Dual NPN wideband transistor — BFM520

FEATURES

- Small size
- Temperature and h_{FE} matched
- Low noise and high gain
- High gain at low current and low capacitance at low voltage
- Gold metallization ensures excellent reliability.

APPLICATIONS

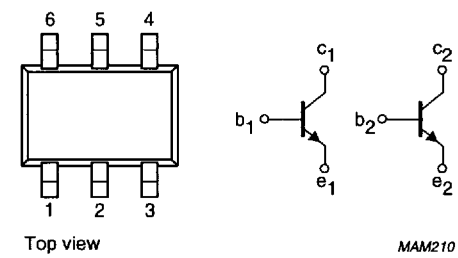
- Oscillator and buffer amplifiers
- Balanced amplifiers
- LNA/mixers.

DESCRIPTION

Dual transistor with two silicon NPN RF dies in a surface mount 6-pin SOT363 (S-mini) package. The transistor is primarily intended for wideband applications in the GHz-range in the RF front end of analog and digital cellular phones, cordless phones, radar detectors, pagers and satellite TV-tuners.

PINNING - SOT363A

PIN	SYMBOL	DESCRIPTION
1	b_1	base 1
2	e_1	emitter 1
3	c_2	collector 2
4	b_2	base 2
5	e_2	emitter 2
6	c_1	collector 1



Marking code: N2.

Fig.1 Simplified outline and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Any single transistor						
C_{re}	feedback capacitance	$I_e = 0$; $V_{CB} = 3$ V; f = 1 MHz	–	0.4	–	pF
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 3$ V; f = 900 MHz	–	9	–	GHz
$\|s_{21}\|^2$	insertion power gain	$I_C = 20$ mA; $V_{CE} = 3$ V; f = 900 MHz; $T_{amb} = 25$ °C	13	14.5	–	dB
G_{UM}	maximum unilateral power gain	$I_C = 20$ mA; $V_{CE} = 3$ V; f = 900 MHz; $T_{amb} = 25$ °C	–	15	–	dB
F	noise figure	$I_C = 5$ mA; $V_{CE} = 3$ V; f = 900 MHz; $\Gamma_S = \Gamma_{opt}$	–	1.2	1.6	dB
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point	single loaded	–	–	230	K/W
		double loaded	–	–	115	K/W

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Any single transistor					
V_{CBO}	collector-base voltage	open emitter	–	20	V
V_{CEO}	collector-emitter voltage	open base	–	8	V
V_{EBO}	emitter-base voltage	open collector	–	2.5	V
I_C	DC collector current		–	70	mA
P_{tot}	total power dissipation	up to T_s = 118 °C; note 1	–	1	W
T_{stg}	storage temperature		–65	+175	°C
T_j	junction temperature		–	175	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to soldering point; note 1	single loaded	230	K/W
		double loaded	115	K/W

Note to the Limiting values and Thermal characteristics

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
DC characteristics of any single transistor						
$V_{(BR)CBO}$	collector-base breakdown voltage	$I_C = 2.5$ μA; $I_E = 0$	20	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	$I_C = 10$ μA; $I_B = 0$	8	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	$I_E = 2.5$ μA; $I_C = 0$	2.5	–	–	V
I_{CBO}	collector-base leakage current	$V_{CB} = 6$ V; $I_E = 0$	–	–	50	nA
h_{FE}	DC current gain	$I_C = 20$ mA; $V_{CE} = 6$ V	60	120	250	
DC characteristics of the dual transistor						
Δh_{FE}	ratio of highest and lowest DC current gain	$I_{C1} = I_{C2} = 20$ mA; $V_{CE1} = V_{CE2} = 6$ V	1	1.2	–	
ΔV_{BEO}	difference between highest and lowest base-emitter voltage (offset voltage)	$I_{E1} = I_{E2} = 30$ mA; $T_{amb} = 25$ °C	0	1	–	mV
AC characteristics of any single transistor						
f_T	transition frequency	$I_C = 20$ mA; $V_{CE} = 3$ V; f = 1 GHz	–	9	–	GHz
C_c	collector capacitance	$I_E = i_e = 0$; $V_{CB} = 3$ V; f = 1 MHz	–	0.5	–	pF
C_{re}	feedback capacitance	$I_C = 0$; $V_{CB} = 3$ V; f = 1 MHz	–	0.4	–	pF
G_{UM}	maximum unilateral power gain; note 1	$I_C = 20$ mA; $V_{CE} = 3$ V; $T_{amb} = 25$ °C; f = 900 MHz	–	15	–	dB
		$I_C = 20$ mA; $V_{CE} = 3$ V; $T_{amb} = 25$ °C; f = 2 GHz	–	9	–	dB
$\|s_{21}\|^2$	insertion power gain	$I_C = 20$ mA; $V_{CE} = 3$ V; f = 900 MHz; $T_{amb} = 25$ °C	13	14.5	–	dB
F	noise figure	$I_C = 5$ mA; $V_{CE} = 3$ V; f = 900 MHz; $\Gamma_S = \Gamma_{opt}$	–	1.2	1.6	dB
		$I_C = 20$ mA; $V_{CE} = 3$ V; f = 900 MHz; $\Gamma_S = \Gamma_{opt}$	–	1.7	2.1	dB
		$I_C = 5$ mA; $V_{CE} = 3$ V; f = 2 GHz; $\Gamma_S = \Gamma_{opt}$	–	1.9	–	dB

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

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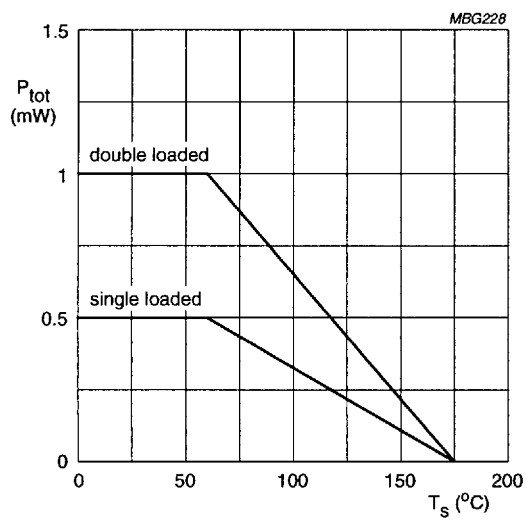
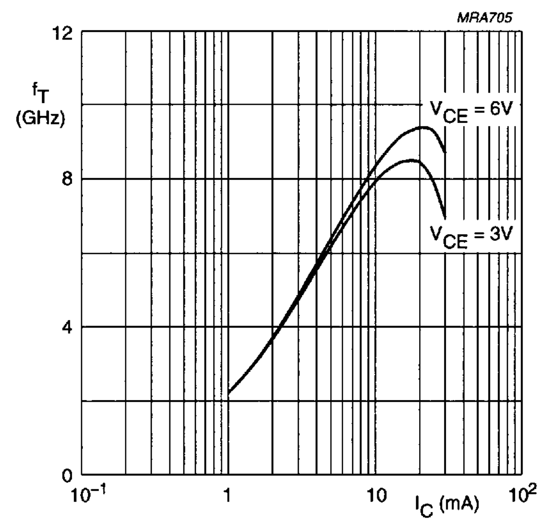
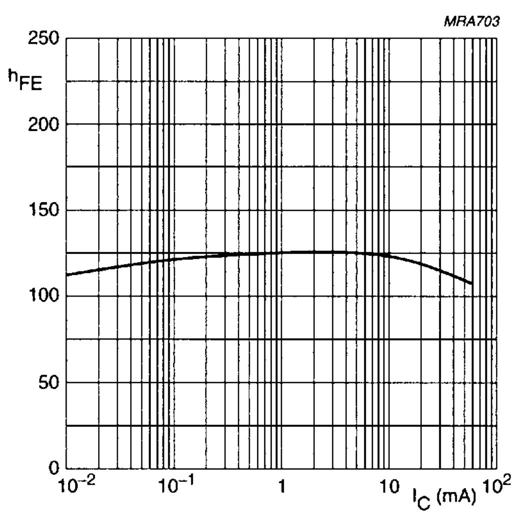


Fig.2 Power derating as a function of soldering point temperature; typical values.



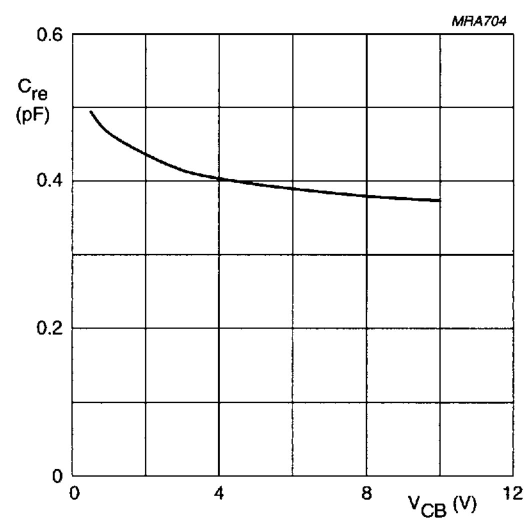
f = 1 GHz; T_{amb} = 25 °C.

Fig.3 Transition frequency as a function of collector current; typical values.



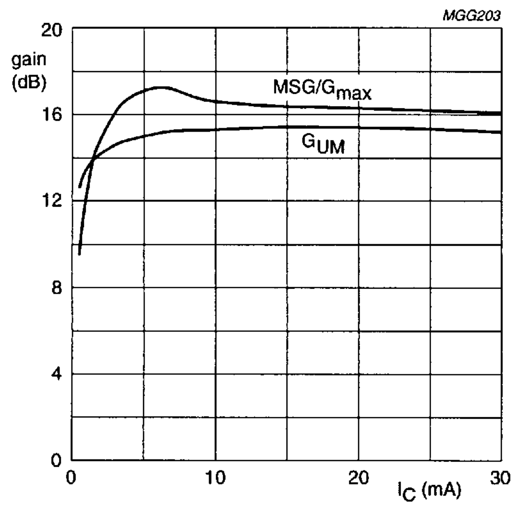
V_{CE} = 6 V.

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



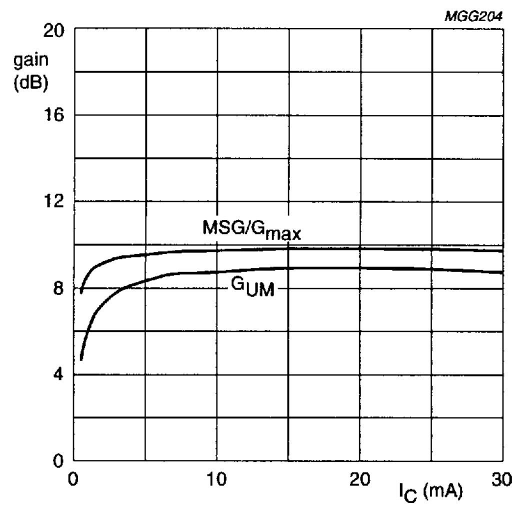
I_C = 0; f = 1 MHz.

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



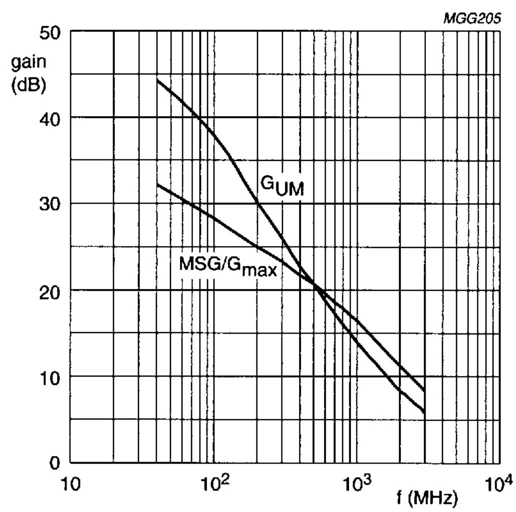
f = 900 MHz; V_{CE} = 3 V.

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



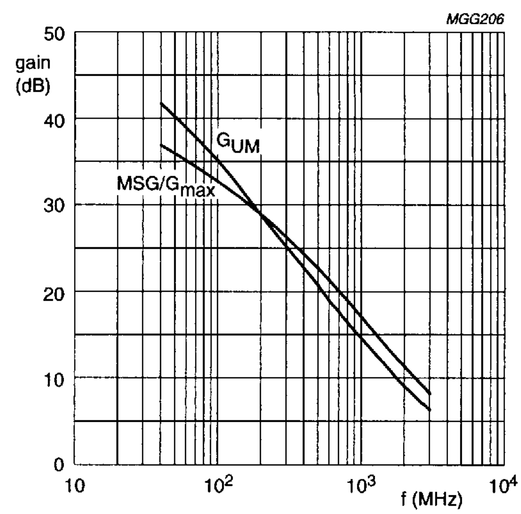
f = 2 GHz; V_{CE} = 3 V.

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



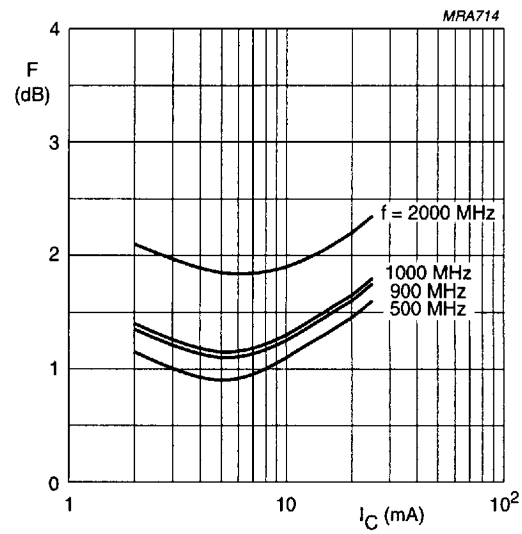
I_C = 5 mA; V_{CE} = 3 V.

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



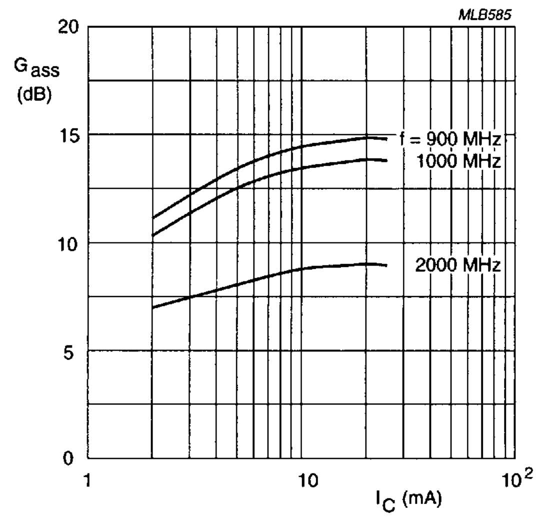
I_C = 20 mA; V_{CE} = 3 V.

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



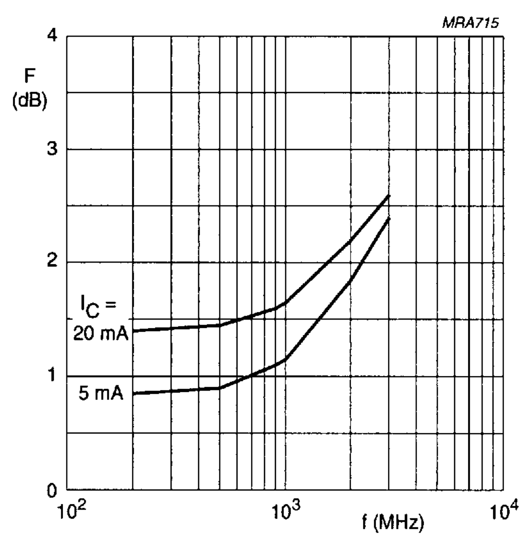
V_{CE} = 3 V.

Fig.10 Minimum noise figure as a function of collector current, typical values.



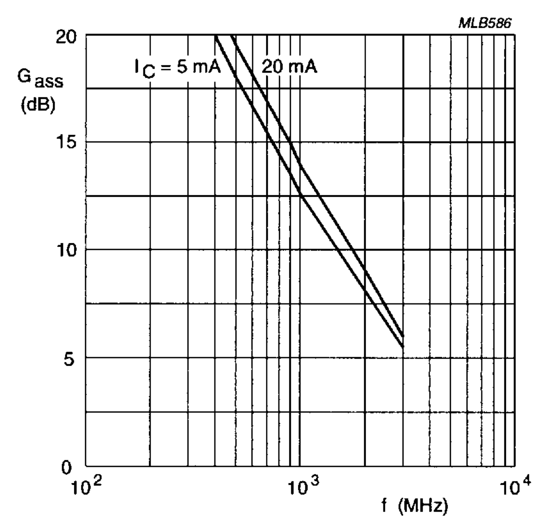
V_{CE} = 3 V.

Fig.11 Associated available gain as a function of collector current, typical values.



V_{CE} = 3 V.

Fig.12 Minimum noise figure as a function of frequency, typical values.



V_{CE} = 3 V.

Fig.13 Associated available gain as a function of frequency, typical values.

APPLICATION INFORMATION

SPICE parameters for any single BFM520 die

SEQUENCE No.	PARAMETER	VALUE	UNIT
1	IS	1.016	fA
2	BF	220.1	–
3	NF	1.000	–
4	VAF	48.06	V
5	IKF	510.0	mA
6	ISE	283.0	fA
7	NE	2.035	–
8	BR	100.7	–
9	NR	0.988	–
10	VAR	1.692	V
11	IKR	2.352	mA
12	ISC	24.48	aA
13	NC	1.022	–
14	RB	10.00	Ω
15	IRB	1.000	μA
16	RBM	10.00	Ω
17	RE	0.775	Ω
18	RC	2.210	Ω
19(1)	XTB	0.000	–
20(1)	EG	1.110	eV
21(1)	XTI	3.000	–
22	CJE	1.245	pF
23	VJE	600.0	mV
24	MJE	0.258	–
25	TF	8.616	ps
26	XTF	6.788	–
27	VTF	1.414	V
28	ITF	110.3	mA
29	PTF	45.01	deg
30	CJC	447.6	fF
31	VJC	189.2	mV
32	MJC	0.071	–
33	XCJC	0.130	–
34	TR	543.7	ps
35(1)	CJS	0.000	F
36(1)	VJS	750.0	mV
37(1)	MJS	0.000	–
38	FC	0.780	–

Note

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

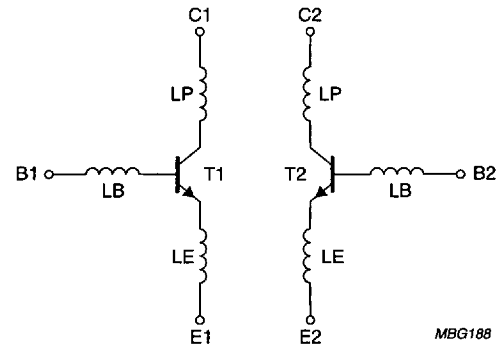


Fig.14 Package equivalent circuit SOT363A (inductance only).

Lead inductances (nH)

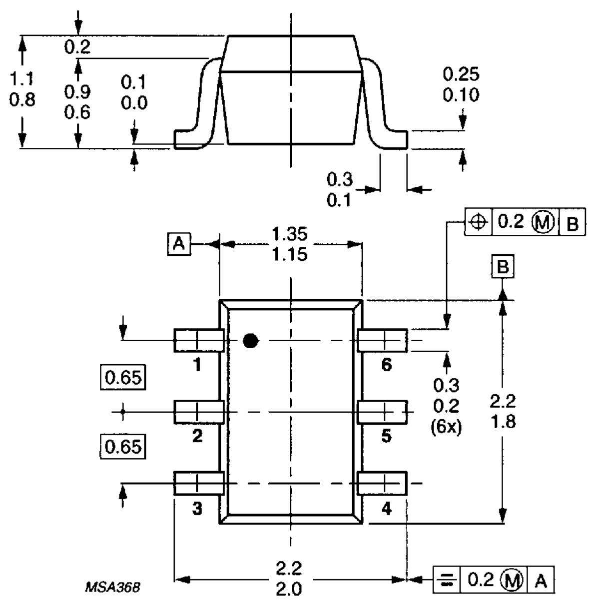
LP	0.4
LB	0.6
LE	1.0

E2	3				
E1	27	6			
B2	1	27	3		
C2	3	17	36	48	
C1	48	36	17	3	6
	B1	E2	E1	B2	C2

MBG189

Fig.15 Package capacitance (fF) between indicated nodes.

PACKAGE OUTLINE



Dimensions in mm.

Fig.16 SOT363.