

BFG93A; BFG93A/X

NPN 6 GHz wideband transistors

Rev. 05 — 26 November 2007

Product data sheet

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NXP Semiconductors

NPN 6 GHz wideband transistors

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FEATURES

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

APPLICATIONS

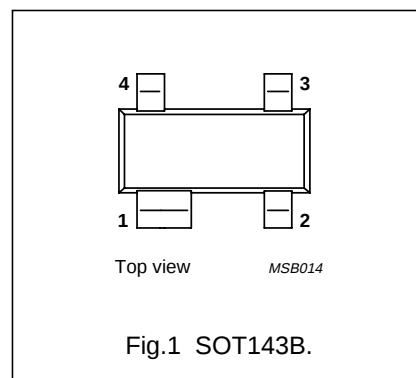
Wideband applications in the UHF and microwave range.

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	%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	$T_s \leq 85\text{ }^{\circ}\text{C}$	—	—	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

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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	$T_s \leq 85\text{ °C}$; note 1	–	300	mW
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction operating temperature		–	175	°C

Note

- 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

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

CHARACTERISTICS

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

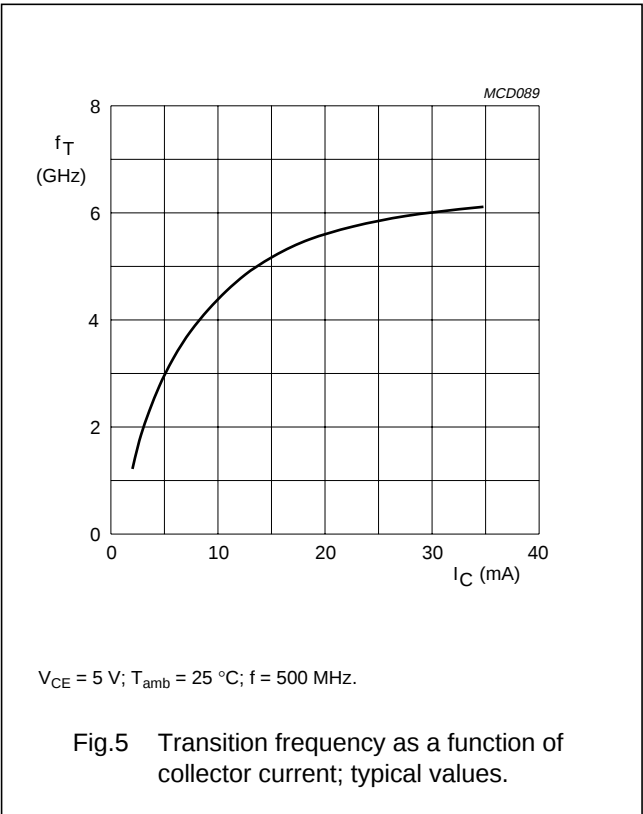
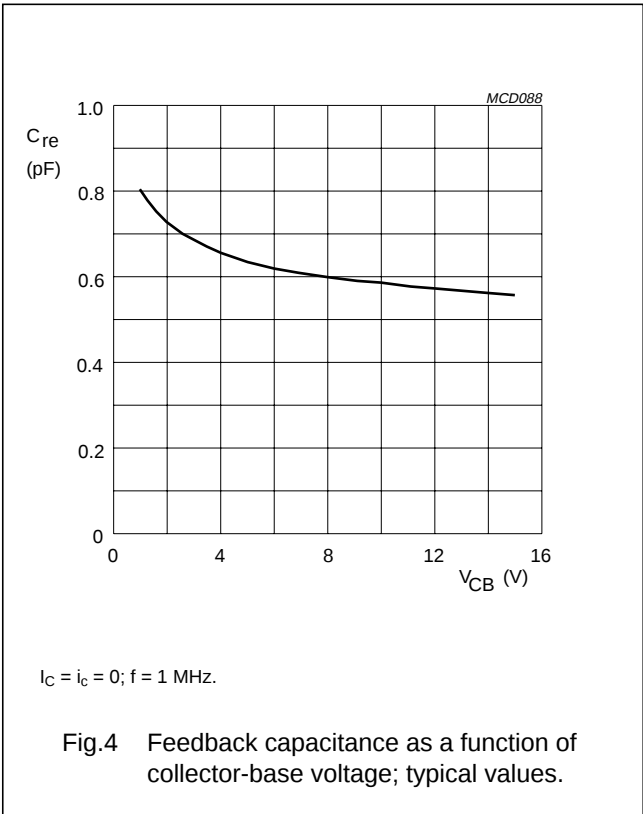
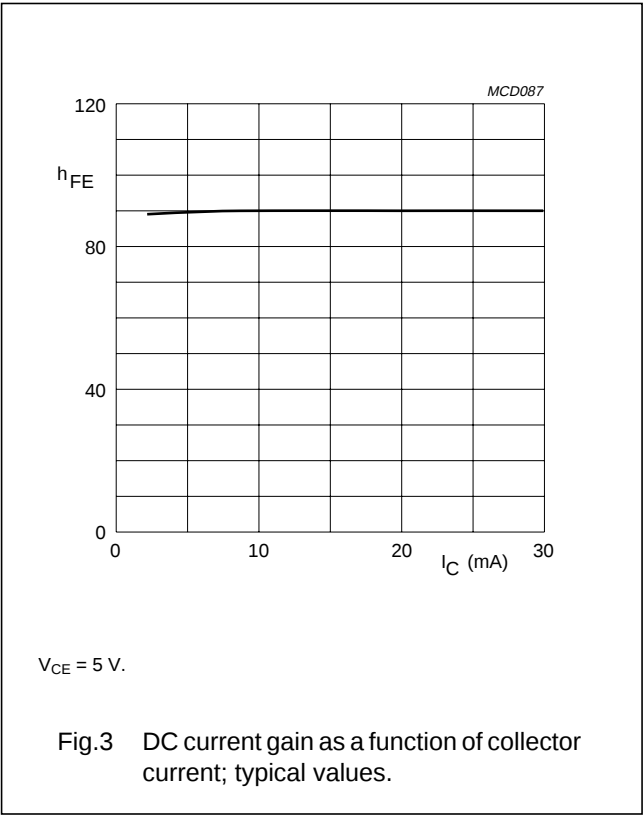
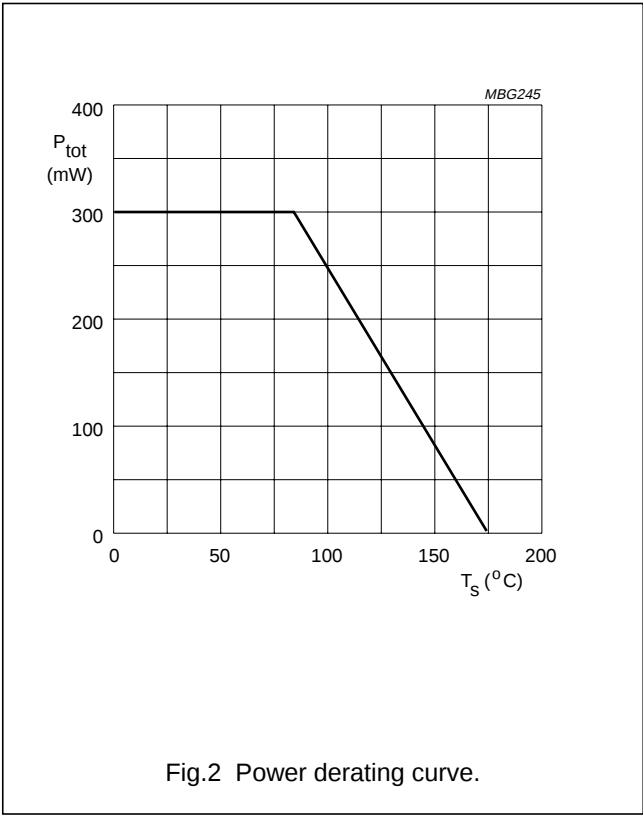
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	$I_E = 0$; $V_{CB} = 5\text{ V}$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$	40	90	–	
C_c	collector capacitance	$I_E = I_C = 0$; $V_{CB} = 5\text{ V}$; $f = 1\text{ MHz}$	–	0.9	–	pF
C_e	emitter capacitance	$I_C = I_C = 0$; $V_{EB} = 5\text{ V}$; $f = 1\text{ MHz}$	–	1.9	–	pF
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; note 1	$I_C = 30\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 1\text{ GHz}$	–	16	–	dB
		$I_C = 30\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 2\text{ GHz}$	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 1\text{ GHz}$	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 5\text{ mA}$; $V_{CE} = 8\text{ V}$; $T_{amb} = 25\text{ °C}$; $f = 2\text{ GHz}$	–	2.3	–	dB

Note

- 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.

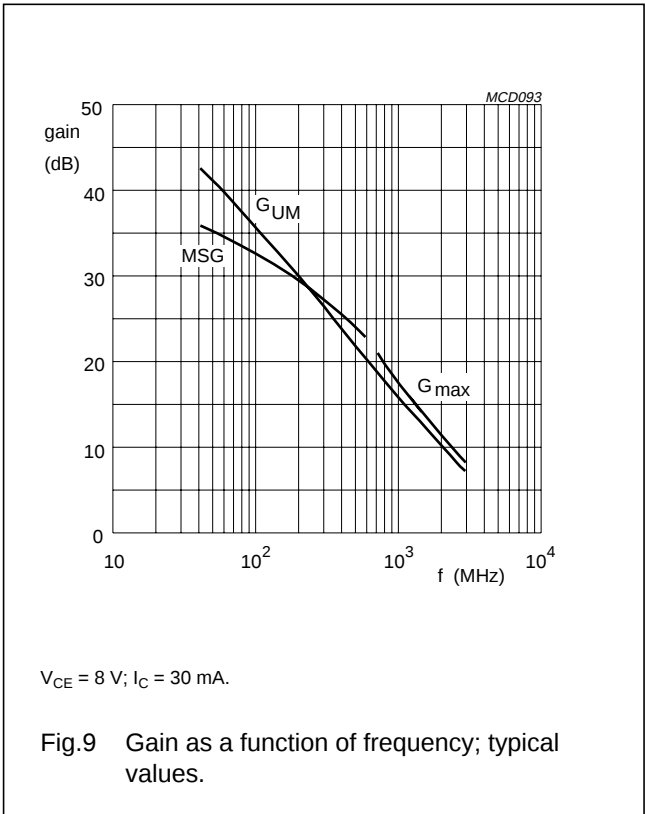
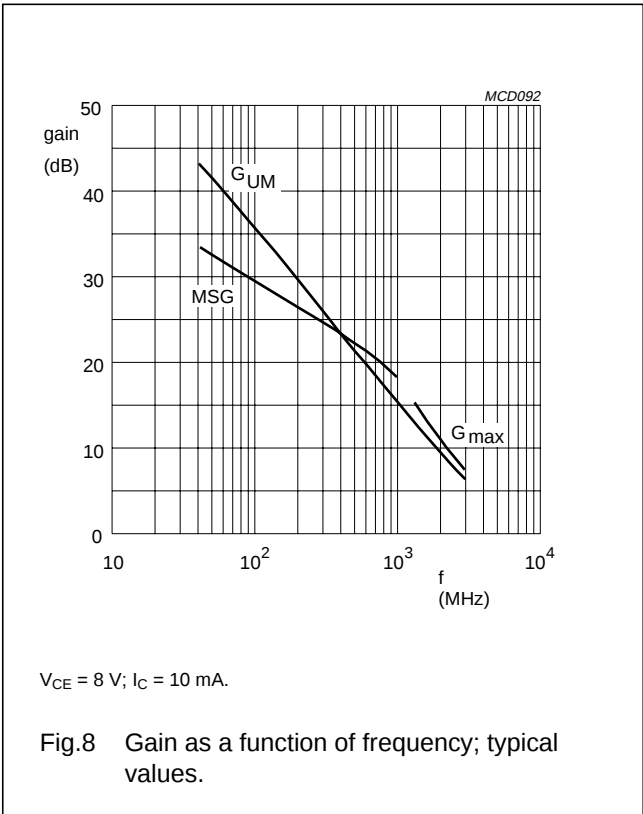
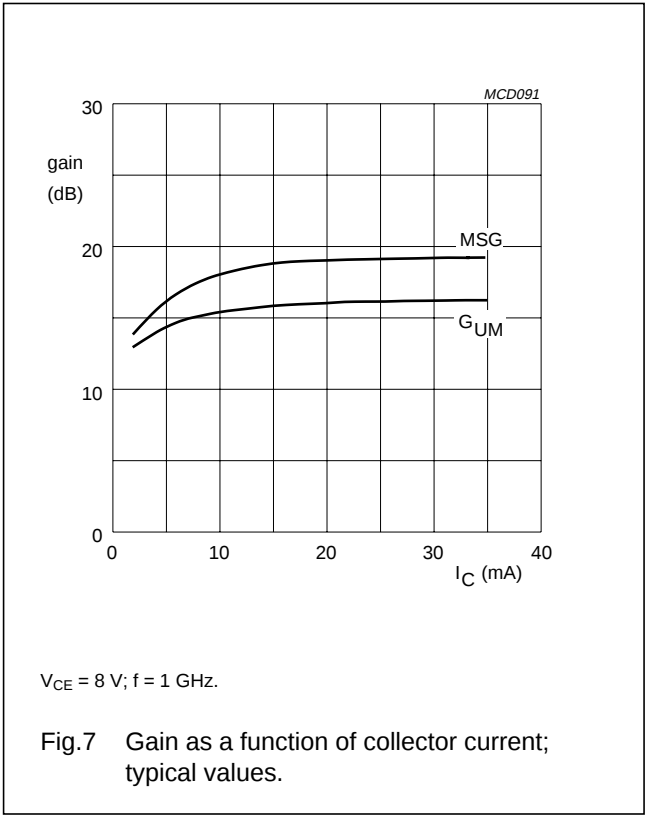
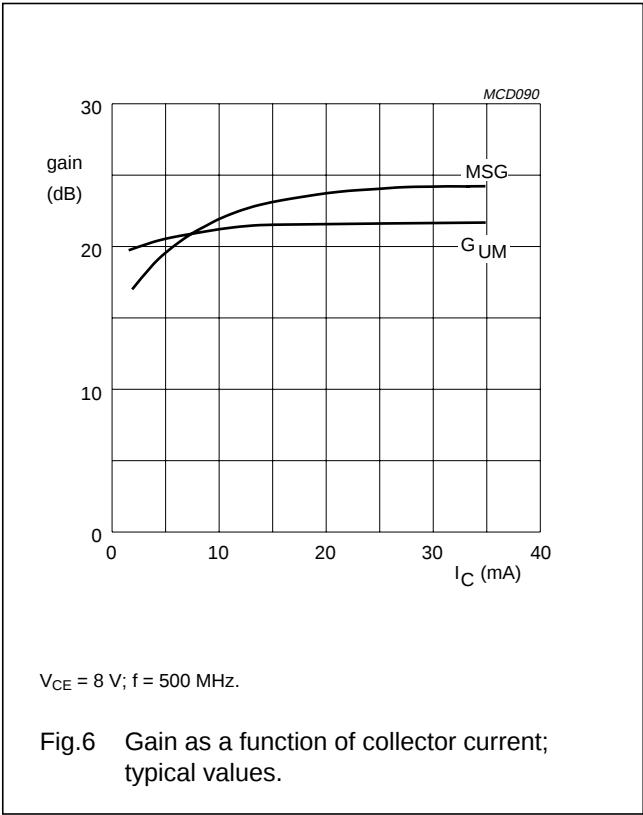
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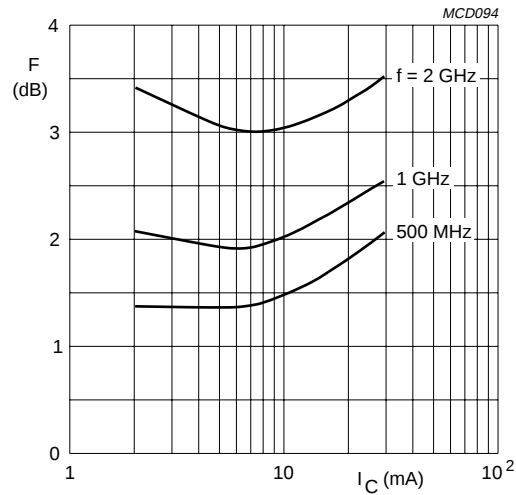
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BFG93A; BFG93A/X



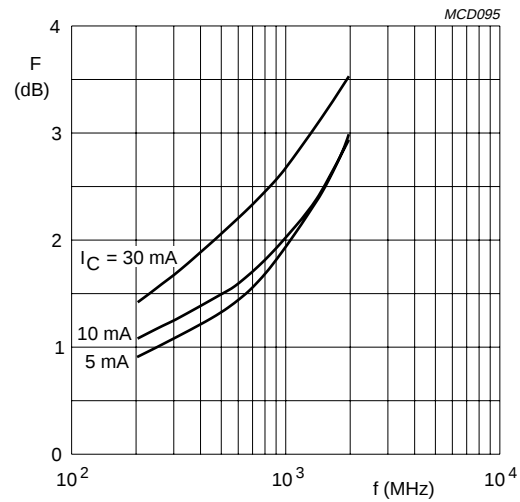
NPN 6 GHz wideband transistors

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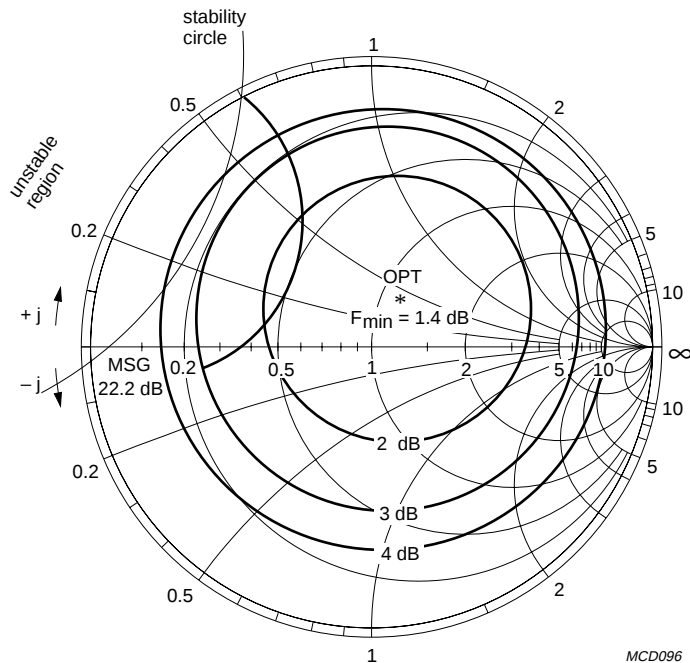
$V_{CE} = 8$ V.

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.

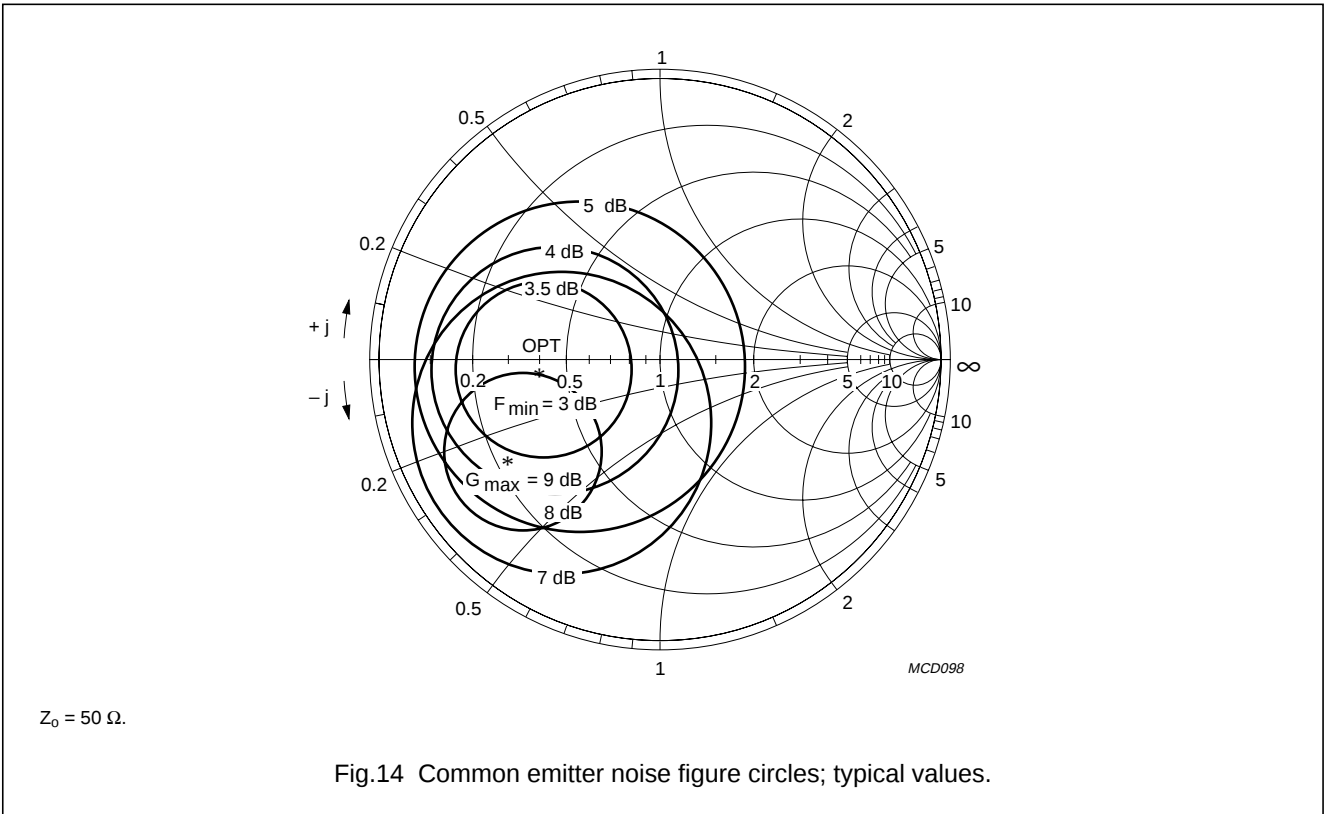
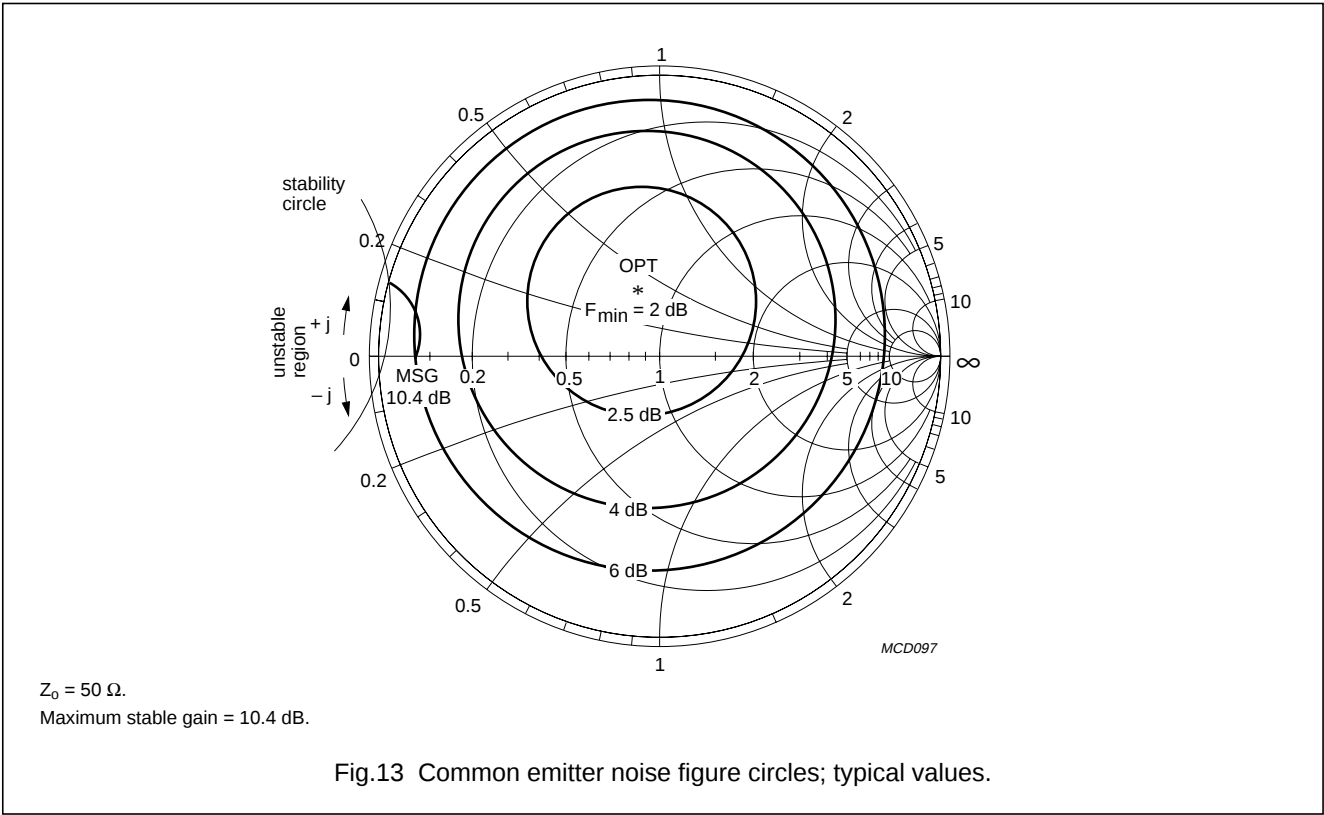


$Z_0 = 50 \Omega$.
Maximum stable gain = 22.2 dB.

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

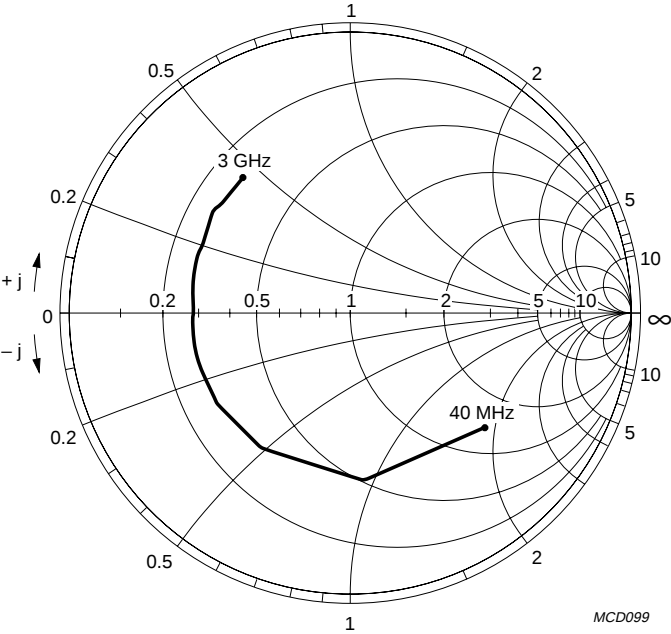
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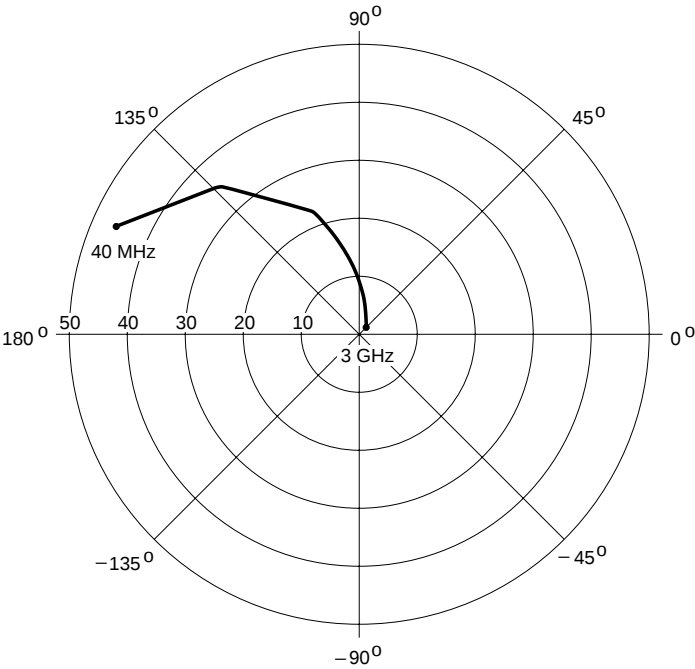
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$V_{CE} = 8\text{ V}$; $I_C = 30\text{ mA}$; $Z_0 = 50\ \Omega$.

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

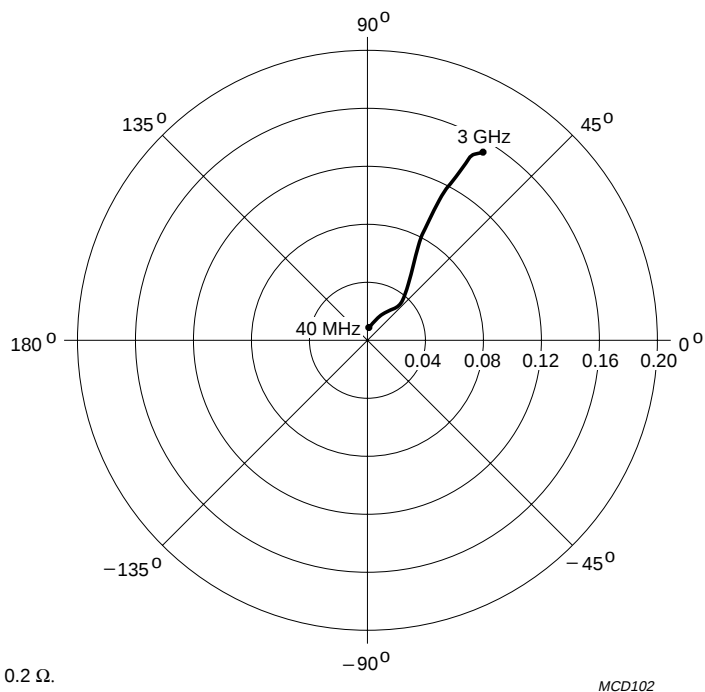
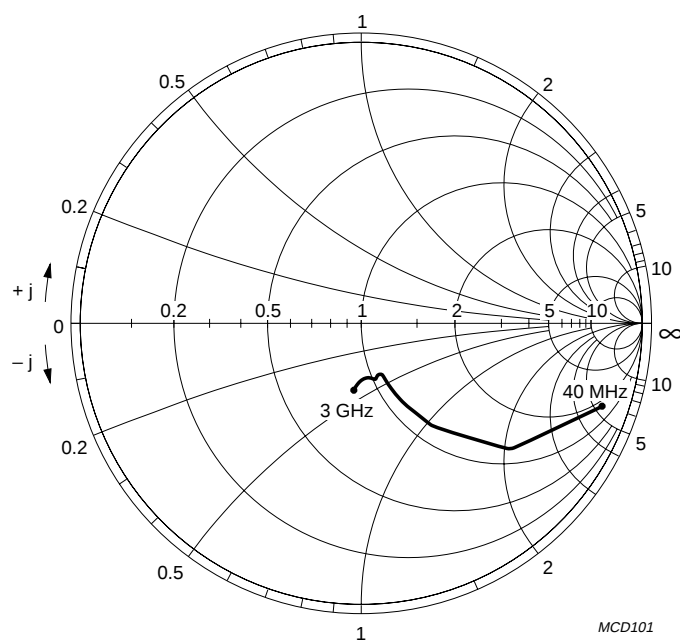


$V_{CE} = 8\text{ V}$; $I_C = 30\text{ mA}$; $R_{max} = 50\ \Omega$.

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

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Fig.17 Common emitter reverse transmission coefficient (S_{12}).Fig.18 Common emitter output reflection coefficient (S_{22}).

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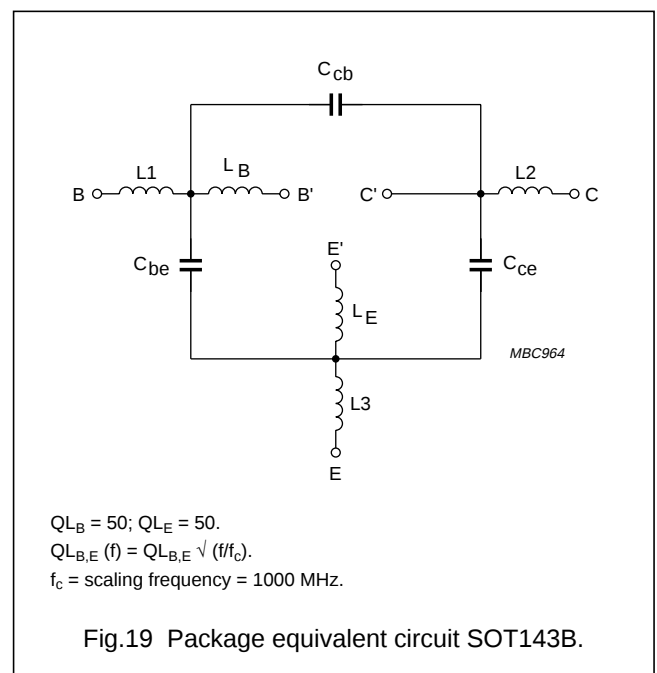
SPICE parameters for BFR91A(X) die

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	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

SEQUENCE No.	PARAMETER	VALUE	UNIT
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.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

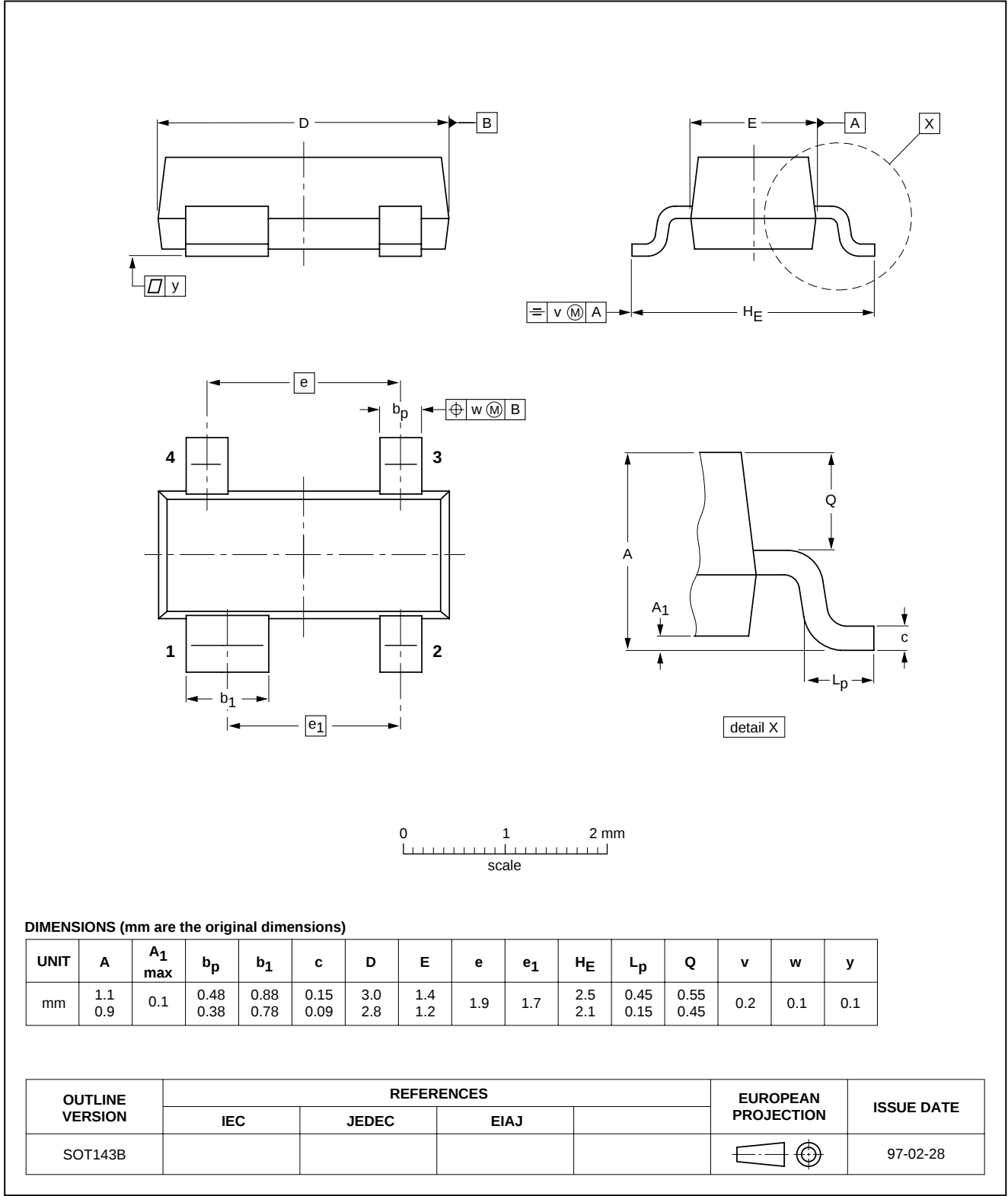
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PACKAGE OUTLINE

Plastic surface mounted package; 4 leads

SOT143B



Legal information

Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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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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