

# Voltage-controlled oscillator

## SPECIFICATION

### 1 FEATURES

- TSMC SiGe BiCMOS 180nm technology
- 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 ( $V_{ctrl}$ ).

Frequency tuning range (3995...4708 MHz) is defined by a control voltage of a build-in switched capacitor sections, and the built-in varicap is used for a fine adjustment.

The block is fabricated on TSMC SiGe BiCMOS 180nm technology.

### 4 STRUCTURE

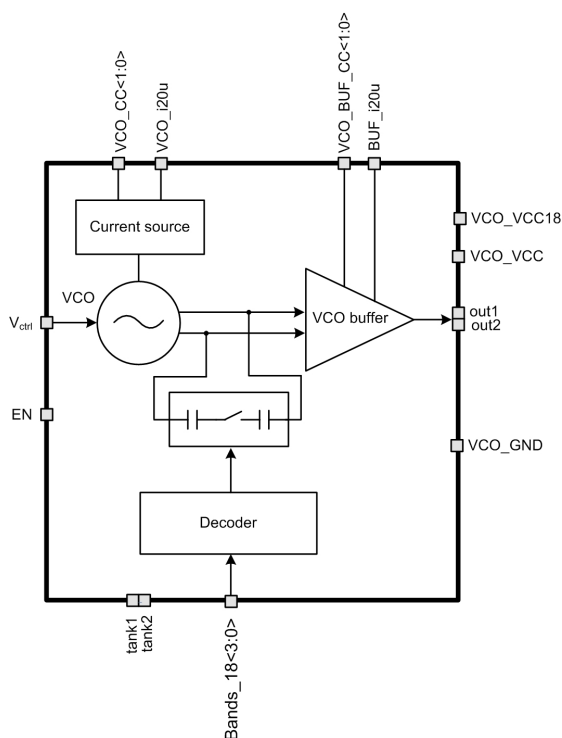


Figure 1: Voltage-controlled oscillator structure

## 5 PIN DESCRIPTION

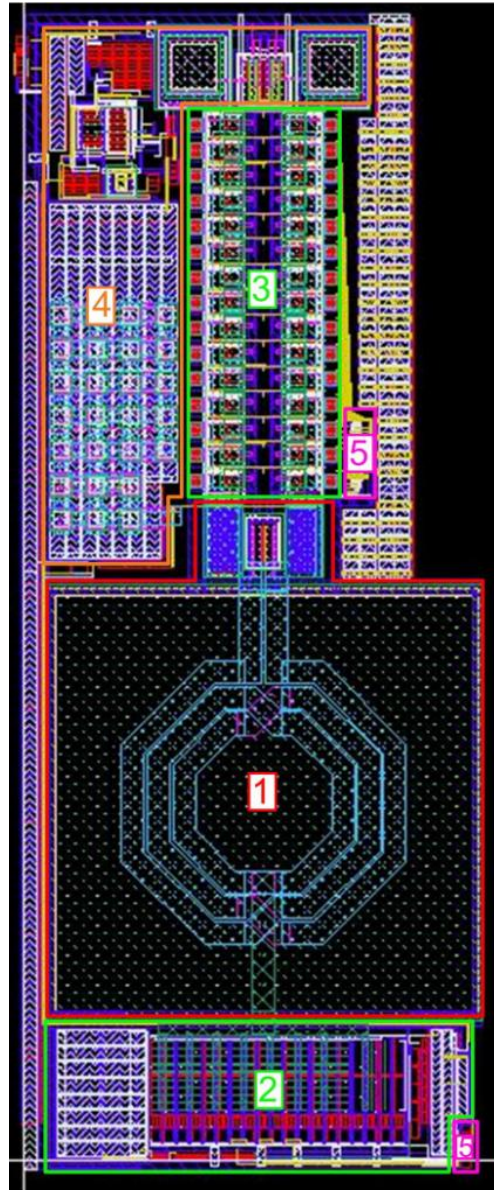
Name	Direction	Description
VCO_i20u	IO	VCO reference current
BUF_i20u	IO	VCO output buffer current
V <sub>ctrl</sub>	I	Control voltage
EN	I	VCO enable/disable
Bands_18<3:0>	I	Digital code defined a subband selection
VCO_BUF_CC<1:0>	I	VCO output buffer current consumption control
VCO_CC<1:0>	I	VCO current consumption control
tank1	O	VCO differential output, unused
tank2	O	
out1	O	VCO output buffer differential output
out2	O	
VCO_VCC18	IO	Supply voltage 1.8 V
VCO_VCC	IO	Supply voltage 3 V
VCO_GND	IO	Ground

## 6 LAYOUT DESCRIPTION

Voltage controlled oscillator dimensions are given in the table 1.

**Table 1:** Block dimensions.

Dimension	Value	Unit
Height	765	$\mu\text{m}$
Width	302	$\mu\text{m}$



**Figure 2:** VCO layout view

1. VCO core
2. Current source
3. Band cells
4. VCO buffer
5. Decoder

## 7 OPERATING CHARACTERISTICS

### 7.1 TECHNICAL CHARACTERISTICS

Technology \_\_\_\_\_ TSMC SiGe BiCMOS 180nm  
 Status \_\_\_\_\_ silicon proven  
 Area \_\_\_\_\_ 0.23mm<sup>2</sup>

### 7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for  $V_{cc\_3.0v} = 2.8 \div 3.6$  V,  $V_{cc\_1.8v} = 1.6 \div 2.0$  V and  $T = -40 \div +85^{\circ}\text{C}$ . Typical values are at  $V_{cc\_3.0v} = 3.15$  V,  $V_{cc\_1.8v} = 1.8$  V and  $T = +27^{\circ}\text{C}$ ., unless otherwise specified.

Parameter	Symbol	Condition	Value			Unit
			min	typ	max	
Supply voltage	$V_{cc\_1.8v}$	-	1.6	1.8	2.0	V
	$V_{cc\_3.0v}$	-	2.8	3.15	3.6	
Operating temperature range	T	-	-40	+27	+85	$^{\circ}\text{C}$
VCO frequency tuning range	F	Min. frequency	-	3995	4309	MHz
		Max. frequency	4457	4708	-	MHz
Phase noise	NF	100 KHz	-	-93	-	dBm/Hz
		1 MHz	-	-115	-	
Control voltage	$V_{ctrl}$	-	0.3	-	2.6	V
Tuning sensitivity	K	$V_{ctrl} = 1$ V	-	94	-	MHz/V
Adjustable output amplitude	$A_{out\ p-p}$	Differential output	400	-	-	mV
Supply current	$I_{cc}$	-	2.61	3.69	4.23	mA
Stand-by current	$I_{stb}$	-	-	5	150	nA
Input logic-level high	$V_{IH}$	For digital inputs	$0.7V_{cc\_3.0v}$	-	$V_{cc\_3.0v} + 0.25$	V
Input logic-level low	$V_{IL}$		-0.25	-	$0.3 V_{cc\_3.0v}$	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