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BGA751N7

SiGe Bipolar 3G/3.5G/4G Single-Band LNA

Data Sheet

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BGA751N7 SiGe Bipolar 3G/3.5G/4G Single-Band LNA

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Page	Subjects (major changes since last revision)
37	Footprint recommendation drawing added
38	Marking pattern drawing updated

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Table of Contents

	Table of Contents	4
	List of Figures	5
	List of Tables	6
1	Features	7
2	Electrical Characteristics	9
2.1	Absolute Maximum Ratings	9
2.2	Thermal Resistance	9
2.3	ESD Integrity	9
2.4	DC Characteristics	10
2.5	Gain Mode Select Truth Table	10
2.6	Switching Times	10
2.7	Supply Current Characteristics	11
2.8	Logic Signal Characteristics	12
2.9	Measured RF Characteristics 700 MHz Band	13
2.10	Measured RF Characteristics 750 MHz Band	14
2.11	Measured RF Characteristics 800 MHz Band	15
2.12	Measured RF Characteristics 880 MHz Band	16
2.13	Measured RF Characteristics 900 MHz band	17
2.14	Measured RF Characteristics 1100 MHz band	18
2.15	Measured Performance Band 13 Application High Gain Mode vs. Frequency	19
2.16	Measured Performance Band 13 Application High Gain Mode vs. Temperature	20
2.17	Measured Performance Band 13 Application Low Gain Mode vs. Frequency	21
2.18	Measured Performance Band 13 Application Low Gain Mode vs. Temperature	22
2.19	Measured Performance Band 5 Application High Gain Mode vs. Frequency	23
2.20	Measured Performance Band 5 Application High Gain Mode vs. Temperature	25
2.21	Measured Performance Band 5 Application Low Gain Mode vs. Frequency	26
2.22	Measured Performance Band 5 Application Low Gain Mode vs. Temperature	28
3	Application Circuit and Block Diagram	29
3.1	700 MHz Band Application Circuit Schematic	29
3.2	750 MHz Band Application Circuit Schematic	30
3.3	800 MHz Band Application Circuit Schematic	31
3.4	880 MHz Band Application Circuit Schematic	32
3.5	900 MHz Band Application Circuit Schematic	33
3.6	1100 MHz Band Application Circuit Schematic	34
3.7	Pin Definition	34
3.8	Application Board	35
4	Physical Characteristics	37
4.1	Package Footprint	37
4.2	Package Dimensions	38
4.3	Product Marking Pattern	38

List of Figures

Figure 1	Block Diagram of Single-Band LNA	8
Figure 2	Application Circuit with Chip Outline (top view)	29
Figure 3	Application Circuit with Chip Outline (top view)	30
Figure 4	Application Circuit with Chip Outline (top view)	31
Figure 5	Application Circuit with Chip Outline (top view)	32
Figure 6	Application Circuit with Chip Outline (top view)	33
Figure 7	Application Circuit with Chip Outline (top view)	34
Figure 8	Application Board Layout on 3-layer FR4	35
Figure 9	Cross-Section view of Application Board	35
Figure 10	Detail of Application Board Layout	36
Figure 11	Footprint Recommendation 1 for the TSNP-7-1 Package	37
Figure 12	Footprint Recommendation 2 for the TSNP-7-1 Package	37
Figure 13	Package Outline (top, side and bottom view)	38
Figure 14	Tape & Reel Dimensions	38
Figure 15	Marking Pattern (top view)	38

List of Tables

Table 1	Absolute Maximum Ratings	9
Table 2	Thermal Resistance	9
Table 3	ESD Integrity	9
Table 4	DC Characteristics, $T_A = 25\text{ }^\circ\text{C}$	10
Table 5	Truth Table	10
Table 6	Typical switching times; $T_A = -30 \dots 85\text{ }^\circ\text{C}$	10
Table 7	Typical Characteristics 700 MHz Band, $T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = 5.6\text{ k}\Omega$	13
Table 8	Typical Characteristics 750 MHz Band, $T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = 5.6\text{ k}\Omega$	14
Table 9	Typical Characteristics 800 MHz Band, $T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = 5.6\text{ k}\Omega$	15
Table 10	Typical Characteristics 880 MHz Band, $T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = \text{n/c}$	16
Table 11	Typical Characteristics 900 MHz Band, $T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = \text{n/c}$	17
Table 12	Typical Characteristics 1100 MHz Band, $T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = 8.2\text{ k}\Omega$	18
Table 13	Parts List	29
Table 14	Parts List	30
Table 15	Parts List	31
Table 16	Parts List	32
Table 17	Parts List	33
Table 18	Parts List	34
Table 19	Pin Definition and Function	34

1 Features

Main features:

- Gain: 16 / -8 dB in high / low gain mode (f.e. at 850MHz)
- Noise figure: 1.05 dB in high gain mode (f.e. at 850MHz)
- Supply current: 3.3 / 0.5 mA in high / low gain mode
- Standby mode (< 2 μ A typ.)
- Output internally matched to 50 Ω
- Inputs pre-matched to 50 Ω
- 2 kV HBM ESD protection
- Low external component count
- Small leadless TSNP-7-1 package (2.0 x 1.3 x 0.39 mm)
- Pb-free (RoHS compliant) package



Description

The BGA751N7 is a low current single-band low noise amplifier MMIC for 3G, 3.5G and 4G. The LNA is based upon Infineon's proprietary and cost-effective SiGe:C technology and comes in a low profile TSNP-7-1 leadless green package. Because the matching is off chip, the RFpath can be easily converted into a 700MHz to 1150MHz path by optimizing the input and output matching network. This document specifies the electrical parameters, pinout, application circuit and packaging of the chip.



Product Name	Package	Chip	Marking
BGA751N7	TSNP-7-1	T1533	B5

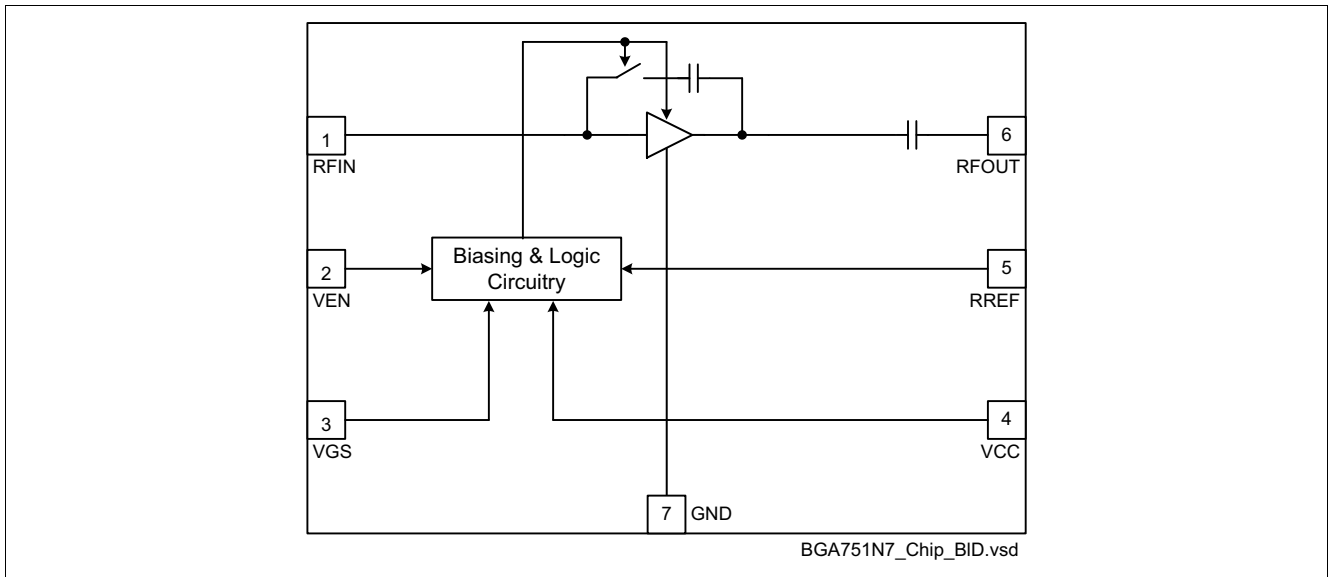


Figure 1 Block Diagram of Single-Band LNA

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 1 Absolute Maximum Ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	-0.3	–	3.6	V	–
Supply current	I_{CC}	–	–	10	mA	–
Pin voltage	V_{PIN}	-0.3	–	$V_{CC}+0.3$	V	All pins except RF input pins.
Pin voltage RF Input Pins	V_{RFIN}	-0.3	–	0.9	V	–
RF input power	P_{RFIN}	–	–	4	dBm	–
Junction temperature	T_j	–	–	150	°C	–
Ambient temperature range	T_A	-30	–	85	°C	–
Storage temperature range	T_{stg}	-65	–	150	°C	–

Attention: Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.

2.2 Thermal Resistance

Table 2 Thermal Resistance

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance junction to soldering point	R_{thJS}	–	150	–	K/W	–

2.3 ESD Integrity

Table 3 ESD Integrity

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
ESD hardness HBM ¹⁾	$V_{ESD-HBM}$	–	2000	–	V	All pins

1) According to JESD22-A114

2.4 DC Characteristics

Table 4 DC Characteristics, $T_A = 25\text{ °C}$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	2.6	2.8	3.0	V	–
Supply current high gain mode	I_{CCHG}	–	3.3	–	mA	Typical value without reference resistor
Supply current low gain mode	I_{CCLG}	–	0.5	–	mA	
Supply current standby mode	I_{CCOFF}	–	0.1	2.0	μA	–
Logic level high	V_{HI}	1.4	2.8	–	V	All logic pins
Logic level low	V_{LO}	-0.2	0.0	0.5	V	
Logic currents	I_{LO}	–	–	0.1	μA	All logic pins
	I_{HI}	–	5.0	6.0	μA	

2.5 Gain Mode Select Truth Table

Table 5 Truth Table

Control Voltage		State	
		All Bands	
VEN	VGS	HG	LG
H	L	OFF	ON
H	H	ON	OFF
L	L	STANDBY ¹⁾	
L	H		

1) In order to achieve minimum standby current it is encouraged to apply logic low-level at the VGS pin in standby mode although this is not mandatory. Details see section 2.4.

2.6 Switching Times

Table 6 Typical switching times; $T_A = -30 \dots 85\text{ °C}$

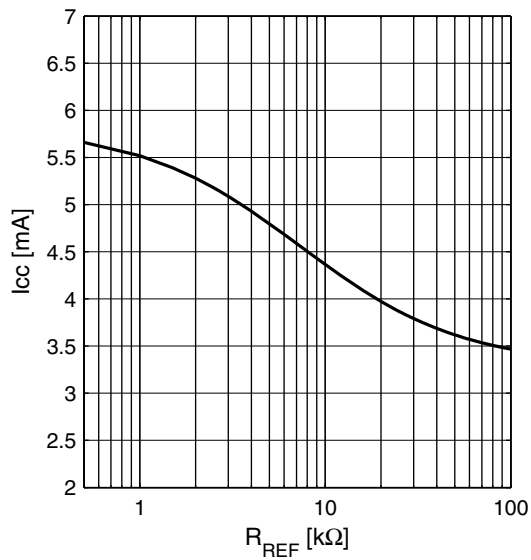
Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Settling time gainstep	t_{GS}	–	1	–	μs	Switching LG \leftrightarrow HG

2.7 Supply Current Characteristics

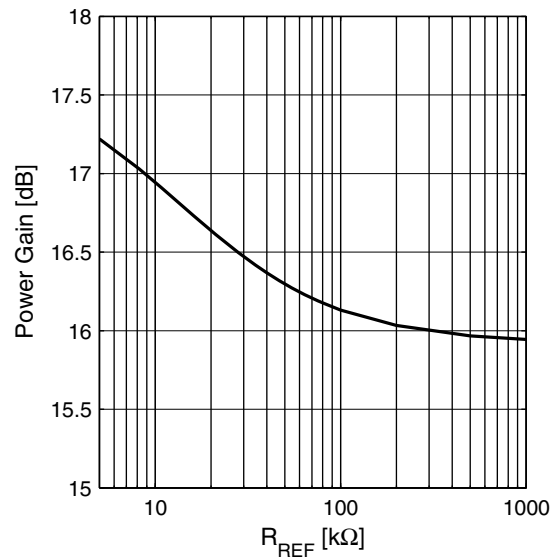
Supply current and Power gain high gain mode versus reference resistor R_{REF} (low gain mode supply current is independent of reference resistor).

Note: In order to achieve higher gain an external reference resistor can be soldered between RREF (Pin 5) and ground (see Figure 3.4 on Page 32).

Supply Current $I_{CC} = f(R_{REF})$
 $V_{CC} = 2.8 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$



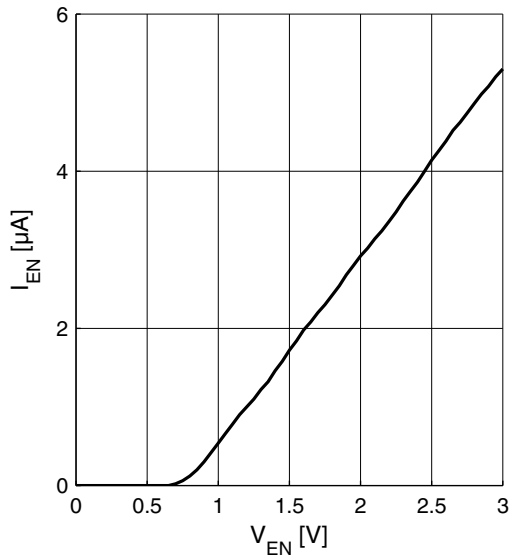
Power Gain $|S_{21}| = f(R_{REF})$
 $V_{CC} = 2.8 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$



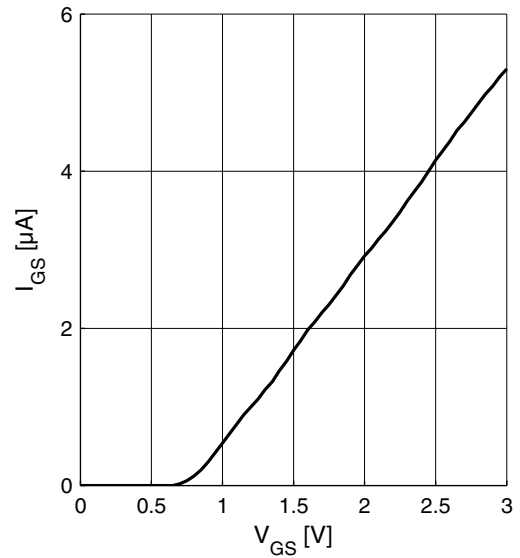
2.8 Logic Signal Characteristics

Current consumption of logic inputs VEN, VGS

Logic Current $I_{EN} = f(V_{EN})$
 $V_{CC} = 2.8 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$



Logic Current $I_{GS} = f(V_{GS})$
 $V_{CC} = 2.8 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$



2.9 Measured RF Characteristics 700 MHz Band

Table 7 Typical Characteristics 700 MHz Band, $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = 5.6\text{ k}\Omega$ ¹⁾²⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		700		750	MHz	F.e. band 12 and 17
Current consumption	I_{CCHG}	–	4.8	–	mA	High gain mode
	I_{CCLG}	–	0.50	–	mA	Low gain mode
Gain	S_{21HG}	–	15.3	–	dB	High gain mode
	S_{21LG}	–	-9.9	–	dB	Low gain mode
Reverse isolation	S_{12HG}	–	-40	–	dB	High gain mode
	S_{12LG}	–	-9.9	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	9.9	–	dB	Low gain mode
Input return loss	S_{11HG}	–	-13	–	dB	50 Ω , high gain mode
	S_{11LG}	–	-14	–	dB	50 Ω , low gain mode
Output return loss	S_{22HG}	–	-27	–	dB	50 Ω , high gain mode
	S_{22LG}	–	-19	–	dB	50 Ω , low gain mode
Stability factor	k	–	>2.2	–		DC to 8 GHz; all gain modes
Input compression point	IP_{1dBHG}	–	-7	–	dBm	High gain mode
	$IP_{1dB LG}$	–	-12	–	dBm	Low gain mode
Inband IIP3 $f_1 - f_2 = 1\text{ MHz}$	$IIP3_{HG}$	–	-8	–	dBm	High gain mode
	$IIP3_{LG}$	–	-2	–	dBm	Low gain mode

1) Performance based on application circuit in Figure 3.1 on Page 29

2) Guaranteed by device design; not tested in production

2.10 Measured RF Characteristics 750 MHz Band

Table 8 Typical Characteristics 750 MHz Band, $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = 5.6\text{ k}\Omega$ ¹⁾²⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		740		790	MHz	F.e. band 13 and 14
Current consumption	I_{CCHG}	–	4.8	–	mA	High gain mode
	I_{CCLG}	–	0.50	–	mA	Low gain mode
Gain	S_{21HG}	–	15.5	–	dB	High gain mode
	S_{21LG}	–	-9.8	–	dB	Low gain mode
Reverse isolation	S_{12HG}	–	-39	–	dB	High gain mode
	S_{12LG}	–	-9.8	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.1	–	dB	High gain mode
	NF_{LG}	–	9.8	–	dB	Low gain mode
Input return loss	S_{11HG}	–	-15	–	dB	50 Ω , high gain mode
	S_{11LG}	–	-12	–	dB	50 Ω , low gain mode
Output return loss	S_{22HG}	–	-15	–	dB	50 Ω , high gain mode
	S_{22LG}	–	-20	–	dB	50 Ω , low gain mode
Stability factor	k	–	>2.3	–		DC to 8 GHz; all gain modes
Input compression point	IP_{1dBHG}	–	-7	–	dBm	High gain mode
	IP_{1dBLG}	–	-11	–	dBm	Low gain mode
Inband IIP3 $f_1 - f_2 = 1\text{ MHz}$	$IIP3_{HG}$	–	-7	–	dBm	High gain mode
	$IIP3_{LG}$	–	-2	–	dBm	Low gain mode

1) Performance based on application circuit in Figure 3.2 on Page 30

2) Guaranteed by device design; not tested in production

2.11 Measured RF Characteristics 800 MHz Band

Table 9 Typical Characteristics 800 MHz Band, $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}$, $R_{REF} = 5.6\text{ k}\Omega$ ¹⁾²⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		790		840	MHz	F.e. band 20
Current consumption	I_{CCHG}	–	4.8	–	mA	High gain mode
	I_{CCLG}	–	0.50	–	mA	Low gain mode
Gain	S_{21HG}	–	15.9	–	dB	High gain mode
	S_{21LG}	–	-8.4	–	dB	Low gain mode
Reverse isolation	S_{12HG}	–	-38	–	dB	High gain mode
	S_{12LG}	–	-8.4	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.0	–	dB	High gain mode
	NF_{LG}	–	8.4	–	dB	Low gain mode
Input return loss	S_{11HG}	–	-16	–	dB	50 Ω , high gain mode
	S_{11LG}	–	-11	–	dB	50 Ω , low gain mode
Output return loss	S_{22HG}	–	-13	–	dB	50 Ω , high gain mode
	S_{22LG}	–	-27	–	dB	50 Ω , low gain mode
Stability factor	k	–	>2.3	–		DC to 8 GHz; all gain modes
Input compression point	IP_{1dBHG}	–	-6	–	dBm	High gain mode
	IP_{1dBLG}	–	-10	–	dBm	Low gain mode
Inband IIP3 $f_1 - f_2 = 1\text{ MHz}$	$IIP3_{HG}$	–	-8	–	dBm	High gain mode
	$IIP3_{LG}$	–	-1	–	dBm	Low gain mode

1) Performance based on application circuit in Figure 3.3 on Page 31

2) Guaranteed by device design; not tested in production

2.12 Measured RF Characteristics 880 MHz Band

Table 10 Typical Characteristics 880 MHz Band, $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}^{1)}$, $R_{REF} = n/c$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		840	–	900	MHz	F.e. band 5 and 6
Current consumption	I_{CCHG}	–	3.3	–	mA	High gain mode
	I_{CCLG}	–	0.5	–	mA	Low gain mode
Gain	S_{21HG}	–	15.8	–	dB	High gain mode
	S_{21LG}	–	-7.7	–	dB	Low gain mode
Reverse Isolation ²⁾	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-8.0	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.05	–	dB	High gain mode
	NF_{LG}	–	7.9	–	dB	Low gain mode
Input return loss ²⁾	S_{11HG}	–	-21	–	dB	50 Ω , high gain mode
	S_{11LG}	–	-13	–	dB	50 Ω , low gain mode
Output return loss ²⁾	S_{22HG}	–	-21	–	dB	50 Ω , high gain mode
	S_{22LG}	–	-13	–	dB	50 Ω , low gain mode
Stability factor ³⁾	k	–	>2.3	–		DC to 8 GHz; all gain modes
Input compression point ²⁾	IP_{1dBHG}	–	-5	–	dBm	High gain mode
	IP_{1dBLG}	–	-8	–	dBm	Low gain mode
Inband IIP3 ²⁾ $f_1 - f_2 = 1\text{ MHz}$	$IIP3_{HG}$	–	-7	–	dBm	High gain mode
	$IIP3_{LG}$	–	1	–		Low gain mode

1) Performance based on application circuit in Figure 3.4 on Page 32

2) Verification based on AQL; random production test.

3) Guaranteed by device design; not tested in production.

2.13 Measured RF Characteristics 900 MHz band

Table 11 Typical Characteristics 900 MHz Band, $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}^{1)2)}$, $R_{REF} = n/c$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		900	–	1040	MHz	F.e. band 8
Current consumption	I_{CCHG}	–	3.3	–	mA	High gain mode
	I_{CCLG}	–	0.5	–	mA	Low gain mode
Gain	S_{21HG}	–	15.5	–	dB	High gain mode
	S_{21LG}	–	-7.2	–	dB	Low gain mode
Reverse Isolation	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-7.0	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.15	–	dB	High gain mode
	NF_{LG}	–	7.7	–	dB	Low gain mode
Input return loss	S_{11HG}	–	-12	–	dB	50 Ω , high gain mode
	S_{11LG}	–	-15	–	dB	50 Ω , low gain mode
Output return loss	S_{22HG}	–	-12	–	dB	50 Ω , high gain mode
	S_{22LG}	–	-12	–	dB	50 Ω , low gain mode
Stability factor	k	–	>2.3	–		DC to 8 GHz; all gain modes
Input compression point	IP_{1dBHG}	–	-4	–	dBm	High gain mode
	IP_{1dBLG}	–	-5	–	dBm	Low gain mode
Inband IIP3 $f_1 - f_2 = 1\text{ MHz}$	$IIP3_{HG}$	–	-6	–	dBm	High gain mode
	$IIP3_{LG}$	–	1	–	dBm	Low gain mode

1) Performance based on application circuit in Figure 3.5 on Page 33

2) Guaranteed by device design; not tested in production.

2.14 Measured RF Characteristics 1100 MHz band

Table 12 Typical Characteristics 1100 MHz Band, $T_A = 25\text{ °C}$, $V_{CC} = 2.8\text{ V}^{1)2)}$, $R_{REF} = 8.2\text{ k}\Omega$

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Pass band range		1040	–	1150	MHz	–
Current consumption	I_{CCHG}	–	4.3	–	mA	High gain mode
	I_{CCLG}	–	0.5	–	mA	Low gain mode
Gain	S_{21HG}	–	16.2	–	dB	High gain mode
	S_{21LG}	–	-7.0	–	dB	Low gain mode
Reverse Isolation	S_{12HG}	–	-36	–	dB	High gain mode
	S_{12LG}	–	-7.0	–	dB	Low gain mode
Noise figure	NF_{HG}	–	1.2	–	dB	High gain mode
	NF_{LG}	–	7.0	–	dB	Low gain mode
Input return loss	S_{11HG}	–	-15	–	dB	50 Ω , high gain mode
	S_{11LG}	–	-10	–	dB	50 Ω , low gain mode
Output return loss	S_{22HG}	–	-15	–	dB	50 Ω , high gain mode
	S_{22LG}	–	-11	–	dB	50 Ω , low gain mode
Stability factor	k	–	>2.3	–		DC to 8 GHz; all gain modes
Input compression point	IP_{1dBHG}	–	-5	–	dBm	High gain mode
	IP_{1dBLG}	–	-2	–	dBm	Low gain mode
Inband IIP3 $f_1 - f_2 = 1\text{ MHz}$	$IIP3_{HG}$	–	-3	–	dBm	High gain mode
	$IIP3_{LG}$	–	3	–	dBm	Low gain mode

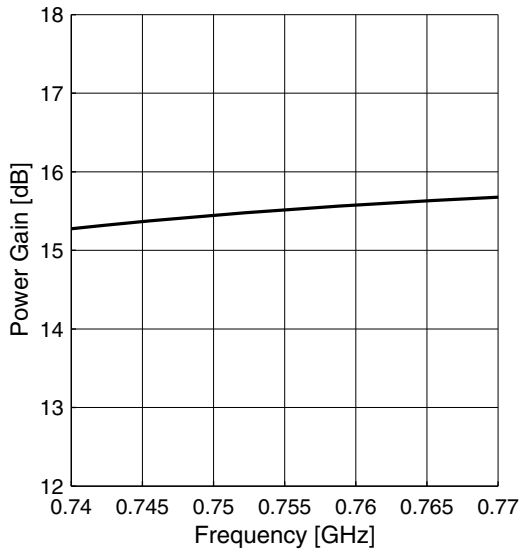
1) Performance based on application circuit in Figure 3.6 on Page 34

2) Guaranteed by device design; not tested in production.

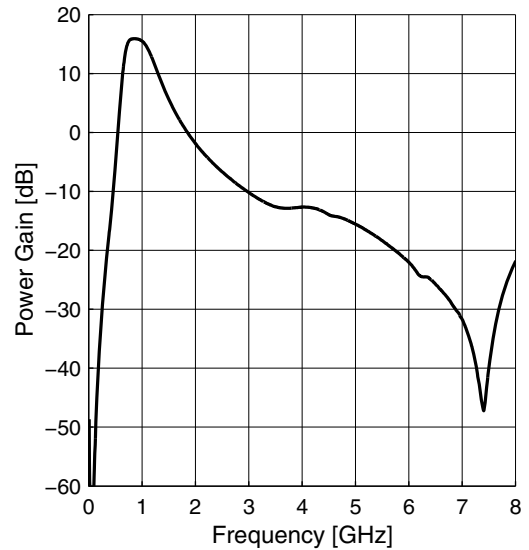
2.15 Measured Performance Band 13 Application High Gain Mode vs. Frequency

$T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $V_{GS} = 2.8\text{ V}$, $V_{EN} = 2.8\text{ V}$, $R_{REF} = 5.6\text{ k}\Omega$

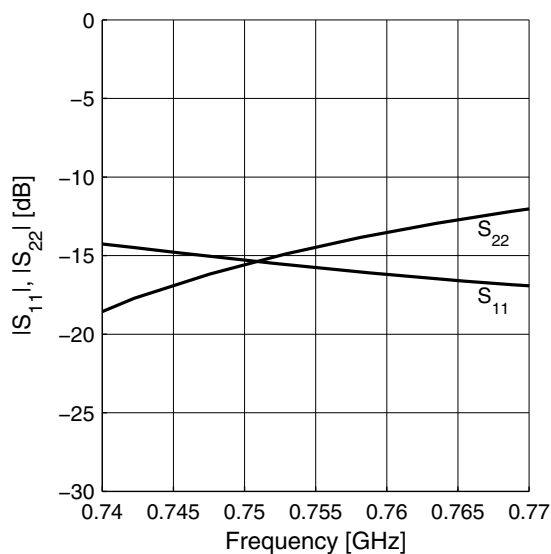
Power Gain $|S_{21}| = f(f)$



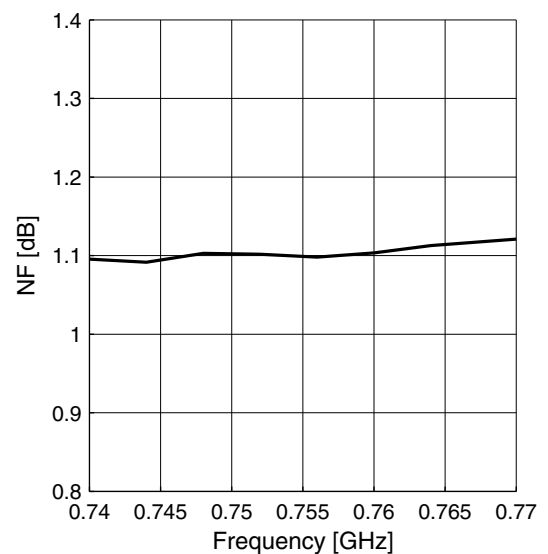
Power Gain wideband $|S_{21}| = f(f)$



Matching $|S_{11}| = f(f)$, $|S_{22}| = f(f)$



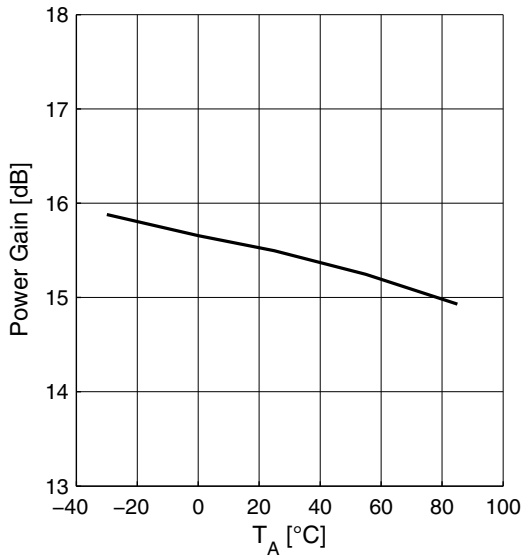
Noise Figure $NF = f(f)$



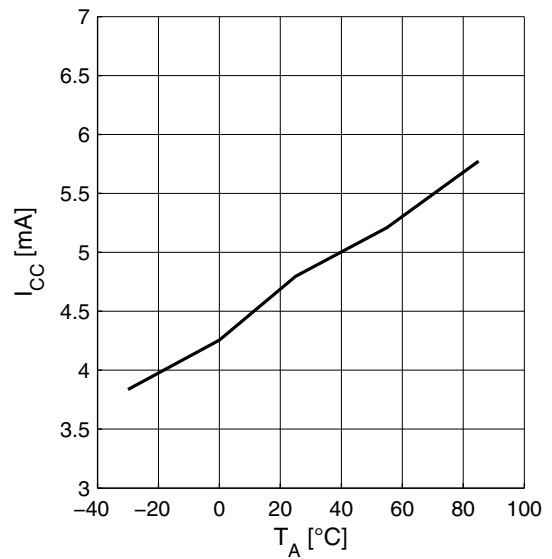
2.16 Measured Performance Band 13 Application High Gain Mode vs. Temperature

$V_{CC} = 2.8\text{ V}$, $V_{GS} = 2.8\text{ V}$, $V_{EN} = 2.8\text{ V}$, $f = 750\text{ MHz}$, $R_{REF} = 5.6\text{ k}\Omega$

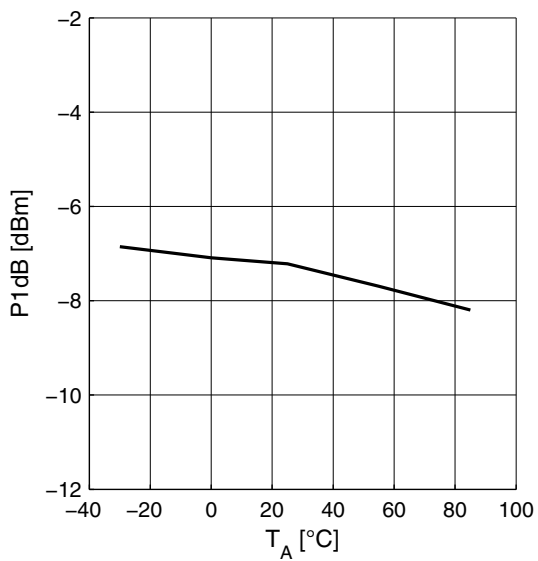
Power Gain $|S_{21}| = f(T_A)$



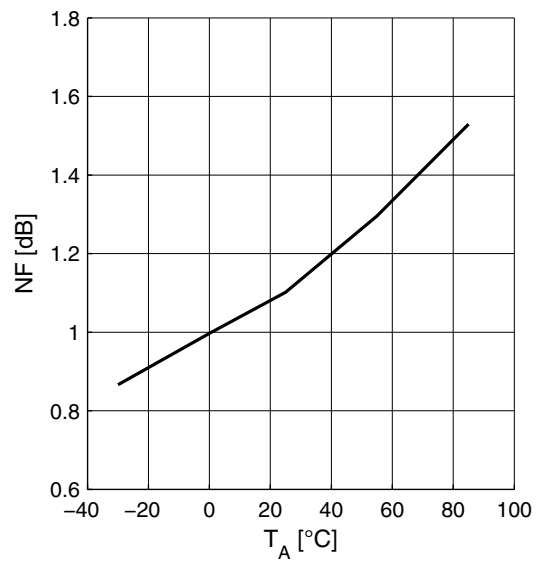
Supply Current $I_{CC} = f(T_A)$



Input Compression $P1dB = f(T_A)$



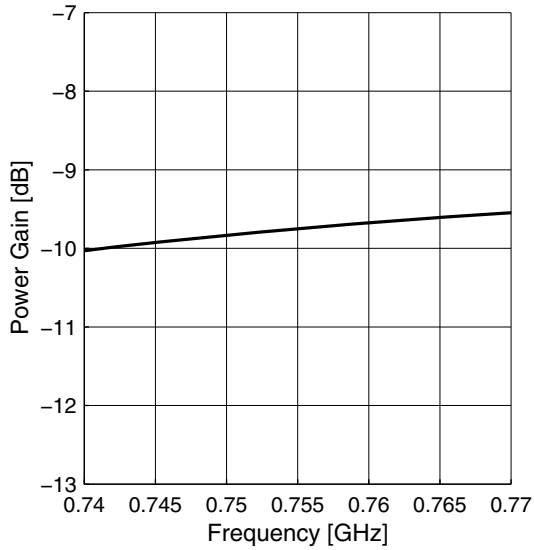
Noise Figure $NF = f(T_A)$



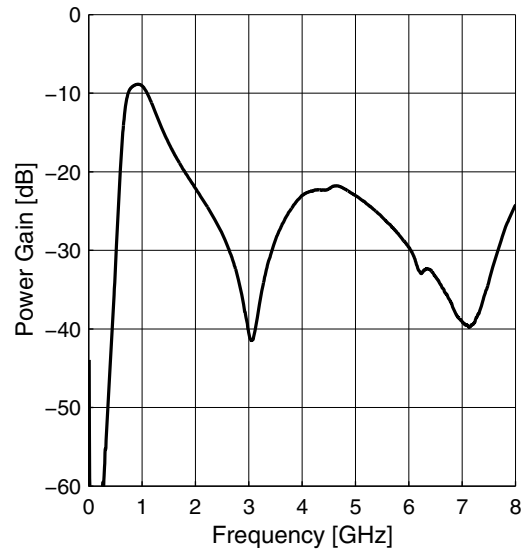
2.17 Measured Performance Band 13 Application Low Gain Mode vs. Frequency

$T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $V_{GS} = 0\text{ V}$, $V_{EN} = 2.8\text{ V}$, $R_{REF} = 5.6\text{ k}\Omega$

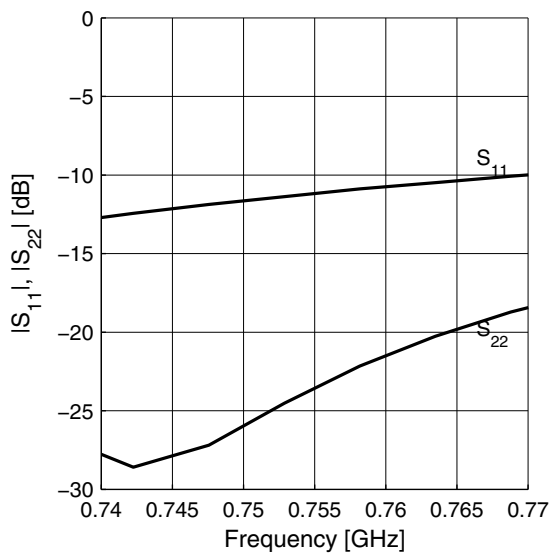
Power Gain $|S_{21}| = f(f)$



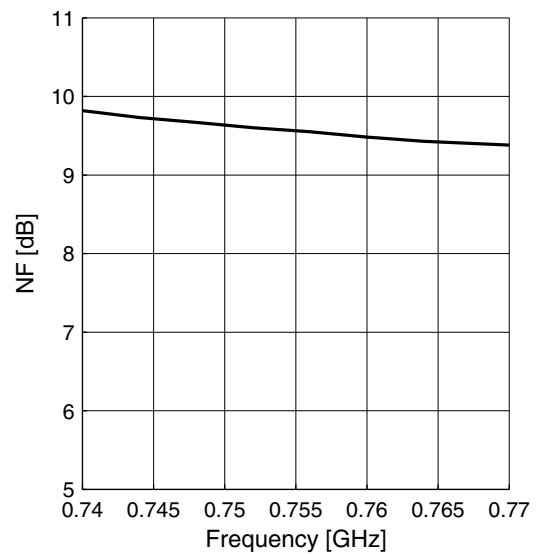
Power Gain wideband $|S_{21}| = f(f)$



Matching $|S_{11}| = f(f)$, $|S_{22}| = f(f)$



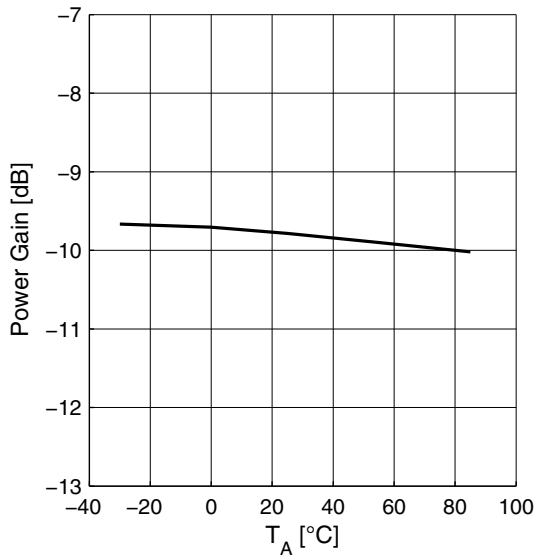
Noise Figure $NF = f(f)$



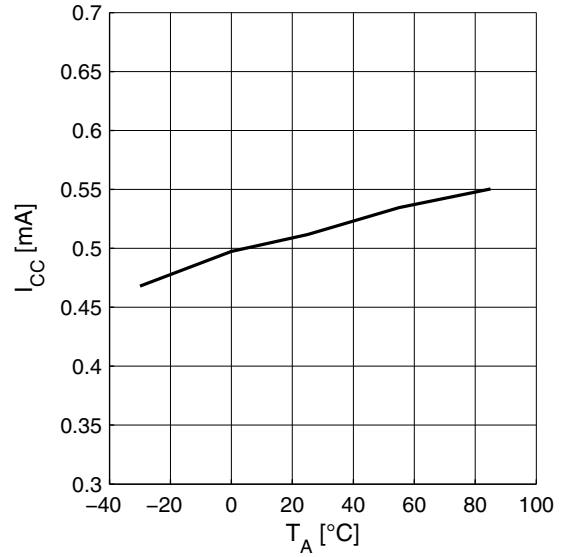
2.18 Measured Performance Band 13 Application Low Gain Mode vs. Temperature

$V_{CC} = 2.8\text{ V}$, $V_{GS} = 0\text{ V}$, $V_{EN} = 2.8\text{ V}$, $f = 750\text{ MHz}$, $R_{REF} = 5.6\text{ k}\Omega$

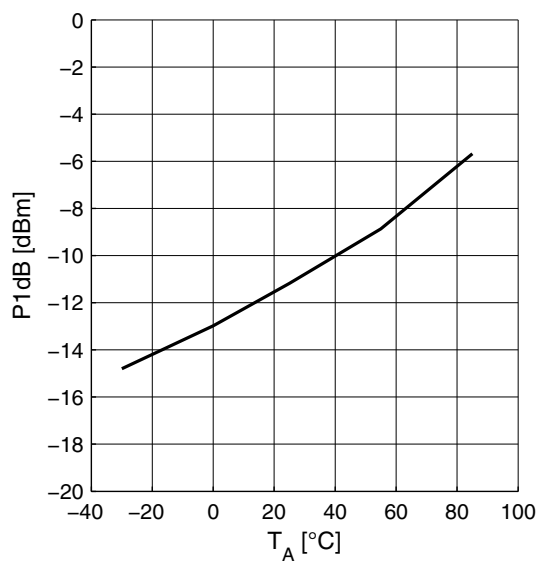
Power Gain $|S_{21}| = f(T_A)$



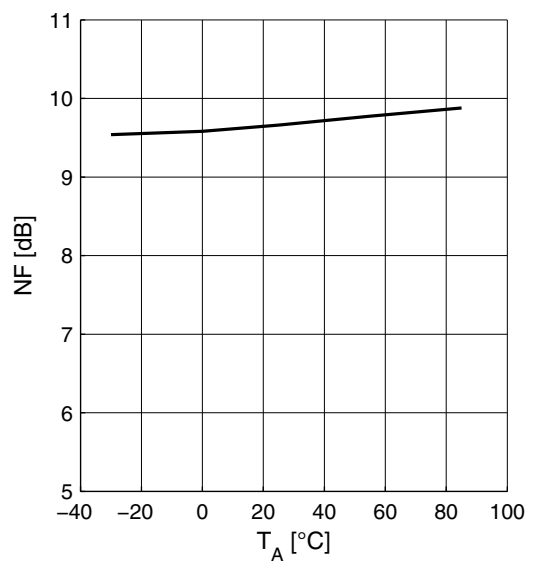
Supply Current $I_{CC} = f(T_A)$



Input Compression $P1dB = f(T_A)$



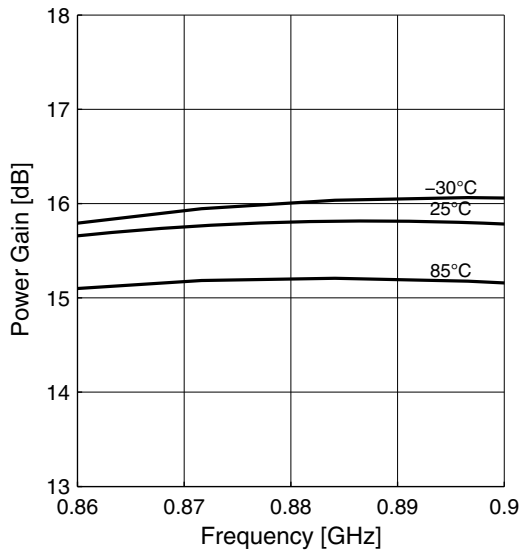
Noise Figure $NF = f(T_A)$



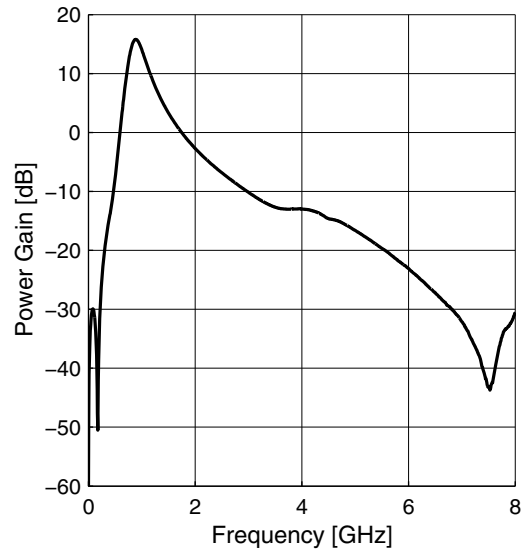
2.19 Measured Performance Band 5 Application High Gain Mode vs. Frequency

$T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $V_{GS} = 2.8\text{ V}$, $V_{EN} = 2.8\text{ V}$, $R_{REF} = n/c$

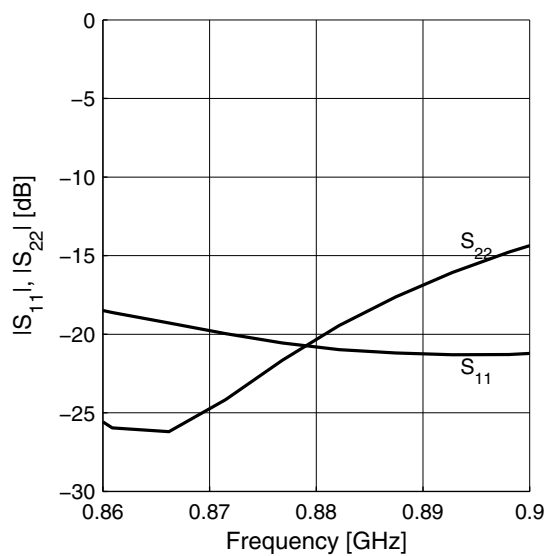
Power Gain $|S_{21}| = f(f)$



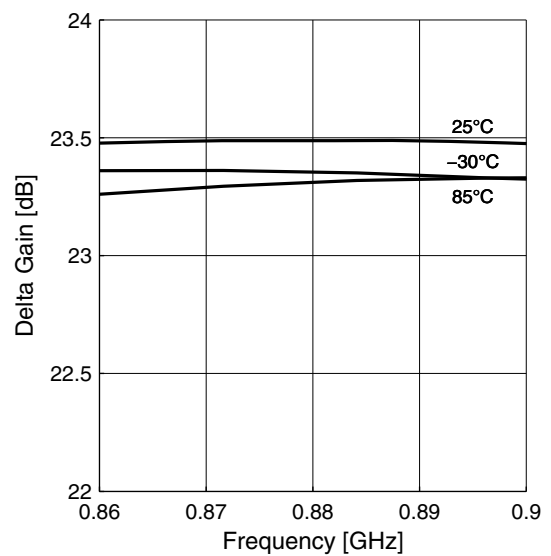
Power Gain wideband $|S_{21}| = f(f)$



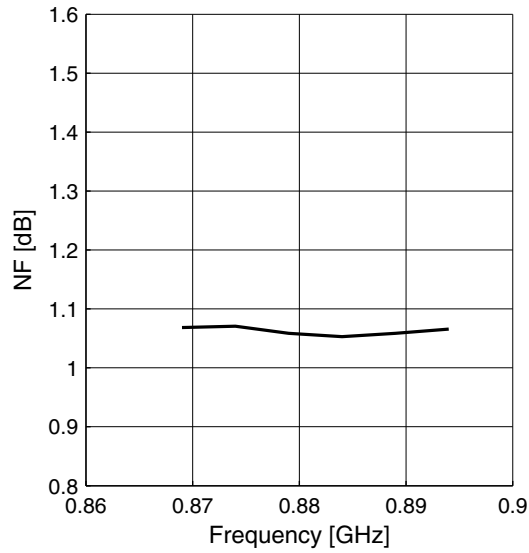
Matching $|S_{11}| = f(f)$, $|S_{22}| = f(f)$



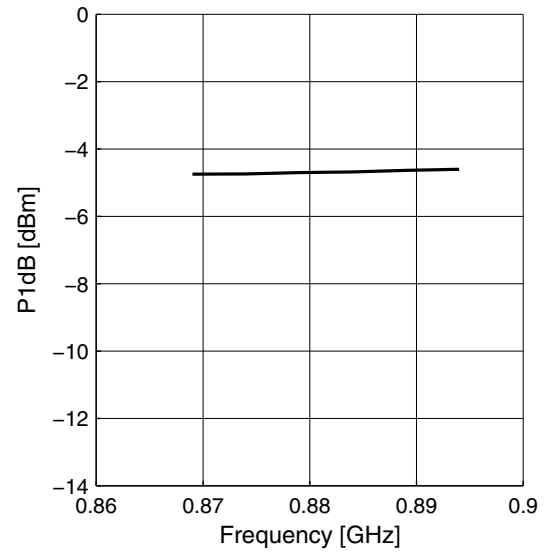
Gainstep HG-LG $|\Delta S_{21}| = f(f)$



Noise Figure $NF = f(f)$



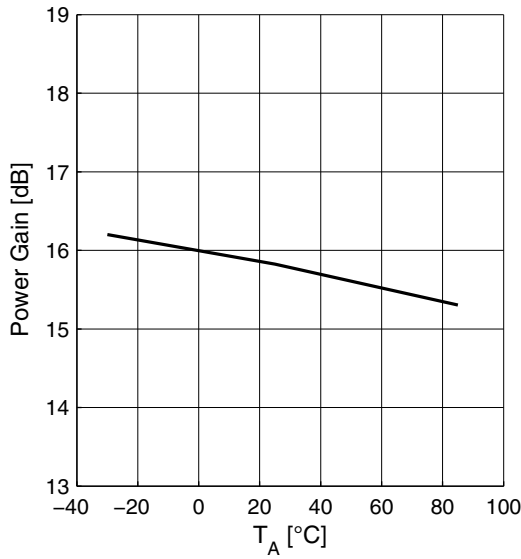
Input Compression $P1dB = f(f)$



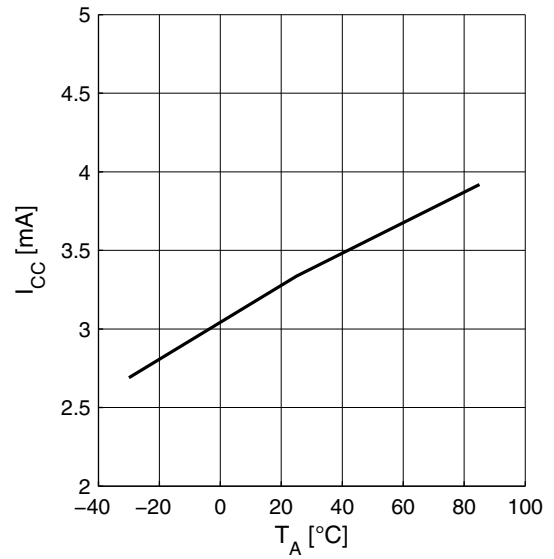
2.20 Measured Performance Band 5 Application High Gain Mode vs. Temperature

$T_A = 25\text{ }^\circ\text{C}$, $V_{CC} = 2.8\text{ V}$, $V_{GS} = 2.8\text{ V}$, $V_{EN} = 2.8\text{ V}$, $f = 800\text{ MHz}$, $R_{REF} = n/c$

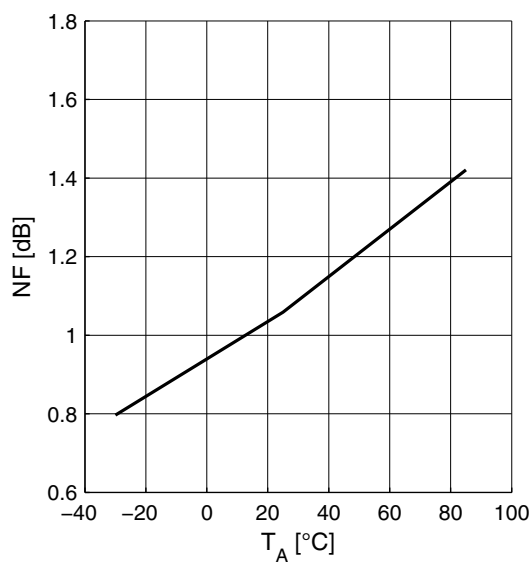
Power Gain $|S_{21}| = f(T_A)$



Supply Current $I_{CC} = f(T_A)$



Noise Figure $NF = f(T_A)$



Input Compression $P1dB = f(T_A)$

