

# Voltage-controlled oscillator

## SPECIFICATION

### 1 FEATURES

- iHP SiGe BiCMOS 0.25 um
- Low phase noise
- Wide frequency range
- Adjustable output amplitude
- Low current consumption
- Portable to other technologies (upon request)

### 2 APPLICATION

- Phase-locked loop synthesizer

### 3 OVERVIEW

Voltage-controlled oscillator (VCO) is the generator that can be tuned over a wide range of frequencies by applying a control voltage to it.

This structure consists of two VCO cores: HF VCO for L1 (1590...1606 MHz) band and LF VCO for L2 (1237...1259 MHz) band which outputs are multiplexed. The VCO output signal can be fed to internal blocks or to external devices through buffer LO<sub>out</sub>. Also it is able to work with an external generator signal from a buffer LO<sub>in</sub>.

The block is fabricated on iHP SiGe BiCMOS 0.25 um technology.

### 4 STRUCTURE

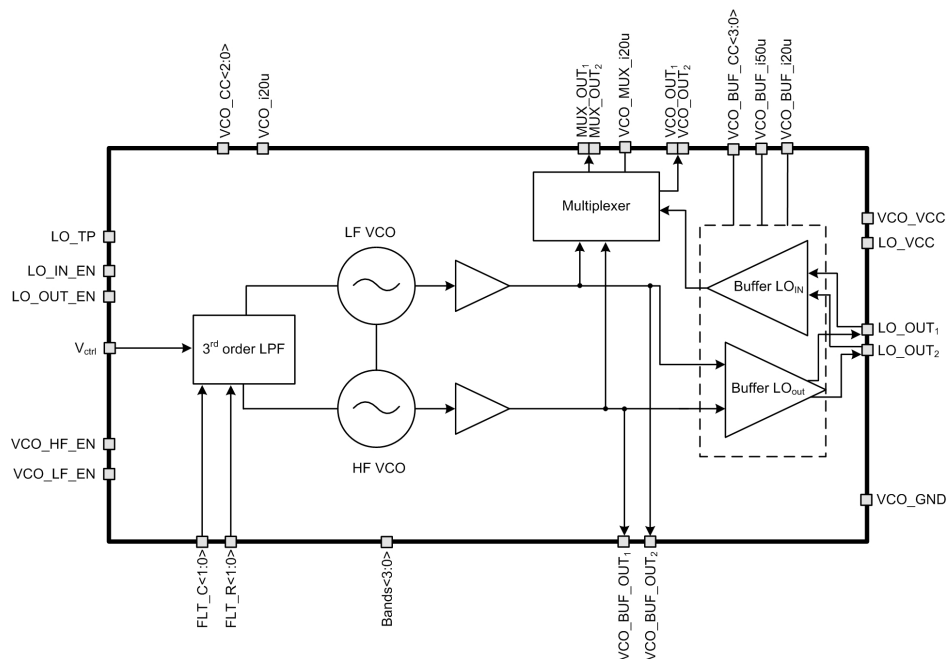


Figure 1: Voltage-controlled oscillator structure

## 5 PIN DESCRIPTION

Name	Direction	Description
VCO_i20u	IO	VCO reference current 20 uA
VCO_BUF_i20u	IO	VCO output buffer current 20 uA
VCO_BUF_i50u	IO	VCO output LO <sub>out</sub> buffer current 50 uA
VCO_MUX_i20u	IO	VCO output multiplexer current 20 uA
Vctrl	I	Control voltage
LO_TP	I	Heterodyne signal source type (internal/external)
VCO_HF_EN	I	HF VCO enable/disable
VCO_LF_EN	I	LF VCO enable/disable
LO_IN_EN	I	Enable/disable of input buffer for external heterodyne signal
LO_OUT_EN	I	Enable/disable of output buffer for external heterodyne signal
Bands<2:0>	I	Subband select system
VCO_CC<2:0>	I	VCO current consumption
VCO_BUF_CC<1:0>	I	VCO output buffer current consumption
FLT_C<1:0>	I	Digital code for a selection of control voltage filter capacitor
FLT_R<1:0>	I	Digital code for a selection of control voltage filter resistor
VCO_BUF_OUT <sub>1</sub>	IO	VCO buffer differential output
VCO_BUF_OUT <sub>2</sub>	IO	
LO_OUT <sub>1</sub>	IO	Heterodyne differential input/output
LO_OUT <sub>2</sub>	IO	
MUX_OUT <sub>1</sub>	IO	VCO multiplexer differential output (1)
MUX_OUT <sub>2</sub>	IO	
MUX_OUT <sub>3</sub>	IO	VCO multiplexer differential output (2)
MUX_OUT <sub>4</sub>	IO	
VCO_VCC	IO	Supply voltage
LO_VCC	IO	Supply voltage of input/output buffer for heterodyne signal
VCO_GND	IO	Ground
LO_GND	IO	Ground of input/output buffer for heterodyne signal

## 6 LAYOUT DESCRIPTION

Voltage controlled oscillator dimensions are given in the table 1.

Table 1: Block dimensions.

Dimension	Value	Unit
Height	1140	um
Width	1360	um

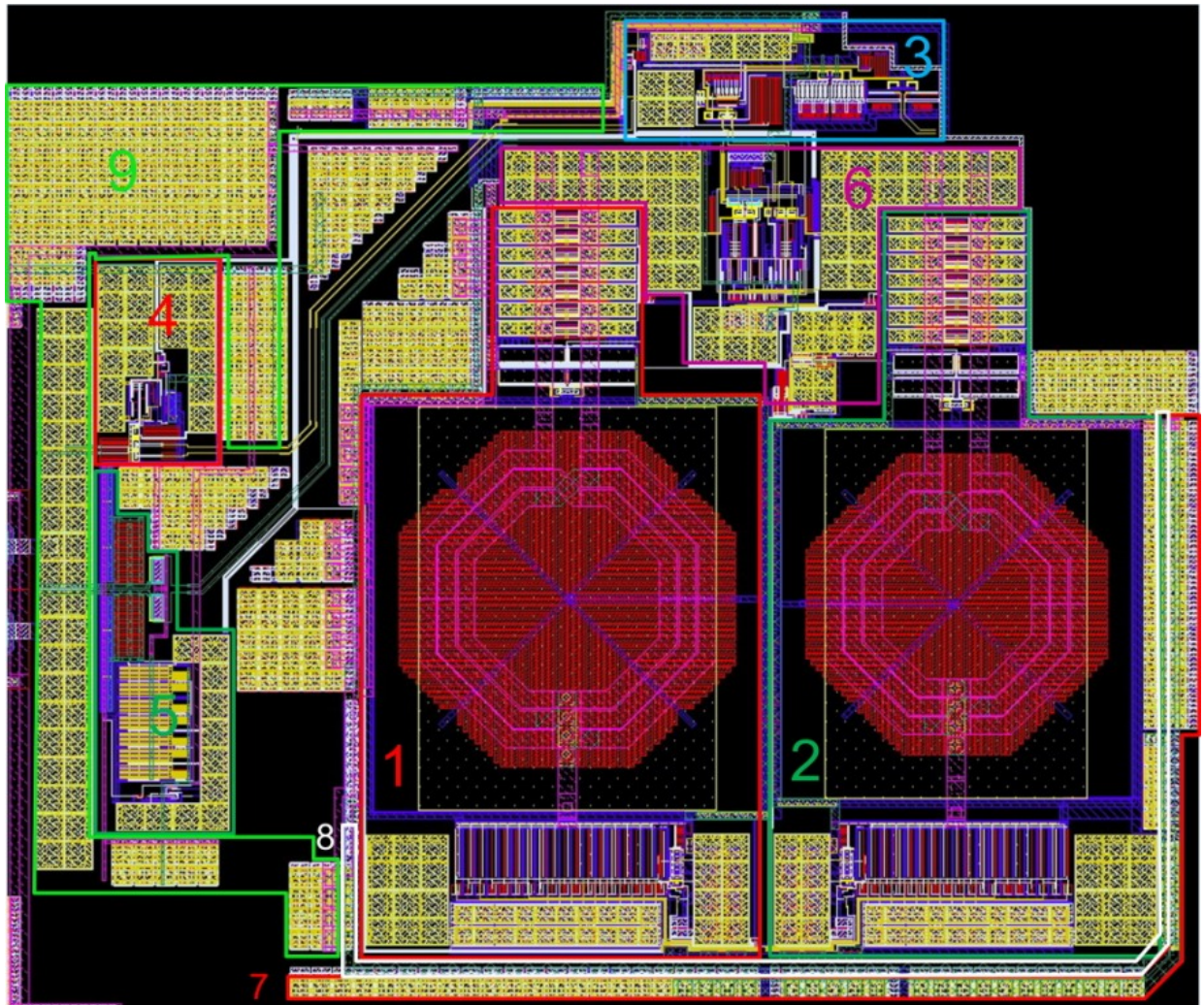


Figure 2: Voltage-controlled oscillator layout view

1. HF VCO core
2. LF VCO core
3. Multiplexer
4. VCO buffer LO<sub>IN</sub>
5. VCO buffer LO<sub>OUT</sub>
6. Ground bus with filter capacitors
7. Supply voltage bus with filter capacitors
8. Filter capacitors

## 7 OPERATING CHARACTERISTICS

### 7.1 TECHNICAL CHARACTERISTICS

Technology \_\_\_\_\_ iHP SiGe BiCMOS 0.25 um  
Status \_\_\_\_\_ silicon proven  
Area \_\_\_\_\_ 0.27 mm<sup>2</sup>

### 7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for  $V_{cc} = 1.8 \div 2.7$  V and  $T_a = -60 \div +125^\circ\text{C}$ . Typical values are at  $V_{cc} = 2.0$  V,  $T_a = +27^\circ\text{C}$ , unless otherwise specified.

Parameter	Symbol	Condition	Value			Unit
			min	typ.	max	
Supply voltage	$V_{cc}$	-	1.8	2.0	2.7	V
Operating temperature range	$T_a$	-	-60	27	125	$^\circ\text{C}$
HF VCO frequency tuning range	F	Min. frequency	-	1260	1303	MHz
		Max. frequency	1975	2084	-	
LF VCO frequency tuning range	F	Min. frequency	-	1130	1183	MHz
		Max. frequency	1785	1869	-	
HF VCO phase noise	NF	100 kHz	-	-92	-	dBm/Hz
LF VCO phase noise	NF	100 kHz	-	-93	-	dBm/Hz
Control voltage	$V_{ctrl}$	-	0.3	-	2.2	V
Tuning sensitivity (for HF and LF VCO)	K	$V_{ctrl} = 1$ V	-	153	-	MHz/V
Output amplitude (for HF and LF VCO)	$A_{out\ p-p}$	Differential output	-	400	-	mV
Supply current*	$I_{cc}$	-	-	3.27	-	mA
Stand-by current*	$I_{stb}$	-	-	2	-	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	-	0.3	V

Note:

\* – the values for the one of VCOs: HF VCO or LF VCO.

## 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