24 GHz Transceiver with two RX-Channels

SILICON radar

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Preliminary Data Sheet

TRXS2_024_03

Overview

The IC is an integrated transceiver circuit for the 24 GHz ISM-band in the frequency range 24.0GHz –24.25GHz with one transmitter and two receivers. The chip comprises one transmitter with voltage controlled oscillator power amplifier and two receivers with low-noise-amplifier (LNA) with gain control, quadrature mixers and poly-phase filter each. The functionality inside the chip is controlled via digital control interfaces for power and gain control. For frequency stabilization, an external PLL can be implemented in the radar system. For this, a frequency divider is integrated acting as prescaler. The chip is fabricated in SiGe BiCMOS technology with a chip area of 1.4 x 1.1 mm^2.

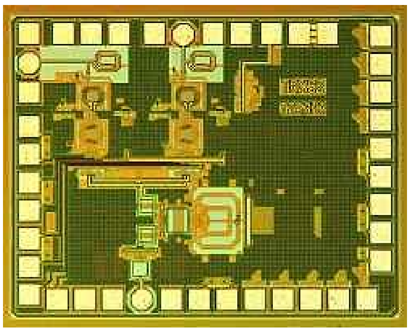
Applications

The main use of the TRX transceiver IC is for radar systems for the ISM-band from 24.0 GHz to 24.25 GHz and for UWB-applications between 23GHz and 27GHz.

Characteristics

Parameter	High Gain	Low Gain
Bandwidth	23.2 – 25.9 GHz	
Conversion Gain RX1	16.5 dB	9 dB
Linearity RX1 – 1dB ICP	-22 dBm	-18 dBm
Conversion Gain RX2	13 dB	6 dB
Linearity RX2 – 1dB ICP	-22 dBm	-15 dBm
Receiver Isolation (signal measured at IF_RX2 and RF signal fed at RX1)	26 dB	
IQ Amplitude Imbalance	0.4 dB	
Spur power @ 12GHz	-44 dBm	
Output Power	1 dBm	
Power Consumption @ Vcc = 3.3V	400 mW	
Chip size	1400 x 1100 μm^2	
Operating temp	-40°C to +95°C	

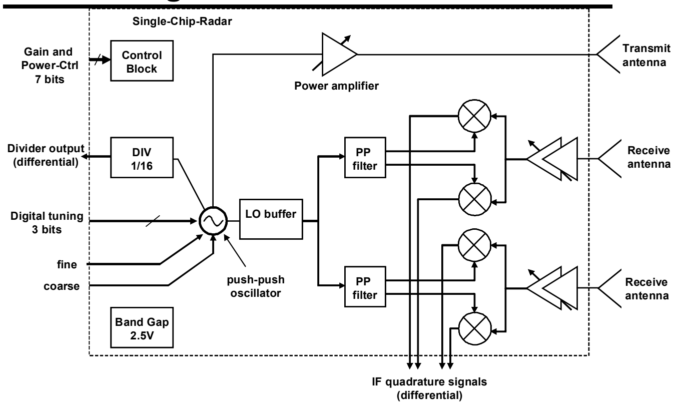
Chip Photo



Form of delivery

The TRX transceiver IC could be delivered packaged in QFN package or in form of a die chip for direct board bonding assymbly. Bond-wires should be shorter than 400µm for RXin and and TXout pins in this case. Please contact Silicon Radar for support in chip bonding technologies.

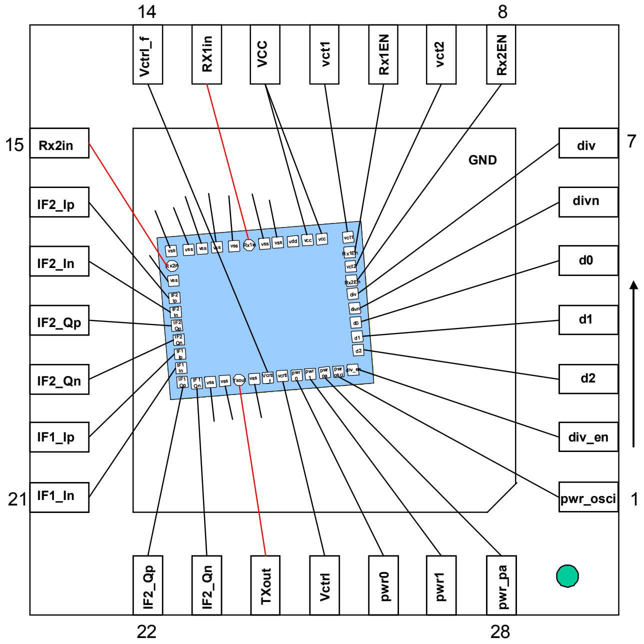
Circuit diagram



Pinout of the Chip (QFN package)

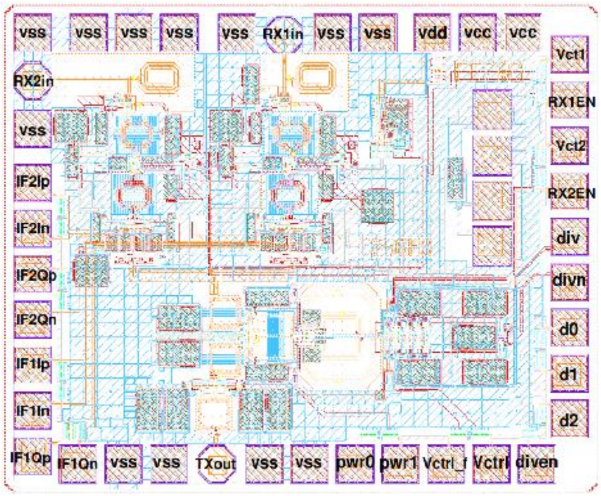
	Name	Description
1	pwr-osci	oscillator power-down (ON=3.3V, OFF=0V)
2	div_en	Divider power-down (ON=3.3V, OFF=0V)
3	d2	VCO band switching
4	d1	
5	d0	
6	divn	Divider output (differential)
7	div	
8	RX2EN	Receiver 2 enable (ON=3.3V, OFF=0V)
9	vct2	LNA gain control (Receiver 2) (HG=3.3V, LG=0V)
10	RX1EN	Receiver 1 enable (ON=3.3V, OFF=0V)
11	vct1	LNA gain control (Receiver 1) (HG=3.3V, LG=0V)
12	Vcc	supply voltage: 3.3V
13	RX1in	Receiver 1 input
14	Vctrl_f	fine tuning input of the VCO
15	RX2in	Receiver 2 input
16	IF2_Ip	Quadrature Receiver 2 outputs
17	IF2_In	
18	IF2_Qp	
19	IF2_Qn	
20	IF1_Ip	Quadrature Receiver 1 outputs
21	IF1_In	
22	IF1_Qp	
23	IF1_Qn	
24	TXout	Transmitter output, 50Ω
25	Vctrl	analog tuning input of the VCO
26	pwr0	Power Amplifier Gain control bits (11 – max gain)
27	pwr1	
28	pwr_pa	Power Amplifier power-down (ON=3.3V, OFF=0V)

Diagram Package Footprint



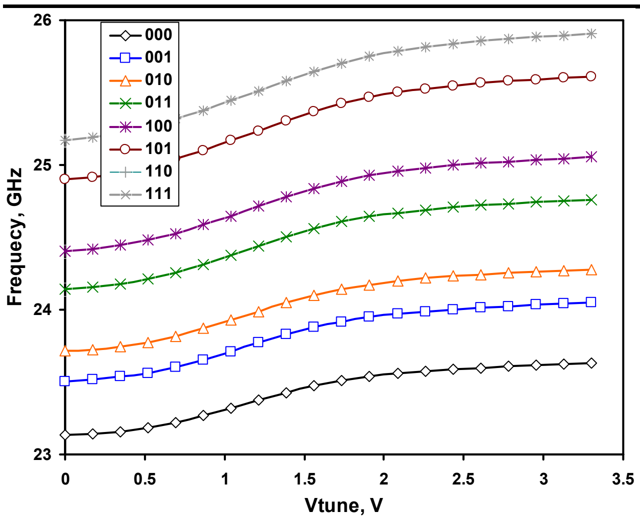
Pinout top view

Diagram Die Chip Pinout

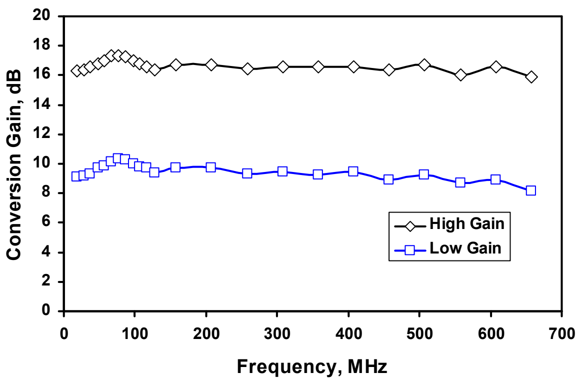


Bonding: RF input bond-wire L< 0.4 mm
TX output bond-wire L< 0.4 mm

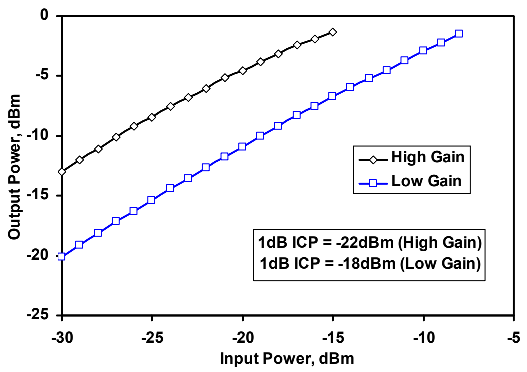
Measurement Results



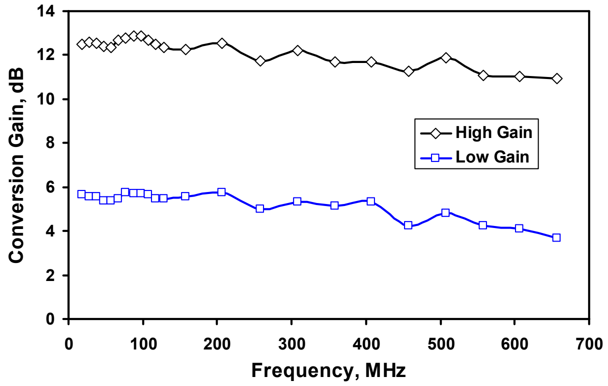
Frequency bands of integrated oscillator



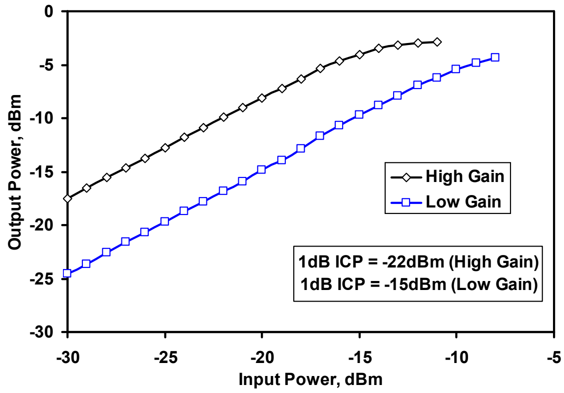
Conversion gain of receiver 1 for high and low gain state



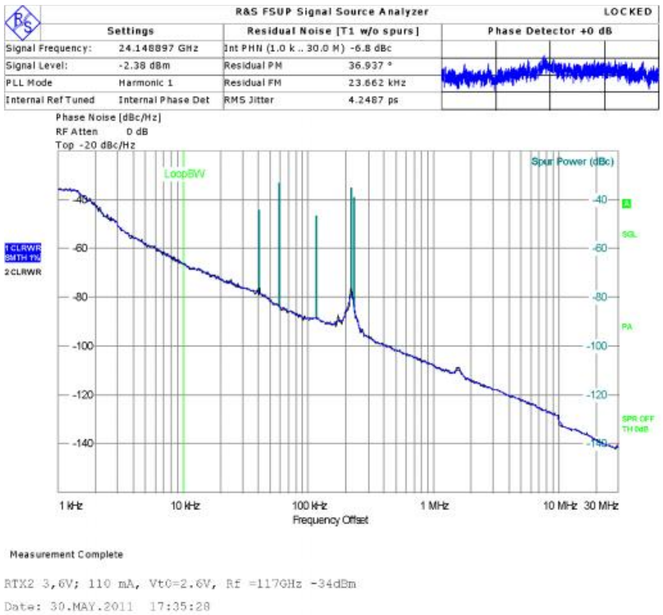
Liniarity of receiver 1 (IF output power versus RF input power) for high and low gain state



Conversion gain of receiver 2
for high and low gain state



Liniarity of receiver 2 (IF output power versus
RF input power) for high and low gain state



Phase noise charackteristic of integrated oscillator