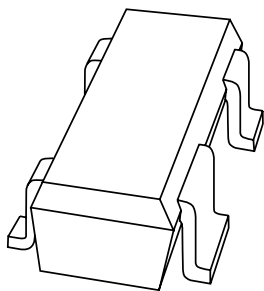


# DATA SHEET



## **BFG590W; BFG590W/X** NPN 5 GHz wideband transistors

Product specification  
Supersedes data of August 1995

1998 Oct 15

# NPN 5 GHz wideband transistors

# BFG590W; BFG590W/X

### FEATURES

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

### APPLICATIONS

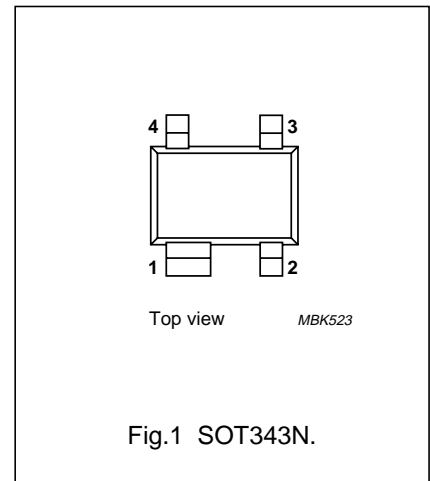
- MATV/CATV amplifiers and RF communications subscriber equipment in the GHz range
- Ideally suitable for use in class-A, (A)B and C amplifiers with either pulsed or continuous drive.

### DESCRIPTION

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

### PINNING

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



### 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	$T_s \leq 85\text{ °C}$	–	–	500	mW
$h_{FE}$	DC current gain	$I_C = 70\text{ mA}; V_{CE} = 8\text{ V}$	60	90	250	
$C_{re}$	feedback capacitance	$I_C = 0; V_{CB} = 8\text{ V}; f = 1\text{ MHz}$	–	0.7	–	pF
$f_T$	transition frequency	$I_C = 80\text{ mA}; V_{CE} = 4\text{ V}; f = 1\text{ GHz}; T_{amb} = 25\text{ °C}$	–	5	–	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 80\text{ mA}; V_{CE} = 4\text{ V}; f = 900\text{ MHz}; T_{amb} = 25\text{ °C}$	–	13	–	dB
$ S_{21} ^2$	insertion power gain	$I_C = 80\text{ mA}; V_{CE} = 4\text{ V}; f = 900\text{ MHz}; T_{amb} = 25\text{ °C}$	–	11	–	dB

## NPN 5 GHz wideband transistors

## BFG590W; BFG590W/X

**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	$T_s \leq 85\text{ °C}$ ; see Fig.2; note 1	–	500	mW
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	junction temperature		–	175	°C

**Note**

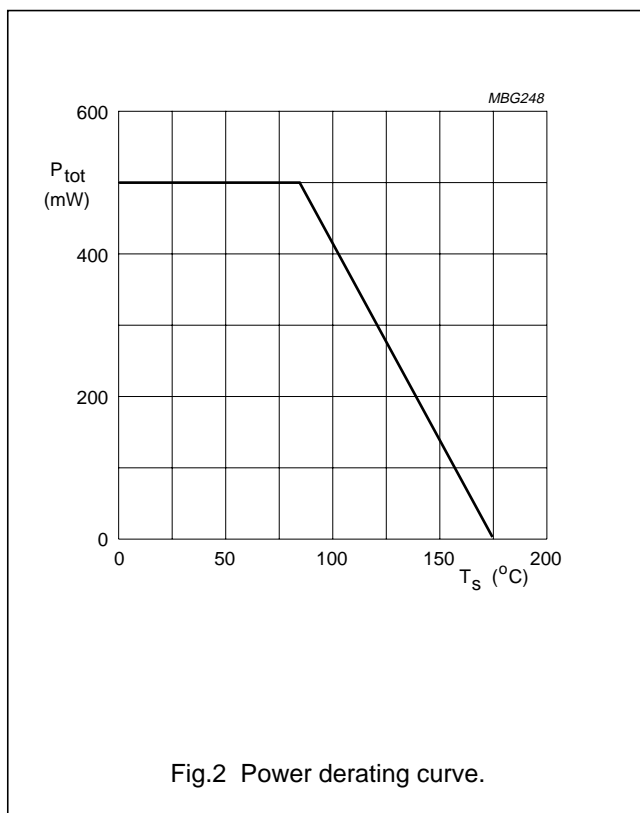
- $T_s$  is the temperature at the soldering point of the collector pin.

**THERMAL CHARACTERISTICS**

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

**Note**

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



## NPN 5 GHz wideband transistors

## BFG590W; BFG590W/X

**CHARACTERISTICS**

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

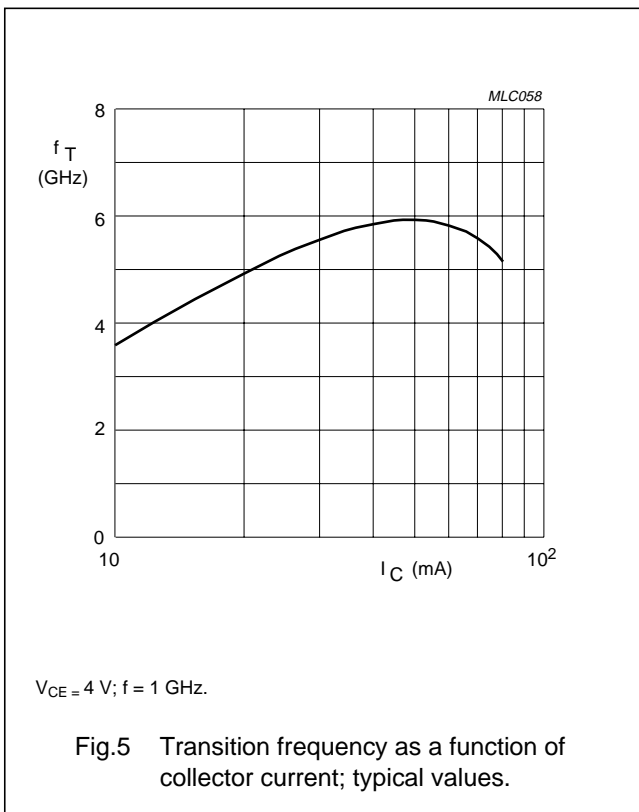
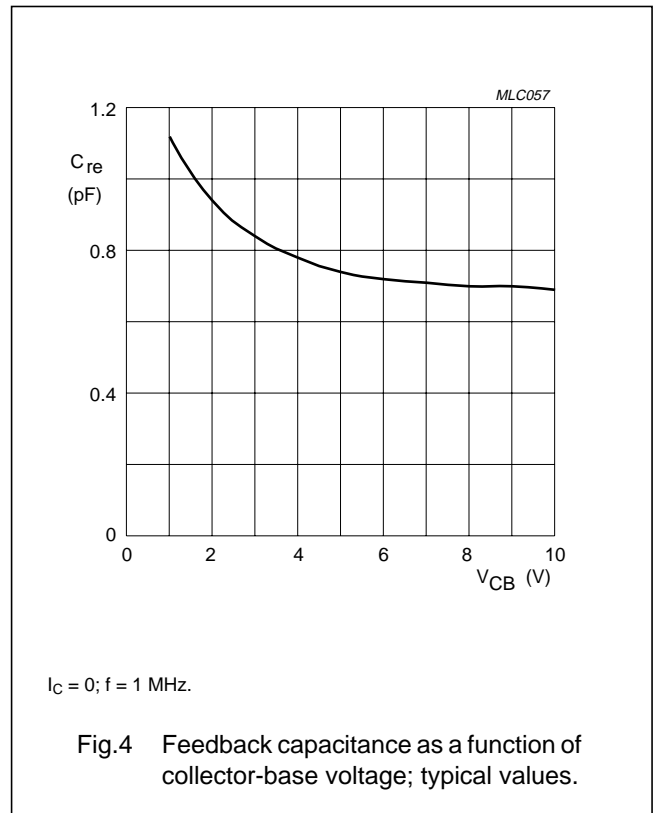
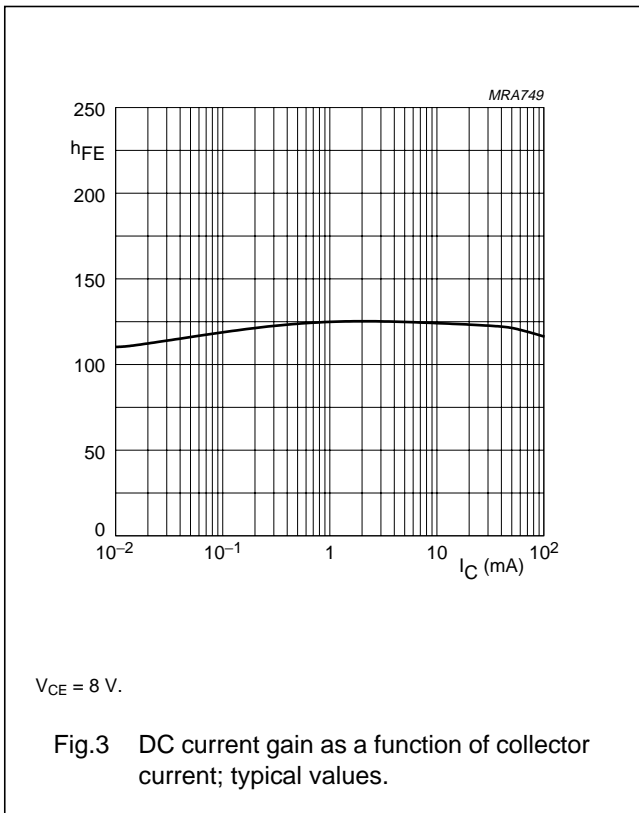
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 0.1\text{ mA}; I_E = 0$	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 10\text{ mA}; I_B = 0$	15	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 0.1\text{ mA}; I_C = 0$	3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

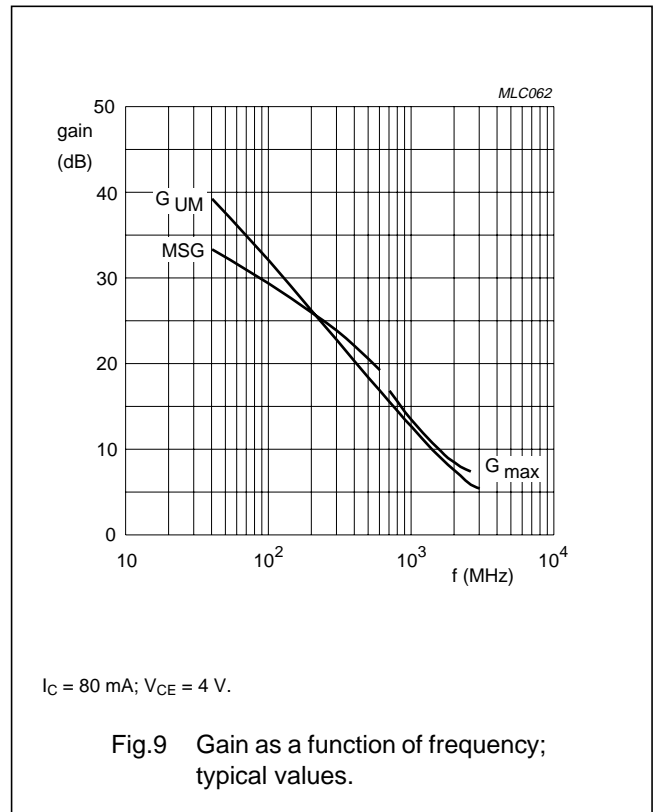
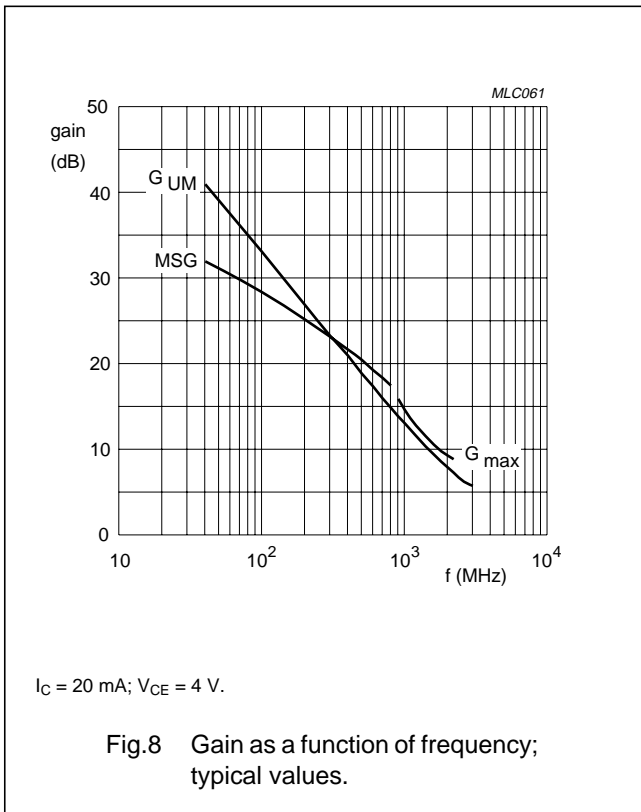
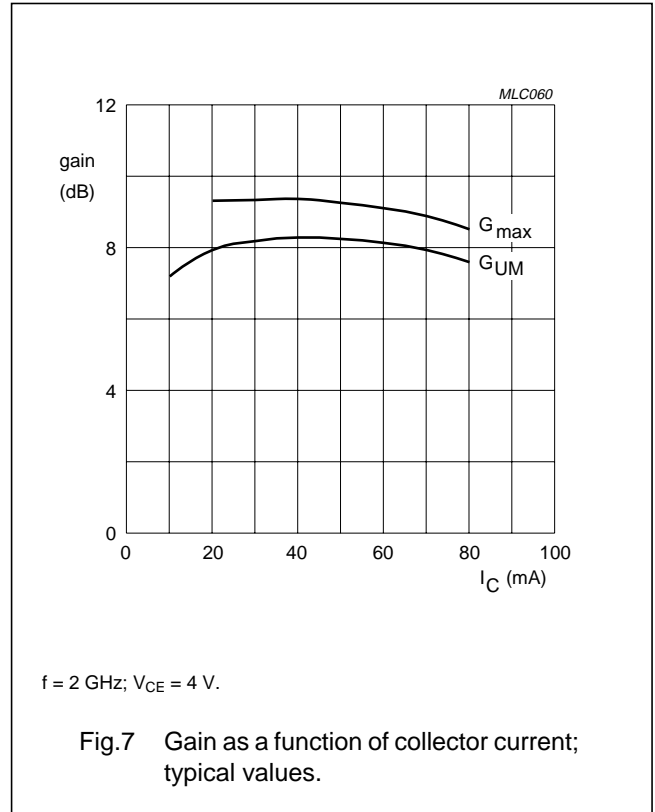
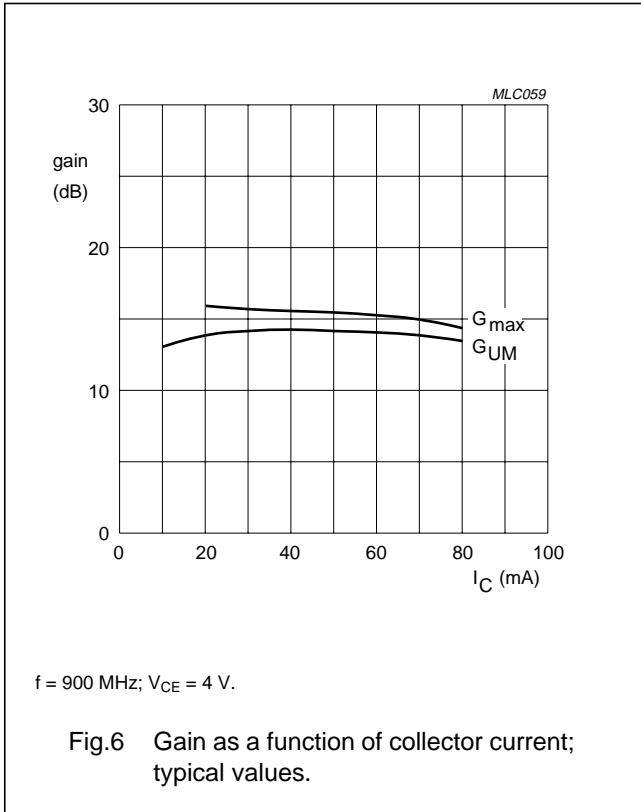
NPN 5 GHz wideband transistors

BFG590W; BFG590W/X



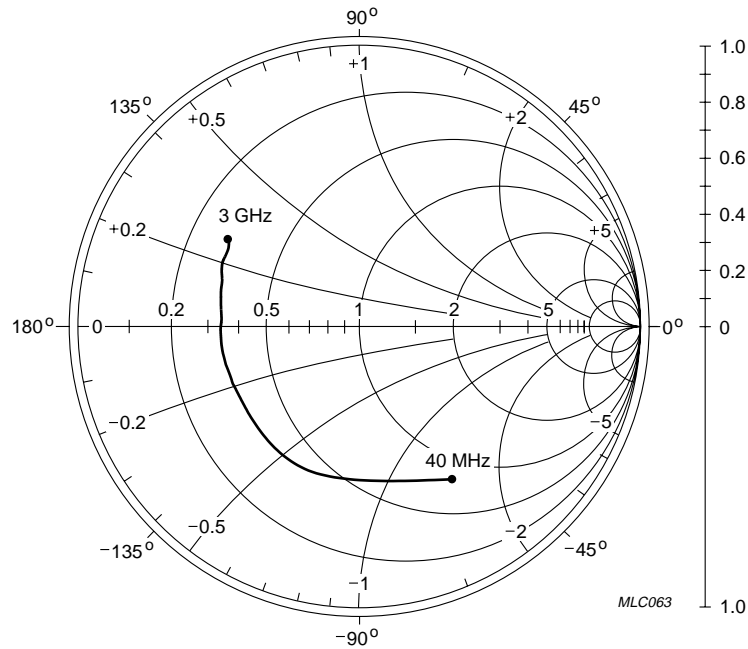
NPN 5 GHz wideband transistors

BFG590W; BFG590W/X



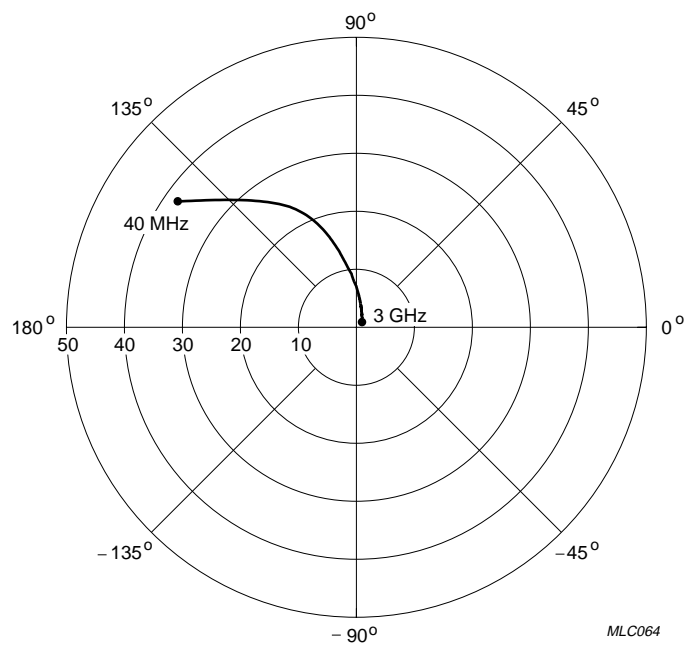
NPN 5 GHz wideband transistors

BFG590W; BFG590W/X



$I_C = 80 \text{ mA}$ ;  $V_{CE} = 4 \text{ V}$ ;  $Z_0 = 50 \Omega$ .

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

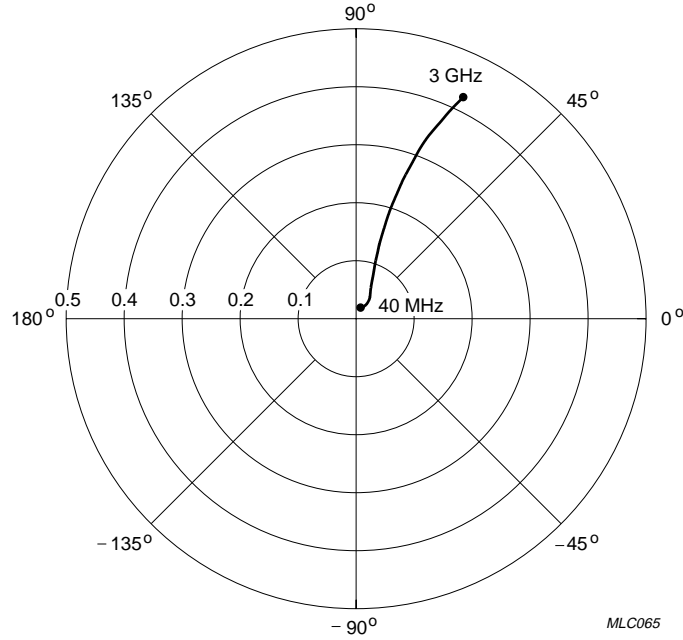


$I_C = 80 \text{ mA}$ ;  $V_{CE} = 4 \text{ V}$ .

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

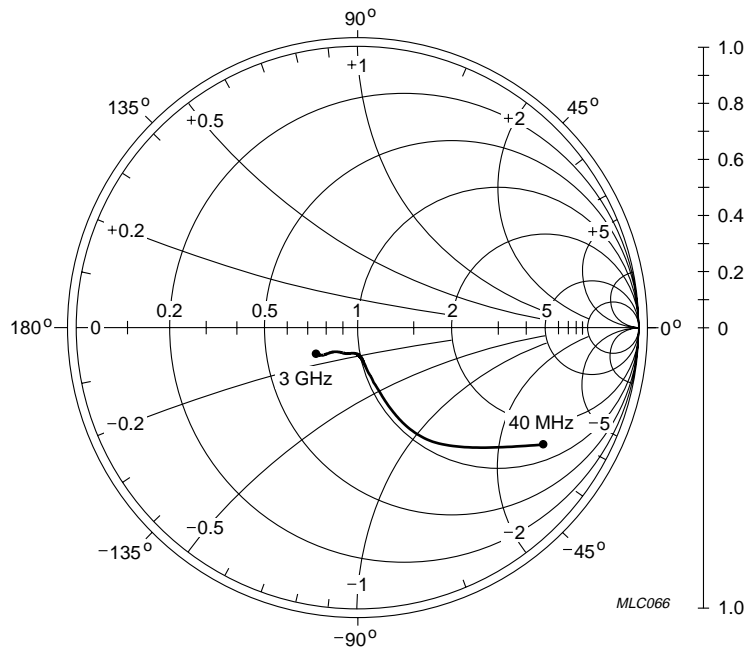
NPN 5 GHz wideband transistors

BFG590W; BFG590W/X



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

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



$I_C = 80 \text{ mA}; V_{CE} = 4 \text{ V}; Z_0 = 50 \Omega.$

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

NPN 5 GHz wideband transistors

BFG590W; BFG590W/X

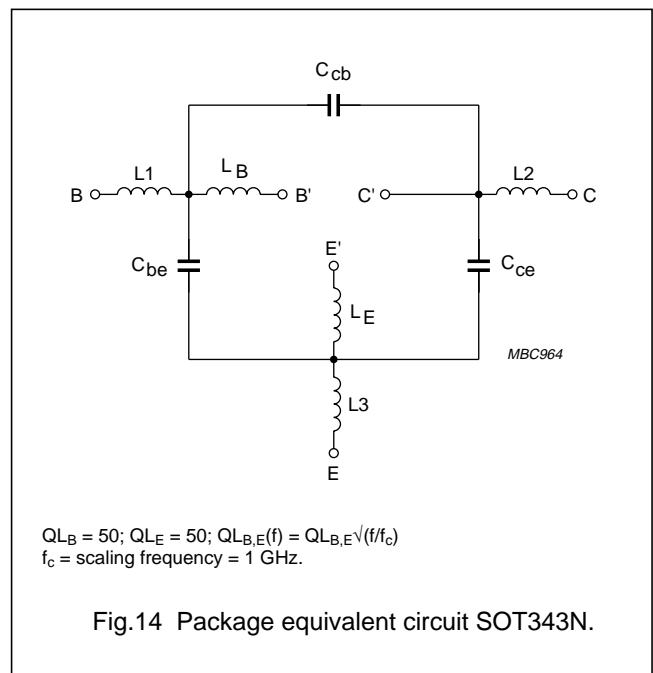
SPICE parameters for the BFG590W die

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

SEQUENCE No.	PARAMETER	VALUE	UNIT
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.



List of components (see Fig.14)

DESIGNATION	VALUE	UNIT
C <sub>be</sub>	70	fF
C <sub>cb</sub>	50	fF
C <sub>ce</sub>	115	fF
L1	0.34	nH
L2	0.10	nH
L3	0.25	nH
L <sub>B</sub>	0.40	nH
L <sub>E</sub>	0.40	nH

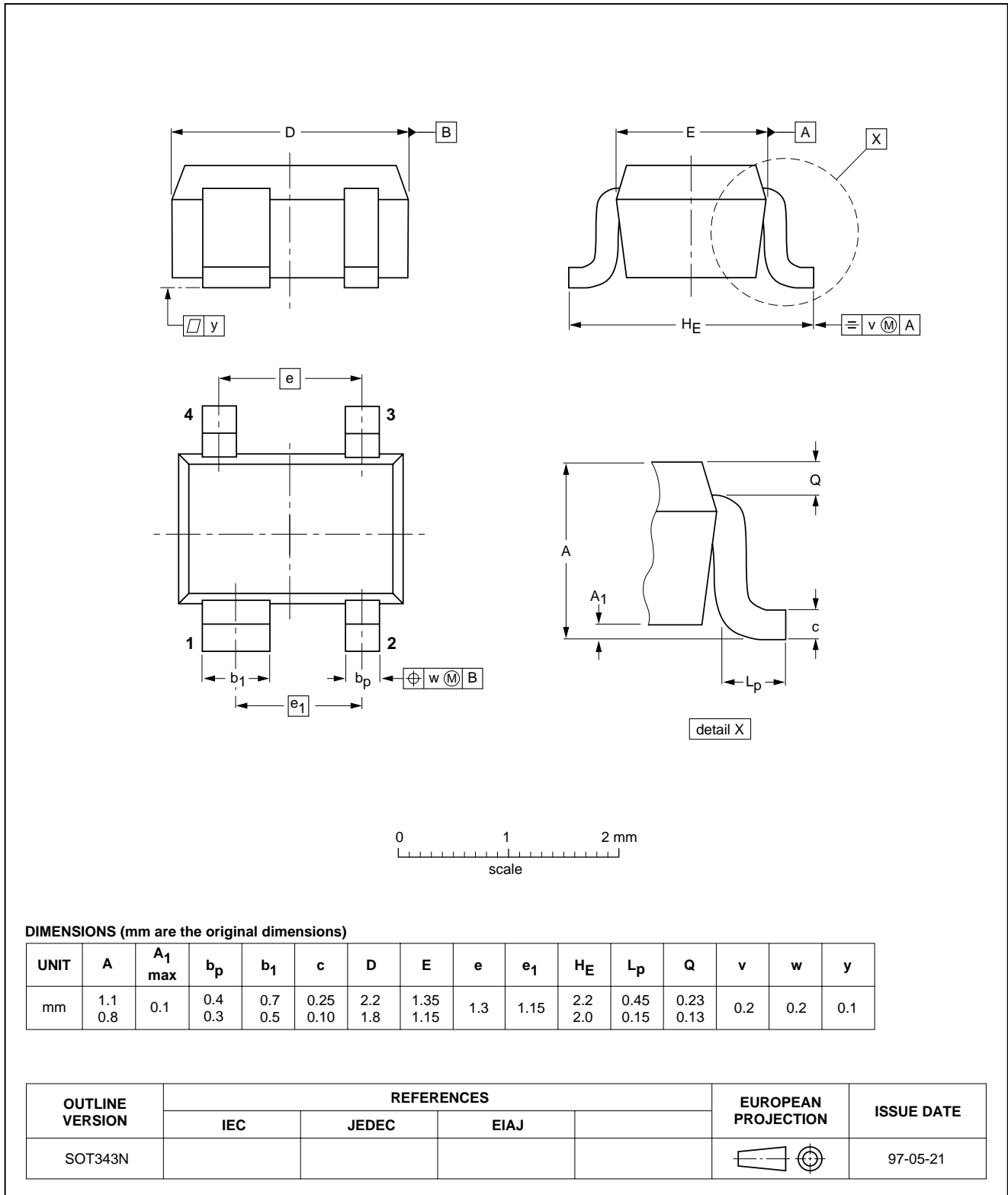
NPN 5 GHz wideband transistors

BFG590W; BFG590W/X

PACKAGE OUTLINE

Plastic surface mounted package; 4 leads

SOT343N



## NPN 5 GHz wideband transistors

## BFG590W; BFG590W/X

**DEFINITIONS**

<b>Data sheet status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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