DATA SHEET

BFM520
Dual NPN wideband transistor

Product specification
Supersedes data of 1995 Sep 04
File under Discrete Semiconductors, SC14

1996 Oct 08

Philips Semiconductors

PHILIPS

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

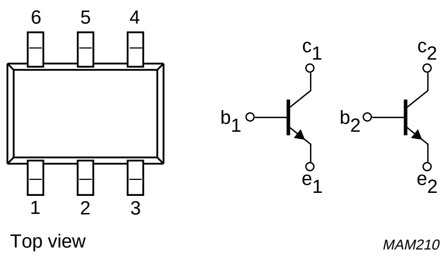
- Oscillator and buffer amplifiers
- Balanced amplifiers
- LNA/mixers.

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

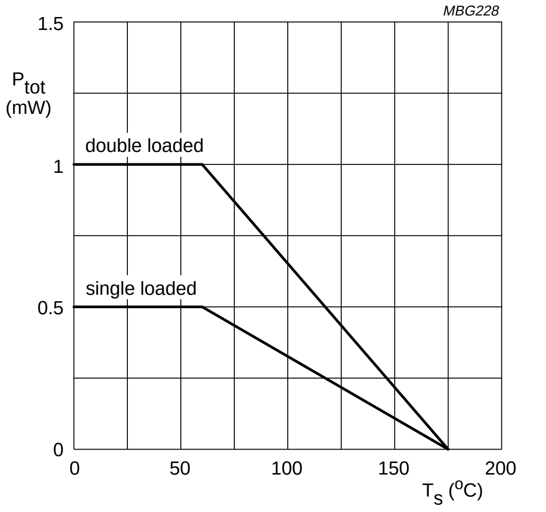
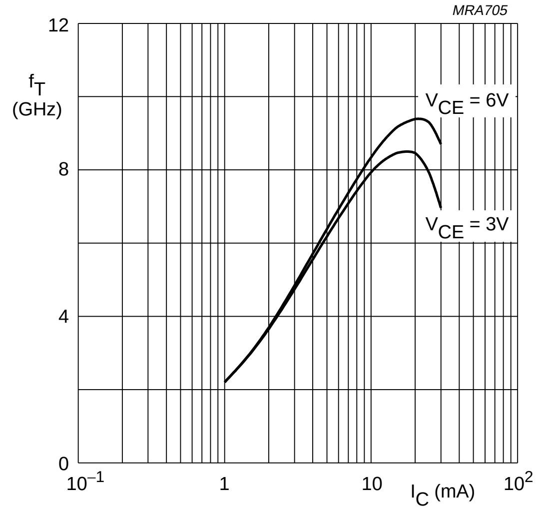
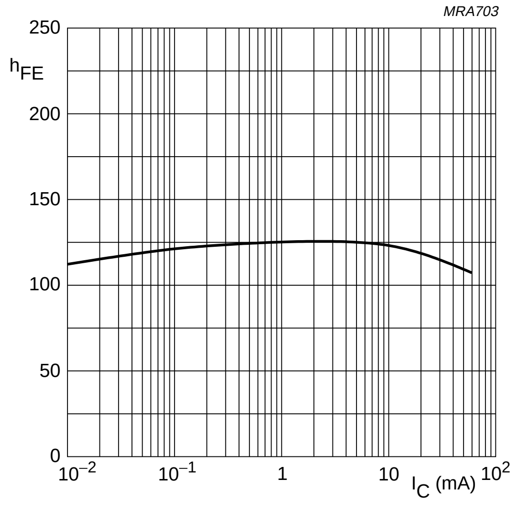


Fig.2 Power derating as a function of soldering point temperature; typical values.



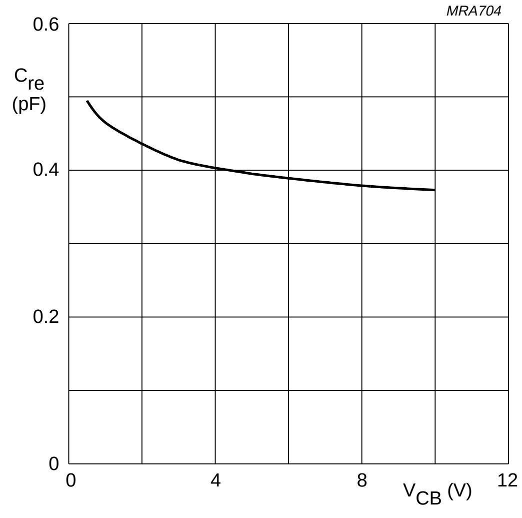
f = 1 GHz; T_{amb} = 25 °C.

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



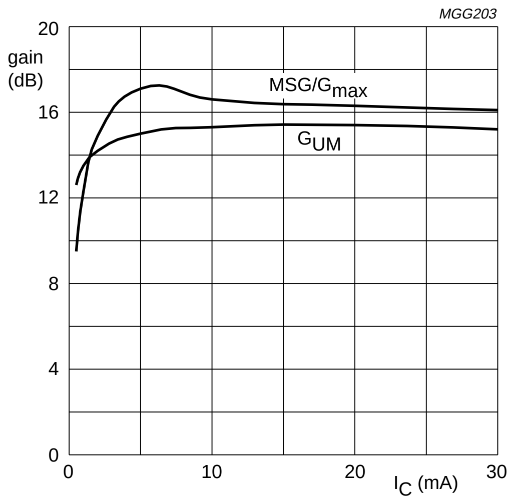
V_{CE} = 6 V.

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



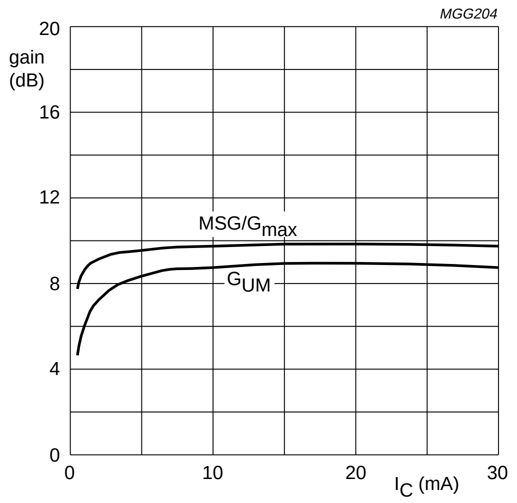
I_C = 0; f = 1 MHz.

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



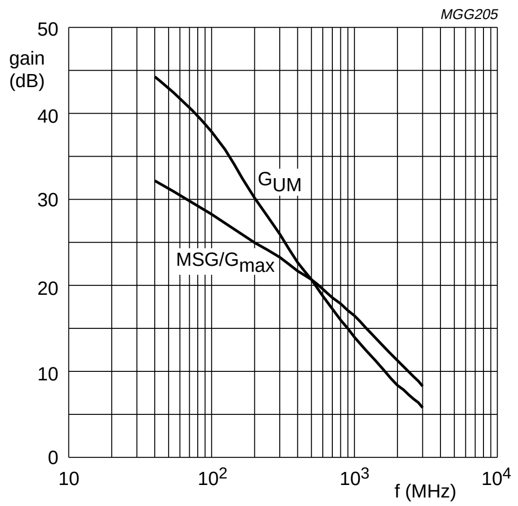
f = 900 MHz; V_{CE} = 3 V.

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



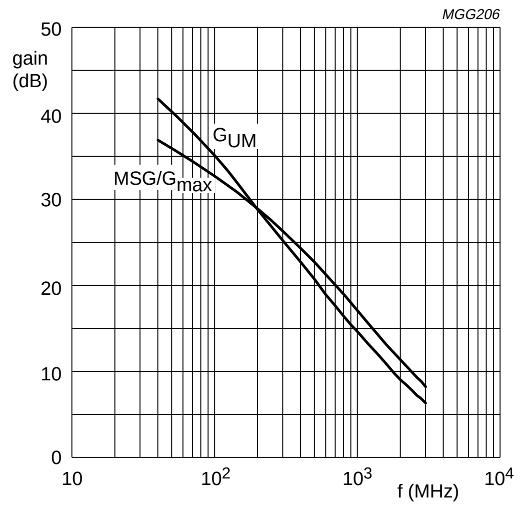
f = 2 GHz; V_{CE} = 3 V.

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



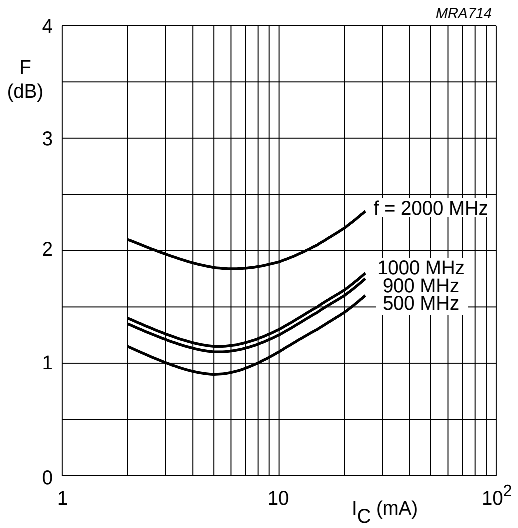
I_C = 5 mA; V_{CE} = 3 V.

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



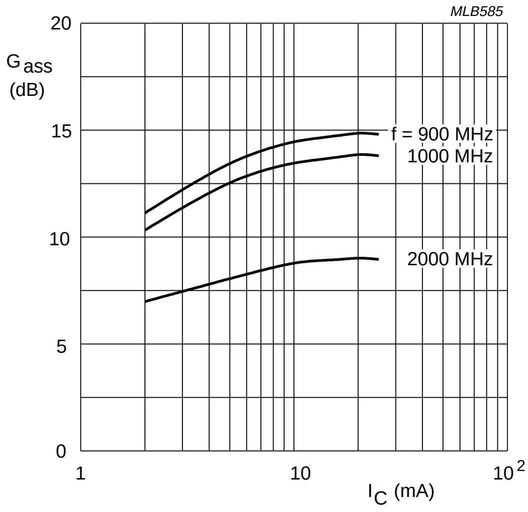
I_C = 20 mA; V_{CE} = 3 V.

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



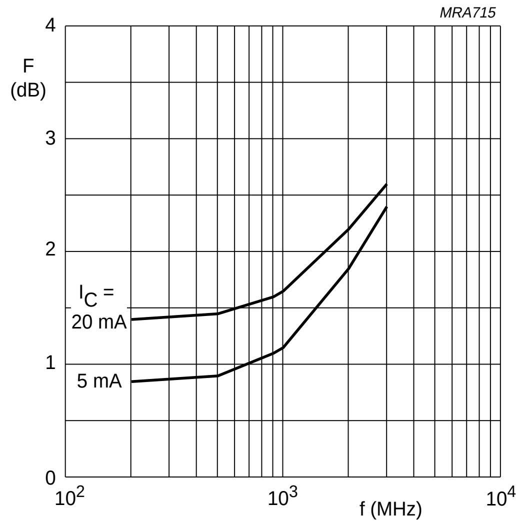
V_{CE} = 3 V.

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



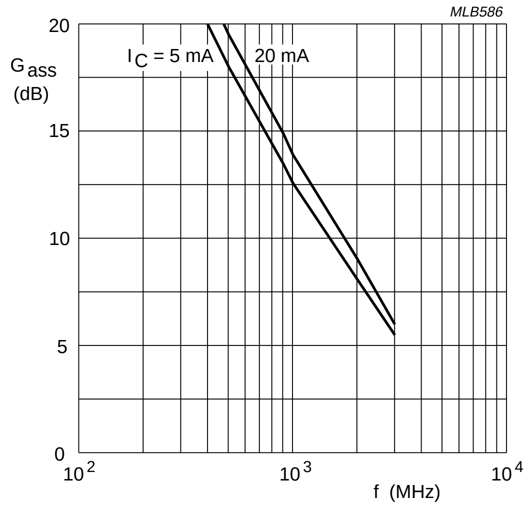
V_{CE} = 3 V.

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.

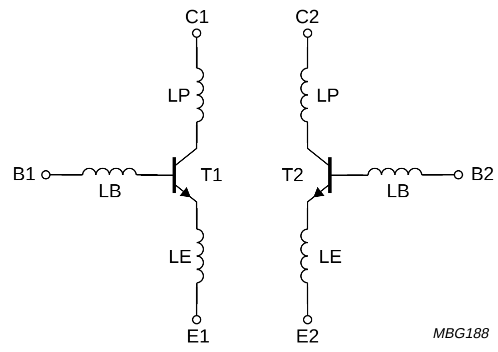


Fig.14 Package equivalent circuit SOT363A (inductance only).

Lead inductances (nH)

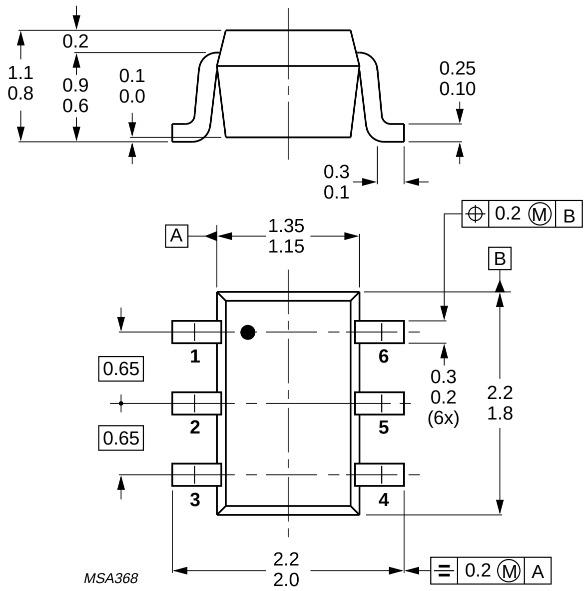
LP	0.4
LB	0.6
LE	1.0

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

MBG189

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

PACKAGE OUTLINE



Dimensions in mm.

Fig.16 SOT363.

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.
Short-form specification	The data in this specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.
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

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