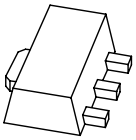

BFQ591

NPN 7 GHz wideband transistor

Rev. 04 — 2 October 2007 **Product data sheet**

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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

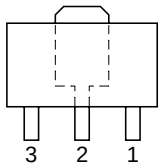


Fig.1 Simplified outline (SOT89).

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

Note

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

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

Note

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

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
$V_{(BR)CES}$	collector-emitter breakdown voltage	I_C = 0.1 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-base leakage current	I_E = 0; V_{CB} = 10	–	–	100	nA
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} = 12 V; f = 1 MHz	–	0.8	–	pF
f_T	transition frequency	I_C = 70 mA; V_{CE} = 12 V; f = 1 GHz	–	7	–	GHz
G_{UM}	maximum unilateral power gain; note 1	I_C = 70 mA; V_{CE} = 12 V; T_{amb} = 25 °C				
		f = 900 MHz	–	11	–	dB
		f = 2 GHz	–	5.5	–	dB
$\|s_{21}\|^2$	insertion power gain	I_C = 70 mA; V_{CE} = 12 V; f = 1 GHz; T_{amb} = 25 °C	–	10	–	dB
V_o	output voltage	note 2	–	700	–	mV

Notes

1. 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.

2. d_{im} = 60 dB (DIN45004B); $V_p = V_o$; $V_q = V_o - 6$ dB; f_p = 795.25 MHz; f_q = 803.25 MHz; f_r = 803.25 MHz; measured at $f_{(p+q+r)}$ = 793.25 MHz.

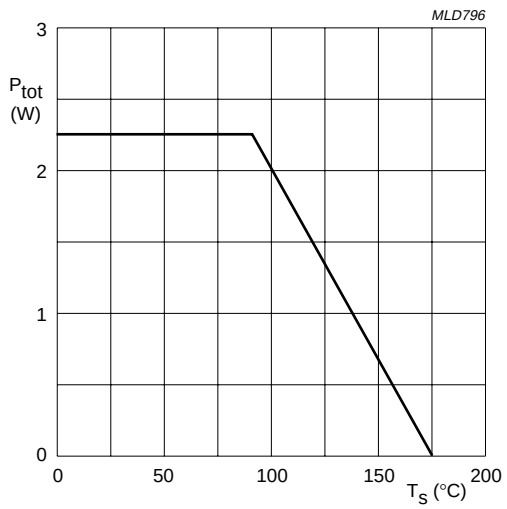
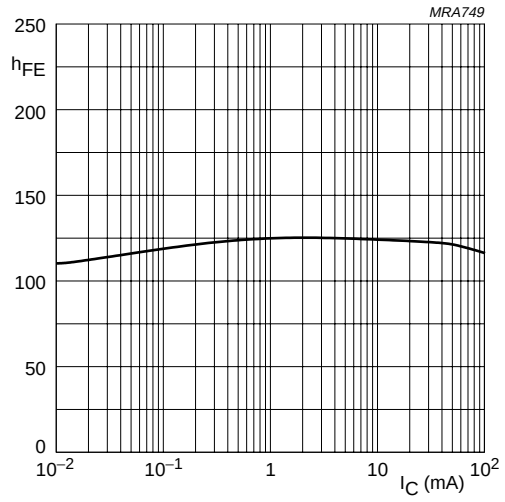
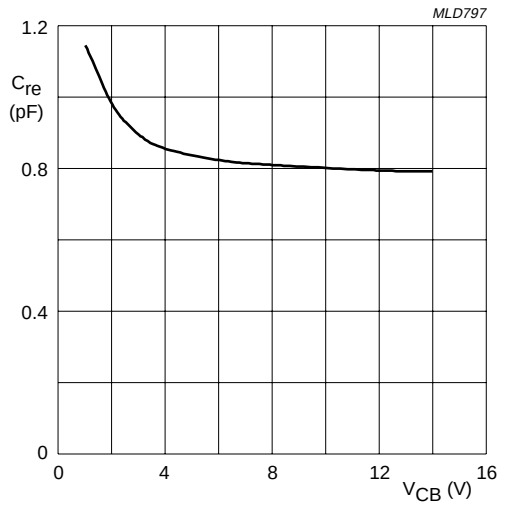


Fig.2 Power derating curve.



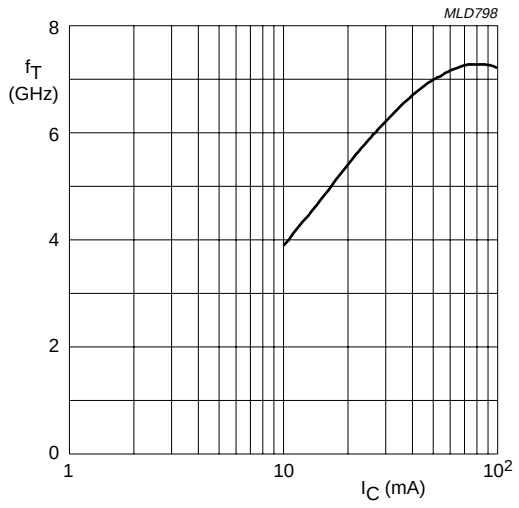
V_{CE} = 12 V.

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



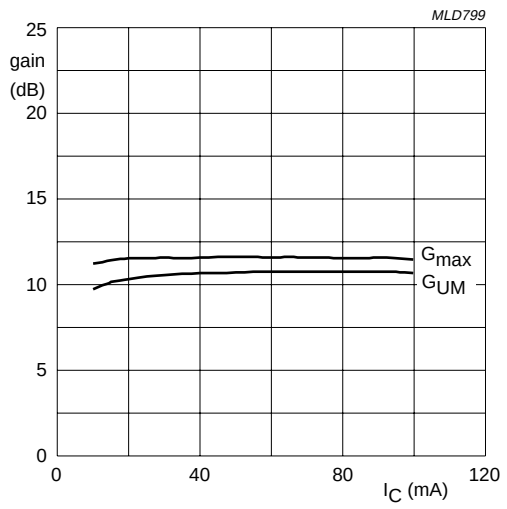
I_C = 0; f = 1 MHz.

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



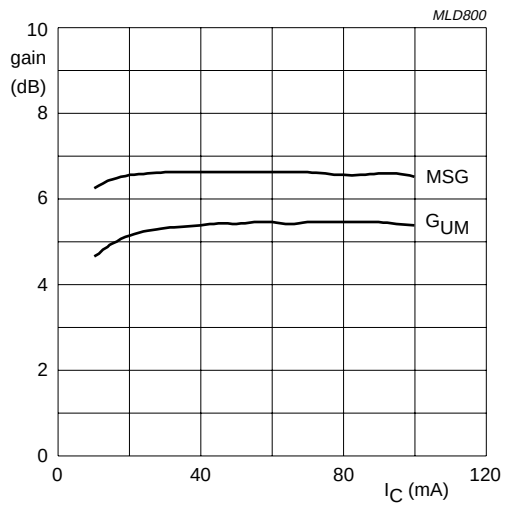
V_{CE} = 12 V; f = 1 GHz.

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



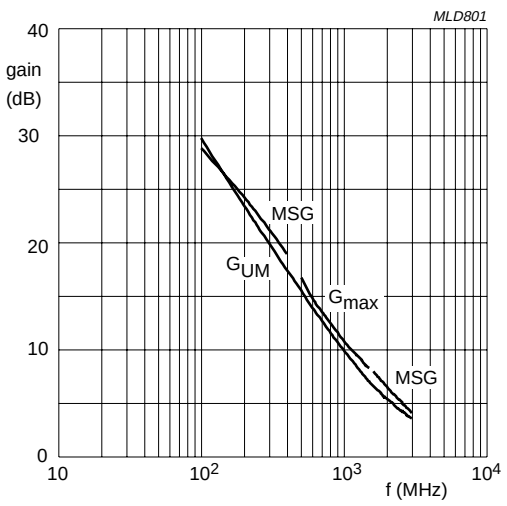
V_{CE} = 12 V; f = 900 MHz.

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



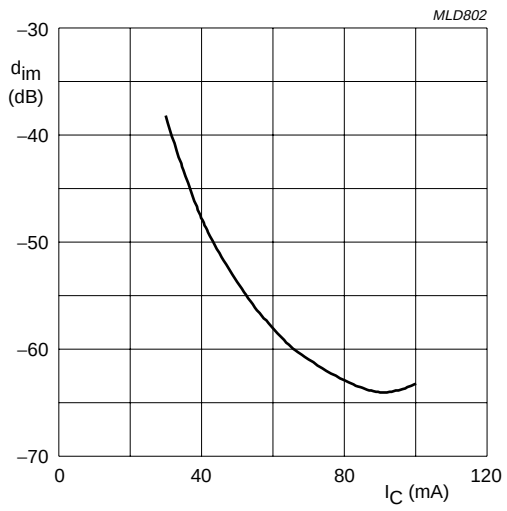
V_{CE} = 12 V; f = 2 GHz.

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



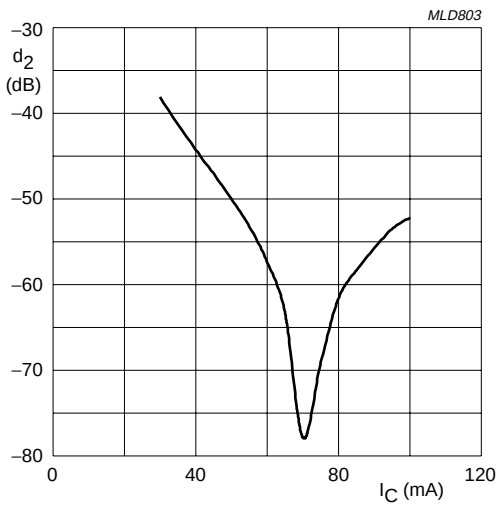
I_C = 70 mA; V_{CE} = 12 V.

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



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

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



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

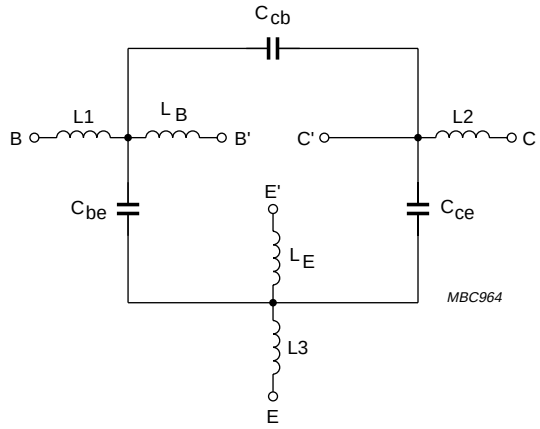
Fig.10 Second order intermodulation distortion as function of collector current; typical values.

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(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	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(1)	CJS	0.000	F
36(1)	VJS	750.0	mV
37(1)	MJS	0.000	–
38	FC	733.2	–

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.

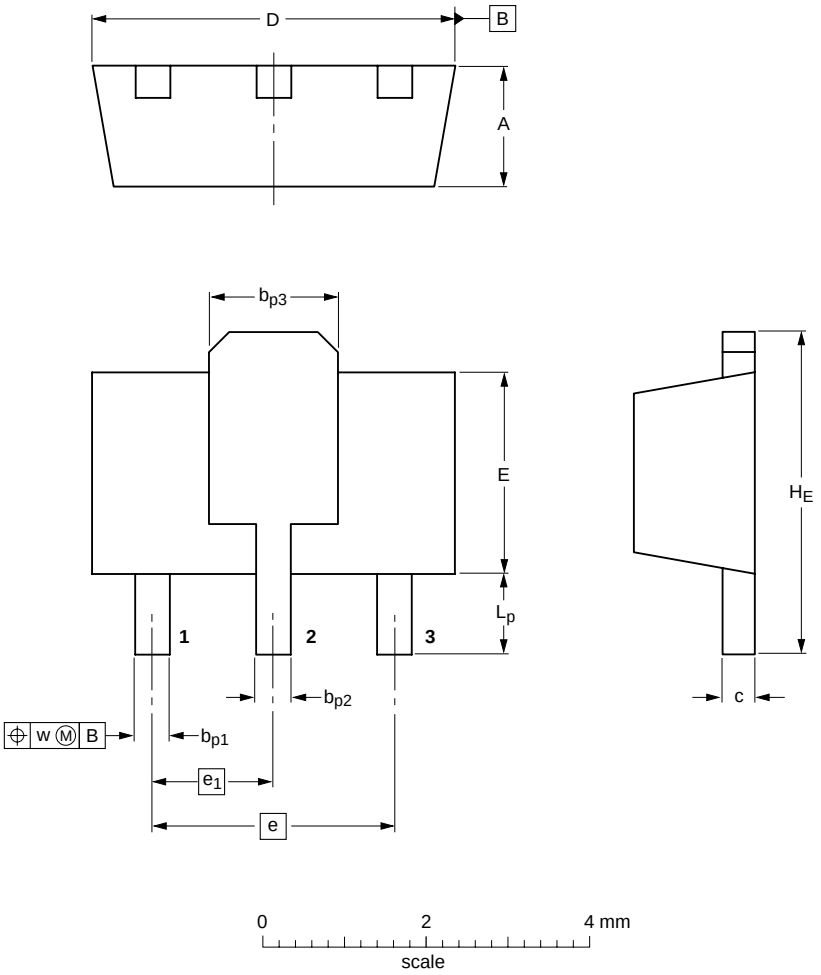
Fig.11 Package equivalent circuit SOT89.

List of components (see Fig.11)

DESIGNATION	VALUE	UNIT
C_{be}	16	fF
C_{cb}	150	fF
C_{ce}	150	fF
L1	1	nH
L2	0.01	nH
L3	1	nH
L_B	1.2	nH
L_E	1.2	nH

PACKAGE OUTLINE

Plastic surface-mounted package; collector pad for good heat transfer; 3 leads **SOT89**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b_{p1}	b_{p2}	b_{p3}	c	D	E	e	e_1	H_E	L_p	w
mm	1.6 1.4	0.48 0.35	0.53 0.40	1.8 1.4	0.44 0.23	4.6 4.4	2.6 2.4	3.0	1.5	4.25 3.75	1.2 0.8	0.13

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT89		TO-243	SC-62			~~06-03-16~~ 06-08-29

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Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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Revision history

Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BFQ591_N_4	20071002	Product data sheet	-	BFQ591_3
Modifications:	• Fig. 1 and package outline updated			
BFQ591_3	20020204	Product specification	-	BFQ591_N_2
BFQ591_N_2 (9397 750 09252)	20020102	Preliminary specification		BFQ591_N_1
BFQ591_N_1 (9397 750 09013)	20011203	Preliminary specification	-	-

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