ICL1112

1. General Description

The ICL1112 is an integrated single-chip mmWave sensor SoC based on FMCW radar transceiver technology. It works in the 24 GHz K-band with up to 1 GHz modulation bandwidth in each single frequency sweeping chirp.

The ICL1112 offers a fully integrated solution for all critical mmWave functions with full transceiver and signal processing path, including full K-band RF transceiver, on-chip pattern generator, PLL, and ADCs. The pattern generator supports multiple frequency sweeping modes with different time-frequency waveforms, e.g. saw-tooth and triangular waveforms. The pattern generator and PLL support fast chirp mode up to 8 kHz chirp rate. The digitized signals from the receiver chain can be serialized via multiple output interfaces.

The device is packaged in a 32 pin 4 mm × 4 mm leadless ROHS compliant QFN package for easy interfacing to a wide range of antenna board technologies.

2. Main Features

- 24 GHz K-band highly integrated FMCW radar sensor SoC
- Up to 1 GHz bandwidth FM tuning range
- Integrated signal generator, low phase noise PLL, transmitter, receiver, baseband and ADCs
- One transmit channel and one receive channel
- Ultra-low power: As low as 55 μA current dissipation with 0.3% duty cycle operation
- TX maximum output power: 12 dBm
- RX noise figure: 10.0 dB
- Phase noise @ 1 MHz offset: -97 dBc/Hz
- Built-in 2.5 MHz conversion rate ADC with 16 bits resolution
- Fast FMCW chirp ramp rate: up to 20 MHz/μs
- High FMCW chirp linearity of 0.45‰ at 250 MHz tuning range
- Precise TX power control enhanced by on-chip power detector and temperature sensor
- Built-in hardware accelerator, support complex FFT and CFAR function
- Configuration interface support: I2C/SPI/UART
- Data output interface support: DS RAW/SPI (master/slave mode)/UART
- Support flexible power supply modes
- Easy hardware design: 4 mm × 4 mm QFN32 package for ultra-compact PCB design
- Junction temperature range：−40°C to 105°C

3. Applications

- Smart Home Radar Sensor
- Smart Lock / Ring Bell
- Proximity and Position Sensor
- Home Appliance Radar Sensor
- Motion Detector
- Gesture Recognition

4. Block Diagram

The RF and analog subsystem implements the FMCW (frequency-modulated continuous-wave) transceiver system with one transmitter (TX), one receiver, synthesizer, mixer, and baseband. Gain controls are applied to both transmitter and receiver to adjust the whole link budget to work in different scenarios. The baseband includes inter-mediate frequency (IF) programmable amplifier, filters, and ADCs. A built-in DSP accelerator can process the IQ ADC's raw data with Range FFT or Doppler FFT.

The ICL1112 can be configured via I2C/SPI/UART interface, DS RAW data can be directly outputted, DSP processed data can be serialized and outputted via SPI/UART interface.

Figure 4-1 presents the illustration of the design of ICL1112.

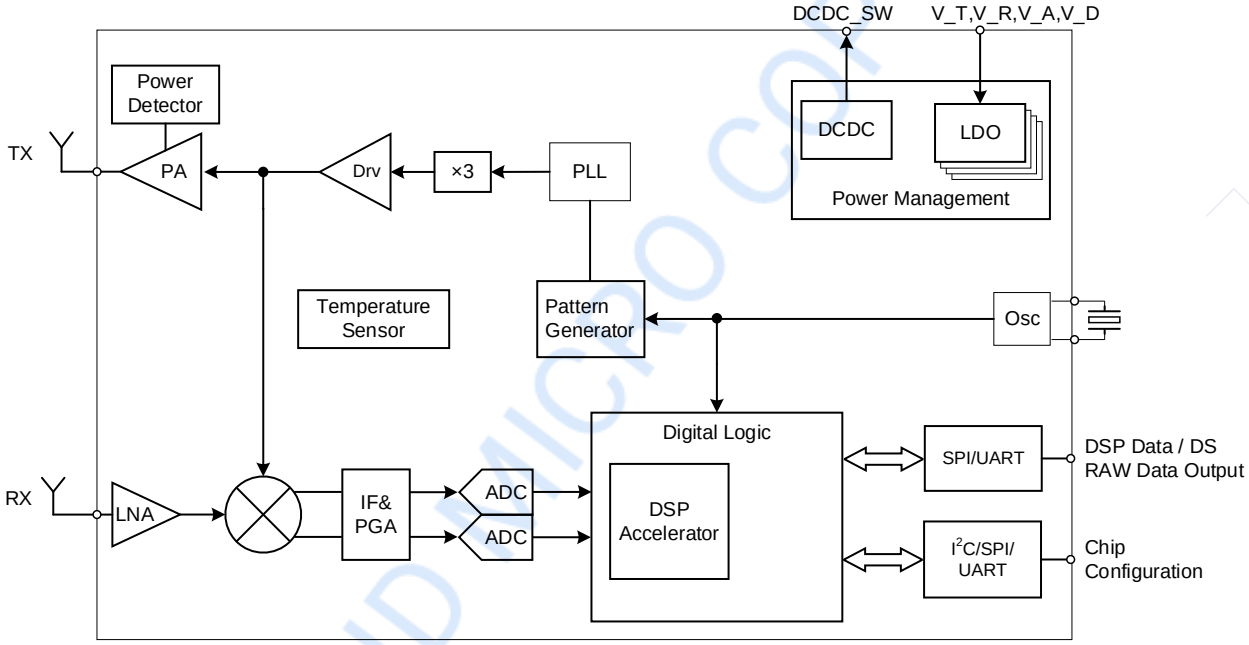

Figure 4-1 ICL1112 block diagram