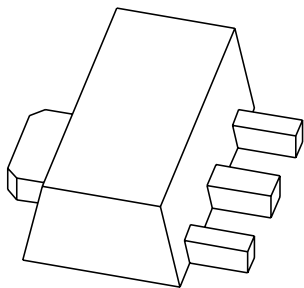


# DATA SHEET



## **BFQ591** NPN 7 GHz wideband transistor

Product specification  
Supersedes data of 2002 Jan 07

2002 Feb 04

## NPN 7 GHz wideband transistor

## BFQ591

## FEATURES

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

## APPLICATIONS

Intended for applications in the GHz range such as MATV or CATV amplifiers and RF communications subscribers equipment.

## DESCRIPTION

NPN wideband transistor in a SOT89 plastic package.

## MARKING

TYPE NUMBER	MARKING CODE
BFQ591	BCp

## PINNING

PIN	DESCRIPTION
1	emitter
2	collector
3	base

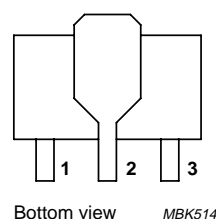


Fig.1 Simplified outline (SOT89).

## 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	$T_s \leq 90\text{ }^\circ\text{C}$ ; note 1	—	—	2.25	W
$h_{FE}$	DC current gain	$I_C = 70\text{ mA}$ ; $V_{CE} = 8\text{ V}$	60	90	250	
$C_{re}$	feedback capacitance	$I_C = 0$ ; $V_{CB} = 12\text{ V}$ ; $f = 1\text{ MHz}$	—	0.8	—	pF
$f_T$	transition frequency	$I_C = 70\text{ mA}$ ; $V_{CE} = 12\text{ V}$ ; $f = 1\text{ GHz}$	—	7	—	GHz
$G_{UM}$	maximum unilateral power gain	$I_C = 70\text{ mA}$ ; $V_{CE} = 12\text{ V}$ ; $f = 900\text{ MHz}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$	—	11	—	dB
$ S_{21} ^2$	insertion power gain	$I_C = 70\text{ mA}$ ; $V_{CE} = 12\text{ V}$ ; $f = 900\text{ MHz}$ ; $T_{amb} = 25\text{ }^\circ\text{C}$	—	10	—	dB

## Note

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

## NPN 7 GHz wideband transistor

BFQ591

**LIMITING VALUES**

In accordance with the Absolute Maximum System (IEC 60134).

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	$T_s \leq 90\text{ °C}$ ; note 1	–	2.25	W
$T_{stg}$	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
$R_{th\ j-s}$	thermal resistance from junction to soldering point	$T_s \leq 90\text{ °C}$ ; note 1	38	K/W

**Note**

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

## NPN 7 GHz wideband transistor

## BFQ591

## 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
$V_{(BR)CES}$	collector-emitter breakdown voltage	$I_C = 0.1\text{ mA}$ ; $I_B = 0$	–	–	15	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 0.1\text{ mA}$ ; $I_C = 0$	–	–	3	V
$I_{CBO}$	collector-base leakage current	$I_E = 0$ ; $V_{CB} = 10$	–	–	100	nA
$h_{FE}$	DC current gain	$I_C = 70\text{ mA}$ ; $V_{CE} = 8\text{ V}$	60	90	250	
$C_{re}$	feedback capacitance	$I_C = 0$ ; $V_{CB} = 12\text{ V}$ ; $f = 1\text{ MHz}$	–	0.8	–	pF
$f_T$	transition frequency	$I_C = 70\text{ mA}$ ; $V_{CE} = 12\text{ V}$ ; $f = 1\text{ GHz}$	–	7	–	GHz
$G_{UM}$	maximum unilateral power gain; note 1	$I_C = 70\text{ mA}$ ; $V_{CE} = 12\text{ V}$ ; $T_{amb} = 25\text{ °C}$				
		$f = 900\text{ MHz}$	–	11	–	dB
		$f = 2\text{ GHz}$	–	5.5	–	dB
$ S_{21} ^2$	insertion power gain	$I_C = 70\text{ mA}$ ; $V_{CE} = 12\text{ V}$ ; $f = 1\text{ GHz}$ ; $T_{amb} = 25\text{ °C}$	–	10	–	dB
$V_o$	output voltage	note 2	–	700	–	mV

## Notes

- $G_{UM}$  is the maximum unilateral power gain, assuming  $s_{12}$  is zero and  $G_{UM} = 10 \log \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$  dB.
- $d_{im} = 60\text{ dB}$  (DIN45004B);  $V_p = V_o$ ;  $V_q = V_o - 6\text{ dB}$ ;  $f_p = 795.25\text{ MHz}$ ;  $f_q = 803.25\text{ MHz}$ ;  $f_r = 803.25\text{ MHz}$ ;  
measured at  $f_{(p+q+r)} = 793.25\text{ MHz}$ .

NPN 7 GHz wideband transistor

BFQ591

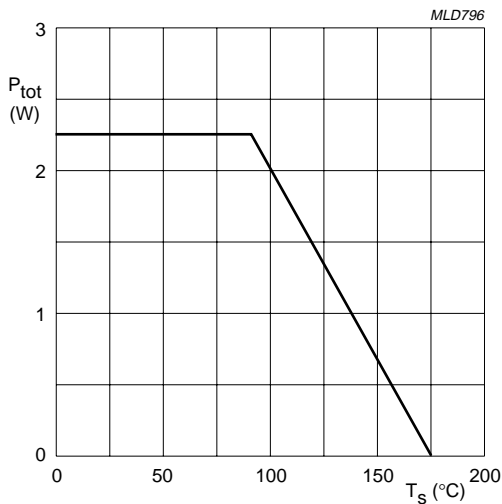
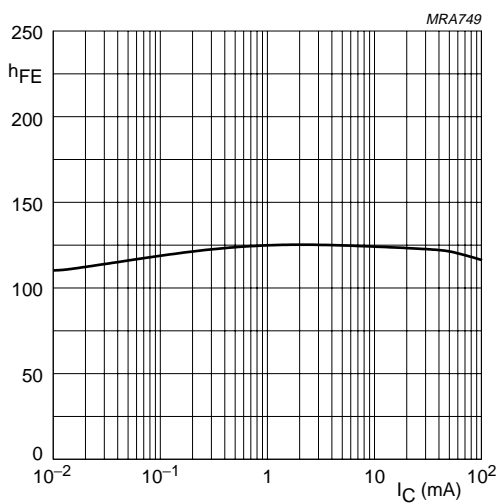
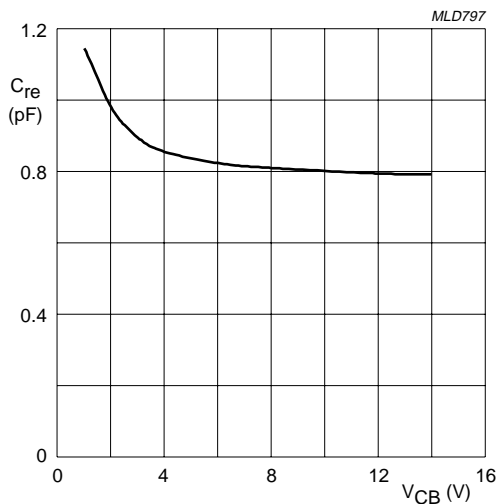


Fig.2 Power derating curve.



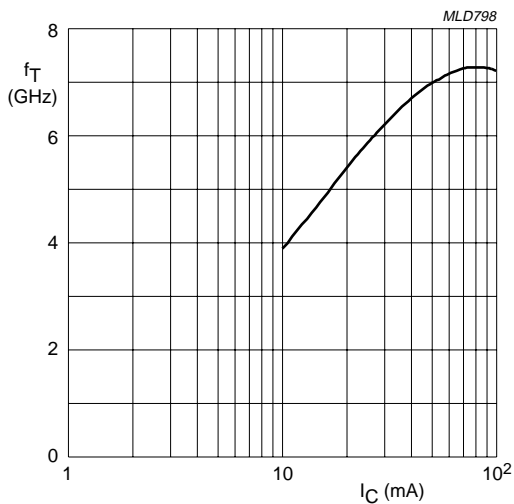
$V_{CE} = 12$  V.

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.

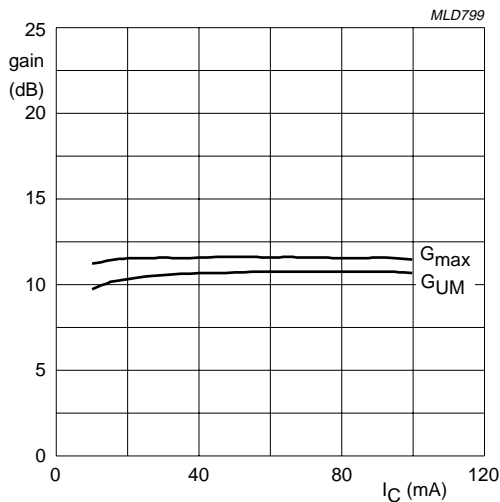


$V_{CE} = 12$  V;  $f = 1$  GHz.

Fig.5 Transition frequency as a function of collector current.

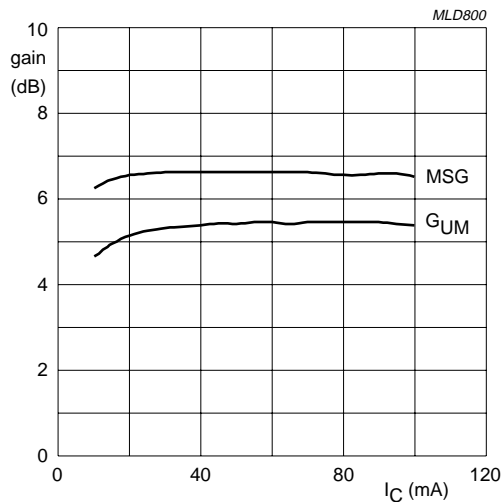
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BFQ591



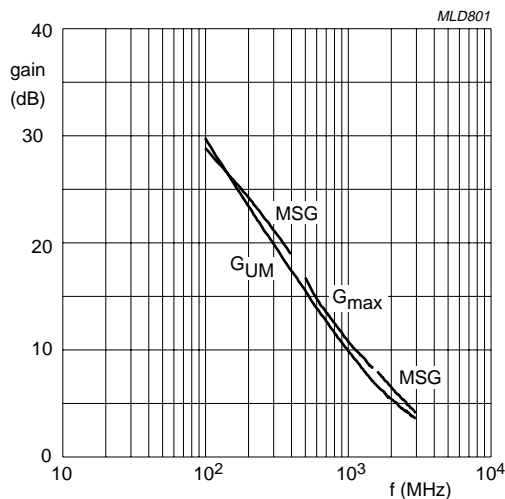
$V_{CE} = 12\text{ V}$ ;  $f = 900\text{ MHz}$ .

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



$V_{CE} = 12\text{ V}$ ;  $f = 2\text{ GHz}$ .

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

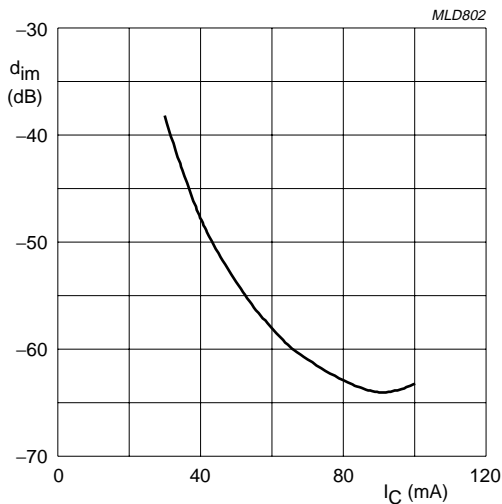


$I_C = 70\text{ mA}$ ;  $V_{CE} = 12\text{ V}$ .

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

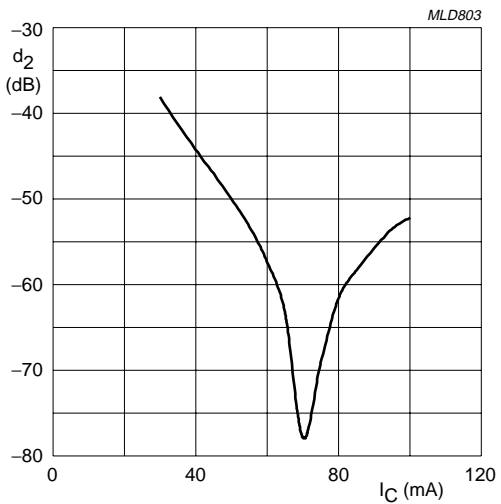
NPN 7 GHz wideband transistor

BFQ591



$V_o = 700\text{ mV}$ ;  $V_{CE} = 12\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $f_{(p+q+r)} = 793.25\text{ MHz}$ .

Fig.9 Intermodulation distortion as function of collector current; typical values.



$V_o = 316\text{ mV}$ ;  $V_{CE} = 12\text{ V}$ ;  $f_{(p+q)} = 810\text{ MHz}$ .

Fig.10 Second order intermodulation distortion as function of collector current; typical values.

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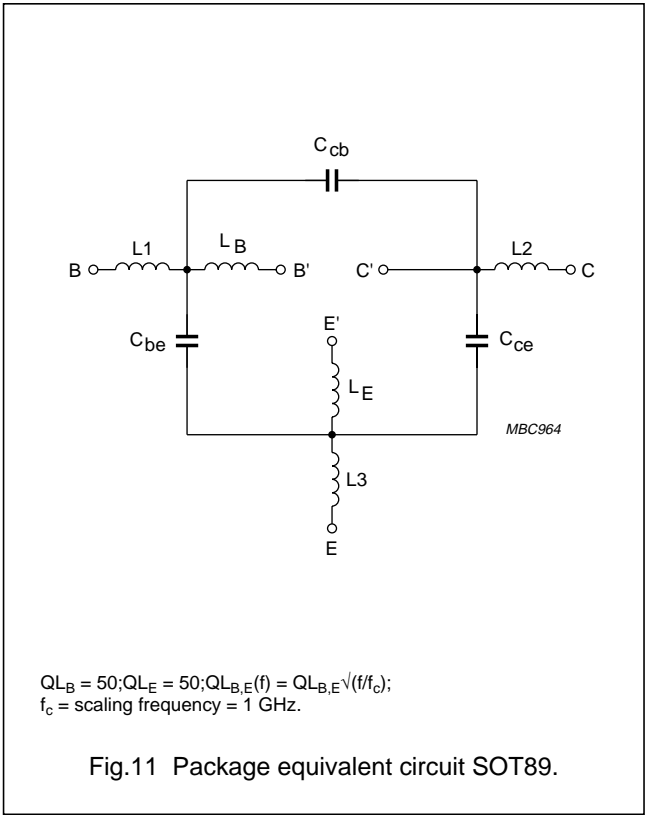
BFQ591

SPICE parameters for the BFQ591 die.

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	1.341	fA
2	BF	123.5	–
3	NF	.988	–
4	VAF	75.85	V
5	IKF	9.656	mA
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	997.2	–
14	RB	5.00	Ω
15	IRB	1.000	μA
16	RBM	5.00	Ω
17	RE	1.275	Ω
18	RC	920.6	Ω
19 <sup>(1)</sup>	XTB	0.000	–
20 <sup>(1)</sup>	EG	1.110	eV
21 <sup>(1)</sup>	XTI	3.000	–
22	CJE	3.821	pF
23	VJE	600.0	mV
24	MJE	348.5	–
25	TF	13.60	ps
26	XTF	71.73	–
27	VTF	10.28	V
28	ITF	1.929	mA
29	PTF	0.000	deg
30	CJC	1.409	fF
31	VJC	219.4	mV
32	MJC	166.5	–
33	XCJ	2.340	–
34	TR	543.7	ps
35 <sup>(1)</sup>	CJS	0.000	F
36 <sup>(1)</sup>	VJS	750.0	mV
37 <sup>(1)</sup>	MJS	0.000	–
38	FC	733.2	–

Note

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



List of components (see Fig.11)

DESIGNATION	VALUE	UNIT
C <sub>be</sub>	16	fF
C <sub>cb</sub>	150	fF
C <sub>ce</sub>	150	fF
L1	1	nH
L2	0.01	nH
L3	1	nH
L <sub>B</sub>	1.2	nH
L <sub>E</sub>	1.2	nH



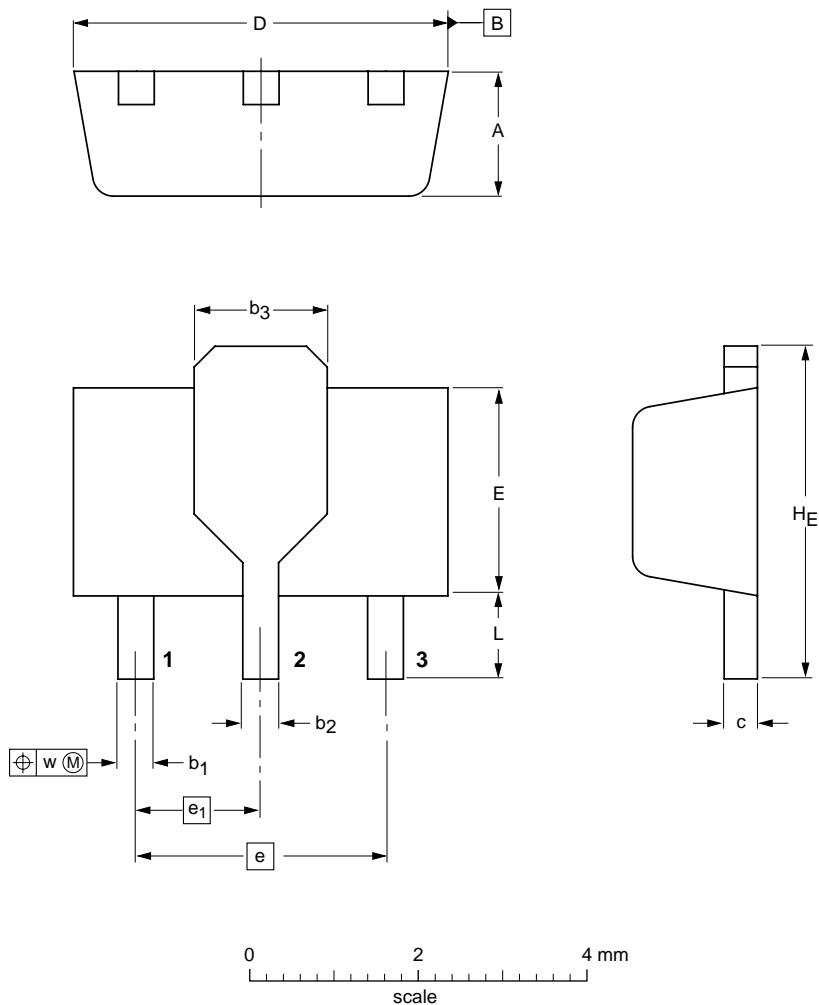
NPN 7 GHz wideband transistor

BFQ591

PACKAGE OUTLINE


Plastic surface mounted package; collector pad for good heat transfer; 3 leads

SOT89



DIMENSIONS (mm are the original dimensions)

UNIT	A	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	c	D	E	e	e <sub>1</sub>	H <sub>E</sub>	L min.	w
mm	1.6 1.4	0.48 0.35	0.53 0.40	1.8 1.4	0.44 0.37	4.6 4.4	2.6 2.4	3.0	1.5	4.25 3.75	0.8	0.13

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT89		TO-243	SC-62			97-02-28 99-09-13

## NPN 7 GHz wideband transistor

BFQ591

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