DATA SHEET

BFG67W
BFG67W/X; BFG67W/XR
NPN 8 GHz wideband transistor

Product specification
File under Discrete Semiconductors, SC14

September 1994

Philips Semiconductors

PHILIPS

NPN 8 GHz wideband transistor

BFG67W BFG67W/X; BFG67W/XR

FEATURES

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

APPLICATIONS

They are intended for wideband applications in the GHz range such as analog satellite television systems and portable RF communication equipment.

DESCRIPTION

NPN silicon planar epitaxial transistors in plastic, 4-pin dual-emitter SOT343 and SOT343R packages.

MARKING

TYPE NUMBER	CODE
BFG67W	V2
BFG67W/X	V6
BFG67W/XR	V7

PINNING

PIN	DESCRIPTION
BFG67W (see Fig.1)	
1	collector
2	base
3	emitter
4	emitter
BFG67W/X (see Fig.1)	
1	collector
2	emitter
3	base
4	emitter
BFG67W/XR (see Fig.2)	
1	collector
2	emitter
3	base
4	emitter

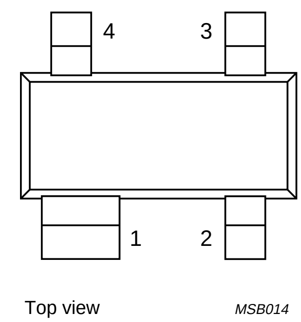

Fig.1 SOT343.

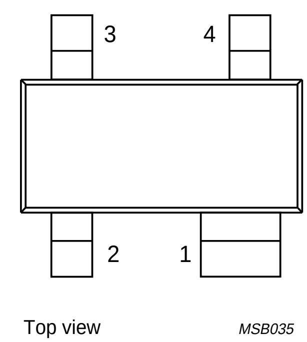

Fig.2 SOT343R.

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)		–	–	50	mA
P_{tot}	total power dissipation	up to T_s = 60 °C	–	–	500	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V	60	100	–	
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 8 V; f = 1 MHz	–	0.5	–	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	7.5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	15.5	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz	–	2.2	–	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	–	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)		–	50	mA
P_{tot}	total power dissipation	up to T_s = 60 °C; see Fig.3; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	up to T_s = 60 °C; note 1	180	K/W

Note to the “Limiting values” **and “Thermal characteristics”**

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

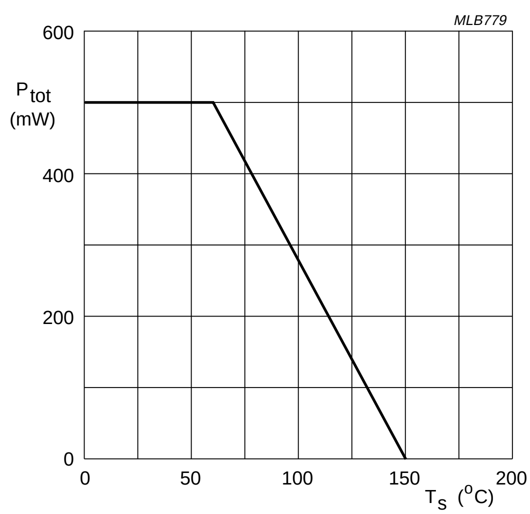

Fig.3 Power derating curve.

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CHARACTERISTICS

T_j = 25 °C (unless otherwise specified).

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 10 μA; I_E = 0	–	–	20	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 10 mA; I_B = 0	–	–	10	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 10 μA; I_C = 0	–	–	2.5	V
I_{CBO}	collector cut-off current	open emitter; V_{CB} = 5 V; I_E = 0	–	–	50	nA
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 5 V	60	100	–	
f_T	transition frequency	I_C = 15 mA; V_{CE} = 8 V; f = 500 MHz; T_{amb} = 25 °C	–	7.5	–	GHz
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CE} = 8 V; f = 1 MHz	–	0.7	–	pF
C_e	emitter capacitance	$I_C = i_c$ = 0; V_{EB} = 0.5 V; f = 1 MHz	–	1.3	–	pF
C_{re}	feedback capacitance	I_C = 0; V_{CE} = 8 V; f = 1 MHz	–	0.5	–	pF
G_{UM}	maximum unilateral power gain; note 1	I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz; T_{amb} = 25 °C	–	15.5	–	dB
		I_C = 15 mA; V_{CE} = 8 V; f = 2 GHz; T_{amb} = 25 °C	–	10	–	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 1 GHz	–	1.3	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 15 mA; V_{CE} = 8 V; f = 1 GHz	–	1.7	–	dB
		$\Gamma_s = \Gamma_{opt}$; I_C = 5 mA; V_{CE} = 8 V; f = 2 GHz	–	2.2	–	dB

Note

1. G_{UM} is the maximum unilateral power gain, assuming s_{12} is zero. $G_{UM} = 10\ \log\frac{|s_{21}|^2}{(1-|s_{11}|^2)\ (1-|s_{22}|^2)}$ dB.

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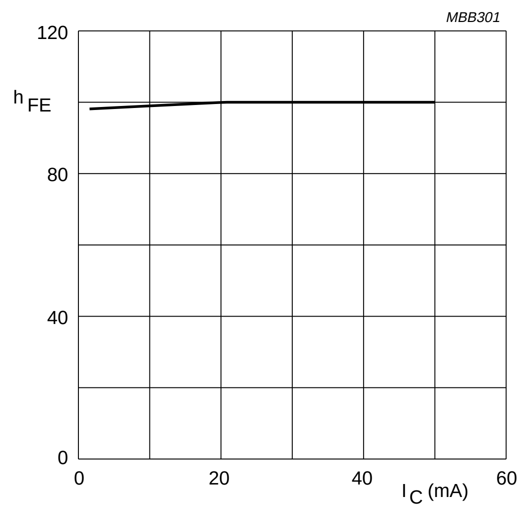
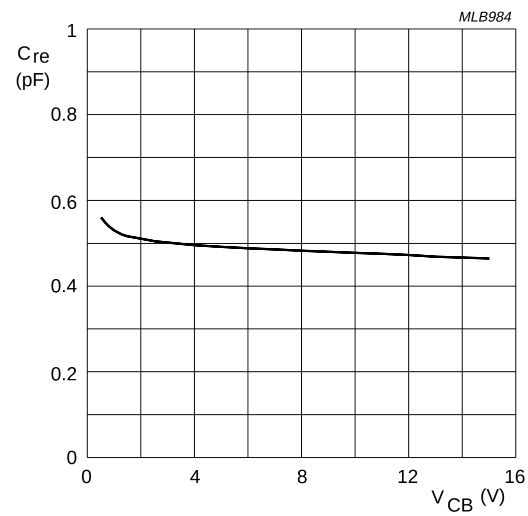


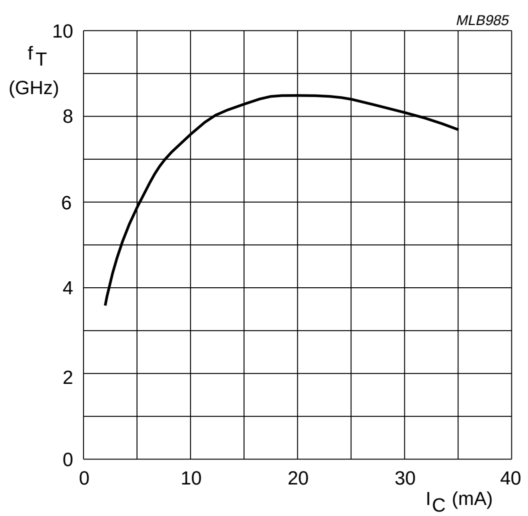
V_{CE} = 5 V.

Fig.4 DC current gain as a function of collector current; typical values.



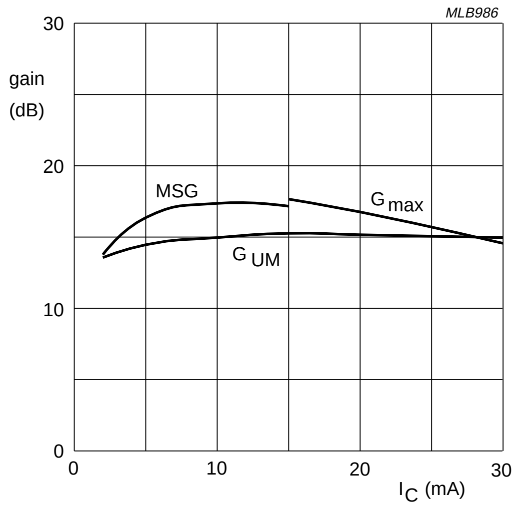
I_C = 0; f = 1 MHz.

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



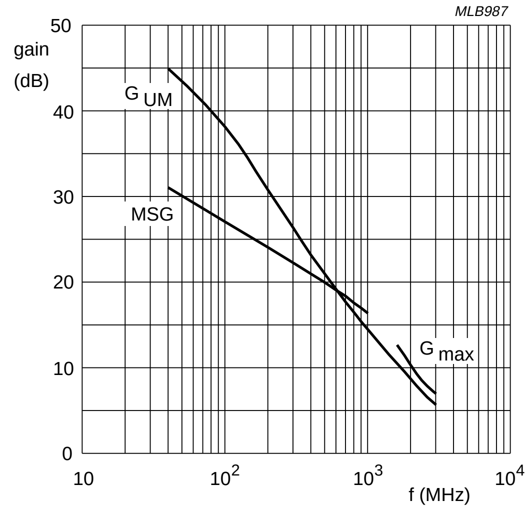
f = 2 GHz; V_{CE} = 8 V; T_{amb} = 25 °C.

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



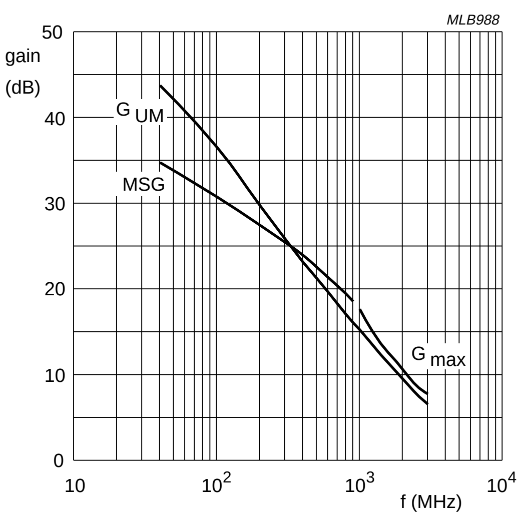
f = 1 GHz; V_{CE} = 8 V.

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



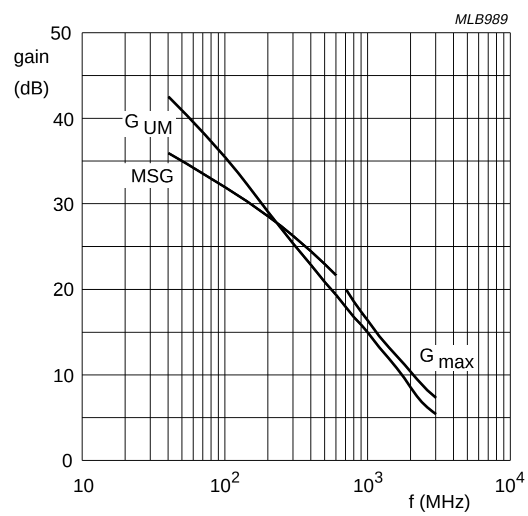
I_C = 5 mA; V_{CE} = 8 V.

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



I_C = 15 mA; V_{CE} = 8 V.

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



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

Fig.10 Gain as a function of frequency; typical values.

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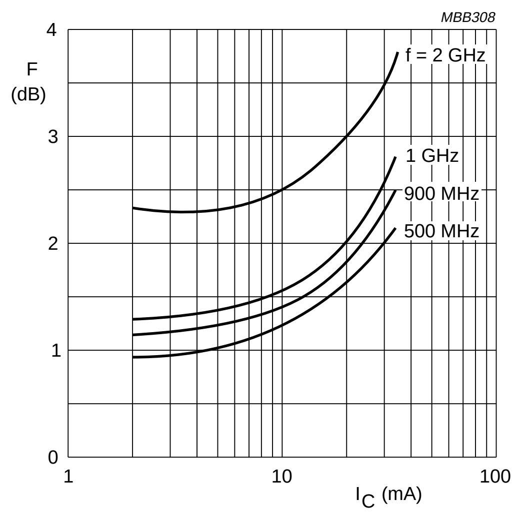
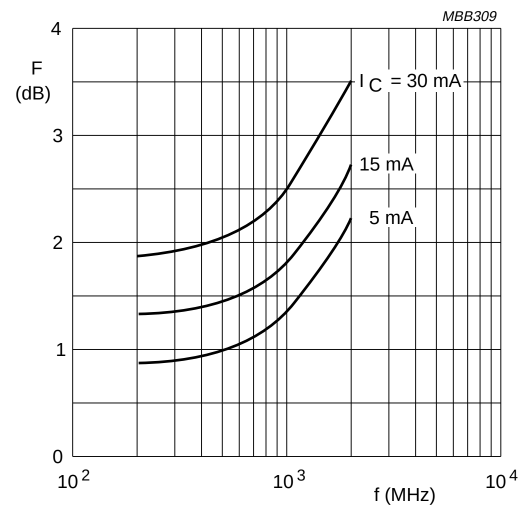


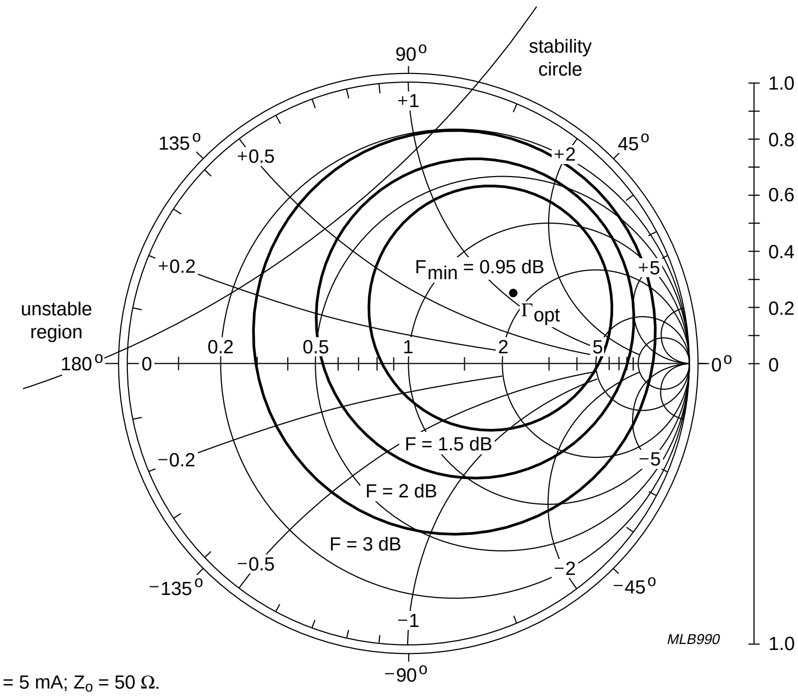
V_{CE} = 8 V.

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



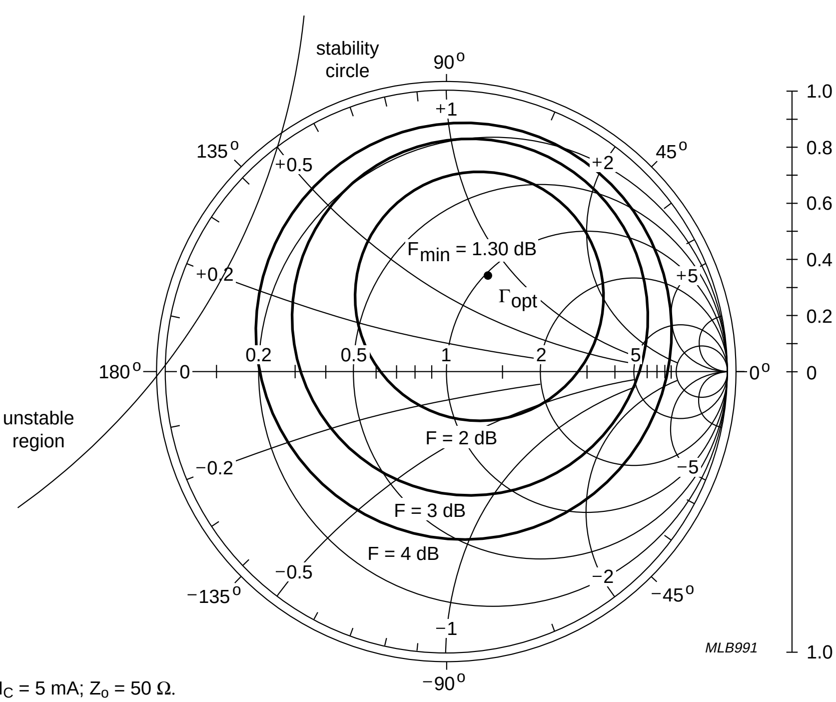
V_{CE} = 8 V.

Fig.12 Minimum noise figure as a function of frequency; typical values.



f = 500 MHz; V_{CE} = 8 V; I_C = 5 mA; Z_o = 50 Ω.

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



f = 1 GHz; V_{CE} = 8 V; I_C = 5 mA; Z_o = 50 Ω.

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

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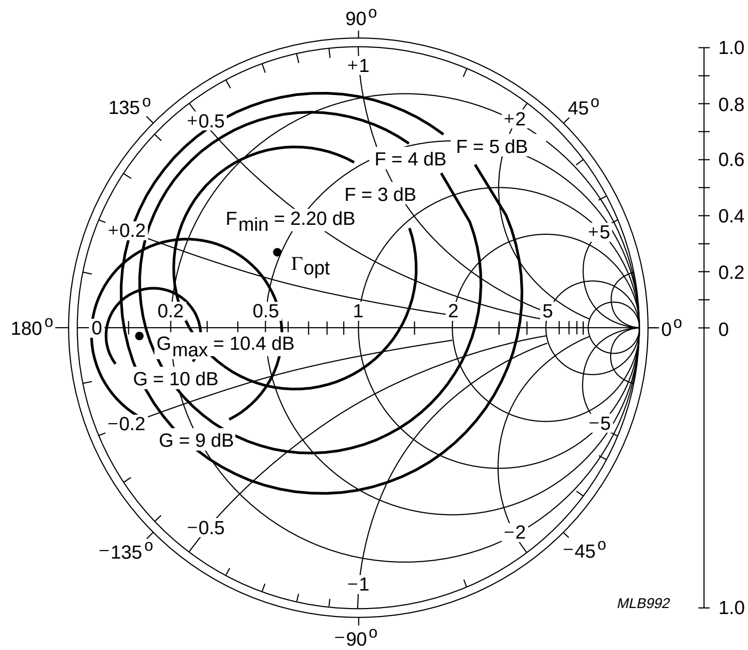
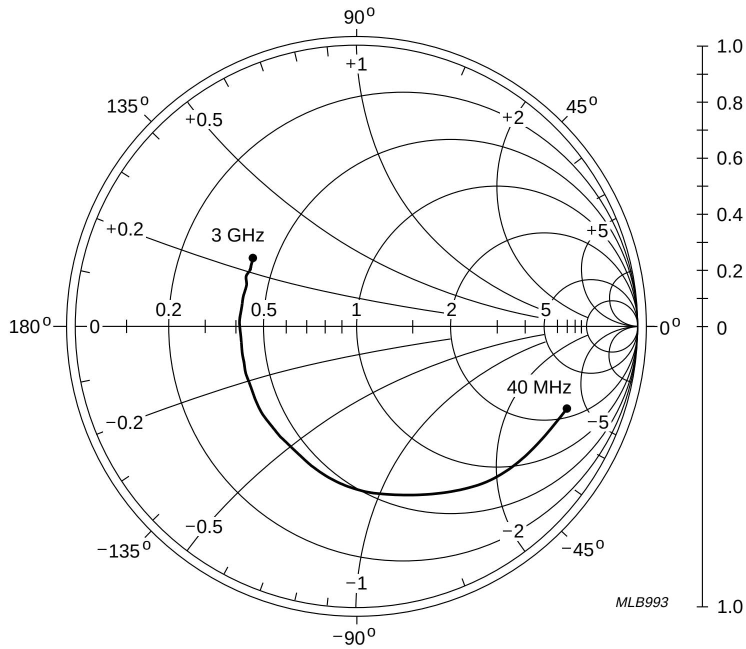


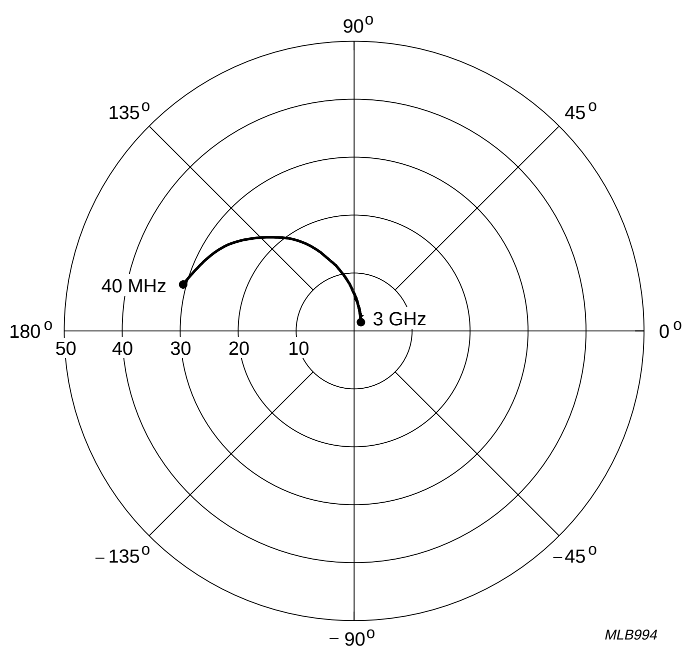
f = 2 GHz; V_{CE} = 8 V; I_C = 5 mA; Z_o = 50 Ω.

Fig.15 Common emitter noise figure circles; typical values.



V_{CE} = 8 V; I_C = 15 mA; Z_o = 50 Ω.

Fig.16 Common emitter input reflection coefficient (s_{11}); typical values.



V_{CE} = 8 V; I_C = 15 mA.

Fig.17 Common emitter forward transmission coefficient (s_{21}); typical values.

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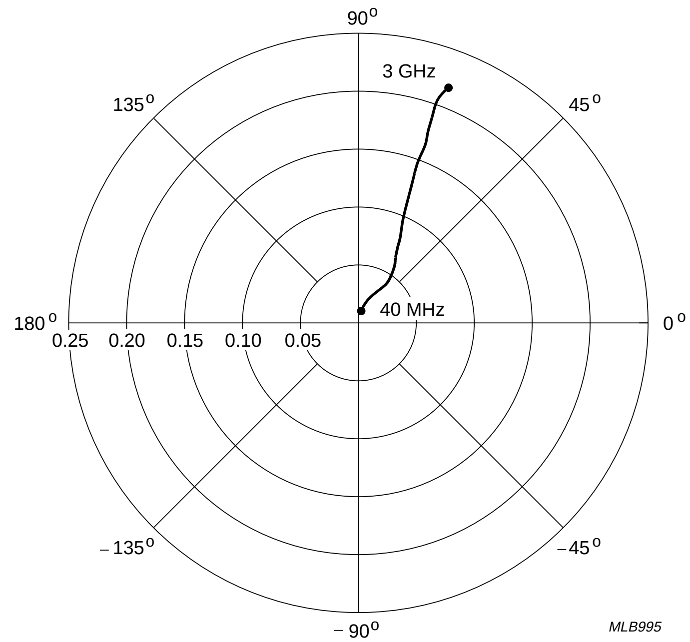
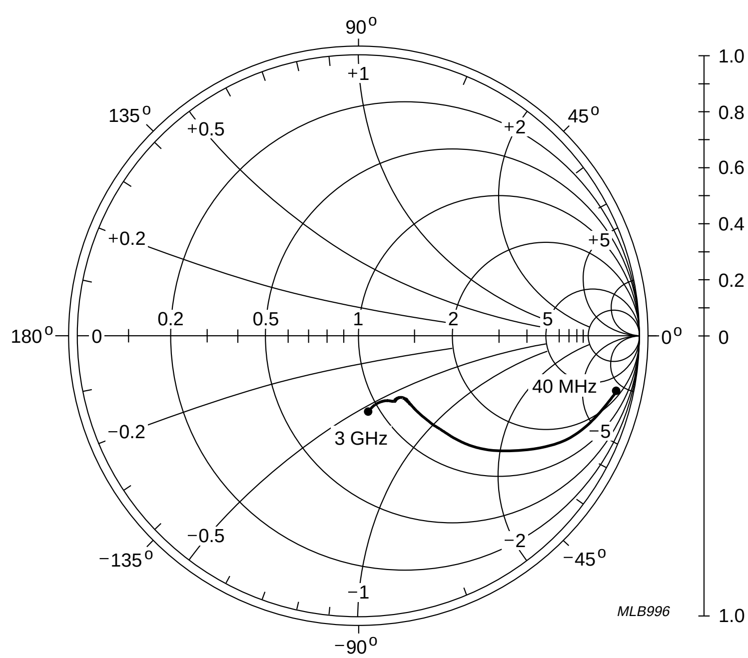


V_{CE} = 8 V; I_C = 15 mA.

Fig.18 Common emitter reverse transmission coefficient (s_{12}); typical values.



V_{CE} = 8 V; I_C = 15 mA; Z_o = 50 Ω.

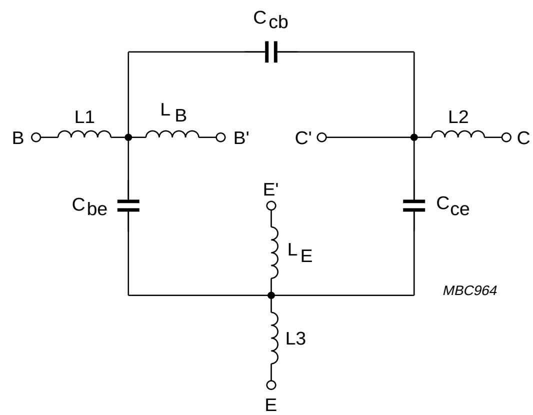
Fig.19 Common emitter output reflection coefficient (s_{22}); typical values.

SPICE parameters for the BFG67W crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	556.4	aA
2	BF	170.0	–
3	NF	0.995	–
4	VAF	48.03	V
5	IKF	918.1	mA
6	ISE	10.47	fA
7	NE	1.479	–
8	BR	142.1	–
9	NR	0.994	–
10	VAR	2.555	V
11	IKR	9.632	A
12	ISC	438.2	aA
13	NC	1.089	–
14	RB	10.00	Ω
15	IRB	1.000	μA
16	RBM	10.00	Ω
17	RE	655.9	mΩ
18	RC	2.000	Ω
19(1)	XTB	0.000	–
20(1)	EG	1.110	eV
21(1)	XTI	3.000	–
22	CJE	1.137	pF
23	VJE	600.0	mV
24	MJE	0.249	–
25	TF	11.97	ps
26	XTF	25.99	–
27	VTF	1.223	V
28	ITF	197.3	mA
29	PTF	10.03	deg
30	CJC	515.9	fF
31	VJC	155.8	mV
32	MJC	56.02	–
33	XCJC	130.0	–
34	TR	1.877	ns
35(1)	CJS	0.000	F
36(1)	VJS	750.0	mV
37(1)	MJS	0.000	–
38	FC	0.870	–

Note

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



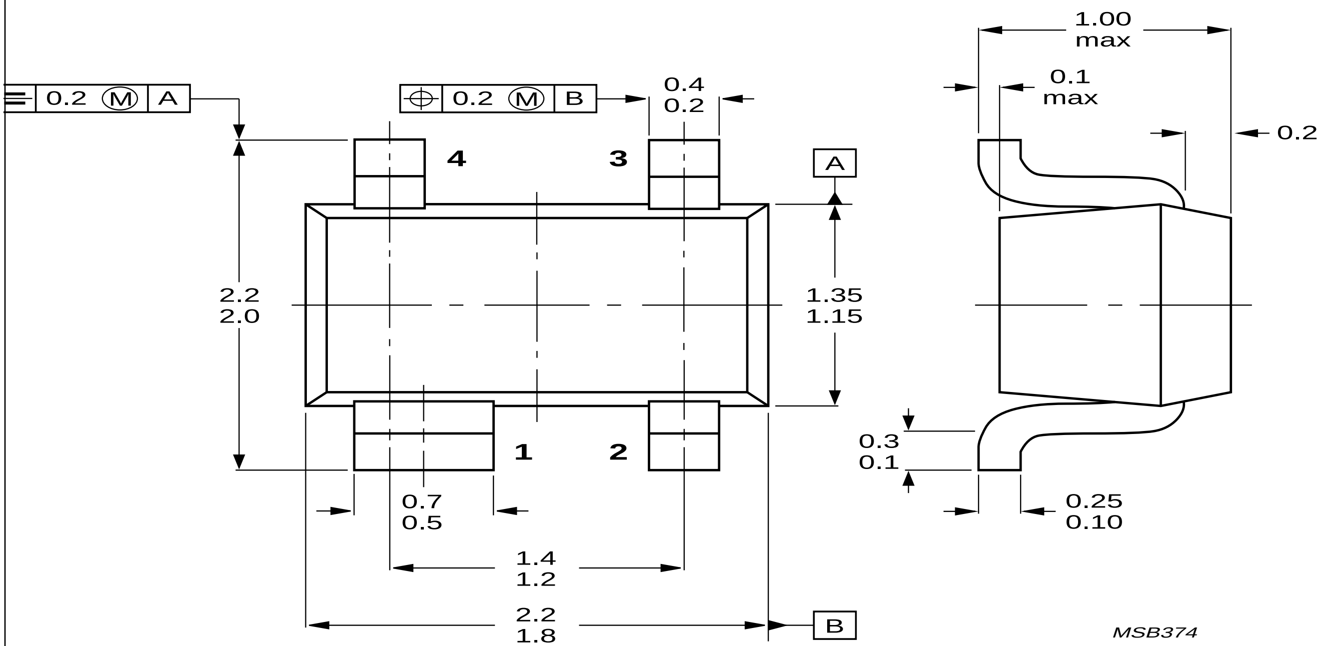
$QL_B = 50$; $QL_E = 50$; $QL_{B,E}(f) = QL_{B,E}\sqrt{(f/f_c)}$;
f_c = scaling frequency = 1 GHz.

Fig.20 Package equivalent circuit SOT343; SOT343R.

List of components (see Fig.20)

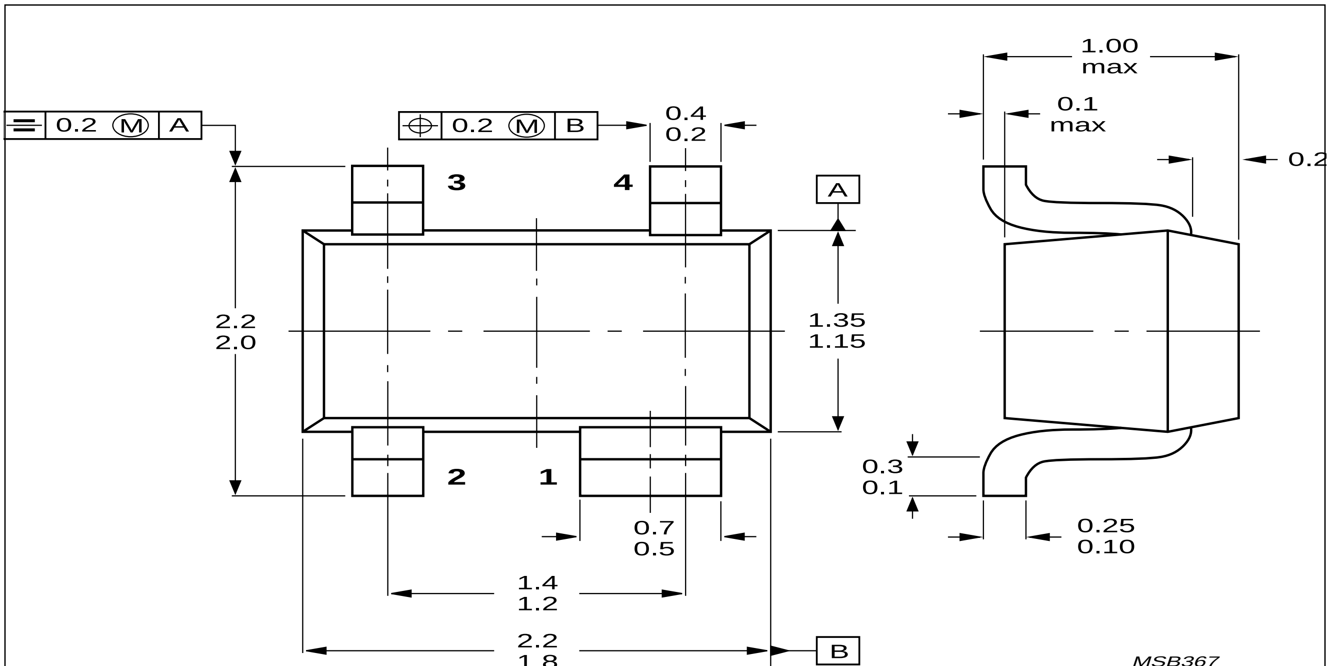
DESIGNATION	VALUE	UNIT
C_{be}	70	fF
C_{cb}	50	fF
C_{ce}	115	fF
L1	0.34	nH
L2	0.10	nH
L3	0.25	nH
L_B	0.40	nH
L_E	0.40	nH

PACKAGE OUTLINES



Dimensions in mm.

Fig.21 SOT343.



Dimensions in mm.

Fig.22 SOT343R.

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.	

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