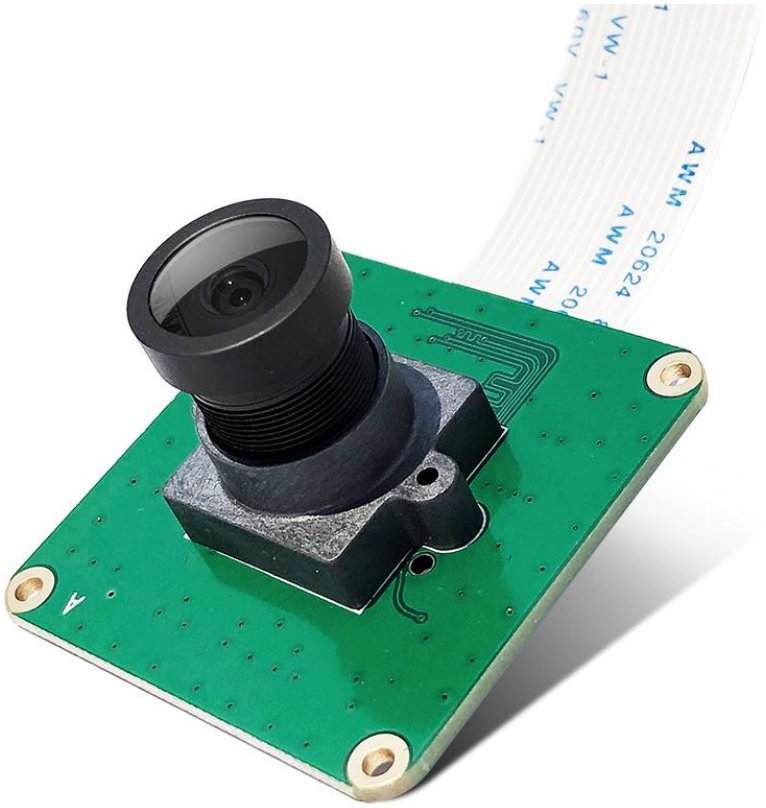
CAM-MIPI290-327-462RAW UserManual



1. General

CAM-MIPI327RAW, CAM-MIPI462RAW, and CAM-MIPI290RAW are modules designed based on Sony's IMX327LQR-C, IMX462LQR-C, and IMX290LLR-C sensors, respectively. These sensor characteristics are quite similar and the software is also relatively compatible. In Linux, they use mutually compatible drivers. Therefore, this manual groups these three camera boards together.

All three sensors belong to Sony's STARVIS series. STARVIS is a trademark of Sony Corporation. STARVIS is back-illuminated pixel technology used in CMOS image sensors for surveillance camera applications. It features a sensitivity of 2000 mV or more per 1 μm^2 (for color products, when imaging with a 706 cd/m^2 light source, F5.6 in 1-second accumulation equivalent), and achieves high picture quality in both visible-light and near-infrared light regions

On-board sensor features with diagonal 6.46 mm (Type 1/2.8) and up to 1920 (H) × 1080 (V) Resolution. With triple power supply, and has low power consumption. High sensitivity, low dark current and no smear are achieved through the adoption of R, G and B primary color mosaic filters. This chip features an electronic shutter with variable charge-integration time. Suitable for surveillance cameras, FA (Factory Automation) cameras, and industrial cameras.

This series of cameras board is paired with a wide-angle camera and features a CSI interface compatible with Raspberry Pi camera interface, making it adaptable to the entire series of Raspberry Pi boards(PI5/PI4/PI3/CM4/CM3/Zero/Zero W). The camera board can directly use the Raspberry Pi's built-in driver, without the need for additional driver installation. It can also be tested directly using the libcamera and RpiCam tools available in the system.

2. Hardware Description

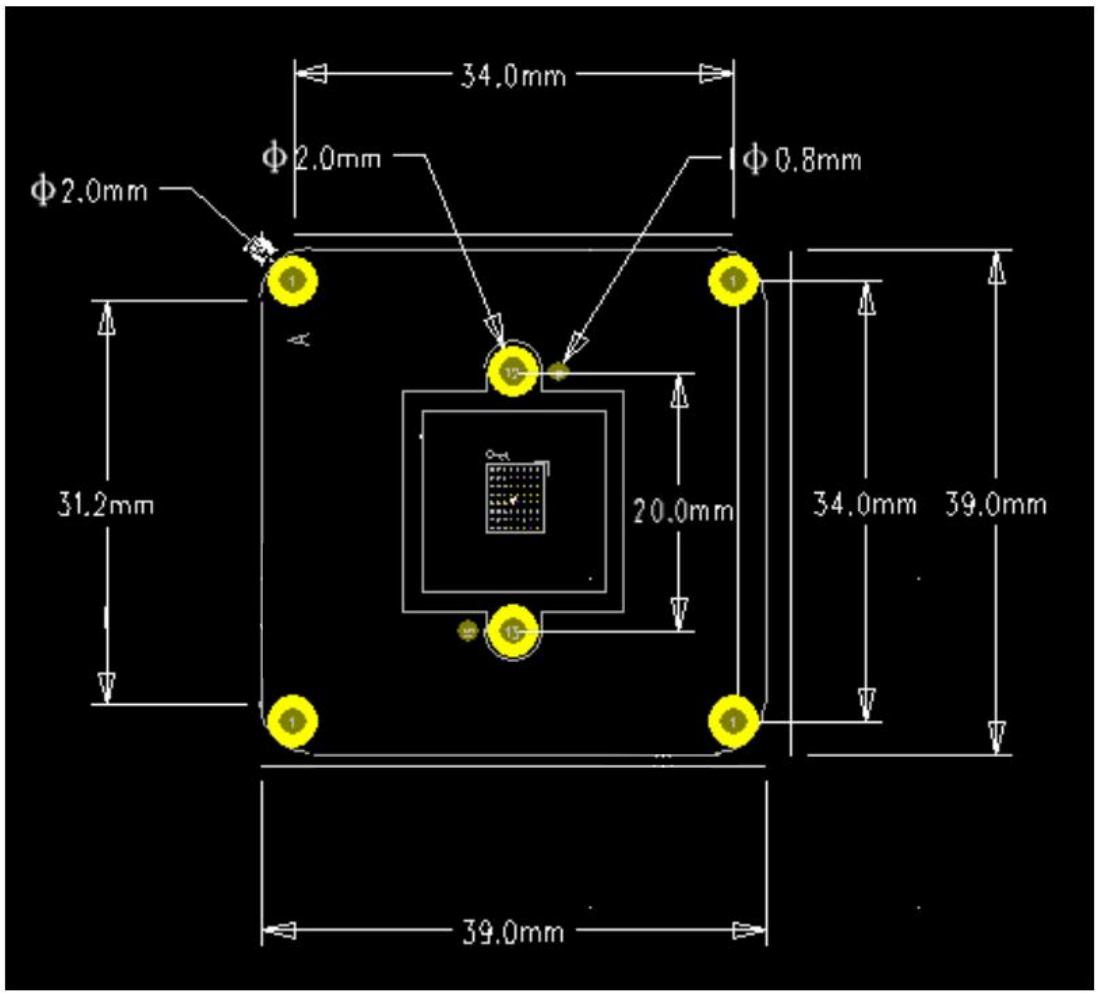
2.1 Overview

IMX290LLR-C/IMX462LQR-C /IMX327LQR-C Sensor		
Optical size	Type 1/2.8" , Diagonal 6.46 mm	
Effective pixels	2.13 M pixels	
Number of recommended recording pixels	2.07M pixels	
Readout rate	Maximum frame rate in Full HD 1080p mode: 120 frame / s	
Sensor Resolution	1920 (H) × 1080 (V)	
Sensor size		
Pixel size /Unit cell size	2.9 µm (H) × 2.9 µm (V)	
Wide dynamic range	IMX290LLR IMX327LQR	Multiple exposure WDR Digital overlap WDR
	IMX462LQR	Multiple exposure HDR Digital overlap HDR
CDS / PGA function	IMX290LLR	0 dB to 30 dB: Analog Gain 30 dB (step pitch 0.3 dB) 30.3 dB to 72 dB: Analog Gain 30 dB + Digital Gain 0.3 to 42 dB (step pitch 0.3 dB)
	IMX462LQR	0 dB to 29.4 dB: Analog Gain 29.4 dB (step pitch 0.3 dB) 29.7 dB to 71.4 dB: Analog Gain 29.4 dB + Digital Gain 0.3 to 42 dB (step pitch 0.3 dB)
	IMX327LQR	0 dB to 27 dB: Analog Gain 27 dB (step pitch 0.3 dB) 27.3 dB to 69 dB: Analog Gain 27 dB + Digital Gain 0.3 to 42 dB (step pitch 0.3 dB)
Readout mode	All-pixel scan mode 720p-HD readout mode Window cropping mode Vertical / Horizontal direction-normal / inverted readout mode	
Output formats	RAW12/RAW10	

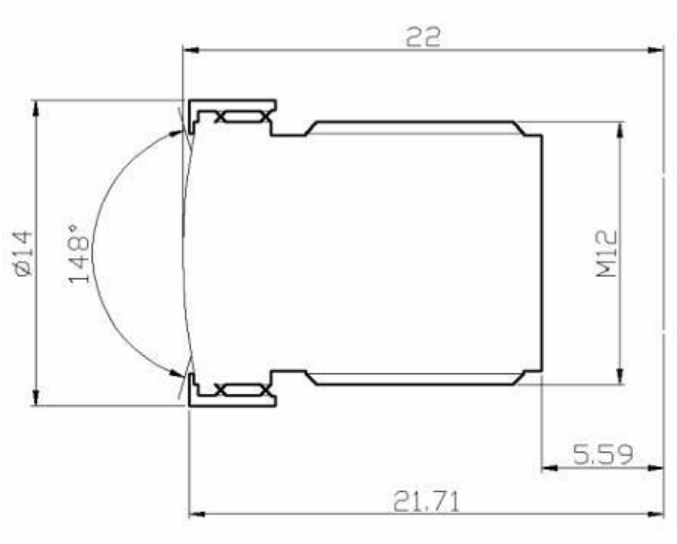
Optical black	Horizontal (H) direction: Front 0 pixels, rear 0 pixels Vertical (V) direction: Front 10 pixels, rear 0 pixels
Dummy	Horizontal (H) direction: Front 0 pixels, rear 3 pixels Vertical (V) direction: Front 0 pixels, rear 0 pixels
Night vision	STARVIS
PCBA	
Size	39mm x 39mm
Weight	4g
Mounting Hole	Φ2mm x 4
Lens	
Field of view	Fov(D) = 148 degrees , Fov(H) = 118 degrees
Focal Length	2.8 mm
TV DISTORTION	<-17%
F(N) /Aperture	2.2
Focal Distance	Adjustable
Software	
Linux integration	V4L2 Libcamera RpiCam

2.2 Size

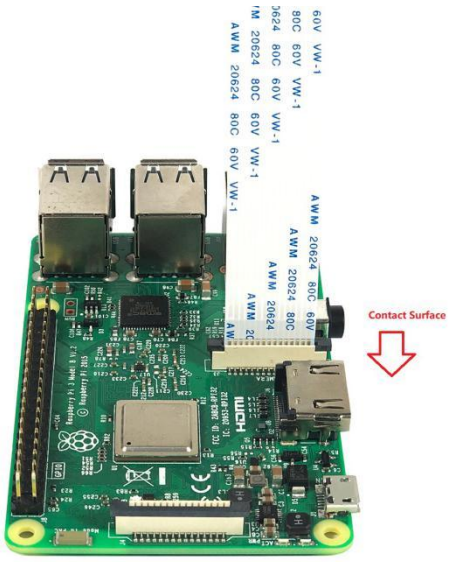
2.2.1 PCB Size

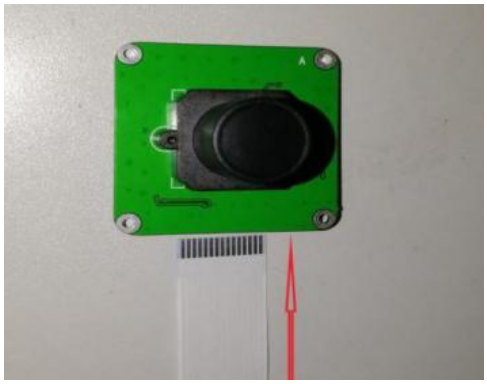


2.2.2 Len Size



2.3 Connection Of The Hardware

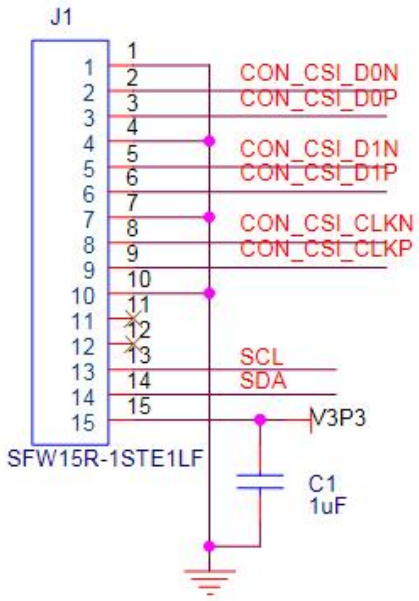




2.4 Pin-Out

3.4.1 Signal/Power Connector J1

The J1 pin map is same Raspberry Pi camera.



PIN	Symbol	Description
1	GND	Ground Pin
2	CON_CSI_D0N	Pixel Data Lane0 Negative
3	CON_CSI_D0P	Pixel Data Lane0 Positive
4	GND	Ground Pin
5	CON_CSI_D1N	Pixel Data Lane1 Negative
6	CON_CSI_D1P	Pixel Data Lane1Positive
7	GND	Ground Pin
8	CON_CSI_CLKN	Pixel Clock Output Form Sensor Negative
9	CON_CSI_CLKP	Pixel Clock Output Form Sensor Positive
10	GND	Ground Pin
11	None	None
12	None	None
13	SCL	CLK input, SIO_C of SCCB
14	SDA	DATA input,SIO_D of SCCB
15	3.3V Power	Power Supply

3. Using Raspbian Build-In Driver

3.1 Load Raspberry Pi image

Prepare a capacity of more than 8GB TF card(16Gb Class10 is better) and a card reader. Load the image file on to the SD card, using the instructions provided on the Raspberry Pi website for Linux, Mac or PC:
https://www.raspberrypi.org/documentation/installation/installing-images/README.md

Raspbian Image download:
https://www.raspberrypi.org/downloads/

3.2 Driver Sources Codes

The existing IMX290 driver and overlay also work fine with IMX327 and IMX426.

The open source driver on Raspbian:
https://github.com/raspberrypi/linux/blob/rpi-5.10.y/drivers/media/i2c/imx290.c

Reference codes：
https://github.com/torvalds/linux/blob/master/drivers/media/i2c/imx290.c

3.3 Dtoverlay on Raspberry Pi board

(1) Open the config.txt on Raspbian:

```
sudo nano /boot/firmware/config.txt
```

(2) Add the following text below the [all] line in the config.txt file.,The default interface being used is cam1.

```
dtoverlay=imx290,clock-frequency=74250000
```

```
# Don't have the firmware create an initial video= setting in cmdline.txt.
# Use the kernel's default instead.
disable_fw_kms_setup=1

# Run in 64-bit mode
arm_64bit=1

# Disable compensation for displays with overscan
disable_overscan=1

# Run as fast as firmware / board allows
arm_boost=1

[cm4]
# Enable host mode on the 2711 built-in XHCI USB controller.
# This line should be removed if the legacy DWC2 controller is required
# (e.g. for USB device mode) or if USB support is not required.
otg_mode=1

[cm5]
dtoverlay=dwc2,dr_mode=host

[all]
dtoverlay=imx290,clock-frequency=74250000
```

If you want to use cam0 interface

```
dtoverlay=imx290,clock-frequency=74250000,cam0
```

(3) And then press ctrl+ x to exit nad press ‘y’ to save.

(4) Rebooted your Pi

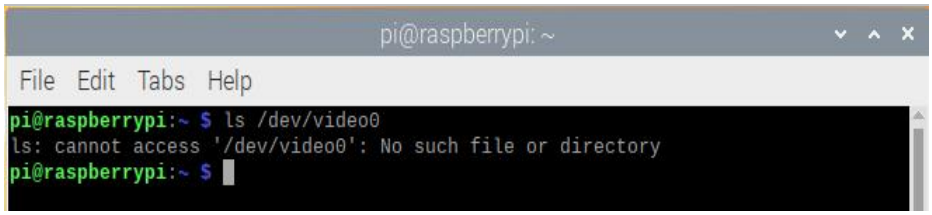
```
sudo reboot
```

(5) Use below command to check the camera is ready.

```
ls /dev/video0
```

Successful:

Unsuccessful:



(6) Download tuning file and point to use this tuning file

git clone https://github.com/INNO-MAKER/CAM-MIPI327RAW-and-CAM-MIPI462RAW.git

Or download from below link :

https://github.com/INNO-MAKER/CAM-MIPI327RAW-and-CAM-MIPI462RAW/blob/main/innomakerpi5_imx290.json

(7) Use the following command to perform a simple test

libcamera-still -t 0 --tuning-file /home/pi/CAM-MIPI327RAW-and-CAM-MIPI462RAW/innomakerpi5_imx290.json

4.4 Dtoverlay on CM4

(1) Open the config.txt on Raspbian:

sudo nano /boot/firmware/config.txt

(2) Add the dtoverlay into the config.txt file, CAM1 is the default camera same as Raspberry Pi.

dtoverlay=imx290,clock-frequency=74250000

dtoverlay=imx290,clock-frequency=74250000,cam0

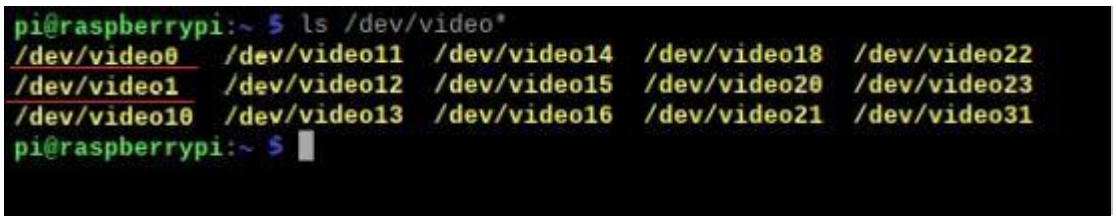
(8) And then press ctrl+ x to exit nad press ‘y’ to save.

(9) Rebooted your Pi

```
sudo reboot
```

(10) Use below command to check the camera video0 and video1 are available.

```
ls /dev/video *
```



4. Rpicam-apps/Libcamera

Raspberry Pi supplies a small set of example rpicam-apps. These CLI applications, built on top of libcamera, capture images and video from a camera.

https://www.raspberrypi.com/documentation/computers/camera_software.html#info-text

libcamera is an open source Linux community project. More information is available at the libcamera website:
https://libcamera.org/

The libcamera source code can be found and checked out from the official libcamera repository.
https://git.linuxtv.org/libcamera.git/

5. User Manual Version Descriptions

Version	Description	Date	E-mail
V1.0		2021.11.25	support@inno-maker.com sales@inno-maker.com
V1.1	Add camera runing on the CM4 Add Rpican	2024.08.09	support@inno-maker.com sales@inno-maker.com

If you have any suggestions, ideas, codes and tools please feel free to email to me. I will update the user manual and record your name and E-mail in list. Look forward to your letter and kindly share.