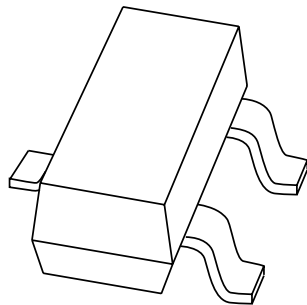


# DATA SHEET



**BFQ67**

**NPN 8 GHz wideband transistor**

Product specification  
Supersedes data of September 1995  
File under Discrete Semiconductors, SC14

1998 Aug 27

## NPN 8 GHz wideband transistor

BFQ67

## FEATURES

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

## APPLICATIONS

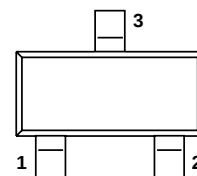
Satellite TV tuners and RF portable communications equipment up to 2 GHz.

## DESCRIPTION

Silicon NPN wideband transistor in a plastic SOT23 package.

## PINNING

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



Top view MSB003

Marking code: V2p.

Fig.1 SOT23.

## 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)        |                                                                   | —    | —    | 50   | mA   |
| $P_{tot}$ | total power dissipation       | $T_s \leq 97\text{ }^\circ\text{C}$ ; note 1                      | —    | —    | 300  | mW   |
| $h_{FE}$  | DC current gain               | $I_C = 15\text{ mA}$ ; $V_{CE} = 5\text{ V}$                      | 60   | 100  | —    |      |
| $f_T$     | transition frequency          | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$                      | —    | 8    | —    | GHz  |
| $G_{UM}$  | maximum unilateral power gain | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 1\text{ GHz}$ | —    | 14   | —    | dB   |
| F         | noise figure                  | $I_C = 5\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 1\text{ GHz}$  | —    | 1.3  | —    | dB   |

## Note

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

## 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                                 | —    | 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)    |                                              | —    | 50   | mA               |
| $P_{tot}$ | total power dissipation   | $T_s \leq 97\text{ }^\circ\text{C}$ ; note 1 | —    | 300  | mW               |
| $T_{stg}$ | storage temperature range |                                              | −65  | +150 | $^\circ\text{C}$ |
| $T_j$     | junction temperature      |                                              | —    | 175  | $^\circ\text{C}$ |

## Note

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

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## THERMAL CHARACTERISTICS

| SYMBOL        | PARAMETER                                           | CONDITIONS | VALUE | UNIT |
|---------------|-----------------------------------------------------|------------|-------|------|
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | note 1     | 260   | K/W  |

## Note

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

## CHARACTERISTICS

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

| SYMBOL    | PARAMETER                              | CONDITIONS                                                                                                               | MIN. | TYP. | MAX. | UNIT |
|-----------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{CBO}$ | collector cut-off current              | $I_E = 0$ ; $V_{CB} = 5\text{ V}$                                                                                        | –    | –    | 50   | nA   |
| $h_{FE}$  | DC current gain                        | $I_C = 15\text{ mA}$ ; $V_{CE} = 5\text{ V}$                                                                             | 60   | 100  | –    |      |
| $C_c$     | 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                   | $I_C = 0$ ; $V_{CB} = 8\text{ V}$ ; $f = 1\text{ MHz}$                                                                   | –    | 0.5  | –    | pF   |
| $f_T$     | transition frequency                   | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$                                                                             | –    | 8    | –    | GHz  |
| $G_{UM}$  | maximum unilateral power gain (note 1) | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $T_{amb} = 25\text{ °C}$ ; $f = 1\text{ GHz}$                             | –    | 14   | –    | dB   |
|           |                                        | $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $f = 2\text{ GHz}$                                                        | –    | 8    | –    | 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   |
|           |                                        | $\Gamma_s = \Gamma_{opt}$ ; $I_C = 5\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $T_{amb} = 25\text{ °C}$ ; $f = 2\text{ GHz}$  | –    | 2.2  | –    | 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   |
|           |                                        | $\Gamma_s = \Gamma_{opt}$ ; $I_C = 15\text{ mA}$ ; $V_{CE} = 8\text{ V}$ ; $T_{amb} = 25\text{ °C}$ ; $f = 2\text{ GHz}$ | –    | 2.7  | –    | 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

- $G_{UM}$  is the maximum unilateral power gain, assuming  $S_{12}$  is zero and  $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)} \text{ dB}$ .

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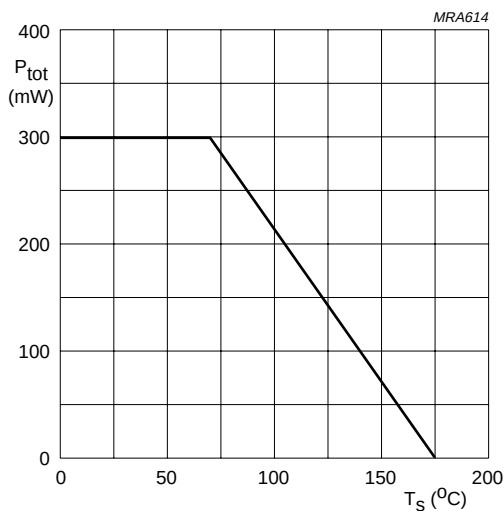
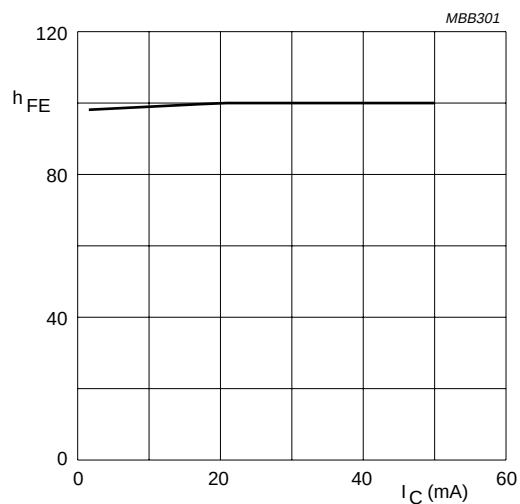
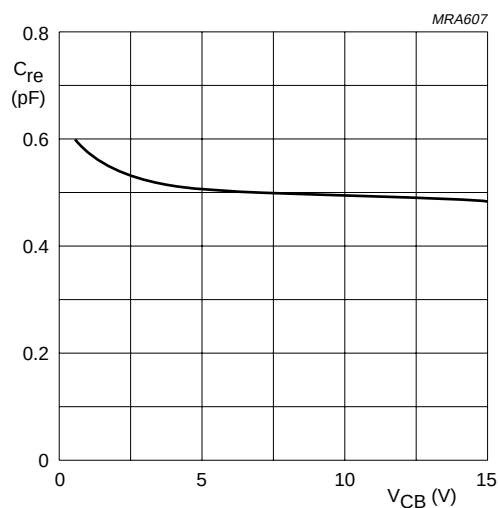


Fig.2 Power derating curve.



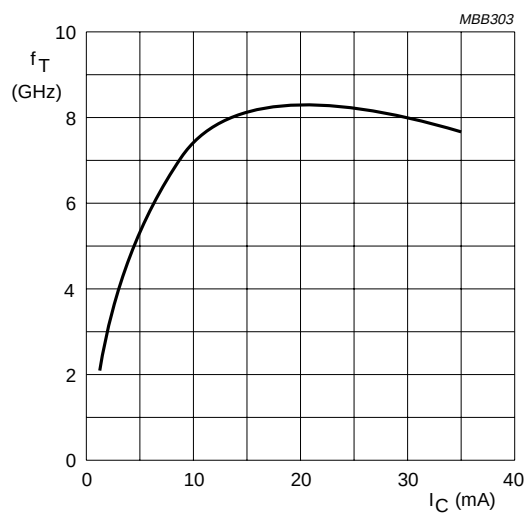
$V_{CE} = 5\text{ V}$ .

Fig.3 DC current gain as a function of collector current, typical values.



$I_C = i_c = 0$ ;  $f = 1\text{ MHz}$ .

Fig.4 Feedback capacitance as a function of collector-base voltage, typical values.

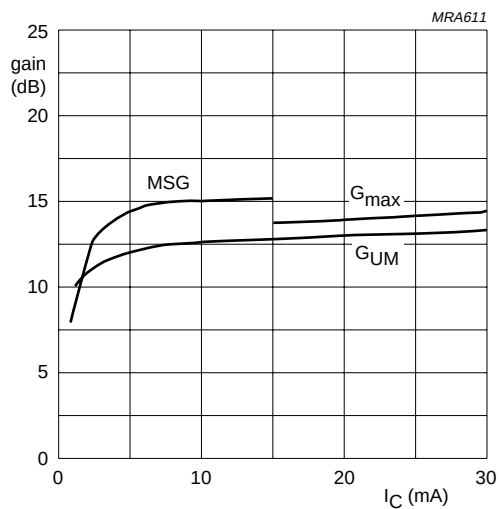


$V_{CE} = 8\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ;  $f = 2\text{ GHz}$ .

Fig.5 Transition frequency as a function of collector current, typical values.

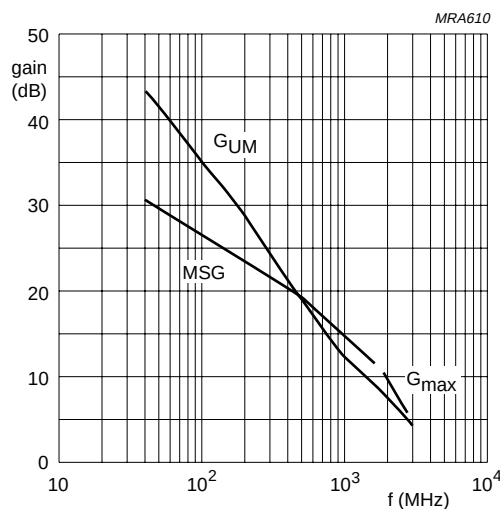
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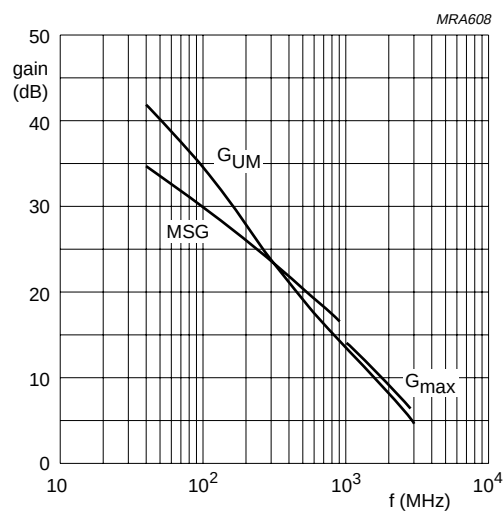
$V_{CE} = 8\text{ V}$ ;  $f = 1\text{ GHz}$ .

Fig.6 Gain as a function of collector current, typical values.



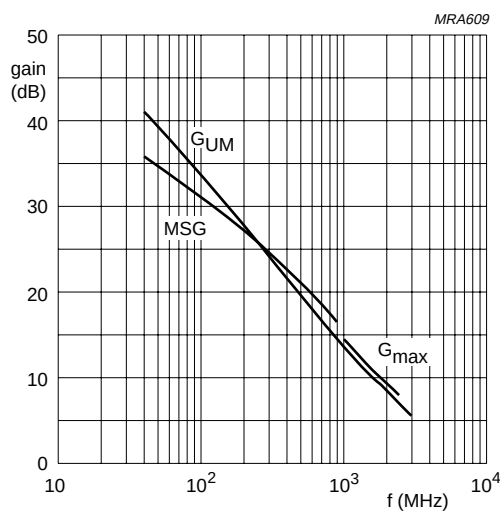
$V_{CE} = 8\text{ V}$ ;  $I_C = 5\text{ mA}$ .

Fig.7 Gain as a function of frequency, typical values.



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

Fig.8 Gain as a function of frequency, typical values.

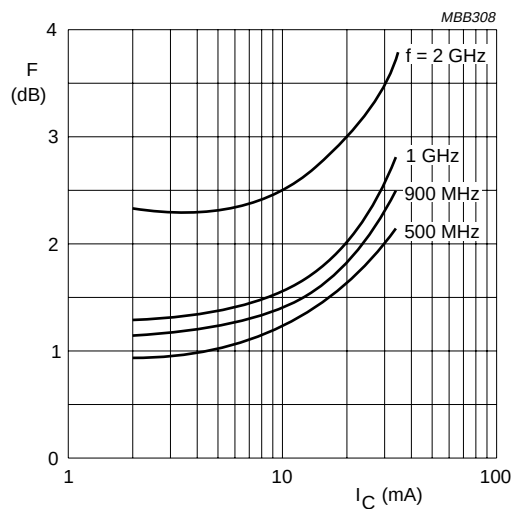


$V_{CE} = 8\text{ V}$ ;  $I_C = 30\text{ mA}$ .

Fig.9 Gain as a function of frequency, typical values.

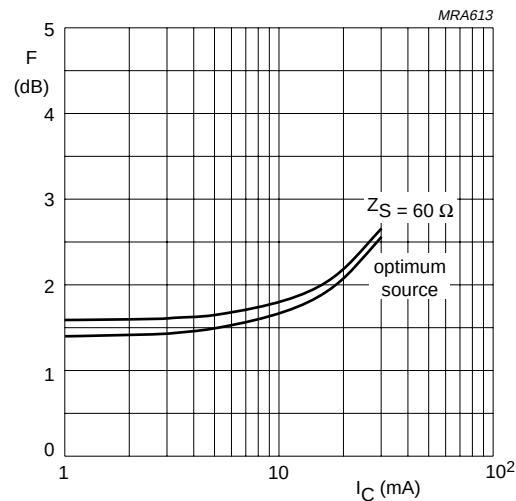
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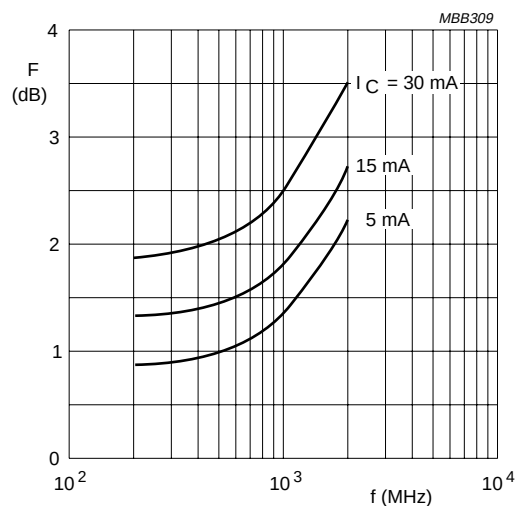
V<sub>CE</sub> = 8 V.

Fig.10 Minimum noise figure as a function of collector current, typical values.



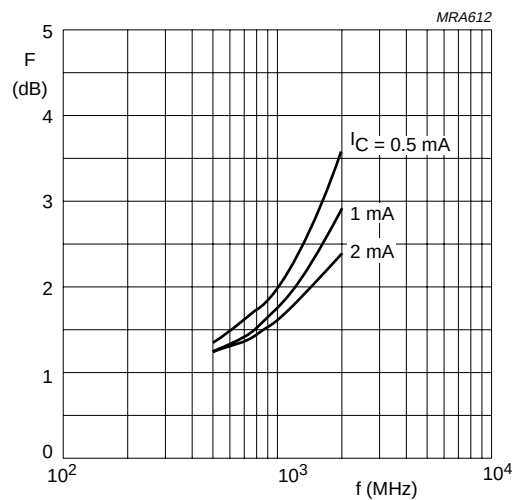
V<sub>CE</sub> = 6 V; f = 900 MHz.

Fig.11 Noise figure as a function of collector current, typical values.



V<sub>CE</sub> = 8 V.

Fig.12 Minimum noise figure as a function of frequency, typical values.

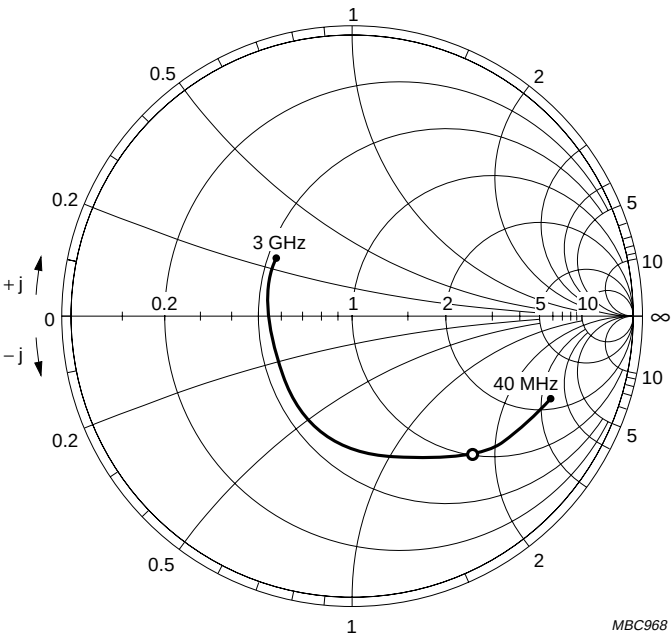


V<sub>CE</sub> = 1 V.

Fig.13 Minimum noise figure as a function of frequency, typical values.

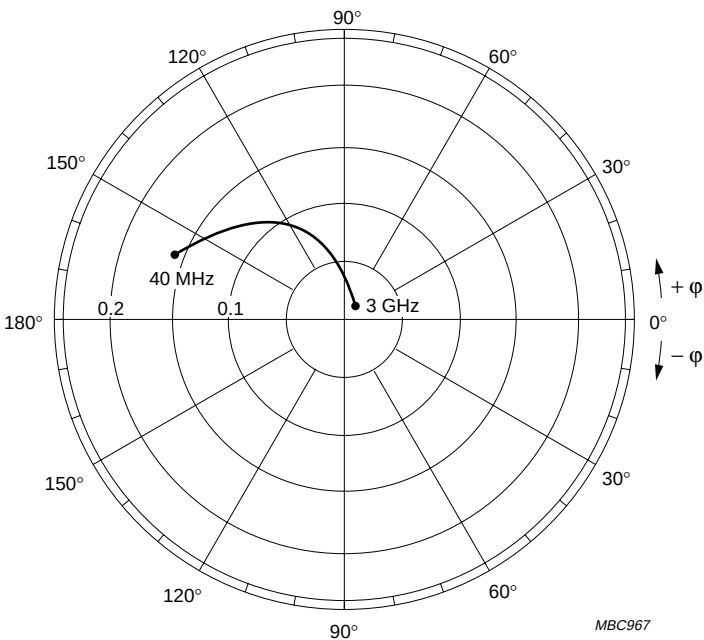
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$V_{CE} = 8\text{ V}$ ;  $I_C = 15\text{ mA}$ ;  $Z_0 = 50\ \Omega$ .

Fig.14 Common emitter input reflection coefficient ( $S_{11}$ ), typical values.

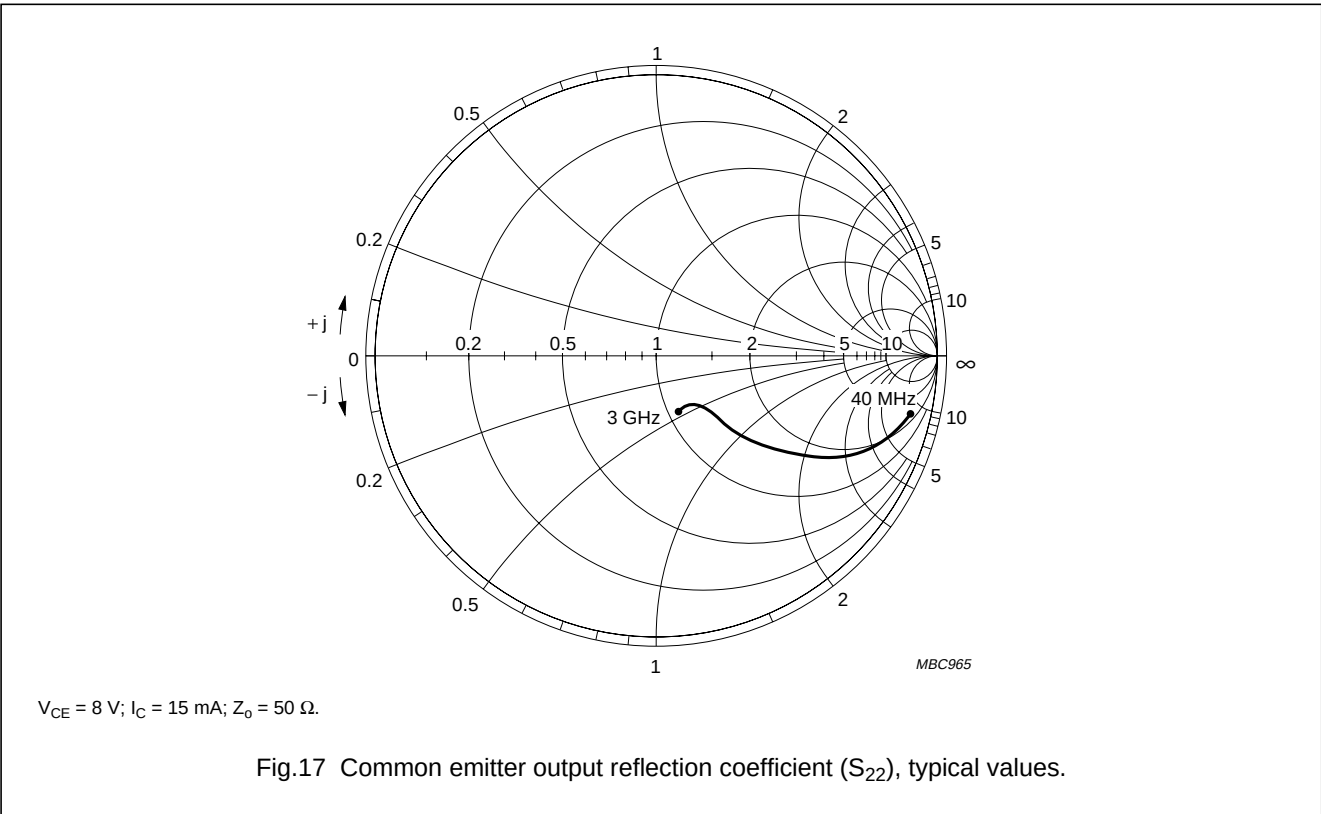
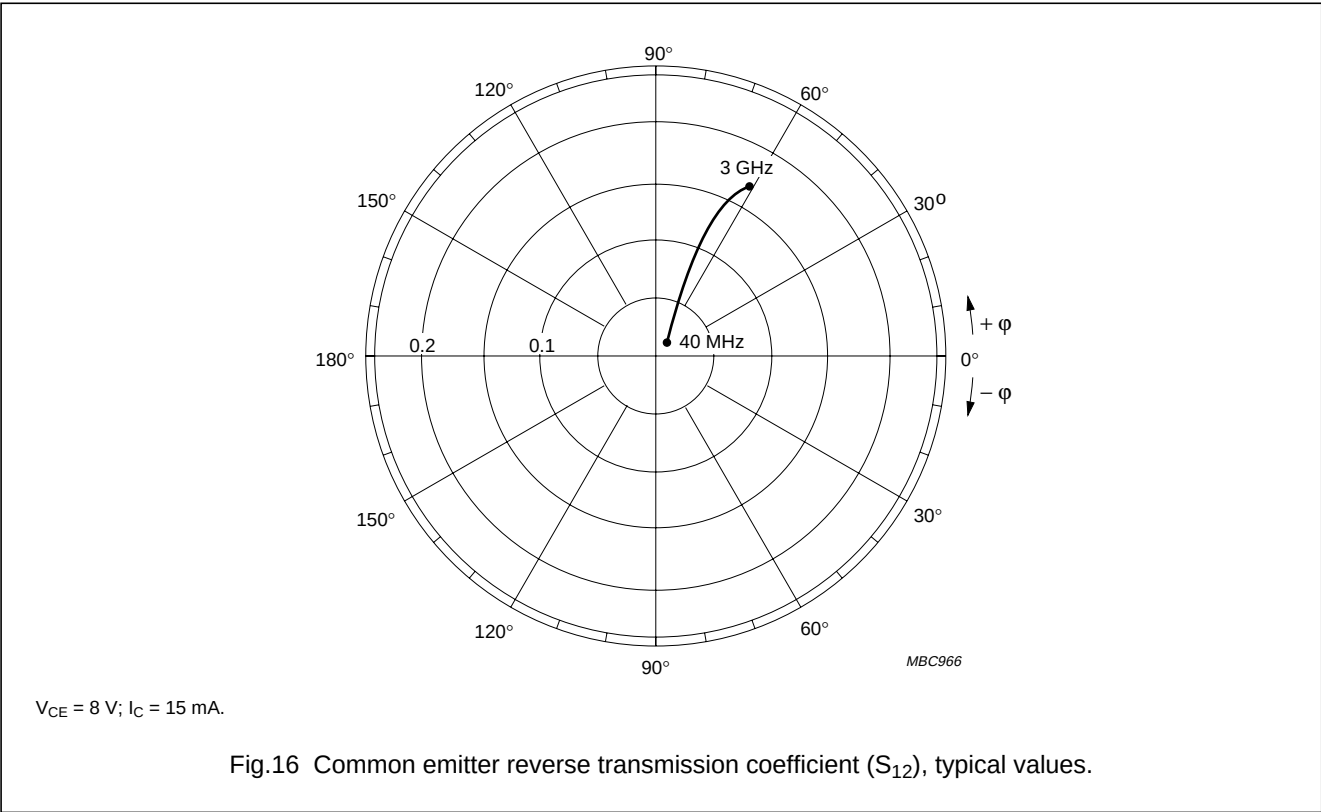


$V_{CE} = 8\text{ V}$ ;  $I_C = 15\text{ mA}$ .

Fig.15 Common emitter forward transmission coefficient ( $S_{21}$ ), typical values.

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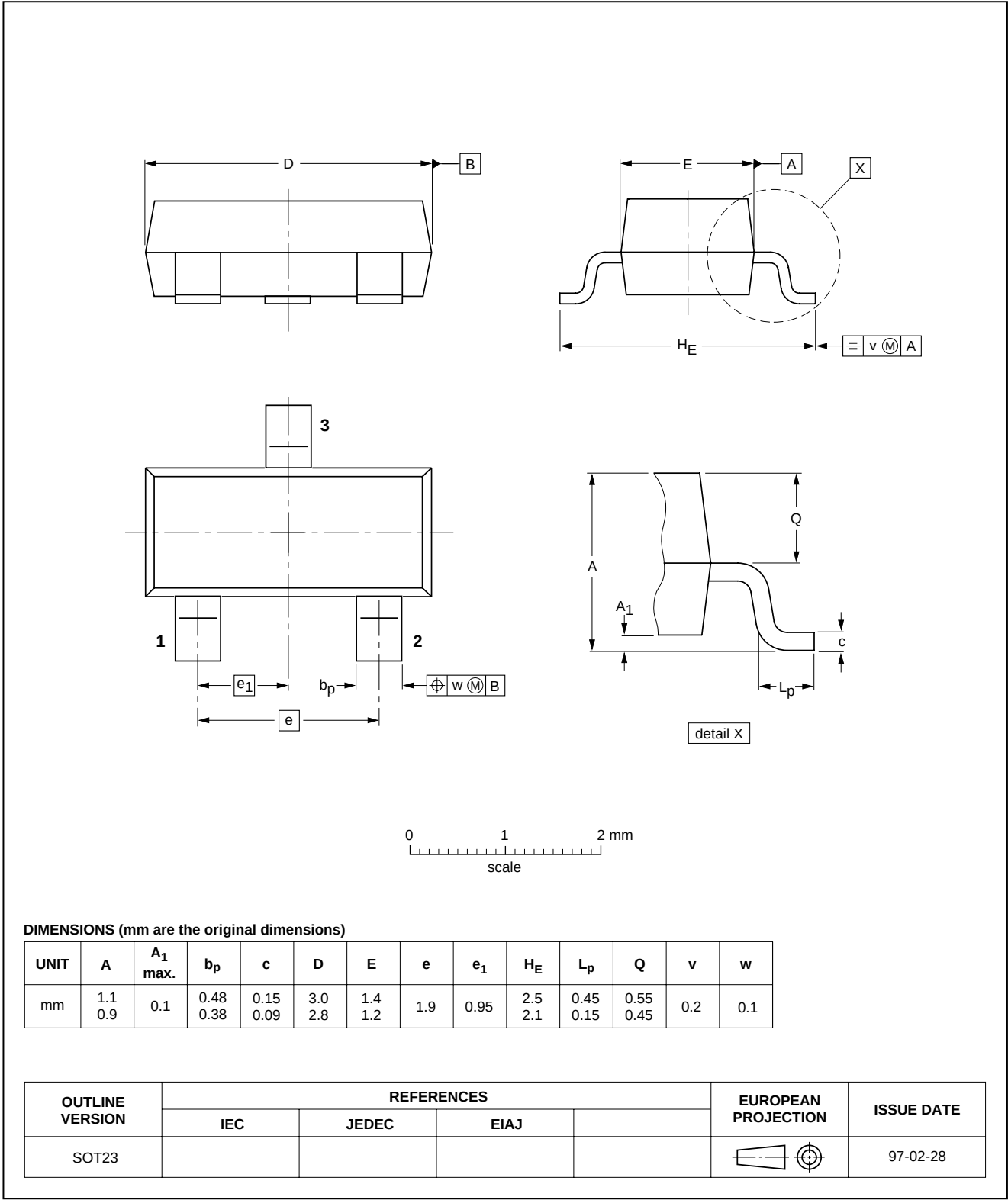
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PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT23



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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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