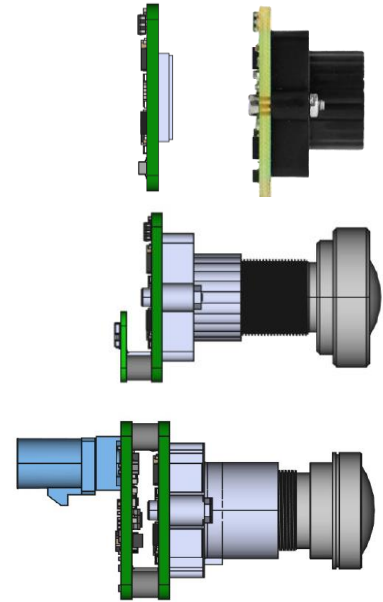




FSM:GO - IMX678C

8MP/4K optical sensor module with Sony Starvis2 low-light image sensor.

What is the FSM:GO?

- Family of ready to mount image sensor modules
- Paired with a standard lens from the selected range
- Focused to your specific working distance
- Assembled with your interface choice
- Simple and off-the-shelf

Contact Information

Framos GmbH

Technical Support:

support@framos.com

Website:

<https://www.framos.com>



Product Specification - Overview

Sensor Module

Type	Sony IMX678-AAQR1 (AR)
Shutter Type	CMOS Rolling Shutter
Technology	Starvis2
Spectrum	Color (RGB)
Optical Format	1/1.8"
Pixel Size	2 x 2 μm
Resolution (max.)	3840 x 2160 (4K / 8MP)
Framerate (max.)*	10Bit: 72 FPS 12Bit: 60 FPS
Bit Depth*	10 / 12 bit

*Platform dependent

Platform Support (Driver, ISP)

NVIDIA	Jetson Xavier, Orin Family
NXP	i.MX8MP



Lens Option(s)

FOV (H)	54°	100°	110°
Optical Filter	IR cut (650 nm)	IR cut (660 nm)	IR cut (650 nm)
Aperture	F/2	F/2.7	F/2
Lens Mount	M12 x 0.5	M12 x 0.5	M12 x 0.5

Interface Option(s)

Data Interface	MIPI CSI 2 (D-PHY, v1.2)	GMSL3 (12Gbps)
Physical Interface	PixelMate (60 pin)	FAKRA (Single Coax)
	Micro Coax (50 pin)	
	FFC (40 pin) (unshielded)	
Communication	I ² C	I ² C
Power Supply	Two Rails (3.8V, 1.8V)	Power over Coax (12V)
Power Cons. (Max)	540mW	1.2W

Mechanical Specification

Dimensions	26.5 (W) x 26.5 (D)
[mm]	H: [min 4.81 – max 57.36]
Housing	None / Boardlevel
Lens Mount	M12 x 0.5 (var. options)

Applications:

- Security and surveillance
- Drones - AGV and AGVs
- Streaming and conferencing
- Sport analytics
- Mapping, digital twins
- Industrial, robotics

Environmental

Ingress Protection	None
Operating Temperature	-30° to +85°C*
Storage Temperature	-40°to +85°C*
Ambient Humidity	Max 95% RH, non-condensing

*Sensor module without lens, check [Lens Options](#) for configurations with Lens.

The comprehensive specifications are outlined within the contents of this datasheet.



Table of Contents

1 Order Code Scheme/Options 1

2 Lens Options 2

3 Focusing Service and Focusing Distance 3

4 Lens Mount Options 4

5 Interface Options..... 5

 5.1 Pinouts..... 6

 5.2 Signal Description 9

6 Mechanical Drawings..... 11

 6.1 Sensor Module (Bare FSM:GO)..... 11

 6.2 FSM:GO with Lens 12

 6.3 FSM:GO with Mount 13

 6.4 FSM:GO with Interface Adapter..... 14

7 Platform & Software Specification 16

 7.1 Nvidia Jetson Family Support 16

 7.2 NXP i.MX8MP Support..... 17

1 Order Code Scheme/Options

FSM:GO-IMX678C-[LM]-[L]-[FS][FD]-[IF]-[MH]-A1Q1

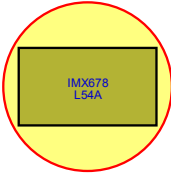
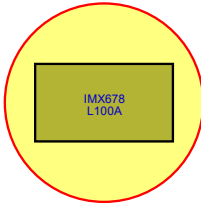
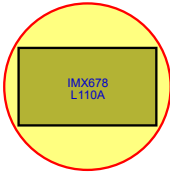
LM: Lens Holder (Optional)

- *M12A*: 8.6 mm Height
- *M12B*: 12.5 mm Height
- *M12C*: 16.2 mm Height
- *M12D*: 7.9 mm Height
- **L:** Lens Type (Optional)
 - *L54A*: 54° HFOV (LM: M12B)
 - *L100A*: 100° HFOV (LM: M12B)
 - *L110A*: 110° HFOV (LM: M12B)
- **FS:** Focusing Service (Optional)
 - FCS: Center Focusing (L: Required)
- **FD:** Focusing Distance
 - HYP: Hyperfocal Distance
 - xxxx: Custom Distance in mm (FS: Required)
- **IF:** Interface (Mandatory)
 - *PM*: PixelMate (60 pin)
 - *MC50A*: MicroCoax (50 pin)
 - *FFC40A*: Flat-Flex Cable (40 pin)
 - *GMSL3A*: GMSL3 (FAKRA, Single Coax)
- **MH:** Mechanicals/Housing
 - None: Board Level



2 Lens Options

2.1 Module Specifications

Lens Type (PN)	FLP-AM-077-00-V-00	FLP-EM-044-00-V-00	FLP-AM-040-02-V-00
Field of View [°]			
Horizontal	54	100	110
Vertical	32	55	62
Diagonal	61	114	127
Aperture (F-Number)	F/2	F/2.7	F/2
Optical Filter	IRC@650 (±10nm)	IRC@660 (±10nm)	IRC@650 (±10nm)
Mount Thread	M12 x 0.5	M12 x 0.5	M12 x 0.5
Mating Mount (PN)	FLA-MI-M-12522-00	FLA-MI-M-12522-00	FLA-MI-M-12522-00
Temperature Range	-20°to +70°C*	-40°to +85°C*	-30°to +85°C*
Sensor Coverage			

*Image tuning and assembly are performed at 25°C. Temperature variations may affect performance and focus.

2.2 Lens Specification

Focal length [mm]	7.68	4.5	4
Min. Object Dist. [m]	0.1	0.1	0.3
Hyperfocal Dist. [m]	7.38	1.88	2.00
Max. IC [mm]	9.4	11.06	9.25
Back Focal Length [m]	8.86	7.33	6.5
Distortion [%]	-2.19 (F-Tan-Theta)	-35.8 (F-Tan-Theta)	-0.177 (F-Theta)
Rel. Illumination [%]	55	86	30
Max. CRA [°]	10.8	9.2	14.5
TTL [mm]	33.62	29.64	31.61
Construction	9 (Glass)	7 (Glass)	8-7 (Glass)

3 Focusing Service and Focusing Distance

Specification Description	No Focusing ¹	Focusing to Hyperfocal	Focusing to Custom Distance
Type (Code)	-	FCSHYP	FCS[FD]
Focus Distance	N/A	Hyperfocal Distance [HYP] ²	Custom Focus Distance [FD] ³
Focus Target	N/A	Virtual Image (Collimator)	Virtual Image (Collimator)
Focus Area ⁴	N/A	Image Center	Image Center
Lens Fixation	N/A	Permanent (Epoxy)	Permanent (Epoxy)

¹ Lens is properly screwed into the lens mount without focusing and fixation.
² Please see "Hyperfocal Distance [m]" in Focusing Specifications – Table 2.2.
³ Please see "Min. Object Distance [m]" to infinity in Focusing Specifications – Table 2.2.
⁴ Please see Figure 3.1 below showing the virtual target at image center as the focus area.

Focus Area

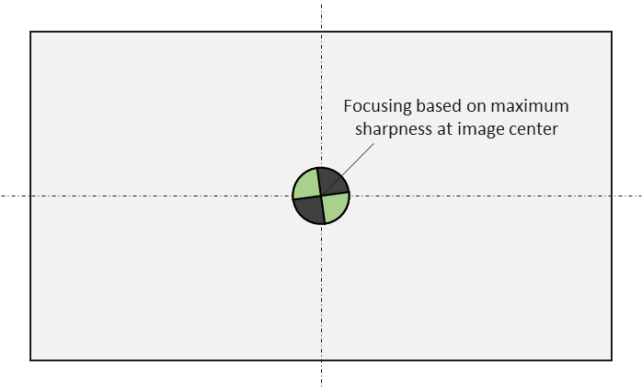


Figure 3.1



4 Lens Mount Options

Specification				
Type (Code)	M12A	M12B	M12C	M12D
Type (PN)	FLA-MA-M-08622-00	FLA-MI-M-12522-00	FLA-MO-M-16222-00	FLA-MC-M-07922-00
Thread Type	M12 x 0.5	M12 x 0.5	M12 x 0.5	M12 x 0.5
Height [mm]	8.6	12.5	16.2	7.9
Barrel Diameter (Outer) [mm]	13.8	13.8	14.5	14.5
Thread Length	4.6	7.9	11.2	3
Mounting Hole Distance [mm]	22	22	22	22
Mounting Screw Size	M1.6	M1.6	M1.6	M1.6
Material	PC+30%GF	ABS	C1200 PC/ABS	PC+10%GF
Appearance [Color]	Black	Black	Black	Black
Mating Std. Lens (Code)	-	L54A L100A L110A	-	-



5 Interface Options

Type (Code)	PM	MC50A	FFC40A	GMSL3A
Description	PixelMate	Micro-Coax	Flat-Flex Cable	GMSL/SerDes
FSM:GO Integration	Default FSM:GO Interface	Adapter Board (Piggyback)	Adapter Board (Piggyback)	Adapter Board (Piggyback)
Interface Standard	FRAMOS PixelMateC	Proprietary	Proprietary	GMSL, FAKRA Coaxial
Connector Type	Hirose DF40C-60DP-0.4V(51)	I-PEX 20525-050E-02	Molex 5051104091	Amphenol RF 2FA1-NZSP-PCBB6
Pin Count [#]	60	50	40	1+GND
Pin Pitch [mm]	0.4mm	0.4mm	0.5mm	-
Locking Style	Self-Locking	Mechanical locking	Mechanical locking	Mechanical locking
Shielding	Yes	Yes	No	Yes
Power Supply [V]	3V8, 1V8	3V8, 1V8	3V8, 1V8	12V (Power over Coax)
Data Lanes/Bandwidth	4-Lanes, 2.5 Gbps (ea.)	4-Lanes, 2.5 Gbps (ea.)	4-Lanes, 2.5 Gbps (ea.)	1-Line at 12Gbps (10Gbps Effective)
Mating Connector	Hirose DF40C-60DS-0.4V(51)	I-PEX 20525-050E-02	Molex 5051104091	Amphenol RF 2FA1-NZSP-PCBB6
Mating Cable(s)	FMA-FC-150/60	FMA-CBL-MC50-0.3m	Molex 0150200440	FMA-CBL-FAK.LD302-*
Receiver Boards	Various FPAs	FFA-MC50/A	FFA-FFC40/A	FFA-GMSL-DES-V2

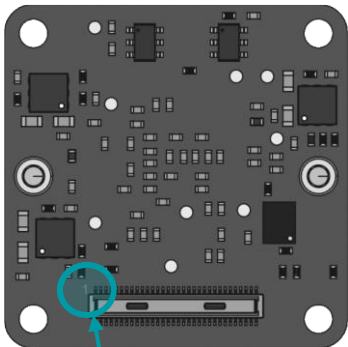


5.1 Pinouts

WARNING Pin 1 is identified on the board. Orient accordingly, paying close attention to the pin number in reference to the locator view illustrated below. Failure to align correctly will cause permanent damage.

PixelMate:

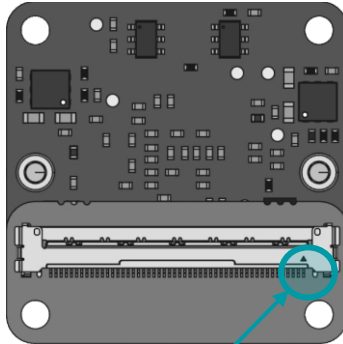
Type: Hirose DF40C-60DP-0.4V(51)



PIN 1

Pinout

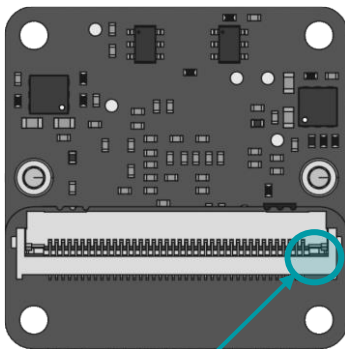
1	3V8_VDD	2	1V8_VDD
3	3V8_VDD	4	1V8_VDD
5	NC	6	NC
7	NC	8	NC
9	NC	10	NC
11	GND	12	GND
13	GND	14	GND
15	IS_RST_0	16	NC
17	NC	18	NC
19	XMASTER	20	TOUT1
21	I2C_SCL	22	NC
23	NC	24	NC
25	XVS	26	NC
27	I2C_SDA	28	NC
29	XHS	30	TENABLE
31	NC	32	TOUT0
33	NC	34	NC
35	SLAMODE0	36	SLAMODE1
37	GND	38	GND
39	NC	40	NC
41	NC	42	NC
43	GND	44	GND
45	NC	46	D_DATA_3_P
47	NC	48	D_DATA_3_N
49	GND	50	GND
51	D_DATA_0_N	52	D_DATA_1_N
53	D_DATA_0_P	54	D_DATA_1_P
55	GND	56	GND
57	D_DATA_2_P	58	D_CLK_0_P
59	D_DATA_2_N	60	D_CLK_0_N

MC50:**Type: I-PEX 20525-050E-02**

PIN 1

Pinout

1	GND	26	I2C_SDA
2	D_CLK_0_N	27	NC
3	D_CLK_0_P	28	XVS
4	GND	29	NC
5	D_DATA_2_N	30	NC
6	D_DATA_2_P	31	I2C_SCL
7	GND	32	TOUT1
8	D_DATA_1_P	33	XMASTER
9	D_DATA_1_N	34	NC
10	GND	35	NC
11	D_DATA_0_P	36	NC
12	D_DATA_0_N	37	IS_RST_0
13	GND	38	GND
14	D_DATA_3_N	39	NC
15	D_DATA_3_P	40	NC
16	GND	41	NC
17	NC	42	NC
18	SLAMODE1	43	NC
19	SLAMODE0	44	NC
20	NC	45	GND
21	NC	46	1V8_VDD
22	TOUT0	47	1V8_VDD
23	NC	48	GND
24	TENABLE	49	3V8_VDD
25	XHS	50	3V8_VDD

FFC40:**Type: Molex 5051104091**

PIN 1

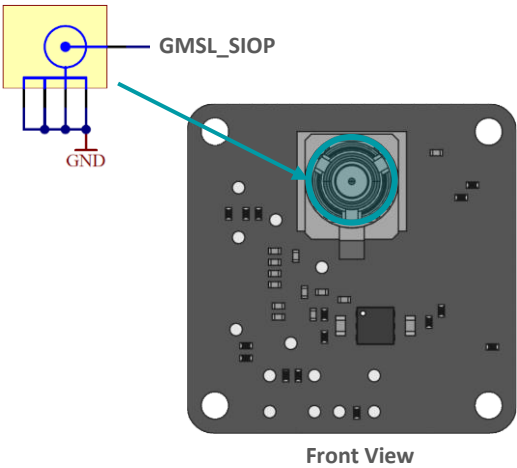
Pinout

1	GND	21	NC
2	D_CLK_0_N	22	XHS
3	D_CLK_0_P	23	XVS
4	GND	24	I2C_SDA
5	D_DATA_2_N	25	I2C_SCL
6	D_DATA_2_P	26	XMASTER0
7	GND	27	IS_RST_0
8	D_DATA_1_P	28	NC
9	D_DATA_1_N	29	NC
10	GND	30	NC
11	D_DATA_0_P	31	NC
12	D_DATA_0_N	32	NC
13	GND	33	NC
14	D_DATA_3_N	34	GND
15	D_DATA_3_P	35	1V8_VDD
16	GND	36	1V8_VDD
17	NC	37	GND
18	GND	38	3V8_VDD
19	NC	39	3V8_VDD
20	NC	40	GND



GMSL3A:

Type: 2FA1-NZSP-PCBB6	Pinout
1	GMSL_SIOP
2	GND



5.2 Signal Description

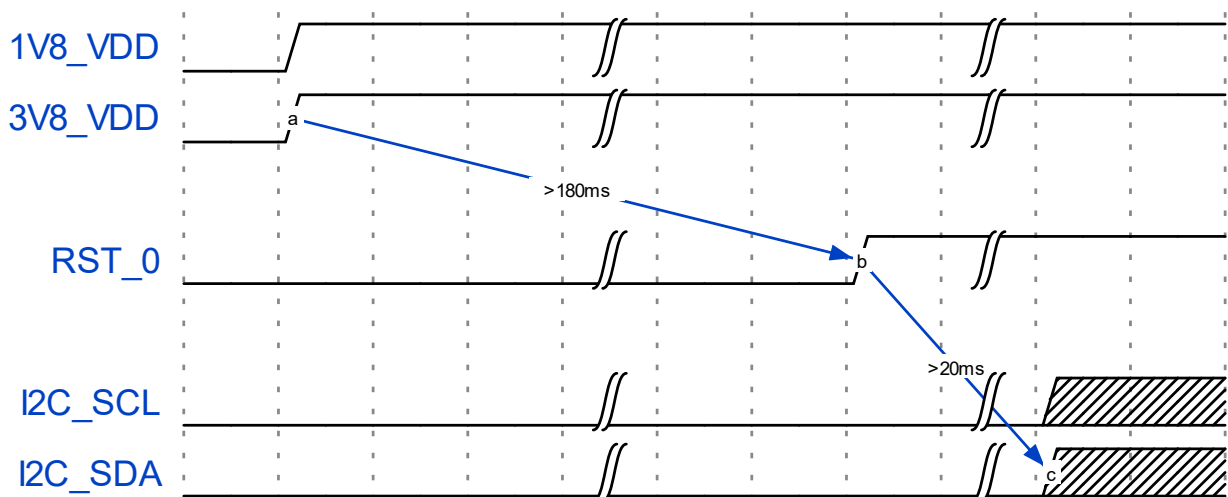
3V8_VDD		1V8_VDD	
I/O Type	Power	I/O Type	Power
Function	3.8V Power supply	Function	1.8V Power supply
Connected to	LDO_IC	Connected to	LDO_IC
DC Charact.	3V8_VDD=3.7V-5.1V, max. 0.3A per line	DC Charact.	1V8_VDD=1.7V-1.9V, max. 0.3A per line
IS_RST_0		SLAMODE0/1	
I/O Type	IN	I/O Type	IN
Function	Image sensor reset (XCLR)	Function	I2C slave address configuration
Connected to	Reset_IC	Connected to	Image Sensor, pull-down res. 10k
I/O Standard	LVC MOS18 (1.8V)	I/O Standard	LVC MOS18 (1.8V)
I/O State	Normal: High, Reset: Low	DC Charact.	VILmax=0.36V, VIHmin=1.44V
DC Charact.	VILmax=0.36V, VIHmin=1.44V		
I2C_SCL		I2C_SDA	
I/O Type	IN/OUT	I/O Type	IN/OUT
Function	I2C clock	Function	I2C data
Connected to	Image Sensor, no pull-up	Connected to	Image Sensor, no pull-up
I/O Standard	LVC MOS18 (1.8V)	I/O Standard	LVC MOS18 (1.8V)
DC Charact.	VILmax=0.54V, VIHmin=1.26V	DC Charact.	VILmax=0.36V, VIHmin=1.44V
XMASTER		XVS / XHS	
I/O Type	IN	I/O Type	IN/OUT
Function	Image sensor master/slave	Function	Vertical/Horizontal sync signal
Connected to	Image Sensor, pull-down res. 10k	Connected to	Image Sensor, pull-up res. 10k
I/O Standard	LVC MOS18 (1.8V)	I/O Standard	LVC MOS18 (1.8V)
DC Charact.	VOLmax=0.36, VOLmin=1.44V	DC Charact.	VILmax=0.36V, VIHmin=1.44V, VOLmax=0.2V, VOHmin=1.6V
TENABLE		TOUT0/1	
I/O Type	IN	I/O Type	OUT
Function	Test enable	Function	Test output pins from image sensor
Connected to	Image Sensor	Connected to	Image Sensor
I/O Standard	LVC MOS18 (1.8V)	I/O Standard	LVC MOS18 (1.8V)
DC Charact.	VILmax=0.36V, VIHmin=1.44V	DC Charact.	VILmax=0.36V, VIHmin=1.44V
D_DATA_#_P/N		D_CLK_0_P/N	
I/O Type	OUT	I/O Type	OUT
Function	MIPI-CSI2 output data (Lane #, Positive/Negative)	Function	MIPI-CSI2 output clock (Positive/Negative)
Connected to	Image sensor	Connected to	Image sensor
I/O Standard	MIPI D-PHY	I/O Standard	MIPI D-PHY

5.3 I2C Address Configuration (SLAMODE)

SLAMODE0	SLAMODE1	I2C Address
0	0	0x1A
1	0	0x10
0	1	0x36
1	1	0x37

5.4 Power-On Sequencing

For correct function, the host system must follow the below timing to properly power up or reset the module. 3V8_VDD should be generated after 1V8_VDD, or, ideally at the same time. RST_0 pin low after powering up PixelMate voltage rails; **180 ms**.



Legend

Times and voltages which are represented in the above figure are as follows:

- 3V8_VDD - 3V8 voltage supply from host
- 1V8_VDD - 1V8 voltage supply from host
- RST_0 - reset signal driven from the host
- I2C_SCL - I2C Clock
- I2C_SDA - I2C Data

6 Mechanical Drawings

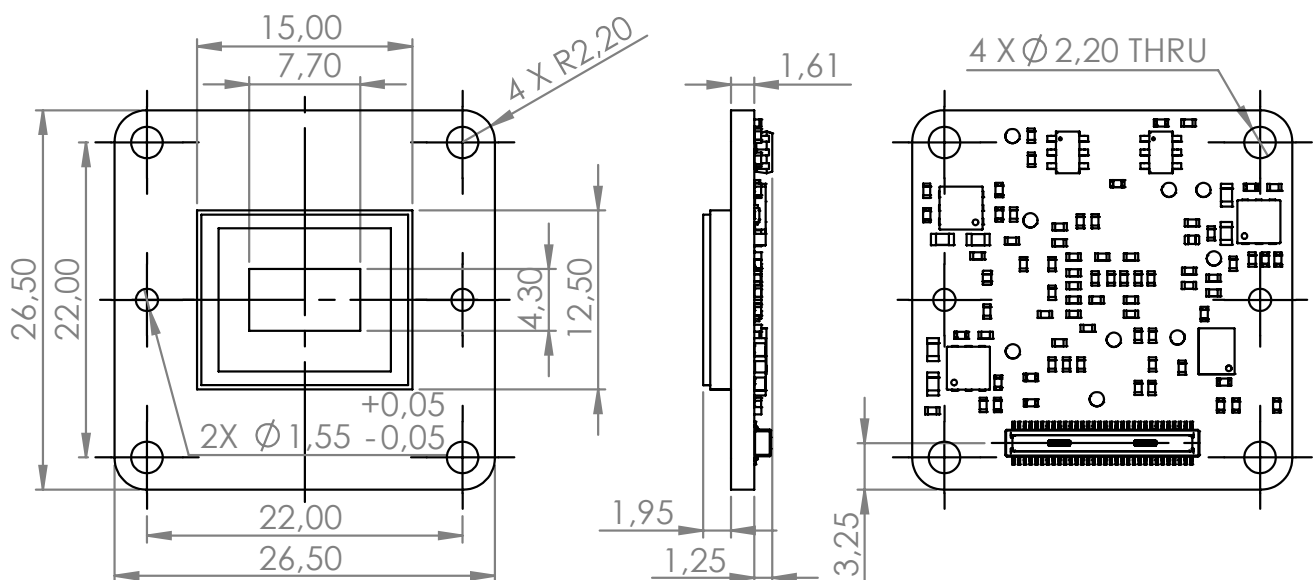
The following chapter contains the measured drawings split into the core segments of the product.

- Bare Sensor Module
- with Lens
- with Lens Mount only
- with Interface Adapter

All measures refer to the backside of the sensor module PCB and allow this way to obtain the overall measures. Unit of measurements is millimeters [mm].

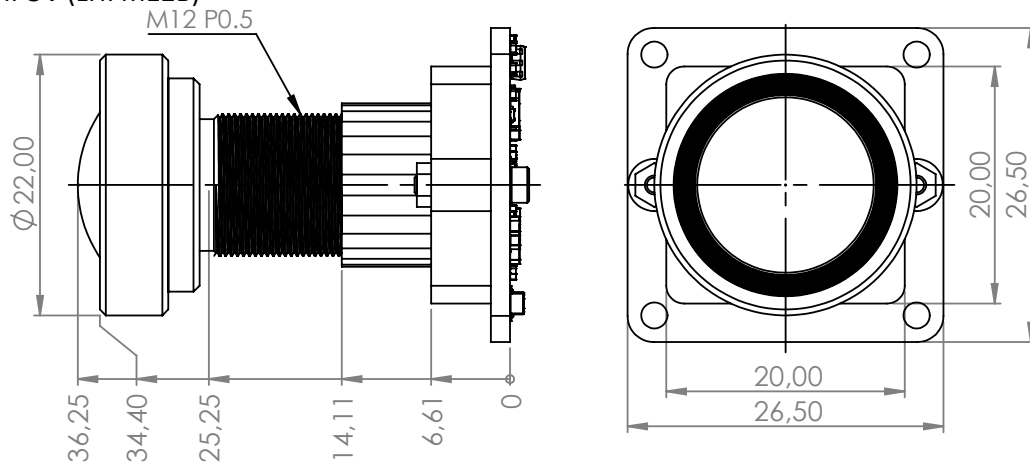
6.1 Sensor Module (Bare FSM:GO)

Interface: PixelMate

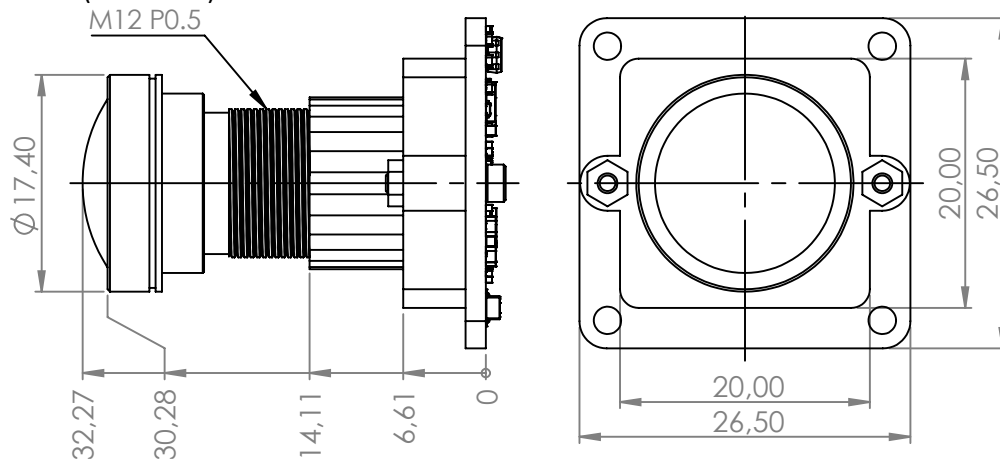


6.2 FSM:GO with Lens

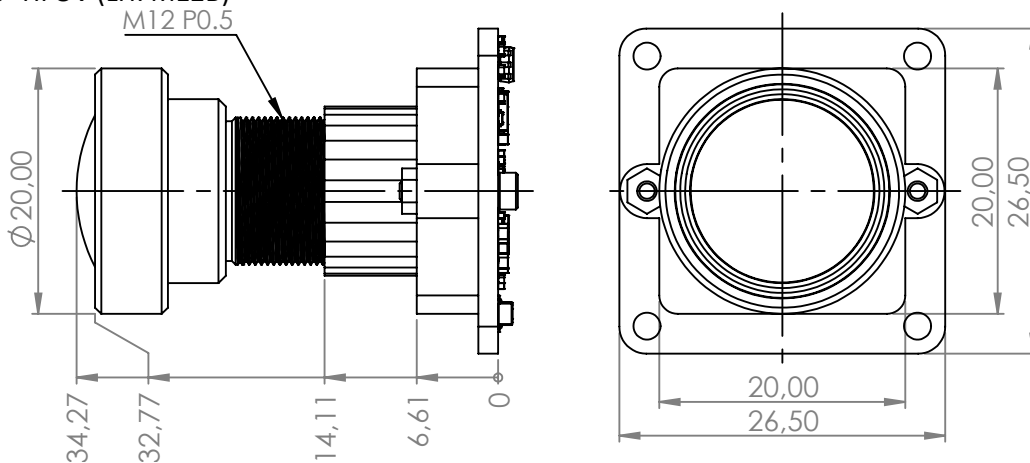
L54A: 54° HFOV (LH: M12B)



L100A: 100° HFOV (LH: M12B)

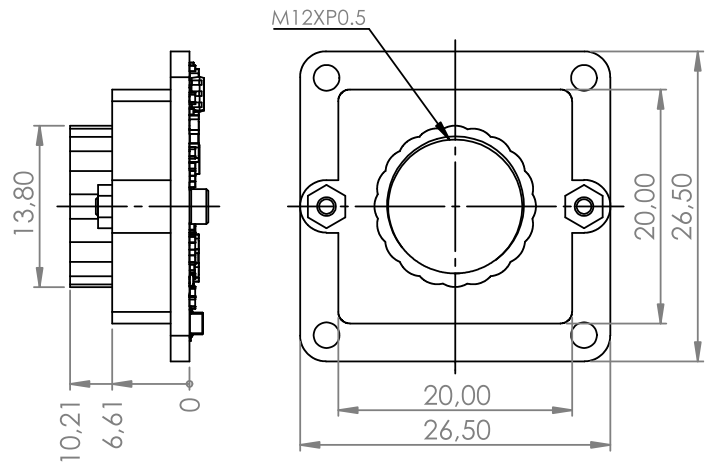


L110A: 110° HFOV (LH: M12B)

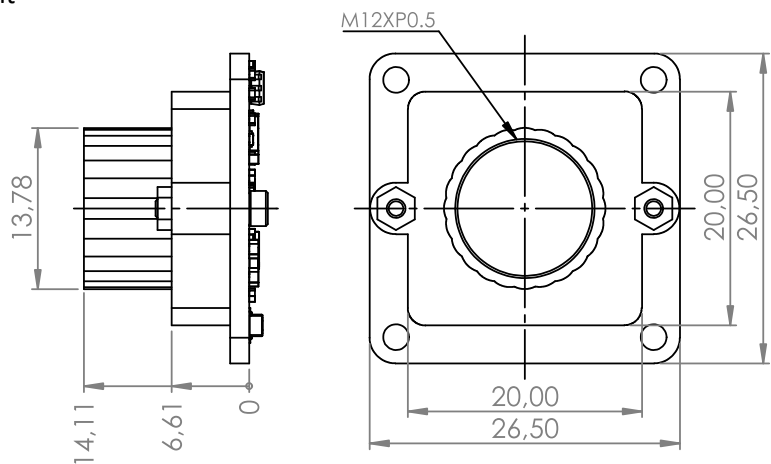


6.3 FSM:GO with Mount

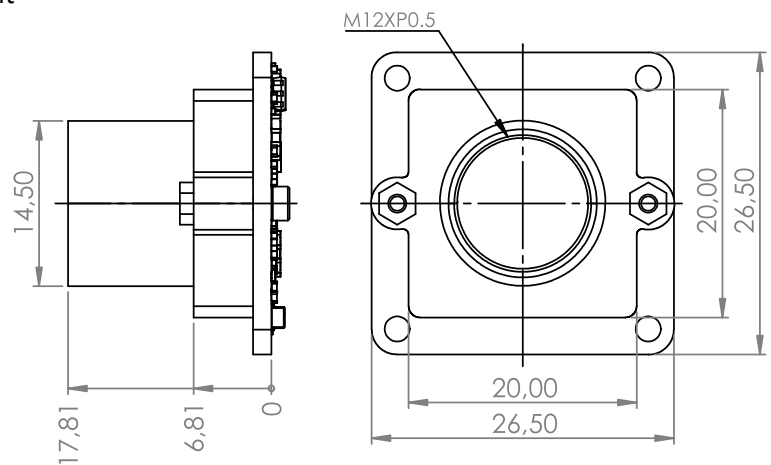
M12A: 8.6 mm Height



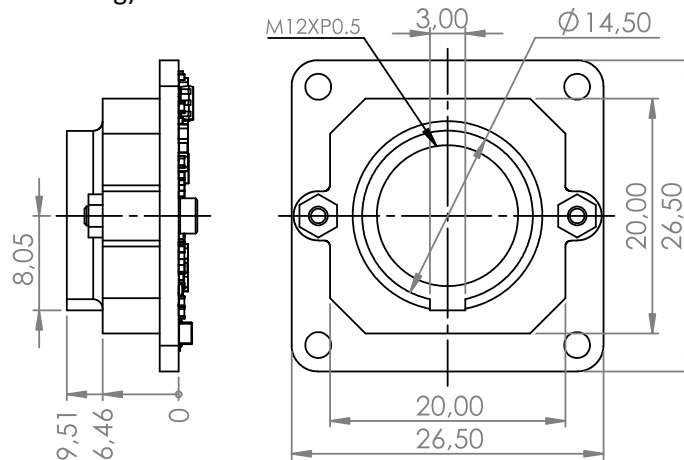
M12B: 12.5 mm Height



M12C: 16.2 mm Height



M12D: 7.9 mm Height (wider fitting)

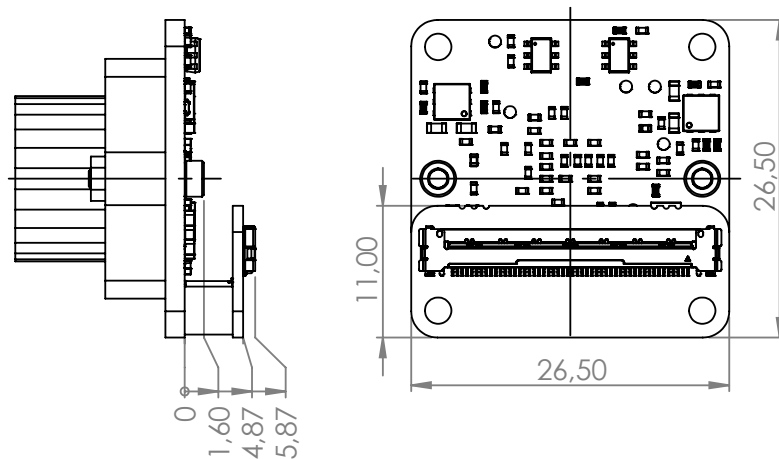


6.4 FSM:GO with Interface Adapter

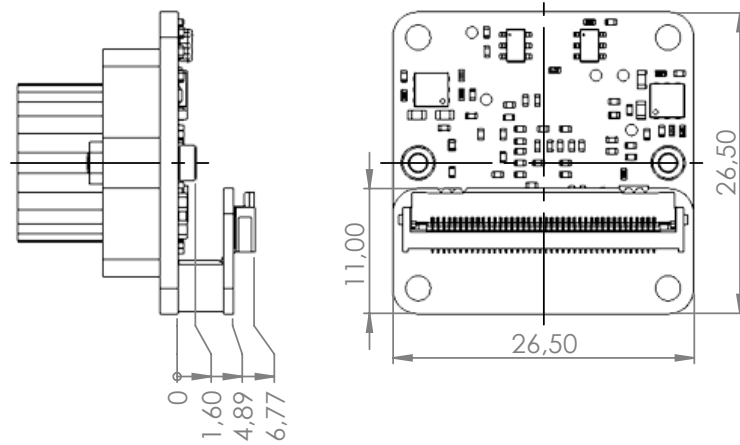
PM: See bare "Sensor Module"

NOTE Interface adapters fixed with screws for transport, mounting screws not included in product photos and drawings.

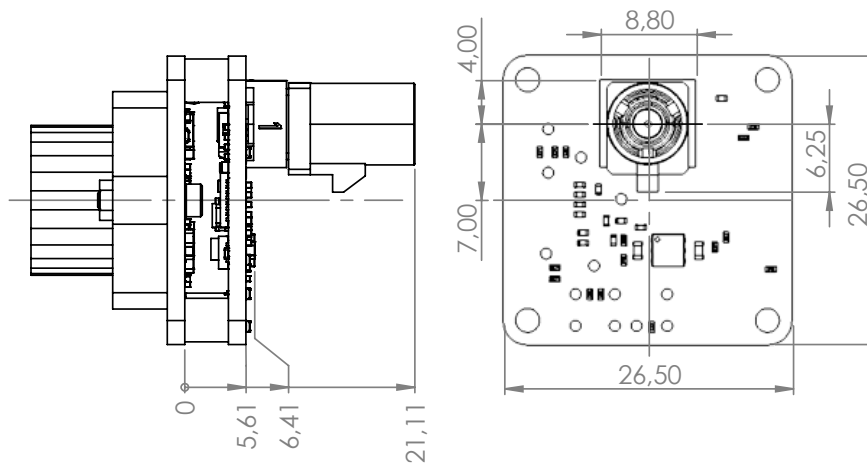
MC50A: MicroCoax (50 pin)



FFC40A: Flat-Flex Cable (40 pin)



GMSL3A (FAKRA, Single Coax)





7 Platform & Software Specification

7.1 Nvidia Jetson Family Support

Supported Platforms:

Image sensor	Jetson AGX Xavier Devkit		Jetson Xavier NX Devkit		Jetson AGX Orin Devkit		Jetson Orin Nano & Jetson Orin NX Devkits	
	Support (Native)	GMSL	Support (Native)	GMSL	Support (Native)	GMSL	Support (Native)	GMSL
IMX678	+	+	+	+	+	+	+	+

Supported Features:

Mode	Resolution	Description	2lane/10b [FPS]	2lane/12b [FPS]	4lane/10b [FPS]	4lane/12b [FPS]
0	3856x2180	FULL_PIX	30.0	30.0	72.1	60.0
1	2608x1964	CROP	33.2	33.2	79.7	66.4
2	1920x1080	CROP	58.7	58.7	140.9	117.4
3	1928x1090	BINNING H2V2	-	30.0	-	60.0

Implemented Sensor Features:

Sensor Feature	Support
Gain (Analog/Digital)	+
Frame Rate	+
Exposure	+
Flip/Mirror	-
IS Mode (Master/Slave)	+
Sensor Mode ID	+
Test Pattern	+
Black Level	+
Clear HDR	-
Broadcast	+
Data Rate	+
Synchronizing (Master/Slave)	+



Supported ISP Features:

Image Signal Processing Feature	Support
Demosaic	+
Black Level Compensation	+
Bad Pixel Correction	+
Color Correction	+
Auto White Balance (A, TL84, D65)	+
Manual White Balancing	+
Lens Shading/Falloff Correction	+
Noise Reduction	+
Sharpening	+
Auto Exposure, Gain, Gamma, Color/Tone, Contrast Tuning	+

7.2 NXP i.MX8MP Support

Supported Platforms:

i.MX 8M PLUS Devkit			
Image sensor	Driver	Support (Native)	GMSL
IMX678	IMX678	+	-

Supported Features:

Mode	Resolution	Description	4lane/10b [FPS]	4lane/12b [FPS]
0	3840x2160	FULL_PIX	25 (720 Mbps) 30 (891 Mbps)	25 (891 Mbps) 30 (1188 Mbps)
1	1920x1080	BINNING H2V2 + CROP	-	30 (720 Mbps)

Implemented Features:

Supported Features	FSM:GO-IMX678C
Gain (Analog/Digital)	+
Frame Rate	+
Exposure	+
Flip/Mirror	-
IS Mode (Master/Slave)	-
Sensor Mode ID	+
Test Pattern	+
Black Level	+
HDR	-
Broadcast	-
Data Rate	+
Synchronizing Master mode	+

FSM:GO



Contact Information

Framos GmbH

Technical Support:

support@framos.com

Website:

<https://www.framos.com>