DATA SHEET

BF747
NPN 1 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

September 1995

Philips
Semiconductors

PHILIPS

NPN 1 GHz wideband transistor BF747

FEATURES

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

APPLICATIONS

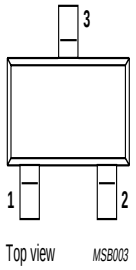
- It is intended for VHF and UHF TV-tuner applications and can be used as a mixer and/or oscillator.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector

DESCRIPTION

Low cost NPN transistor in a plastic SOT23 package.



Marking code: E15.

Fig.1 SOT23.

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 °C; note 1	–	300	mW
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 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 °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.

THERMAL CHARACTERISTICS

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

Note

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

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} = 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; V_{CB} = 10 V; f = 1 MHz	–	0.5	–	pF
G_{UM}	maximum unilateral power gain; note 1	I_C = 15 mA; V_{CE} = 10 V; f = 100 MHz	–	20	–	dB

Note

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

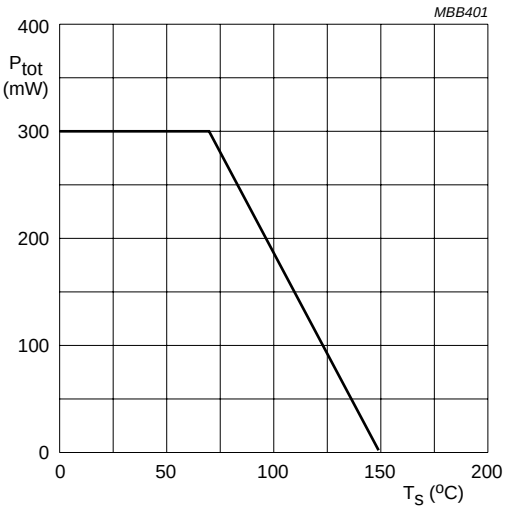
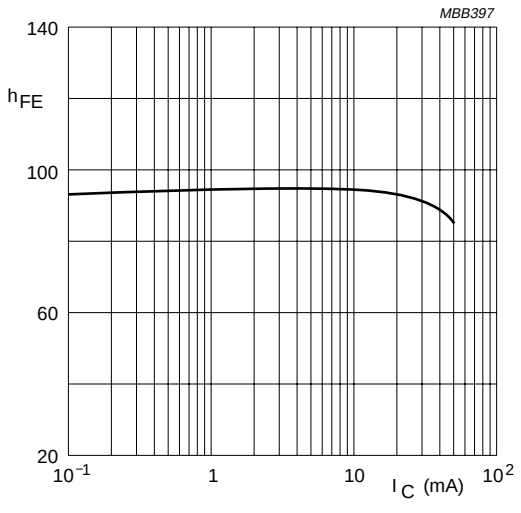
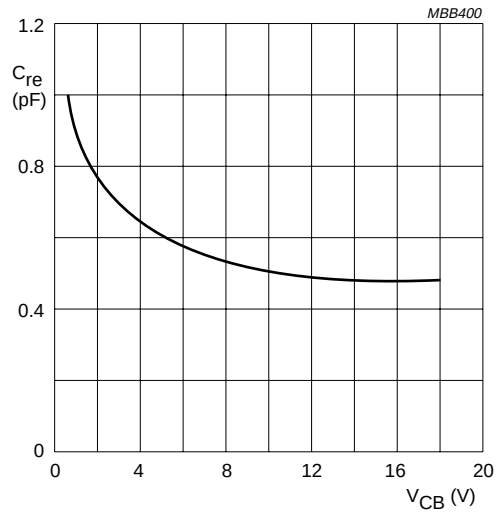


Fig.2 Power derating curve.



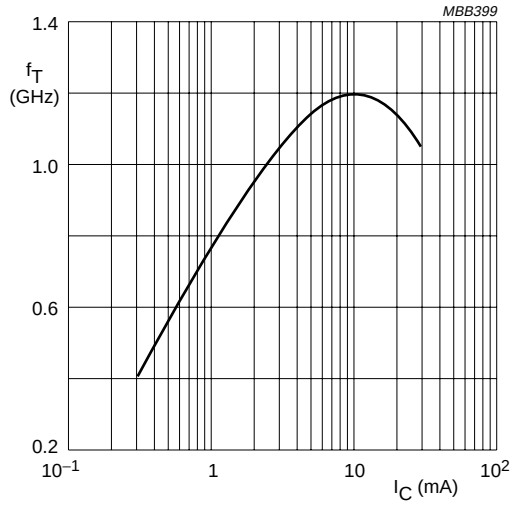
V_{CE} = 10 V.

Fig.3 DC current gain as a function of collector current.



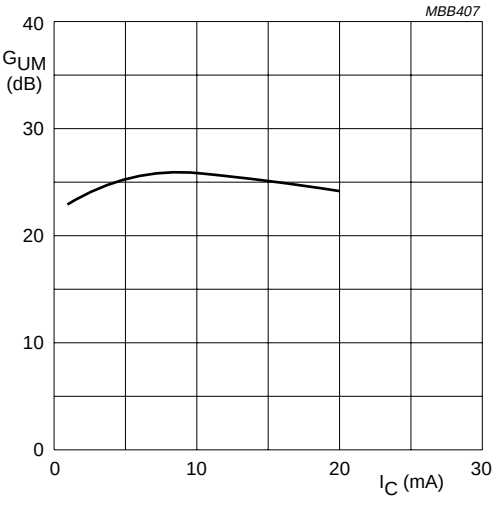
$I_E = i_e = 0$; f = 1 MHz.

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



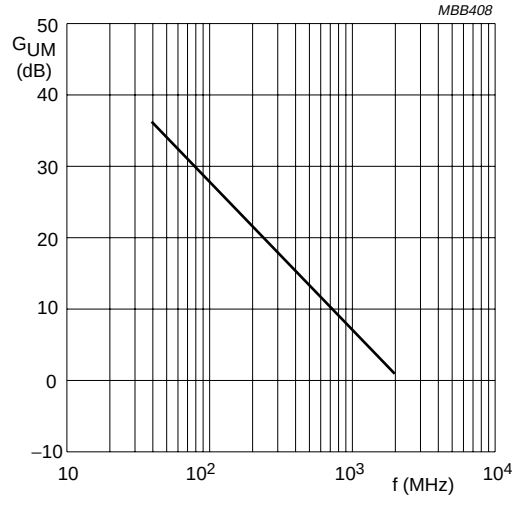
V_{CE} = 10 V; f = 500 MHz.

Fig.5 Transition frequency as a function of collector current.



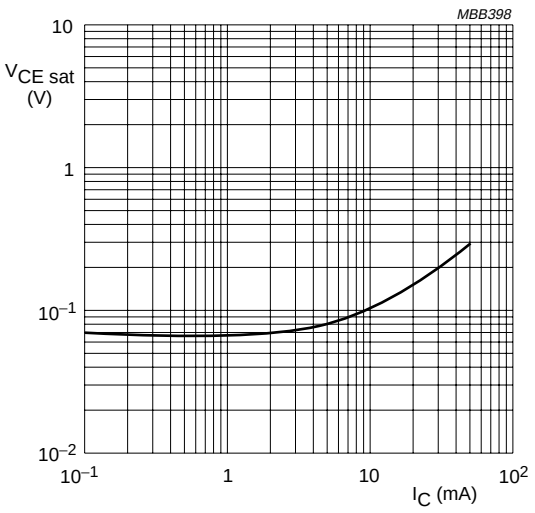
V_{CE} = 10 V; f = 100 MHz.

Fig.6 Maximum unilateral power gain as a function of collector current.



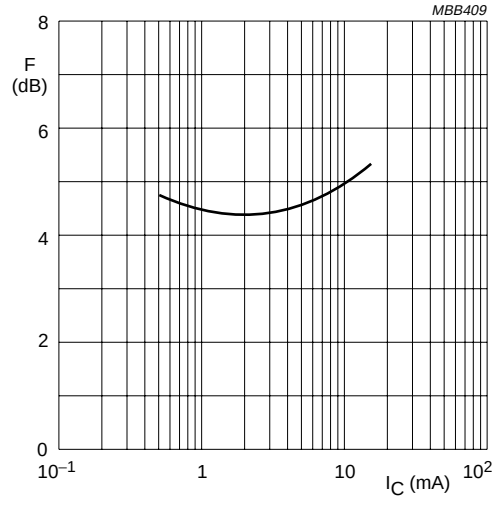
I_C = 15 mA; V_{CE} = 10 V.

Fig.7 Maximum unilateral power gain as a function of frequency.



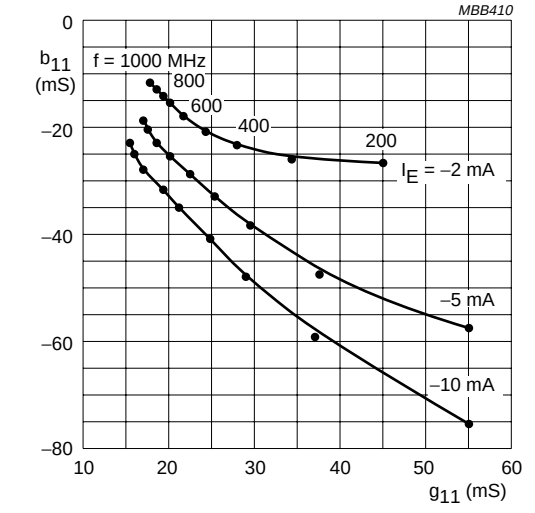
$I_C/I_B = 10$.

Fig.8 Collector-emitter saturation voltage as a function of collector current.



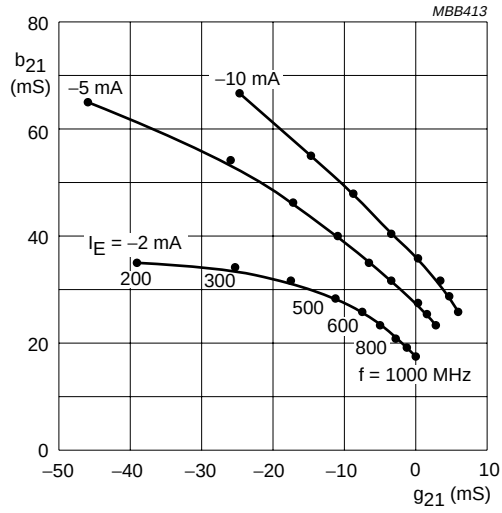
$V_{CE} = 10$ V; $Z_S = Z_L = 50\ \Omega$.; f = 100 MHz.

Fig.9 Common emitter noise figure as a function of collector current.



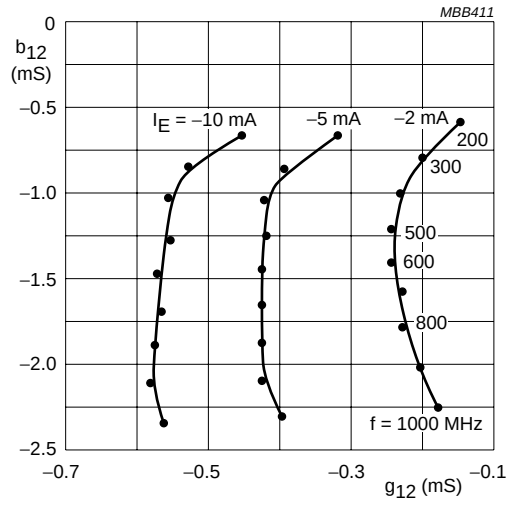
$V_{CB} = 10$ V.

Fig.10 Common base input admittance (Y_{11}).



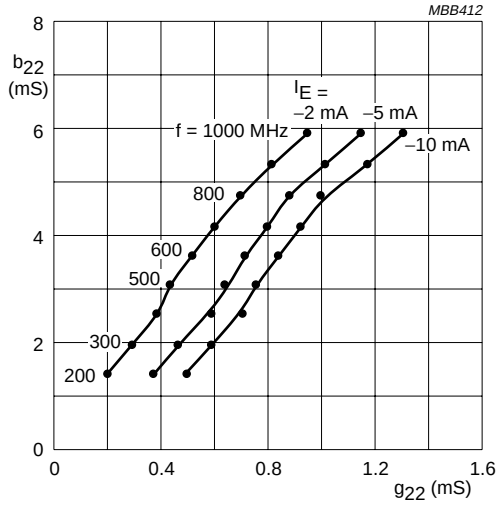
$V_{CB} = 10$ V.

Fig.11 Common base forward admittance (Y_{21}).



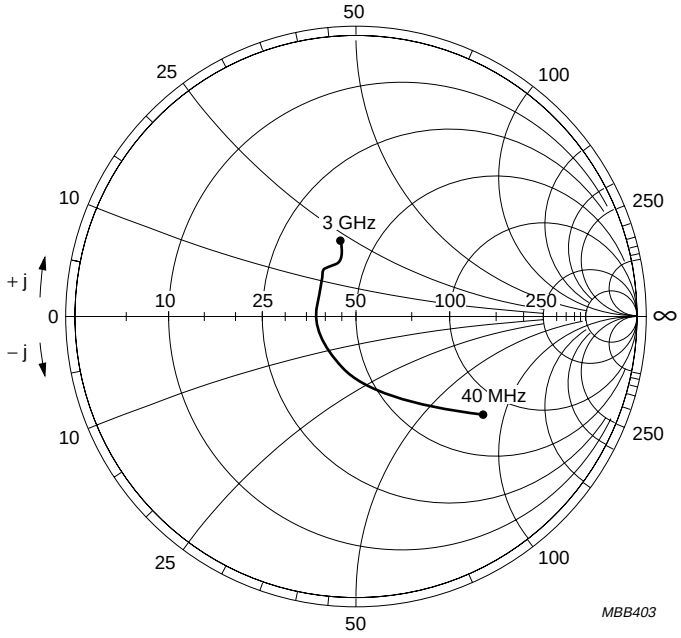
V_{CB} = 10 V.

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



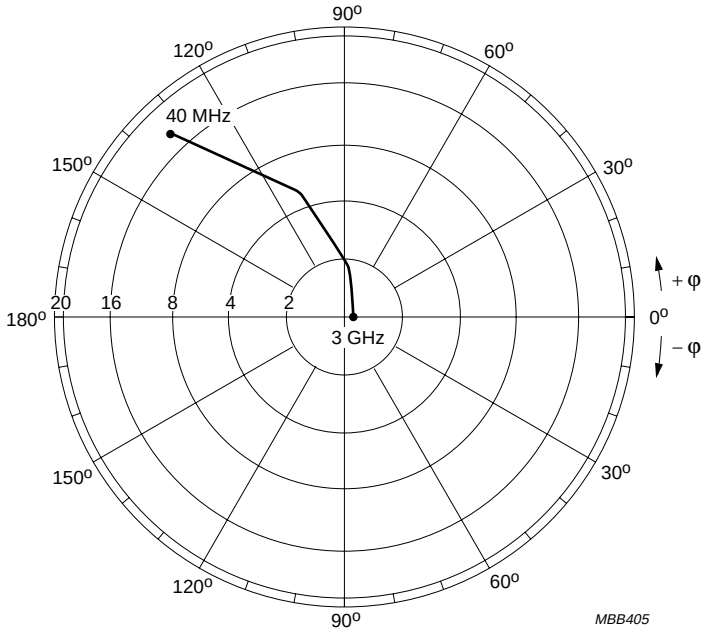
V_{CB} = 10 V.

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



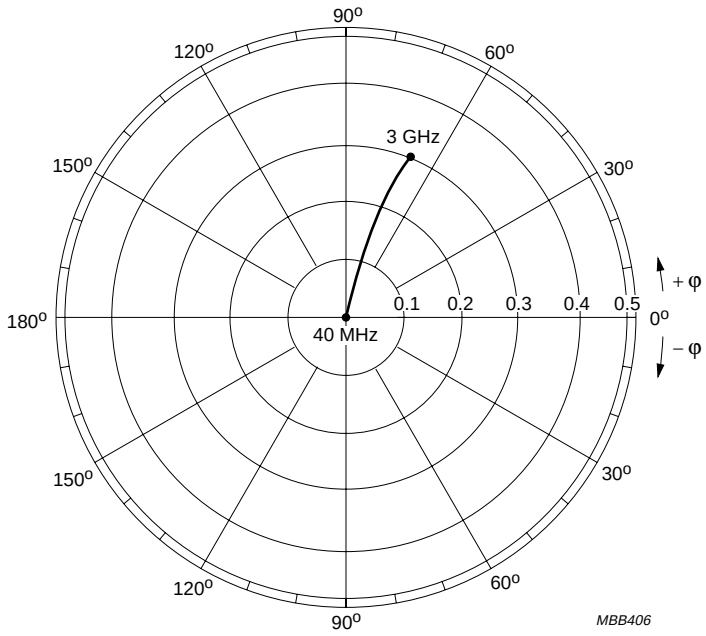
I_C = 15 mA; V_{CE} = 10 V; Z_O = 50 Ω..

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



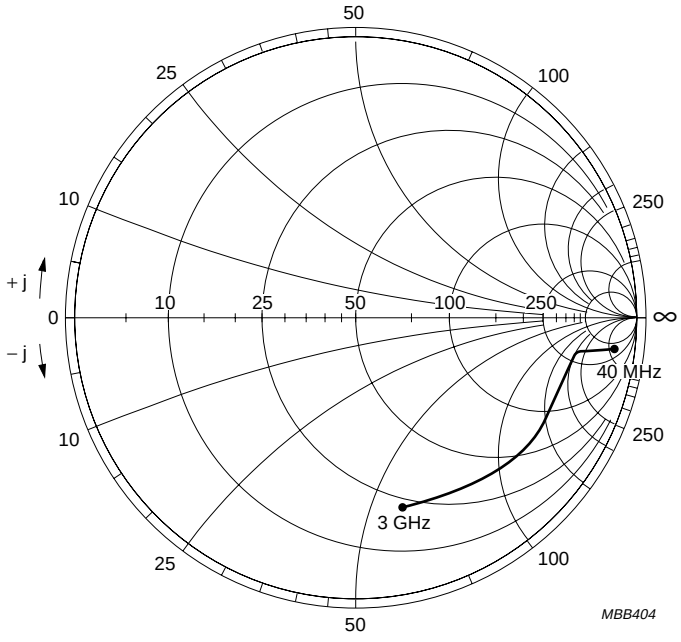
I_C = 15 mA; V_{CE} = 10 V.

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



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

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



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

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

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

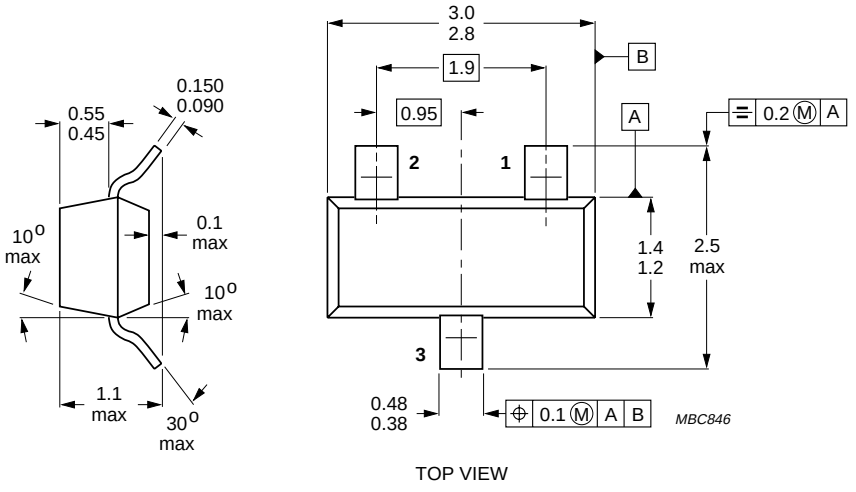
Table 3 Common base Y-parameters, I_E = –10 mA; V_{CB} = 10 V, typical values.

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

PACKAGE OUTLINE



Dimensions in mm.

Fig.18 SOT23.

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.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.