

# MLX90640-D55 Thermal Camera

From Waveshare Wiki

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## Overview

### Introduction

This is a  $32 \times 24$  pixel,  $55^\circ$  field of view, IR array thermal imaging camera, communicating via the I<sup>2</sup>C interface. It is compatible with 3.3V/5V operating voltage and supports host platforms such as Raspberry Pi/Arduino(ESP32)/STM32, etc. With MLX90640 far-infrared thermal sensor array, it can accurately detect target objects in specific regions and temperature ranges, and a small size for easy integration into miscellaneous industrial or intelligent control applications.

**MLX90640-D55 Thermal Camera**



(<https://www.waveshare.com/mlx90640-d55-thermal-camera.htm>)

MLX90640 IR Array Thermal Imaging Camera,  
 $32 \times 24$  Pixels,  $55^\circ$  Field of View, I<sup>2</sup>C Interface

## Features

- Adopts MLX90640 far-infrared thermal sensor array,  $32 \times 24$  pixels.
- Communicating via I<sup>2</sup>C interface, configurable to fast mode (up to 1MHz data rate).
- Noise Equivalent Temperature Difference (NETD) 0.1K RMS @1Hz refresh rate.
- Onboard voltage translator, compatible with 3.3V/5V operating voltage.
- Comes with online development resources and manual (examples for Raspberry Pi/Arduino(ESP32)/STM32).

## Specification

- Operating voltage: 3.3V/5V
- Operating current: < 23mA
- Communication interface: I<sup>2</sup>C (address 0x33)
- Field of view (Horizontal × Vertical):
  - MLX90640-D55 Thermal Camera (<https://www.waveshare.com/mlx90640-d55-therma-l-camera.htm>):  $55^\circ \times 35^\circ$  (narrow angle FOV, for long-range measuring)
  - MLX90640-D110 Thermal Camera (<https://www.waveshare.com/MLX90640-D110-The-rmal-Camera.htm>):  $110^\circ \times 75^\circ$  (wide angle FOV, for short-range measuring)

- Operating temperature: -40°C ~ 85°C
- Target temperature: -40°C ~ 300°C
- Resolution:  $\pm 1^\circ\text{C}$
- Refresh rate: 0.5Hz~64Hz (programmable)
- Dimensions: 28mm × 16 mm
- Mounting hole size: 2.0mm

## Hardware Description



(/wiki/File:MLX90640\_05.jpg)

## Hardware Connection

The MLX9064x-Dxx Thermal Camera has 4 pins that need to be connected to the controller and currently supports the Raspberry Pi series, STM32F405R and ESP32 series. For details, please refer to the instruction section.

## Interface

In the figure above, the MLX9064x-Dxx Thermal Camera has an onboard level shifter circuit.

- VCC, GND pin for the power supply, VCC connected to the control 3.3V or 5V power supply, GND corresponds to the connection of the GND.

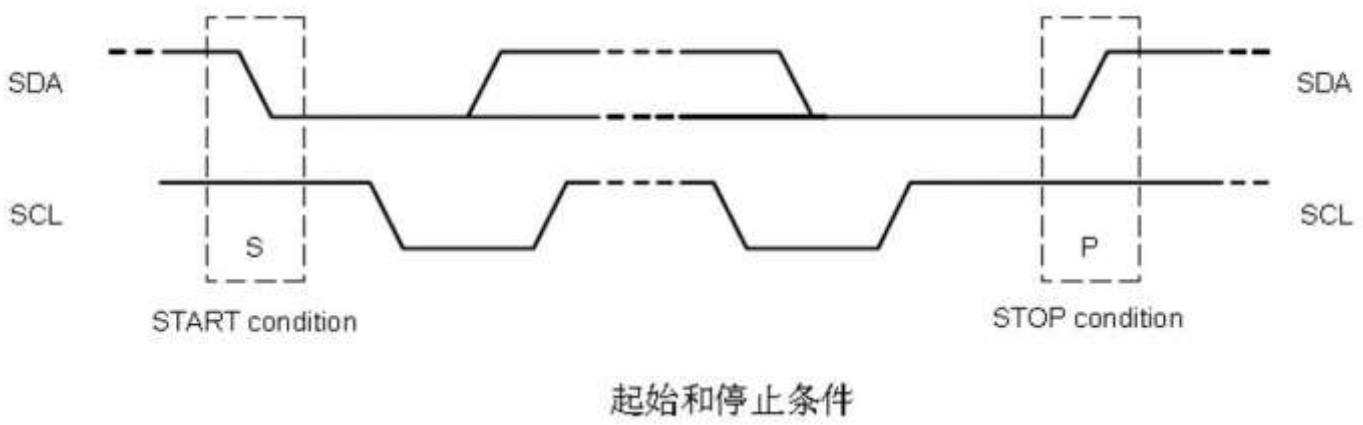
- SDA is the data pin of I2C, connected to the GPIO of the controller, without an external pull-up resistor.
- SCL is the clock pin of I2C, connected to the GPIO of the controller, without an external pull-up resistor.

## Application

- High-precision non-contact object temperature detection.
- Infrared thermal imager, infrared thermometer.
- Smart Home, Smart Building, Smart Lighting.
- Industrial temperature control, security, intrusion/motion detection.

## Communication Protocol

The communication protocol of MLX90640-D55 Thermal Camera is I2C, which supports I2C high-speed mode (up to 1MHz), and can only be used as a slave device on the I2C bus. The SDA and SCL ports can withstand 5V voltage and can be directly connected to the 5V I2C bus, the device address of the module can be programmed, there can be up to 127 addresses, and the factory default value is 0x33. Like the general I2C bus, there are three types of signals in the process of data transmission: start signal, end signal and response signal.



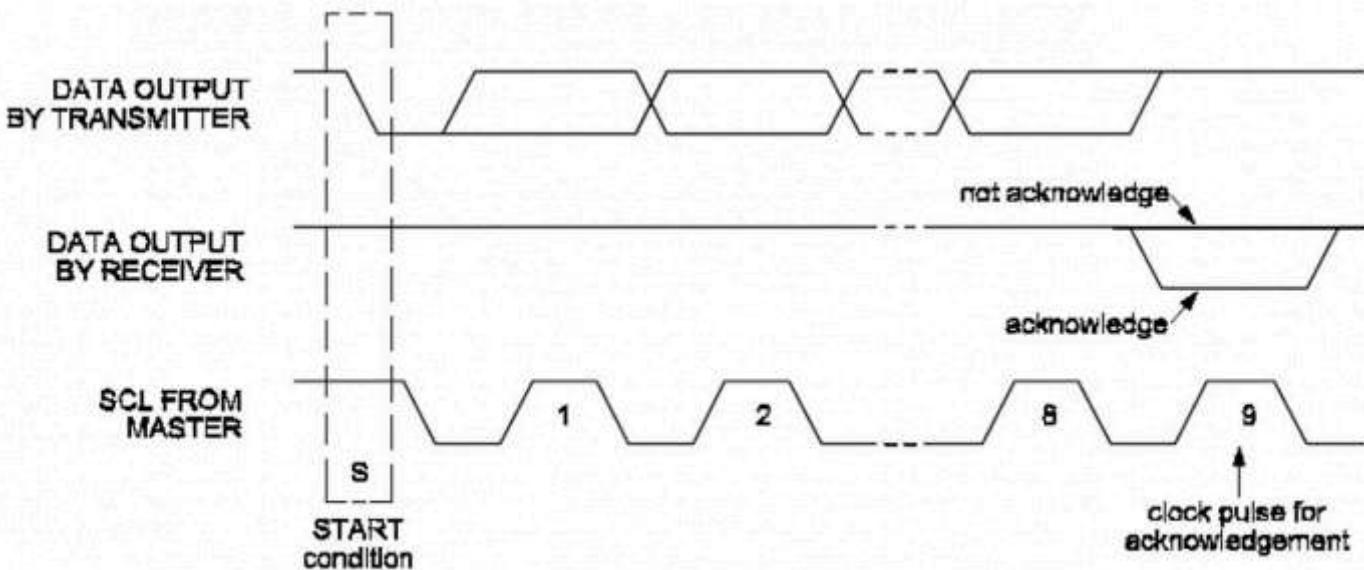
起始和停止条件

(/wiki/File:MLX90640-D55\_Thermal\_Camera\_020.jpg)

Start signal: SCL is high level, SDA is converted from high level to low level.

End signal: SCL is high level, SDA is converted from low level to high level.

It can be seen that the start signal and the end signal are completed when the SCL bus is high.



## I<sup>2</sup>C 总线的响应

(/wiki/File:MLX90640-D55\_Thermal\_Camera\_021.jpg)

Response signal: During the 9th clock period after each byte transmission, the sending data end device releases the SDA bus, and the receiving data end device pulls down the SDA bus to indicate that bytes are received (ACK), or the SDA bus is high level with no acknowledgment (NoACK).

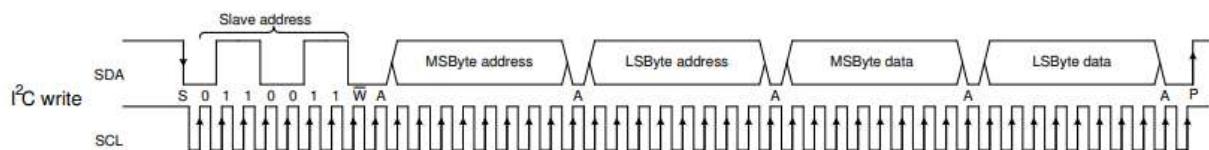


Figure 4 I<sup>2</sup>C write command format (default SA=0x33 is used)

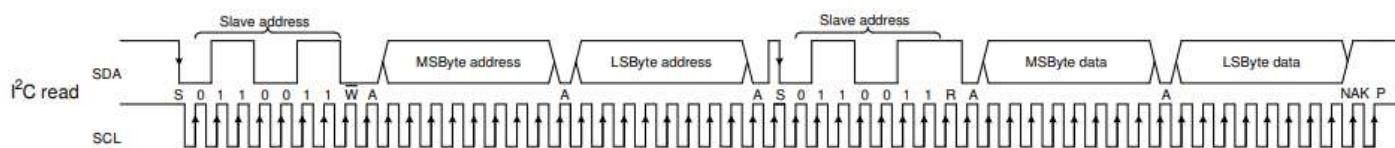
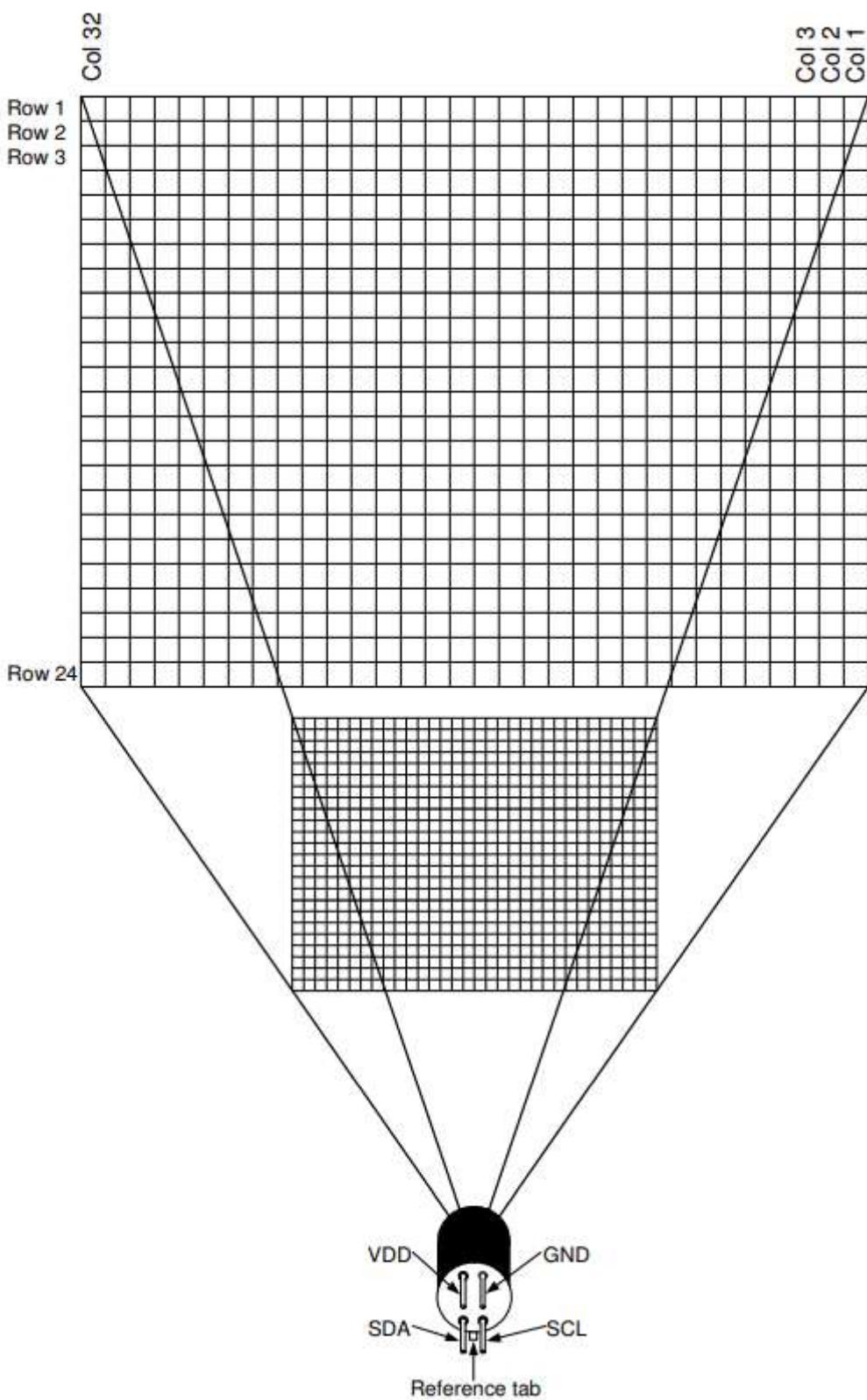


Figure 5 I<sup>2</sup>C read command format (default SA=0x33 is used)

(/wiki/File:MLX90640\_Thermal\_Camera\_manual-1.png)

Device Address: The master addresses the slave by sending a 7-bit slave address after a START condition. The first seven bits are dedicated to this address, and the 8th is the read/write (R/W) bit. This bit indicates the transfer direction, The high level means that the master will read data from the slave, and the low level means that the master will send data to the slave.



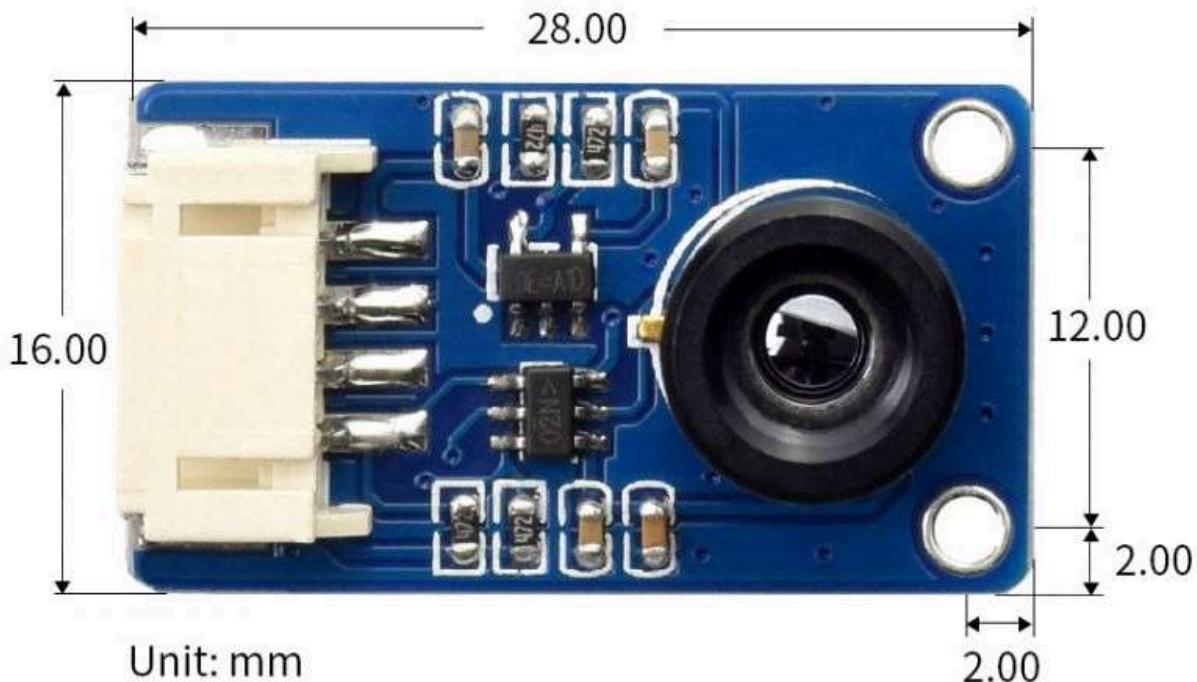
(/wiki/File:MLX90640\_Thermal\_Camera\_manual-2.png)

The MLX90640-D55 Thermal Camera consists of a total of 768 IR sensors (also called pixels). The row and column positions of each pixel are identified as  $\text{Pixel}(i, j)$ , where  $i$  is its row number (from 1 to 24), and  $j$  is its column number (from 1 to 32), the pixel specific to a certain plane can refer to the above figure.

- It should be noted that the original sensor is allowed to have less than 4 dead points when the sensor leaves the factory, and each dead point is marked in the EEPROM table, so the module may have a certain probability of dead points, that is to say, this cannot be used

as a basis for return or exchange. The original recommendation for this is to use the average value of adjacent pixels instead.

## Dimensions



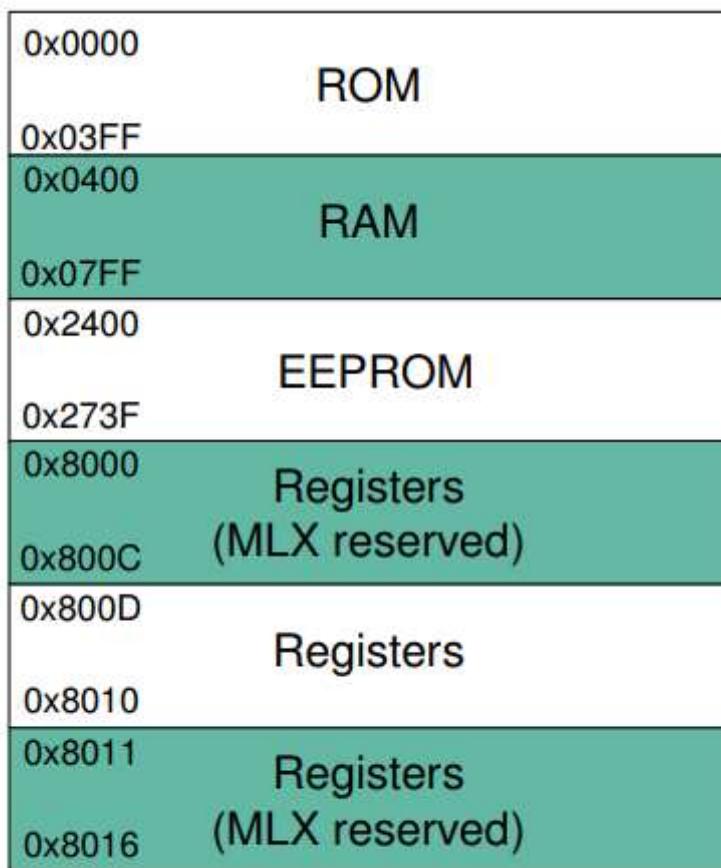
(/wiki/File:MLX90640\_Dimension.jpg)

## Other Description

- The MLX9064x-Dxx Thermal Camera utilizes thermopile technology, consisting of a total of 768 IR sensors. Each IR sensor is treated as a pixel. The row and column positions of each pixel in the field of view of the MLX9064x-Dxx Thermal Camera are identified as Pixel(i, j), where i represents its row number (ranging from 1 to 24), and j represents its column number (ranging from 1 to 32).
- The sensor manufacturer allows for up to 4 defective pixels at the time of sensor production. Each defective pixel is identified in the EEPROM table. As a result, there is a possibility that the module may have some defective pixels. This means that the presence of defective pixels cannot be used as a basis for returning or exchanging the product. The

manufacturer's recommendation for addressing this issue is to use the average value of adjacent pixels as a replacement.

## Memory and registers



*Figure 10 MLX90640 memory map*

(/wiki/File:MLX90640\_Thermal\_Camera\_manual-3.png)

The above picture shows the distribution of RAM area and control registers of MLX90640, in which there are two data modes in RAM area, and EEPROM is used to store calibration constants and device configuration parameters, as shown in the following figure:

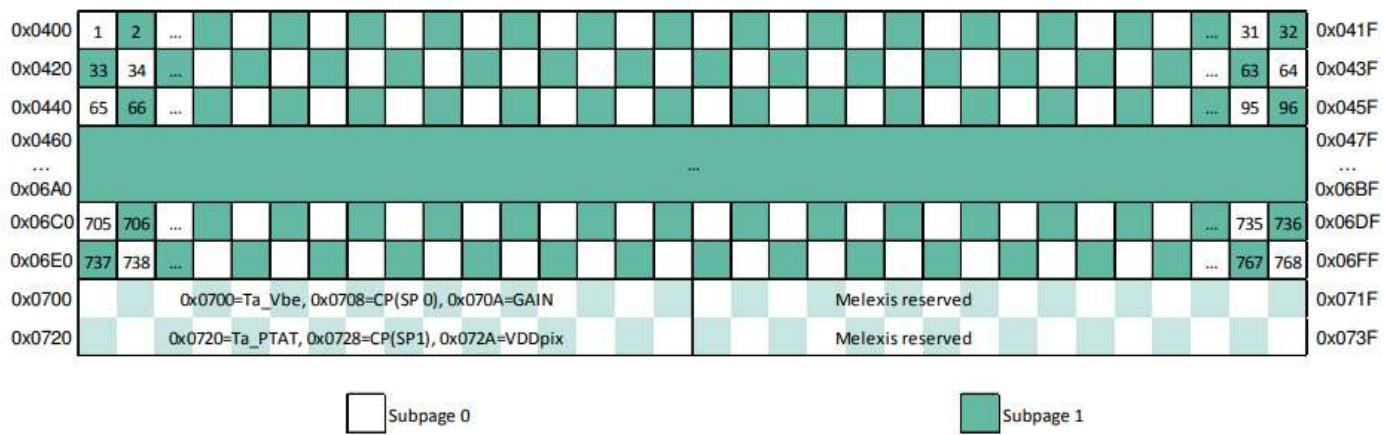


Figure 14 RAM memory map (Chess pattern mode) – factory default mode

0x0400	Pixels 1...32 (subpage 0)	0x041F
0x0420	Pixels 33...64 (subpage 1)	0x043F
0x0440	Pixels 65...96 (subpage 0)	0x045F
0x0460	...	0x047F
...		...
0x06A0		0x06BF
0x06C0	Pixels 705...736 (subpage 0)	0x06DF
0x06E0	Pixels 737...768 (subpage 1)	0x06FF
0x0700	0x0700=Ta_Vbe, 0x0708=CP(SP 0), 0x070A=GAIN	Melexis reserved
0x0720	0x0720=Ta_PTAT, 0x0728=CP(SP1), 0x072A=VDDpix	Melexis reserved

Figure 15 RAM memory map (Interleaved mode)

(/wiki/File:MLX90640\_Thermal\_Camera\_manual-4.png)

## Refresh rate

This module supports 8 kinds of refresh rates, up to 64Hz. The refresh rate is controlled by the control register 1 (0x800D), as shown below:

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0					
Melexis reserved		Reading pattern		Resolution control		Refresh rate control			Select subpage		Enable subpages repeat		Enable data hold		Melexis reserved					
																Control register 1 - 0x800D				
																0 No subpages, only one page will be measured 1 Subpage mode is activated (default)				
																0 Keep this bit = "0" (default) 1 Transfer the data into storage RAM at each measured frame (default) 0 Transfer the data into storage RAM only if en_overwrite = 1 (check 0x8000)				
																0 Toggles between subpage "0" and subpage "1" if Enable subpages mode = "1" (default) 1 Select subpage determines which subpage to be measured if Enable subpages mode = "1"				
												0 0 0 Subpage 0 is selected (default) 0 0 1 Subpage 1 is selected 0 1 0 Not Applicable 0 1 1 Not Applicable 1 0 0 Not Applicable 1 0 1 Not Applicable 1 1 0 Not Applicable 1 1 1 Not Applicable								
												0 0 0 IR refresh rate = 0.5Hz 0 0 1 IR refresh rate = 1Hz 0 1 0 IR refresh rate = 2Hz (default) 0 1 1 IR refresh rate = 4Hz 1 0 0 IR refresh rate = 8Hz 1 0 1 IR refresh rate = 16Hz 1 1 0 IR refresh rate = 32Hz 1 1 1 IR refresh rate = 64Hz								
												0 0 ADC set to 16 bit resolution 0 1 ADC set to 17 bit resolution 1 0 ADC set to 18 bit resolution (default) 1 1 ADC set to 19 bit resolution								
												0 Interleaved (TV) mode 1 Chess pattern (default)								
Melexis reserved																				

(/wiki/File:MLX90640\_Thermal\_Camera\_manual-6.png)

The settings of the 8 refresh rates are determined by bit 7, bit 8 and bit 9 of the control register 1 (0x800D), among which there are Chess mode (factory default setting) and TV interleave mode, as shown below:

Subpage 0 --> 0x8000 = 0xFFFF8

Subpage 1 --> 0x8000 = 0xFFFF9

Subpage 0 --> 0x8000 = 0xFFFF8

Subpage 1 --> 0x8000 = 0xFFFF9

0x0400	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
0x0401	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
0x0402	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
0x0403	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
0x0404	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224
0x0405	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288
0x0406	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352
0x0407	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416
0x0408	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500
0x0409	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544
0x040A	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608
0x040B	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672
0x040C	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736
0x040D	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820

0x0420	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
0x0460	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
0x04A0	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192
0x04E0	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256
0x0520	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
0x0560	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384
0x05A0	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448
0x05E0	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512
0x0620	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576
0x0660	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640
0x06A0	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704
0x06E0	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768

Figure 8 TV mode reading pattern (only highlighted cells are updated)

(/wiki/File:MLX90640\_Thermal\_Camera\_manual-7.png)

0x0400	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31
0x0420	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64
0x0440	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95
0x0460	96	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128
0x0480	129	131	133	135	137	139	141	143	145	147	149	151	153	155	157	159
0x04A0	162	164	166	168	170	172	174	176	178	180	182	184	186	188	190	192
0x04C0	193	195	197	199	201	203	205	207	209	211	213	215	217	219	221	223
0x04E0	226	228	230	232	234	236	238	240	242	244	246	248	250	252	254	256
0x0500	257	259	261	263	265	267	269	271	273	275	277	279	281	283	285	287
0x0520	290	292	294	296	298	300	302	304	306	308	310	312	314	316	318	320
0x0540	321	323	325	327	329	331	333	335	337	339	341	343	345	347	349	351
0x0560	354	356	358	360	362	364	366	368	370	372	374	376	378	380	382	384
0x0580	385	387	389	391	393	395	397	399	401	403	405	407	409	411	413	415
0x05A0	418	420	422	424	426	428	430	432	434	436	438	440	442	444	446	448
0x05C0	449	451	453	455	457	459	461	463	465	467	469	471	473	475	477	479
0x05E0	482	484	486	488	490	492	494	496	498	500	502	504	506	508	510	512
0x0600	513	515	517	519	521	523	525	527	529	531	533	535	537	539	541	543
0x0620	546	548	550	552	554	556	558	560	562	564	566	568	570	572	574	576
0x0640	577	579	581	583	585	587	589	591	593	595	597	599	601	603	605	607
0x0660	610	613	614	616	618	620	622	624	626	628	630	632	634	636	638	640
0x0680	641	643	645	647	649	651	653	655	657	659	661	663	665	667	669	671
0x06A0	674	676	678	680	682	684	686	688	690	692	694	696	698	700	702	704
0x06C0	705	707	709	711	713	715	717	719	721	723	725	727	729	731	733	735
0x06E0	738	740	742	744	746	748	750	752	754	756	758	760	762	764	766	768

Figure 9 Chess reading pattern (only highlighted cells are updated)

(/wiki/File:MLX90640\_Thermal\_Camera\_manual-8.png)

The two modes differ in the way subpages are updated. As a standard the MLX90640 is calibrated in Chess pattern mode, this results in better fixed pattern noise behavior of the sensor when in Chess pattern mode. For best results, we advise to use Chess pattern mode. The setting of both modes depends on bit 12 in “Control register 1” (0x800D).

## Temperature measurement principle and measurement distance

### Temperature measurement principle

What is infrared temperature measurement?(quoted from OPTRIS (<https://www.optris.com/infrared-basics>)).

Next to time, temperature is the most frequently measured physical property. Infrared temperature measurement devices define the temperature according to the radiation law of Planck and Boltzmann through infrared radiation released by the measured object. But how does non-contact temperature measurement work?

Each body, with a temperature above the absolute zero (0 K or -273.15°C) emits an electromagnetic radiation from its surface, which is proportional to its intrinsic temperature. A part of this radiation is infrared radiation which is used to measure temperature. The radiation of the body penetrates the atmosphere and can be focused on a detector element with the help of a lens. The detector element generates an electrical

signal proportional to the radiation. This signal is amplified and, using successive digital signal processing, is transformed into an output signal proportional to the object temperature. The measuring value can be shown on a display or released as a signal.

The emissivity  $\epsilon$  (Epsilon) has a central importance, if the temperature is measured through radiation. The emissivity defines the relation of the radiation value in real and of the black body. This is maximal 1 for a black body. But only few bodies meet the ideal of the black body. For the calibration of sensors, the contact faces of radiators are generally used, which consists of the favoured wave length of 0.99.

Many bodies have a constant emissivity regarding the wave length, but do emit far less radiation than black bodies. They are called grey bodies. Bodies whose emissivity depends on the temperature and the wave length, such as metals, are called selective radiator. The missing radiation part is compensated in both cases through the definition of emissivity. When using a selective radiator, one needs to bear in mind the measured wave length (short-wave for metal).

The infrared sensor receives the emitted radiation from the object surface, but also reflected radiation from the surroundings and perhaps penetrated infrared radiation from the measuring object.

## Measurement distance

The FOV of this module is determined by 50% radiation signal which is received by the thermopile, it is also influenced by the main axis of the sensor. The temperature measured is the weighted average of the detected object's temperature in FOV. To improve the accuracy, you should make sure that the detected object is in the FOV totally.

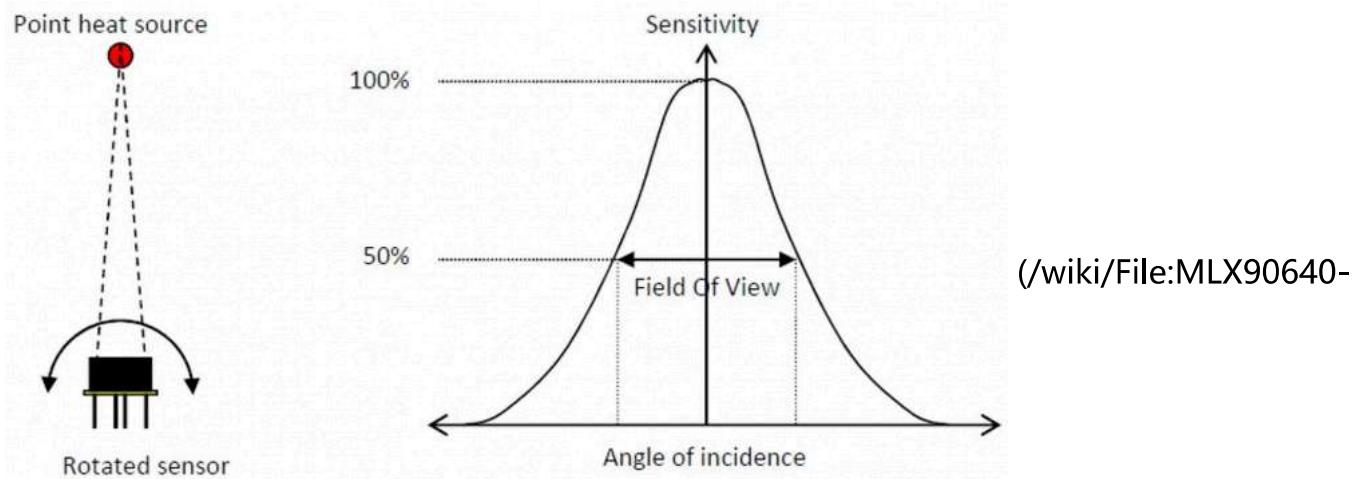
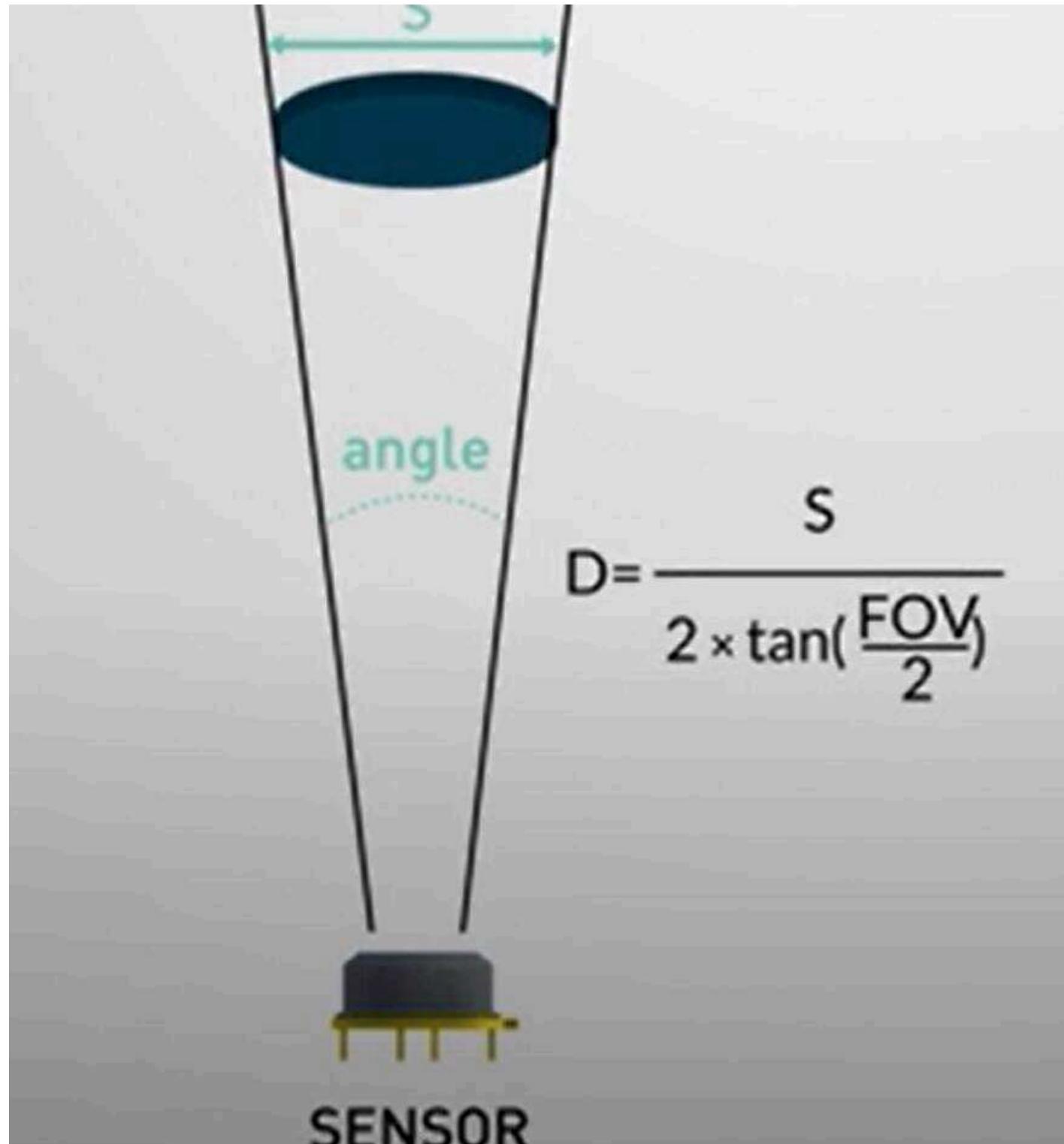


Figure 24: Field Of View measurement

For the relationship between the measurement distance and the field of view, please refer to the calculation formula shown in the following figure mentioned by Melexis (<https://www.melexis.com/en/product/MLX90640/Far-Infrared-Thermal-Sensor-Array>).



(/wiki/File:MLX90640-D55\_Thermal\_Camera\_036.jpg)

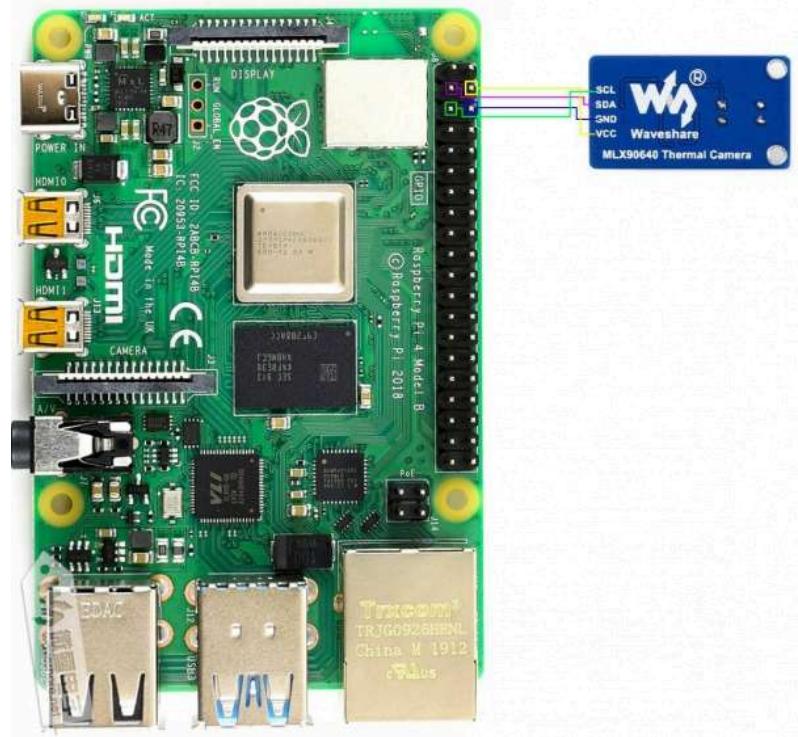
## Examples

### Raspberry Pi 4B

#### Hardware Connection

**1. When using the sensor, please pay attention to avoiding direct contact with the onboard IC devices in your hands. Pay attention to preventing static electricity and checking the power supply to prevent reverse connection before powering on.**

**2. When the sensor is working, please avoid excessive vibration and do not plug or unplug cables. Since MLX90640 has EEPROM, it will easily be damaged by vibration and a hot plug. Do not use too long cables for communication, which may cause EEPROM writing errors and failure.**

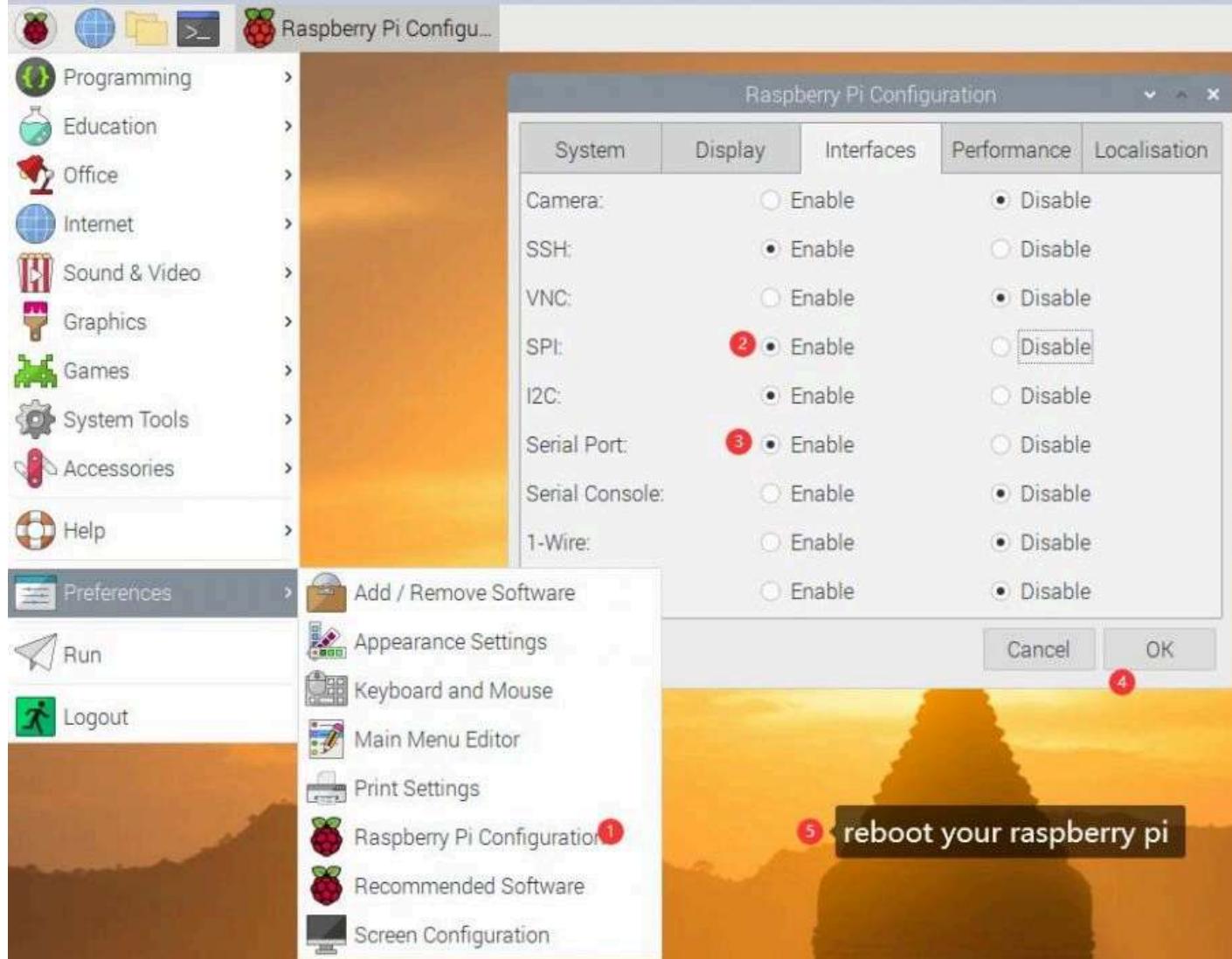


(/wiki/File:MLX90640-D55\_Thermal\_Camera\_031.jpg)

Pi-4B	MLX90640 Thermal Camera
5V	5V
GND	GND
SDA(BCM2)	SDA
SCL(BCM3)	SCL

## Environment Setting

- It is recommended to use an image with the library installed for testing, and the use of mirrors for testing, please ignore the following environment settings and other operations.
- Raspberry Pi Drive-Google Drive ([https://drive.google.com/file/d/1scgWyG6iaKrkB12Huc698ZVpczvIZNzI/view?usp=drive\\_link](https://drive.google.com/file/d/1scgWyG6iaKrkB12Huc698ZVpczvIZNzI/view?usp=drive_link)), the image account and password both are "test".
- Enable the Raspberry Pi I2C bus, and reboot it after setting. It is recommended to reboot after setting the next step.



(/wiki/File:Thermal\_Camera\_HAT\_Use03.jpg)

- Adjust the I2C rate, and add the speed parameter in the /boot/config.txt file. Reboot to take effect after changing. The commands are as shown below:

```
sudo nano /boot/config.txt
dtparam=i2c_arm=on,i2c_arm_baudrate=400000
```

- If you want to install library and download the C/C++ example demo by yourself, you can refer to the following commands:

```
cd ~
wget https://files.waveshare.com/upload/5/57/Mlx90640-thermal_camera.zip
unzip Mlx90640_thermal_camera.zip
cd mlx90640_thermal_camera/RaspberryPi/cpp/
chmod +x install.sh
sudo ./install.sh
```

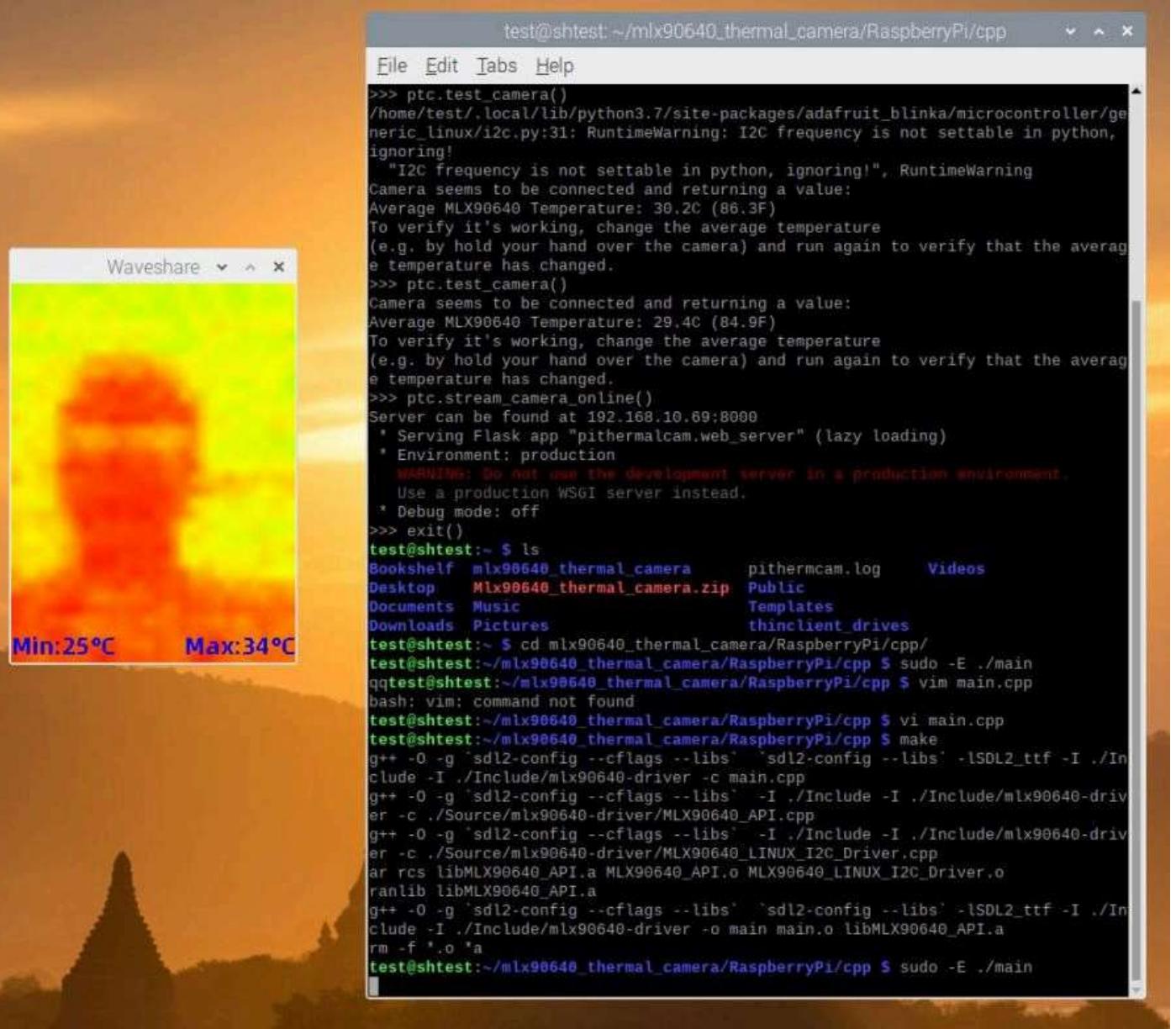
- If you install library and download the Python example demo by yourself, you can refer to the following commands:

```
sudo apt update  
pip3 install opencv-python==4.6.0.66  
pip3 install pithermalcam  
sudo apt-get install libatlas-base-dev
```

## C/C++ Example

- Input the following commands in the Raspberry Pi terminal and execute the example program, the effect is shown below:

```
make  
sudo ./main  
#If you are using Windodws MSTSC to log in remotely, you will need to use the following  
commands:  
sudo -E ./main
```



(/wiki/File:MLX90640\_Thermal\_Camera\_-02.jpg)

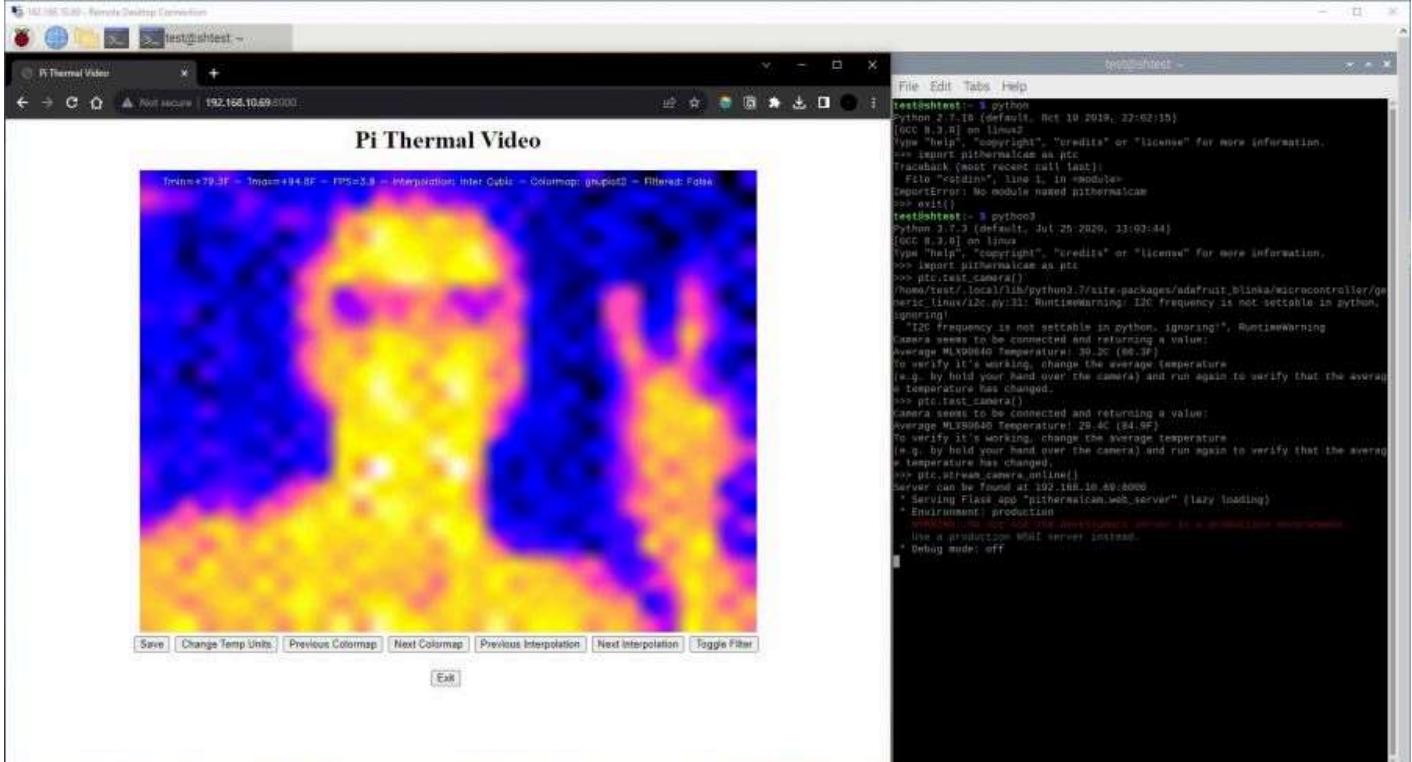
## Python Example

- Thanks to pithermalcam open-source code (<https://github.com/tomshaffner/PiThermalCam>), you can install it referring to this link (<https://tomshaffner.github.io/PiThermalCam/#software-setup>).
- Input the following commands in the Raspberry Pi terminal to execute the sample demo. After the execution of the local network video streaming example, other mobile devices or computers open the browser to enter the Raspberry Pi terminal to print the information, the effect is shown in the following figure:

```

python3
import pithermalcam as ptc
# Example of performing local network video push streaming
ptc.stream_camera_online()
# Example of executing real-time video streaming display, and reference terminal printin
g information operation
ptc.display_camera_live()

```



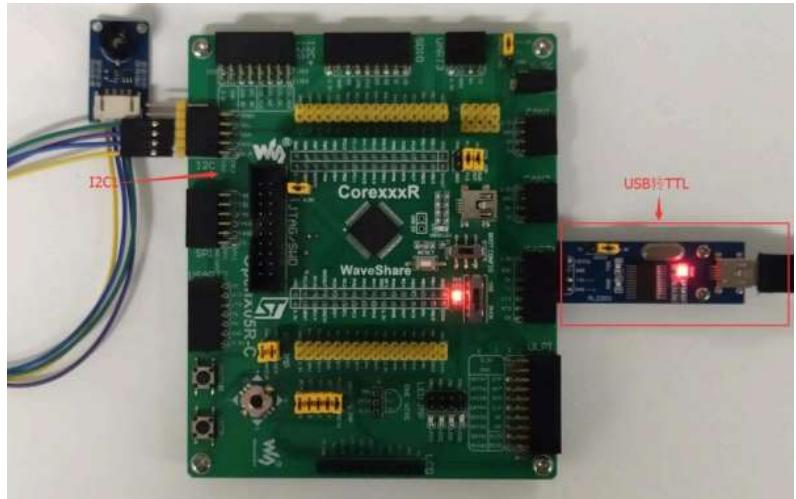
(/wiki/File:MLX90640\_-03.jpg)

## STM32

### Hardware Connection

**1. When using the sensor, please pay attention to avoiding direct contact with the onboard IC devices in your hands. Pay attention to preventing static electricity and checking the power supply to prevent reverse connection before powering on.**

**2. When the sensor is working, please avoid excessive vibration and do not plug or unplug cables. Since the MLX90640 has EEPROM, it will easily damaged by vibration and hot plug. Do not use too long cables for communication, which may cause EEPROM writing errors and failure.**



(/wiki/File:MLX90640-D55\_Thermal\_Camera\_032.jpg)

STM32	MLX90640 Thermal Camera
5V	5V
GND	GND

SDA(PB11)	SDA
SCL(PB10)	SCL

## ESP32

### Hardware Connection

**1. When using the sensor, please pay attention to avoiding direct contact with the onboard IC devices by your hands, Pay attention to preventing static electricity, and checking the power supply to prevent reverse connection before powering on.**

**2. When the sensor is working, please avoid excessive vibration and do not plug or unplug cables. Since the MLX90640 has EEPROM, it will easily be damaged by vibration and hot plug. Do not use too long cables for communication, which may cause EEPROM writing errors and failure.**



(/wiki/File:MLX90640-D55\_Thermal\_Camera\_034.jpg)

ESP32	MLX90640 Thermal Camera
5V	5V
GND	GND
SDA(P21)	SDA
SCL(P22)	SCL

### Software Installation

#Arduino ESP32/8266 Online Installation

### Operating Steps

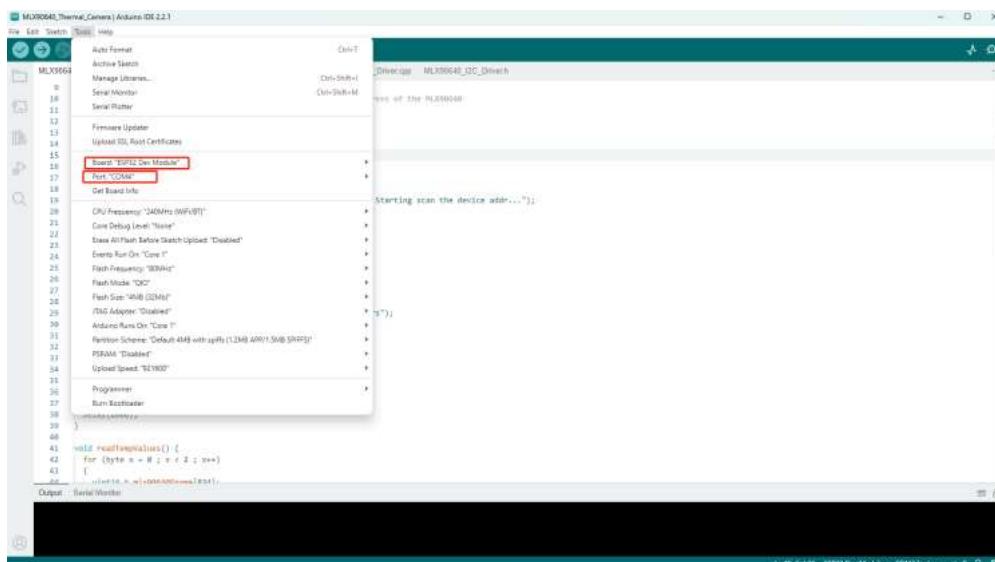
- Download the demo ([https://files.waveshare.com/upload/5/57/MLx90640-thermal\\_camera.zip](https://files.waveshare.com/upload/5/57/MLx90640-thermal_camera.zip)).
- Unzip it, enter the following directory, double-click `MLX90640_Thermal_Camera.ino` file.

	Name	Date modified	Type	Size
*	MLX90640_API.cpp	9/12/2019 11:28 PM	C++ Source	33 KB
*	MLX90640_API.h	9/12/2019 11:28 PM	C/C++ Header	3 KB
*	MLX90640_I2C_Driver.cpp	9/12/2019 11:28 PM	C++ Source	4 KB
*	MLX90640_I2C_Driver.h	9/12/2019 11:28 PM	C/C++ Header	2 KB
MLX90640_THERMAL_Camera.ino	9/25/2019 7:52 PM	INO File	3 KB	

(/wiki/File:MLX90640-

1.png)

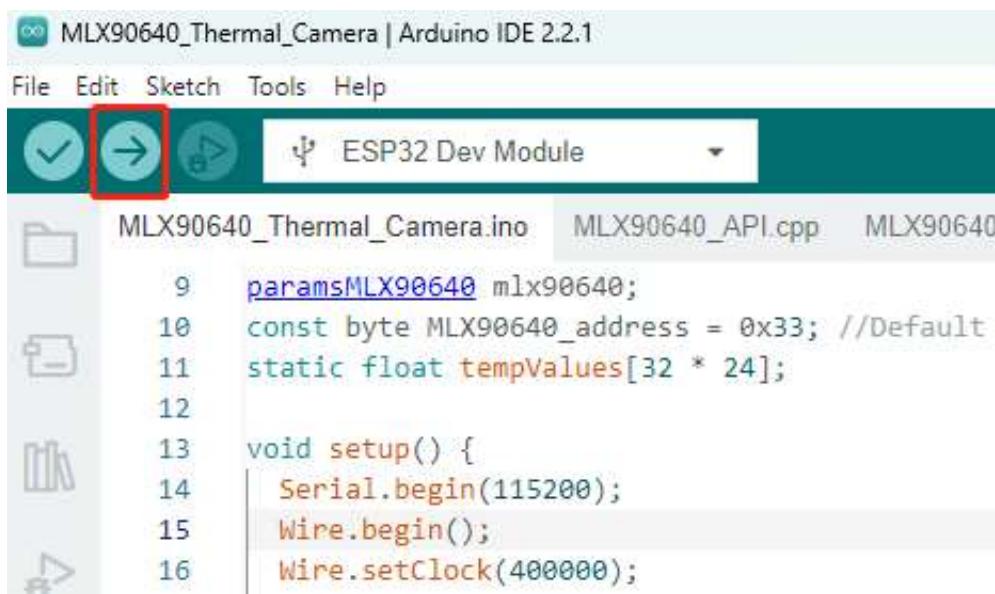
- Click Tools to select the development board and port.



(/wiki/File:MLX90640-

2.png)

- Click the arrow to upload.



(/wiki/File:MLX90640-

3.png)

- After uploading, click Serial Monitor to view the output.

```
#include "Arduino.h"
#include <Wire.h>
#include "MLX90640_API.h"
#include "MLX90640_I2C_Driver.h"

#define EMMISIVITY 0.95
#define TA_SHIFT 8

paramsMLX90640 mlx90640;
const byte MLX90640_address = 0x33; //Default 7-bit unshifted address of the MLX90640
static float tempValues[32 * 24];

void setup() {
  Serial.begin(115200);
  Wire.begin();
  Wire.setClock(400000);
}
```

(/wiki/File:MLX90640-

4.png)

```
15:26:08.519 -> 25 25 25 25 25 25 25 25 25 26 26 26 26 24 25 25 25 26 26 25 25 25 25 25 25 26
15:26:08.519 -> 26 25 25 25 25 26 25 26 25 25 25 26 26 26 25 25 26 26 25 25 26 24 25 25 25 25 25
15:26:08.519 -> 25 25 26 25 26 25 25 25 26 25 26 24 26 26 25 25 25 25 26 25 25 24 25 26 25 25 25 26
15:26:08.519 -> 26 24 25 25 25 25 25 25 26 25 25 26 25 26 25 25 26 25 25 25 26 26 24 25 26 25 26
15:26:08.567 -> 25 26 25 25 25 25 26 25 24 26 25 25 25 25 25 26 26 25 26 26 25 26 25 26 25 26 25 25
15:26:08.567 -> 25 24 24 26 26 25 24 24 25 25 26 26 25 24 25 24 25 25 25 25 25 26 26 27 24 26 25
15:26:08.567 -> 25 26 25 25 25 26 25 26 26 26 26 26 25 26 24 27 25 26 26 25 25 25 26 25 26 26 25
15:26:08.567 -> 26 25 25 25 26 25 26 27 26 25 26 25 25 25 25 26 25 25 27 26 25 25 26 24 25 26 26 24
15:26:08.567 -> 25 26 25 25 26 25 25 27 26 25 26 25 25 26 25 25 24 25 26 26 26 25 26 26 27 27 27
15:26:08.617 -> 25 25 25 25 25 25 25 25 25 26 25 26 25 25 25 25 25 25 25 25 25 26 24 25 26 24 25 24
15:26:08.617 -> 25 25 25 25 25 25 25 27 25 26 26 25 26 25 25 25 25 25 25 25 25 27 25 26 27 27 25
15:26:08.617 -> 25 24 25 27 27 24 25 25 26 26 25 26 25 24 26 25 25 25 26 26 25 26 26 27 25 26 26
15:26:08.617 -> 24 26 26 26 24 25 26 24 25 26 25 25 26 25 24 26 26 25 26 25 25 26 25 26 26 27
15:26:08.617 -> =====WaveShare MLX90640 Thermal Camera=====
```

(/wiki/File:MLX90640-

5.png)

# Resources

## Documents

- Schematic ([https://files.waveshare.com/upload/8/84/MLX90640\\_Thermal\\_Camera\\_SchDoc.pdf](https://files.waveshare.com/upload/8/84/MLX90640_Thermal_Camera_SchDoc.pdf))

## Demo codes

- Demo codes ([https://files.waveshare.com/upload/5/57/MLx90640-thermal\\_camera.zip](https://files.waveshare.com/upload/5/57/MLx90640-thermal_camera.zip))

## Software

- Sscom5.13.1 (<https://files.waveshare.com/upload/b/b3/Sscom5.13.1.zip>)

- CP210x USB TO UART ([https://files.waveshare.com/upload/6/62/CP210x\\_USB\\_TO\\_UART.zip](https://files.waveshare.com/upload/6/62/CP210x_USB_TO_UART.zip))
- Panasonic SDFormatter ([https://files.waveshare.com/upload/d/d7/Panasonic\\_SDFormatter.zip](https://files.waveshare.com/upload/d/d7/Panasonic_SDFormatter.zip))
- Win32DiskImager (<https://files.waveshare.com/upload/7/76/Win32DiskImager.zip>)
- Raspberry Pi Image-Google Drive ([https://drive.google.com/file/d/1scgWyG6iaKrkB12Huc698ZVpczvIZNzI/view?usp=drive\\_link](https://drive.google.com/file/d/1scgWyG6iaKrkB12Huc698ZVpczvIZNzI/view?usp=drive_link))

## Datasheet

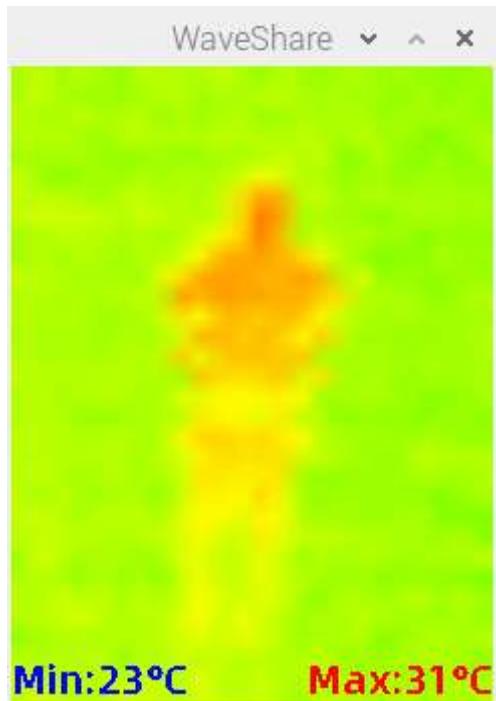
- MLX90640 Datasheet (<https://files.waveshare.com/upload/7/73/MLX90640-EN.pdf>)

## FAQ

**Question:How far is the measurement distance of the MLX90640-D55 Thermal Camera? What is the maximum supported frame rate?**

**Answer:**

The official device manual does not give the measurement distance parameters. The test result of Waveshare Electronics is that when the indoor temperature is 22°C and the light is dim, the tester with a height of 178cm starts to wave at 1 meter away from the MLX90640-D55 Thermal Camera, and steps back to 11 meters, the MLX90640-D55 Thermal Camera captures the focus disappears, and the body contour cannot be recognized after 5 meters (about) away from the lens of MLX90640-D55 Thermal Camera. MLX90640-D55 Thermal Camera supports a maximum frame rate of 32Hz.

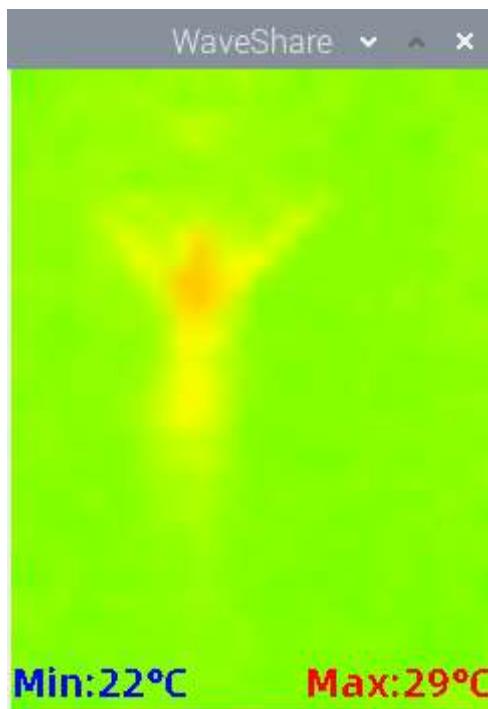


(/wiki/File:MLX90640-D55\_Thermal\_Camera\_001.gif)

## **Question:How far is the measurement distance of the MLX90640-D110 Thermal Camera? What is the maximum supported frame rate?**

### **Answer:**

The official device manual does not give the measurement distance parameters. The test result of Waveshare Electronics is that the indoor temperature is 22°C and the light is dim. The tester with a height of 178cm starts to wave at 1 meter away from the MLX90640-D110 Thermal Camera and back to 9 meters. After the MLX90640 -D110 Thermal Camera captures the focus disappears, and when the lens is 2 meters away from the MLX90640-D110 Thermal Camera (about 2 meters), the silhouette of the human body cannot be recognized. The MLX90640-D110 Thermal Camera supports a maximum frame rate of 32Hz.



(/wiki/File:Thermal\_camera.gif)

## **Question:I was wondering what range of IR wavelengths?**

### **Answer:**

The wavelength is 5.5 to 14um.

## **Question:I am working on a project that involves detecting moving people from a range of 40m. What is the range of this thermal camera and would it be a viable option for this type of project?**

## **Answer:**

This module can not be used in short distances from 1m to 9m.

# **Support**

## **Technical Support**

If you need technical support or have any feedback/review, please click the **Submit Now** button to submit a ticket. Our support team will check and reply to you within 1 to 2 working days. Please be patient as we make every effort to help you to resolve the issue.

Working Time: 9 AM - 6 PM GMT+8  
(Monday to Friday)

**Submit Now (<https://service.waveshare.com/>)**

*Retrieved from "[https://www.waveshare.com/w/index.php?title=MLX90640-D55\\_Thermal\\_Camera&oldid=89963](https://www.waveshare.com/w/index.php?title=MLX90640-D55_Thermal_Camera&oldid=89963)"  
[https://www.waveshare.com/w/index.php?title=MLX90640-D55\\_Thermal\\_Camera&oldid=89963](https://www.waveshare.com/w/index.php?title=MLX90640-D55_Thermal_Camera&oldid=89963)"*