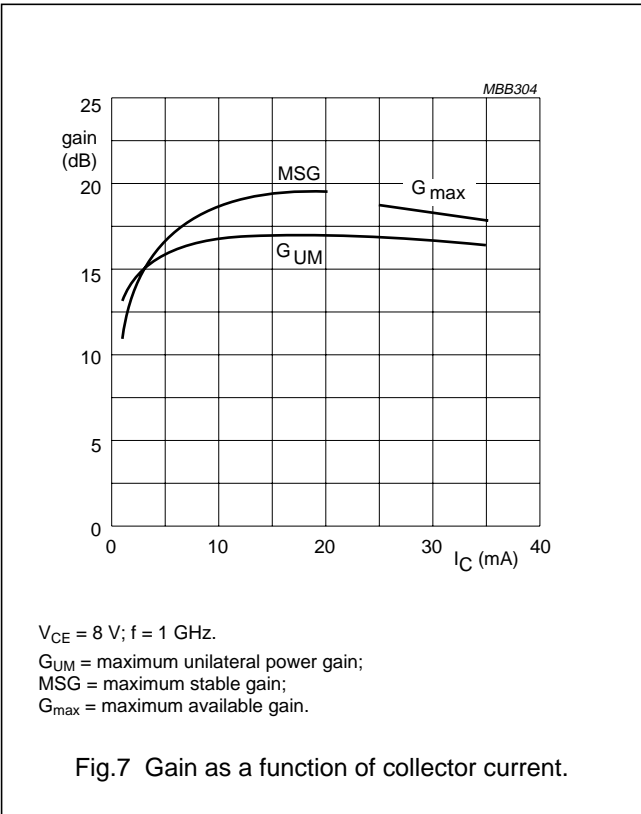
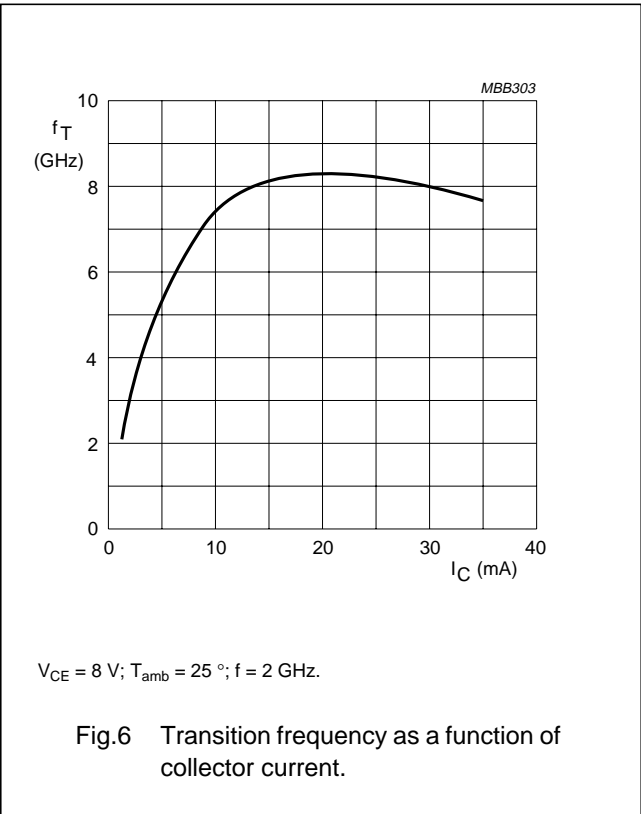
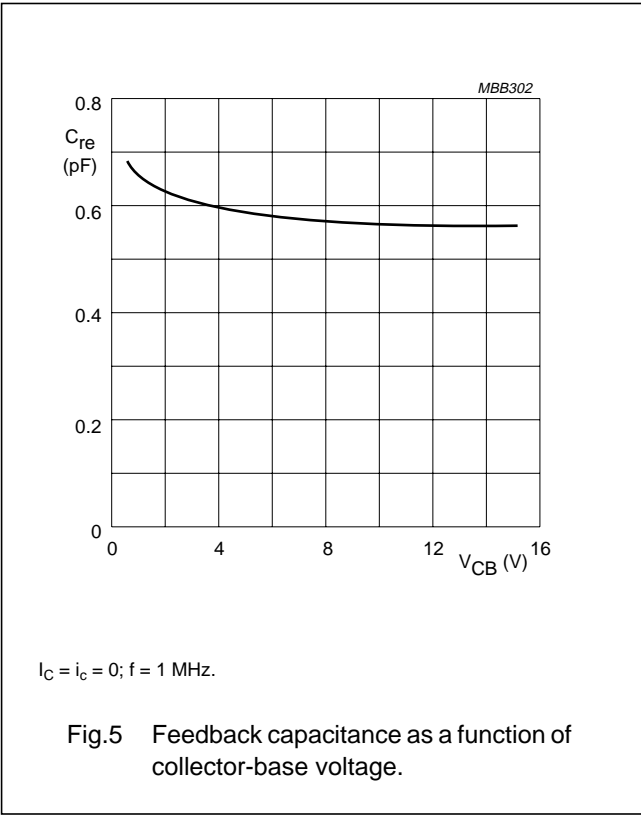
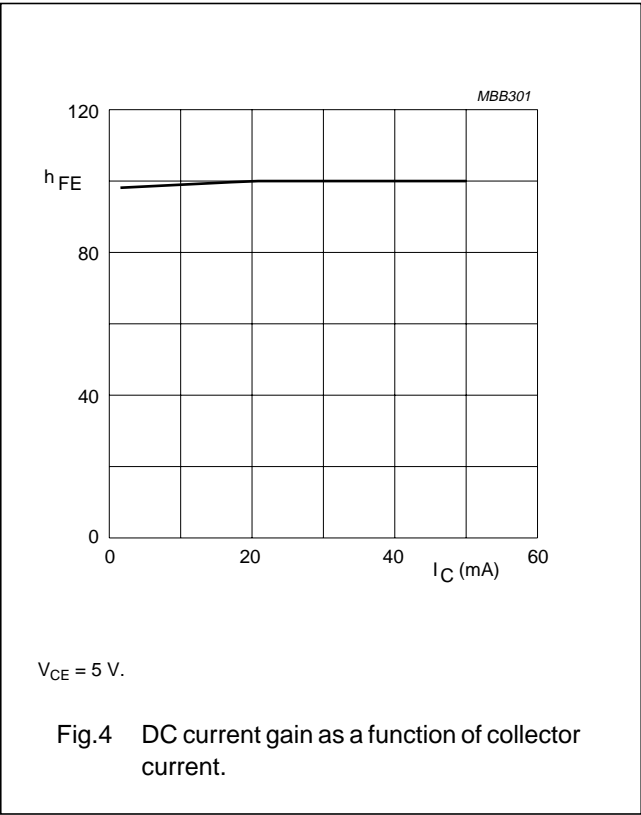
| SYMBOL    | PARAMETER                             | CONDITIONS   | MIN. | TYP. | MAX. | UNIT |
|-----------|---------------------------------------|--|------|------|------|------|
| $I_{CBO}$ | collector leakage current             | $V_{CB} = 5\text{ V}; I_E = 0$   | –    | –    | 50   | nA   |
| $h_{FE}$  | DC current gain                       | $I_C = 15\text{ mA}; V_{CE} = 5\text{ V}$  | 60   | 100  | –    |      |
| $f_T$     | transition frequency                  | $I_C = 15\text{ mA}; V_{CE} = 8\text{ V}; f = 500\text{ MHz}$  | –    | 8    | –    | GHz  |
| $C_c$     | collector capacitance                 | $I_E = i_e = 0; V_{CB} = 8\text{ V}; f = 1\text{ MHz}$   | –    | 0.7  | –    | pF   |
| $C_e$     | emitter capacitance                   | $I_C = i_c = 0; V_{EB} = 0.5\text{ V}; f = 1\text{ MHz}$   | –    | 1.3  | –    | pF   |
| $C_{re}$  | feedback capacitance                  | $I_C = i_c = 0; V_{CB} = 8\text{ V}; f = 1\text{ MHz}$   | –    | 0.5  | –    | pF   |
| $G_{UM}$  | maximum unilateral power gain; note 1 | $I_C = 15\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 1\text{ GHz}$                          | –    | 17   | –    | dB   |
|           |                                       | $I_C = 15\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 2\text{ GHz}$                          | –    | 10   | –    | dB   |
| F         | noise figure                          | $\Gamma_s = \Gamma_{opt}; I_C = 5\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 1\text{ GHz}$  | –    | 1.3  | –    | dB   |
|           |                                       | $\Gamma_s = \Gamma_{opt}; I_C = 15\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 1\text{ GHz}$ | –    | 1.7  | –    | dB   |
|           |                                       | $I_C = 5\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 2\text{ GHz}; Z_S = 60\text{ }\Omega$   | –    | 2.5  | –    | dB   |
|           |                                       | $I_C = 15\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ °C}; f = 2\text{ GHz}; Z_S = 60\text{ }\Omega$  | –    | 3    | –    | dB   |

## Note

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.

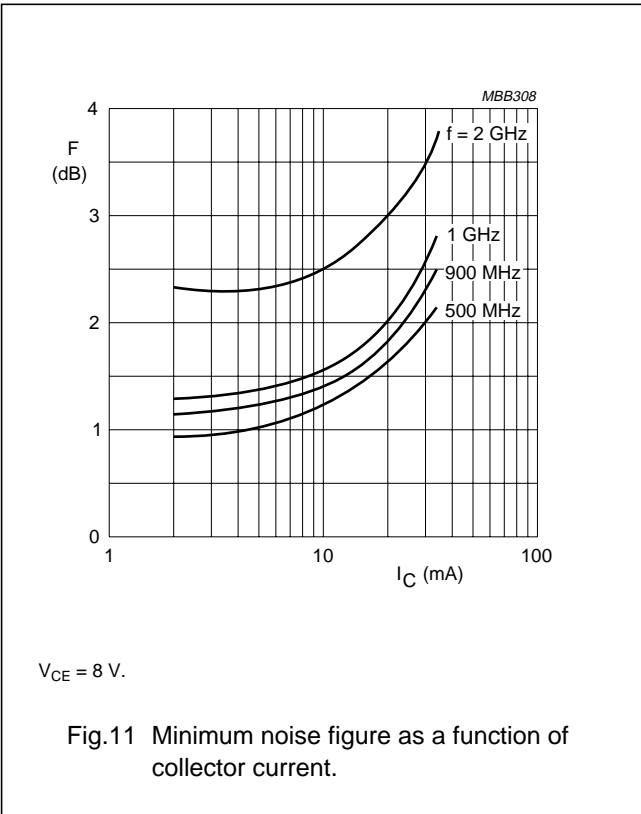
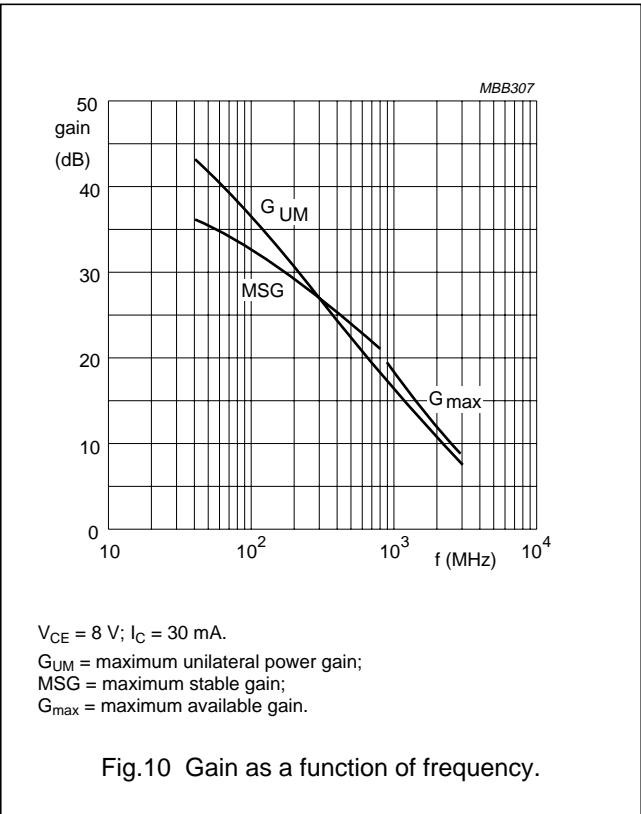
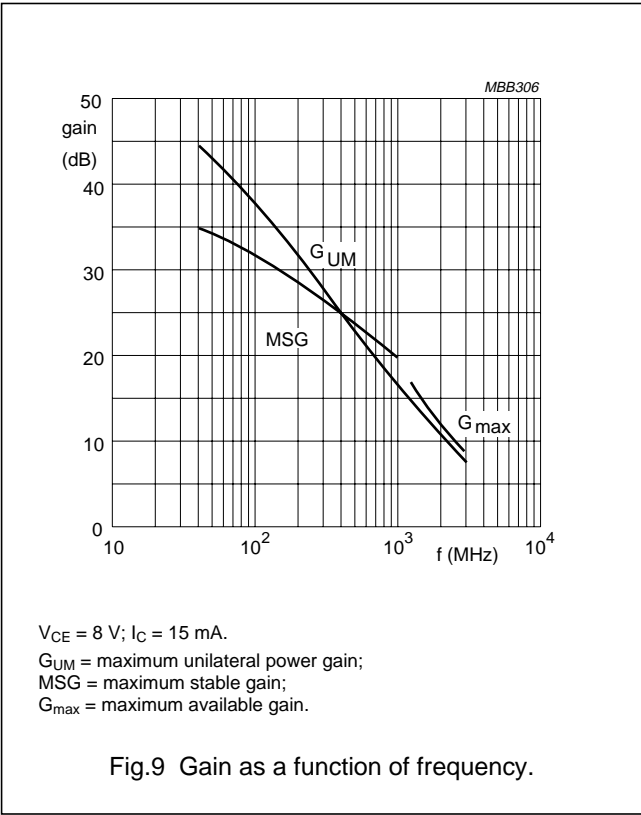
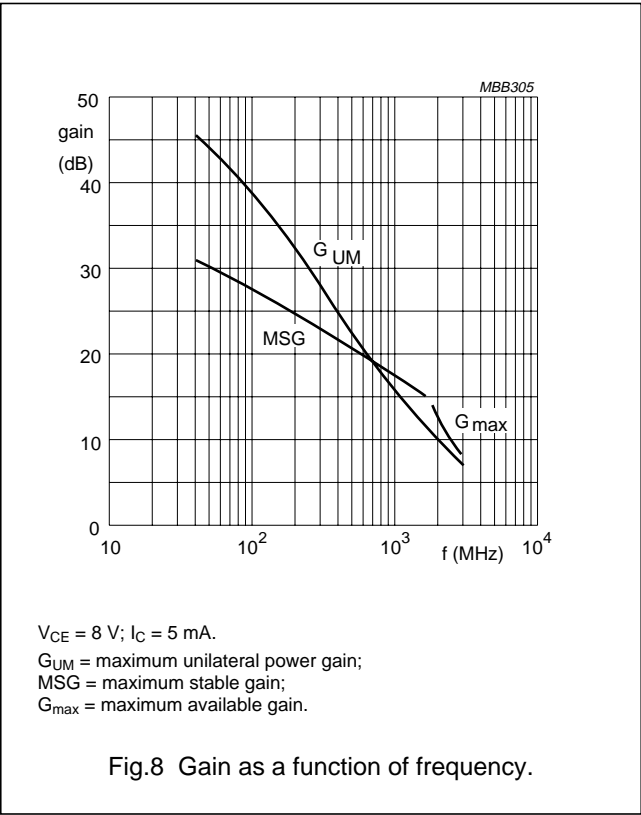
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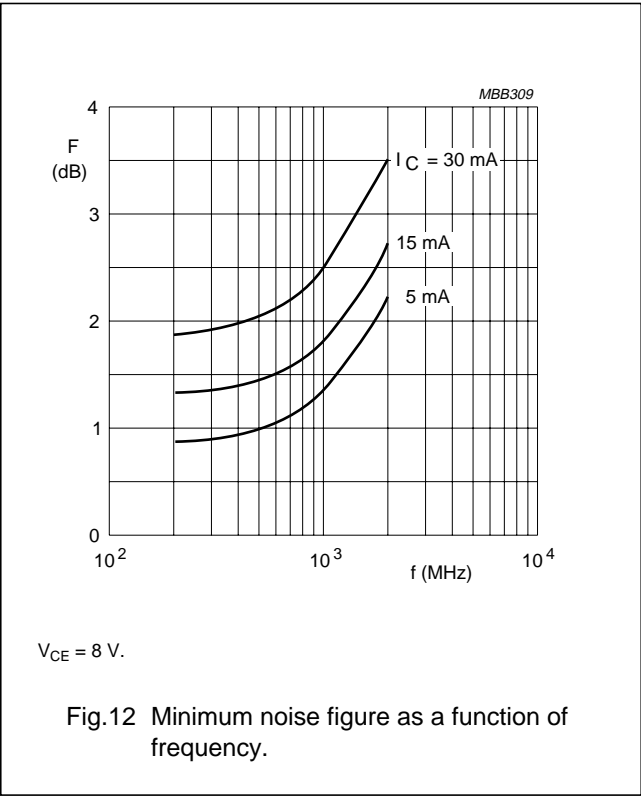
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NPN 8 GHz wideband transistors

BFG67; BFG67/X; BFG67/XR



BFG67/X

| f<br>(MHz) | V <sub>CE</sub><br>(V) | I <sub>C</sub><br>(mA) |
|------------|------------------------|------------------------|
| 500        | 8                      | 5                      |

Noise Parameters

| F <sub>min</sub><br>(dB) | Gamma (opt) |       | R <sub>n</sub> /50 |
|--------------------------|-------------|-------|--------------------|
|                          | (mag)       | (ang) |                    |
| 0.95                     | 0.455       | 33.8  | 0.288              |

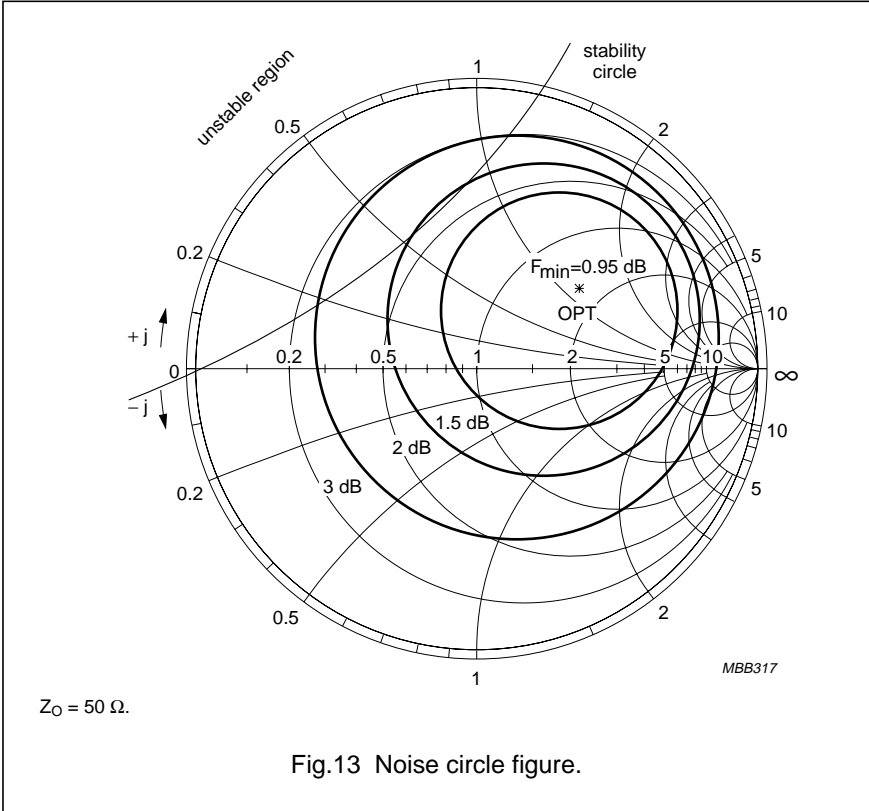


Fig.13 Noise circle figure.

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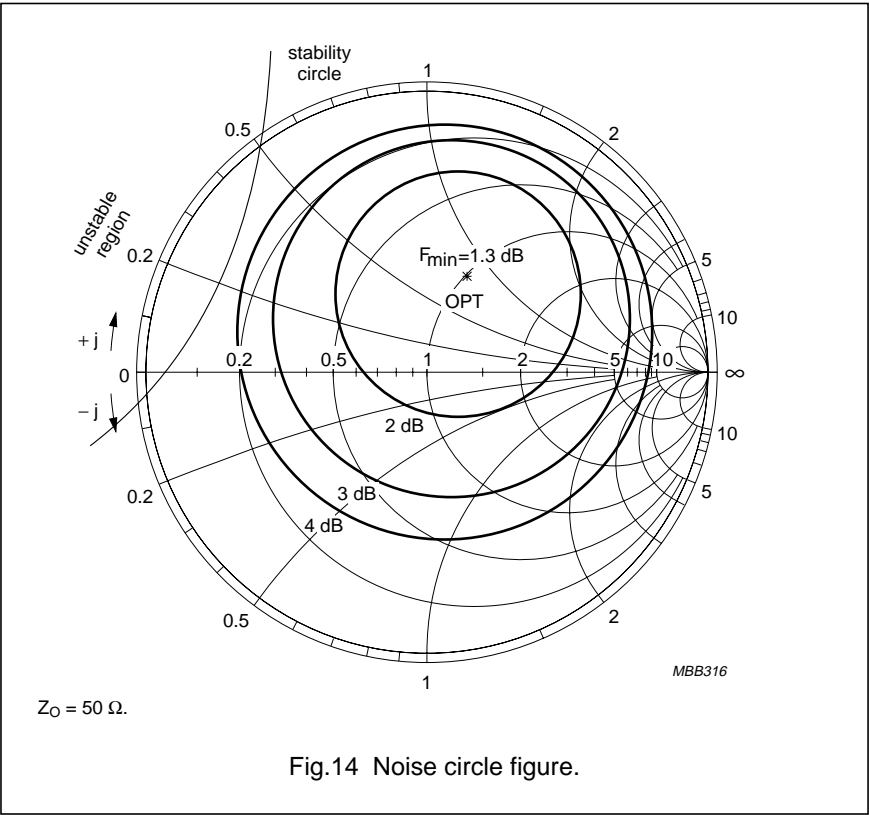
BFG67; BFG67/X; BFG67/XR

BFG67/X

| f<br>(MHz) | V <sub>CE</sub><br>(V) | I <sub>C</sub><br>(mA) |
|------------|------------------------|------------------------|
| 1000       | 8                      | 5                      |

Noise Parameters

| F <sub>min</sub><br>(dB) | Gamma (opt) |       | R <sub>n</sub> /50 |
|--------------------------|-------------|-------|--------------------|
|                          | (mag)       | (ang) |                    |
| 1.3                      | 0.375       | 65.9  | 0.304              |



BFG67/X

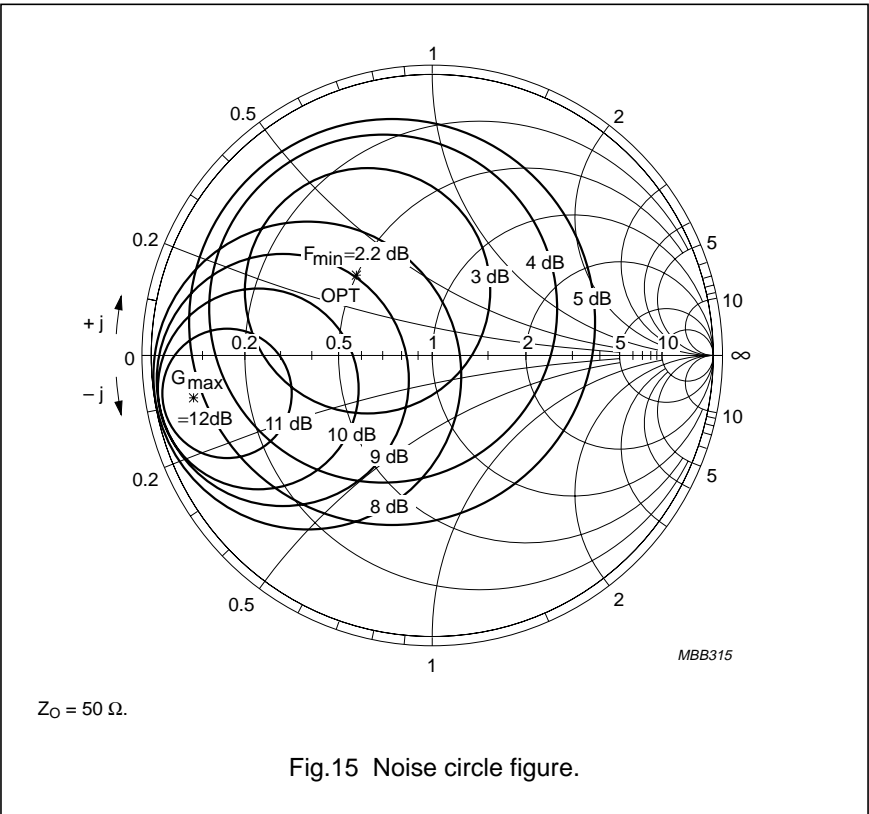
| f<br>(MHz) | V <sub>CE</sub><br>(V) | I <sub>C</sub><br>(mA) |
|------------|------------------------|------------------------|
| 2000       | 8                      | 5                      |

Noise Parameters

| F <sub>min</sub><br>(dB) | Gamma (opt) |       | R <sub>n</sub> /50 |
|--------------------------|-------------|-------|--------------------|
|                          | (mag)       | (ang) |                    |
| 2.2                      | 0.391       | 136.5 | 0.184              |

Average Gain Parameters

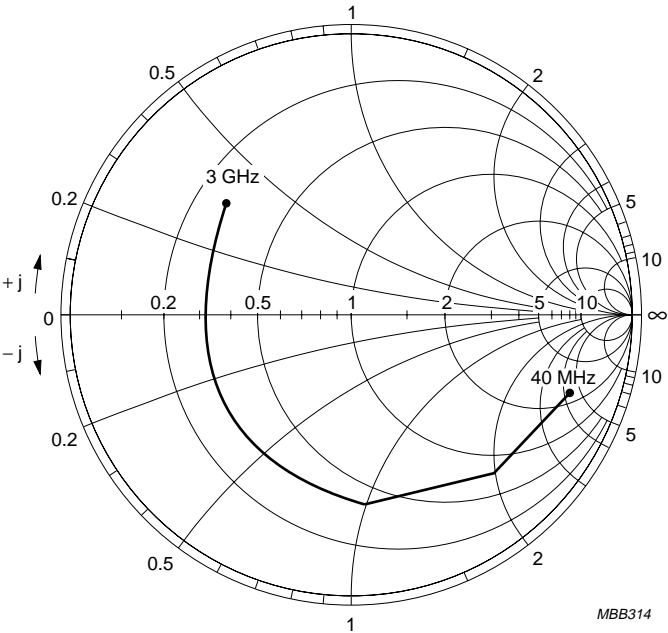
| G <sub>MAX</sub><br>(dB) | Gamma (max) |       |
|--------------------------|-------------|-------|
|                          | (mag)       | (ang) |
| 12                       | 0.839       | -170  |





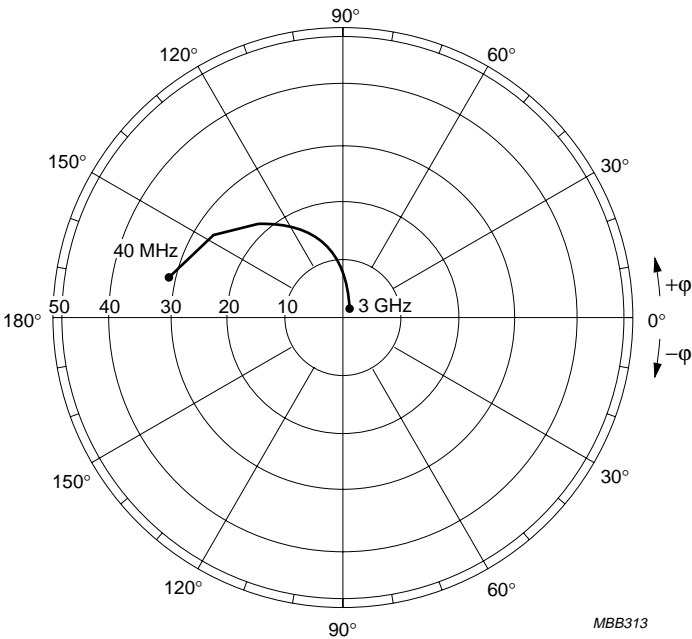
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$V_{CE} = 8\text{ V}$ ;  $I_C = 15\text{ mA}$ ;  $Z_O = 50\ \Omega$ .

Fig.16 Common emitter input reflection coefficient ( $S_{11}$ ).

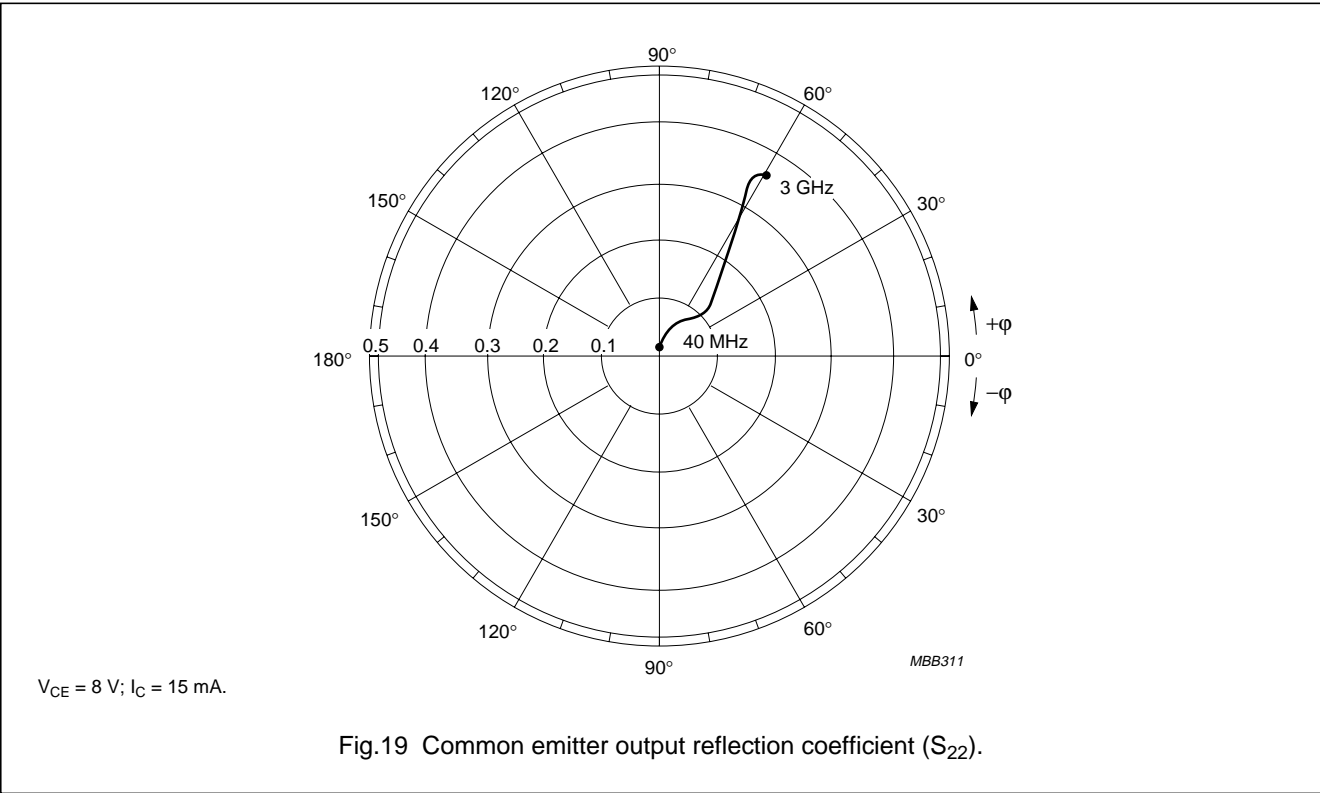
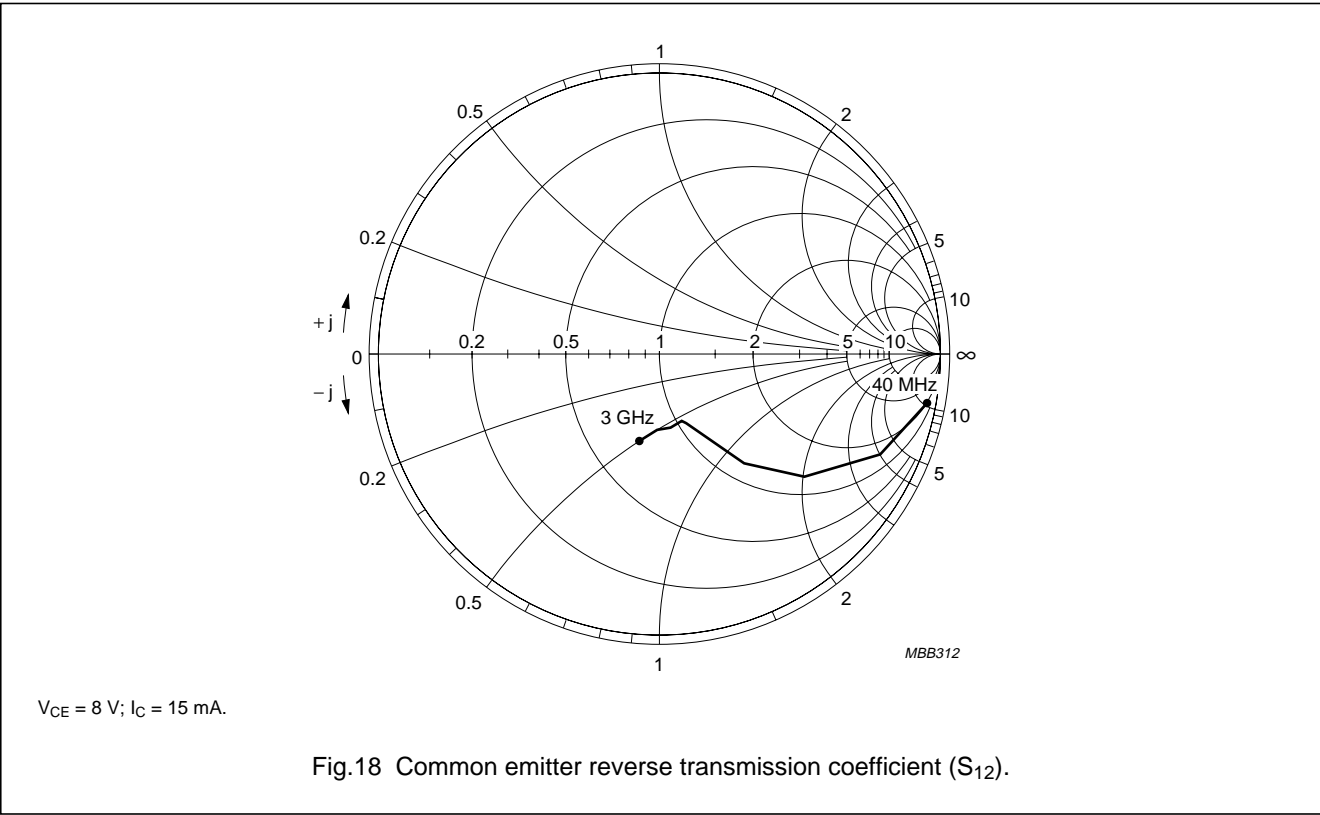


$V_{CE} = 8\text{ V}$ ;  $I_C = \text{mA}$ ;  $Z_O = 50\ \Omega$ .

Fig.17 Common emitter forward transmission coefficient ( $S_{21}$ ).

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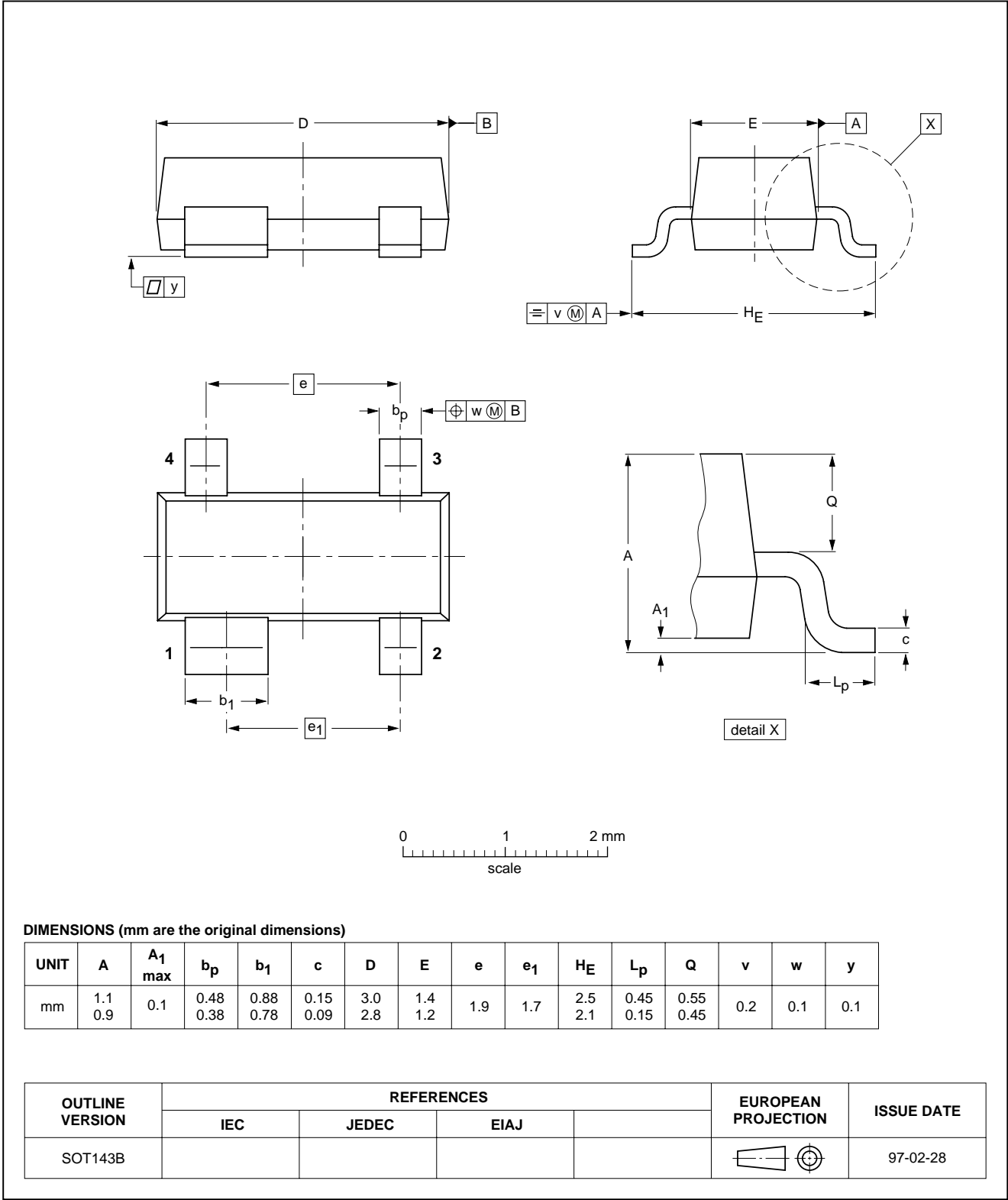
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BFG67; BFG67/X; BFG67/XR

PACKAGE OUTLINES

Plastic surface mounted package; 4 leads

SOT143B

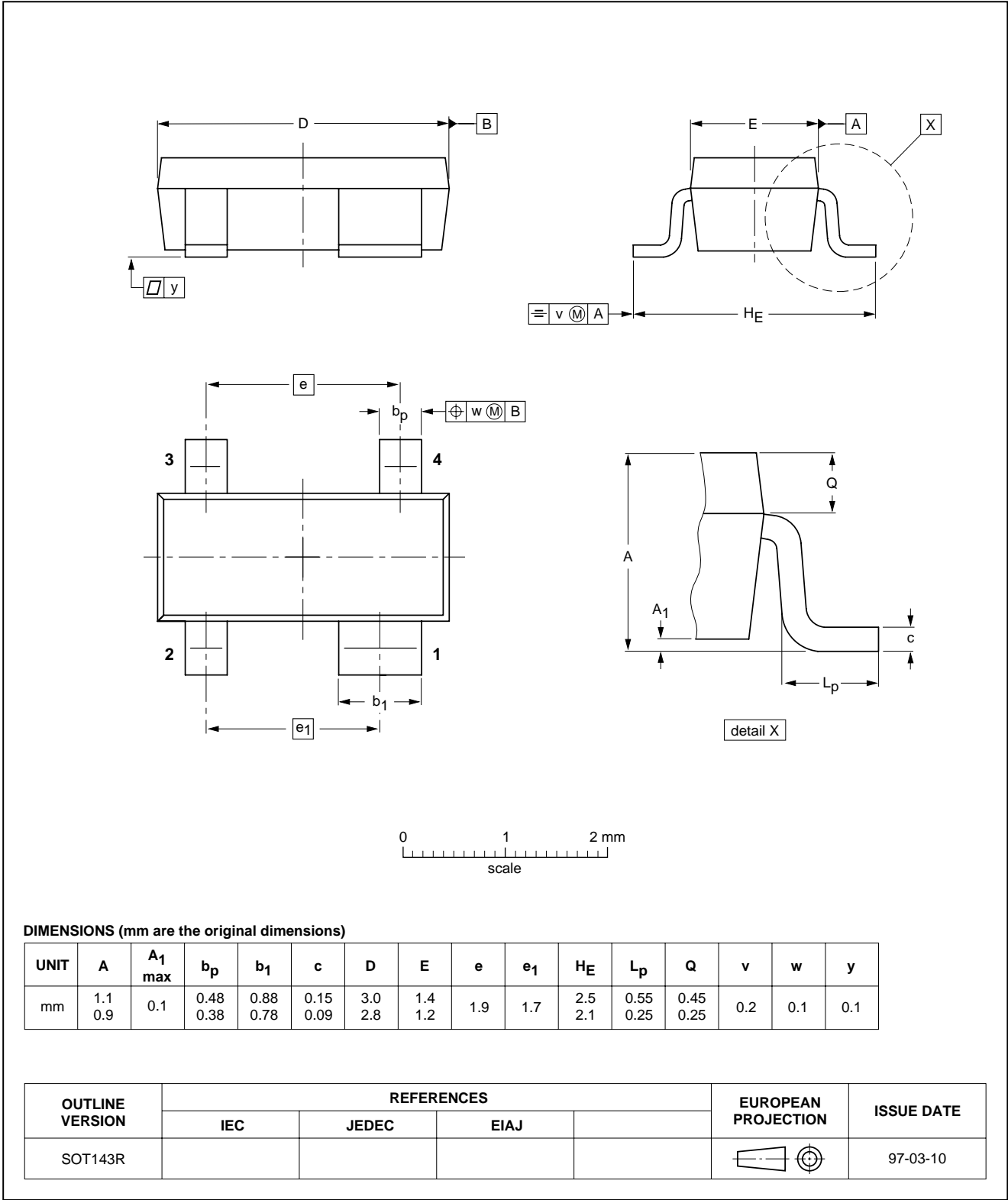


NPN 8 GHz wideband transistors

BFG67; BFG67/X; BFG67/XR

Plastic surface mounted package; reverse pinning; 4 leads

SOT143R



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NPN 8 GHz wideband transistorsBFG67; BFG67/X; BFG67/XR

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**DEFINITIONS**

| <b>Data Sheet Status</b>  |   |
|---|---|
| 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.                                |
| <b>Limiting values</b>  |   |
| 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. |   |
| <b>Application information</b>  |   |
| Where application information is given, it is advisory and does not form part of the specification.   |   |

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**NOTES**

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**NOTES**

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