DATA SHEET

BF547W
NPN 1 GHz wideband transistor

Product specification
June 1994
Supersedes data of November 1992
File under Discrete Semiconductors, SC14

Philips Semiconductors

PHILIPS

NPN 1 GHz wideband transistor BF547W

FEATURES

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

APPLICATIONS

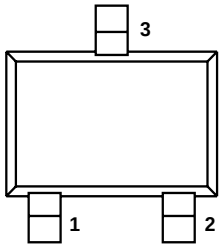
It is primarily intended as a mixer, oscillator and IF amplifier in UHF and VHF tuners.

DESCRIPTION

Silicon NPN transistor in a plastic SOT323 (S-mini) package. The BF547W uses the same crystal as the SOT23 version, BF547.

PINNING

PIN	DESCRIPTION
1	base
2	emitter
3	collector



Top view MBC870

Marking code: E2.

Fig.1 SOT323

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	–	20	V
I_C	collector current (DC)		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 63 °C; note 1	–	–	300	mW
h_{FE}	DC current gain	I_C = 2 mA; V_{CE} = 10 V	40	95	250	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	1	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	0.8	1.2	1.6	GHz
G_{UM}	maximum unilateral power gain	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C	–	20	–	dB

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	–	30	V
V_{CEO}	collector-emitter voltage	open base	–	20	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	50	mA
P_{tot}	total power dissipation	up to T_s = 63 °C; note 1	–	300	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	+150	°C

Note to the “Quick reference data” and “Limiting values”

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 = 63 °C; note 1	290	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
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 0.01 mA; I_E = 0	–	–	30	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 10 mA; I_B = 0	–	–	20	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.01 mA; I_C = 0	–	–	3	V
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	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 10 V; f = 1 MHz	–	1	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 10 V; f = 500 MHz	0.8	1.2	1.6	GHz
G_{UM}	maximum unilateral power gain; note 1	I_C = 1 mA; V_{CE} = 10 V; f = 100 MHz; T_{amb} = 25 °C;	–	20	–	dB

Note

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

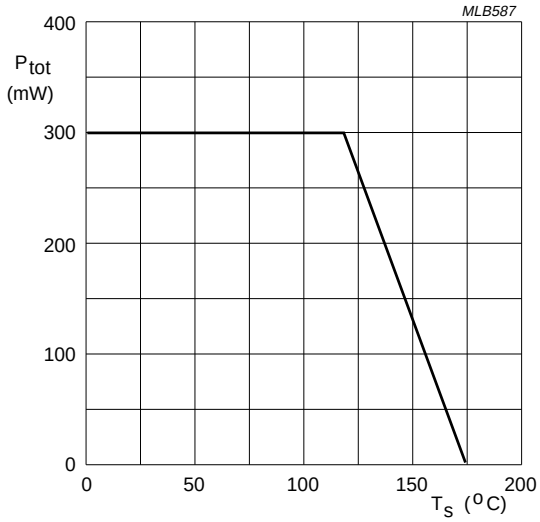
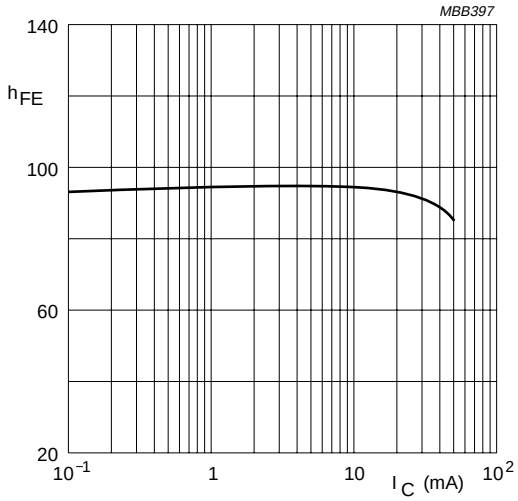
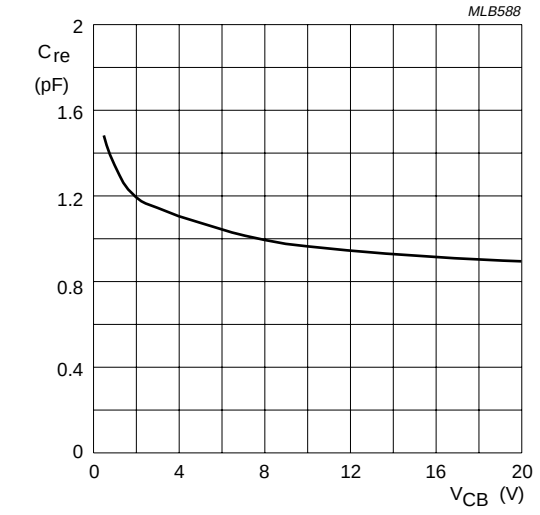


Fig.2 Power derating curve.



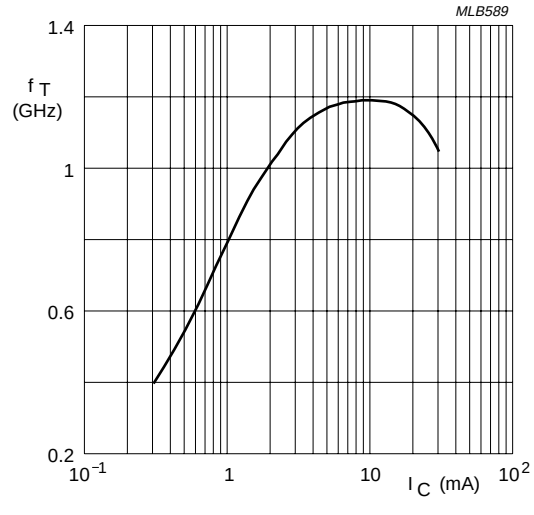
V_{CE} = 10 V; T_j = 25 °C.

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



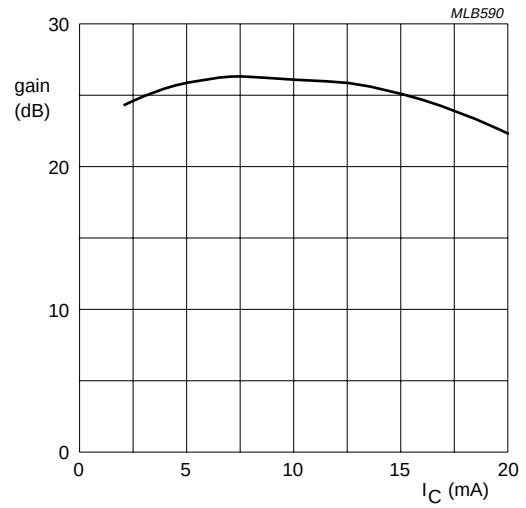
I_C = 0; f = 1 MHz.

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



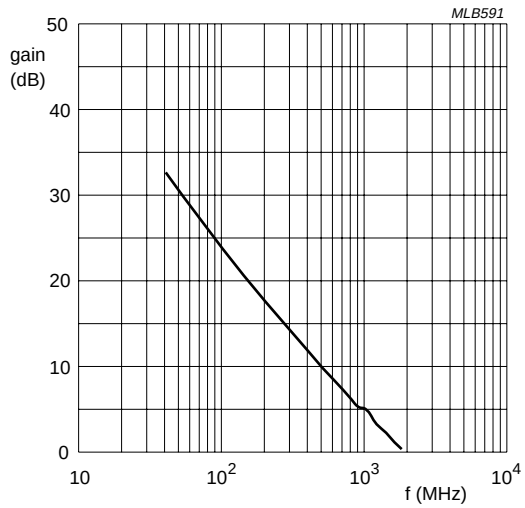
V_{CE} = 10 V; f = 500 MHz.

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



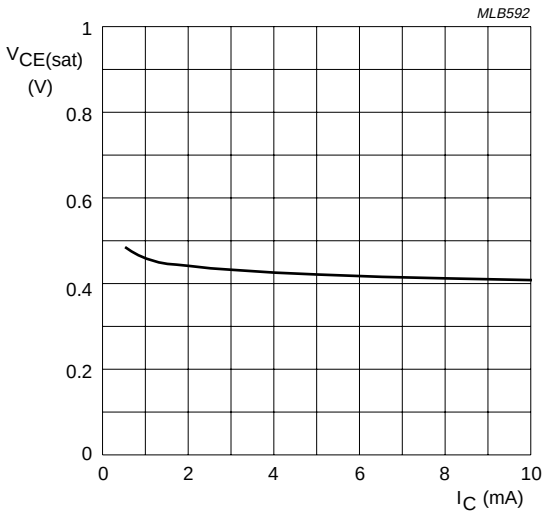
V_{CE} = 10 V; f = 100 MHz.

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



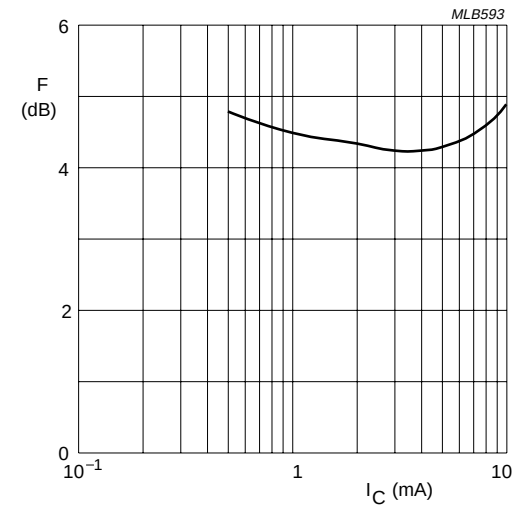
V_{CE} = 10 V; I_C = 15 mA.

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



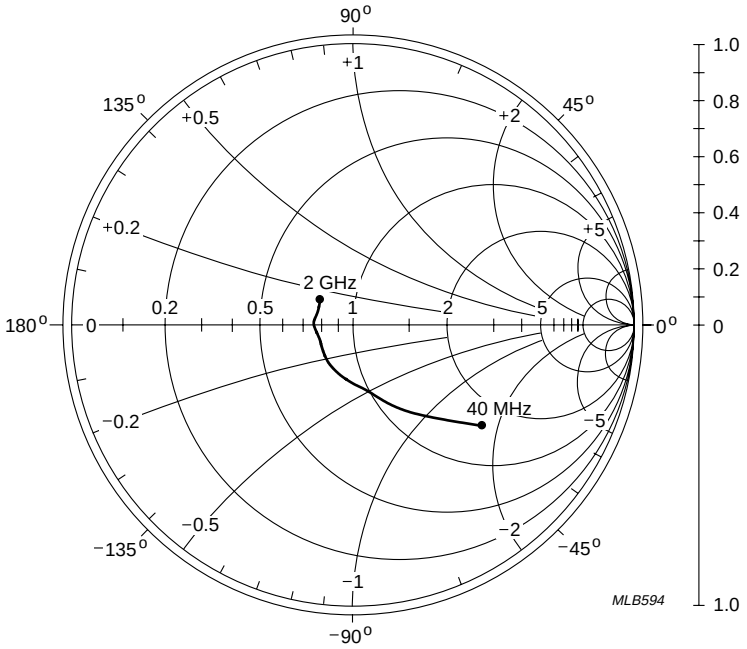
I_C/I_B = 10.

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



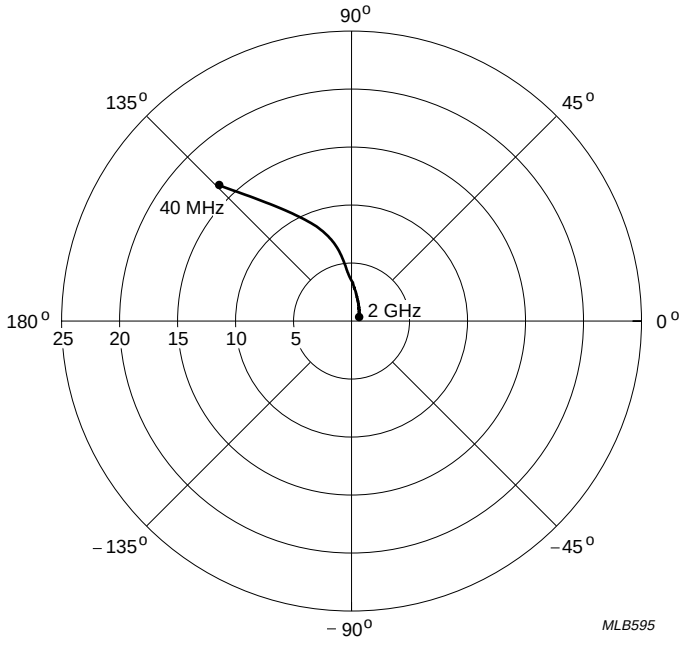
V_{CE} = 10 V; $Z_S = Z_L$ = 50 Ω; f = 100 MHz.

Fig.9 Minimum noise figure as a function of collector current; typical values.



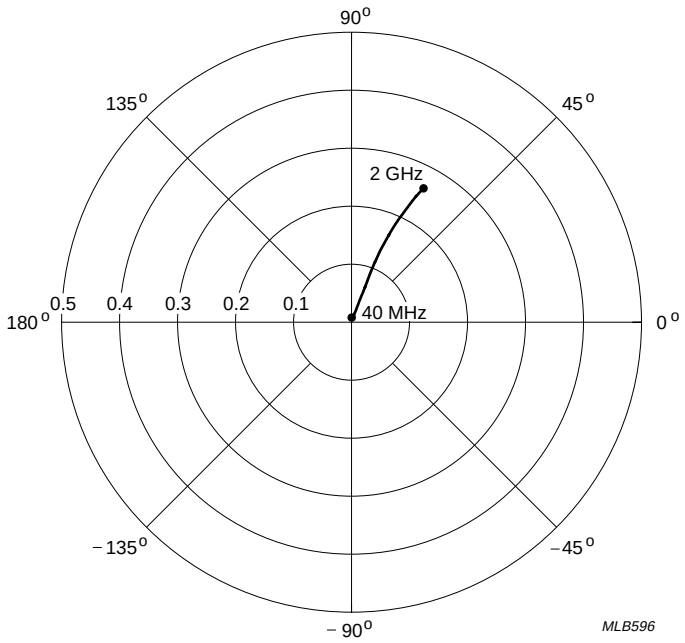
V_{CE} = 10 V; I_C = 15 mA; Z_o = 50 Ω.

Fig.10 Common emitter input reflection coefficient (s_{11}); typical values.



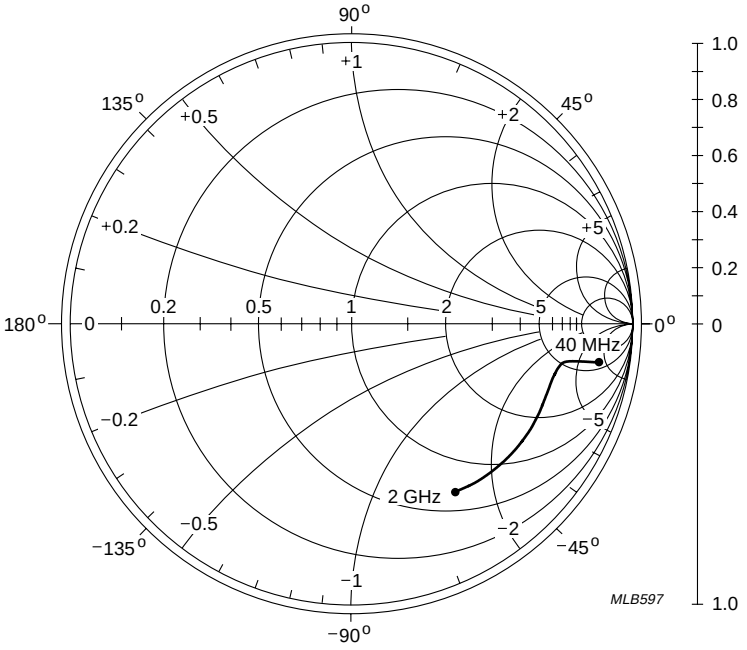
V_{CE} = 10 V; I_C = 15 mA.

Fig.11 Common emitter forward transmission coefficient (s_{21}); typical values.



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

Fig.12 Common emitter reverse transmission coefficient (s_{12}); typical values.



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

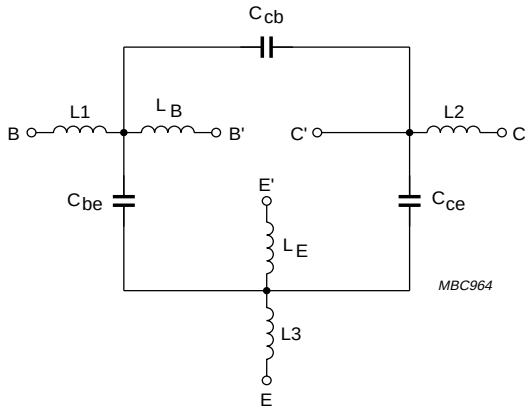
Fig.13 Common emitter output reflection coefficient (s_{22}); typical values.

SPICE parameters for the BF547W crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	289.1	aA
2	BF	94.29	–
3	NF	0.989	–
4	VAF	90.00	V
5	IKF	158.6	mA
6	ISE	426.6	aA
7	NE	1.491	–
8	BR	12.32	–
9	NR	0.989	–
10	VAR	19.39	V
11	IKR	24.75	mA
12	ISC	249.7	pA
13	NC	1.200	–
14	RB	50.00	Ω
15	IRB	1.000	µA
16	RBM	50.00	Ω
17	RE	0.500	Ω
18	RC	1.309	Ω
19(1)	XTB	0.000	–
20(1)	EG	1.110	eV
21(1)	XTI	3.000	–
22	CJE	1.071	pF
23	VJE	727.3	mV
24	MJE	0.332	–
25	TF	92.98	ps
26	XTF	43.89	–
27	VTF	1.813	V
28	ITF	143.9	mA
29	PTF	0.000	deg
30	CJC	1.167	pF
31	VJC	489.0	mV
32	MJC	0.253	–
33	XCJC	0.150	–
34	TR	50.00	ns
35(1)	CJS	0.000	F
36(1)	VJS	750.0	mV
37(1)	MJS	0.000	–
38	FC	0.950	–

Note

1. These parameters have not been extracted, the default values are shown.



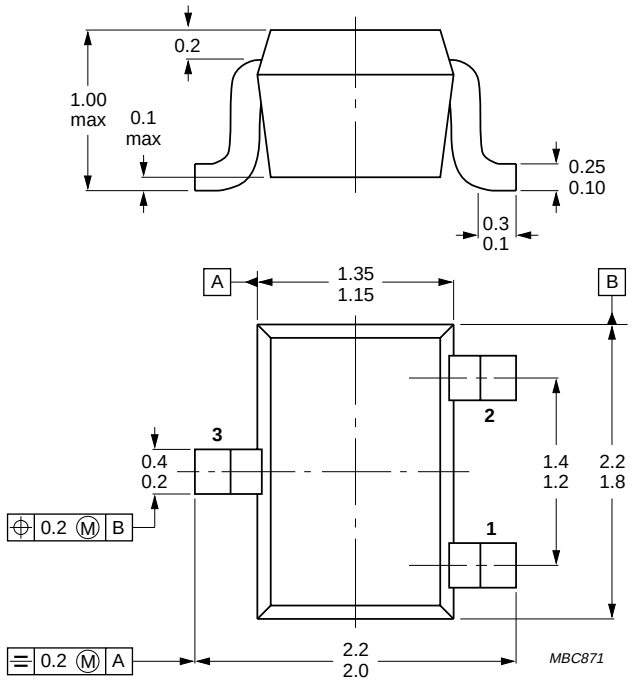
$QL_B = 50$; $QL_E = 50$; $QL_{B,E}(f) = QL_{B,E}\sqrt{(f/f_c)}$;
f_c = scaling frequency = 100 MHz.

Fig.14 Package equivalent circuit SOT323.

List of components (see Fig.14).

DESIGNATION	VALUE	UNIT
C_{be}	2	fF
C_{cb}	100	fF
C_{ce}	100	fF
L1	0.34	nH
L2	0.10	nH
L3	0.34	nH
L_B	0.60	nH
L_E	0.60	nH

PACKAGE OUTLINE



Dimensions in mm.

Fig.15 SOT323.

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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NOTES

NOTES

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