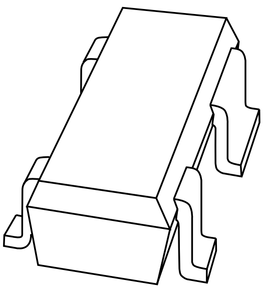
DATA SHEET



BFU510
NPN SiGe wideband transistor

Product specification
Supersedes data of 2001 Nov 08

2003 Jun 12

Philips
Semiconductors

PHILIPS

NPN SiGe wideband transistor | BFU510

FEATURES

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

APPLICATIONS

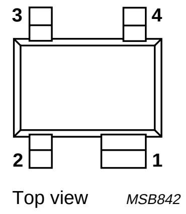
- RF front end
- Wideband applications, e.g. analog and digital cellular telephones, cordless telephones (PHS, DECT, etc.)
- Radar detectors
- Pagers
- Satellite television tuners (SATV)
- High frequency oscillators.

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



Marking code: A5.

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)		–	10	15	mA
P_{tot}	total power dissipation	$T_s \leq 115$ °C	–	–	35	mW
h_{FE}	DC current gain	$I_C = 10$ mA; $V_{CE} = 2$ V; $T_j = 25$ °C	70	140	210	
G_{max}	maximum power gain	$I_C = 10$ mA; $V_{CE} = 2$ V; f = 2 GHz; $T_{amb} = 25$ °C	–	23	–	dB
NF	noise figure	$I_C = 0.5$ mA; $V_{CE} = 2$ V; f = 2 GHz; $\Gamma_S = \Gamma_{opt}$	–	1	–	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)		–	15	mA
P_{tot}	total power dissipation	$T_s \leq 115$ °C; note 1; see Fig.2	–	35	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	1000	K/W

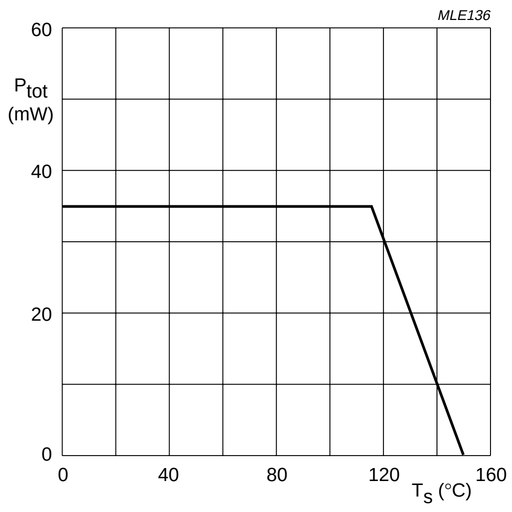


Fig.2 Power derating curve.

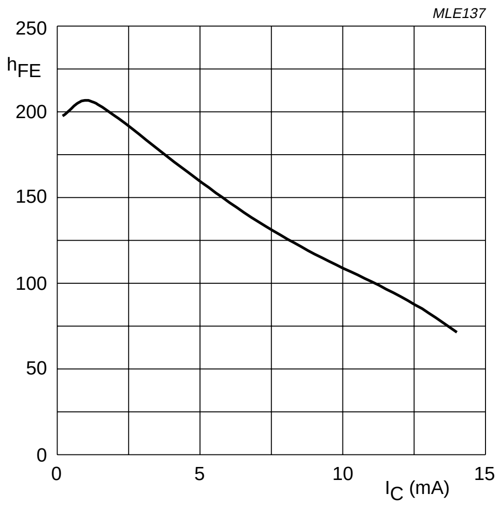
CHARACTERISTICS

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 = 10 mA; V_{CE} = 2 V	70	140	210	
C_c	collector capacitance	$I_E = i_e$ = 0; V_{CB} = 2 V; f = 1 MHz	–	150	–	fF
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 2 V; f = 1 MHz	–	25	–	fF
G_{max}	maximum power gain; note 1	I_C = 10 mA; V_{CE} = 2 V; f = 2 GHz; T_{amb} = 25 °C	–	23	–	dB
NF	noise figure	I_C = 0.5 mA; V_{CE} = 2 V; f = 2 GHz; $\Gamma_S = \Gamma_{opt}$	–	1	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 5 mA; V_{CE} = 2 V; f = 2 GHz; $Z_S = Z_{S\,opt}$; $Z_L = Z_{L\,opt}$; note 2	–	2	–	dBm
ITO	third order intercept point	I_C = 10 mA; V_{CE} = 2 V; f = 2 GHz; $Z_S = Z_{S\,opt}$; $Z_L = Z_{L\,opt}$; note 2	–	7	–	dBm

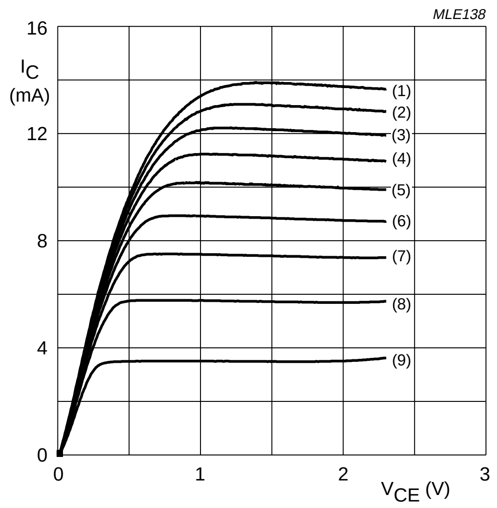
Notes

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.



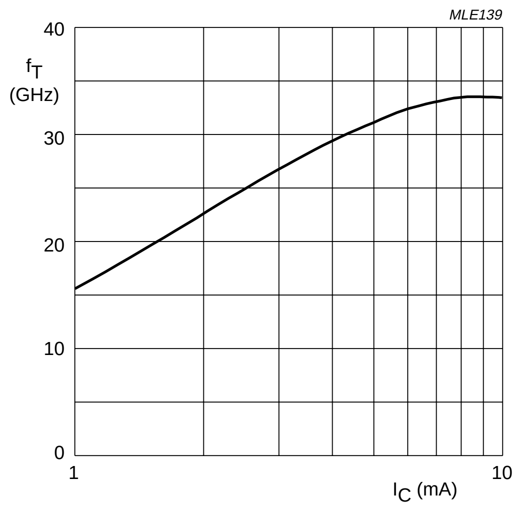
V_{CE} = 2 V; T_j = 25 °C.

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



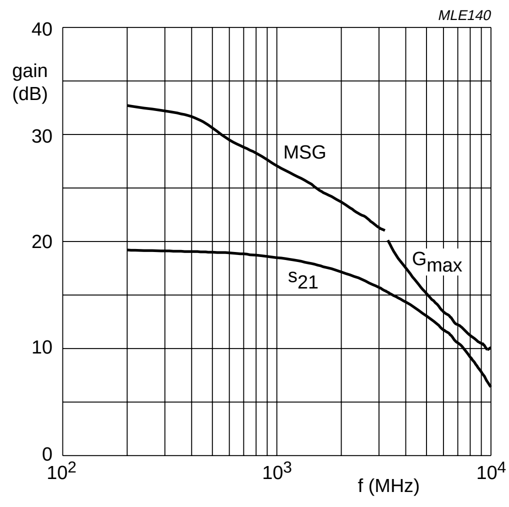
(1) I_B = 180 μA.
(2) I_B = 160 μA.
(3) I_B = 140 μA.
(4) I_B = 120 μA.
(5) I_B = 100 μA.
(6) I_B = 80 μA.
(7) I_B = 60 μA.
(8) I_B = 40 μA.
(9) I_B = 20 μA.

Fig.4 Output characteristics; typical values.



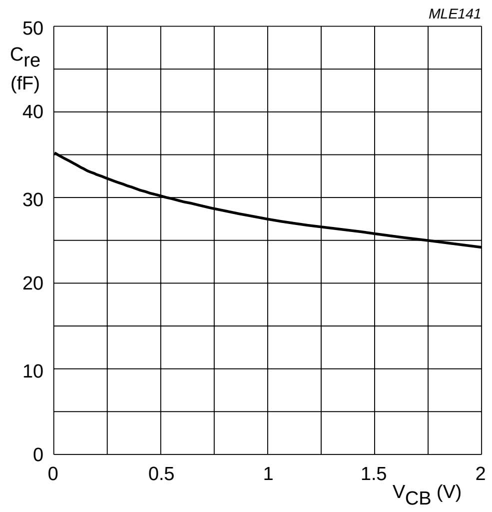
V_{CB} = 1 V; f = 2 GHz; T_{amb} = 25 °C.

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



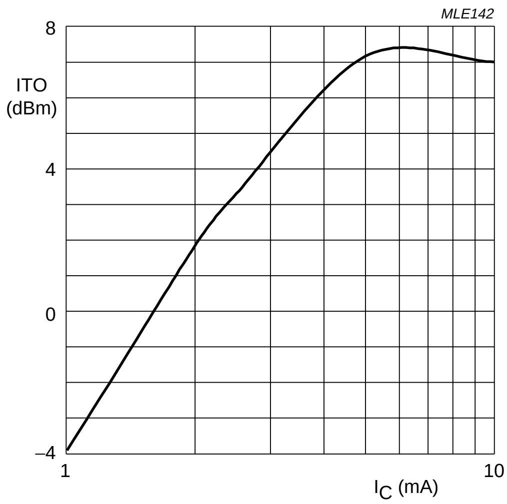
I_C = 10 mA; V_{CE} = 2 V; T_{amb} = 25 °C.

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



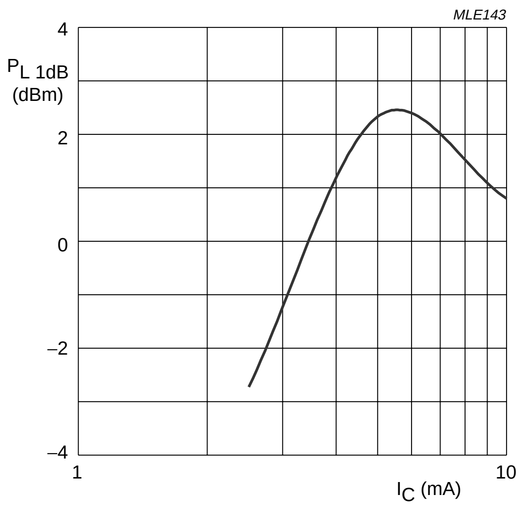
I_C = 0; f = 1 MHz; T_{amb} = 25 °C.

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



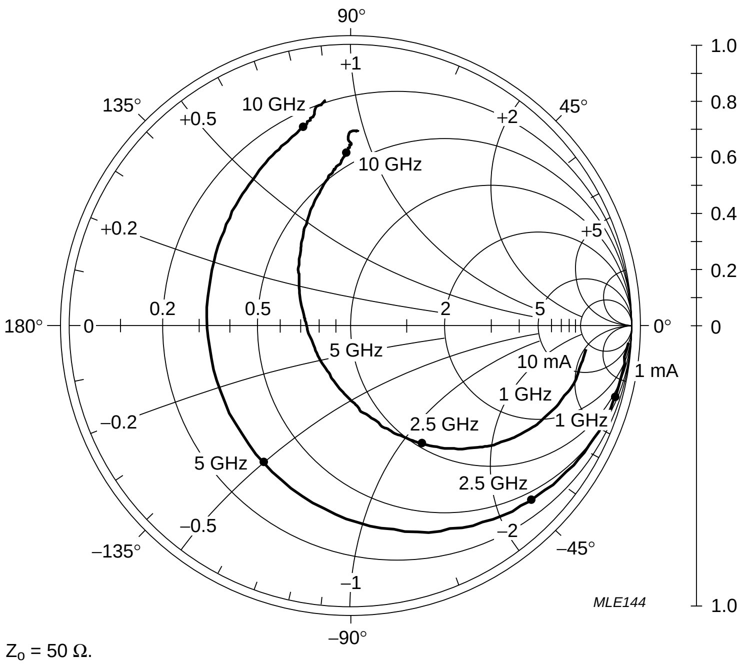
V_{CE} = 2 V; f = 2 GHz.

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



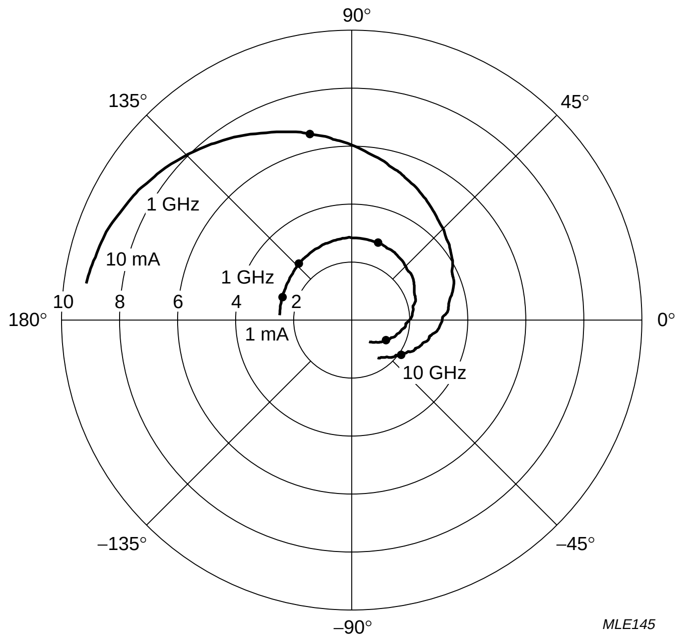
V_{CE} = 2 V; f = 2 GHz; source and load tuned for optimum gain.

Fig.9 Output power at 1 dB gain compression as a function of collector current.



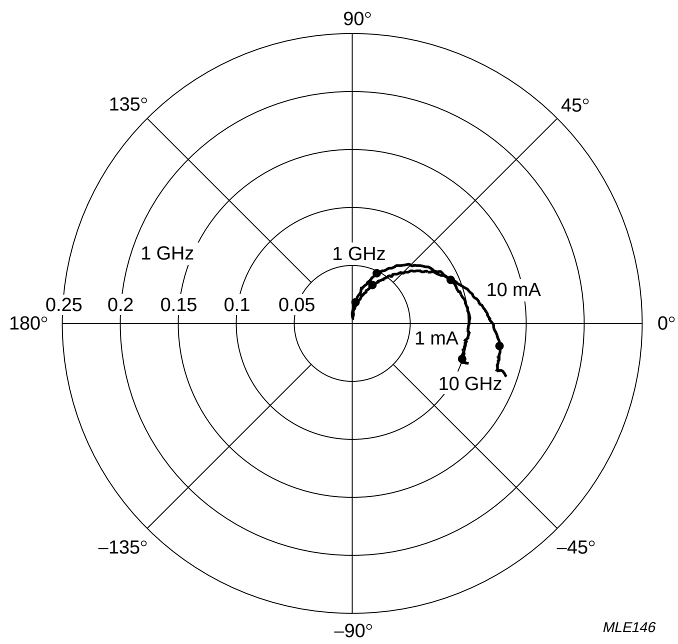
I_C = 1 mA and 10 mA; V_{CE} = 2 V; Z_o = 50 Ω.

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



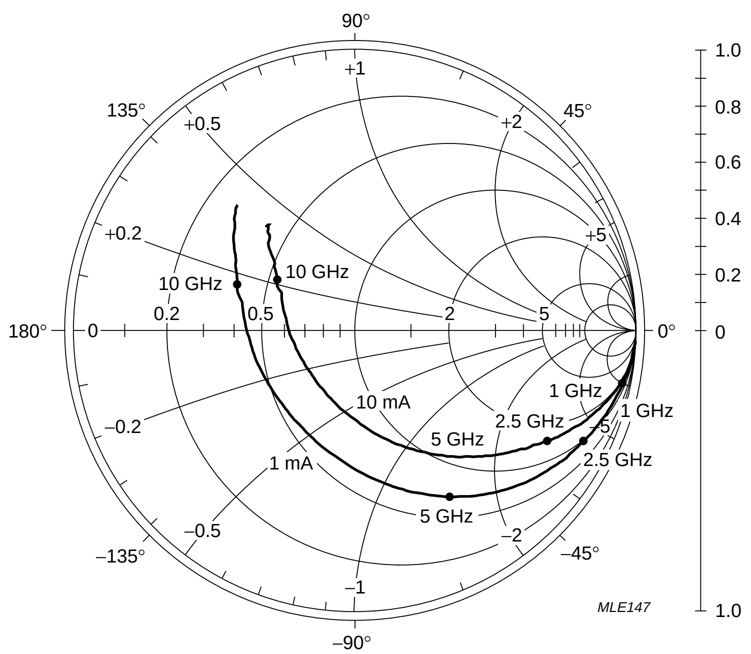
I_C = 1 mA and 10 mA; V_{CE} = 2 V; Z_o = 50 Ω.

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



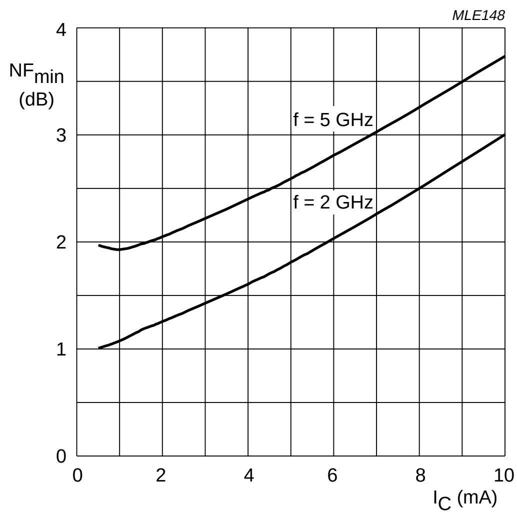
I_C = 1 mA and 10 mA; V_{CE} = 2 V; Z_o = 50 Ω.

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



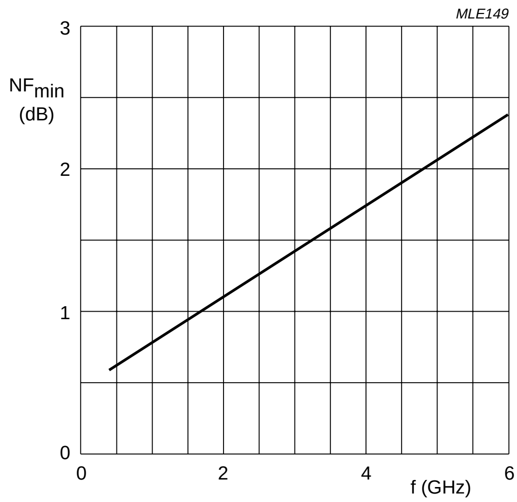
I_C = 1 mA and 10 mA; V_{CE} = 2 V; Z_o = 50 Ω.

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 = 0.5 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 = 1 mA; T_{amb} = 25 °C; typical values

f (GHz)	F_{min} (dB)	Γ_{opt}		r_n (Ω)
		(mag)	(deg)	
2	1.2	0.79	36.5	1.07
3	1.5	0.72	57.9	0.84
4	1.9	0.60	81.2	0.60
5	2.2	0.55	103.7	0.36
6	2.5	0.43	133.7	0.22
7	2.7	0.30	168.3	0.18
8	3.0	0.27	–152.7	0.23
9	3.2	0.27	–103.2	0.42
10	3.3	0.33	–62.8	0.71
11	3.4	0.43	–38.5	0.96
12	3.5	0.46	–16.0	1.25

SPICE parameters for the BFU510 die

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	0.277	aA
2	BF	270	–
3	NF	1.06077	–
4	VAF	45	V
5	IKF	11.1	mA
6	ISE	265	fA
7	NE	2.9	–
8	BR	50	–
9	NR	1.01	–
10	VAR	1	MV
11	IKR	0.001	A
12	ISC	0.4	fA
13	NC	1.21	–
14	RB	21	Ω
15 (1)	IRB	–	–
16	RBM	30	Ω
17	RE	4.36	mΩ
18	RC	20.5	Ω
19	XTB	–2.2	–
20	EG	1.014	eV
21	XTI	3	–
22	CJE	54.3	fF
23	VJE	877	mV
24	MJE	0.202	–
25	TF	2.8	ps
26	XTF	0.9	–
27	VTF	0.026	V
28	ITF	0.9	A
29	PTF	30	deg
30	CJC	30	fF
31	VJC	577	mV
32	MJC	0.239	–
33	XCJC	0.44	–
34	TR	20	ns
35	CJS	8.84	fF
36	VJS	500	mV
37	MJS	0.6447	–
38	FC	0.7	–

Note

1. Not used.

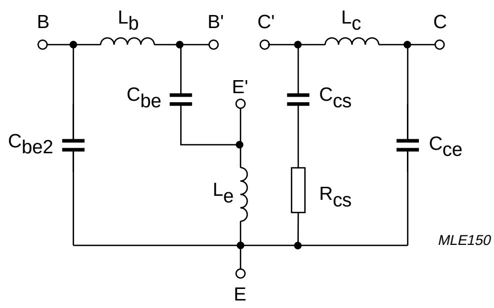


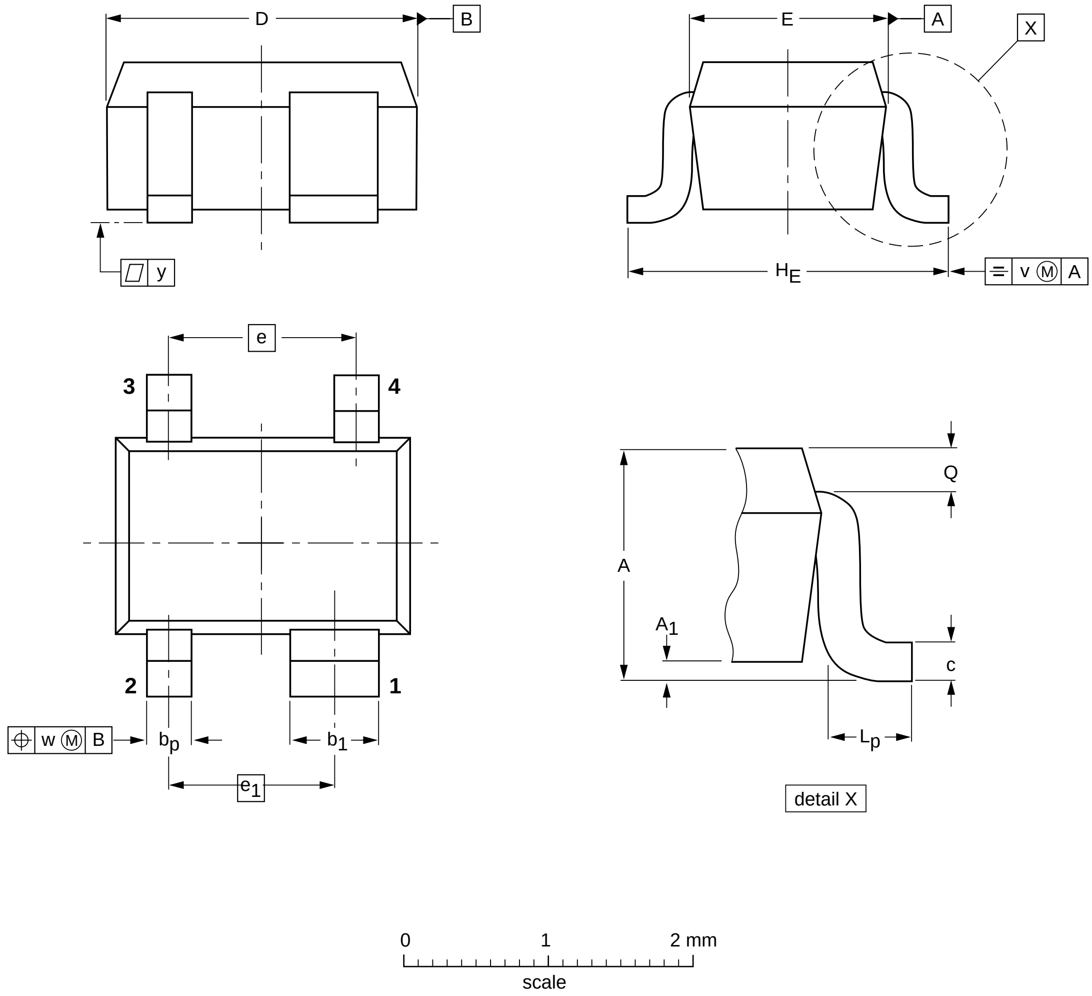
Fig.16 Package equivalent circuit SOT343R2.

List of components (see Fig.16)

DESIGNATION	VALUE	UNIT
L_b	0.90	nH
L_c	1.02	nH
L_e	0.33	nH
C_{be1}	133	fF
C_{be2}	65	fF
C_{ce}	66	fF
C_{cs}	100	fF
R_{cs}	170	Ω

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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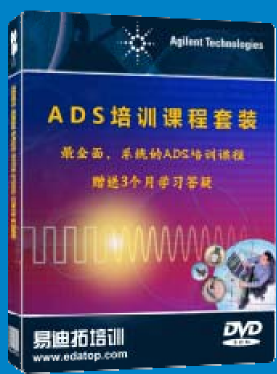

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※ 一直致力并专注于微波射频和天线设计工程师的培养，更了解该行业对人才的要求

※ 经验丰富的一线资深工程师讲授，结合实际工程案例，直观、实用、易学

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