DATA SHEET

(DOC No. WM0201-00 DS)

WiseGuard™
WM-Series AI Sensor

WM0201-00
WM0202-00

Preliminary version 03 October 2026

Himax Technology, Inc.
http://www.himax.com.tw

Revision History

October 2026

Version	Date	Description of changes
01	2026/08/07	New setup.
02	2026/09/25	- Updated current consumption spec.
03	2026/10/16	- Updated Electrical specification - Added SPI master mode - Updated mechanical drawing and lens specification - Revised sensor list

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1. General Description

The Himax WiseGuard™ is a family of ultra-low-power, compact, edge-AI vision solution designed for battery-powered smart devices. Powered by Himax's award-winning WiseEye™ Neural Processing Unit (NPU), WiseGuard™ integrates optimized firmware, AI models, and Himax image sensor into a compact streamlined sensor module package.

Key Capabilities & Performance:

- Out-of-the-Box Intelligence: Pre-loaded with optimized firmware integrating human body detection machine learning models and low power motion detection for immediate deployment.
- Local Edge Processing: Delivers reliable body detection with location coordinates up to 6 meters ideal for smart security and automation.
- Data Efficiency: Utilizes an event-driven pipeline that transmits secure metadata instead of raw video streams. It can also capture compressed color images upon valid event triggers.
- Extreme Power Efficiency: Engineered for battery-constrained environments, the module can operate for up to 5 years on just two standard CR123A batteries. This longevity is driven by versatile wake-up modes that keep the module in deep sleep until triggered via external Passive Infrared (PIR) sensors, Host processor commands or configurable internal self-timers.
- Ultra-Compact Design: 13mm x 11mm x 7.06mm form factor
- Hardware-Level Security: Firmware, proprietary AI models, and user data are processed and stored entirely within the module to ensure strict privacy and IP protection.

1.1. Additional Documents

Please visit Himax GitHub: https://github.com/HimaxWiseEyePlus for the latest documents.

- WiseGuard™ Hardware Design Guide document provides application circuit, layout design, connector information and optical guidelines.
- WiseGuard™ Application Note (AN) document provides state machine, programming guide, I2C protocol, register tables, output data format and DFU description.
- WiseGuard™ Evaluation Kit User Guide provides evaluation system overview, installation instructions, and feature operation description.

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2. Product Configurations

Product	Features	Color	Field Of View	IO Voltage
WM0201-00	- AI Body Detection - Motion Detection - Event Triggered VGA Snapshot - Smart Crop Snapshot	RGB	98.1° (H) x 73.2° (V)	1.8V
WM0202-00		RGB	159° (H) x 118.7° (V)	1.8V

Table 2.1: WiseGuard™ Sensor Configurations

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3. System Block Diagram

The diagram below shows the WiseGuard™ AI sensor system level block diagram. The sensor embeds internal reference clock, NAND flash memory and power management circuits. The sensor is programmed by the host controller via industry standard I2C and sends metadata and / or JPEG image data to the host controller over SPI. Additional GPIO pins support sensor wake (WAKE), hardware reset (RESETN), and host interrupt (INT). Please reference WiseGuard™ Application Note (AN) document for design details.

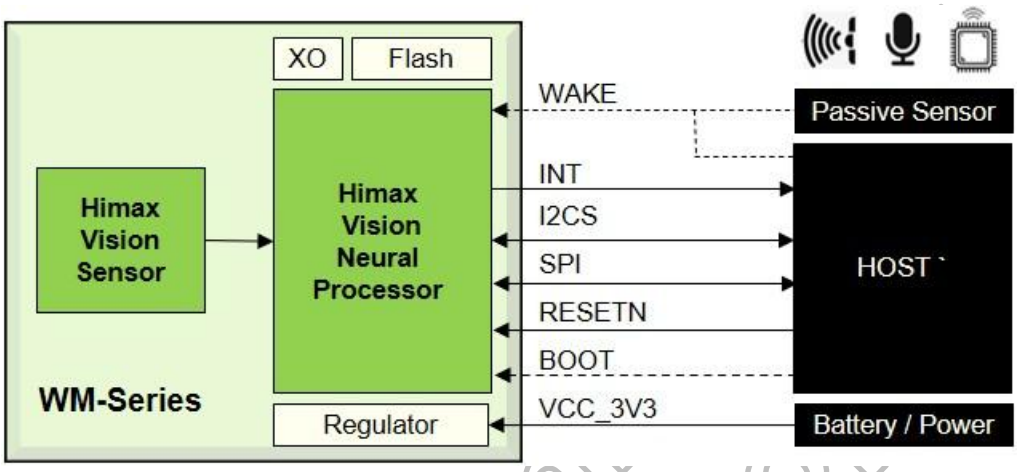


Figure 3.1: System Block Diagram

4. Pin Description

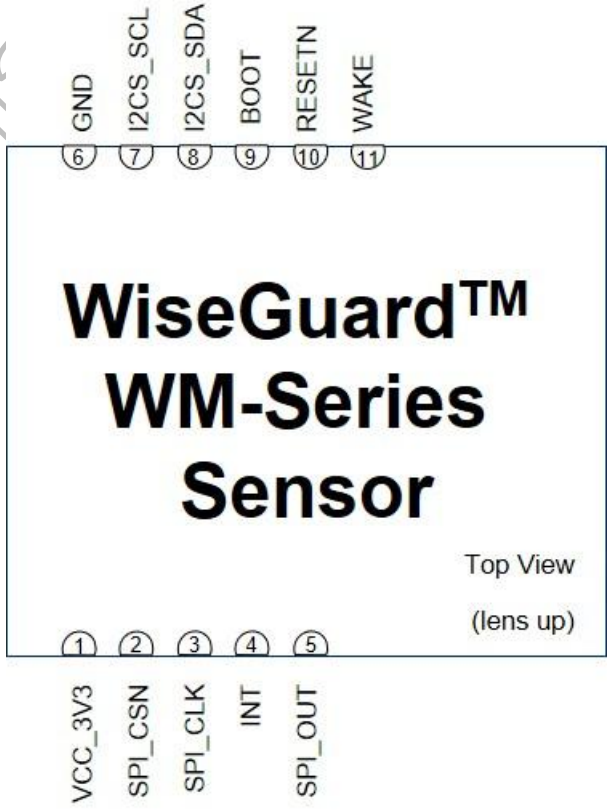


Figure 4.1: Pin Assignment

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Pin no.	Pin name	Type	Description
1	VCC_3V3	Power (3.3V)	3.3V Sensor Power
2	SPI_CSN	Input / Output	SPI Chip Select (Slave / Master)
3	SPI_CLK	Input / Output	SPI Clock (Slave / Master)
4	INT	Output	Interrupt
5	SPI_OUT	Output	SPI Output
6	GND	Ground	Ground
7	I2CS_SCL	Input	Serial clock input
8	I2CS_SDA	Input/Output	Serial data bus
9	BOOT	Input	Boot select
10	RESETN	Input	Hard Reset Function (Active Low)
11	WAKE	Input	Wake Function (Active High)

Table 4.1: Pin Definition

5. Functional Description

5.1. Trigger Modes

WiseGuard™ behaves as a slave sensor and supports two trigger options from the host controller – Single Trigger and Always On (AON) mode.

- Single trigger mode: The host will configure the sensor and issue a trigger command. The sensor will notify the host when the operation is completed and metadata is ready. After the host reads the metadata, the host can place the sensor in Deep Power Down, which is the lowest power state, or power off the sensor.

- Always On mode: The host will configure the sensor for Always On, set the timer and low power management option (PD_EN), and issue a trigger command. When a motion event or person has been detected, the sensor will notify the host and prepare the metadata to be read. Otherwise, the sensor continues to run until the host disables the trigger.

Please refer to the WiseGuard™ Application Note (AN) for design details of each trigger mode.

Trigger Mode	Feature	FRAMES / TRIG	TIMER / TRIG	PD_EN
Single Trigger	Body Detect + JPEG	1 – 65535 frames	N/A	N/A
	Motion Detect	1 – 65535 frames	N/A	N/A
	JPEG	1 frame	N/A	N/A
Always On Trigger	Body Detect + JPEG	1 – 65535 frames	Continuous, 1ms – 32767s	Yes
		1 frame	Continuous, 1ms – 32767s	No
	Motion Detect + JPEG	1 – 65535 frames	Continuous, 1ms – 32767s	Yes
		1 frame	330ms	

Table 5.1: Trigger Features

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5.2. AI Body Detection

WiseGuard™ Body Detection accurately identifies up to ten people and reports the following metadata:

- Human Presence indicator (0: BD count = 0; 1 BD count ≥1)
- BD count (value range 0 – 10)
- BD Bounding box coordinates (x, y) and size (width, height)

Please refer to the WiseGuard™ Application Note (AN) for BD metadata format.

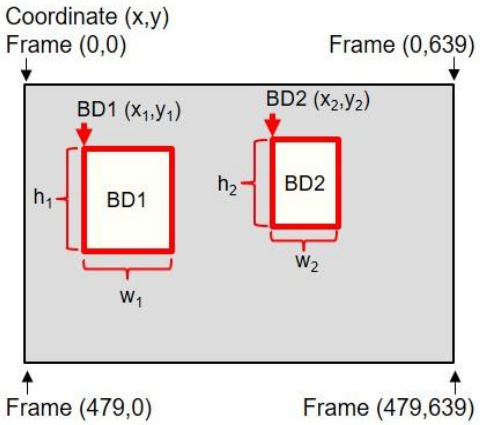


Figure 5.1: Coordinate map for BD Metadata

5.3. Motion Detection

Motion Detection feature can identify movement and reports the following metadata:

- Motion Event indicator (0: No Motion; 1: Motion)
- MD Bounding box coordinates (x, y) and size (width, height)

Please refer to the WiseGuard™ Application Note (AN) for MD metadata format.

5.4. Programmable Rotation

WiseGuard™ features programmable rotation of 90°, 180° and 270° to accommodate flexible sensor mounting orientation. This configuration optimizes performance based on application requirements:

- Vertical FOV Enhancement: 90° maximizes vertical detection field for close-proximity body detection.
- Range Extension: 90° increase the detection range for high-mounting height installation.
- Horizontal Flip: 180° and 270° supports physical horizontal flip orientation

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5.5. Event Triggered JPEG (Full Frame and Smart Crop)

WiseGuard™ supports the simultaneous capture of single of multiple JPEG images in either Single Trigger or Always On (AON) Trigger modes. Image capture is automatically synchronized with both Body Detection and Motion Detection event trigger. There are two JPEG modes – Full Frame and Smart Crop.

- Full Frame (default): 640 x 480 (H) resolution

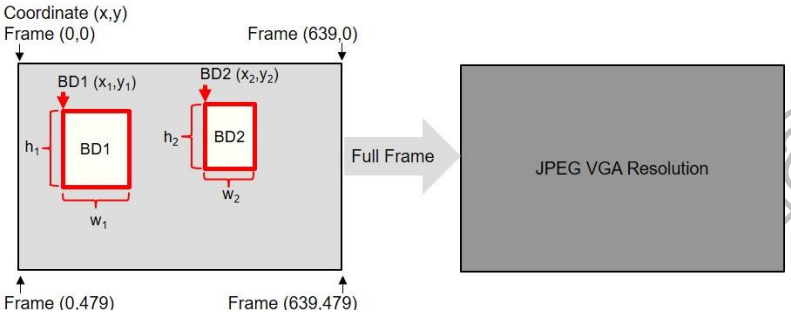


Figure 5.2: Full Frame JPEG Image Data Output

- Smart Crop: JPEG image size and location is dynamically set to the body detection bounding box (x_1, y_1, w_1, h_1). In the case when more than one body has been detected, the resolution will include one contiguous JPEG image framing all bounding box as shown in Figure 5.4. In the case when no body has been detected, the sensor will revert to full frame output.

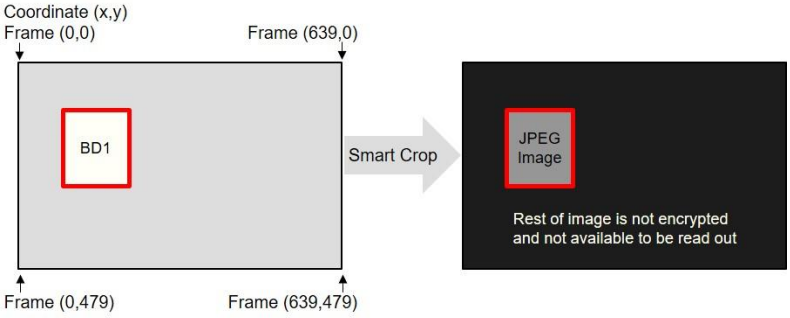


Figure 5.3: Smart Crop JPEG Image Data Output (Single BD Detected)

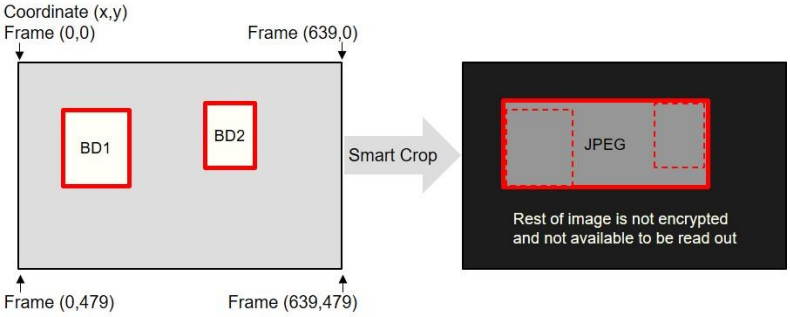


Figure 5.4: Smart Crop JPEG Image Data Output (Multiple BD Detected)

Please refer to the WiseGuard™ Application Note (AN) for JPEG image data format.

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5.6. Store JPEG to Flash

WiseGuard™ implements an 8-slot circular buffer for storing JPEG image data in non-volatile Flash memory. Writes to the flash memory occur sequentially. The first image is stored in slot 0, and subsequent writes increment the memory slot index. Upon reaching slot 7, the internal pointer wraps around to slot 0, overwriting the oldest image data.

5.7. Deep Power Down (DPD)

WiseGuard™ supports Deep Power Down (DPD) mode. The host can enter and exit DPD mode using WAKE GPIO pin. A timer can also be programmed to exit DPD mode.

5.8. Reset

Host controller can apply hard reset to the sensor by pulling RESETN GPIO pin low. The sensor will halt all operations, clear all registers, flags and peripheral configurations to revert to default hardware values. The WiseGuard™ sensor will reload its firmware and set all peripheral configurations, then wait for the host to configure and trigger the sensor.

5.9. Device Firmware Update

WiseGuard™ supports a robust in-system and in-field device firmware update (DFU) capability, supporting secure boot, remote system upgrades with zero bricking risk.

6. Serial Interface Description

6.1. I2C Control Interface

WiseGuard™ uses I2C for sensor status and control registers.

- Slave operation only
- 7-bit slave device ID of 0x62.
- Support Standard (up to 100Kb/s), Fast (up to 400Kb/s) and Fast Mode+ (up to 1Mb/s) transmission
- 2 types of registers – Write-Only **(WO)** and Read-Only **(RO)**
- Register Address is 1 byte; Register Data is 2 bytes (Write) and 4 bytes (Read); little endian.

Please refer to the WM0201-WiseGuard Application Note (AN) for I2C register table and protocol.

6.2. SPI Data Interface

WiseGuard™ supports SPI (mode 0) slave operation (up to 40MHz) and SPI master operation (up to 50MHz) for metadata and JPEG image data transmission. Please refer to the WiseGuard™ Application Note (AN) for SPI image data format.

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7. Electrical Characteristics

7.1. Operating Conditions

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Supply Voltage	VCC_3V3	3.1	3.3	3.5	V
Operating Temperature	T_A	-10	25	85	°C

Table 7.1: Operating Conditions

7.2. Current Consumption

VCC = 3.3V; T_A = 25C

Parameter	Condition	Spec.			Unit
		Min.	Typ.	Max.	
Deep Power Down	-	-	TBD	-	µA
Cold boot	RESET to SENS_RDY – 185ms	-	26	-	mA
SENS_RDY	-	-	5	-	mA
SENS_RUN (AI + JPEG)	Trigger to Interrupt ~ 170ms	-	34	-	mA
SPI Data Output	Metadata & JPEG ~ 120ms	-	28	-	mA

Table 7.2: Power Consumption

7.3. DC Electrical Characteristics

7.3.1. I/O Pins

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Digital Inputs						
Input voltage high	V_{IH}	-	0.7 x V_{IO} (1)	-	V_{IO} (1)	V
Input voltage low	V_{IL}	-	GND	-	0.3 x V_{IO} (1)	V
Digital Output						
Output voltage high	V_{OH}	I_{OH}=-2mA	0.8 x V_{IO} (1)	-	V_{IO} (1)	V
Output voltage low	V_{OL}	I_{OL}=2mA	GND	-	0.2 x V_{IO} (1)	V

Note: (1) The VDD_{IO} domain is 1.8V.

Table 7.3: GPIO DC characteristics

7.4. AC Electrical Characteristics

7.4.1. I²C Interface

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Clock period	t_{CLK}		-	-	1	MHz
Data input setup time	t_{SU}		50	-	-	ns
Data input hold time	t_{HD}		5	-	-	ns

Table 7.4: I2C Characteristics

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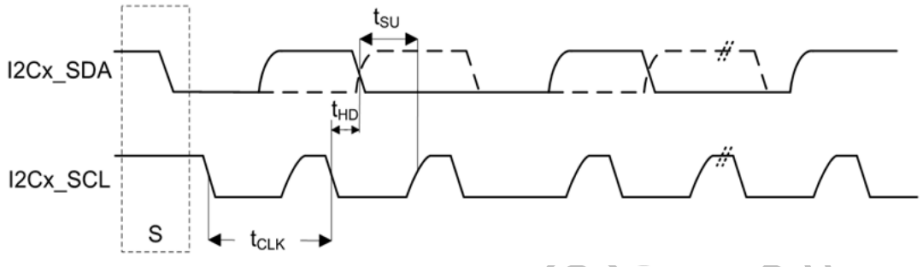


Figure 7.1: I²C Bus Timing

7.4.2. SPI Interface (Slave)

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Clock period	t_{CLK}	V_{IO} = 1.8V	-	-	40	MHz
Data input setup time	t_{SU}	V_{IO} = 1.8V	0	-	-	ns
Data input hold time	t_{HD}	V_{IO} = 1.8V	10	-	-	ns
Data output valid time	t_{DV}	V_{IO} = 1.8V	10	-	22	

Table 7.5: SPI Slave AC Parameters

7.4.3. SPI Interface (Master)

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Clock period	t_{CLK}	V_{IO} = 1.8V	-	-	50	MHz
Data input setup time	t_{SU}	V_{IO} = 1.8V	4	-	-	ns
Data input hold time	t_{HD}	V_{IO} = 1.8V	0	-	-	ns
Data output valid time	t_{DV}	V_{IO} = 1.8V	-2(1)	-	8	

Note: (1) A negative time indicates the actual output data edge is earlier than clock appearing at pin.

Table 7.6: SPI Master AC Parameters

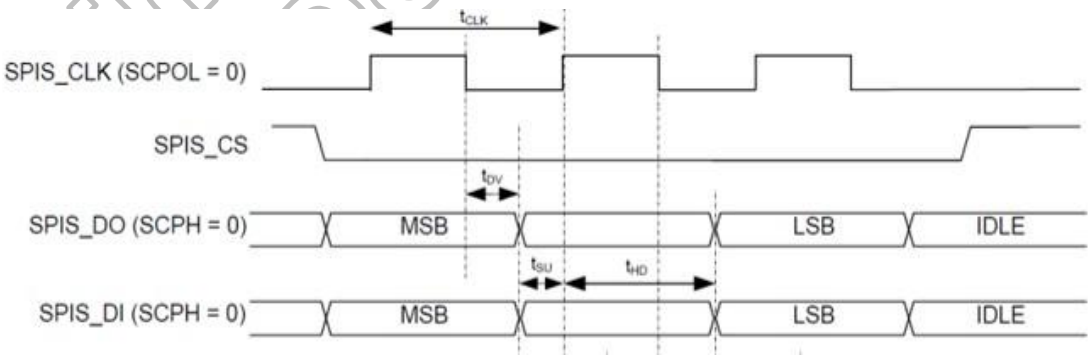


Figure 7.2: SPI Timing (Mode 0)

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7.5. Power-On Sequence

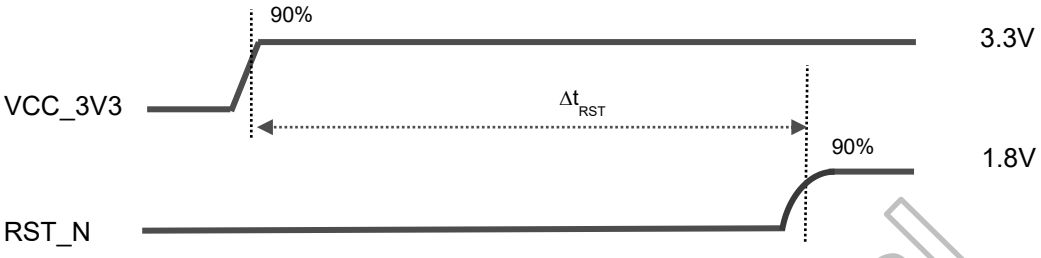


Figure 7.3: Power Up Sequence

Parameter	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Power-On Reset	Δt_{RST}	V_{IO} = 1.8V	3	-	-	ms

Table 7.7: Power On Timing

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8. Optical Specification

8.1. WM0201-00

Parameter		Specification
F/NO		2.4
FOV	Diagonal	129.4°
	Horizontal	98.1°
	Vertical	73.2°

Table 8.1: WM0201-00 Lens View Angle Specification

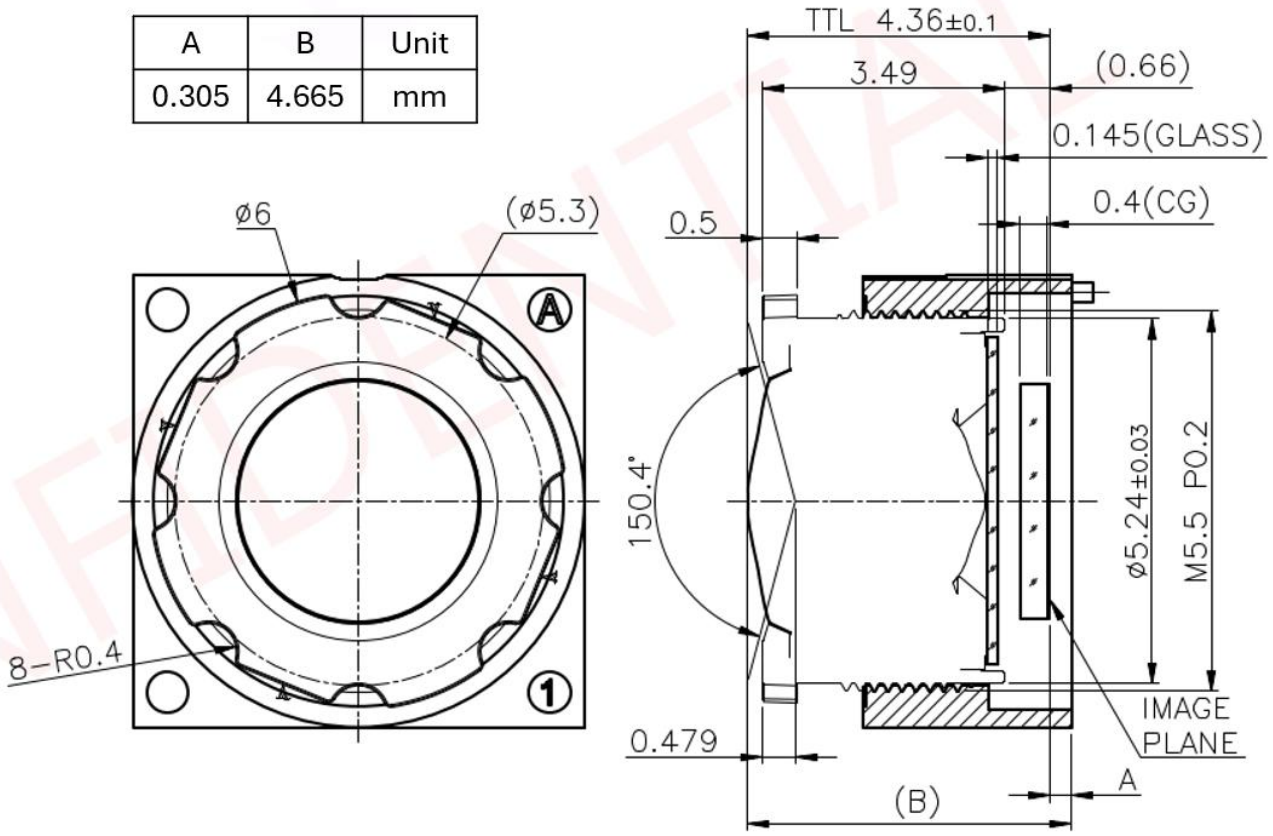


Figure 8.1: WM0201-00 Lens Mechanical Specification

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8.2. WM0202-00

Parameter		Specification
F/NO		2.0
FOV	Diagonal	183.4°
	Horizontal	159.0°
	Vertical	118.7°

Table 8.2: WM0202-00 Lens View Angle Specification

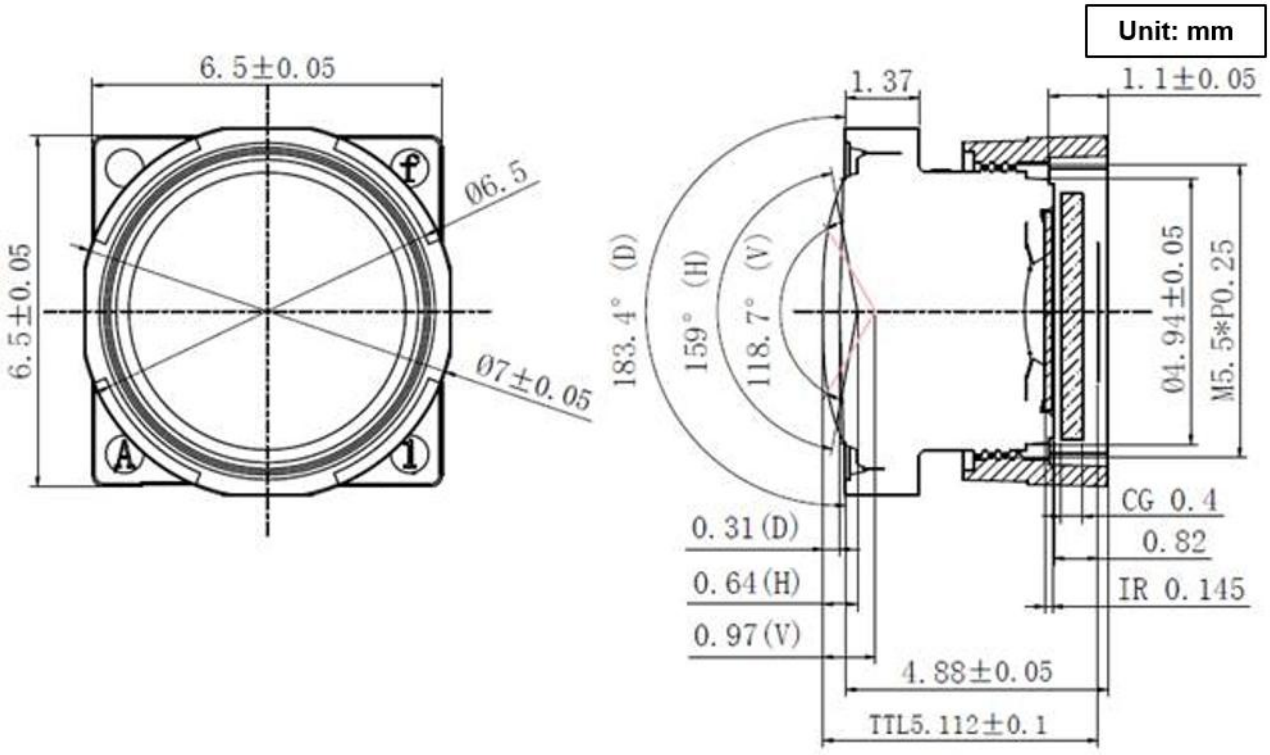


Figure 8.2: WM0202-00 Lens Mechanical Specification

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9. Mechanical Drawing

9.1. WM0201-00

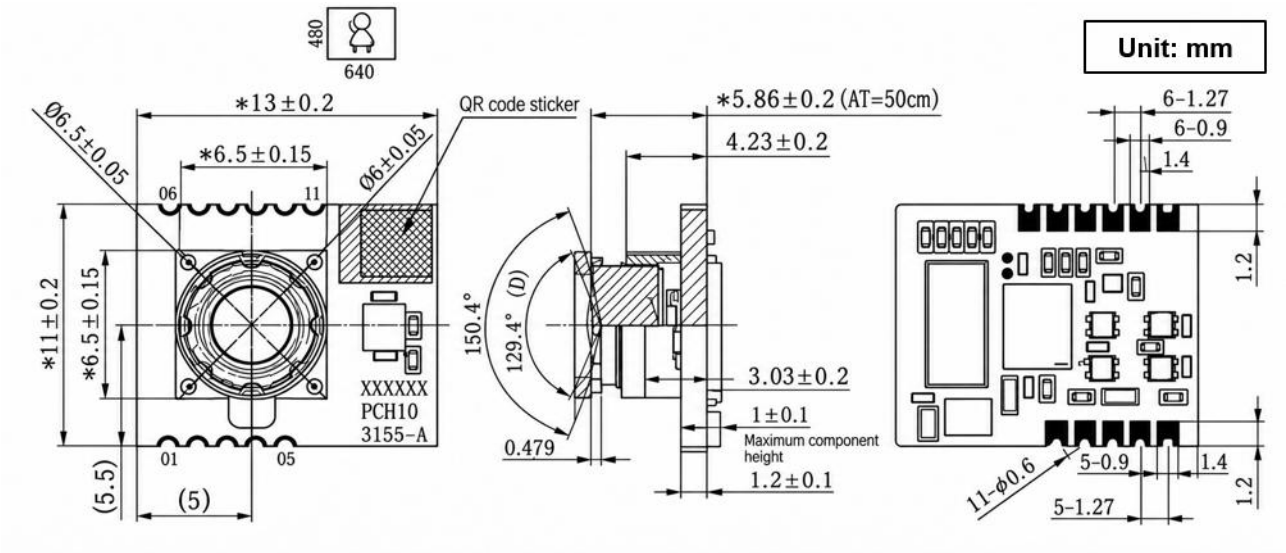


Figure 9.1: WM0201-00 Mechanical Drawing

9.2. WM0202-00

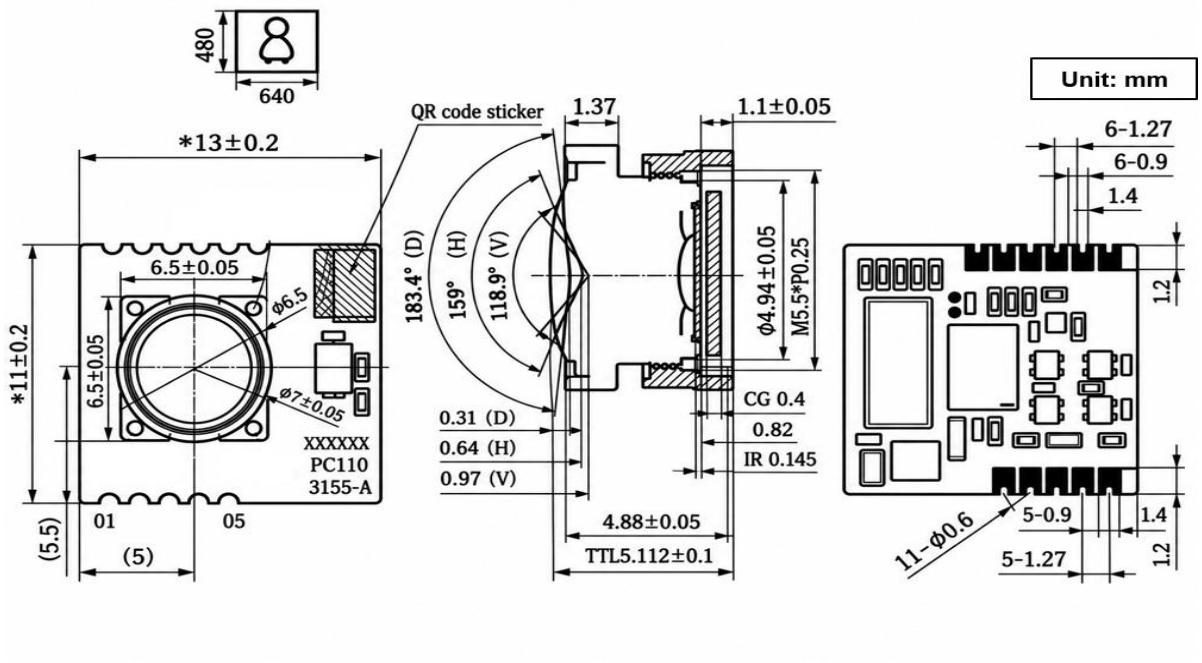


Figure 9.2: WM0202-00 Mechanical Drawing

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