STRADA431

24 GHz Transceiver MMIC for Automotive Radar Sensor

Data brief

Applications

24 to 24.25 GHz automotive radar applications.

Features

- AEC-Q100 qualified
- Single-channel transmitter with differential output Pout: 13 dBm
- On-chip low phase noise VCO
- Three single-ended RX channels
- Low noise figure NFssb: 11 dB
- High programmable conversion gain up to 60 dB
- IF variable gain function
- IF switchable bandpass filters
- Rail-to-rail single-ended IF output
- Programmable VC0 driver output at 750 MHz and 1.5 MHz or 23 kHz
- On-chip power and temperature sensors
- 3.3 V supply voltage
- 4-pin SPI for chip configuration
- QFN 6x6 mm^2 and 40 leads - wettable flanks

Table 1. Device summary

Package	Order code	
	Tray	Tape and reel
QFN-40L	STRADA431	STRADA431-TR

1 Description

STRADA431 is a single-chip transceiver for automotive radar able of covering the frequency band from 24 to 24.25 GHz in order to be compliant with ISM band applications.

STRADA431 can be operated by a single power supply at 3.3 V thanks to integrated LDOs.

The device consists of:

- One differential RF transmitter
- Three single-ended RF receivers

and it is full configurable via SPI.

The transmitter part is based on:

- On-chip voltage-controlled oscillator (VCO) controlled by an external fine tuning voltage (VTUNEF pin) and a coarse digital control driven via SPI;
- Two stages of Power amplifier (PA) digitally-controlled;
- Two output signals, proportional to VCO output frequency:
  - DIV_OUT pin with 2 possible frequency ranges: 1.5 MHz or 23 kHz dividing RF signal by 2^{14} or 2^{20}
  - HV _DIV_OUT with a frequency around 750 MHz dividing RF signal by $2^{5.}$

The transmitter delivers a typical output power of 13 dBm to the antenna.

Each receiver chain consists of:

- A high linearity down converter
- A VGA with 16 steps of programmable gain and band-pass filter with possibility to center the cut-off frequencies (High Pass filter = 60 kHz; Low Pass filter = 500 kHz or 1 MHz configurable via SPI).
- IF analog output

STRADA431 includes monitoring functions for compliancy to ISO-26262 Road Vehicles Functional Safety: junction temperature sensor, transmitted output power detector and complete Rx chain via Test-Tone.

Test-Tone can be used also for band pass filter calibration.

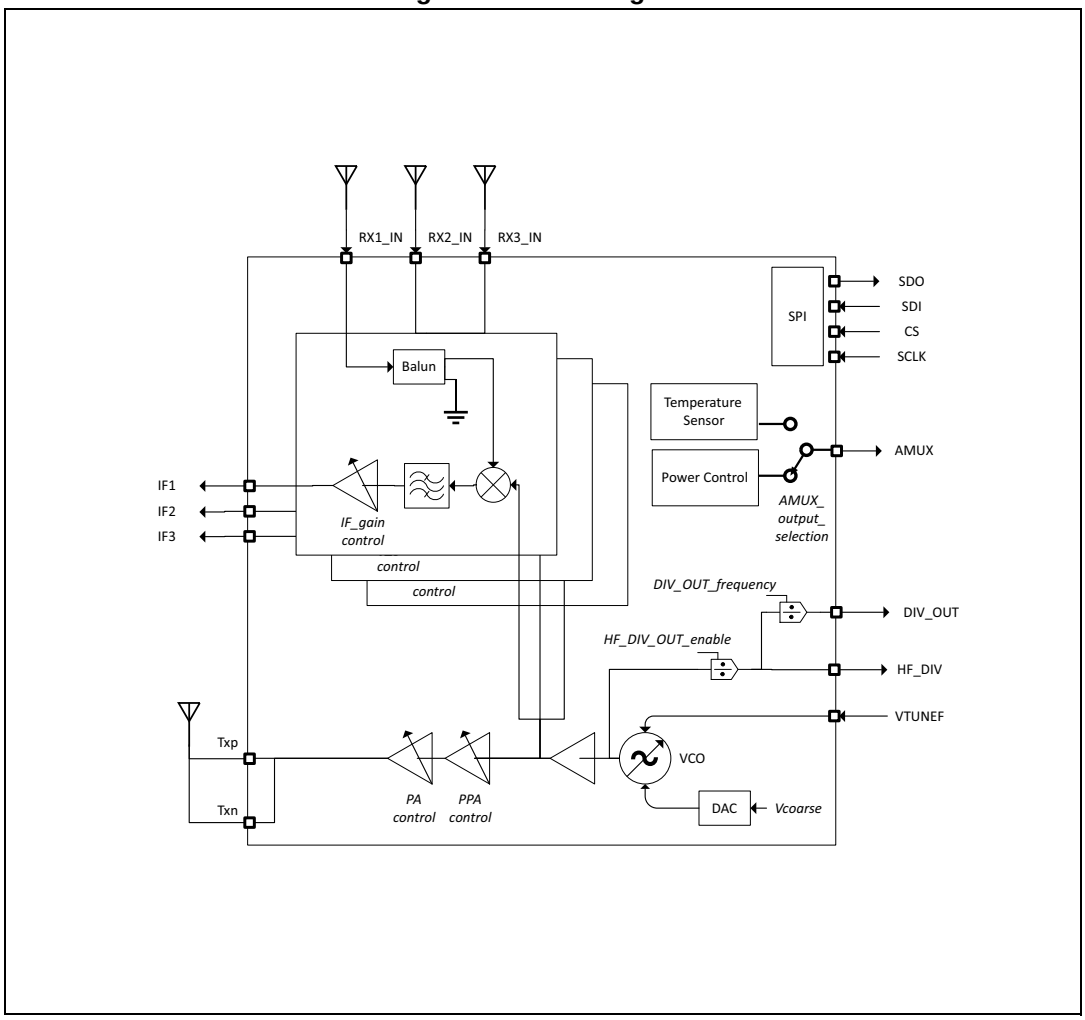
Table 2. Main parameters

Symbol	Parameter	Note/Test condition	Min	Typ	Max	Unit
V_{cc}	Supply voltage			3.3		V
I_{CCTot}	Current consumption	All blocks active at max gain with 3 Receivers powered		270		mA
P_{OUT}	Output power			13		dBm

Table 2. Main parameters (continued)

Symbol	Parameter	Note/Test condition	Min	Typ	Max	Unit
PN	Phase noise	VCO frequency = 24.15 GHz; Offset freq = 100 kHz for minimum digital control word achieve desidered VCO frequency		-75		dBc/Hz
CG_{Max}	Maximum Conversion gain	VGA at max gain at 200 kHz IF frequency		60		dB
CG_{Min}	Minimum Conversion gain	VGA at max gain at 200 kHz IF frequency		43		dB
NF	Noise Figure	At 300 kHz IF frequency; VGA at max gain		11		dB
$P_{1dBmaxG}$	Input 1 dB compression point at maximum gain	max conversion gain at 200 kHz IF frequency		-47		dBm
$P_{1dBminG}$	Input 1 dB compression point at minimum gain	min conversion gain at 200 kHz IF frequency		-30		dBm
IF_{HP3dB}	High Pass filter 3 dB cut-off frequency			60		kHz
IF_{LP3dB}	Low Pass filter 3 dB cut-off frequency	2 programmable cut off frequency	0.5		1	MHz

Figure 1. Block diagram



2 Revision history

Table 3. Document revision history

Date	Revision	Changes
19-Feb-2016	1	Initial release.
15-Mar-2017	2	Updated *: Features on page 1*, change of low noise value and change of high conversion gain value.
15-Nov-2018	3	Added *Chapter 1: Description* and *Table 2: Main parameters*. Minor text changes.
09-May-2019	4	Typing errors.