

NPN 5 GHz wideband transistor

BFG590W
BFG590W/X; BFG590W/XR

FEATURES

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

APPLICATIONS

They are intended for wideband applications in the GHz range such as MATV/CATV amplifiers and RF communications subscriber equipment. They are ideally suitable for use in class-A, (A)B and C amplifiers with either pulsed or continuous drive.

DESCRIPTION

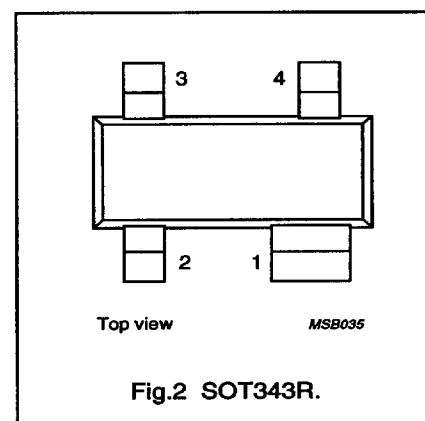
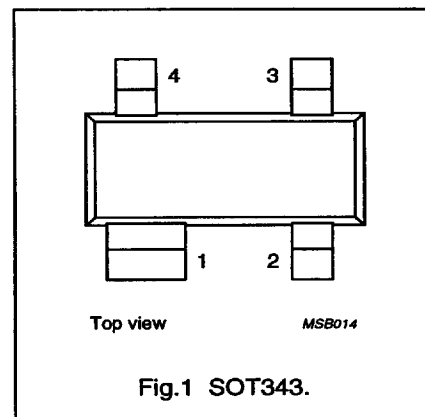
NPN silicon planar epitaxial transistors in plastic, 4-pin dual-emitter SOT343 and SOT343R packages.

MARKING

TYPE NUMBER	CODE
BFG590W	T1
BFG590W/X	T2
BFG590W/XR	T3

PINNING

PIN	DESCRIPTION
BFG590W (see Fig.1)	
1	collector
2	base
3	emitter
4	emitter
BFG590W/X (see Fig.1)	
1	collector
2	emitter
3	base
4	emitter
BFG590W/XR (see Fig.2)	
1	collector
2	emitter
3	base
4	emitter



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	up to $T_s = 60\text{ }^{\circ}\text{C}$	—	—	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	$I_C = 80\text{ mA}$; $V_{CE} = 4\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	5	—	GHz
G_{UM}	maximum unilateral power gain	$I_C = 80\text{ mA}$; $V_{CE} = 4\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	13	—	dB
$ S_{21} ^2$	insertion power gain	$I_C = 80\text{ mA}$; $V_{CE} = 4\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	11	—	dB

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

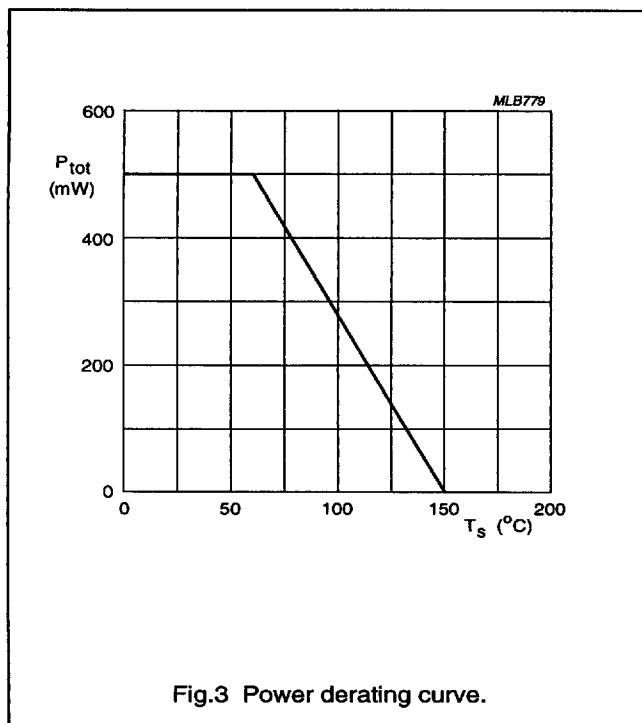
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	15	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	collector current (DC)		–	200	mA
P_{tot}	total power dissipation	up to $T_s = 60\text{ }^{\circ}\text{C}$; see Fig.3; note 1	–	500	mW
T_{stg}	storage temperature		–65	+150	$^{\circ}\text{C}$
T_j	junction temperature		–	150	$^{\circ}\text{C}$

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-s}$	thermal resistance from junction to soldering point	up to $T_s = 60\text{ }^{\circ}\text{C}$; 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.



NPN 5 GHz wideband transistor

BFG590W
BFG590W/X; BFG590W/XR

CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; $I_C = 0.1\text{ mA}$; $I_E = 0$	—	—	20	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; $I_C = 10\text{ mA}$; $I_B = 0$	—	—	15	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; $I_E = 0.1\text{ mA}$; $I_C = 0$	—	—	2.5	V
I_{CBO}	collector cut-off 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	$I_C = 80\text{ mA}$; $V_{CE} = 4\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	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	$I_C = 80\text{ mA}$; $V_{CE} = 4\text{ V}$; $f = 900\text{ MHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	13	—	dB
		$I_C = 80\text{ mA}$; $V_{CE} = 4\text{ V}$; $f = 2\text{ GHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	7.5	—	dB
$ s_{21} ^2$	insertion power gain	$I_C = 80\text{ mA}$; $V_{CE} = 4\text{ V}$; $f = 1\text{ GHz}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	11	—	dB
P_{L1}	output power at 1 dB gain compression	$I_C = 80\text{ mA}$; $V_{CE} = 5\text{ V}$; $f = 900\text{ MHz}$; $R_L = 50\text{ }\Omega$; $T_{amb} = 25\text{ }^{\circ}\text{C}$	—	21	—	dBm

Notes

1. G_{UM} is the maximum unilateral power gain, assuming s_{12} is zero. $G_{UM} = 10 \log \frac{|s_{21}|^2}{(1 - |s_{11}|^2)(1 - |s_{22}|^2)} \text{ dB}$.

NPN 5 GHz wideband transistor

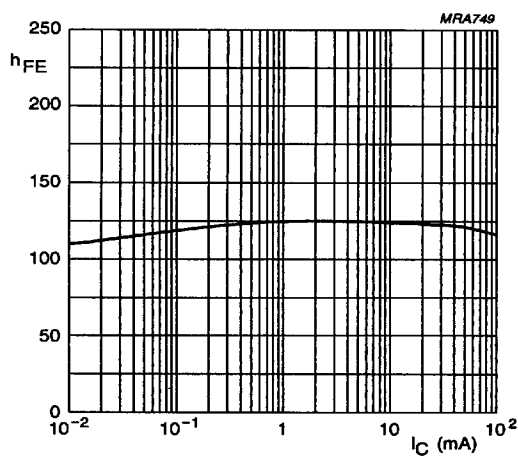
BFG590W
BFG590W/X; BFG590W/XR $V_{CE} = 8$ V.

Fig.4 DC current gain as a function of collector current; typical values.

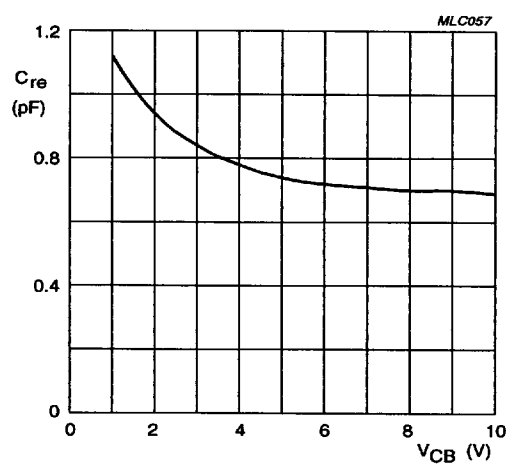
 $I_C = 0$; $f = 1$ MHz.

Fig.5 Feedback capacitance as a function of collector-base voltage; typical values.

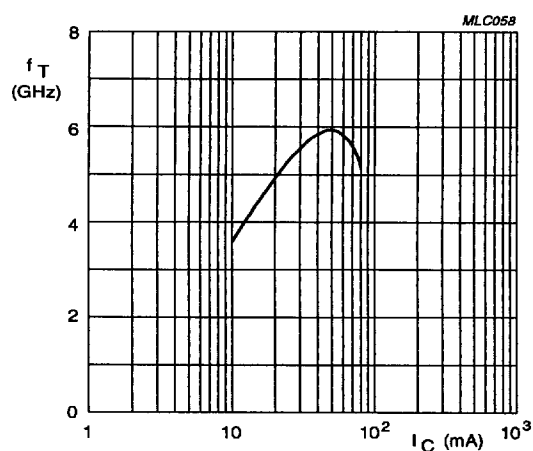
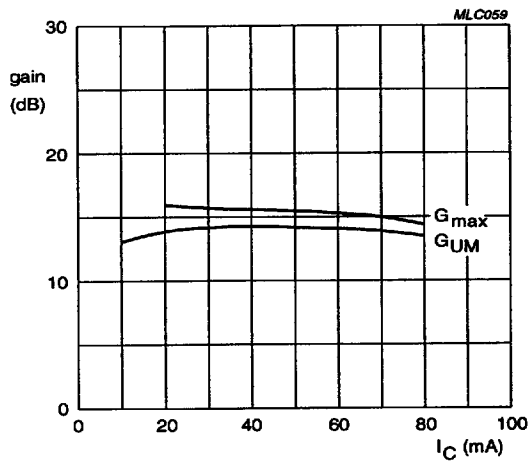
 $V_{CE} = 4$ V; $f = 1$ GHz.

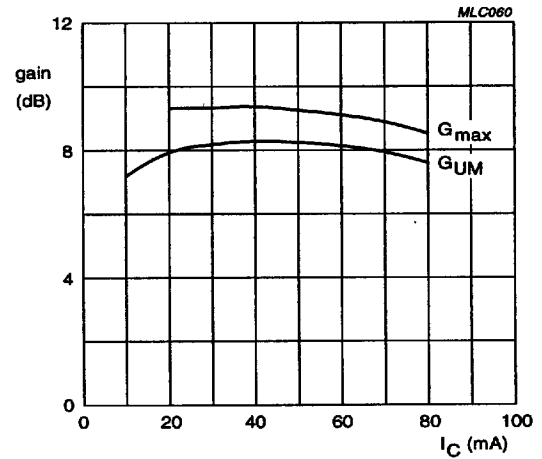
Fig.6 Transition frequency as a function of collector current; typical values.

NPN 5 GHz wideband transistor

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BFG590W/X; BFG590W/XR

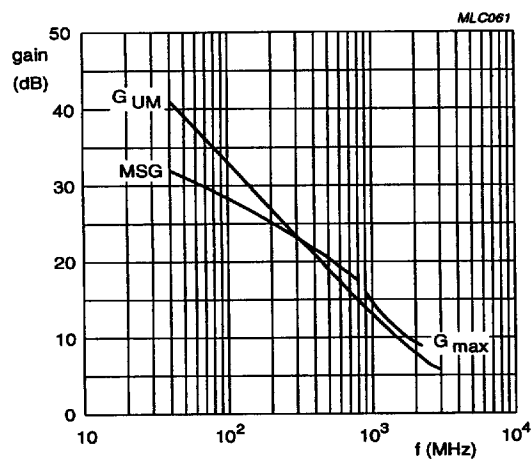
$f = 900 \text{ MHz}$; $V_{CE} = 4 \text{ V}$.

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



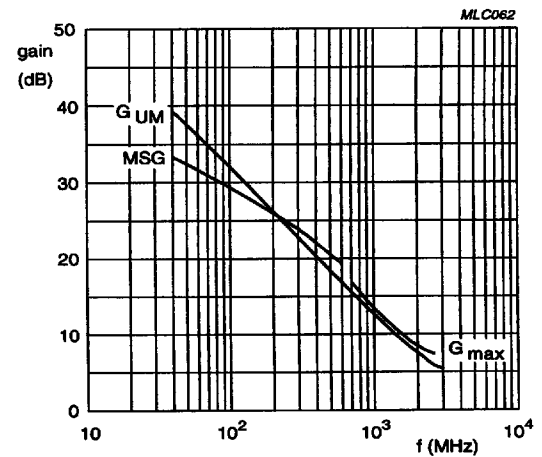
$f = 2 \text{ GHz}$; $V_{CE} = 4 \text{ V}$.

Fig.8 Gain as a function of collector current; typical values.



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

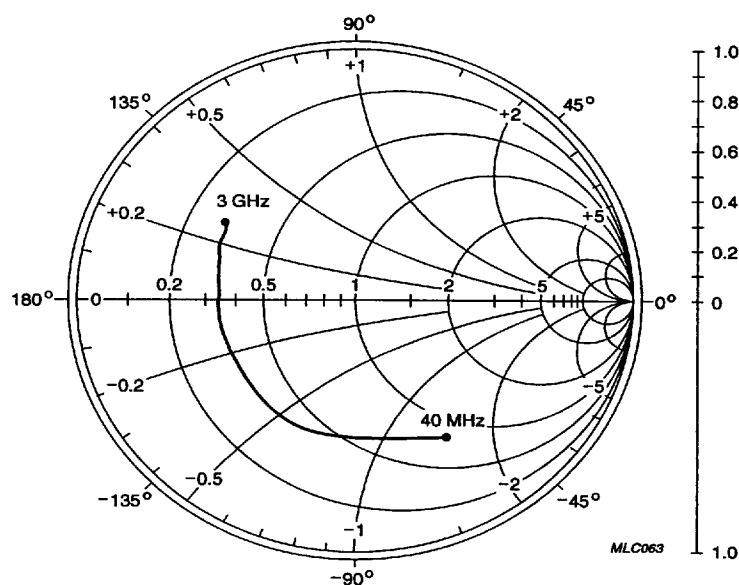
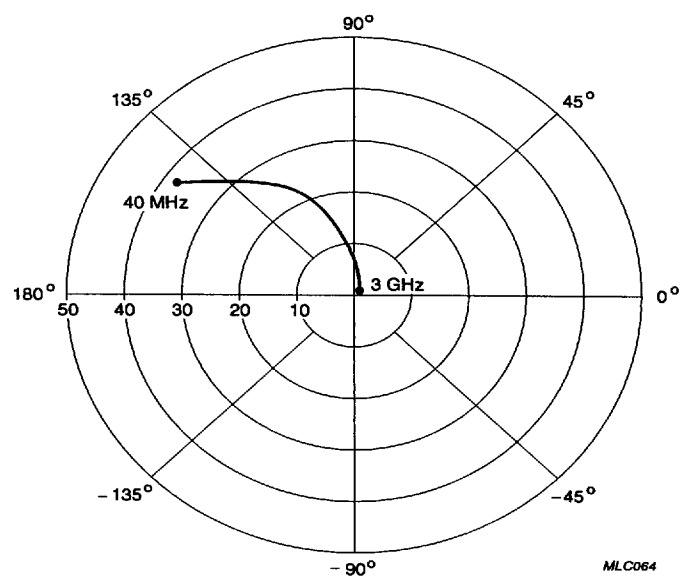
Fig.9 Gain as a function of frequency; typical values.



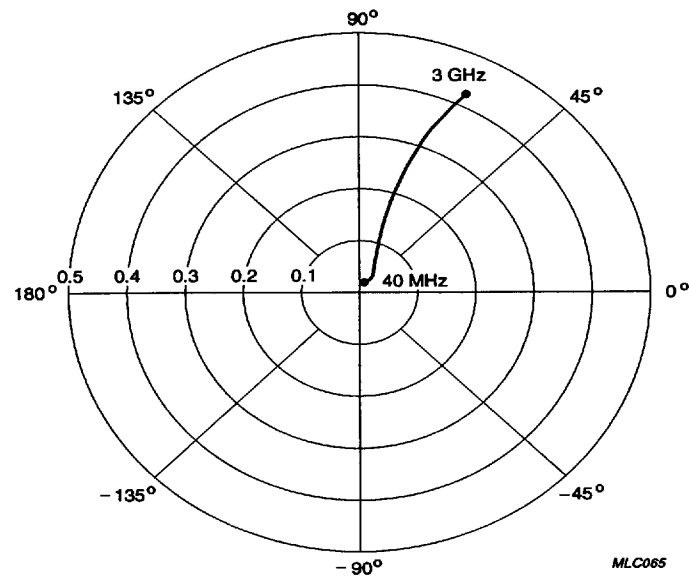
$I_C = 80 \text{ mA}$; $V_{CE} = 4 \text{ V}$.

Fig.10 Gain as a function of frequency; typical values.

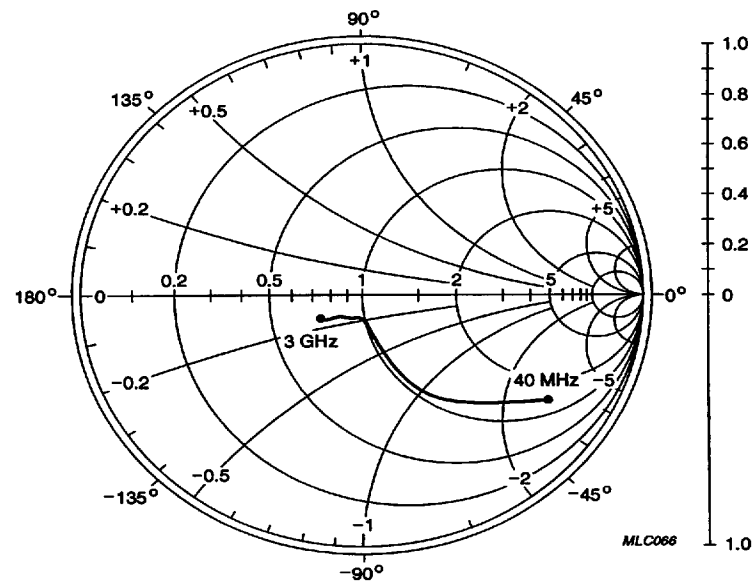
NPN 5 GHz wideband transistor

BFG590W
BFG590W/X; BFG590W/XR $I_C = 80 \text{ mA}$; $V_{CE} = 4 \text{ V}$; $Z_0 = 50 \Omega$.Fig.11 Common emitter input reflection coefficient (s_{11}); typical values. $I_C = 80 \text{ mA}$; $V_{CE} = 4 \text{ V}$.Fig.12 Common emitter forward transmission coefficient (s_{21}); typical values.

NPN 5 GHz wideband transistor

BFG590W
BFG590W/X; BFG590W/XR $I_C = 80 \text{ mA}$; $V_{CE} = 4 \text{ V}$.

MLC065

Fig.13 Common emitter reverse transmission coefficient (s_{12}); typical values. $I_C = 80 \text{ mA}$; $V_{CE} = 4 \text{ V}$; $Z_0 = 50 \Omega$.

MLC066

Fig.14 Common emitter output reflection coefficient (s_{22}); typical values.

NPN 5 GHz wideband transistor

BFG590W
BFG590W/X; BFG590W/XR

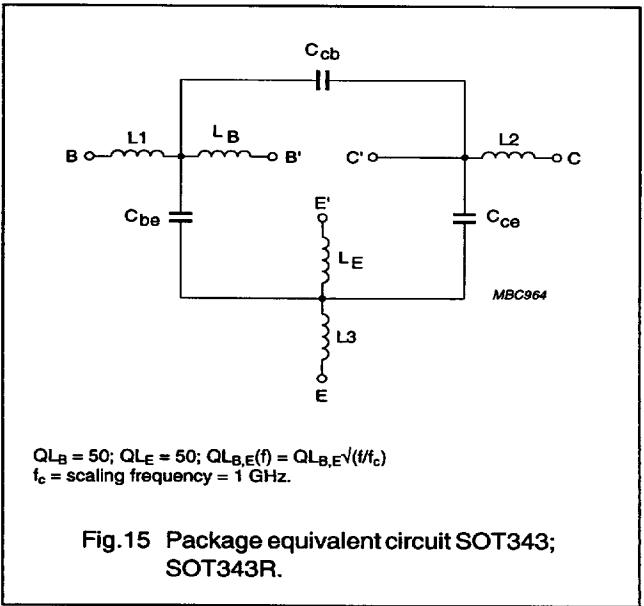
SPICE parameters for the BFG590W crystal

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.



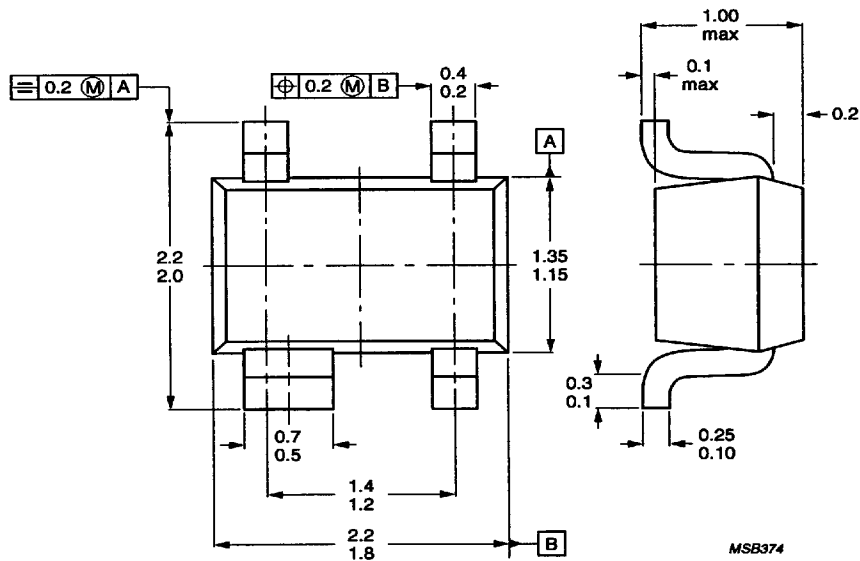
List of components (see Fig.15).

DESIGNATION	VALUE	UNIT
Cbe	70	fF
Ccb	50	fF
Cce	115	fF
L1	0.34	nH
L2	0.10	nH
L3	0.25	nH
LB	0.40	nH
LE	0.40	nH

NPN 5 GHz wideband transistor

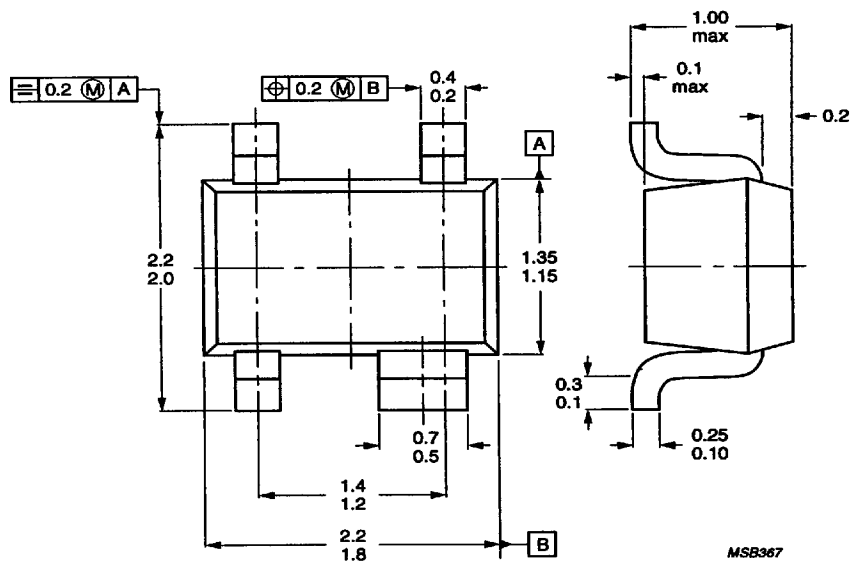
BFG590W
BFG590W/X; BFG590W/XR

PACKAGE OUTLINES



Dimensions in mm.

Fig.16 SOT343.



Dimensions in mm.

Fig.17 SOT343R.

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BFG590W/X; BFG590W/XR

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.	

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.