

# **TC2-C 256**

## **Uncooled Infrared Thermal Module**

### **Product Manual**



Document Version: V2.0 (August 8, 2024)

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## Change History

Changes between document issues are cumulative. The latest document issue contains all the changes in previous issues.

Version	Release Date	Revision Content
V1.0	October 12, 2023	Create
V1.1	December 14, 2023	Updated product drawings, image output, and room temperature power consumption.
V1.2	March 13, 2024	<ol style="list-style-type: none"><li>1. Unified document style and format.</li><li>2. Added warranty instructions.</li><li>3. Updated temperature measurement accuracy;</li><li>4. Updated structural drawings.</li></ol>
V1.3	May 16, 2024	Updated the document style.
V1.4	May 22, 2024	Updated the document style.
V1.5	June 14, 2024	<ol style="list-style-type: none"><li>1. Updated the dimensional parameters of the module.</li><li>2. Updated structural drawings.</li></ol>
V2.0	August 08, 2024	<ol style="list-style-type: none"><li>1. Updated power consumption value.</li><li>2. Updated the document style.</li></ol>

## 1. Product Introduction

### 1.1. Product Description

TC2-C is a long-wave infrared (8~14 $\mu$ m, LWIR) infrared thermal imaging module, which can convert the thermal radiation of the object itself into images and temperature data. With small size, excellent performance and low power consumption, this product is suitable for mobile phones, consumer electronics, temperature measuring devices, monitoring, and IOT.

### 1.2. Product Features

- Focus on consumer thermal imaging market.
- 256× 192@12 $\mu$ m WLP high performance vanadium oxide uncooled infrared detector.
- 25Hz high frame rate.
- Excellent lens optical design with high-resolution detector, adjustable focus position.
- Built-in shutter, compact size 13mm x 13mm x 8.75mm (as per drawing), easy for integration.
- Support comprehensive array temperature data output.
- The imaging module supports Shuttless to improve image smoothness.
- Independently researched and developed a new generation of infrared ASIC-ISP chip, which has low power consumption, good performance and low development difficulty for users.

### 1.3. Application Scenarios

- Smart life: smart home appliances, smart sensors.
- Handheld terminal: built-in or external plug-in for mobile phone, temperature measuring tool, night vision equipment.
- Security inspection: industrial monitoring, perimeter scanning, inspection robot, photoelectric pod.
- Fire safety: fire warning, fire helmet.
- Medical health: medical heat map, cell temperature measurement.

## 2. Product Selection

### 2.1. Model Introduction

Table 2-1 TC2-C Product Model Number Explanation

TC2-C	256	02011X	SIM	XX
Model	Resolution	Lens Focal Length	Version	Reserved
TC2-C	256: 256×192	02011X: 2.0mm F1.1 03211X: 3.2mm F1.1 04312X: 4.3mm F1.2 07010X: 7.0mm F1.0	HIM: Imaging version SWR: Temperature measurement version	XX: Standard version

### 2.2. Available Models

Table 2-2 List of Recommended Models for TC2-C

No.	Model	Features
1	TC2-C 256 03211X HIM XX	Standard Model

NOTE 1. If necessary, you can contact our company to customize the selection combination that is not recommended in the list.

### 2.3. Lens Selection Reference

Table 2-3 TC2-C Lens Parameters

Lens Code	Lens Parameters				Focus	Detection Distance	Recognition Distance	Identification Distance
	Focal Length	F-number	FOV	IFOV				
02011X	2.0 mm	1.1	90°×65°	6mrad	0.1 m~∞	200 m	50 m	25 m
03211X	3.2 mm	1.1	56°×42°	3.75mrad	0.25 m~∞	320 m	80 m	40 m
04312X	4.3 mm	1.2	40°×30°	2.79mrad	0.40 m~∞	430 m	108 m	54 m

Lens Code	Lens Parameters				Focus	Detection Distance	Recognition Distance	Identification Distance
	Focal Length	F-number	FOV	IFOV				
<b>07010X</b>	7.0 mm	1.0	25°×19°	1.71mrad	1 m~∞	700 m	175 m	87 m

NOTE 1. The above detection distance, recognition distance and identification distance are estimated according to Johnson's Criteria, taking pedestrians (1.8×0.5×0.3 m) as the target. The temperature measuring distance is estimated by a non-point source blackbody with a diameter of 0.15 m.

### 3. Specifications

Table 3-1 TC2-C Module System Specifications\*1\*2\*3

Technical Parameters	TC2-C
	<b>Overview</b>
Detector Type	Vanadium Oxide Uncooled Infrared Focal Plane Detector
IR Wavelength	8~14μm
Resolution	256×192
Pixel Pitch	12μm
Noise Equivalent Temperature Difference (NETD)	<50mK @25°C, F#1.0, 25Hz
Thermal Time Constant	<10ms
Detector Framerate	≤25Hz
Non-uniformity Correction	Automatic with shutter correction/shutterless
Image Output Formats	YUV422 (image data)/Y16 (temperature data)
Focusing Mode	Fixed focus, athermalized
	<b>Temperature Measurement</b>
Measurement Range	-20°C~150°C (high quality) 50°C~550°C (wide range)
Measurement Accuracy	±2°C or ±2% (typical value)
	<b>Electricity</b>
Input Supply Voltage	5V (analog), 3.3V, 1.8V
Video Output Format	DVP/VOSPI/MIPI/USB
Command and Control Interface	I2C/USB/UART
Typical Power Consumption @25°C	Normal operation: 280mW (typical value) Shutter pressed: 750mW (typical value)
	<b>Physical Characteristics of Module (with lens and flange)</b>
Package Dimension (W×L×H)	13.2mm×13.2mm×8.75mm (as per drawing)
	<b>Environment</b>
Operating Temperature	Imaging: -40°C~80°C Temperature measurement: -10°C~70°C

Storage Temperature	-45°C~85°C
<b>NOTE 1.</b> Shock	NOTE 2. 25g, 11msec, half sine wave, 3 axes

NOTE 1. The above parameters are measured under laboratory conditions, the actual specifications and test methods are subject to the test report.

NOTE 2. The temperature measurement range is related to the product selection.

NOTE 3. For applications requiring high temperature measurement accuracy and image uniformity, the module needs a secondary temperature correction and lid-pattern noise correction after installation. Please refer to the Quick Start Manual for details.

## 4. Hardware Introduction

### 4.1. Pin Definition

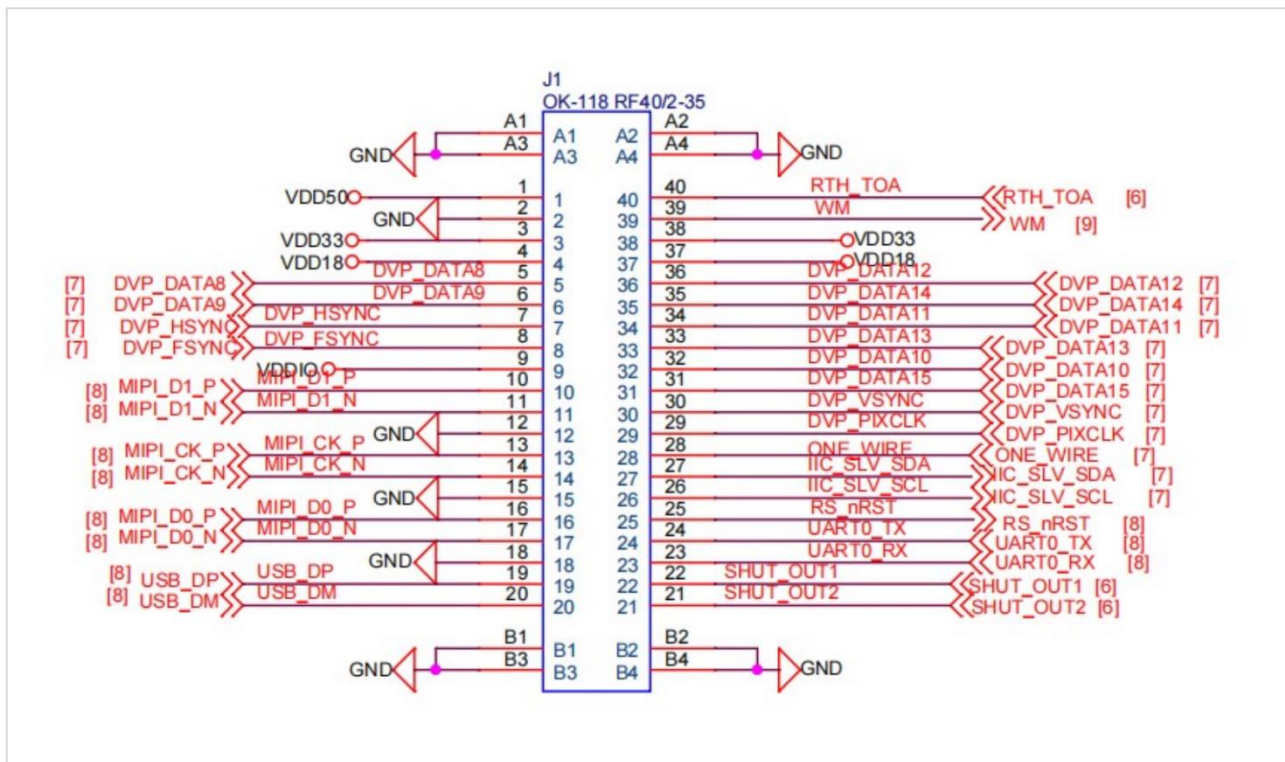


Figure 4-1 TC2-C Pin Diagram

Table 4-1 TC2-C Pin Definition

No.	Name	Type	Description
1	VDD50	POWER	Analog Power Supply
2	GND	GND	GND
3	VDD33	POWER	Digital Power Supply
4	VDD18	POWER	Digital Power Supply
5	DVP_DATA8	DVP	Video Output DVP Signal:DATA8
6	DVP_DATA9	DVP	Video Output DVP Signal:DATA9
7	DVP_HSYNC	DVP	Video Output DVP Signal:HSYNC
8	DVP_FSYNC	DVP	Video Output DVP Signal:FSYNC
9	VDDIO	POWER	Digital I/Os Power Supply
10	MIPI_D1_P	MIPI	Video Output MIPI Signal:MIPI_D1_P

No.	Name	Type	Description
11	MIPI_D1_N	MIPI	Video Output MIPI Signal:MIPI_D1_N
12	GND	GND	GND
13	MIPI_CK_P	MIPI	Video Output MIPI Signal:MIPI_CK_P
14	MIPI_CK_N	MIPI	Video Output MIPI Signal:MIPI_CK_N
15	GND	GND	GND
16	MIPI_D0_P_OUT	MIPI	Video Output MIPI Signal:MIPI_D0_P
17	MIPI_D0_N_OUT	MIPI	Video Output MIPI Signal:MIPI_D0_N
18	GND	GND	GND
19	USB_DP_OUT	USB2.0	Data signal positive terminal of USB2.0 port
20	USB_DM_OUT	USB2.0	Data signal negative terminal of USB2.0 port
21	SHUT_OUT1		Directly connected to a shutter(positive control) in the module
22	SHUT_OUT2		Directly connected to a shutter(positive control) in the module
23	UART0_RX	UART	UART0
24	UART0_TX	UART	UART0
25	RS_nRST	RESET	Reset signal for SOC
26	IIC_SLV_SCL	IIC	IIC Slave:CLK
27	IIC_SLV_SDA	IIC	IIC Slave:DATA
28	ONE_WIRE		Temperature sensor interface
29	DVP_PIXCLK	DVP	Video Output DVP Signal:CLK
30	DVP_VSYNC	DVP	Video Output DVP Signal:VSYNC
31	DVP_DATA15	DVP	Video Output DVP Signal:DATA15
32	DVP_DATA10	DVP	Video Output DVP Signal:DATA10

No.	Name	Type	Description
33	DVP_DATA13	DVP	Video Output DVP Signal:DATA13
34	DVP_DATA11	DVP	Video Output DVP Signal:DATA11
35	DVP_DATA14	DVP	Video Output DVP Signal:DATA14
36	DVP_DATA12	DVP	Video Output DVP Signal:DATA12
37	VDD18	POWER	Digital Power Supply
38	VDD33	POWER	Digital Power Supply
39	WM	CONTROL I/O	Control the working mode of Module
40	RTH_TOA	TEST	Test signal for Module
A1	GND	Reinforcing metal fitting	Reinforcing metal fitting
A2	GND	Reinforcing metal fitting	Reinforcing metal fitting
A3	GND	Reinforcing metal fitting	Reinforcing metal fitting
A4	GND	Reinforcing metal fitting	Reinforcing metal fitting
B1	GND	Reinforcing metal fitting	Reinforcing metal fitting
B2	GND	Reinforcing metal fitting	Reinforcing metal fitting
B3	GND	Reinforcing metal fitting	Reinforcing metal fitting
B4	GND	Reinforcing metal fitting	Reinforcing metal fitting

NOTE 1. The hardware description here is only for product selection reference. Please contact our technicians for detailed hardware development information during specific development.

## 4.2. Power Supply

Table 4-2 TC2-C Working voltage, current and noise requirement

Type	Description	Status	Voltage Requirement			Power Consumption	Power Supply Noise Requirement (Max)
			Min	Type	Max		
VDDA_5V0	Analog Power Supply for Sensor	Normal Operating	4.5V	5V	5.5V	23mA	200uV(1Hz~50KHz)
VDD_1V8	Digital Power Supply	Normal Operating	1.62V	1.8V	1.98V	10mA	1mV(1Hz~50KHz)
VDDIO	Digital I/Os Power Supply	Normal Operating	1.62V	3.3V	3.6V	5mA	1mV(1Hz~50KHz)

Type	Description	Status	Voltage Requirement			Power Consumption	Power Supply Noise Requirement (Max)
			Min	Type	Max		
VDD_3V3	Digital Power Supply	Normal Operating	3.0V	3.3V	3.6V		

## **5. Functions**

### **5.1. Software Resources**

We provide the following software and software development resources:

- Linux/Windows/Android SDK;

Developers can contact our technical support personnel to obtain the latest version of software development materials.

## 6. Structure and Dimensions

Note: Only drawings of some lens models are shown here. For detailed 2D and 3D drawings, please contact our technicians.

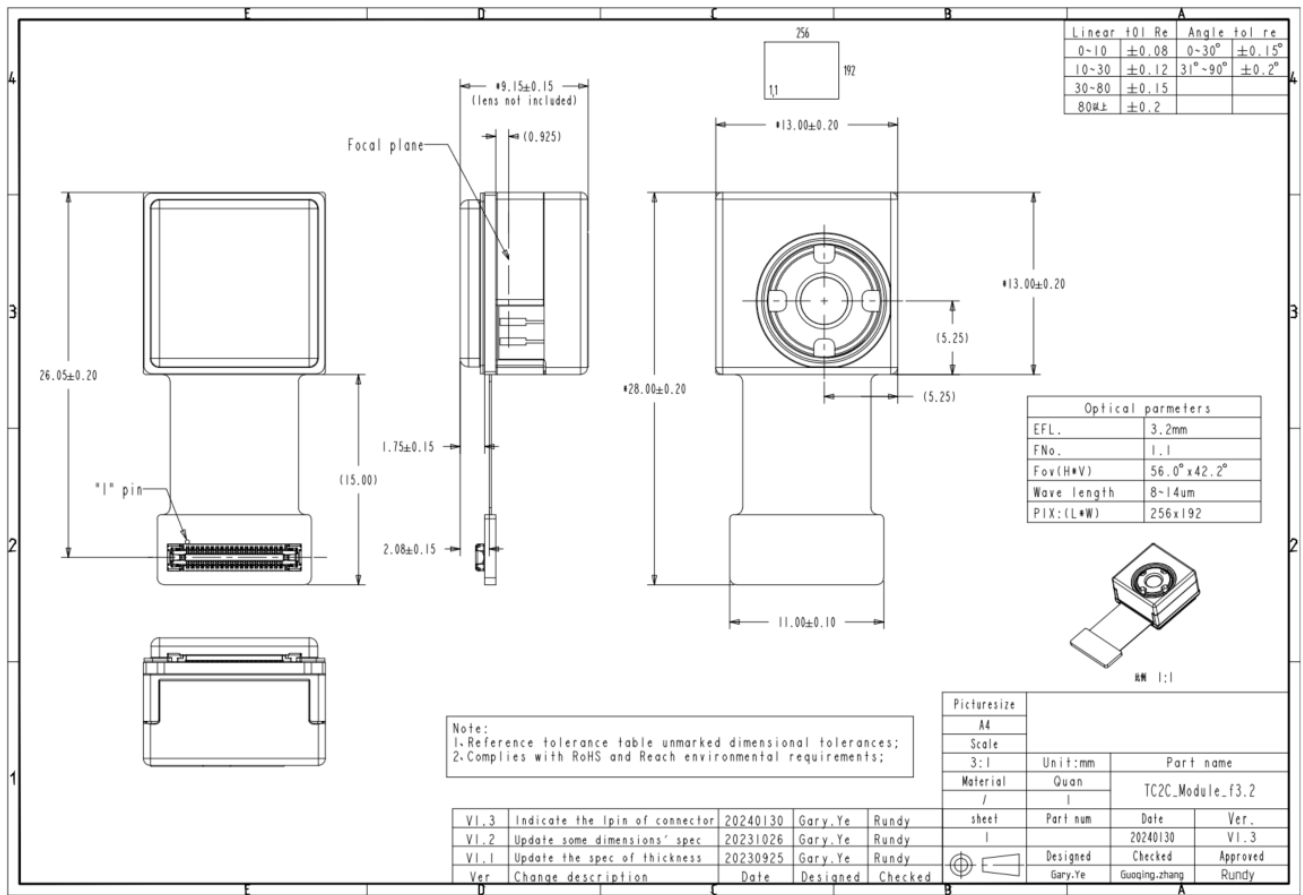


Figure 6-1 TC2-C Module Drawing

## 7. Precautions

To protect you and others from injury or to protect your equipment from damage, please read all the information below before using the equipment.

1. Do not look directly at high-intensity radiation sources such as the sun.
2. The ideal operating environment temperature is  $-10^{\circ}\text{C}\sim 50^{\circ}\text{C}$ .
3. Do not touch devices and cables with wet hands.
4. Do not bend or damage the cables.
5. Do not scrub your device with diluent.
6. Do not unplug other cables before cutting off the power supply.
7. Do not connect the attached cables in the wrong way to avoid damaging the device.
8. Take measures to prevent static electricity.
9. Do not dismantle the device. If there is any fault, please contact us to have it repaired by professionals.

## 8. Warranty

Dear User,

Thank you for choosing our products, we will, as always, to provide you with satisfactory service!

1. This product in normal use under the circumstances of failure the company will provide 1-year warranty, life-long maintenance services.

2. Warranty scope:

Failure under normal circumstances is generally defined as natural damage caused by the user of the product during normal use without human intent or due to negligence factors.

3. The following cases are not in our warranty scope:

- 1) Any damage caused by modification or repair not authorized and permitted by the company.
- 2) Failure or damage caused by the use of third-party product software, service behavior.
- 3) Accidental factors or human behavior caused by product damage. Such as into the liquid, drop damage, input the wrong voltage, excessive extrusion, deformation of the motherboard and so on. Appearance of obvious hard object damage, cracks, broken foot, serious deformation, power cord broken, broken wire, bare core and other phenomena.
- 4) Product data loss or damage.
- 5) Cannot effectively present the product warranty certificate. (Product nameplates, SN barcodes, and tamper-evident labels are torn off or damaged, blurred and unrecognizable.)
- 6) Not in accordance with the instructions for installation, use, maintenance, storage of the product failure or damage.
- 7) It has exceeded the warranty period.
- 8) Failure or damage due to uncontrollable factors (e.g. fire, earthquake, flood, etc.).

## **9. Supports and Services**

The company provides services such as pre-sales training, in-sales support, and after-sales maintenance. Please contact our sales-reps for specific information.