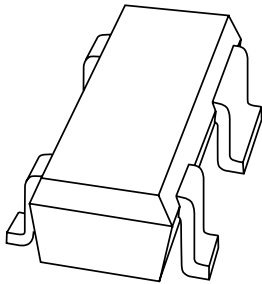


DATA SHEET



BFU540 NPN SiGe wideband transistor

Preliminary specification

2002 Jan 28

NPN SiGe wideband transistor

BFU540

FEATURES

- Very high power gain
- Very low noise figure
- High transition frequency
- Emitter is thermal lead
- Low feedback capacitance
- 45 GHz SiGe process.

APPLICATIONS

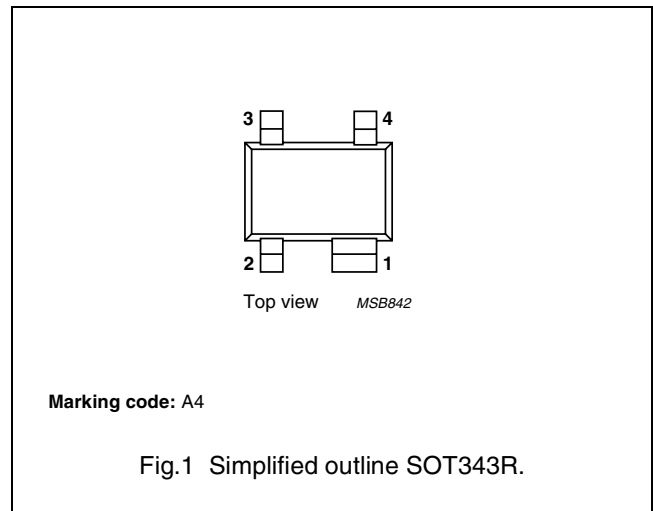
- RF front end
- Wideband applications, e.g. analog and digital cellular telephones, cordless telephones (PHS, DECT, etc.)
- Radar detectors
- Pagers
- Satellite television tuners (SATV)
- High frequency oscillators.

DESCRIPTION

NPN SiGe wideband transistor for low voltage applications in a plastic, 4-pin dual-emitter SOT343R package.

PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	emitter
4	collector



QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CB0}	collector-base voltage	open emitter	–	–	9	V
V_{CEO}	collector-emitter voltage	open base	–	–	2.3	V
I_C	collector current (DC)		–	40	50	mA
P_{tot}	total power dissipation	$T_s \leq 98\text{ }^\circ\text{C}$	–	–	115	mW
h_{FE}	DC current gain	$I_C = 40\text{ mA}; V_{CE} = 2\text{ V}; T_J = 25\text{ }^\circ\text{C}$	70	140	210	
G_{max}	maximum power gain	$I_C = 40\text{ mA}; V_{CE} = 2\text{ V}; f = 2\text{ GHz}; T_{amb} = 25\text{ }^\circ\text{C}$	–	20	–	dB
NF	noise figure	$I_C = 2\text{ mA}; V_{CE} = 2\text{ V}; f = 2\text{ GHz}; \Gamma_S = \Gamma_{opt}$	–	0.9	–	dB

CAUTION

This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A and SNW-FQ-302B.

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LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 60134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	9	V
V_{CEO}	collector-emitter voltage	open base	–	2.3	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	50	mA
P_{tot}	total power dissipation	$T_s \leq 98\text{ °C}$; note 1; see Fig.2	–	115	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C

Note

- T_s is the temperature at the soldering point of the emitter pins.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	450	K/W

CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 2.5\ \mu\text{A}$; $I_E = 0$	9	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 1\ \text{mA}$; $I_B = 0$	2.3	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 2.5\ \mu\text{A}$; $I_C = 0$	2.5	–	–	V
I_{CBO}	collector-base leakage current	$I_E = 0$; $V_{CB} = 4.5\ \text{V}$	–	–	15	nA
h_{FE}	DC current gain	$I_C = 40\ \text{mA}$; $V_{CE} = 2\ \text{V}$	70	140	210	
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 2\ \text{V}$; $f = 1\ \text{MHz}$	–	520	–	fF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 2\ \text{V}$; $f = 1\ \text{MHz}$	–	105	–	fF
G_{max}	maximum power gain; note 1	$I_C = 40\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $T_{amb} = 25\text{ °C}$	–	20	–	dB
NF	noise figure	$I_C = 2\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $\Gamma_S = \Gamma_{opt}$	–	0.9	–	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 20\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $Z_S = Z_{S\ opt}$; $Z_L = Z_{L\ opt}$; note 2	–	11	–	dBm
ITO	third order intercept point	$I_C = 40\ \text{mA}$; $V_{CE} = 2\ \text{V}$; $f = 2\ \text{GHz}$; $Z_S = Z_{S\ opt}$; $Z_L = Z_{L\ opt}$; note 2	–	21	–	dBm

Notes

- G_{max} is the maximum power gain, if $K > 1$. If $K < 1$ then $G_{max} = \text{MSG}$.
- Z_S and Z_L are optimized for gain.

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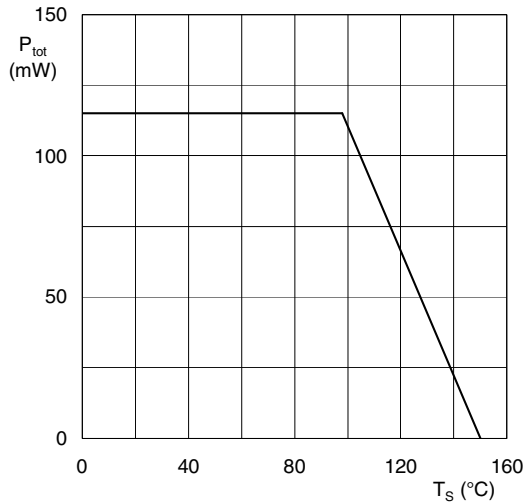
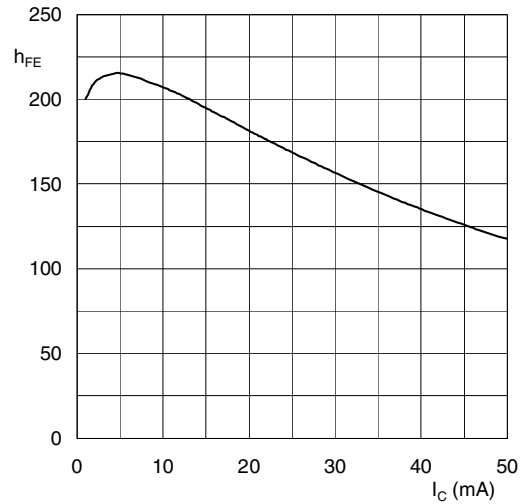


Fig.2 Power derating curve.



$V_{CE} = 2 V$; $T_j = 25 ^{\circ}C$.

Fig.3 DC current gain as a function of collector current; typical values.

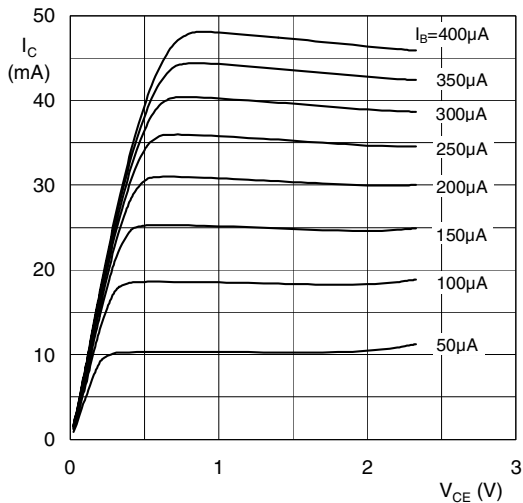
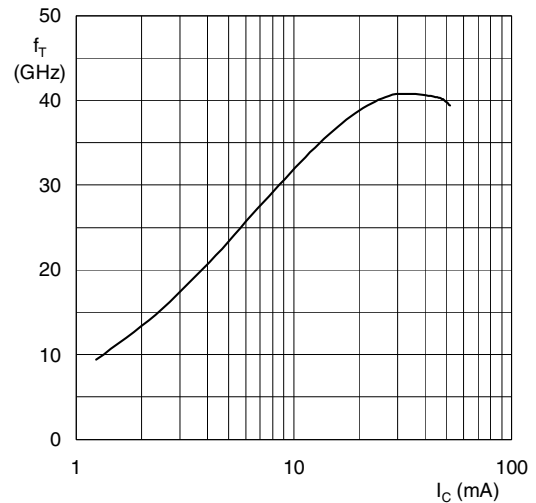


Fig.4 Output characteristics; typical values.

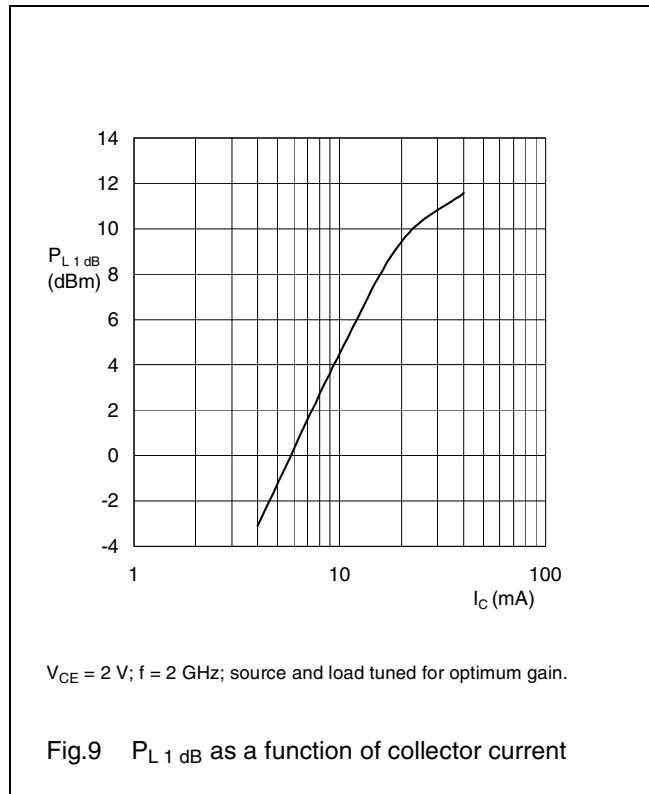
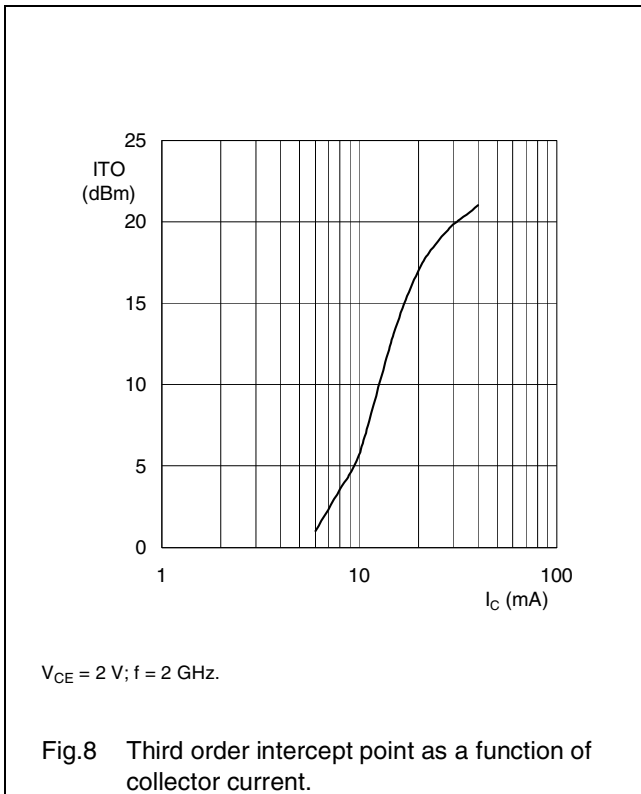
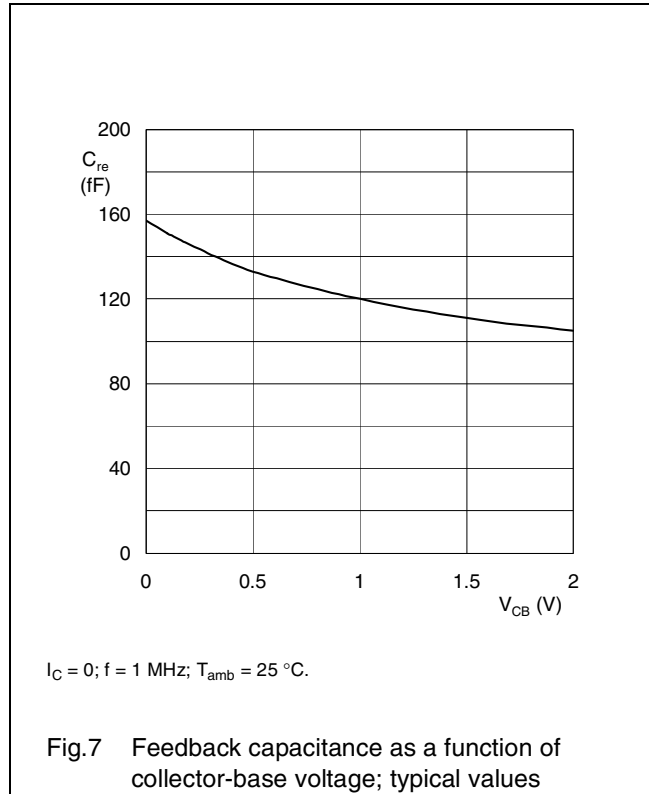
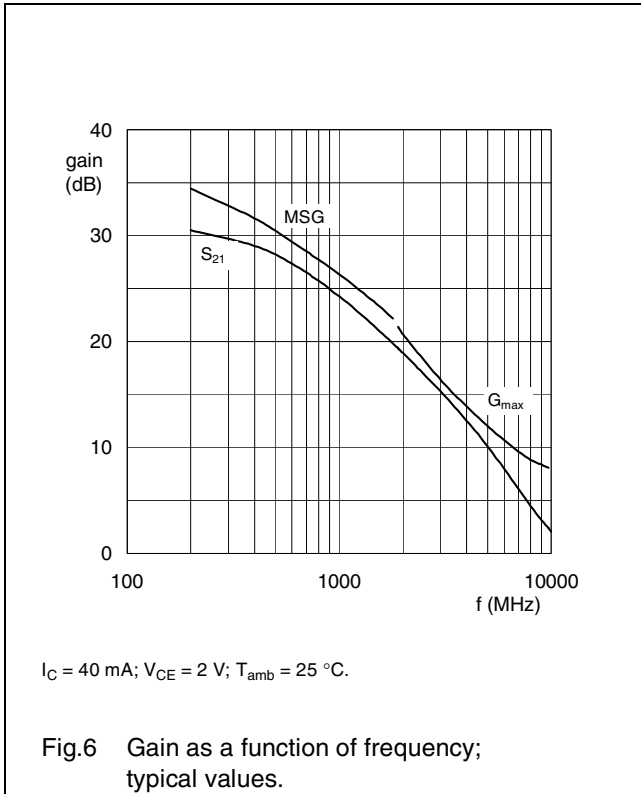


$V_{CB} = 1 V$; $f = 2 GHz$; $T_{amb} = 25 ^{\circ}C$;

Fig.5 Transition frequency as a function of collector current; typical values.

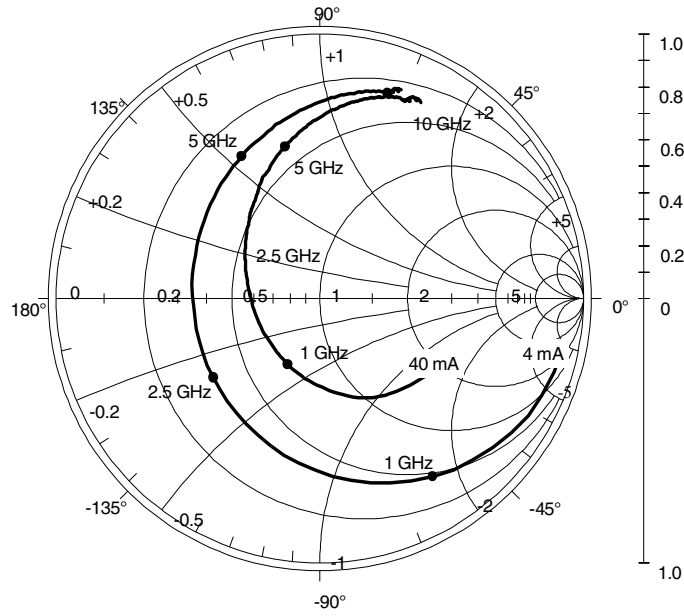
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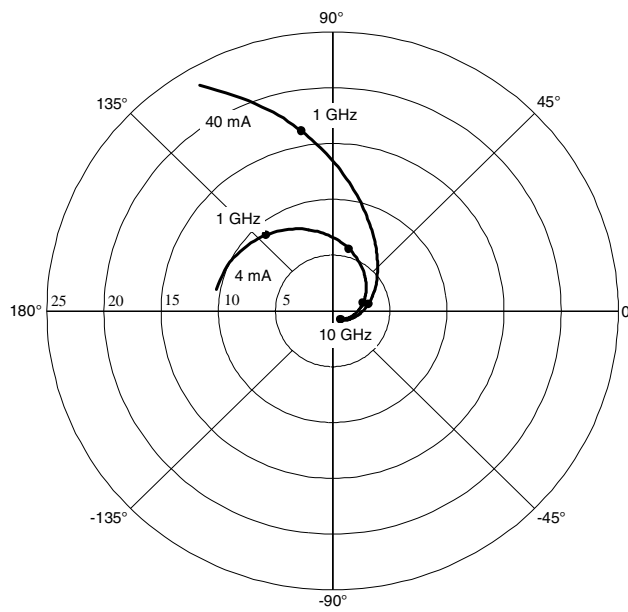
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$I_C = 4 \text{ mA}$ and 40 mA ; $V_{CE} = 2 \text{ V}$; $Z_o = 50 \Omega$.

Fig.10 Common emitter input reflection coefficient (S_{11}).

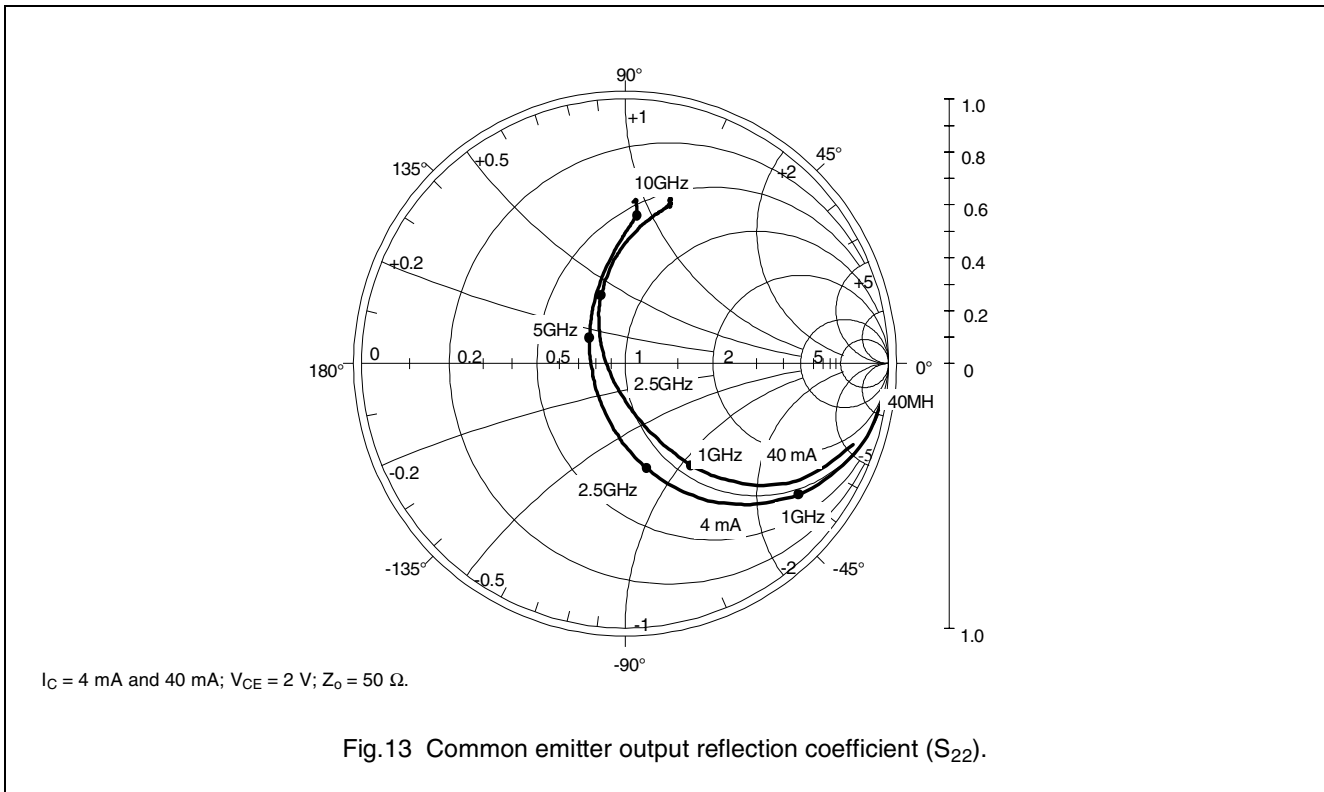
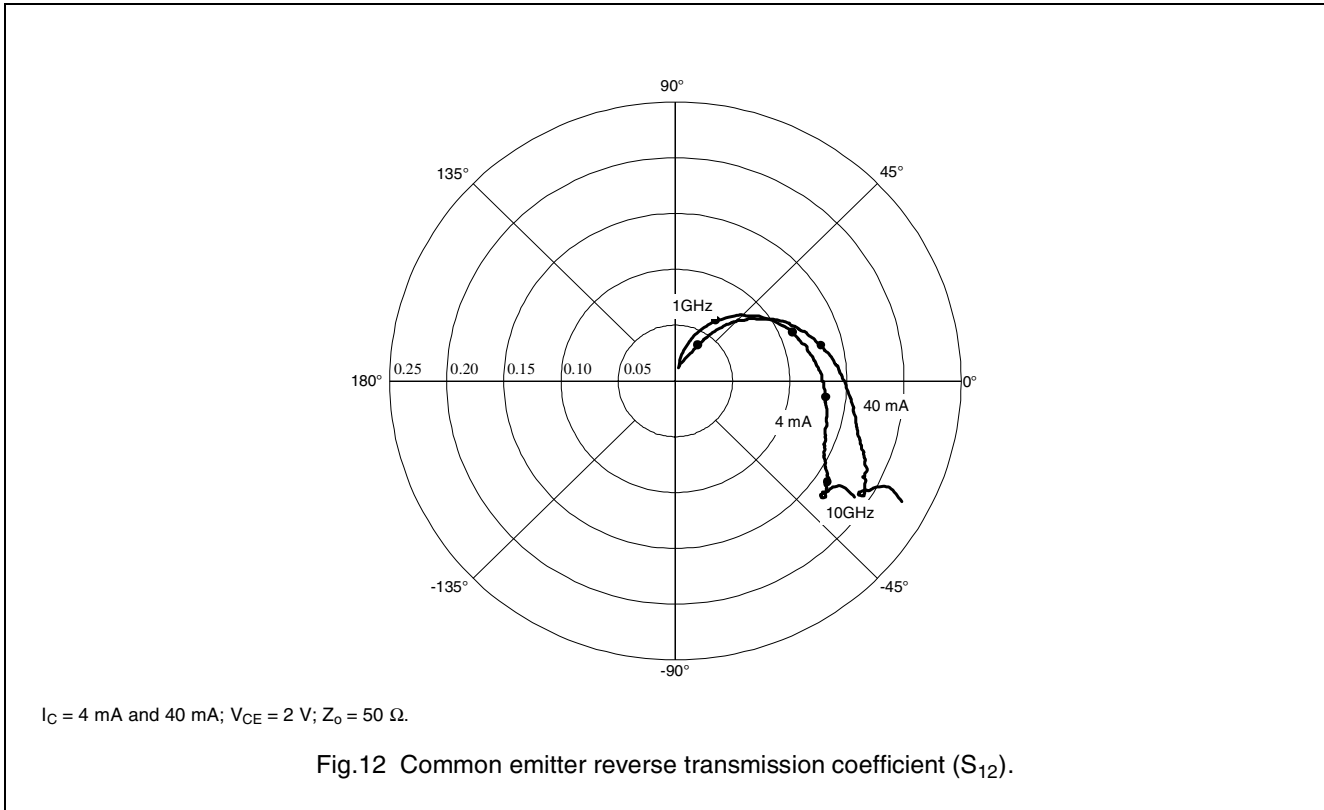


$I_C = 4 \text{ mA}$ and 40 mA ; $V_{CE} = 2 \text{ V}$; $Z_o = 50 \Omega$.

Fig.11 Common emitter forward transmission coefficient (S_{21}).

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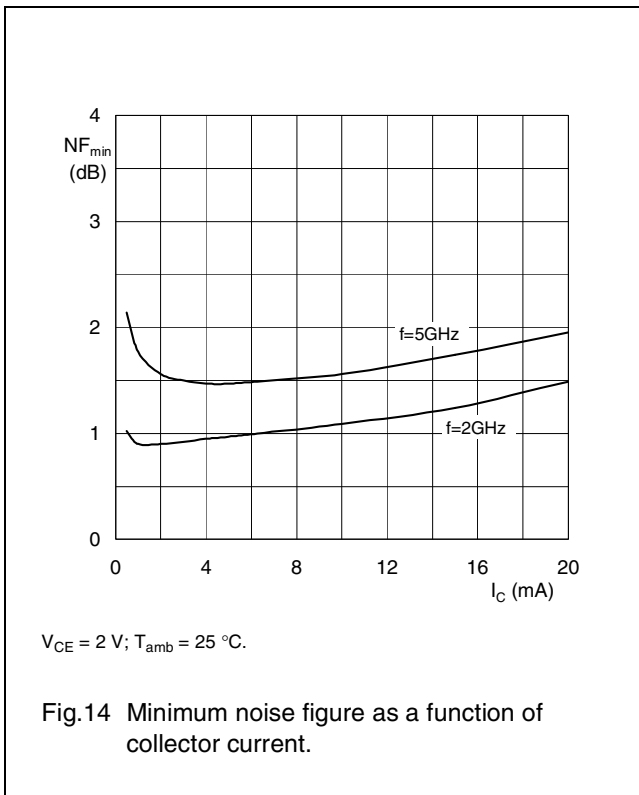


Fig.14 Minimum noise figure as a function of collector current.

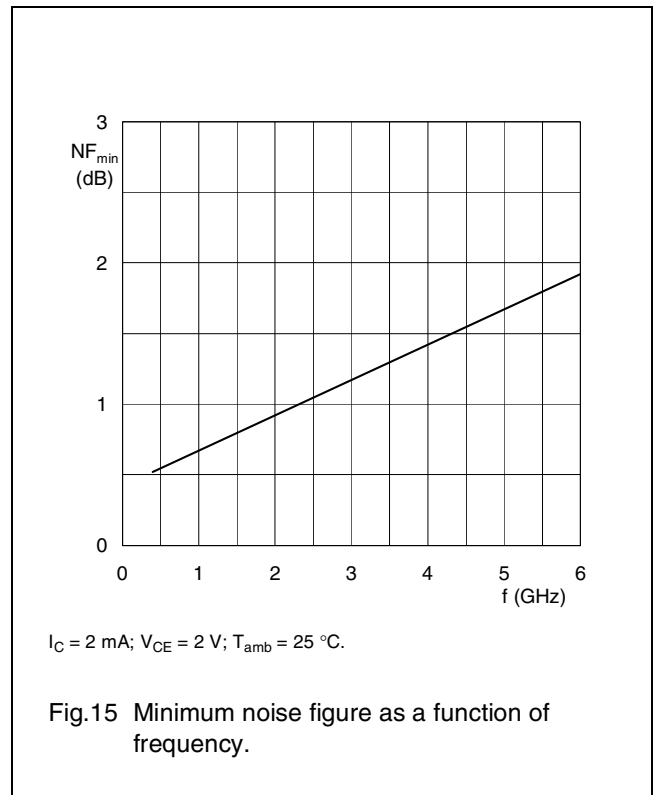


Fig.15 Minimum noise figure as a function of frequency.

Noise data: V_{CE} = 2 V; I_C = 4 mA; T_{amb} = 25 °C; typical values

f (GHz)	F _{min} (dB)	Γ _{opt}		r _n (Ω)
		(mag)	(deg)	
2	1.0	0.39	55.9	0.20
3	1.2	0.23	86.8	0.15
4	1.4	0.11	142.5	0.13
5	1.6	0.14	-121.0	0.16
6	1.7	0.28	-74.2	0.27
7	1.9	0.41	-52.1	0.43
8	2.1	0.47	-32.6	0.66
9	2.3	0.54	-14.1	0.91
10	2.6	0.62	3.7	1.22
11	2.8	0.63	22.7	1.44
12	3.0	0.61	36.8	1.65

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SPICE parameters for the BFU540 die

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	1.5	aA
2	BF	271.5	–
3	NF	1.061	–
4	VAF	25	V
5	IKF	68	mA
6	ISE	1060	fA
7	NE	2.9	–
8	BR	50	–
9	NR	1.01	–
10	VAR	1000000	V
11	IKR	6.4	mA
12	ISC	1.2	fA
13	NC	1.21	–
14	RB	8.75	Ω
15 (1)	IRB	–	–
16	RBM	5	Ω
17	RE	0.9	m Ω
18	RC	9.25	Ω
19	XTB	-2.2	–
20	EG	1.014	eV
21	XTI	3	–
22	CJE	222	fF
23	VJE	918	mV
24	MJE	0.27	–
25	TF	2.1	ps
26	XTF	10	–
27	VTF	1.5	V
28	ITF	0.92	A
29	PTF	30	deg
30	CJC	147	fF
31	VJC	587	mV
32	MJC	0.246	–
33	XCJC	0.44	–
34	TR	20	ps
35	CJS	51	fF
36	VJS	441	mV
37	MJS	0.313	–
38	FC	0.7	–

Notes

1. Not used.

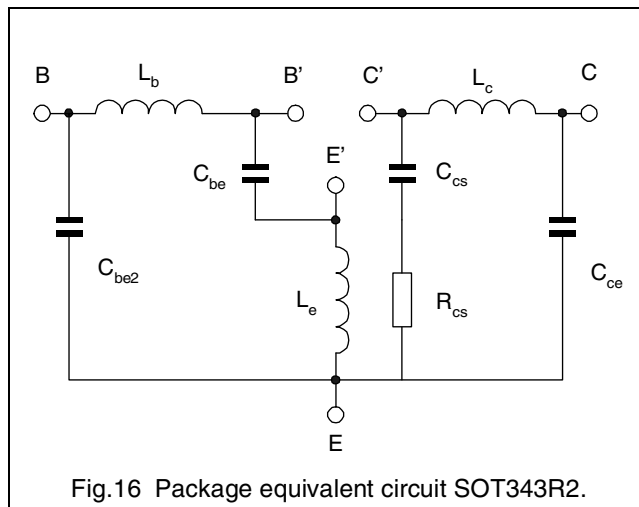


Fig.16 Package equivalent circuit SOT343R2.

List of components (see fig 16)

DESIGNATION	VALUE	UNIT
L_b	1.18	nH
L_c	1.04	nH
L_e	0.32	nH
C_{be1}	146	fF
C_{be2}	55	fF
C_{ce}	56	fF
C_{cs}	100	fF
R_{cs}	170	Ohm

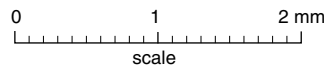
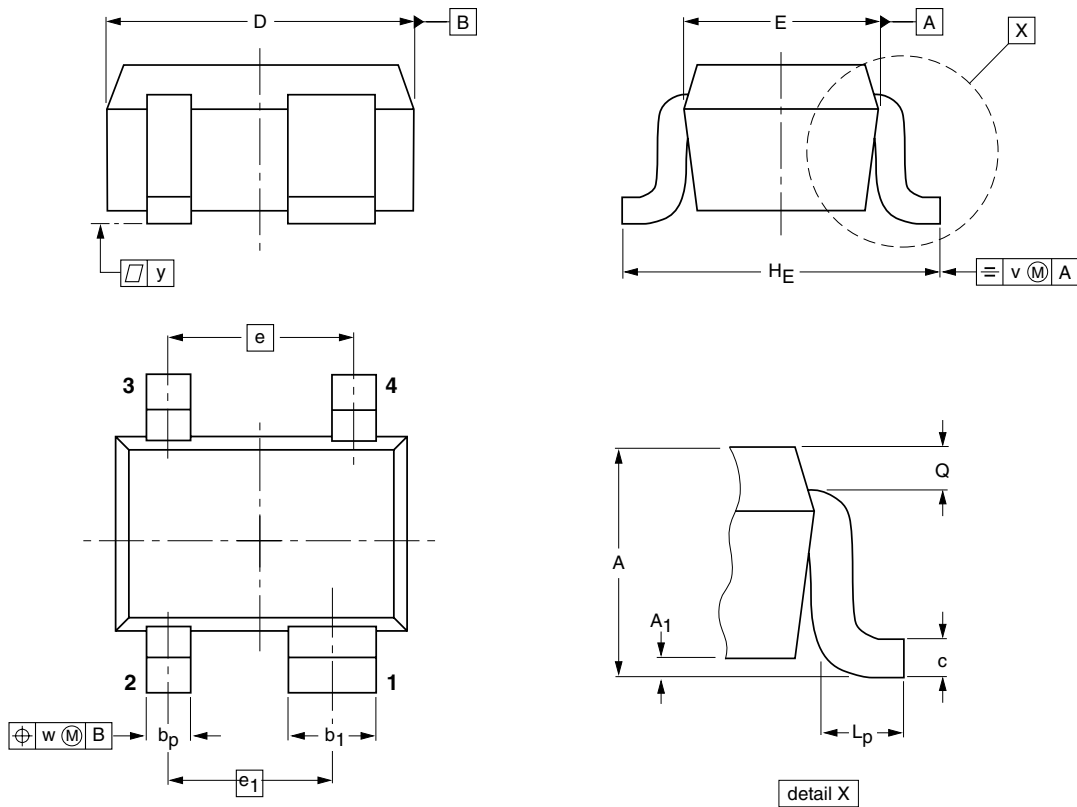
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PACKAGE OUTLINE

Plastic surface mounted package; reverse pinning; 4 leads

SOT343R



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₁ max	b _p	b ₁	c	D	E	e	e ₁	H _E	L _p	Q	v	w	y
mm	1.1 0.8	0.1	0.4 0.3	0.7 0.5	0.25 0.10	2.2 1.8	1.35 1.15	1.3	1.15	2.2 2.0	0.45 0.15	0.23 0.13	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT343R						97-05-21

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