L384

Uncooled Thermal Imaging Module

Product Manual

V1.0.1

Revision History

Version	Date	Comments
V1.0.0	2024-07	Initial release
V1.0.1	2024-07	The analog video expansion component is also available for radiometric thermal imaging cores.

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1. Product Overview

The L384 uncooled thermal imaging module makes a further breakthrough in technology, sets the standard for longwave infrared (LWIR) OEM thermal camera performance and size, weight, and power (SWaP), which make it the perfect choice for compact platform design. The L384 cores meet the professional needs of inspection, security, search and rescue, industrial monitoring and other fields, while providing excellent miniaturized high-resolution solutions for consumer products.The series offers options including non-radiometric and radiometric types.

2. Lens Parameters

Table 2.1 Lens Specs

Array Format	E.F.L./F#	Focus Type	FOV (H×V)	IFOV
384×288	2.88mmF1.2	Athermalized	90°×67.5°	4.17mrad
	5.3mmF1.2		50°×37.3°	2.26mrad
	9mmF1.0		29.1°×21.8°	1.33mrad
	19mmF1.0		13.8°×10.4°	0.63mrad
	19mmF1.0	Manual Focus	13.8°×10.4°	0.63mrad

3. Product Specs

Table 3.1 Product Performance Specs

Model	384	384 (Radiometric)
Performance Indicators		
Detector Type	VOx Uncooled IRFPA	
Resolution	384×288	
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)	

Model	384	384 (Radiometric)
Image Processing	Shutterless	Temperature Control Algorithm(w/o TEC)
	NUC	
	Brightness &Contrast Adjustment	
	DNR	
	DDE	
	Histogram equalization	
Image Mirror	Left-right/Up-down/Diagonal	
Power Supply		
Typical Supply Voltage	3.8～5.2VDC / 1.8V / 3.3V(2)	
	The user expansion component supports USB2.0, 5V	
Typical Power Consumption @25℃	≤0.35W	≤0.25W
Interfaces		
Digital Video	14Bit LVCMOS(3)	
	Progressive BT.656/BT.1120	CDS2
Serial Communication Interfaces	UART(1.8V)	
Temperature Measurement Performance		
Temperature Measurement Range	————	-20℃～+550℃ (650℃ custom)
Accuracy	————	±3℃ or ±3% of reading, the larger value shall prevail (±2℃ optional)
Physical Properties		
Weight (w/o lens & expansion component)	<4.8g	
Size(w/o lens)	18mm × 18mm	
Environmental Adaptation		
Operating Temperature Range	-40℃～+80℃(-20℃～+60℃ for radiometric function)	
Storage Temperature Range	-45℃～+85℃	
Humidity	5～95%, no condensation	
Vibration	6.06g, random vibration, all axes	
Shock	80g, 4ms, post-peak sawtooth wave, 3-axis six-direction	
Environmental certification		
RoHS2.0	Yes	

Note:

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

(2) Here refers to the voltage to the connector of the thermal imaging module.

(3) 14Bit LVCMOS digital video, is only supported in Hirose 50-pin connector.

4. User Interface Description

The Hirose 50PIN connector named DF40C-50DP-0.4V (51) is used on the imaging module, including power supply interfaces, UART interfaces, 14Bit LVCMOS digital video interfaces and other interfaces. Users can adopt Hirose 50 Pin DF40HC (3.0)-50DS-0.4V (51) board-to-board connector to implement the connection between imaging module and user expansion components.

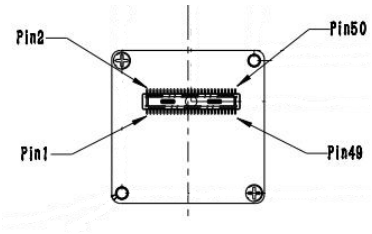


Figure 4.1 Hirose User Interface

4.1 Definition of Hirose 50-pin Connector

Table 4.1 Definition of Hirose 50-pin Connector (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

Pin No.	Pin Name	Type	Description			
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 (14bit)		Data signal
25	DV14			——		Data signal
26	DV15			——		Data signal MSB (CDS2/BT.1120)
27	Line_Valid			Line Sync		Line Sync
28	Frame_Valid			Frame Sync		Frame Sync
29	Clock			CLK signal		CLK signal
34	UART_RX	Input(3)	UART (1.8V)		Receive Module	
36	UART_TX	Output(3)			Transmit Module	
33(4)	Reserve OUT	Output	1.8V			
30,35, 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.

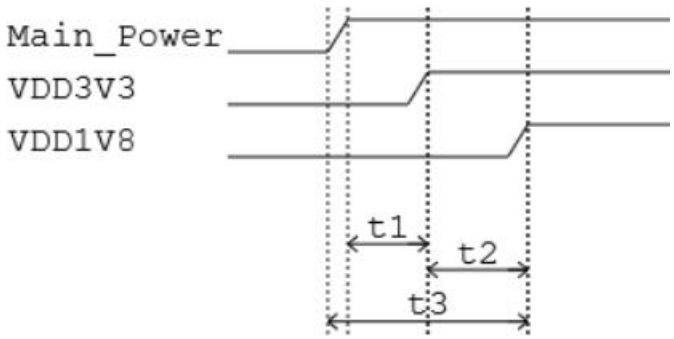
(4) The pin No. 33 can only output, which has pullup resistor inside.

4.2 Power Supply Requirement for Hirose 50-pin Connector

The L384 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:

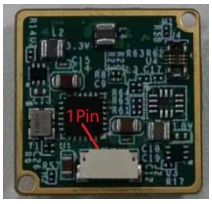
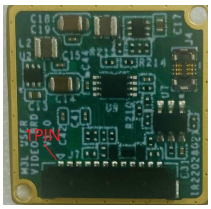
(1) Both the steady current and power consumption are typical values at 25℃, which are for reference purpose only;

(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 Expansion Board List

Table 5 Expansion Board List

Model	Figure	Main Interface/Function	Fit Module
TLX01V100F026		● USB power supply, typical voltage is 5 VDC ● Communication USB virtual serial port ● Video USB UVC	384/384 radiometric
TLX01V100F022C		● USB power supply, typical voltage is 5 VDC ● Communication USB virtual serial port ● Video USB UVC	384/384 radiometric
TLX01V100F023C		● Power supply, typical voltage is 5V ● RS232 communication by default ● Analog video (PAL)	384/384 radiometric
TLX01V100F025C		● Power supply 5V~20V ● UART communication ● Analog video output	384/384 radiometric

4.4 Parallel Digital Video Format

Table 4.4 Description of Digital Video Format

Video Format	LVCMOS		BT.656	BT.1120	CDS_2(1)
Supported Models	Non-radiometric	Radiometric	Non-radiometric	Non-radiometric	Radiometric
I/O Qty.(bit)	CLK(1) HSync(1) VSync(1) Data signal(16)		CLK(1) HSync(1) VSync(1) Data signal (8)	CLK(1) HSync(1) VSync(1) Data signal(16)	CLK(1) HSync(1) VSync(1) Data signal(16)
Progressive/ interlaced	Progressive				
CLK Rate /MHz	25	25	25	25	25
External Sync	Yes				
Internal Reference Code	No		Yes	Yes	Yes
Data Format	RAW8/14		YUV422 2 CLKs for 1 pixel UY first, VY follow-up	YUV422 1 CLK for 1 pixel High 8-bit UV, low 8-bit Y	YUV422+TEMP 1CLK for 1 pixel High 8-bit Y, low 8-bit UV
Support Color Palettes/ Polarity	No		Yes	Yes	Yes
Image Data Source	NUC or DNS or DRC		DRC	DRC	DRC
Array Format (2) (column×line)	M×N	M×N	2M×N	M×N	2M×N

Note:

(1) The second half of each line of CDS_2 is 16-bit temperature data;

(2) M = 384, N = 288 for L384 series.

4.4.1 LVCMOS Timing

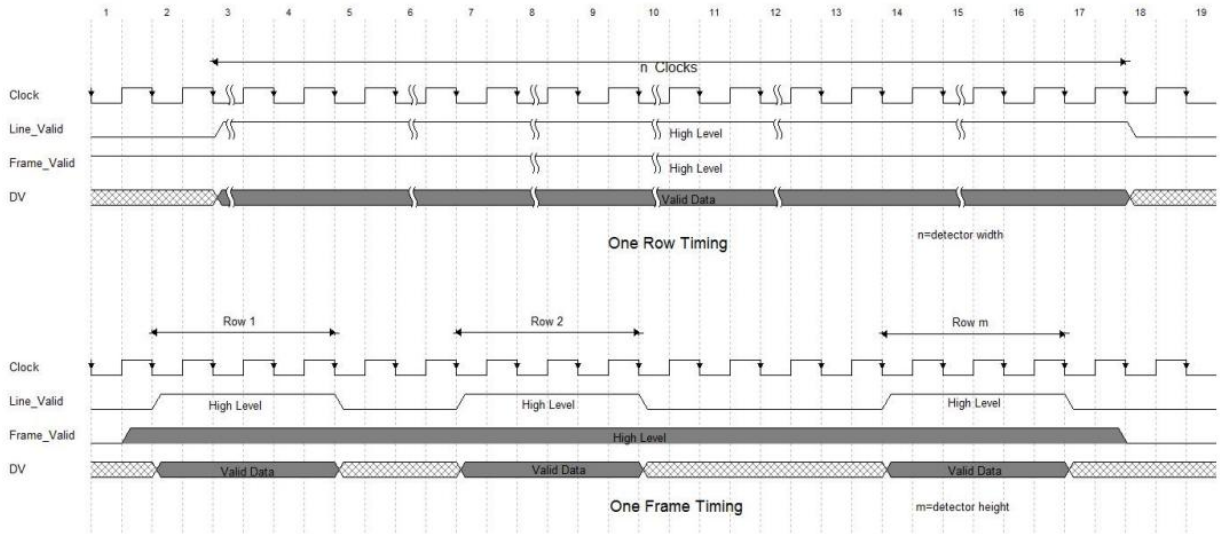


Figure 4.3 Timing of 14bit or 8bit LVCMOS Digital Video

Note: *LVCMOS does not support change of color palettes and polarity;*

4.4.2 BT.656 Timing

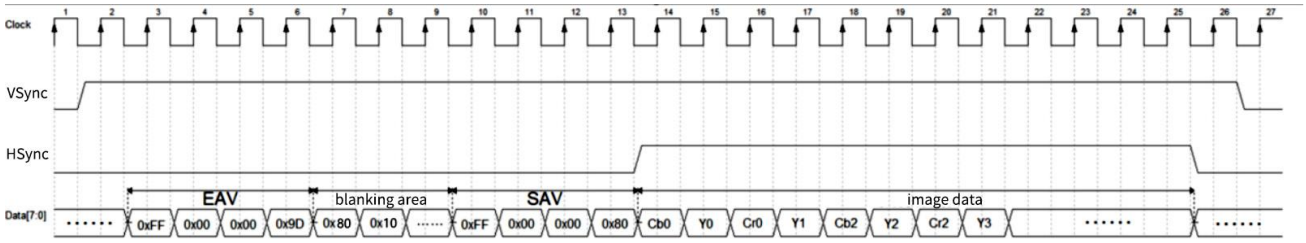


Figure 4.4 Timing of BT.656 Digital Video

4.4.3 BT.1120 Timing

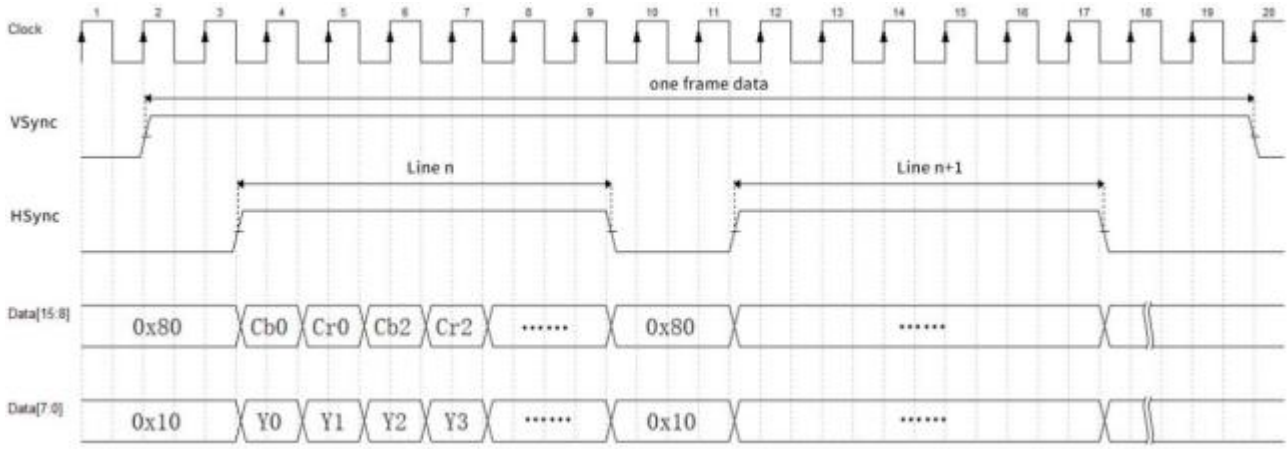


Figure 4.5 Timing of BT.1120 Digital Video in External Mode

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 384*288 for thermal imaging modules with 384*288 array format.
Reference code in invalid line EAV 0xB6B6	Blanking Area 0x8010	Reference code in invalid line SAV 0xABAB	Invalid data 0x8010

4.4.4 CDS2 Timing

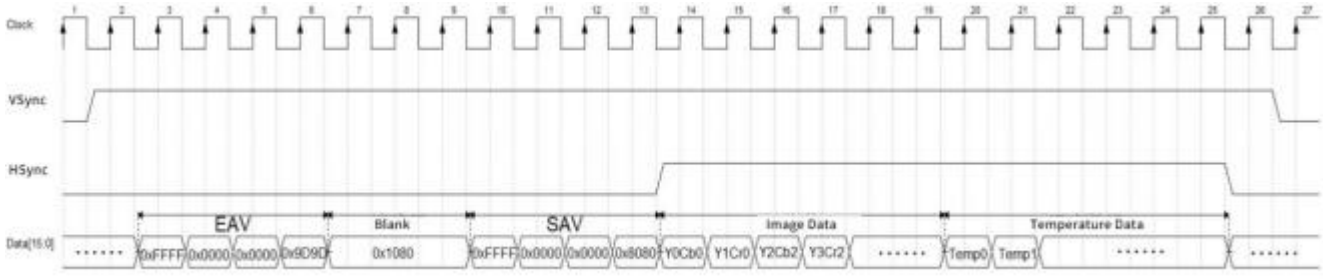


Figure 4.6 Timing of CDS2 Digital Video

Note:

(1) Temp refers to temperature data.(valid data bit is low 14-bit, fill up 0 for high 2-bit);

*(2) The output data in each line is 2M,M refers to array columns, take the thermal imaging module with 384*288 array format, it contains 384*2=768 CLK Periods, 288 lines for each frame.*

5. Dimension

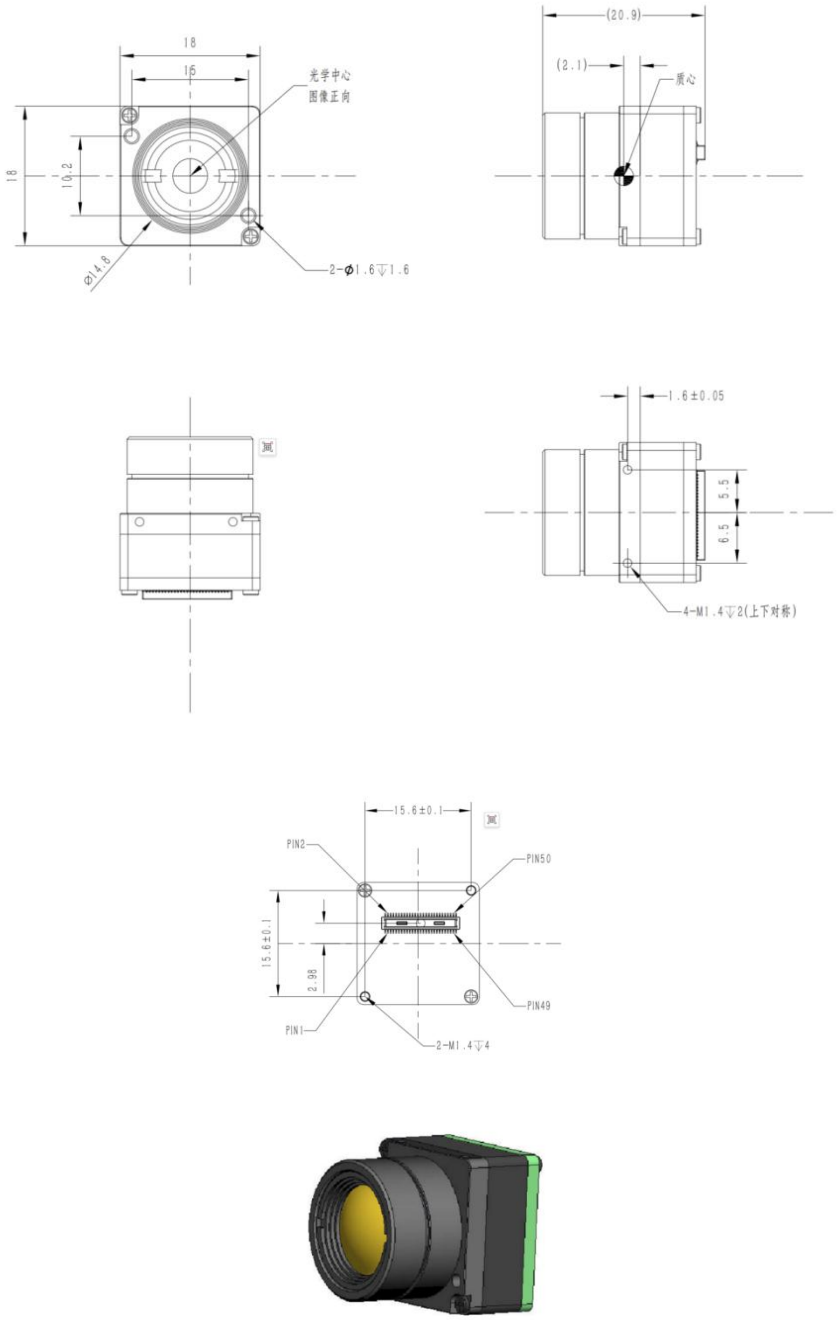


Figure 5.1 Dimension of Module with 9mm F1.0 Lens

The core dimensions with varied lens and user expansion board are different, see the drawings for detailed dimension.

6. Cautions

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.