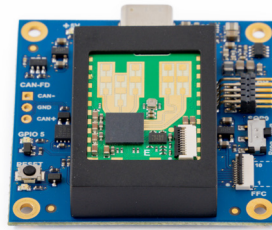


# V-LD3-EVAL

## V-LD3 evaluation kit



### Features

- › Pre-mounted V-LD3-RFB radar sensor, designed for human detection and multi-object tracking up to 20 meters
- › Access to SPI, UART, JTAG, and CAN interfaces for complete control and customization during development
- › Compact design with simple USB-C connectivity for easy integration with your host PC
- › Generates a detailed 3D point cloud for both static and moving targets, perfect for real-time object tracking
- › No calibration required - the evaluation kit comes pre-calibrated and pre-programmed for immediate use
- › Compatible with Texas Instruments' low-power SDK, providing flexibility for firmware development and customization.

### Description

Experience the full capabilities of RFbeam's V-LD3-RFB radar sensor module through our easy-to-use evaluation kit. Powered by Texas Instruments low-power IWR6432 chipset, the V-LD3 is perfect for human detection and multi-object tracking up to 20 meters, making it an ideal solution for advanced radar applications.

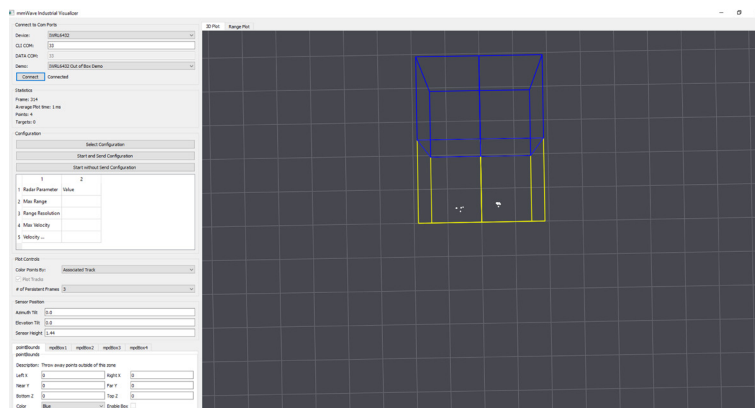
The V-LD3-RFB comes pre-programmed with TI's innovative motion and presence detection demo and includes a human/non-human classifier, making setup and testing effortless. Optimized onboard antennas, pre-calibrated RF frontend, and a compact design make this sensor module ready for immediate use in your radar projects.

With the V-LD3 sensor already mounted, RFbeam's evaluation kit provides immediate access to all the advanced features you need for development. The kit includes full access to sensor pins, SPI RAW data capture, JTAG, and CAN interfaces. Simply connect via USB-C to start evaluating the IWR6432 chipset's extensive capabilities for your project.

No need to wait - start exploring advanced radar functionality today with the V-LD3-RFB Evaluation Kit, designed to streamline your development process!

### Control Panel

Figure 1: TI mmwave Industrial Visualizer

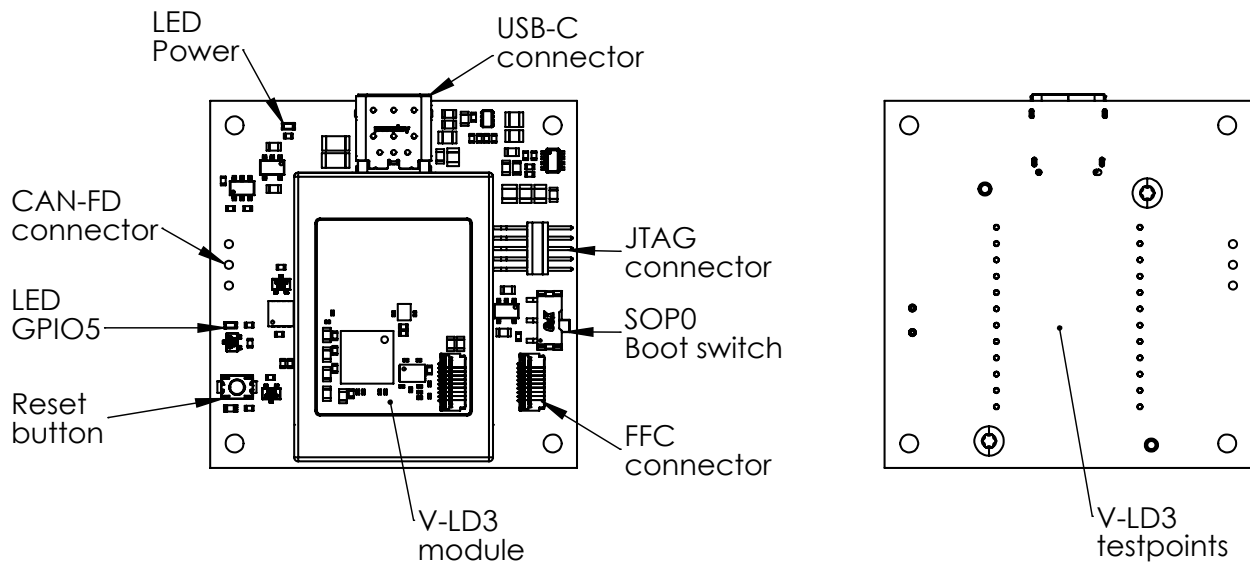


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## 1 Pin Configurations and Functions

Figure 2: Pin configuration and functions



The V-LD3 Evaluation Kit consists of a PCB with a mounted V-LD3 module connected via spring-loaded contacts. The kit features an FTDI FT4232 chipset, enabling direct access to multiple interfaces through a single USB-C connection to a host PC. The USB-C interface also provides power to the board. In addition, the board includes the following peripherals, directly accessible on the PCB:

- JTAG connector for direct use with TI's XDS110 debugger
- JSOP0 boot switch and reset button for easy bootloader access
- JFFC connector for off-board V-LD3 module connection
- JGPIO5 user LED for custom signaling
- JCAN-FD connector with on-board transceiver (PHY)
- JTest points for all V-LD3 SMT pads for easy probing and debugging

## 1.1 JTAG connector

The JTAG connector provides direct access to the JTAG interface of the IWRL6432 chipset mounted on the V-LD3 module. It supports debugging and programming using Texas Instruments' XDS110 JTAG debug probe, and is directly compatible with the included TI 20-pin to Arm Cortex 10-pin adapter.

Table 1: **JTAG connector description**

Connector	Pin. No.	Name	Description
JTAG connector X107	1	VCC	+3.3V VIO supply
	2	SWDIO/TMS	JTAG test mode select
	3	GND	GND
	4	SWDCLK/TCK	JTAG test clock input
	5	GND	GND
	6	SWO/TDO	JTAG test data output
	7	KEY	Not connected
	8	NC/TDI	JTAG Test data input
	9	GND	GND
	10	nRESET	nRESET signal

## 1.2 SOP0 boot switch

The SOP0 boot switch can be used in combination with the reset button to change the IWRL6432 boot mode. To change the boot mode, set the switch to the desired position and press the reset button to apply the configuration.

Table 2: **SOP0 boot switch description**

Connector	Position	Name	Description
SOP0 boot switch	1-2	Prog mode	Pulls the SOP0 to GND
SW101	2-3	Run mode	Releases the SOP0 pin -> Pull up on the V-LD3 module

### 1.3 FFC connector

The FFC connector allows the V-LD3 module to be connected off-board via an FFC cable. The connector features top and bottom contacts and uses the same pinout as the connector on the V-LD3 module, without any signal mirroring. This allows for a direct 1:1 connection using a standard FFC cable.


 Before using the FFC connection, make sure to remove the V-LD3 module from the spring contacts to avoid electrical conflicts.

Table 3: **FFC connector description**

Connector	Pin. No.	Name	Description
FFC connector X100	1	+1.8V	+1.8V VCC supply
	2	GND	GND
	3	nRESET	nRESET input
	4	SOP0	SOP0 boot mode input
	5	UART TX	UART TX output, IWR6432 Pin E10
	6	UART RX	UART RX input, IWR6432 Pin F11
	7	GPIO5	GPIO5, IWR6432 Pin J10
	8	VCCIO	+3.3V VIO supply
	9	GND	GND
	10	+1.8V	+1.8V VCC supply

### 1.4 GPIO5 user LED

GPIO5 is connected to a green user LED via a FET switch. In Texas Instruments' default examples, this GPIO is used both as a status indicator and as a trigger output for raw SPI data capture. For this reason, GPIO5 is also routed to the FTDI FT4232 bridge, enabling access and monitoring from the host PC.

### 1.5 CAN-FD connector

The evaluation kit includes a 3-pin, 2.54 mm pitch CAN-FD connector footprint. The connector is not pre-assembled, allowing users to either solder a cable directly or mount a connector of their choice.

A CAN-FD transceiver (PHY) is placed between the IWR6432 pins and the connector to ensure proper signal conditioning. Additionally, the CAN-FD interface is equipped with ESD protection diodes and a pre-mounted 120  $\Omega$  termination resistor.

Table 4: **CAN-FD connector description**

Connector	Pin. No.	Name	Description
CAN-FD connector X105	1	CAN-	CAN-FD negative signal
	2	GND	GND
	3	CAN+	CAN-FD positive signal

## 1.6 V-LD3 SMT pads

All SMT pads of the V-LD3 module are routed through spring contacts to the evaluation kit. Each pin is accessible via dedicated test points on the bottom side of the PCB, providing convenient access for probing and debugging.

To facilitate development, each test point is labeled on the silkscreen with the corresponding signal name and where applicable, the associated IWRL6432 pin number.

## 1.7 FTDI FT4232 bridge

The FTDI FT4232 bridge offers multiple options for direct communication between the host PC and the IWRL6432 chip-set. A single USB-C connection provides access to four virtual COM ports by default (Port A, B, C, and D), which appear automatically on the host system.

Using FTDI's D2XX direct access drivers allows reconfiguration of the FT4232 to unlock its full capabilities, including MPSSE, BitBang, and UART modes.

Table 5: **FTDI FT4232 bridge connection description**

Connector	Pin. No.	Name	Description
FTDI FT4232HQ U202	A	MPSSE mode	SPI RAW data capture (supported by TI SDK)
	B	MPSSE mode	1.8V supply current measurement via I2C (not supported by TI SDK)
	C	BitBang mode	Automatic V-LD3 update option (not supported by TI SDK)
	D	RS232 mode	Main UART access for configuration, data readout or firmware update

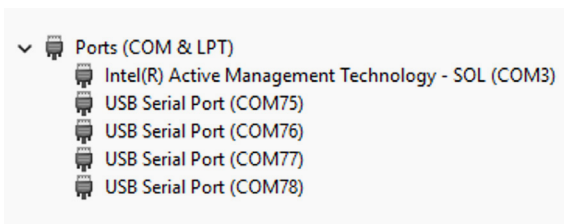
## 2 Quick Start

### 2.1 mmWave SDK Visualizer

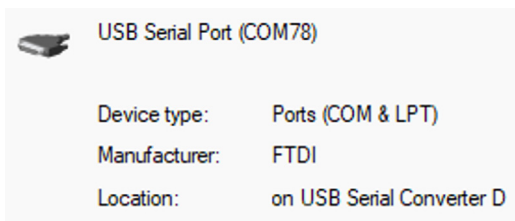
RFbeam and TI do not recommend using the mmWave SDK Visualizer for the V-LD3. Please start evaluation directly with TI's mmWave Industrial Visualizer, which is part of the Radar Toolbox package provided by Texas Instruments.

### 2.2 mmWave Industrial Visualizer

1. Connect the USB-C cable to the USB-C connector of the evaluation kit.
2. Connect the other end of the USB cable to your PC and wait until the serial COM port driver is installed.
3. The FTDI chip on the evaluation kit will show up as 4 virtual COM ports in the device manager:

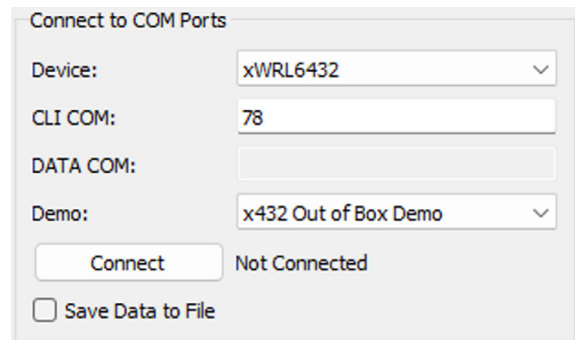


4. The default UART communication port is connected to channel D of the FTDI chip. Port enumeration under Windows can be random. Locate channel D by checking the settings of each port and identifying the COM port listed as "USB Serial Converter D" (for example COM78 in the picture above).

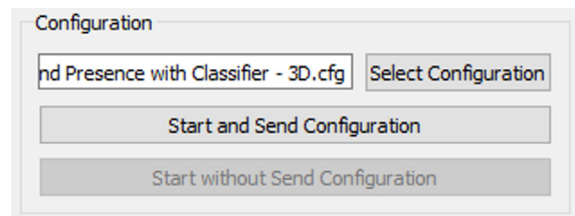


5. Check that the SOP0 boot switch is set to the "Run" position
6. Download the latest version of the TI RADAR-TOOLBOX here [https://dev.ti.com/tirex/global?id=RADAR\\_TOOLBOX](https://dev.ti.com/tirex/global?id=RADAR_TOOLBOX)
7. Install the radar toolbox and start the industrial visualizer software located in the folder `\tools\visualizers\Applications_Visualizer\Industrial_Visualizer` of the installation directory.
8. TI provides an Applications Visualizer User Guide in the folder `\tools\visualizers\Applications_Visualizer\docs/` of the installed SDK.

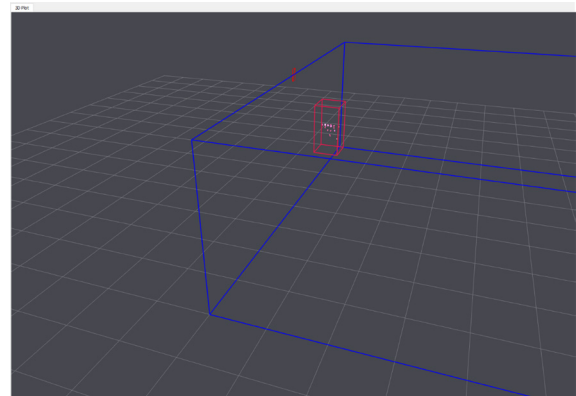
9. Type in the correct COM port of channel D from the FTDI chip and press the Connect button:



10. Upload a custom configuration under "Select Configuration" and press "Start and Send Configuration". RFbeam provides a few optimized settings for the V-LD3 under the downloads section of the evaluation kit:



11. The visualizer will write the configuration to the V-LD3 and starts visualizing the measurement data.



## 2.3 Texas Instruments Resources

Texas Instruments provides multiple useful resources that can be used in combination with the V-LD3, as it is fully compatible with the TI framework for the IWRL6432 chipset.

There are two main resources available:

- MMWAVE-L-SDK
- Radar Toolbox

### MMWAVE-L-SDK

The MMWAVE-L-SDK from Texas Instruments is the core software development kit for devices based on the IWRL6432 chipset. It provides low-level drivers, middleware, and reference firmware for configuring and operating the radar front end, including RF control, data path processing, and peripheral interfaces. The SDK also includes build environments, APIs, and example applications such as motion and presence detection or the out-of-the-box mmWave demo. These enable developers to implement and customize radar signal processing and system integration on the device.

<https://dev.ti.com/tirex/global?id=MMWAVE-L-SDK>

### Radar Toolbox

The Radar Toolbox complements the SDK with a comprehensive set of precompiled demos, reference designs, configuration files, and development tools. It includes ready-to-use application examples such as motion and presence detection, people tracking, and industrial sensing use cases. In addition, it provides utilities such as the mmWave Industrial Visualizer for real-time data evaluation and parameter tuning. This allows fast prototyping and system validation without requiring deep firmware modifications.

[https://dev.ti.com/tirex/global?id=RADAR\\_TOOLBOX](https://dev.ti.com/tirex/global?id=RADAR_TOOLBOX)

## 2.4 Texas Instruments Guides

The Radar Toolbox from Texas Instruments contains several useful guides that support customization of the preprogrammed motion and presence detection demo on the V-LD3:

- Low Power SDK Guides
- Tuning Guides

### Low Power SDK Guides

The Low Power SDK Guides provide an overview of the MMWAVE-L-SDK structure, including architecture, directory organization, and available example applications. As the V-LD3 is delivered with a slightly modified version of the motion and presence detection demo, these guides help to understand the underlying processing chain and software framework, and how the demo can be adapted or extended for custom applications.

[http://dev.ti.com/tirex/local?id=Low\\_Power\\_SDK\\_Overview&packageId=radar\\_toolbox](http://dev.ti.com/tirex/local?id=Low_Power_SDK_Overview&packageId=radar_toolbox)

### Tuning Guides

The Tuning Guides describe how to adapt radar configurations to specific applications by adjusting parameters such as chirp settings, detection thresholds, and tracking behavior. For the V-LD3, they are particularly useful to optimize the provided motion and presence detection demo with respect to detection range, sensitivity, and filtering. Tools such as the mmWave Sensing Estimator further support performance prediction and configuration.

[http://dev.ti.com/tirex/local?id=tuning\\_overview&packageId=radar\\_toolbox](http://dev.ti.com/tirex/local?id=tuning_overview&packageId=radar_toolbox)

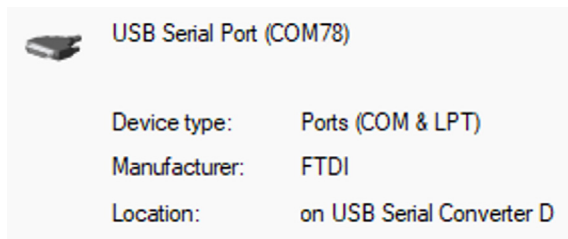
<https://dev.ti.com/gallery/view/mmwave/mmWaveSensingEstimator>

### 3 Software Update via UniFlash

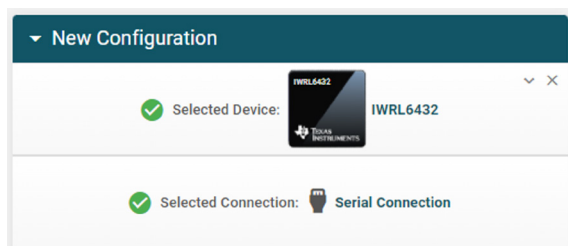
1. Connect the USB-C cable to the USB-C connector of the evaluation kit.
2. Connect the other end of the USB cable to your PC and wait until the serial COM port driver is installed.
3. The FTDI chip on the evaluation kit will show up as 4 virtual COM ports in the device manager:



4. The default UART communication port is connected to channel D of the FTDI chip. Port enumeration under Windows can be random. Locate channel D by checking the settings of each port and identifying the COM port listed as "USB Serial Converter D" (for example COM78 in the picture above).



5. Download and install the latest version of the TI UniFlash here: <https://www.ti.com/tool/UNIFLASH>
6. Start UniFlash and select the IWRL6432 with serial connection. Proceed by pressing the start button.




7. Select the checkbox for Meta Image 1 and browse for the .appimage file to program. RFbeam provides a modified version of TI's default motion and presence detection demo in the downloads section of the evaluation kit.



8. Switch to the Settings and Utilities tab and change the COM port to the one noted before.



9. Switch back to the Program tab and start programming by pressing the Load Image button.
10. Wait until the update has finished and switch back the SOP0 switch to the "Run" position. Press the reset button on the evaluation kit and the module will be ready for connection.

 TI provides multiple precompiled application examples in its mmWave SDK or in the Radar Toolbox. These can be programmed using UniFlash according to the instructions above, using the provided .appimage files from Texas Instruments.

## 4 Antenna Information

### 4.1 Antenna array geometry

The antenna array of the V-LD3 differs from the default patterns used in TI's evaluation kits. To ensure correct operation, customers must configure the appropriate antenna geometry using the CLI command `antGeometryCfg`. Using the correct configuration is mandatory when working with the V-LD3. Detailed information is provided in the V-LD3 datasheet.

Recommended CLI command for V-LD3 antenna geometry:  
`antGeometryCfg 1 0 0 1 1 2 1 1 0 2 1 3 2.5 2.5`

### 4.2 Pre-calibration

To ensure optimal out-of-the-box performance, RFbeam performs factory-side antenna and RF front-end calibration for the V-LD3 module. This eliminates the need for expensive end-of-line calibration for OEM integrators in most applications.

RFbeam has slightly modified TI's default motion and presence demo to directly load calibrations stored in flash during configuration via a simple CLI command.


Simply replace the `compRangeBiasAndRxChanPhase` CLI command in the configuration with:  
`loadAntennaCal 1`

The value can be in the range of 1-20 and represents the storage index of the calibration dataset.

The V-LD3 module contains multiple pre-stored calibration datasets generated during factory calibration, which can be selected in the `.cfg` file using the corresponding index.

A table of available calibration datasets is provided in the V-LD3 datasheet. Corresponding default configuration files with applied calibrations are available in the downloads section of the V-LD3 sensor module.

 Custom pre-stored calibration datasets can be generated for configurations using start frequencies or bandwidths different from those listed in the V-LD3 datasheet. Please contact RFbeam to discuss available options.

 Modified motion and presence demo source code is available on request.

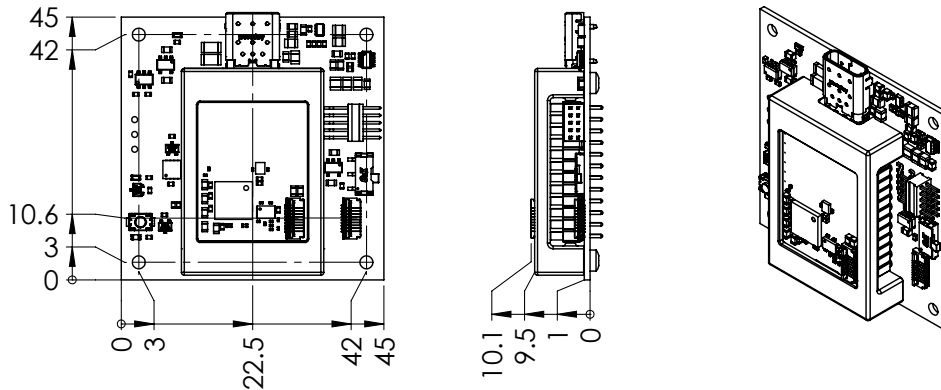
## 5 Hardware information

### 5.1 Schematic and bill of material

Full schematic and bill of material can be downloaded from the RFbeam Microwave homepage under Downloads on the product site for the V-LD3 evaluation kit.

### 5.2 Outline Dimensions

Figure 3: Outline dimensions in millimetre



## 6 Order Information

The ordering number consists of different parts with the structure below

Figure 4: Ordering number structure

<b>Product</b>	-	<b>Customer</b>	-	<b>HW variant</b>	<b>Supply</b>
= V-LD3-EVAL		= RFB for standard products		= 00 for standard variant	= H for 3.3V...5V version

Table 6: Available ordering numbers

Ordering number	Description
V-LD3-EVAL-RFB-00H	Standard V-LD3 evaluation kit

## 7 Packing list

1. Assembled evaluation kit with mounted V-LD3 sensor
2. USB-C to USB-A cable

## 8 Revision History

05/2026 - Revision A: - Initial version

RFbeam does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and RFbeam reserves the right at any time without notice to change said circuitry and specifications.