

## Voltage-controlled oscillator

### SPECIFICATION

#### 1 FEATURES

- SMIC CMOS 0.18 $\mu$ m
- Wide frequency range (2.8...3.3 GHz)
- Wide range of control voltage (300...1500 mV)
- Built-in switched capacitor sections for VCO frequency adjustment
- No external components required
- Portable to other technologies (upon request)

#### 2 APPLICATION

- Phase-locked loop synthesizer
- Functional signal generators

#### 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. The device uses internal oscillation circuit and operates without external components. Frequency tuning range is defined by a control voltage of a built-in switched capacitor sections, and the built-in varicap is used for a fine adjustment. The block is fabricated on SMIC CMOS 0.18 $\mu$ m technology.

#### 4 STRUCTURE

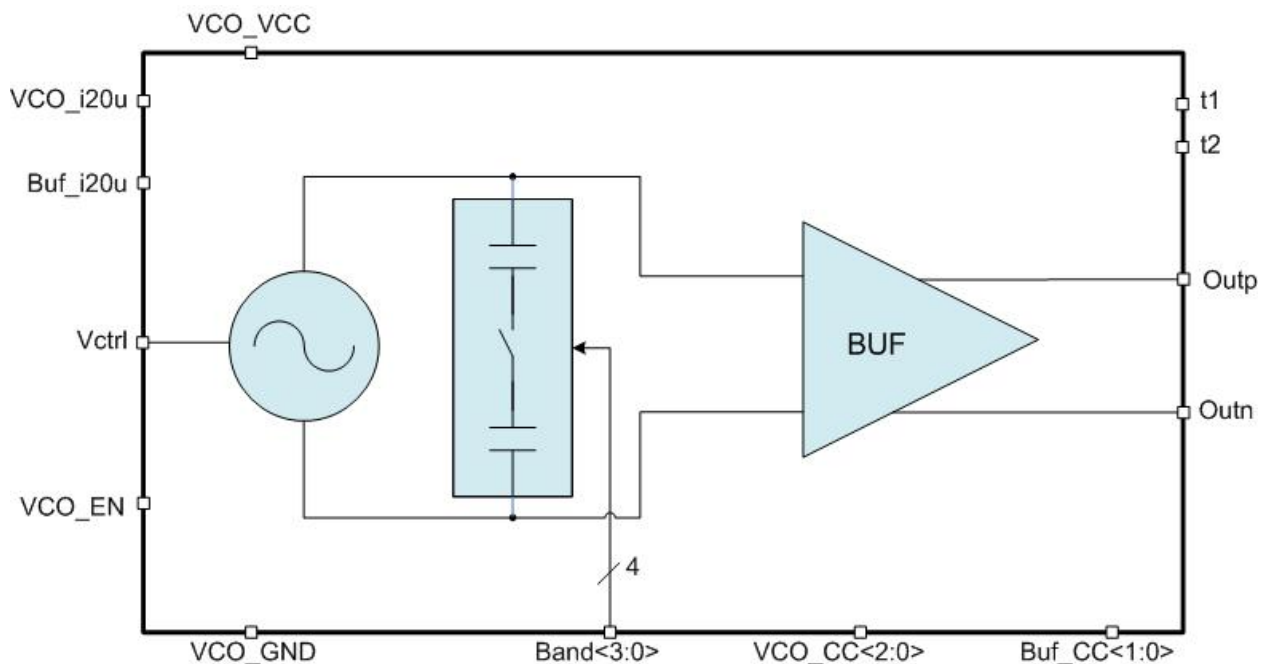


Figure 1: Voltage-controlled oscillator structure

## 5 PIN DESCRIPTION

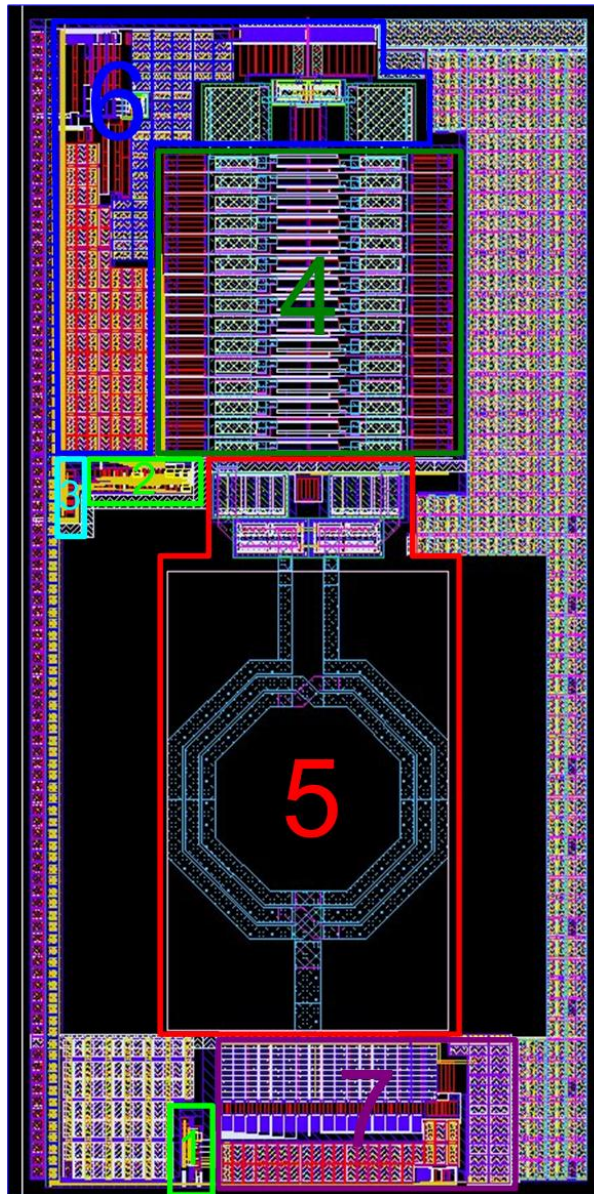
| Name        | Direction | Description                               |
|-------------|-----------|---|
| VCO_i20u    | IO        | VCO core reference current (20 $\mu$ A)   |
| BUF_i20u    | IO        | VCO buffer reference current (20 $\mu$ A) |
| VCO_EN      | I         | Buffer enable / disable                   |
| Vctrl       | IO        | Control voltage input                     |
| Band<3:0>   | I         | Switching capacitor sections              |
| VCO_CC<2:0> | IO        | VCO core current selection                |
| Buf_CC<1:0> | IO        | Buffer current selection                  |
| t1          | IO        | VCO core outputs                          |
| t2          | IO        |   |
| Outp        | IO        | VCO core differential output              |
| Outn        | IO        |   |
| VCO_VCC     | IO        | Supply voltage                            |
| VCO_GND     | IO        | Ground                                    |

## 6 LAYOUT DESCRIPTION

The block dimensions are given in the table 1.

**Table 1:** Block dimensions.

| Dimension | Value  | Unit          |
|-----------|--------|---------------|
| Height    | 314.37 | $\mu\text{m}$ |
| Width     | 660.67 | $\mu\text{m}$ |



**Figure 2:** Device layout view

1. Decoder of VCO core reference current source
2. Trimmer capacitors decoder
3. Decoder of VCO buffer reference current source
4. Switched capacitors sections
5. VCO core
6. VCO buffer
7. VCO and buffer current source

## 7 OPERATING CHARACTERISTICS

### 7.1 TECHNICAL CHARACTERISTICS

Technology \_\_\_\_\_ SMIC CMOS 0.18 $\mu$ m  
 Status \_\_\_\_\_ silicon proven  
 Area \_\_\_\_\_ 0.21 mm<sup>2</sup>

### 7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for  $V_{cc} = 1.7 \div 1.9$  V and  $T = -45 \div +85$  °C. Typical values are at  $V_{cc} = 1.8$  V,  $T = +27$  °C, unless otherwise specified.

| Parameter                             | Symbol              | Condition           | Value       |     |       | Unit   |
|---------------------------------------|---------------------|---------------------|-------------|-----|-------|--------|
|                                       |                     |                     | min         | typ | max   |        |
| Supply voltage                        | $V_{cc}$            | -                   | 1.7         | 1.8 | 1.9   | V      |
| Operating temperature range           | T                   | -                   | -45         | 27  | 85    | °C     |
| Oscillation frequency                 | $F_{VCO}$           | -                   | 2.8         | -   | 3.3   | GHz    |
| Output amplitude                      | $A_{VCO}$           | Differential output | 742         | -   | -     | mV     |
| Control voltage                       | $V_{ctrl}$          | -                   | 0.3         | -   | 1.5   | V      |
| Phase noise                           | PhN <sub>100K</sub> | at 100 kHz          | -           | -90 | -     | dBc/Hz |
| Tuning sensitivity                    | $K_{VCO}$           | -                   | 75.5        | -   | 110.1 | MHz/V  |
| Current consumption in an active mode | $I_{cc}$            | -                   | -           | -   | 3.75  | mA     |
| Current consumption in a standby mode | $I_{stb}$           | -                   | -           | 26  | -     | nA     |
| Input logic-high level                | $V_{IH}$            | For digital inputs  | $0.7V_{cc}$ | -   | 3.6   | V      |
| Input logic-low level                 | $V_{IL}$            |                     | -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

## REVISION HISTORY

1. From version 1.0:
  - Table “Pin description” (refer to page 2)