

1571 to 1606 MHz mixer with polyphase filter

SPECIFICATION

1 FEATURES

- SMIC CMOS 0.18 μ m
- Adjusted gain
- Built-in matched input
- Reference current 10 μ A
- Supply voltage 1.8 V
- Temperature compensation
- Adding of built-in 1.8 V voltage regulator available
- Supported foundries: TSMC, UMC, Global Foundries, SMIC, iHP, AMS, Vanguard, SilTerra

2 APPLICATION

- Mobile devices
- Navigation receiver

3 OVERVIEW

The cell includes matched input, intermediate and output buffers with gain control, separated quadrature mixers and polyphase filter. Quadrature mixer is based on Gilbert cells and converts RF frequency to a low intermediate frequency (IF). Polyphase filter is used to block image frequency signal. Buffer amplifiers are used to improve qualitative characteristics, reduce input signals and improve output signals, reduce rejection, harmonic and intermodulation distortions. The block is fabricated on SMIC CMOS 0.18 μ m technology.

4 STRUCTURE

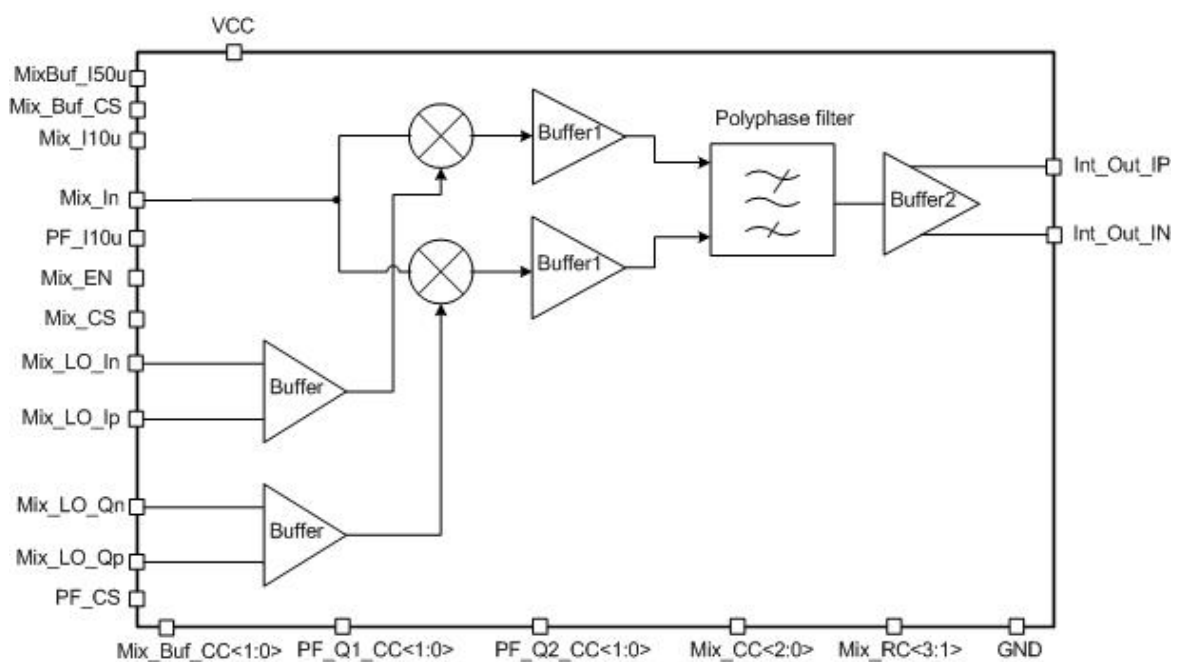


Figure 1: Mixer structure

5 PIN DESCRIPTION

Name	Direction	Description
MixBuf_I50u	I	Buffer reference current (50 μ A)
Mix_Buf_CS	I	Buffer temperature compensation mode enable
Mix_I10u	I	Mixer reference current (10 μ A)
Mix_In	I	Mixer input
PF_I10u	I	Polyphase filter buffer current
Mix_EN	I	Enable/ disable
Mix_CS	I	Mixer temperature compensation mode enable
MIX_LO_In	I	Quadrature mixer differential input for local-oscillator signals
MIX_LO_Ip	I	
MIX_LO_Qn	I	
MIX_LO_Qp	I	
Int_Out_IP	O	Differential mixer output
Int_Out_IN	O	
PF_CS	I	Polyphase filter temperature compensation mode enable
Mix_Buf_CC<1:0>	I	Buffer current consumption control
PF_Q1_CC<1:0>	I	Buffer 1 current consumption control
PF_Q2_CC<1:0>	I	Buffer 2 current consumption control
MIX_CC<2:0>	I	Mixer current consumption control
MIX_RC<2:0>	I	Input matching adjustment
MIX_i1u	I	Reference current (1 μ A)
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	646.8	μm
Width	808.5	μm

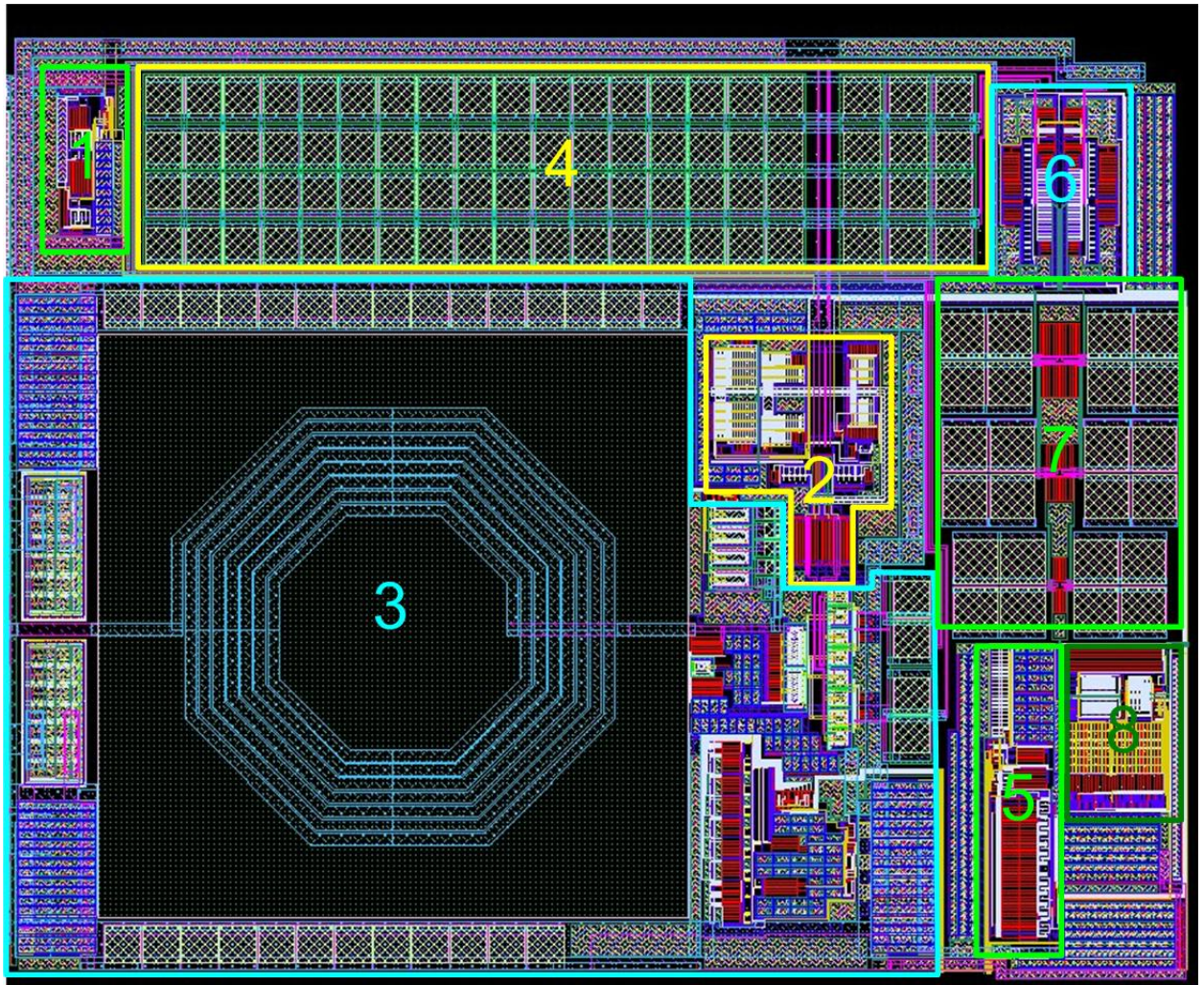


Figure 2: Device layout

1. Reference current source
2. Mixer buffer
3. Mixer core
4. Separating capacitors
5. Polyphase filter reference current
6. Polyphase filter input buffer
7. Polyphase filter
8. Polyphase filter output buffer

7 OPERATING CHARACTERISTICS

7.1 TECHNICAL CHARACTERISTICS

Technology _____ SMIC CMOS 0.18 μ m
 Status _____ silicon proven
 Area _____ 0.5mm²

7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for $V_{cc} = 1.7 \div 1.9$ V and $T_a = -45 \div +90$ °C. Typical values are at $V_{cc} = 1.8$ V and $T_a = +27$ ° 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_a	-	-45	27	90	°C
Input frequency range	F_{in}	Band L1	1571	-	1579	MHz
		Band L2	1598	-	1606	
Local-oscillator frequency	F_{osc}	-	-	1589.8	-	MHz
Output frequency range	F_{out}	-	8.3	-	18.76	MHz
Input SWR	SWR	50 Ω without external matching circuits	-	1.16	1.25	-
Noise figure	NF	-	-	9	9.23	dB
Power gain	G_p	Signal source 50 Ω , loading 2 k Ω	-	6.5	-	dB
Gain ripple	G	-	-	2.0	-	dB
Input 1dB compression point	P_{1dB}	-	-	-32	-	dBm
Input impedance	R_{in}	-	1800	2000	2200	Ω
Peak-to-peak voltage at mixer differential input	A	With loading 1pF	-	1.232	-	mV
Polyphase filter poles	P_s	-	-	4.8	-	MHz
			-	10.0	-	
			-	21.0	-	
Image channel rejection	S_{ch}	At quadrature signals differed from 90° no more than 3°	35	-	-	dB
Group delay time ripple	t_{del}	In IF range in view of polyphase filter	-	7.97	-	ns
Current consumption	I_{cc}	-	-	4.71	-	mA
Current consumption in a standby mode	I_{stb}	-	-	15.05	-	nA
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

Note:

The local-oscillator with rectangular pulse is recommended to use for getting optimal parameters.

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