



Intel® RealSense™ Stereo Depth



Intel® RealSense™ Product Overview

V4.0





Intel® RealSense™ Stereo Depth Technology

Bringing 3D vision to devices and machines that only see 2D today

Stereo Depth Cameras enable devices to see, understand, interact with, and learn from their environment. The onboard Intel® RealSense™ Vision Processor D4 performs all the depth calculations on the camera, allowing for low power, platform agnostic devices. Stereo image sensing technologies work both indoors and outdoors in a wide variety of lighting conditions and can also be used in multiple camera configurations without the need for custom calibration.

Experience the world in 3D with the Intel® RealSense™ products, available from stock at Rutronik. Based on Stereo image sensing technology, the Intel® RealSense™ Cameras provide a solution for a wide range of different applications. Supported by Intel's open-source SDKs, it's fast and easy to build your future vision solution.



Industry-leading depth-sensing technology

Why Intel® RealSense™ Technology?

- Wide range of stereo-based products to align to your specific needs
- On-board vision processor for calculation of depth
- High quality, competitively priced depth cameras
- Designed into hundreds of robotics products worldwide

15+
years
3M+
units

developing and
selling vision
processing
technology

shipped and
designed
into working
solutions



Advantages of 3D and Depth Data

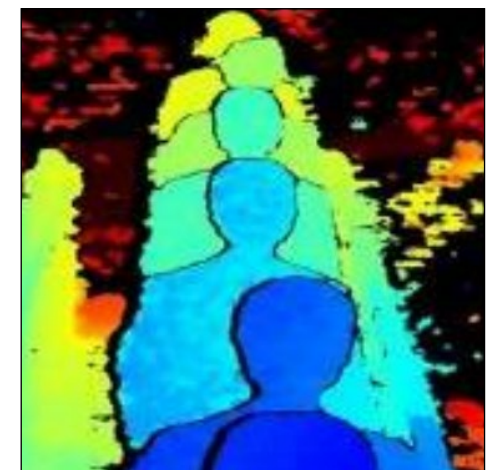
3D depth cameras provide information that 2D cameras are unable to deliver without extensive AI and modeling support. Depth cameras provide real-time depth and RGB information about every point or pixel. This provides a device with human-like vision, enabling movement or scene understanding in any environment.

Depth data communicates distance. This enables:

- Collision avoidance for robots and drones
- Multiple cameras increase accuracy without interference
- Better inference from more data, resulting in improved machine learning
- Reduced compute and time requirements with on board vision processor
- IMU synchronized with depth and wide FOV for VSLAM



This 2D Color
image is showing
an optical illusion.

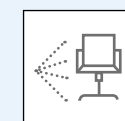


The depth Image shows
individual objects and
their position. Faux color
represents range to object
(red=far, blue=near)

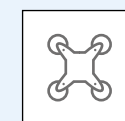
Discover endless possibilities of cutting edge Intel® RealSense™ technology. Adding computer vision to your project, whatever it is, will elevate it to the next level. Here are some application examples accelerated by Intel® RealSense™ solutions.



Robotics & AMRs



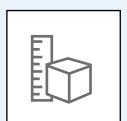
3D Scanning



Recognition & Interaction



Facial Authentication



Measurement & Logistics

Depth Cameras

Intel® RealSense™ D400 Series

Designed for easy setup and portability, Intel® RealSense™ D400 series cameras feature high depth resolution and include active infrared (IR) stereo with standard or wide field of view.

Type	D405	D415	D435 / D435i / D435f / D435if	D455 / D457 / D455f / D456
				
Typical Use Cases	Pick & Place Defect Detection	Collision avoidance / Recognition and Interaction / Scanning		
Value	Shortest Range	Mid-Range Value	Mid-Range WFOV/Flexibility (IMU or IR Pass Filter optional)	Longest Range / Matched Depth & RGB FOV
Ideal Range	7 cm to 50 cm	0.5 m to 3 m	0.3 m to 3 m	0.6 m to 6 m
Depth Accuracy ²	1.4 % at 20 cm	2 % at 2 m		2 % at 4 m
Min Z @Max Resolution	Sub-mm @7 cm	Min Z ~45 cm	Min Z ~28 cm	Min Z ~52 cm
Depth Technology	Stereoscopic	Active IR Stereo	Active IR Stereo	Active IR Stereo
Max Depth Resolution	1280x720 @ 30fps 640x360 @ 90fps1280x720 @ 30fps / 840x480 @90fps			
Depth FOV ¹ HD / Shutter	87° x 58° / Global	65° x 40° / Rolling	87° x 58° / Global	
RGB FOV ¹ / Shutter	1MP 87° x 58° Global via Left Depth Imager	2MP 69° x 42° Rolling	2MP 69° x 42° Rolling	1MP 90° x 65° Global
Dimensions (WxHxD mm)	42 x 42 x 22	99 x 23 x 20	90 x 25 x 25 / 90 x 25 x 25 / 90 x 25 x 26 / 90 x 25 x 26	124 x 29 x 26 / 124 x 29 x 36 / 124 x 29 x 27 / 124 x 29 x 26
Main Components	D401 Depth Module D4 Vision Processor V4	D415 Depth Module D4 Vision Processor	D430 Depth Module D4 Vision Processor	D450 Depth Module D4 Vision Processor V3/V5
IMU	No	No	Optional (D435i & D435if)	Yes
Depth Filter	IR Cut	No	IR Pass (D435f & D435if)	IR Pass (D455f)
IP rate	No	No	No	IP65 (D456 & D457)
Connectors	USB3 Micro-B	USB-C 3.1 Gen 1		USB-C 3.1 Gen 1 / GMSL FAKRA
Use Environment	Indoor / Outdoor			

1) measured +/-3° of stated value 2) measured as out of the factory

D405

Short-range stereo depth

D405 is a short-range stereo camera with sub-millimeter detection accuracy for close-range computer vision needs.

Key features:

- Passive stereo
- Global shutter
- 87° x 58° FOV (HxV)
- Min Z: 7 cm

D405 (Bulk)
82635DSD405MP

D405 (Retail)
82635DSD405



D415

Cost-efficient stereo depth

D415 offers high-value precision and accuracy across a multitude of use cases at low cost.

Key features:

- Active stereo
- Rolling shutter
- 65° x 40° FOV (HxV)

D415 (Bulk)
82635ASRCDVKMP

D415 (Retail)
82635ASRCDVKHV



Retail: Package contains camera, USB cable and Tripod | Bulk: Package contains only the camera



D435, D435i and D455

Broadest vision + optional IMU

D435 features a wide FOV for high-speed depth applications and refined depth awareness in situations where the camera is moving. An inertial measurement unit (IMU) provides position information along with depth data. D455 improves this design with several enhancements.

Key features:

- Active stereo
- Global shutter
- 87° x 58° FOV (HxV)
- Integrated IMU (D435i & D455)
- 2% at 4 m Z-Error (D455)



D435

D435 (Bulk) 82635AWGDVKPM	D435 (Retail) 82635AWGDVKPR
D435i (Bulk) 82635D435IDKMP	D435i (Retail) 82635D435IDK5P
D455 (Bulk) 82635DSD455MP	D455 (Retail) 82635DSD455

D456

IP65 rated long range depth camera

D456 is Intel's longest-range widest field of view global shutter camera with IP65 enclosure and USB interface.

Key features:

- Active stereo
- Global shutter depth and RGB
- 87° x 58° FOV (HxV)
- Integrated IMU
- USB interface
- IP65 enclosure



D456 (Bulk) 82635DSD456MP	D456 (Retail) 82635DSD456
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Retail: Package contains camera, USB cable and Tripod | Bulk: Package contains only the camera

D435f, D435if and D455f

IR Pass Vision + optional IMU

An IR pass filter over the depth lenses increases the relative strength of the textured IR projector pattern, improving depth noise quality and performance range. D455f is ideal for use cases such as fast-moving robotics or drones where reflective light or transparency can be a problem.

Key features:

- Active stereo
- Global shutter
- 87° x 58° FOV (HxV)
- Integrated IMU (D435if & D455f)
- 2% at 4 m Z-Error (D455f)
- IR Pass Filter



D455f

D435f (Bulk) 82635D435FDKMP	D435f (Retail) 82635D435FDK
D435if (Bulk) 82635D435IFMP	D435if (Retail) 82635D435IF
D455f (Bulk) 82635DSD455FMP	D455f (Retail) 82635DSD455F

D457

High bandwidth with GMSL/FAKRA interface

D457 is ideal for applications that require large amounts of data to be transmitted, especially over long distances. The stereo depth camera also has an IP65 grade enclosure.

Key features:

- Active stereo
- Global shutter w/ IMU
- 87° x 58° FOV (HxV)
- GMSL/FAKRA interface
- Supports 15 m cable length
- IP65 enclosure



D457 (Bulk) 82635DSD457MP	D457 (Retail) 82635DSD457
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Depth Modules & Processors

Intel® RealSense™ D421 - Entry-level Stereo Depth Module

Intel RealSense Depth Module D421 is the first all-in-one module integrating the D4 Vision Processor with the optical module on the same board – no additional ASIC board is needed. The Intel RealSense vision processor D4 does all depth calculations onboard, making this a low power, platform-agnostic device. With its compact dimensions of 95 mm (W) x 32 mm (H) x 10.18 mm (D), ease of use, and high-performance depth-sensing capabilities, this module opens up a world of possibilities for applications ranging from 3D scanning to 3D glasses to toys and fast-moving consumer robots. This is a new target group of customers and Intel expects significant volume for this product going forward. Offering depth capabilities at an entry-level price point, the module provides exceptional value for developers, researchers, and hobbyists seeking to explore the possibilities of depth-based imaging as well as consumer products.

Key features

- Single board with optical module and D4 Vision Processor
- Active stereo
- 4% at 2 m Z-Error
- Global shutter depth
- 75° x 50° FOV (HxV)
- IR Filter
- Recommended range 0.2 m to 3 m



Easy integration

Plug-and-play functionality and the integrated single board with the module and the D4 vision processor ensure easy setup and compatibility with popular development frameworks. Designed for seamless integration, Intel RealSense Depth Module D421 is supported by the Intel RealSense SDK 2.0 and compatible with a wide range of platforms and operating systems, including Windows, Linux, and Android.

Ordering information

Intel® RealSense™ D421 Depth Module

D421 (Bulk)
82635DSD421

Currently, there is no camera version of the D421.
A package includes 10x D421 camera modules without USB cable or a tripod.

Target applications



Versatile Vision-based AI Applications

Intel RealSense 3D Stereo technology is an integral part of any vision-based AI solution. Seeing the world in 3D allows for faster machine learning and lowers the time to deployment for automated solutions. D421 is equipped with 1MP global shutter depth sensors, and advanced depth-sensing algorithms for high-speed depth applications.



Moving Robots and more

Lightweight, low-power, and easy-to-use depth cameras give robots the ability to navigate landscapes, avoid obstacles, and recognize objects, people, and more. With its compact size, ease of use, and high-performance depth-sensing capabilities, this module opens up a world of possibilities for applications ranging from 3D scanning to 3D glasses to toys and fast-moving consumer robots.

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Depth Modules & Processors

Intel® RealSense™ D400 Series

For the integration of Intel® RealSense™ technology into higher volume products, depth modules can offer the best compromise between price and flexibility. Multiple different configurations are offered to better suit your needs and product requirements. Designed for easy system integration, all modules feature an imaging sub-system with stereo sensors. When paired with an Intel® RealSense™ Vision Processor, depth data can be output via USB to any platform.

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Type	D401	D415	D430	D450
Use Environment	Indoor/Outdoor			
Image Sensor Technology	Global Shutter			
Depth FOV (H x V)	84° x 58°	65° x 40°	87° x 58°	87° x 58°
Depth Resolution	1280x720			
Depth Frame Rate	Up to 90 fps			
RGB Sensor Technology	Global Shutter	- / Rolling Shutter	-	Global Shutter
RGB Frame Rate & Resol.	1280 x 720 at 30 fps	1920 x 1080 at 30 fps	-	1280 x 800 at 30 fps
Interface	50-pin Board to Board Connector			
Dimensions (L x D x H)	42 x 42 x 23 mm	99 x 20 x 23 mm	90 x 25 x 25 mm	124 x 26 x 29 mm

Also available: Phased-out Depth Module [D410](#)

Ordering Information

Intel® RealSense™
Depth Modules

D401 (Bulk)
82635DSD401

D415 (Bulk)
82635DSASRCPRQ

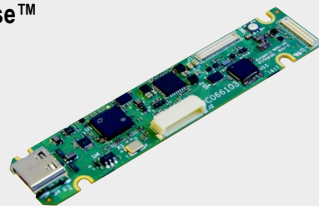
D430 (Bulk)
82635DSAWGPRQ

D450 (Bulk)
82635DSD450

Recommended Accessories

D415 & D430 - Intel® RealSense™
Vision Processor D4 Board
82635DSASMDLPRQ

D450 - Intel® RealSense™
Vision Proc. D4 Board V3
82635DSASICBDIF



Intel® RealSense™
D400 Interposer Rigid
82635DSITR50P



D450 - Intel® RealSense™
Vision Processor D4 Board V5 (GMSL/FAKRA)
82635DSD457ASIC



D405 - Intel® RealSense™
Vision Processor D4 Board V4
82635DSASICBDV4



Intel RealSense SDK 2.0

- Intel® OpenVINO™ integration
- Fast and easy data integration tool
- Open Source cross platform library

More information

www.intelrealsense.com/sdk-2

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with **OpenVINO™**

Operating Systems

- Windows
- Linux
- mac OS
- Android

Programming Languages

- Python
- C/C++
- C#/ .NET
- Node.js

Frameworks and Wrappers

- ROS
- OpenCV
- OpenNI
- MATLAB
- PCL
- UnrealEngine4
- LabVIEW
- Unity

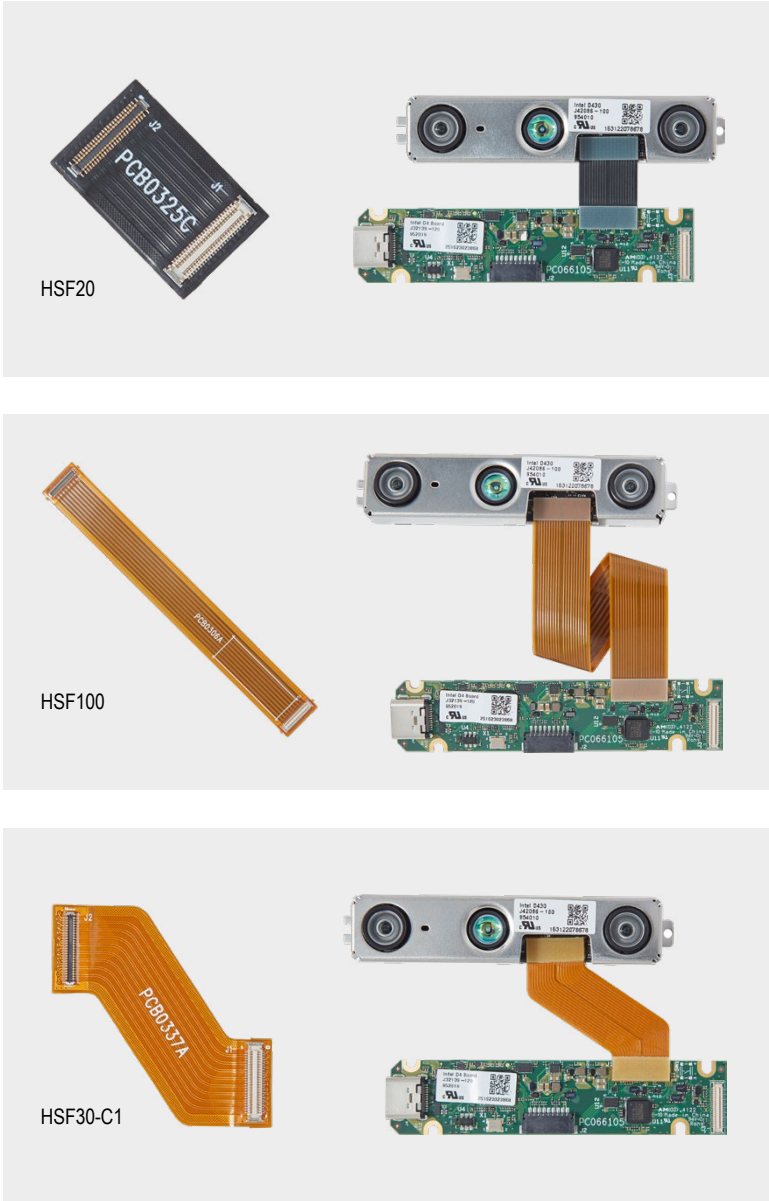
High Speed Flexi Cables for Intel® RealSense™

Cocom® High Speed Flexi (HSF) Cables



Rutronik offers Cocom® High Speed Flexi (HSF) Cables for Intel® D4xx Series Stereo Vision products. HSF cables are used to connect RealSense Depth Modules to the Vision Processor Boards. The wide variety of Cocom's HSF cable portfolio enables easy and flexible system integration of Intel® RealSense D4xx Series products, according to your specific product requirements. Datasheets and 3D step files for further information are linked in the table below.

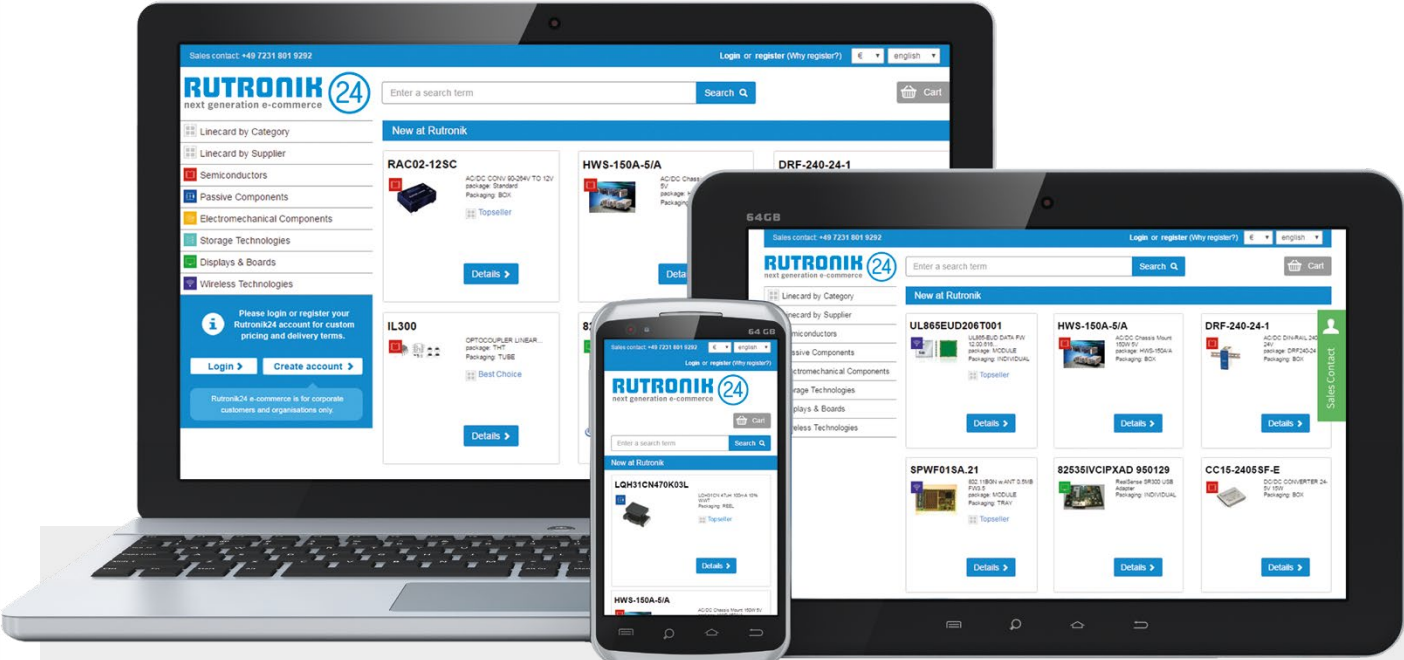
Description	Number	Datasheet	3D Step file
HSF20	PCB0325C	Link	Link
HSF50	PCB0305A	Link	Link
HSF88	PCB0265A	Link	Link
HSF100	PCB0306A	Link	Link
HSF150	PCB0307A	Link	Link
HSF200	PCB0308A	Link	Link
HSF25-C1	PCB0361A	Link	n/a
HSF30-C1	PCB0337A	Link	Link
HSF50-C2	PCB0332B	Link	Link
HSF55-C1	PCB0324A	Link	Link
HSF60-C1	PCB0384A	Link	Link
HSF125-CJ1	PCB0358A	Link	Link



Custom shapes, sizes available on request. Designed and made in UK. Signal descriptions and information available in the Intel RealSense datasheets.



Order Cocom HSF Cables at Rutronik 24



e-commerce made easy

FASTER. EASIER.
JUST MORE PERSONAL.

rutronik24.com

Facial Authentication Solution

Intel® RealSense™ ID



Intel RealSense ID is a trusted and accurate on-device facial authentication solution. By combining an active stereo-depth sensor with a specialized neural network Intel RealSense ID is delivering an intuitive and secure solution that adapts over time. Intel RealSense ID Facial Authentication enables secure entry solutions for a wide variety of use cases. It supports people of varied heights and is designed for Kiosks, Access Control, ATMs, Time-Card Checks, Point-of-Sale, and more. Authenticating users in less than a second, it combines industry-leading hardware, vision technology, and AI software to ensure reliability in varied conditions.

FAST

Authentication in less than a second

ACCURATE

One-in-a-million false acceptance rate

SECURE

On-device encrypted (AES-256) transactions with the use of embedded secure element

Intel RealSense ID is designed to ensure reliable authentication, regardless of skin tone and shade, from darkness to strong sunlight, indoors or outdoors. An active depth sensor projects an infrared pattern that enables accurate authentication even in low light conditions. The camera allows natural interaction for most people from 120 cm to 190 cm in height at a 55 cm distance from many different angles. This makes it easy to use for everyone from children to tall adults. Intel RealSense ID adapts over time, no matter how much a person's style changes. Anti-spoofing ensures that the person in front of the camera is the real person (99.76% assurance). The Intel Facial Authentication solution is protecting against attacks using photographs, videos, or high-quality 3D masks.

Every component of Intel RealSense ID Facial Authentication solution is engineered to work together, for security, privacy, reliability and speed. With fast and easy enrollment, only registered users are authenticated. Intel RealSense ID does not store face images, personal data, or any other identifiable information. Instead, Intel RealSense ID takes a faceprint – like a fingerprint, unique to each person's face – leveraging our vision AI software to determine a match, with one in a million false acceptance rate (FAR). The faceprint cannot be reconstructed into a face image, protecting user's privacy.



Target applications



Kiosk



Access Control



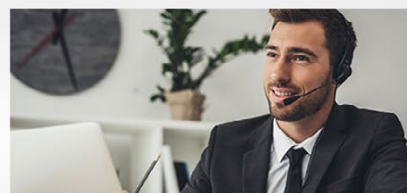
ATM



Time-Card Check



Point-of-Sale



Custom Use Cases

Facial Authentication Solution

Intel® RealSense™ ID

intel REALSENSE™

F455 Peripheral

Ready-to-Use Camera

Intel RealSense ID Solution F455 is ready-to-use and perfect for integration out-of-the-box.



Key features

- Use environment: Indoor/Outdoor
- Operating temperature: 0° to 55°C
- Field of View (H x V): 59° x 80°
- Recommended range: 0.3 to 1 m
- Dimensions: 32.5 mm x 62 mm x 11 mm
- Connectors: USB-C, AUX
- Operating system: Windows, Linux, Android
- Programming languages: C, C++, C#/.NET, Android Java, Python (coming soon)

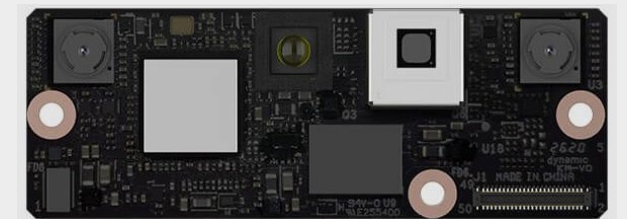
F455* (Bulk)
82635DSF455LMP

F455* (Retail)
82635DSF455L

F450 Module

Camera module for Custom Designs

Intel RealSense ID F450 module for facial authentication is ready for tighter integration into various form factors. Architected for excellent price-performance.



Key features

- Use environment: Indoor/Outdoor
- Operating temperature: 0° to 60°C
- Field of View (H x V): 59° x 80°
- Recommended range: 0.3 to 1 m
- Dimensions: 18 mm x 50 mm x 4.4 mm
- Operating system: Windows, Linux, Android
- Programming languages: C, C++, C#/.NET, Android Java, Python (coming soon)

F450* (Bulk)
82635DSF450L

* With Perpetual Software License (for Facial Authentication + Anti-Spoofing)

Retail: Package contains camera, USB cable and Tripod | Bulk: Package contains only the camera

Intel RealSense ID SDK

The Intel® RealSense™ ID SDK for Facial Authentication is a library providing Facial Authentication capabilities to applications using the Intel® RealSense™ ID Solution F450 or F455. It is open source and available on <https://github.com/IntelRealSense/RealSenseID>.

Intel RealSense ID SDK is only used by the Intel RealSense ID F455 peripheral and F450 module, whereas Intel RealSense SDK 2.0 is meant to be used with Intel RealSense depth cameras.



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