# 11MHz to 25MHz band-pass filter

# SPECIFICATION

## 1 FEATURES

- SMIC CMOS 0.18 µm
- Wide cut-off frequency adjustment range (11MHz…25MHz)
- Programmable bandwidth
- Narrowband and wideband modes (3MHz, 5MHz)
- Automatic cut-off frequency adjustment system
- There are 4 operation modes
- No external components required
- Portable to other technologies (upon request)

## 2 APPLICATION

- Intermediate frequency signal processing
- Navigation systems

## 3 FUNCTIONAL DESCRIPTION

Band-pass filter (BPF) is two coupled circuits with capacitive external coupling. There are two modes for cut-off frequency programming: manually or automatically. In automatic mode one of the circuits is used in an oscillator mode therewith the oscillation frequency correlates with the BPF central frequency.

BPF operates in narrowband (GPS) or wideband (Galileo) modes with a bandwidth of 3 MHz and 5 MHz, respectively.

There are 4 operation modes with different rated signal level under the same value of distortion. Greater level of signal corresponds to a higher current consumption.

The block is fabricated on SMIC CMOS 0.18 µm technology.

# 4 STRUCTURE

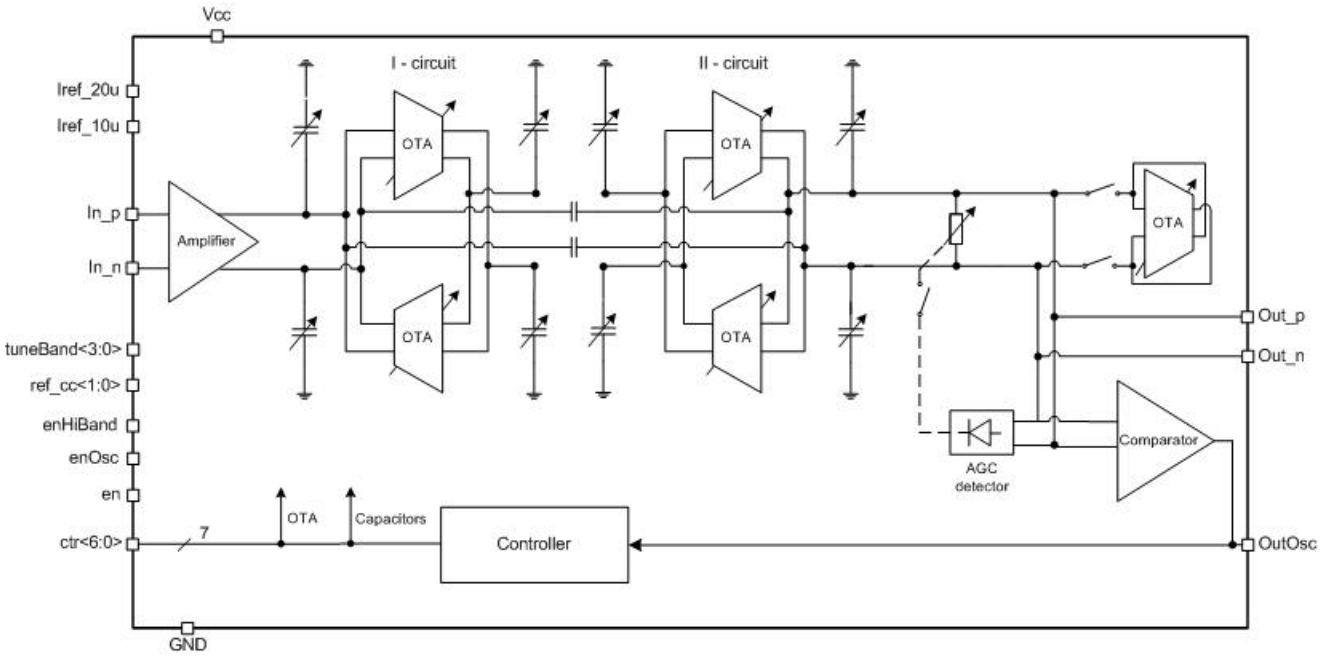


Figure 1: Band-pass filter structure

# 5 PIN DESCRIPTION

| Name | Direction | Description |
|---|---|---|
| In_p | I | Analog differential input |
| In_n | I | |
| ctr<6:0> | I | Digital code controlling a central frequency |
| tuneBand<3:0> | I | Passband width adjustment |
| ref_cc<1:0> | I | Reference voltage control |
| Iref_20uA | I | Reference current (20 µA) |
| Iref_10uA | I | Reference current (10 µA) |
| enHiBand | I | Galileo mode enable (wideband)) |
| enOsc | O | Oscillator mode enable |
| en | I | Enable/disable |
| Out_p | O | Analog differential output |
| Out_n | O | |
| OutOsc | O | Oscillator digital output |
| Vcc | IO | Supply voltage |
| Gnd | IO | Ground |

# 6 LAYOUT DESCRIPTION

The block dimensions are given in the table 1.

Table 1: Block dimensions

| Dimension | Value | Unit |
|---|---|---|
| Height | 541.2 | µm |
| Width | 540.87 | µm |

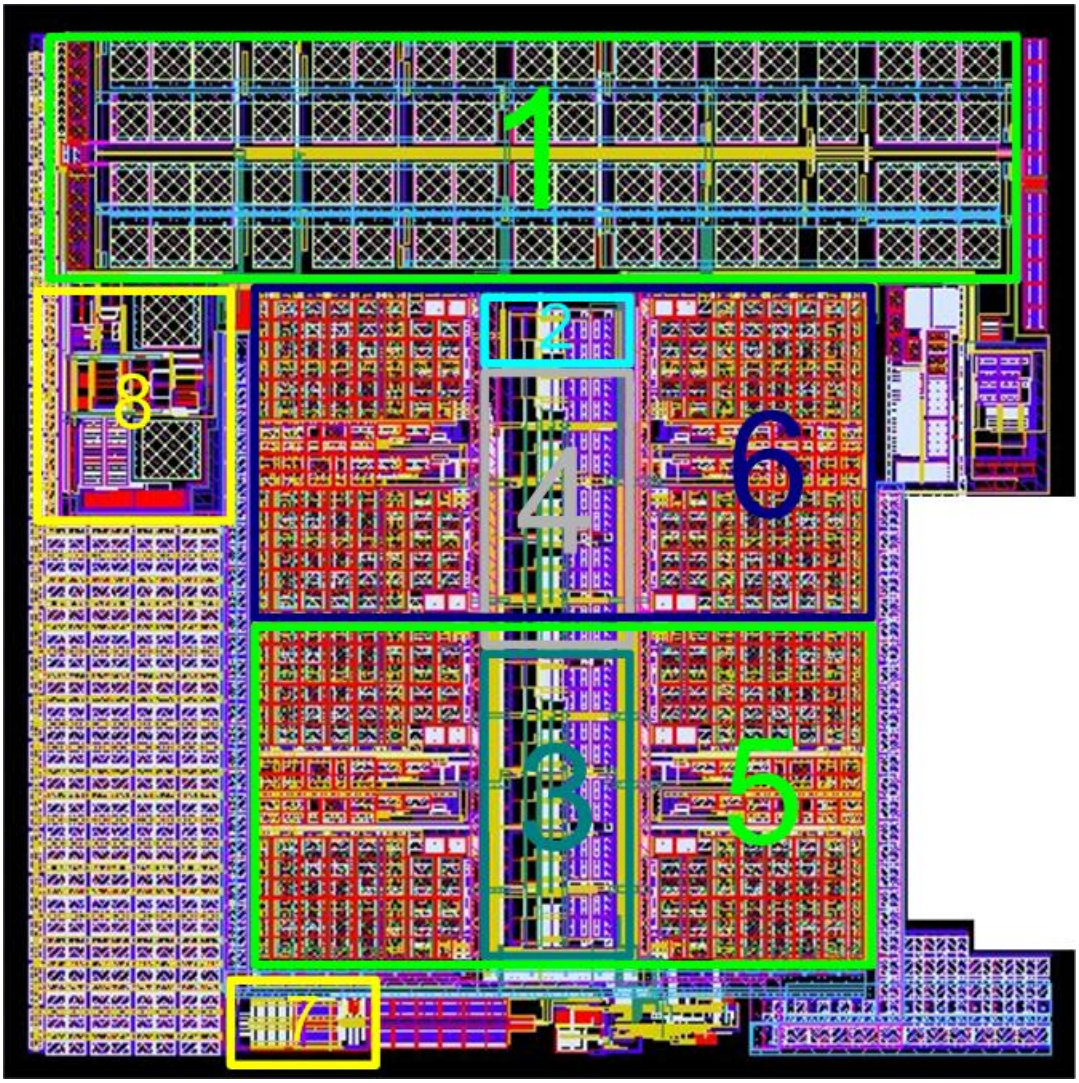


Figure 2: Device layout

1. Capacitive coupling
2. Negative resistance circuit
3. The 1st circuit gyrator
4. The 2nd circuit gyrator
5. The 1st circuit tuned capacitors
6. The 2nd circuit tuned capacitors
7. Amplifier
8. Detector

# 7 OPERATING CHARACTERISTICS

## 7.1 TECHNICAL CHARACTERISTICS

Technology SMIC CMOS 0.18 µm
Status silicon proven
Area 0.3 $mm^2$

## 7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for $V_{cc}$ = 1.7 ÷ 1.9 V and Ta = -45 ÷ +90 °C. Typical values are at $V_{cc}$ = 1.8 V and Ta = +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 | Ta | - | -45 | 27 | 90 | ºC |
| Input frequency range | $F_{in}$ | GPS | 10.76 | - | 18.76 | MHz |
| | | Galileo | 8.3 | - | 15.62 | |
| Filter order | k | - | - | 2 | - | - |
| Insertion loss | G | GPS | - | 10 | - | dB |
| | | Galileo | - | 12 | - | |
| Input signal bandwidth | F | GPS | - | 3 | - | MHz |
| | | Galileo | - | 5 | - | |
| Noise figure | NF | GPS | - | 18.86 | 9.4 | dB |
| | | Galileo | - | 15.08 | 9.8 | dB |
| 1 dB compression point | $P_{1dB}$ | - | - | -43.3 | - | dBm |
| 3rd order intercept point | IP3 | - | - | -12.6 | - | dBm |
| Input impedance | $R_{in}$ | Differential input | - | 2 | - | kΩ |
| Output impedance | $R_{out}$ | Differential output | - | 2 | - | kΩ |
| Current consumption | $I_{cc}$ | - | - | 3.63 | 4.8 | mA |
| Current consumption in a standby mode | $I_{stb}$ | - | - | - | 1 | µA |
| Input logic-high level | $V_{IH}$ | For digital inputs | 0.7 $V_{cc}$ | - | 3.6 | V |
| Input logic-low level | $V_{IL}$ | | -0.25 | - | 0.3 | V |

# 8 DELIVERABLES

Depending on license type IP may include:

- Schematic or NetList
- Abstract view (.lef and .lib files)
- Layout (optional)
- Verilog behavior model
- Extracted view (optional)
- GDSII
- DRC, LVS, antenna report
- Test bench with saved configurations (optional)
- Documentation