

# BFG92A/X

NPN 5 GHz wideband transistor

Rev. 05 — 26 November 2007

Product data sheet

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NXP Semiconductors

# NPN 5 GHz wideband transistor

# BFG92A/X

### FEATURES

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

### APPLICATIONS

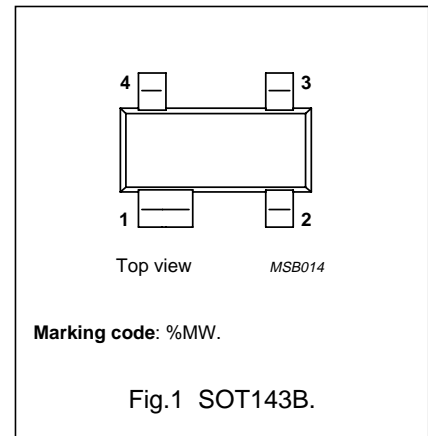
Wideband applications in the UHF and microwave range.

### DESCRIPTION

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

### PINNING

PIN	DESCRIPTION
1	collector
2	emitter
3	base
4	emitter



### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{CBO}$	collector-base voltage		–	–	20	V
$V_{CEO}$	collector-emitter voltage		–	–	15	V
$I_C$	collector current (DC)		–	–	25	mA
$P_{tot}$	total power dissipation	$T_s \leq 60\text{ }^\circ\text{C}$	–	–	400	mW
$C_{re}$	feedback capacitance	$I_C = i_c = 0$ ; $V_{CB} = 10\text{ V}$ ; $f = 1\text{ MHz}$	–	0.35	–	pF
$f_T$	transition frequency	$I_C = 15\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $f = 500\text{ MHz}$	3.5	5	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 15\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; $f = 1\text{ GHz}$	–	16	–	dB
		$I_C = 15\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; $f = 2\text{ GHz}$	–	11	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$ ; $I_C = 5\text{ mA}$ ; $V_{CE} = 10\text{ V}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$ ; $f = 1\text{ GHz}$	–	2	–	dB

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## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CBO</sub>	collector-base voltage	open emitter	–	20	V
V <sub>CEO</sub>	collector-emitter voltage	open base	–	15	V
V <sub>EBO</sub>	emitter-base voltage	open collector	–	2	V
I <sub>C</sub>	collector current (DC)		–	25	mA
P <sub>tot</sub>	total power dissipation	T <sub>s</sub> ≤ 60 °C; note 1	–	400	mW
T <sub>stg</sub>	storage temperature range		–65	150	°C
T <sub>j</sub>	junction temperature		–	175	°C

## Note

1. T<sub>s</sub> is the temperature at the soldering point of the collector pin.

## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
R <sub>th j-s</sub>	thermal resistance from junction to soldering point	note 1	290	K/W

## Note

1. T<sub>s</sub> is the temperature at the soldering point of the collector pin.

## CHARACTERISTICS

T<sub>j</sub> = 25 °C unless otherwise specified.

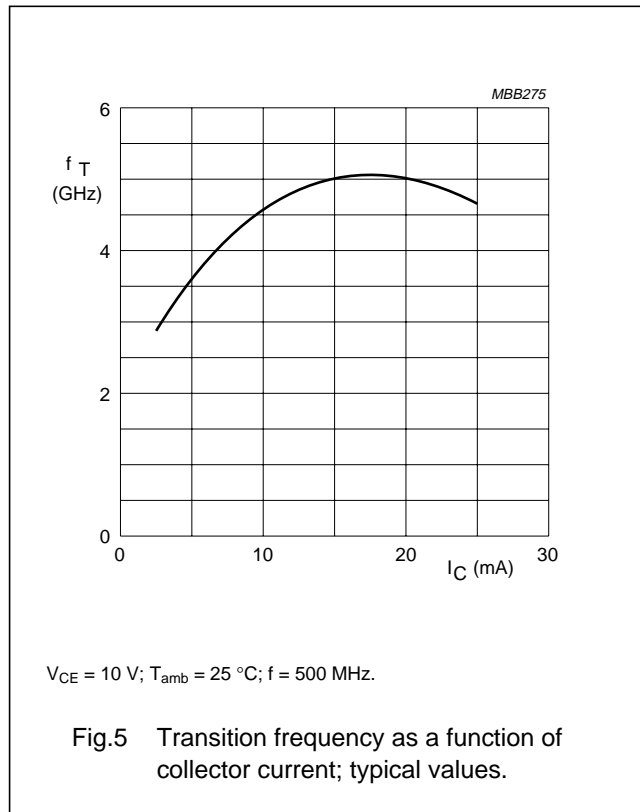
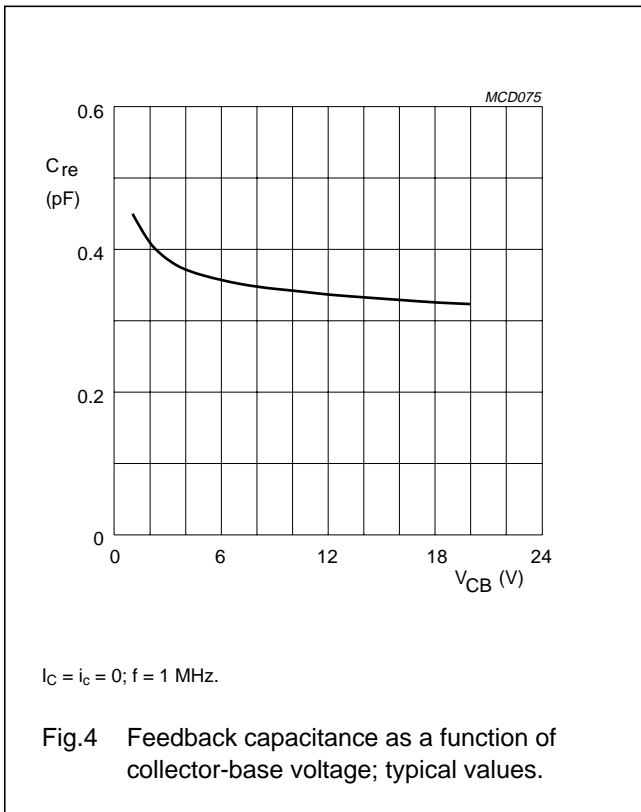
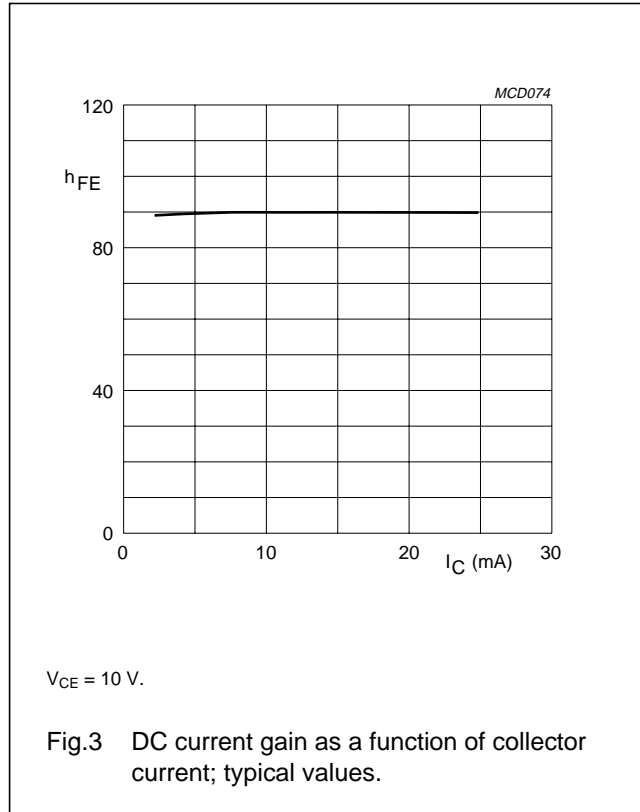
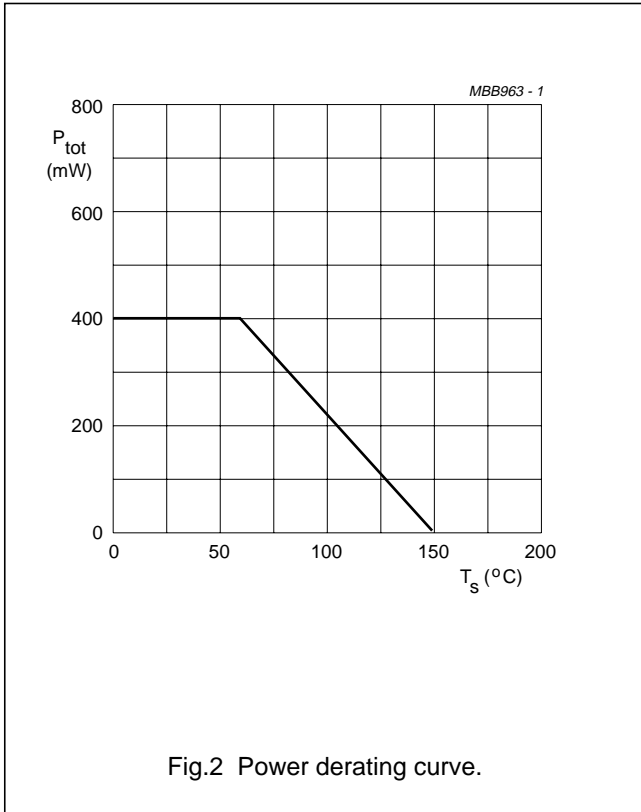
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I <sub>CBO</sub>	collector leakage current	I <sub>E</sub> = 0; V <sub>CB</sub> = 10 V	–	–	50	nA
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 15 mA; V <sub>CE</sub> = 10 V	40	90	–	
C <sub>c</sub>	collector capacitance	I <sub>E</sub> = i <sub>e</sub> = 0; V <sub>CB</sub> = 10 V; f = 1 MHz	–	0.6	–	pF
C <sub>e</sub>	emitter capacitance	I <sub>C</sub> = i <sub>c</sub> = 0; V <sub>EB</sub> = 10 V; f = 1 MHz	–	0.9	–	pF
C <sub>re</sub>	feedback capacitance	I <sub>C</sub> = i <sub>c</sub> = 0; V <sub>CB</sub> = 10 V; f = 1 MHz	–	0.35	–	pF
f <sub>T</sub>	transition frequency	I <sub>C</sub> = 15 mA; V <sub>CE</sub> = 10 V; f = 500 MHz	3.5	5	–	GHz
G <sub>UM</sub>	maximum unilateral power gain; note 1	I <sub>C</sub> = 15 mA; V <sub>CE</sub> = 10 V; T <sub>amb</sub> = 25 °C; f = 1 GHz	–	16	–	dB
		I <sub>C</sub> = 15 mA; V <sub>CE</sub> = 10 V; T <sub>amb</sub> = 25 °C; f = 2 GHz	–	11	–	dB
F	noise figure	Γ <sub>s</sub> = Γ <sub>opt</sub> ; I <sub>C</sub> = 5 mA; V <sub>CE</sub> = 10 V; T <sub>amb</sub> = 25 °C; f = 1 GHz	–	2	–	dB
		Γ <sub>s</sub> = Γ <sub>opt</sub> ; I <sub>C</sub> = 5 mA; V <sub>CE</sub> = 10 V; T <sub>amb</sub> = 25 °C; f = 2 GHz	–	3	–	dB

## Note

1. G<sub>UM</sub> is the maximum unilateral power gain, assuming S<sub>12</sub> is zero and  $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$  dB.

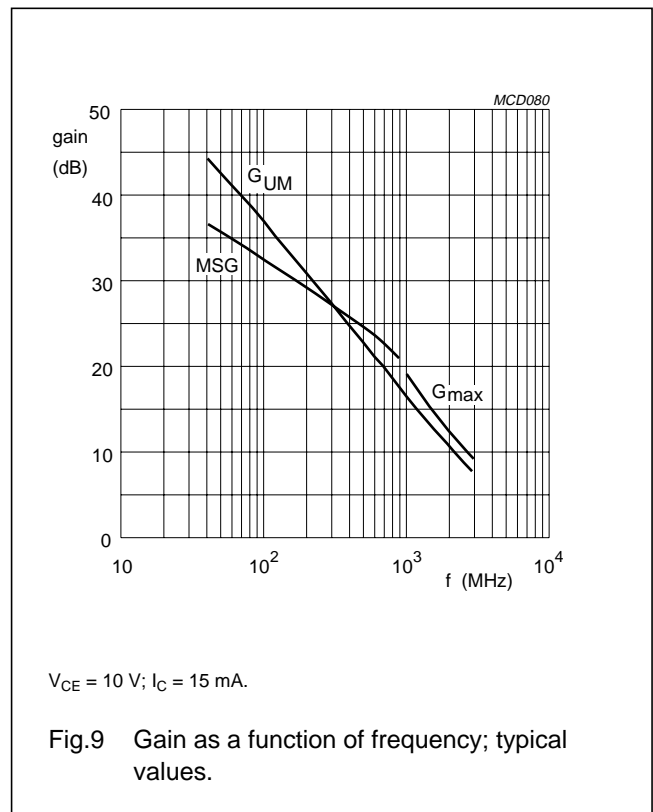
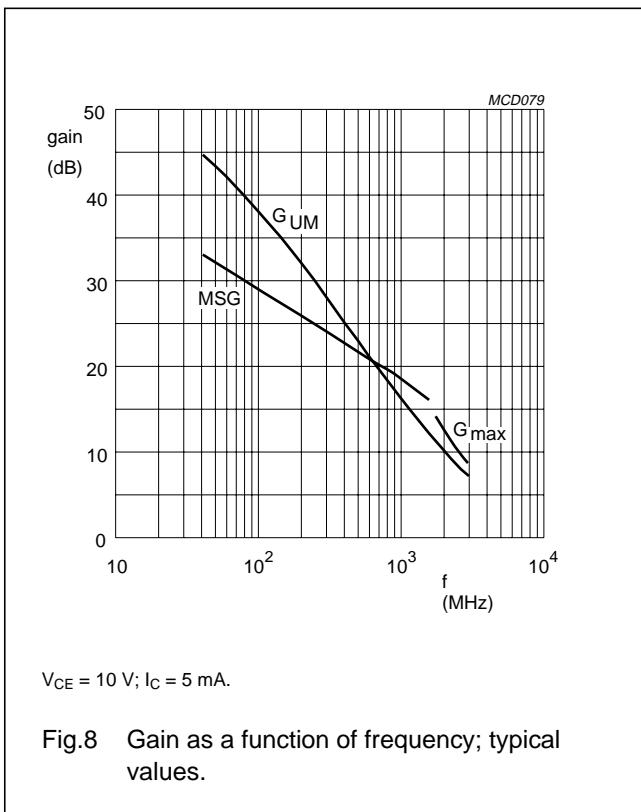
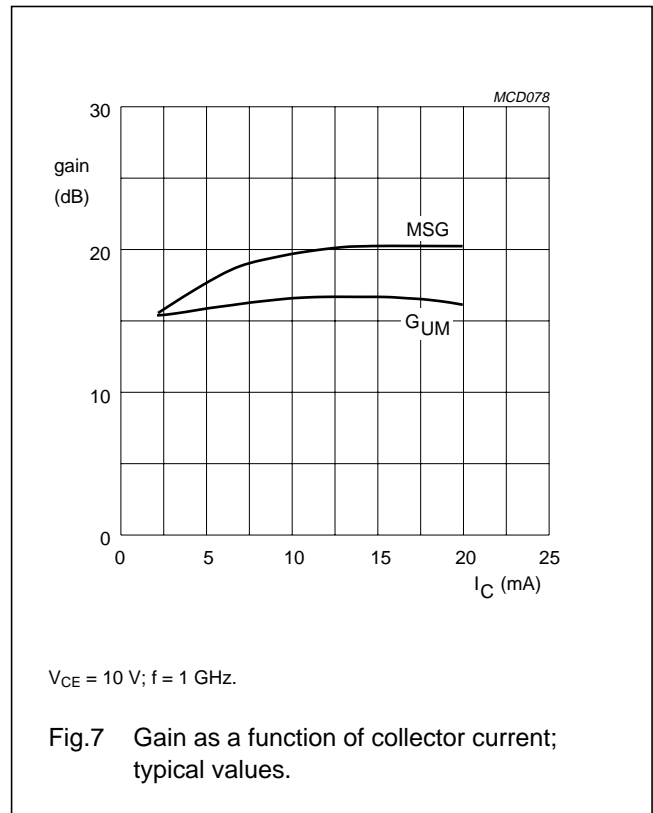
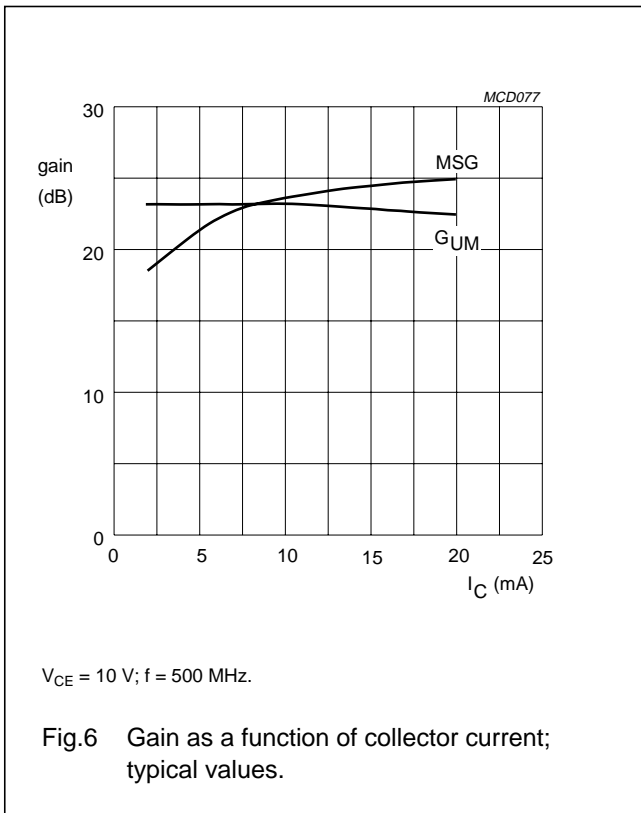
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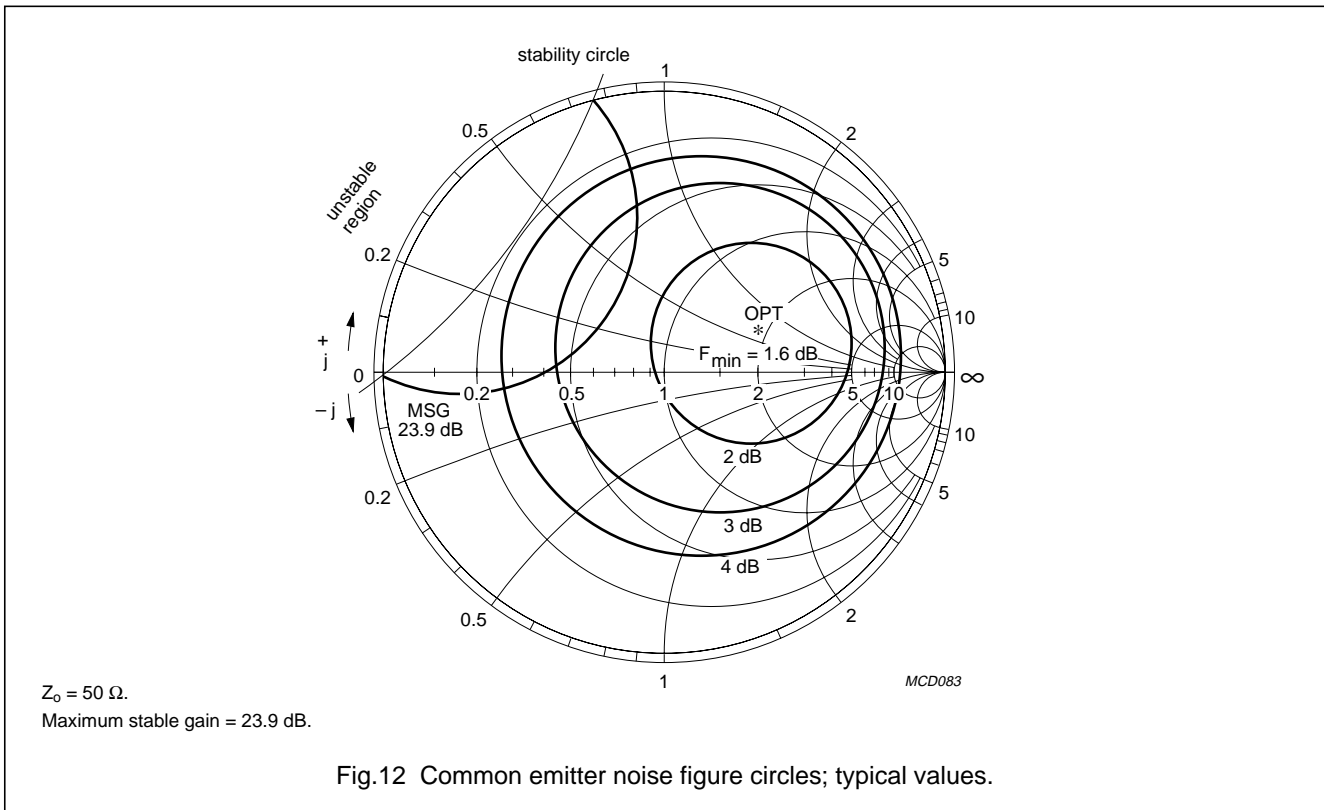
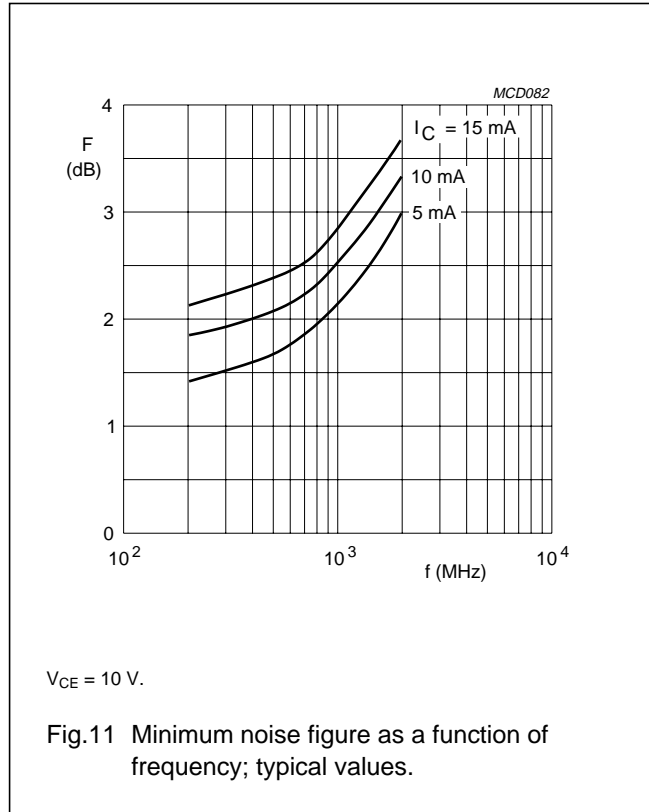
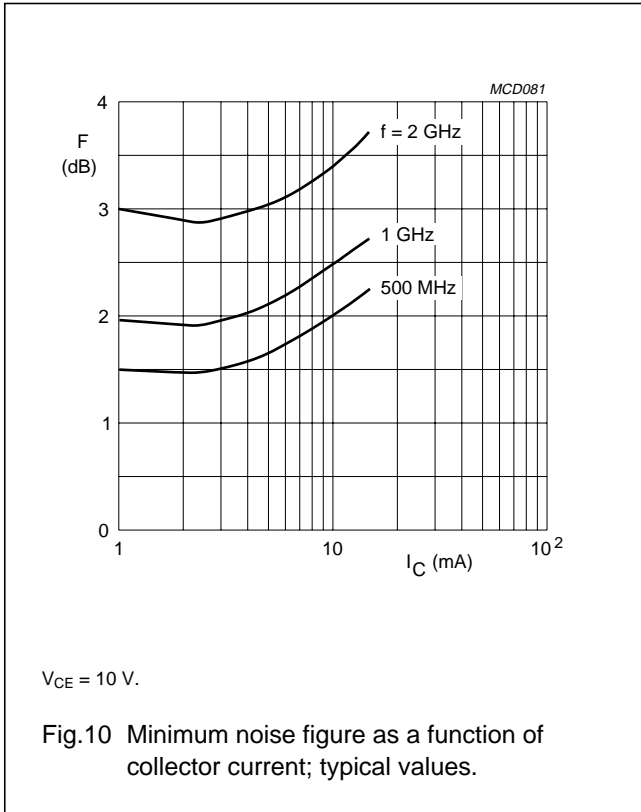
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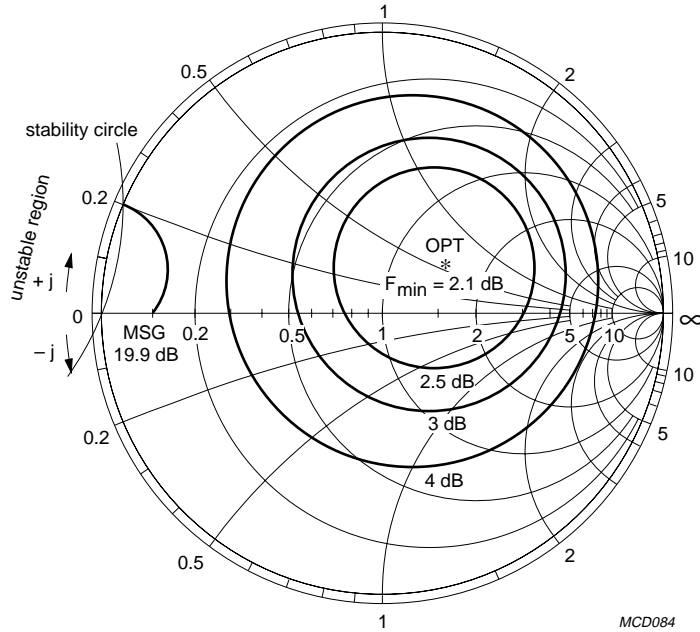
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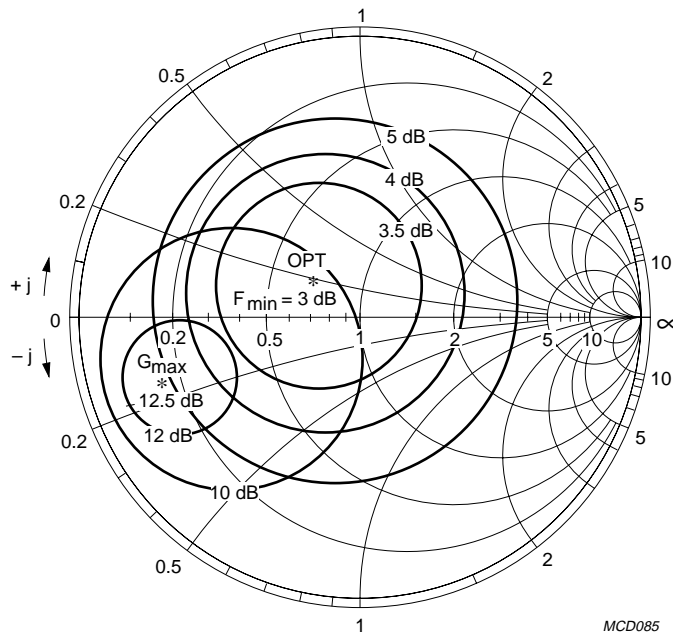
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$Z_0 = 50 \Omega$ .  
Maximum stable gain = 19.9 dB.

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

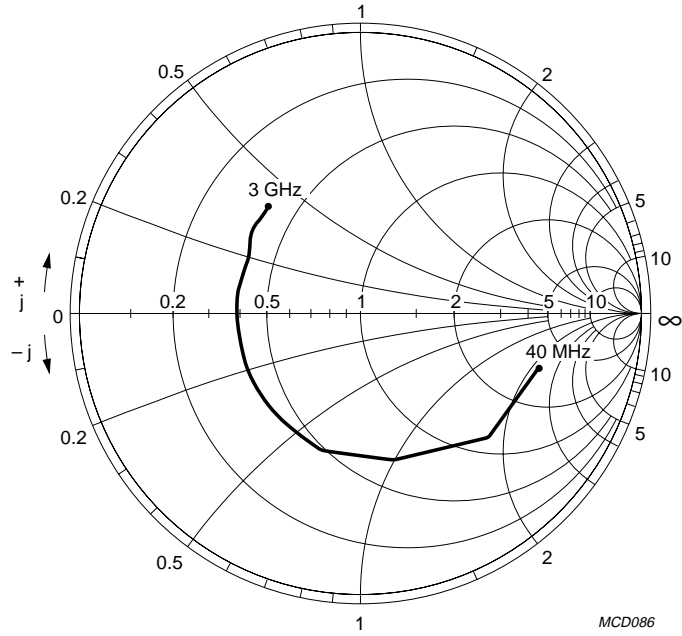


$Z_0 = 50 \Omega$ .

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

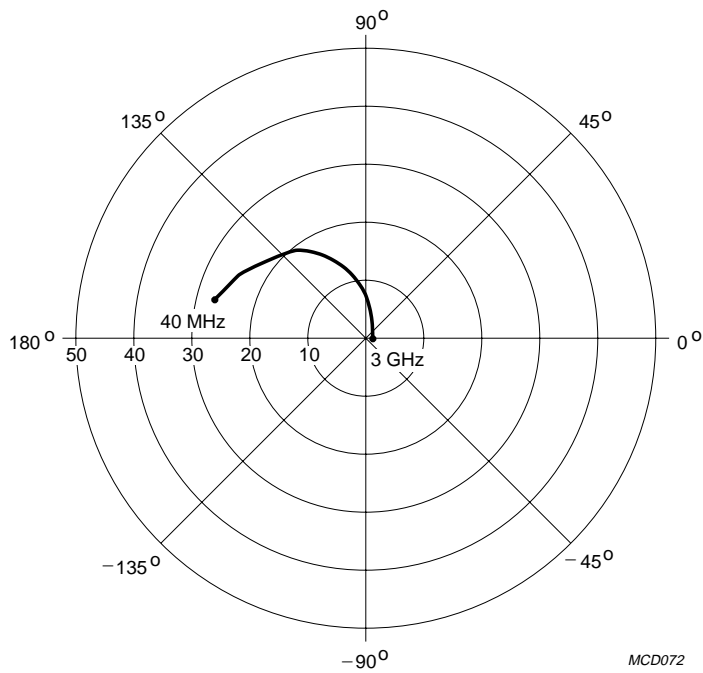
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$V_{CE} = 10\text{ V}; I_C = 15\text{ mA}$ .

Fig.15 Common emitter input reflection coefficient ( $S_{11}$ ); typical values.



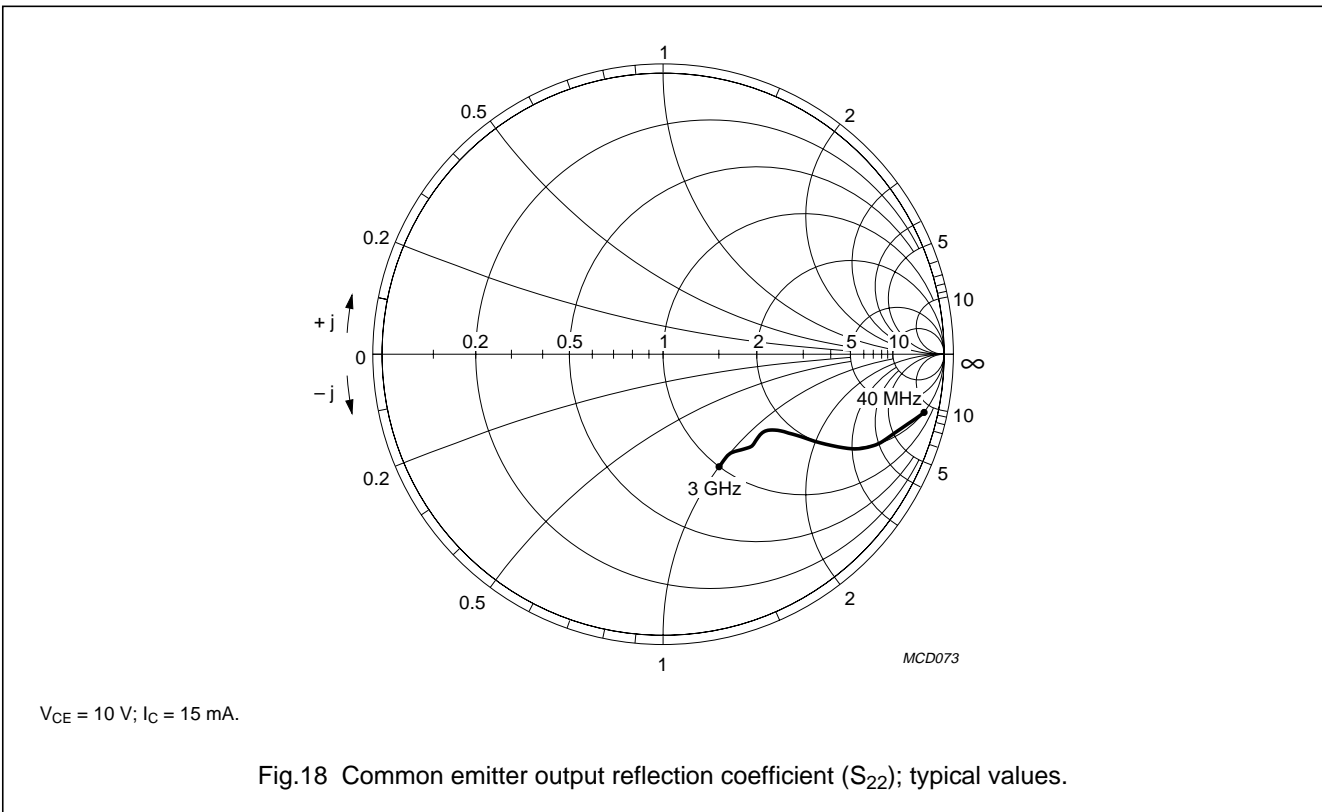
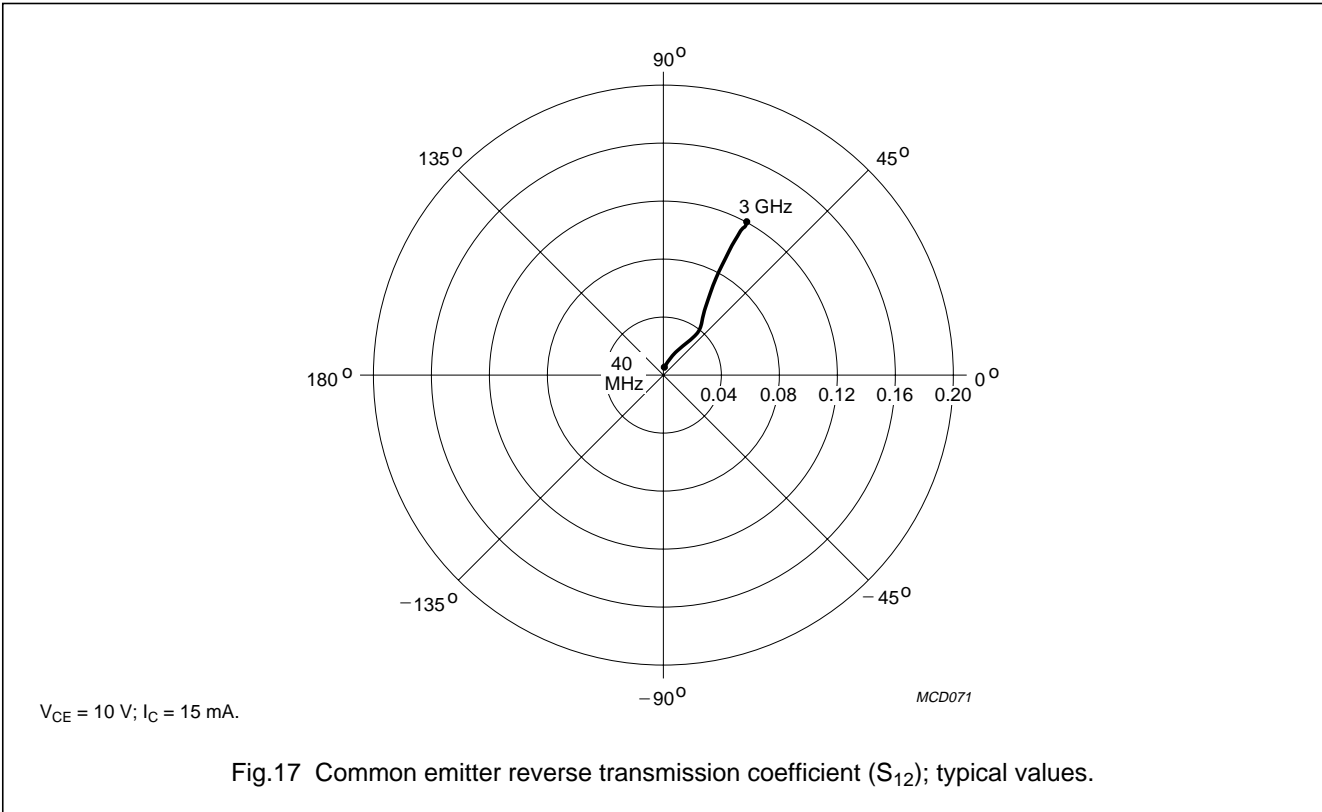
$V_{CE} = 10\text{ V}; I_C = 15\text{ mA}$ .

Fig.16 Common emitter forward transmission coefficient ( $S_{21}$ ); typical values.



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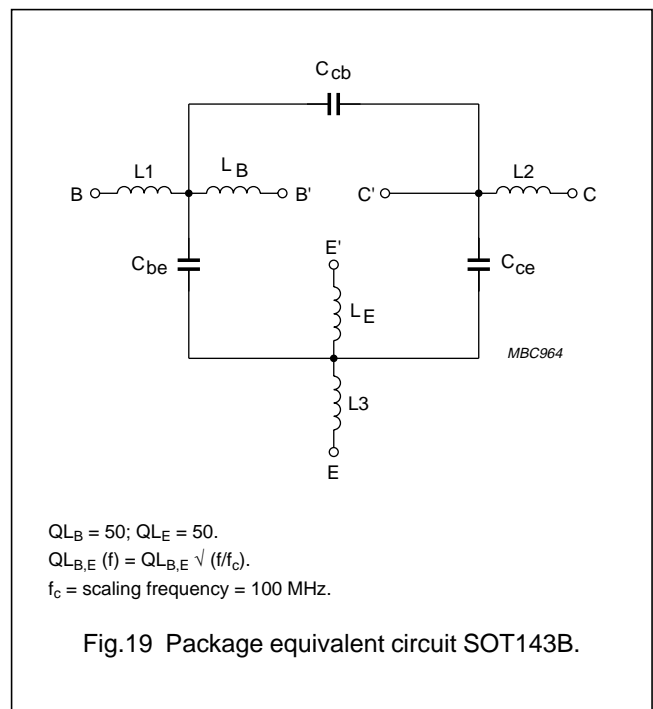
SPICE parameters for BFR90A/X die

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	411.8	aA
2	BF	102.6	–
3	NF	997.2	m
4	VAF	62.67	V
5	IKF	3.200	A
6	ISE	4.010	fA
7	NE	1.577	–
8	BR	18.10	–
9	NR	996.2	m
10	VAR	3.369	V
11	IKR	1.281	A
12	ISC	279.9	aA
13	NC	1.075	–
14	RB	10.00	Ω
15	IRB	1.000	μA
16	RBM	10.00	Ω
17	RE	1.164	Ω
18	RC	2.320	Ω
19 (note 1)	XTB	0.000	–
20 (note 1)	EG	1.110	eV
21 (note 1)	XTI	3.000	–
22	CJE	890.5	fF
23	VJE	600.0	mV
24	MJE	258.5	m
25	TF	15.49	ps
26	XTF	39.14	–
27	VTF	2.152	V
28	ITF	213.7	mA
29	PTF	0.000	deg
30	CJC	546.5	fF
31	VJC	380.8	mV
32	MJC	202.9	m
33	XCJC	150.0	m
34	TR	5.618	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	850.0	m

Note

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



List of components (see Fig.19)

DESIGNATION	VALUE	UNIT
C <sub>be</sub>	84	fF
C <sub>cb</sub>	17	fF
C <sub>ce</sub>	191	fF
L1	0.12	nH
L2	0.21	nH
L3	0.06	nH
L <sub>B</sub>	0.95	nH
L <sub>E</sub>	0.40	nH

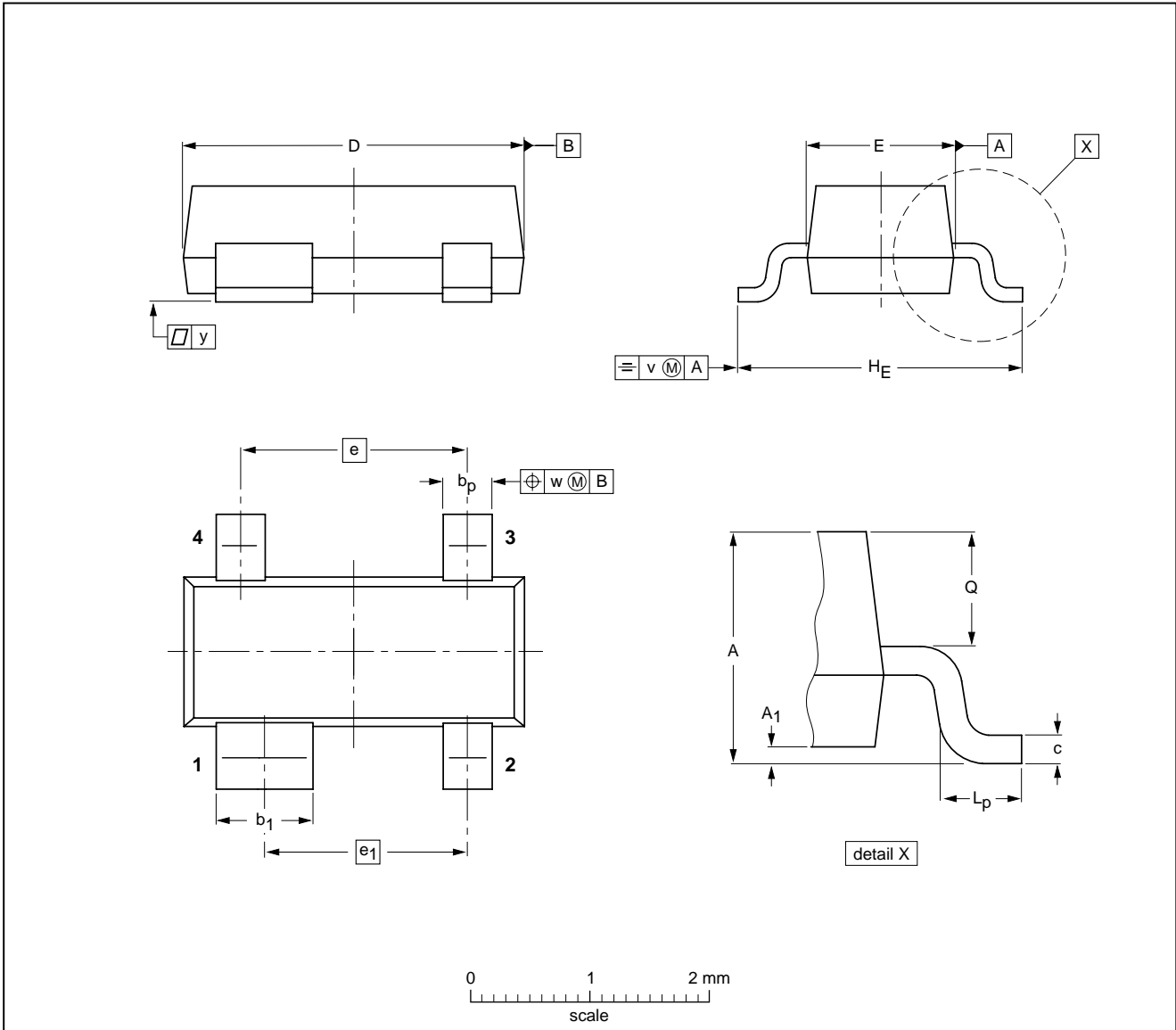
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PACKAGE OUTLINES

Plastic surface mounted package; 4 leads

SOT143B



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub> max	b <sub>p</sub>	b <sub>1</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L <sub>p</sub>	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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### Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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
BFG92AX_N_5	20071126	Product data sheet	-	BFG92AX_4
Modifications:	• Fig. 1 on page 2; Figure note changed			
BFG92AX_4 (9397 750 04344)	19980923	Product specification	-	BFG92SERIES_3
BFG92SERIES_3	19950912	Product specification	-	BFG92SERIES_2
BFG92SERIES_2	19921101	Product specification	-	BFG92_SERIES_1
BFG92_SERIES_1	-	-	-	-

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