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InfiRay XcoreMicroIII Series Uncooled Thermal Imaging Module User Manual

Contents

InfiRay XcoreMicroIII Series Uncooled Thermal Imaging Module

Product Overviews

Xcore MicroIII Series thermal imaging module is specially designed for applications that are sensitive to volume, weight, and power consumption. It is small in size, light in weight, and low in power consumption. It supports a variety of serial communication interfaces, video output interfaces, and lightweight infrared lenses. It is suitable for miniaturized handheld devices, enhanced night vision goggles (ENVG), UAVs, and multi-spectral systems, which supports a thorough thermal image solution. The temperature measuring products can be used in industrial measurement, power station measurement, security&surveillance measurement, machine vision etc.

Product Models

M3384	011	01312X	C	Y	P
Models	**Expansion board**	**Lens**	**Language**	**Startup Screen**	**Analog video**
M3384: MicroIII 384 M3640: MicroIII 640 M3384T: MicroIII 384T M3640T: MicroIII 640T M3384S: MicroIII 384S M3640S: MicroIII 640S	000: Null 011:MRIII00V110F016C 012: MRIII00V100F012 013:MRIII00V100F011C 014:MRIII00V100F008C 015:MRIII00V110F017C	00000X: no lens, flange dia.Φ22mm 00001X: no lens flange dia.Φ27mm 4D112X:4.1mm 5D812X:5.8mm 9D110X:9.1mm 01312X: 13mm 01910X: 19mm 02510X: 25mm 03510X: 35mm 05510X: 55mm(T,TH series is not	C: Chinese E: English	Y: Yes N: No	P: PAL N: NTSC

| | | supported) 07510X:75mm(T,T H series is not supported) 10010X:100mm(T,TH series is not supported) | | | |

Lens Parameters

Module	MicroIII384/640							
Resolution	384×288	640×512	384×288	640×512	384×288	640×512	384×288	640×512
Focus	4.1mm F1.2		5.8mm F1.2		9.1mm F1.0		13mm F1.2	
Focus Type	Athermalization		Athermalization		Athermalization		Athermalization	
FOV	59°×46°	89°×75°	44°×33°	70°×57°	28°×21°	48°×38°	20°×15°	33°×26°
IFOV	2.92mrad	2.92mrad	2.06mrad	2.06mrad	1.31mrad	1.31mrad	0.92mrad	0.92mrad
Module	MicroIII384/640							
Resolution	384×288	640×512	384×288	640×512	384×288	640×512	384×288	640×512
Focus	19mm F1.0		25mm F1.0		35mm F1.0		55mm F1.0	
Focus Type	Athermalization		Athermalization		Athermalization		Athermalization	
FOV	13°×10°	22°×18°	10°×7.9°	17°×14°	7.5°×5.6°	12.5 ° × 10°	4.8°×3.6°	8°×6.4°
IFOV	0.63mrad	0.63mrad	0.48mrad	0.48mrad	0.34mrad	0.34mrad	0.21mrad	0.21mrad
Module	MicroIII384/640							
Resolution	384×288		640×512		384×288		640×512	
Focus	75mm F1.0				100mm F1.0			
Focus Type	Thermalization		Thermalization		Thermalization		Thermalization	
FOX	3.5°×2.6°		5.9°×4.7°		2.6°×2°		4.4°×3.5°	
IFOV	0.16mrad		0.16mrad		0.12mrad		0.12mrad	

Product Specification

Module	MicroIII384/ MicroIII384S	MicroIII384T MicroIII384TH	MicroIII640/ MicroIII640S	MicroIII640T MicroIII640TH
Detector Type	VOx Uncooled Infrared FPA			
Resolution	384×288		640×512	
Pixel Pitch	12μm			
Frame Rate	50Hz /30Hz(1)			

Response Spectra	8 14μm
NETD	≤50mK@25℃, F#1.0 ≤40mK optional
TEC	No

Image

Brightness & Contrast Adjustment	Manual/Auto0/Auto1
Polarity	Black hot / white hot
Palette	Support(2)
Reticle	Display/disappear/move(2)
Digital Zoom	1.0~8.0×continuing zooming step 0.1 (2)
Image Processing	Shutter-less(8)
	NUC
	Digital filtering/noise reduction
	DDE
Image flip	Right-left/Up-down/Diagonal

Power Supply

Supply Voltage	4 6VDC(3)	
	Expansion boards support 3.5 18VDC(3)	
Typical Supply Voltage	4VDC(3)	
Power Protection	Over-voltage/Under-voltage/Reverse Connection	
Typical Consumption @25℃	Excluding expansion board	1.0W	1.3W
	Including expansion board	1.2W	1.6W

Interface

Video Output	Analog video	1 channel PAL (4)
		Or 1 channel NTSC
	Digital video	BT.656
		14Bit or 8Bit LVCMOS(5)
		LVDS_H
Serial Communication Interface		RS-232
		UART 3.3V
Key		4 keys
Temperature Measurement Function(6)		
Measuring Range		T series: -20℃ +150℃ 0~+550℃
		TH series: 0~60℃
Measuring Accuracy		T series: ±3℃ or ±3% of reading The larger value shall prevail @ ambient temperature of -20℃~60℃
		TH series: ±0.5℃@ target temperature 33℃~42℃;±1.0℃@ target temperature 20℃~33℃;±1.0℃@ target temperature 42℃~50℃
Measuring Tools		Spot, line, Area
Physical Property		
Weight (without lens and expansion board)		21g±3g
Size (without lens)		26mm × 26mm
Environmental adaptation		
Operating Temperature		T series: -40℃ +80℃(Measuring temp. at -20℃ +60℃)
		TH series: -10℃ +50℃ 16℃~32℃ for accurate temperature measurement
Storage Temperature		-45℃ +85℃
Humidity		5~95%, non-condensing
Vibration		6.06g, Random vibration, all axial direction
Shock		80g, 4ms, Final peak sawtooth wave, 3 axial 6 direction

Table 2 Product Specification
Note

1. The detector frequency of PAL is 50Hz and 30Hz for NTSC.

2. The digital video is without a palette, the reticle of displaying/disappearing/moving, digital zoom, and image flip function except BT.656.

3. All these power supply voltage values represent the voltage on the module connector.

4. PAL analog video output format is PAL-D.

5. 14Bit or 8Bit LVCMOS digital video is only supported in the connector of Hirose 70 in the module.

6. MicroIII384T and MicroIII640T supporting only.

7. TH series requires the shell to meet the overall thermal conductivity of the shell heat flux≥800mW, Average heat of thermal conductors≥90J/°C.

8. Only available for the S series.

User Interface Description

The Hirose 70PIN connector named DF40C-70DP-0.4V(51) is used on the imaging module of power supply interfaces, RS-232 interfaces, UART interfaces, analog video interfaces, BT.656 digital video interfaces, 14Bit or 8Bit LVCMOS digital video interfaces and 4 keys interfaces are contained on the connector. Users can adopt the Hirose 70Pin DF40HC(3.0)-70DS-0.4V(51) to implement the connection between imaging module and user expansion components.
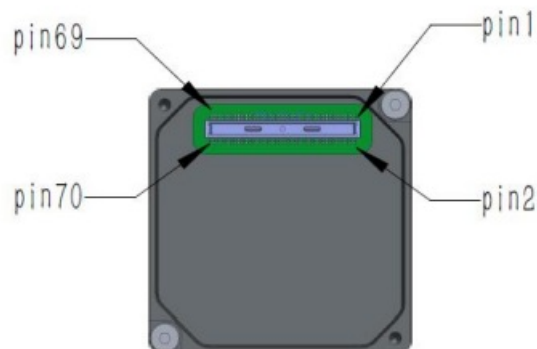

Figure 2 Hirose User Interface

Hirose 70pin Connector Definition

Pin NO.	Name	Type	Description			
1 2 3 4	Power Supply	Power	Power Input 4 6VDC (1)			
12 19 22 42	——	——	Not available			
15	RS-232_RX	Input	RS-232 Serial communication interface (2)			
16	RS-232_TX	Output				
9 11	VGND	Power	Ground of analog video (3)			
10	VIDEO	Output	Analog video			
25	DV1			Data	BT.656	Data
26	DV0			Data LSB	BT.1120	Data

Pin NO.	Name	Type	Description			
						LSB(BT.656)
27	DV3			Data		Data
28	DV2			Data		Data
29	DV5			Data		Data
30	DV4		16Bit or 14Bit or 8Bit LVCMOS Digital video(3.3V)	Data		Data
31	DV7			Data MSB(8bit)		Data MSB (BT.656)

32	DV6	Output		Data		Data
33	DV9			Data		—
34	DV8			Data	3.3V	—
35	DV11			Data		—
36	DV10			Data		—
37	DV13	Output		Data MSB(14bit)		—
38	DV12			Data		—
24	DV14			Data		Data
23	DV15		16Bit or14Bit or 8Bit LVCMOS Digital video (3.3V)	Data MSB(16 bit)		Data MSB(BT.1 120)
39	Line_Valid			Line valid signal		Line valid signal

Pin NO.	Name	Type	Description		
40	Frame_Valid			Frame valid signal	Frame valid signal
41	Clock			Clock signal	Clock signal
45	UART_TX	Input/ Output	UART communication interface 3.3V (2)		
46	UART_RX				
48	KEY1		Button interface 3.3V	M menu	
50	KEY2	Input		+ plus	
52	KEY3			- minus	
54	KEY4			C correction	

Pin NO.	Name	Type	Description	
47	LVDS_CLK+			Clock signal
49	LVDS_CLK-			
51	LVDS_DATA0+			Data
53	LVDS_DATA0-			
57	LVDS_DATA1+			Data
59	LVDS_DATA1-		LVDS_H	

		Output	VCCIO=2.5V	
61	LVDS_DATA2+			Data
63	LVDS_DATA2-			
65	LVDS_DATA3+			Data
67	LVDS_DATA3-			
58	IO0	Input/ Output	Reserved	
60	IO1		Reserved	
62	IO2		Reserved	
64	IO3		Reserved	
66	IO4		Reserved	
68	IO5		Reserved	
5 6 7 8 13 14 17 18 43 44 55 56 69 70	GND	Power	Ground of power supply (3)	

Note:

1. Typical value of power supply is 4VDC, setup time 10% 90% 4mS, peak current 1.0A, ripple&noise 40mVp-p.
2. The TX and RX in serial communication interface represent the transfer and receive of this module.
3. GND and VGND are shorted internally.

Expansion Board List

Model	Figure	IRay PN	Function	Connectors	Fit module
			l USB power supply typical 5		MicroIII384
MRIII00V110F016C		2030101240	V DC l USB communication l USB UVC Video	TYPE C	MicroIII640 MicroIII640T MicroIII384T
			l Power input3.5~18	Hirose 20 pin DF52-20S- 0.8H connector Molex 20 pin 52745-2097 connector	
			VDC, typical 12		
			VDC		MicroIII384
MRIII00V100F012C		2030100889	l RS-232 Uart /RS- 422 l Analog video		MicroIII640 MicroIII640T
			l BT.656 digital video		MicroIII384T
			l 4 Keys		
			l Power input		
MRIII00V100F011C		2030100902	3.5~18v, typical 12 VDC l RS232 RS422 l 4 keys l LVDS_H digital video l Analog video	DF56C-30S-0.3V 51	MicroIII384 MicroIII640 MicroIII640T MicroIII384T
			l Power input		
MRIII00V100F008C		2030101595	3.5~18v, typical 12 VD l RS232 RS422 l 4 keys l Cameralink digital video l Analog video	DF56C 30S-0.3V 51	MicroIII384 MicroIII640 MicroIII640T MicroIII384T

Model	Figure	IRay PN	Function	Connectors	Fit module
			l Power input		
MRIII00V110F017C		2030101721	3.5~18v, typical 12 VDC l RS232 RS422 l 4 keys l MIPI digital video l Analog video	DF56C-30S-0.3V 51	MicroIII384 MicroIII640 MicroIII640T MicroIII384T
Please contact salesman to confirm model.		Specific model corresponde nce	l Used for fine-tuning of lens- focus	None	MicroIII 384 MicroIII 640 MicroIII 640T MicroIII384T

LVCOMS Digital Video

LVCMOS digital video includes 1 Clock signal (Clock), 1 Line_Valid signal and 1 valid frame signal(Frame_Valid), and 14 data signals (dv0-dv13).Pixel data bits are divided into 14 bit and 8 bit, when the user chooses to lose. When RAW data or temperature (TMP) data is selected, there is all together 14-bit data, namely DV[13:0], where DV0 is LSB and DV13 is the MSB. When the user selects the data after the output image processing (DRC), there is all together 8-bit data, namely DV[7:0], where DV0 is LSB and DV7 is the MSB. LVCMOS digital video can be turned on or off with control commands. While the LVCMOS digital video is turned on, you can choose to output raw data (ORG) or non-uniform correction (NUC) data, or image processing (DRC) data.
When DRC data is selected, the thermal camera module does not support the function of digital zoom and temperature information display.

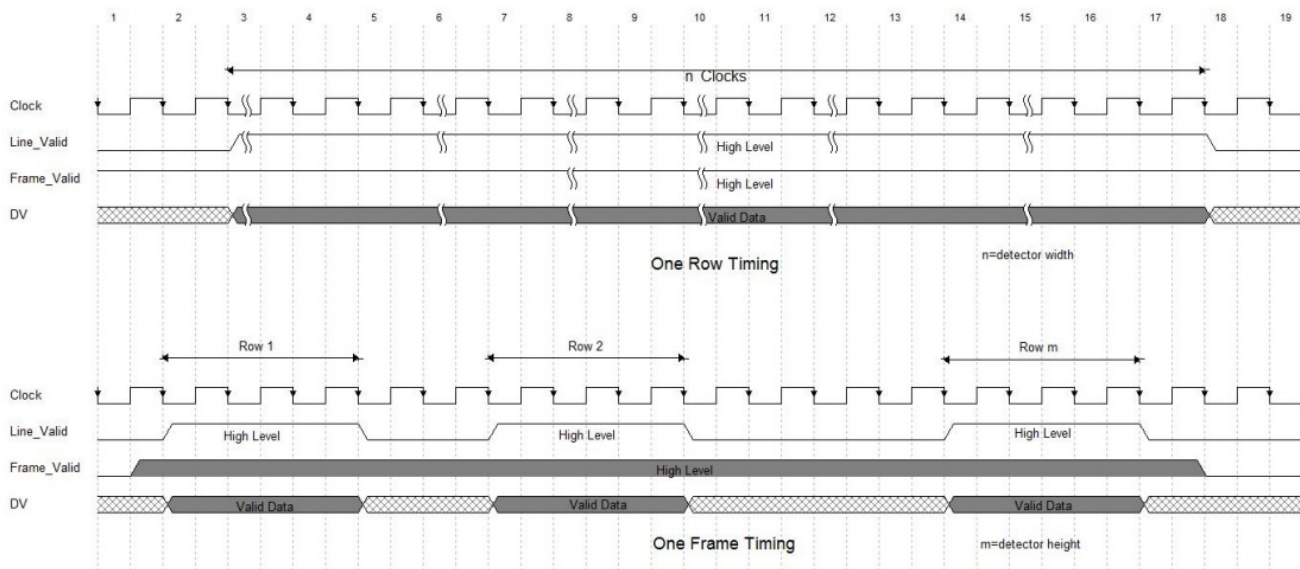| Product model	Clock frequency
M3384	12.857MHz
M3640	19.286MHz
M3 384T	6.4286MHZ
M3 640T	12.857MHZ

Figure 3 14bit or 8bit LVCMOS Digital Video Sequence Diagram

Note:

1. Clock rising edge sampling is recommended for DV.
2. Line_Valid and Frame_Valid are both high-level valid.
3. after Line_Valid is valid, it lasts for n Clock, which corresponds to the data of the first column to the last column of the row in turn.

LVDS Digital Video

LVDS digital video includes 1 clock signal (LVDS_CLK) and 4 data signals (LVDS_DATA1, LVDS_DATA2, LVDS_DATA3, and LVDS_DATA4), which can be easily analyzed by domestic mainstream video coding & decoding chip.

LVDS digital video can be turned on or off with control commands. In the open state, choose to output raw data (ORG) or non-uniformity correction (NUC) data, or image processing (DRC) data.

When choosing to use image processing (DRC) data, the core component does not support the function of electronic zoom and temperature information display.

Product model	Clock frequency (LVDS_CLK)
M3 384	22.500MHz
M3 640	33.750MHz
M3 384T	11.250MHZ
M3 640T	22.500MHZ
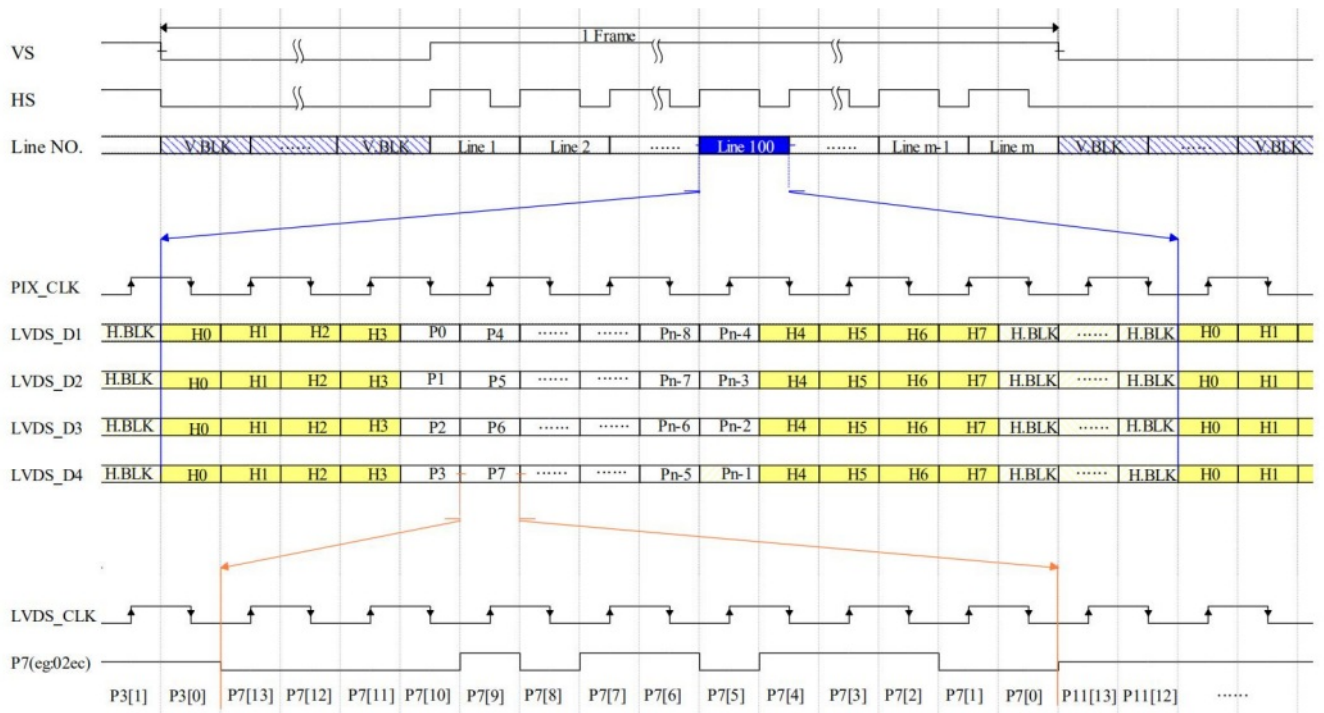
Figure 4 N×M Array of LVDS_H Digital Video Sequence Diagram

	H0	H1	H2	H3	H4	H5	H6	H7
BLANK LINE	3FFF	0000	0000	2AC0	3FFF	0000	0000	2D80
VALID LINE	3FFF	0000	0000	2000	3FFF	0000	0000	2740

BT.1120 Digital Video

Bt.1120 digital video is the line-by-line output signal, including the Clock signal (Clock), frame effective signal, line effective signal, 16 data signals (dv0-dv15). FIG. 5 sequence diagram takes the n×m array as an example:
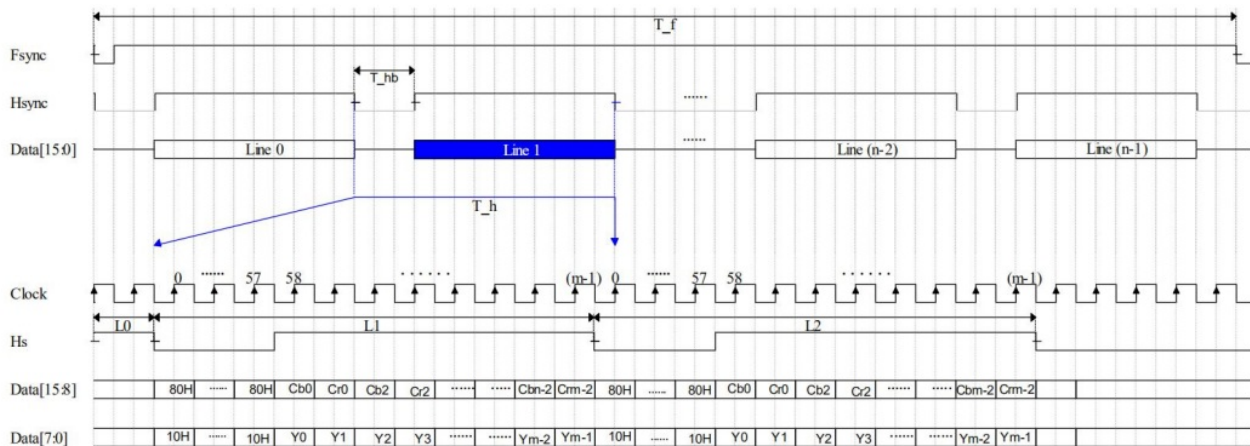
Figure 5 Bit.1120 Digital Video Sequence Diagram

When choosing to use bt.1120 digital video, the thermal camera component does not support the electronic zoom, temperature information display function.

BT.656 Digital Video
Bt.656 digital video, including 1 Clock signal (Clock) and 8 data signals (DV0-DV7).

BT.656 digital video supports all functions of the thermal camera module (see table 1 for image adjustment and temperature measurement), including brightness/contrast adjustment, polarity selection, color Palette selection, reticle control, digital zoom and image flip functions, and only supports output image processing (DRC) data.

CDS_2 digital video (only available for T-series)

CDS_2 digital video contains 1 Clock signal (Clock), 1 frame valid signal (Vsync), 1 line valid signal (Hsync), and 16 DATA signals (DATA).The video data consists of two parts, the first half of each row of data is divided into an image, which conforms to the YUV422 format. The high 8 bits is the brightness component, the low 8 bits is the chroma component, and the image supports pseudo-color mapping. The second half of each row is divided into temperature data. The actual significant bit is 14 bits, and the higher two bits complement 0.
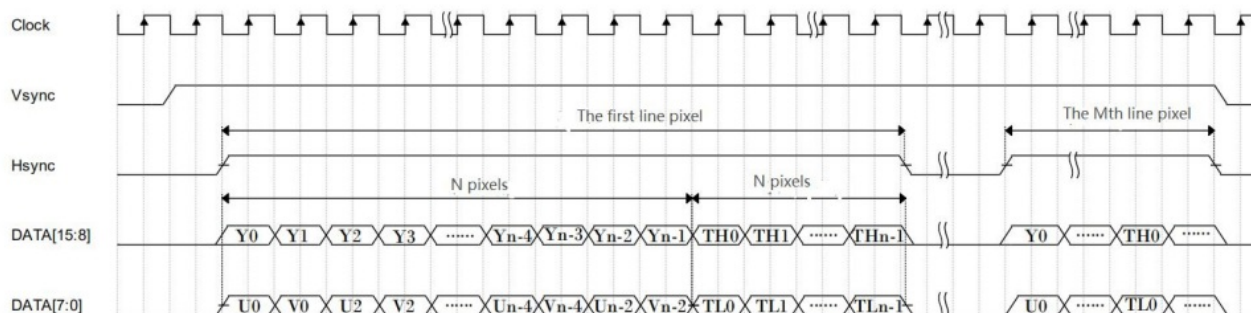

Figure 6 CDS_2 Digital Video Sequence Diagram

Remark:

1. The output image data format is YUV, the high 8bit is Y, the low 8bit is UV.

2. "T" stands for temperature data (effective data bits are 14 bits lower, two bits higher complement 0), "TH" stands for 8 bits higher, and "TL" stands for 8 bits lower.

3. External synchronization signal mode is adopted. "Vsync" represents the frame synchronization signal and "Hsync" represents row synchronization signal.

4. The output data of each row is 2 times of the array N, such as a thermal camera module with array of 640*512, each row contains 640*2=1280 clock cycles (N = 640), and each frame contains 512 rows (M=512).

Product Model	CLK Frequency Clock
M3 384T	22.5MHZ
M3 640T	45.0MHZ

Table 7 CDS_2 CLK Frequency

MIPI Protocol

MIPI digital video includes 1 pair of source-synchronized differential clocks (MIPI_CLK+,MIPI_CLK-), and 4 pairs of differential data lines (MIPI_DATA0+,MIPI_DATA0-,MIPI_DATA1+,MIPI_DATA1-,MIPI_DATA2+, MIPI_DATA2-, MIPI_DATA3+, MIPI_DATA3-).
The clock signal enters the high-speed mode at the beginning of each frame and exits it at the end of the frame. The inter-frame is in the low-power mode (the data and clock lines are both at a 1.2V high level). The data line sends a packet header at the beginning of each frame, and a packet footer at the end of the frame. There are 192 data packets between the packet header and the packet footer, and each long packet data contains one line of valid data. The data format and electrical characteristics comply with the CSI-2 standard and D-PHY protocols with an output clock frequency 200MHz and 4lane data lines.
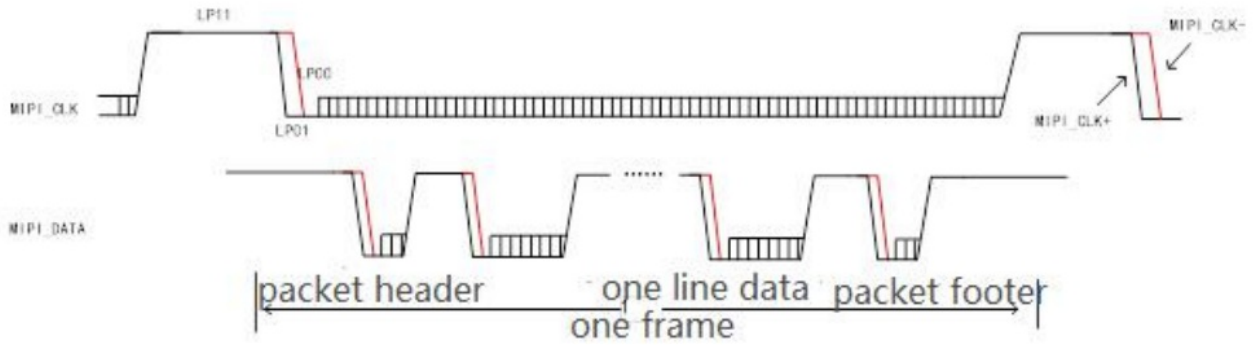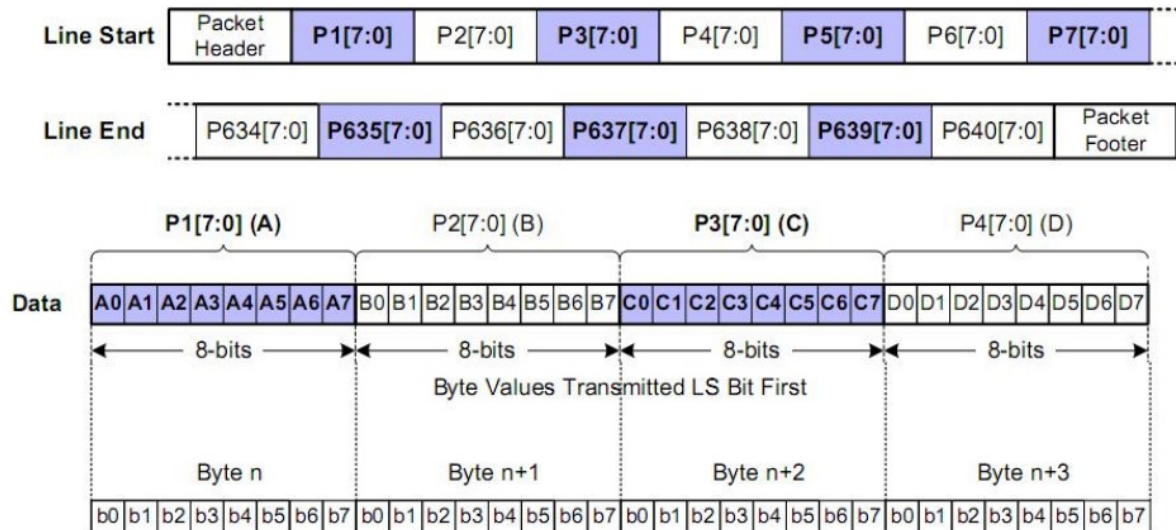
Figure 7 A Frame of Data

Imaging Modules

After the module is connected to power, it will start to output MIPI digital video and data of 640*512 array. The data format can be set to RAW8, RAW14, and YVU422 through the refreshing program, and the settings are as follows:
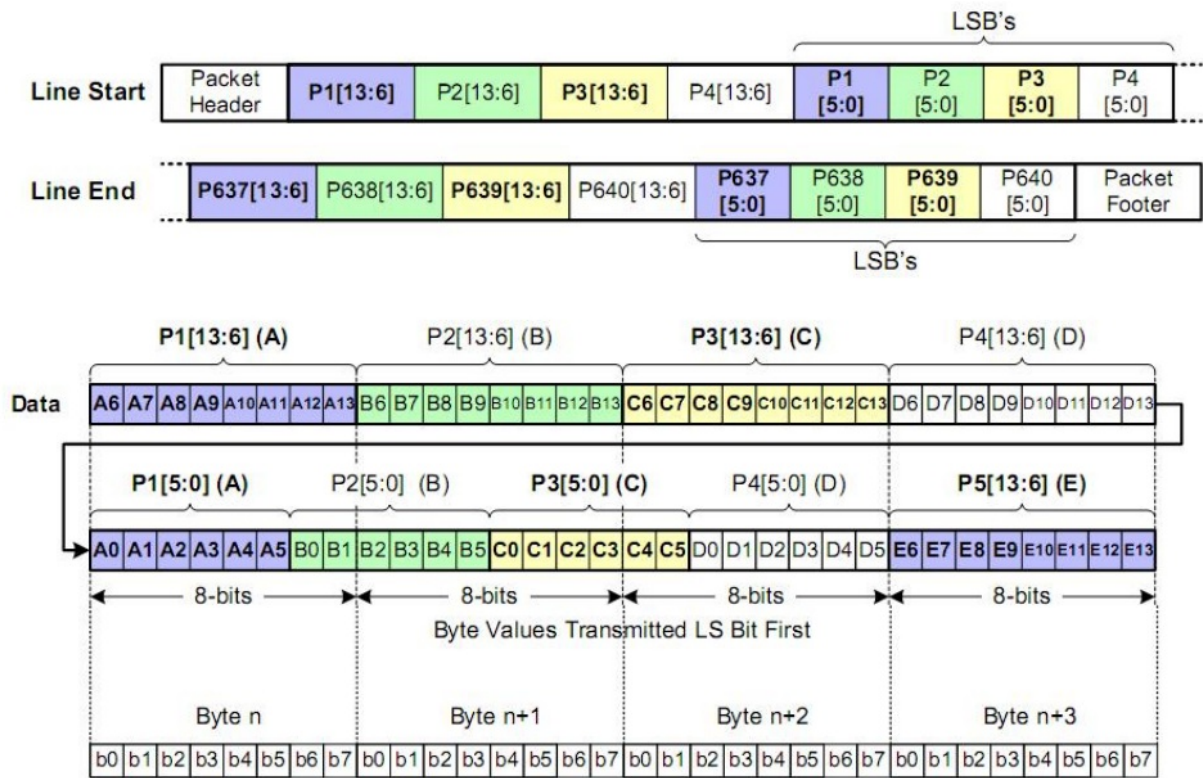
Data Format	Module Setting	Module Output
RAW8	DRC+LVCOMS	DRC
RAW14	NUC+LVCOMS	NUC
YVU422	BT1120	DRC with palette

The data format is the standard MIPI CSI-2 protocol, as shown below.

1. RAW8

2. RAW14

3. YUV422
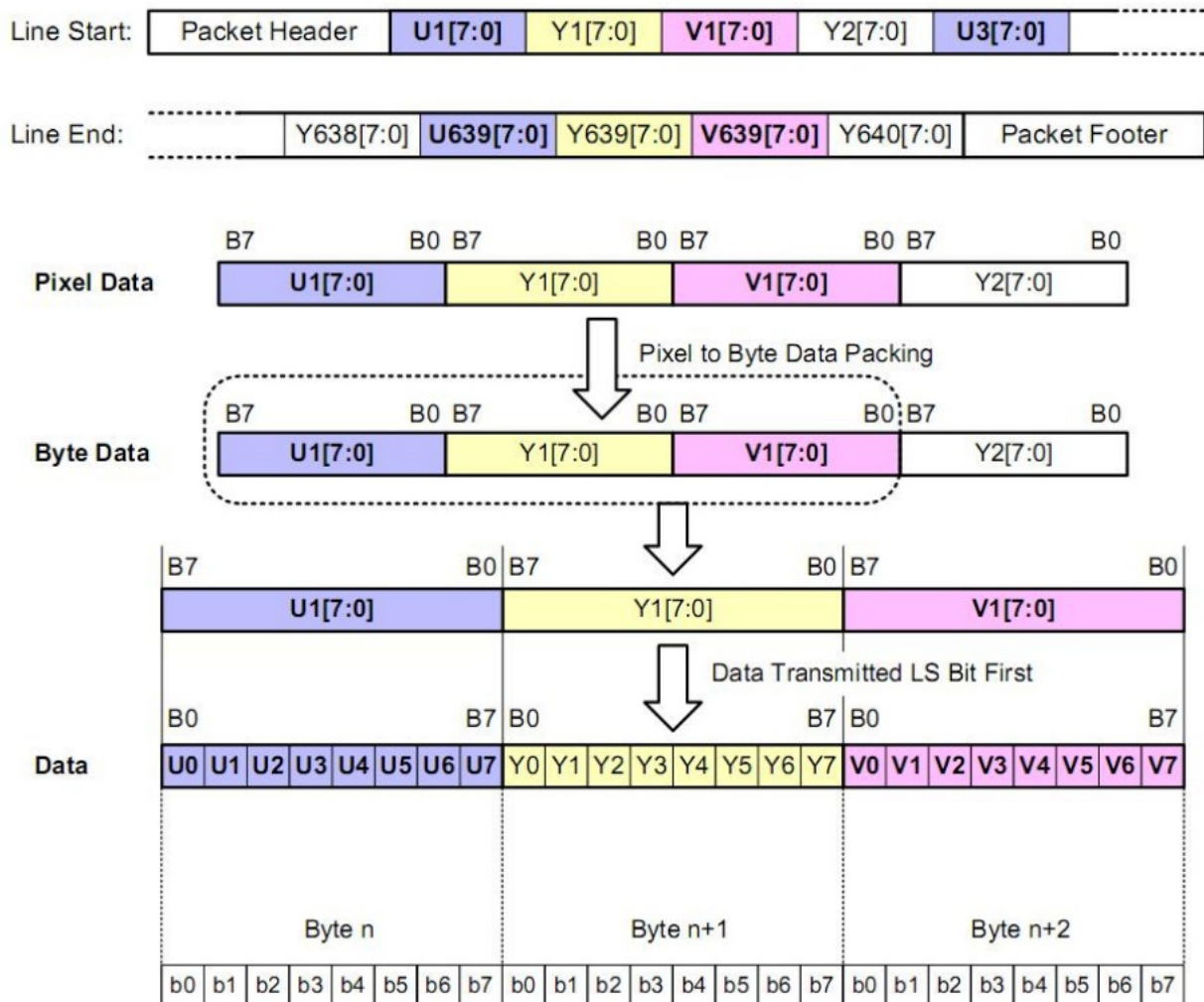
Thermographic Module

After the module is connected to power, it will start to output MIPI digital video and data of 1280*512 array. The

data format can be set to YVU422 format through the refresh program. The module settings are as follows:

Data Format	Module Setting	Module Output
YUV422	CDS2	DRC with palette (left) +temperature(right)

The output of YUV422 is 1280*512 array data. The first 640 pixels of line valid data are image data, which can be output directly in YVU422 format. The last 640 pixels of line valid data are temperature data, which requires that the UYVY backend of 2 pixels is spliced into two 16-bit temperature data by itself, with the more significant byte first. The data format of one line is shown in the figure below.
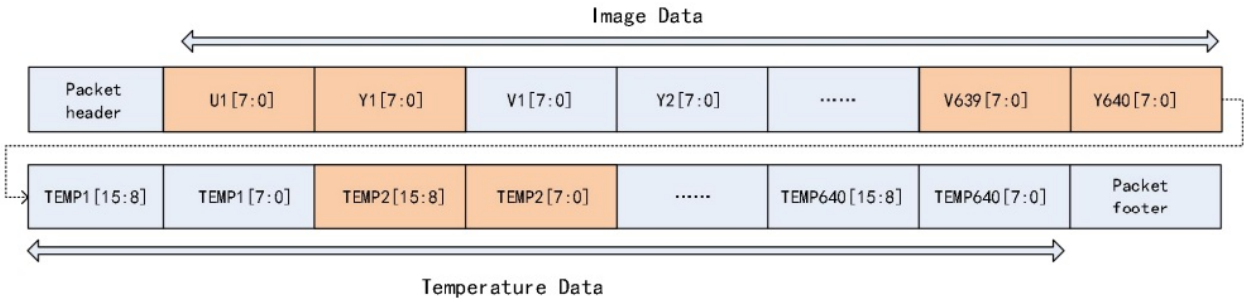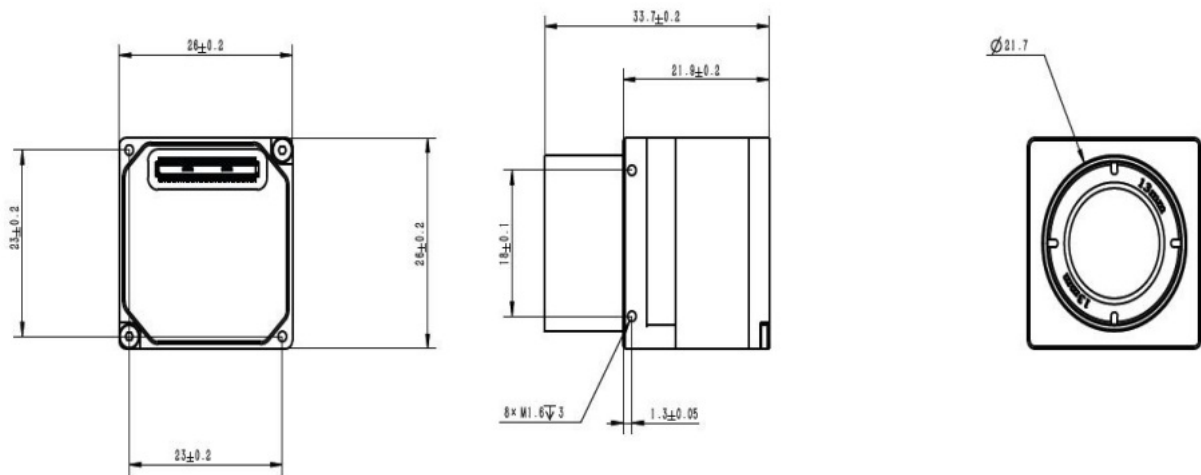

Figure 8 One Line of Valid Data

Dimension

Announcements

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 °C to 50 °C;

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. the Wrong cable should not be connected in case that brings damages to the equipment;

9. Please pay attention to preventing static electricity;

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

Supports and Services

Technical Supports

1. Modification design can be carried out according to different application requirements of users.

2. System training can be carried out for users' technical staff and operators.

After-sales Services

MicroIII is developed and manufactured by IRay. It has good after-sales service guarantees such as technical support and equipment maintenance. If you have any questions, please contact us.

Company Information

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Revision History

Version	Date	Comments	Remark	Revised by	Checked by
V0.1	2019-03	Initial Version			

V0.2	2019-03	Add brightness/contract mode, digital zoom, products module, extension board .			
V0.3	2019-04	Add two product models without lens, expansion board.			
V0.4	2019-09	Modify lens code in product model table	Page 1		
V0.5	2019-12	Add digital video description			
V0.6	2020-02	Add TH series			
V0.7	2020-03	Add TH house requirements			
V0.8	2020-05	16bit LVCMOS description added			
V0.9	2020-05	flange with no lens dia. description added	Page 2		
V1.0.0	2020-06	5.8mm lens description revised	Page 2		
V1.0.1	2020-06	Modify the connector model on MRIII00V100F011C Add a description in temperature measurement range	Page 9 Page 5		
V1.0.2	2020-06	Add two user expansion boards Revise the power supply range of expansion board		Ma Yanjing Lin Wenjuan	Lu Fengjuan
V1.0.3	2020-09	Revise pin definition of 51,53,23 and		Wu	Lu Fengjuan

				Changhao Lin Wenjuan	
		24.			
V1.0.4	2020-10	Add CLK frequency of MicroⅢ 384T and MicroⅢ 640T		Wu Changhao Lin Wenjuan	
V1.0.5	2020-11	Add CLK frequency of CDS_2 and remarks of shutterless			
V1.0.6	2020-11	Modify CLK frequency of CDS_2			
V1.0.7	2020-12	Revise pin definition of 48,50,52 and 54			
V1.0.8	2021-3	Add MIPI description			
V1.0.9	2021-4	Revise description of LVCMOS Add a note for lens parameters			
V1.1.0	2021-4	Revise F-number of 9.1mm lens			
V1.1.1	2021-6	Revise the FOV parameters in Table 1			

Documents / Resources

InfiRay XcoreMicroIII Series Uncooled Thermal Imaging Module [pdf] User Manual
XcoreMicroIII Series, Uncooled Thermal Imaging Module, Thermal Imaging Module, Imaging Module, XcoreMicroIII Series, Module

References

- **InfiRay Thermal Camera Manufacturer/Supplier**

- iRay è‰¾ç¿å…‰ç"µå®˜ç½'-ä¸"ä¸šçºå¤–çfåfä»ª_çfæˆåfå¤œè§†ä»ª_çfæˆåfæµæ©ä»ªåŽ‚å®¶

- iRay è‰¾ç¿å…‰ç"µå®˜ç½'-ä¸"ä¸šçºå¤–çfåfä»ª_çfæˆåfå¤œè§†ä»ª_çfæˆåfæµæ©ä»ªåŽ‚å®¶