

DATA SHEET

BFG93A; BFG93A/X; BFG93A/XR NPN 6 GHz wideband transistors

Product specification
Supersedes data of November 1992
File under discrete semiconductors, SC14

1995 Sep 25

NPN 6 GHz wideband transistors

BFG93A; BFG93A/X; BFG93A/XR

FEATURES

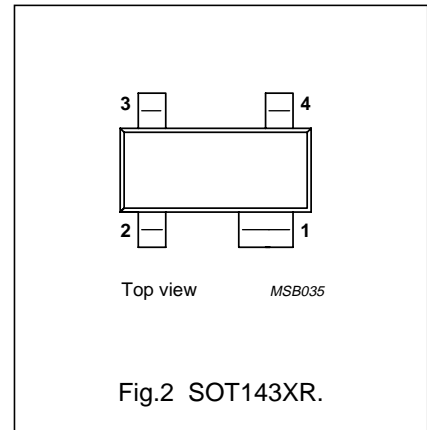
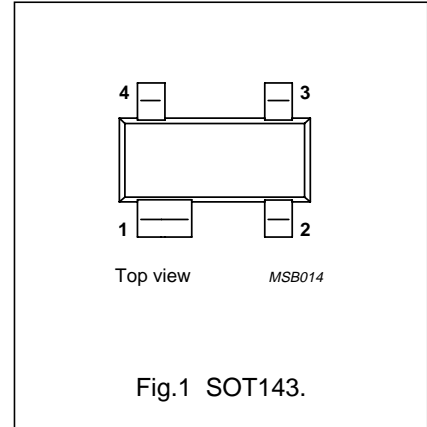
- High power gain
- Low noise figure
- Gold metallization ensures excellent reliability.

DESCRIPTION

The BFG93 is a silicon NPN transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is primarily intended for wideband applications in the UHF and microwave range.

PINNING

PIN	DESCRIPTION
BFG93A (Fig.1) Code: R8	
1	collector
2	base
3	emitter
4	emitter
BFG93A/X (Fig.1) Code: V15	
1	collector
2	emitter
3	base
4	emitter
BFG93A/XR (Fig.2) Code: V33	
1	collector
2	emitter
3	base
4	emitter



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	15	V
V_{CEO}	collector-emitter voltage	open base	–	–	12	V
I_C	collector current	DC value	–	–	35	mA
P_{tot}	total power dissipation	up to $T_S = 85\text{ }^\circ\text{C}$; note 1	–	–	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

Note

1. T_S is the temperature at the soldering point of the collector tab.

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LIMITING VALUES

In accordance with the Absolute Maximum 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 value, continuous	–	35	mA
P _{tot}	total power dissipation	up to T _S = 85 °C; note 1	–	300	mW
T _{stg}	storage temperature range		–65	+150	°C
T _j	junction operating temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
R _{th j-s}	from junction to soldering point; note 1	290	K/W

Note

1. T_S is the temperature at the soldering point of the collector tab.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

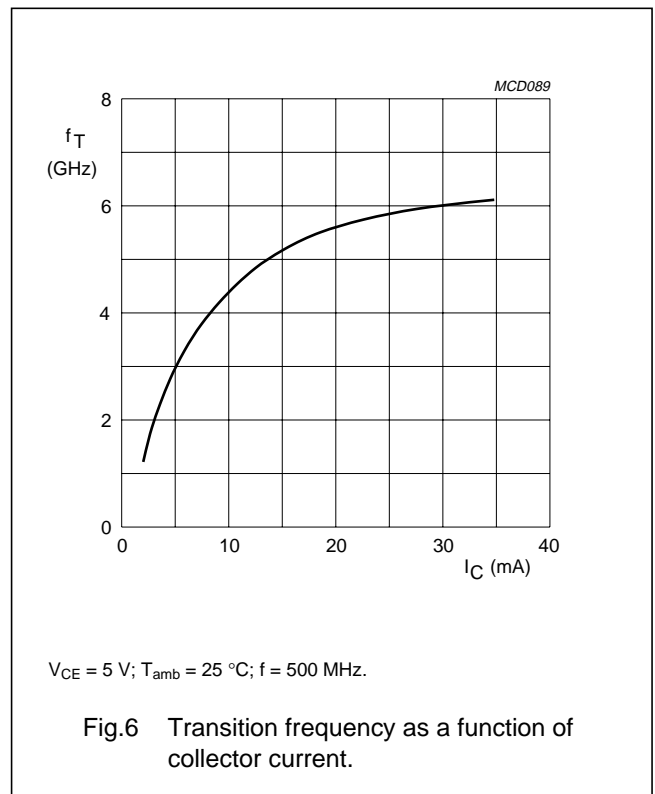
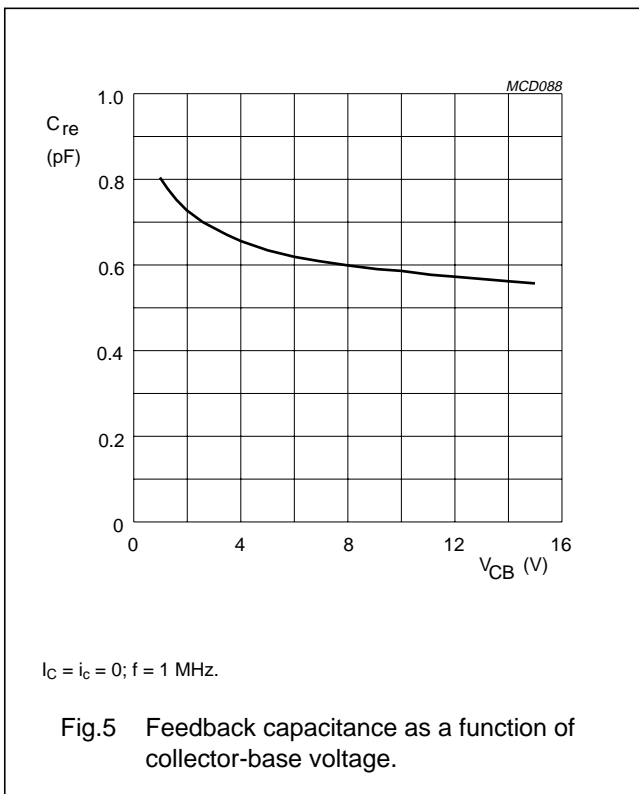
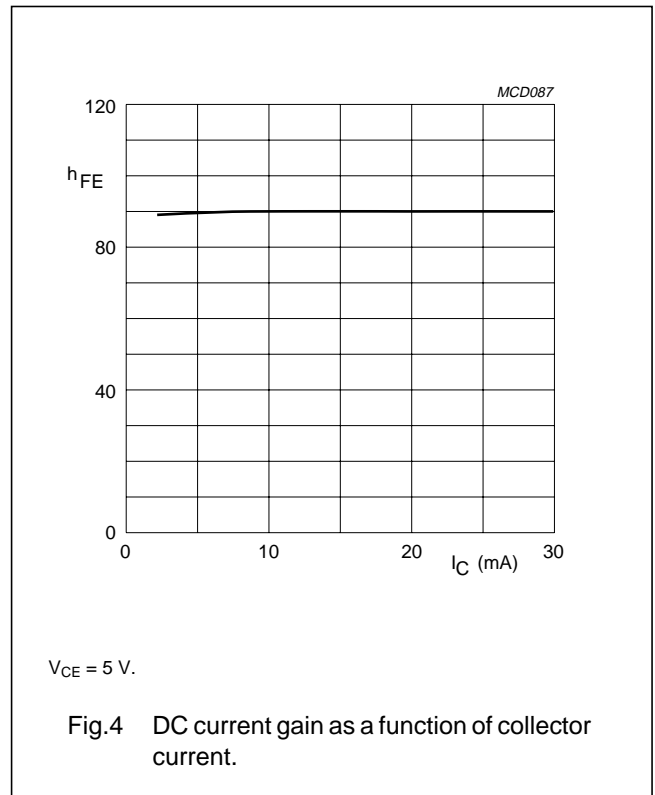
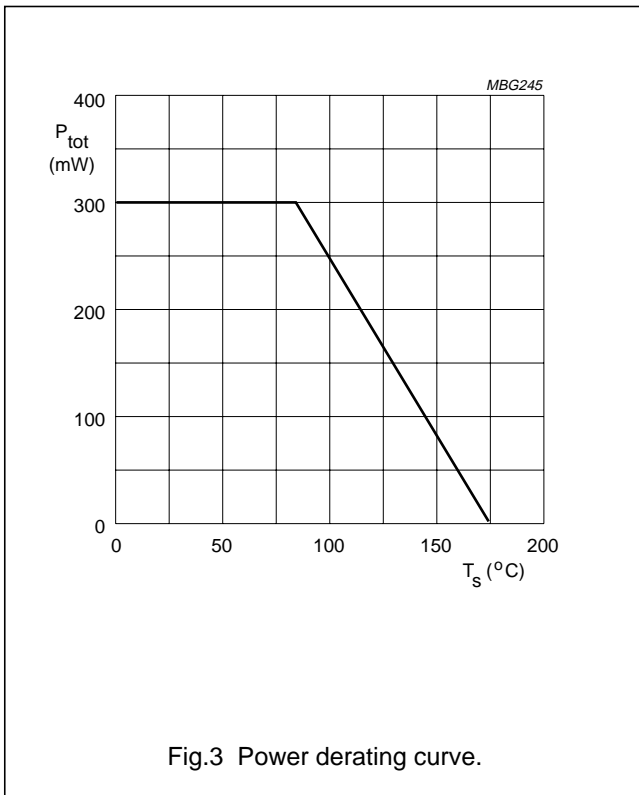
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I _{CBO}	collector leakage current	I _E = 0; V _{CB} = 5 V	–	–	50	nA
h _{FE}	DC current gain	I _C = 30 mA; V _{CE} = 5 V	40	90	–	
C _c	collector capacitance	I _E = i _e = 0; V _{CB} = 5 V; f = 1 MHz	–	0.9	–	pF
C _e	emitter capacitance	I _C = i _c = 0; V _{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.

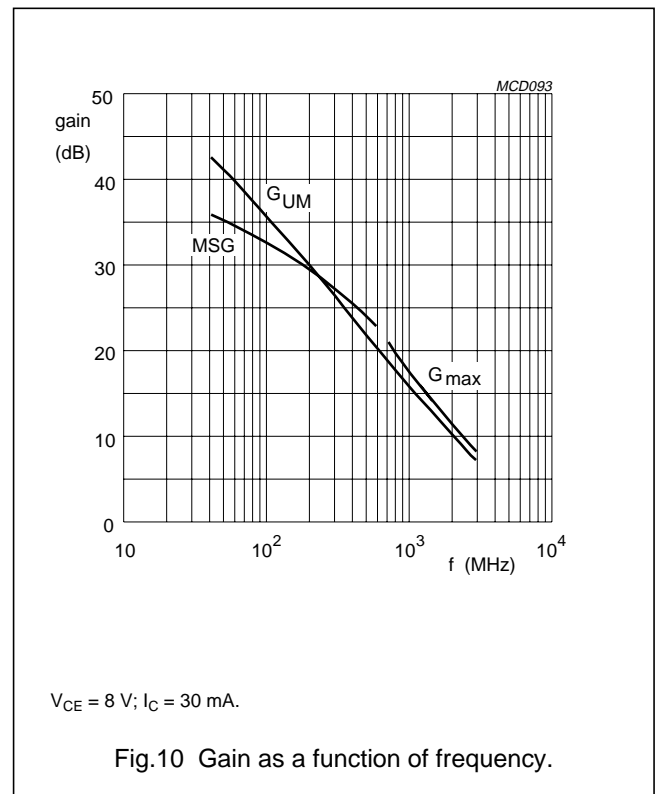
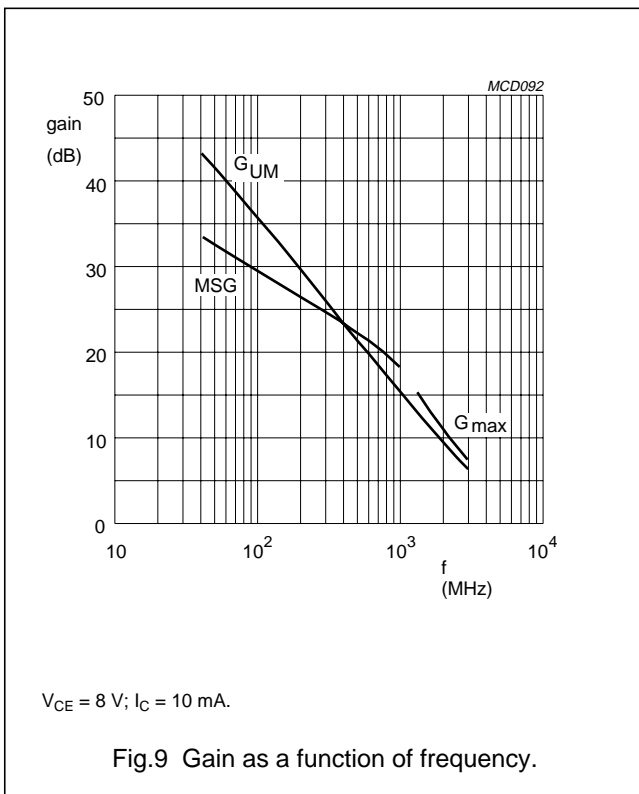
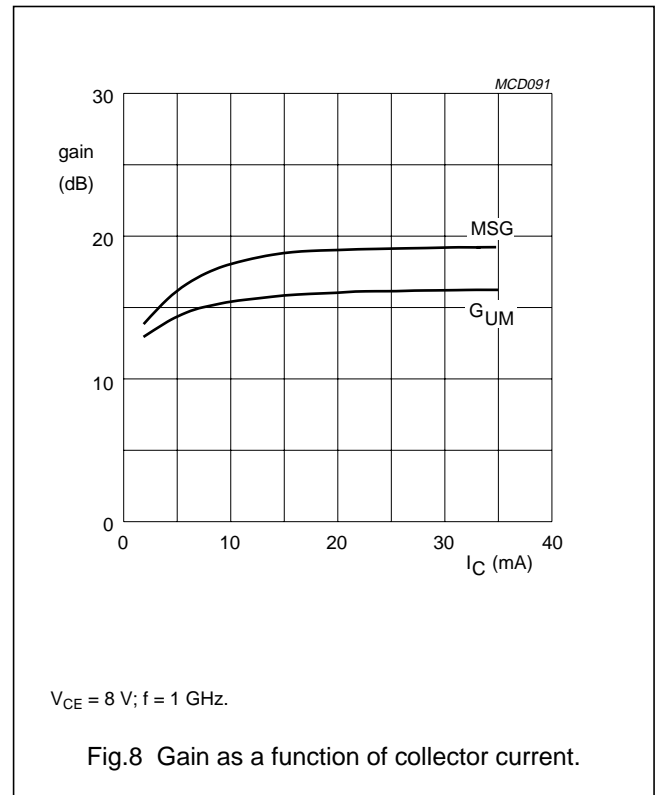
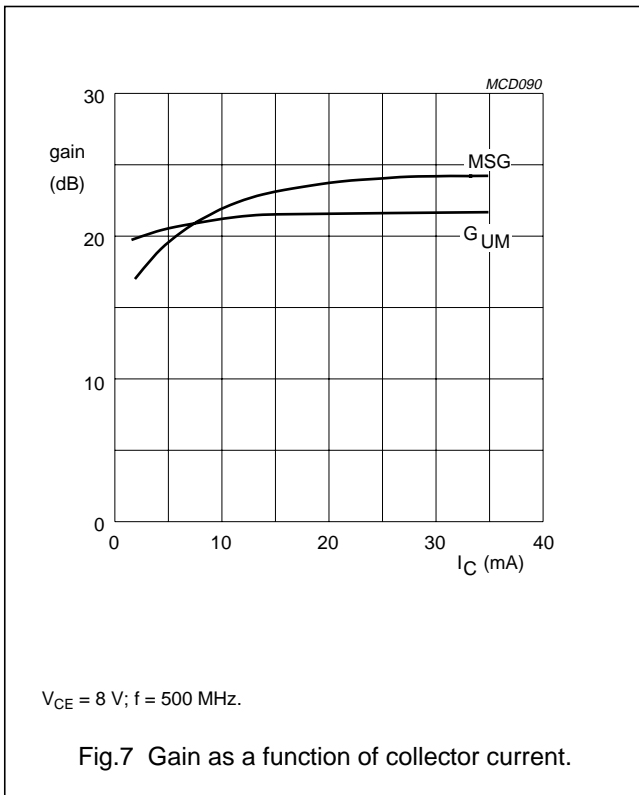
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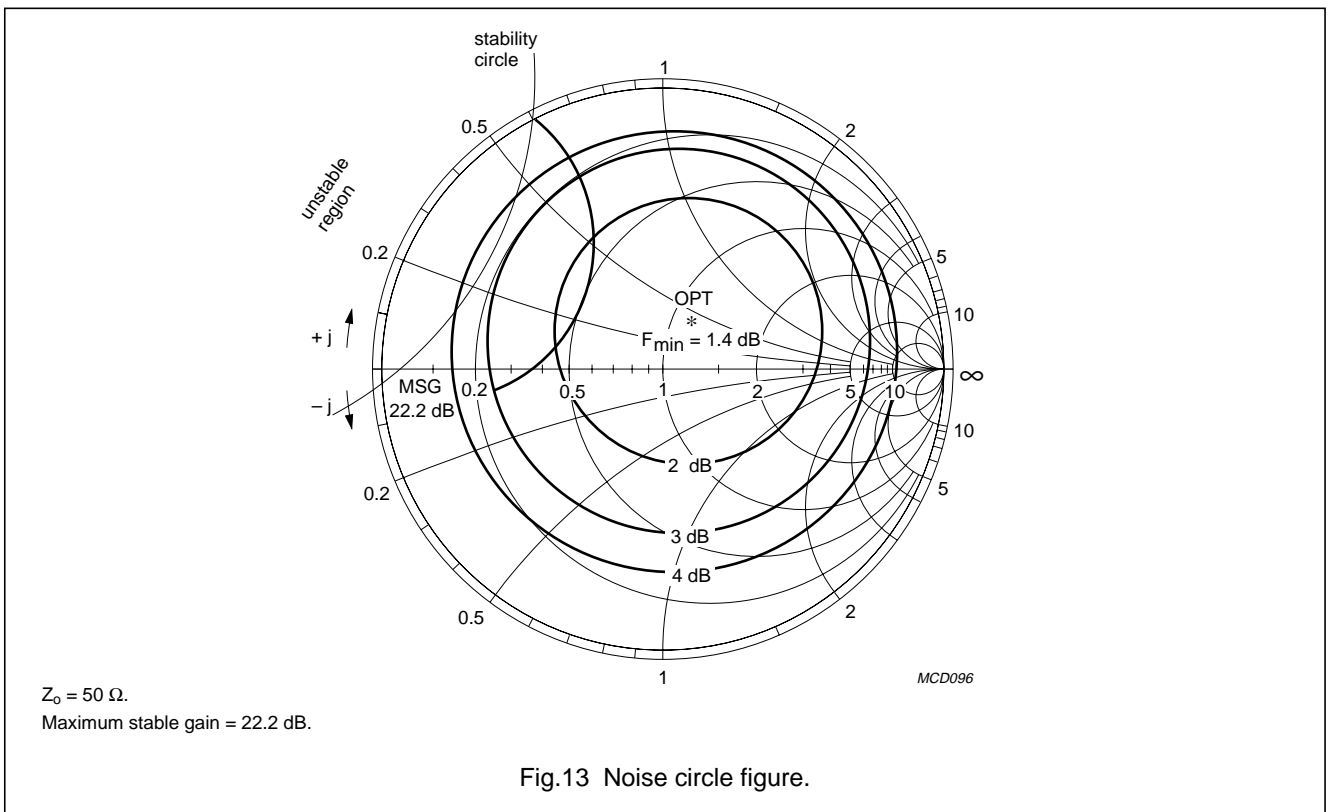
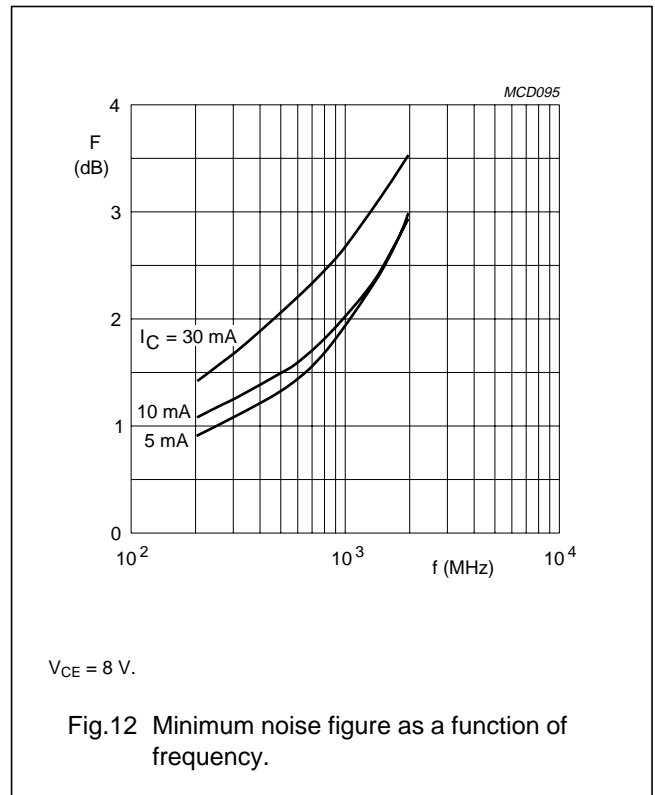
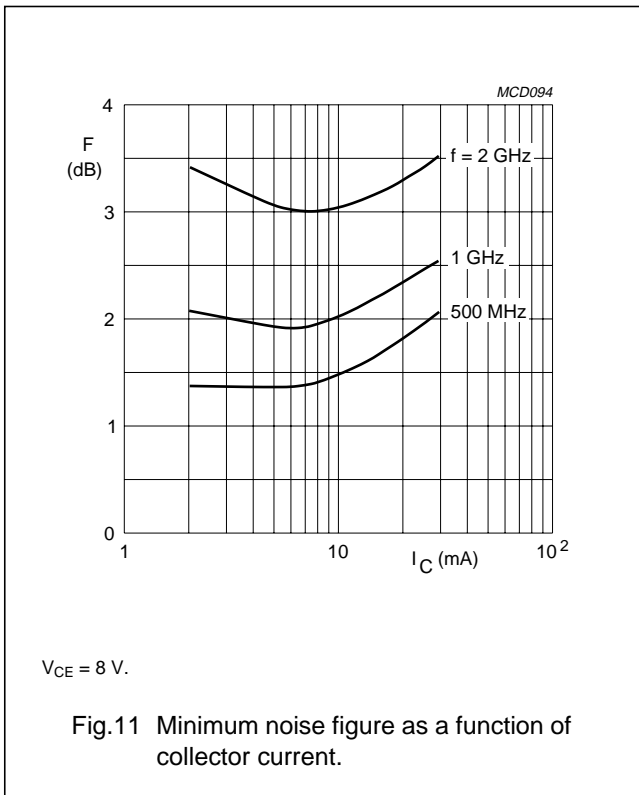
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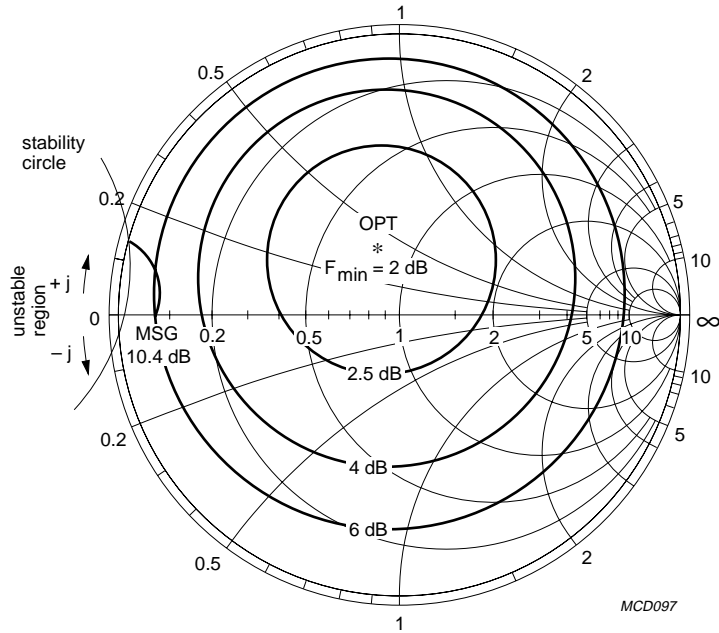
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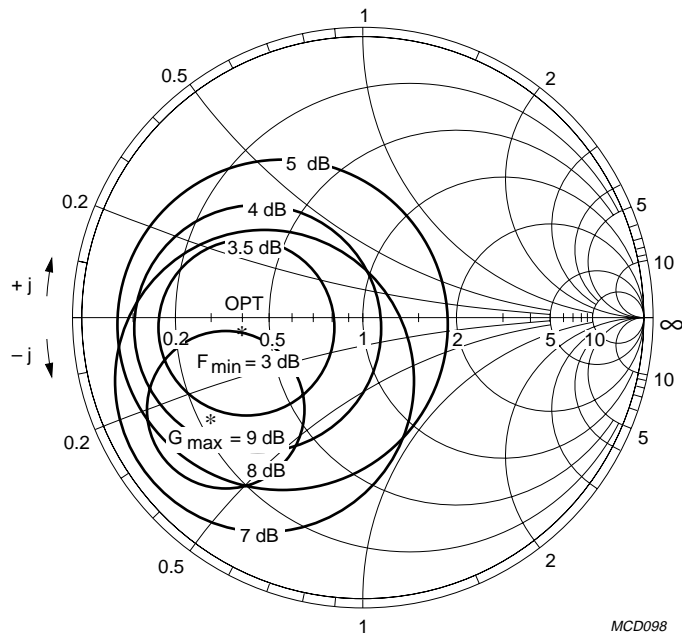
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$Z_0 = 50 \Omega$.
Maximum stable gain = 10.4 dB.

Fig.14 Noise circle figure.

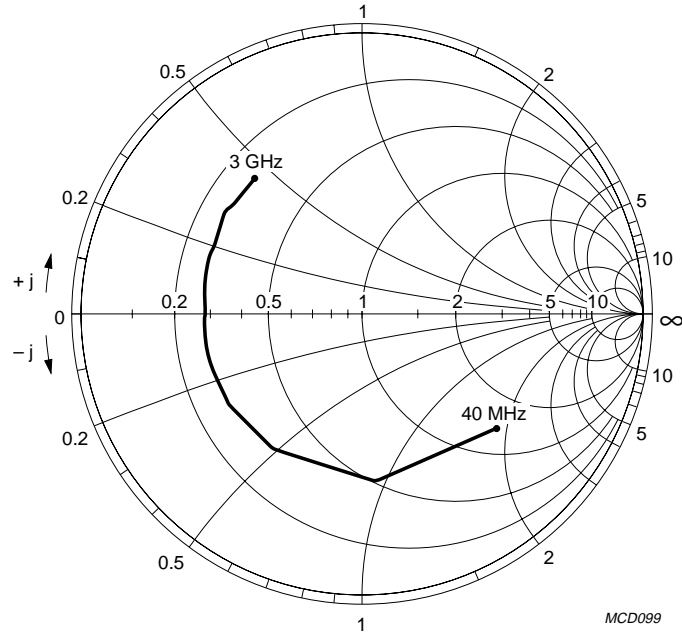


$Z_0 = 50 \Omega$.

Fig.15 Noise circle figure.

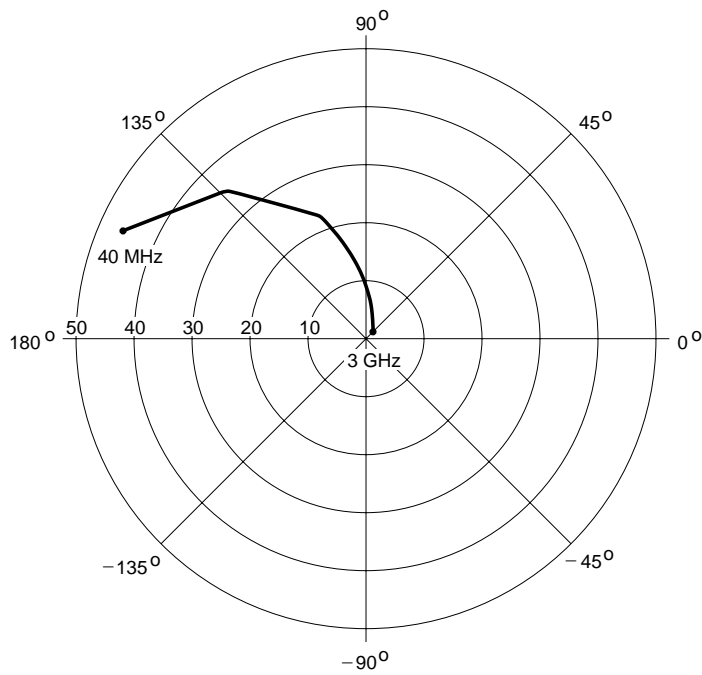
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$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}; Z_o = 50\ \Omega.$

Fig.16 Common emitter input reflection coefficient (S_{11}).

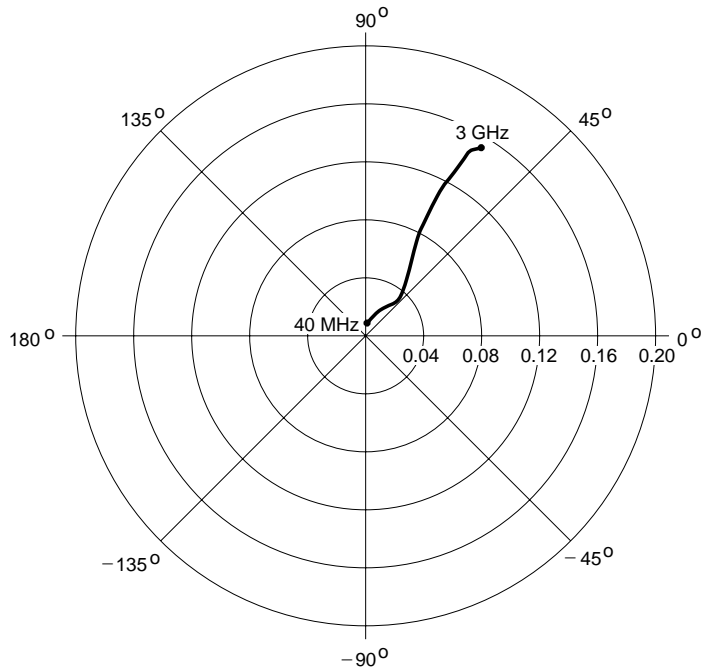


$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}; R_{max} = 50\ \Omega$

Fig.17 Common emitter forward transmission coefficient (S_{21}).

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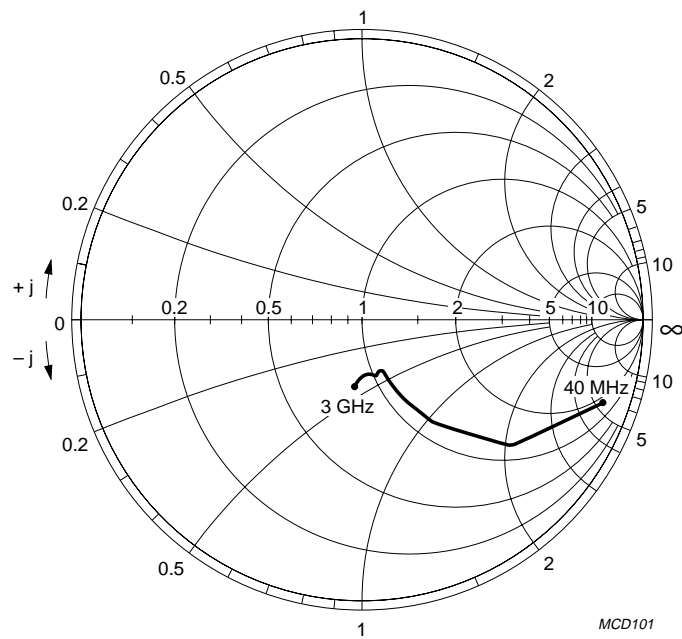
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$V_{CE} = 8\text{ V}; I_C = 30\text{ mA}; R_{max} = 0.2\ \Omega$

MCD102

Fig.18 Common emitter reverse transmission coefficient (S_{12}).



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

MCD101

Fig.19 Common emitter output reflection coefficient (S_{22}).

NPN 6 GHz wideband transistors

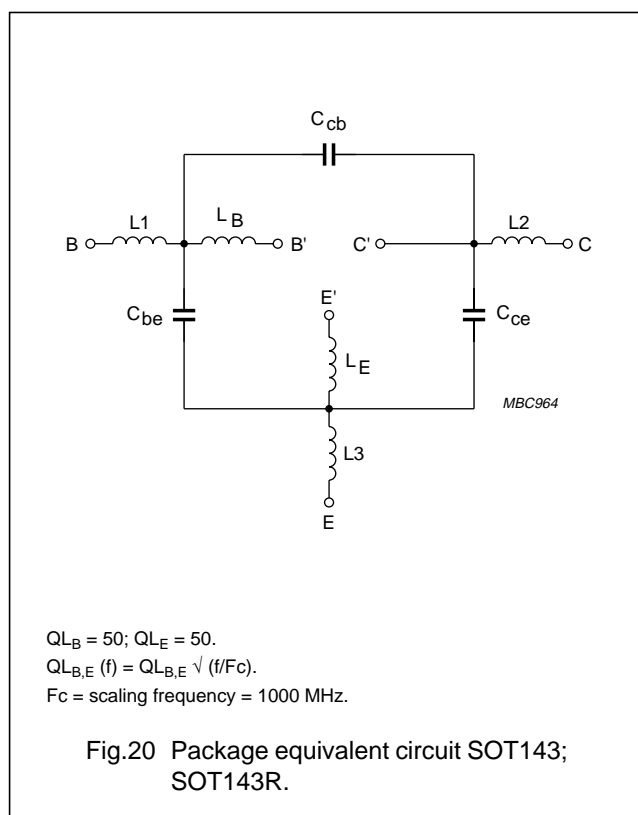
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BFG93A/XR

SPICE parameters for BFR91A crystal

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	μ A
16	RBM	10.00	Ω
17	RE	763.6	m Ω
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
36 (note 1)	VJS	750.0	mV
37 (note 1)	MJS	0.000	–
38	FC	800.0	m

Note

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

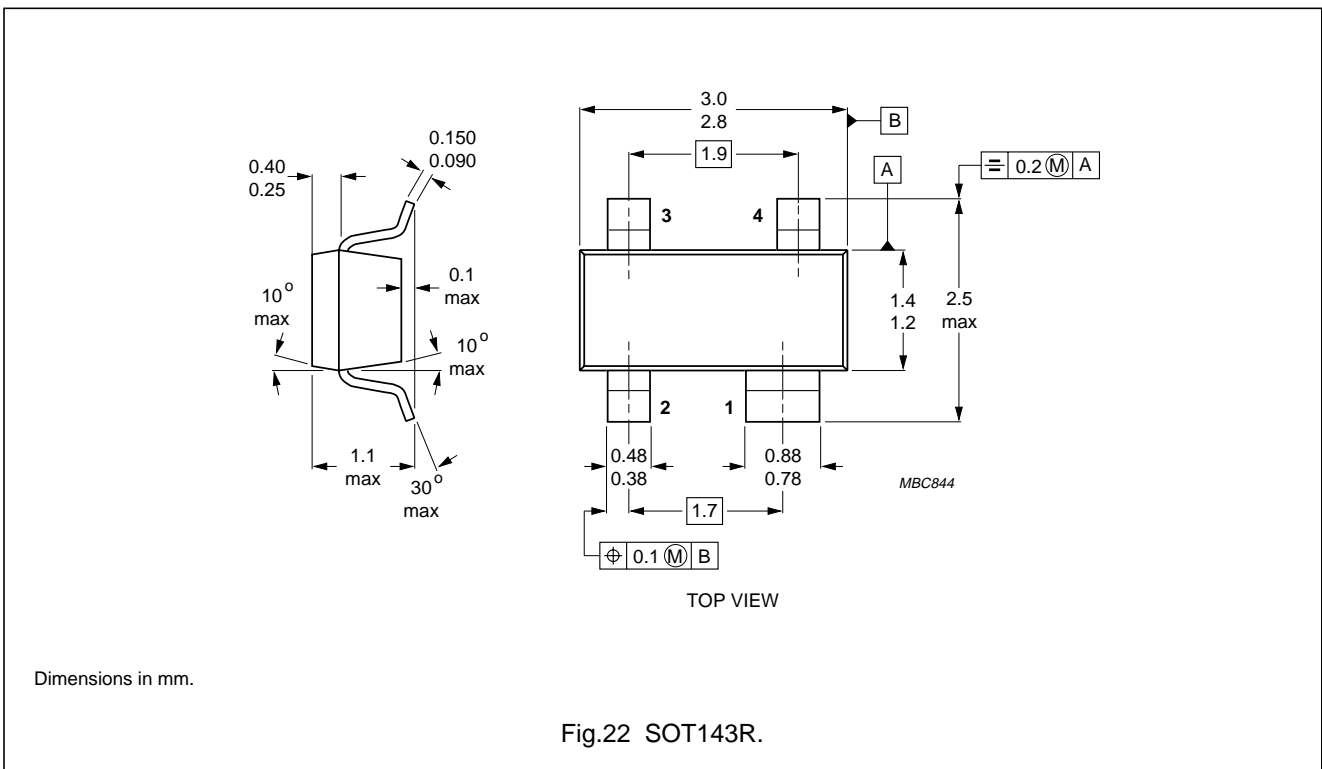
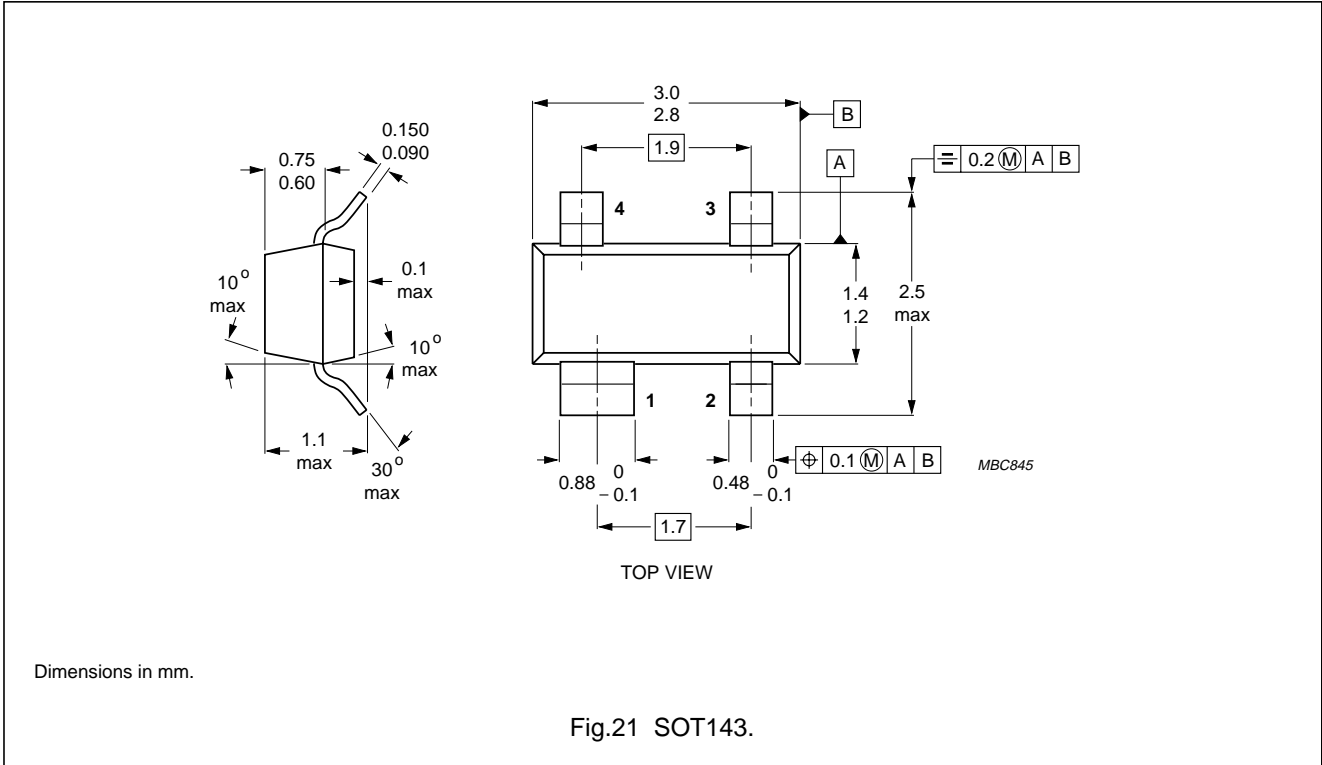
**List of components (see Fig.20)**

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

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PACKAGE OUTLINES



NPN 6 GHz wideband transistors

BFG93A; BFG93A/X;
BFG93A/XR**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

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