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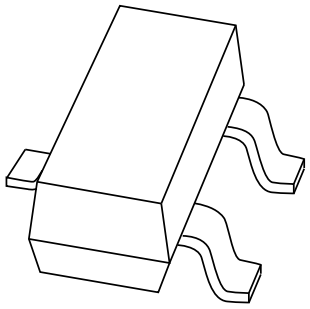
# DATA SHEET



# BFQ67
## NPN 8 GHz wideband transistor

Product specification
Supersedes data of September 1995

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

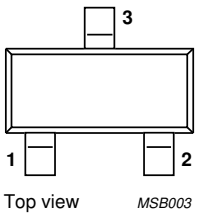
Satellite TV tuners and RF portable communications equipment up to 2 GHz.

## DESCRIPTION

Silicon NPN wideband transistor in a plastic SOT23 package.

## PINNING

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




**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 | $T_s \leq 97$ °C; note 1 | – | – | 300 | mW |
| $h_{FE}$ | DC current gain | $I_C$ = 15 mA; $V_{CE}$ = 5 V | 60 | 100 | – | |
| $f_T$ | transition frequency | $I_C$ = 15 mA; $V_{CE}$ = 8 V | – | 8 | – | GHz |
| $G_{UM}$ | maximum unilateral power gain | $I_C$ = 15 mA; $V_{CE}$ = 8 V; f = 1 GHz | – | 14 | – | dB |
| F | noise figure | $I_C$ = 5 mA; $V_{CE}$ = 8 V; f = 1 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 | $T_s \leq 97$ °C; note 1 | – | 300 | mW |
| $T_{stg}$ | storage temperature range | | –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 | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}s}$ | thermal resistance from junction to soldering point | note 1 | 260 | K/W |

**Note**

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

## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $I_{CBO}$ | collector cut-off current | $I_E$ = 0; $V_{CB}$ = 5 V | – | – | 50 | nA |
| $h_{FE}$ | DC current gain | $I_C$ = 15 mA; $V_{CE}$ = 5 V | 60 | 100 | – | |
| $C_c$ | collector capacitance | $I_E = i_e$ = 0; $V_{CB}$ = 8 V; f = 1 MHz | – | 0.7 | – | pF |
| $C_e$ | emitter capacitance | $I_C = i_c$ = 0; $V_{EB}$ = 0.5 V; f = 1 MHz | – | 1.3 | – | pF |
| $C_{re}$ | feedback capacitance | $I_C$ = 0; $V_{CB}$ = 8 V; f = 1 MHz | – | 0.5 | – | pF |
| $f_T$ | transition frequency | $I_C$ = 15 mA; $V_{CE}$ = 8 V | – | 8 | – | GHz |
| $G_{UM}$ | maximum unilateral power gain (note 1) | $I_C$ = 15 mA; $V_{CE}$ = 8 V; $T_{amb}$ = 25 °C; f = 1 GHz | – | 14 | – | dB |
| | | $I_C$ = 15 mA; $V_{CE}$ = 8 V; f = 2 GHz | – | 8 | – | dB |
| F | noise figure | $\Gamma_s = \Gamma_{opt}$; $I_C$ = 5 mA; $V_{CE}$ = 8 V; $T_{amb}$ = 25 °C; f = 1 GHz | – | 1.3 | – | dB |
| | | $\Gamma_s = \Gamma_{opt}$; $I_C$ = 15 mA; $V_{CE}$ = 8 V; $T_{amb}$ = 25 °C; f = 1 GHz | – | 1.7 | – | dB |
| | | $\Gamma_s = \Gamma_{opt}$; $I_C$ = 5 mA; $V_{CE}$ = 8 V; $T_{amb}$ = 25 °C; f = 2 GHz | – | 2.2 | – | dB |
| | | $I_C$ = 5 mA; $V_{CE}$ = 8 V; $T_{amb}$ = 25 °C; f = 2 GHz; $Z_s$ = 60 Ω | – | 2.5 | – | dB |
| | | $\Gamma_s = \Gamma_{opt}$; $I_C$ = 15 mA; $V_{CE}$ = 8 V; $T_{amb}$ = 25 °C; f = 2 GHz | – | 2.7 | – | dB |
| | | $I_C$ = 15 mA; $V_{CE}$ = 8 V; $T_{amb}$ = 25 °C; f = 2 GHz; $Z_s$ = 60 Ω | – | 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 .

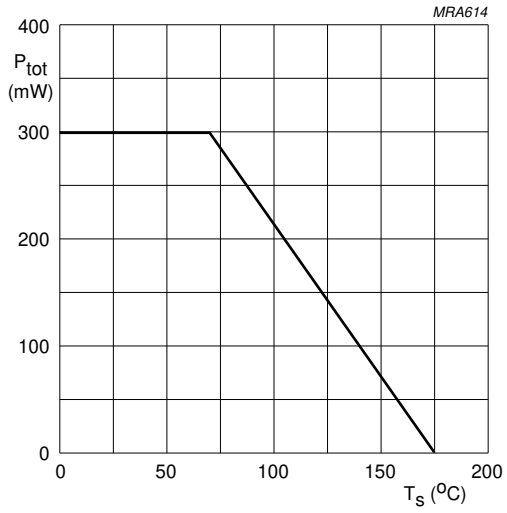
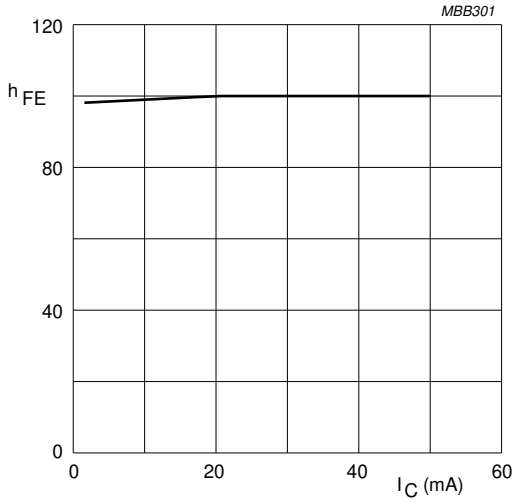
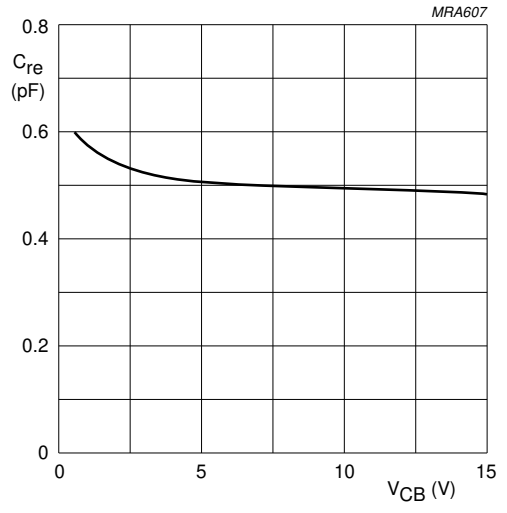



Fig.2 Power derating curve.



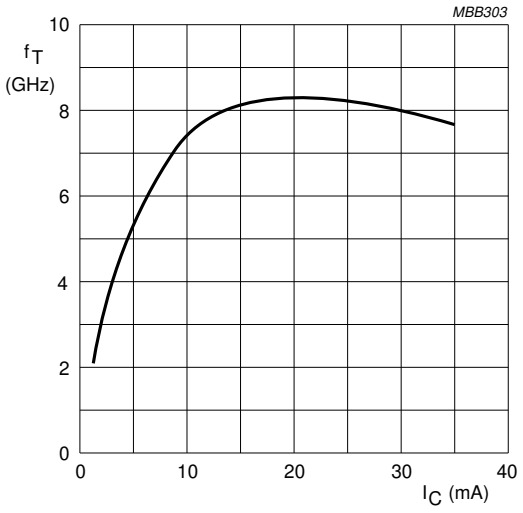

$V_{CE}$ = 5 V.

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



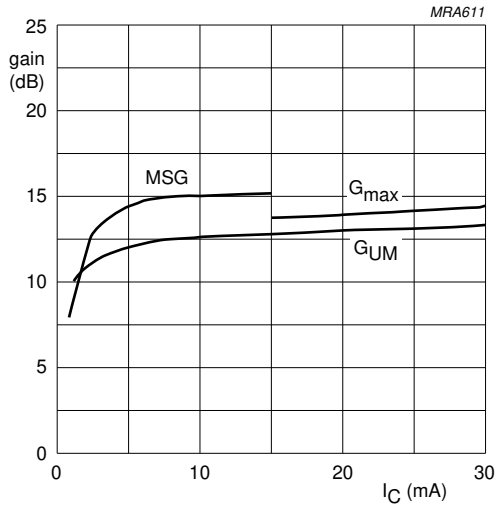

$I_C = i_c = 0$; f = 1 MHz.

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



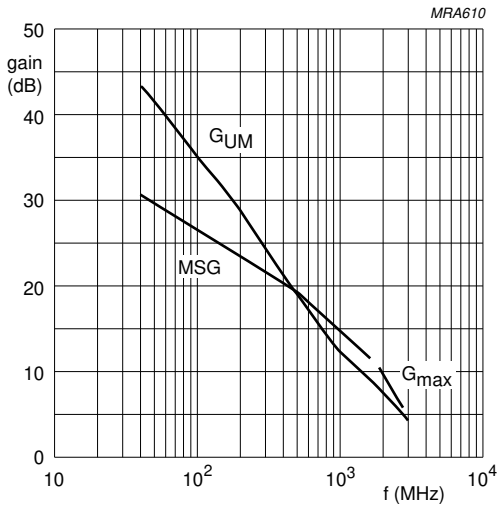

$V_{CE}$ = 8 V; $T_{amb}$ = 25 °C; f = 2 GHz.

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



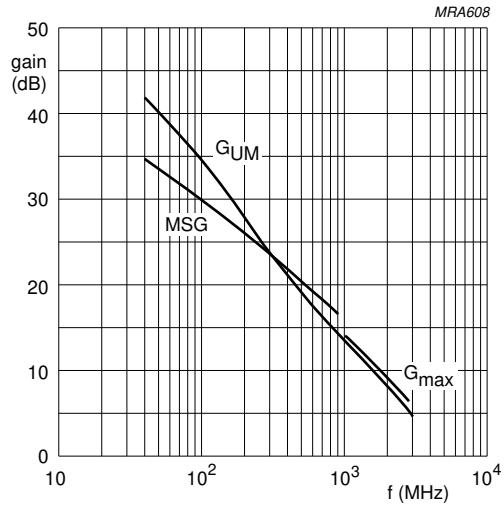

$V_{CE}$ = 8 V; f = 1 GHz.

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



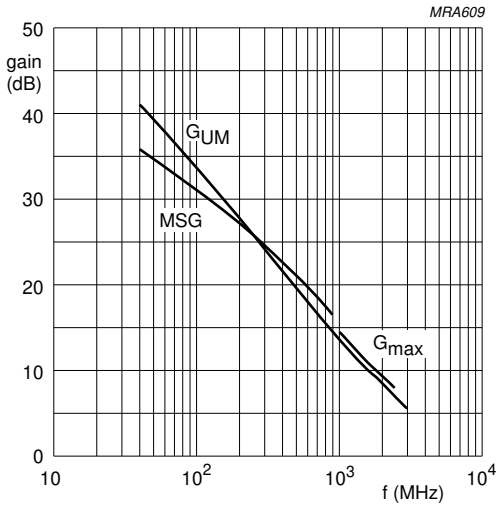

$V_{CE}$ = 8 V; $I_C$ = 5 mA.

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



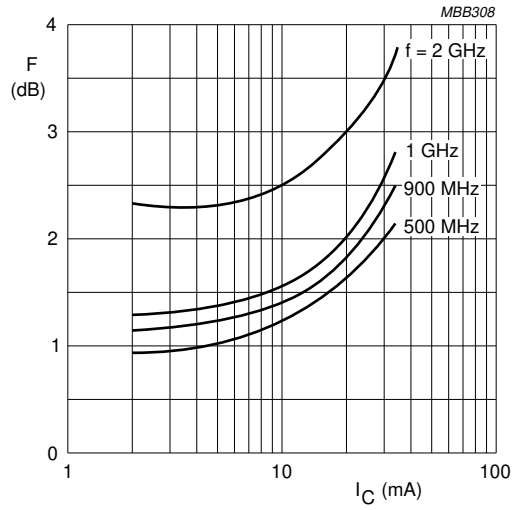

$V_{CE}$ = 8 V; $I_C$ = 15 mA.

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



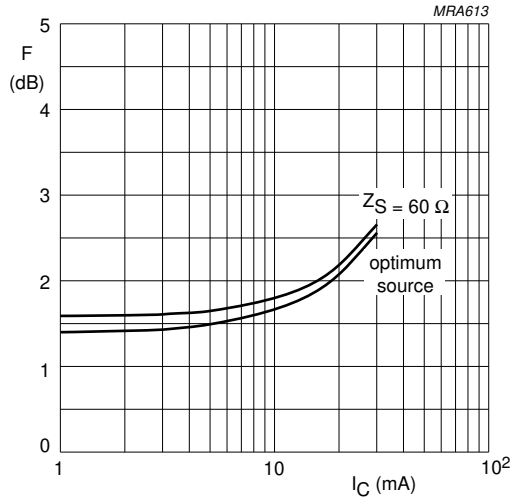

$V_{CE}$ = 8 V; $I_C$ = 30 mA.

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



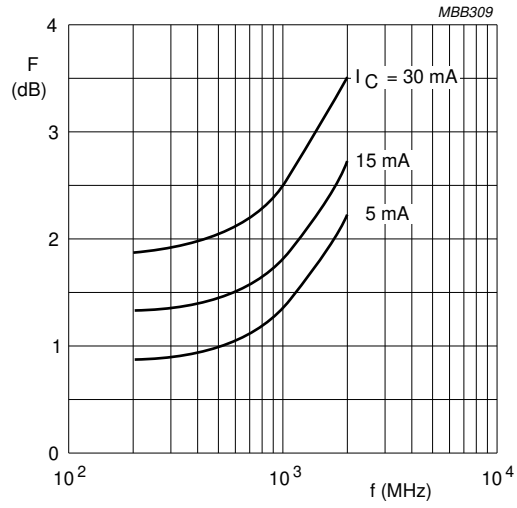

$V_{CE}$ = 8 V.

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



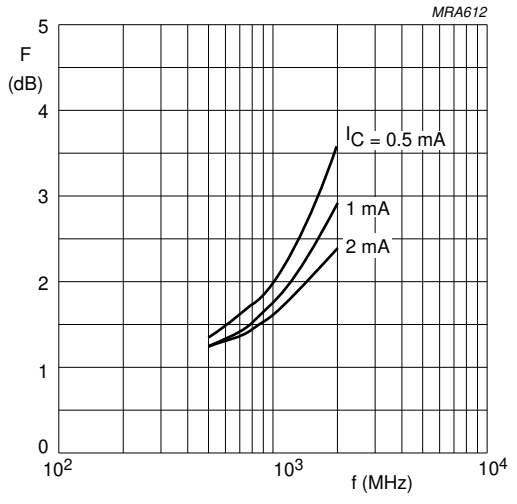

$V_{CE}$ = 6 V; f = 900 MHz.

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



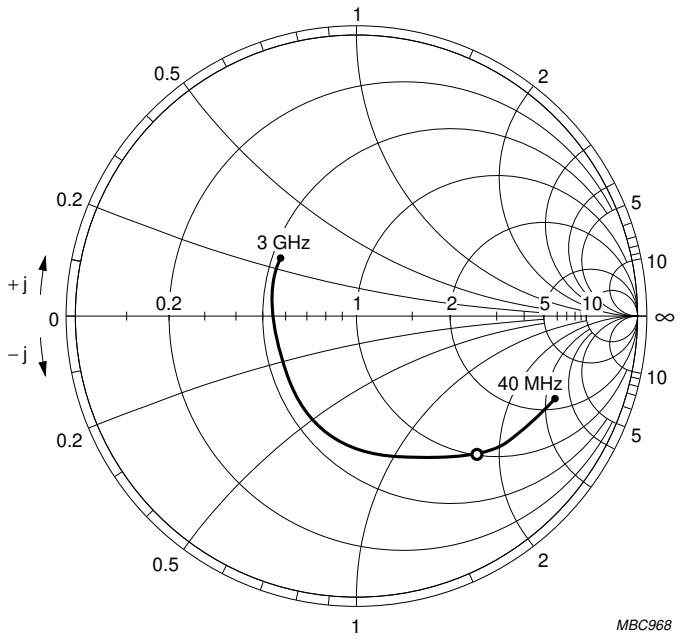

$V_{CE}$ = 8 V.

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



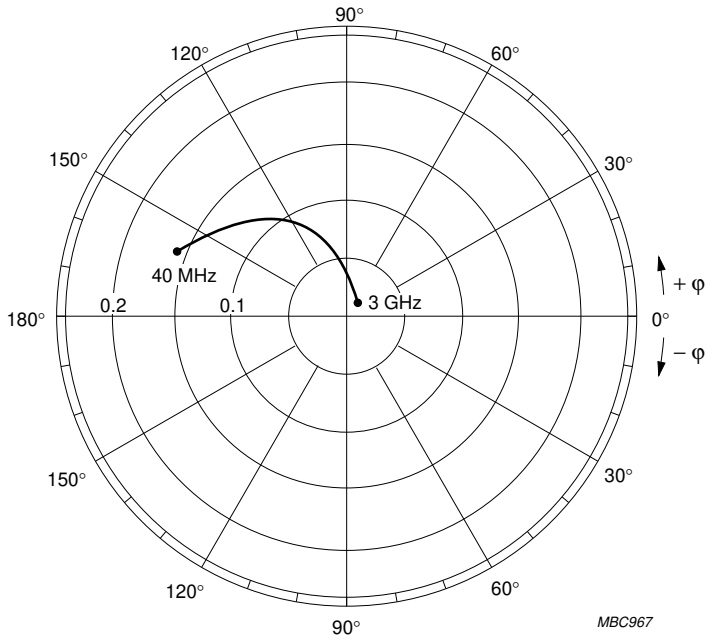

$V_{CE}$ = 1 V.

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



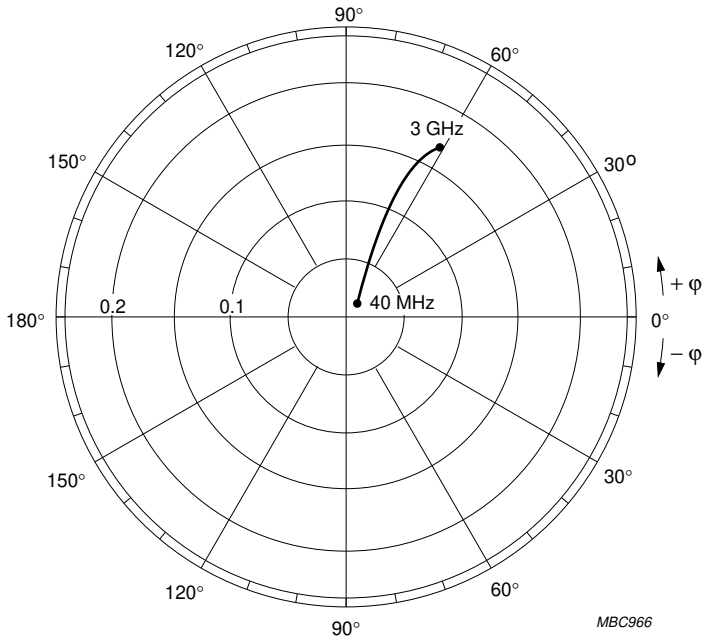

$V_{CE}$ = 8 V; $I_C$ = 15 mA; $Z_o$ = 50 Ω.

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



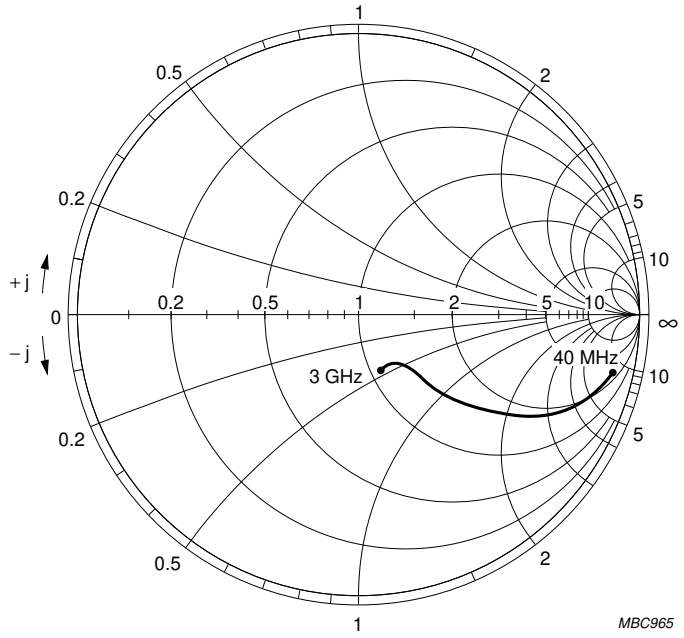

$V_{CE}$ = 8 V; $I_C$ = 15 mA.

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




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

Fig.16 Common emitter reverse transmission coefficient ($S_{12}$), typical values.

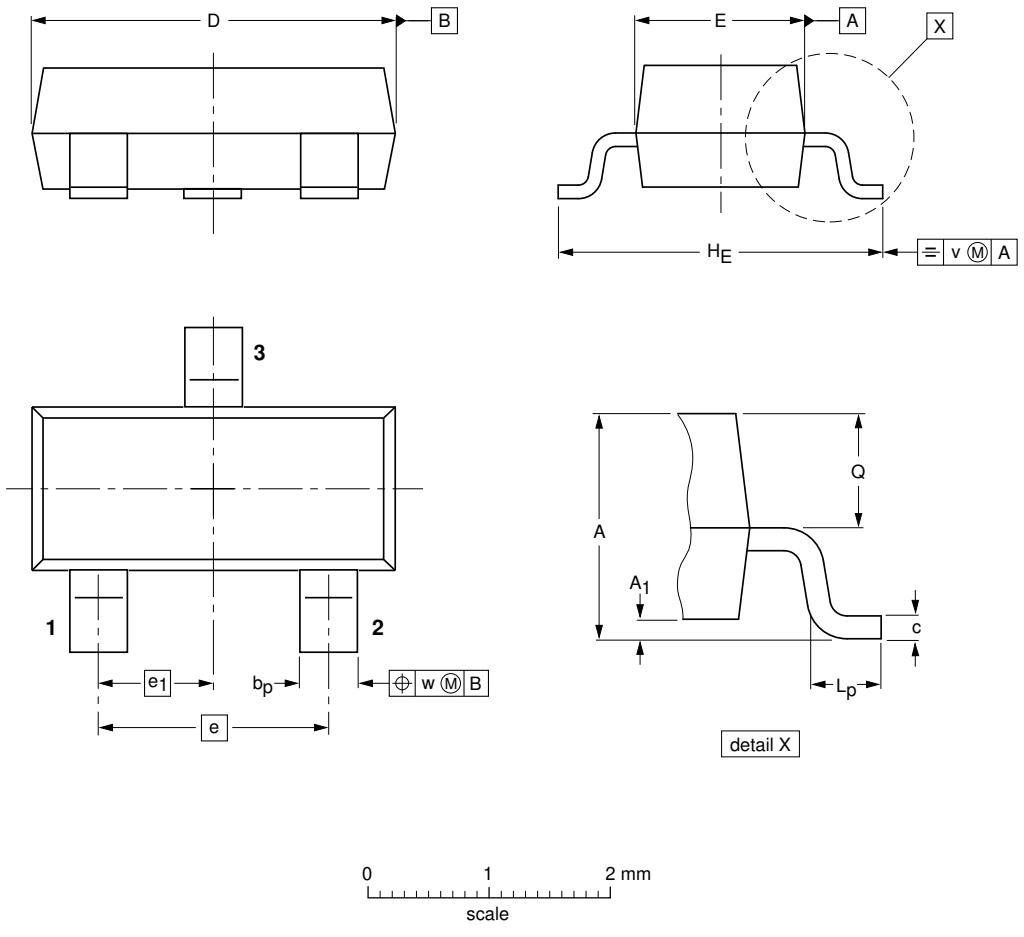



$V_{CE}$ = 8 V; $I_C$ = 15 mA; $Z_o$ = 50 Ω.

Fig.17 Common emitter output reflection coefficient ($S_{22}$), typical values.

## PACKAGE OUTLINE

**Plastic surface-mounted package; 3 leads** **SOT23**




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

| UNIT | A | $A_1$ max. | $b_p$ | c | D | E | e | $e_1$ | $H_E$ | $L_p$ | Q | v | w |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1<br>0.9 | 0.1 | 0.48<br>0.38 | 0.15<br>0.09 | 3.0<br>2.8 | 1.4<br>1.2 | 1.9 | 0.95 | 2.5<br>2.1 | 0.45<br>0.15 | 0.55<br>0.45 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT23 | | TO-236AB | | | | ~~04-11-04~~<br>06-03-16 |

**DATA SHEET STATUS**

| DOCUMENT STATUS[1] | PRODUCT STATUS[2] | DEFINITION |
|---|---|---|
| Objective data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary data sheet | Qualification | This document contains data from the preliminary specification. |
| Product data sheet | Production | This document contains the product specification. |

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Printed in The Netherlands R77/04/pp12 Date of release: 1998 Aug 27