



## Ka-Band Transceiver IC for Electronically Steerable Phased Array Antennas

The ENS92030 is a versatile multi-channel, Ka-Band frequency, beamforming transceiver IC for phased-array electronically steerable antenna systems.

EnSilica offers customization services to provide an optimal solution based on the core IP in the ENS92030. Customization may include Rx-only & Tx-only separate ICs, changing the number of RF paths per IC, changing the supported signal bandwidths or frequency bands/planning and adding more integration i.e. full PL or data converters.

The device is implemented in a standard bulk-CMOS technology, offering high levels of integration, low power consumption, small footprint and scalable low cost.

The ENS92030 integrates 4 receive and 4 transmit paths operating at 17.7-21.2GHz and 27.5-30 GHz respectively, with each RF path containing independent 5-bit phase control and fine gain control to achieve accurate beam steering and gain compensation/weighting between antenna elements.

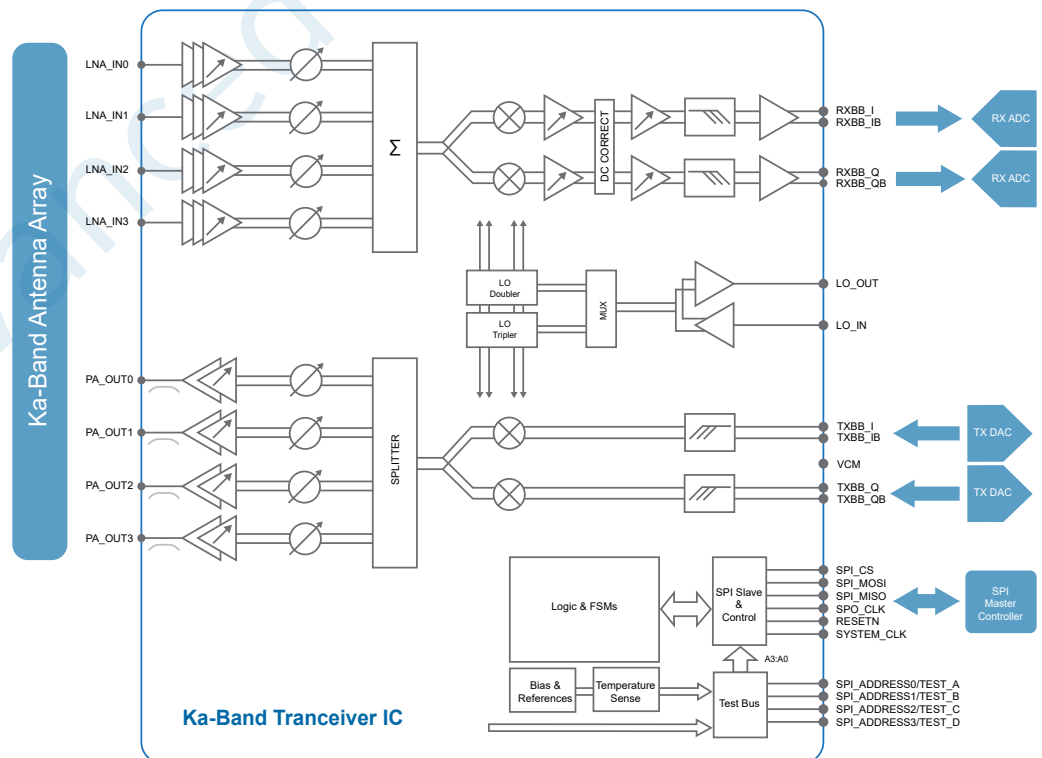
The on-chip receive path sums the Ka-Band receive elements before IQ down-conversion to Zero-IF/Low-IF, with further variable gain and filtering to interface to an external IQ ADC.

The on-chip transmit path takes input IQ baseband signals from an external IQ DAC and provides filtering before modulating up to the Ka-Band beam forming transmit elements.

Internal frequency multiplier circuits generate the clocking signals, required for the receiver frequency IQ down-conversion and transmitter IQ up-conversion, from a single external LO input.

An integrated LO buffer allows for LO daisy chaining to efficiently support large antenna array build up using multiple transceiver ICs.

The device is controlled via an addressable SPI interface to allow a single SPI bus to control multiple transceivers.



## Features

- Ka-Band operation
  - Rx 17.7 to 21.2 GHz
  - Tx 27.5 to 30 GHz
- 4 receive and 4 transmit elements
- 5-bit Ka-Band phase control in each Rx/Tx element
- Ka-Band fine gain control in each Rx/Tx element
- Ka-Band Rx element signal combining
- Ka-Band Tx element signal splitting
- IQ down-conversion/IQ up-conversion for Rx/Tx
- LO generation for Rx/Tx and daisy chaining
- Flexible baseband/IF interface to external IQ ADC/DAC
- SPI control interface; addressable to support parallel devices on a single SPI bus
- Integrated temperature sensor, bias, regulators and comprehensive monitoring and test circuitry
- Supply voltage 1.1V core and 1.8V IO control
- -40°C to 85°C ambient operation
- 3.3 x 3.3mm die for flip-chip bumping

## Typical Application Areas

- Electronic steerable Ka-Band antenna arrays and beam forming applications
- LEO, MEO, GEO satellite communications
- Aerospace, maritime, defence comms/radar
- Test and measurement
- TDD (Time Division Duplex) applications
- FDD (Frequency Division Duplex) applications
- Support for RHCP, LHCP and linear polarization

## Performance Specification Overview

Parameter	Minimum	Typical	Max	Comments
Receive frequency	17.7 GHz		21.2 GHz	
Transmit frequency	27.5 GHz		30 GHz	
Number of Rx antenna feeds		4		
Number for Tx antenna feeds		4		
Antenna feed impedance, Rx or Tx		50 Ω		Single-ended
Receiver noise		3.0 dB 3.3 dB		Each Rx RF element Single Rx path to baseband
Receiver maximum gain		68 dB		Single Rx path
Transmit output power		10 dBm		Single Tx path into 50 Ω
RF phase shifter resolution Rx/Tx		11.25 deg		
RF gain control step size RX/Tx		0.5 dB		
Baseband/IF bandwidth Rx/Tx		325 MHz		I or Q, low pass response
Baseband interface impedance (differential I or Q)		100 Ω		Rx: external IQADC Zin. Tx: programmable to support multiple external IQDAC configurations.
External LO input frequency	8.7 GHz		10.7 GHz	
External LO input power		-5 dBm		50Ω interface
Active power consumption (Rx)		200 mW		All 4 Rx paths active at maximum gain
Active power consumption (Tx)		380 mW		All 4 Tx paths active at +10dBm each
Thermal resistance		20°C / W		Flip-chip bumped direct on to PCB