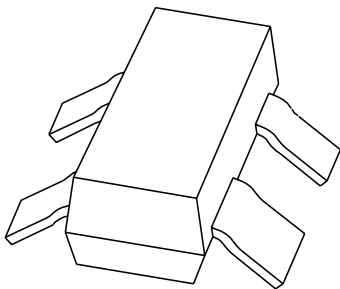


DATA SHEET



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

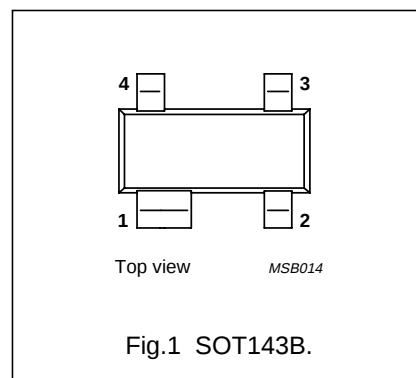
Wideband applications in the UHF and microwave range.

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_{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

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	$T_s \leq 85\text{ °C}$; 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.

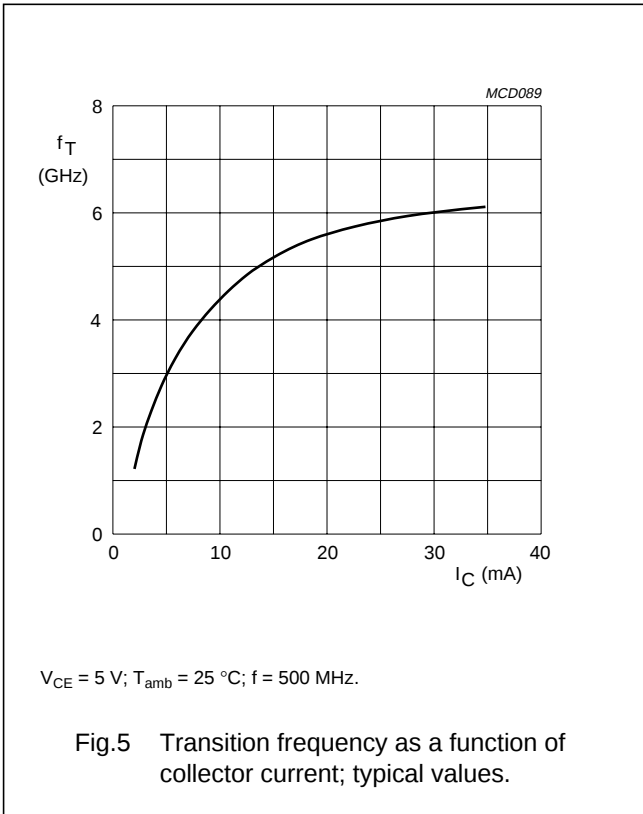
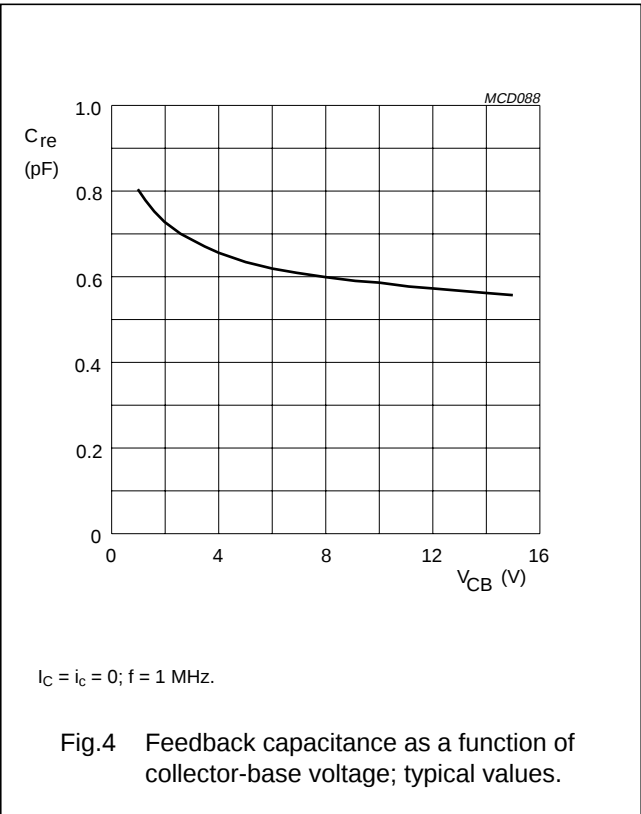
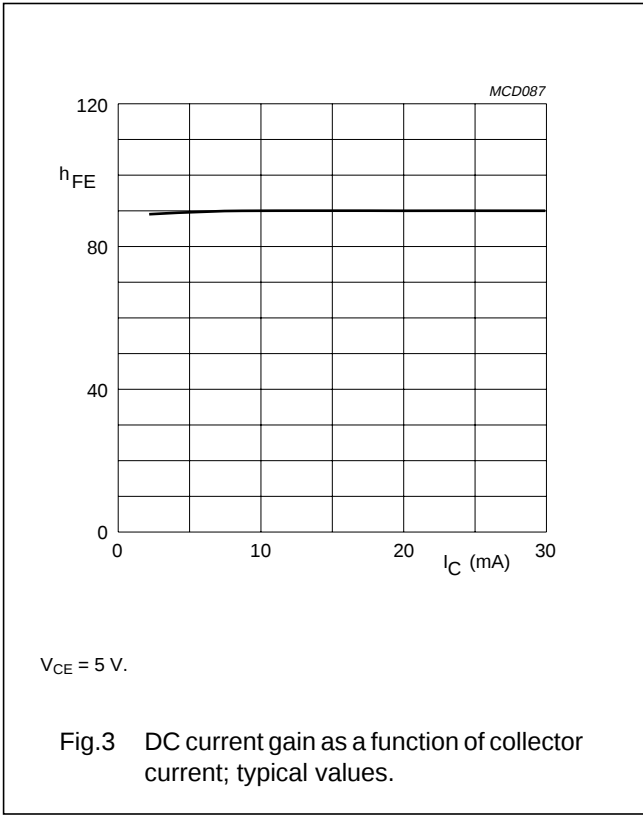
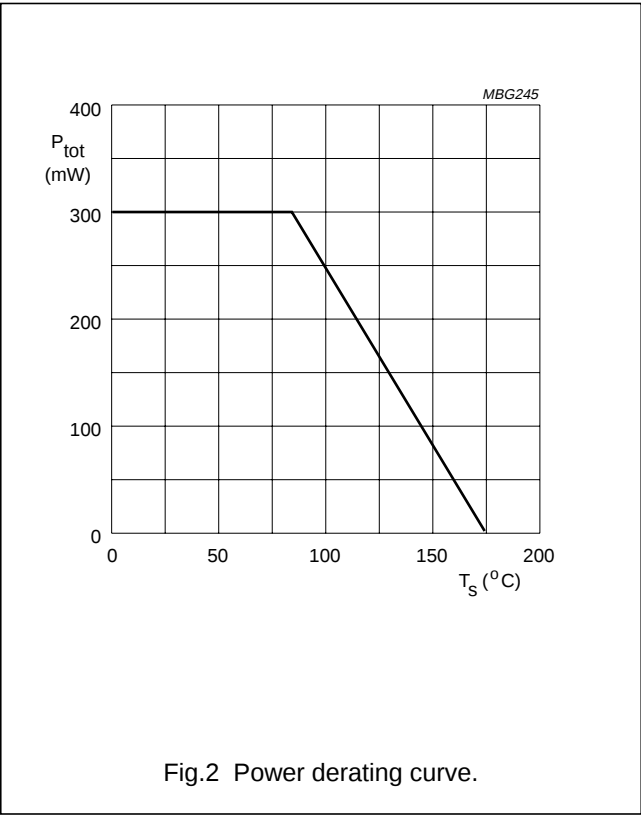
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CBO}	collector leakage current	$I_E = 0$; $V_{CB} = 5\text{ V}$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 30\text{ mA}$; $V_{CE} = 5\text{ V}$	40	90	–	
C_c	collector capacitance	$I_E = I_C = 0$; $V_{CB} = 5\text{ V}$; $f = 1\text{ MHz}$	–	0.9	–	pF
C_e	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.

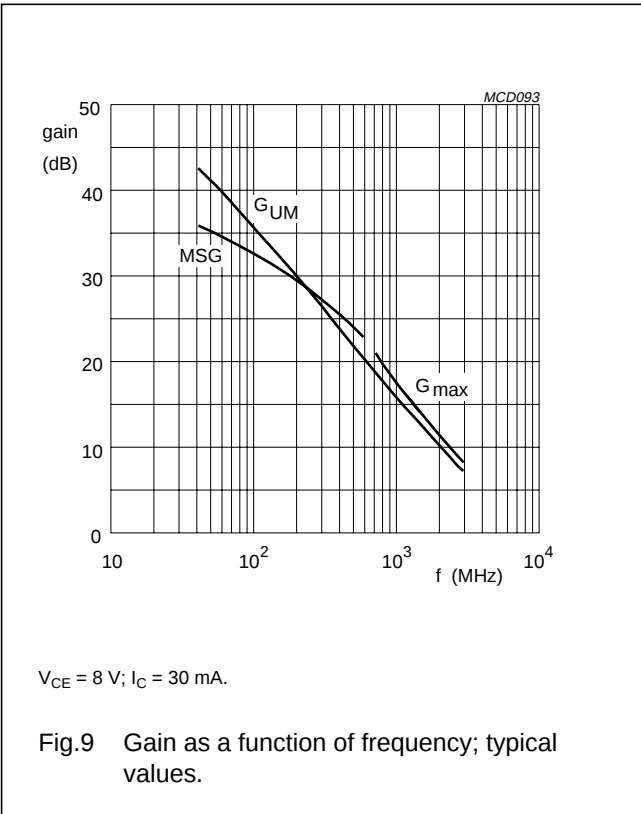
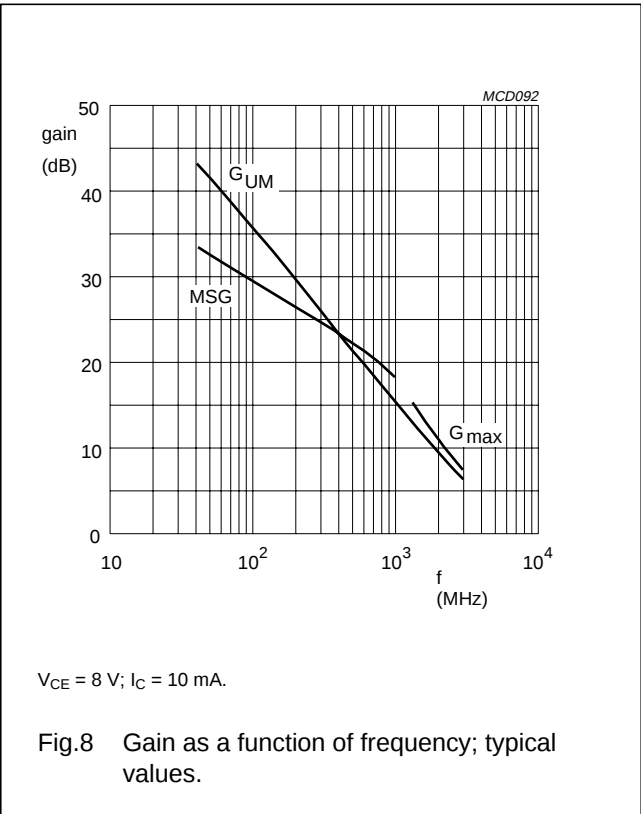
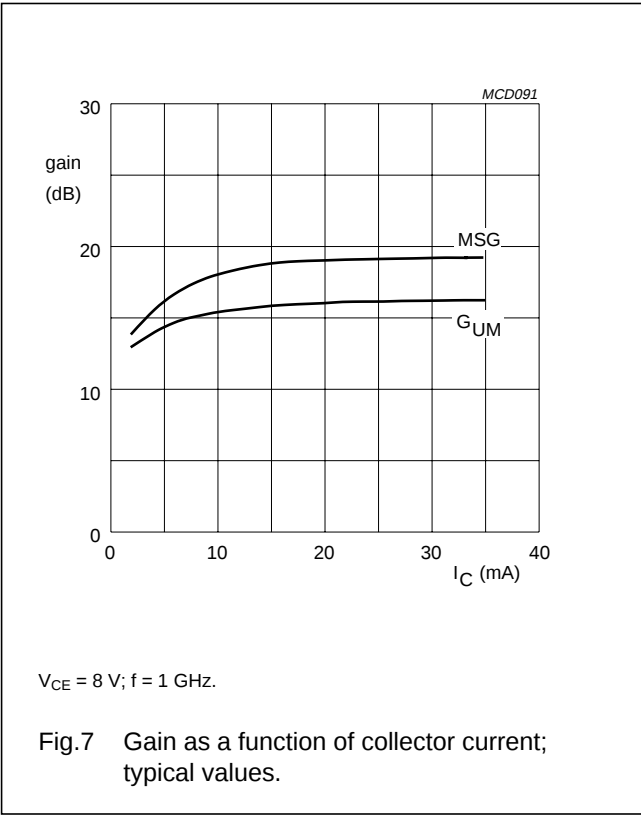
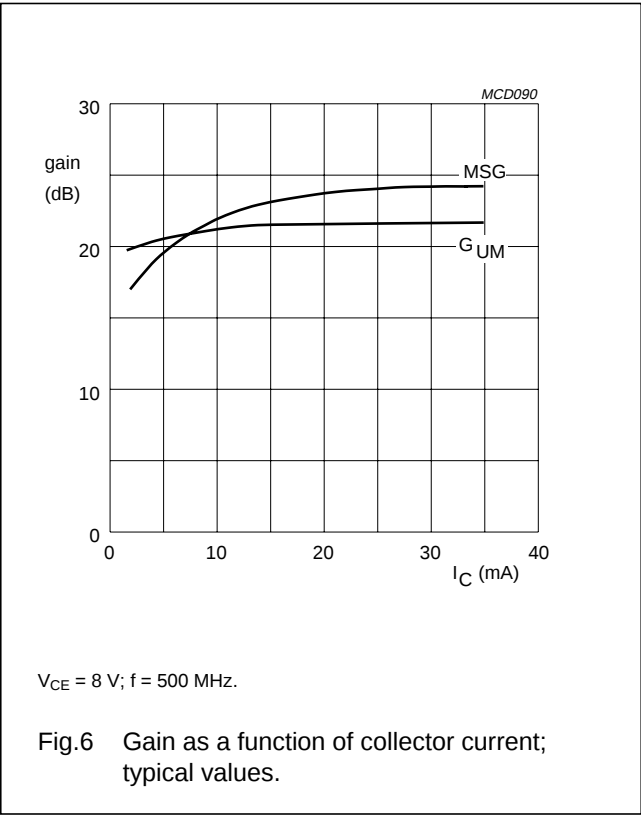
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BFG93A; BFG93A/X



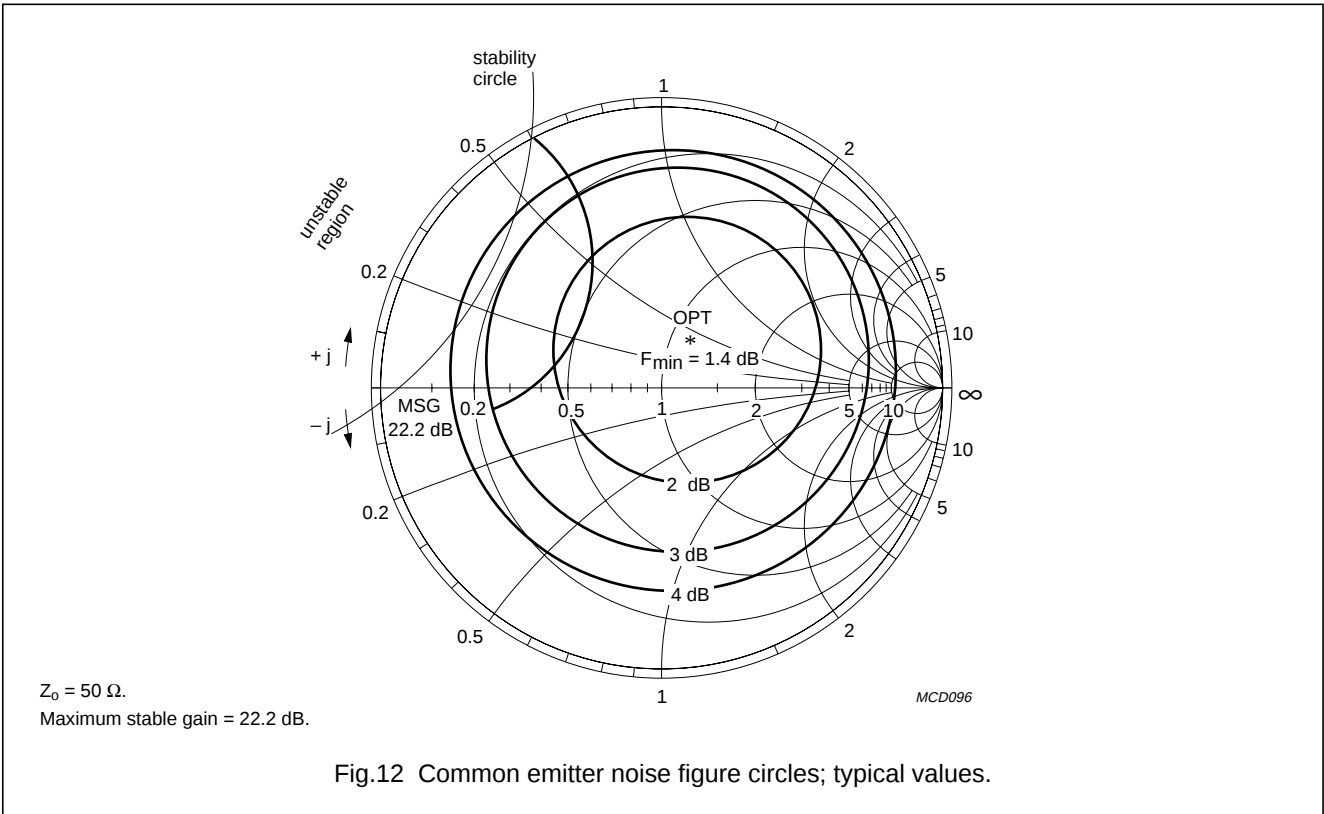
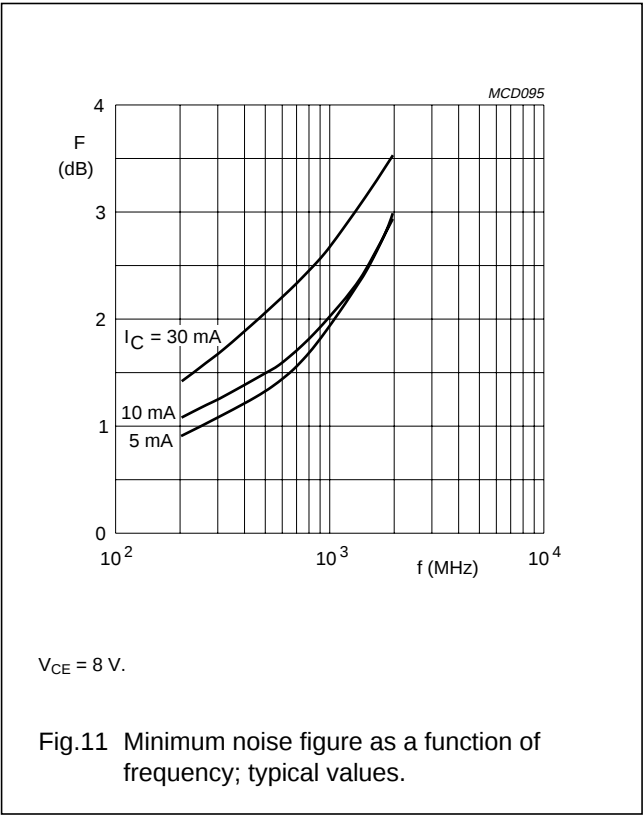
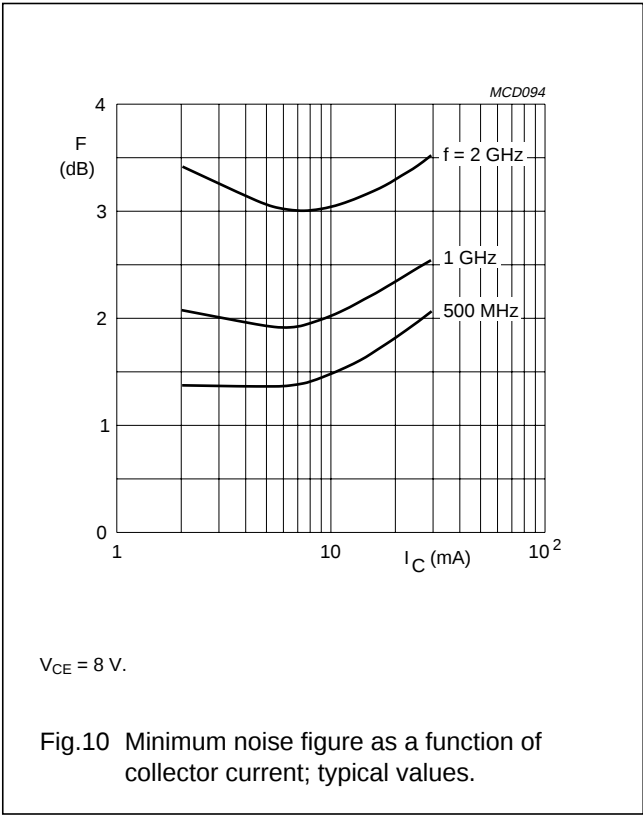
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



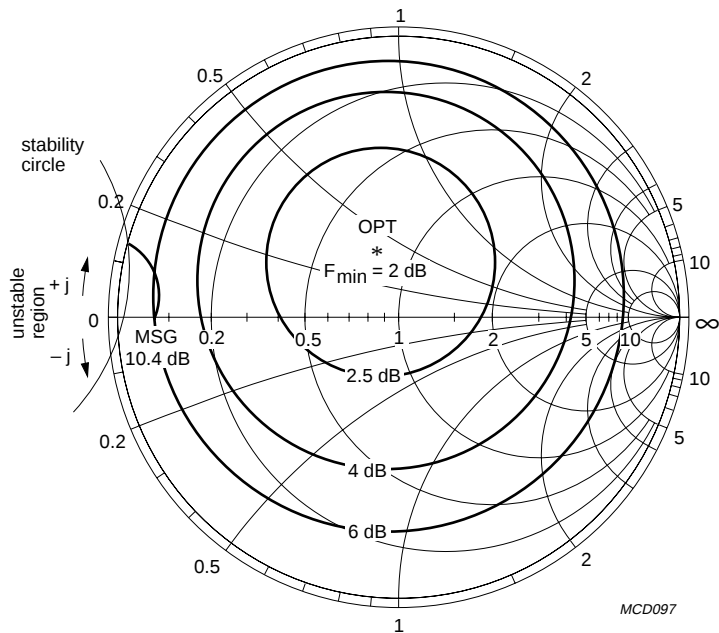
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



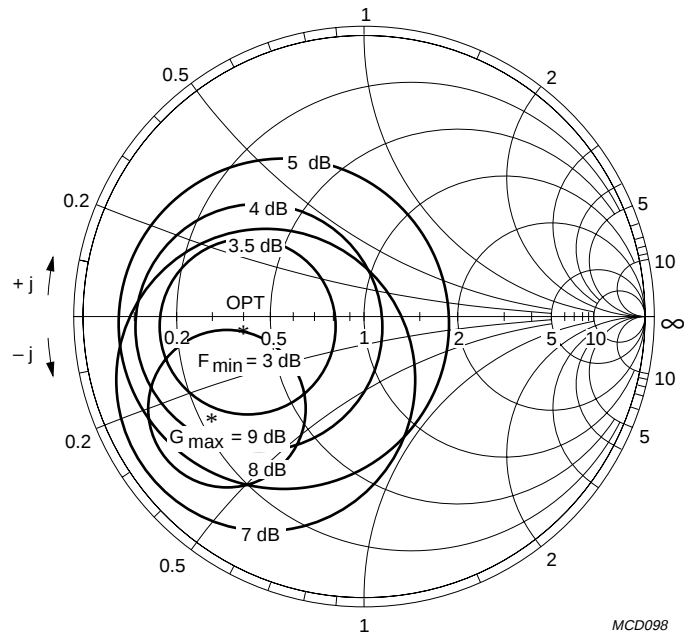
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



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

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

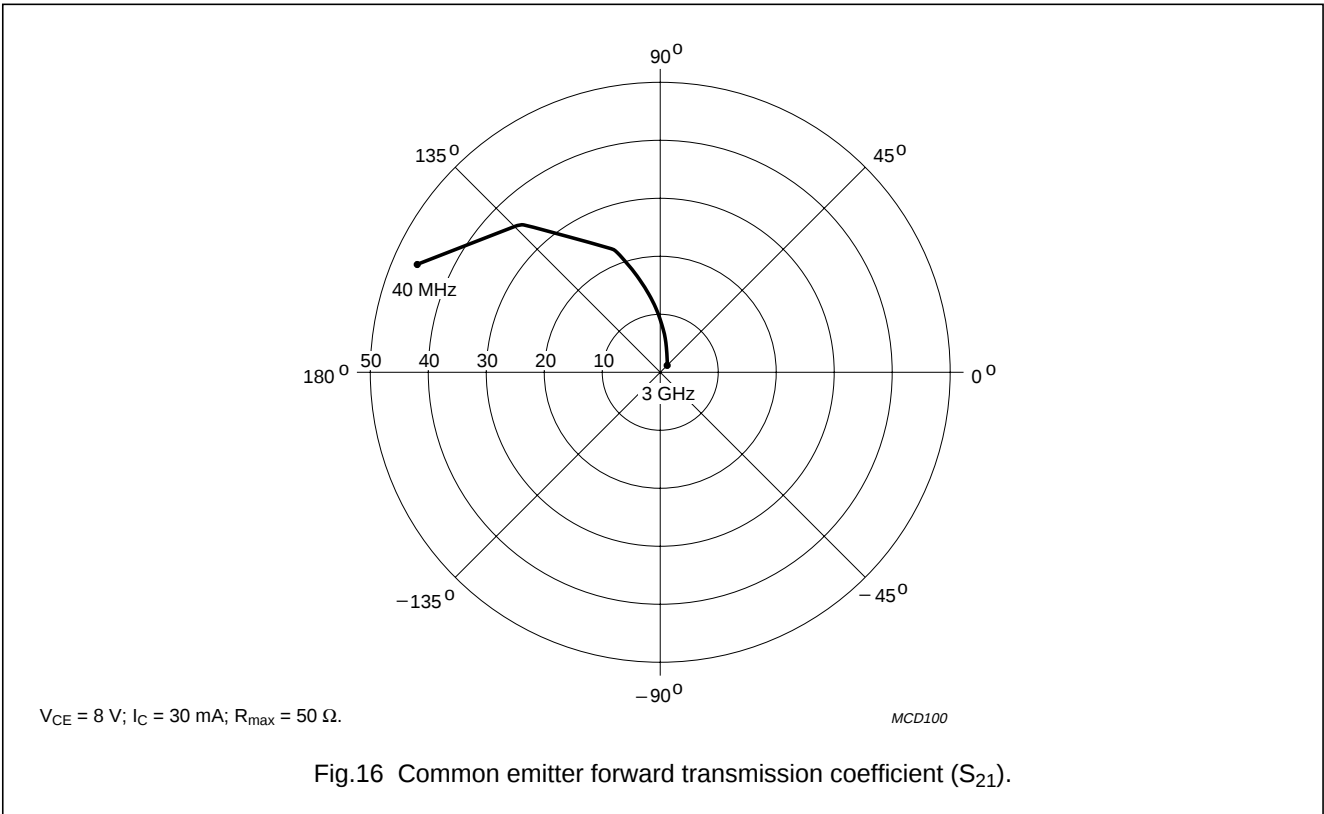
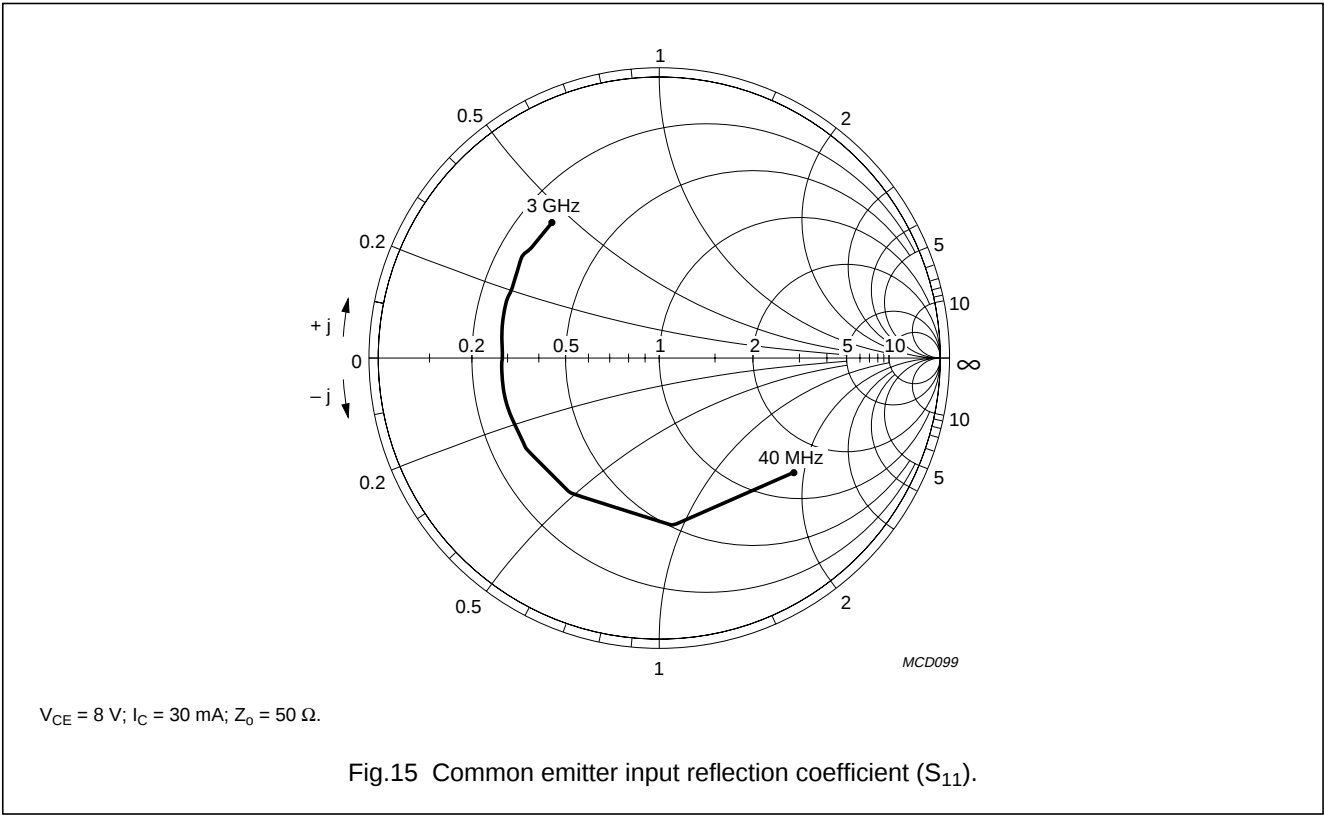


$Z_0 = 50 \Omega$.

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

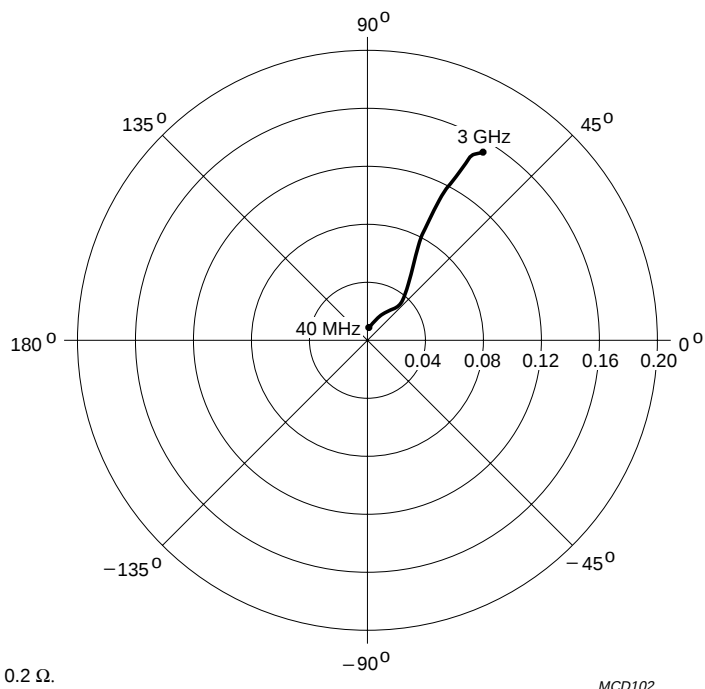
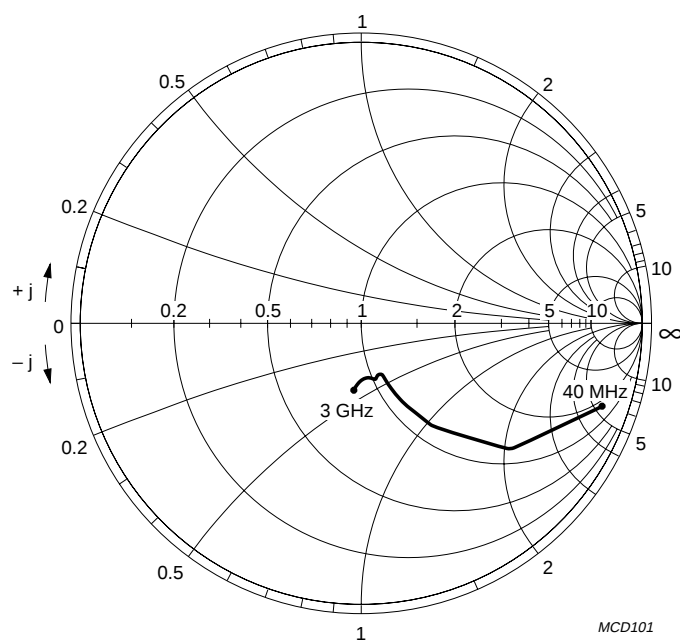
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X



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

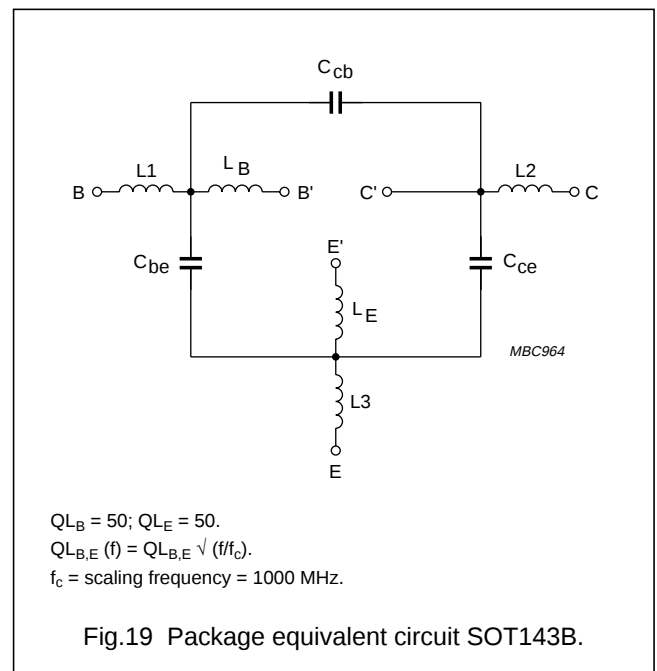
SPICE parameters for BFR91A(X) die

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	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

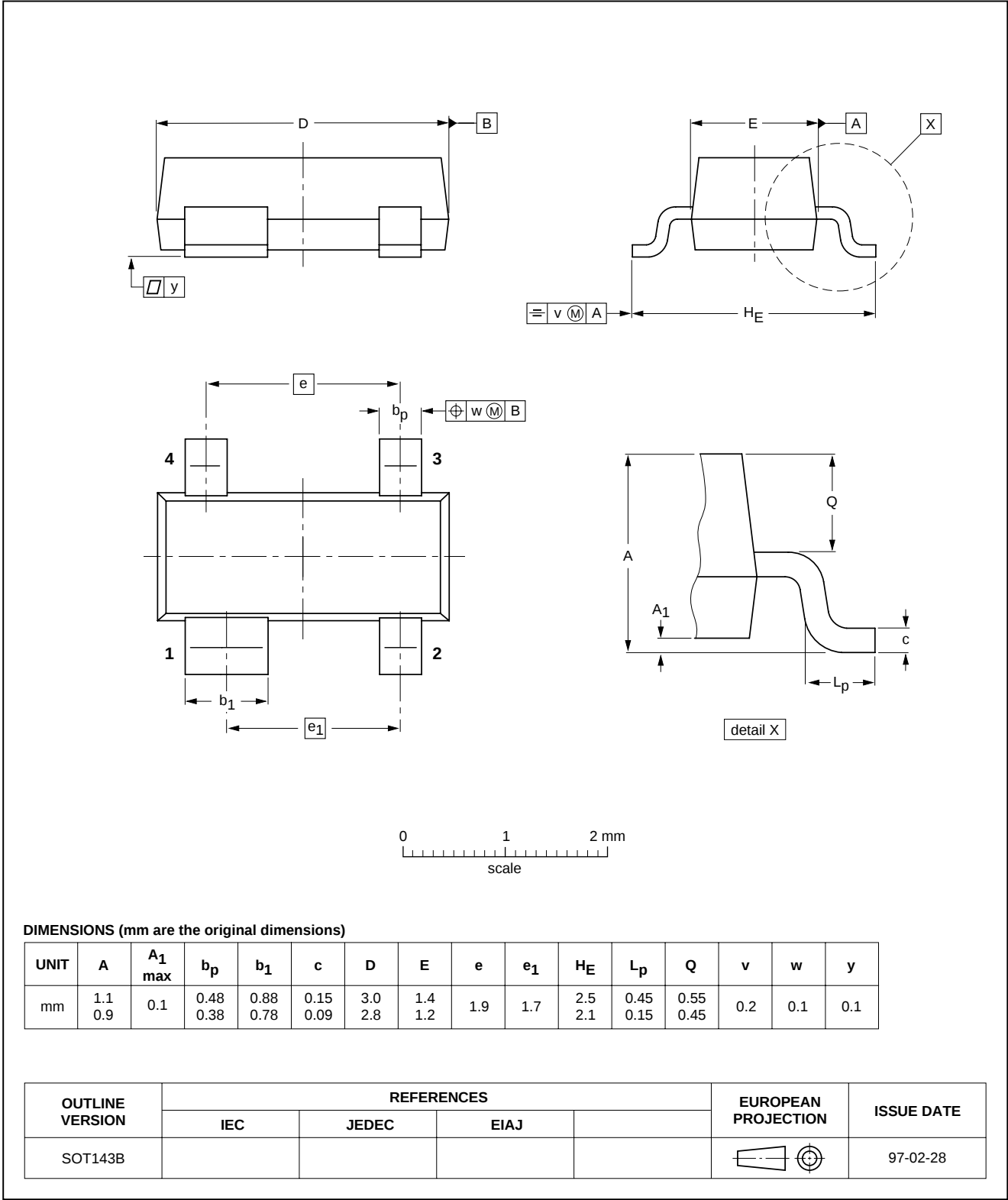
NPN 6 GHz wideband transistors

BFG93A; BFG93A/X

PACKAGE OUTLINES

Plastic surface mounted package; 4 leads

SOT143B



NPN 6 GHz wideband transistorsBFG93A; 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.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

NPN 6 GHz wideband transistors

BFG93A; BFG93A/X

NOTES

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NOTES

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