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BGB420

Active Biased Transistor

Wireless
Silicon Discretes

Never stop thinking.

Edition 2001-08-10

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D-81541 München

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BGB420
Data sheet
Revision History: 2001-08-10

Previous Version: 2000-11-28

Page	Subjects (major changes since last revision)
7	S-Parameter table added
8	Figure “Output Compression Point” added
9	SPICE Model added

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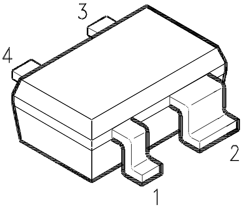
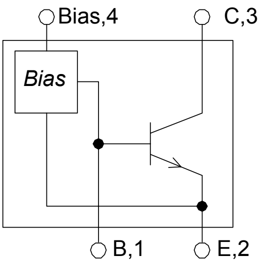
BGB420 Active Biased Transistor

BGB420

Features

- For high gain low noise amplifiers
- Ideal for wideband applications, cellular telephones, cordless telephones, SAT-TV and high frequency oscillators
- G_{ma}=17.5dB at 1.8GHz
- Small SOT343 package
- Current easy adjustable by an external resistor
- Open collector output
- Typical supply voltage: 1.4-3.3V
- SIEGET®-25 technology





Description

SIEGET®-25 NPN Transistor with integrated biasing for high gain low noise figure applications. I_C can be controlled using I_{Bias} according to $I_C=10*I_{Bias}$.

ESD: Electrostatic discharge sensitive device, observe handling precaution!

Type	Package	Marking	Chip
BGB420	SOT343	MBs	T0514

Maximum Ratings

Parameter	Symbol	Value	Unit
Maximum collector-emitter voltage	V_{CE}	3.5	V
Maximum collector current	I_C	30	mA
Maximum bias current	I_{Bias}	3	mA
Maximum emitter-base voltage	V_{EB}	1.5	V
Maximum base current	I_B	0.7	mA
Total power dissipation, T_S < 107°C[1)]	P_{tot}	120	mW
Junction temperature	T_j	150	°C
Operating temperature range	T_{OP}	-40 ..+85	°C
Storage temperature range	T_{STG}	-65 ... +150	°C
Thermal resistance: junction-soldering point	$R_{th\ JS}$	<270	K/W

Notes:
For detailed symbol description refer to figure 1.
[1)] T_S is measured on the emitter lead at the soldering point to the PCB

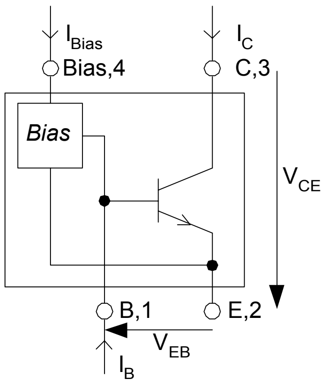


Fig. 1: Symbol definition

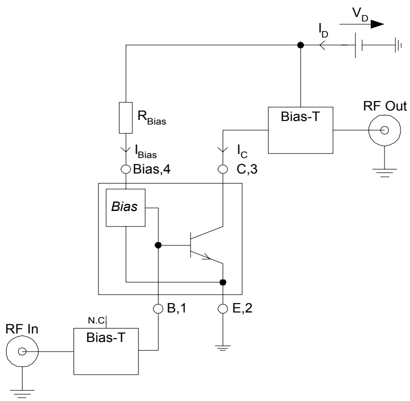


Fig. 2: Test Circuit for Electrical Characteristics and S-Parameter

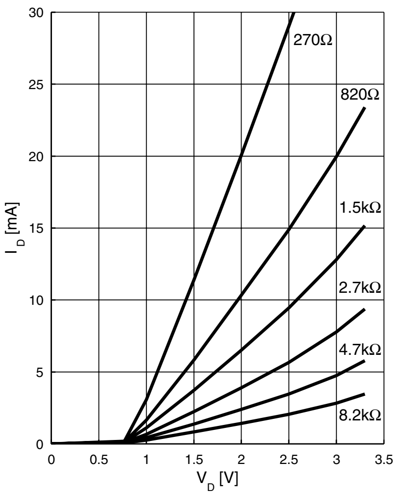
Electrical Characteristics at T_A=25°C (measured in test circuit specified in fig. 2, min./max. values verified by random sampling)

Parameter		Symbol	min.	typ.	max.	Unit
Maximum available power gain V_D=2V, I_c=20mA, f=1.8GHz		G_{MA}	16.0	17.5		dB
Insertion power gain V_D=2V, I_c=20mA	f=0.9GHz f=1.8GHz	$\|S_{21}\|^2$		22 16		dB
Insertion loss V_D=2V, I_c=0mA	f=0.9GHz f=1.8GHz	IL		21 15		dB
Noise figure (Z_S=50Ω) V_D=2V, I_c=5mA	f=0.9GHz f=1.8GHz	$F_{50\Omega}$		1.3 1.5	1.8 2.0	dB
Output power at 1dB gain compression V_D=2V, I_c=20mA, f=1.8GHz	Z_L=Z_{LOPT} Z_L=50Ω	P_{-1dB}	 7	12 10		dBm
Output third order intercept point V_D=2V, I_c=20mA, f=1.8GHz	$Z_{L/S}$=$Z_{L/SOPT}$ $Z_{L/S}$=50Ω	OIP_3	 17	22 20		dBm
Collector-base capacitance V_{CB}=2V, f=1MHz		C_{CB}		0.16		pF
Current Ratio I_C/I_{Bias} I_{Bias}=0.5mA, V_D=3V		CR	7	10	13	

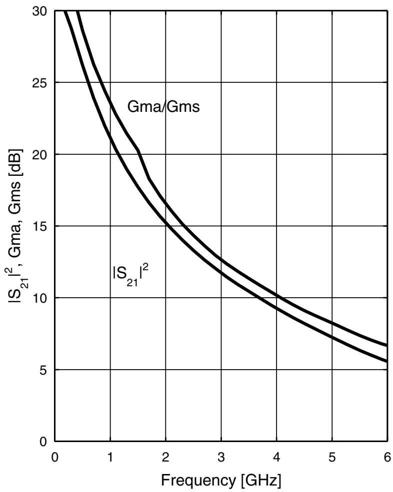
S-Parameter V_D=2V, I_C=20mA (see Electrical Characteristics for conditions)

Frequency [GHz]	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
0.1	0.4412	-24.8	35.7070	160.6	0.0078	83.5	0.9225	-14.1
0.2	0.4064	-47.4	31.7670	143.9	0.0157	77.5	0.8321	-26.2
0.4	0.3261	-81.6	23.1980	120.9	0.0261	70.9	0.6380	-41.4
0.6	0.2854	-105.8	17.2590	106.9	0.0351	69.4	0.5012	-49.6
0.8	0.2615	-124.2	13.5050	97.5	0.0444	68.9	0.4100	-54.2
1.0	0.2525	-136.4	10.9810	90.6	0.0537	68.2	0.3435	-57.4
1.2	0.2505	-148.9	9.1940	84.8	0.0628	67.3	0.2946	-60.2
1.4	0.2476	-158.2	7.8930	80.1	0.0720	65.9	0.2571	-62.6
1.6	0.2533	-167.1	6.9070	75.6	0.0819	64.6	0.2228	-64.2
1.8	0.2579	-173.3	6.1460	71.7	0.0915	62.9	0.1966	-66.0
2.0	0.2584	-178.7	5.5300	68.2	0.1009	61.4	0.1751	-66.3
3.0	0.2874	157.6	3.6990	51.6	0.1495	51.7	0.0802	-70.1
4.0	0.3505	139.0	2.7770	36.1	0.1970	40.4	0.0366	-178.8
5.0	0.4061	125.9	2.1930	21.5	0.2392	29.4	0.0913	126.7
6.0	0.4450	117.1	1.8050	8.6	0.2864	18.9	0.1340	99.8

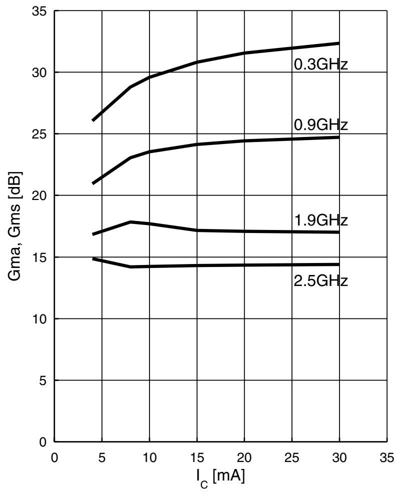
Device Current $I_D = f(V_D, R_{Bias})$



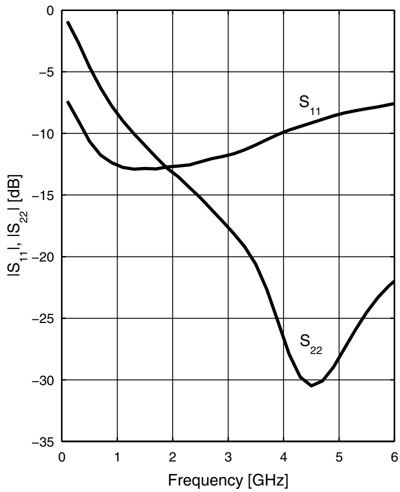
Power Gain $|S_{21}|^2$, Gma, Gms=f(f)
V_D = 3V, I_C=20mA



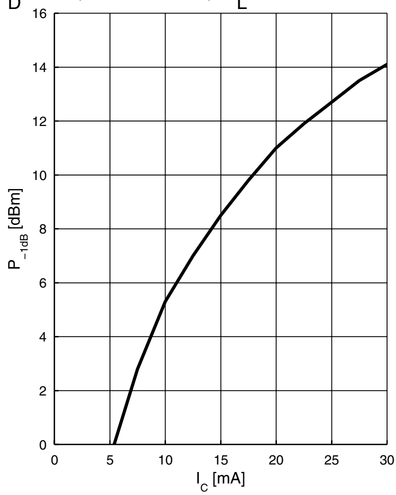
Power Gain Gma, Gms=f(I_C)
V_D = 3V



Matching $|S_{11}|$,$|S_{22}|$=f(f)
V_D = 3V, I_C=20mA

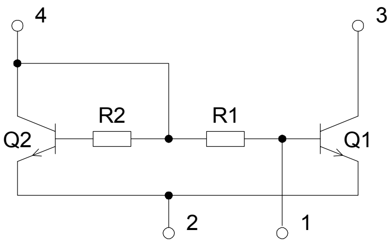


Output Compression Point
P_{-1dB} = f(I_C)
V_D = 3V, f = 1.8GHz, Z_L = 50Ω



SPICE Model

BGB420-Chip



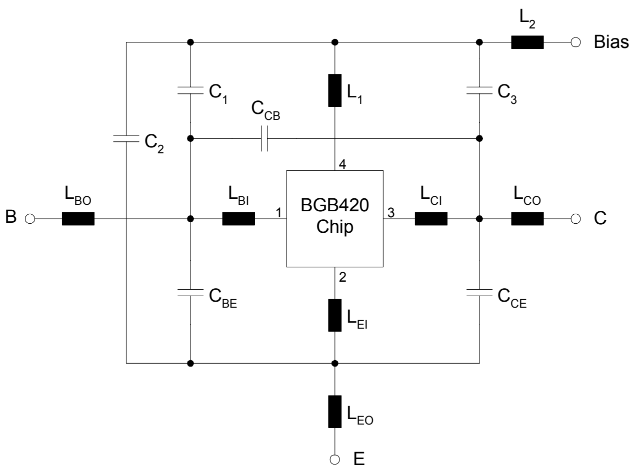
Q1	T502
Q2	T502 (area factor: 0.1)
R1	2.7kΩ
R2	27kΩ

Transistor Chip Data T502 (Berkley-SPICE 2G.6 Syntax)

.MODEL T502 NPN(

+ IS = 2.0045e-16	BF = 72.534	NF = 1.2432	VAF = 28.383
+ IKF = 0.48731	ISE = 1.9049e-14	NE = 2.0518	BR = 7.8287
+ NR = 1.3325	VAR = 19.705	IKR = 0.69141	ISC = 1.9237e-17
+ NC = 1.1724	RB = 8.5757	IRB = 0.00072983	RBM = 3.4849
+ RE = 0.31111	RC = 0.10105	CJE = 1.8063e-15	VJE = 0.8051
+ MJE = 0.46576	TF = 6.7661e-12	XTF = 0.42199	VTF = 0.23794
+ ITF = 0.001	PTF = 0	CJC = 2.3453e-13	VJC = 0.81969
+ MJC = 0.30232	XCJC = 0.3	TR = 2.3249e-09	CJS= 0
+ VJS = 0.75	MJS = 0	XTB = 0	EG = 1.11
+ XTI = 3	FC = 0.73234)		

Package Equivalent Circuit



L_{BI}	0.36	nH
L_{BO}	0.4	nH
L_{EI}	0.3	nH
L_{EO}	0.15	nH
L_{CI}	0.36	nH
L_{CO}	0.4	nH
L_1	0.6	nH
L_2	0.4	nH
C_{BE}	95	fF
C_{CB}	6	fF
C_{CE}	132	fF
C_1	28	fF
C_2	88	fF
C_3	8	fF

Valid up to 3GHz

Typical Application

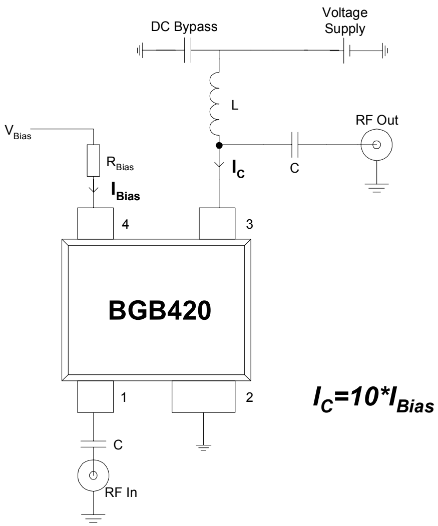


Fig. 3: Typical application circuit. This proposal demonstrates how to use the BGB420 as a Self-Biased Transistor. As for a discrete Transistor matching circuits have to be applied. A good starting point for various applications are the Application Notes provided for the BFP420.

Package Outline