

DATA SHEET

BF747

NPN 1 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

September 1995

NPN 1 GHz wideband transistor

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FEATURES

- Stable oscillator operation
- High current gain
- Good thermal stability.

APPLICATIONS

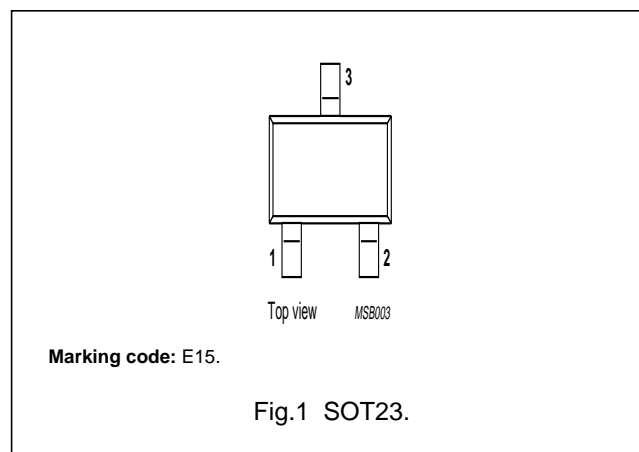
- It is intended for VHF and UHF TV-tuner applications and can be used as a mixer and/or oscillator.

PINNING

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

DESCRIPTION

Low cost NPN transistor in a plastic SOT23 package.



QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | TYP. | MAX. | UNIT |
|-----------|---------------------------|--|------|------|------|
| V_{CEO} | collector-emitter voltage | open base | – | 20 | V |
| V_{CBO} | collector-base voltage | open emitter | – | 30 | V |
| V_{EBO} | emitter-base voltage | open collector | – | 3 | V |
| I_{CM} | peak collector current | | – | 50 | mA |
| P_{tot} | total power dissipation | up to $T_s = 70\text{ °C}$; note 1 | – | 300 | mW |
| f_T | transition frequency | $I_C = 15\text{ mA}$; $V_{CE} = 10\text{ V}$; $f = 500\text{ MHz}$ | 1.2 | 1.6 | GHz |

Note

1. T_s is the temperature at the soldering point of the collector pin.

LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|-----------|---------------------------|-------------------------------------|------|------|------|
| V_{CEO} | collector-emitter voltage | open base | – | 20 | V |
| V_{CBO} | collector-base voltage | open emitter | – | 30 | V |
| V_{EBO} | emitter-base voltage | open collector | – | 3 | V |
| I_{CM} | peak collector current | | – | 50 | mA |
| P_{tot} | total power dissipation | up to $T_s = 70\text{ °C}$; note 1 | – | 300 | mW |
| T_{stg} | storage temperature | | –55 | +150 | °C |
| T_j | junction temperature | | – | 150 | °C |

Note

1. T_s is the temperature at the soldering point of the collector pin.

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THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---------------|---|---|-------|------|
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | up to $T_s = 70\text{ }^\circ\text{C}$; note 1 | 260 | K/W |

Note

- T_s is the temperature at the soldering point of the collector pin.

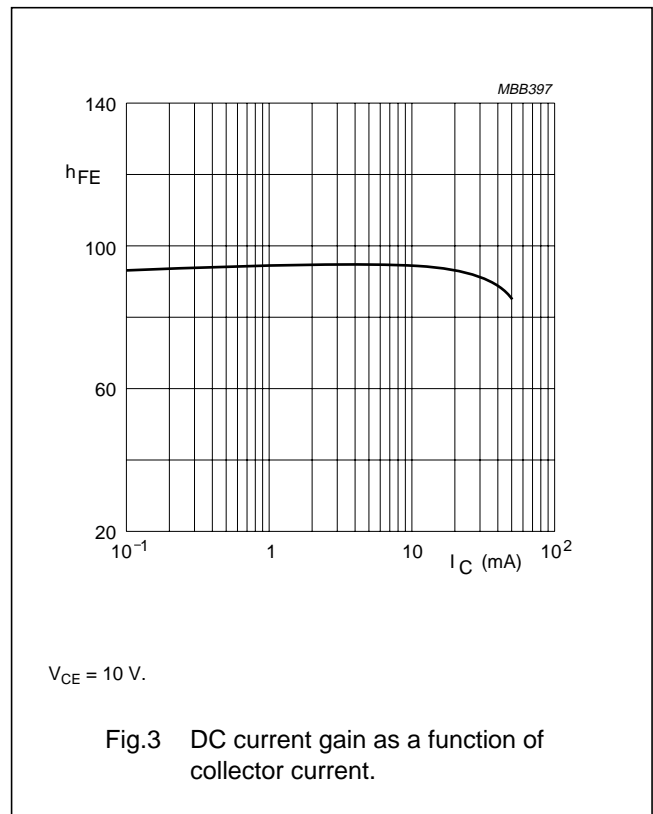
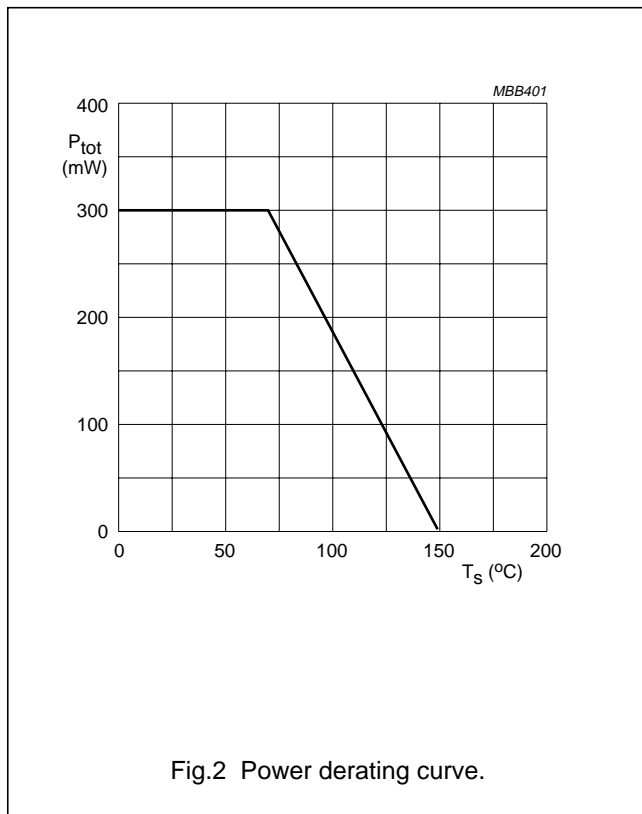
CHARACTERISTICS

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------|---------------------------------------|--|------|------|------|------|
| I_{CBO} | collector cut-off current | $I_E = 0; V_{CB} = 10\text{ V}$ | – | – | 100 | nA |
| h_{FE} | DC current gain | $I_C = 2\text{ mA}; V_{CE} = 10\text{ V}$ | 40 | 95 | 250 | |
| f_T | transition frequency | $I_C = 15\text{ mA}; V_{CE} = 10\text{ V}; f = 500\text{ MHz}$ | 0.8 | 1.2 | 1.6 | GHz |
| C_{re} | feedback capacitance | $I_E = i_e = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$ | – | 0.5 | – | pF |
| G_{UM} | maximum unilateral power gain; note 1 | $I_C = 15\text{ mA}; V_{CE} = 10\text{ V}; f = 100\text{ MHz}$ | – | 20 | – | dB |

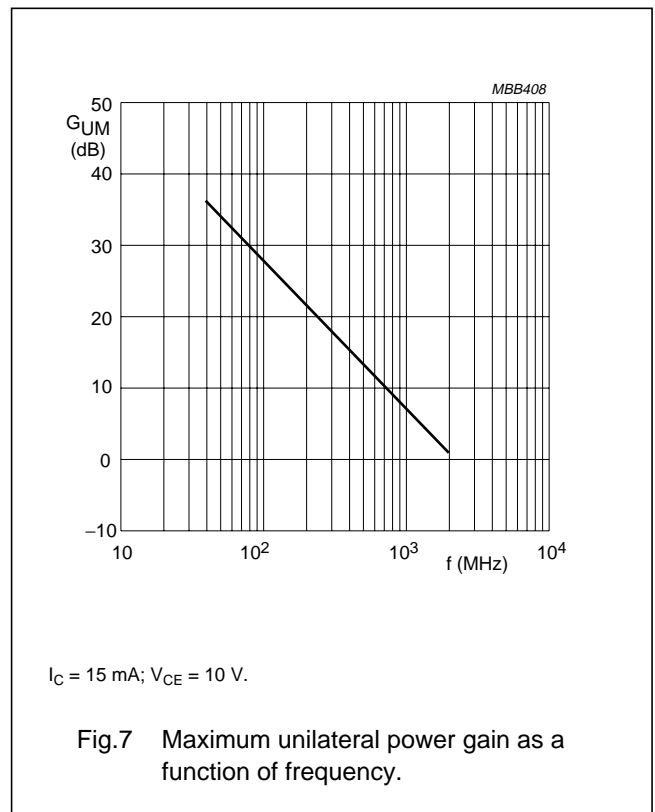
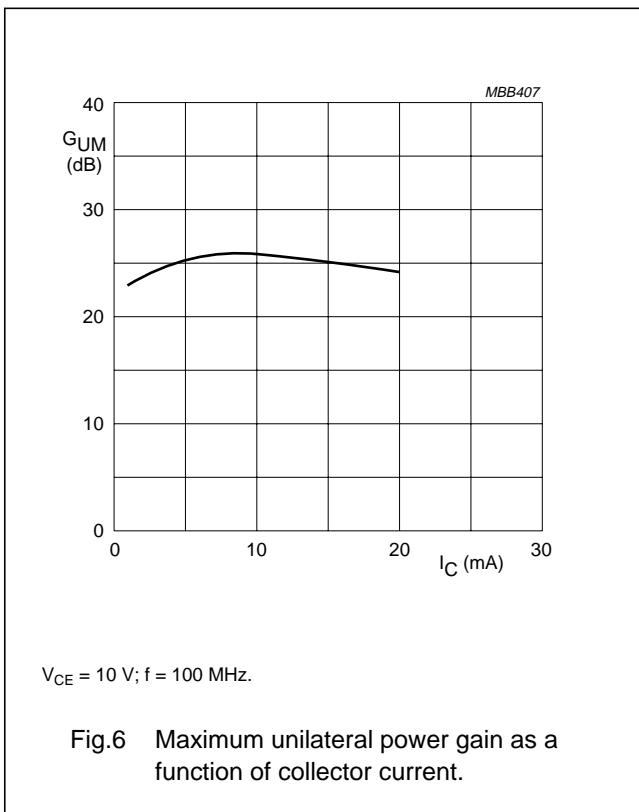
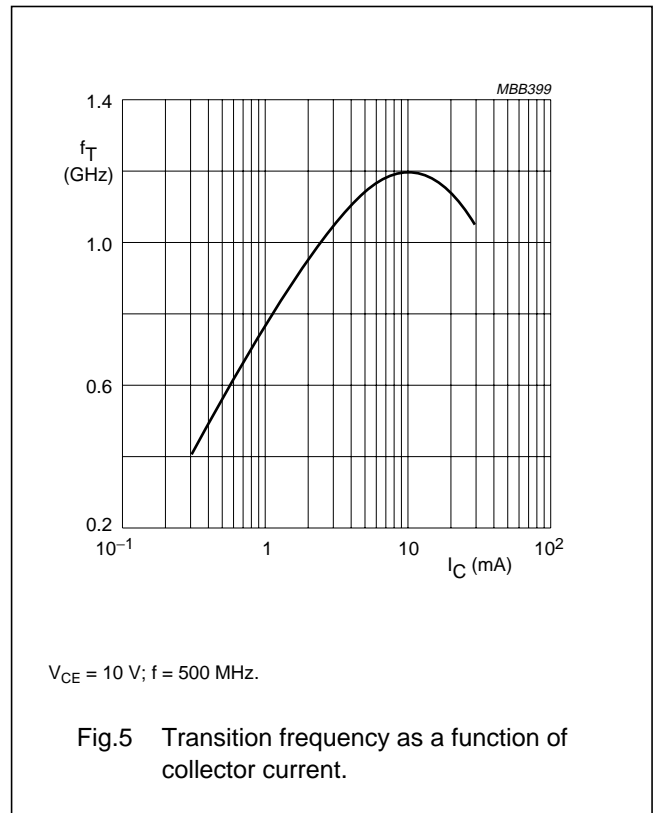
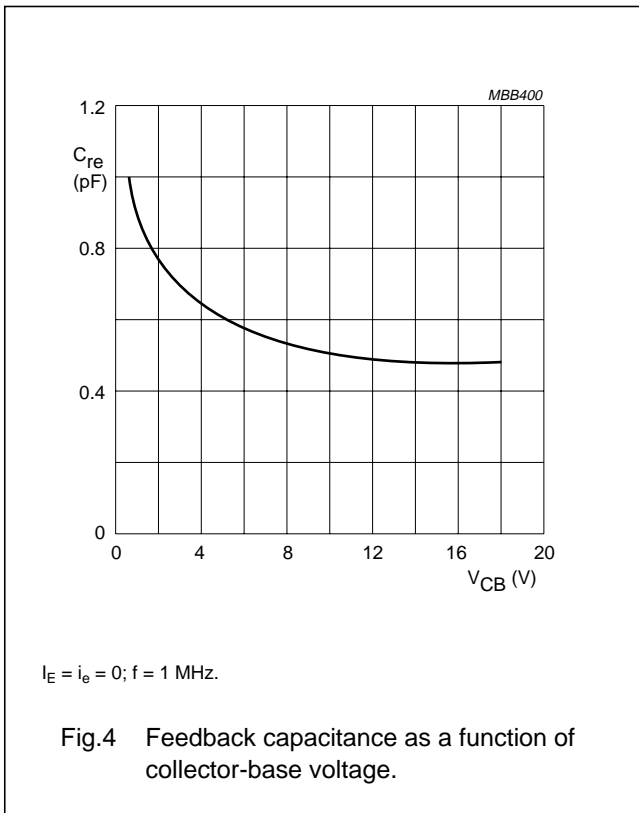
Note

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



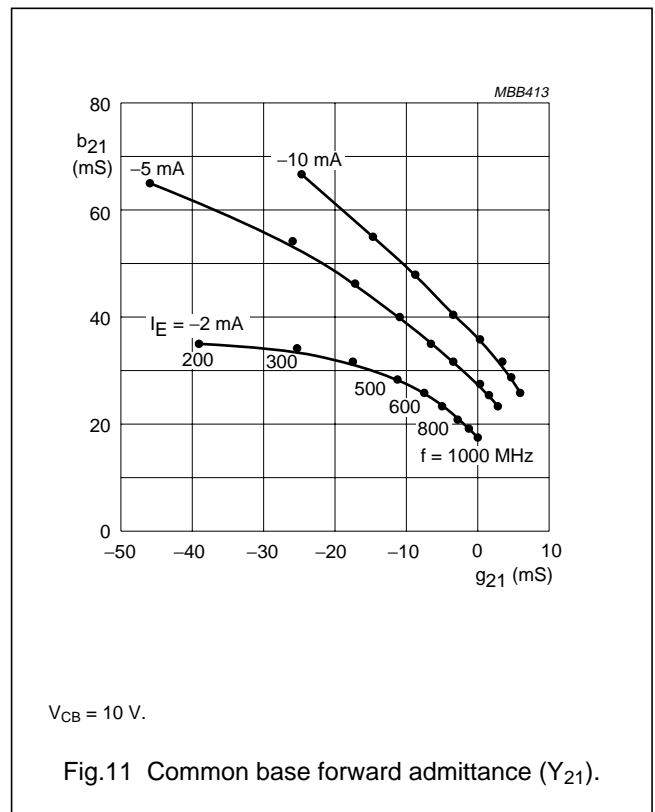
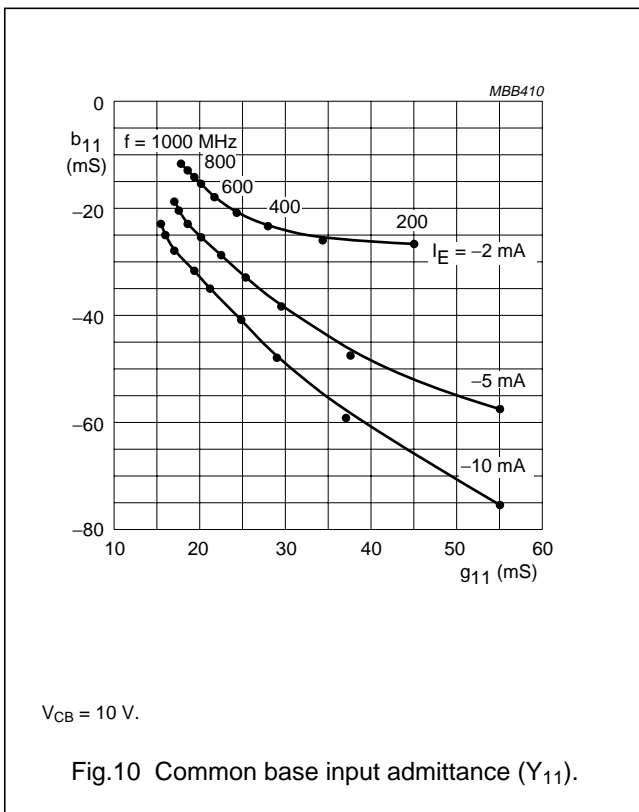
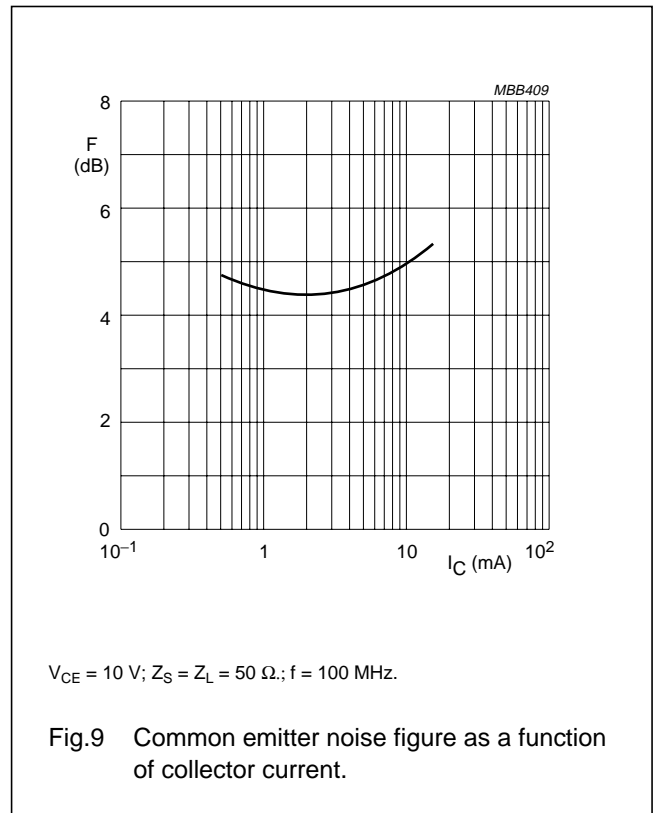
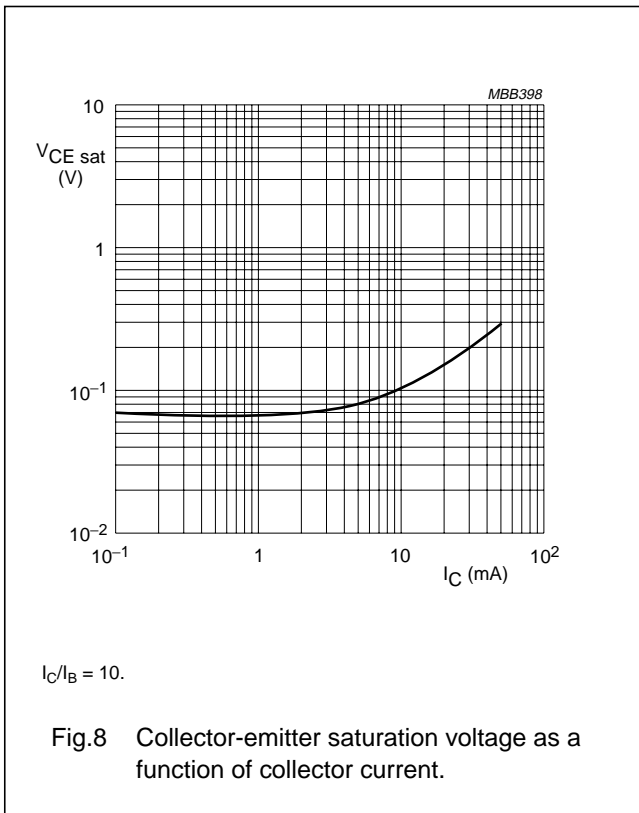
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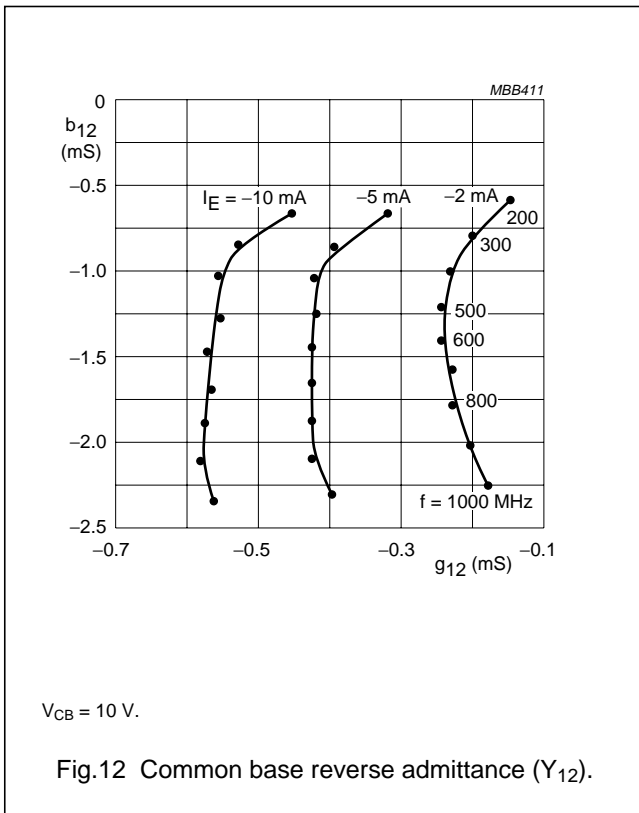


Fig.12 Common base reverse admittance (Y_{12}).

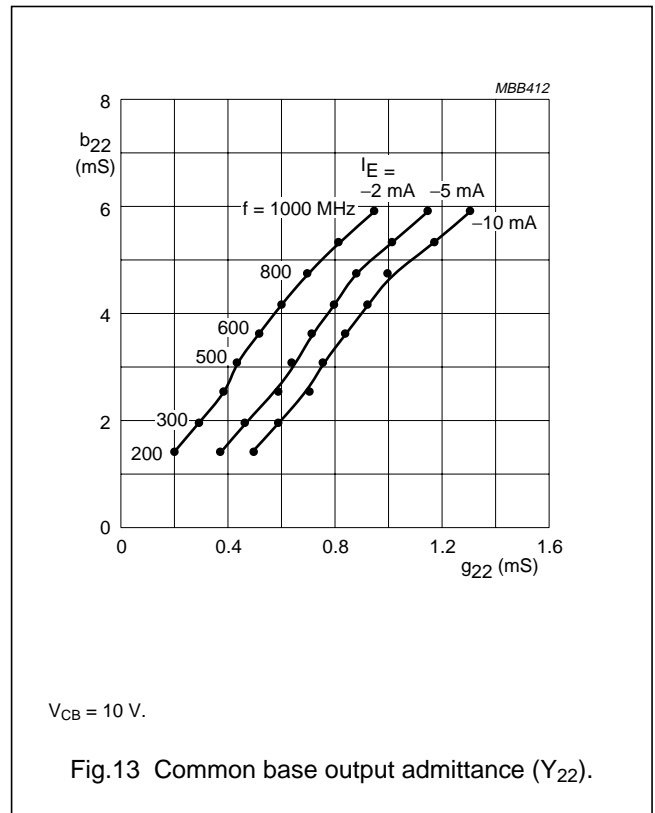
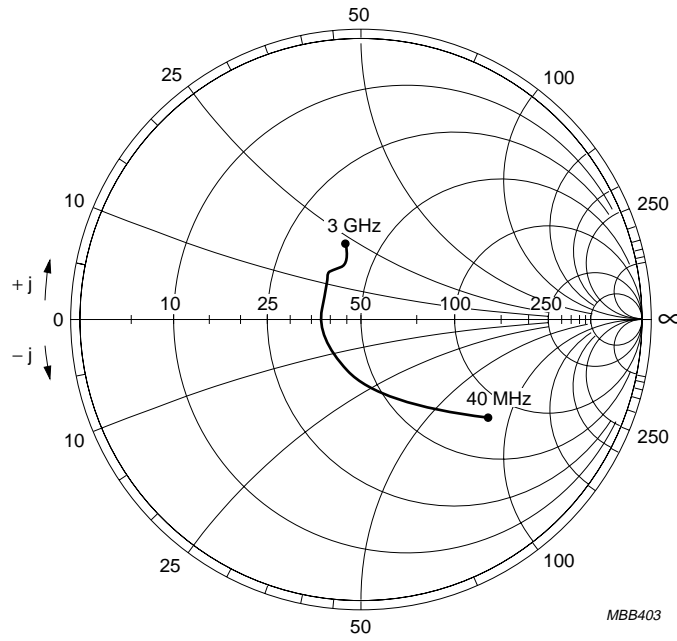


Fig.13 Common base output admittance (Y_{22}).

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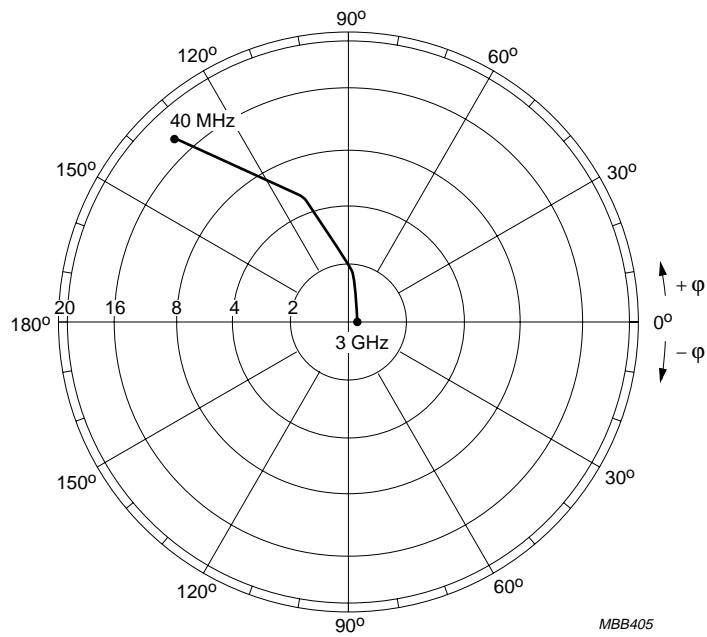
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$I_C = 15 \text{ mA}; V_{CE} = 10 \text{ V}; Z_O = 50 \Omega.$

MBB403

Fig.14 Common emitter input reflection coefficient (S_{11}).



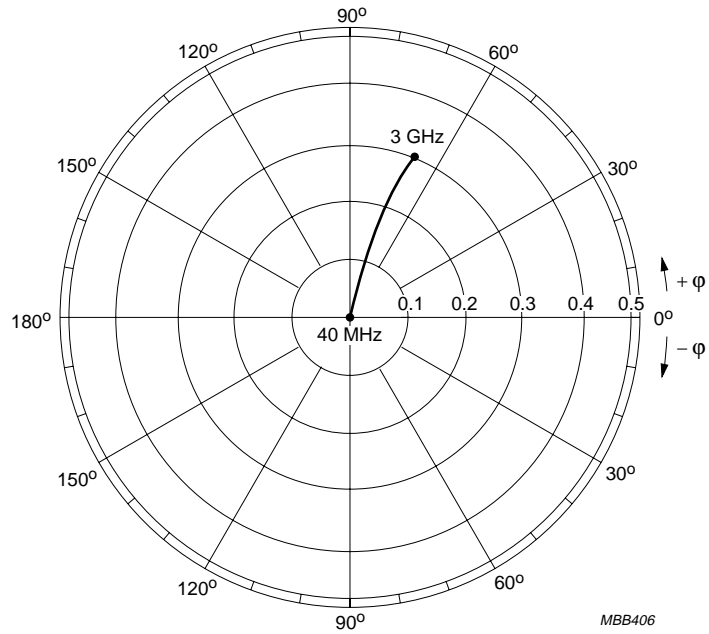
$I_C = 15 \text{ mA}; V_{CE} = 10 \text{ V}.$

MBB405

Fig.15 Common emitter forward transmission coefficient (S_{21}).

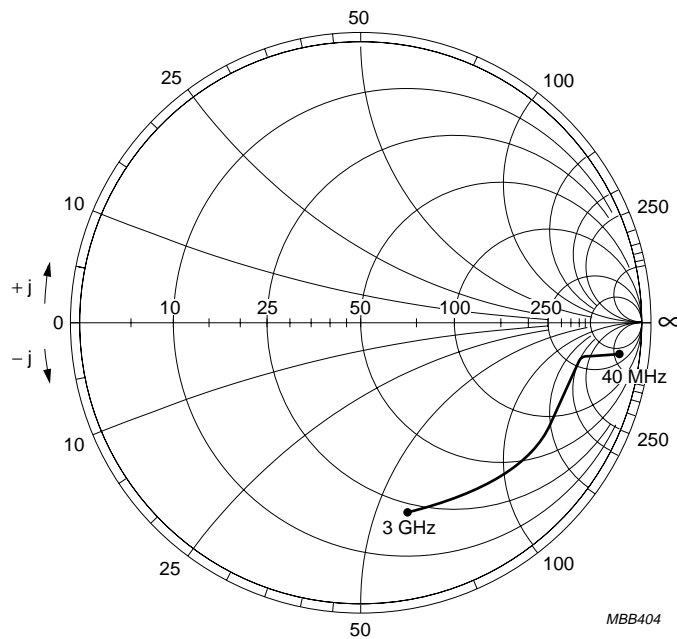
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$I_C = 15 \text{ mA}; V_{CE} = 10 \text{ V}.$

Fig.16 Common emitter reverse transmission coefficient (S_{12}).



$I_C = 15 \text{ mA}; V_{CE} = 10 \text{ V}; Z_O = 50 \Omega.$

Fig.17 Common emitter output reflection coefficient (S_{22}).

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Table 1 Common base Y-parameters, $I_E = -2$ mA; $V_{CB} = 10$ V, typical values.

| f (MHz) | Y ₁₁ | | Y ₂₁ | | Y ₁₂ | | Y ₂₂ | |
|---------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|
| | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) |
| 40 | 69.0 | -10.2 | -68.0 | 12.3 | -0.02 | -0.1 | -0.01 | 0.3 |
| 100 | 60.4 | -20.6 | -58.0 | 25.6 | -0.06 | -0.3 | -0.08 | 0.7 |
| 200 | 45.0 | -27.4 | -39.1 | 34.5 | -0.10 | -0.6 | 0.19 | 1.4 |
| 300 | 34.3 | -26.4 | -25.4 | 34.0 | -0.20 | -0.8 | 0.29 | 1.9 |
| 400 | 27.7 | -23.3 | -17.2 | 31.1 | -0.20 | -1.0 | 0.37 | 2.5 |
| 500 | 24.0 | -20.4 | -11.7 | 27.6 | -0.20 | -1.2 | 0.45 | 3.0 |
| 600 | 21.5 | -18.0 | -7.8 | 25.0 | -0.20 | -1.4 | 0.53 | 3.6 |
| 700 | 20.0 | -15.6 | -5.3 | 22.6 | -0.20 | -1.6 | 0.60 | 4.2 |
| 800 | 18.6 | -14.0 | -3.0 | 20.2 | -0.20 | -1.8 | 0.69 | 4.7 |
| 900 | 18.3 | -12.8 | -1.3 | 18.7 | -0.20 | -2.0 | 0.82 | 5.3 |
| 1000 | 17.8 | -11.7 | -0.1 | 17.1 | -0.20 | -2.2 | 0.95 | 5.9 |

Table 2 Common base Y-parameters, $I_E = -5$ mA; $V_{CB} = 10$ V, typical values.

| f (MHz) | Y ₁₁ | | Y ₂₁ | | Y ₁₂ | | Y ₂₂ | |
|---------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|
| | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) |
| 40 | 132.6 | -35.7 | -130.5 | 38.8 | -0.06 | -0.2 | -0.06 | 0.4 |
| 100 | 96.3 | -62.0 | -91.1 | 67.9 | -0.20 | -0.5 | 0.21 | 0.8 |
| 200 | 54.7 | -57.8 | -46.0 | 64.7 | -0.30 | -0.7 | 0.38 | 1.4 |
| 300 | 37.5 | -46.9 | -26.4 | 53.8 | -0.40 | -0.8 | 0.47 | 2.0 |
| 400 | 29.2 | -38.6 | -16.6 | 45.8 | -0.40 | -1.0 | 0.58 | 2.5 |
| 500 | 25.3 | -32.8 | -11.0 | 39.8 | -0.40 | -1.3 | 0.63 | 3.1 |
| 600 | 22.0 | -28.4 | -6.3 | 35.0 | -0.40 | -1.4 | 0.71 | 3.6 |
| 700 | 20.3 | -25.2 | -3.3 | 31.4 | -0.40 | -1.6 | 0.80 | 4.2 |
| 800 | 18.7 | -22.6 | -0.6 | 27.6 | -0.40 | -1.9 | 0.88 | 4.7 |
| 900 | 17.8 | -20.7 | 1.4 | 25.2 | -0.40 | -2.1 | 1.01 | 5.3 |
| 1000 | 17.3 | -19.1 | 3.0 | 23.0 | -0.40 | -2.3 | 1.15 | 6.0 |

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Table 3 Common base Y-parameters, $I_E = -10$ mA; $V_{CB} = 10$ V, typical values.

| f (MHZ) | Y ₁₁ | | Y ₂₁ | | Y ₁₂ | | Y ₂₂ | |
|---------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|
| | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) |
| 40 | 189.0 | -79.6 | -185.5 | 83.0 | -0.10 | -0.3 | -0.09 | 0.4 |
| 100 | 108.5 | -99.0 | -101.4 | 105.4 | -0.30 | -0.5 | 0.30 | 0.9 |
| 200 | 55.2 | -76.2 | -44.6 | 82.8 | -0.50 | -0.7 | 0.44 | 1.4 |
| 300 | 37.1 | -59.0 | -24.3 | 65.7 | -0.50 | -0.9 | 0.60 | 2.0 |
| 400 | 28.8 | -47.6 | -14.6 | 54.4 | -0.60 | -1.0 | 0.69 | 2.5 |
| 500 | 24.7 | -40.2 | -8.6 | 46.7 | -0.60 | -1.3 | 0.75 | 3.1 |
| 600 | 21.2 | -35.0 | -3.4 | 40.8 | -0.60 | -1.5 | 0.84 | 3.6 |
| 700 | 19.3 | -31.0 | -0.2 | 36.2 | -0.60 | -1.7 | 0.93 | 4.2 |
| 800 | 17.2 | -27.5 | 2.6 | 31.1 | -0.60 | -1.9 | 1.00 | 4.7 |
| 900 | 16.4 | -25.2 | 4.6 | 28.3 | -0.60 | -2.1 | 1.15 | 5.3 |
| 1000 | 15.8 | -23.0 | 6.0 | 25.5 | -0.60 | -2.3 | 1.31 | 6.0 |

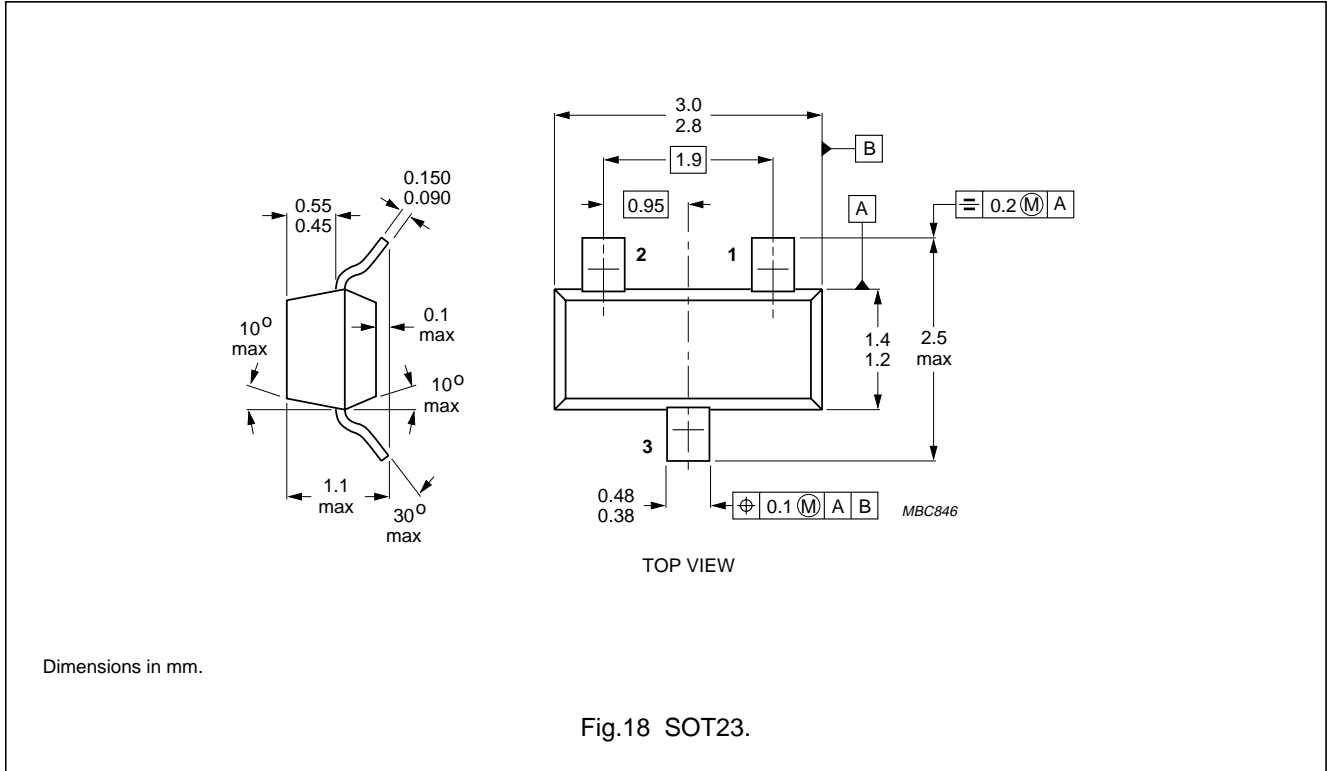
Table 4 Common base Y-parameters, $I_E = -15$ mA; $V_{CB} = 10$ V, typical values.

| f (MHz) | Y ₁₁ | | Y ₂₁ | | Y ₁₂ | | Y ₂₂ | |
|---------|-----------------|------------|-----------------|------------|-----------------|------------|-----------------|------------|
| | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) | REAL (mS) | IMAG. (mS) |
| 40 | 206.5 | -113.8 | -202.6 | 118.1 | -0.20 | -0.3 | 0.2 | 0.5 |
| 100 | 104.3 | -114.0 | -96.4 | 120.1 | -0.40 | -0.5 | 0.4 | 0.9 |
| 200 | 53.1 | -81.1 | -41.7 | 87.7 | -0.50 | -0.7 | 0.6 | 1.4 |
| 300 | 35.9 | -62.1 | -22.0 | 68.6 | -0.60 | -0.8 | 0.7 | 2.0 |
| 400 | 28.1 | -50.0 | -12.5 | 56.9 | -0.60 | -1.1 | 0.8 | 2.5 |
| 500 | 23.4 | -42.3 | -6.1 | 48.2 | -0.60 | -1.3 | 0.8 | 3.1 |
| 600 | 20.1 | -36.4 | -1.2 | 41.6 | -0.60 | -1.5 | 0.9 | 3.6 |
| 700 | 18.2 | -32.0 | 2.0 | 36.7 | -0.60 | -1.7 | 1.0 | 4.2 |
| 800 | 16.2 | -28.2 | 4.5 | 31.3 | -0.60 | -1.9 | 1.1 | 4.7 |
| 900 | 15.5 | -25.7 | 6.5 | 28.1 | -0.60 | -2.1 | 1.3 | 5.3 |
| 1000 | 14.7 | -23.5 | 7.9 | 24.9 | -0.60 | -2.3 | 1.4 | 5.9 |

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PACKAGE OUTLINE



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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