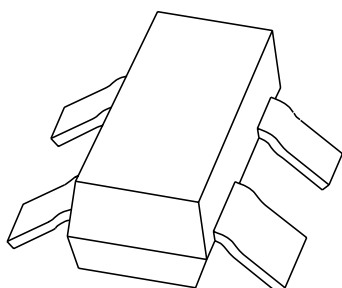


DATA SHEET



BFG93A; BFG93A/X NPN 6 GHz wideband transistors

Product specification
Supersedes data of 1995 Sep 25

1998 Sep 23

NPN 6 GHz wideband transistors

BFG93A; BFG93A/X

FEATURES

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

APPLICATIONS

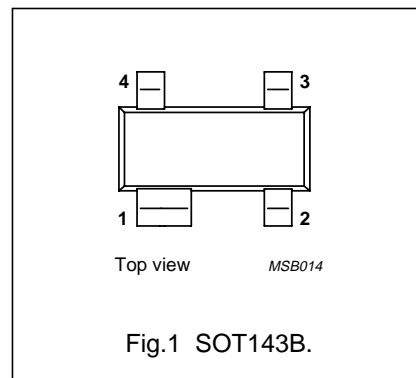
Wideband applications in the UHF and microwave range.

DESCRIPTION

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

PINNING

PIN	DESCRIPTION
BFG93A	
1	collector
2	base
3	emitter
4	emitter
BFG93A/X	
1	collector
2	emitter
3	base
4	emitter



MARKING

TYPE NUMBER	CODE
BFG93A	R8
BFG93A/X	V15

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CB0}	collector-base voltage	open emitter	–	–	15	V
V_{CE0}	collector-emitter voltage	open base	–	–	12	V
I_C	collector current (DC)		–	–	35	mA
P_{tot}	total power dissipation	$T_s \leq 85\text{ }^\circ\text{C}$	–	–	300	mW
C_{re}	feedback capacitance	$I_C = i_c = 0; V_{CB} = 5\text{ V}; f = 1\text{ MHz}$	–	0.6	–	pF
f_T	transition frequency	$I_C = 30\text{ mA}; V_{CE} = 5\text{ V}; f = 500\text{ MHz}$	4.5	6	–	GHz
G_{UM}	maximum unilateral power gain	$I_C = 30\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; f = 1\text{ GHz}$	–	16	–	dB
		$I_C = 30\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; f = 2\text{ GHz}$	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}; I_C = 5\text{ mA}; V_{CE} = 8\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}; f = 1\text{ GHz}$	–	1.7	–	dB

NPN 6 GHz wideband transistors

BFG93A; BFG93A/X

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	–	15	V
V _{CEO}	collector-emitter voltage	open base	–	12	V
V _{EBO}	emitter-base voltage	open collector	–	2	V
I _C	collector current (DC)		–	35	mA
P _{tot}	total power dissipation	T _s ≤ 85 °C; note 1	–	300	mW
T _{stg}	storage temperature range		–65	+150	°C
T _j	junction operating temperature		–	175	°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-s}	thermal resistance from junction to soldering point	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.

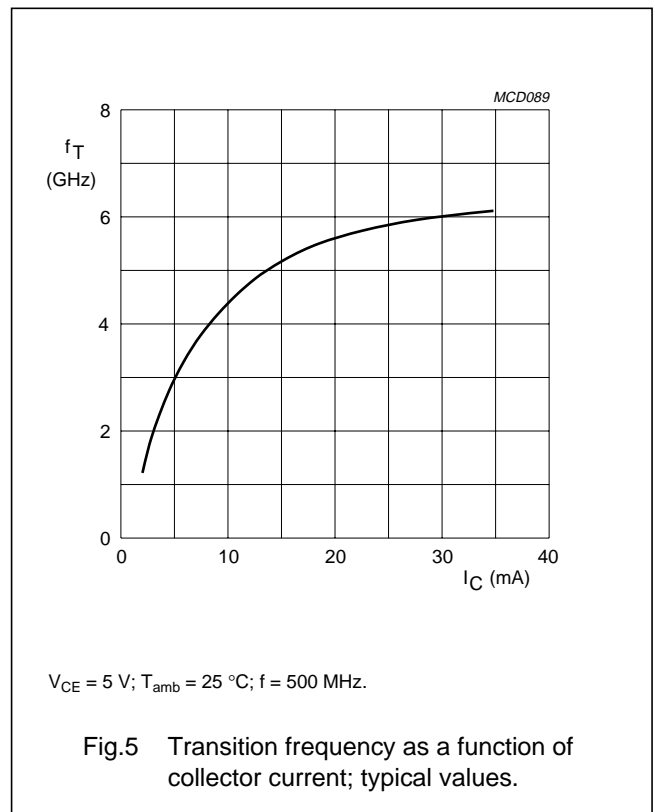
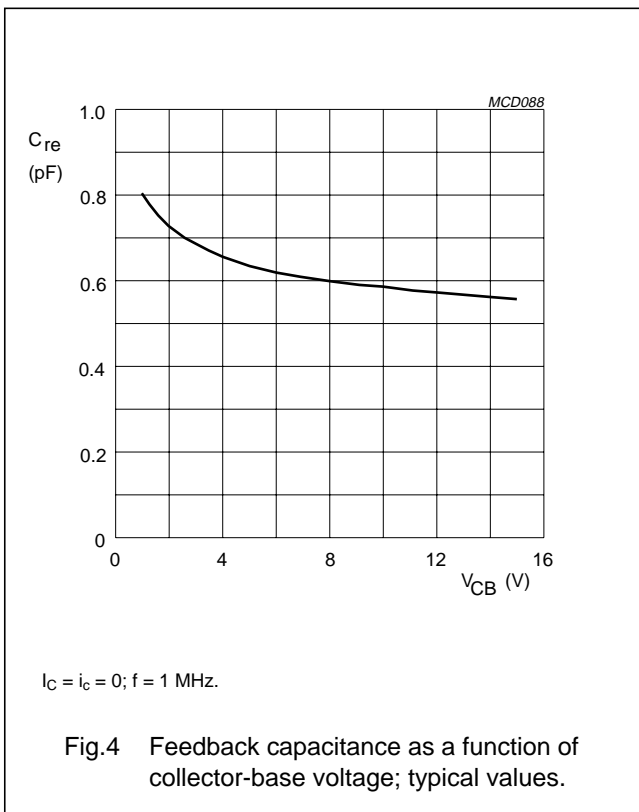
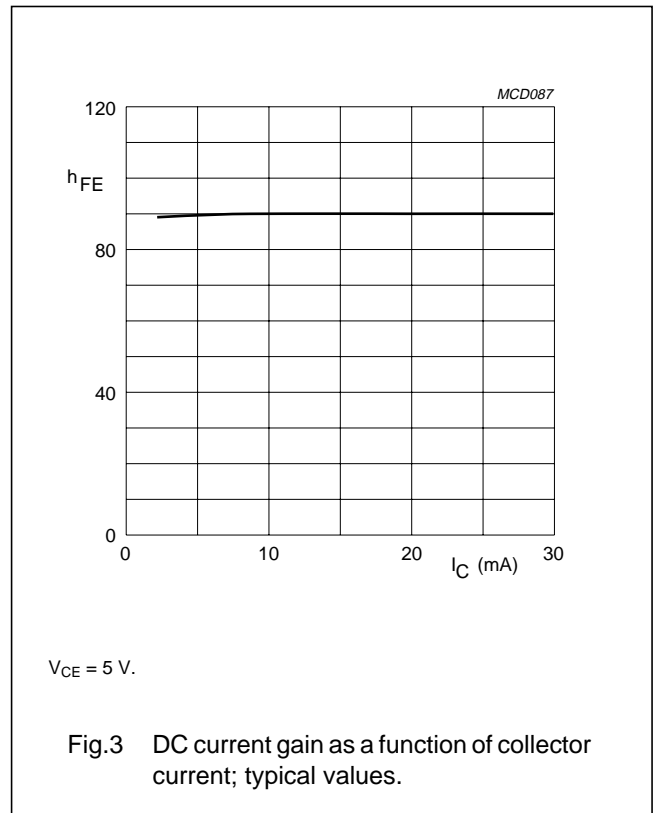
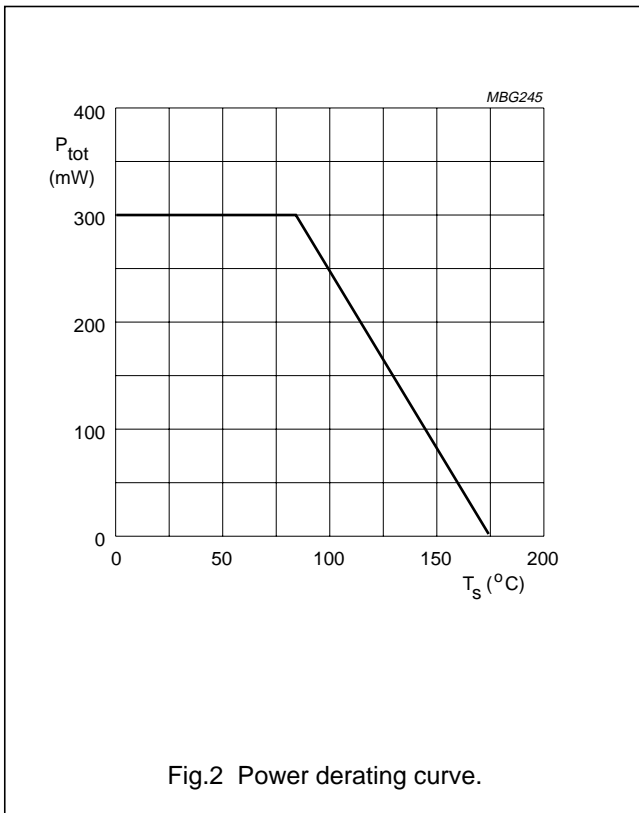
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I _{CBO}	collector leakage current	I _E = 0; V _{CB} = 5 V	–	–	50	nA
h _{FE}	DC current gain	I _C = 30 mA; V _{CE} = 5 V	40	90	–	
C _c	collector capacitance	I _E = i _e = 0; V _{CB} = 5 V; f = 1 MHz	–	0.9	–	pF
C _e	emitter capacitance	I _C = i _c = 0; V _{EB} = 5 V; f = 1 MHz	–	1.9	–	pF
C _{re}	feedback capacitance	I _C = i _c = 0; V _{CB} = 5 V; f = 1 MHz	–	0.6	–	pF
f _T	transition frequency	I _C = 30 mA; V _{CE} = 5 V; f = 500 MHz	4.5	6	–	GHz
G _{UM}	maximum unilateral power gain; note 1	I _C = 30 mA; V _{CE} = 8 V; T _{amb} = 25 °C; f = 1 GHz	–	16	–	dB
		I _C = 30 mA; V _{CE} = 8 V; T _{amb} = 25 °C; f = 2 GHz	–	10	–	dB
F	noise figure	Γ _s = Γ _{opt} ; I _C = 5 mA; V _{CE} = 8 V; T _{amb} = 25 °C; f = 1 GHz	–	1.7	–	dB
		Γ _s = Γ _{opt} ; I _C = 5 mA; V _{CE} = 8 V; T _{amb} = 25 °C; f = 2 GHz	–	2.3	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming S₁₂ is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$ dB.

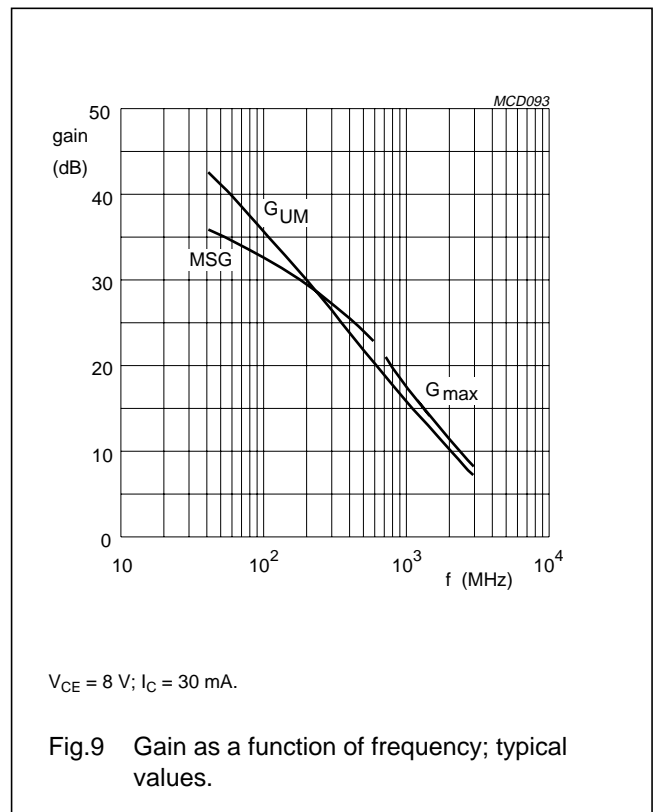
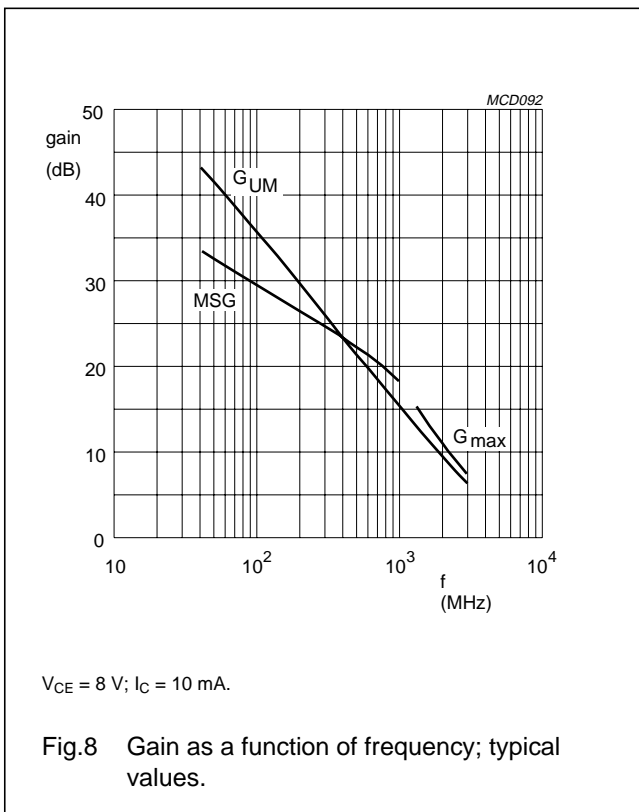
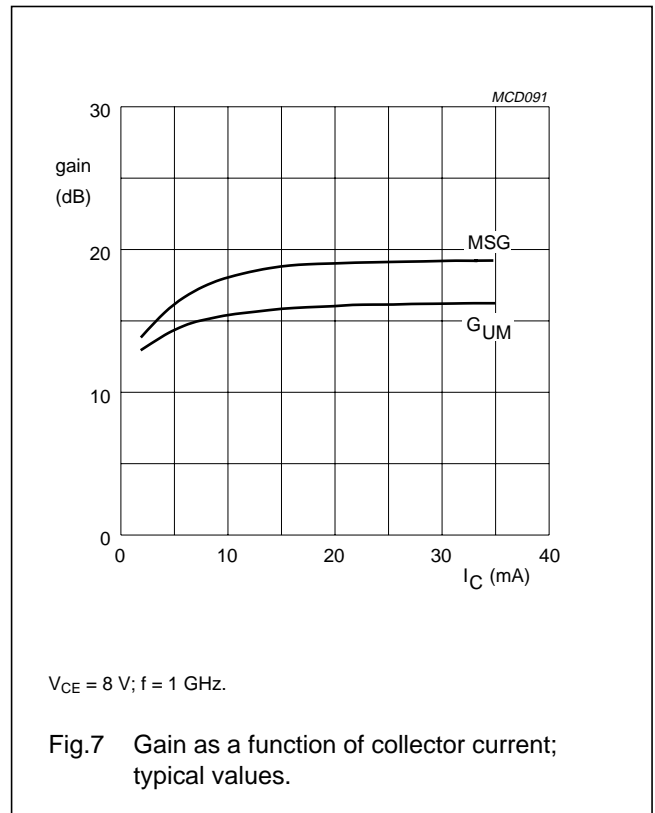
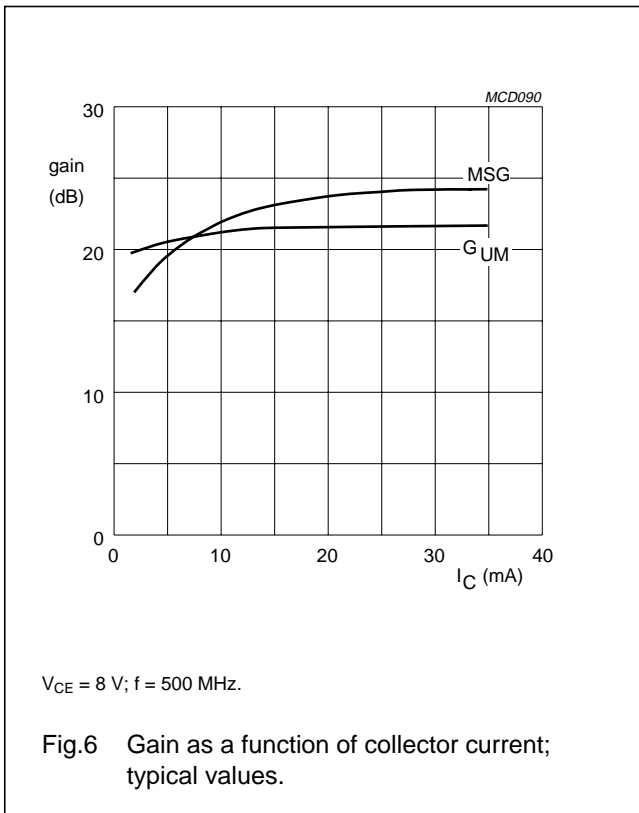
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



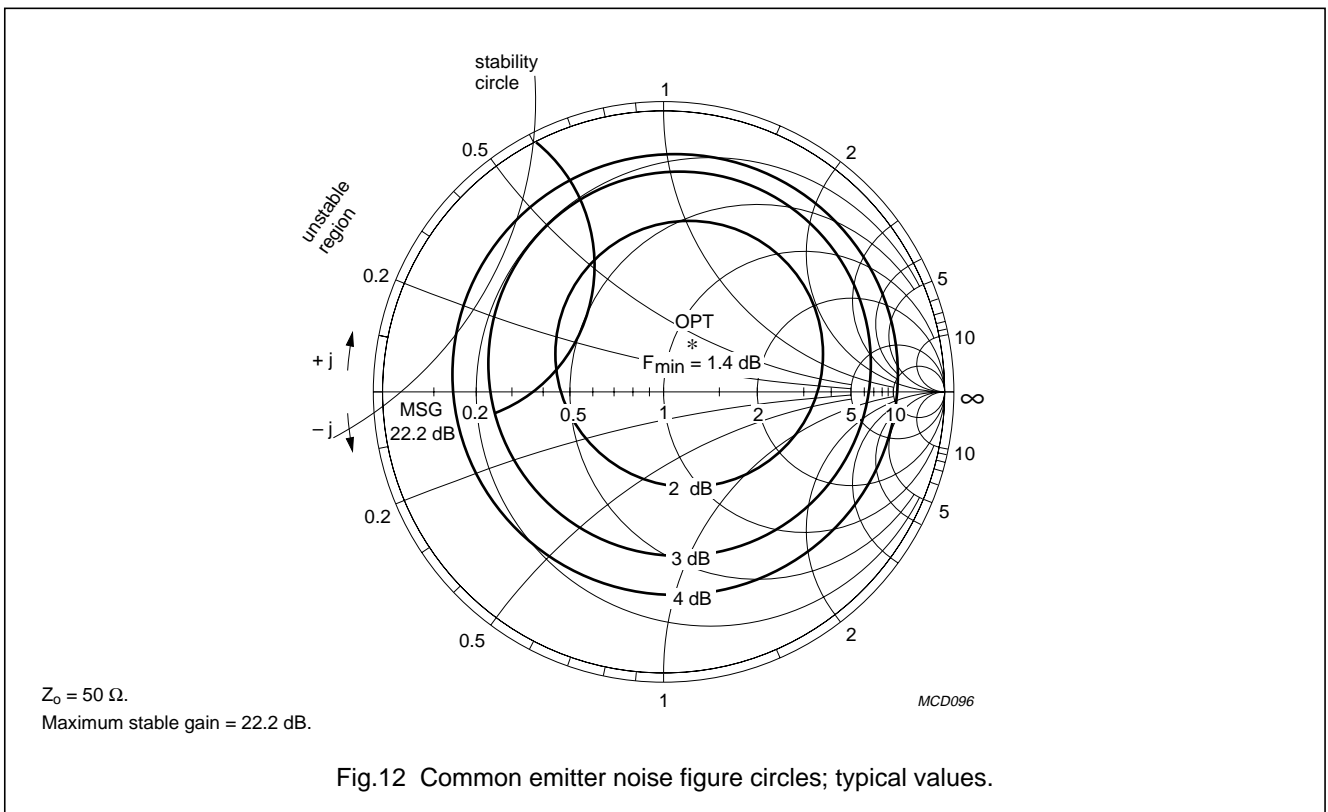
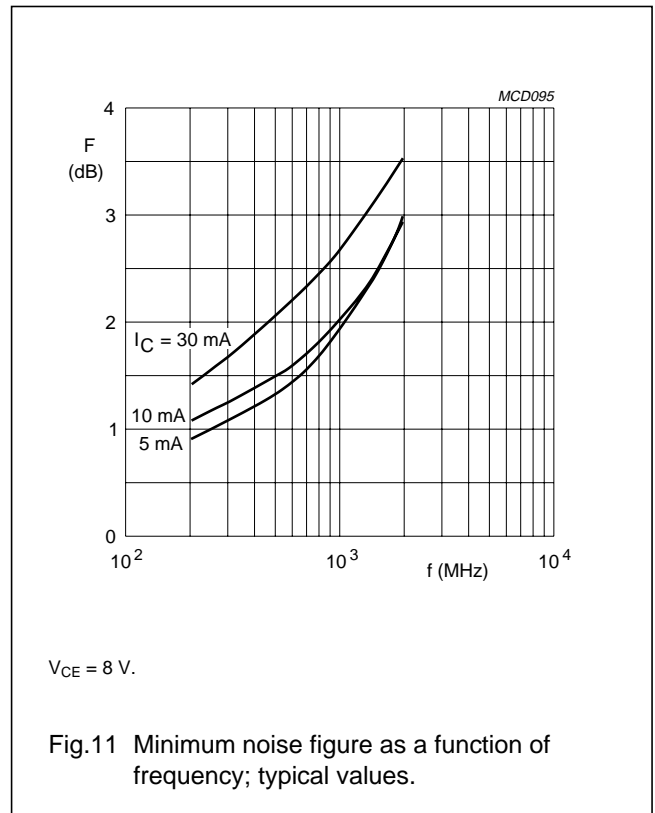
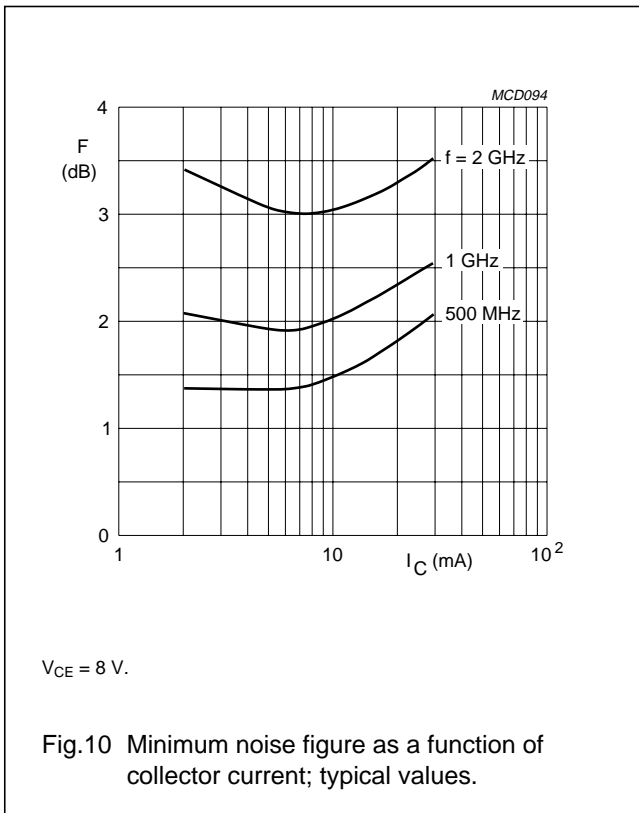
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



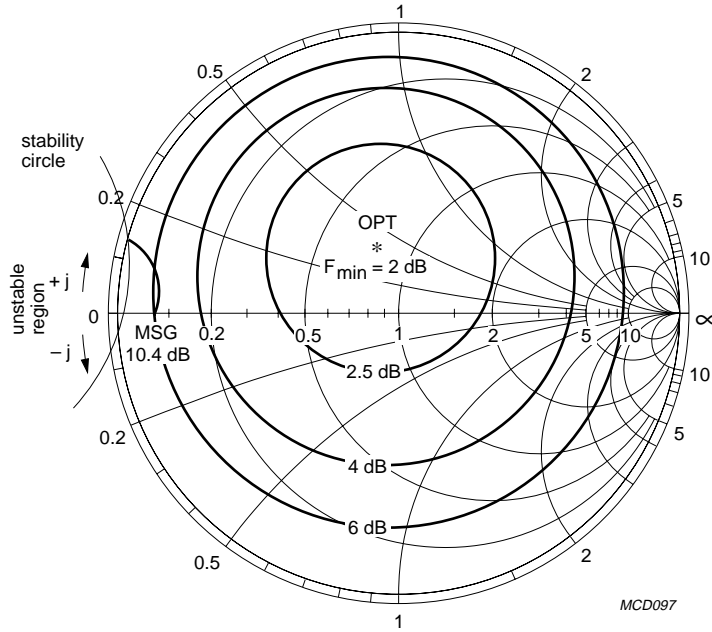
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



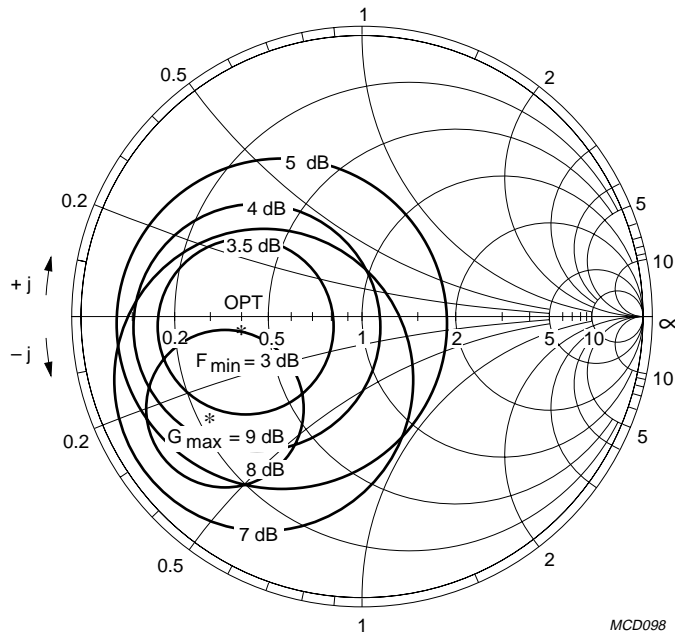
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



$Z_0 = 50 \Omega$.
Maximum stable gain = 10.4 dB.

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

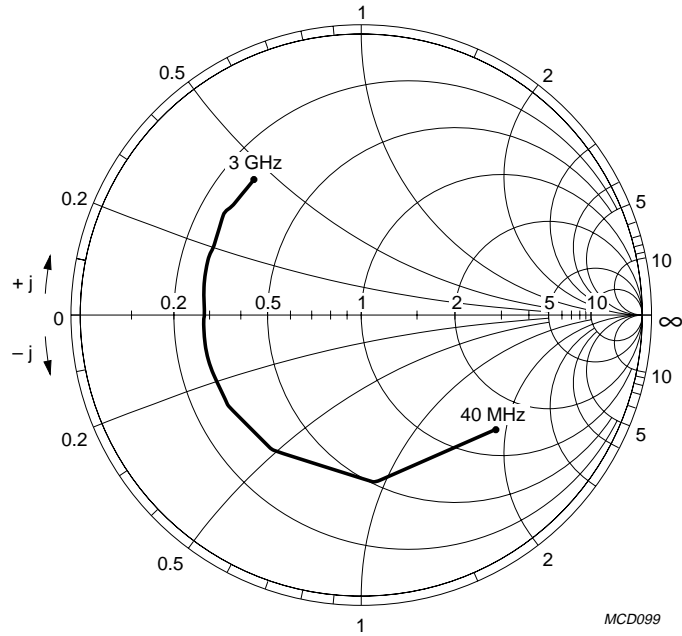


$Z_0 = 50 \Omega$.

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

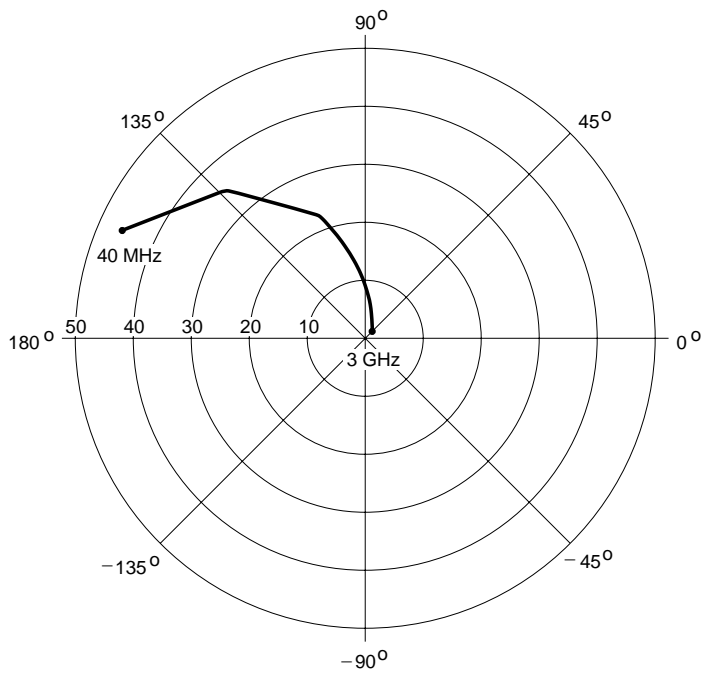
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}; Z_o = 50\ \Omega.$

Fig.15 Common emitter input reflection coefficient (S_{11}).



$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}; R_{max} = 50\ \Omega.$

Fig.16 Common emitter forward transmission coefficient (S_{21}).

NPN 6 GHz wideband transistors

BFG93A; BFG93A/X

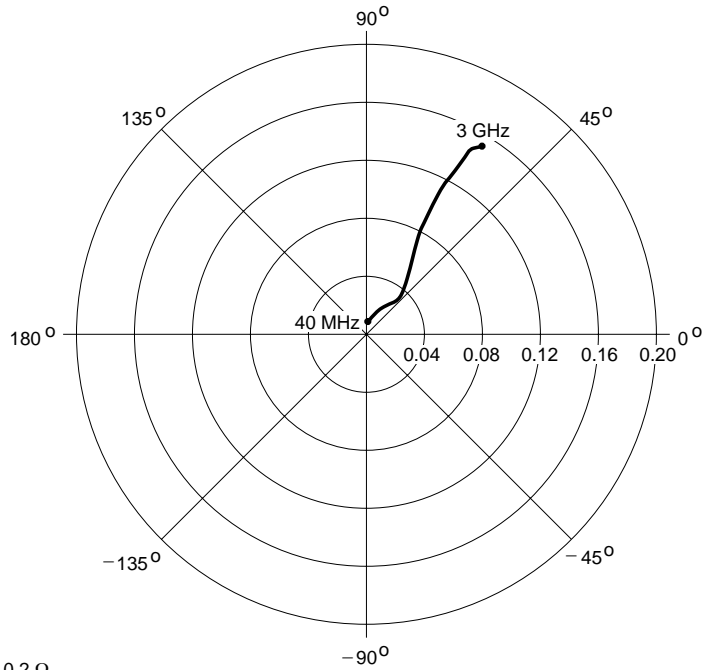


Fig.17 Common emitter reverse transmission coefficient (S_{12}).

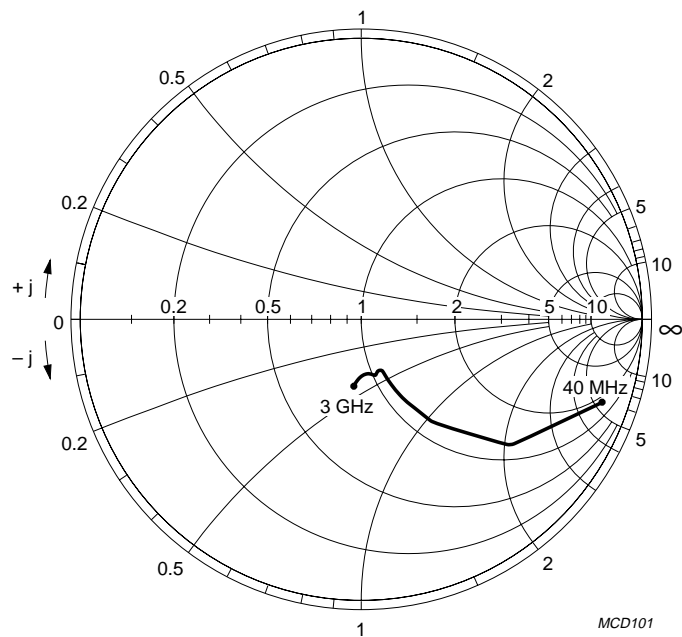


Fig.18 Common emitter output reflection coefficient (S_{22}).

NPN 6 GHz wideband transistors

BFG93A; BFG93A/X

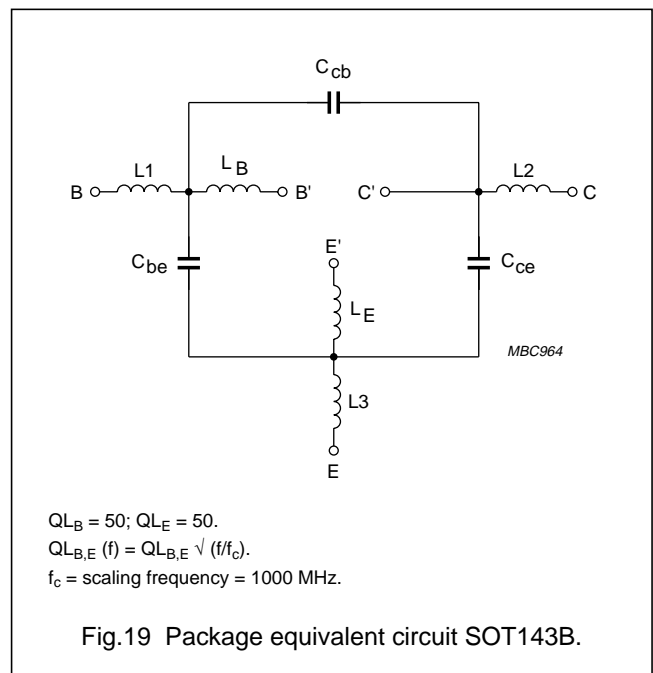
SPICE parameters for BFR91A(X) die

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	1.328	fA
2	BF	102.0	–
3	NF	1.000	–
4	VAF	51.90	V
5	IKF	8.155	A
6	ISE	13.90	fA
7	NE	15.12	–
8	BR	17.69	–
9	NR	994.0	m
10	VAR	3.280	V
11	IKR	10.00	A
12	ISC	1.043	aA
13	NC	1.189	–
14	RB	10.00	Ω
15	IRB	1.000	μA
16	RBM	10.00	Ω
17	RE	763.6	mΩ
18	RC	9.000	Ω
19 (note 1)	XTB	0.000	–
20 (note 1)	EG	1.110	EV
21 (note 1)	XTI	3.000	–
22	CJE	2.032	pF
23	VJE	600.0	mV
24	MJE	290.0	m
25	TF	6.557	ps
26	XTF	38.97	–
27	VTF	10.93	V
28	ITF	521.0	mA
29	PTF	0.000	deg
30	CJC	1.003	pF
31	VJC	340.8	mV
32	MJC	194.2	m
33	XCJC	120.0	m
34	TR	3.073	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	800.0	m

Note

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



List of components (see Fig.19)

DESIGNATION	VALUE	UNIT
C_{be}	84	fF
C_{cb}	17	fF
C_{ce}	191	fF
L1	0.12	nH
L2	0.21	nH
L3	0.06	nH
L_B	0.95	nH
L_E	0.40	nH

NPN 6 GHz wideband transistors

BFG93A; BFG93A/X

PACKAGE OUTLINES

Plastic surface mounted package; 4 leads

SOT143B



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max	b _p	b ₁	c	D	E	e	e ₁	H _E	L _p	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 6 GHz wideband transistors

BFG93A; BFG93A/X

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

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NOTES

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Philips Semiconductors – a worldwide company

Argentina: see South America

Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113, Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

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Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6, 220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

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Canada: PHILIPS SEMICONDUCTORS/COMPONENTS, Tel. +1 800 234 7381

China/Hong Kong: 501 Hong Kong Industrial Technology Centre, 72 Tat Chee Avenue, Kowloon Tong, HONG KONG, Tel. +852 2319 7888, Fax. +852 2319 7700

Colombia: see South America

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Finland: Sinikalliontie 3, FIN-02630 ESPOO, Tel. +358 9 615800, Fax. +358 9 61580920

France: 51 Rue Carnot, BP317, 92156 SURESNES Cedex, Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG, Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

Greece: No. 15, 25th March Street, GR 17778 TAVROS/ATHENS, Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

Hungary: see Austria

India: Philips INDIA Ltd, Band Box Building, 2nd floor, 254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025, Tel. +91 22 493 8541, Fax. +91 22 493 0966

Indonesia: PT Philips Development Corporation, Semiconductors Division, Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510, Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

Ireland: Newstead, Clonskeagh, DUBLIN 14, Tel. +353 1 7640 000, Fax. +353 1 7640 200

Israel: RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053, TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

Italy: PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3, 20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR, Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905, Tel. +9-5 800 234 7381

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB, Tel. +31 40 27 82785, Fax. +31 40 27 88399

New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND, Tel. +64 9 849 4160, Fax. +64 9 849 7811

Norway: Box 1, Manglerud 0612, OSLO, Tel. +47 22 74 8000, Fax. +47 22 74 8341

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Philippines: Philips Semiconductors Philippines Inc., 106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI, Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Ul. Lukiska 10, PL 04-123 WARSZAWA, Tel. +48 22 612 2831, Fax. +48 22 612 2327

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Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW, Tel. +7 095 755 6918, Fax. +7 095 755 6919

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South Africa: S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale, 2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000, Tel. +27 11 470 5911, Fax. +27 11 470 5494

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Spain: Balmes 22, 08007 BARCELONA, Tel. +34 93 301 6312, Fax. +34 93 301 4107

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Ukraine: PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7, 252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes, MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

United States: 811 East Arques Avenue, SUNNYVALE, CA 94088-3409, Tel. +1 800 234 7381

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