

# DATA SHEET

**BF747**

**NPN 1 GHz wideband transistor**

Product specification  
File under Discrete Semiconductors, SC14

September 1995

## NPN 1 GHz wideband transistor

BF747

## FEATURES

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

## APPLICATIONS

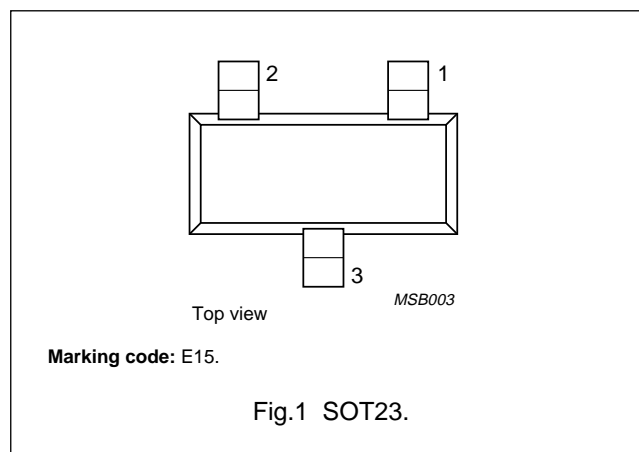
- It is intended for VHF and UHF TV-tuner applications and can be used as a mixer and/or oscillator.

## 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.

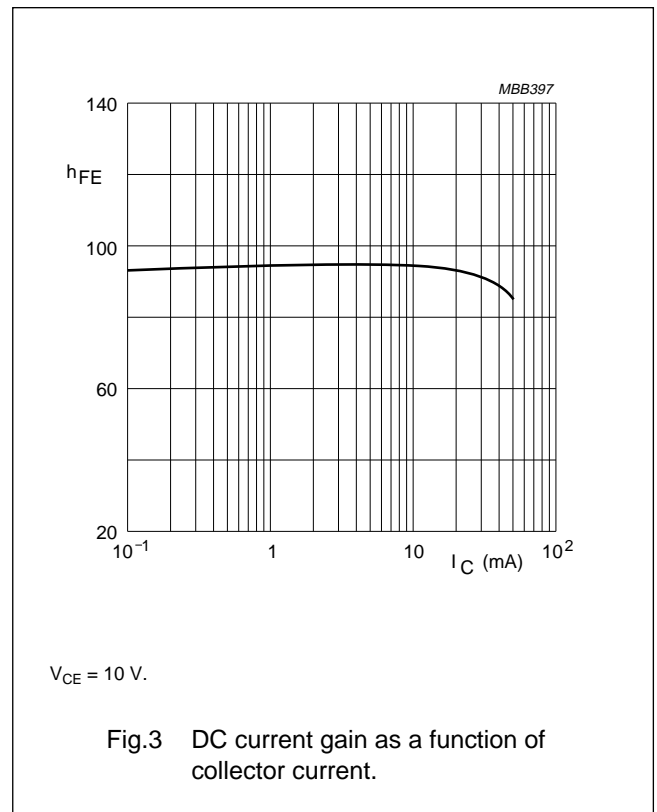
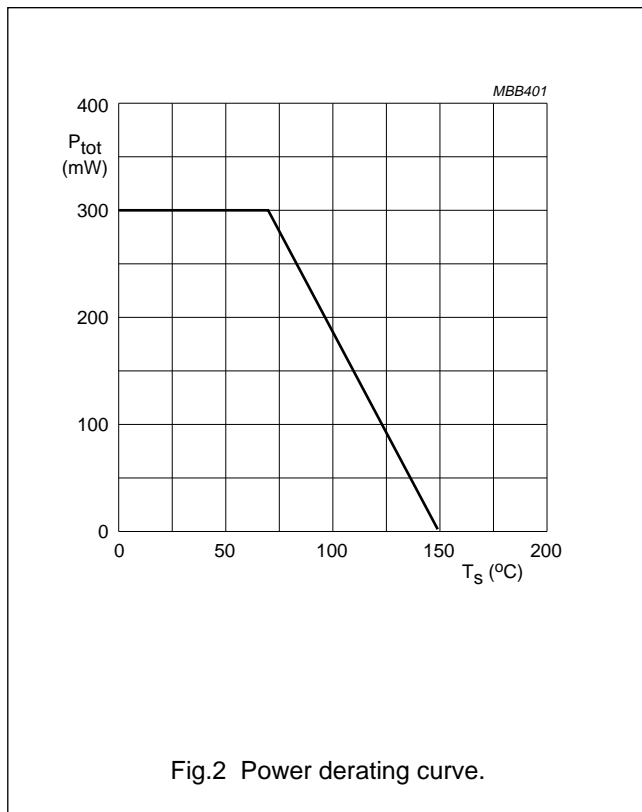
**CHARACTERISTICS**

$T_j = 25\text{ }^\circ\text{C}$  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

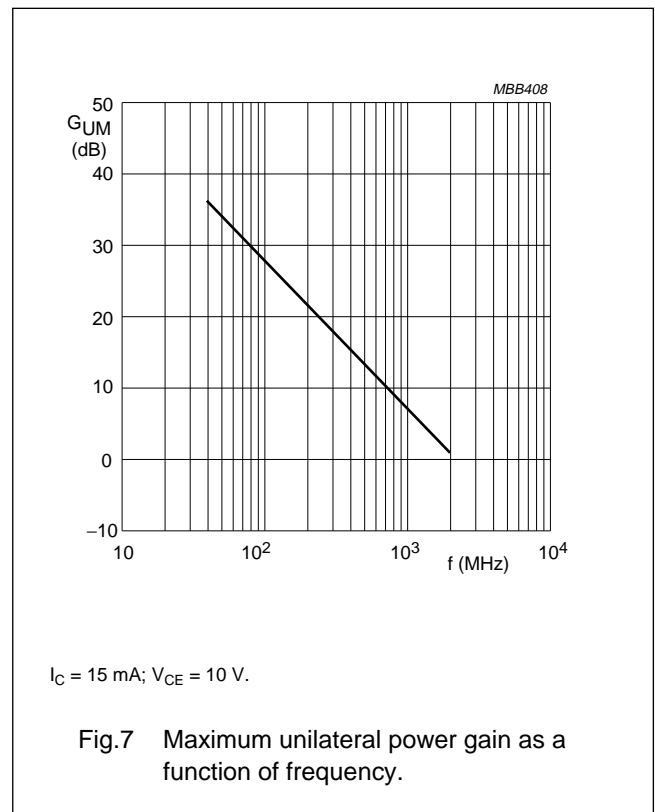
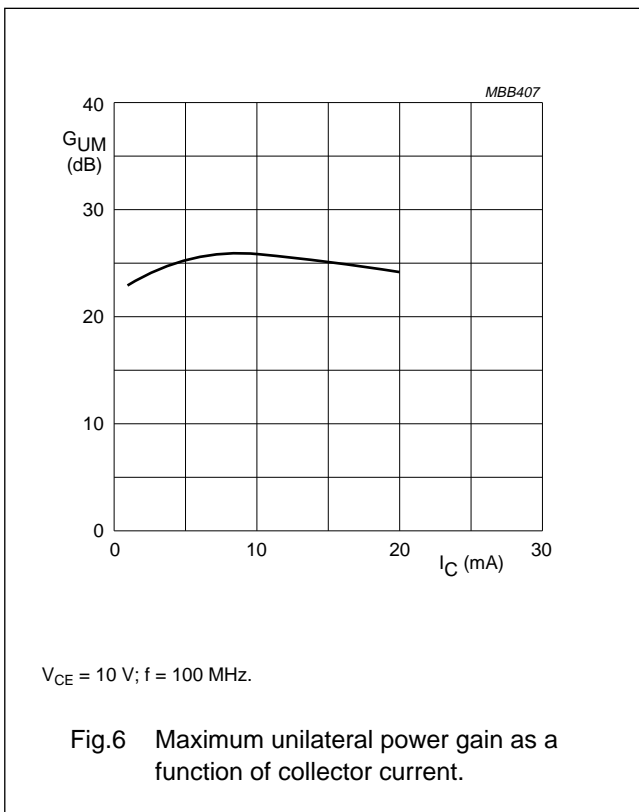
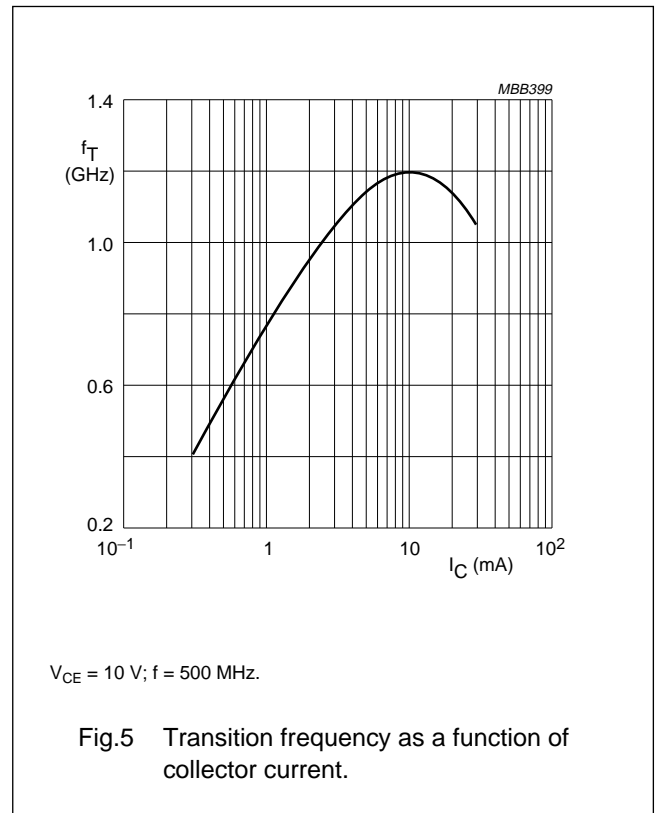
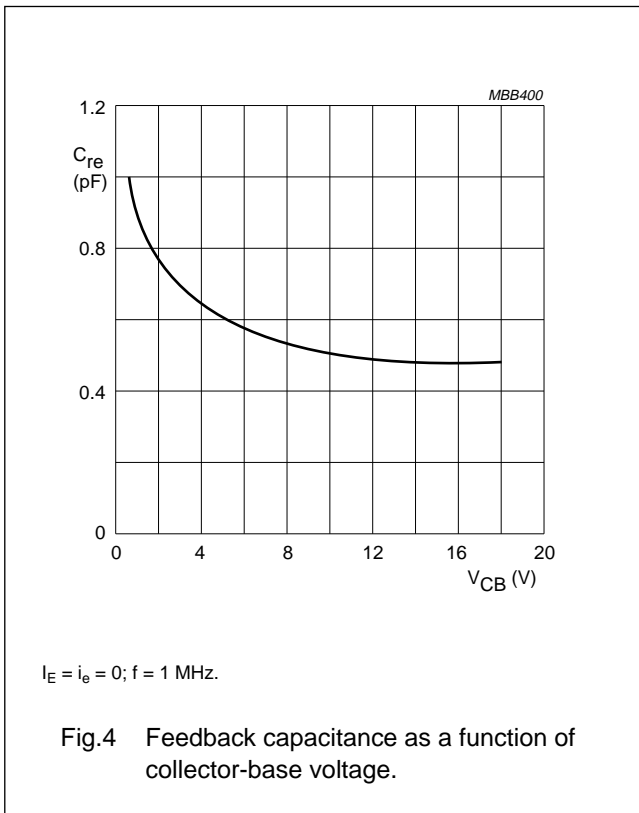
**Note**

- $G_{UM}$  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 .



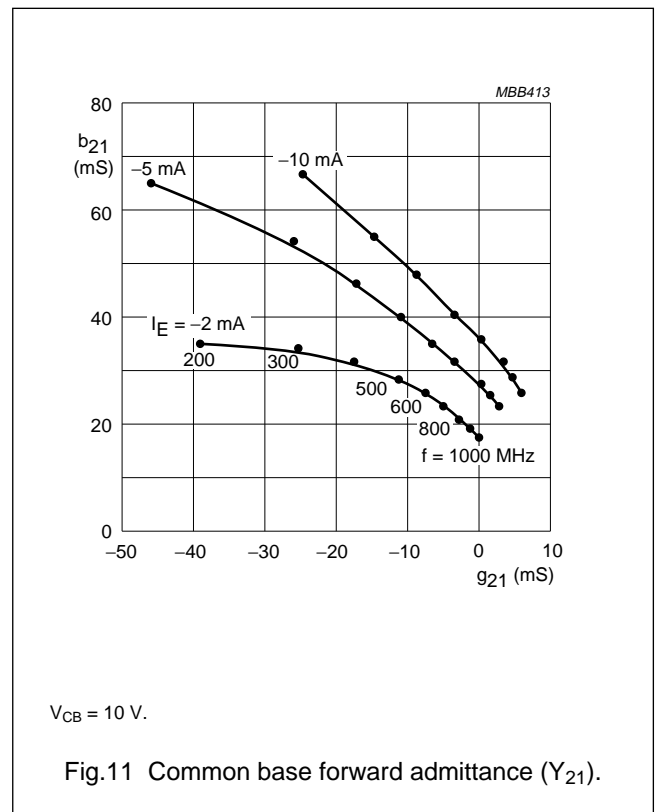
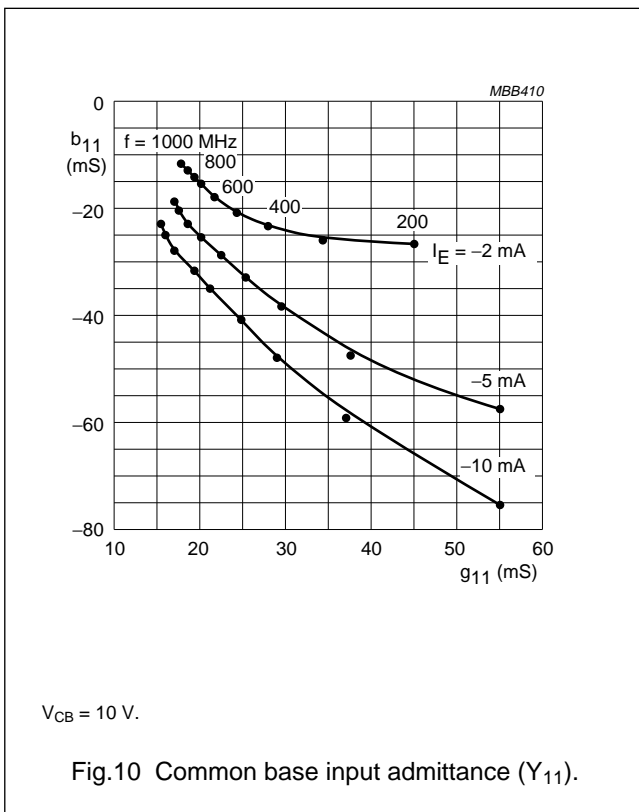
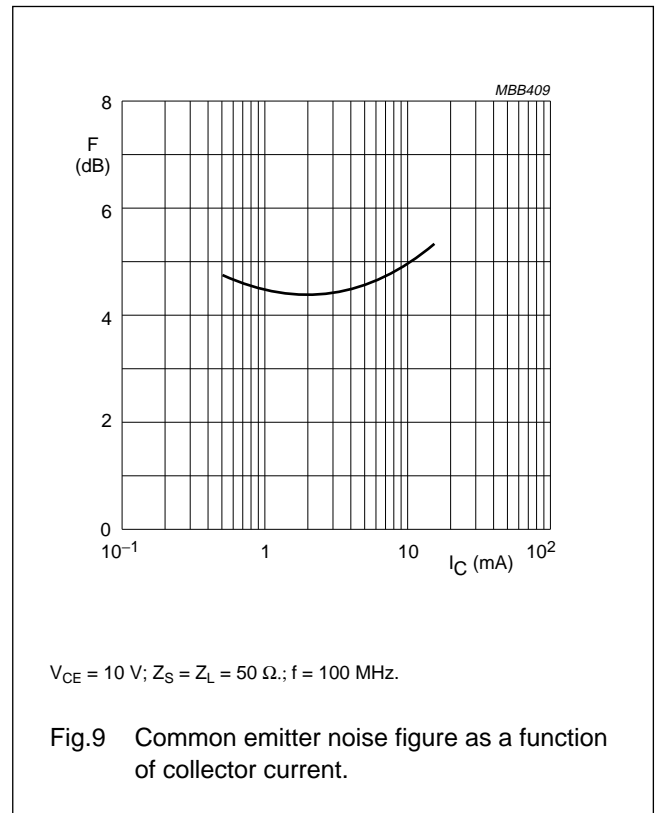
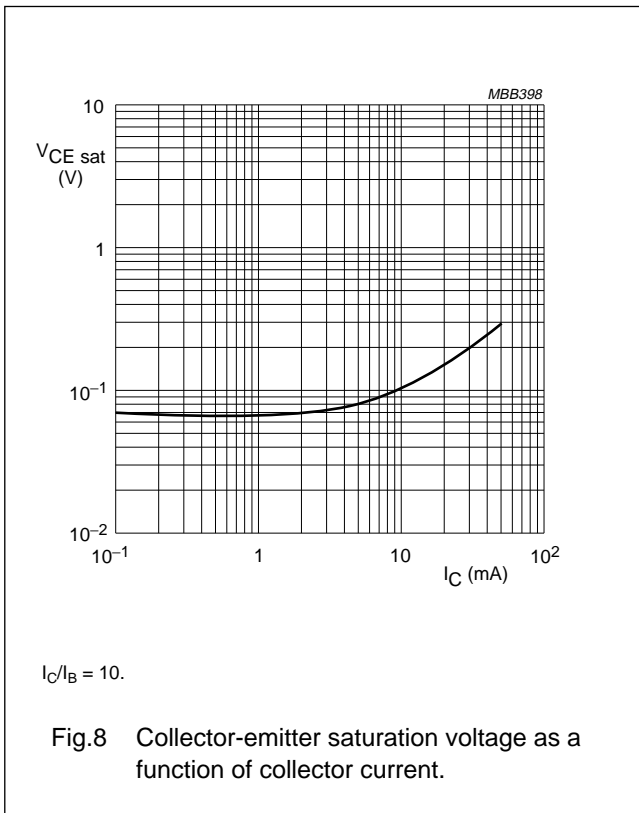
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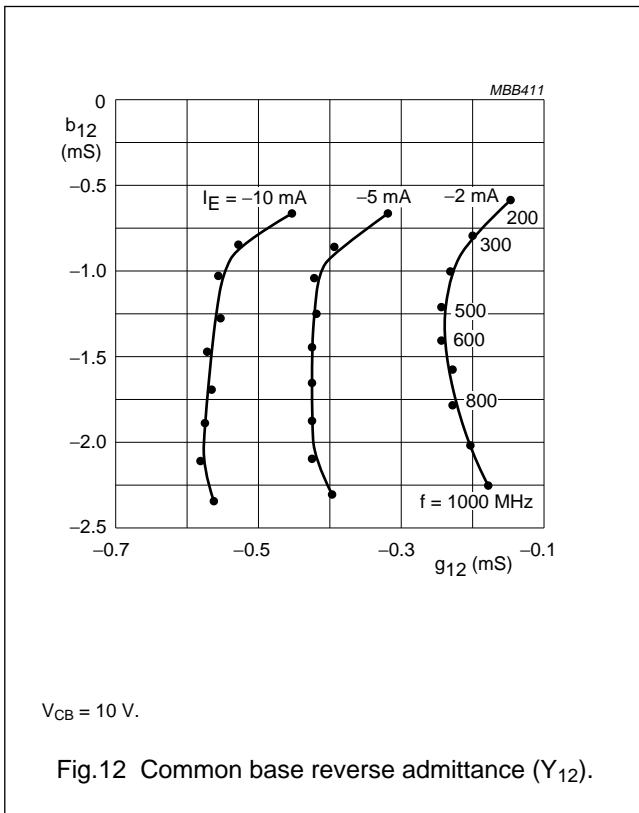


Fig.12 Common base reverse admittance ( $Y_{12}$ ).

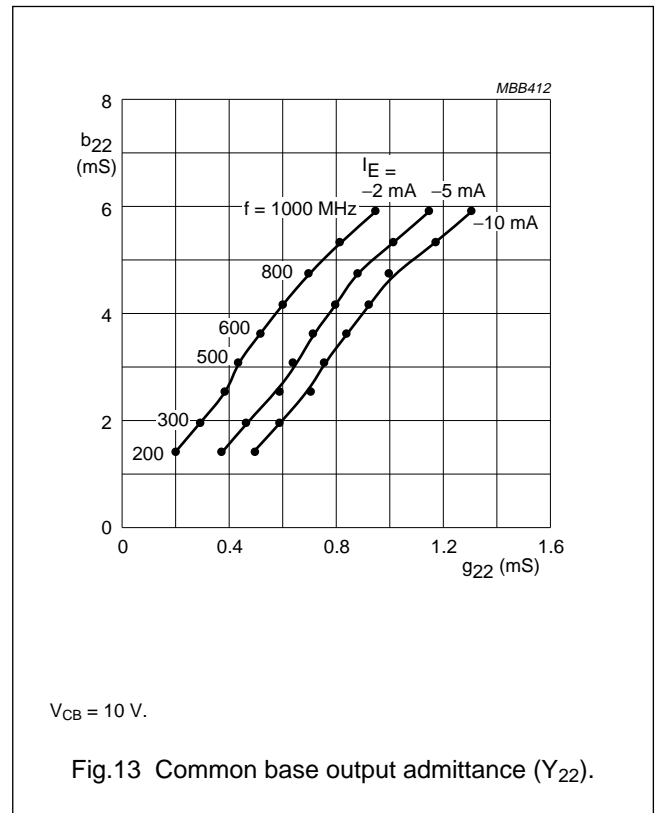
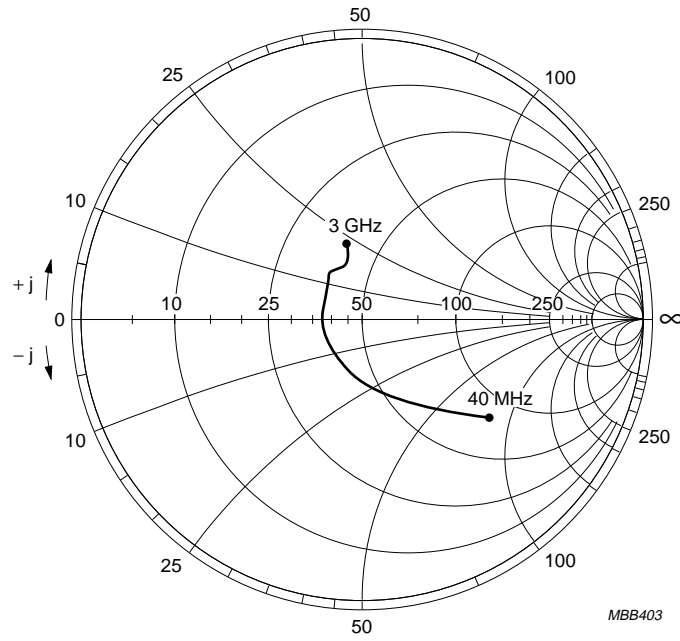


Fig.13 Common base output admittance ( $Y_{22}$ ).

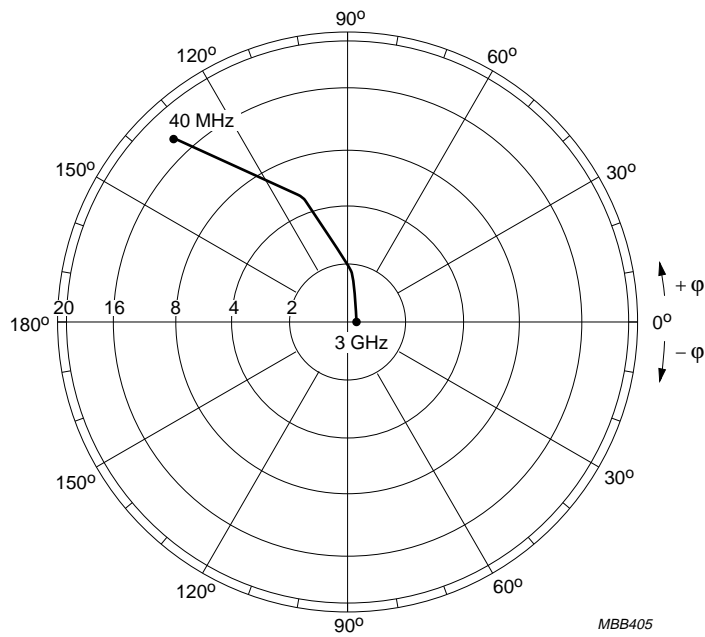
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$I_C = 15 \text{ mA}; V_{CE} = 10 \text{ V}; Z_O = 50 \Omega.$

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

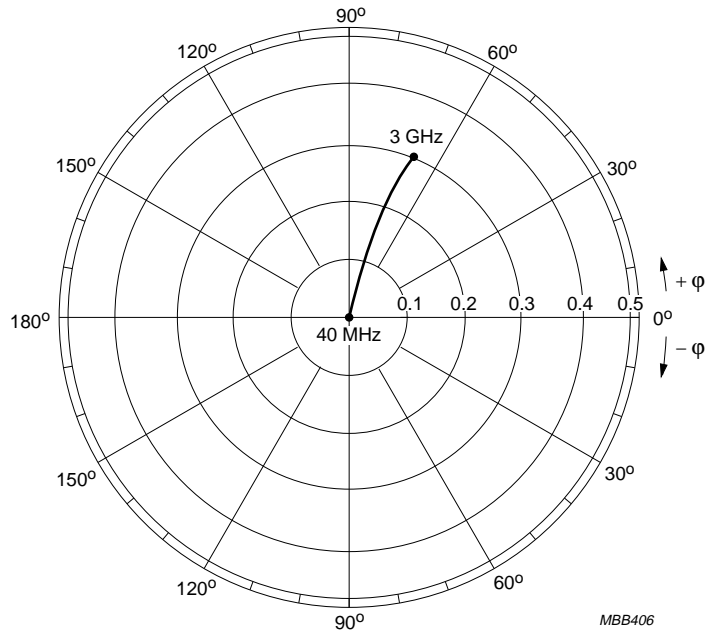


$I_C = 15 \text{ mA}; V_{CE} = 10 \text{ V}.$

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

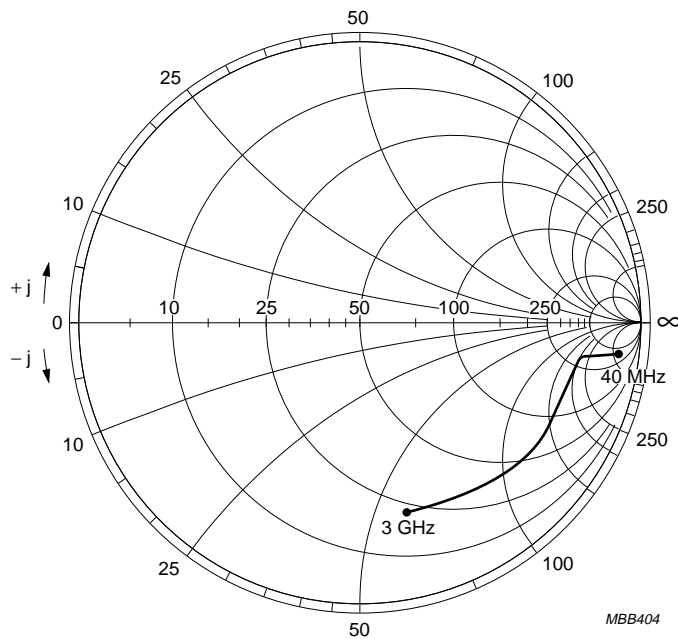
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$I_C = 15 \text{ mA}; V_{CE} = 10 \text{ V}.$

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 <sub>11</sub>		Y <sub>21</sub>		Y <sub>12</sub>		Y <sub>22</sub>	
	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 <sub>11</sub>		Y <sub>21</sub>		Y <sub>12</sub>		Y <sub>22</sub>	
	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 <sub>11</sub>		Y <sub>21</sub>		Y <sub>12</sub>		Y <sub>22</sub>	
	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

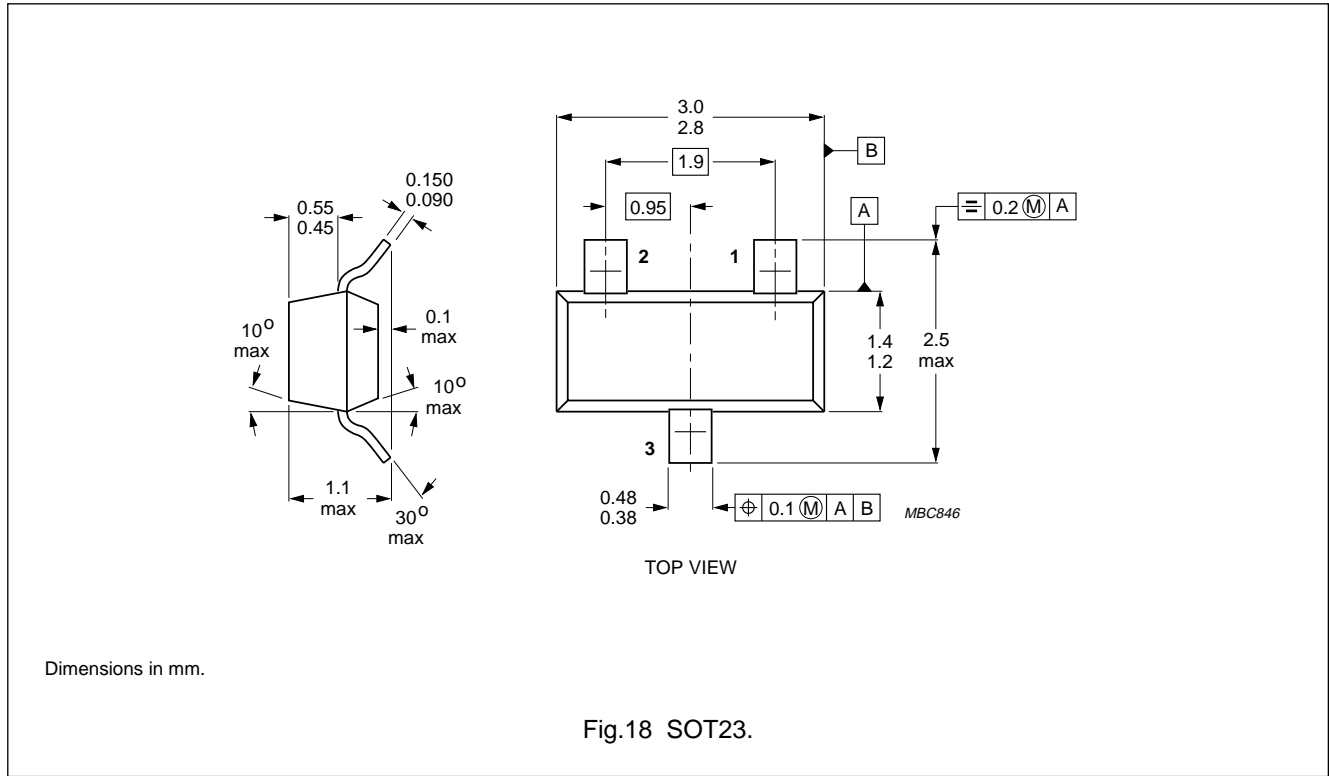
**Table 4** Common base Y-parameters,  $I_E = -15$  mA;  $V_{CB} = 10$  V, typical values.

f (MHz)	Y <sub>11</sub>		Y <sub>21</sub>		Y <sub>12</sub>		Y <sub>22</sub>	
	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

<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.	

LIFE SUPPORT APPLICATIONS

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