

# Low noise amplifier

## SPECIFICATION

### 1 FEATURES

- TSMC018 SiGe
- Operating frequency range 1550...1610 MHz
- High gain
- Low noise figure
- Output matching to 50  $\Omega$
- Current source type: temperature dependent or temperature independent
- Supported foundries: TSMC, UMC, Global Foundries, SMIC, iHP, AMS, Vanguard, SiTerra

### 2 APPLICATION

- Front-end HF signal amplification in receivers

### 3 OVERVIEW

Low noise amplifier (LNA) is usually used as the first stage of receivers and is characterized by low noise figure and high linearity.

LNA consists of two stages. The first one is based on the circuit with common emitter. Two elements are needed to provide the input matching. Cascode MOS-transistor is applied for good isolation between the input and the output of the amplifier. The second stage is an amplifier with common collector (emitter follower) matching the output to 50  $\Omega$  in the wide frequency range without using external elements.

The block is fabricated on TSMC018 SiGe technology.

### 4 STRUCTURE

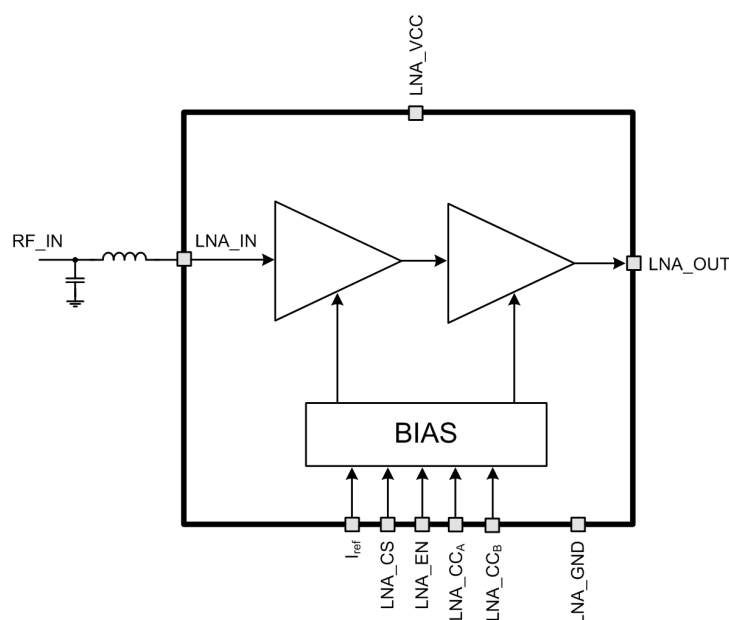


Figure 1: Low noise amplifier structure.

## 5 PIN DESCRIPTION

Name	Direction	Description
I <sub>ref</sub>	IO	Reference current 10 $\mu$ A
LNA_IN	I	LNA input
LNA_OUT	O	LNA output
LNA_CS	I	Digital code defined the current source type (temperature independent/temperature dependent)
LNA_CC <sub>A</sub> <2:0>	I	LNA first stage current consumption control
LNA_CC <sub>B</sub> <2:0>	I	LNA second stage current consumption control
LNA_EN	I	Enable/disable
LNA_VCC	IO	Supply voltage
LNA_GND	IO	Ground

## 6 LAYOUT DESCRIPTION

Low noise amplifier dimensions are given in the table 1.

Table 1: Block dimensions.

Dimension	Value	Unit
Height	381	$\mu\text{m}$
Width	661	$\mu\text{m}$

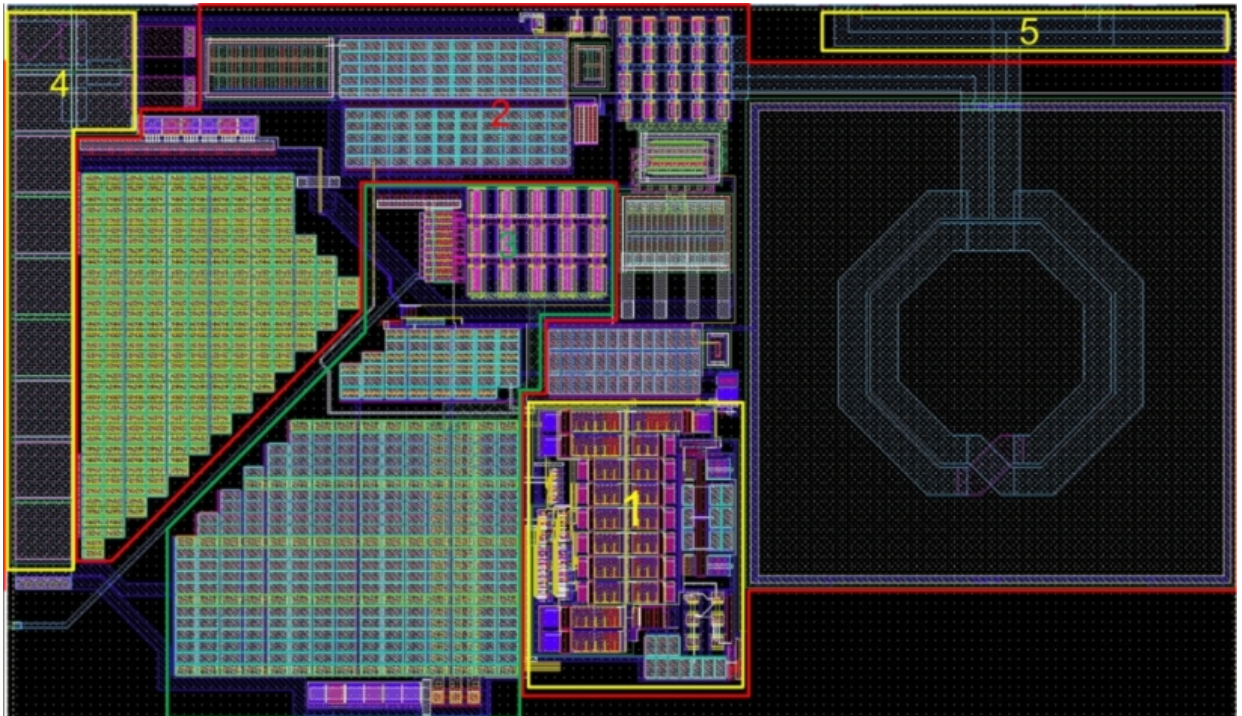


Figure 2: Low noise amplifier layout view.

1. Reference voltage and current source
2. LNA 1<sup>st</sup> stage
3. LNA 2<sup>nd</sup> stage
4. Supply voltage bus with filtering capacitors
5. Ground bus

## 7 OPERATING CHARACTERISTICS

### 7.1 TECHNICAL CHARACTERISTICS

Technology \_\_\_\_\_ TSMC018 SiGe  
 Status \_\_\_\_\_ silicon proven  
 Area \_\_\_\_\_ 0.26 mm<sup>2</sup>

### 7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for  $V_{cc} = 2.8 \div 3.6$  V and  $T = -40 \div +85^{\circ}\text{C}$ . Typical values are at  $V_{cc} = 3.15$  V,  $T = +27^{\circ}\text{C}$ , unless otherwise specified.

Parameter	Symbol	Condition	Value			Unit
			min	typ	max	
Supply voltage	$V_{cc}$	-	2.8	3.15	3.6	V
Operating temperature range	T	-	-40	+27	+85	$^{\circ}\text{C}$
Operating input frequency	$F_{IN}$	-	1550	-	1610	MHz
Noise figure	NF	-	-	1.5	-	dB
Gain	G	-	-	20	-	dB
Input VSWR	$VSWR_{IN}$	50 $\Omega$	-	1.5	-	-
Output VSWR	$VSWR_{OUT}$	50 $\Omega$	-	1.5	-	-
Input 1dB compression point	$P_{1dB}$	-	-	-28	-	dBm
Intermodulation point 3 <sup>rd</sup> order	IIP3	-	-	-18	-	dBm
Current limit	$I_{cc}$	-	4.3	7.2	11.2	mA
Stand-by current	$I_{stb}$	-	-	-	250	nA
Input logic-level high	$V_{IH}$	For digital inputs	$0.7V_{cc}$	-	$V_{cc}+0.25$	V
Input logic-level low	$V_{IL}$		-0.25	-	0.3	V

## 8 DELIVERABLES

IP contents:

- Schematic or NetList
- Layout or blackbox
- Extracted view (optional)
- GDSII
- DRC, LVS, antenna report
- Test bench with saved configurations (optional)
- Documentation