DATA SHEET

BFG197; BFG197/X; BFG197/XR
NPN 7 GHz wideband transistor

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

1995 Sep 13

Philips
Semiconductors

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NPN 7 GHz wideband transistor

BFG197; BFG197/X; BFG197/XR

FEATURES

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

DESCRIPTION

The BFG197 is a silicon NPN transistor in a 4-pin, dual-emitter plastic SOT143 envelope. It is primarily intended for wideband applications in the GHz range, such as satellite TV systems and repeater amplifiers in fibre-optic systems.

PINNING

PIN	DESCRIPTION
BFG197 (Fig.1) Code: V5	
1	collector
2	base
3	emitter
4	emitter
BFG197/X (Fig.1) Code: V13	
1	collector
2	emitter
3	base
4	emitter
BFG197A/XR (Fig.2) Code: V35	
1	collector
2	emitter
3	base
4	emitter

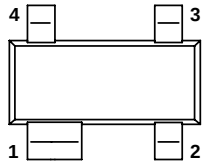


Fig.1 SOT143.

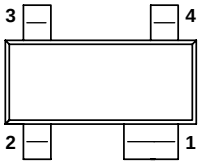


Fig.2 SOT143XR.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	–	10	V
I_C	collector current	DC value	–	–	100	mA
P_{tot}	total power dissipation	up to T_s = 75 °C; note 1	–	–	350	mW
C_{re}	feedback capacitance	$I_C = i_c = 0$; V_{CB} = 8 V; f = 1 MHz	–	0.85	–	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 4 V; f = 2 GHz	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 1 GHz	–	16	–	dB
		I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.7	–	dB

Note

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

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	10	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current	DC value, continuous	–	100	mA
P_{tot}	total power dissipation	up to T_s = 75 °C; note 1	–	350	mW
T_{stg}	storage temperature range		–65	+150	°C
T_j	junction operating temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}s}$	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	–	–	100	nA
h_{FE}	DC current gain	I_C = 50 mA; V_{CE} = 5 V	40	110	–	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 8 V; f = 1 MHz	–	1.5	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	3.3	–	pF
C_{re}	feedback capacitance	$I_C = i_c$ = 0; V_{CB} = 8 V; f = 1 MHz	–	0.85	–	pF
f_T	transition frequency	I_C = 50 mA; V_{CE} = 4 V; f = 2 GHz	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain (note 1)	I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 1 GHz	–	16	–	dB
		I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 15 mA; V_{CE} = 8 V; T_{amb} = 25 °C; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 50 mA; V_{CE} = 6 V; T_{amb} = 25 °C; f = 2 GHz	–	2.3	–	dB
d_2	second order intermodulation distortion	V_{CE} = 6 V; V_o = 50 dBmV;	–	–51	–	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.

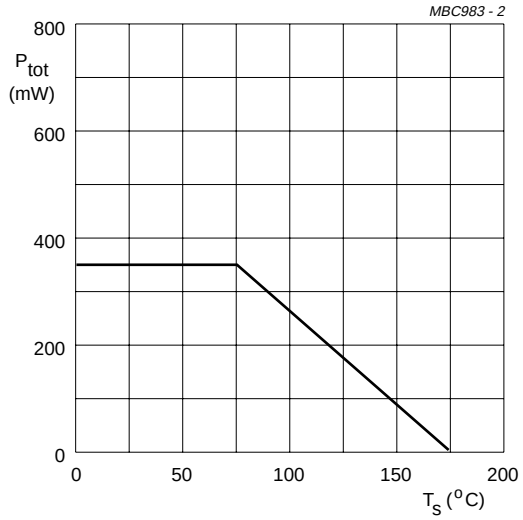
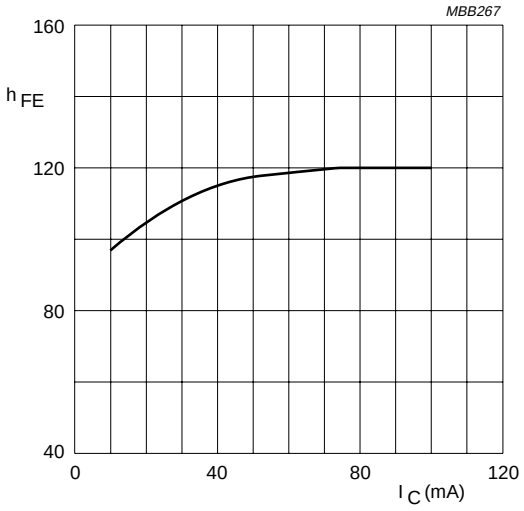
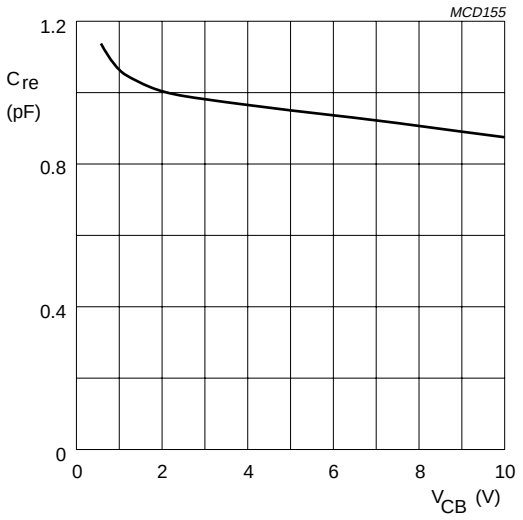


Fig.3 Power derating curve.



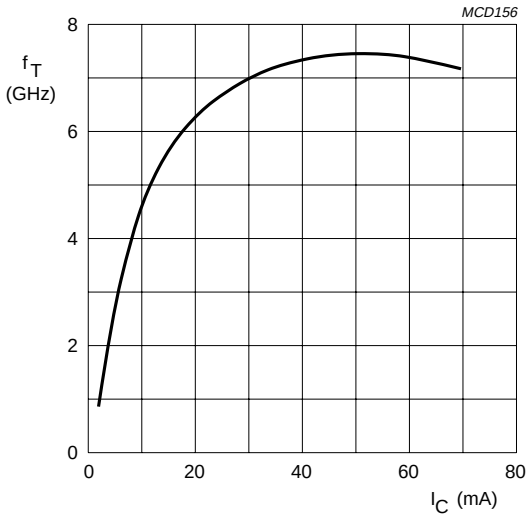
V_{CE} = 5 V.

Fig.4 DC current gain as a function of collector current.



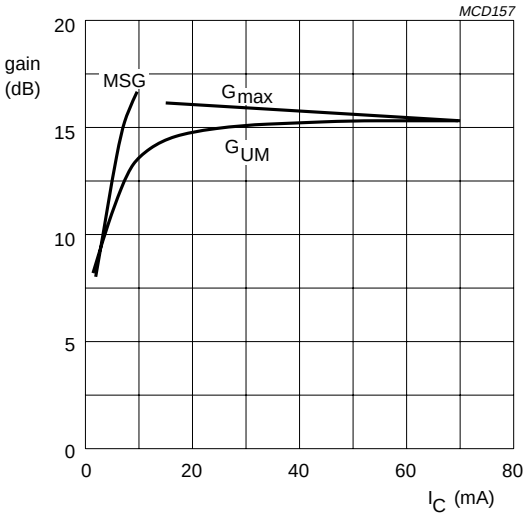
$I_C = i_c = 0$; f = 1 MHz.

Fig.5 Feedback capacitance as a function of collector-base voltage.



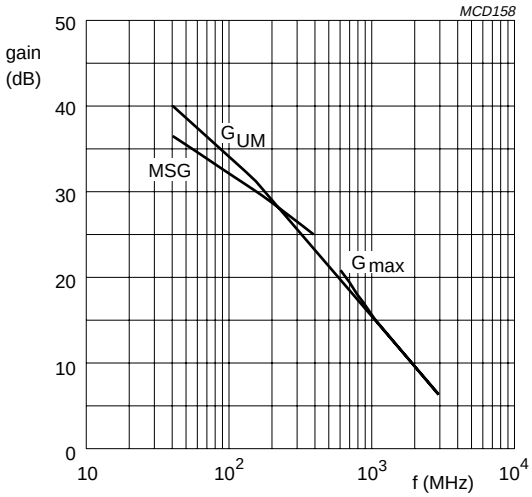
V_{CE} = 4 V; T_{amb} = 25 °C; f = 2 GHz.

Fig.6 Transition frequency as a function of collector current.



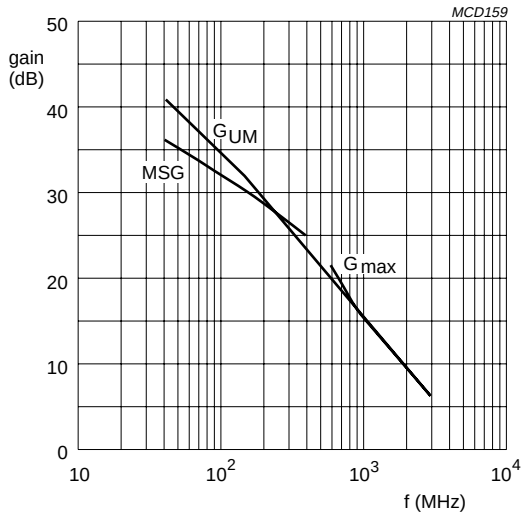
V_{CE} = 4 V; f = 1 GHz.

Fig.7 Gain as a function of collector current.



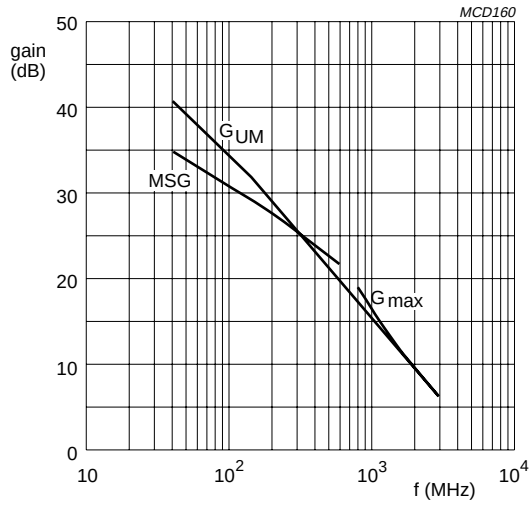
V_{CE} = 4 V; I_C = 50 mA.

Fig.8 Gain as a function of frequency.



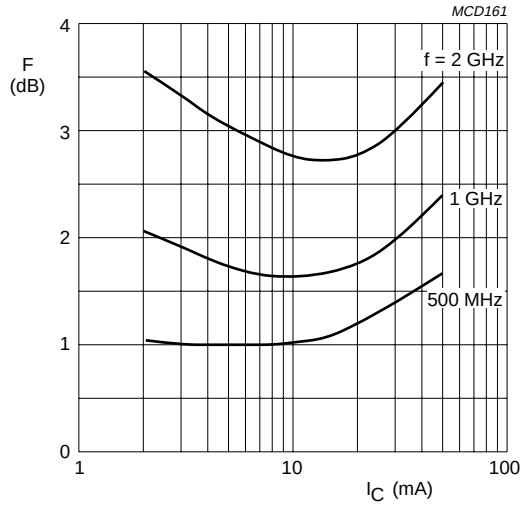
V_{CE} = 6 V; I_C = 50 mA.

Fig.9 Gain as a function of frequency.



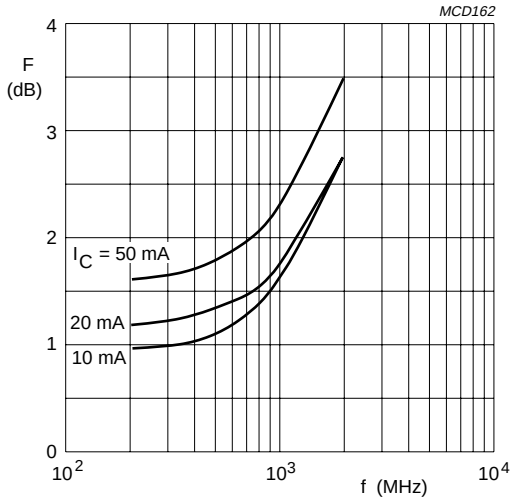
V_{CE} = 8 V; I_C = 30 mA.

Fig.10 Gain as a function of frequency.



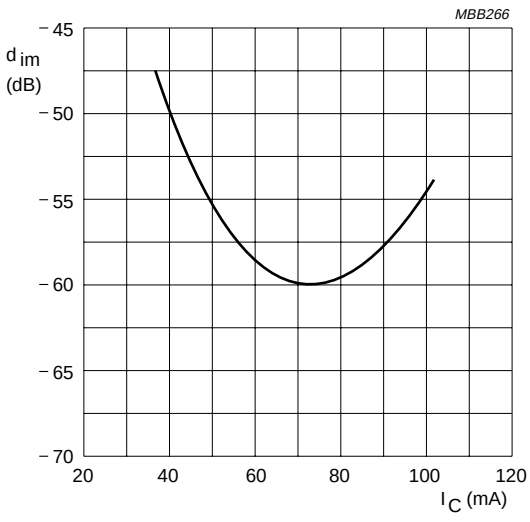
V_{CE} = 6 V.

Fig.11 Minimum noise figure as a function of collector current.



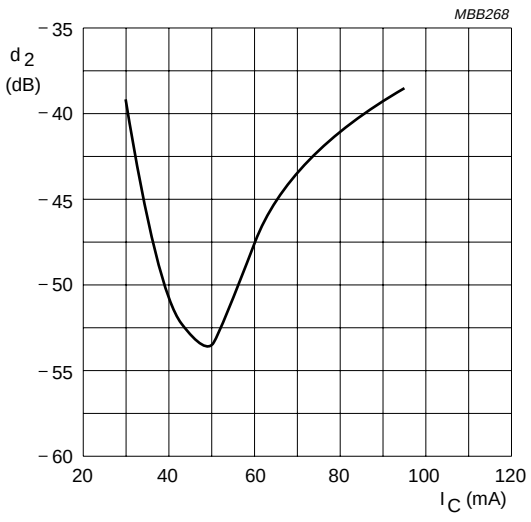
V_{CE} = 6 V.

Fig.12 Minimum noise figure as a function of frequency.



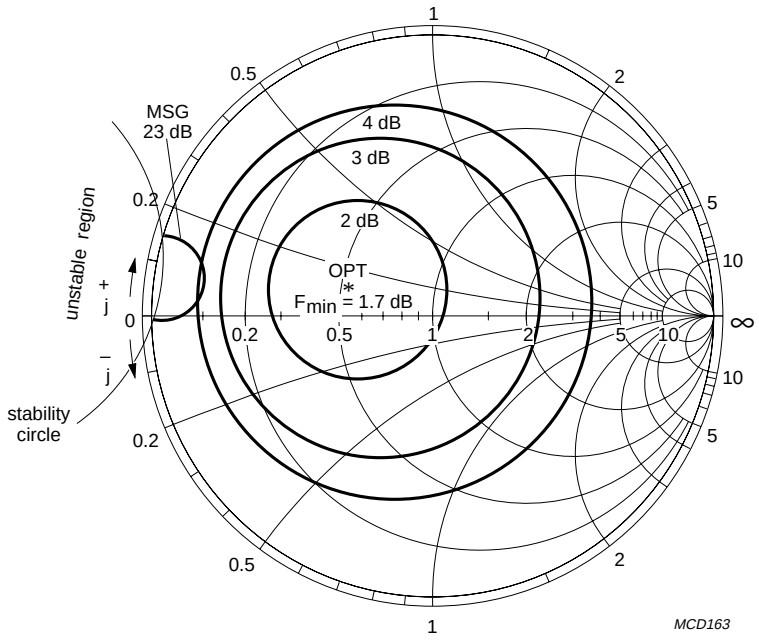
V_{CE} = 8 V ; V_o = 700 mV; $f_{(p+q-r)}$ = 793.25 MHz; T_{amb} = 25 °C.

Fig.13 Intermodulation distortion, typical values.



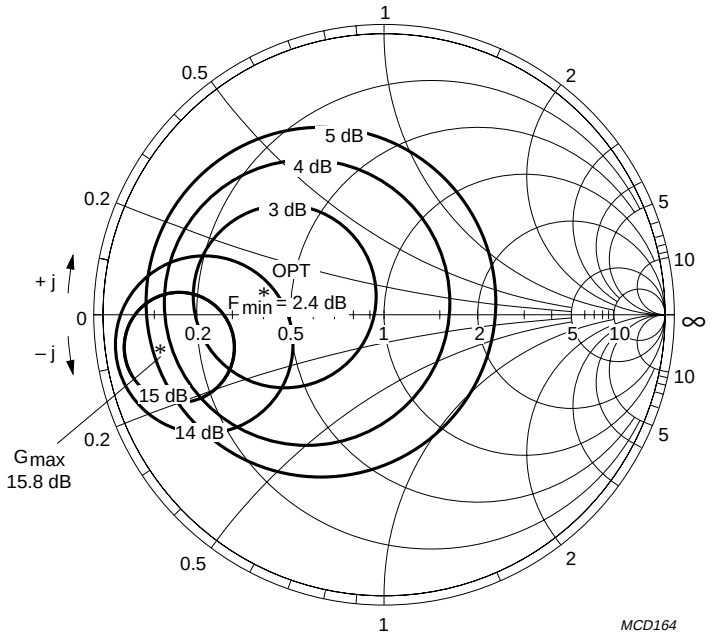
V_{CE} = 8 V; V_o = 50 mV; $f_{(p+q-r)}$ = 810 MHz; T_{amb} = 25 °C.

Fig.14 Second order intermodulation distortion, typical values.



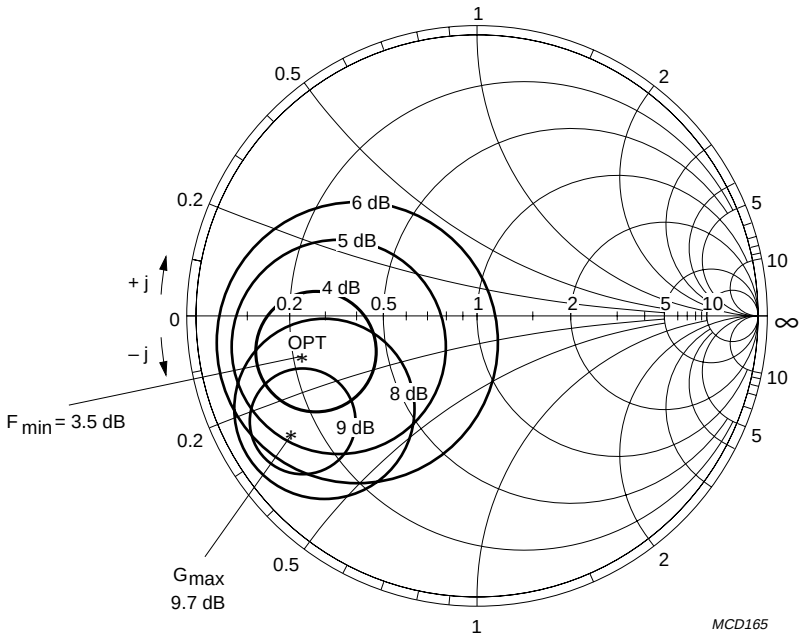
Z_o = 50 Ω.
Maximum stable gain = 23 dB.

Fig.15 Noise circle figure.



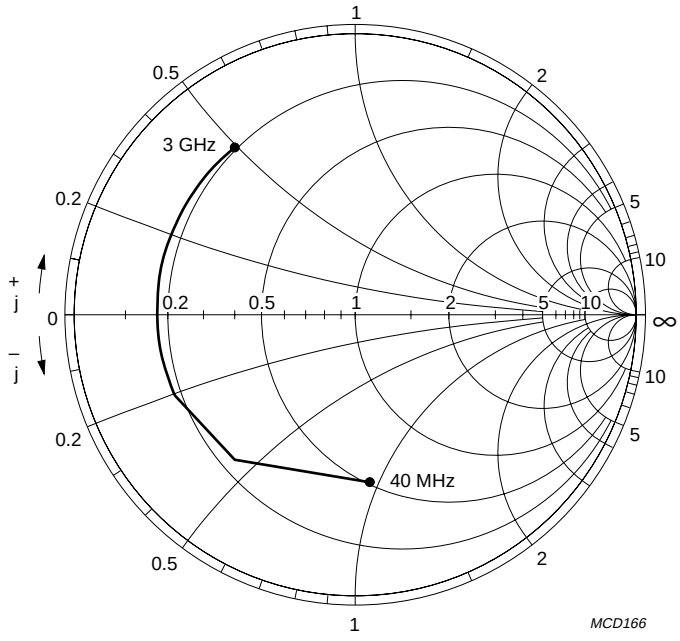
Z_o = 50 Ω.

Fig.16 Noise circle figure.



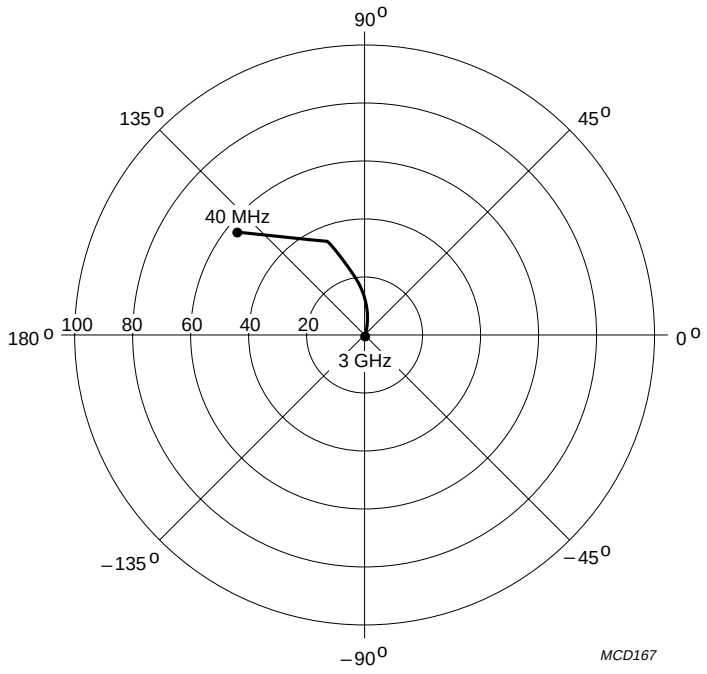
Z_o = 50 Ω.

Fig.17 Noise circle figure.



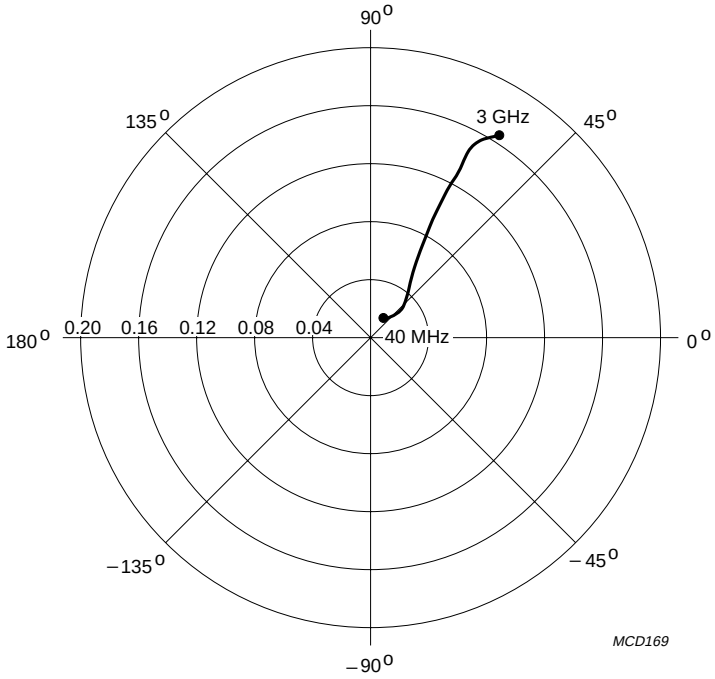
V_{CE} = 6 V; I_C = 50 mA.

Fig.18 Common emitter input reflection coefficient (S_{11}).



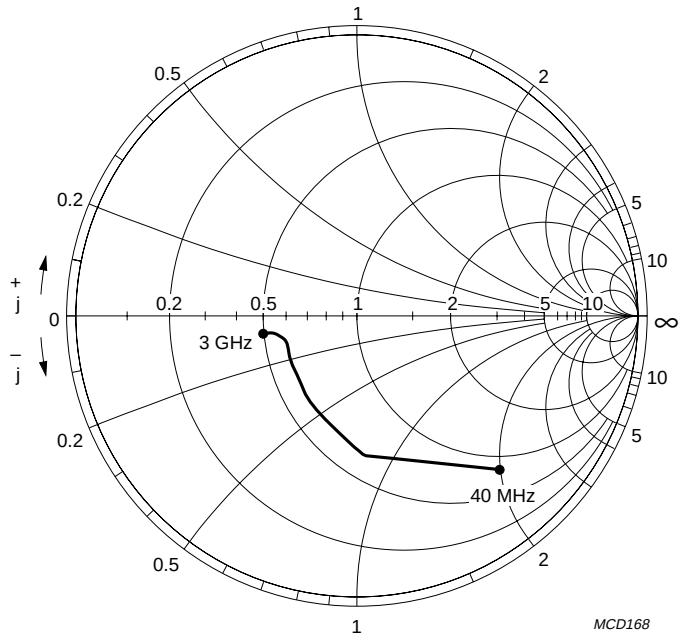
V_{CE} = 6 V; I_C = 50 mA.

Fig.19 Common emitter forward transmission coefficient (S_{21}).



V_{CE} = 6 V; I_C = 50 mA.

Fig.20 Common emitter reverse transmission coefficient (S_{12}).



V_{CE} = 6 V; I_C = 50 mA.

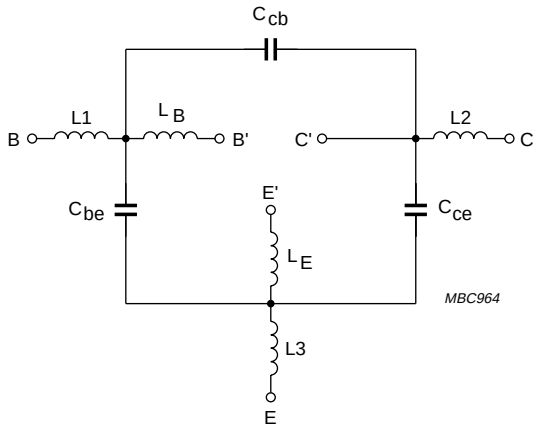
Fig.21 Common emitter output reflection coefficient (S_{22}).

SPICE parameters for BFQ195 crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	1.972	fA
2	BF	150.0	–
3	NF	990.8	m
4	VAF	54.72	V
5	IKF	30.00	A
6	ISE	47.82	fA
7	NE	1.580	–
8	BR	165.4	–
9	NR	993.9	m
10	VAR	2.351	V
11	IKR	9.967	A
12	ISC	3.510	aA
13	NC	1.124	–
14	RB	5.000	Ω
15	IRB	1.000	μA
16	RBM	5.000	Ω
17	RE	368.1	mΩ
18	RC	937.2	mΩ
19 (note 1)	XTB	0.000	–
20 (note 1)	EG	1.110	EV
21 (note 1)	XTI	3.000	–
22	CJE	3.388	pF
23	VJE	600.0	mV
24	MJE	302.9	m
25	TF	11.06	ps
26	XTF	30.02	–
27	VTF	1.649	V
28	ITF	401.9	mA
29	PTF	0.000	deg
30	CJC	1.190	pF
31	VJC	160.1	mV
32	MJC	89.44	m
33	XCJC	130.0	m
34	TR	2.148	ns
35 (note 1)	CJS	0.000	F
36 (note 1)	VJS	750.0	mV
37 (note 1)	MJS	0.000	–
38	FC	785.9	m

Note

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



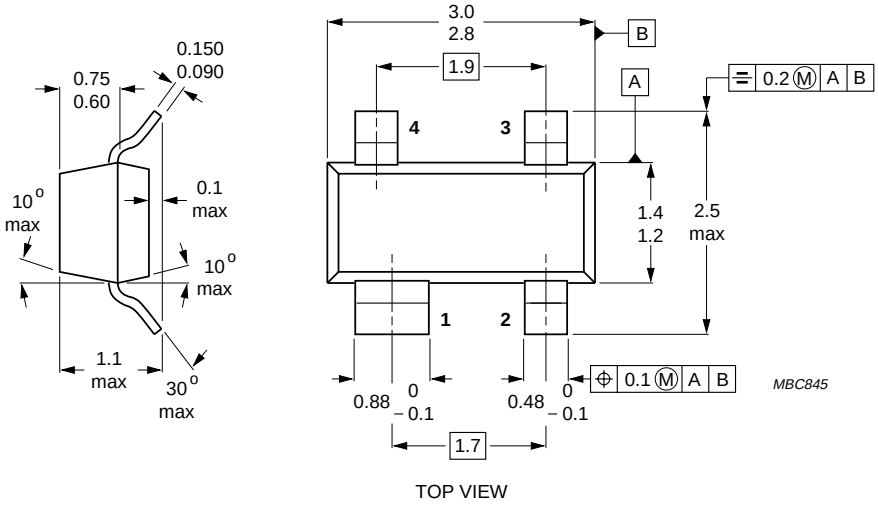
$QL_B = 50$; $QL_E = 50$.
$QL_{B,E}(f) = QL_{B,E} \sqrt{(f/Fc)}$.
Fc = scaling frequency = 1000 MHz.

Fig.22 Package equivalent circuit SOT143; SOT143R.

List of components (see Fig.22)

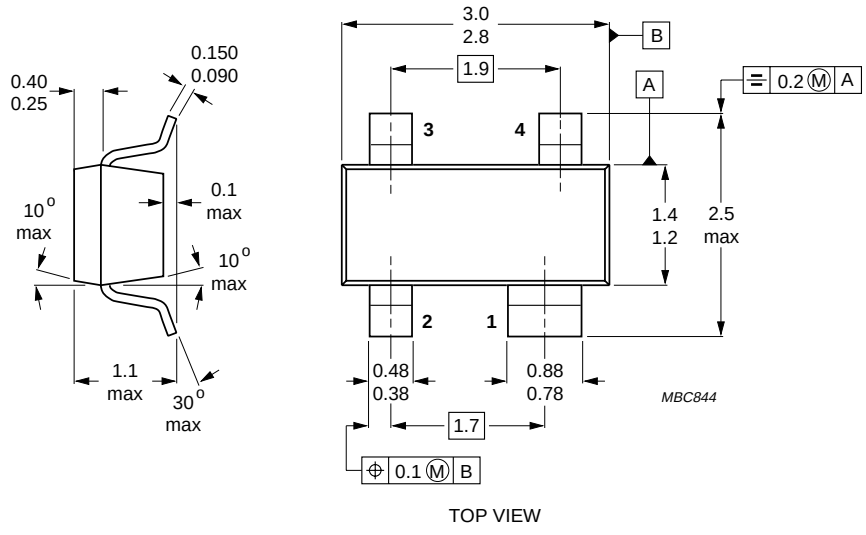
DESIGNATION	VALUE	UNIT
C_{be}	84	fF
C_{cb}	17	fF
C_{ce}	191	fF
L1	0.12	nH
L2	0.21	nH
L3	0.06	nH
L_B	0.95	nH
L_E	0.40	nH

PACKAGE OUTLINES



Dimensions in mm.

Fig.23 SOT143.



Dimensions in mm.

Fig.24 SOT143R.

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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