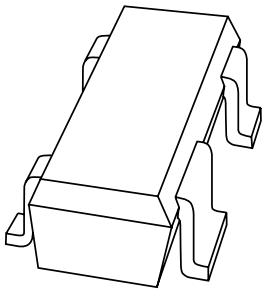
DATA SHEET



BFG590W; BFG590W/X
NPN 5 GHz wideband transistors

Product specification
Supersedes data of August 1995

1998 Oct 15

Philips
Semiconductors

PHILIPS

NPN 5 GHz wideband transistors BFG590W; BFG590W/X

FEATURES

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

APPLICATIONS

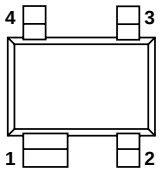
- MATV/CATV amplifiers and RF communications subscriber equipment in the GHz range
- Ideally suitable for use in class-A, (A)B and C amplifiers with either pulsed or continuous drive.

DESCRIPTION

NPN silicon planar epitaxial transistor in a 4-pin dual-emitter SOT343N plastic package.

PINNING

PIN	DESCRIPTION
BFG590W	
1	collector
2	base
3	emitter
4	emitter
BFG590W/X	
1	collector
2	emitter
3	base
4	emitter



Top view MBK523

Fig.1 SOT343N.

MARKING

TYPE NUMBER	CODE
BFG590W	T1
BFG590W/X	T2

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	–	–	15	V
I_C	collector current (DC)		–	–	200	mA
P_{tot}	total power dissipation	$T_s \leq 85$ °C	–	–	500	mW
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 8 V	60	90	250	
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 8 V; f = 1 MHz	–	0.7	–	pF
f_T	transition frequency	I_C = 80 mA; V_{CE} = 4 V; f = 1 GHz; T_{amb} = 25 °C	–	5	–	GHz
G_{UM}	maximum unilateral power gain	I_C = 80 mA; V_{CE} = 4 V; f = 900 MHz; T_{amb} = 25 °C	–	13	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 80 mA; V_{CE} = 4 V; f = 900 MHz; T_{amb} = 25 °C	–	11	–	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	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	200	mA
P_{tot}	total power dissipation	$T_s \leq 85$ °C; see Fig.2; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	175	°C

Note

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

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	$T_s \leq 85$ °C; note 1	180	K/W

Note

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

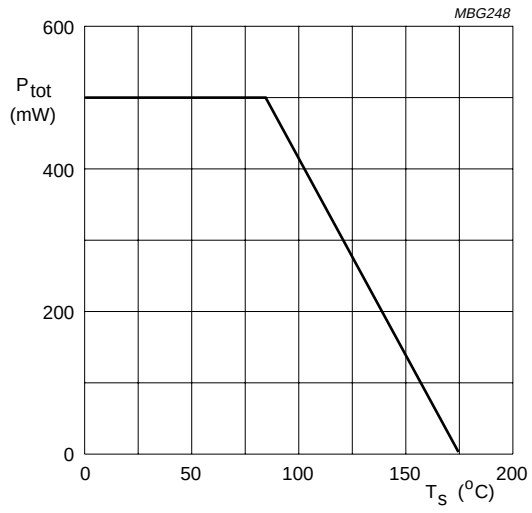


Fig.2 Power derating curve.

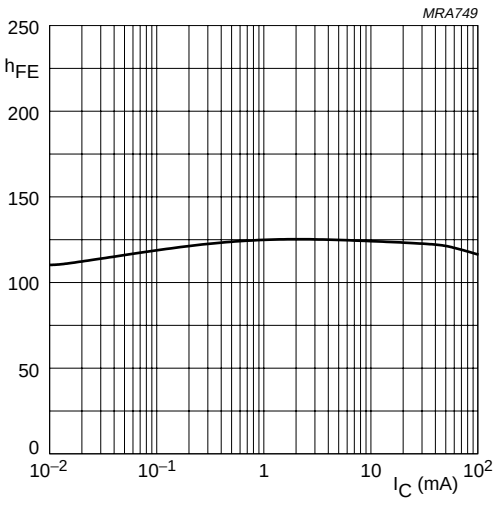
CHARACTERISTICS

T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	I_C = 0.1 mA; I_E = 0	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	I_C = 10 mA; I_B = 0	15	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	I_E = 0.1 mA; I_C = 0	3	–	–	V
I_{CBO}	collector leakage current	V_{CB} = 10 V; I_E = 0	–	–	100	nA
h_{FE}	DC current gain	I_C = 70 mA; V_{CE} = 8 V	60	90	250	
f_T	transition frequency	I_C = 80 mA; V_{CE} = 4 V; f = 1 GHz; T_{amb} = 25 °C	–	5	–	GHz
C_{re}	feedback capacitance	I_C = 0; V_{CB} = 8 V; f = 1 MHz	–	0.7	–	pF
G_{UM}	maximum unilateral power gain; note 1	I_C = 80 mA; V_{CE} = 4 V; f = 900 MHz; T_{amb} = 25 °C	–	13	–	dB
		I_C = 80 mA; V_{CE} = 4 V; f = 2 GHz; T_{amb} = 25 °C	–	7.5	–	dB
$\|S_{21}\|^2$	insertion power gain	I_C = 80 mA; V_{CE} = 4 V; f = 1 GHz; T_{amb} = 25 °C	–	11	–	dB
P_{L1}	output power at 1 dB gain compression	I_C = 80 mA; V_{CE} = 5 V; f = 900 MHz; R_L = 50 Ω; T_{amb} = 25 °C	–	21	–	dBm

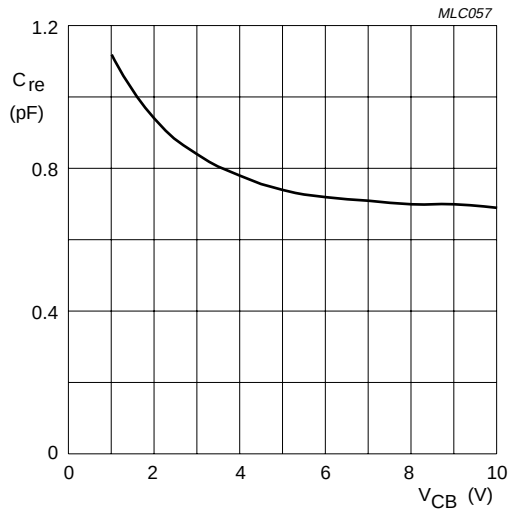
Note

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.



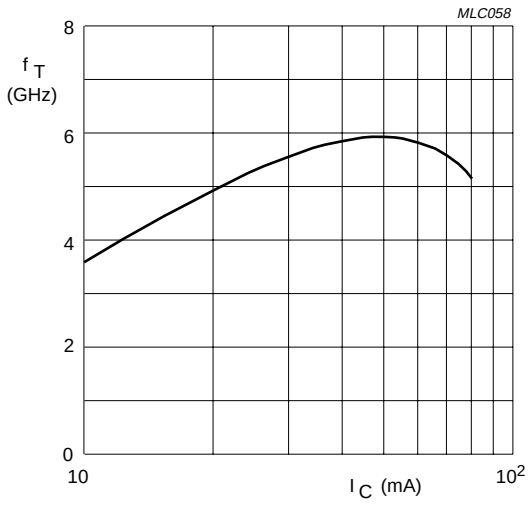
V_{CE} = 8 V.

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



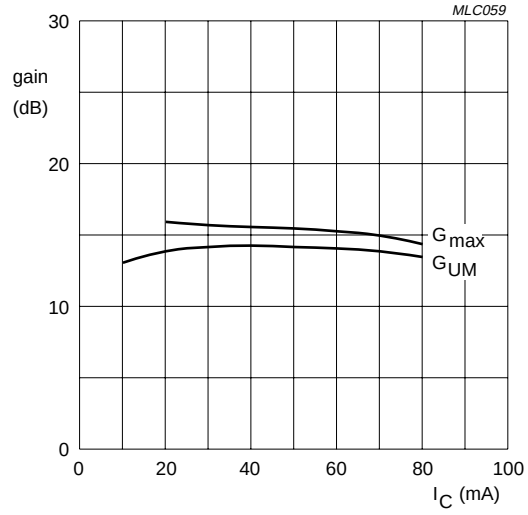
I_C = 0; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage; typical values.



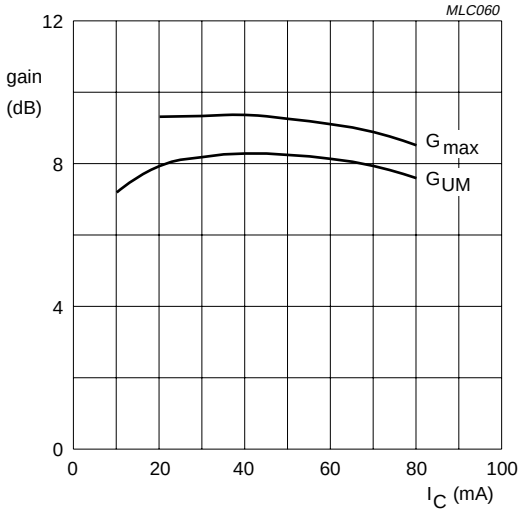
V_{CE} = 4 V; f = 1 GHz.

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



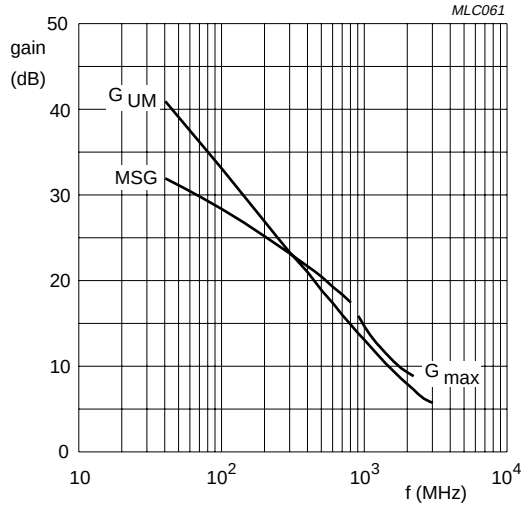
f = 900 MHz; V_{CE} = 4 V.

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



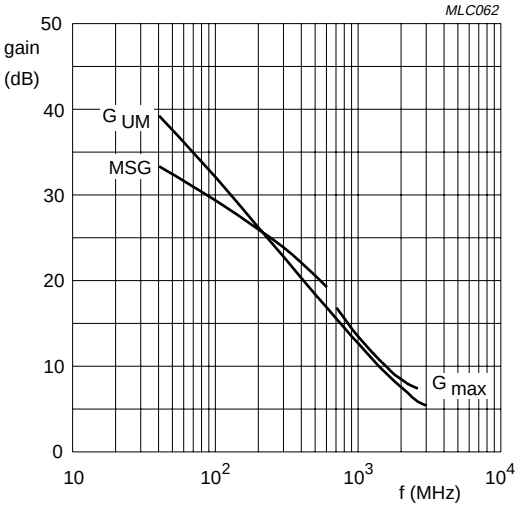
f = 2 GHz; V_{CE} = 4 V.

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



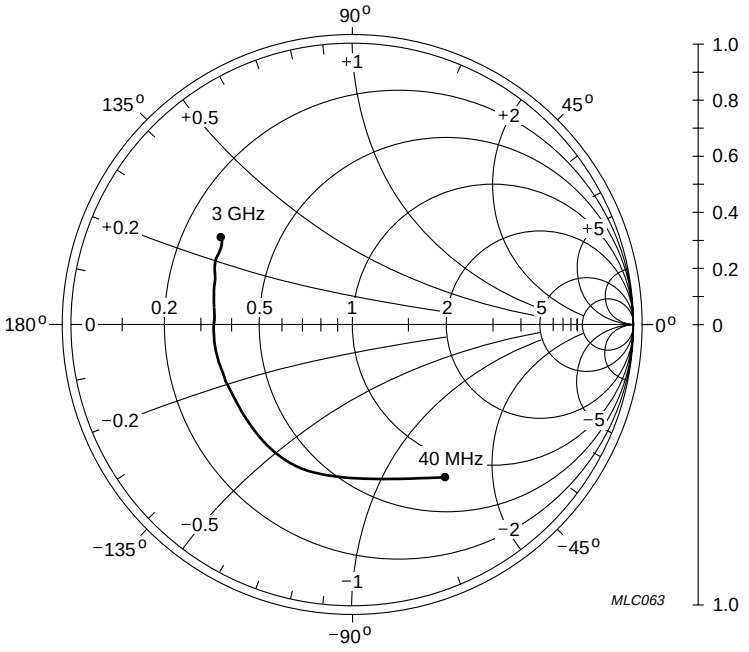
I_C = 20 mA; V_{CE} = 4 V.

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



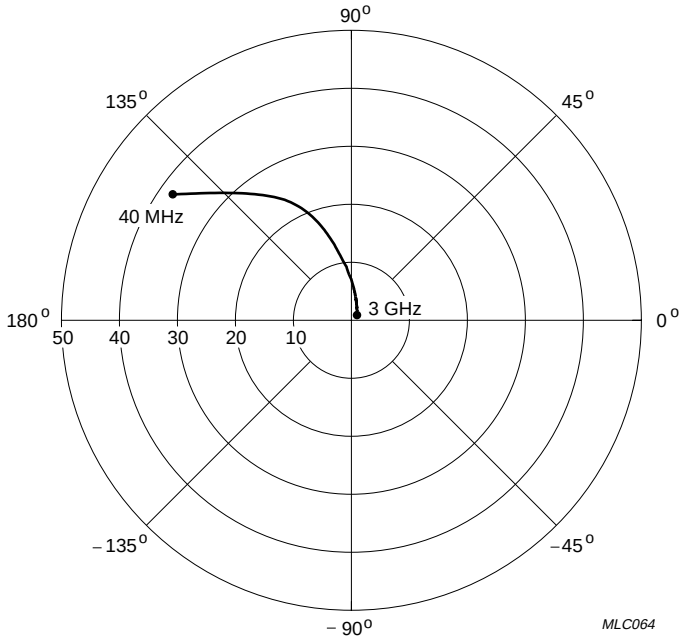
I_C = 80 mA; V_{CE} = 4 V.

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



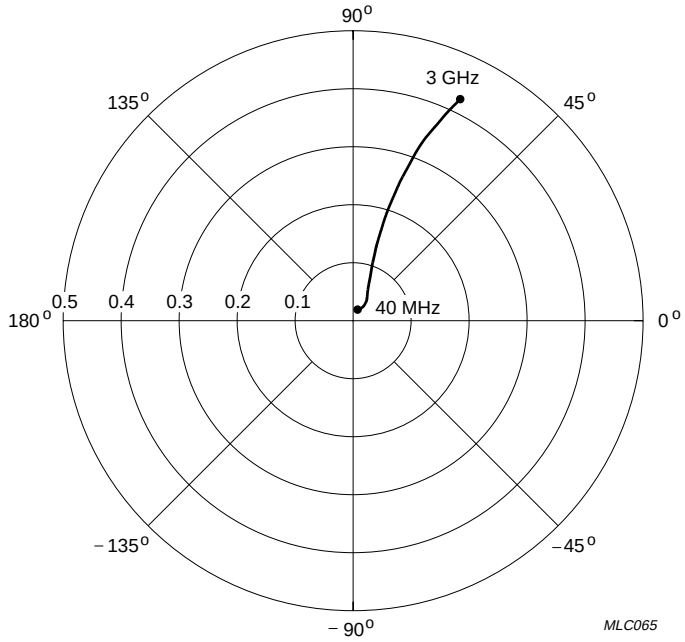
I_C = 80 mA; V_{CE} = 4 V; Z_o = 50 Ω.

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



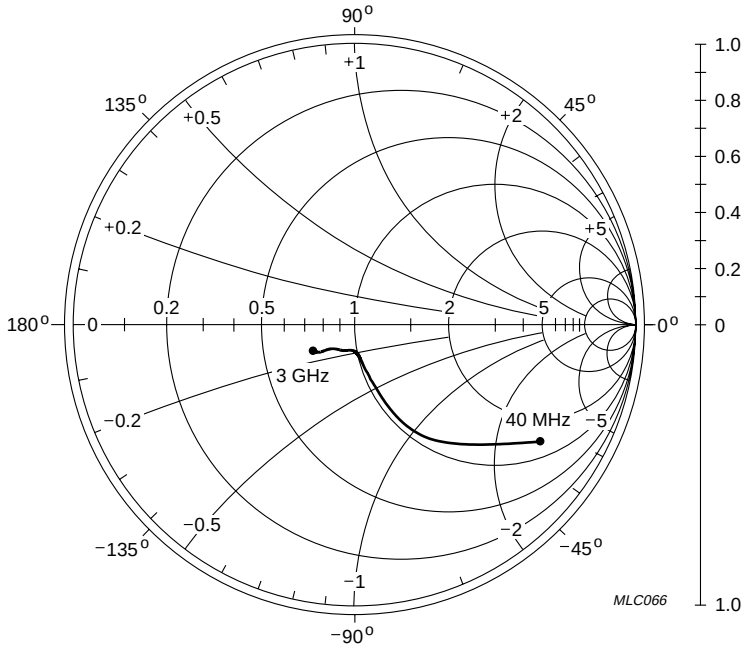
I_C = 80 mA; V_{CE} = 4 V.

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



I_C = 80 mA; V_{CE} = 4 V.

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



I_C = 80 mA; V_{CE} = 4 V; Z_o = 50 Ω.

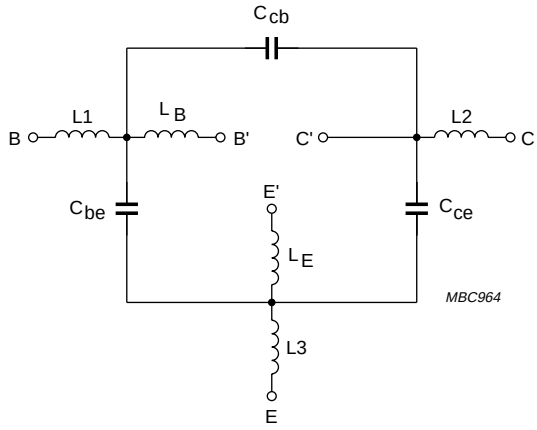
Fig.13 Common emitter output reflection coefficient (S_{22}); typical values.

SPICE parameters for the BFG590W die

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	1.341	fA
2	BF	123.5	–
3	NF	0.988	–
4	VAF	75.85	V
5	IKF	9.656	A
6	ISE	232.2	fA
7	NE	2.134	–
8	BR	10.22	–
9	NR	1.016	–
10	VAR	1.992	V
11	IKR	294.1	mA
12	ISC	211.0	aA
13	NC	0.997	–
14	RB	5.000	Ω
15	IRB	1.000	μA
16	RBM	5.000	Ω
17	RE	1.275	Ω
18	RC	920.6	mΩ
19 (1)	XTB	0.000	–
20 (1)	EG	1.110	eV
21 (1)	XTI	3.000	–
22	CJE	3.821	pF
23	VJE	600.0	mV
24	MJE	0.348	–
25	TF	13.60	ps
26	XTF	71.73	–
27	VTF	10.28	V
28	ITF	1.929	A
29	PTF	0.000	deg
30	CJC	1.409	pF
31	VJC	219.4	mV
32	MJC	0.166	–
33	XCJC	0.150	–
34	TR	2.340	ns
35 (1)	CJS	0.000	F
36 (1)	VJS	750.0	mV
37 (1)	MJS	0.000	–
38	FC	0.733	–

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.

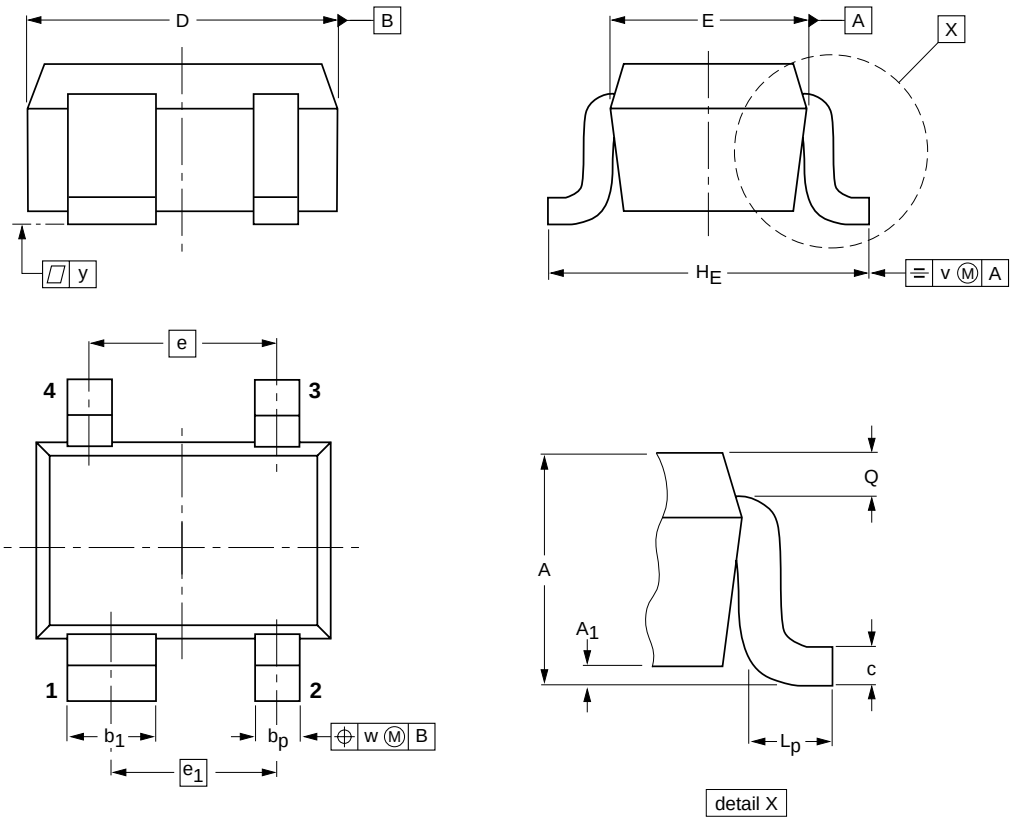
Fig.14 Package equivalent circuit SOT343N.

List of components (see Fig.14)

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 OUTLINE

Plastic surface mounted package; 4 leads **SOT343N**



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			
SOT343N						97-05-21

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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