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LT103OEM UWB Radar Module

Rev.1.6

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LT103OEM UWB Radar Module

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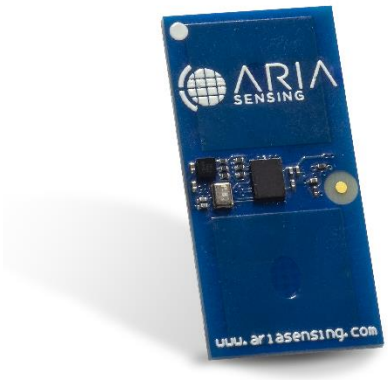
1 Summary

LT103OEM is a high-precision, compact and lightweight SMT Ultra-Wide Band Radar module for indoor applications. LT103OEM integrates high-end antennas, the signal processing unit and the communication interface. It is designed to comply with EU EN 302 065 (EU), ARIB STD-T91 Ver. 2.0 2015 (Japan), FCC CFR 47 Part 15 (USA), RS220 03/2009 (Canada), KCC (South Korea) UWB Regulations.



General Specifications

- Maximum detection range: 10 meters
- Maximum power consumption: 150mW @ 1.8V
- Operating frequency: 7.3GHz to 8.5GHz
- Power supply: 1.8Vdc to 3.3Vdc
- Operating temperature: -40°C to +85°C
- Embedded antenna aperture: ±60° (azimuth) by ±60° (elevation)
- Communication interface: UART
- Dimensions: 15mm x 30mm

General Applications:

- Presence detection
- Position tracking
- Breath detection and monitoring
- Gesture recognition

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2 Features

The LT103OEM is a high configurable UWB radar. This module combines a full UWB transceiver and an on board MCU.
The module is targeted for application like presence detection, position tracking, breath detection and analysis. The communication is achieved with a **U**niversal **A**synchronous **R**eceiver-**T**ransmitter interface.

3 Operating principle

The operating principle of the system is based on the direct readout of the backscattered pulse

- The transmitter emits pulses (Fig. 1a) which travels into space and hits the targets that are into active area of the radar;
- The targets reflect part of the incoming energy (echoes) backward to the radar module (Fig. 1b);
- The receiver converts the incoming signal to digital data, these data are provided to the MCU and processed according to the application.

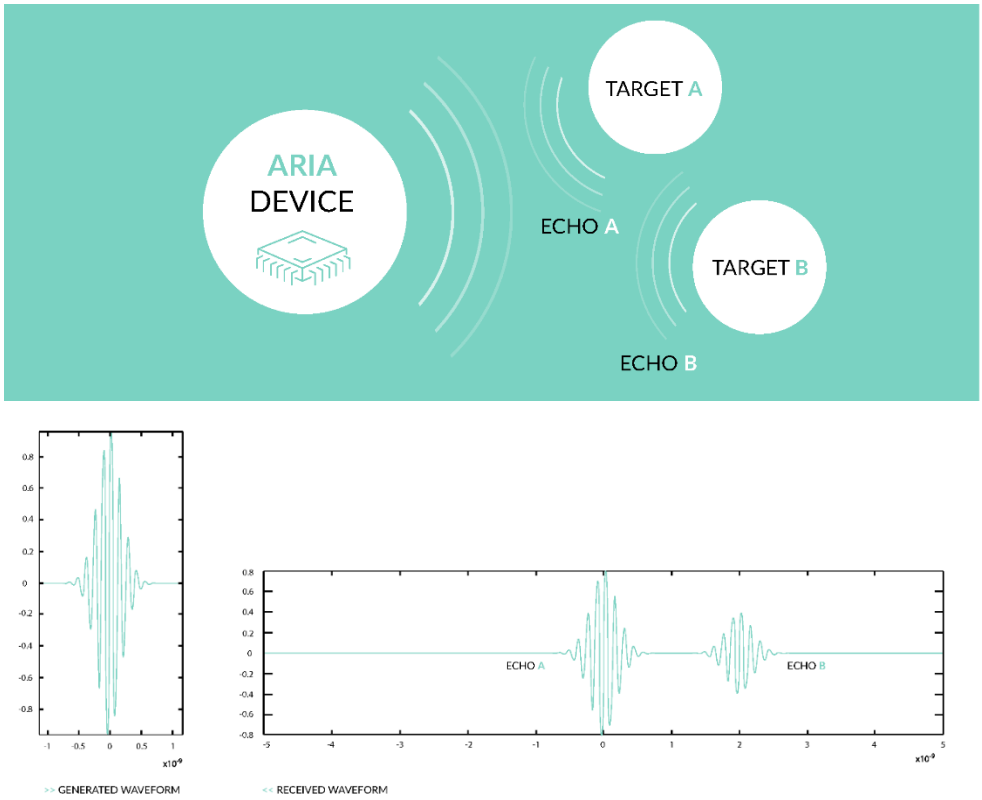

Fig. 1: The basic principle and the waveforms: a) generated pulse at transmitter (left) and b) generated echoes from targets (right)

4 Electrical specifications

	Min	Typ	Max
Operating frequency	7.3GHz	7.9GHz	8.5GHz
Temperature range	-40°C		+85°C
Supply voltage (VddRF)	1.8V	3.3V	3.6V
Supply voltage (VddDIG)	1.8V	3.3V	3.6V
Supply current (IddRF+IddDIG)			85 mA
Range resolution		7 mm	
VIL	0		0.3 · VddDIG
VIH	0.7 · VddDIG		VddDIG
VOL (IOL=0 mA)	0.0		
VOH (IOH=0 mA)			VddDIG
Rseries IO (protection resistors, UART, SWDIO and SWDCLK)		220 Ohm	

Table 1: LT103OEM electrical specifications

5 Radar Diagram

The LT103OEM emitted power is radiated mainly in the radar front side, along the so-called **downrange direction** where the radiated power is at maximum.

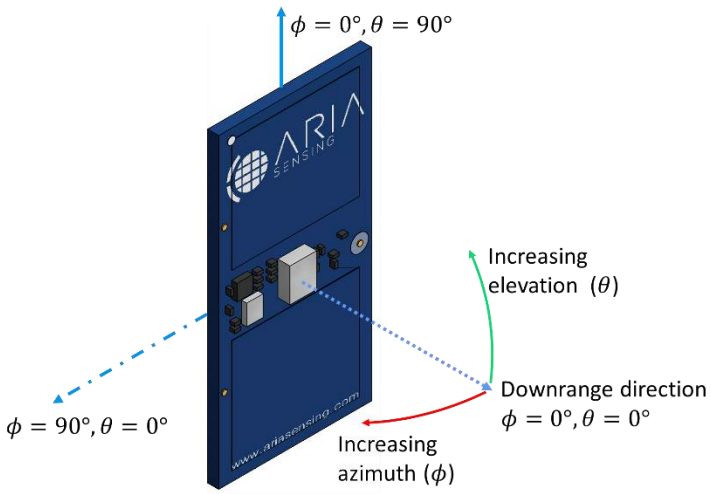

Fig. 2 Radar refence axes

Moving from the downrange direction, the emitted and received power decay. Thus, the same target placed at the same distance but at different azimuth and elevation angles will generate different echo's amplitudes (and lower when compared to the downrange direction).

The received power is shown in the next pictures. In Fig. 3, the power (dB scale) is taken over the "horizontal" (i.e. over θ=0°cut-plane). The power is normalized to the power received from the same target placed along the down-range direction.

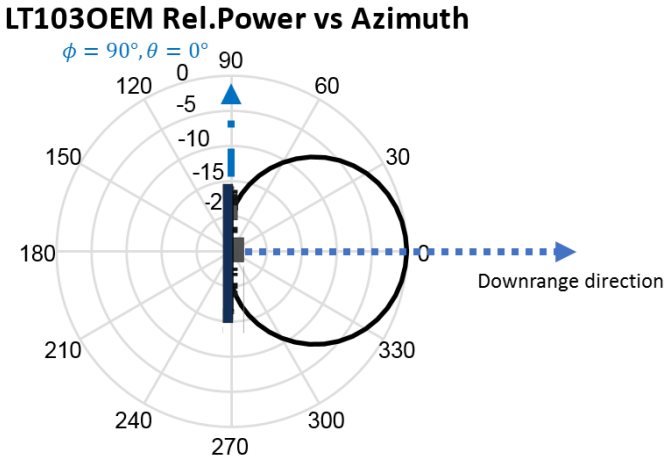

Fig. 3 Relative power (dB) over $\theta = 0°$ cut-plane relative to the downrange axis

In Fig. 4, the power (dB scale) is taken over the "vertical" (i.e. over φ=0° cut-plane). The power is normalized to the power received from the same target placed along the down-range direction.

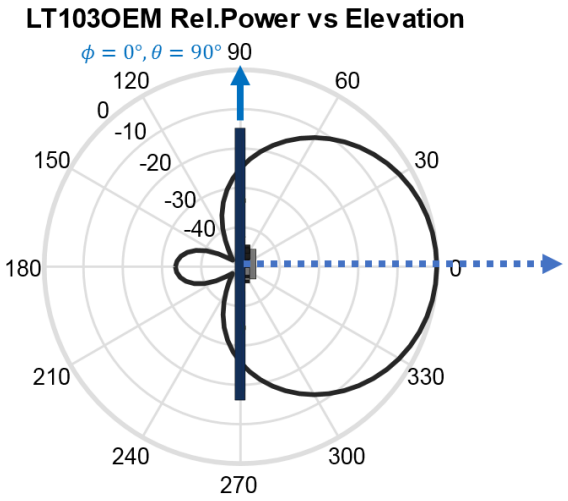

Fig. 4 Relative power (dB) over $\phi = 0°$ cut-plane relative to the downrange axis.

6 Pin-out description

The LT103OEM pin-out reference drawing and functionality is described in Fig. 2 and Table 2 respectively.

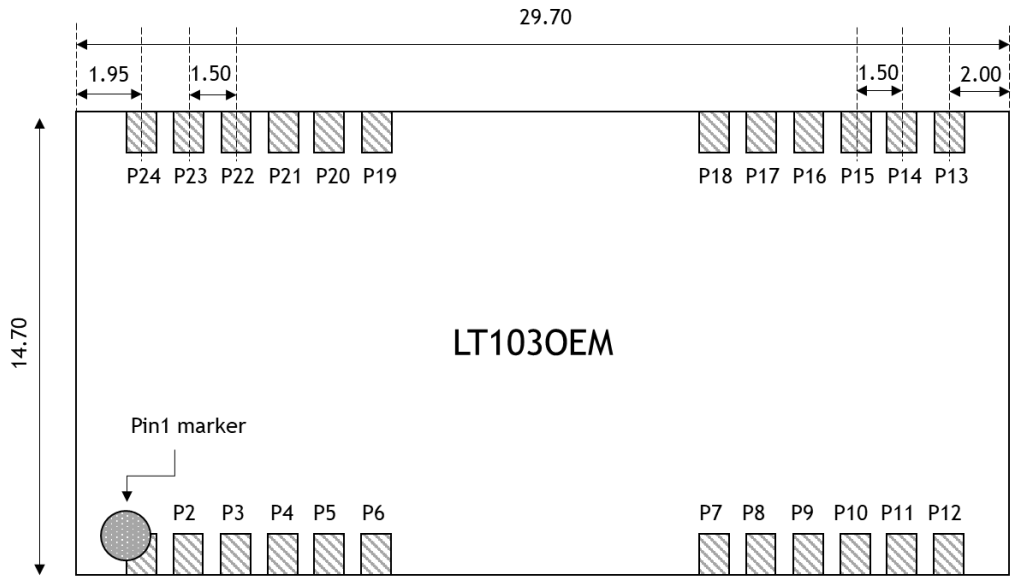

Fig. 5: Reference Drawing for Pin Out (top-side, top-view)

Pin	Description
1	Ground
2	CKIO_P <In/Out> LVDS Synchronization Clock Pos (multi-module)
3	CKIO_N<In/Out> LVDS Synchronization Clock Neg (multi-module)
4	Ground
5	VddRF: RF Power Supply Voltage (may be shorted to P19)
6	Ground
7	Ground
8	SYSRST: system reset (active low)
9	SWDCLK: Debugger Clock
10	SWDIO: Debugger I/O
11	Ground
12	Ground
13	Ground
14	Ground
15	Ground
16	UART_RX: UART Receiver Pin
17	UART_TX: UART Transmitter Pin
18	Ground
19	VddDIG: Digital Power Supply Voltage (may be shorted to P5)
20	Ground
21	Ground
22	TRX_SYNC: Synchronization Signal (Multi-module)
23	Ground
24	Ground

Table 2: LT103OEM pins description

7 Firmware

LT103OEM module is provided with a pre-programmed FW, this FW provides:

- Direct access to the data processing section: raw data or partially processed data
- Moving target detection algorithm
- Front-end control and parametrization

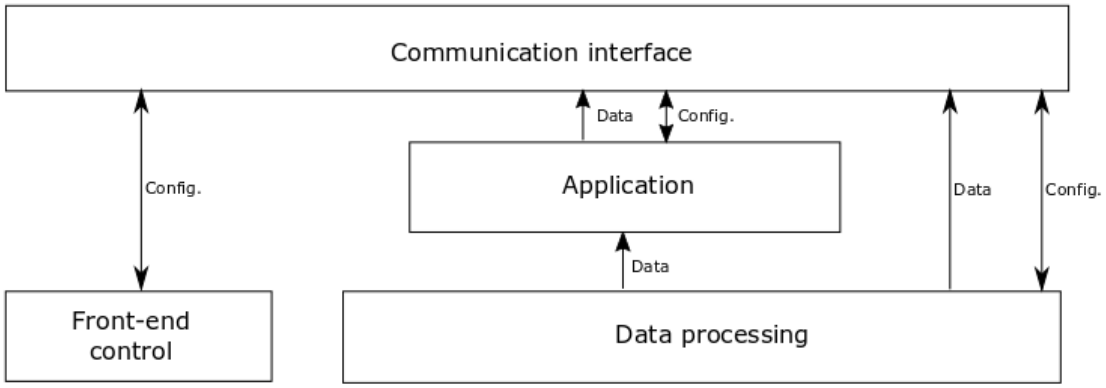

Fig. 6: FW structure

The figure shows the basic structure of the FW. Currently only one application is provided, but the module can run multiple application according to the user needs (ex. Presence detection, breath analysis, etc.). See documentation for details about communication protocol and algorithms.

Bootloader (optional)

The module may be provided with a bootloader application. This feature enables the on-field reprogramming of the module but require an additional start-up sequence in order to run the application FW (see protocol documentation).

This feature is provided on demand.

8 Typical Schematic

The typical schematic for LT103OEM is reported in Fig. 4.

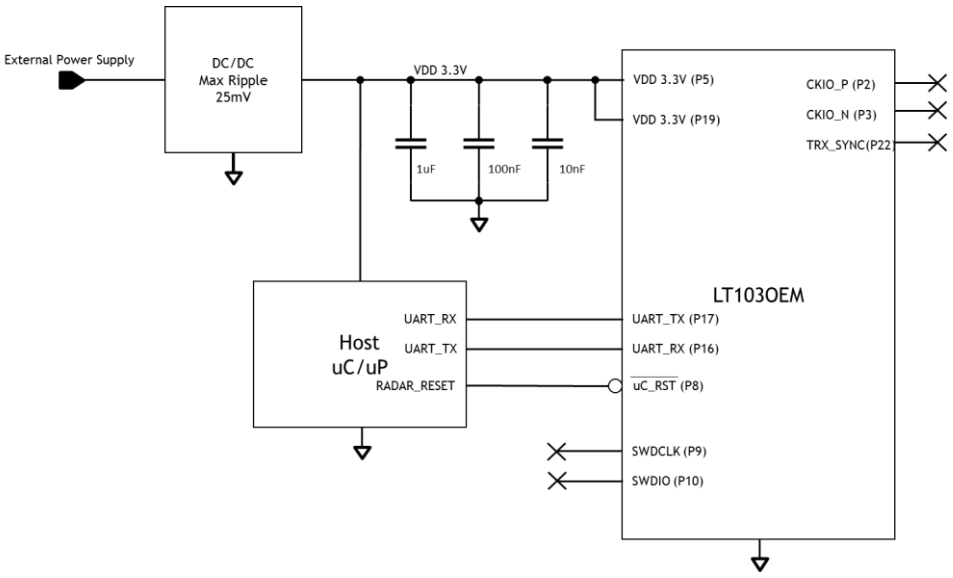

Fig. 7 Typical Schematic

A LDO may be used instead of DC/DC converter. The maximum ripple for the DC/DC output is 25mV.

9 Suggested layout

Reference layout files in Gerber format for host board is available on demand.

10 Communication Interface

The communication to/from the LT103OEM device is performed through a UART interface. The details and specifications of the communication protocol are provided in "*LT102 and LT103OEM COM Protocol*" document.

11 Drawings

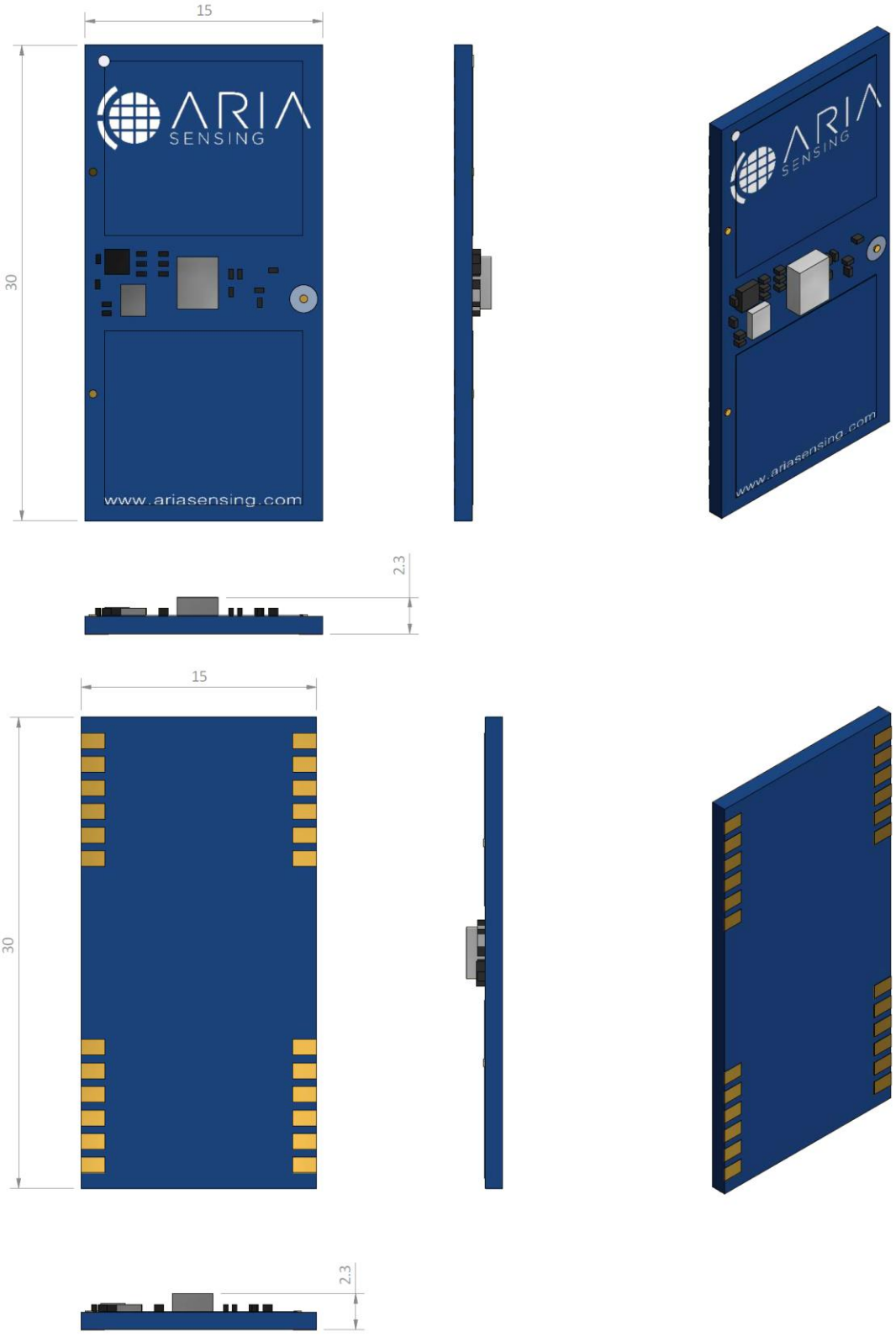

Fig. 8: LT103OEM drawings (15mm x 30mm)