

NPN 9 GHz wideband transistor

BFG540W
BFG540W/X; BFG540W/XR

FEATURES

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

APPLICATIONS

They are intended for applications in the RF front end, in wideband applications in the GHz range such as analog and digital cellular telephones, cordless telephones (CT2, CT3, PCN, DECT, etc.), radar detectors, pagers, satellite television tuners (SATV), MATV/CATV amplifiers and repeater amplifiers in fibre-optic systems.

DESCRIPTION

NPN silicon planar epitaxial transistors in plastic, 4-pin dual-emitter SOT343N and SOT343R packages.

MARKING

TYPE NUMBER	CODE
BFG540W	N9
BFG540W/X	N7
BFG540W/XR	N8

PINNING

PIN	DESCRIPTION
BFG540W (see Fig.1)	
1	collector
2	base
3	emitter
4	emitter
BFG540W/X (see Fig.1)	
1	collector
2	emitter
3	base
4	emitter
BFG540W/XR (see Fig.2)	
1	collector
2	emitter
3	base
4	emitter

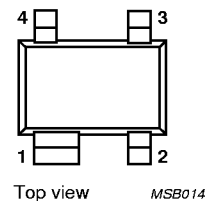


Fig.1 SOT343N.

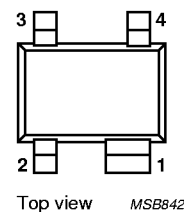


Fig.2 SOT343R.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	—	—	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	—	—	15	V
I_C	collector current (DC)		—	—	120	mA
P_{tot}	total power dissipation	up to $T_s = 85\text{ °C}$	—	—	500	mW
h_{FE}	DC current gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$	60	120	250	
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8\text{ V}$; $f = 1\text{ MHz}$	—	0.5	—	pF
f_T	transition frequency	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	9	—	GHz
G_{UM}	maximum unilateral power gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ °C}$	—	16	—	dB
		$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	10	—	dB
$ s_{21} ^2$	insertion power gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ °C}$	14	15	—	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 2\text{ GHz}$	—	2.1	—	dB

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LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

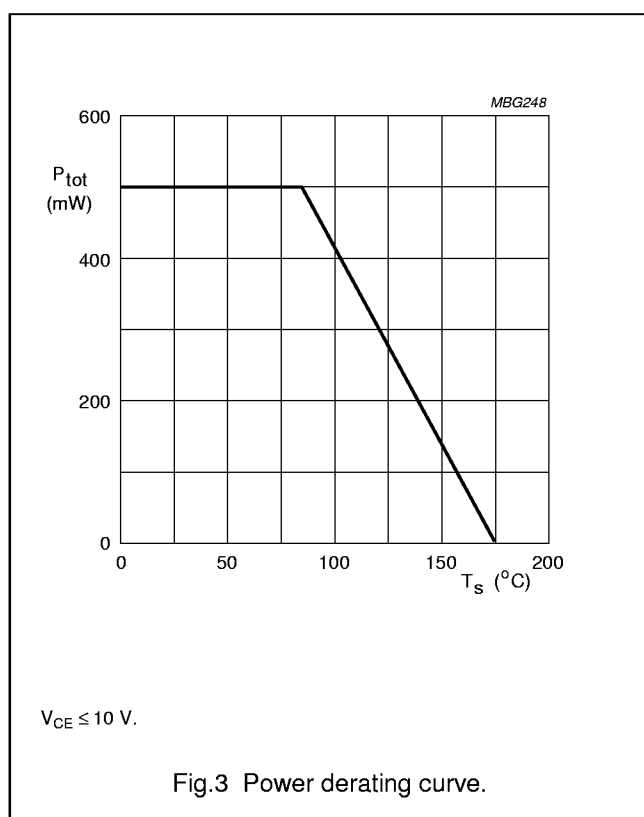
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CES}	collector-emitter voltage	$R_{BE} = 0$	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	120	mA
P_{tot}	total power dissipation	up to $T_s = 85\text{ °C}$; see Fig.3; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		–	175	°C

THERMAL CHARACTERISTICS

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

Note to the “Limiting values” and “Thermal characteristics”

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



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CHARACTERISTICS

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

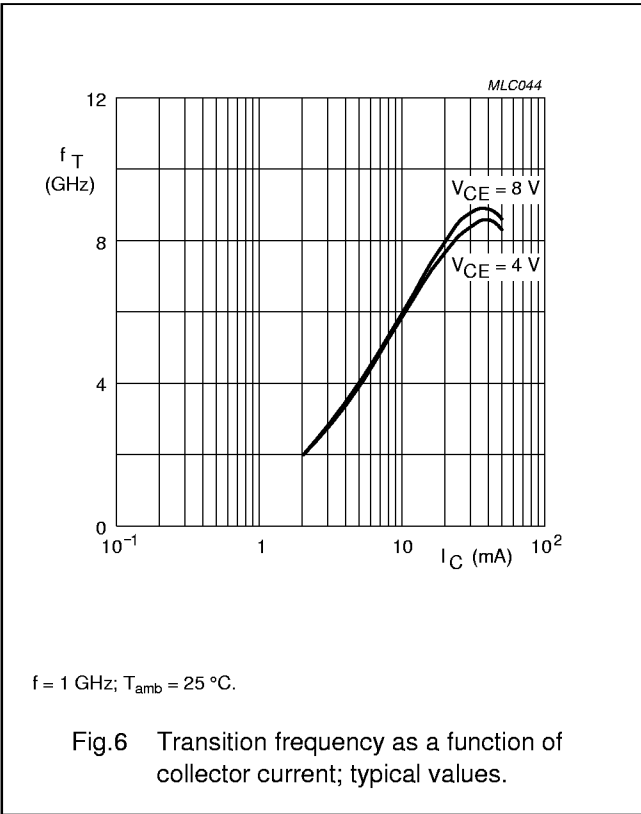
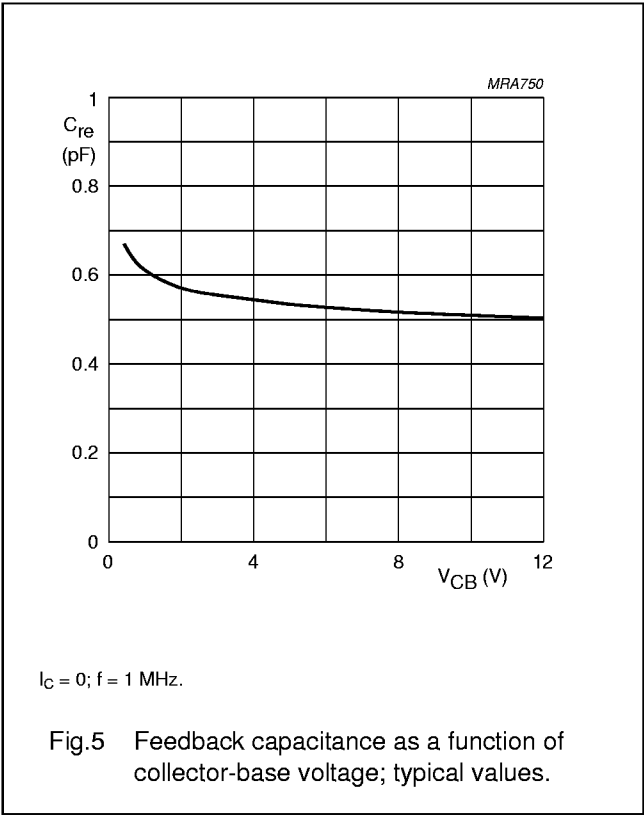
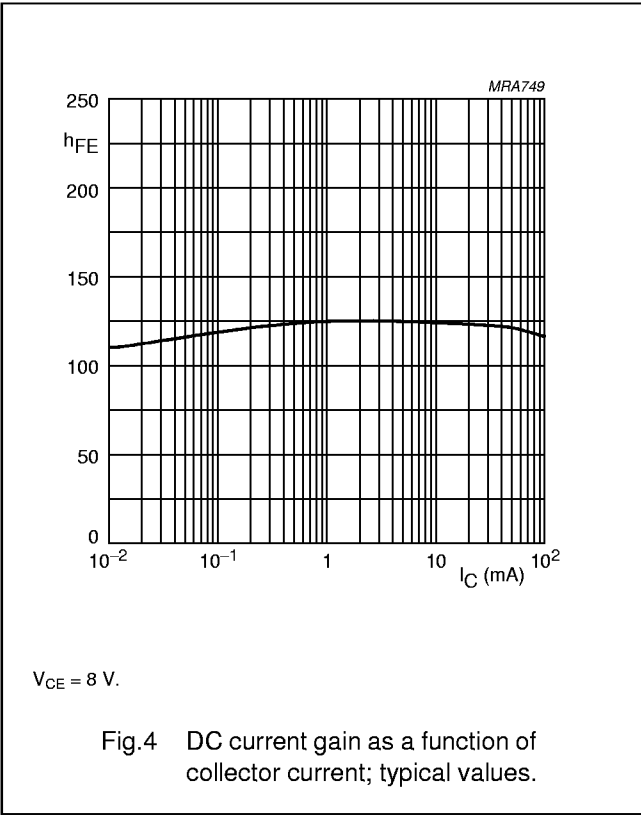
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 10\text{ }\mu\text{A}$; $I_E = 0$	20	—	—	V
$V_{(BR)CES}$	collector-emitter breakdown voltage	$R_{BE} = 0$; $I_C = 40\text{ }\mu\text{A}$	15	—	—	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 100\text{ }\mu\text{A}$; $I_C = 0$	2.5	—	—	V
I_{CBO}	collector cut-off current	open emitter; $V_{CB} = 8\text{ V}$; $I_E = 0$	—	—	50	nA
h_{FE}	DC current gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$	60	120	250	
f_T	transition frequency	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	9	—	GHz
C_c	collector capacitance	$I_E = I_e = 0$; $V_{CB} = 8\text{ V}$; $f = 1\text{ MHz}$	—	0.9	—	pF
C_e	emitter capacitance	$I_C = I_c = 0$; $V_{EB} = 0.5\text{ V}$; $f = 1\text{ MHz}$	—	2	—	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 8\text{ V}$; $f = 1\text{ MHz}$	—	0.5	—	pF
G_{UM}	maximum unilateral power gain; note 1	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ °C}$	—	16	—	dB
		$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ °C}$	—	10	—	dB
$ s_{21} ^2$	insertion power gain	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ °C}$	14	15	—	dB
F	noise figure	$\Gamma_s = \Gamma_{opt}$; $I_C = 10\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 900\text{ MHz}$	—	1.3	1.8	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 900\text{ MHz}$	—	1.9	2.4	dB
		$\Gamma_s = \Gamma_{opt}$; $I_C = 10\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 2\text{ GHz}$	—	2.1	—	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $f = 900\text{ MHz}$; $R_L = 50\text{ }\Omega$; $T_{amb} = 25\text{ °C}$	—	21	—	dBm
ITO	third order intercept point	note 2	—	34	—	dBm
V_o	output voltage	note 3	—	500	—	mV
d_2	second order intermodulation distortion	note 4	—	−50	—	dB

Notes

- 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.
- $I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $R_L = 50\text{ }\Omega$; $T_{amb} = 25\text{ °C}$;
 - $f_p = 900\text{ MHz}$; $f_q = 902\text{ MHz}$; measured at $f_{(2p-q)} = 898\text{ MHz}$ and $f_{(2q-p)} = 904\text{ MHz}$.
- $d_{im} = -60\text{ dB}$ (DIN45004B); $V_p = V_o$; $V_q = V_o - 6\text{ dB}$; $V_r = V_o - 6\text{ dB}$; $R_L = 75\text{ }\Omega$; $V_{CE} = 8\text{ V}$; $I_C = 40\text{ mA}$;
 - $f_p = 795.25\text{ MHz}$; $f_q = 803.25\text{ MHz}$; $f_r = 805.25\text{ MHz}$; measured at $f_{(p+q-r)} = 793.25\text{ MHz}$.
- $I_C = 40\text{ mA}$; $V_{CE} = 8\text{ V}$; $V_o = 275\text{ mV}$; $R_L = 75\text{ }\Omega$; $T_{amb} = 25\text{ °C}$;
 - $f_p = 250\text{ MHz}$; $f_q = 560\text{ MHz}$; measured at $f_{(p+q)} = 810\text{ MHz}$.

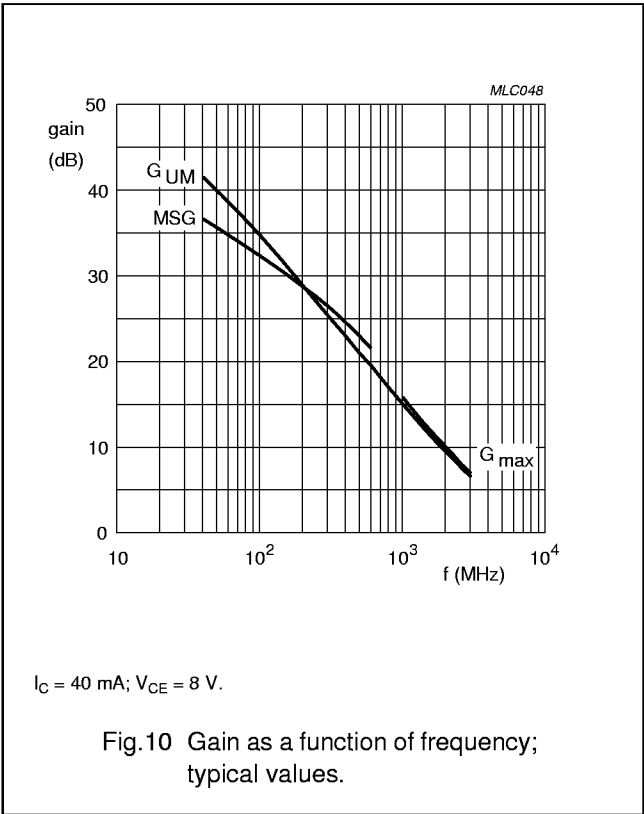
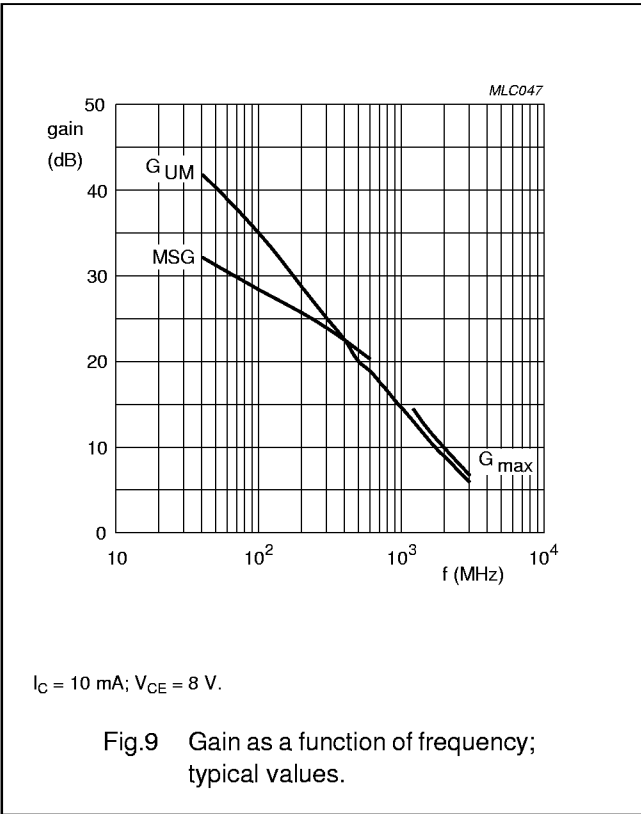
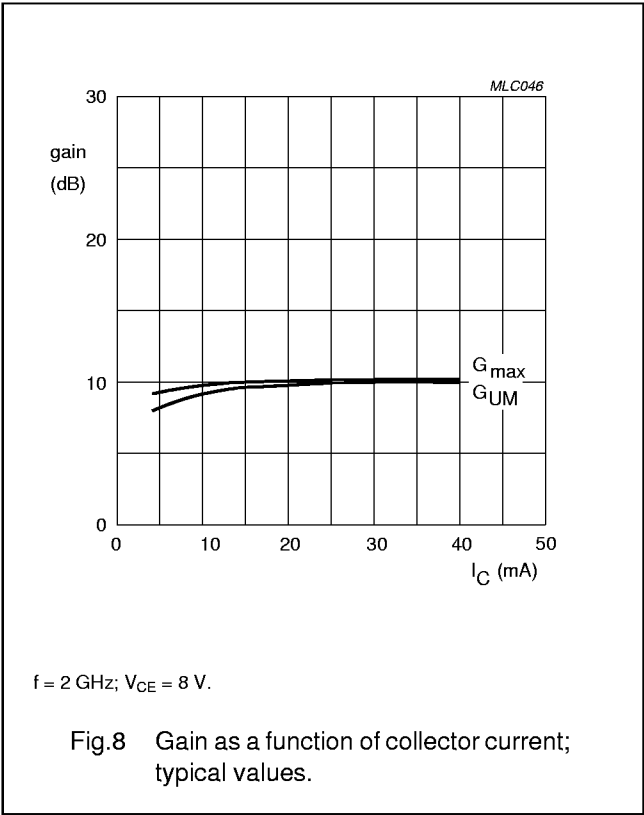
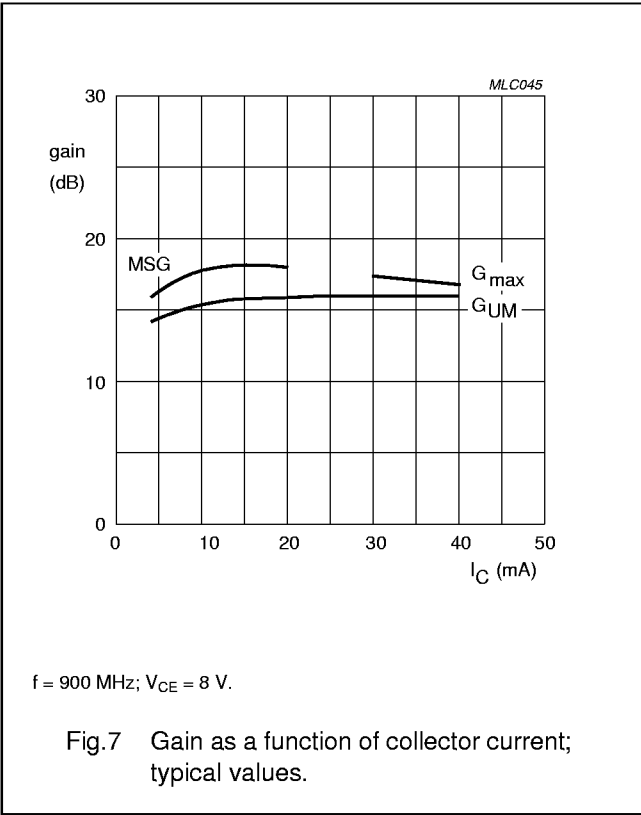
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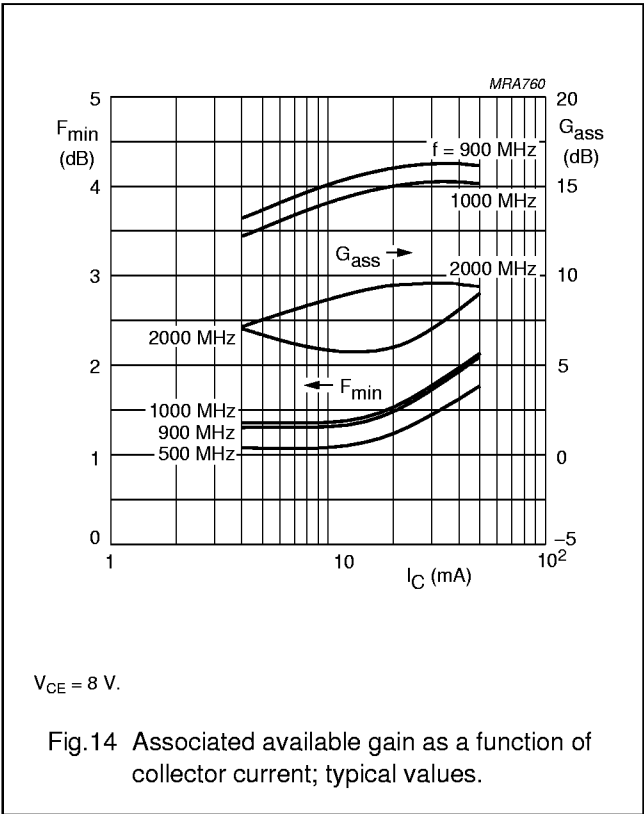
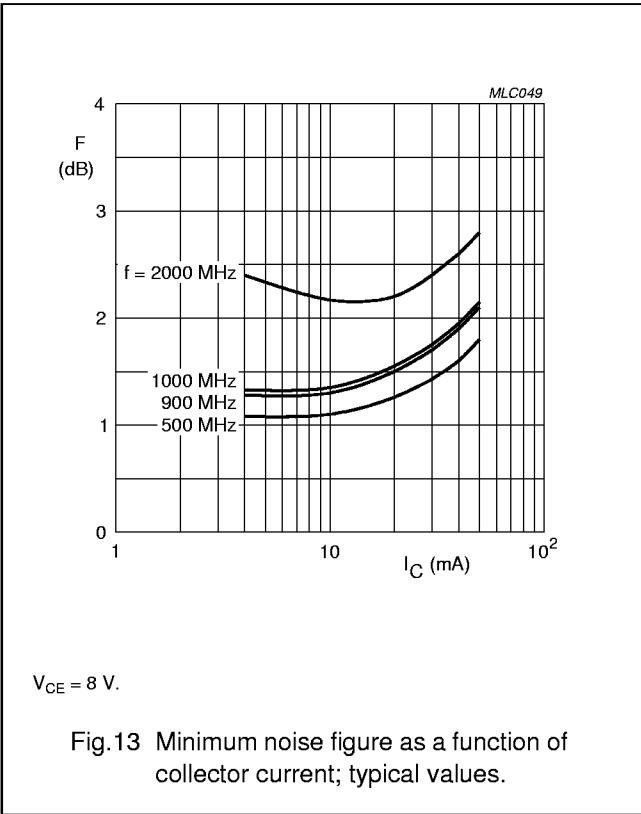
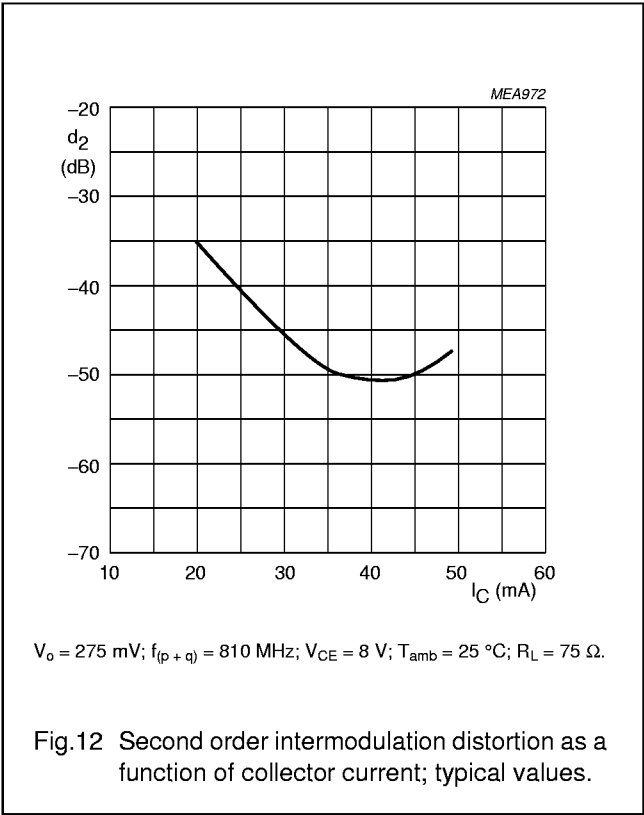
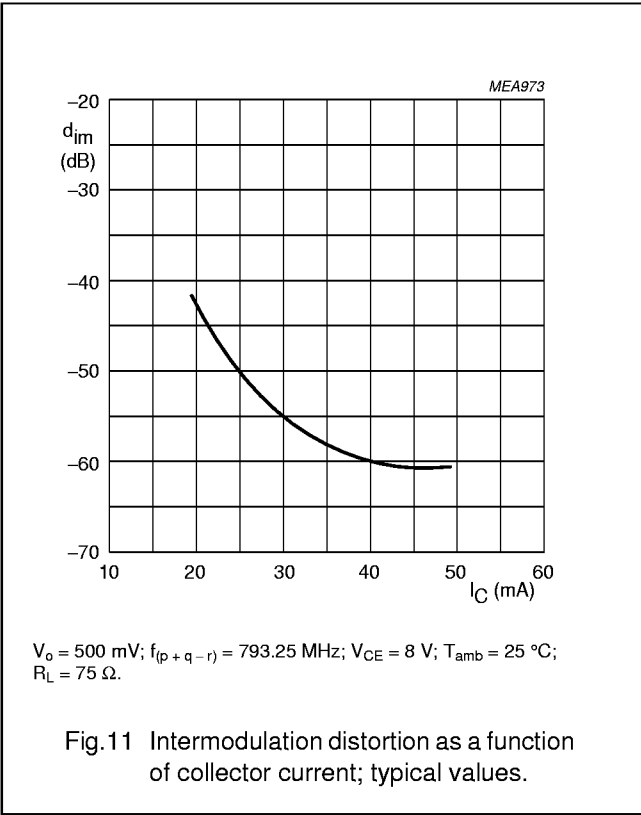
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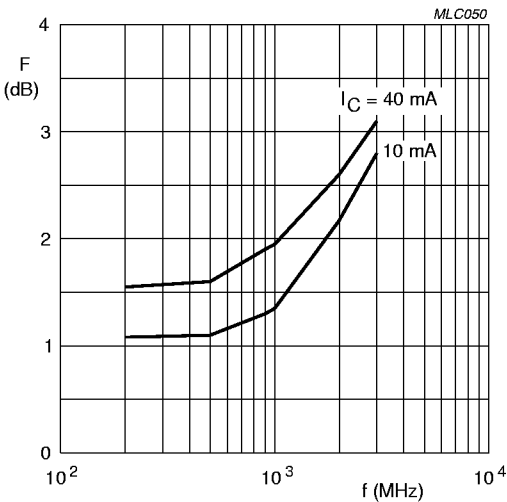
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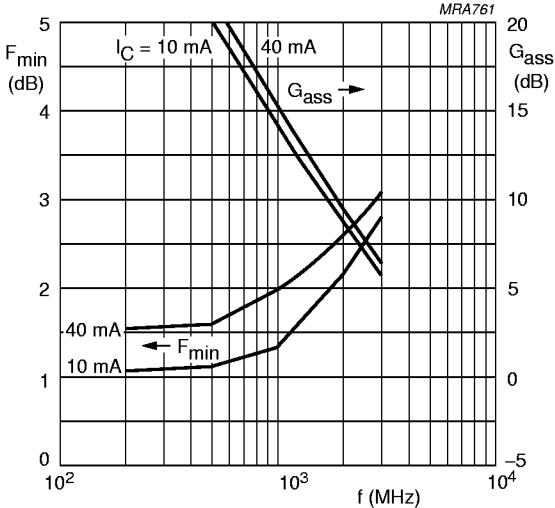
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V_{CE} = 8 V.

Fig.15 Minimum noise figure as a function of frequency; typical values.



V_{CE} = 8 V.

Fig.16 Associated available gain as a function of frequency; typical values.

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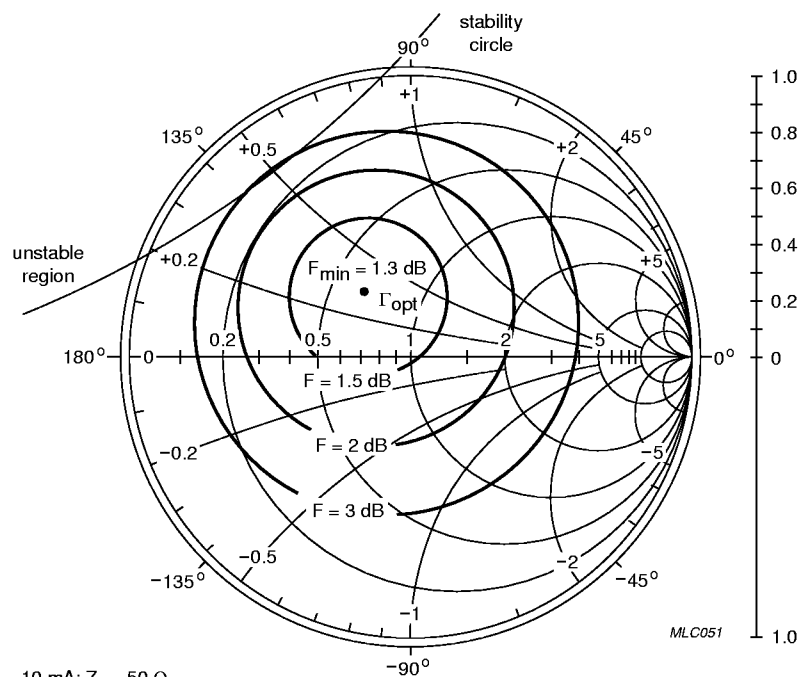
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Fig.17 Common emitter noise figure circles; typical values.

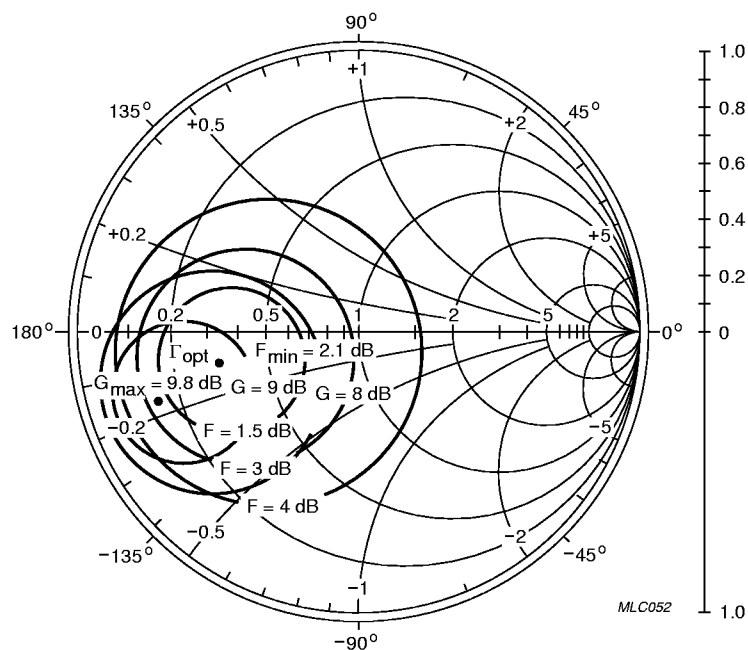
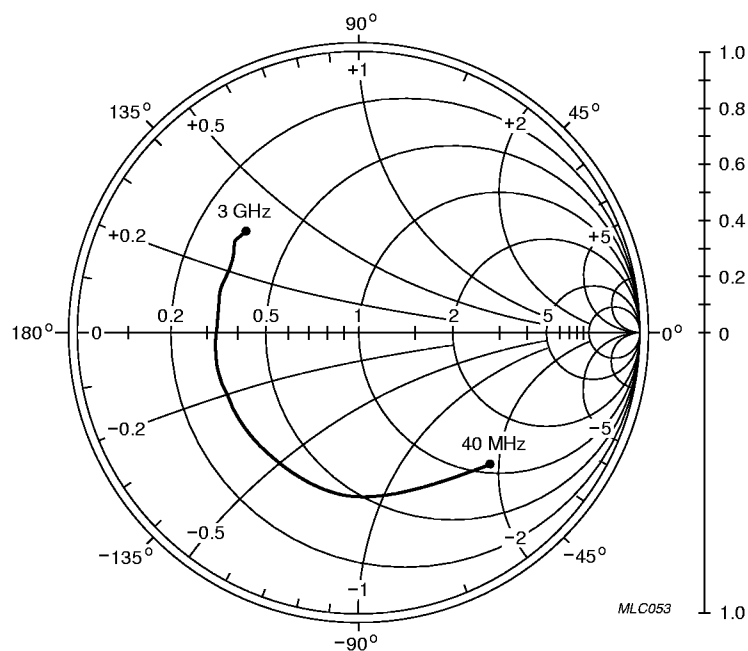
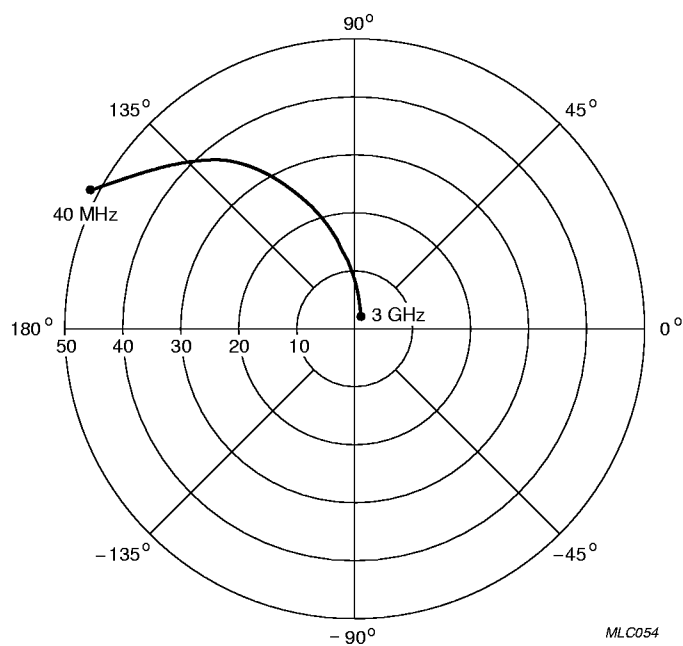
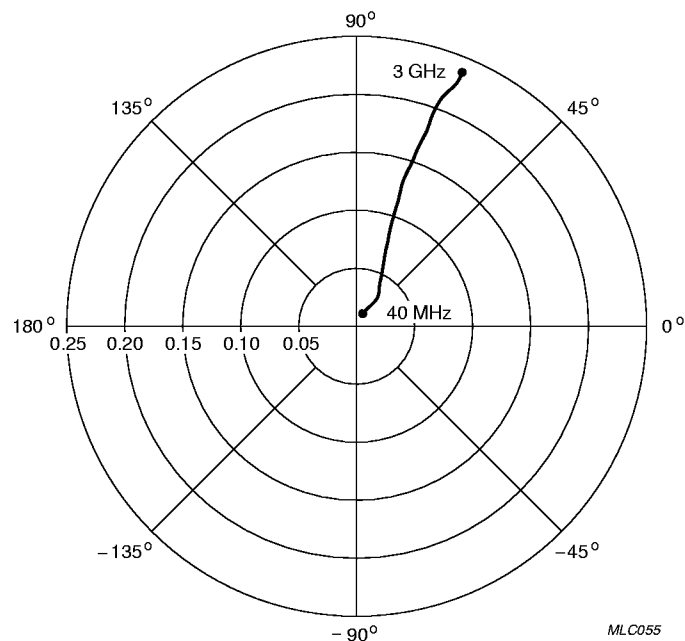
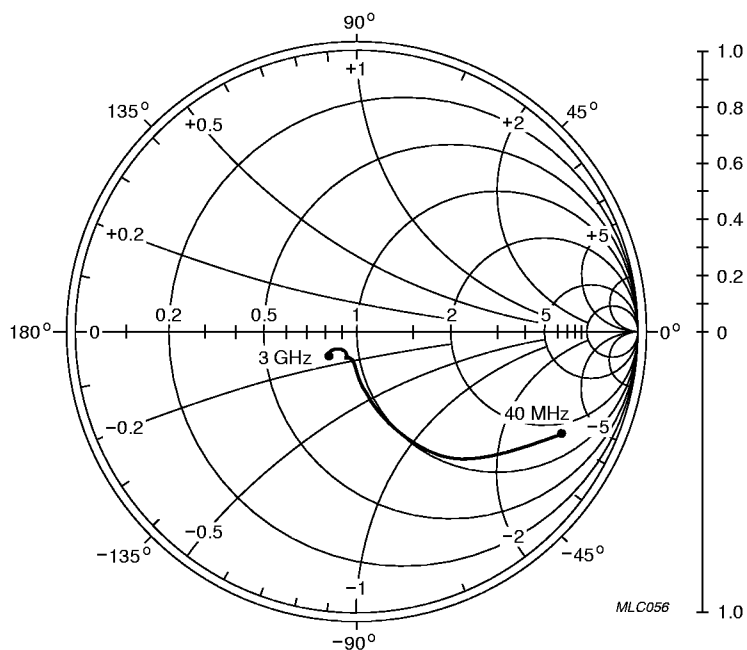


Fig.18 Common emitter noise figure circles; typical values.

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BFG540W/X; BFG540W/XR $V_{CE} = 8\text{ V}; I_C = 40\text{ mA}; Z_o = 50\ \Omega$.Fig.19 Common emitter input reflection coefficient (s_{11}); typical values. $V_{CE} = 8\text{ V}; I_C = 40\text{ mA}$.Fig.20 Common emitter forward transmission coefficient (s_{21}); typical values.

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BFG540W
BFG540W/X; BFG540W/XR $V_{CE} = 8\text{ V}$; $I_C = 40\text{ mA}$.Fig.21 Common emitter reverse transmission coefficient (s_{12}); typical values. $V_{CE} = 8\text{ V}$; $I_C = 40\text{ mA}$; $Z_0 = 50\ \Omega$.Fig.22 Common emitter output reflection coefficient (s_{22}); typical values.

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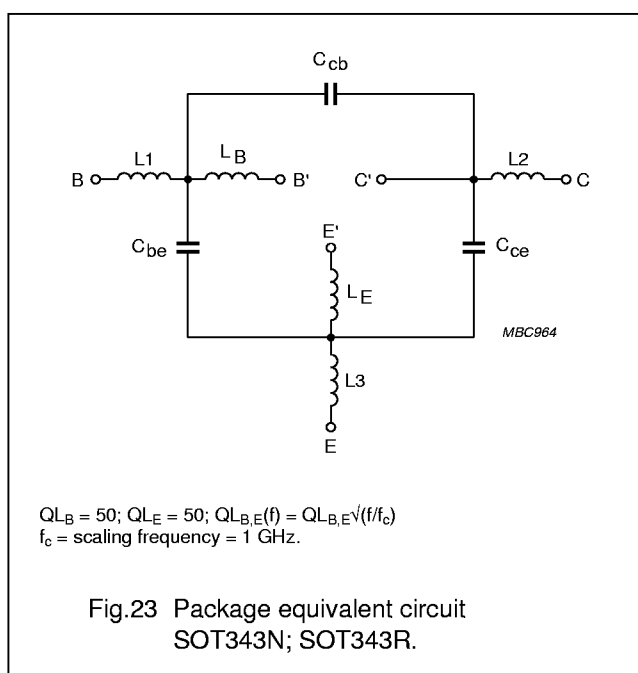
SPICE parameters for the BFG540W crystal

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	1.045	fA
2	BF	184.3	—
3	NF	0.981	—
4	VAF	41.69	V
5	IKF	10.00	A
6	ISE	232.4	fA
7	NE	2.028	—
8	BR	43.99	—
9	NR	0.992	—
10	VAR	2.097	V
11	IKR	166.2	mA
12	ISC	129.8	aA
13	NC	1.064	—
14	RB	5.000	Ω
15	IRB	1.000	μ A
16	RBM	5.000	Ω
17	RE	353.5	m Ω
18	RC	1.340	Ω
19 (1)	XTB	0.000	—
20 (1)	EG	1.110	eV
21 (1)	XTI	3.000	—
22	CJE	1.978	pF
23	VJE	600.0	mV
24	MJE	0.332	—
25	TF	7.457	ps
26	XTF	11.40	—
27	VTF	3.158	V
28	ITF	156.9	mA
29	PTF	0.000	deg
30	CJC	793.7	fF
31	VJC	185.5	mV
32	MJC	0.084	—
33	XCJC	0.150	—
34	TR	1.598	ns
35 (1)	CJS	0.000	F

SEQUENCE No.	PARAMETER	VALUE	UNIT
36 (1)	VJS	750.0	mV
37 (1)	MJS	0.000	—
38	FC	0.814	—

Note

- These parameters have not been extracted, the default values are shown.

**List of components** (see Fig.23).

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

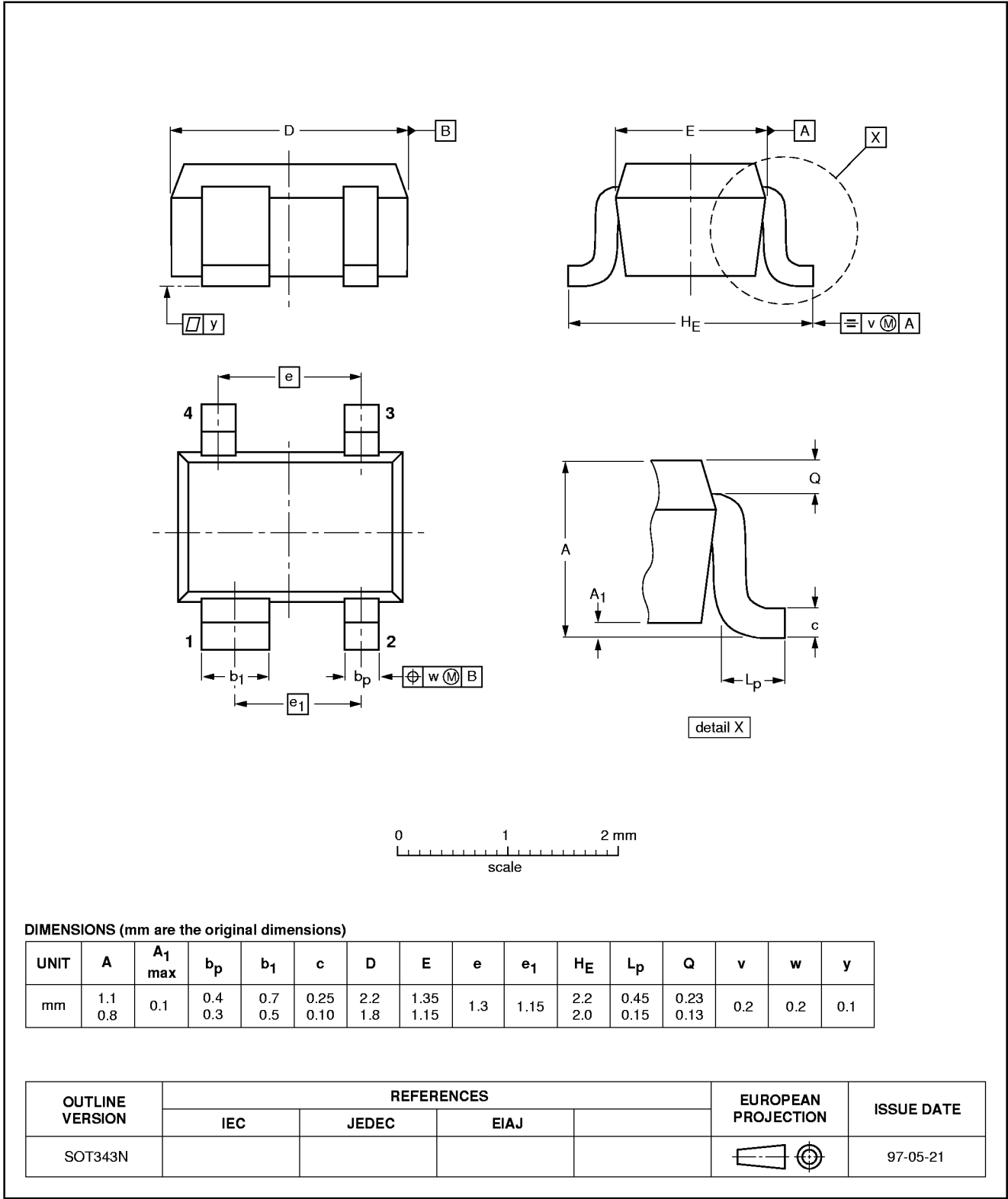
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PACKAGE OUTLINES

Plastic surface mounted package; 4 leads

SOT343N

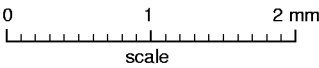
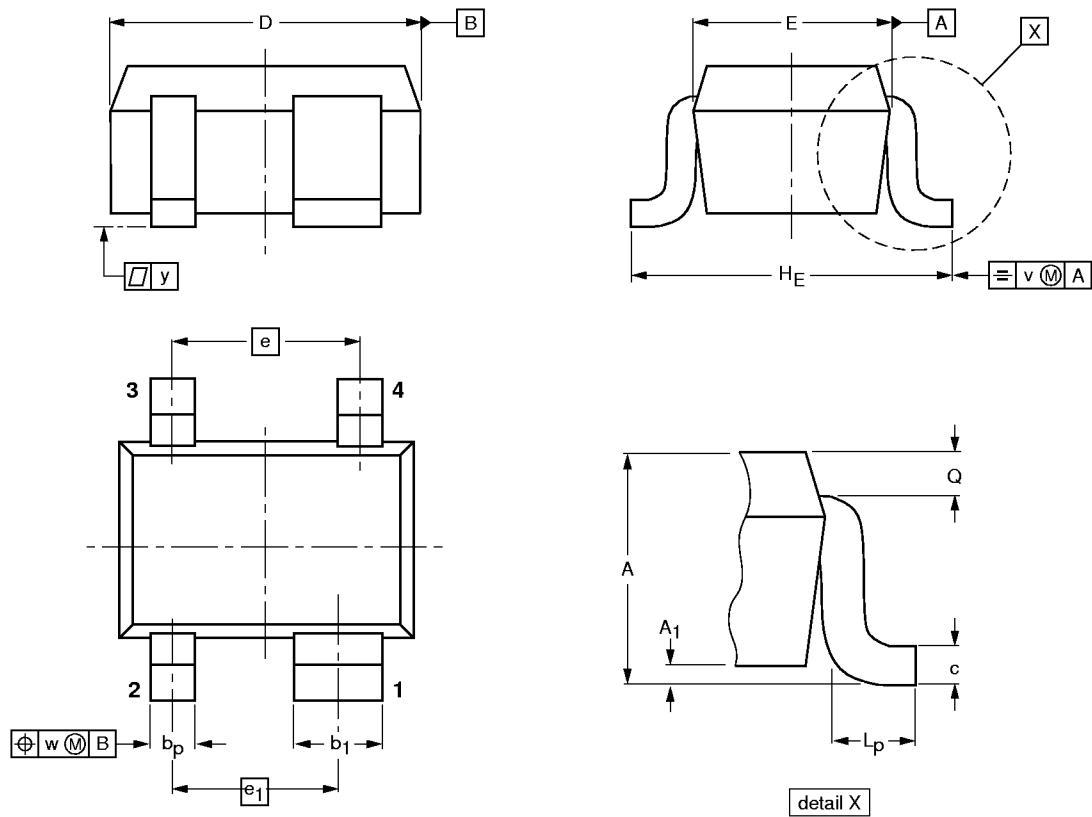


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Plastic surface mounted package; reverse pinning; 4 leads

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