ELECTRONIC RESEARCH & DESIGN

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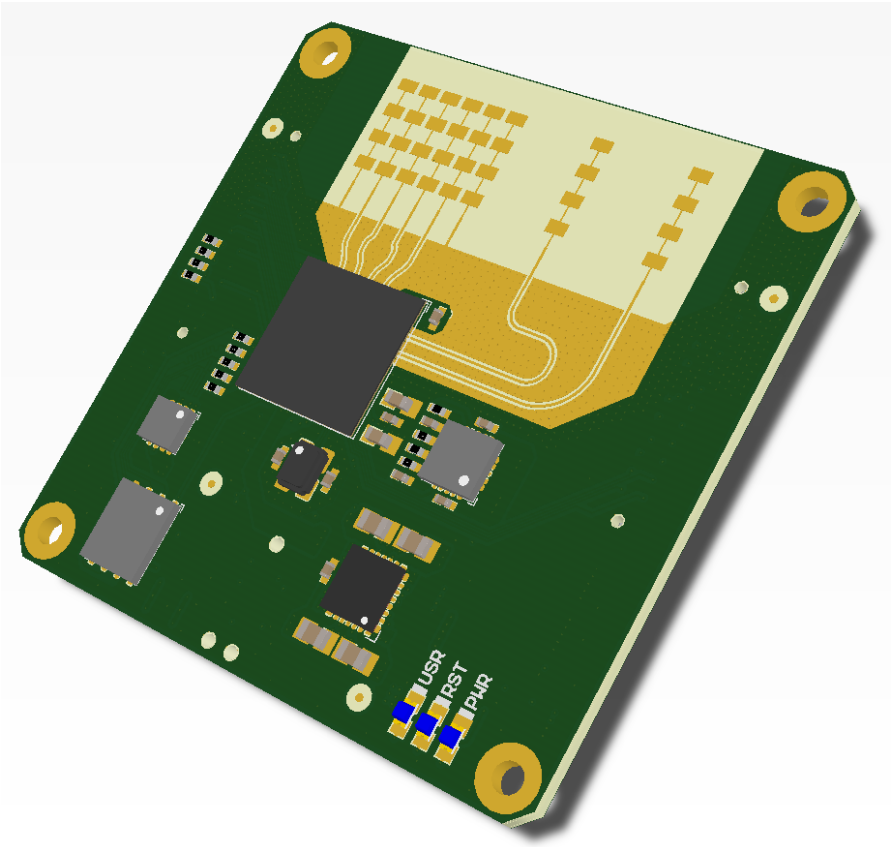
ERD Stealth Radar Module

The ERD Stealth Radar Module is a mmWave Radar board based on the Texas Instruments industrial radar device.

mmWave Radar is an extremely valuable sensing technology for detection of objects and providing the range, velocity and angle of these objects. It is a contactless-technology which operates in the spectrum between 30GHz and 300GHz. Due to the technology's use of small wavelengths it can provide sub-mm range accuracy and is able to penetrate certain materials such as plastic, drywall, clothing, and is impervious to environmental conditions such as rain, fog, dust and snow.



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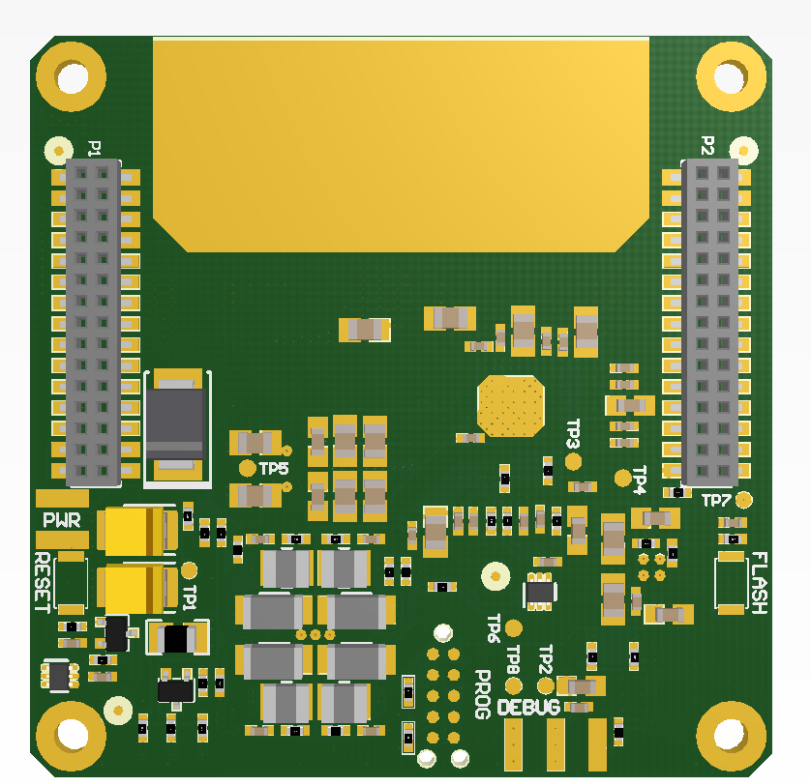

It has the following features:

- The unit has 2 transmit and 4 receive antennas.
- Operates in the 76- to 81-GHz band with up to 4 GHz continuous chirp.
- Integrates a DSP subsystem, which contains TI's high-performance C674x DSP for the radar signal processing.
- The device includes an ARM R4F-based processor subsystem, which is responsible for front-end configuration, control, and calibration.
- This module has Ti’s reference software with their pre-defined API pre-programmed.
- Software configurable for short range (20m) or long range (50m) operation
- 5V, 1A supply required (300mA average).
- There are 2 Asynchronous serial ports at 3.3V levels:
    - Command and control interface (115200 baud)(RS232_RX/TX)
    - Data from Radar (921600 baud)(MSS_UARTB_TX)
- Dimensions are 45mm x 45mm
- JTAG interface
- 16Mbit QSPI flash.
- 0 to 70 deg C operating.
- Stackable design.
- Connector placement with dimensions and pinout available.

Pinouts

The pinout for the various connectors are:

P2:

Pin	Name	Pin	Name
1	GND	2	GND
3	GND	4	GND
5	ADC2	6	ADC1
7	ADC3	8	ADC4
9	GPIO_31	10	NRST
11	GPIO_32	12	GPIO_33
13	GPIO_34	14	GPIO_36
15	GPIO_35	16	GPIO_38
17	RS232_RX	18	GPIO_37
19	RS232_TX	20	ERROR_OUT
21	ERROR_IN	22	TDI
23	TMS	24	WARMRST
25	TCK	26	SOP2
27	TDO	28	GPIO_48
29	GPIO_47	30	PMICOUT_3V3

P1:

Pin	Name	Pin	Name
1	GND	2	GND
3	GND	4	GND
5	GND	6	GPIO_46
7	GND	8	GPIO_42
9	GPIO_45	10	GPIO_44
11	GPIO_43	12	GPIO_1
13	GPIO_39	14	SPI_A_CLK
15	SPI_A_MOSI	16	SDA_B
17	SPI_A_MISO	18	GPIO_0
19	SPI_B_CS	20	MSS_UARTB_TX
21	SPI_A_CS	22	SCL_B
23	ADC5	24	GPIO_40
25	GPIO_41	26	ADC6
27	5V_IN	28	5V_IN
29	5V_IN	30	5V_IN

Interface

The Radar supports a command-line type interface on the control serial port (RS232_RX, RS232_TX.

Commands and defaults are defined below:

sensorStart

[doReconfig(optional, default:enabled)]

sensorStop

No arguments

guiMonitor

<subFrameIdx> <detectedObjects> <logMagRange> <noiseProfile> <rangeAzimuthHeatMap> <rangeDopplerHeatMap> <statsInfo>

cfarCfg

<subFrameIdx> <procDirection> <averageMode> <winLen> <guardLen> <noiseDiv> <cyclicMode> <thresholdScale> <peakGroupingEn>

multiObjBeamForming

<subFrameIdx> <enabled> <threshold>

calibDcRangeSig

<subFrameIdx> <enabled> <negativeBinIdx> <positiveBinIdx> <numAvgFrames>

clutterRemoval

<subFrameIdx> <enabled>

adcbufCfg

<subFrameIdx> <adcOutputFmt> <SampleSwap> <ChanInterleave> <ChirpThreshold>

compRangeBiasAndRxChanPhase

<rangeBias> <Re00> <Im00> <Re01> <Im01> <Re02> <Im02> <Re03> <Im03> <Re10> <Im10> <Re11> <Im11> <Re12> <Im12> <Re13> <Im13>

measureRangeBiasAndRxChanPhase

<enabled> <targetDistance> <searchWin>

aoaFovCfg

<subFrameIdx> <minAzimuthDeg> <maxAzimuthDeg> <minElevationDeg> <maxElevationDeg>

cfarFovCfg

<subFrameIdx> <procDirection> <min (meters or m/s)> <max (meters or m/s)>

extendedMaxVelocity

<subFrameIdx> <enabled>

bpmCfg

<subFrameIdx> <enabled> <chirp0Idx> <chirp1Idx>

CQRxSatMonitor

<profile> <satMonSel> <priSliceDuration> <numSlices> <rxChanMask>

CQSigImgMonitor

<profile> <numSlices> <numSamplePerSlice>

analogMonitor

<rxSaturation> <sigImgBand>

lvdsStreamCfg

<subFrameIdx> <enableHeader> <dataFmt> <enableSW>

version

No arguments

flushCfg

No arguments

dfeDataOutputMode

<modeType> 1-Chirp and 2-Continuous

channelCfg

<rxChannelEn> <txChannelEn> <cascading>",

adcCfg

<numADCBits> <adcOutputFmt>

profileCfg

<profileId> <startFreq> <idleTime> <adcStartTime> <rampEndTime> <txOutPower> <txPhaseShifter> <freqSlopeConst> <txStartTime> <numAdcSamples> <digOutSampleRate> <hpfCornerFreq1> <hpfCornerFreq2> <rxGain>

chirpCfg

<startIdx> <endIdx> <profileId> <startFreqVar> <freqSlopeVar> <idleTimeVar> <adcStartTimeVar> <txEnable>

frameCfg

<chirpStartIdx> <chirpEndIdx> <numLoops> <numFrames> <framePeriodicity> <triggerSelect> <frameTriggerDelay>

advFrameCfg

<numOfSubFrames> <forceProfile> <numFrames> <triggerSelect> <frameTrigDelay>

subFrameCfg

<subFrameNum> <forceProfileIdx> <chirpStartIdx> <numOfChirps> <numLoops> <burstPeriodicity> <chirpStartIdxOffset> <numOfBurst> <numOfBurstLoops> <subFramePeriodicity>

lowPower

<reserved> <lpAdcMode>

contModeCfg

<startFreq> <txOutPower> <txPhaseShifter> <digOutSampleRate> <hpfCornerFreq1> <hpfCornerFreq2> <rxGain> <reserved> <numSamples>

bpmCfgAdvanced

<chirpStartIdx> <chirpEndIdx> <constBpmVal>

Default initialization:

version

sensorStop

flushCfg

dfeDataOutputMode 1

channelCfg 15 3 0

adcCfg 2 1

adcbufCfg -1 0 1 1 0

profileCfg 0 77 429 7 57.14 0 0 70 1 256 5209 0 0 30

chirpCfg 0 0 0 0 0 0 0 1

chirpCfg 1 1 0 0 0 0 0 2

frameCfg 0 1 16 0 100 1 0

lowPower 0 1

guiMonitor -1 1 1 0 0 0 1

cfarCfg -1 0 2 8 4 3 0 15 1

cfarCfg -1 1 0 4 2 3 1 15 1

multiObjBeamForming -1 1 0.5

clutterRemoval -1 0

calibDcRangeSig -1 0 -5 8 256

extendedMaxVelocity -1 0

bpmCfg -1 0 0 1

lvdsStreamCfg -1 0 0 0

compRangeBiasAndRxChanPhase 0.0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0

measureRangeBiasAndRxChanPhase 0 1.5 0.2

CQRxSatMonitor 0 3 5 121 0

CQSigImgMonitor 0 127 4

analogMonitor 0 0

aoaFovCfg -1 -90 90 -90 90

cfarFovCfg -1 0 0 8.92

cfarFovCfg -1 1 -1 1.00

sensorStart

Basic Radar Functionality Software

The radar module produces a stream of detections at the rate of its internal processing. To have any value these have to be processed. In the days of analogue radar the CRT display provided inherent integration and limiting. It takes somewhat algorithmic processing to separate interesting information from noise. In radar the term clutter is often used for the background and speculative reflections. The idea of interesting information is heavily dependent on application and operating mode.

Static Mode

In this mode the radar assumes it is stationary and that most of its scene is stationary. Only persistent detections are reported. Filter parameters include minimum and maximum distance and angles. Whether preference should be given to anything that moves either laterally or longitudinally.

Dynamic Mode

In this mode the platform is assumed to be moving. Speed of the platform if available, is used algorithmically. The filter parameters are similar to the static mode.

Object Tracking

Any persistent detections are tracked. Both the defaults and per detection tracking parameters can be adjusted. This includes target dynamic model selection, maximum fade duration and priority of tracked objects.

Software support for the above is available from:

To order the board (and related stacker boards), please contact:

ALTRON | ARROW

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