NPN 5 GHz wideband transistors BFG590W; BFG590W/X

FEATURES

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

APPLICATIONS

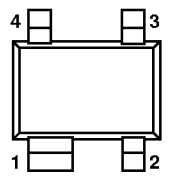
- MATV/CATV amplifiers and RF communications subscriber equipment in the GHz range
- Ideally suitable for use in class-A, (A)B and C amplifiers with either pulsed or continuous drive.

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.

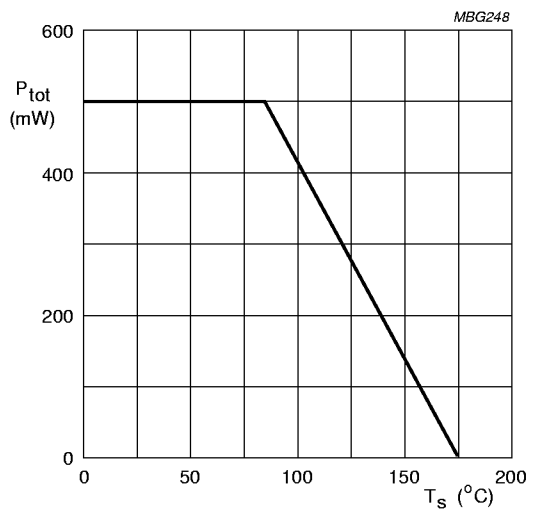


Fig.2 Power derating curve.

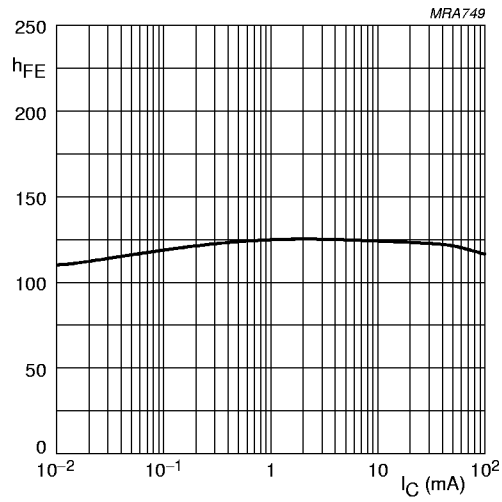
CHARACTERISTICS

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

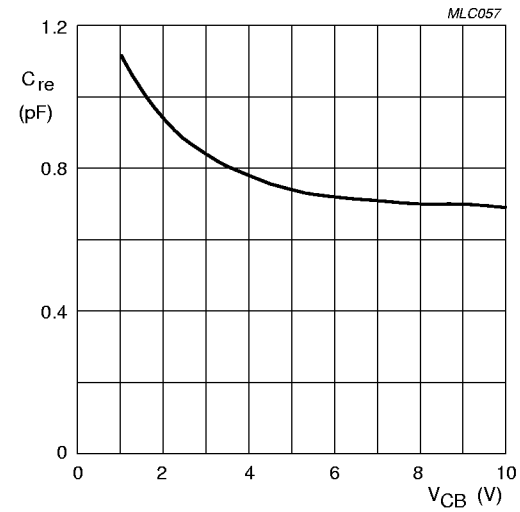
Note

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.



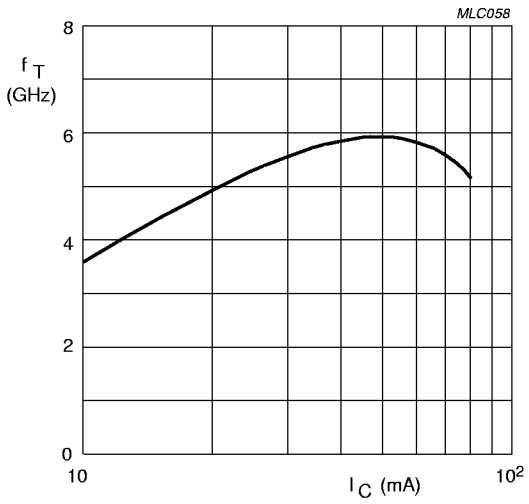
V_{CE} = 8 V.

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



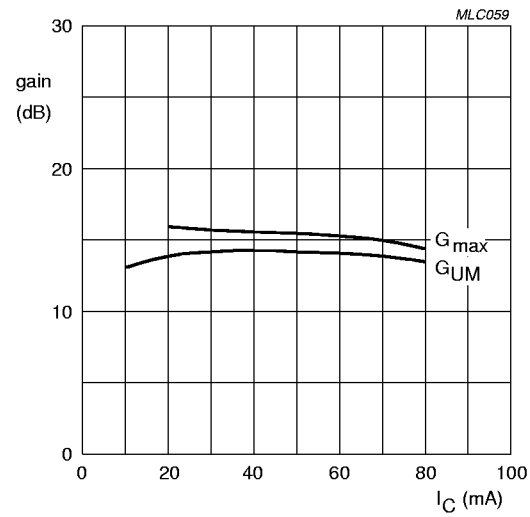
I_C = 0; f = 1 MHz.

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



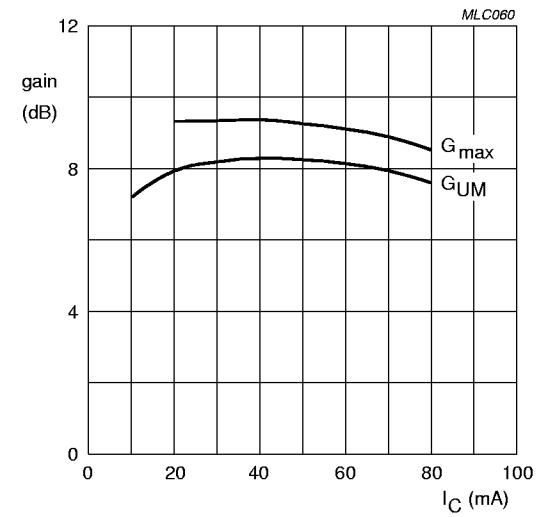
V_{CE} = 4 V; f = 1 GHz.

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



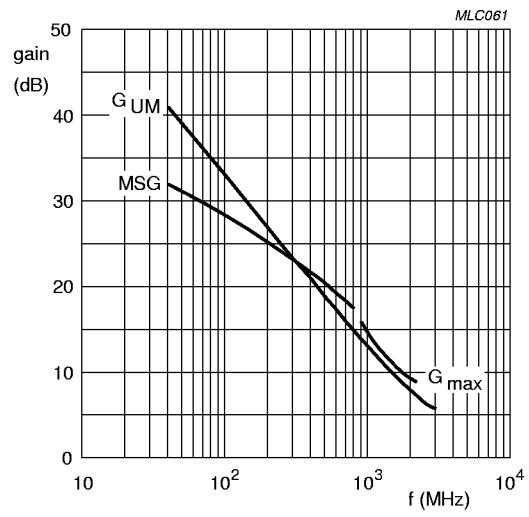
$f = 900$ MHz; $V_{CE} = 4$ V.

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



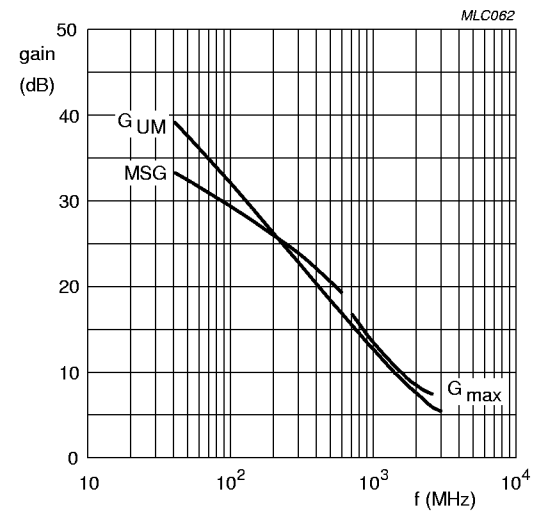
$f = 2$ GHz; $V_{CE} = 4$ V.

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



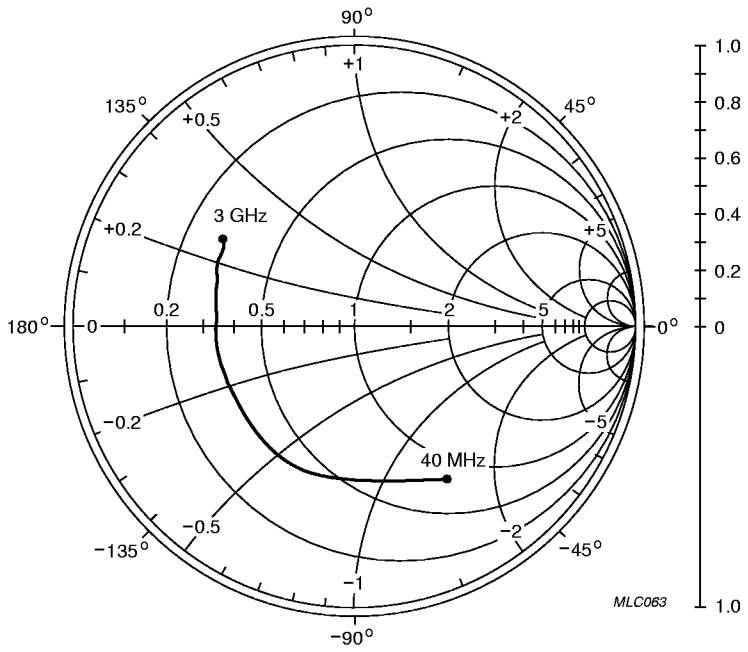
$I_C = 20$ mA; $V_{CE} = 4$ V.

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



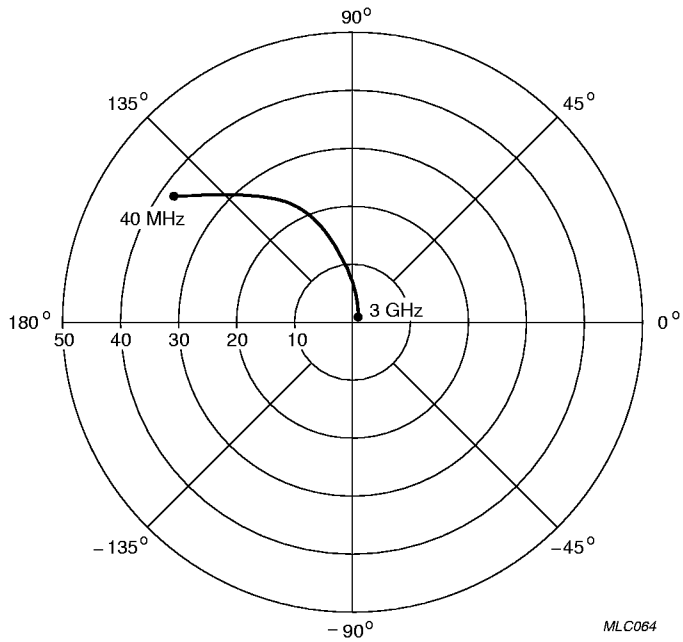
$I_C = 80$ mA; $V_{CE} = 4$ V.

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



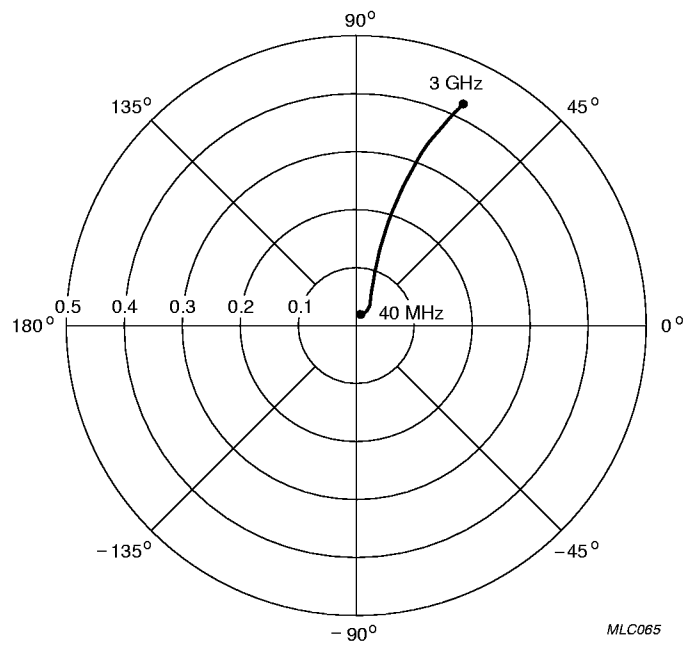
I_C = 80 mA; V_{CE} = 4 V; Z_o = 50 Ω.

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



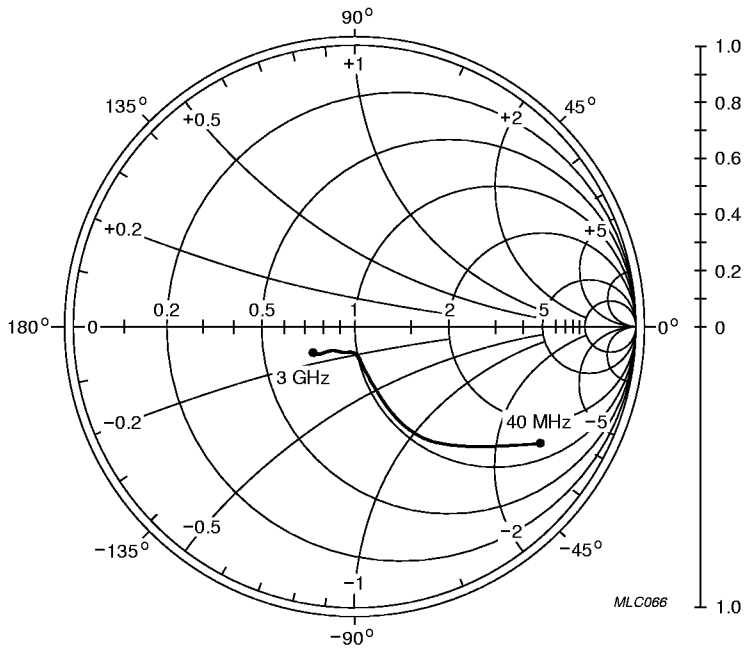
I_C = 80 mA; V_{CE} = 4 V.

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.

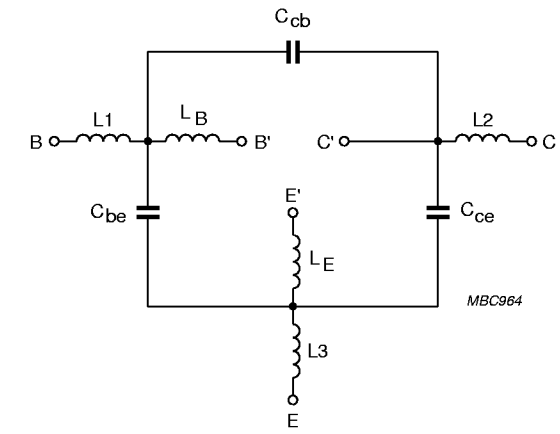
Fig.13 Common emitter output reflection coefficient (S_{22}); typical values.

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.

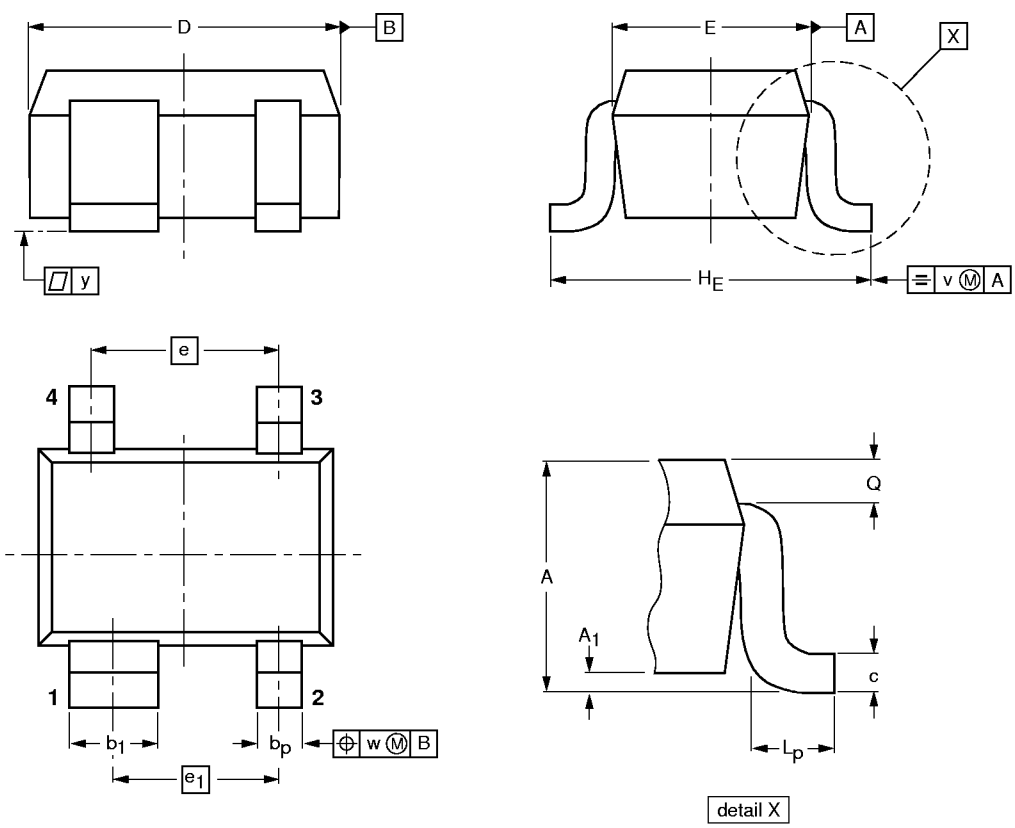
Fig.14 Package equivalent circuit SOT343N.

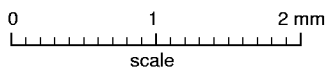
List of components (see Fig.14)

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