

BFG93A; BFG93A/X

NPN 6 GHz wideband transistors

Rev. 05 — 26 November 2007 Product data sheet

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NPN 6 GHz wideband transistors BFG93A; BFG93A/X

FEATURES

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

APPLICATIONS

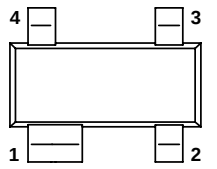
Wideband applications in the UHF and microwave range.

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



Top view MSB014

Fig.1 SOT143B.

MARKING

TYPE NUMBER	CODE
BFG93A	R8%
BFG93A/X	%MX

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)		–	–	35	mA
P_{tot}	total power dissipation	$T_s \leq 85$ °C	–	–	300	mW
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	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	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.7	–	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	–	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	$T_s \leq 85$ °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
$R_{th\ j\text{-}s}$	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	$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ mA; $V_{CE} = 8$ V; $T_{amb} = 25$ °C; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5$ 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 S_{12} is zero and $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$ dB.

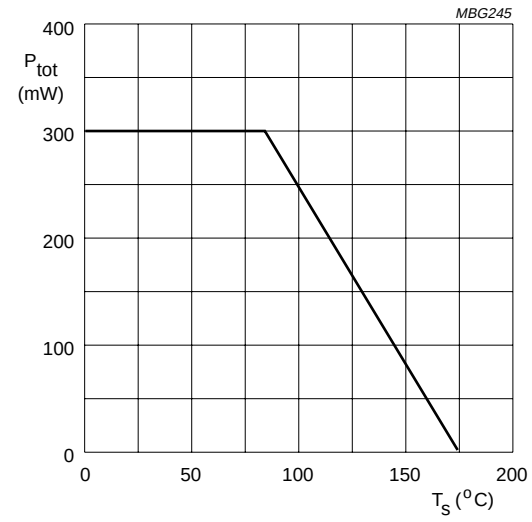
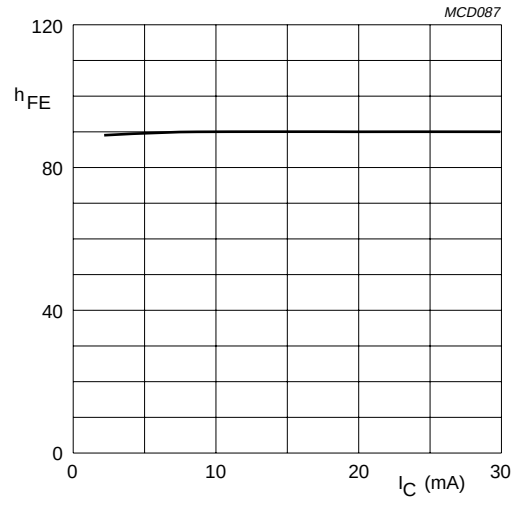
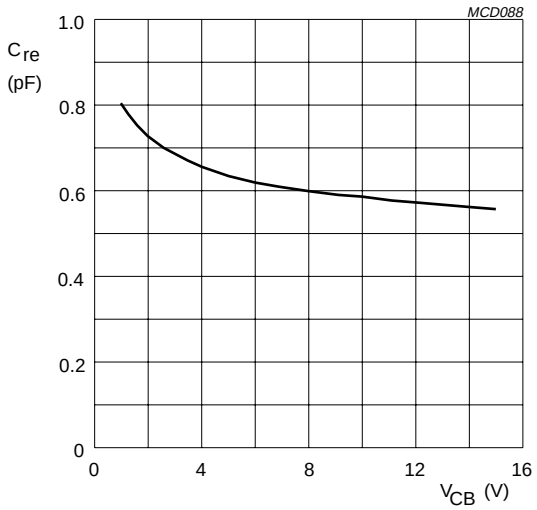


Fig.2 Power derating curve.



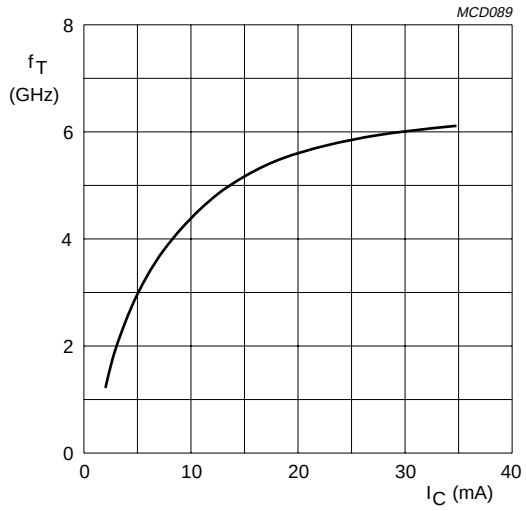
V_{CE} = 5 V.

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



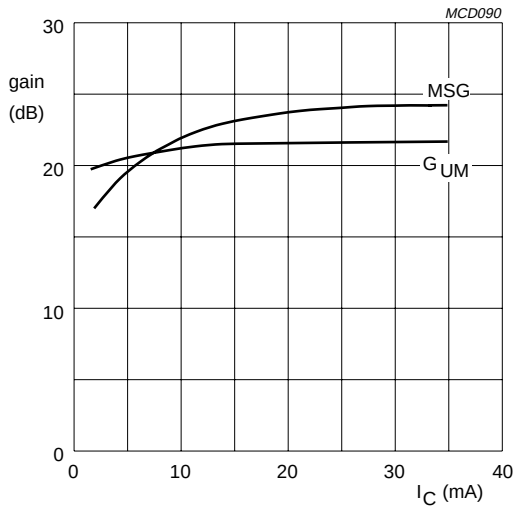
$I_C = i_c = 0$; f = 1 MHz.

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



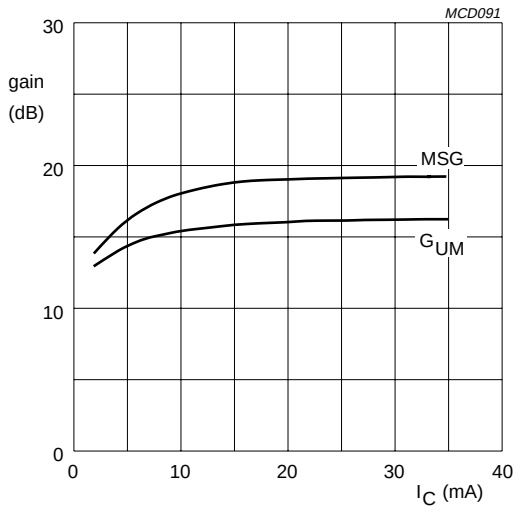
V_{CE} = 5 V; T_{amb} = 25 °C; f = 500 MHz.

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



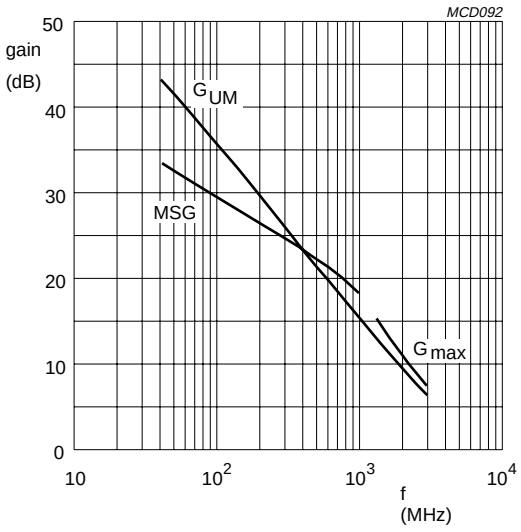
V_{CE} = 8 V; f = 500 MHz.

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



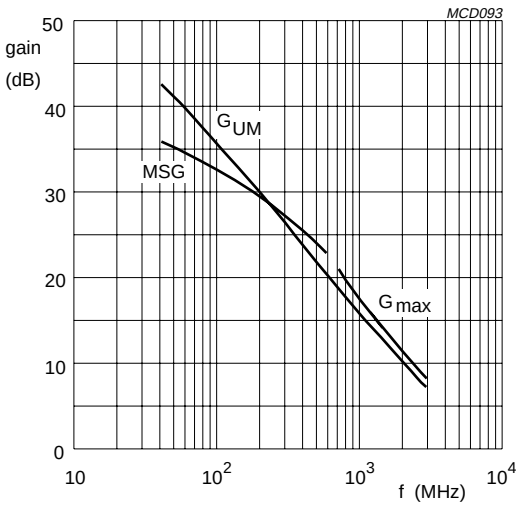
V_{CE} = 8 V; f = 1 GHz.

Fig.7 Gain as a function of collector current; typical values.



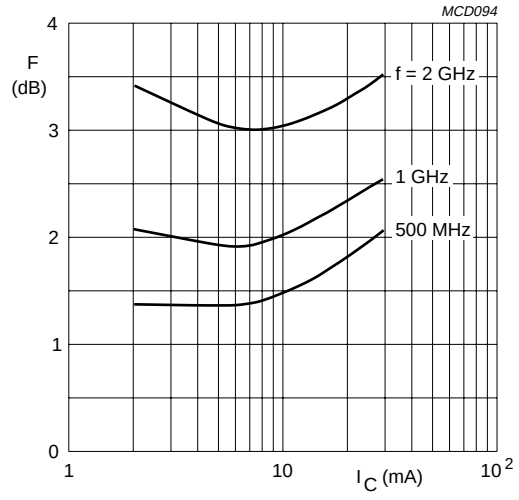
V_{CE} = 8 V; I_C = 10 mA.

Fig.8 Gain as a function of frequency; typical values.



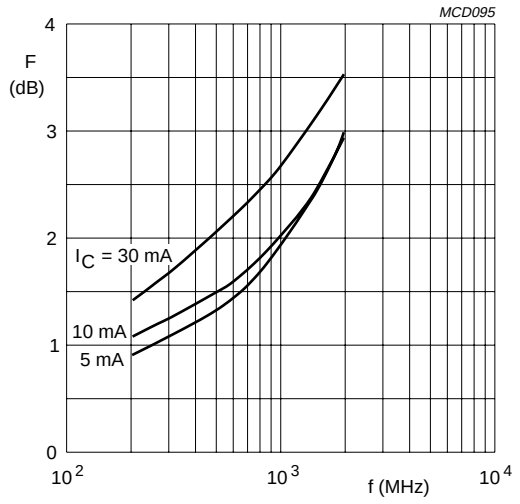
V_{CE} = 8 V; I_C = 30 mA.

Fig.9 Gain as a function of frequency; typical values.



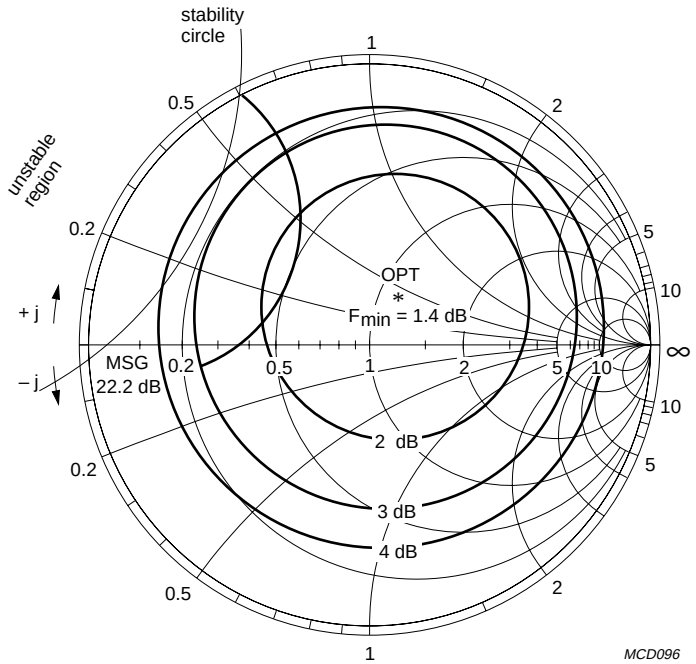
V_{CE} = 8 V.

Fig.10 Minimum noise figure as a function of collector current; typical values.



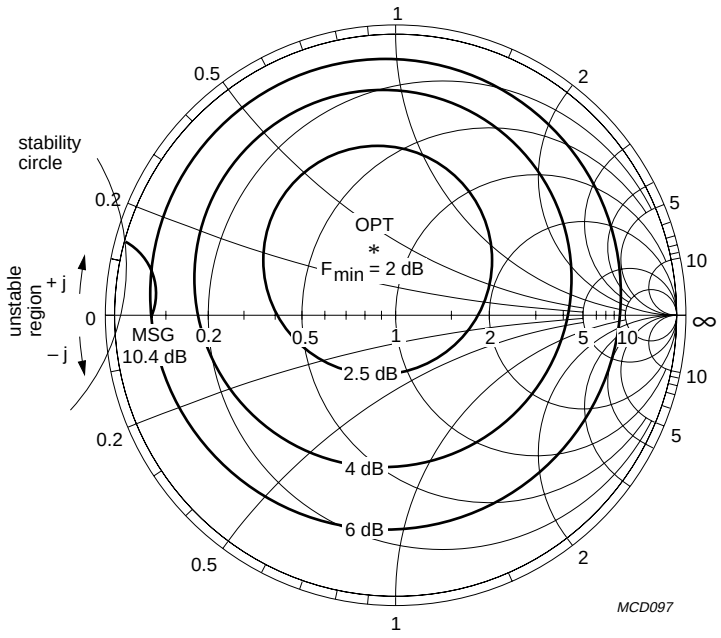
V_{CE} = 8 V.

Fig.11 Minimum noise figure as a function of frequency; typical values.



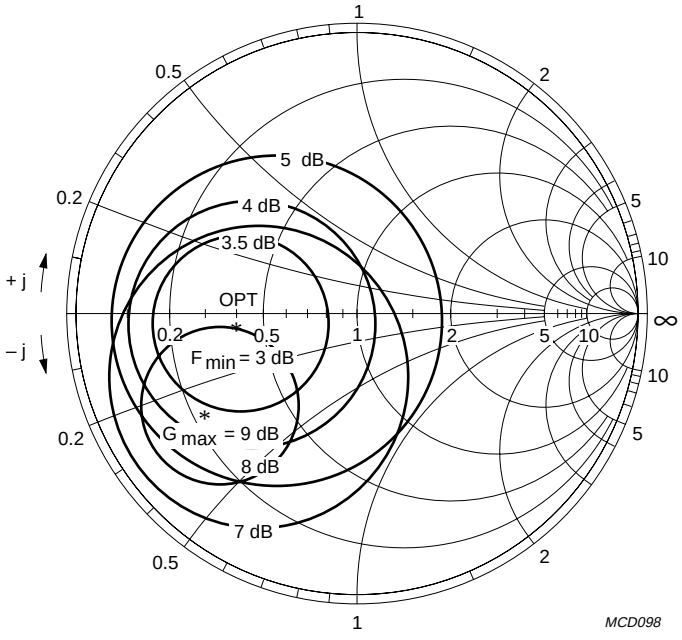
Z_o = 50 Ω.
Maximum stable gain = 22.2 dB.

Fig.12 Common emitter noise figure circles; typical values.



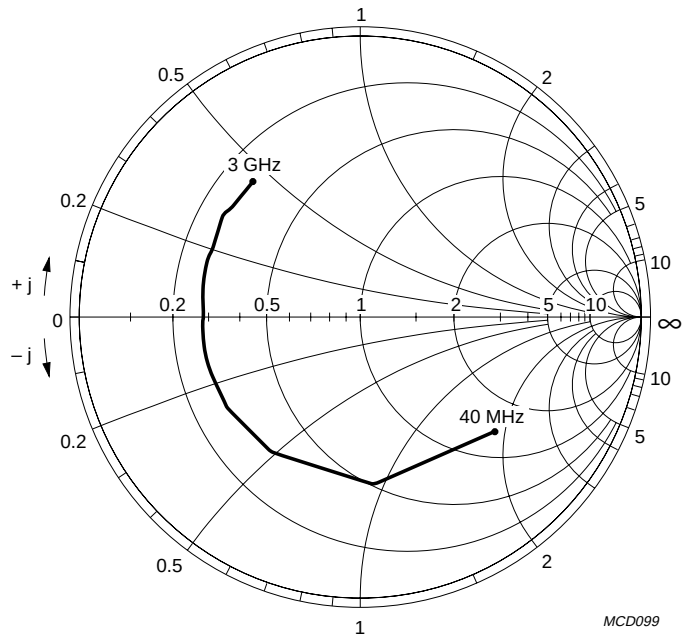
Z_o = 50 Ω.
Maximum stable gain = 10.4 dB.

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



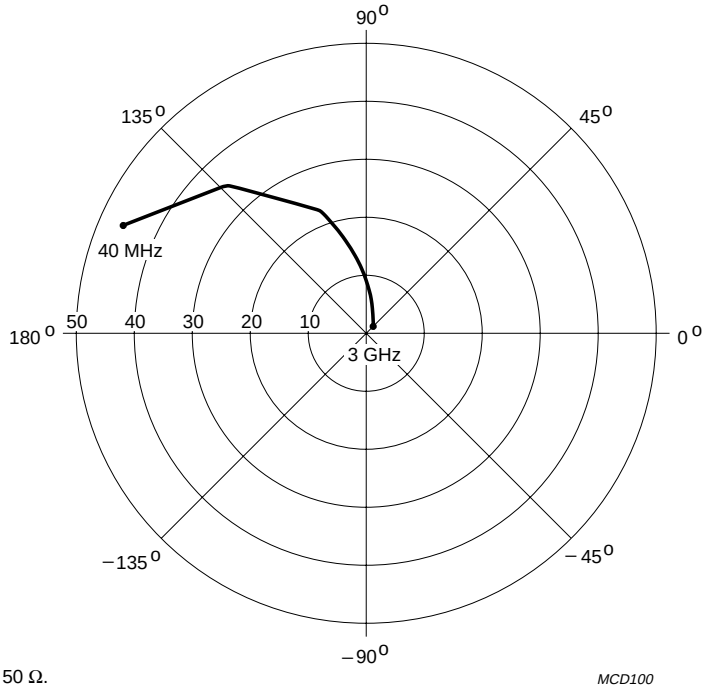
Z_o = 50 Ω.

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



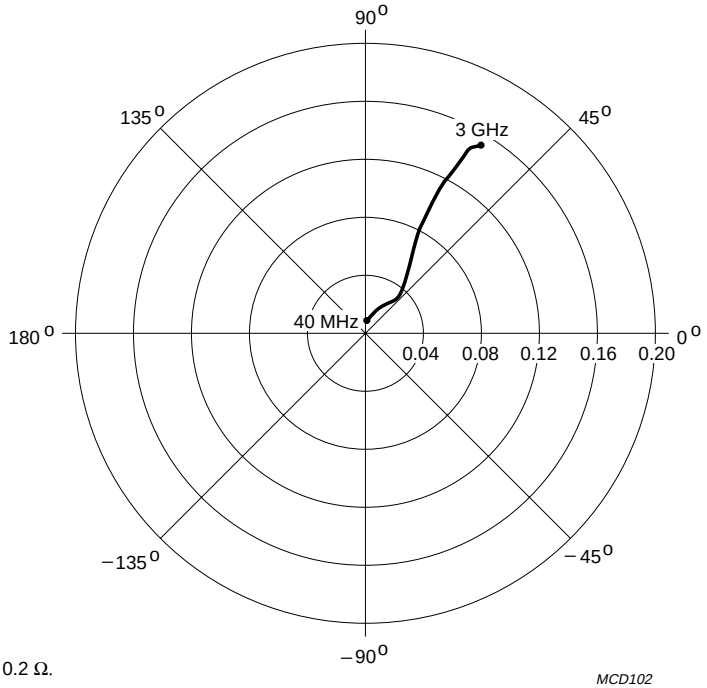
V_{CE} = 8 V; I_C = 30 mA; Z_o = 50 Ω.

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



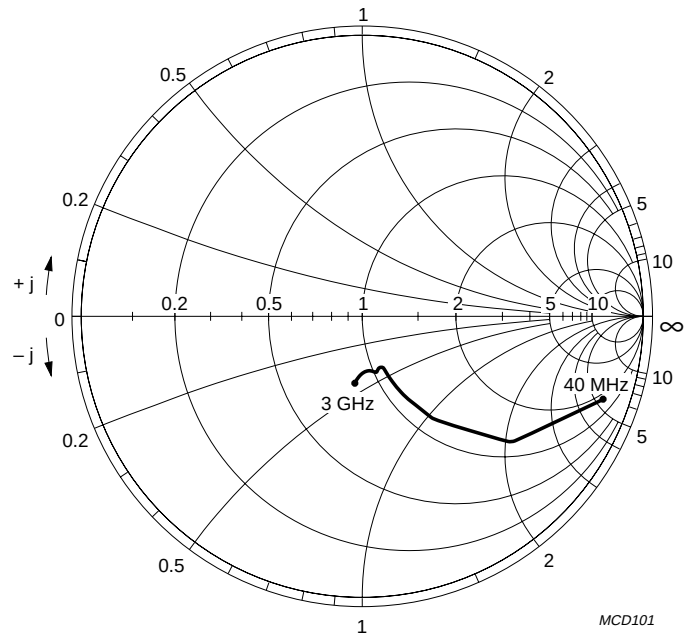
V_{CE} = 8 V; I_C = 30 mA; R_{max} = 50 Ω.

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



V_{CE} = 8 V; I_C = 30 mA; R_{max} = 0.2 Ω.

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



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

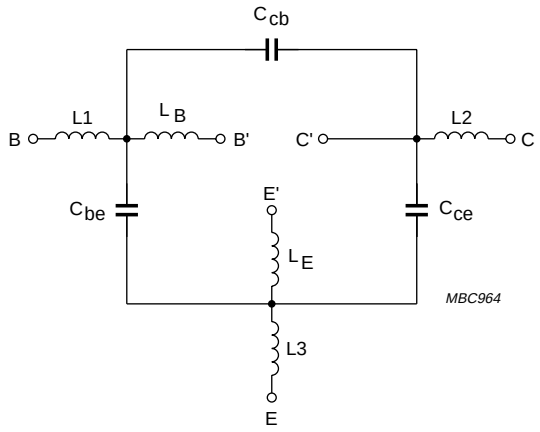
Fig.18 Common emitter output reflection coefficient (S_{22}).

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
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.



$QL_B = 50$; $QL_E = 50$.
$QL_{B,E}(f) = QL_{B,E} \sqrt{(f/f_c)}$.
f_c = scaling frequency = 1000 MHz.

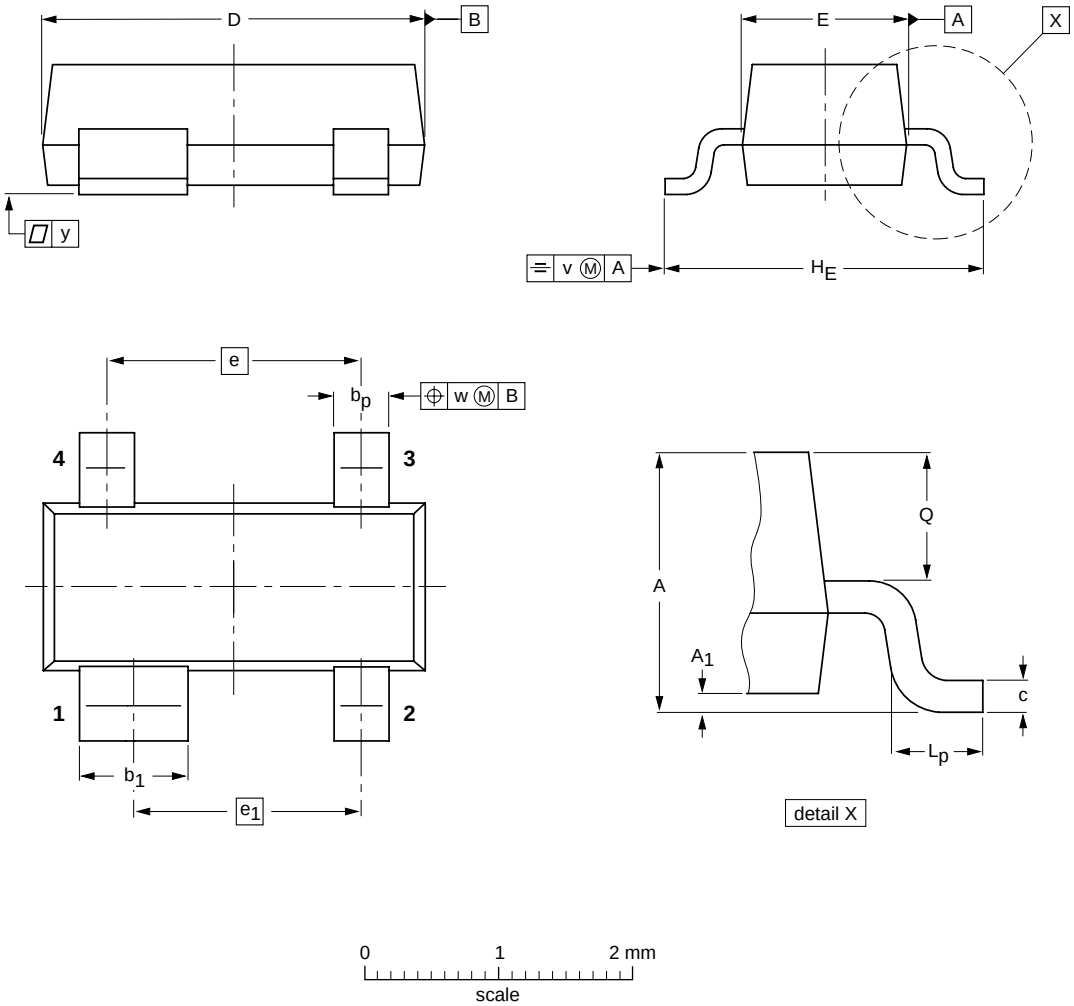
Fig.19 Package equivalent circuit SOT143B.

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

PACKAGE OUTLINE

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

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Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Revision history

Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFG93A_X_N_5	20071126	Product data sheet	-	BFG93A_X_4
Modifications:	• Marking table on page 2; changed code			
BFG93A_X_4 (9397 750 04351)	19980923	Product specification	-	BFG93SERIES_3
BFG93SERIES_3	19950925	Product specification	-	BFG93SERIES_2
BFG93SERIES_2	-	Product specification	-	BFG93_SERIES_1
BFG93_SERIES_1	-	-	-	-

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