DATASHEET
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ORBBEC® 3D Camera Gemini 2 Series

ORBBEC Inc.

Gemini 2 / Gemini 2 L

Revision History

Version	Date	Note
V1.0	2023.2.7	Initial release
V1.1	2023.3.24	● Modify product brief, product features, application scenarios, recommended system ● Modify product specification sheet ● Modify Figure 1-4-1 sensor arrangement ● Modify PS(PROXIMITY SENSOR) of 2.4.4 to LDP ● Modify the no blind area content of 3.4 and list it separately as 3.7 for detailed explanation ● Modify Table 3-6-1 and Table 3-6-2 resolution and frame rate ● Modify 3.8 Depth start point parameter ● Modify Table 3-12-1 to add typical scenarios ● Modify the fixed trigger of 3.12 to the specific trigger ● Modify the arbitrary frequency passive trigger of 3.13 to free trigger mode ● Modify 3.15 Multi-Camera Synchronization error data ● Modify Multi-Camera Synchronization description in Table 3-16-1 ● Add electronic performance parameters in Table 3-16-2 ● Modify resolution and FPS of Binned Sparse Default in Table 4-1-2
V1.2	2023.4.24	● Modify product lifetime description ● Modify Table 3-6-2 image format ● Modify 3.15 Muti-Camera Synchronization time error data ● Delete Image Mirroring and Dynamic Switching ● Modify 7.3 camera glass parameter description
V1.3	2023.6.30	● Add Gemini 2 L
V1.3	2023.8.15	● Add Depth and Color camera IMU coordinate system ● Modify Appendix II / III
V1.4	2023.10.10	● Add Figure 3-1-10 Bottom view ● Add Figure 4-3-1, 4-3-2, 4-3-3, 4-3-4, 4-3-5 ● Add Figure 4-9-1, 4-9-2, 4-9-3, 4-9-4, 4-9-5 ● Add aspect ratio in Table 4-9-1& Table 4-9-2 ● Modify 4.8 depth start point data ● Modify Power description ● Modify Appendix II / III
V1.5	2023.12.12	● Gemini 2 add Obstacle Avoidance Mode
V1.6	2024.3.16	● Modify IP Rating ● Add 5.1.3

Content

1 Description and Features

Orbbec Gemini 2 Series is a new generation depth camera product based on active stereo technology. This series of products provides a complete range of depth modules, RGB color modules, image signal processors, and depth computing engines. This cameras provide six-axis IMU/inertial data and high quality RGB images. This series also integrates the hardware depth image and color image spatial alignment function, which saves computing power of the host computer. The camera comes with a variety of depth operating modes to choose from to adapt to different application scenarios. It provides flexible and rich frame synchronization and multi-camera synchronization functions. It supports the Orbbec SDK, a unified development toolkit across platforms.

Usages / Markets	● Robot ● AVG / AMR ● 3D body/object scan ● Dimension ● Body tracking ● AR/VR ● Gesture control
System Requirements	**x86/x64** ● OS:Windows 10、Ubuntu18.04/20.04 ● Connector:USB 3.0/USB 2.0 ● CPU:qual-core, 2.9GHz ● RAM:4GB **ARM** ● OS:Ubuntu18.04/20.04、Android 7or above ● Connector:USB 3.0/USB 2.0 ● CPU:Jetson Nano or A311D(quad-core Cortex-A73,dual- core Cortex-A53) ● RAM:4GB ● Support LibUSB + LibUVC ● Support UVC
General Feature	● Hardware Align (Depth to Color) ● No Blind Zone ● Infrared (IR) Laser Projector ● Free Trigger Mode ● Multi-Camera Synchronization Function ● Depth Working Modes

Product Specification

	Name	Gemini 2	Gemini 2 L
Feature	Use Environment	Indoor/semi-outdoor	Indoor/semi-outdoor
	Depth Range[1]	0.15m - 10m	0.20m - 10m
	Ideal Range	0.2m - 5m	0.25m - 7m
	Camera Driver	UVC	UVC
	SDK	Orbbec SDK	Orbbec SDK
Depth	Depth Technology	Stereo Structure Light	Stereo Structure Light
	Baseline	50mm	100mm
	Depth Accuracy[2]	< 2% (1280 x 800 @ 2m & 81% ROI)	< 2% (1280 x 800 @ 4m & 81% ROI)
	Depth Working Mode	Unbinned Dense Default Unbinned Sparse Default Binned Sparse Default Obstacle Avoidance	Unbinned Dense Default Unbinned Sparse Default Binned Sparse Default Dimensioning
	Depth Output Resolution	1280 x 800@30fps 640 x 400@60fps[3]	1280 x 800@30fps 640 x 400@60fps[3]
	Depth Field of View FOV	H91° / V66° / D101° ± 3° @ 2m	H91° / V66° / D101° ± 3° @ 4m
	Shutter Type	Global shutter	Global shutter
IR	IR Image Output Resolution	1280 x 800@30fps 640 x 400@60fps[3]	1280 x 800@30fps 640 x 400@60fps[3]
	IR FOV	H94° / V66.5° / D102° ± 3°	H94° / V68° / D104° ± 3°
RGB	Color Image Output Resolution	1920 x 1080@30fps 1280 x 720@60fps[3] 640 x 480@60fps 640 x 360@60fps	1280 x 800@30fps 1280 x 720@60fps[3] 800 x 600@60fps 640 x 400@60fps 640 x 360@60fps
	RGB FOV	16:9 H86° / V55° / D94° ± 3° 4:3 H63° / V50° / D75° ± 3°	16:10 H93° / V68° / D104° ± 3° 16:9 H93° / V61° / D101±3° 4:3 H65°/ V52°/ D78±3°
	Shutter Type	Rolling shutter	Global shutter
Function	D2C Depth Image FOV	16:9 H86° / V55° / D94° ± 3° @2m 4:3 H63° / V50° / D75° ± 3° @2m	16:10 H91° / V66° / D101°±3° @4m 16:9 H91° / V60° / D98±3° @4m 4:3 H65°/ V52°/ D78±3° @4m
	LDP[4]	Wavelength 940nm Distance measuring range: 0mm - 400mm	Wavelength 940nm Distance measuring range: 0mm - 400mm
	IMU	6 axis	6 axis
	IR Image AE Function	Support	Support
	UVC RGB Function	Support	Support
	Data Connection	USB 3.0 & USB 2.0	USB 3.0 & USB 2.0

Electrical	Power	Typical average[5] < 2.0W Max average[6] < 2.5W Max peak value[7] < 6.5W	Typical average[5] < 2.5W Max average[6] < 3W Max peak value[7] < 8.5W
	Power Input	DC 5V ≥1.5A	DC 5V ≥2A
Physical	Ambient Temperature	0℃ - 40℃	0℃ - 40℃
	Working Humidity	＜ 95 %RH (non-condensing)	＜ 95 %RH (non-condensing)
	Storage Temperature	-20℃ - 60℃	-20℃ - 60℃
	Multi-Camera Connector	8-Pin	8-Pin
	Connector	Type-C	Type-C
	Size	L90 x W25 x D30 mm ± 0.5mm	L124 x W29 x D26 mm ± 0.5mm
	Weight	97g ± 3g	144g ± 3g
	IP Rating	IP 5X	IP 5X
	Mounting Mechanism	1 x 1/4-20 UNC thread mounting point 2 x M3 thread mounting points	1 x 1/4-20 UNC thread mounting point 2 x M4 thread mounting points
	Heat Dissipation	Passive heat transfer	Passive heat transfer
Others	Certification	Class 1、RoHS、FCC、CE、Reach、KC	Class 1、RoHS、FCC、CE、Reach、KC
	Lifetime[8]	3 years	3 years

Notes:

[1] Measure object reflectivity > 10%, up to 10m distance depth data, but the actual accuracy varies with the distance and the object to be measured.

[2] The test object is a reflectivity > 80% plane, and the reference range is 81% FOV (81% FOV is the remaining center 81% of the depth map area after cropping 5% of the top and bottom of the depth map). The root mean square of the distance sequence from all valid points in the area to the best-fit point of the fitted plane is calculated.

[3] 60* fps for depth images in Binned Sparse Default mode.

[4] The actual working range output value range of LDP is 1mm - 400mm in 1mm..

[5] Typical average operating modes with only Depth and RGB data streams turned on and IR images turned off, operating according to typical parameters:

	Gemini 2	Gemini 2 L
Unbinned Dense Default	Depth:1280x800@30fps Y14 RGB:1920x1080@30fps MJPEG	Depth:1280x800@30fps Y14 RGB:1280x800@30fps MJPEG
Unbinned Sparse Default	Depth:1280x800@30fps Y14 RGB:1920x1080@3fps MJPEG	Depth:1280x800@30fps Y14 RGB:1280x800@30fps MJPEG
Binned Sparse Default	Depth:640x400@30fps Y14 RGB:1920x1080@30fps MJPEG	Depth:640x400@30fps Y14 RGB:1280x800@30fps MJPEG
Dimensioning	N/A	Depth:1280x800@30fps Y14 RGB:1280x800@30fps MJPEG
Obstacle avoidance	Depth:1280x800@30fps Y14 RGB:1920x1080@30fps MJPEG	N/A

[6] Maximum average: when depth mode is Unbinned Sparse Default with RGB, IR and Depth data streams are turned on:

	Gemini 2	Gemini 2 L
Depth Mode	Unbinned Sparse Default	Unbinned Sparse Default
RGB	1920x1080@30 fps MJPEG	1280x800@30 fps MJPEG
Depth	1280x800@30 fps RLE	1280x800@30 fps RLE

IR	1280x800@30 fps MJPEG	1280x800@30 fps MJEPG
Exposure	5000us	3000us
Laser Energy Level	5	7

[7] Maximum peak power consumption is maximum instantaneous power, depth mode and parameter setting are the same as [6].

[8] Operating in typical working mode within the supported temperature(0-40℃) for up to 8 hours a day.

2 Introduction

2.1 Purpose

This document describes the specifications and some design details of ORBBEC® Gemini 2 Series depth camera products, as well as for developers to understand and use the related products.

2.2 Terminology

Table 2- 2-1 Terminology Description

Term	Description
Baseline	Distance between left and right infrared camera imaging centers
Depth	The depth video stream is basically the same as the color video stream, except that each pixel value represents the spatial depth of the observed object from the camera, rather than the color information in the color image.
FOV	Field of view, used to describe the angular range of the camera to observe a given scene, there are three main horizontal field of view (H FOV), vertical field of view (V FOV) and diagonal field of view (D FOV).
Depth Processor	Depth computation processor, a dedicated ASIC chip for implementing depth computation algorithms and outputting depth images, such as MX6600.
IR Camera	Infrared camera, or infrared camera.
LDMP/LDM	Laser modules, also known as IR projector, etc., for emitting structured light patterns.
Depth Camera	Only the depth imaging module and the external interface are included, where the depth imaging module generally consists of an infrared projector, an infrared camera and a depth computing processor.
PS	Proximity Sensor, a proximity sensor for laser safety protection.
ISP	Image signal processor for post-processing of images.
LDP	Proximity Sensor for laser safety protection and distance measurement.
IR Flood	IR floodlight, using infrared light to illuminate the environment, used to fill the infrared imaging light.
Lens	Lens sets for imaging in infrared cameras, color cameras, and for projection in laser diffuser.
MIPI	MIPI Alliance, the Mobile Industry Processor Interface (MIPI) Alliance, is an open standard and a specification for mobile application processors initiated by the MIPI Alliance.
SoC	System on Chip, also known as System on Chip, means that it is a product that is an integrated circuit with a dedicated target that contains a complete system with embedded software in its entirety.
ASIC	ASIC is considered to be an integrated circuit designed for a specific purpose. It is an integrated circuit designed and manufactured in response to specific user requirements and the needs of a specific electronic system. ASIC are characterized by being oriented to the needs of specific users. ASIC have the advantages of smaller size, lower power consumption, increased reliability, improved performance, enhanced confidentiality, and lower cost when compared to general-purpose integrated circuits in mass production. In this document, it mainly refers to MX6600.
PCBA	PCB(Printed Circuit Board) that carry deep computing processors, memories and other electronic devices.

TBD	TBD, information will be provided in a later revision.

2.3 Introduction to Active Stereo 3D Imaging Technology

The Gemini 2 Series is a depth camera that utilises active stereo 3D imaging technology. It comprises of IR Left and IR Right cameras, a laser projection module (LDM), and a depth computation processor (MX6600). The laser projection module projects structured light patterns onto the target scene, while the left and right IR cameras acquire the corresponding images. These images are then processed by the depth computation processor using an algorithm to produce a depth image of the scene.

2.4 Depth Field of View at Distance(Depth Z)

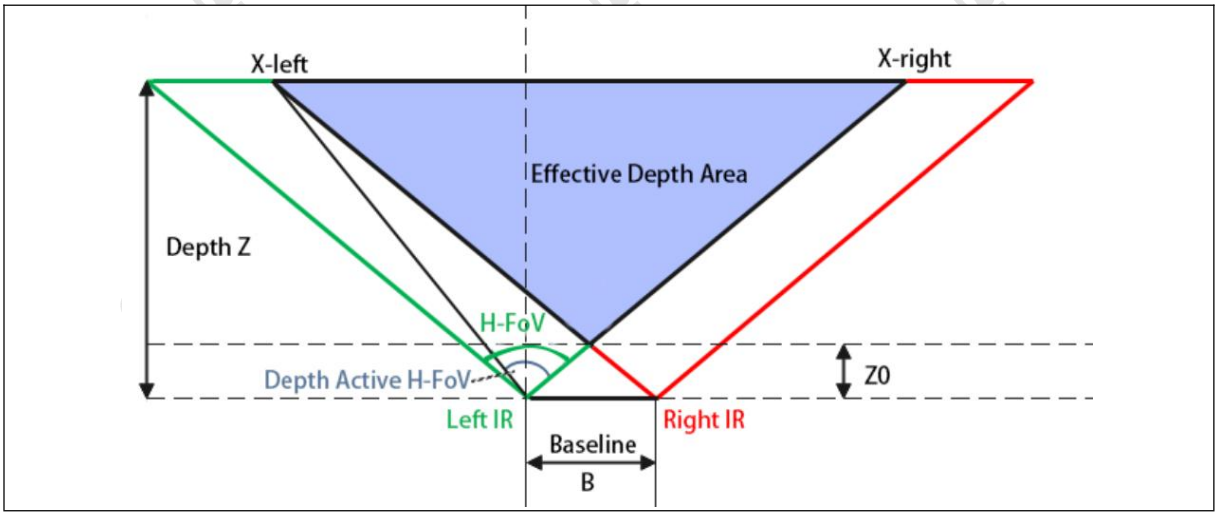


Figure2-4-1 Depth Field of View to Depth Map Illustration

Depth Field of View (Depth FOV) at any distance (Z) can be calculated using the following equation:

$$\text{Depth Active H-FoV} = \arctan\left(\frac{cx}{fx} - \frac{B}{Z}\right) + \arctan\frac{width - 1 - cx}{fx}$$

$$H - FoV = \arctan\frac{cx}{fx} + \arctan\frac{width - 1 - cx}{fx}$$

$$Z0 = \frac{B}{2\left(\tan\frac{H-FoV}{2}\right)}$$

Definitions:

1. cx = X-direction image coordinates of the main point of the depth image

2. fx = Depth camera focal length
3. width= Depth image width
4. H-FOV = IR H-FOV

Note:

1. cx, fx, and width parameters are obtained through the SDK Depth Intrinsic for the relevant camera parameters, and each depth camera parameters are not the same.

2. At different distances, the depth FOV is different. The farther the distance, the greater the depth FOV.

2.5 Depth Camera System Framework

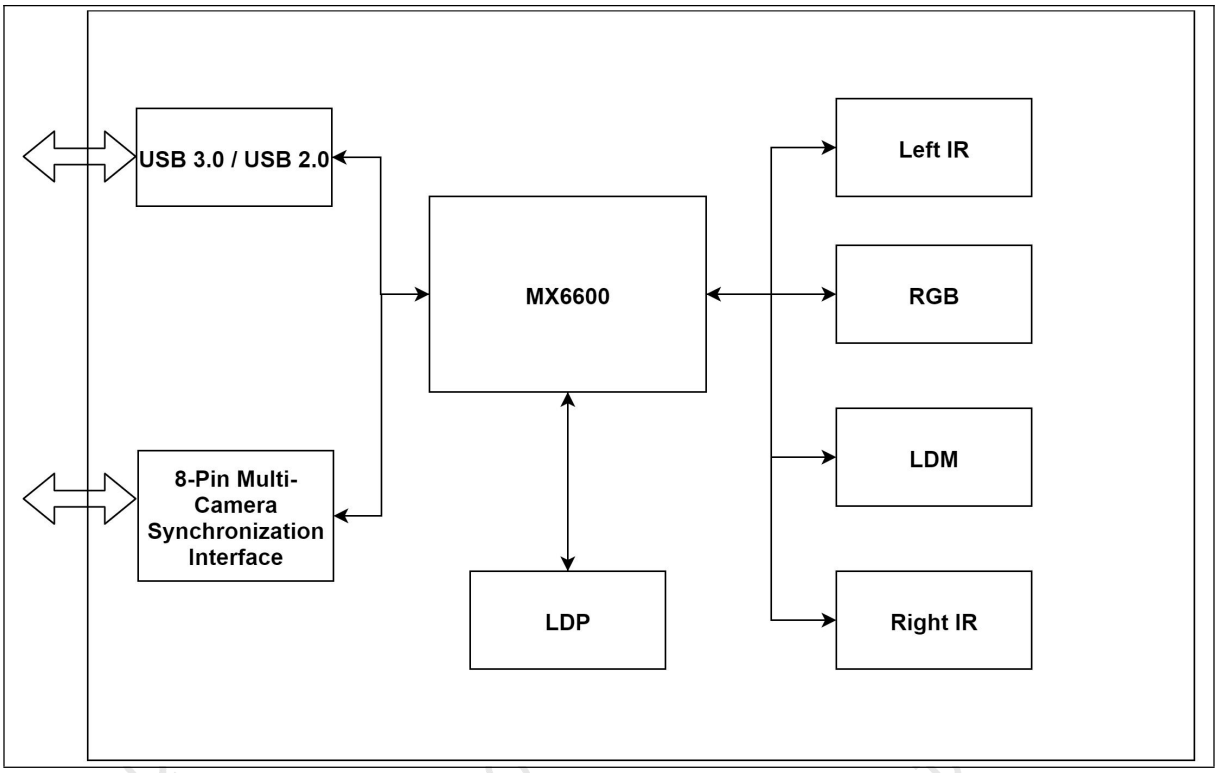


Figure 2-5-1 Gemini 2 Series System Framework Diagram

3 Product Composition

3.1 Component Composition

This section introduces the basic structure of the Gemini 2 Series depth camera. Please note that structure size data and pictures may vary slightly due to product-specific configuration differences. For more accurate information, please refer to the actual product.

3.1.1 Product Physical Picture

Figure 3-1-1 Gemini 2 Front View

Figure 3-1-2 Gemini 2 Rear View

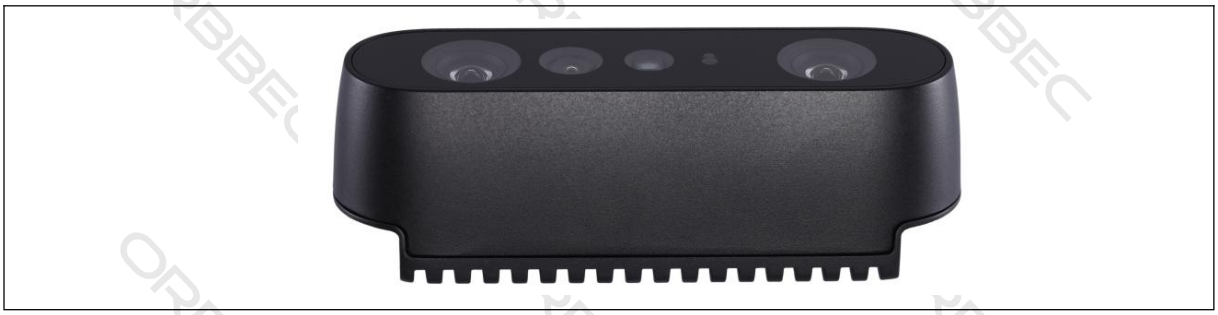


Figure 3-1-3 Gemini 2 Top View

Figure 3-1-4 Gemini 2 L Front View

Figure 3-1-5 Gemini 2 L Rear View

Figure 3-1-6 Gemini 2 L Top View

Figure 3-1-7 Gemini 2 L Bottom View

3.1.2 Camera Dimension

Table 3-1-1 Gemini 2 Dimension

Dimension	Nominal	Unit
Width	90	mm
Height	25	mm
Depth	30	mm

Gemini 2 dimension diagram:

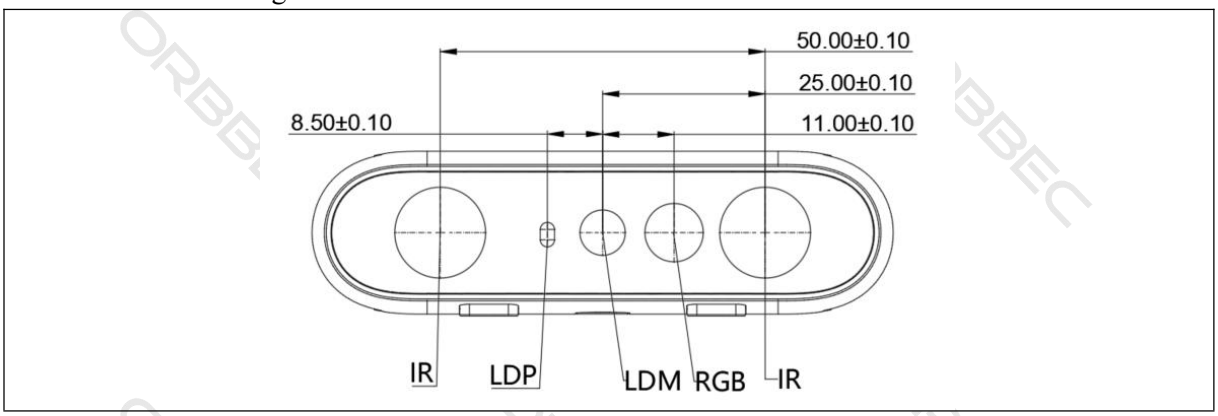


Figure 3-1-8 Front View

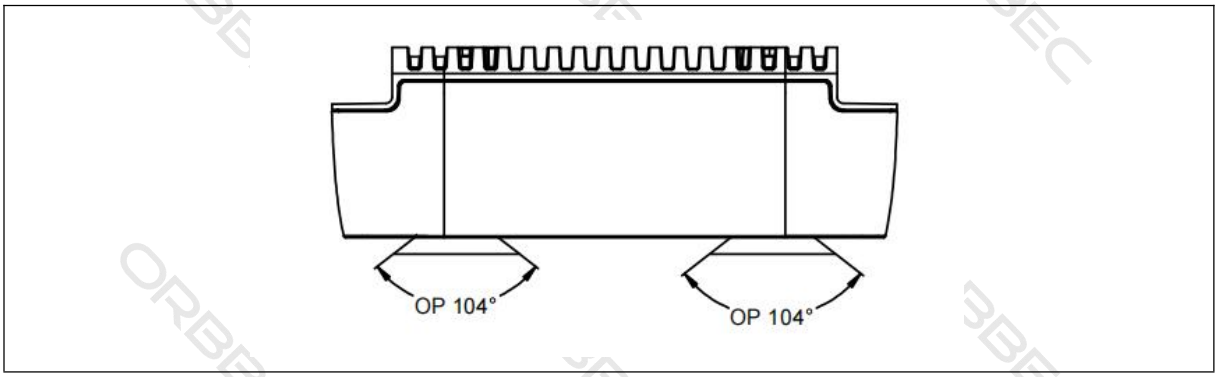


Figure 3-1-9 Top View

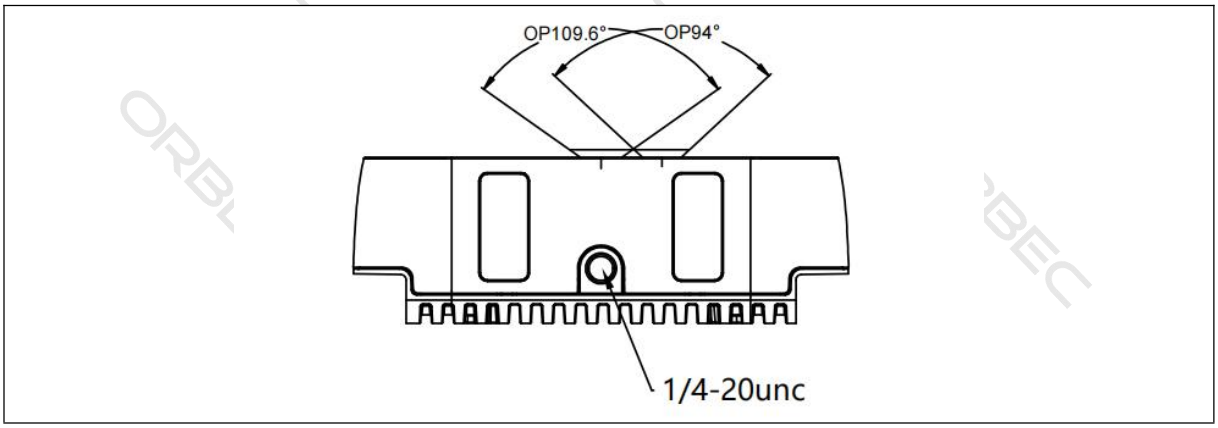


Figure 3-1-10 Bottom View

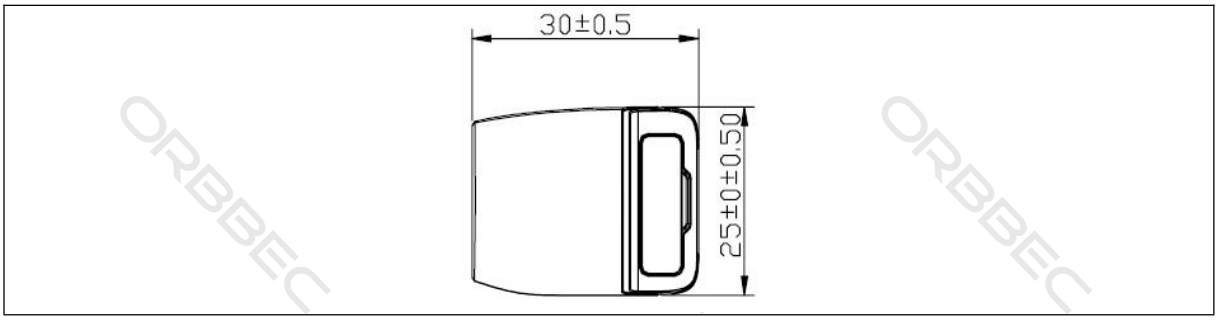


Figure 3-1-11 Right View

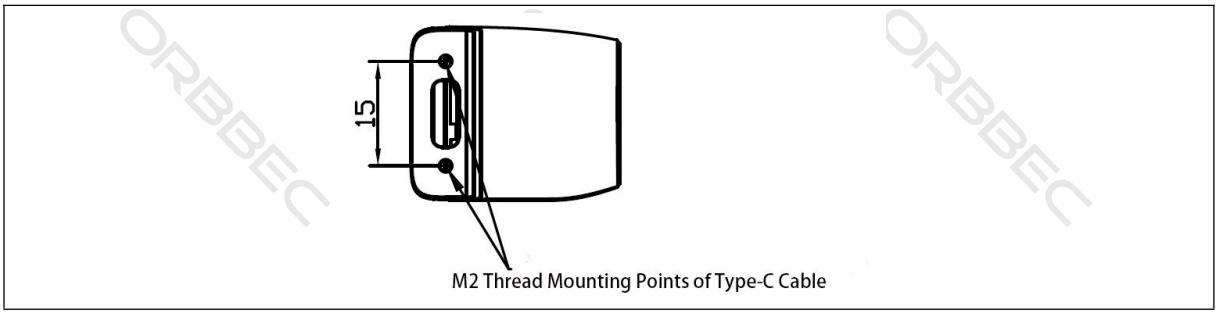


Figure 3-1-12 Left View

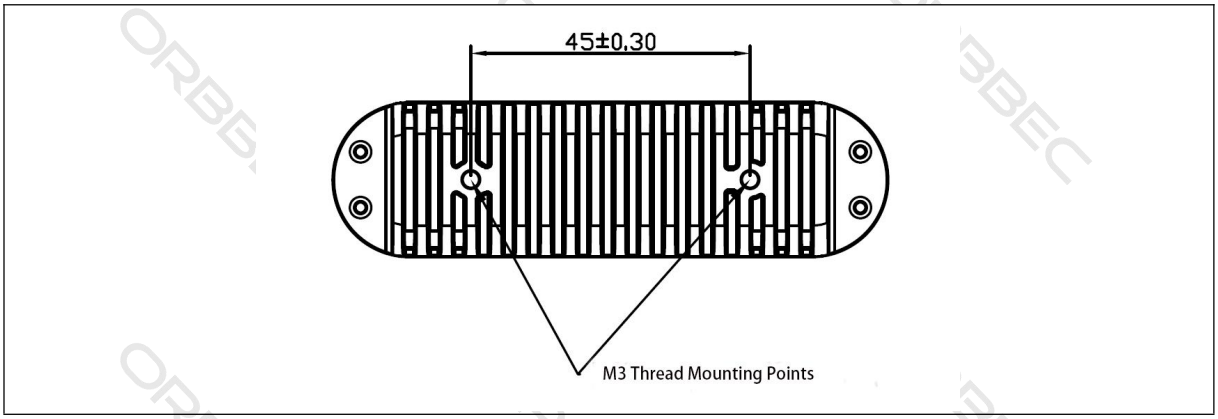


Figure 3-1-13 Rear View

Table 3-1-2 Gemini 2 L Dimension

Dimension	Nominal	Unit
Width	124	mm
Height	29	mm
Depth	26	mm

Gemini 2 L dimension diagram:

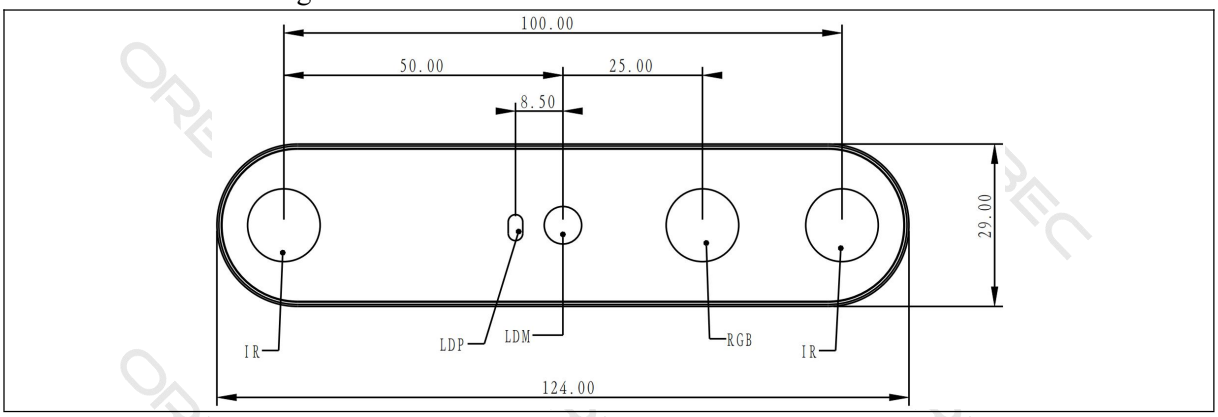


Figure 3-1-13 Front View

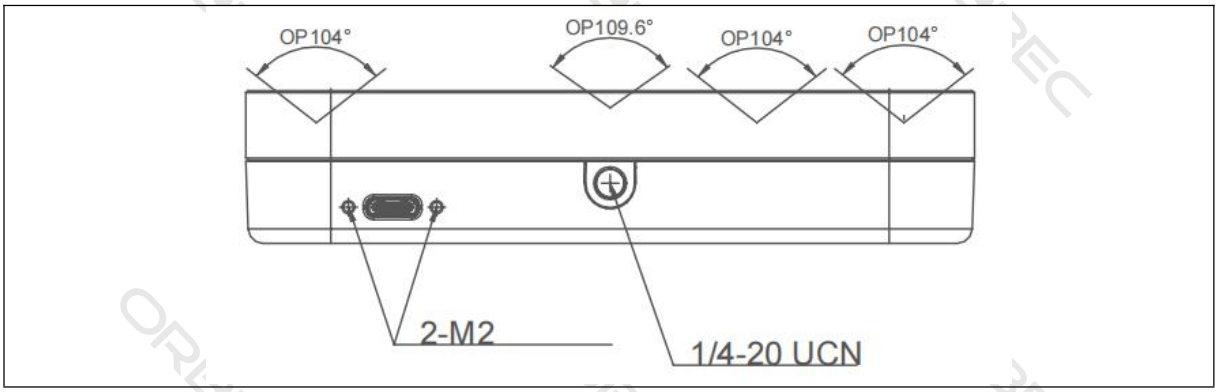


Figure 3-1-14 Bottom View

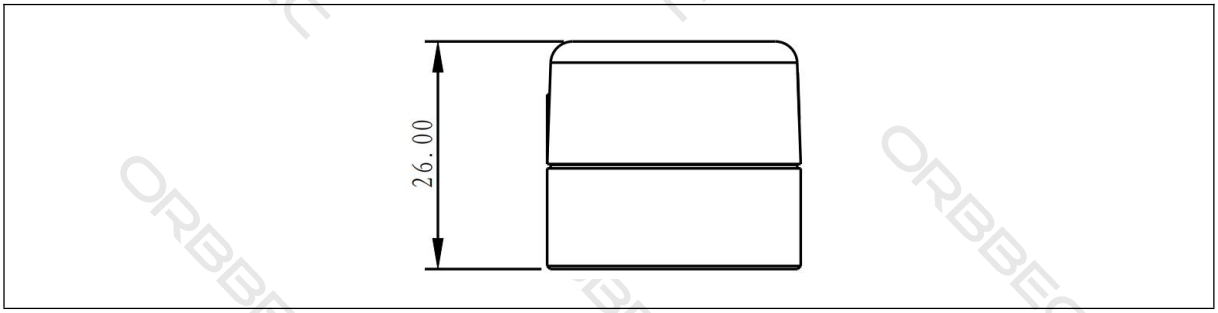


Figure 3-1-15 Side View

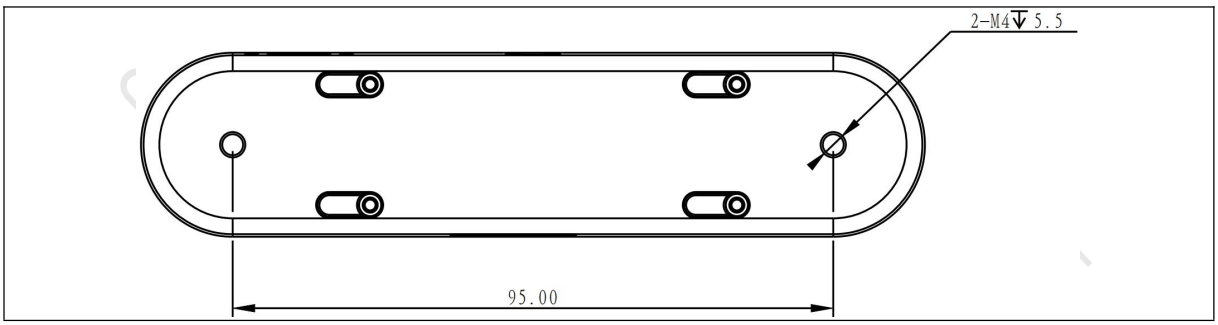


Figure 3-1-16 Rear View

3.2 Component Description

Figure 3-2-1 Gemini 2 Series Product Diagram

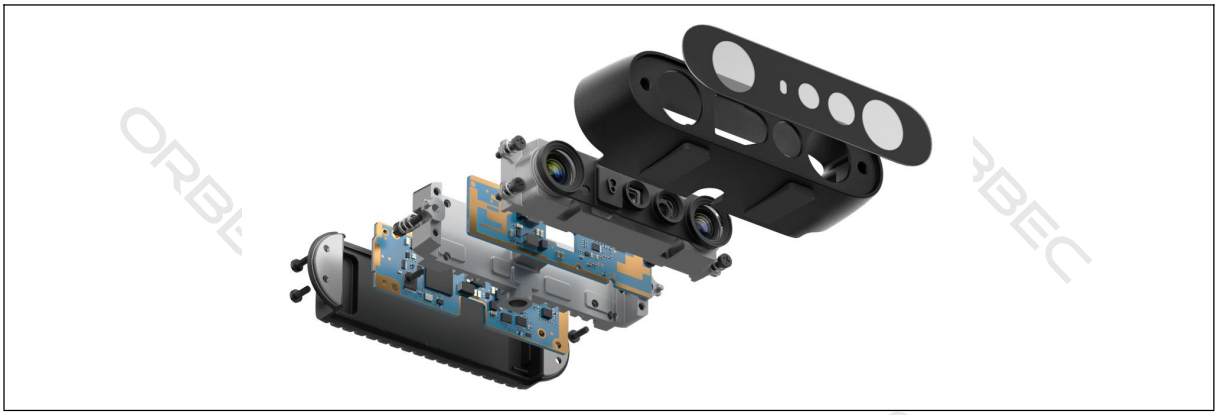


Figure 3-2-2 Exploded View

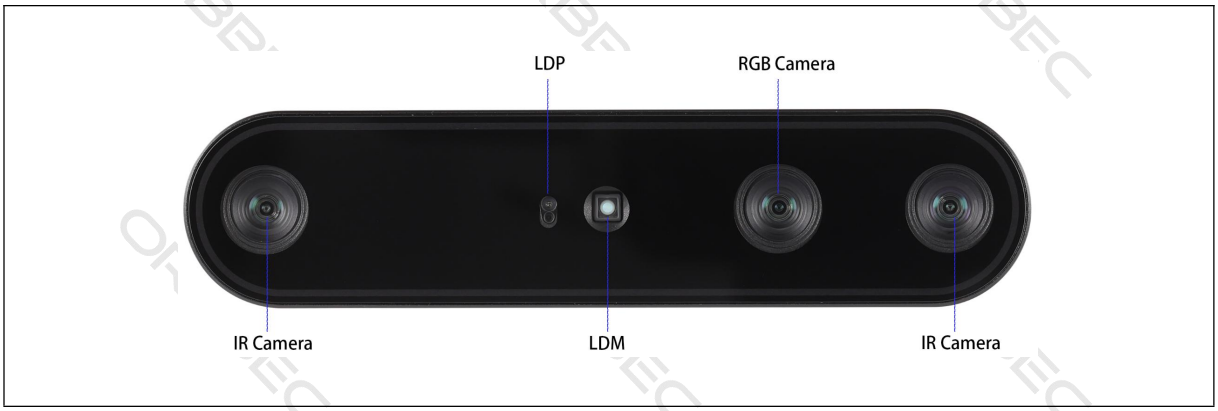


Figure 3-2-3 Gemini 2 L Product Diagram

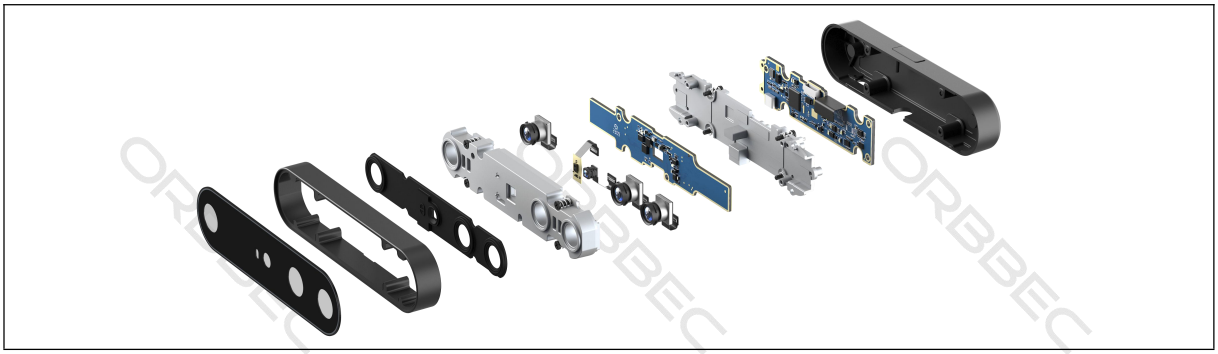


Figure 3-2-4 Gemini 2 L Exploded View

3.3 Depth Engine

The Depth Computing Processor MX6600 is mainly used for depth image calculations. The host computer communicates with the depth camera through Type-C and receives image data from the Depth Computing Processor.

3.4 Depth Camera Module

3.4.1 Infrared Camera

Table 3-4-1 Infrared Camera Parameter

Parameters	Gemini 2 / Gemini 2 L
Effective Pixels	1280 x 800
Aspect Ratio	16 : 10
Focal Length	Fixed focus
Shutter Type	Global shutter
Signal Interface	MIPI
Horizontal FOV	94°
Vertical FOV	68°
Diagonal FOV	104°
FOV Error	±3.0°

3.4.2 Laser Module

The laser module (LDM) comprises an array of vertical cavity surface emitting lasers and a spot diffuser. It enhances the depth camera system's ability to detect depth information by projecting static infrared patterns onto the scene, adding texture to low-quality scenes. The Gemini 2 Series laser module is a Class 1 Laser Product under normal conditions.

Table 3-4-2 Laser Module Parameters

Parameters	Gemini 2 / Gemini 2 L
Type	Infrared
Lighting Component	Vertical Cavity Surface Laser Emitter(VCSEL) + Optics
Laser Controller	Pulse
Wavelength	850nm
Horizontal FOV	101°
Vertical FOV	72.5°
FOV Error	±3.0°

3.4.3 Color Camera

Table 3-4-3 Color Camera Parameters

Parameters	Gemini 2	Gemini 2 L
Effective Pixels	1920 x 1080	1280 x 800
Aspect Ratio	16:9	16:10
Format	MJPEG & YUYV	MJPEG & YUYV
Focal Length	Fixed focus	Fixed focus
Shutter Type	Rolling shutter	Global shutter
Signal Interface	MIPI	MIPI
Horizontal FOV	86.2°	94°
Vertical FOV	55.2°	68°
Diagonal FOV	94.2°	104°
FOV Error	±3.0°	±3.0°

3.4.4 Proximity Sensors(LDP)

The Gemini 2 Series supports LDP, which detects objects in close proximity and enables laser safety protection.

Gemini 2: LDP protection standard is ≤ 10cm ±2mm.

Gemini 2 L: LDP protection standard is ≤ 15cm ±2mm.

The LDP function is tested as follows.

The camera system will reduce or turn off the power supply and IR image brightness when an object moves closer to the camera. This is due to the activation of laser safety protection. During this stage, the IR image brightness value will decrease below its original value. When the object moves away from the

camera, the aforementioned changes will be reversed, and the laser safety protection will be turned off at the end.

3.4.5 Gemini 2 Series Interface

Gemini 2 support Type-C and 8-Pin multi-camera synchronization :

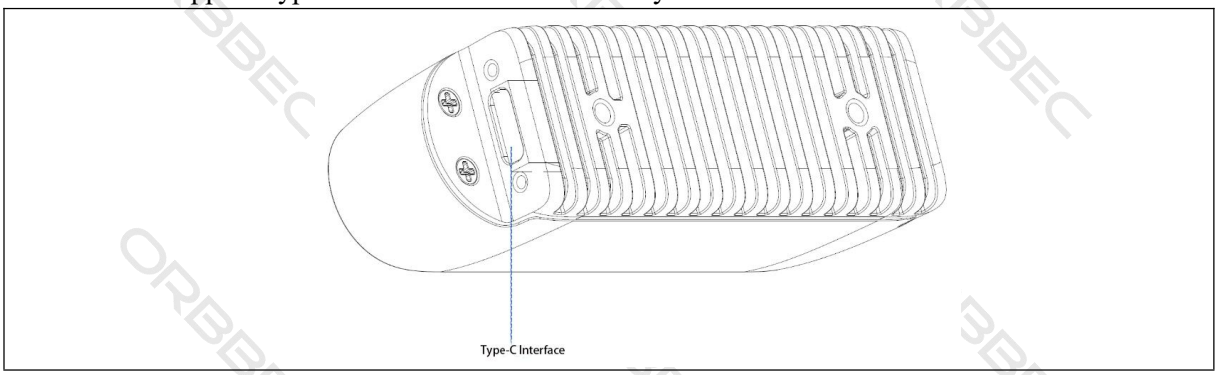


Figure 3-4-1 Type-C Interface

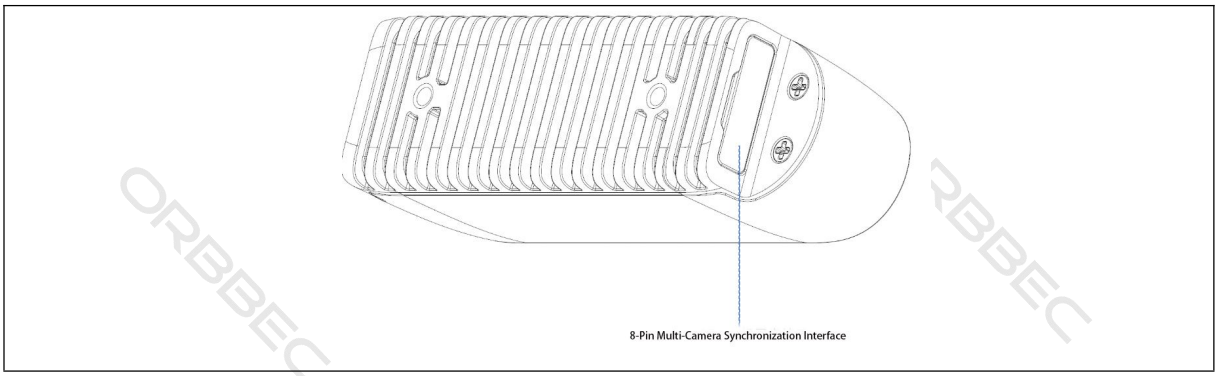


Figure 3-4-2 8-Pin Multi-Camera Synchronization Interface

Gemini 2 L support Type-C and 8-Pin multi-camera synchronization :

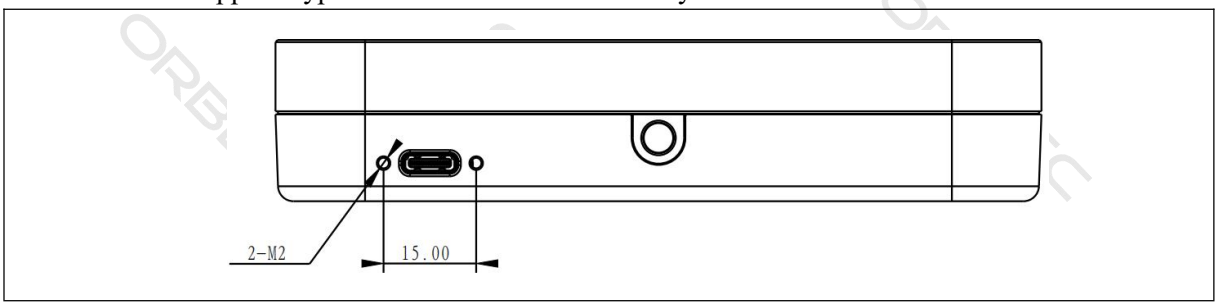


Figure 3-4-3 Type-C Interface

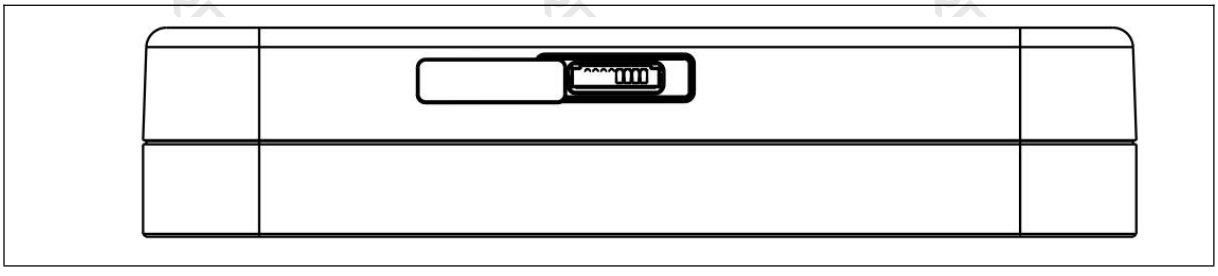


Figure 3-4-4 8-Pin Multi-Camera Synchronization Interface

4 Functional Specification

4.1 Vendor Identification(VID) and Product Identification(PID)

Table 4-1-1 Gemini 2 Series VID and PID

Name	Model	VID	PID
Gemini 2	G20155-15	0x2BC5	0x0670
Gemini 2 L	G20055-15	0x2BC5	0x0673

4.2 Platform and System Requirements

This product connects to the host computer using Type-C, which is compatible with various platforms and system requirements.

Table 4-2-1 Gemini 2 Series Platforms and Systems

Chip	x86 / x64		ARM		
OS	Windows 10	Ubuntu 18.04/20.04	Android 8/9/10	Ubuntu 18.04/20.04	ROS / ROS2
USB	USB 3.0 & USB 2.0	USB 3.0 & USB 2.0	USB 3.0 & USB 2.0(support host)	USB 3.0 & USB 2.0(support host)	USB 3.0 & USB 2.0(support host)
CPU	Quad-core, 2.9GHz	Quad-core, 2.9GHz	Quad-core Cortex-A73, dual-core Cortex-A53	Quad-core Cortex-A73, dual-core Cortex-A53	Quad-core Cortex-A73, dual-core Cortex-A53
RAM	8GB	4GB	4GB	4GB	4GB

4.3 Depth Image of FOV

The table presents the depth FOV values for the Gemini 2 Series, including horizontal, vertical, and diagonal FOV, as well as FOV error.

Table 4-3-1 Gemini 2 / Gemini 2 L Depth Image of FOV

Parameters	Gemini 2	Gemini 2 L
Horizontal FOV	91°	91°
Vertical FOV	66°	66°
Diagonal FOV	101°	101°
FOV error	±3.0°	±3.0°
Distance	2m	4m

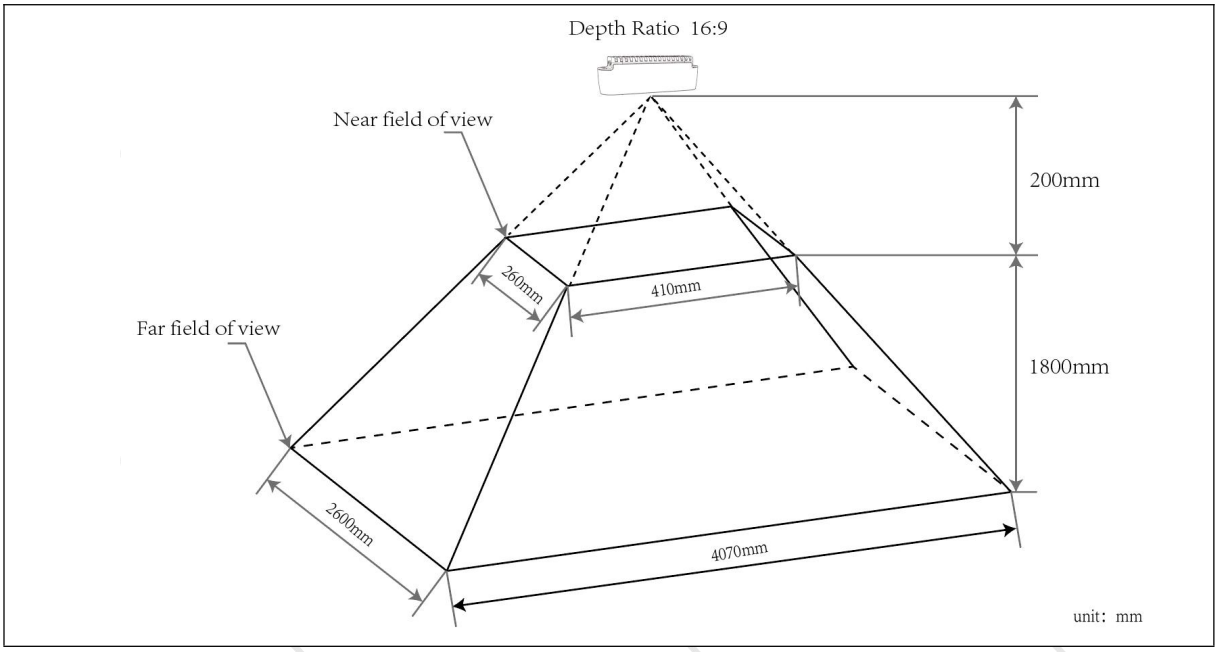


Figure 4-3-1 Gemini 2 Depth Aspect Ratio16:9 FOV

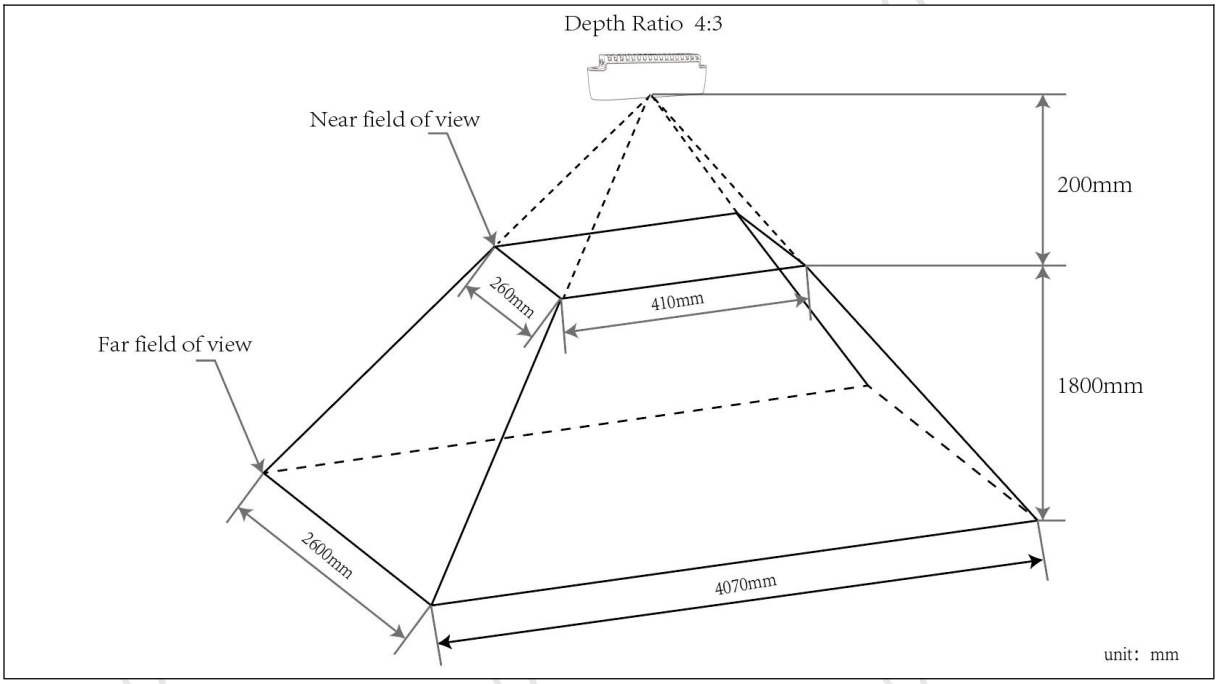


Figure 4-3-2 Gemini 2 Depth Aspect Ratio 4:3 FOV

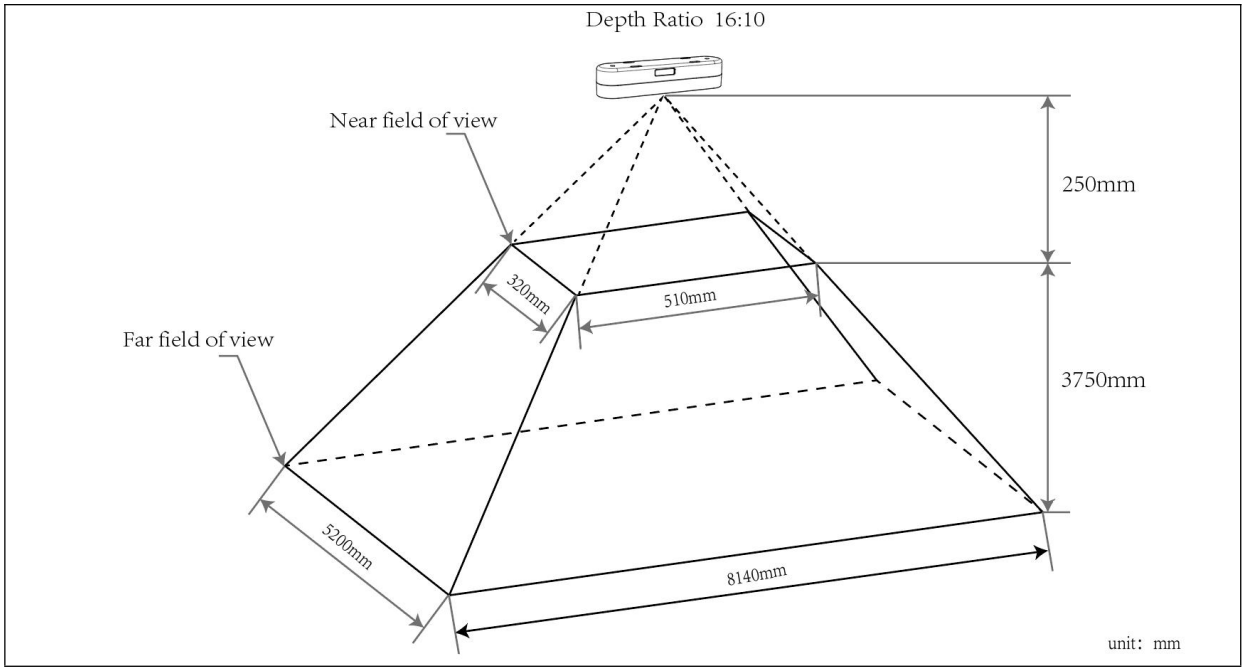


Figure 4-3-3 Gemini 2 L Depth Aspect Ratio16:10 FOV

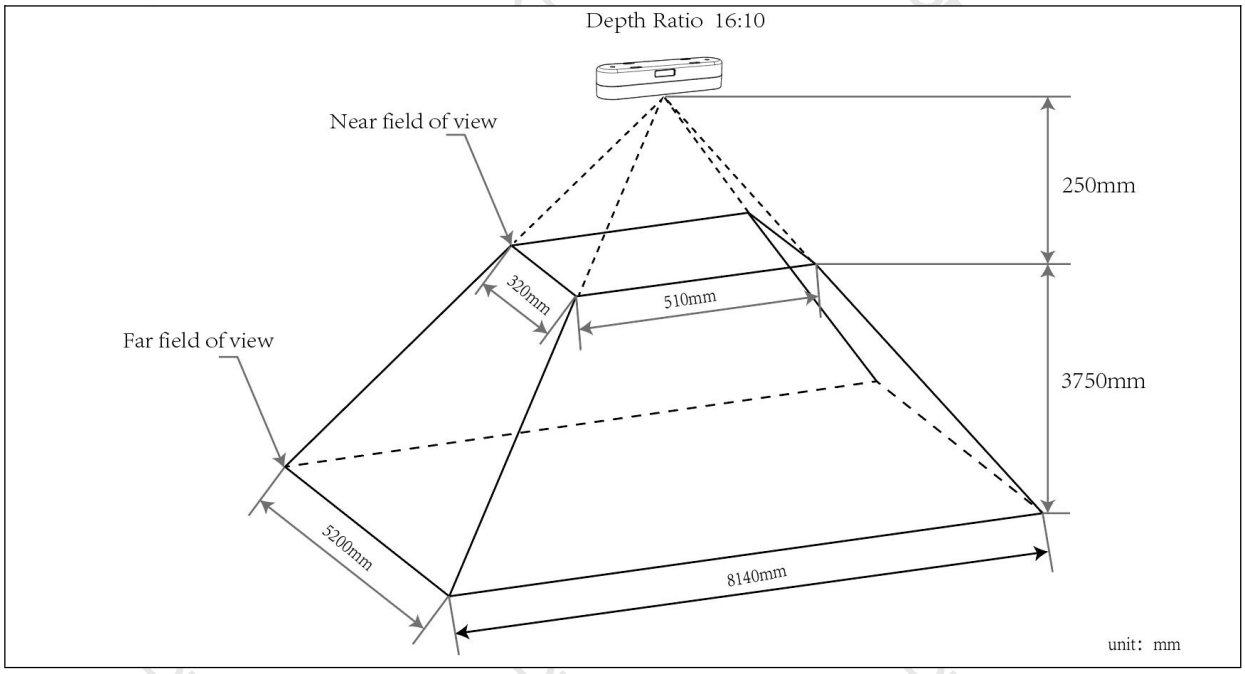


Figure 4-3-4 Gemini 2 L Depth Aspect Ratio16:9 FOV

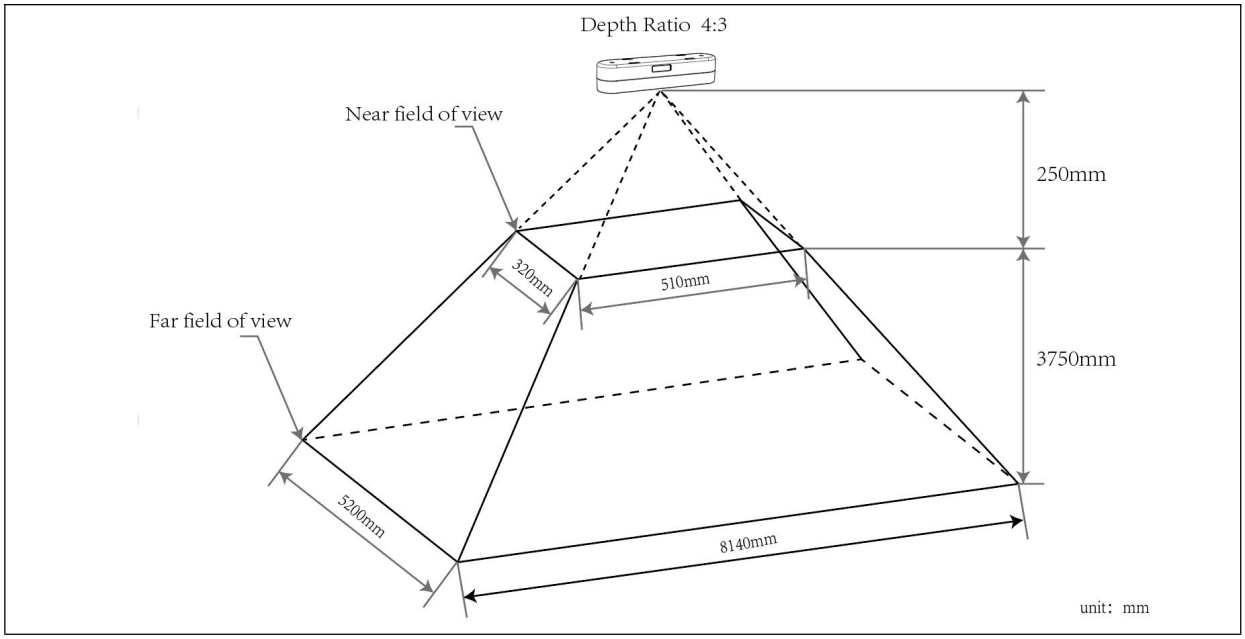


Figure 4-3-5 Gemini 2 L Depth Aspect Ratio 4:3 FOV

4.4 Depth Data Streams

The Gemini 2 Series is capable of outputting depth data streams. Depth image data is generated using active stereo technology, which can acquire and output depth data of objects between 0.15m and 10m. The format of the depth stream output is Y14/RLE..

4.5 Color Image Data Streams (UVC)

The Gemini 2 Series is capable of outputting both depth data and color image data. The color camera can capture and output color images of objects in MJPEG and YUYV format.

4.6 Depth and Color Image Data Stream Formats

The Gemini 2 Series offers high-quality, multi-resolution depth and high-definition colour image data. The camera outputs depth image data in Y14/RLE format, which affects USB bandwidth usage, while the upper computer SDK outputs in Y16 format. The camera also outputs colour image data in MJPEG/YUYV format, and the SDK supports output in MJEPG/YUYV/RGB888 format.

Table 4-6-1 Gemini 2 (USB 3.0) Image Formats

Format	Resolution	Frame Rate(FPS)	Comment
Y14H14	1280 x 800	5, 10, 15, 30	Depth
	640 x 400	5, 10, 15, 30, 60*	
	320 x 200	5, 10, 15, 30, 60*	
RLE	1280 x 800	5, 10, 15, 30	
	640 x 400	5, 10, 15, 30, 60*	
	320 x 200	5, 10, 15, 30, 60*	

Y8H8	1280 x 800	5, 10, 15, 30	IR
	640 x 400	5, 10, 15, 30, 60*	
	320 x 200	5, 10, 15, 30, 60*	
MJPEG	1280 x 800	5, 10, 15, 30	
	640 x 400	5, 10, 15, 30, 60*	
	320 x 200	5, 10, 15, 30, 60*	
YUYV	1920 x 1080	5, 10, 15, 30	Color
	1280 x 720	5, 10, 15, 30, 60*	
	640 x 480	5, 10, 15, 30, 60*	
	640 x 360	5, 10, 15, 30, 60*	
MJPEG	1920 x 1080	5, 10, 15, 30	
	1280 x 720	5, 10, 15, 30, 60*	
	640 x 480	5, 10, 15, 30, 60*	
	640 x 360	5, 10, 15, 30, 60*	

Note: 60* fps is used in Binned Sparse Default

Table 4-6-2 Gemini 2 (USB 2.0) Image Formats

Format	Resolution	Frame Rate (FPS)	Comment
Y14H14	1280 x 800	5, 10	Depth
	640 x 400	5, 10, 15, 30	
	320 x 200	5, 10, 15, 30	
RLE	1280 x 800	5, 10	
	640 x 400	5, 10, 15, 30	
	320 x 200	5, 10, 15, 30	
Y8H8	1280 x 800	5, 10	IR
	640 x 400	5, 10, 15, 30	
	320 x 200	5, 10, 15, 30	
MJPEG	1280 x 800	5, 10	
	640 x 400	5, 10, 15, 30	
	320 x 200	5, 10, 15, 30	
YUYV	640 x 480	5, 10, 15, 30	Color
	640 x 360	5, 10, 15, 30	
MJPEG	1920 x 1080	5, 10, 15, 30	
	1280 x 720	5, 10, 15, 30	
	640 x 480	5, 10, 15, 30	
	640 x 360	5, 10, 15, 30	

Note: Single output video streams can support all resolutions and frame rates. However, for two or three output depth and color video streams, the actual bandwidth of USB2.0 and the performance of the host computer may limit some combinations, which may not be supported..

Table 4-6-3 Gemini 2 L (USB 3.0) Image Formats

Format	Resolution	Frame Rate (FPS)	Comment
Y14H14	1280 x 800	5, 10, 15, 30	Depth
	640 x 400	5, 10, 15, 30, 60*	
	320 x 200	5, 10, 15, 30, 60*	
RLE	1280 x 800	5, 10, 15, 30	
	640 x 400	5, 10, 15, 30, 60*	
	320 x 200	5, 10, 15, 30, 60*	
Y8H8	1280 x 800	5, 10, 15, 30	IR
	640 x 400	5, 10, 15, 30, 60*	
	320 x 200	5, 10, 15, 30, 60*	
MJPEG	1280 x 800	5, 10, 15, 30	
	640 x 400	5, 10, 15, 30, 60*	
	320 x 200	5, 10, 15, 30, 60*	
YUYV	1280 x 800	5, 10, 15, 30	Color
	640 x 400	5, 10, 15, 30, 60*	

	320 x 200	5, 10, 15, 30, 60*	
MJPEG	1280 x 800	5, 10, 15, 30	
	1280 x 720	5, 10, 15, 30, 60*	
	800 x 600	5, 10, 15, 30, 60*	
	640 x 400	5, 10, 15, 30, 60*	
	640 x 360	5, 10, 15, 30, 60*	

Note: 60* fps is used in Binned Sparse Default

Table 4-6-4 Gemini 2 L (USB 2.0) Image Formats

Format	Resolution	Frame Rate (FPS)	Comment
Y14H14	1280 x 800	5, 10	Depth
	640 x 400	5, 10, 15, 30	
	320 x 200	5, 10, 15, 30	
RLE	1280 x 800	5, 10	
	640 x 400	5, 10, 15, 30	
	320 x 200	5, 10, 15, 30	
Y8H8	1280 x 800	5, 10	IR
	640 x 400	5, 10, 15, 30	
	320 x 200	5, 10, 15, 30	
MJPEG	1280 x 800	5, 10	
	640 x 400	5, 10, 15, 30	
	320 x 200	5, 10, 15, 30	
YUYV	800 x 600	5, 10, 15	Color
	640 x 400	5, 10, 15, 30	
	640 x 360	5, 10, 15, 30	
MJPEG	1280 x 800	5, 10, 15, 30	
	1280 x 720	5, 10, 15, 30	
	800 x 600	5, 10, 15, 30	
	640 x 400	5, 10, 15, 30	
	640 x 360	5, 10, 15, 30	

Note: Single output video streams can support all resolutions and frame rates. However, for two or three output depth and color video streams, the actual bandwidth of USB2.0 and the performance of the host computer may limit some combinations, which may not be supported..

4.7 No-Blind Zone Depth Data

The Gemini 2 Series not only generates depth maps and outputs depth data through stereo structured light technology, but it can also detect no-blind zones within 0-10 meters using the LDP module, which has the function of single-point ranging. A value of 0 for LDP indicates the absence of any obstacles within a 400mm range.

The following table gives reference values for the LDP ranging accuracy of the Gemini 2 Series.

Table 4-7-1 Gemini 2 Series LDP Ranging Accuracy Reference Values

	Distance	Value	Unit
LDP Distance Measurement Accuracy	≥ 200mm	±5%	/
	20mm – 200mm	±15	mm

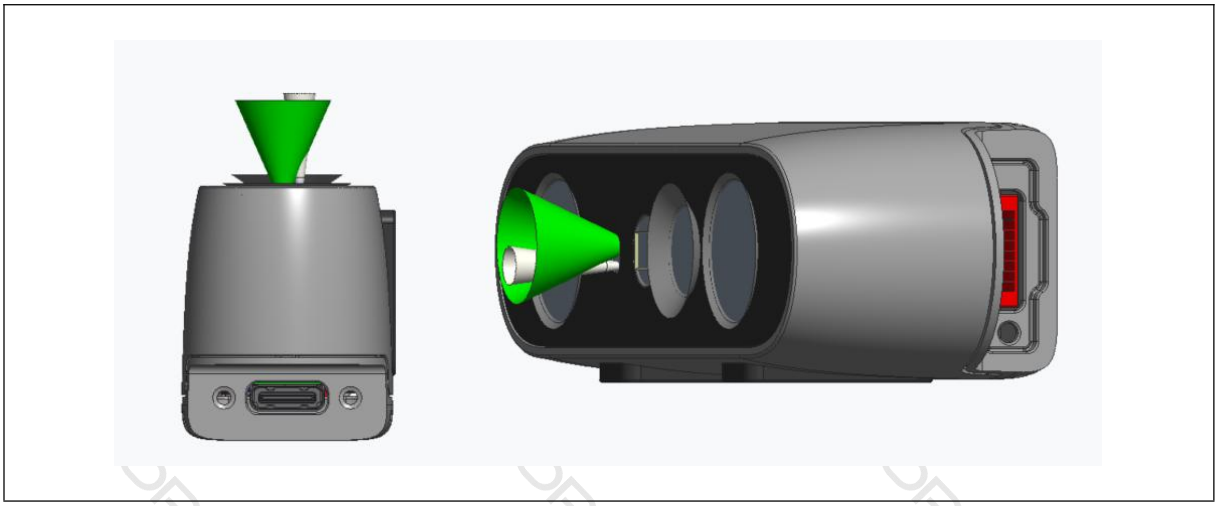


Figure 4-7-1 3D Schematic of Gemini 2 LDP FOV

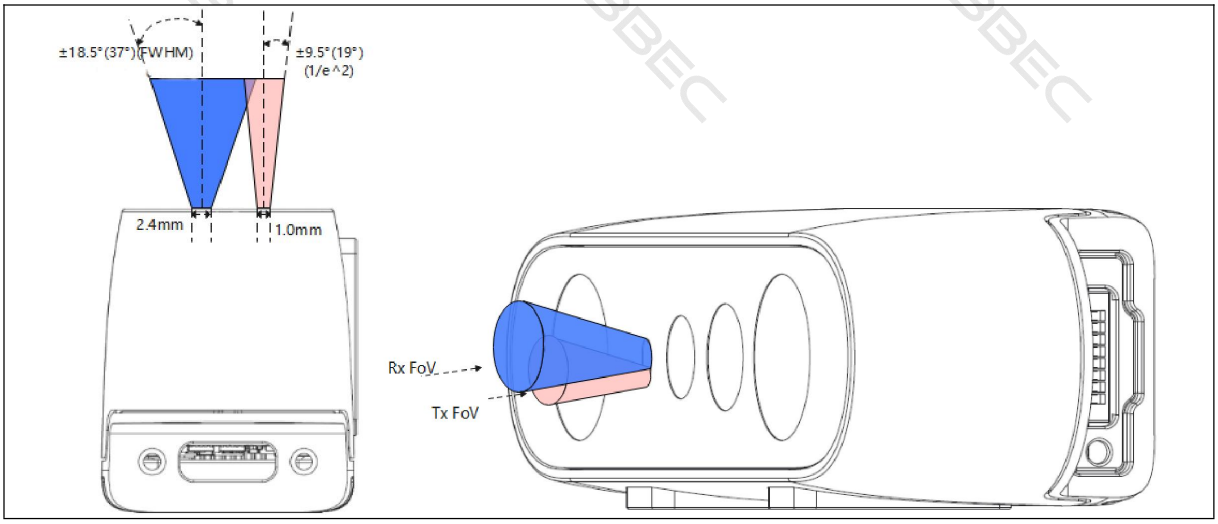


Figure 4-7-2 Gemini 2 LDP FOV Data

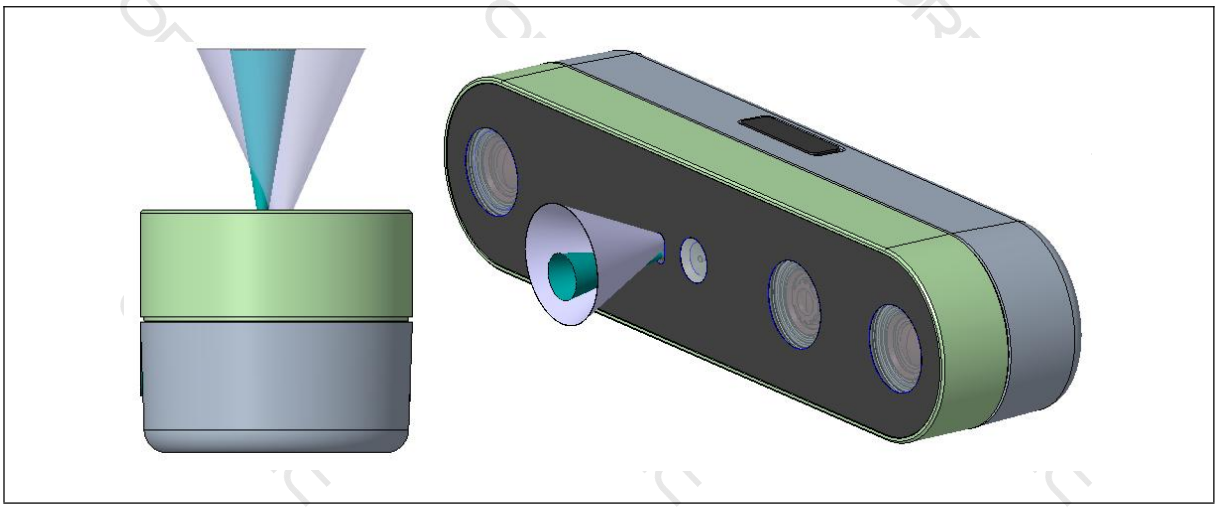


Figure 4-7-3 3D Schematic of Gemini 2 L LDP FOV

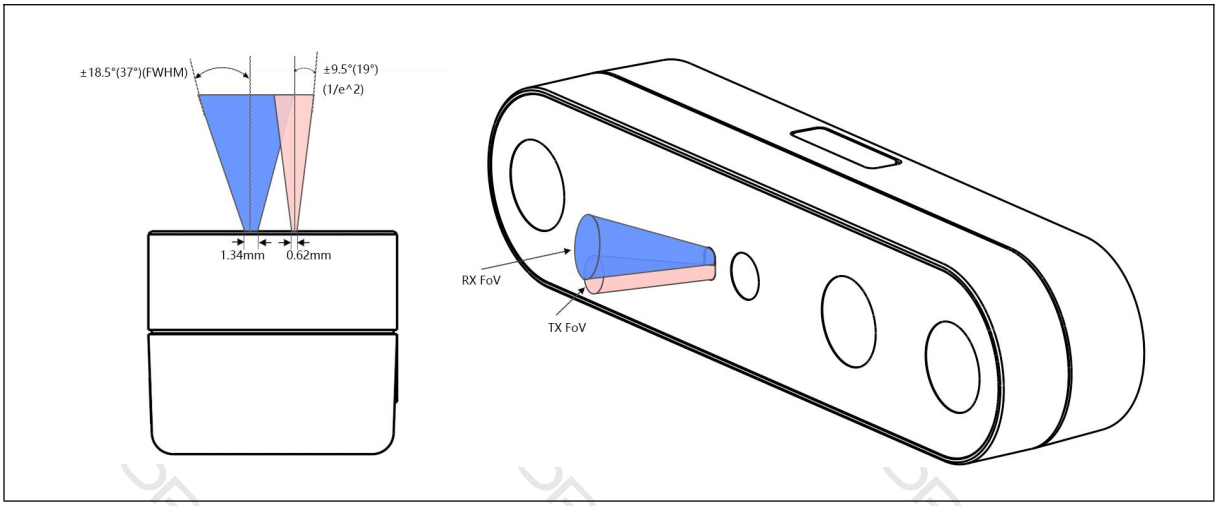


Figure 4-7-4 Gemini 2 L LDP FOV Data

4.8 Depth Start Point Reference

The starting point for depth, also known as the ground zero datum, can be defined as a plane or point with a depth of 0. In the case of the Gemini 2 Series depth camera, the distance between the depth zero point and the front face of the module is provided in tables.

Camera	Front Cover Glass of Thickness	Start Point Distance（Z'）
Gemini 2	0.7mm	4.23mm
Gemini 2 L	1.1mm	4.48mm

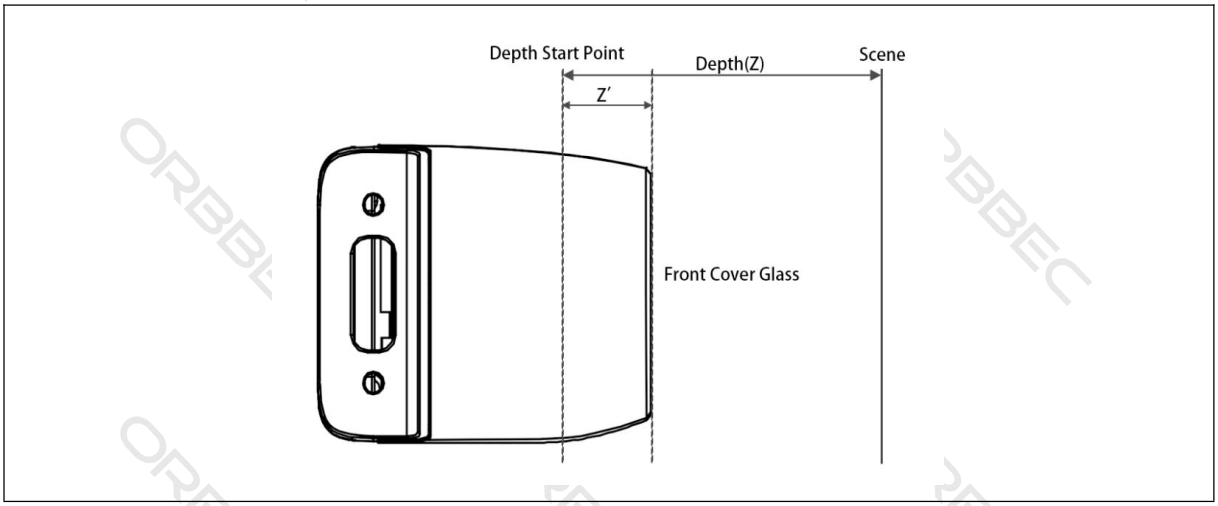


Figure 4-8-1 Schematic of Gemini 2 Depth Start Point

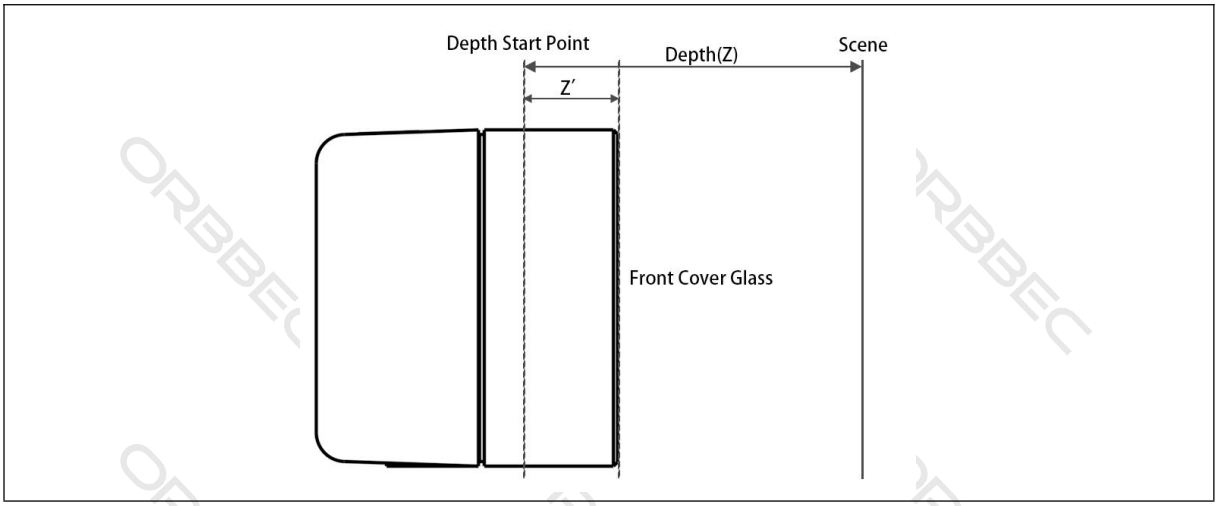


Figure 4-8-2 Schematic of Gemini 2 L Depth Start Point

4.9 Depth to Color Alignment

The Gemini 2 Series enables the simultaneous output of D2C (Depth To Color). This maps each pixel point on the depth map to the corresponding position on the color image based on the internal and external parameters of the depth and color cameras, resulting in an RGBD map.

Table 4-9-1 Gemini 2 Depth to Color

Pre-D2C Depth Image	Color Image	Post D2C Depth Image	Aspect Ratio
1280 x 800@5/10/15/30fps	1920 x 1080@5/10/15/30fps	1920 x 1080@5/10/15/30fps	16:9
1280 x 800@5/10/15/30fps	1280 x 720@5/10/15/30fps	1280 x 720@5/10/15/30fps	
640 x 400@5/10/15/30fps	1920 x 1080@5/10/15/30fps	1920 x 1080@5/10/15/30fps	
640 x 400@5/10/15/30fps	1280 x 720@5/10/15/30fps	1280 x 720@5/10/15/30fps	
640 x 400@5/10/15/30/60fps	640 x 360@5/10/15/30/60fps	640 x 360@5/10/15/30/60fps	
320 x 200@5/10/15/30/60fps	1920 x 1080@5/10/15/30fps	1920 x 1080@5/10/15/30fps	
320 x 200@5/10/15/30/60fps	1280 x 720@5/10/15/30fps	1280 x 720@5/10/15/30fps	
320 x 200@5/10/15/30/60fps	640 x 360@5/10/15/30/60fps	640 x 360@5/10/15/30/60fps	
1280 x 800@5/10/15/30fps	640 x 480@5/10/15/30/60fps	640 x 480@5/10/15/30/60fps	4:3
640 x 400@5/10/15/30/60fps	640 x 480@5/10/15/30/60fps	640 x 480@5/10/15/30/60fps	
320 x 200@5/10/15/30/60fps	640 x 480@5/10/15/30/60fps	640 x 480@5/10/15/30/60fps	

Table 4-9-2 Gemini 2 L Depth to Color

Pre-D2C Depth Image	Color Image	Post D2C Depth Image	Aspect Ratio
1280 x 800@5/10/15/30fps	1280 x 800@5/10/15/30fps	1280 x 800@5/10/15/30fps	16:10
640 x 400@5/10/15/30fps	1280 x 800@5/10/15/30fps	1280 x 800@5/10/15/30fps	
320 x 200@5/10/15/30/60fps	1280 x 800@5/10/15/30fps	1280 x 800@5/10/15/30fps	
640 x 400@5/10/15/30/60fps	640 x 400@5/10/15/30/60fps	640 x 400@5/10/15/30/60fps	
320 x 200@5/10/15/30/60fps	640 x 400@5/10/15/30/60fps	640 x 400@5/10/15/30/60fps	
1280 x 800@5/10/15/30fps	1280 x 720@5/10/15/30fps	1280 x 720@5/10/15/30fps	16:9
640 x 400@5/10/15/30fps	1280 x 720@5/10/15/30fps	1280 x 720@5/10/15/30fps	
320 x 200@5/10/15/30/60fps	1280 x 720@5/10/15/30fps	1280 x 720@5/10/15/30fps	
640 x 400@5/10/15/30/60fps	640 x 360@5/10/15/30/60fps	640 x 360@5/10/15/30/60fps	
320 x 200@5/10/15/30/60fps	640 x 360@5/10/15/30/60fps	640 x 360@5/10/15/30/60fps	
1280 x 800@5/10/15/30fps	800 x 600@5/10/15/30fps	800 x 600@5/10/15/30fps	4:3
640 x 400@5/10/15/30/60fps	800 x 600@5/10/15/30fps	800 x 600@5/10/15/30fps	
320 x 200@5/10/15/30/60fps	800 x 600@5/10/15/30fps	800 x 600@5/10/15/30fps	

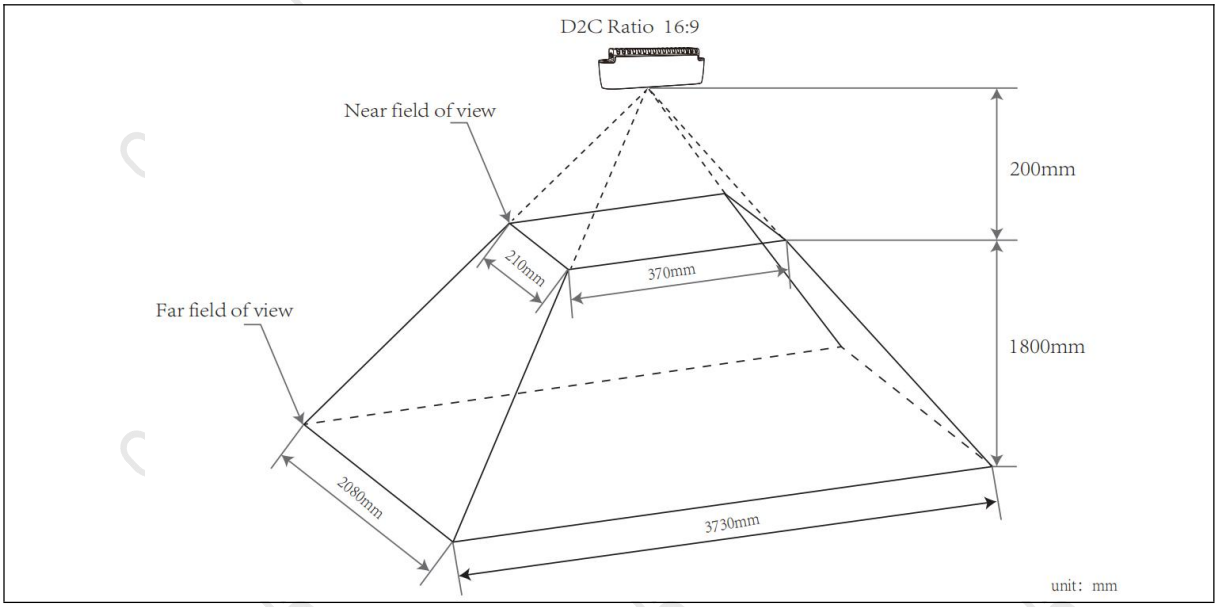


Figure 4-9-1 Gemini 2 D2C Image Aspect Ratio16:9 FOV

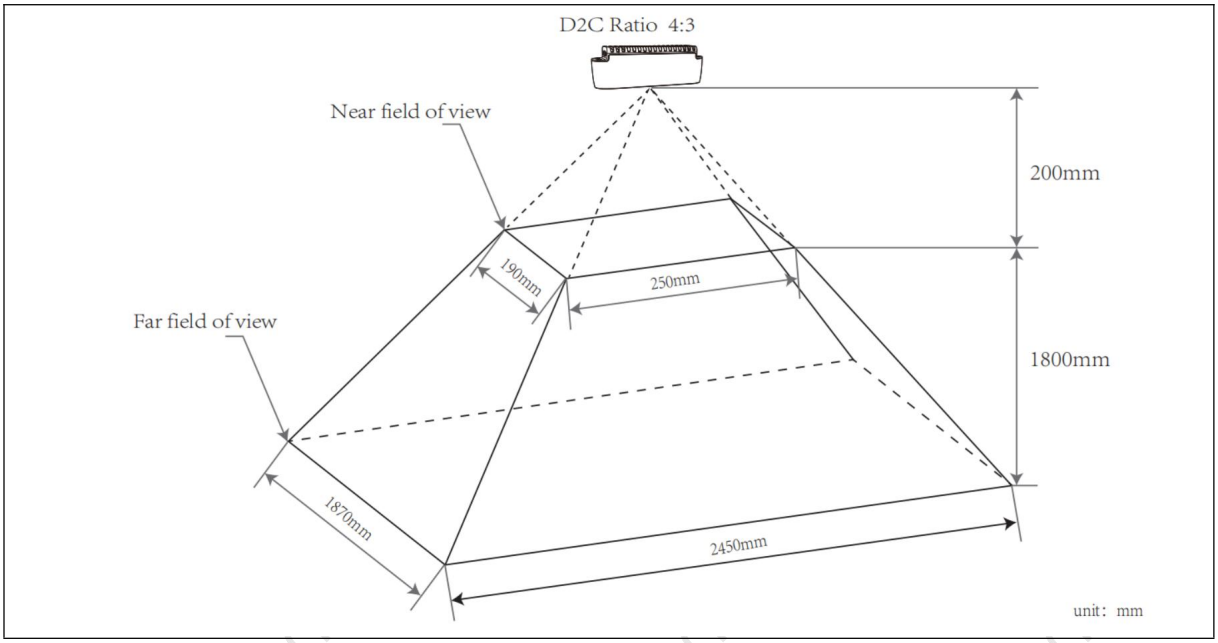


Figure 4-9-2 Gemini 2 D2C Image Aspect Ratio 4:3 FOV

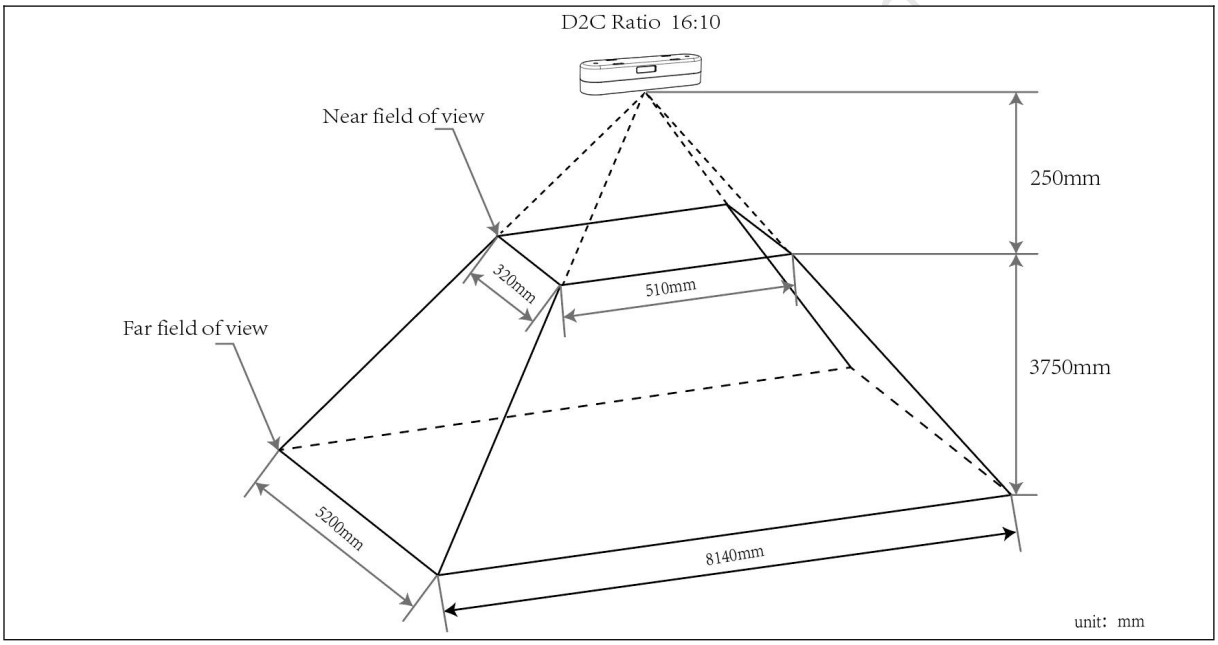


Figure 4-9-3 Gemini 2 L D2C Image Aspect Ratio16:10 FOV

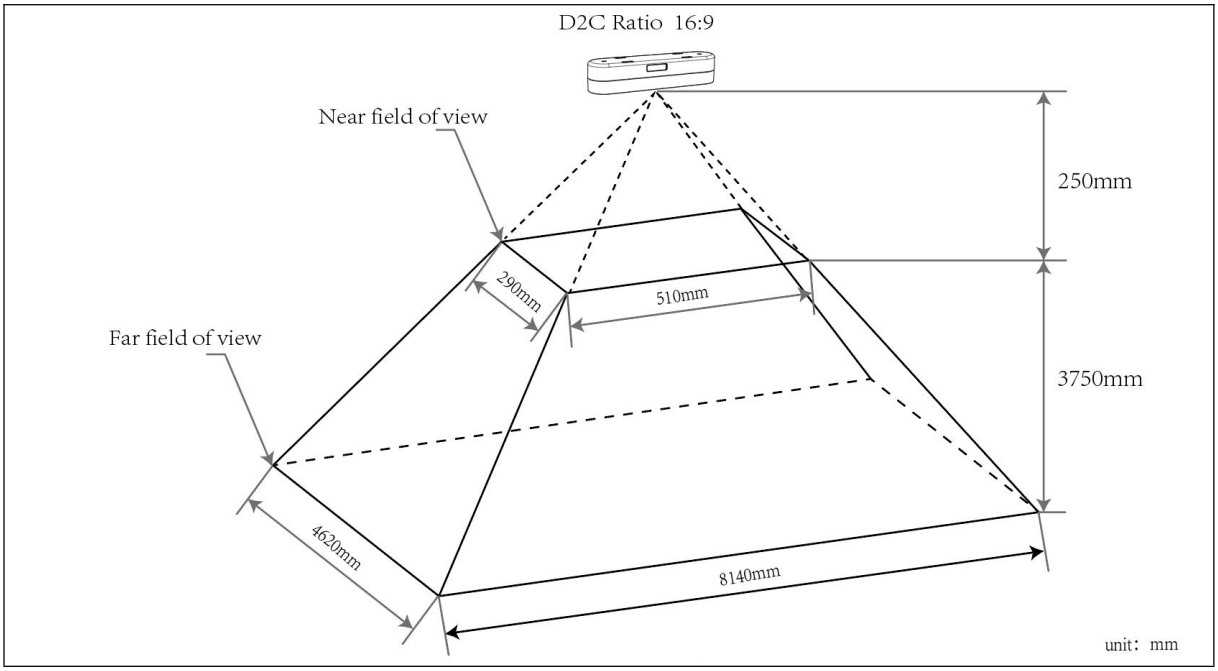


Figure 4-9-4 Gemini 2 L D2C Image Aspect Ratio16:9 FOV

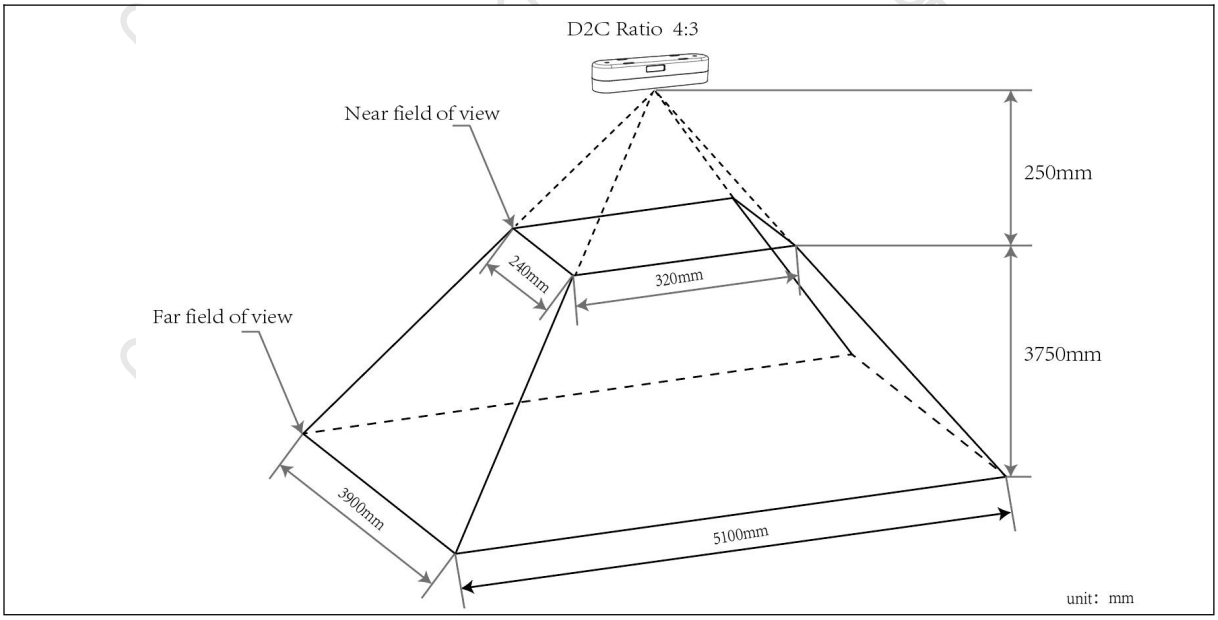


Figure 4-9-5 Gemini 2 L D2C Image Aspect Ratio 4:3 FOV

4.10 IMU Specification

4.10.1 IMU Specification Description

Table 4-10-1 Gemini 2 Series IMU Specification Description

	Parameters		Gemini 2 Series
IMU	Timestamp		Timestamp synchronization (us) with IR, depth and RGB data all using the same time reference and clock frequency
	X/Y/Z axis orientation		X-axis in line with depth, pointing to the left of the camera Y-axis in line with depth, pointing below the camera Z-axis in line with depth, pointing in front of the camera
	Gyroscope	Format	3x16-bit
		Measurement Range	±17.45rad/s(1000dps)
		Output Frequency (Hz)	100/200/500/1000
	Accelerometer	Format	3x16-bit
		Measurement Range	± 39.2m/s²(4g)
		Output Frequency (Hz)	100/200/500/1000
	Temperature	Format	1x16-bit
		Measurement Range	-40~85℃
		Output Frequency (Hz)	Follows gyroscope and accelerometer frequencies

4.10.2 IMU Coordinate System

The origin of the IMU coordinate system is situated at the physical sensor center point. The accelerometer and gyroscope coordinate systems are located at the back of the left IR. The positive X-axis of the coordinate system points to the right, the positive Y-axis points downwards, and the positive Z-axis points forwards.

The origin is located at the focal point of the depth and color camera. The positive X-axis of the coordinate system points to the right, while the positive Y-axis points downwards, and the positive Z-axis points forwards. This is illustrated in the diagram below.

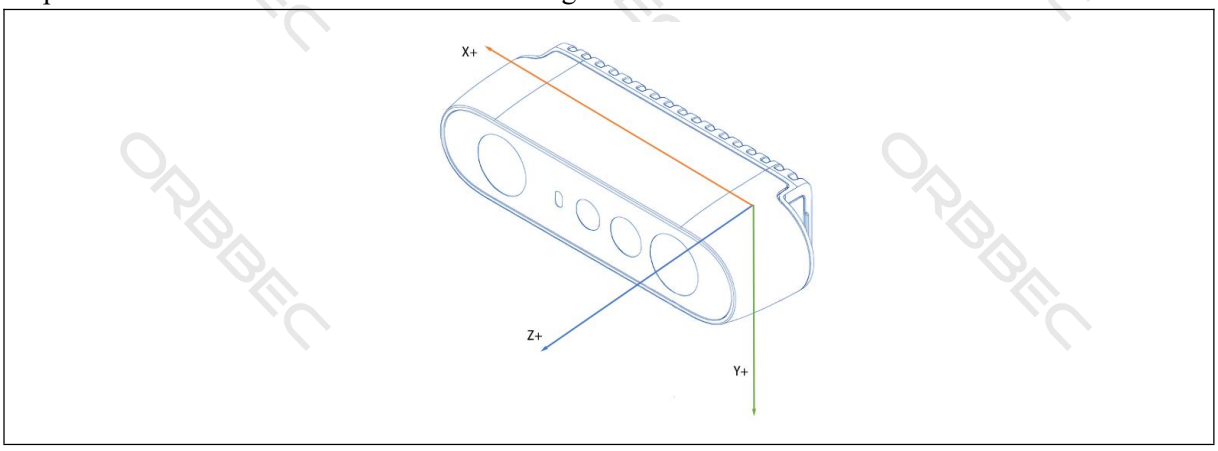


Figure 4-10-1 Gemini 2 IMU Coordinate System

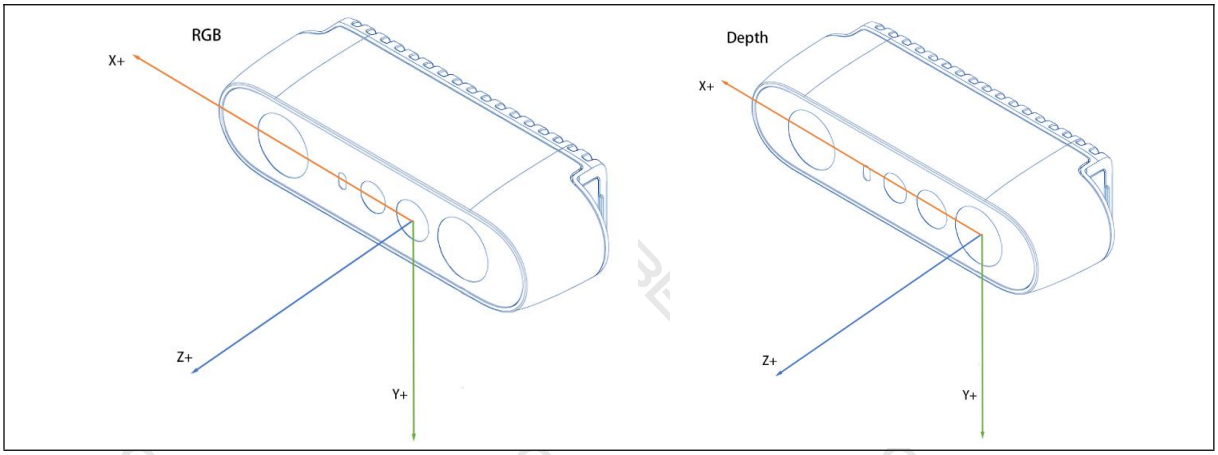


Figure 4-10-2 Gemini 2 Depth and RGB Coordinate System

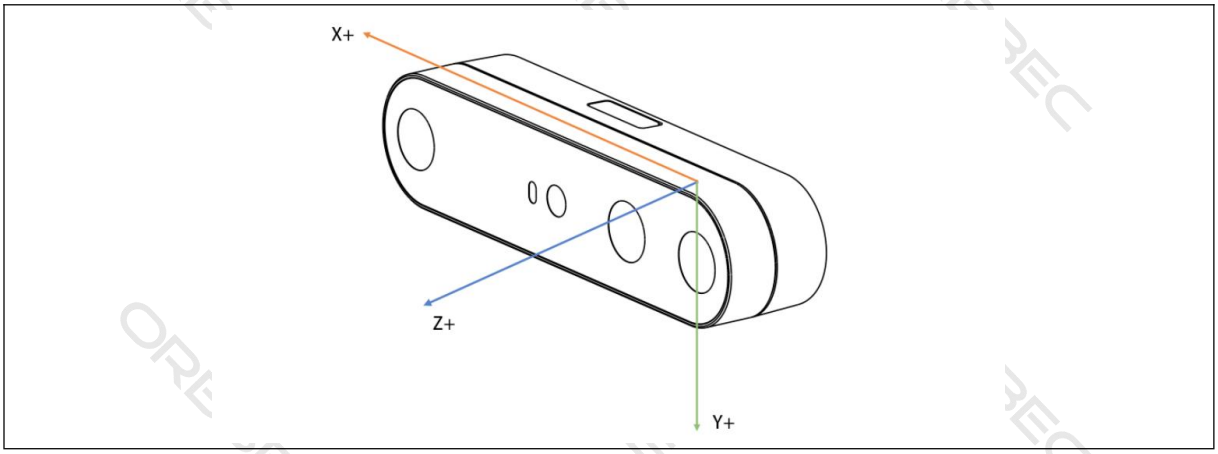


Figure 4-10-3 Gemini 2 L IMU Coordinate System

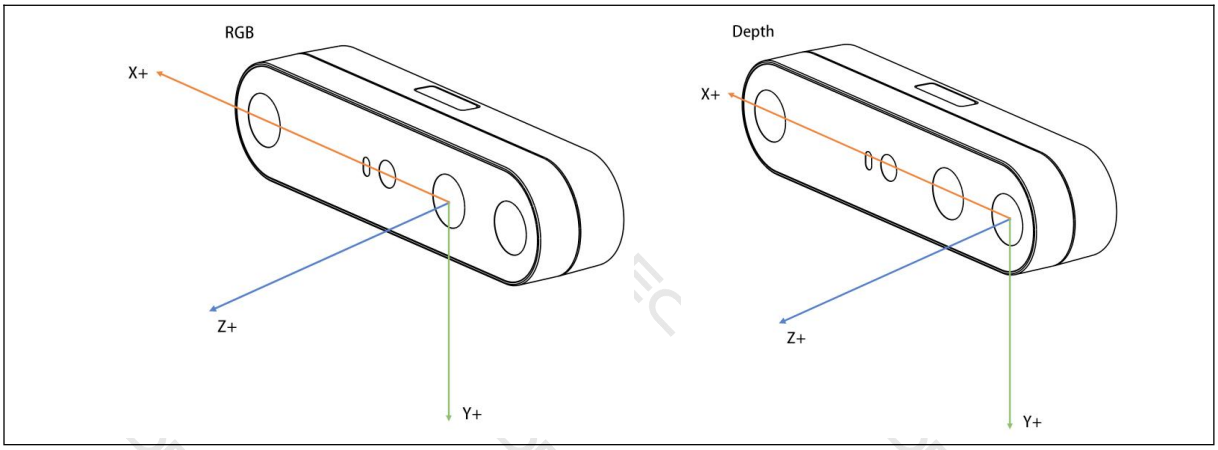


Figure 4-10-4 Gemini 2 L Depth and RGB Coordinate System

4.11 Depth Mode

Table 4-11-1 Gemini 2 Series Depth Mode

	Unbinned Dense Default	Unbinned Sparse Default	Binned Sparse Default	Dimensioning	Obstacle Avoidance
Ideal Range (Gemini 2)	0.20m - 5.0m	0.20m - 5.0m	0.15m - 2.5m	N/A	0.20m - 5.0m
Ideal Range (Gemini 2 L)	0.30m - 7.0m	0.30m - 7.0m	0.25m - 5.0m	0.30m - 4.0m	N/A
Accuracy	High	Medium	Low	High	High
Resolution (Gemini 2)	1280x800@5/10/15/30fps 640x400@5/10/15/30fps 320x200@5/10/15/30fps	1280x800@5/10/15/30fps 640x400@5/10/15/30fps 320x200@5/10/15/30fps	640x400@5/10/15/30/60fps 320x200@5/10/15/30/60fps	N/A	1280x800@5/10/15/30fps 640x400@5/10/15/30fps 320x200@5/10/15/30fps
Resolution (Gemini 2 L)	1280x800@5/10/15/30fps 640x400@5/10/15/30fps 320x200@5/10/15/30fps	1280x800@5/10/15/30fps 640x400@5/10/15/30fps 320x200@5/10/15/30fps	640x400@5/10/15/30/60fps 320x200@5/10/15/30/60fps	1280x800@5/10/15/30fps 640x400@5/10/15/30fps 320x200@5/10/15/30fps	N/A
Power	High	Medium	Low	High	High
Feature	High accuracy and High quality depth data	Balancing depth accuracy and power & Optimizing for low inversion and semi-outdoor	Low power & Support 60fps & Small blind zone	High accuracy and High quality depth data	Enables the recognition of small objects, & high and low inverted objects.
Typical Usages	Robots / Body Tracking	Robots / Gesture Control	Robots / Sports	Dimension / 3D Scan	Robots / AMR

4.12 Specific Frame Rate Trigger Mode

The Gemini 2 Series offers users flexible methods for acquiring IR, Depth, and RGB image data, with the most common being the specific frame rate trigger mode. In this mode, users set a target frame rate, resolution, and image format for each type of data, and then activate the corresponding data streams in sequence. The camera captures and outputs image data at the user-defined target frame rate, resolution, and image format. The user can select a specific frame rate for the current scene from predefined fixed frame rate values of 5fps, 10fps, 15fps, 30fps, and 60fps, depending on the camera's currently configured depth mode and resolution, and capture image data at that frame rate.

4.13 Free Trigger Mode

The Gemini 2 Series supports image data acquisition methods based on specific frame rates, as well as a free trigger mode that supports arbitrary frequencies. In this mode, the camera waits for an external input trigger signal and only completes an image data acquisition after receiving a valid external trigger signal, as configured by the camera. The camera then continues to wait for the next external trigger signal. As there is no set time limit between two consecutive triggers, but only a single acquisition time greater than that of the camera, it is possible to control the time interval between two consecutive triggers to achieve any desired frequency. This allows for passive acquisition of trigger image data. The camera can be triggered through a soft signal sent by the host computer via USB command or an external device through the 8-Pin synchronous interface. This allows for passive trigger mode at any frequency.

In free trigger mode, the camera's IR, Depth, and RGB fixed frame rates must be set to a uniform value of 5fps, 10fps, 15fps, 30fps, or 60fps upon request. This is necessary to determine the minimum time interval between two consecutive active triggers. Table 3-14-1 shows the relationship between the fixed frame rate, the minimum time interval, and the upper frequency limit for passive triggering. In summary, the camera will only respond to trigger signals within the allowable range. This means that the trigger frequency can be any value within the valid frequency range for passive triggering.

Table 4-13-1 Table of Arbitrary Frame Rates Allowed to be Passively Triggered

Set The Camera's Fixed Frame Rate(fps)	Supportable Passive Trigger Interval(ms)	Supportable Passive Trigger Frequency(Hz)
60	≥ 250	0 - 4
30	≥ 250	0 - 4
15	≥ 500	0 - 2
10	≥ 750	0 – 1.33
5	≥ 1500	0 – 0.66

Table 4-13-2 Table of Arbitrary Frame Rates Allowed to be Passively Triggered

Set The Camera's Fixed Frame Rate(fps)	Supportable Passive Trigger Interval(ms)	Supportable Passive Trigger Frequency(Hz)
60	≥ 40	0 - 24
30	≥ 80	0 - 12
15	≥ 160	0 - 6
10	≥ 250	0 – 4
5	≥ 500	0 – 2

4.14 Multi-Camera Synchronization Function

4.14.1 Specification Description

Each depth camera device is equipped with a synchronization interface that enables multiple camera connections. The use of multiple depth camera devices allows for a wider range of applications, including:

- Filling the masked area: The depth and RGB cameras on the depth camera maintain a small distance between them, which can cause occlusion. Occlusion occurs when a foreground object blocks part of the view of the background object from one of the two cameras on the

device. To the human eye, the foreground object appears to cast a shadow on the background object in the resulting color image.

- Better scanning of 3D objects.
- Increasing the spatial coverage of the camera.
- Increase the effective frame rate to a value above 30 frames per second (FPS).
- Capturing multiple color images of the same scene.
- Multi-camera synchronization is particularly useful in scenarios such as shooting volumetric video and requiring a large field of view.

The synchronization function can be implemented through two types of connections:

Star Topology:

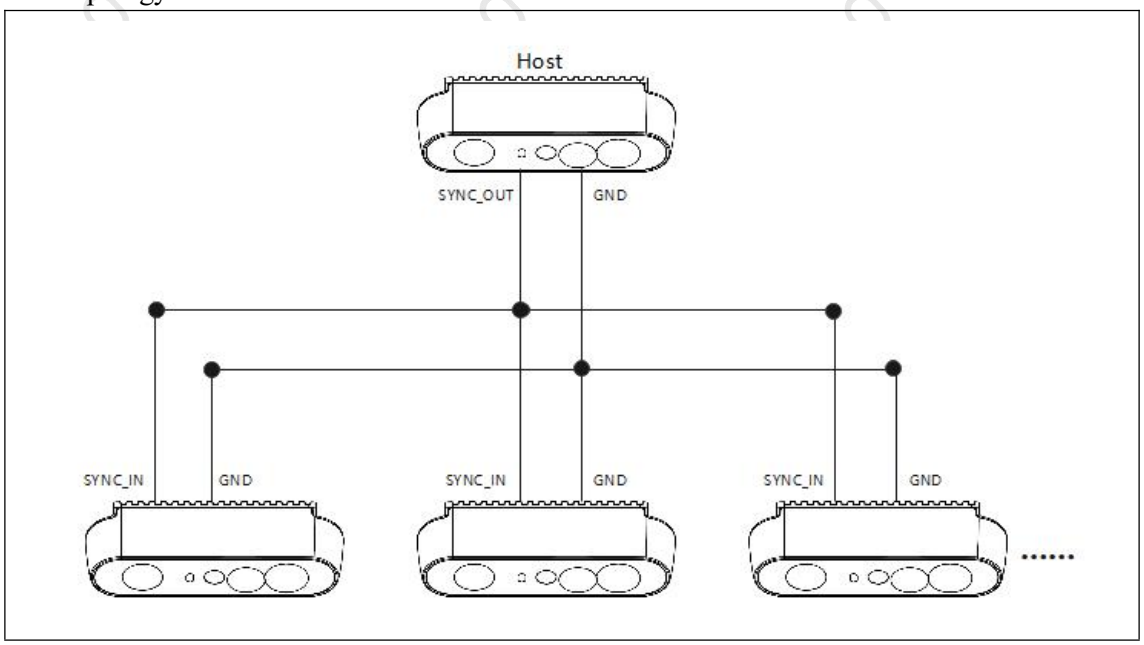


Figure 4-14-1 Star Topology Diagram

Chain Topology:

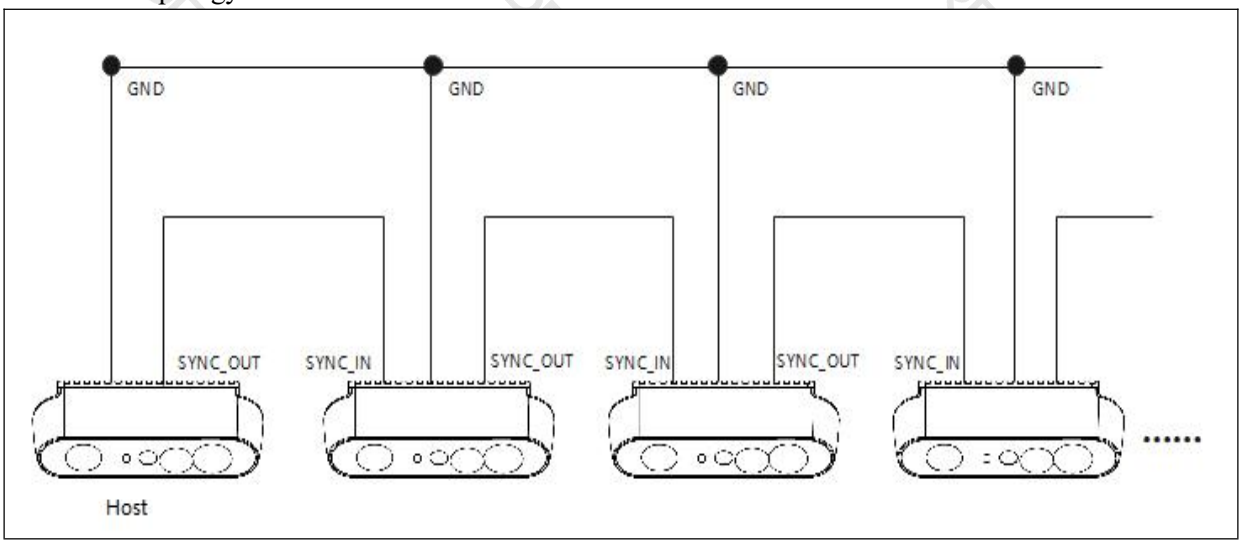


Figure 4-14-2 Chain Topology Diagram

The text describes the synchronization of multi-camera frames in two topologies, namely depth image synchronization and RGB image synchronization. The time difference between the frames is less than or equal to 3ms when auto exposure is off. This is achieved through the use of the multi-camera synchronization function.

4.14.2 Multi-Camera Synchronization Interface

The table below provides a definition of the multi-camera synchronization interface for the Gemini 2 Series.

Table 4-14-1 Gemini 2 Series Multi-Camera Synchronization Interface Definitions

Pin	Definitions	Description
1	VCC	The electrical level setting is set to 1.8V by default. If a 3.3V or 5V drive voltage is provided on the VCC interface, the I/O level setting can be adjusted to 3.3V or 5V as required.
2	GPIO_OUT	The synchronization drive signal is active high and its high-level interval coincides with the IR exposure time. This signal is typically used to drive external fill light.
3	VSYNC_OUT	The trigger signal for secondary devices is provided by a high level, which is active.
4	TIMER_SYNC_OUT	Reset the hardware timestamp of secondary devices using the pulse signal source.
5	RESET_IN	The hardware reset signal triggers the camera to power down and automatically power up and reset. The input signal is detected by analyzing 20Hz with a 50% duty cycle for more than 5 consecutive cycles. Any signal that does not meet these criteria is filtered out. Allowed fluctuations for frequency are ±1Hz and for duty cycle are ±2%.
6	VSYNC_IN	The synchronous trigger signal is active high and is used for the triggering/sync signal from the primary device. The synchronous trigger signal is active high and is used for the triggering/sync signal from the primary device. The synchronous trigger signal is active high and is used for the triggering/sync signal from the primary device. Its duration is 1MS.
7	TIMER_SYNC_IN	Hardware timestamp reset signal input, hardware timestamp clearing
8	GND	Ground

Table 4-14-2 Gemini 2 Series Multi-Camera Synchronization Interface Electronic Performance Parameters

Pin	Definitions	Electronic Performance Parameters
1	VCC	Input voltage: min: 1.75V, max: 5.25V, typical:1.8V/3.3V/5.0V, default:1.8V Input current: ≧100mA Power ripple: ≦50mV/AC
2	GPIO_OUT	Output voltage: =VCC Output current: 1.8V@4mA, 3.3V@24mA, 5.0V@32mA Rise/Fall: 1.8V@≦20ns/V, 3.3V@≦10ns/V, 5.0V@≦6ns/V
3	VSYNC_OUT	Output voltage: =VCC Output current: 1.8V@4mA, 3.3V@24mA, 5.0V@32mA Rise/Fall: 1.8V@≦20ns/V, 3.3V@≦10ns/V, 5.0V@≦6ns/V
4	TIMER_SYNC_OUT	Output voltage: =VCC Output current: 1.8V@4mA, 3.3V@24mA, 5.0V@32mA Rise/Fall: 1.8V@≦20ns/V, 3.3V@≦10ns/V, 5.0V@≦6ns/V
5	RESET_IN	Input voltage: =VCC Input current: VIH:VCC×0.65,VIL:≦0.7V Input current: 1.8V~5.0V @≧4mA Rise:1.8V@≦30ns/V, 3.3V@≦20ns/V, 5.0V@≦8ns/V Fall:1.8V@≦90ns/V, 3.3V@≦90ns/V, 5.0V@≦50ns/V

		Signal: Freq 20Hz ± 1Hz, duty cycle 50% ± 2%, cycle ≧ 8T
6	VSYNC_IN	Input voltage: =VCC Input current: VIH:VCC × 0.65,VIL: ≦ 0.7V Input current: 1.8V~5.0V @ ≧ 4mA Rise:1.8V@ ≦ 30ns/V, 3.3V@ ≦ 20ns/V, 5.0V@ ≦ 8ns/V Fall:1.8V@ ≦ 90ns/V, 3.3V@ ≦ 90ns/V, 5.0V@ ≦ 50ns/V Rise edge trigger & Single pulse triggering
7	TIMER_SYNC_IN	Input voltage: =VCC Input current: VIH:VCC × 0.65,VIL: ≦ 0.7V Input current: 1.8V~5.0V @ ≧ 4mA Rise:1.8V@ ≦ 30ns/V, 3.3V@ ≦ 20ns/V, 5.0V@ ≦ 8ns/V Fall:1.8V@ ≦ 90ns/V, 3.3V@ ≦ 90ns/V, 5.0V@ ≦ 50ns/V Rise edge trigger & Single pulse triggering
8	GND	Ground

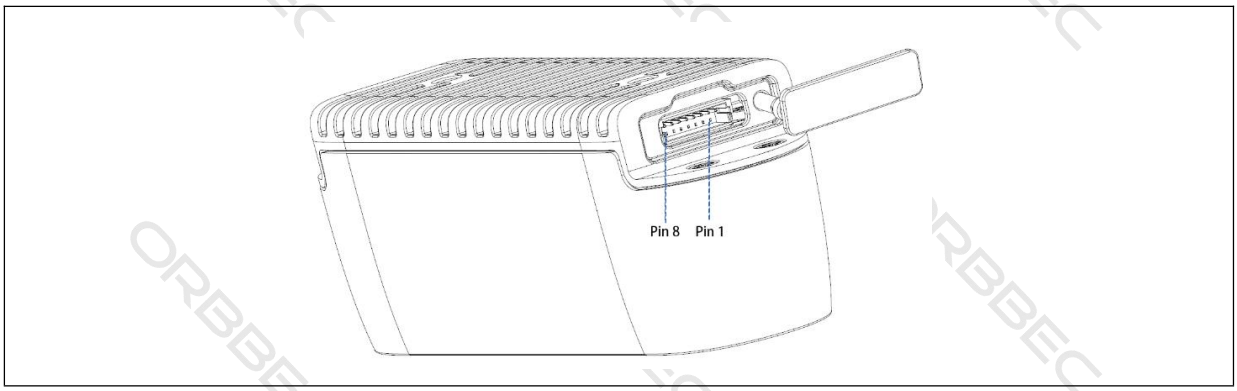


Figure 4-14-3 Gemini 2 Multi-Camera Synchronization Interface Diagram

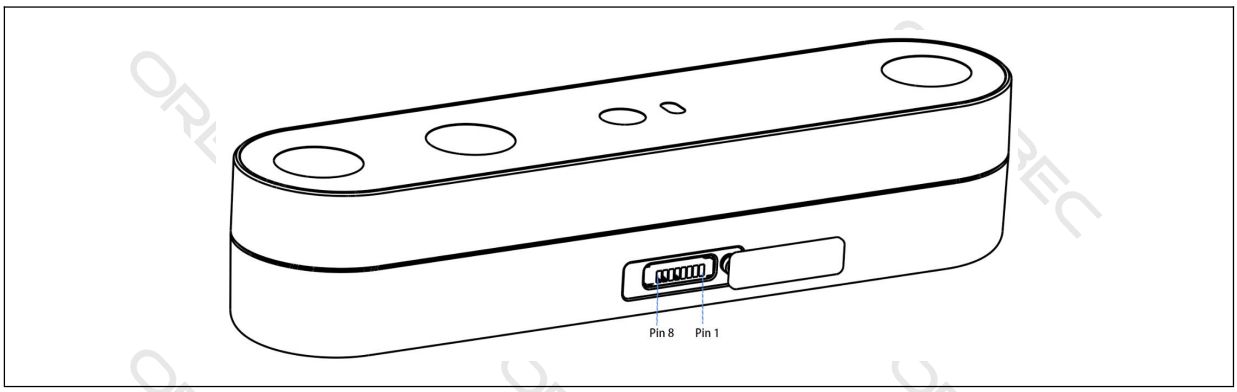


Figure 4-14-4 Gemini 2 L Multi-Camera Synchronization Interface Diagram

5 Performance

5.1 Electrical Performance

5.1.1 Power Supply

The Gemini 2 Series requires Type-C power and it is important to ensure that the power output is standard and that the maximum current of the Type-C power port is 1.5A or higher.

5.1.2 Power

Power consumption varies depending on the selected working mode.

Table 5-1-1 Gemini 2 Typical Average Configuration

Mode	Typical Work Mode Configuration						Average Power (mW)	Standby power (mW)
	Depth Parameter			RGB Parameter				
	Resolution	Format	AE	Resolution	Format	AE		
Unbinned Dense Default	1280x800@30fps	Y14	on	1920x1080@30fps	MJPEG	on	1800	840
Unbinned Sparse Default	1280x800@30fps	Y14	on	1920x1080@30fps	MJPEG	on	1850	840
Binned Sparse Default	640x400@30fps	Y14	on	1920x1080@30fps	MJPEG	on	1500	840
Obstacle Avoidance	1280x800@30fps	Y14	on	1920x1080@30fps	MJPEG	on	1800	840
Note	1. Ensure that there are no obstructions in front of the camera that have not activated the laser auto-adjustment function. 2. During the typical average power consumption test, the laser energy level is set to 5 and the hardware D2C function is turned on; IMU ODR(output data register) is 200Hz; The depth stream and colour RGB stream are both active simultaneously, while the IR image stream is inactive. 3. Test the ambient temperature at 25℃.							

Table 5-1-2 Gemini 2 Max Power Mode Configuration

Mode	Typical Work Mode Configuration									Peak Power (mW)	Average Power (mW)
	Depth Parameter				IR Parameter		RGB Parameter				
	Resolution	Format	AE	Exposure (us)	Resolution	Format	Resolution	Format	AE		
Unbinned Dense Default	1280x800 @30fps	RLE	off	5000	1280x800 @30fps	MJPEG	1920x1080 @30fps	MJPEG	on	6000	2000
Unbinned Sparse Default	1280x800 @30fps	RLE	off	5000	1280x800 @30fps	MJPEG	1920x1080 @30fps	MJPEG	on	6300	2100
Binned Sparse Default	640x400 @60fps	RLE	off	1500	640x400 @60fps	MJPEG	1280x720 @60fps	MJPEG	on	5000	1800
Obstacle Avoidance	1280x800 @30fps	RLE	off	5000	1280x800 @30fps	MJPEG	1920x1080 @30fps	MJPEG	on	6000	2000
Note	1. Ensure that there are no obstructions in front of the camera that have not activated the laser auto-adjustment function. 2. During the typical average power consumption test, the laser energy level is set to 5 and the hardware D2C function is turned on; IMU ODR(output data register) is 200Hz; The depth stream and colour RGB stream are both active simultaneously, while the IR image stream is inactive. 3.IR utilises identical exposure and gain settings as depth. 4. Test the ambient temperature at 25℃.										

Table 5-1-3 Gemini 2 L Typical Average Configuration

Mode	Typical Work Mode Configuration						Average Power (mW)	Standby power (mW)
	Depth Parameter			RGB Parameter				
	Resolution	Format	AE	Resolution	Format	AE		
Unbinned Dense Default	1280x800@30fps	Y14	on	1280x800@30fps	MJPEG	on	2500	810
Unbinned Sparse Default	1280x800@30fps	Y14	on	1280x800@30fps	MJPEG	on	2200	810
Binned Sparse Default	640x400@30fps	Y14	on	1280x720@30fps	MJPEG	on	1700	810
Note	1. Ensure that there are no obstructions in front of the camera that have not activated the laser auto-adjustment function. 2. During the typical average power consumption test, the laser energy level is set to 5 and the hardware D2C function is turned on; IMU ODR(output data register) is 200Hz; The depth stream and colour RGB stream are both active simultaneously, while the IR image stream is inactive. 3. Test the ambient temperature at 25℃.							

Table 5-1-4 Gemini 2 L Max Power Mode Configuration

Mode	Typical Work Mode Configuration									Peak Power (mW)	Average Power (mW)
	Depth Parameter				IR Parameter		RGB Parameter				
	Resolution	Format	AE	Exposure (us)	Resolution	Format	Resolution	Format	AE		
Unbinned Dense Default	1280x800 @30fps	RLE	off	5000	1280x800 @30fps	MJPEG	1280x800 @30fps	MJPEG	on	6000	2600
Unbinned Sparse Default	1280x800 @30fps	RLE	off	5000	1280x800 @30fps	MJPEG	1280x800 @30fps	MJPEG	on	8000	2500
Binned Sparse Default	640x400 @60fps	RLE	off	1500	640x400 @60fps	MJPEG	1280x720 @30fps	MJPEG	on	6200	2300
Note	1. Ensure that there are no obstructions in front of the camera that have not activated the laser auto-adjustment function. 2. During the typical average power consumption test, the laser energy level is set to 5 and the hardware D2C function is turned on; IMU ODR(output data register) is 200Hz; The depth stream and colour RGB stream are both active simultaneously, while the IR image stream is inactive. 3.IR utilises identical exposure and gain settings as depth. 4. Test the ambient temperature at 25℃.										

Note: The data in the above tables are laboratory measurements and are for design reference only.

5.1.3 Storage and Powered Conditions

Table 5-1-5 Gemini 2 Series Storage and Powerd Conditions

Condition	Description	Min	Max	Unit
Storage(Ambient), Not Powerd	Long term storage	0	50	℃
	Short exposure represents temporary max limits acceptable for transportation conditions	-20	70	℃
	Humidity	Temperature / RH：60℃ / 95%		
Ambient, Powerd	The camera ambient temperature when powered	0	40	℃
Backside Case Temperature, Powerd	The maximum temperature of the backside case occurs when the camera is operated in an ambient temperature of 40°C	0	50	℃

6 Firmware

6.1 Update

1. Firmware upgrades do not require access to a specific mode
2. When upgrading the firmware, please make sure all camera streams are turned off
3. The upgrade tool does not currently verify the device's firmware version, which means that it is possible to upgrade or downgrade the version.
4. Please check if you need to "upgrade"

6.2 Update Restrictions

After a successful upgrade, the device can be reboot in the following:

1. To ensure the new firmware version takes effect, disconnect the USB cable and plug it in again. It is also recommended to confirm that the device's USB is disconnected.

2. Restart the device using the software interface (SDK).

6.3 Recovery

Ensure the stability of the USB cable during the upgrade process to avoid upgrade failure. If the upgrade fails, disconnect the USB cable, re-insert it, and burn the product again. If re-burning is unsuccessful, the product may be damaged. Orbbec assumes no liability for any damages or losses resulting from the use of this product.

7 SDK

7.1 SDK Description

The Orbbec SDK is a cross-platform software development kit that provides device parameter configuration, data stream reading, and stream processing for depth cameras, such as Orbbec Structured Light, Stereo, and iToF. It offers a range of features, including:

1. Access and control of hardware devices
2. Access, control, and data acquisition of sensors in the device
3. Control of frame synchronization and alignment
4. Point cloud data acquisition
5. Provides algorithmic capabilities such as filtering
6. Different systems and Wrapper support

Refer to the related software instructions for using Orbbec Viewer.

For SDK development, please refer to the documentation directory in the SDK development kit, which contains relevant software development instructions.

For SDK downloads and updates, please visit https://www.orbbec3d.com/

8 Use Instructions

8.1 Mounting / Fixing Solutions

1. The depth camera housing should use foam or rubber sealing to prevent dust from entering.
2. Do not apply any external force to the depth camera mount during installation.
3. During installation, avoid removing the screws that connect the depth camera bracket and the bridging steel plate.

8.2 Heat Dissipation Recommendations

1. Avoid direct heat source around the camera.
2. Maximize the space inside the external housing may help lowering operating temperature.

Note: For further support of housing design information, please contact Orbbec 3D at info@orbbec3d.com.

8.3 Camera Front Cover Glass Lens Parameters Description

The current light transmission of the Gemini 2 Series front cover glass lens is as follows:

1. RGB(420~650nm)transmittance rate ≥91%
2. IR、LDM (858 ±20nm) transmittance rate ≥91%
3. LDP (940nm±30) transmittance rate ≥91%

The camera has a front cover glass, if a new transparent media is added in front of the front glass lens of the camera cover, may affect the accuracy and imaging effect, for details, please contact our technical support.

9 Regulatory Compliance

The products is certified as follows:

1. RoHS Certification
2. Reach Certification
3. Class 1 Laser Product under the EN/IEC 60825-1:2014

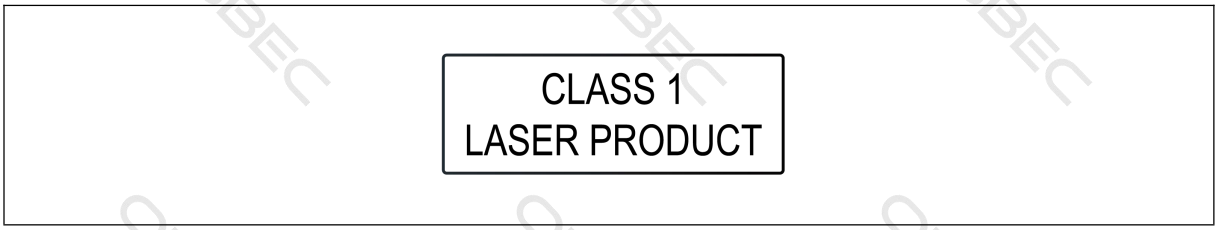


Figure 9-1 Class 1

4. CE Certification

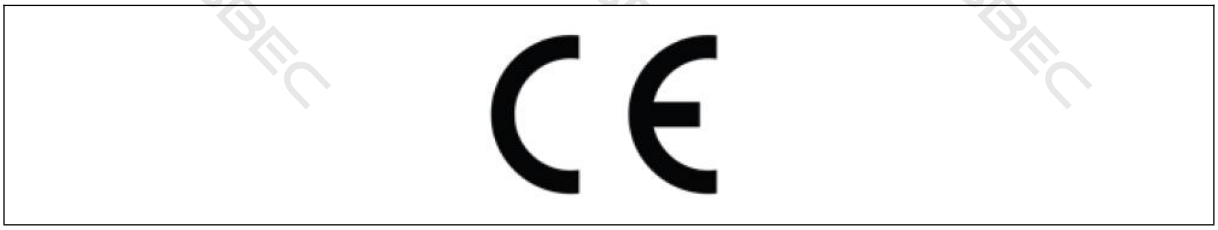


Figure 9-2 CE Certification

5. FCC Certification

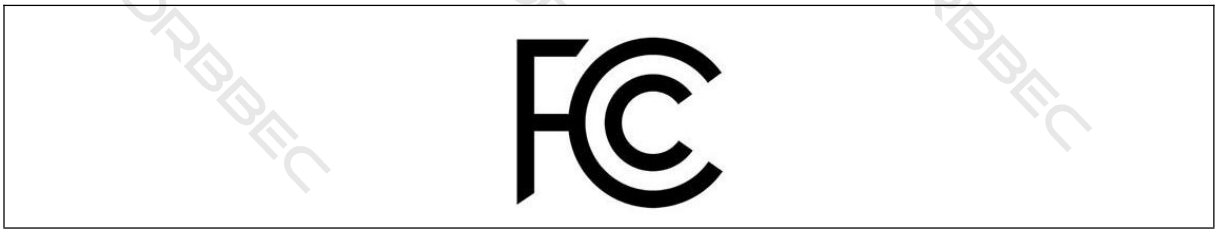


Figure 9-3 FCC Certification

6. KC Certification

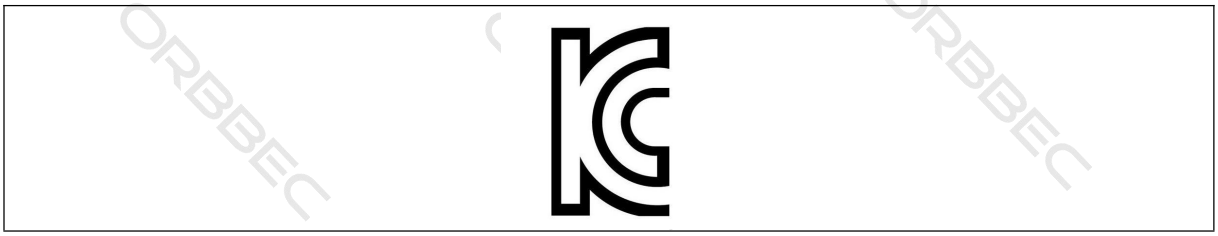


Figure 9-4 KC Certification

10 System Integration Guide

Before choosing Gemini 2 Series for development, users should contact Orbbec sales staff to obtain the user manual and apply for the SDK development kit; through evaluation, debugging and verification steps to confirm whether the solution meets the mass production requirements.

We provide SDK for Gemini 2 Series for various software platforms, you need the SDK for the corresponding platform to develop and use the hardware device. Users can get the depth map through the depth camera, and can use the corresponding API interface to convert the original depth to point cloud data. By using the driver and SDK package, users can develop application layer for the product.

Suggested Process:

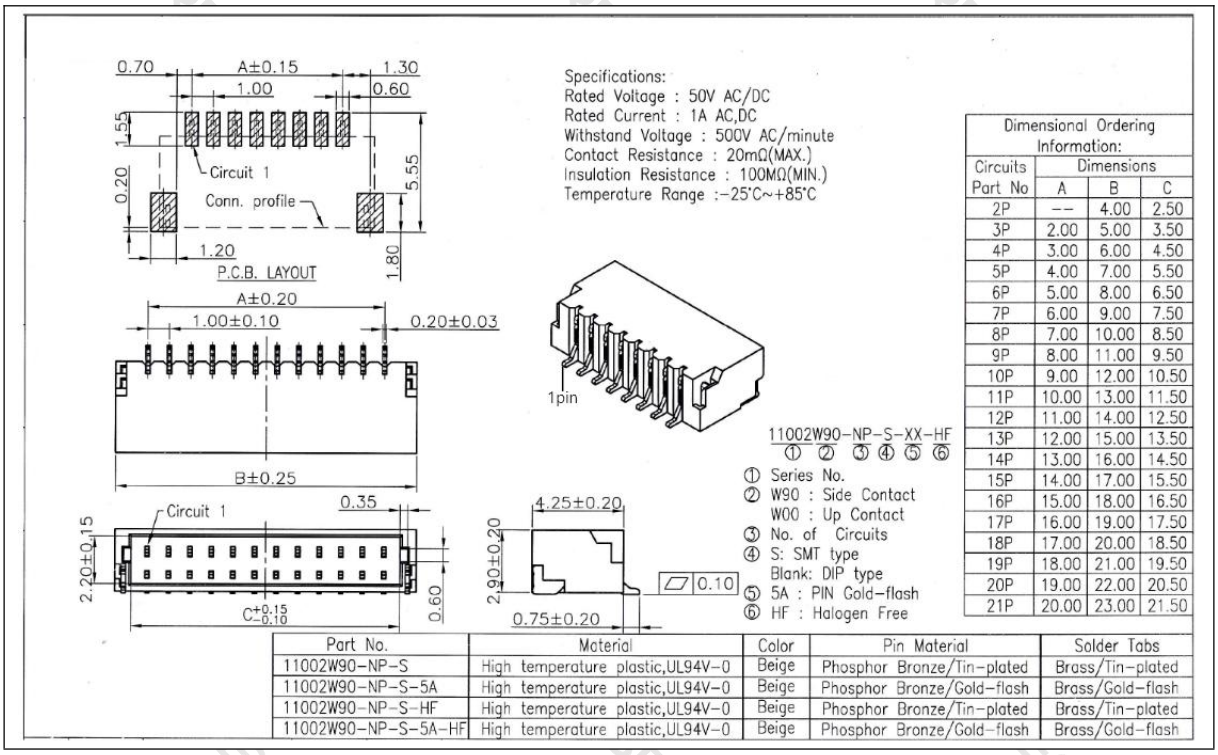
1. Read the product specification
2. Buy the product from the WEB store online
3. Before development, you should get in touch with the sales staff of Orbbec to obtain the user manual and apply for the SDK development kit.
4. Choose the right development platform
5. According to the function of product development, encounter technical problems, please contact with Orbbec staff in time
6. Confirm the mass production plan of the product
7. Mass production of the products according to mass production plan

11 Cautions

1. Please follow the guidelines to operate the device correctly, such as illegal operation may lead to damage to internal components.
2. Do not drop or hit this product to prevent damage to the internal components and loss of accuracy.
3. Do not attempt to modify or disassemble this product in any way during assembly and use, as this may cause damage to the depth camera and loss of accuracy.
4. The product temperature rises after a period of use, which is a normal phenomenon.
5. Please do not touch the lens, so as not to leave a foreign body and thus affect the effect of taking picture.
6. Do not place the product in a place where children or animals can touch it to avoid accidents.
7. If you can't recognize the camera, please check whether the cable meets the power supply requirements and re-plug the USB to check.
8. Although this product uses a Class 1 laser (a harmless, control-free laser), we do not recommend looking directly at the laser emitter for more than 20 seconds to avoid discomfort.

Appendix I Multi-Camera Synchronization Interface

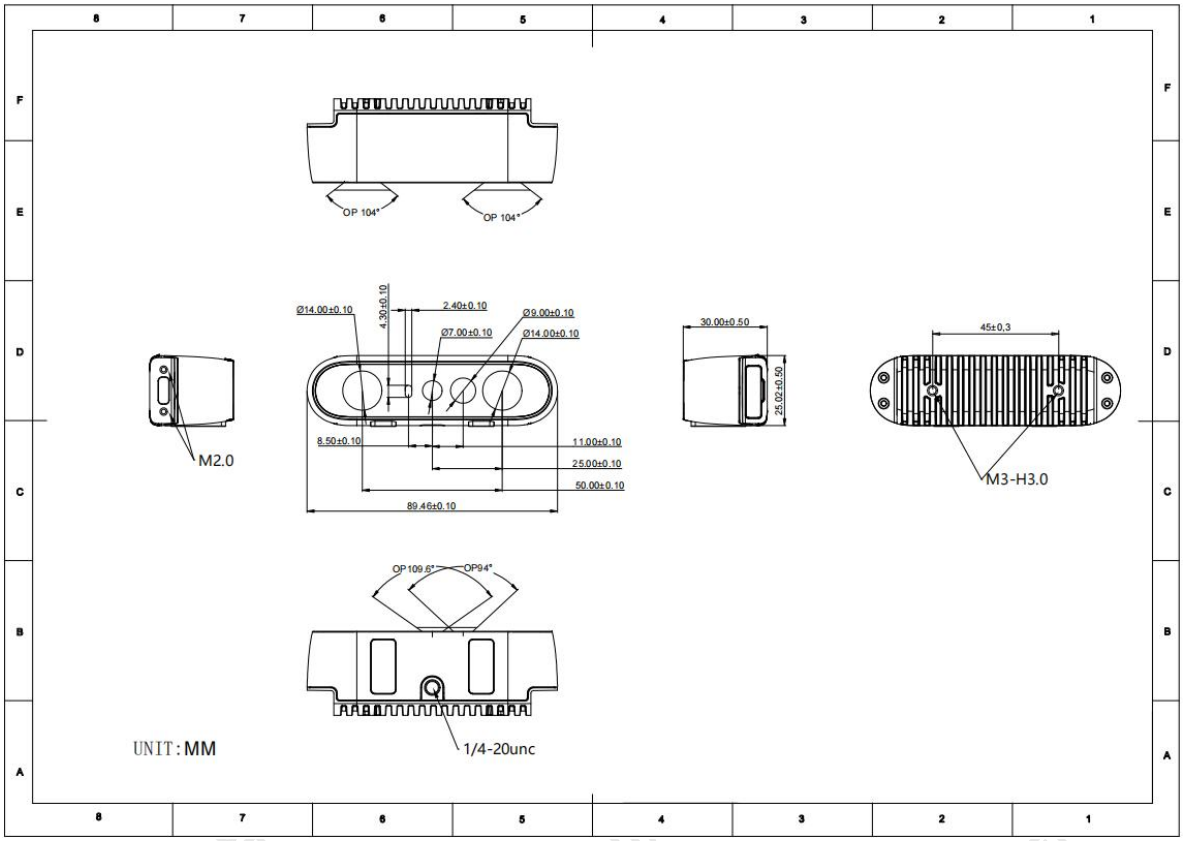
Structure Diagram



Dimensional Ordering Information:			
Circuits	Dimensions		
Part No	A	B	C
2P	--	4.00	2.50
3P	2.00	5.00	3.50
4P	3.00	6.00	4.50
5P	4.00	7.00	5.50
6P	5.00	8.00	6.50
7P	6.00	9.00	7.50
8P	7.00	10.00	8.50
9P	8.00	11.00	9.50
10P	9.00	12.00	10.50
11P	10.00	13.00	11.50
12P	11.00	14.00	12.50
13P	12.00	15.00	13.50
14P	13.00	16.00	14.50
15P	14.00	17.00	15.50
16P	15.00	18.00	16.50
17P	16.00	19.00	17.50
18P	17.00	20.00	18.50
19P	18.00	21.00	19.50
20P	19.00	22.00	20.50
21P	20.00	23.00	21.50

Part No.	Material	Color	Pin Material	Solder Tabs
11002W90-NP-S	High temperature plastic,UL94V-0	Beige	Phosphor Bronze/Tin-plated	Brass/Tin-plated
11002W90-NP-S-5A	High temperature plastic,UL94V-0	Beige	Phosphor Bronze/Gold-flash	Brass/Gold-flash
11002W90-NP-S-HF	High temperature plastic,UL94V-0	Beige	Phosphor Bronze/Tin-plated	Brass/Tin-plated
11002W90-NP-S-5A-HF	High temperature plastic,UL94V-0	Beige	Phosphor Bronze/Gold-flash	Brass/Gold-flash

Appendix II Gemini 2 2D Structure Diagram



Appendix III Gemini 2 L 2D Structure Diagram