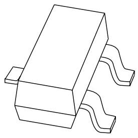


BF747

NPN 1 GHz wideband transistor

Rev. 03 — 27 July 2004 Product data sheet

1. Product profile

1.1 General description

Low cost NPN transistor in a SOT23 plastic package.

1.2 Features

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

1.3 Applications

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

1.4 Quick reference data

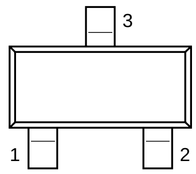
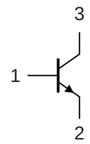
Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	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	$T_s \leq 70$ °C [1]	-	-	300	mW
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	-	1.2	1.6	GHz

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

2. Pinning information

Table 2: Discrete pinning

Pin	Description	Simplified outline	Symbol
1	base	 SOT23	 sym021
2	emitter		
3	collector		

3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
BF747	-	plastic surface mounted package; 3 leads	SOT23

4. Marking

Table 4: Marking

Type number	Marking code [1]
BF747	27*

[1] * = p: Made in Hong Kong.
* = t: Made in Malaysia.
* = W: Made in China.

5. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

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	$T_s \leq 70$ °C [1]	-	300	mW
T_{stg}	storage temperature		–55	+150	°C
T_j	junction temperature		-	150	°C

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

6. Thermal characteristics

Table 6: Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j-s)}$	thermal resistance from junction to soldering point	$T_s \leq 70\ °C$	[1]	260	K/W

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

7. Characteristics

Table 7: Characteristics

T_j = 25 °C unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{CBO}	collector cut-off current	I_E = 0 A; V_{CB} = 10 V		-	-	100	nA
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 10 V		40	95	250	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz		0.8	1.2	1.6	GHz
C_{re}	feedback capacitance	$I_E = i_e$ = 0 A; V_{CB} = 10 V; f = 1 MHz		-	0.5	-	pF
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 10 V; f = 100 MHz	[1]	-	20	-	dB

[1] G_{UM} is the maximum unilateral power gain, assuming s_{12} is zero and

$$G_{UM} = 10 \log \frac{|s_{21}|^2}{(1 - |s_{11}|^2)(1 - |s_{22}|^2)} \text{ dB}$$

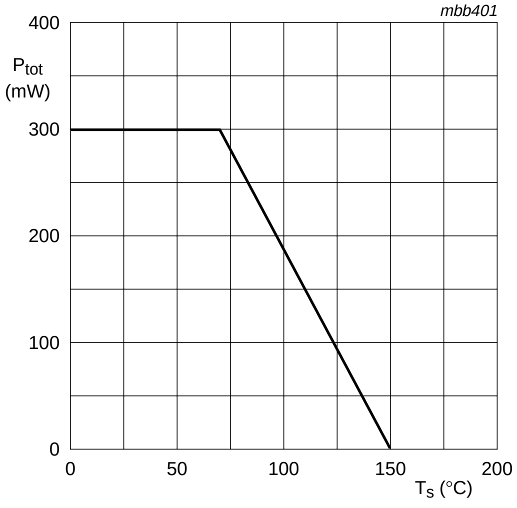
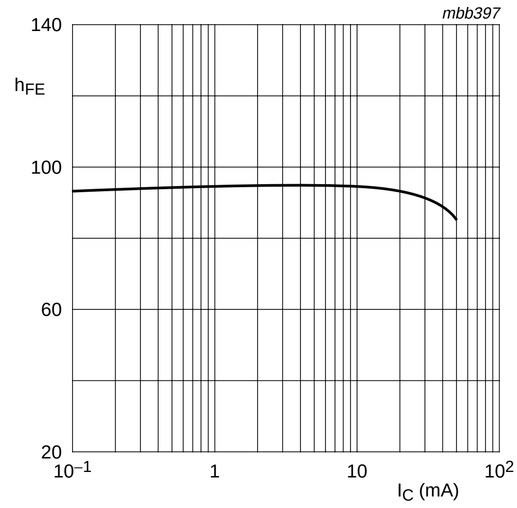
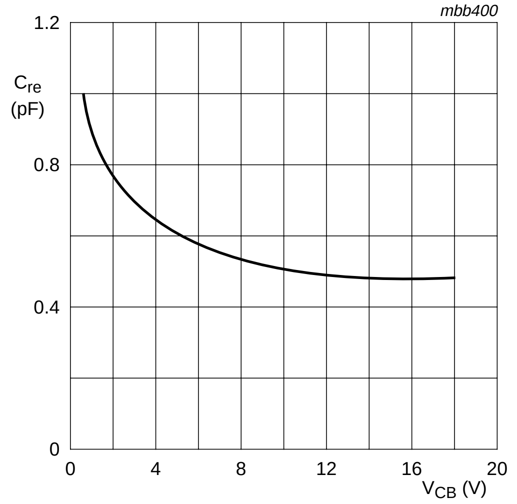


Fig 1. Power derating curve.



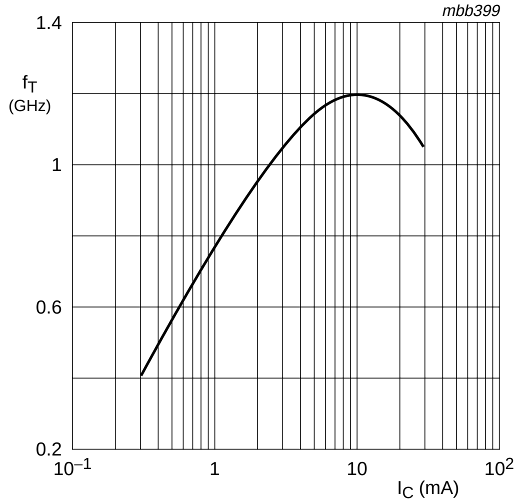
V_{CE} = 10 V.

Fig 2. DC current gain as a function of collector current.



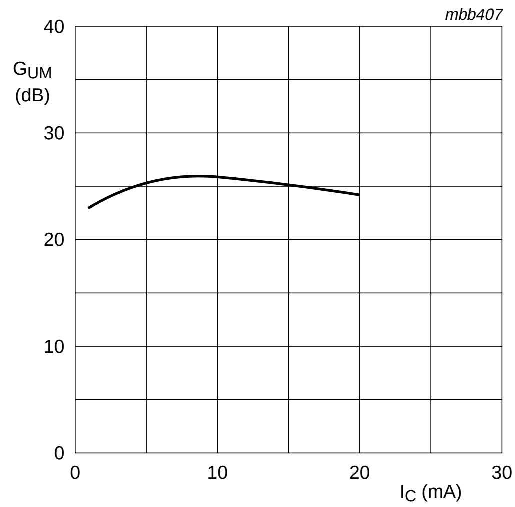
$I_E = i_e = 0$ A; f = 1 MHz.

Fig 3. Feedback capacitance as a function of collector-base voltage.



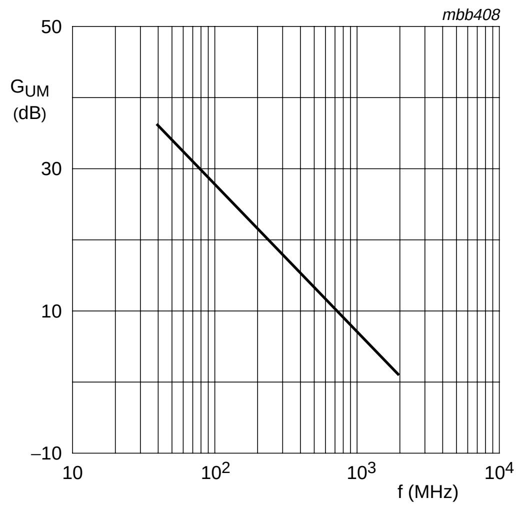
V_{CE} = 10 V; f = 500 MHz.

Fig 4. Transition frequency as a function of collector current.



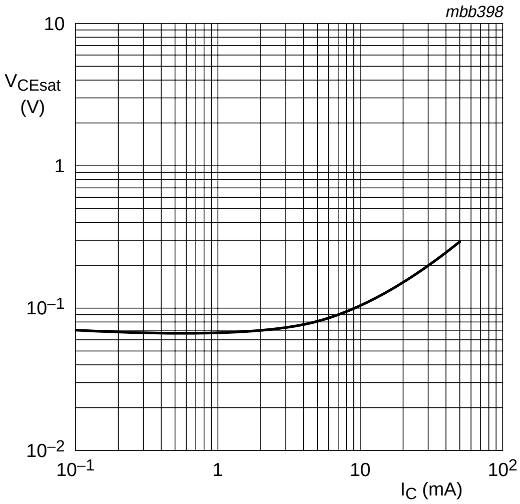
V_{CE} = 10 V; f = 100 MHz.

Fig 5. Maximum unilateral power gain as a function of collector current.



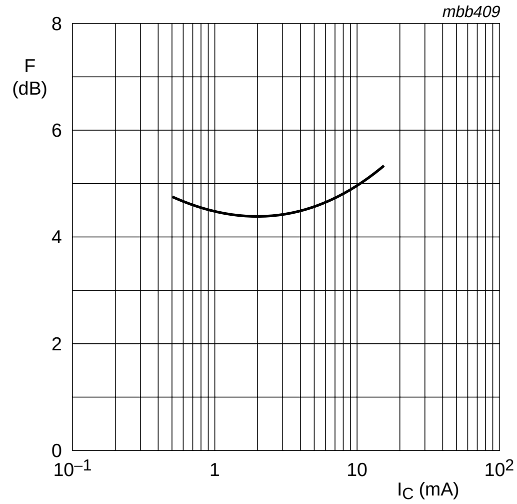
I_C = 15 mA; V_{CE} = 10 V.

Fig 6. Maximum unilateral power gain as a function of frequency.



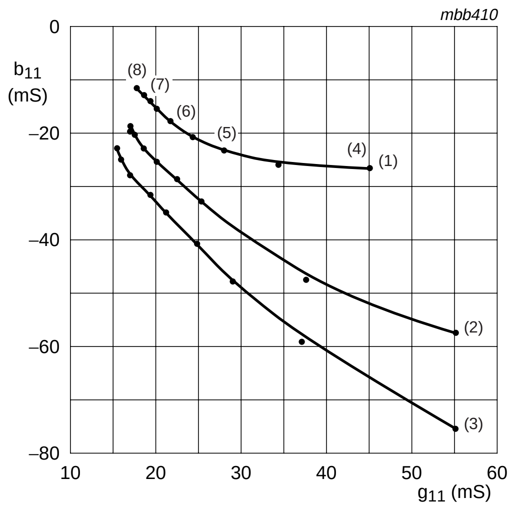
I_C/I_B = 10.

Fig 7. Collector-emitter saturation voltage as a function of collector current.



V_{CE} = 10 V; $Z_S = Z_L$ = 50 Ω; f = 100 MHz.

Fig 8. Common emitter noise figure as a function of collector current.



V_{CB} = 10 V.

(1) I_E = –2 mA.

(2) I_E = –5 mA.

(3) I_E = –10 mA.

(4) f = 200 MHz.

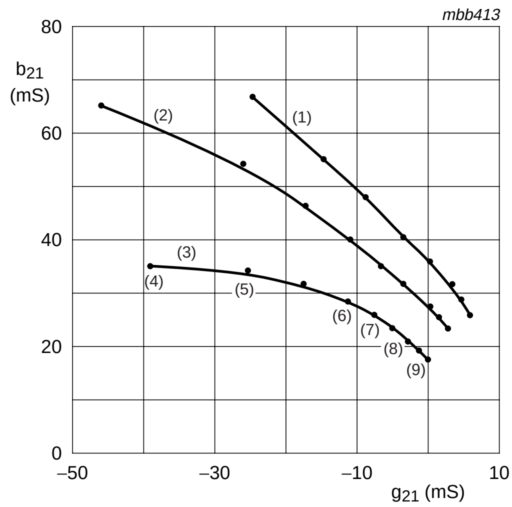
(5) f = 400 MHz.

(6) f = 600 MHz.

(7) f = 800 MHz.

(8) f = 1000 MHz.

Fig 9. Common base input admittance (Y_{11}).



V_{CB} = 10 V.

(1) I_E = –10 mA.

(2) I_E = –5 mA.

(3) I_E = –2 mA.

(4) f = 200 MHz.

(5) f = 300 MHz.

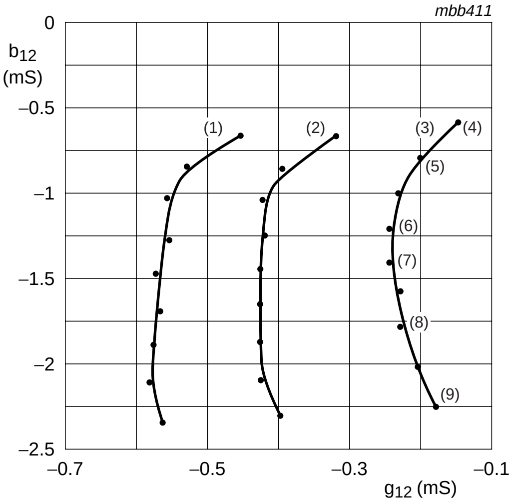
(6) f = 500 MHz.

(7) f = 600 MHz.

(8) f = 800 MHz.

(9) f = 1000 MHz.

Fig 10. Common base forward admittance (Y_{21}).



V_{CB} = 10 V.

(1) I_E = −10 mA.

(2) I_E = −5 mA.

(3) I_E = −2 mA.

(4) f = 200 MHz.

(5) f = 300 MHz.

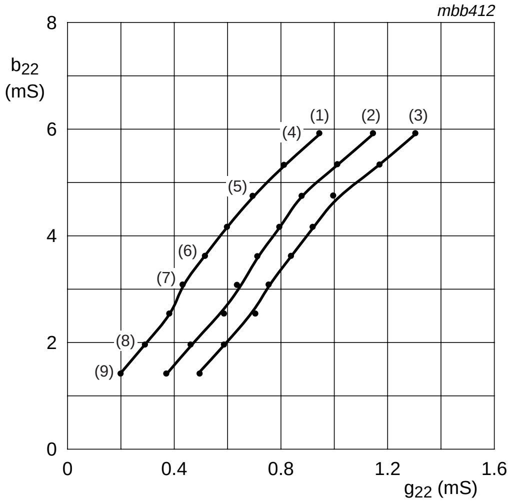
(6) f = 500 MHz.

(7) f = 600 MHz.

(8) f = 800 MHz.

(9) f = 1000 MHz.

Fig 11. Common base reverse admittance (Y_{12}).



V_{CB} = 10 V.

(1) I_E = −2 mA.

(2) I_E = −5 mA.

(3) I_E = −10 mA.

(4) f = 1000 MHz.

(5) f = 800 MHz.

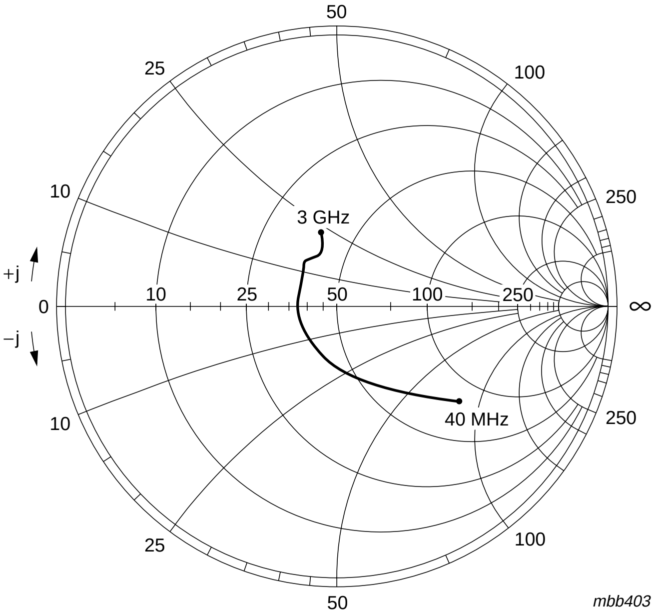
(6) f = 600 MHz.

(7) f = 500 MHz.

(8) f = 300 MHz.

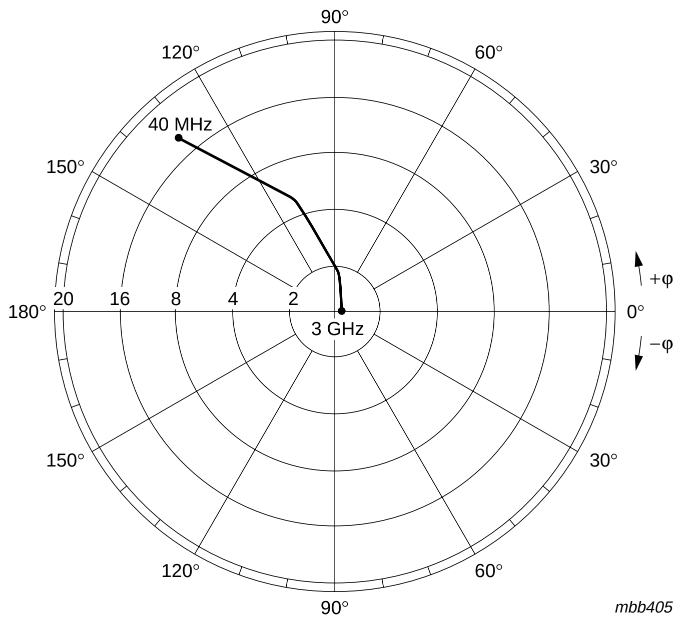
(9) f = 200 MHz.

Fig 12. Common base output admittance (Y_{22}).



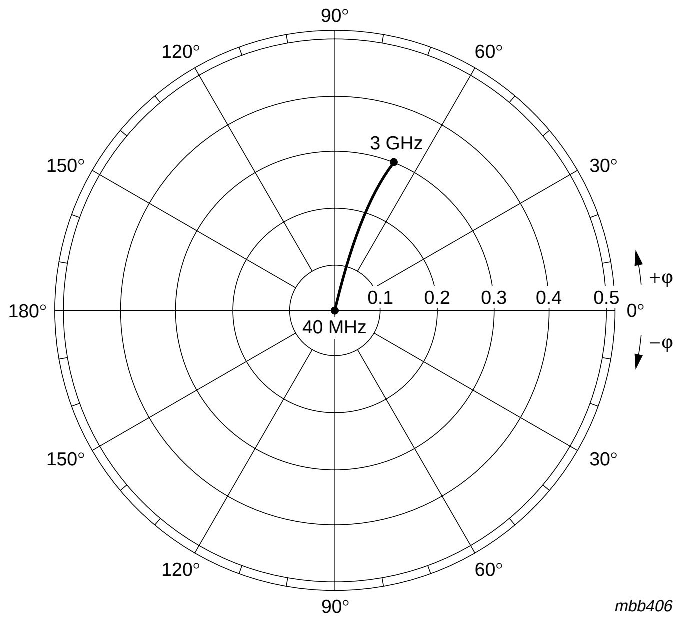
I_C = 15 mA; V_{CE} = 10 V; Z_O = 50 Ω.

Fig 13. Common emitter input reflection coefficient (S_{11}).



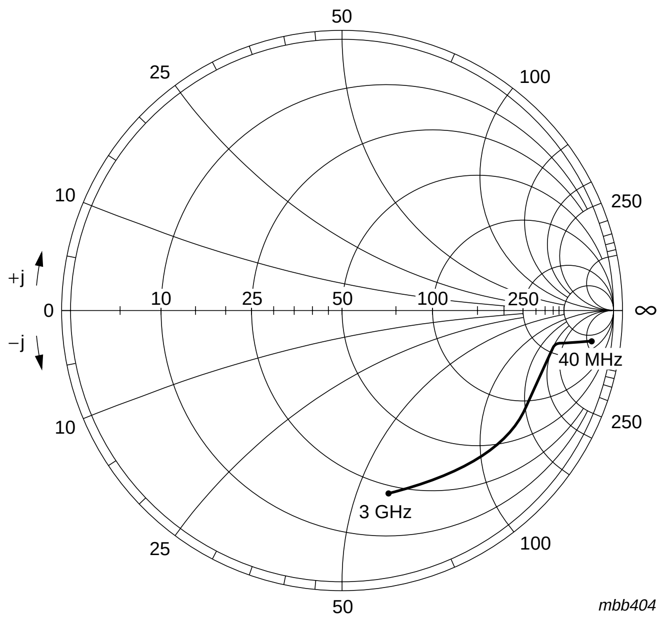
I_C = 15 mA; V_{CE} = 10 V.

Fig 14. Common emitter forward transmission coefficient (s_{21}).



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

Fig 15. Common emitter reverse transmission coefficient (s_{12}).



I_C = 15 mA; V_{CE} = 10 V; Z_O = 50 Ω.

Fig 16. Common emitter output reflection coefficient (s_{22}).

Table 8: Common base Y-parameters; V_{CB} = 10 V; I_E = –2 mA; 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 9: Common base Y-parameters; V_{CB} = 10 V; I_E = –5 mA; 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

Table 10: Common base Y-parameters; V_{CB} = 10 V; I_E = –10 mA; typical values

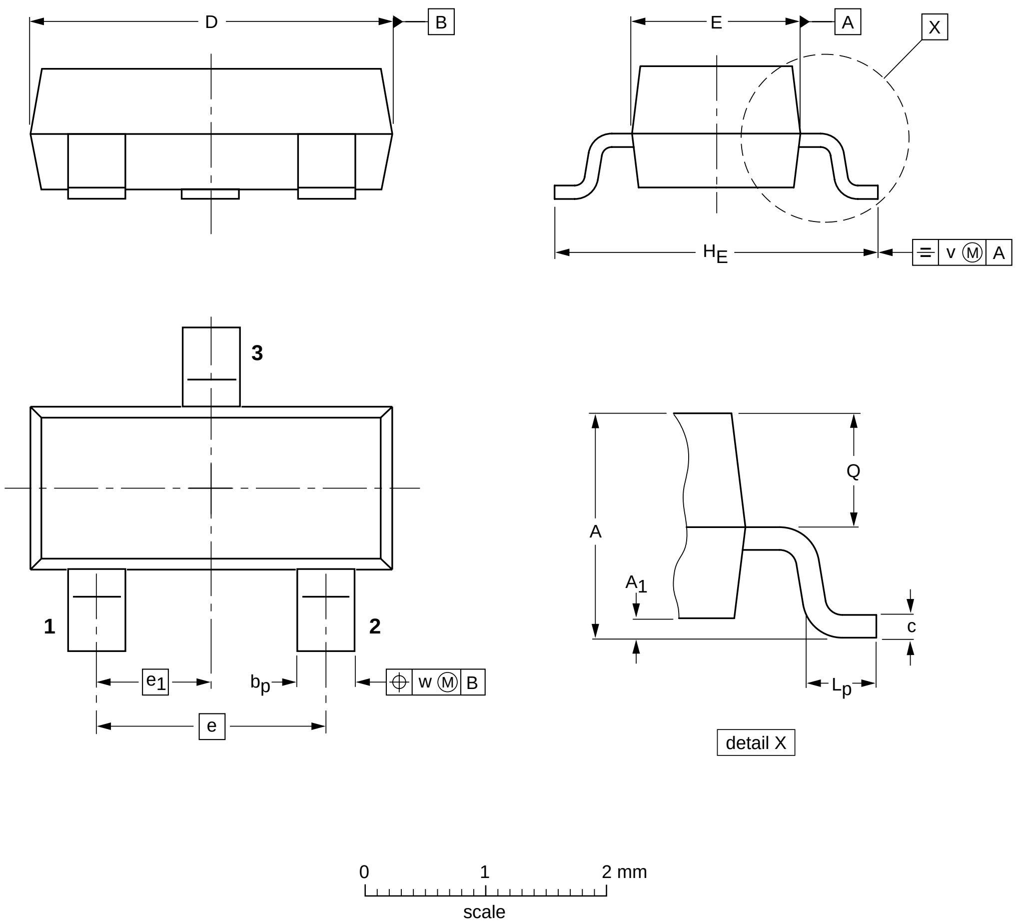
f (MHz)	Y_{11}		Y_{21}		Y_{12}		Y_{22}	
	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)	REAL (mS)	IMAG. (mS)
40	+189.0	–79.6	–185.5	+83.0	–0.10	–0.3	–0.09	+0.4
100	+108.5	–99.0	–101.4	+105.4	–0.30	–0.5	+0.30	+0.9
200	+55.2	–76.2	–44.6	+82.8	–0.50	–0.7	+0.44	+1.4
300	+37.1	–59.0	–24.3	+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 11: Common base Y-parameters; V_{CB} = 10 V; I_E = –15 mA; 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

8. 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 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT23		TO-236AB				~~97-02-28~~ 99-09-13

Fig 17. Package outline.

9. Revision history

Table 12: Revision history

Document ID	Release date	Data sheet status	Change notice	Order number	Supersedes
BF747_3	20040727	Product data sheet	-	9397 750 13394	BF747_2
Modifications:	• Marking code changed; see Table 4				

10. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

11. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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 — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**

14. Contents

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