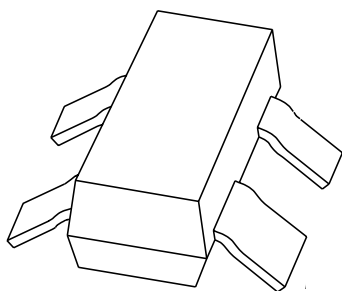


# DATA SHEET



## **BFG92A/X** NPN 5 GHz wideband transistor

Product specification  
Supersedes data of 1995 Sep 12

1998 Sep 23

# NPN 5 GHz wideband transistor

# BFG92A/X

### FEATURES

- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

### APPLICATIONS

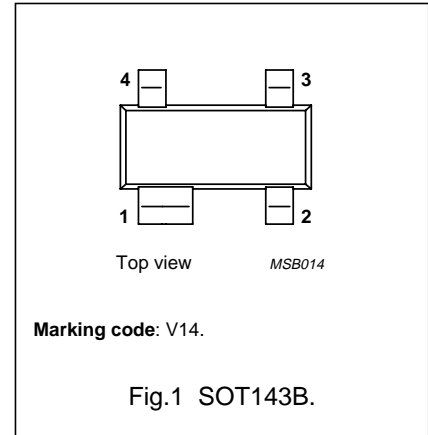
Wideband applications in the UHF and microwave range.

### DESCRIPTION

Silicon NPN transistor in a 4-pin, dual-emitter SOT143B plastic package.

### PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter



### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CBO}$	collector-base voltage		–	–	20	V
$V_{CEO}$	collector-emitter voltage		–	–	15	V
$I_C$	collector current (DC)		–	–	25	mA
$P_{tot}$	total power dissipation	$T_s \leq 60\text{ }^\circ\text{C}$	–	–	400	mW
$C_{re}$	feedback capacitance	$I_C = i_c = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$	–	0.35	–	pF
$f_T$	transition frequency	$I_C = 15\text{ mA}; V_{CE} = 10\text{ V}; f = 500\text{ MHz}$	3.5	5	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 15\text{ mA}; V_{CE} = 10\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; f = 1\text{ GHz}$	–	16	–	dB
		$I_C = 15\text{ mA}; V_{CE} = 10\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; f = 2\text{ GHz}$	–	11	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}; I_C = 5\text{ mA}; V_{CE} = 10\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; f = 1\text{ GHz}$	–	2	–	dB

## NPN 5 GHz wideband transistor

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## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CBO</sub>	collector-base voltage	open emitter	–	20	V
V <sub>CEO</sub>	collector-emitter voltage	open base	–	15	V
V <sub>EBO</sub>	emitter-base voltage	open collector	–	2	V
I <sub>C</sub>	collector current (DC)		–	25	mA
P <sub>tot</sub>	total power dissipation	T <sub>s</sub> ≤ 60 °C; note 1	–	400	mW
T <sub>stg</sub>	storage temperature range		–65	150	°C
T <sub>j</sub>	junction temperature		–	175	°C

## Note

1. T<sub>s</sub> is the temperature at the soldering point of the collector pin.

## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
R <sub>th j-s</sub>	thermal resistance from junction to soldering point	note 1	290	K/W

## Note

1. T<sub>s</sub> is the temperature at the soldering point of the collector pin.

## CHARACTERISTICS

T<sub>j</sub> = 25 °C unless otherwise specified.

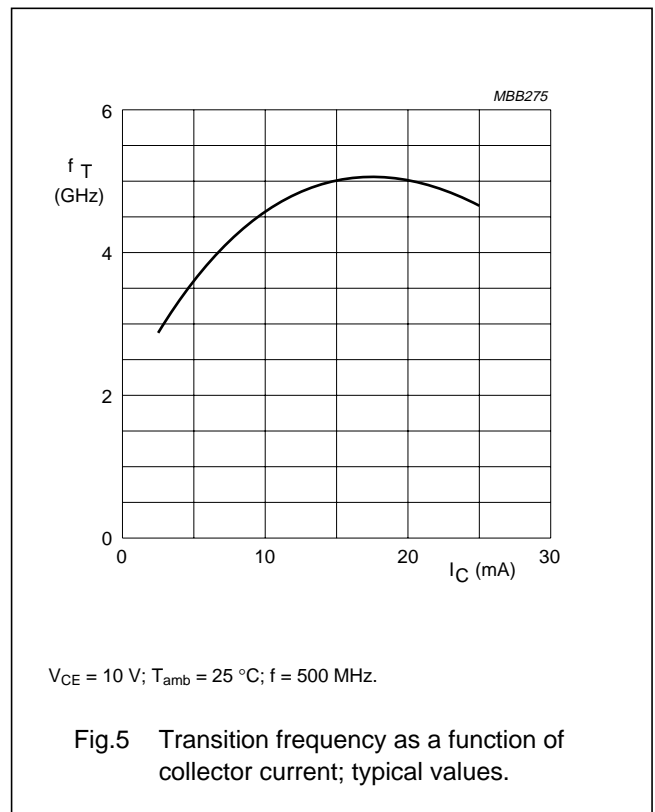
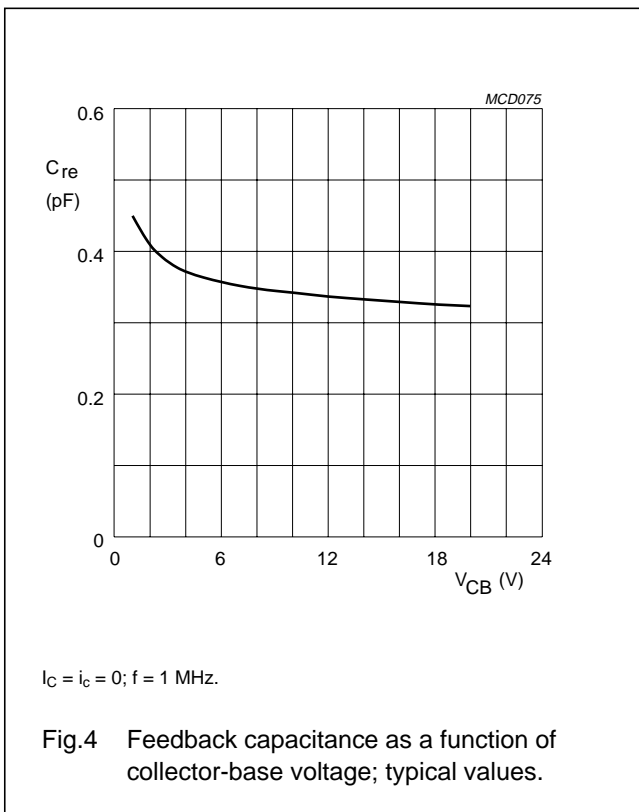
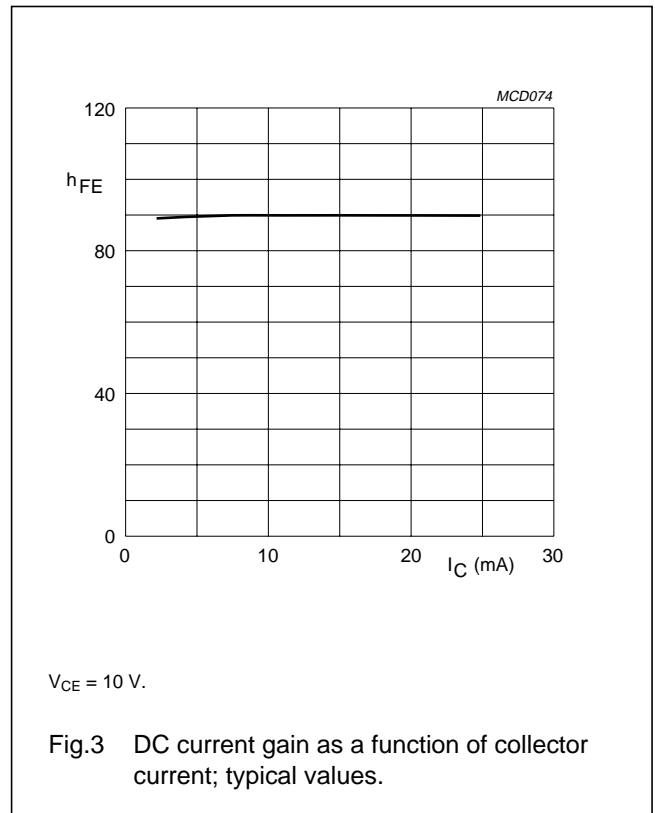
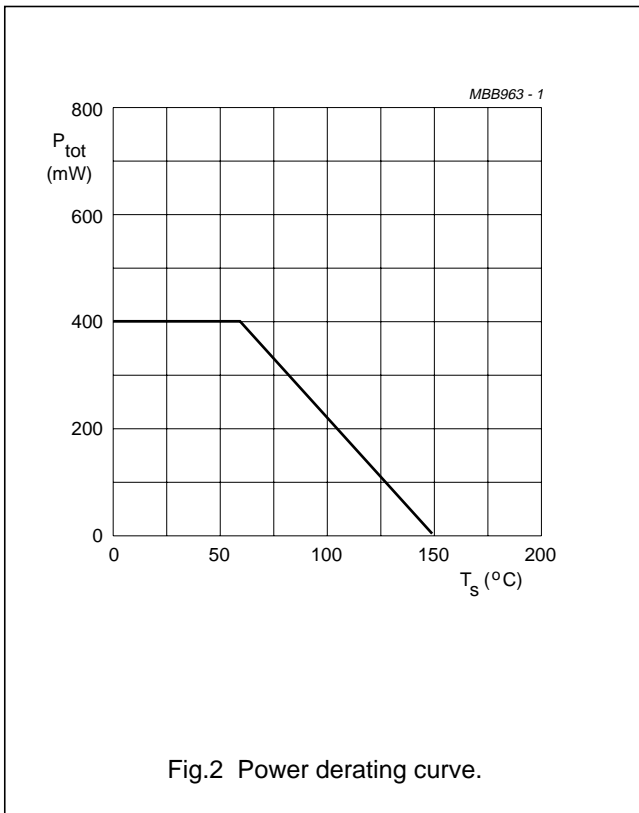
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I <sub>CBO</sub>	collector leakage current	I <sub>E</sub> = 0; V <sub>CB</sub> = 10 V	–	–	50	nA
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 15 mA; V <sub>CE</sub> = 10 V	40	90	–	
C <sub>c</sub>	collector capacitance	I <sub>E</sub> = i <sub>e</sub> = 0; V <sub>CB</sub> = 10 V; f = 1 MHz	–	0.6	–	pF
C <sub>e</sub>	emitter capacitance	I <sub>C</sub> = i <sub>c</sub> = 0; V <sub>EB</sub> = 10 V; f = 1 MHz	–	0.9	–	pF
C <sub>re</sub>	feedback capacitance	I <sub>C</sub> = i <sub>c</sub> = 0; V <sub>CB</sub> = 10 V; f = 1 MHz	–	0.35	–	pF
f <sub>T</sub>	transition frequency	I <sub>C</sub> = 15 mA; V <sub>CE</sub> = 10 V; f = 500 MHz	3.5	5	–	GHz
G <sub>UM</sub>	maximum unilateral power gain; note 1	I <sub>C</sub> = 15 mA; V <sub>CE</sub> = 10 V; T <sub>amb</sub> = 25 °C; f = 1 GHz	–	16	–	dB
		I <sub>C</sub> = 15 mA; V <sub>CE</sub> = 10 V; T <sub>amb</sub> = 25 °C; f = 2 GHz	–	11	–	dB
F	noise figure	Γ <sub>s</sub> = Γ <sub>opt</sub> ; I <sub>C</sub> = 5 mA; V <sub>CE</sub> = 10 V; T <sub>amb</sub> = 25 °C; f = 1 GHz	–	2	–	dB
		Γ <sub>s</sub> = Γ <sub>opt</sub> ; I <sub>C</sub> = 5 mA; V <sub>CE</sub> = 10 V; T <sub>amb</sub> = 25 °C; f = 2 GHz	–	3	–	dB

## Note

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

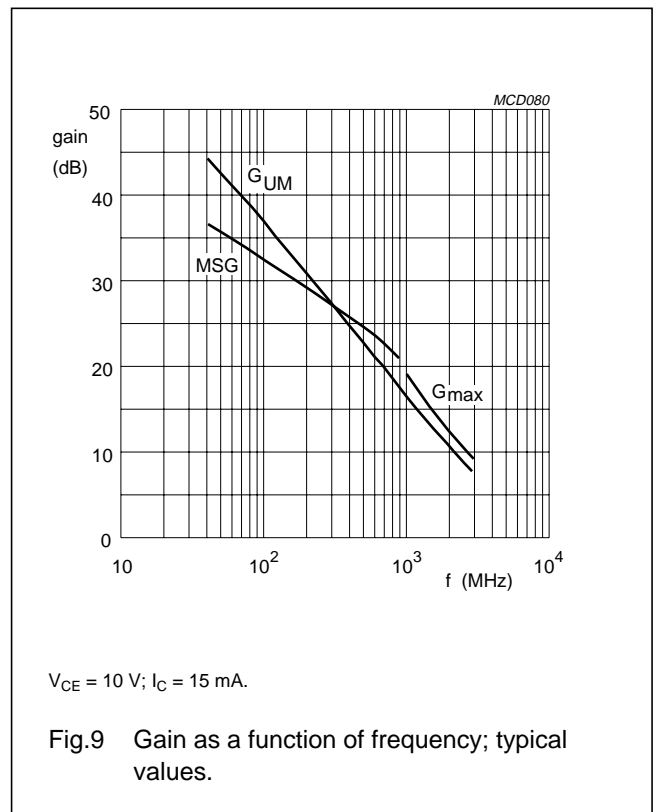
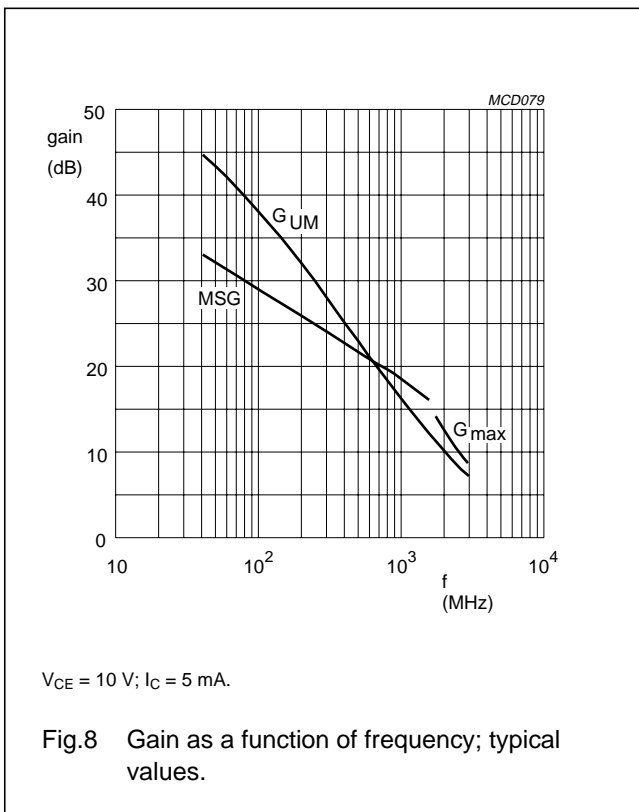
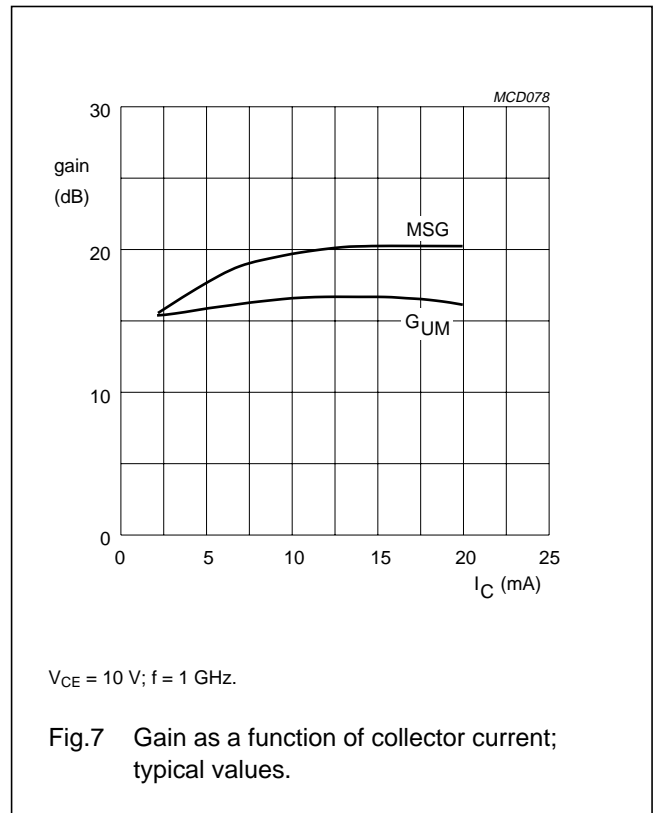
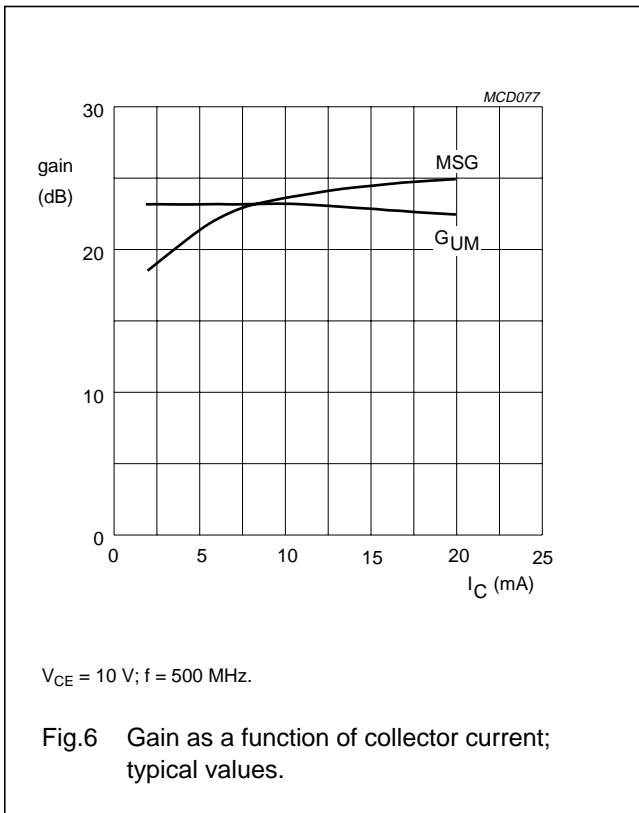
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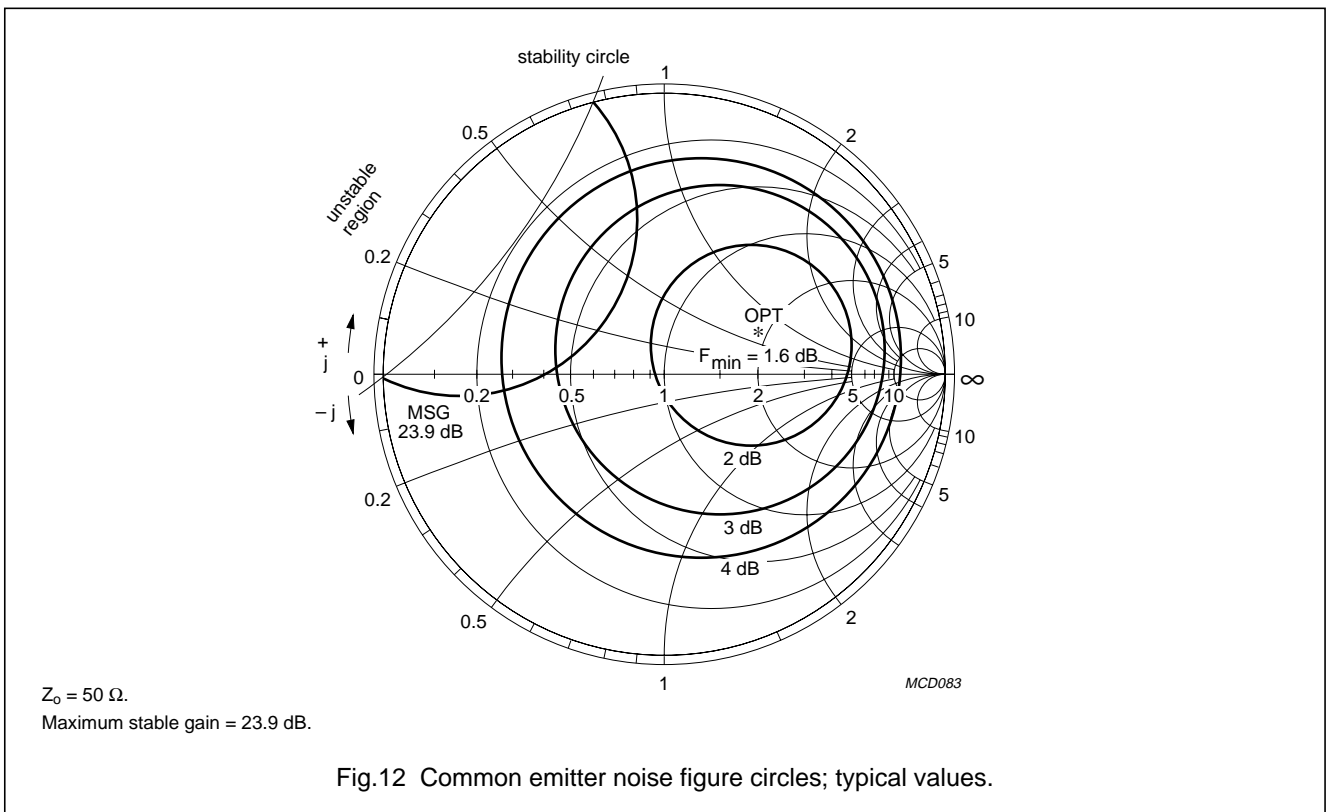
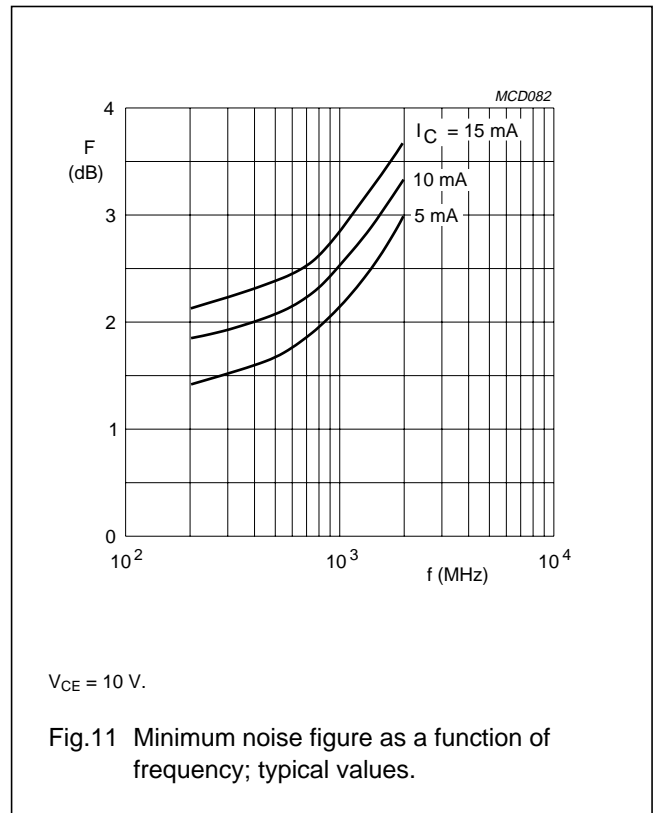
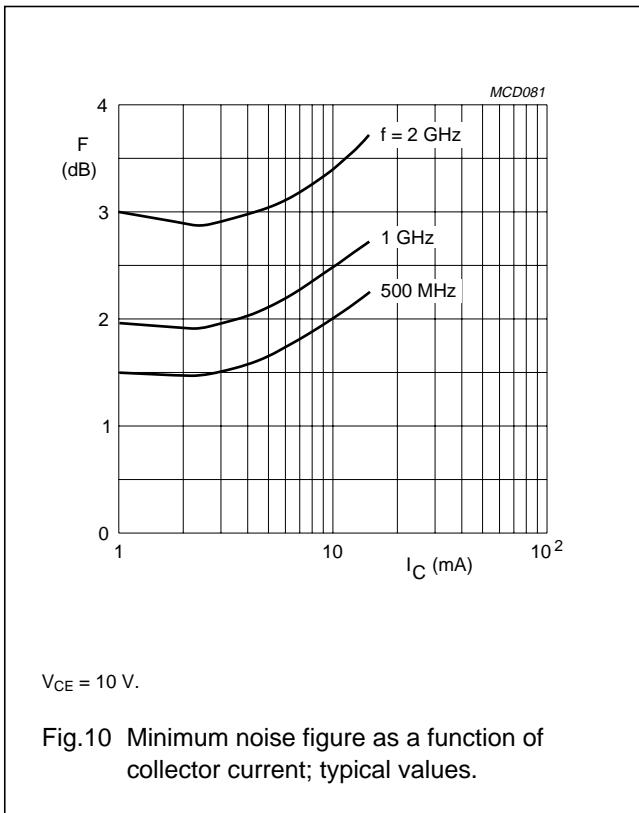
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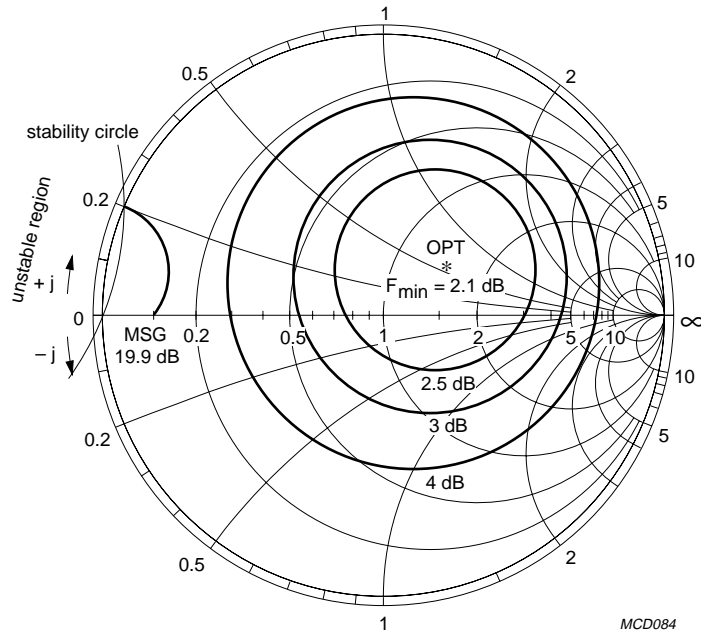
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NPN 5 GHz wideband transistor

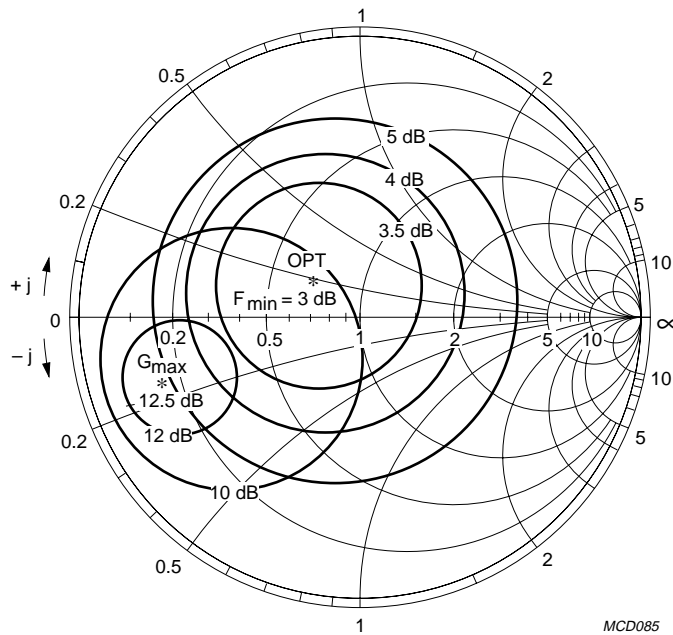
BFG92A/X



MCD084

$Z_0 = 50 \Omega$ .  
Maximum stable gain = 19.9 dB.

Fig.13 Common emitter noise figure circles; typical values.



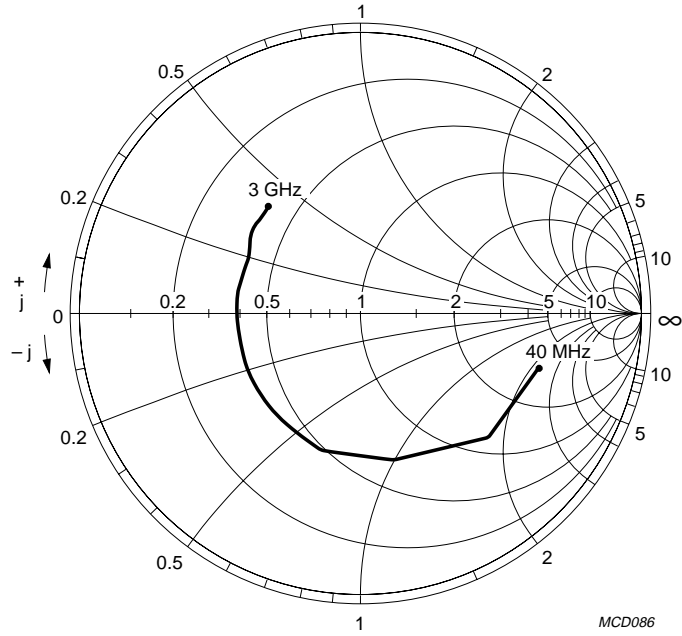
MCD085

$Z_0 = 50 \Omega$ .

Fig.14 Common emitter noise figure circles; typical values.

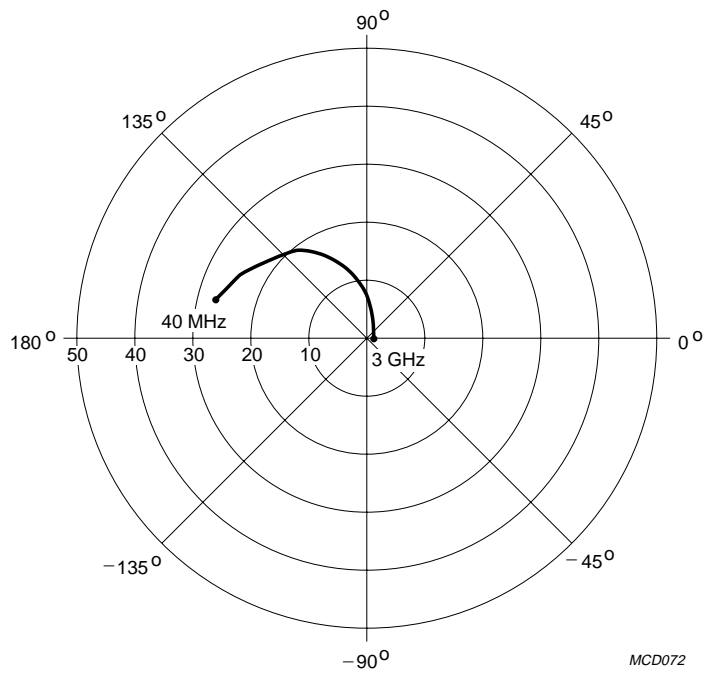
NPN 5 GHz wideband transistor

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

Fig.15 Common emitter input reflection coefficient ( $S_{11}$ ); typical values.



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

Fig.16 Common emitter forward transmission coefficient ( $S_{21}$ ); typical values.



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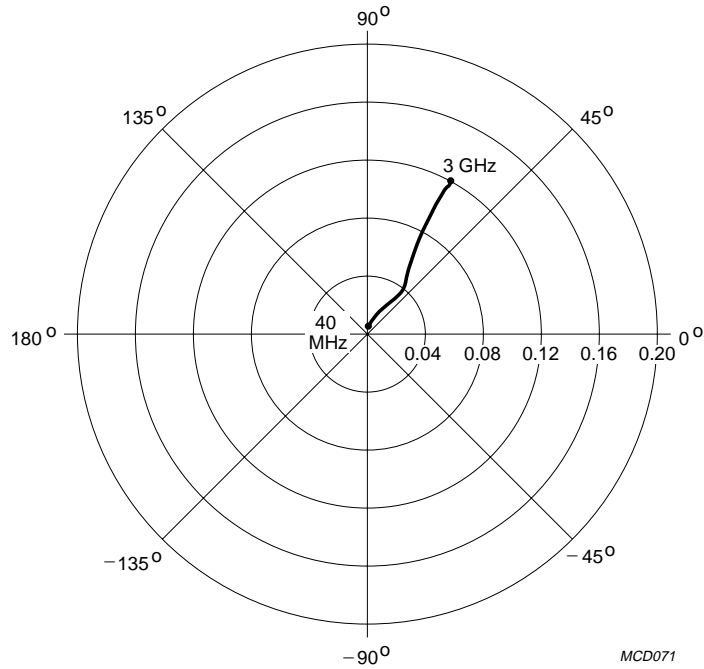


Fig.17 Common emitter reverse transmission coefficient ( $S_{12}$ ); typical values.

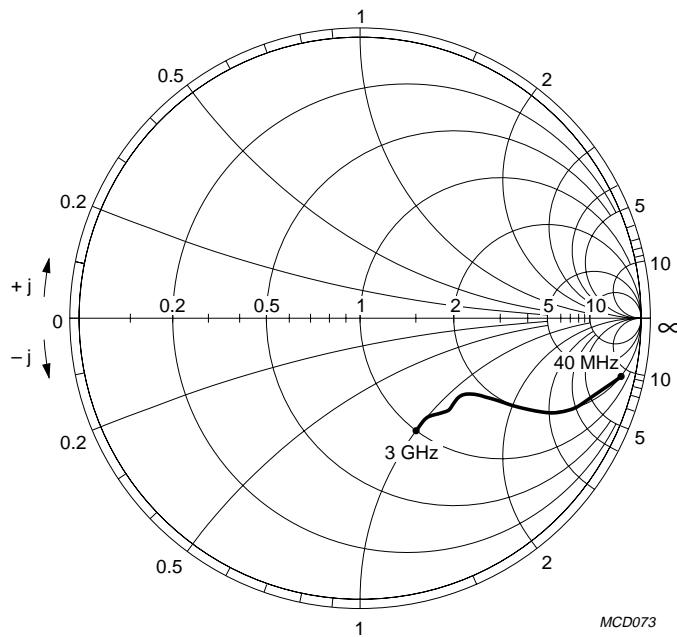


Fig.18 Common emitter output reflection coefficient ( $S_{22}$ ); typical values.

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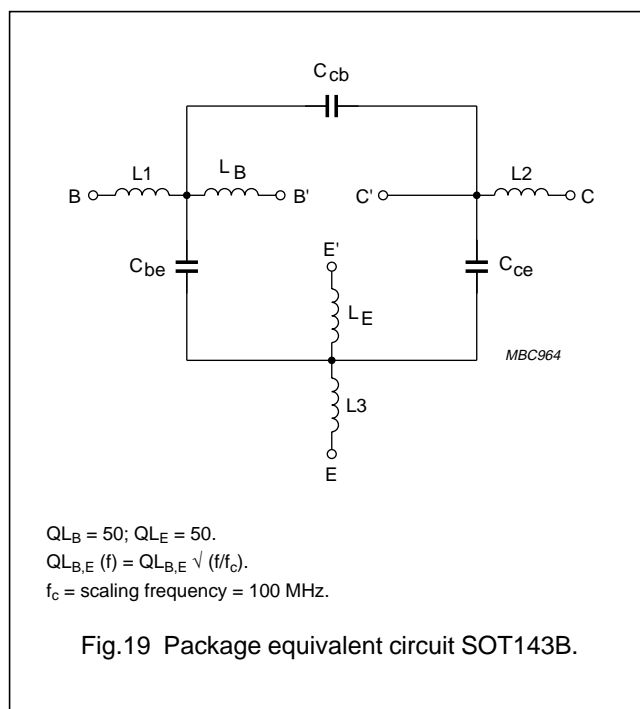
SPICE parameters for BFR90A/X die

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	411.8	aA
2	BF	102.6	–
3	NF	997.2	m
4	VAF	62.67	V
5	IKF	3.200	A
6	ISE	4.010	fA
7	NE	1.577	–
8	BR	18.10	–
9	NR	996.2	m
10	VAR	3.369	V
11	IKR	1.281	A
12	ISC	279.9	aA
13	NC	1.075	–
14	RB	10.00	Ω
15	IRB	1.000	μA
16	RBM	10.00	Ω
17	RE	1.164	Ω
18	RC	2.320	Ω
19 (note 1)	XTB	0.000	–
20 (note 1)	EG	1.110	eV
21 (note 1)	XTI	3.000	–
22	CJE	890.5	fF
23	VJE	600.0	mV
24	MJE	258.5	m
25	TF	15.49	ps
26	XTF	39.14	–
27	VTF	2.152	V
28	ITF	213.7	mA
29	PTF	0.000	deg
30	CJC	546.5	fF
31	VJC	380.8	mV
32	MJC	202.9	m
33	XCJC	150.0	m
34	TR	5.618	ns
35 (note 1)	CJS	0.000	F

SEQUENCE No.	PARAMETER	VALUE	UNIT
36 (note 1)	VJS	750.0	mV
37 (note 1)	MJS	0.000	–
38	FC	850.0	m

Note

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



List of components (see Fig.19)

DESIGNATION	VALUE	UNIT
C <sub>be</sub>	84	fF
C <sub>cb</sub>	17	fF
C <sub>ce</sub>	191	fF
L1	0.12	nH
L2	0.21	nH
L3	0.06	nH
L <sub>B</sub>	0.95	nH
L <sub>E</sub>	0.40	nH

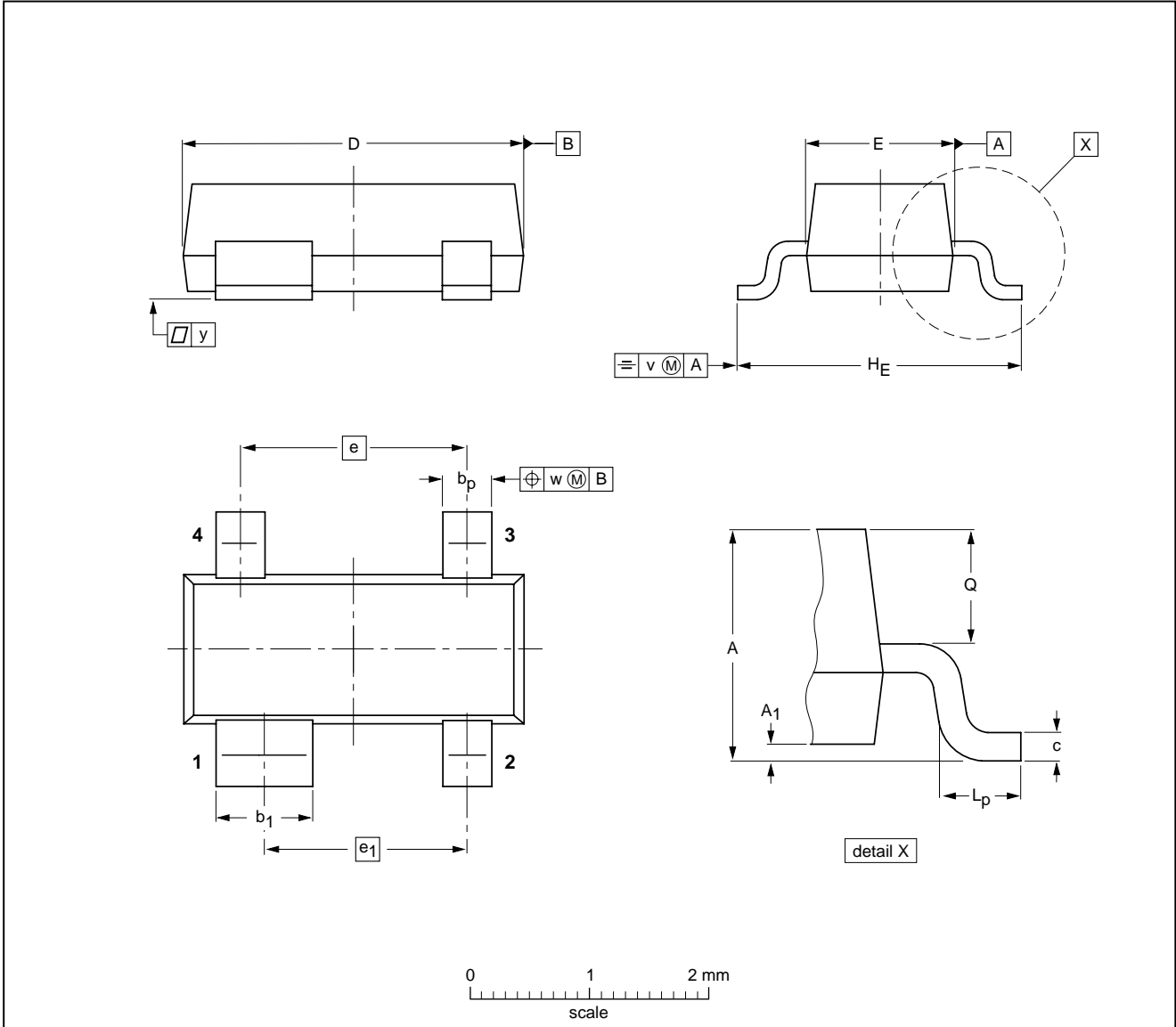
NPN 5 GHz wideband transistor

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PACKAGE OUTLINES

Plastic surface mounted package; 4 leads

SOT143B



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> max	b <sub>p</sub>	b <sub>1</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	Q	v	w	y
mm	1.1 0.9	0.1	0.48 0.38	0.88 0.78	0.15 0.09	3.0 2.8	1.4 1.2	1.9	1.7	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT143B						97-02-28

## NPN 5 GHz wideband transistor

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**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>	
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**NOTES**

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Printed in The Netherlands

125104/00/04/pp16

Date of release: 1998 Sep 23

Document order number: 9397 750 04344

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