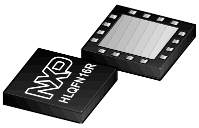


BGU7061

Analog high linearity low noise variable gain amplifier

Rev. 2 — 29 January 2015 **Product data sheet**

1. Product profile

1.1 General description

The BGU7061 is a fully integrated analog-controlled variable gain amplifier module. Its low noise and high linearity performance makes it ideal for sensitive receivers in cellular base station applications. The BGU7061 is operating in the 770 MHz to 915 MHz frequency range and has a gain control range of more than 35 dB. At maximum gain the noise figure is 0.74 dB. The gain is analog-controlled having maximum gain at 0 V and minimum gain at 3.3 V. The LNA can be bypassed extending the dynamic range. The BGU7061 is internally matched to 50 ohm, meaning no external matching is required, enabling ease of use. It is housed in a 16 pins 8 mm × 8 mm × 1.3 mm leadless HLQFN16R package SOT1301.

1.2 Features and benefits

- Input and output internally matched to 50 Ω
- Low noise figure of 0.74 dB
- High input IP3 of 2 dBm
- High $P_{i(1dB)}$ of –12.5 dBm
- Bypass mode of LNA giving high dynamic gain range
- Gain control range of 0 dB to 35 dB
- Single 5 V supply
- Single analog gain control of 0 V to 3.3 V
- Unconditionally stable up to 12.75 GHz
- Moisture sensitivity level 3
- ESD protection at all pins

1.3 Applications

- Cellular base stations, remote radio heads
- 3G, LTE infrastructure
- Low noise applications with variable gain and high linearity requirements
- Active antenna

1.4 Quick reference data

Table 1. Quick reference data
GS1 = LOW; GS2 = HIGH (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
f = 900 MHz							
$I_{CC(tot)}$	total supply current	high gain mode	[1]	197	229	267	mA
		low gain mode	[2]	175	199	230	mA
NF	noise figure	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	[1]	-	0.74	-	dB
		G_p = 35 dB	[1]	-	0.87	1.05	dB
$IP3_I$	input third-order intercept point	G_p = 35 dB; 2-tone; tone-spacing = 1.0 MHz	[1]	1	2.0	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 35 dB	[1]	−13.5	−12.5	-	dBm
f = 788 MHz							
$I_{CC(tot)}$	total supply current	high gain mode	[1]	197	229	267	mA
		low gain mode	[2]	175	199	230	mA
NF	noise figure	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	[1]	-	0.64	-	dB
		G_p = 35 dB	[1]	-	0.86	1.05	dB
$IP3_I$	input third-order intercept point	G_p = 35 dB; 2-tone; tone-spacing = 1.0 MHz	[1]	0	1.3	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 35 dB	[1]	−13.5	−12.4	-	dBm
f = 830 MHz							
$I_{CC(tot)}$	total supply current	high gain mode	[1]	197	229	267	mA
		low gain mode	[2]	175	199	230	mA
NF	noise figure	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	[1]	-	0.61	-	dB
		G_p = 35 dB	[1]	-	0.75	1.05	dB
$IP3_I$	input third-order intercept point	G_p = 35 dB; 2-tone; tone-spacing = 1.0 MHz	[1]	0.5	1.5	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 35 dB	[1]	−13.5	−12.4	-	dBm
f = 850 MHz							
$I_{CC(tot)}$	total supply current	high gain mode	[1]	197	229	267	mA
		low gain mode	[2]	175	199	230	mA
NF	noise figure	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	[1]	-	0.64	-	dB
		G_p = 35 dB	[1]	-	0.77	1.05	dB
$IP3_I$	input third-order intercept point	G_p = 35 dB; 2-tone; tone-spacing = 1.0 MHz	[1]	0.5	1.6	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 35 dB	[1]	−13.5	−12.4	-	dBm

[1] high gain mode: GS1 = LOW; GS2 = HIGH (see Table 15)

[2] low gain mode: GS1 = HIGH; GS2 = LOW (see Table 15)

2. Pinning information

2.1 Pinning

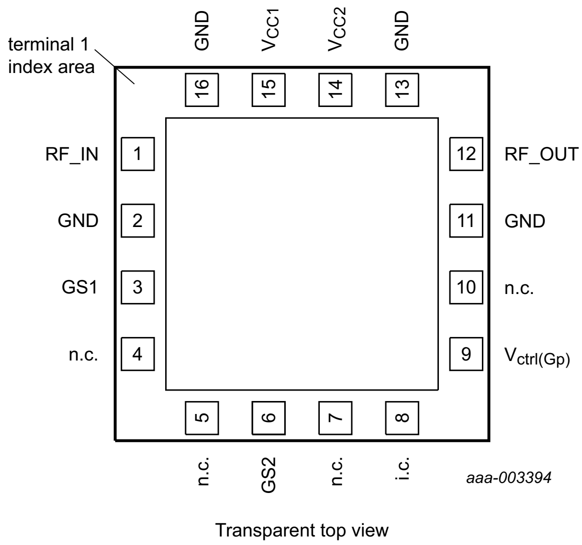


Fig 1. Pin configuration

2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
RF_IN	1	RF input
GND	2, 11, 13, 16	ground
GS1	3	gain switch control 1
n.c.	4, 5, 7, 10	not connected, internally open
GS2	6	gain switch control 2
i.c.	8	internally connected to ground
$V_{ctrl(Gp)}$	9	power gain control voltage
RF_OUT	12	RF output
V_{CC2}	14	supply voltage 2
V_{CC1}	15	supply voltage 1

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BGU7061	HLQFN16R	plastic thermal enhanced low quad flat package; no leads; 16 terminals; body 8 × 8 × 1.3 mm	SOT1301-1

4. Functional diagram

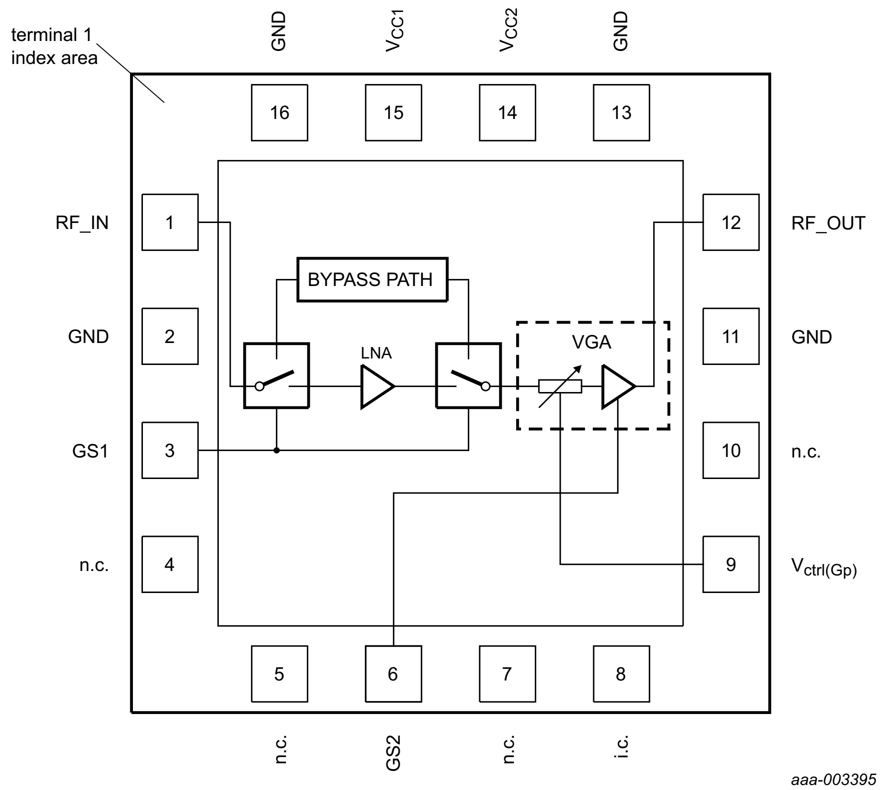


Fig 2. Functional diagram

5. Limiting values

Table 4. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		0	6	V
$V_{ctrl(Gp)}$	power gain control voltage		–1	+3.6	V
$V_{I(GS1)}$	input voltage on pin GS1		–1	+3.6	V
$V_{I(GS2)}$	input voltage on pin GS2		–1	+3.6	V
$P_{i(RF)CW}$	continuous waveform RF input power	$V_{ctrl(Gp)}$ = 0 V; 777 MHz ≤ f ≤ 915 MHz			
		high gain mode [1]	-	10	dBm
		low gain mode [2]	-	15	dBm
T_j	junction temperature		-	150	°C
T_{stg}	storage temperature		–40	+150	°C
V_{ESD}	electrostatic discharge voltage	Human Body Model (HBM); according to ANSI/ESDA-JEDEC JS-001-2020-Device Testing, Human Body Model	-	±2	kV
		Charged Device Model (CDM); according to JEDEC standard 22-C101	-	±750	V

[1] high gain mode: GS1 = LOW; GS2 = HIGH (see Table 15)

[2] low gain mode: GS1 = HIGH; GS2 = LOW (see Table 15)

6. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC1}	supply voltage 1		4.75	5	5.25	V
V_{CC2}	supply voltage 2		4.75	5	5.25	V
$V_{ctrl(Gp)}$	power gain control voltage		0	-	3.3	V
$V_{I(GS1)}$	input voltage on pin GS1		0	-	3.3	V
$V_{I(GS2)}$	input voltage on pin GS2		0	-	3.3	V
Z_0	characteristic impedance		-	50	-	Ω
T_{case}	case temperature		–40	-	+85	°C

7. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-case)}$	thermal resistance from junction to case	[1]	42	K/W

[1] The case temperature is measured at the ground solder pad.

8. Characteristics

8.1 Characteristics at f = 900 MHz

Table 7. Characteristics high gain mode
GS1 = LOW; GS2 = HIGH (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC(tot)}$	total supply current		197	229	267	mA
$G_{p(min)}$	minimum power gain	$V_{ctrl(Gp)}$ = 3.3 V	-	12.7	-	dB
$G_{p(max)}$	maximum power gain	$V_{ctrl(Gp)}$ = 0 V	-	36.7	-	dB
$G_{p(flat)}$	power gain flatness	880 MHz ≤ f ≤ 915 MHz; 18 dB ≤ G_p ≤ 35 dB	-	0.0	-	dB
NF	noise figure	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	0.74	-	dB
		G_p = 35 dB	-	0.87	1.05	dB
		G_p = 18 dB	-	6.47	-	dB
$IP3_I$	input third-order intercept point	2-tone; tone-spacing = 1.0 MHz				
		G_p = 35 dB	1	2.0	-	dBm
		G_p = 30 dB	-	4.8	-	dBm
		G_p = 29 dB	-	5.0	-	dBm
		G_p = 18 dB	-	6.3	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 35 dB	–13.5	–12.5	-	dBm
		G_p = 30 dB	-	–7.6	-	dBm
		G_p = 29 dB	-	–6.8	-	dBm
		G_p = 18 dB	-	–4.8	-	dBm
RL_{in}	input return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	30.5	-	dB
		G_p = 35 dB	-	28.0	-	dB
RL_{out}	output return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	17.5	-	dB
K	Rollett stability factor	0 GHz ≤ f ≤ 12.75 GHz	1	-	-	

Table 8. Characteristics low gain mode
GS1 = HIGH; GS2 = LOW (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC(tot)}$	total supply current		175	199	230	mA
$G_{p(min)}$	minimum power gain	$V_{ctrl(Gp)}$ = 3.3 V	-	–5.9	-	dB
$G_{p(max)}$	maximum power gain	$V_{ctrl(Gp)}$ = 0 V	-	18.3	-	dB
$G_{p(flat)}$	power gain flatness	880 MHz ≤ f ≤ 915 MHz; 3 dB ≤ G_p ≤ 17 dB	-	0.0	-	dB
NF	noise figure	G_p = 17 dB	-	11.2	-	dB
		G_p = 3 dB	-	22.9	-	dB
$IP3_I$	input third-order intercept point	2-tone; tone-spacing = 1.0 MHz			-	
		G_p = 17 dB	-	21.4	-	dBm
		G_p = 12 dB	-	26.5	-	dBm
		G_p = 11 dB	-	27.4	-	dBm
		G_p = 3 dB	-	31.2	-	dBm

Table 8. Characteristics low gain mode *...continued*

GS1 = HIGH; GS2 = LOW (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 17 dB	-	5.6	-	dBm
		G_p = 12 dB	-	10.4	-	dBm
		G_p = 11 dB	-	11.1	-	dBm
		G_p = 3 dB	-	13.2	-	dBm
RL_{in}	input return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	25.1	-	dB
		G_p = 17 dB	-	22.7	-	dB
RL_{out}	output return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	18.3	-	dB
K	Rollett stability factor	0 GHz ≤ f ≤ 12.75 GHz	1	-	-	

8.2 Characteristics at f = 788 MHz

Table 9. Characteristics high gain mode

GS1 = LOW; GS2 = HIGH (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 788 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC(tot)}$	total supply current		197	229	267	mA
$G_{p(min)}$	minimum power gain	$V_{ctrl(Gp)}$ = 3.3 V	-	12.6	-	dB
$G_{p(max)}$	maximum power gain	$V_{ctrl(Gp)}$ = 0 V	-	37.3	-	dB
$G_{p(flat)}$	power gain flatness	777 MHz ≤ f ≤ 798 MHz; 18 dB ≤ G_p ≤ 35 dB	-	0.1	-	dB
NF	noise figure	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	0.64	-	dB
		G_p = 35 dB	-	0.86	1.05	dB
		G_p = 18 dB	-	6.27	-	dB
$IP3_I$	input third-order intercept point	2-tone; tone-spacing = 1.0 MHz				
		G_p = 35 dB	0	1.3	-	dBm
		G_p = 30 dB	-	3.5	-	dBm
		G_p = 29 dB	-	3.7	-	dBm
		G_p = 18 dB	-	5.5	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 35 dB	–13.5	–12.4	-	dBm
		G_p = 30 dB	-	–7.8	-	dBm
		G_p = 29 dB	-	–7.1	-	dBm
		G_p = 18 dB	-	–5.6	-	dBm
RL_{in}	input return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	20.0	-	dB
		G_p = 35 dB	-	20.5	-	dB
RL_{out}	output return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	18.6	-	dB
K	Rollett stability factor	0 GHz ≤ f ≤ 12.75 GHz	1	-	-	

Table 10. Characteristics low gain mode

GS1 = HIGH; GS2 = LOW (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 788 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC(tot)}$	total supply current		175	199	230	mA
$G_{p(min)}$	minimum power gain	$V_{ctrl(Gp)}$ = 3.3 V	-	–5.9	-	dB
$G_{p(max)}$	maximum power gain	$V_{ctrl(Gp)}$ = 0 V	-	18.8	-	dB
$G_{p(flat)}$	power gain flatness	777 MHz ≤ f ≤ 798 MHz; 3 dB ≤ G_p ≤ 17 dB	-	0.0	-	dB
NF	noise figure	G_p = 17 dB	-	11.4	-	dB
		G_p = 3 dB	-	22.9	-	dB
$IP3_I$	input third-order intercept point	2-tone; tone-spacing = 1.0 MHz			-	
		G_p = 17 dB	-	21.0	-	dBm
		G_p = 12 dB	-	25.7	-	dBm
		G_p = 11 dB	-	26.8	-	dBm
		G_p = 3 dB	-	32.1	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 17 dB	-	5.8	-	dBm
		G_p = 12 dB	-	10.5	-	dBm
		G_p = 11 dB	-	11.2	-	dBm
		G_p = 3 dB	-	13.9	-	dBm
RL_{in}	input return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	25.6	-	dB
		G_p = 17 dB	-	25.8	-	dB
RL_{out}	output return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	21.0	-	dB
K	Rollett stability factor	0 GHz ≤ f ≤ 12.75 GHz	1	-	-	

8.3 Characteristics at f = 830 MHz

Table 11. Characteristics high gain mode

GS1 = LOW; GS2 = HIGH (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 830 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC(tot)}$	total supply current		197	229	267	mA
$G_{p(min)}$	minimum power gain	$V_{ctrl(Gp)}$ = 3.3 V	-	12.7	-	dB
$G_{p(max)}$	maximum power gain	$V_{ctrl(Gp)}$ = 0 V	-	36.8	-	dB
$G_{p(flat)}$	power gain flatness	815 MHz ≤ f ≤ 840 MHz; 18 dB ≤ G_p ≤ 35 dB	-	0.1	-	dB
NF	noise figure	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	0.61	-	dB
		G_p = 35 dB	-	0.75	1.05	dB
		G_p = 18 dB	-	5.49	-	dB
$IP3_I$	input third-order intercept point	2-tone; tone-spacing = 1.0 MHz				
		G_p = 35 dB	0.5	1.5	-	dBm
		G_p = 30 dB	-	4.0	-	dBm
		G_p = 29 dB	-	4.3	-	dBm
		G_p = 18 dB	-	6.0	-	dBm

Table 11. Characteristics high gain mode *…continued*

GS1 = LOW; GS2 = HIGH (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 830 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 35 dB	−13.5	−12.4	-	dBm
		G_p = 30 dB	-	−7.6	-	dBm
		G_p = 29 dB	-	−6.9	-	dBm
		G_p = 18 dB	-	−4.8	-	dBm
RL_{in}	input return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	24.0	-	dB
		G_p = 35 dB	-	24.8	-	dB
RL_{out}	output return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	18.0	-	dB
K	Rollett stability factor	0 GHz ≤ f ≤ 12.75 GHz	1	-	-	

Table 12. Characteristics low gain mode

GS1 = HIGH; GS2 = LOW (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 830 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC(tot)}$	total supply current		175	199	230	mA
$G_{p(min)}$	minimum power gain	$V_{ctrl(Gp)}$ = 3.3 V	-	−6.1	-	dB
$G_{p(max)}$	maximum power gain	$V_{ctrl(Gp)}$ = 0 V	-	18.4	-	dB
$G_{p(flat)}$	power gain flatness	815 MHz ≤ f ≤ 840 MHz; 3 dB ≤ G_p ≤ 17 dB	-	0.0	-	dB
NF	noise figure	G_p = 17 dB	-	10.4	-	dB
		G_p = 3 dB	-	22.0	-	dB
$IP3_I$	input third-order intercept point	2-tone; tone-spacing = 1.0 MHz			-	
		G_p = 17 dB	-	21.7	-	dBm
		G_p = 12 dB	-	26.9	-	dBm
		G_p = 11 dB	-	27.7	-	dBm
		G_p = 3 dB	-	31.4	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 17 dB	-	5.8	-	dBm
		G_p = 12 dB	-	10.5	-	dBm
		G_p = 11 dB	-	11.9	-	dBm
		G_p = 3 dB	-	13.6	-	dBm
RL_{in}	input return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	25.5	-	dB
		G_p = 17 dB	-	24.0	-	dB
RL_{out}	output return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	19.4	-	dB
K	Rollett stability factor	0 GHz ≤ f ≤ 12.75 GHz	1	-	-	

8.4 Characteristics at f = 850 MHz

Table 13. Characteristics high gain mode

GS1 = LOW; GS2 = HIGH (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC(tot)}$	total supply current		197	229	267	mA
$G_{p(min)}$	minimum power gain	$V_{ctrl(Gp)}$ = 3.3 V	-	12.7	-	dB
$G_{p(max)}$	maximum power gain	$V_{ctrl(Gp)}$ = 0 V	-	36.7	-	dB
$G_{p(flat)}$	power gain flatness	825 MHz ≤ f ≤ 865 MHz; 18 dB ≤ G_p ≤ 35 dB	-	0.1	-	dB
NF	noise figure	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	0.64	-	dB
		G_p = 35 dB	-	0.77	1.05	dB
		G_p = 18 dB	-	5.54	-	dB
$IP3_I$	input third-order intercept point	2-tone; tone-spacing = 1.0 MHz				
		G_p = 35 dB	0.5	1.6	-	dBm
		G_p = 30 dB	-	4.5	-	dBm
		G_p = 29 dB	-	4.7	-	dBm
		G_p = 18 dB	-	6.0	-	dBm
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 35 dB	−13.5	−12.4	-	dBm
		G_p = 30 dB	-	−7.6	-	dBm
		G_p = 29 dB	-	−6.9	-	dBm
		G_p = 18 dB	-	−5.1	-	dBm
RL_{in}	input return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	25.1	-	dB
		G_p = 35 dB	-	26.5	-	dB
RL_{out}	output return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	17.5	-	dB
K	Rollett stability factor	0 GHz ≤ f ≤ 12.75 GHz	1	-	-	

Table 14. Characteristics low gain mode

GS1 = HIGH; GS2 = LOW (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{CC(tot)}$	total supply current		175	199	230	mA
$G_{p(min)}$	minimum power gain	$V_{ctrl(Gp)}$ = 3.3 V	-	−6.0	-	dB
$G_{p(max)}$	maximum power gain	$V_{ctrl(Gp)}$ = 0 V	-	18.3	-	dB
$G_{p(flat)}$	power gain flatness	825 MHz ≤ f ≤ 865 MHz; 3 dB ≤ G_p ≤ 17 dB	-	0.0	-	dB
NF	noise figure	G_p = 17 dB	-	10.4	-	dB
		G_p = 3 dB	-	22.1	-	dB
$IP3_I$	input third-order intercept point	2-tone; tone-spacing = 1.0 MHz			-	
		G_p = 17 dB	-	21.6	-	dBm
		G_p = 12 dB	-	26.5	-	dBm
		G_p = 11 dB	-	27.5	-	dBm
		G_p = 3 dB	-	31.4	-	dBm

Table 14. Characteristics low gain mode *...continued*

GS1 = HIGH; GS2 = LOW (see Table 15); V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz; T_{amb} = 25 °C; input and output 50 Ω; unless otherwise specified. All RF parameters have been characterized at the device RF input and RF output terminals.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$P_{i(1dB)}$	input power at 1 dB gain compression	G_p = 17 dB	-	5.7	-	dBm
		G_p = 12 dB	-	10.5	-	dBm
		G_p = 11 dB	-	11.2	-	dBm
		G_p = 3 dB	-	13.5	-	dBm
RL_{in}	input return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	25.1	-	dB
		G_p = 17 dB	-	23.5	-	dB
RL_{out}	output return loss	$V_{ctrl(Gp)}$ = 0 V (maximum power gain)	-	18.7	-	dB
K	Rollett stability factor	0 GHz ≤ f ≤ 12.75 GHz	1	-	-	

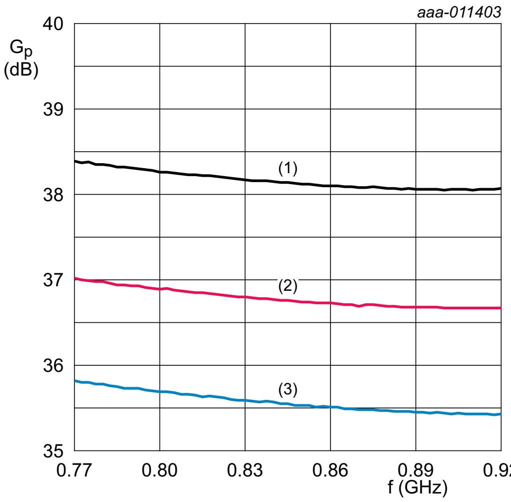
8.5 Gain switch truth table

Table 15. Gain switch truth table

V_{CC1} = 5 V; V_{CC2} = 5 V; T_{amb} = 25 °C

Gain mode	GS1		GS2	
	logic	V_{GS1}	logic	V_{GS2}
high gain mode	LOW	0 V to 0.5 V	HIGH	2 V to 3.3 V
low gain mode	HIGH	2 V to 3.3 V	LOW	0 V to 0.5 V

8.6 Graphs



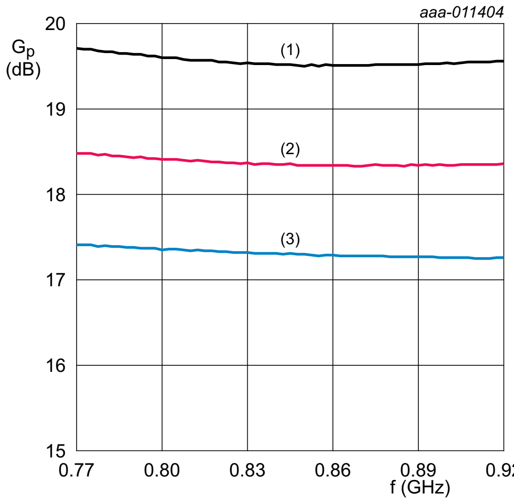
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; $V_{ctrl(Gp)}$ = 0 V.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 3. Power gain as a function of frequency in high gain mode; typical values



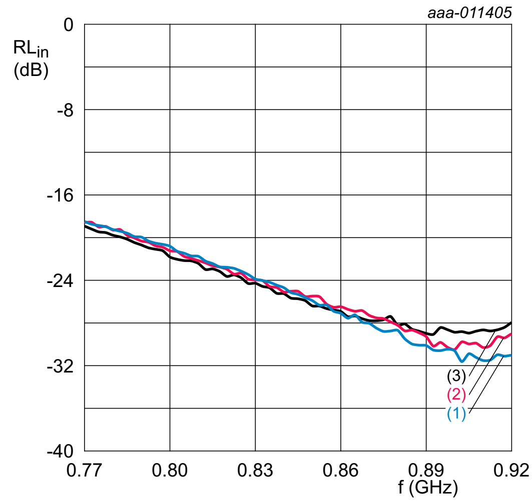
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; $V_{ctrl(Gp)}$ = 0 V.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 4. Power gain as a function of frequency in low gain mode; typical values



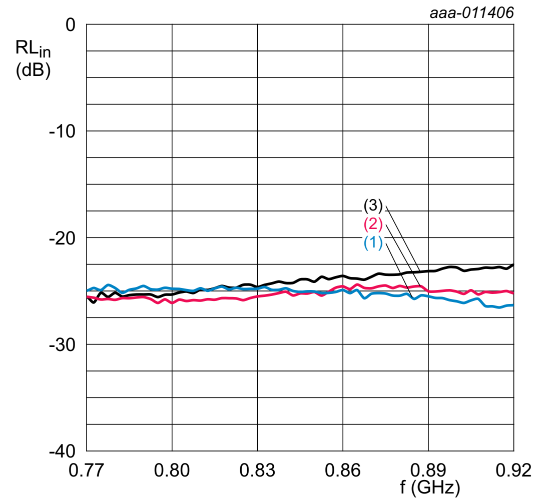
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; $V_{ctrl(Gp)}$ = 0 V.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 5. Input return loss as a function of frequency in high gain mode; typical values



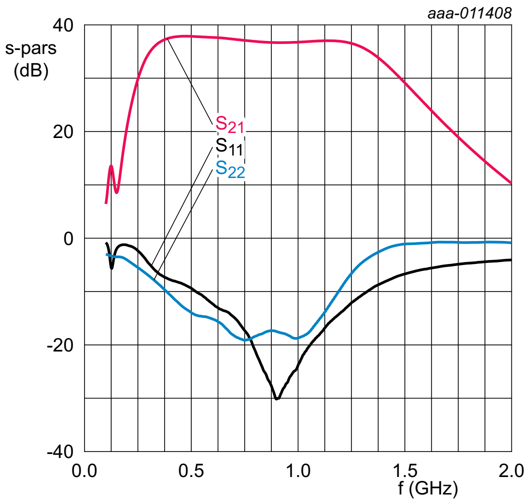
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; $V_{ctrl(Gp)}$ = 0 V.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

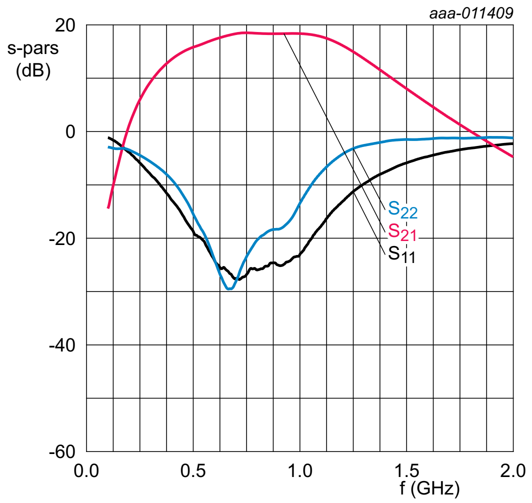
(3) T_{amb} = +85 °C

Fig 6. Input return loss as a function of frequency in low gain mode; typical values



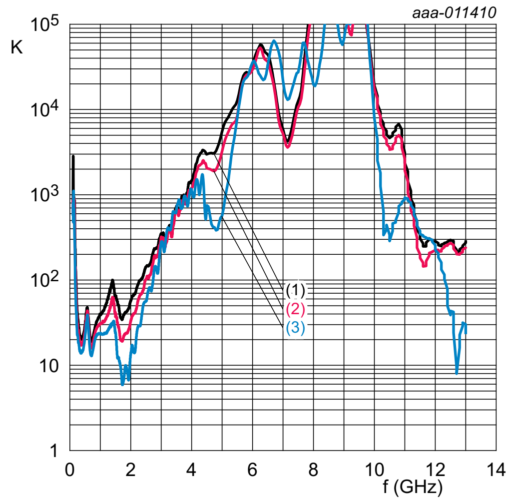
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; $V_{ctrl(Gp)}$ = 0 V; T_{amb} = 25 °C.

Fig 7. S-parameters as a function of frequency in high gain mode; typical values



GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; $V_{ctrl(Gp)}$ = 0 V; T_{amb} = 25 °C.

Fig 8. S-parameters as a function of frequency in low gain mode; typical values



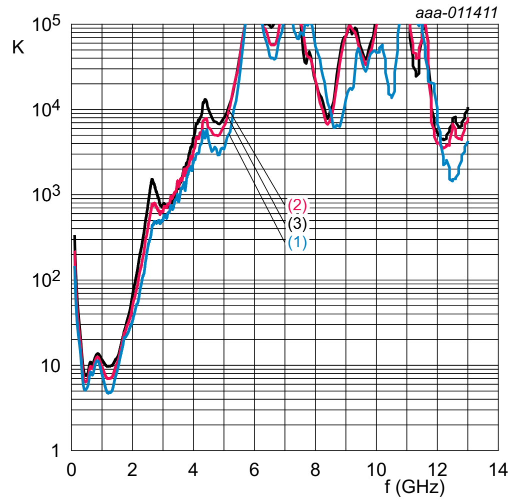
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; $V_{ctrl(Gp)}$ = 0 V.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 9. Rollet stability factor as a function of frequency in high gain mode; typical values



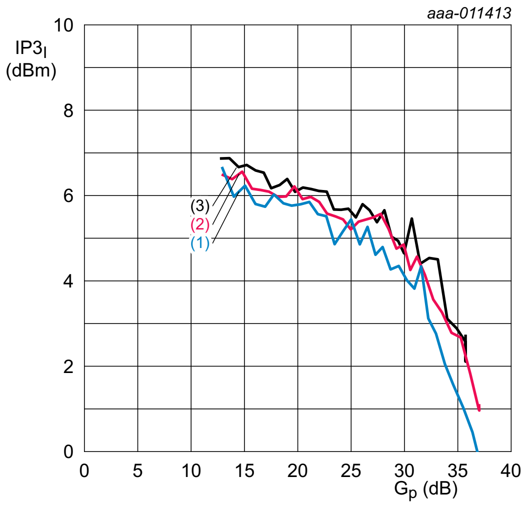
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; $V_{ctrl(Gp)}$ = 0 V.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 10. Rollet stability factor as a function of frequency in low gain mode; typical values



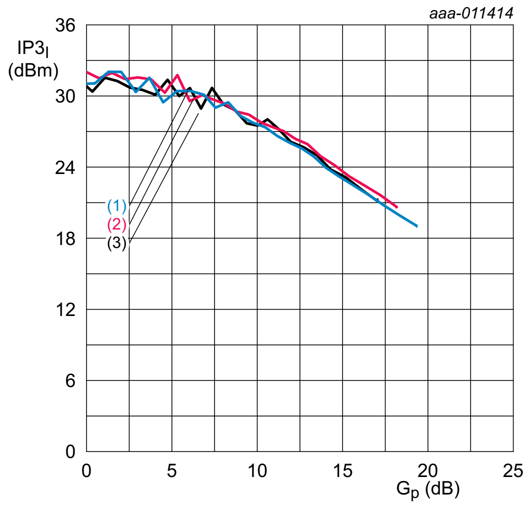
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 11. Input third-order intercept point as a function of power gain in high gain mode; typical values



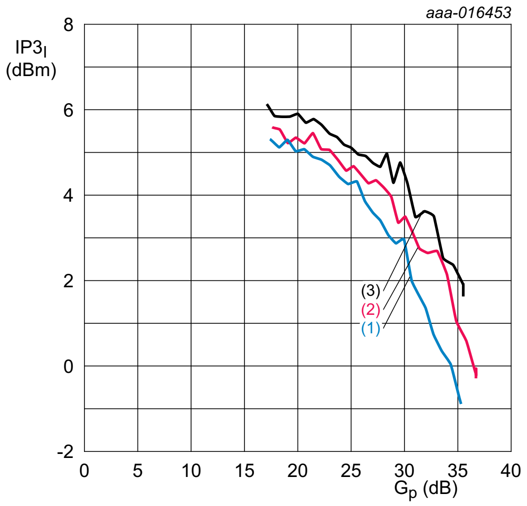
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 12. Input third-order intercept point as a function of power gain in low gain mode; typical values



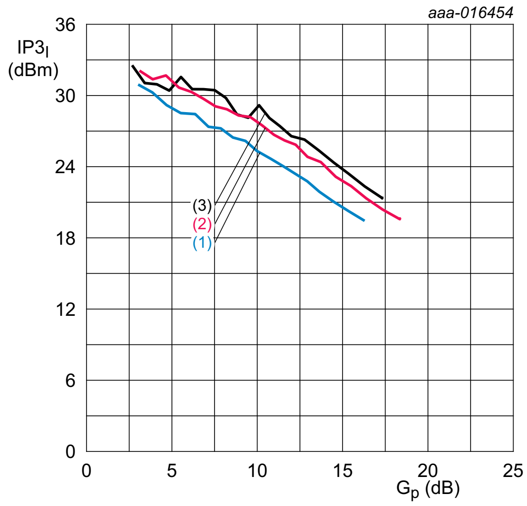
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 788 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 13. Input third-order intercept point as a function of power gain in high gain mode; typical values



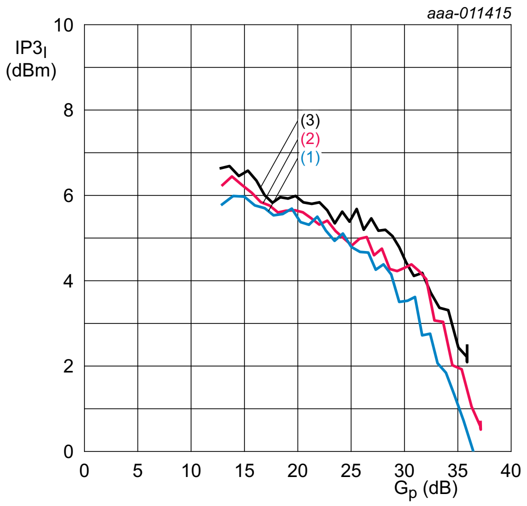
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 788 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 14. Input third-order intercept point as a function of power gain in low gain mode; typical values



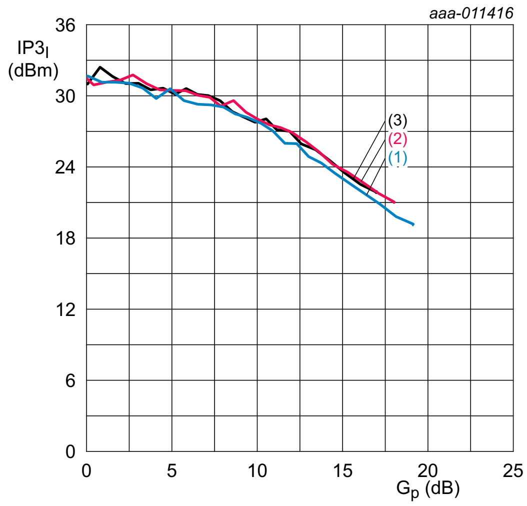
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 830 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 15. Input third-order intercept point as a function of power gain in high gain mode; typical values



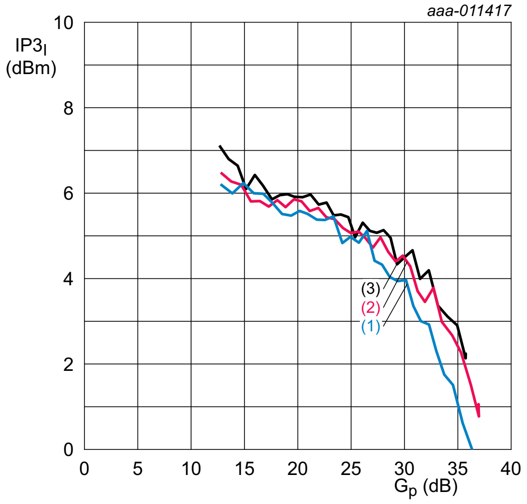
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 830 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 16. Input third-order intercept point as a function of power gain in low gain mode; typical values



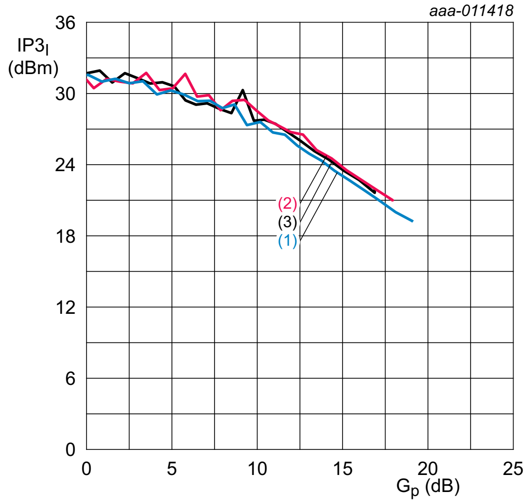
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 17. Input third-order intercept point as a function of power gain in high gain mode; typical values



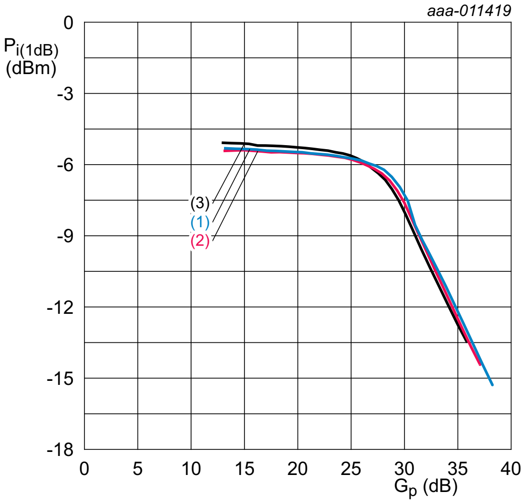
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 18. Input third-order intercept point as a function of power gain in low gain mode; typical values



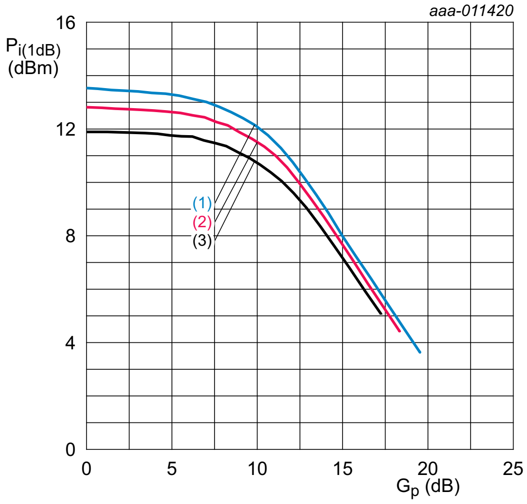
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 19. Input power at 1 dB gain compression as a function of power gain in high gain mode; typical values



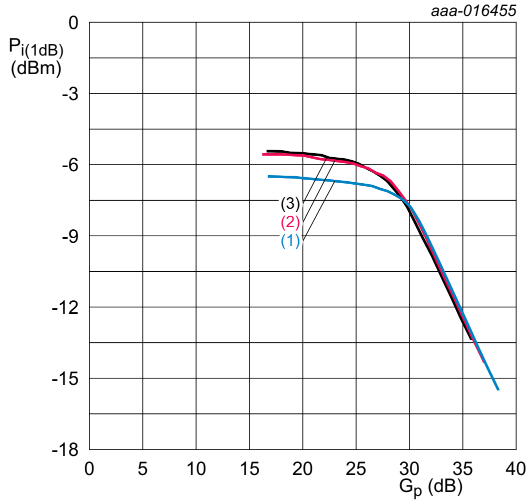
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 20. Input power at 1 dB gain compression as a function of power gain in low gain mode; typical values



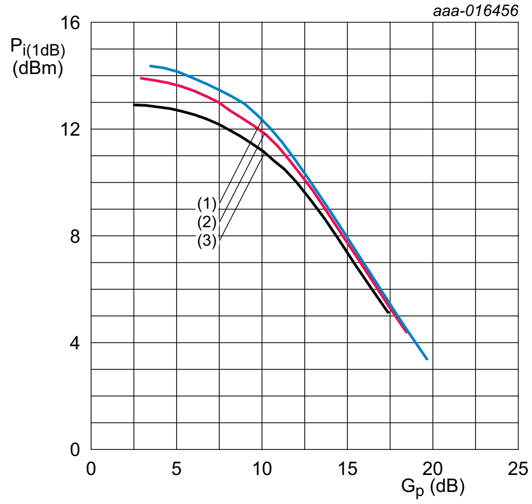
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 788 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 21. Input power at 1 dB gain compression as a function of power gain in high gain mode; typical values



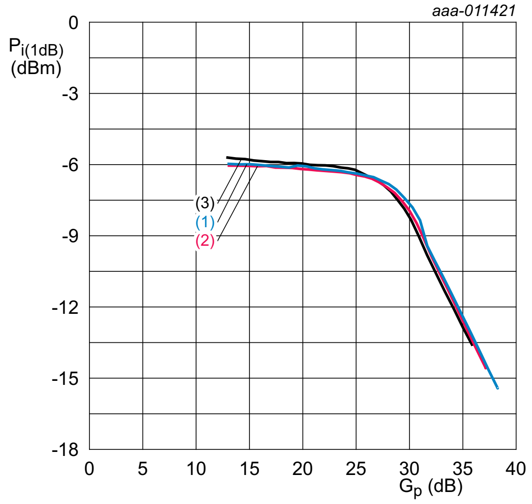
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 788 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 22. Input power at 1 dB gain compression as a function of power gain in low gain mode; typical values



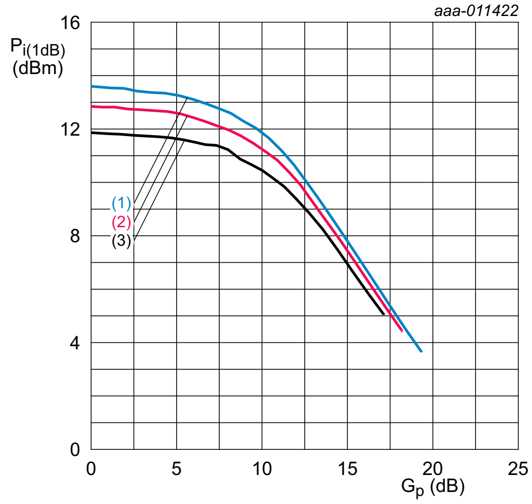
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 830 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 23. Input power at 1 dB gain compression as a function of power gain in high gain mode; typical values



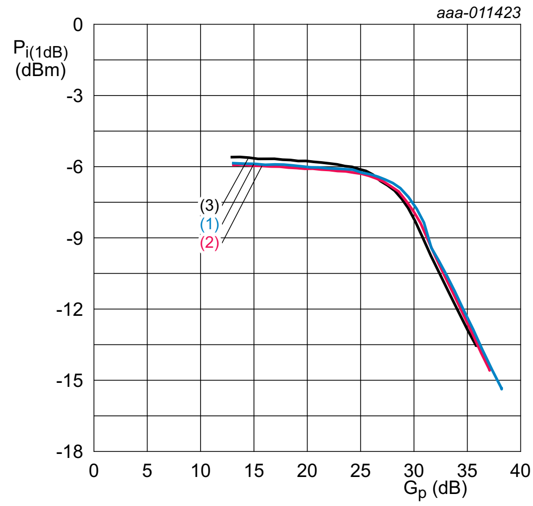
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 830 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 24. Input power at 1 dB gain compression as a function of power gain in low gain mode; typical values



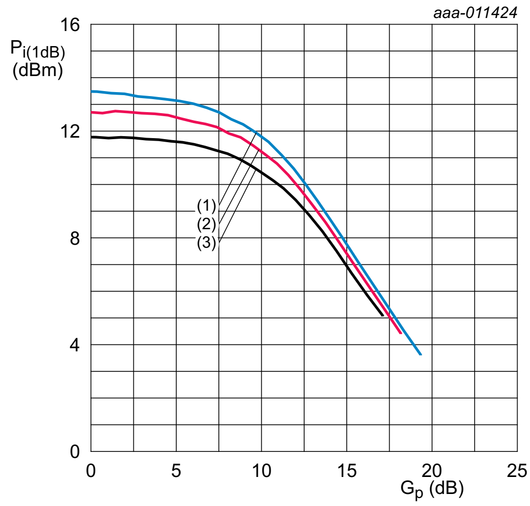
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 850 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 25. Input power at 1 dB gain compression as a function of power gain in high gain mode; typical values



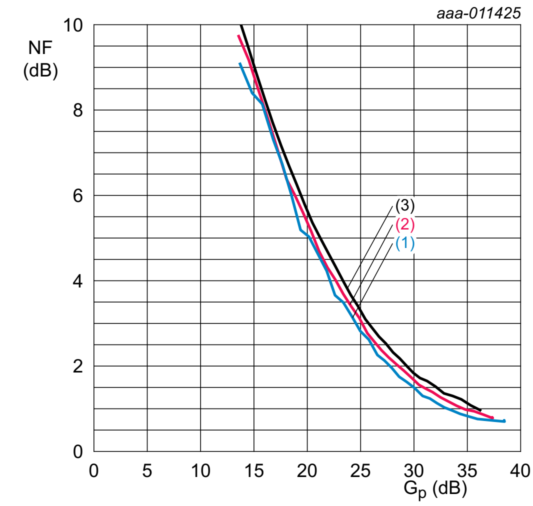
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 850 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 26. Input power at 1 dB gain compression as a function of power gain in low gain mode; typical values



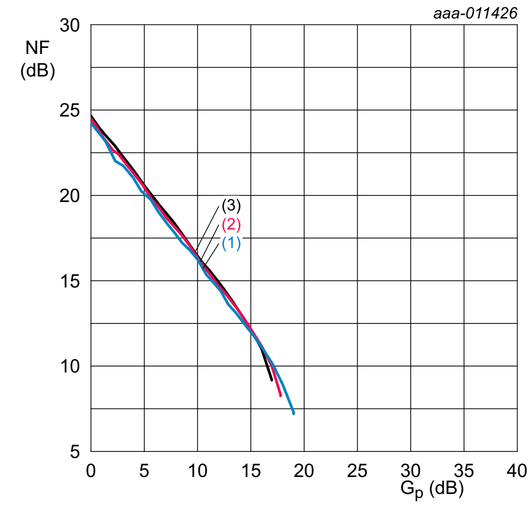
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 900 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 27. Noise figure as a function of power gain in high gain mode; typical values



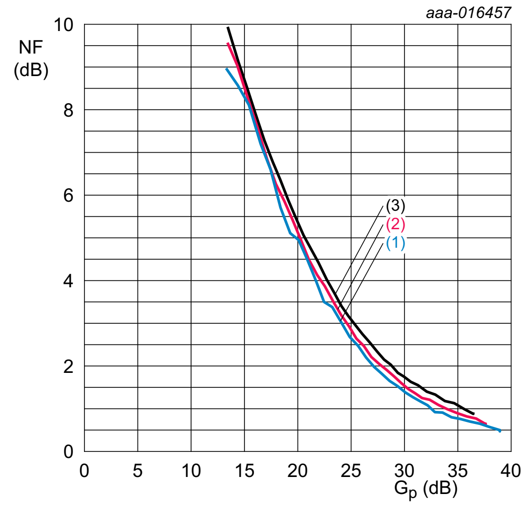
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 900 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 28. Noise figure as a function of power gain in low gain mode; typical values



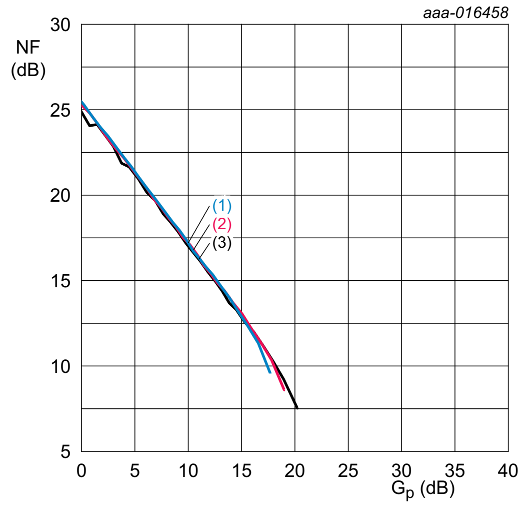
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 788 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 29. Noise figure as a function of power gain in high gain mode; typical values



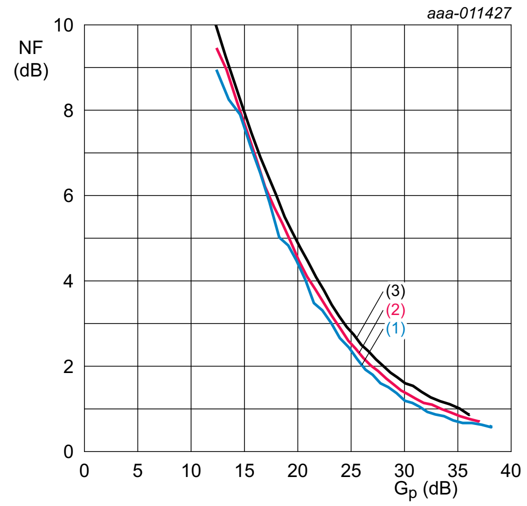
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 788 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 30. Noise figure as a function of power gain in low gain mode; typical values



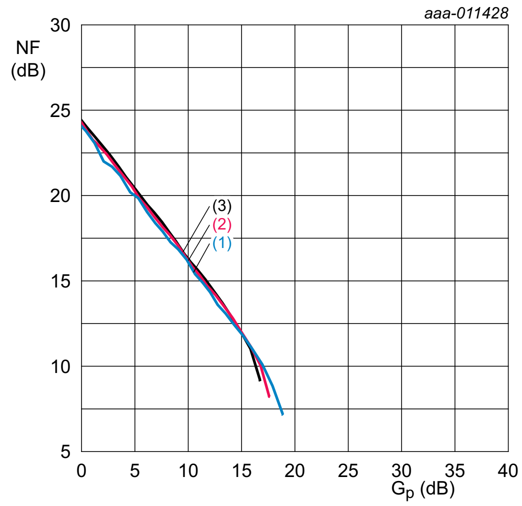
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 830 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 31. Noise figure as a function of power gain in high gain mode; typical values



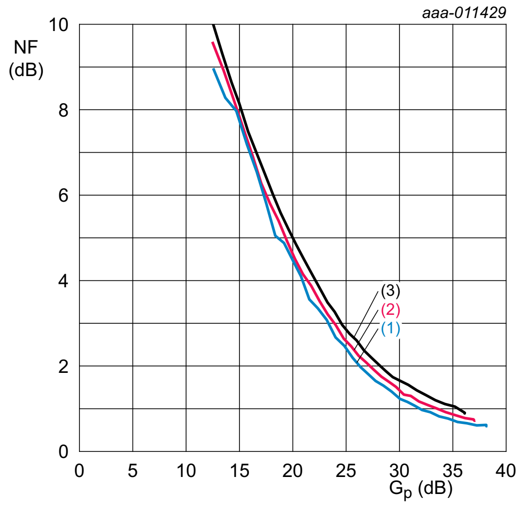
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 830 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 32. Noise figure as a function of power gain in low gain mode; typical values



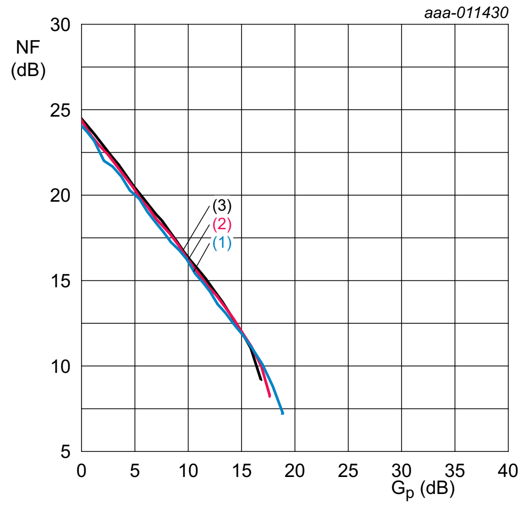
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 33. Noise figure as a function of power gain in high gain mode; typical values



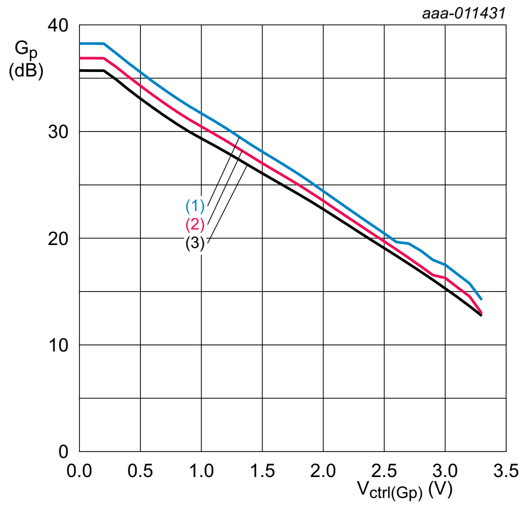
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 34. Noise figure as a function of power gain in low gain mode; typical values



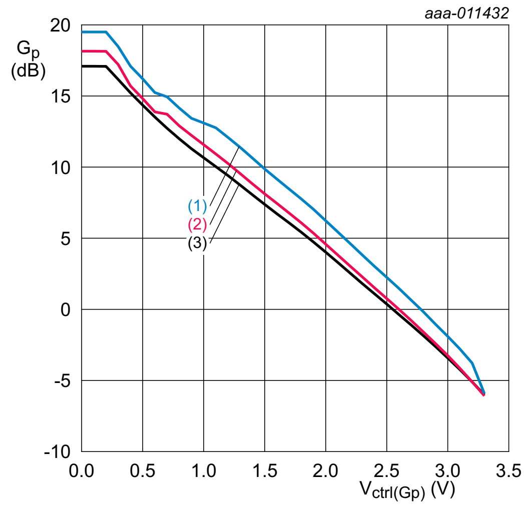
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 35. Power gain as a function of power gain control voltage in high gain mode; typical values



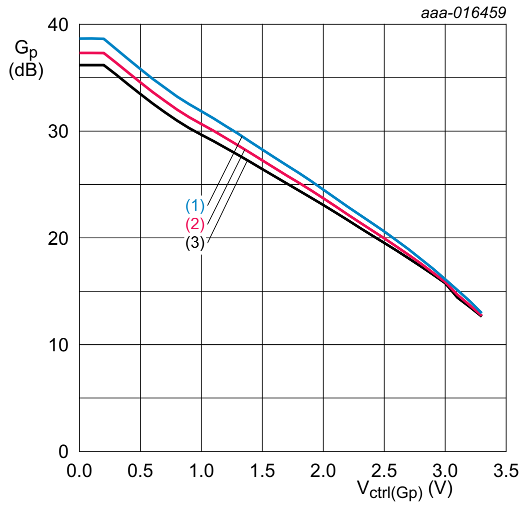
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 900 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 36. Power gain as a function of power gain control voltage in low gain mode; typical values



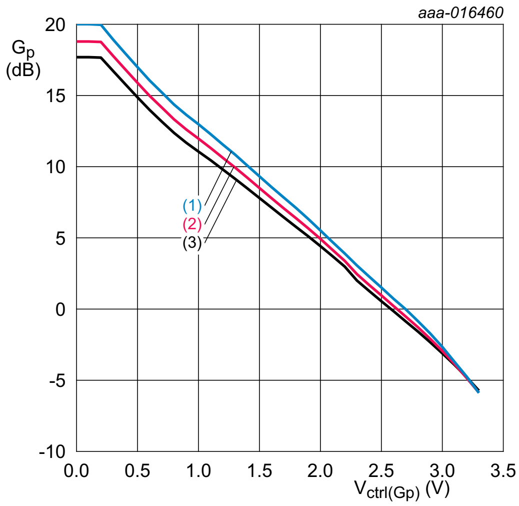
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 788 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 37. Power gain as a function of power gain control voltage in high gain mode; typical values



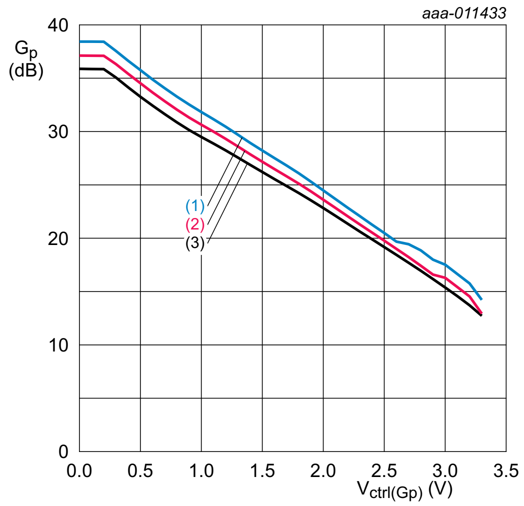
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 788 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 38. Power gain as a function of power gain control voltage in low gain mode; typical values



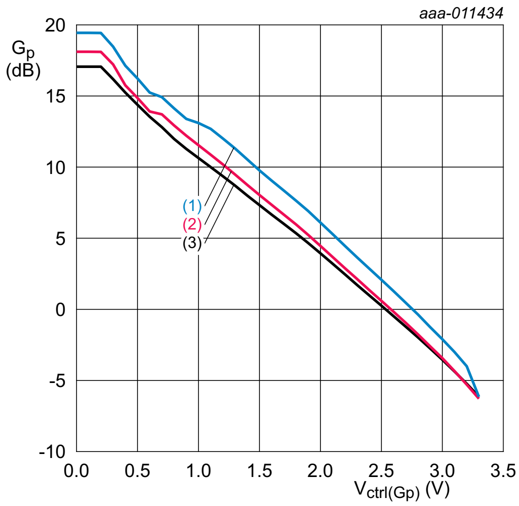
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 830 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 39. Power gain as a function of power gain control voltage in high gain mode; typical values



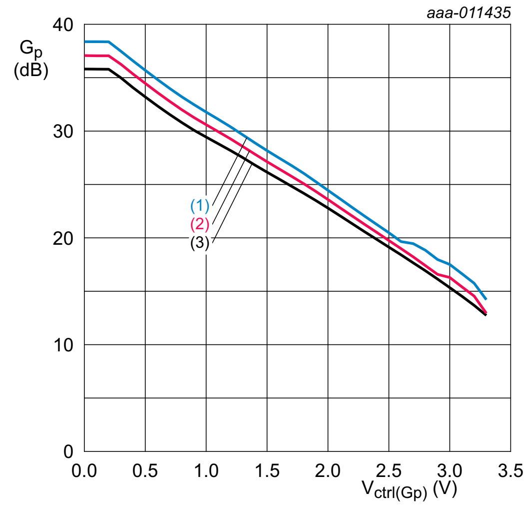
GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V;
f = 830 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 40. Power gain as a function of power gain control voltage in low gain mode; typical values



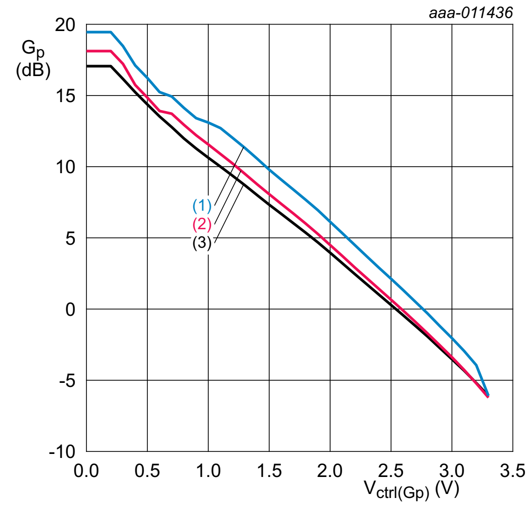
GS1 = LOW; GS2 = HIGH; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 41. Power gain as a function of power gain control voltage in high gain mode; typical values



GS1 = HIGH; GS2 = LOW; V_{CC1} = 5 V; V_{CC2} = 5 V; f = 850 MHz.

(1) T_{amb} = −40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +85 °C

Fig 42. Power gain as a function of power gain control voltage in low gain mode; typical values

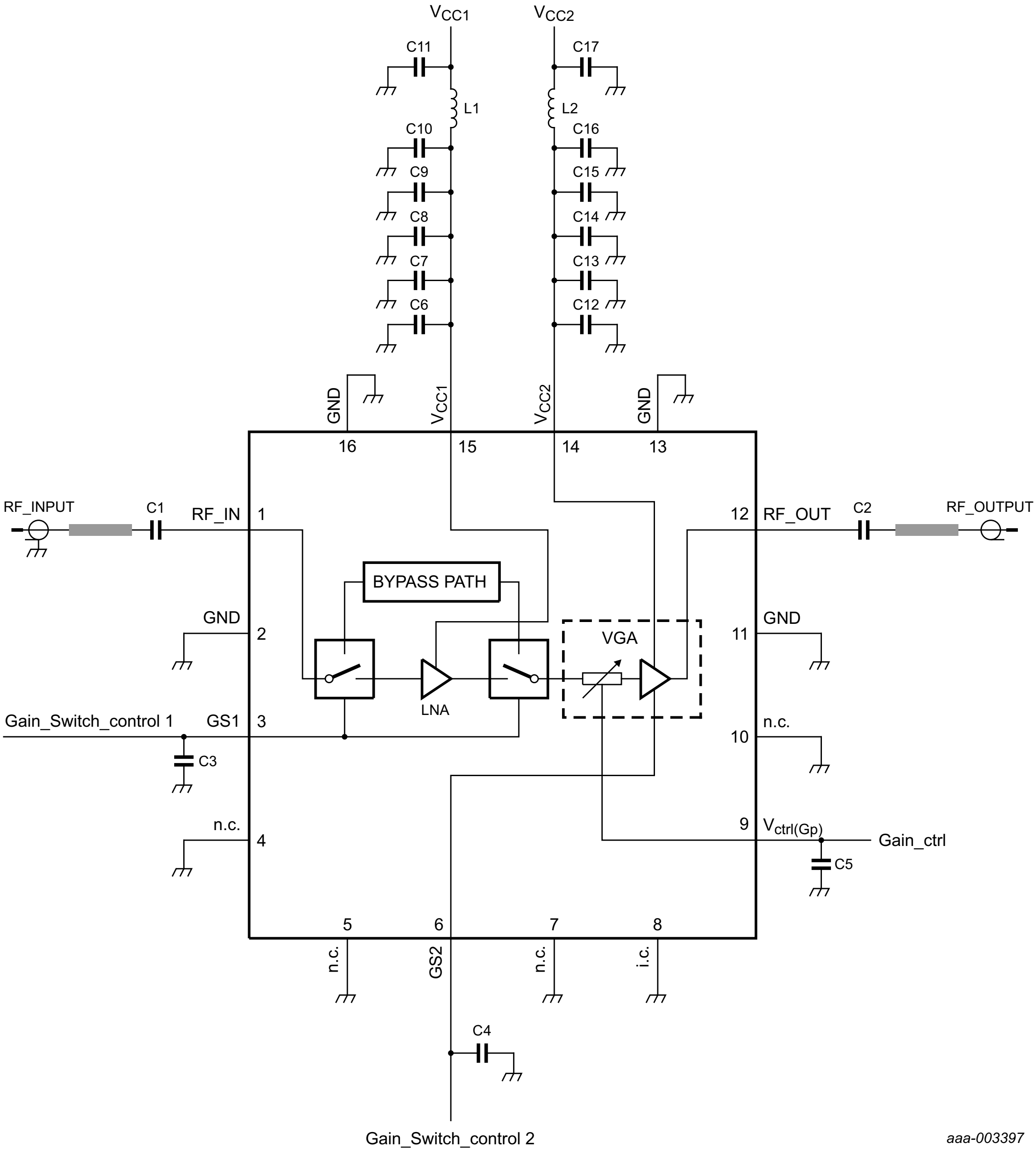
9. Application information

Table 16. List of components
For application circuit see Figure 43.

Component	Description	Value	Remarks
C1, C2	capacitor	1 nF [1]	0402
C3, C4, C5, C6, C12	capacitor	100 pF [1]	0402
C7, C8, C9, C10,	capacitor	optional	
C11, C17	capacitor	100 nF [1]	0402
C13, C14, C15, C16	capacitor	optional	
L1, L2	inductor	10 nH [2]	0402

[1] Murata GRM1555 series.

[2] Murata LQG15 series.

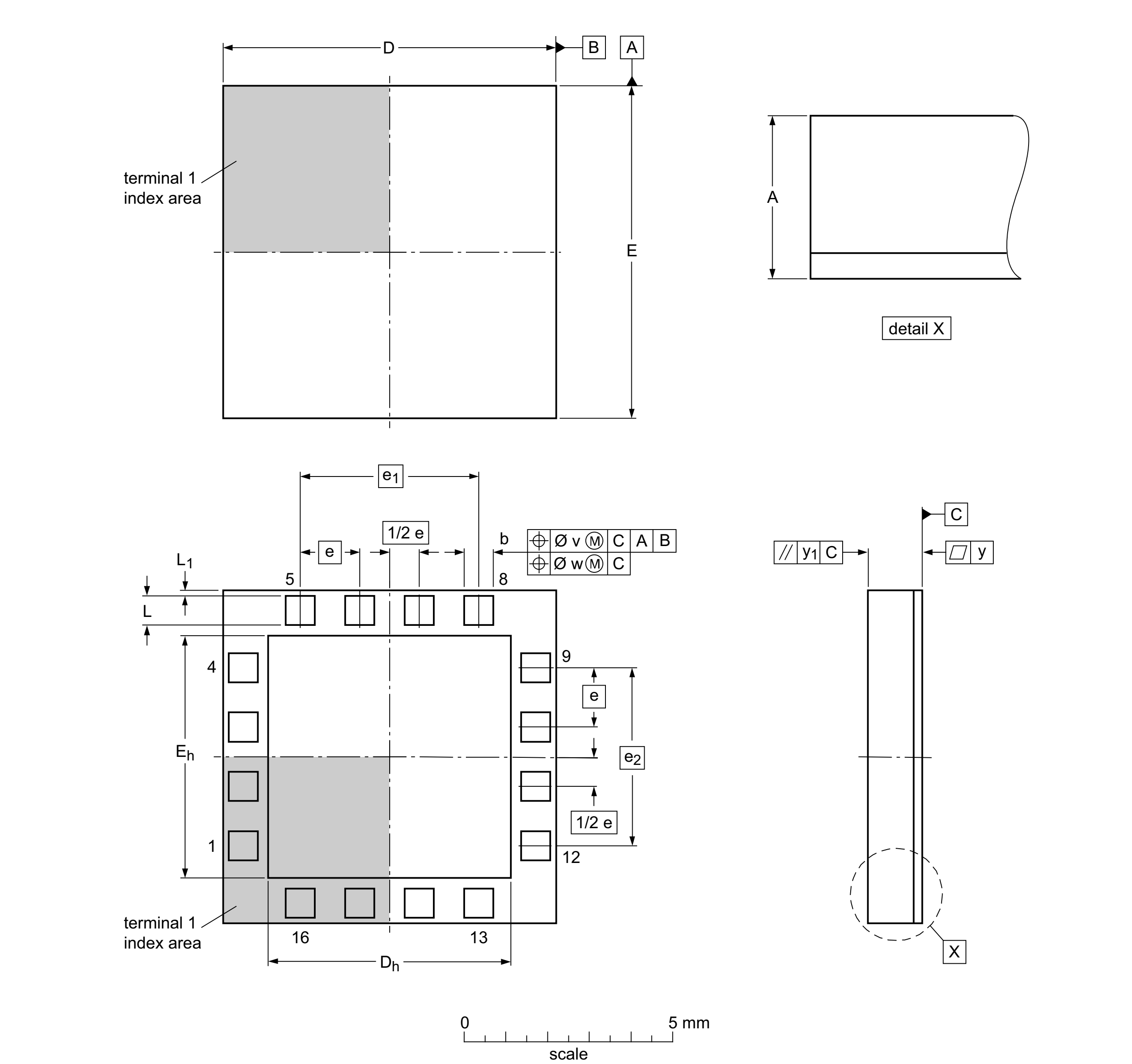


See Table 16 for a list of components.

Fig 43. Schematic layout for application circuit

10. Package outline

HLQFN16R: plastic thermal enhanced low profile quad flat package; no leads; 16 terminals; body 8 x 8 x 1.3 mm SOT1301-1



Dimensions

Unit		A	b	D	D_h	E	E_h	e	e_1	e_2	L	L_1	v	w	y	y_1
mm	max	1.40	0.75	8.1	5.85	8.1	5.85				0.75	0.15				
	nom	1.30	0.70	8.0	5.80	8.0	5.80	1.42	4.26	4.26	0.70	0.10	0.1	0.05	0.08	0.1
	min	1.25	0.65	7.9	5.75	7.9	5.75				0.65	0.05				

sot1301-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1301-1						~~11-08-23~~ 11-08-29

Fig 44. Package outline SOT1301-1 (HLQFN16R)

11. Abbreviations

Table 17. Abbreviations

Acronym	Description
3G	3rd Generation
ESD	ElectroStatic Discharge
LNA	Low Noise Amplifier
LTE	Long Term Evolution

12. Revision history

Table 18. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU7061 v.2	20150129	Product data sheet	-	BGU7061 v.1
Modifications:	• Section 1.1 on page 1: the frequency range has been extended to go from 770 MHz to 915 MHz • Section 1.4 on page 2: data measured at a frequency of 788 MHz has been added. • Section 1.4 on page 2: $IP3_i$ data measured at frequencies 830 MHz and 850 MHz have been changed. • Section 8.2 on page 7: section has been added • Table 11 on page 8: $IP3_i$ data have been changed • Table 13 on page 10: $IP3_i$ data have been changed • Figure 3 on page 11: figure has been updated • Figure 4 on page 11: figure has been updated • Figure 5 on page 12: figure has been updated • Figure 6 on page 12: figure has been updated • Figure 13 on page 14: figure has been added • Figure 14 on page 14: figure has been added • Figure 21 on page 16: figure has been added • Figure 22 on page 16: figure has been added • Figure 29 on page 18: figure has been added • Figure 30 on page 18: figure has been added • Figure 37 on page 20: figure has been added • Figure 38 on page 20: figure has been added			
BGU7061 v.1	20140121	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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