L256

Uncooled Thermal Imaging Module

Product Manual

V1.0.0

Version History

Version	Date	Comments
V1.0.0	2024-07	Initial release

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1. Product Overview

The L256 uncooled thermal imaging module represents a significant technological breakthrough, redefining new standards for weight, size, and power consumption (SWaP³) in the infrared OEM camera module industry. It is the ideal choice for compact platform designs, meeting professional requirements in inspection, security, search and rescue, and industrial monitoring. Additionally, it offers excellent miniaturized and cost-effective solutions for consumer-grade products. This series includes both observation and temperature measurement models for various applications.

2. Lens Parameters

Table 2.1 Lens Parameters

Array Format	E.F.L./F#	Lens Type	FOV (H×V)	IFOV
256×192	3.2mmF1.1	Athermalized	56°×42.2°	3.75mrad
	7mmF1.0		24.8°×18.7°	1.71mrad

3. Product Specifications

Table 3.1 Product Specifications

Model	256	256 Radiometric
Performance Indicators		
Detector Type	VOx Uncooled IRFPA	
Resolution	256*192	
Pixel Pitch	12μm	
Frame Rate	50Hz	25Hz
Spectral Range	8～14μm	
NETD	≤50mK@25℃，F#1.0	
Image Adjustment		
Brightness&Contrast Adjustment	Manual/Auto	
Polarity	Black-hot/White-hot	
Color Palettes	Support（18 types）(1)	
Image Processing	NUC	
	DNR	

Model	256	256 Radiometric
	DDE	
	Histogram equalization	
Image Mirror	Horizontal/Vertical/Diagonal	
Power Supply		
Power Supply Range	3.8～5.2VDC /1.8V / 3.3V(2)	
	User expansion components support the USB 2.0 standard 5V	
Typical Power Consumption @25℃	≤0.35W	≤0.3W
Interfaces		
Digital Video	8Bit LVCMOS(3)	
	BT.1120	CDS3
Serial Communication Interfaces	UART（1.8V）	
Temperature Measurement Performance		
Temperature Measurement Range	————	-20℃～+550℃
Accuracy	————	±3℃ or ±3% of reading, the larger value shall prevail
Physical Properties		
Weight(With 3.2mm lens, w/o expansion component)	About 8.7g	
Size	18mm × 18mm	
Environmental Adaptation		
Operating Temperature Range	-20℃～+60℃	
Storage Temperature Range	-45℃～+85℃	
Humidity	5～95%，no condensation	
Vibration	6.06g, random vibration, all axes	
Shock	40g, 11ms, half-sine wave, three axes, 6 directions	

Note:

(1) The color palettes, polarity are unavailable for LVCMOS.

(2) The voltage values mentioned here refer to the voltage at the camera module connector.

(3) 14-bit LVCMOS digital video is only supported through the 50-pin Hirose interface on the camera module.

4. User Interface Description for Camera Module

The user interface for the camera module uses a Hirose 50-pin DF40C-50DP-0.4V(51) connector, which includes the power supply interface for the camera module, UART communication interface, and 14-bit LVCMOS digital video interface. Users can connect to the camera module's user interface using the Hirose 50-pin DF40HC(3.0)-50DS-0.4V(51) board-to-board connector.

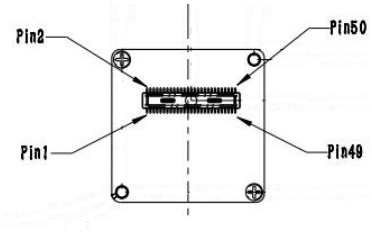


Figure 4.1 Camera Module Hirose User Interface

4.1Hirose 50-pin Connector User Interface Definition

Table 4.1 Hirose 50-pin Connector User Interface Definition (1)

Pin No.	Pin Name	Type	Description			
1, 2	MAIN_POWER	Power(input)	3.8V~5.2V(2)			
5	VDD3V3	Power(input)	3.3V(2)			
6, 10	VDD1V8	Power(input)	1.8V(2)			
11	DV0	Output	14Bit or 8Bit LVCMOS Digital Video（1.8V）	Data signal LSB	CDS2/BT.1120/ BT.656 (1.8V)	Data signal LSB
12	DV1			Data signal		Data signal
13	DV2			Data signal		Data signal
14	DV3			Data signal		Data signal
15	DV4			Data signal		Data signal
16	DV5			Data signal		Data signal
17	DV6			Data signal		Data signal
18	DV7			Data signal MSB (8bit)		Data signal MSB (BT.656)
19	DV8			Data signal		Data signal
20	DV9			Data signal		Data signal
21	DV10			Data signal		Data signal
22	DV11			Data signal		Data signal
23	DV12			Data signal		Data signal
24	DV13			Data signal MSB		Data signal

Pin No.	Pin Name	Type	Description			
				(14bit)		
27	Line_Valid			Line Sync		Line Sync
28	Frame_Valid			Frame Sync		Frame Sync
29	Clock			CLK signal		CLK signal
34	UART_RX	Input/ Output(3)	UART （1.8V）		Receive Module	
36	UART_TX	Output(3)			Transmit Module	
25,26, 30, 33, 35, 37, 38, 39, 40, 43, 44, 45, 46, 47, 48, 49, 50	——	——	NC, Suspend			
3, 4, 7, 8, 9, 31, 32, 41, 42	GROUND					

Note:

(1) The pin assignment and pin description of the Hirose 50-pin connector are only applicable for default product w/o expansion board.

(2) Here refers to the voltage to core connector;

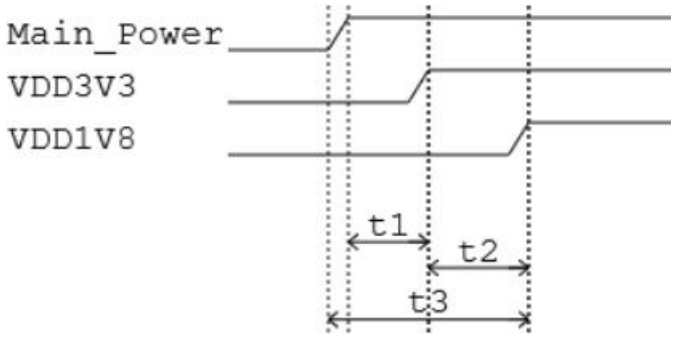
(3) The TX and RX in serial communication interface represent the transmit and receive of this module.

4.2 Power Supply Requirement for Hirose 50-pin Connector

The L256 thermal imaging module adopts multi-channel power supply, see the following figure for the tolerable noise and power-on timing:

Table 4.2 Description of Power Supply

Power Name	Power Supply Range	Max. Noise	Peak Current	Steady State Current (1)	Power Consumption (1)	Power on Timing
Main_Power	3.8V~5.2V	$10mV_{P-P}$	400mA	≤35mA	160mW	See the following figure
VDD3V3	+3.3V	$10mV_{P-P}$	250mA(2)	≤3mA	10mW	
VDD1V8(3)	+1.8V	1mVRMS (1Hz~50KHz)	150mA	≤30mA	54mW	



Time(t)	
t1	t1>2ms
t2	t2>0ms
t3	t3<10ms

Figure 4.2 Power on Timing

Note:

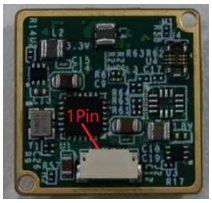
(1) Both the steady current and power consumption are typical values at 25℃, which are for reference purpose only;

(2)The peak VDD3V3 is current when the module is performing shutter calibration;

(3) When VDD1V8 starts powering on, the power-on process of both the Main_Power and the VDD3V3 should finish and become stable, and the whole process should finish within 10ms;

4.3 User Expansion Component Introduction

Table4.3 User Expansion Board Introduction

Model	Figure	Main Interface/Function	Fit Module
TLX01V100F026		Power supply via USB, typical voltage 5 VDC Communication via USB Video via USB 2.0	256/ 256 radiometric
TLX01V100F022C		Power supply via USB, typical voltage 5 VDC Communication via USB Video via USB 2.0	256/ 256 radiometric
TLX01V100F025C		Power supply: 5V~20V UART communication Analog video output	256

4.4 Parallel Digital Video Format

Table 4.4 Description of Digital Video Format

Video Format	LVCMOS		BT.1120	CDS_3
Supported Models	Non-radiometric	Radiometric	Non-radiometric	Radiometric
I/O Qty.(bit)	CLK(1) HSync(1) VSync(1) Data signal(8)		CLK(1) HSync(1) VSync(1) Data signal(8)	CLK(1) Data signal(8)
Progressive/ interlaced	Progressive			Progressive
CLK Rate /MHz	25	25	25	9.375
External Sync	Yes			Yes
Internal Reference Code	No		Yes	Yes
Data Format	RAW8		YUV422 2 CLKs for 1 pixel UY first, VY follow-up	YUV422+TEMP 2 CLK for 1 pixel UY first, VY follow-up Temperature: low byte first, then high byte
Support Color Palettes/ Polarity	No		Yes	Yes
Image Data Source	DRC		DRC	DRC
Array Format (1) (column×line)	M×N	M×N	2M×N	4M×N

Note:

M = 256, N = 192 for L256 series.

4.4.1 LVCMOS Digital Video

LVCMOS digital video includes 1 clock signal (Clock), 1 line valid signal (Line_Valid), 1 frame valid signal (Frame_Valid), and 14 data signals (DV0-DV13). The pixel data bit depth can be either 14 bits or 10 bits. When the user selects raw data (RAW) or temperature (TMP) data, the bit depth is 14 bits, i.e., DV[13:0], where DV0 is the LSB and DV13 is the MSB. When the user selects data processed by image processing (DRC), the bit depth is 10 bits, i.e., DV[9:0], where DV0 is the LSB and DV9 is the MSB.

LVCMOS digital video can be enabled or disabled via control commands. When enabled, it is possible to select the output of raw data (ORG), non-uniformity correction (NUC) data, or image processing (DRC) data.

When image processing (DRC) data is selected, the thermal imaging module does not support digital zoom or temperature information display functions.

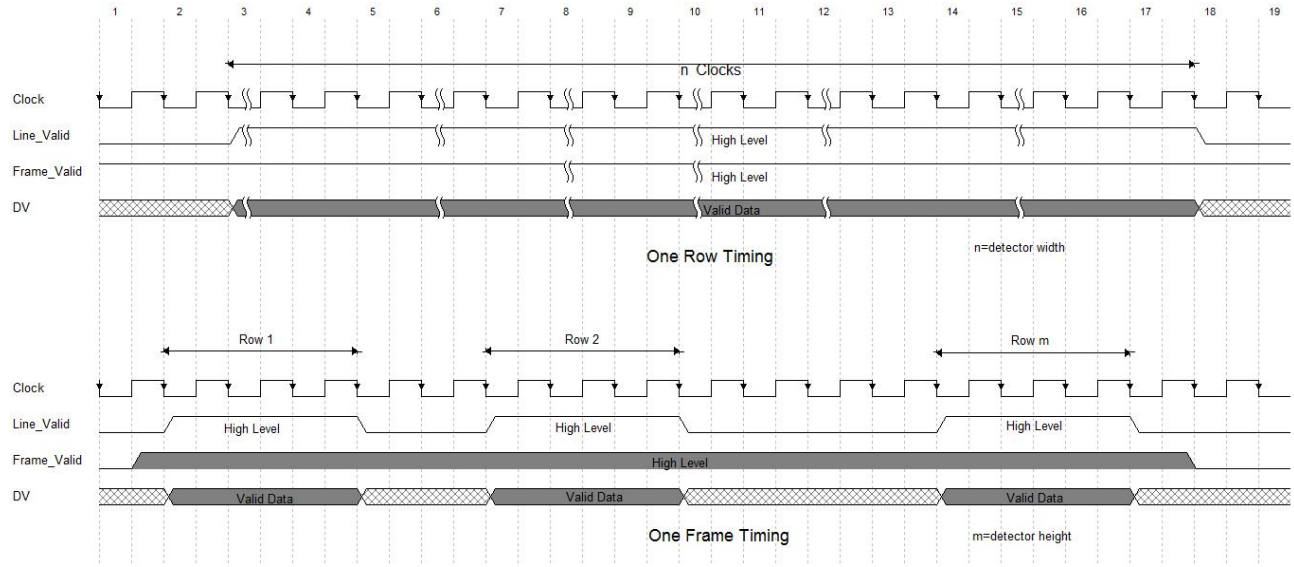


Figure 4.3 LVCMOS Digital Video Timing Diagram

Note:

(1) DV is recommended to be sampled on the rising edge of the Clock.

(2) Both Line_Valid and Frame_Valid are active-high signals.

(3) *After Line_Valid is asserted, it remains active for n Clock cycles, corresponding to the validity of data from the first to the last column of the line.*

4.4.2 BT.1120 Timing

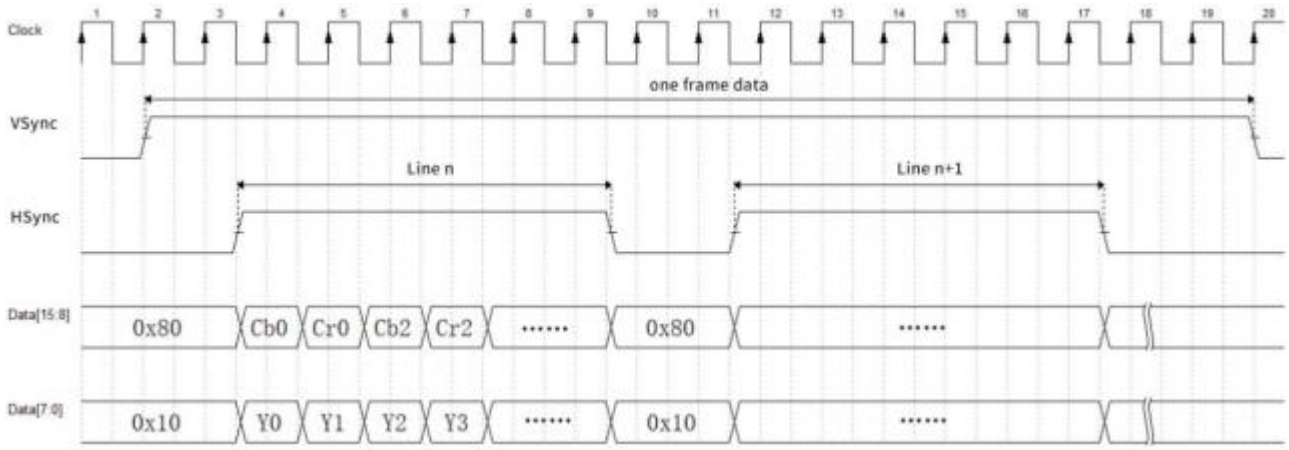


Figure 4.4 Timing of BT.1120 Digital Video in External Mode

Table 4.5 Timing of BT.1120 Digital Video in Internal Sync Mode

Reference code in invalid line EAV 0xB6B6	Blanking Area 0x8010	Reference code in invalid line SAV 0xABAB	Invalid data 0x8010
Reference code in valid line EAV 0x9D9D	Blanking Area 0x8010	Reference code in valid line SAV 0x8080	Valid data area CbYCrY The valid data area is 256*192 for thermal imaging modules with 256*192 array format
Reference code in invalid line EAV 0xB6B6	Blanking Area 0x8010	Reference code in invalid line SAV 0xABAB	Invalid data 0x8010

4.4.3 CDS3 Digital Video

The CDS3 digital video can output images with color palettes, the frame sync signals and line sync signals are not required for CDS3 digital video, only one CLK signal and 8 data lines are needed, and the CLK frequency is 9.375MHz.

CDS3 video data is arranged in a progressive scan format. Each line of CDS3 video data includes three parts: reference codes (EAV/SAV), blanking interval, and data region. The format of one frame of video output from the thermal imaging module is shown in the table below:

Table 4.6 The Format of One Video Frame

Reference code in invalid line EAV	Blanking Region 0x80 0x10	Reference code in invalid line EAV	Invalid data region 0x80 0x10	
Reference code in valid line EAV	Blanking Region 0x80 0x10	Reference code in valid line EAV	Valid image data 256*192 pixel/256*192*2 clk	Valid temp data 256*192 pixel/256*192*2 clk
Reference code in invalid line EAV	Blanking Region 0x80 0x10	Reference code in invalid line SAV	Invalid data area 0x80 0x10	

In above table, the reference code EAV in invalid lines in the top left corner is the start of a frame, the invalid data area in the bottom right corner is the end of a frame. There is no line sync signal or field sync signal for CDS3 video, it adopts the reference codes (SAV or EAV) to represent the start/end of a line or frame, EAV represents the start of the next line and the end of the previous line, SAV represents the start of data area in the line. Each group of reference code is corresponding to 4 CLK cycles, that is , each reference code includes 4 bytes, the contents of the first 3 bytes are fixed: 0xFF, 0x00 and

0x00，the content of the fourth byte depends on the position of the reference code. The contents of the fourth byte are shown in the following table:

Table 4.7 The Fourth Byte of the Reference Code

Reference Code Position	Reference Code
EAV in invalid lines	0xB6
SAV in invalid lines	0xAB
EAV in valid lines	0x9D
SAV in valid lines	0x80

The data in blanking area and data area is arranged in the order of Cb Y Cr Y, the width of Cb, Cr and Y is 8-bit and corresponds to 1 CLK cycle respectively. A group of Cb Y Cr Y is corresponding to 2-pixel data, that is 4 CLK cycles.

For blanking area and invalid data, Cb and Cr are fixed as 0x80, Y is fixed as 0x10. For image area with valid data, the chroma Cb and Cr is 8-bit, the brightness Y is 8-bit gray scale. For temp area with valid data, the chroma Cb and Cr is low 8bits of the temp data, that is TEMP [7:0], the brightness Y is high 8bits of the temp data, that is TEMP [15:8].

For the format and content of CDS3 digital video in each line, see the following figure:

Table 4.8 The Format of One Line of Video Data

	EAV reference code				Blanking region				SAV reference code				Data							
													Image				Temp			
Byte Count	4 Bytes				---				4 Bytes				256*2 Bytes				256*2 Bytes			
	FF	00	00	EVA	Cb	Y	Cr	Y	FF	00	00	SAV	Cb	Y	Cr	Y…	Cb	Y	Cr	Y…
Invalid line	FF	00	00	B6	80	10	80	10	FF	00	00	AB	80	10	80	10	80	10	80	10
Valid line	FF	00	00	9D	80	10	80	10	FF	00	00	80	Cb	Y	Cr	Y	TEMP [7:0]	TEMP [15:8]	TEMP [7:0]	TEMP [15:8]

5. Structural Drawings

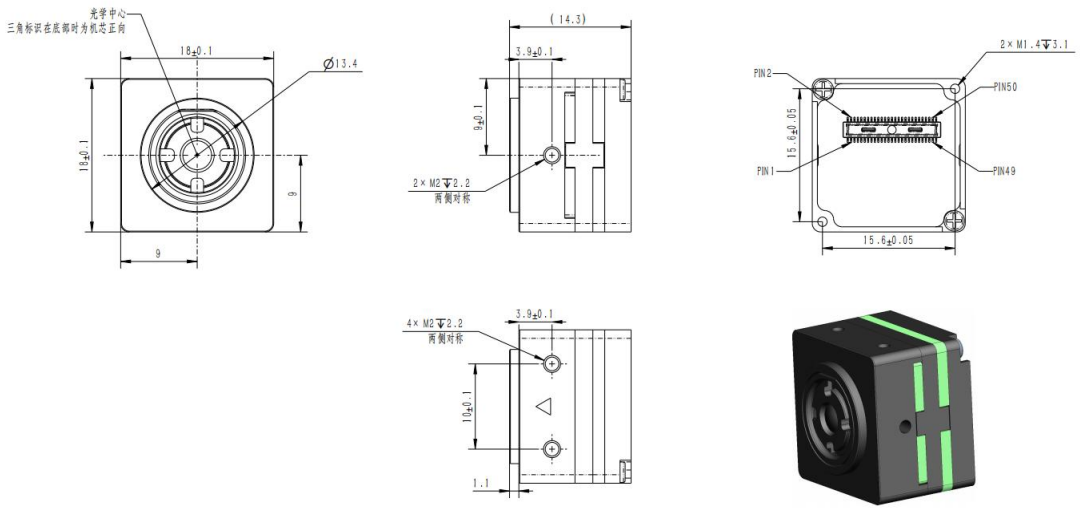


Figure 5.1 Module Dimension (With 3.2mmF1.1 lens)

The size of the camera module varies with different lenses and expansion components. Please refer to the detailed camera module drawings for more information.

6 Precautions

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

(1) The product shall not face towards the sun or other high-intensity radiation sources directly;

(2) The optimal environment temperature for operating is - 20 ℃ to 50 ℃;

(3) The detector window shall not be touched or hit with hands or other objects;

(4) The equipment and cables shall not be touched with wet hands;

(5) Please do not bend or damage cables;

(6) Scrubbing your equipment with diluents is prohibited;

(7) Do not unplug and plug cables when the power is on;

(8) Wrong cable should not be connected in case that brings damages to the equipment;

(9) Please pay attention to prevent static electricity;

(10) Please do not disassemble the equipment. If there is any fault, please contact us, and professional personnel will carry out maintenance.