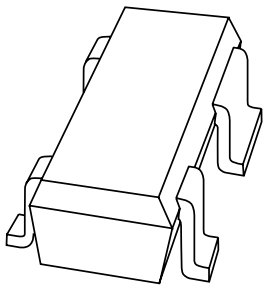
DATA SHEET



BFU540
NPN SiGe wideband transistor

Preliminary specification

2002 Jan 28

Philips
Semiconductors

PHILIPS

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

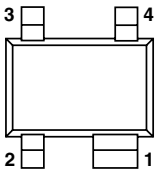
- RF front end
- Wideband applications, e.g. analog and digital cellular telephones, cordless telephones (PHS, DECT, etc.)
- Radar detectors
- Pagers
- Satellite television tuners (SATV)
- High frequency oscillators.

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



Top view MSB842

Marking code: A4

Fig.1 Simplified outline SOT343R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	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	$T_s \leq 98$ °C	–	–	115	mW
h_{FE}	DC current gain	I_C = 40 mA; V_{CE} = 2 V; T_j = 25 °C	70	140	210	
G_{max}	maximum power gain	I_C = 40 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C	–	20	–	dB
NF	noise figure	I_C = 2 mA; V_{CE} = 2 V; f = 2 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.

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	$T_s \leq 98$ °C; note 1; see Fig.2	–	115	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C

Note

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

THERMAL CHARACTERISTICS

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

CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

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

Notes

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

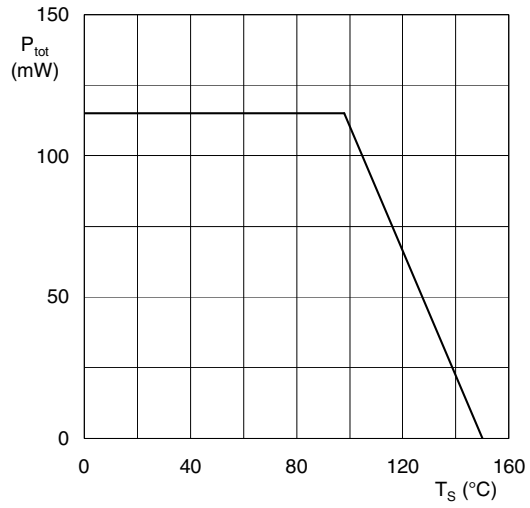
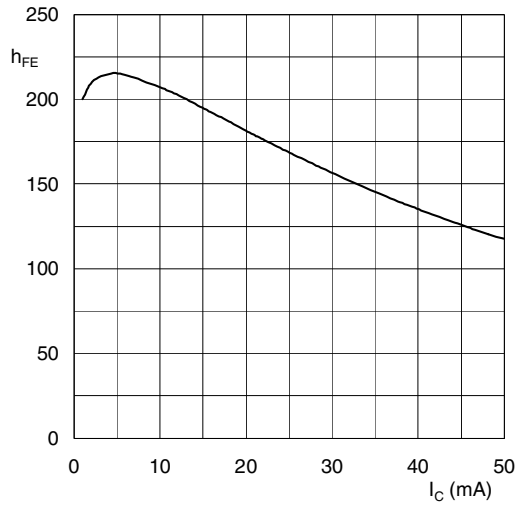


Fig.2 Power derating curve.



V_{CE} = 2 V; T_j = 25 °C.

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

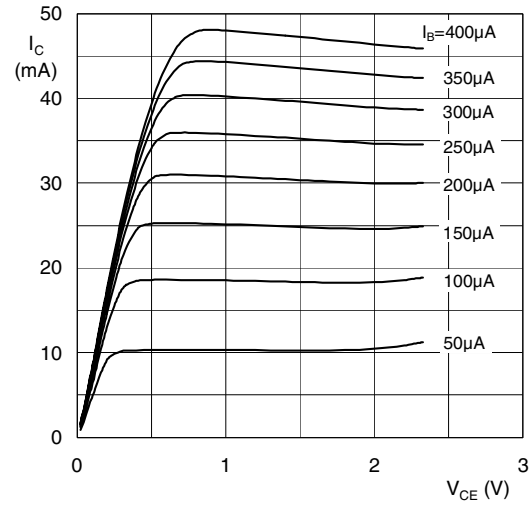
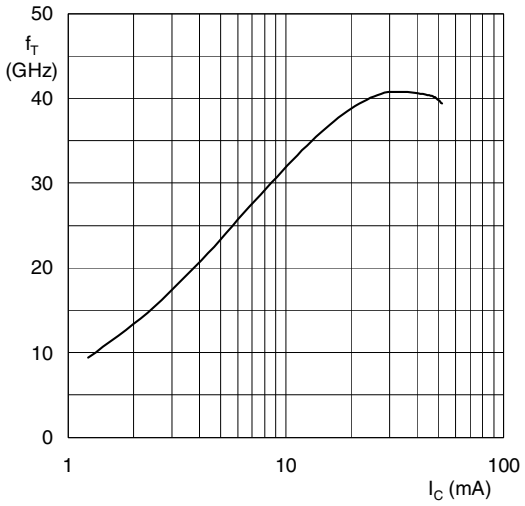
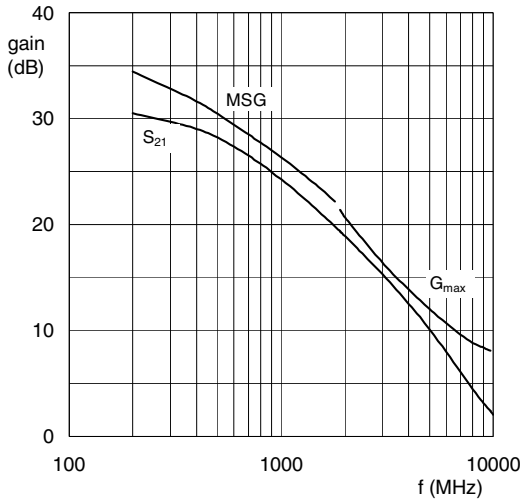


Fig.4 Output characteristics; typical values.



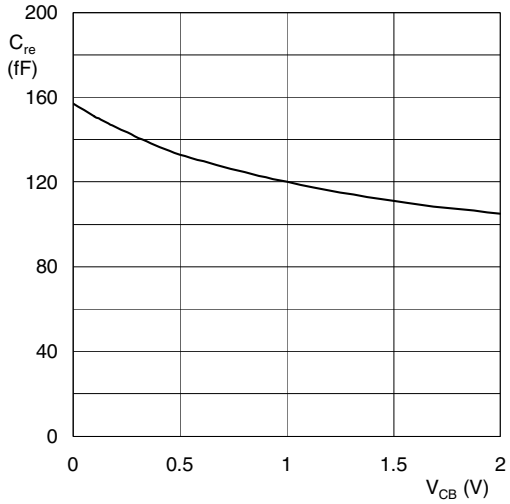
V_{CB} = 1 V; f = 2 GHz; T_{amb} = 25 °C;

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



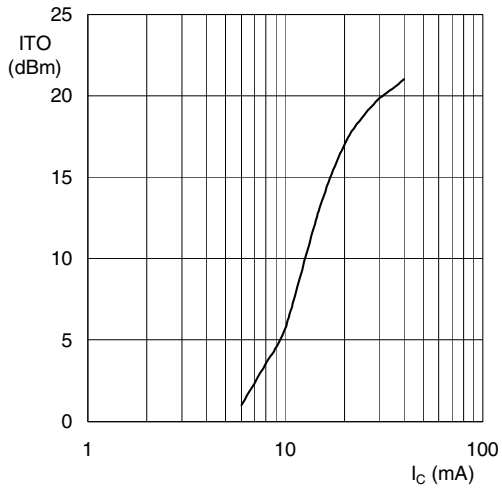
I_C = 40 mA; V_{CE} = 2 V; T_{amb} = 25 °C.

Fig.6 Gain as a function of frequency; typical values.



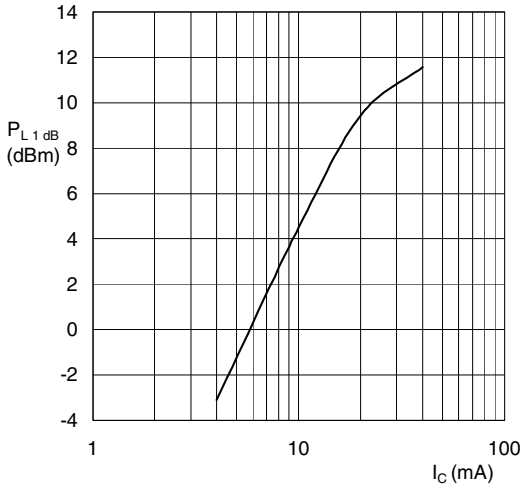
I_C = 0; f = 1 MHz; T_{amb} = 25 °C.

Fig.7 Feedback capacitance as a function of collector-base voltage; typical values



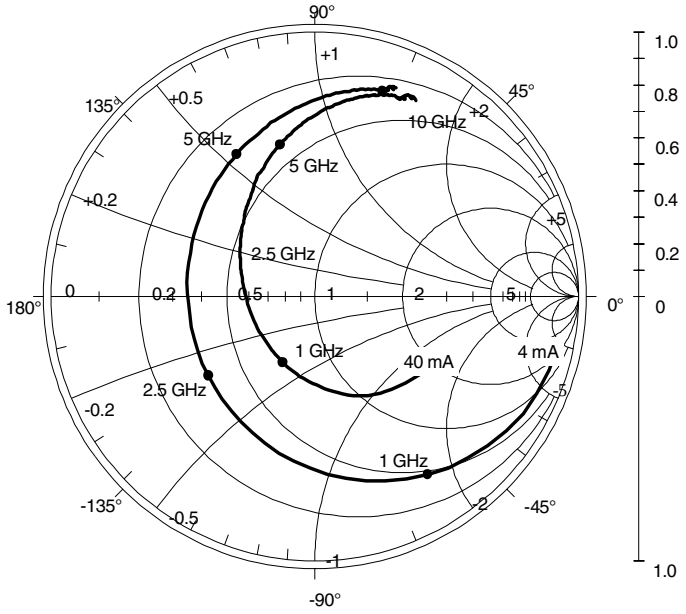
V_{CE} = 2 V; f = 2 GHz.

Fig.8 Third order intercept point as a function of collector current.



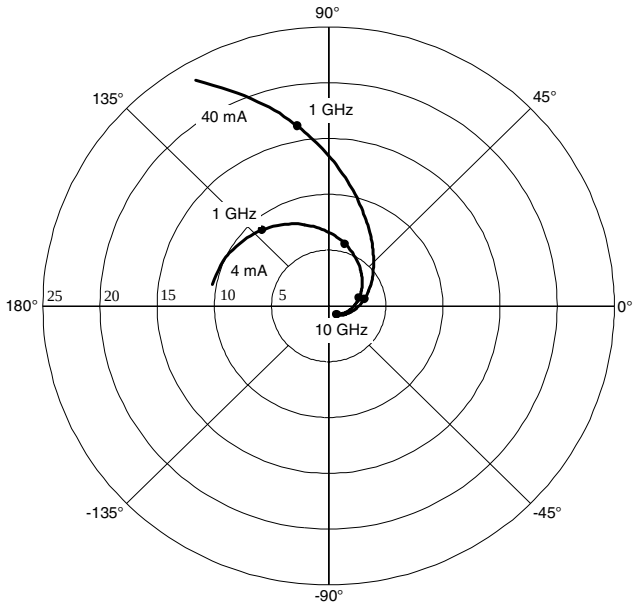
V_{CE} = 2 V; f = 2 GHz; source and load tuned for optimum gain.

Fig.9 $P_{L\ 1\ dB}$ as a function of collector current



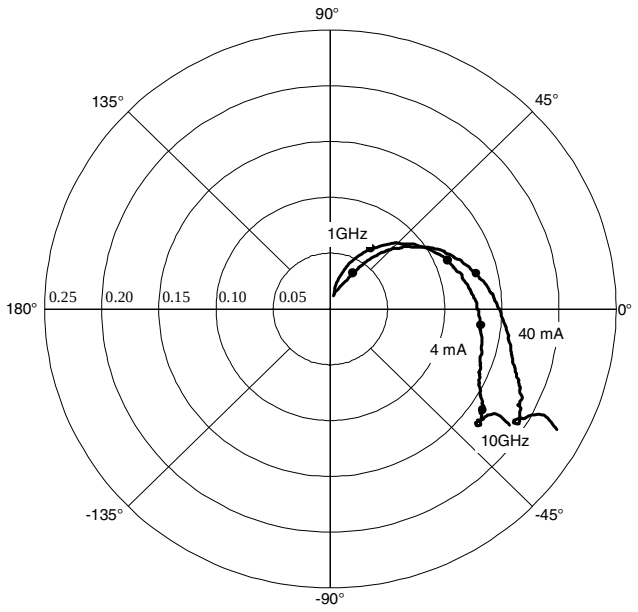
I_C = 4 mA and 40 mA; V_{CE} = 2 V; Z_o = 50 Ω.

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



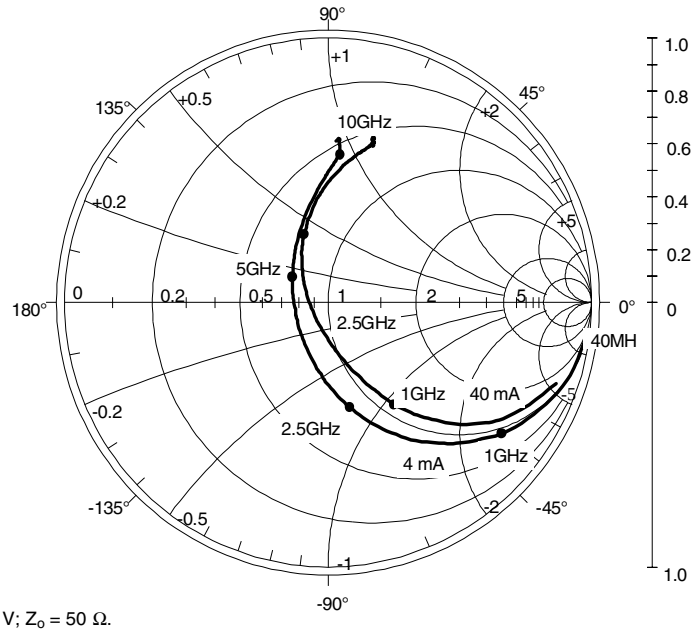
I_C = 4 mA and 40 mA; V_{CE} = 2 V; Z_o = 50 Ω.

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



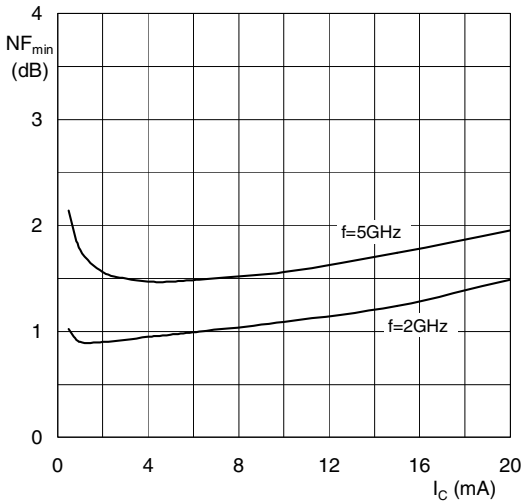
I_C = 4 mA and 40 mA; V_{CE} = 2 V; Z_o = 50 Ω.

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



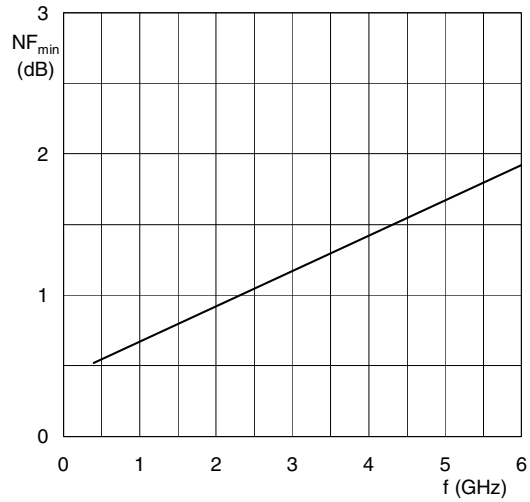
I_C = 4 mA and 40 mA; V_{CE} = 2 V; Z_o = 50 Ω.

Fig.13 Common emitter output reflection coefficient (S_{22}).



V_{CE} = 2 V; T_{amb} = 25 °C.

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



I_C = 2 mA; V_{CE} = 2 V; T_{amb} = 25 °C.

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

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	mΩ
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.

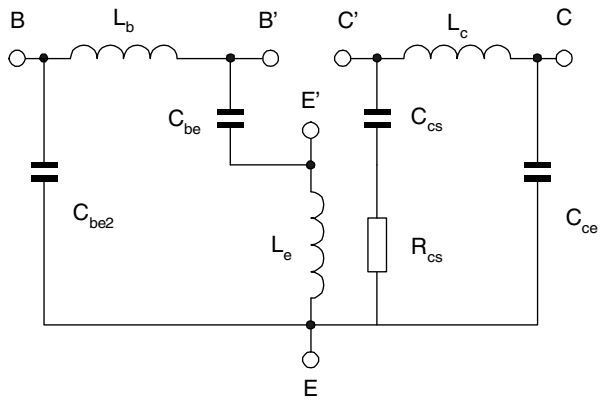


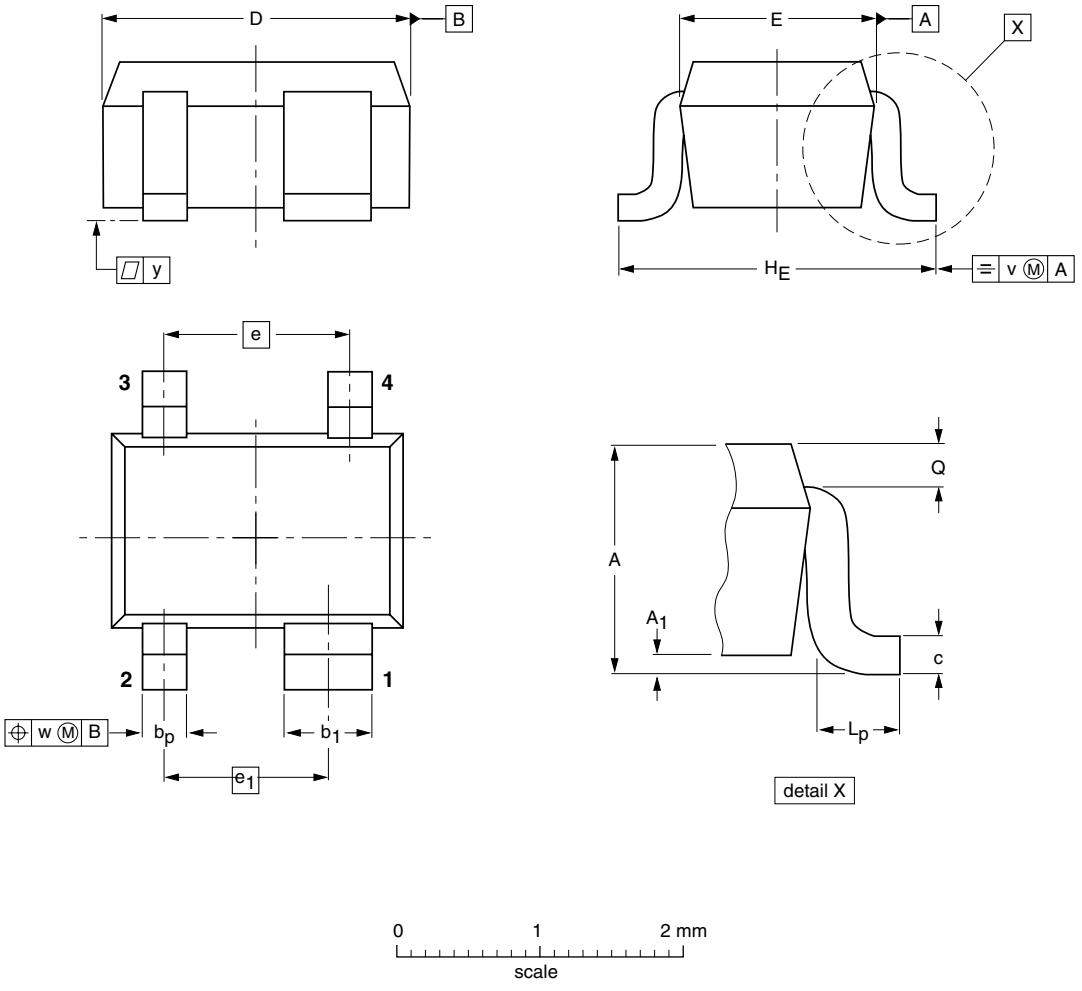
Fig.16 Package equivalent circuit SOT343R2.

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

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

DATA SHEET STATUS

DATA SHEET STATUS[1]	PRODUCT STATUS[2]	DEFINITIONS
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