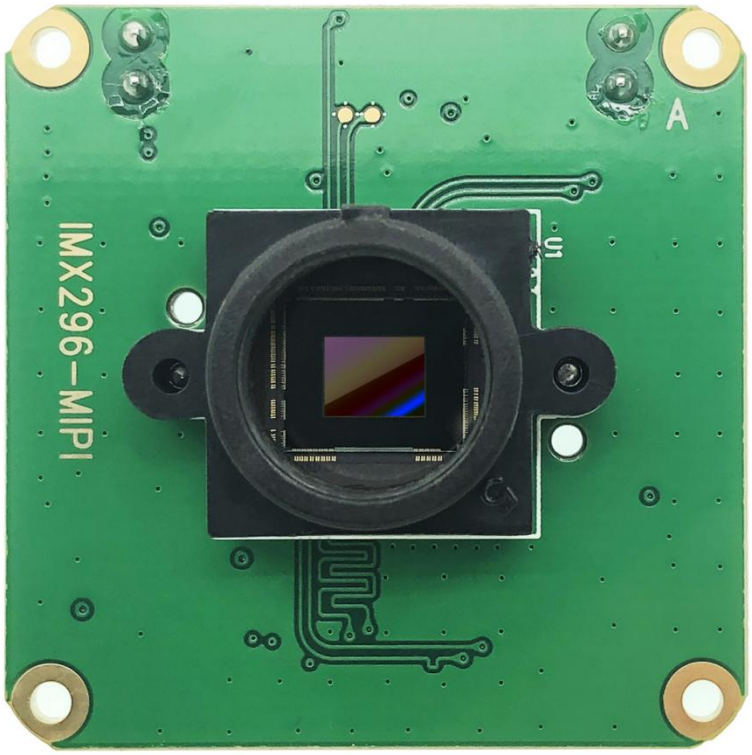
CAM-MIPI296RAW HW User Manual



SONY IMX296LLR-C

Global Shutter CMOS Sensor

1456*1088 / 60fps

Normally We will update our development Mannual here

https://github.com/INNO-MAKER/cam-imx296raw-trigger

https://www.inno-maker.com/product/cam-mipi296raw-trigger/

Date	Revision	Change Details
2023/04/04	V1.0	First Released
2023/05/30	V1.1	Chapter 4.2.1,Preview command change
2023/6/9	V1.2	Chapter3.3,3.4,3.5,3.6 Add python code

2023/06/13	V1.3	Delete 3.6 innocam description
2023/01/15	V1.4	Chapter 2.4，2.5 Update Trigger/Strobe
2024/3/18	V1.5	
2024/12/27	V1.6	Add Chapter 3.3,3.4
2025/8/7	V1.7	Update Chapter2.1 Size

Chapter 1 Description

CAM-MIPI296RAW is a Global Shutter Camera with IMX296LLR-C CMOS Sensor Module support up to 60fps at 1456×1088 Pixels operate with shorter exposure times down to 30μs, given enough light than a rolling shutter camera, which makes it useful for high-speed photography.

- *Support Raspberry Pi OS Build In Drivers totally compatible raspberry pi official gs camera module with libcamera tools for all pi boards*
- *Support Innomaker driver with isolated hardware External Trigger And isolated Strobe function, control by v4l2-ctl -l tools.(InnoMaker Driver did not support libcamera and only support specify system version)*

Module Features:

- Support up to 60fps at 1456×1088 Pixels,Compatible with rasberry pi GS camera;
- Comes with 1x M12 Len-seat and 1xCS Len-Seat, 1x M12 wide angle Len;
- Support Pi 4B/Pi 3B+/Pi 3B/Pi 3A+/CM4/CM3+/CM3 Directly with libcamera tools;
- Output format Y10 with Resolution 1456*1088 up to 60fps (InnoMaker Driver);
- Output format YUV with Resolution 1456*1088 up to 60fps;(Raspberry PI OS Driver);

Sensor Features:

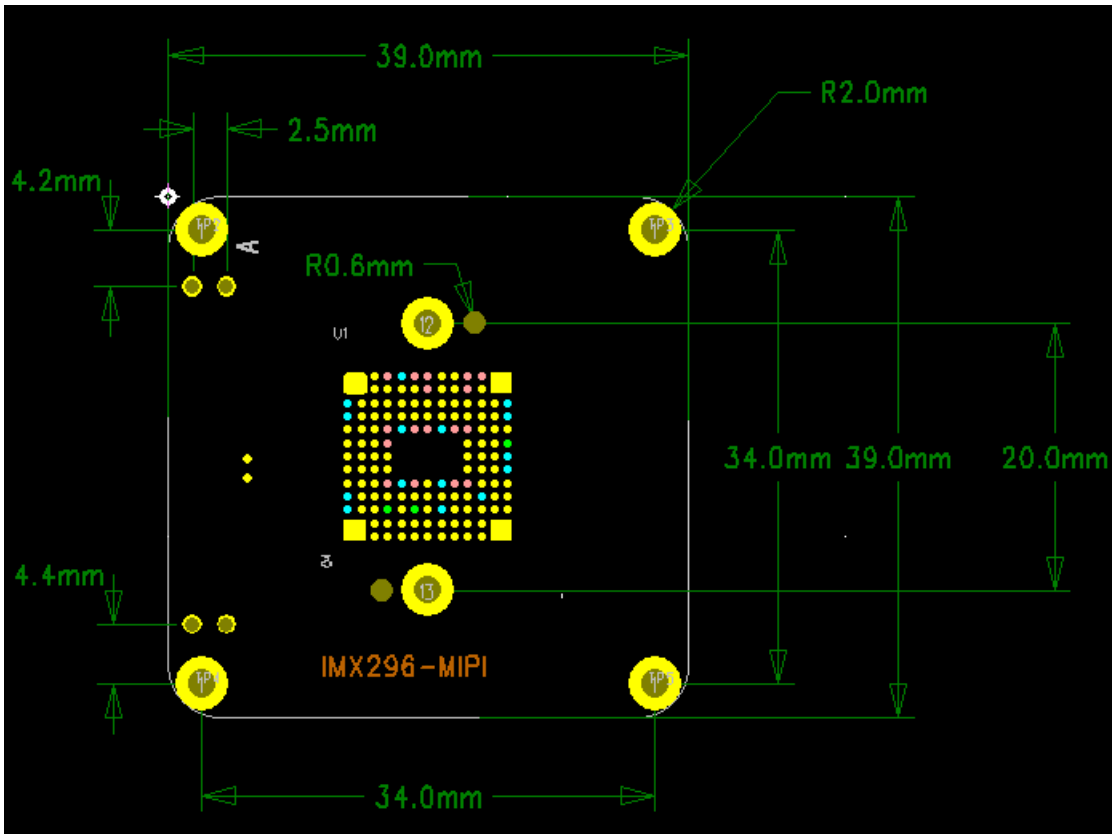
This chip operates with analog 3.3V, digital 1.2V, and interface 1.8V triple power supply :

- **low power consumption.**
- **High sensitivity, low dark current and low PLS characteristics are achieved. (Applications: Sensing)**

Sony IMX296LLR Sensor	
FPS (Sensors):	60.3 fps
Pixel Size (Sensors):	3.4μm x 3.4μm
Resolution (Sensors):	1.58M
Scan/Series:	Pregius
Shutter (Sensors):	Global
Signal (Sensors):	Monochrome
Sensor Size	1 / 2.9

Chapter 2 Hardware

2.1 Module Size

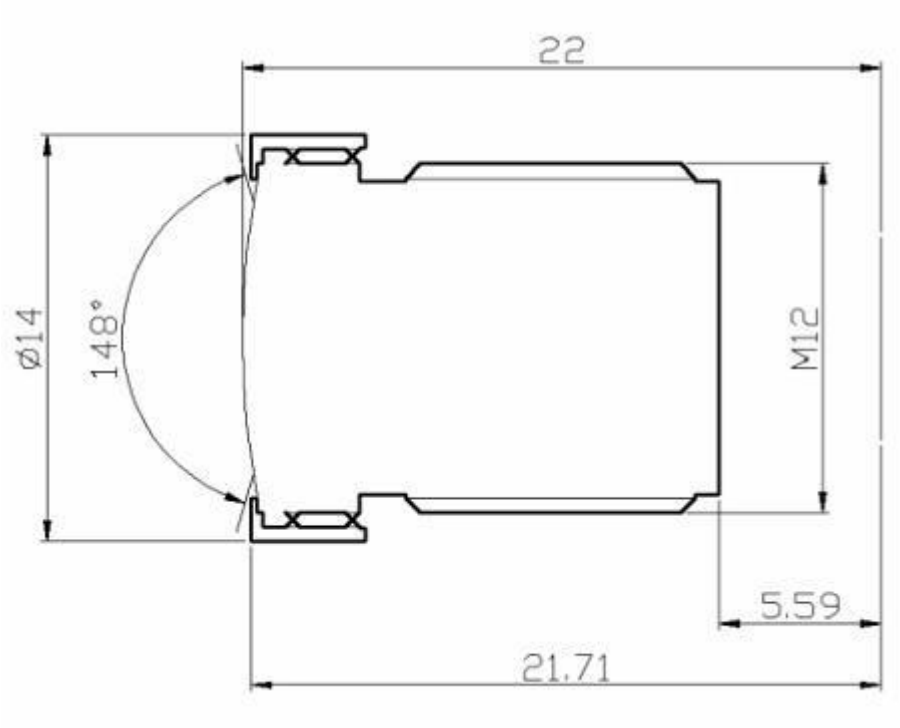


2.2 LEN Seat And LEN

M12 LEN Seat

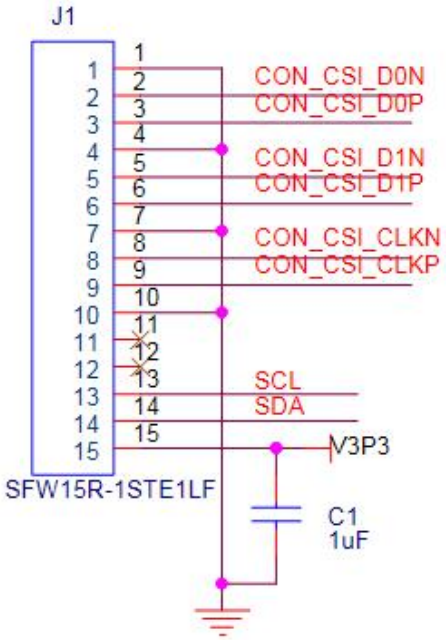
M12-CS Len Seat

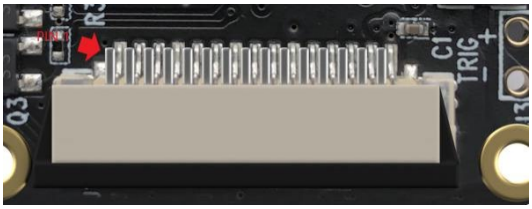
M12 LEN



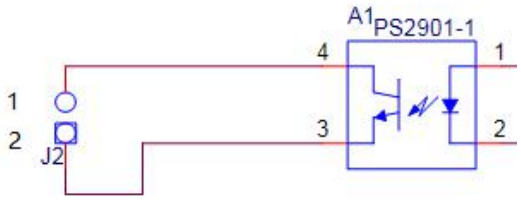
- Interface: M12
- Field of view Fov(D) = wide angle
- Focal Length 2.8 mm
- Focal Distance Adjustable
- TV DISTORTION <-17%
- F(N) /Aperture 2.2

2.3 J1 CSI PIN Out

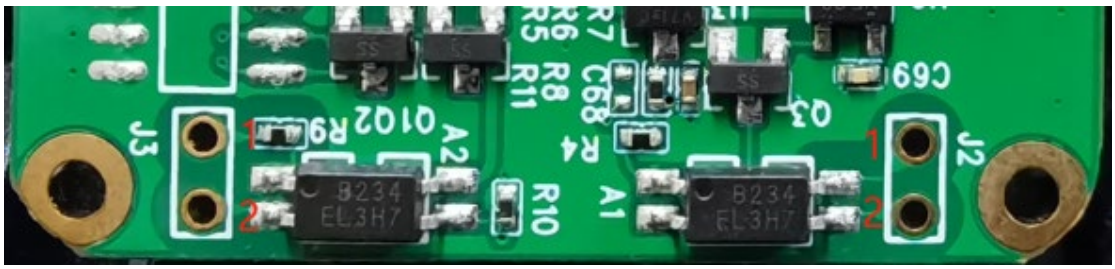




2.4 J2 STROB PINOUT

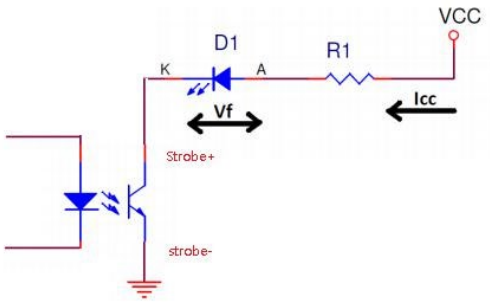


ISO FLASH



J2 PIN	Symbol
1	STROB+
2	STROB-

2.4.1 Reference Circuit



On-board TLP281 optocoupler isolation, Notice the max collector current is 50mA.

Output Specifications

S. No	Parameter	Test Condition	Value			Unit
			Min	Typ	Max	
1	Driver Voltage (VCC)			12	24	V
2	Drive current (Icc)			10	50	mA
3	Collector Emitter Breakdown Voltage				80	V
4	Collector Emitter Saturation Voltage	Icc = 1 mA		0.1	0.2	V
5	Power Dissipation				150	mW

Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_F = 10mA, I_C = 1mA		0.1	0.2	V

So If the current required to drive the Flash LED is no more than 50mA

The value of series resistor: R1 = (VCC- Vf - VCE) / If

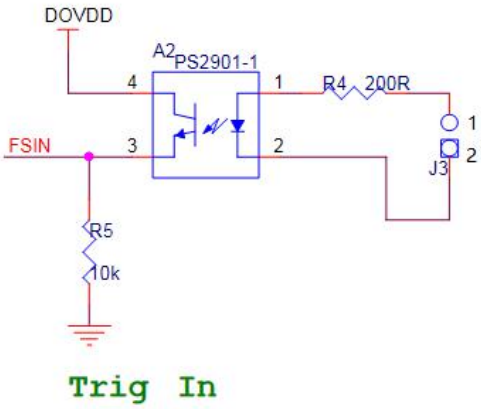
VCC: system Voltage

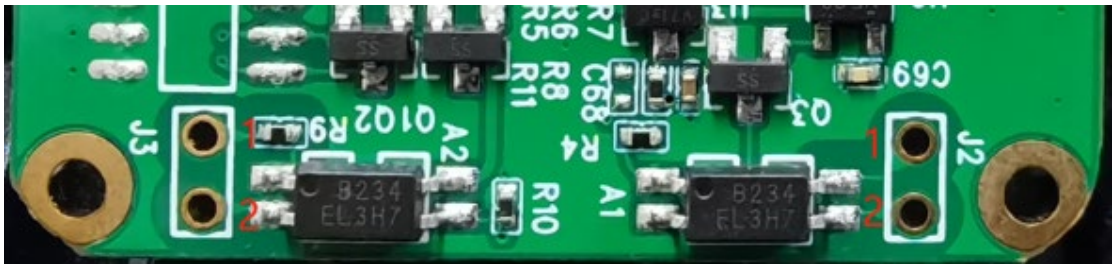
Vf: Forward voltage of Flash LED for current Icc

VCE: Collection Emitter voltage, typical:0.1V

If the current required to drive the flash exceeds 50mA, then it is required to drive it with the help of LED driver circuit, and LED driver circuit can be controlled by using the strobe output pin.

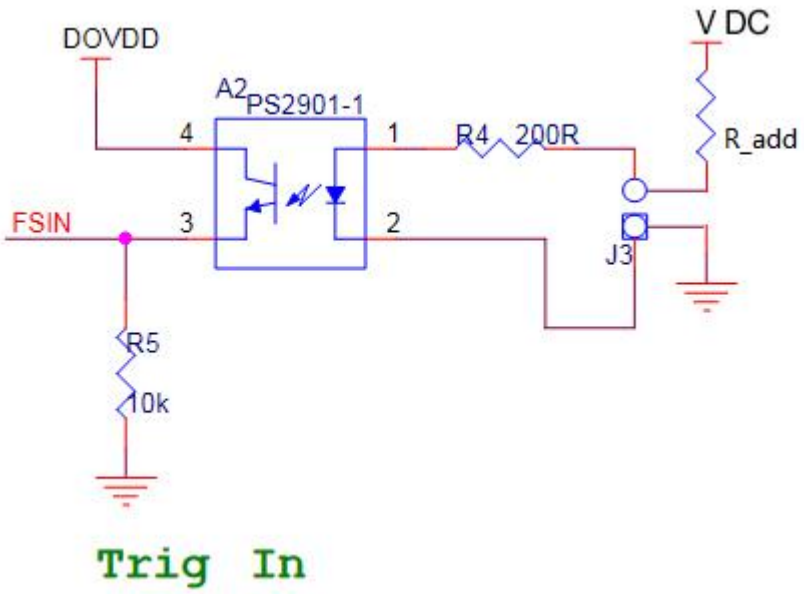
2.5 J3 External TRIG PINOUT





J3 PIN	Symbol	Description
1	TRIG+	3.3V-5.0V External Trigger Input
2	TRIG-	External GND

2.5.1 Reference Circuit



For example, VCC = 12V, Vf = 1.25V

The calculations done here are based on 12VDC. Please do follow these calculations for other voltages like 24VDC.

Let's take the current through IR LED I_f = 20mA.
Voltage drop across the IR LED = 1.25V
The value of Resistor $R_1 = (V_{cc}-V_f)/I_f = (12 – 1.25)/0.02 = 537.5\ \Omega$
Wattage of resistor $R_1 > I_f^2 * R_1 = 0.02^2*537.5 = 0.215W$
Wattage of the resistor R_1 selected should be greater than 0.215W.

And there is a resistor on board(R4 = 200Ω), So the R_add = R1 - R4 = 537.5 - 200 = 337.5Ω

Chapter 3 PI OS Driver Usage

Only Need below setting to enable Raspberry Pi Os BuildIn Driver,
No need to follow Chapter 3

3.1 Simple Setup of config.txt

Update system to latest version

```
$sudo apt-get update
```

```
$sudo apt-get dist-upgrade
```

Edit /boot/config.txt

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

Add below content to the last line and reboot

```
dtoverlay=imx296
```

edit /boot/cmdline.txt

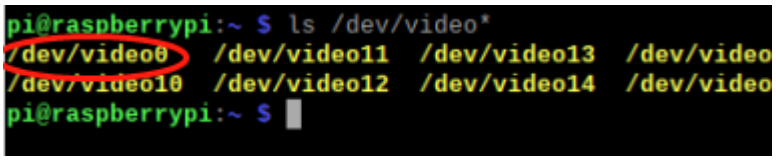
```
cma=128M
```

Reboot

```
$sudo reboot
```

Check camera module status after reboot

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



3.2 Libcamera

3.2.1Preview

```
$libcamera-vid --width 1456 --height 1088 -t 0
```

More about libcamera and libcamera-apps Please Refer:

https://www.raspberrypi.com/documentation/computers/camera_software.html#libcamera-and-libcamera-apps

3.3 Enable Trigger

```
$sudo su
$echo 1 > /sys/module/imx296/parameters/trigger_mode
```

3.4 Enable Strobe

IMX296 official driver provide by RPI default kernel not enable strobe by default.

Imx296 can output strobe while work in normal or fast trigger mode.We can enable strobe by i2c tools.

Imx296 i2c address: 0x1a
Pi5 CSI1 i2c bus address: i2c-4

Note: strobe setting must be done while camera stream is off.

Regs and setting values:
- 0x3026: 0x0F
- 0X3029:0x21
- 0x306D: 0X02(trigger mode strobe enable) /0x01(normal mode strobe enable)
- Strobe start point 3byte:
- 0x3070 :0x00
- 0x3071 :0x00
- 0x3072 :0x00
- Strobe end point 3byte:
- 0x3074 :0x2c
- 0x3075 :0x01
- 0x3076 :0x00

- 0x3079: 0X0A(trigger mode strobe enable) /0x09(normal mode strobe enable)
- Strobe start point 3byte:
- 0x307c :0x00
- 0x307d :0x00
- 0x307e :0x00
- Strobe end point 3byte:
- 0x3080 :0x2c

- 0x3081 :0x01
- 0x3082 :0x00

I2c tools write register:

./i2c_write 4 0x1a <reg addr> <reg val>

I2c tools read register:

./i2c_read 4 0x1a <reg addr> <num of regs regs to read>