

# 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

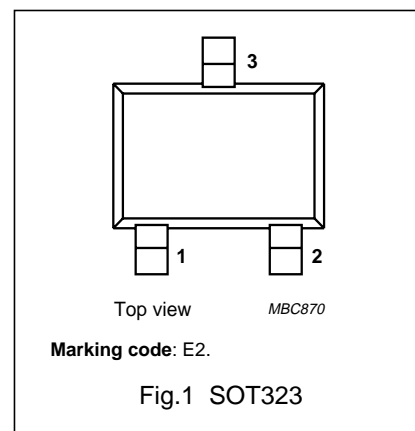
It is primarily intended as a mixer, oscillator and IF amplifier in UHF and VHF tuners.

## 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



## 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 $T_s = 63\text{ °C}$ ; note 1	–	–	300	mW
$h_{FE}$	DC current gain	$I_C = 2\text{ mA}$ ; $V_{CE} = 10\text{ V}$	40	95	250	
$C_{re}$	feedback capacitance	$I_C = 0$ ; $V_{CB} = 10\text{ V}$ ; $f = 1\text{ MHz}$	–	1	–	pF
$f_T$	transition frequency	$I_C = 15\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$	0.8	1.2	1.6	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 1\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 100\text{ MHz}$ ; $T_{amb} = 25\text{ °C}$	–	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 $T_s = 63\text{ °C}$ ; 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.

## NPN 1 GHz wideband transistor

BF547W

## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 63\text{ °C}$ ; note 1	290	K/W

## Note

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

## CHARACTERISTICS

$T_j = 25\text{ °C}$  (unless otherwise specified).

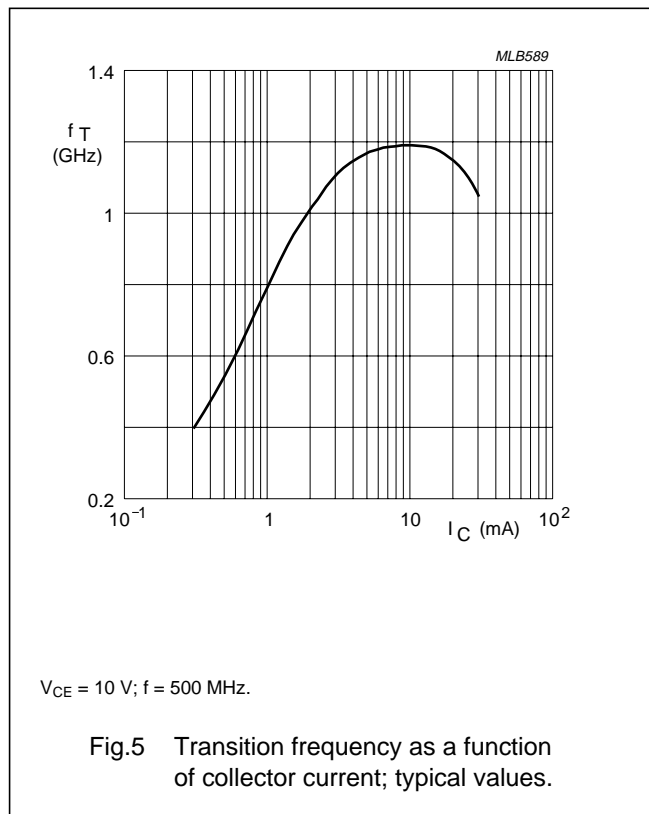
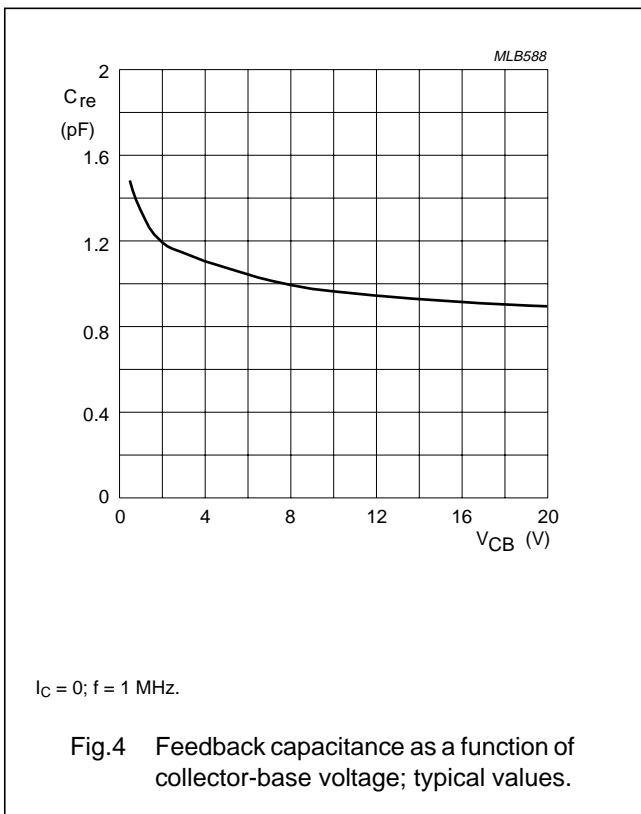
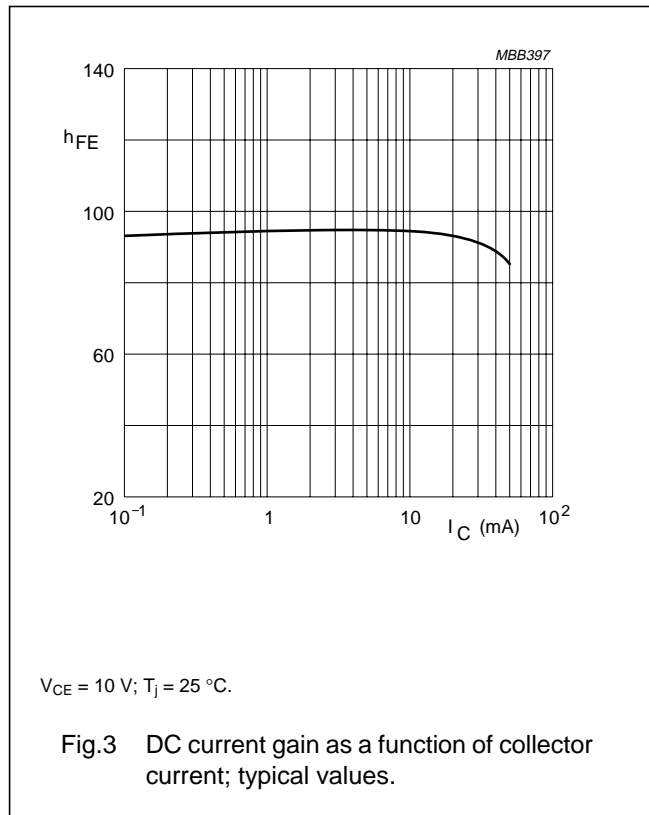
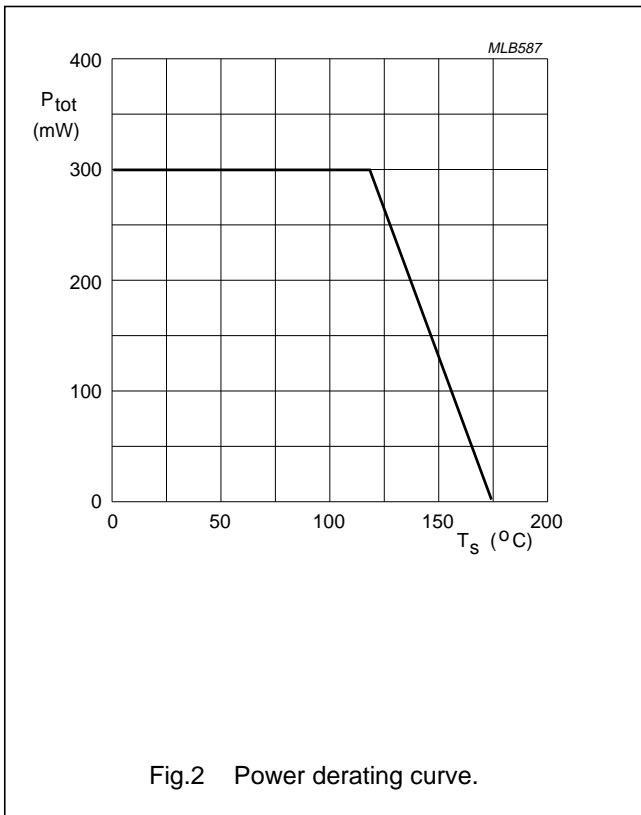
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 0.01\text{ mA}$ ; $I_E = 0$	–	–	30	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 10\text{ mA}$ ; $I_B = 0$	–	–	20	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 0.01\text{ mA}$ ;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

## Note

- $G_{UM}$  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.

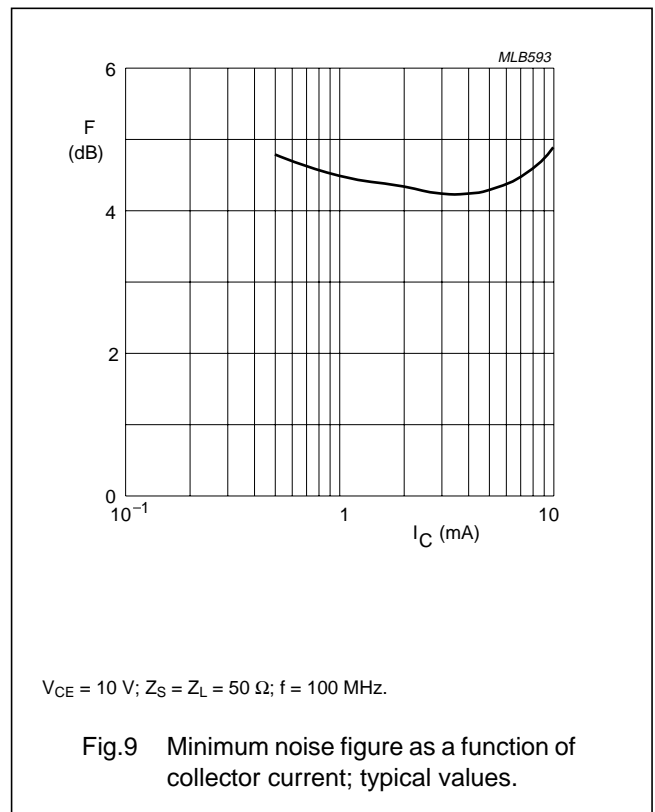
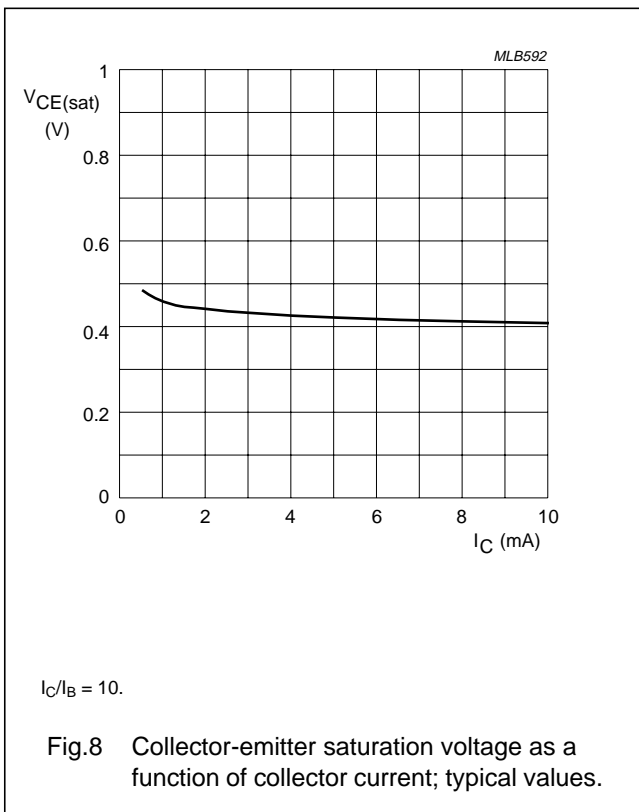
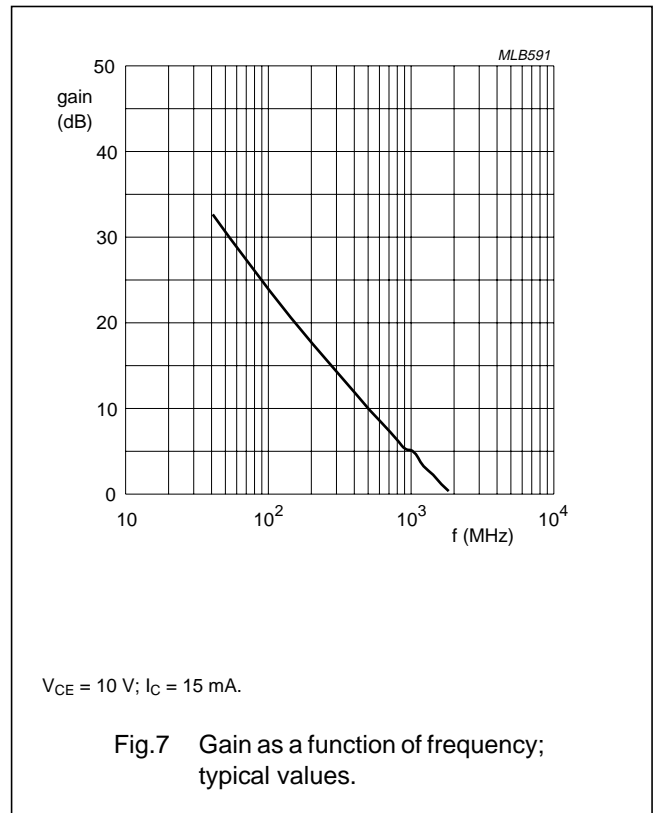
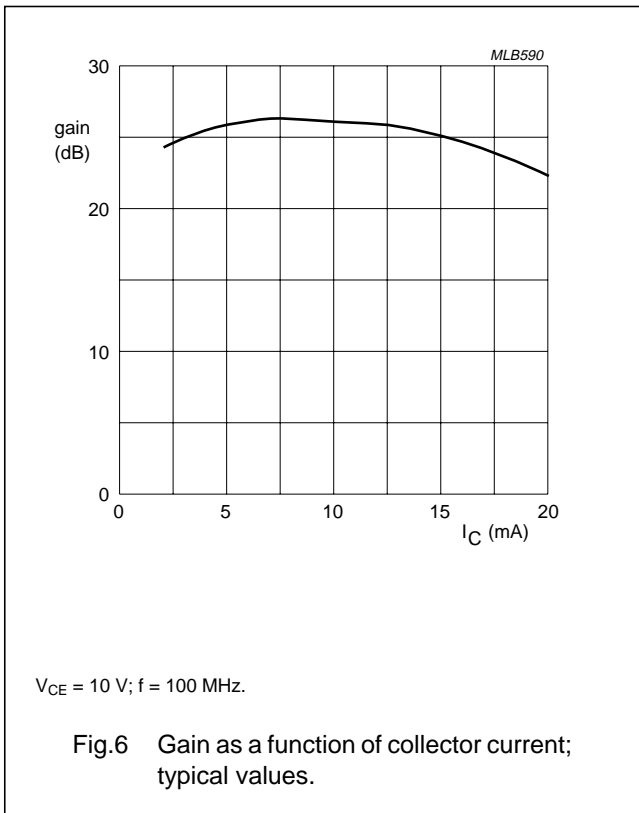
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BF547W



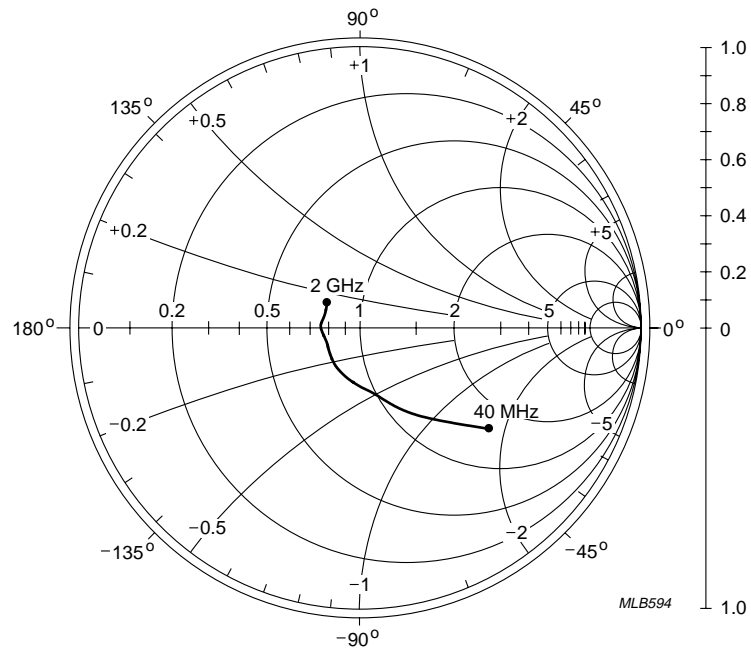
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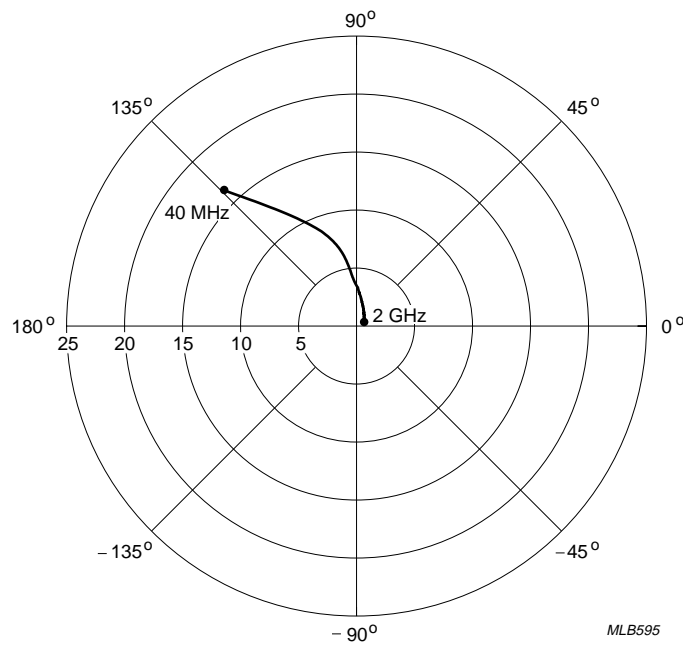
NPN 1 GHz wideband transistor

BF547W



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

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

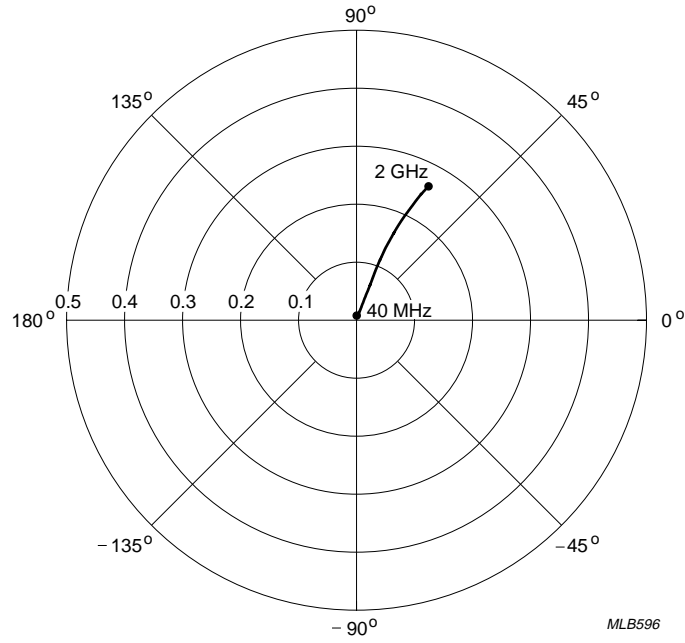


$V_{CE} = 10\text{ V}; I_C = 15\text{ mA}.$

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

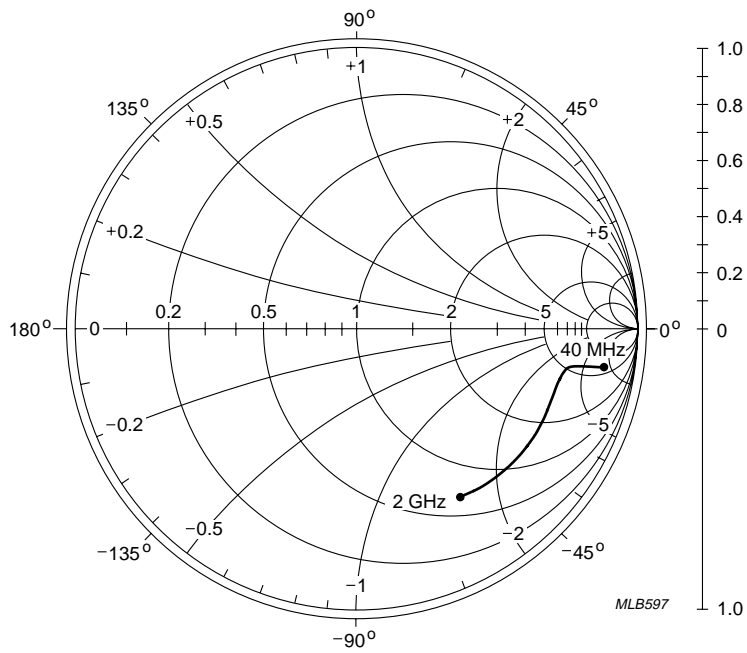
NPN 1 GHz wideband transistor

BF547W



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

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



$V_{CE} = 10\text{ V}; I_C = 15\text{ mA}; Z_0 = 50\ \Omega$ .

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

NPN 1 GHz wideband transistor

BF547W

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 <sup>(1)</sup>	XTB	0.000	–
20 <sup>(1)</sup>	EG	1.110	eV
21 <sup>(1)</sup>	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 <sup>(1)</sup>	CJS	0.000	F

SEQUENCE No.	PARAMETER	VALUE	UNIT
36 <sup>(1)</sup>	VJS	750.0	mV
37 <sup>(1)</sup>	MJS	0.000	–
38	FC	0.950	–

Note

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

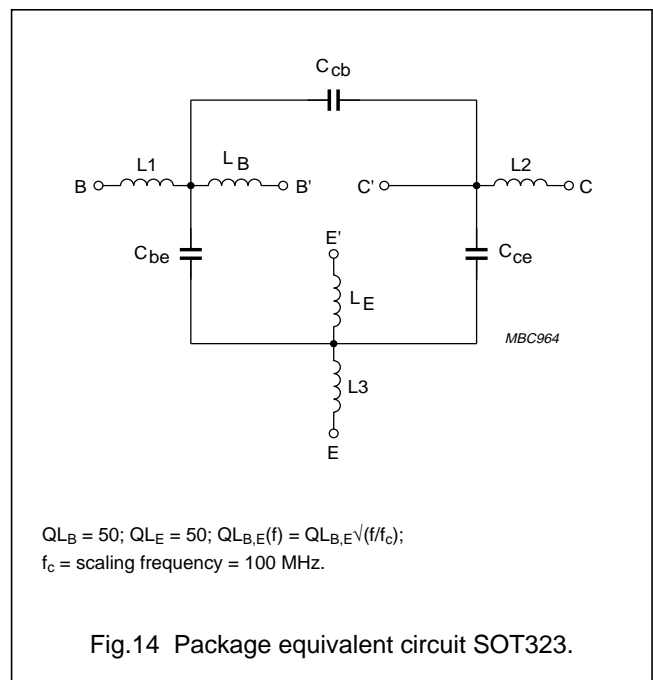


Fig.14 Package equivalent circuit SOT323.

List of components (see Fig.14).

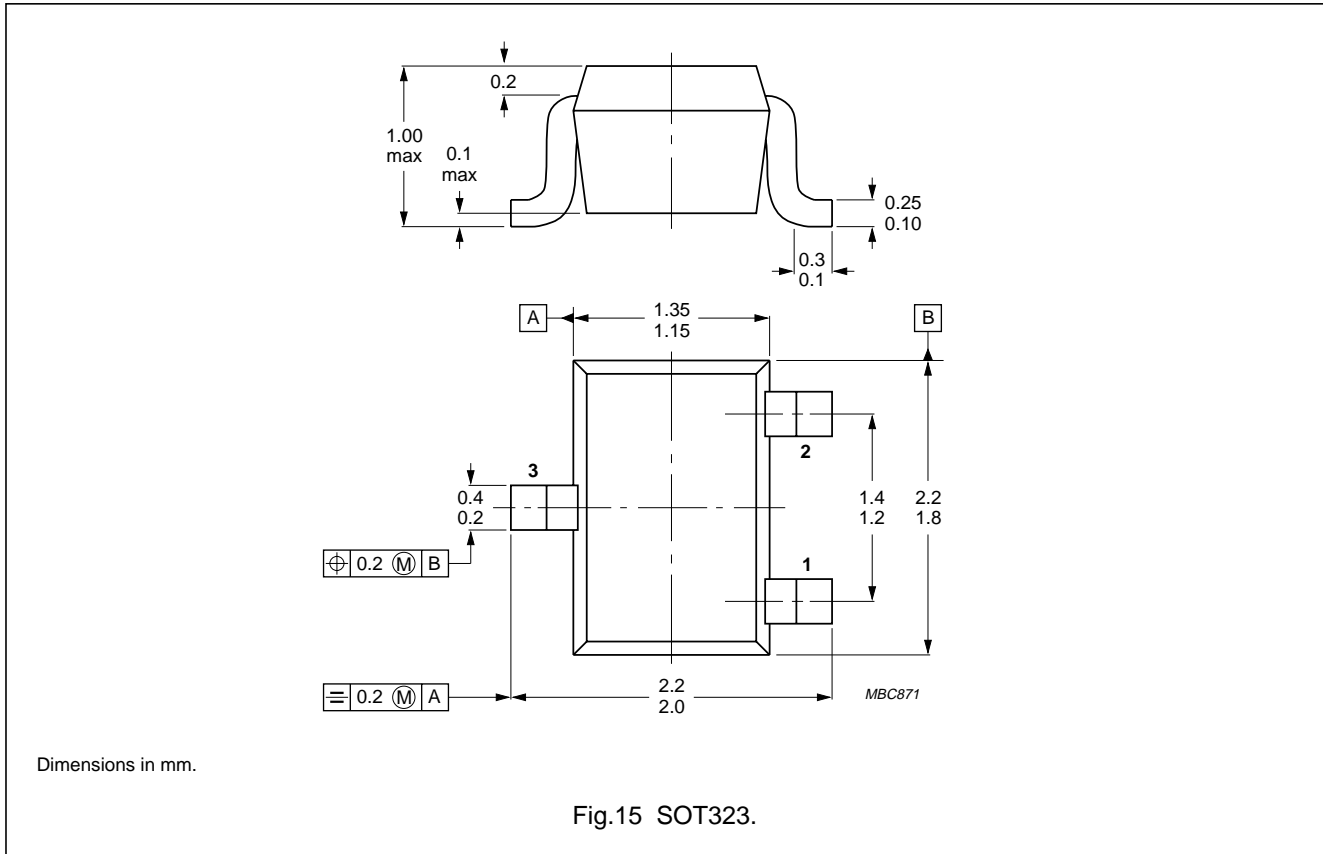
DESIGNATION	VALUE	UNIT
C <sub>be</sub>	2	fF
C <sub>cb</sub>	100	fF
C <sub>ce</sub>	100	fF
L1	0.34	nH
L2	0.10	nH
L3	0.34	nH
L <sub>B</sub>	0.60	nH
L <sub>E</sub>	0.60	nH



NPN 1 GHz wideband transistor

BF547W

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.	

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**NOTES**

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