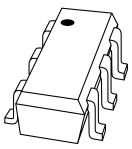


BGA2714

MMIC wideband amplifier

Rev. 01 — 24 May 2007 Product data sheet

1. Product profile

1.1 General description

Silicon Monolitic Microwave Integrated Circuit (MMIC) wideband amplifier with internal matching circuit in a 6-pin SOT363 plastic SMD package.

Table 1. Typical performance

T_{amb} = 25 °C; measured on demo board; typical values.

f (MHz)	V_{SUP} (V)	I_{SUP} (mA)	G_p (dB)	NF (dB)	$P_{L(1dB)}$ (dBm)	$P_{L(sat)}$ (dBm)	$IP3_O$ (dBm)
250	3.0	4.58	20.7	2.4	–7.8	–2.4	4.3
950	3.0	4.58	20.4	2.2	–7.9	–3.4	2.1
2150	3.0	4.58	20.8	3.0	–9.0	–4.7	0.0

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

1.2 Features

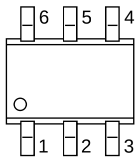
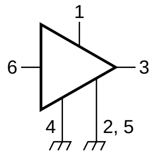
- Internally matched to 50 Ω
- Wide frequency range (2.7 GHz at 3 dB gain bandwidth)
- Flat 21 dB gain (± 1 dB from DC up to 2500 MHz)
- Very low current (4.6 mA) at low supply voltage of 3 V
- Very good reverse isolation (> 50 dB up to 2 GHz)
- Good linearity with low second order and third order products
- Low noise (NF = 2.2 dB at 1 GHz)
- Unconditionally stable (K > 5)

1.3 Applications

- LNB IF amplifiers
- General purpose low noise wideband amplifier for frequencies between DC and 2.7 GHz

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Symbol
1	V_{SUP}		 sym052
2, 5	GND2		
3	RF_OUT		
4	GND1		
6	RF_IN		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BGA2714	-	plastic surface-mounted package; 6 leads	SOT363

4. Marking

Table 4. Marking

Type number	Marking code
BGA2714	BA-

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_{SUP}	supply voltage	RF input AC coupled	-	4	V
I_{SUP}	supply current		-	10	mA
P_{tot}	total power dissipation	T_{sp} = 90 °C	-	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		-	150	°C
P_{drive}	drive power		-	–20	dBm

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	P_{tot} = 200 mW; T_{sp} = 90 °C	300	K/W

7. Characteristics

Table 7. Characteristics

V_{SUP} = 3 V; I_{SUP} = 4.58 mA; T_{amb} = 25 °C; measured on demo board; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{SUP}	supply current		3.7	4.58	5.7	mA
G_p	power gain	f = 100 MHz	20	20.8	21	dB
		f = 250 MHz	20	20.7	21	dB
		f = 950 MHz	20	20.4	21	dB
		f = 2150 MHz	20	20.8	22	dB
		f = 2500 MHz	19	19.5	21	dB
		f = 3000 MHz	16	16.8	18	dB
RL_{in}	input return loss	f = 250 MHz	11	13.9	-	dB
		f = 950 MHz	7	8.9	-	dB
		f = 2150 MHz	12	15.9	-	dB
RL_{out}	output return loss	f = 250 MHz	10	10.6	-	dB
		f = 950 MHz	10	10.8	-	dB
		f = 2150 MHz	8	9.8	-	dB
ISL	isolation	f = 250 MHz	55	58	-	dB
		f = 950 MHz	55	59	-	dB
		f = 2150 MHz	45	49	-	dB
NF	noise figure	f = 250 MHz	-	2.4	2.5	dB
		f = 950 MHz	-	2.2	2.3	dB
		f = 2150 MHz	-	3.0	3.2	dB
B_{-3dB}	–3 dB bandwidth	3 dB below gain at 1 GHz	-	2.7	-	GHz
K	Rollet stability factor	f = 250 MHz	25	30	-	
		f = 950 MHz	35	47	-	
		f = 2150 MHz	7	10	-	
$P_{L(sat)}$	saturated output power	f = 250 MHz	–3	–2.4	-	dBm
		f = 950 MHz	–4	–3.4	-	dBm
		f = 2150 MHz	–6	–4.7	-	dBm
$P_{L(1dB)}$	output power at 1 dB gain compression	f = 250 MHz	–8.5	–7.8	-	dBm
		f = 950 MHz	–8.7	–7.9	-	dBm
		f = 2150 MHz	–10	–9	-	dBm

Table 7. Characteristics *...continued*

V_{SUP} = 3 V; I_{SUP} = 4.58 mA; T_{amb} = 25 °C; measured on demo board; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$IP3_I$	input third-order intercept point	f = 250 MHz	–17.4	–16.4	-	dBm
		f = 950 MHz	–19.1	–18.3	-	dBm
		f = 2150 MHz	–21.8	–20.8	-	dBm
$IP3_O$	output third-order intercept point	f = 250 MHz	3.3	4.3	-	dBm
		f = 950 MHz	1.3	2.1	-	dBm
		f = 2150 MHz	–1.0	0	-	dBm
$P_{L(2H)}$	second harmonic output power	f_{1H} = 250 MHz; f_{2H} = 500 MHz; P_{drive} = –40 dBm	–62	–64	-	dBm
		f_{1H} = 950 MHz; f_{2H} = 1900 MHz; P_{drive} = –40 dBm	–58	–60	-	dBm
ΔIM2	second-order intermodulation distance	f_1 = 250 MHz; f_2 = 251 MHz; P_{drive} = –40 dBm	–36	–38	-	dBc
		f_1 = 950 MHz; f_2 = 951 MHz; P_{drive} = –40 dBm	–31	–33	-	dBc

8. Application information

Figure 1 shows a typical application circuit for the BGA2714 MMIC. The device is internally matched to 50 Ω, and therefore does not need any external matching. The value of the input and output DC blocking capacitors C2 and C3 should not be more than 100 pF for applications above 100 MHz. However, when the device is operated below 100 MHz, the capacitor value should be increased.

The 22 nF supply decoupling capacitor C1 should be located as close as possible to the MMIC.

The PCB top ground plane, connected to pins 2, 4 and 5 must be as close as possible to the MMIC, preferably also below the MMIC. When using via holes, use multiple via holes as close as possible to the MMIC.

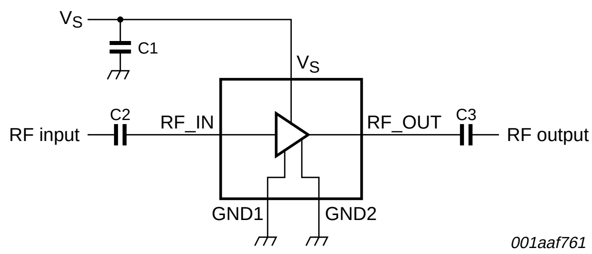
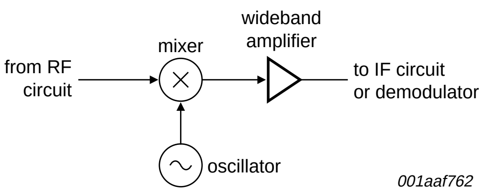


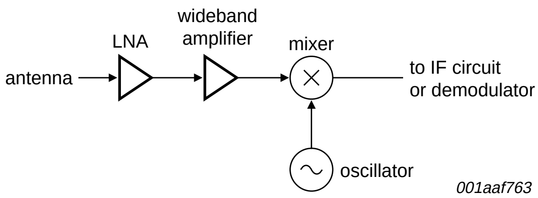
Fig 1. Typical application circuit

8.1 Application examples



The MMIC is very suitable as IF amplifier in e.g. LNB's. The excellent wideband characteristics make it an easy building block.

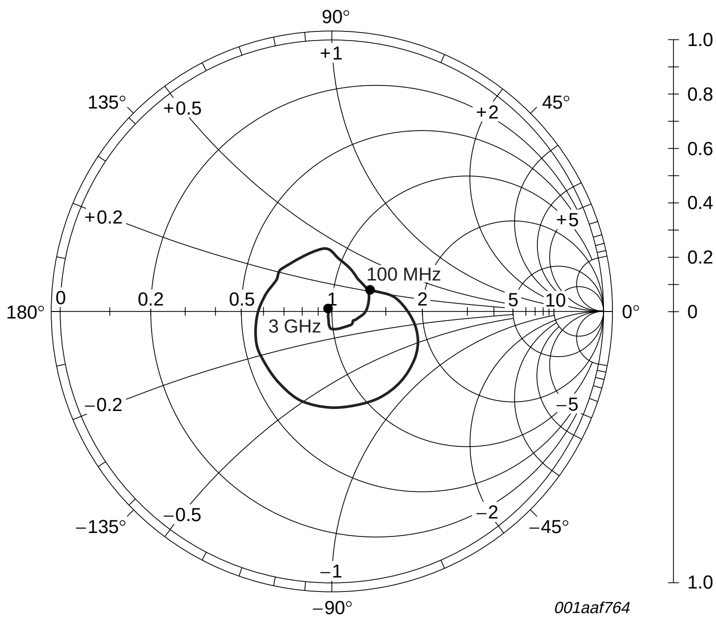
Fig 2. Application as IF amplifier



As second amplifier after an LNA, the MMIC offers an easy matching, low noise solution.

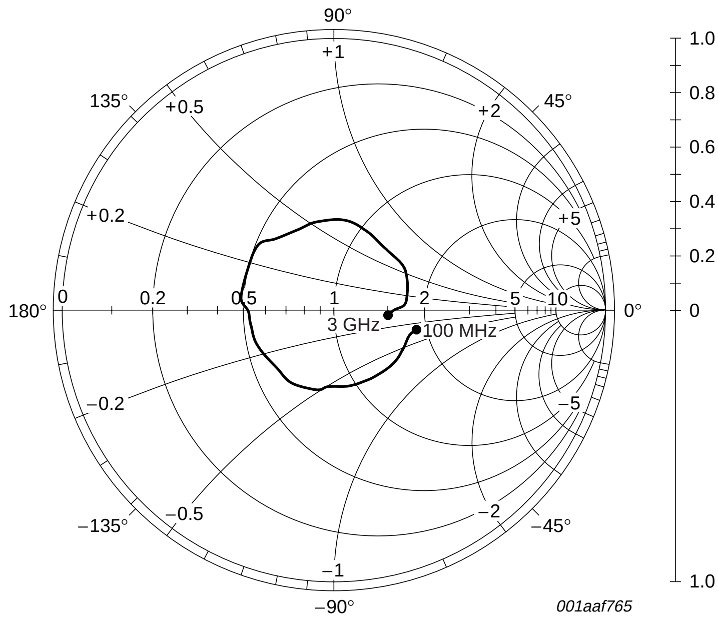
Fig 3. Application as RF amplifier

8.2 Graphs



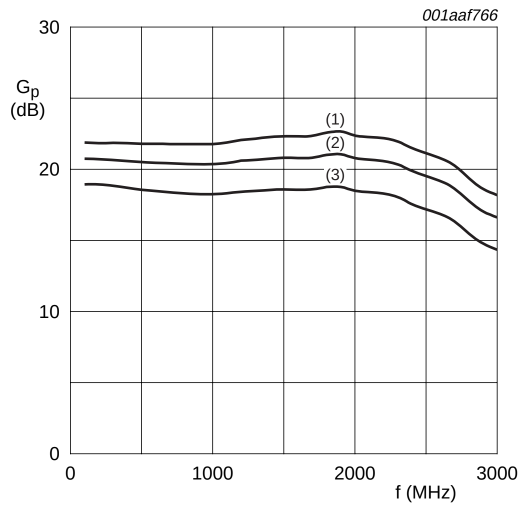
T_{amb} = 25 °C; I_{SUP} = 4.58 mA; V_{SUP} = 3 V; P_{drive} = −40 dBm; Z_0 = 50 Ω.

Fig 4. Input reflection coefficient (S_{11}); typical values



T_{amb} = 25 °C; I_{SUP} = 4.58 mA; V_{SUP} = 3 V; P_{drive} = –40 dBm; Z_0 = 50 Ω.

Fig 5. Output reflection coefficient (S_{22}); typical values



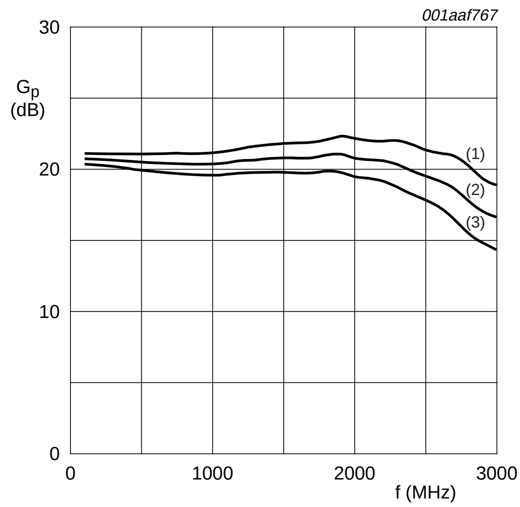
T_{amb} = 25 °C; P_{drive} = –40 dBm; Z_0 = 50 Ω.

(1) V_{SUP} = 3.3 V; I_{SUP} = 4.96 mA.

(2) V_{SUP} = 3.0 V; I_{SUP} = 4.58 mA.

(3) V_{SUP} = 2.7 V; I_{SUP} = 4.16 mA.

Fig 6. Insertion power gain as function of frequency; typical values



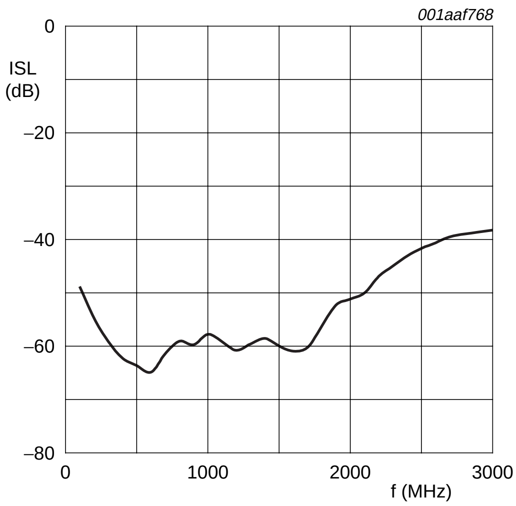
V_{SUP} = 3 V; P_{drive} = –40 dBm; Z_0 = 50 Ω.

(1) T_{amb} = –40 °C; I_{SUP} = 5.01 mA.

(2) T_{amb} = +25 °C; I_{SUP} = 4.58 mA.

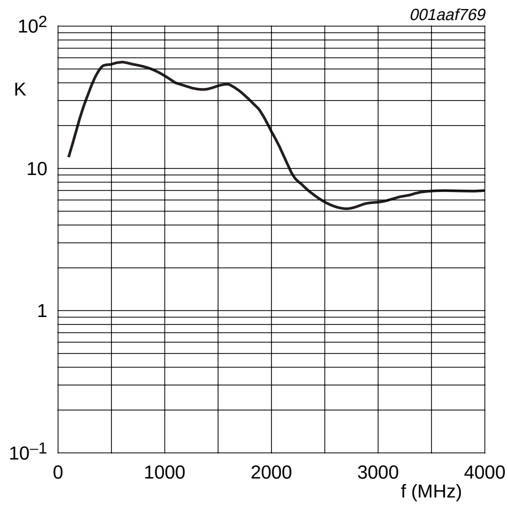
(3) T_{amb} = +85 °C; I_{SUP} = 4.22 mA.

Fig 7. Insertion power gain as function of frequency; typical values



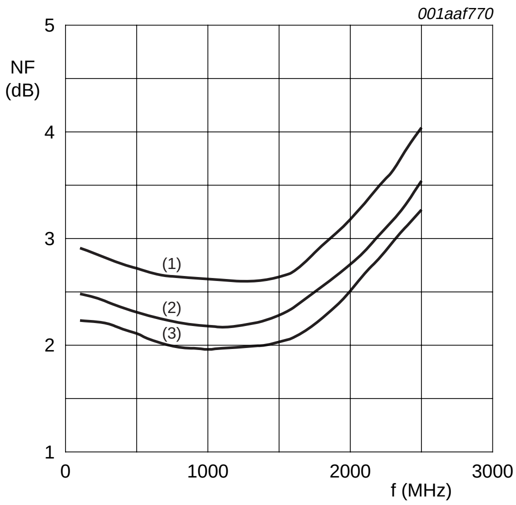
T_{amb} = 25 °C; I_{SUP} = 4.58 mA; V_{SUP} = 3 V;
P_{drive} = −40 dBm; Z_0 = 50 Ω.

Fig 8. Isolation as function of frequency; typical values



T_{amb} = 25 °C; I_{SUP} = 4.58 mA; V_{SUP} = 3 V;
Z_0 = 50 Ω.

Fig 9. Rollet stability factor as function of frequency; typical values



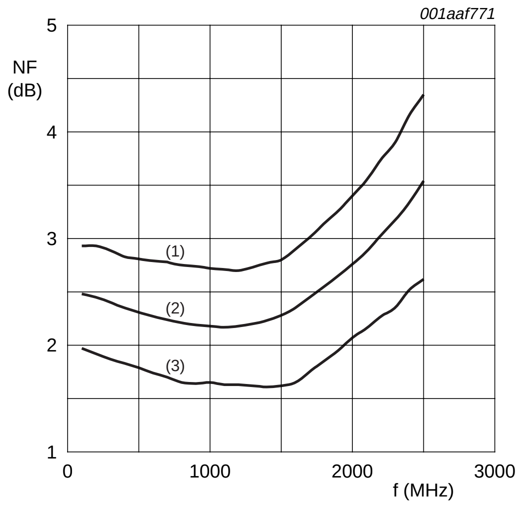
T_{amb} = 25 °C; Z_0 = 50 Ω.

(1) V_{SUP} = 3.3 V; I_{SUP} = 4.96 mA.

(2) V_{SUP} = 3.0 V; I_{SUP} = 4.58 mA.

(3) V_{SUP} = 2.7 V; I_{SUP} = 4.16 mA.

Fig 10. Noise figure as function of frequency



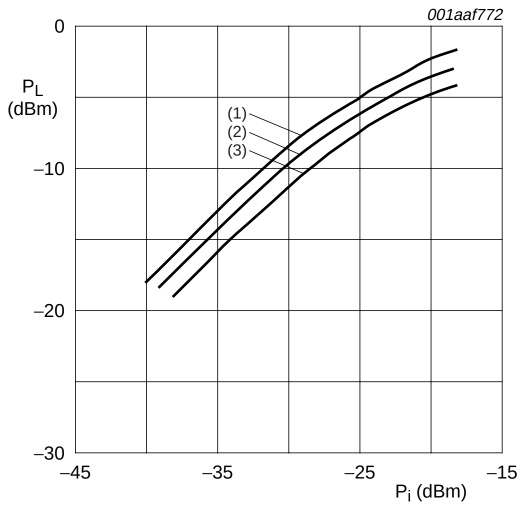
V_{SUP} = 3 V; Z_0 = 50 Ω.

(1) T_{amb} = −40 °C; I_{SUP} = 5.01 mA.

(2) T_{amb} = +25 °C; I_{SUP} = 4.58 mA.

(3) T_{amb} = +85 °C; I_{SUP} = 4.22 mA.

Fig 11. Noise figure as function of frequency



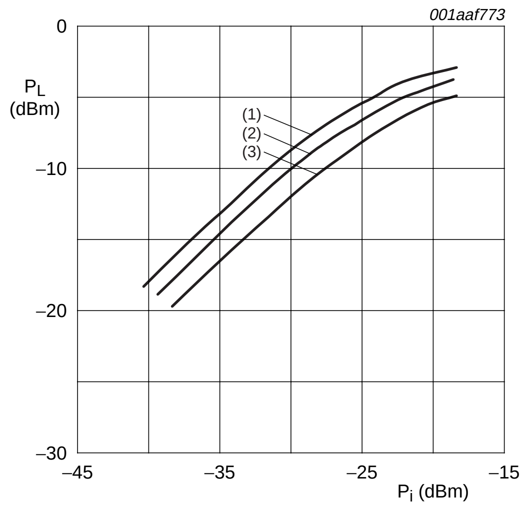
T_{amb} = 25 °C; f = 250 MHz; Z_0 = 50 Ω.

(1) V_{SUP} = 3.3 V.

(2) V_{SUP} = 3.0 V.

(3) V_{SUP} = 2.7 V.

Fig 12. Output power as function of input power at 250 MHz; typical values



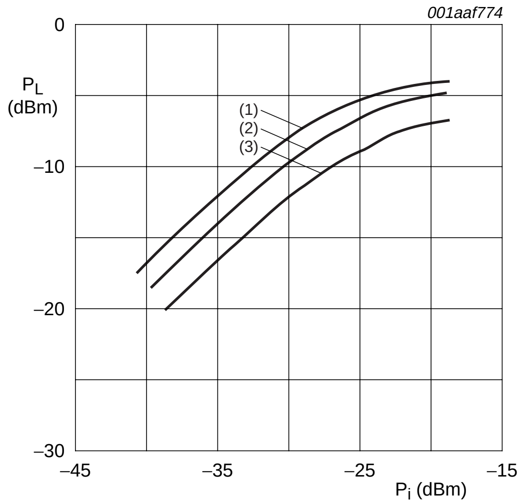
T_{amb} = 25 °C; f = 950 MHz; Z_0 = 50 Ω.

(1) V_{SUP} = 3.3 V.

(2) V_{SUP} = 3.0 V.

(3) V_{SUP} = 2.7 V.

Fig 13. Output power as function of input power at 950 MHz; typical values



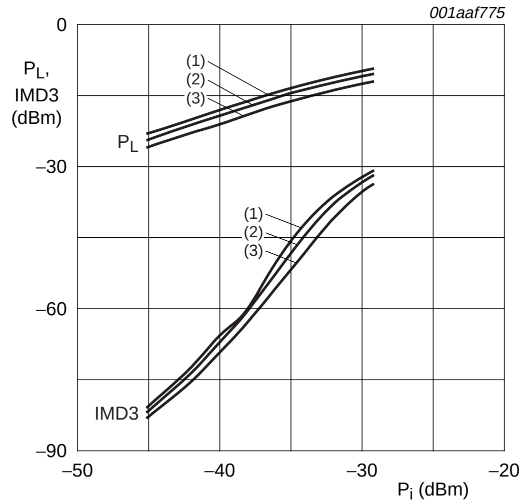
T_{amb} = 25 °C; f = 2150 MHz; Z_0 = 50 Ω.

(1) V_{SUP} = 3.3 V.

(2) V_{SUP} = 3.0 V.

(3) V_{SUP} = 2.7 V.

Fig 14. Output power as function of input power at 2150 MHz; typical values



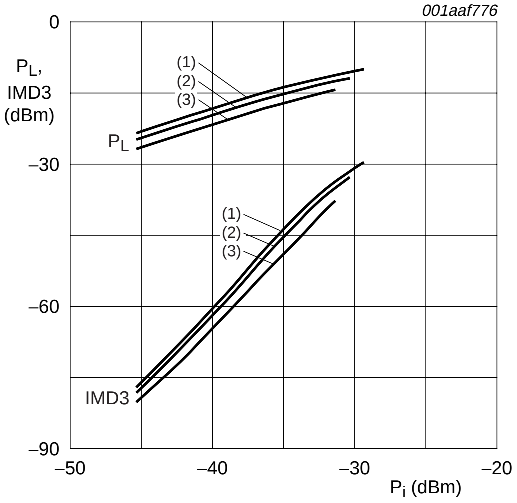
T_{amb} = 25 °C; f_1 = 250 MHz; f_2 = 251 MHz; Z_0 = 50 Ω.

(1) V_{SUP} = 3.3 V.

(2) V_{SUP} = 3.0 V.

(3) V_{SUP} = 2.7 V.

Fig 15. Output power and third order intermodulation as functions of input power around 250 MHz; typical values



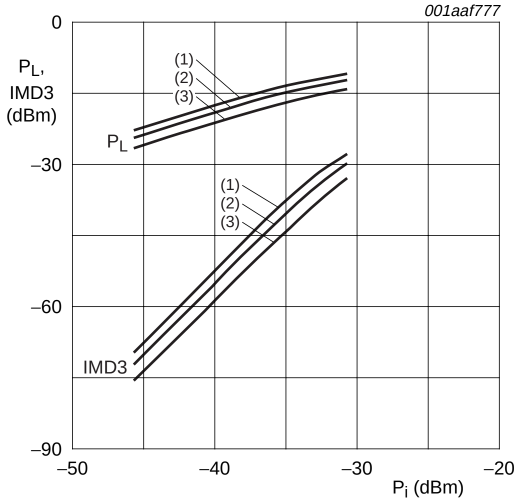
T_{amb} = 25 °C; f_1 = 950 MHz; f_2 = 951 MHz;
Z_0 = 50 Ω.

(1) V_{SUP} = 3.3 V.

(2) V_{SUP} = 3.0 V.

(3) V_{SUP} = 2.7 V.

Fig 16. Output power and third order intermodulation as functions of input power around 950 MHz; typical values



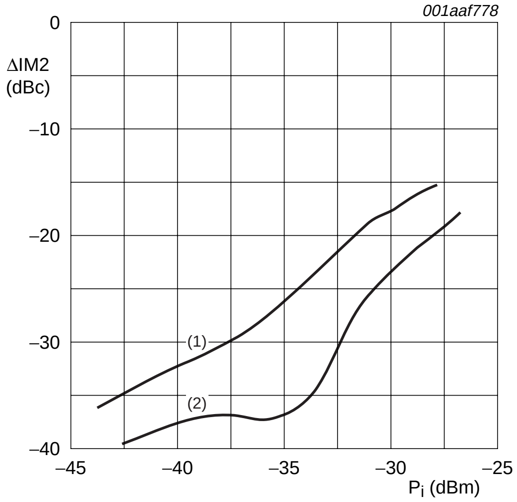
T_{amb} = 25 °C; f_1 = 2150 MHz; f_2 = 2151 MHz;
Z_0 = 50 Ω.

(1) V_{SUP} = 3.3 V.

(2) V_{SUP} = 3.0 V.

(3) V_{SUP} = 2.7 V.

Fig 17. Output power and third order intermodulation as functions of input power around 2150 MHz; typical values



T_{amb} = 25 °C; I_{SUP} = 4.58 mA; V_{SUP} = 3 V; Z_0 = 50 Ω.

(1) f_1 = 950 MHz; f_2 = 951 MHz.

(2) f_1 = 250 MHz; f_2 = 251 MHz.

Fig 18. Second-order intermodulation distance as function of input power; typical values

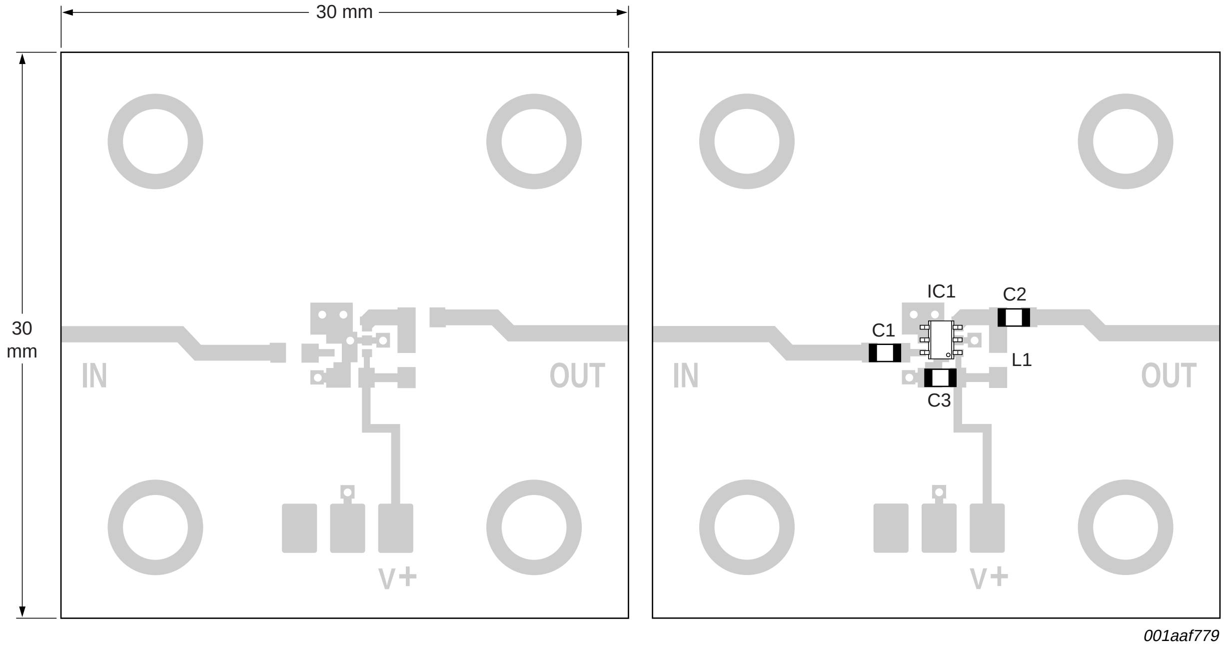
8.3 Scattering parameters

Table 8. Scattering parameters

I_{SUP} = 4.58 mA; V_{SUP} = 3 V; P_{drive} = –40 dBm; Z_0 = 50 Ω; T_{amb} = 25 °C; measured on demo board.

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}		K
	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)	
100	0.155	33.5	10.88	–10.9	0.00364	–155.2	0.313	–14.2	11.2
200	0.170	26.5	10.84	–20.2	0.00183	–21.9	0.294	–19.2	22.3
400	0.280	–2.2	10.69	–43.8	0.00077	–25.5	0.396	–36.4	50.7
600	0.346	–30.4	10.54	–64.1	0.00057	122.0	0.293	–54.9	66.9
800	0.365	–62.7	10.46	–85.9	0.00111	115.1	0.291	–74.4	11.2
1000	0.360	–91.4	10.42	–106.3	0.00129	80.2	0.289	–94.8	29.7
1200	0.335	–124.9	10.72	–127.4	0.00091	–54.8	0.315	–119.5	40.7
1400	0.305	–156.3	10.90	–148.7	0.00118	–55.9	0.304	–140.2	31.9
1600	0.255	167.0	10.94	–172.9	0.00090	157.0	0.310	–167.3	43.0
1800	0.246	139.2	11.22	166.3	0.00155	7.1	0.343	172.3	23.9
2000	0.197	83.5	10.95	140.2	0.00276	133.2	0.335	129.3	14.1
2200	0.153	54.8	10.71	115.3	0.00453	63.4	0.327	101.6	9.0
2400	0.121	1.7	9.87	87.3	0.00700	31.8	0.310	66.2	6.5
2600	0.081	–24.9	9.09	63.3	0.00933	51.9	0.293	45.0	5.4
2800	0.066	–93.6	7.74	36.6	0.01119	24.8	0.266	5.8	5.4
3000	0.019	144.4	6.77	20.5	0.01228	14.1	0.203	–6.6	5.8

9. Test information



True size = 30 mm × 30 mm.

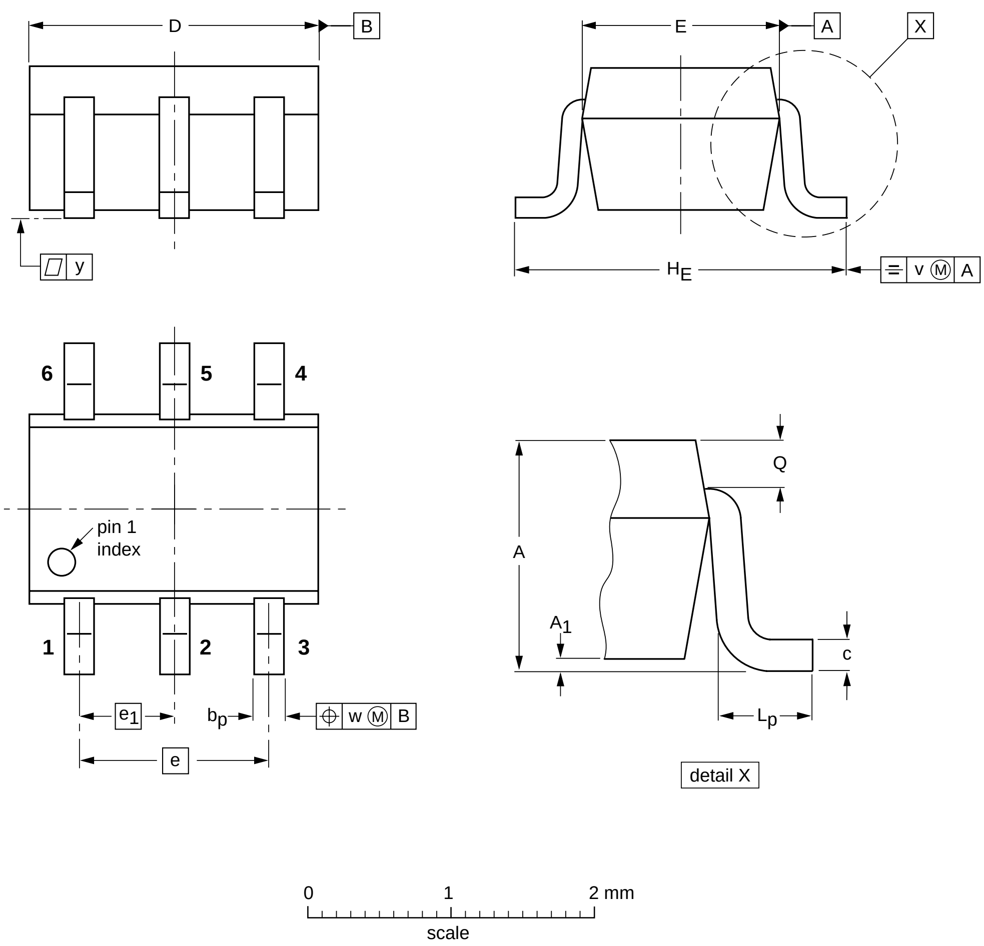
Fig 19. PCB layout and demo board with components

Table 9. List of components used for the typical application

Component	Description	Value	Dimensions
C1, C2	multilayer ceramic chip capacitor	100 pF	0603
C3	multilayer ceramic chip capacitor	22 nF	0603
IC1	BGA2714 MMIC		SOT363
L1	not used		

10. Package outline

Plastic surface-mounted package; 6 leads **SOT363**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT363			SC-88			~~04-11-08~~ 06-03-16

Fig 20. Package outline SOT363

11. Abbreviations

Table 10. Abbreviations

Acronym	Description
DC	Direct Current
IF	Intermediate Frequency
LNA	Low-Noise Amplifier
LNB	Low-Noise Block converter
PCB	Printed-Circuit Board
RF	Radio Frequency

12. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGA2714_1	20070524	Product data sheet	-	-

13. Legal information

13.1 Data sheet status

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.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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