Xcore LA Series

384×288/640×512/1024×768

High Performance Thermal Imaging Module

User Manual

V2.2

IRay Technology Co.,Ltd

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This manual is used as a guide. The photos, graphics, diagrams and illustrations provided in the manual are only used to explain, which may be different from the specific product. Please refer to the real object.We try our best to make sure the contents in this manual are accurate.We do not provide any representations or warranties in this manual.

If you need the latest version of this manual, please contact us. IRay Photoelectric recommends that you use this manual under the guidance of professionals.

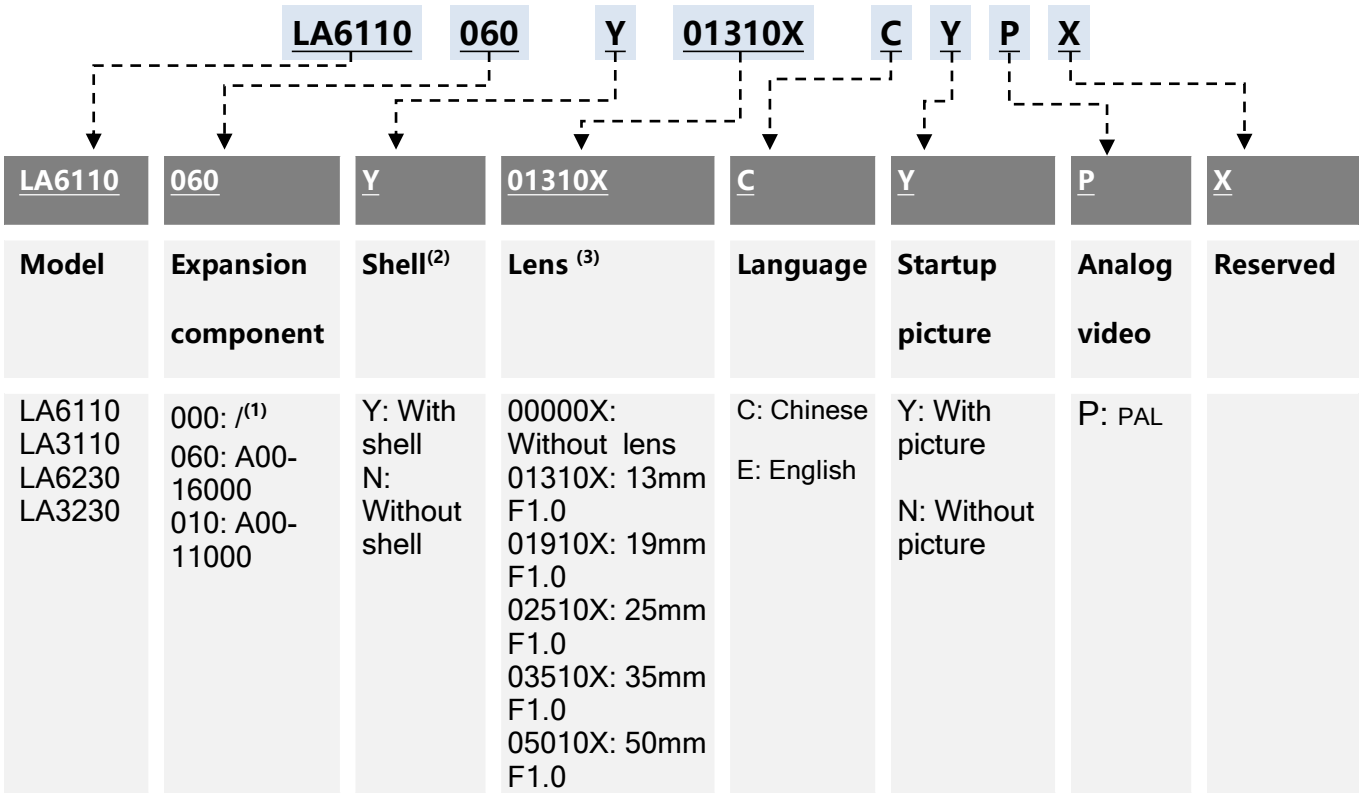
Version History

Version	Date	Description	Remark
V1.5	2016-11	·Initial version	
V2.0	2017-11	·Add product model ·Revise product picture ·Add Lens model	
V2.1	2018-04	·Add the information of lens using in NETD test ·Increasing the multiples of electric zoom to 8 ·Add the video and expanding components description of LA7113 in product model part	
V2.2	2018-09	·Add the description of humidity	Page 6
	2019-09	·Correct the expansion component description in Model table	Page 1, Page 2

1. Overview

Xcore LA series high performance infrared thermal imaging module uses the VOx uncooled infrared focal plane array detector which is developed by IRay as a core component. Xcore LA series has clear images, high sensitivity and supports various of control interfaces and digital video interfaces. It can meet the requirements of applications such as security monitoring and control, fire preventing alarm, high temperature early warning, vehicle night vision, monocular hand-held and so on. It can shorten the development period and reduce the development difficulty in secondary development.

2. Product Model



LA6110	060	Y	01310X	C	Y	P	X
Model	**Expansion component**	**Shell(2)**	**Lens (3)**	**Language**	**Startup picture**	**Analog video**	**Reserved**
LA6110 LA3110 LA6230 LA3230	000: /(1) 060: A00-16000 010: A00-11000	Y: With shell N: Without shell	00000X: Without lens 01310X: 13mm F1.0 01910X: 19mm F1.0 02510X: 25mm F1.0 03510X: 35mm F1.0 05010X: 50mm F1.0	C: Chinese E: English	Y: With picture N: Without picture	P: PAL	

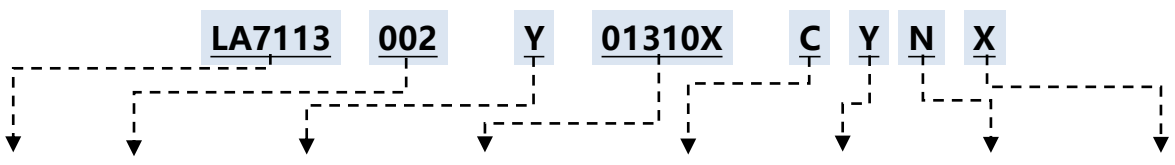
Figure 1 LA6110/LA3110/LA6230/LA3230 Product model

Note:

(1) "000" represents expansion component is not included.

(2) If the expansion component is "010",the shell must be 'Y'; If the expansion component is "000",the shell must be 'N'.

(3) Only "00000X" is optional for LA6230/LA3230 .



LA7113	002	Y	01310X	C	Y	N	X
Model	**Expansion component**	**Shell (5)**	**Lens**	**Language**	**Startup picture**	**Analog video(6)**	**Reserved**
LA7113	000: /(4) 002: A03-10001 003: A03-11002 004: A03-10003	Y: With shell N: Without shell	00000X: Without lens 01310X: 13mm F1.0 01910X: 19mm F1.0 02510X: 25mm F1.0 03510X: 35mm F1.0 05012X: 50mm F1.2	C: Chinese E: English	Y: With picture N: Without picture	N: NTSC Q: without analog video	

Figure 2 LA7113 Product model

Note:

(4) "000" represents expansion component is not included.

(5) If the expansion component is "003",the shell must be 'Y'; If the expansion component is "000",the shell must be 'N'.

(6) If the expansion component is "004", the analog video must be 'Q'. Otherwise, the analog video must be 'N'.

3. Lens Model

Table 1 LA6110/LA3110 optional lens





Array format		640×512	384×288	640×512	384×288	640×512	384×288	640×512	384×288	640×512	384×288
Lens type		13mm F1.0		19mm F1.0		25mm F1.0		35mm F1.0		50mm F1.0	
Focus type		Athermalization		Athermalization		Athermalization		Athermalization		Athermalization	
FOV Horizon * Vertical		45.4°×37°	28.2°×21.3°	32.0°×25.8°	19.5°×14.7°	24.6°×19.8°	14.9°×11.2°	17.7°×14.2°	10.7°×8.0°	12.4°×9.9°	7.5°×5.6°
IFOV		1.308mrad		0.895mrad		0.680mrad		0.486mrad		0.340mrad	
Weight(1)		≤136g		≤173g		≤186g		≤225g		≤346g	
Operating distance(2)	Human detect/ recognition	410m/115m		590m/164m		1030m/195m		1450m/285m		2105m/425m	
	Car detector/ recognition	1100m/285m		1600m/430m		2475m/505m		3390m/725m		4740m/1070m	

Note:

(1) This weight is adaptive to the expansion component of A00-16000 with shell and the weight is different selecting different expansion;

(2) The actual operating distance is different depending on the setting of module, environment condition, user experience, and the type of monitor.

Table 2 LA7113 optional lens





Array format		1024×768	1024×768	1024×768	1024×768	1024×768
Lens type		13mm F1.0	19mm F1.0	25mm F1.0	35mm F1.0	50mm F1.2
Focus type		Athermalization	Athermalization	Athermalization	Athermalization	Athermalization
FOV Horizon * Vertical		57.7°×44.9°	41.3°×31.6°	32.0°×24.3°	23.1°×17.5°	16.3°×12.3°
IFOV		1.0778mrad	0.737mrad	0.560mrad	0.400mrad	0.280mrad
Weight[1]		≤290g	≤281g	≤226g	≤312g	≤327g
Operating distance[2]	**Human** detect/ recognition	498m/140m	716m/199m	1251m/237m	1761m/346m	2556m/516m
	Car detector/ recognition	1336m/346m	1943m/522m	3005m/613m	4116m/880m	5756m/1299m

Note:

(1) This weight is adaptive to the expansion component of A03-10001 with shell, the weight is different selecting different expansion;

(2) The actual operating distance is different depending on the setting of module, environment condition, user experience, and the type of monitor.

4. Product Performance

Table 3 Product performance parameter

Model		LA6230	LA3230	LA6110	LA3110	LA7113
Performance index						
Detector type		VOx Uncooled Infrared FPA Thermal Imaging Sensor				
Resolution		640×512	384×288	640×512	384×288	1024×768
Pixel pitch		20μm		17μm		14μm
Frame rate		50Hz				30Hz
Response spectra		8～14μm or 3～14μm(wide band)				
NETD		≤40mK@25℃,F#1.0(9)				
TEC		Including TEC				
Image Adjustment						
Brightness & contrast adjustment		Manual/Auto0/Auto1				
Polarity		Black hot/White hot				
Palette		Supportable(1)				——
Reticle		Reveal/Hidden/Shift(1)				
Electric zoom		1.0~8.0× Continuing Zooming（step 0.1）(1)				
Image processing		Nun-uniform correction				
		Digital Filter and Imaging Denoising				
		Digital Detail Enhancement				
Video mirror		Right left/Up down/Upper Left Diagonal(1)				
Power supply						
Supply voltage		4～6V DC(2)				5.2～6V DC(2)
		Expansion components support 5-24V DC(2)				
Typical supply voltage		4V DC(2)				5.5V DC(2)
		Expansion components support 12V DC(2)				
Power protection		Over-voltage/Under-voltage/Reverse Connection				
Typical consumption @25℃	**Excluding expansion component**	<1.8W	<1.5W	<1.8W	<1.5W	<2.8W
	Including expansion component	<2.1W	<1.8W	<2.1W	<1.8W	<3.2W

Model		LA6230	LA3230	LA6110	LA3110	LA7113
Interface						
Output video	**Analog video**	1 channel PAL(3)				1 channel NTSC (3) & 1 channel VGA(8)
	Digital video	BT.656 (PAL)				——
		14Bit or 10Bit LVCMOS(4)				
		LVDS(5)				
		Camera Link(6)				
Serial communication interface		RS-232				
		UART (3.3V)				
		RS-422(7)				
Key		4 keys				
Physical Property						
Weight		< 100g				
Size		35mm × 35mm (PCB size)				
Environmental adaptation						
Operating temperature		-40℃ ~ +60℃				
Storage temperature		-45℃ ~ +85℃				
Humidity		5-95%, No Condensation				
Vibration		6.06g, Random vibration, all axial direction				
Impact		100g, 6ms, Final peak sawtooth wave, all axial direction				

Note:

(1) If the output video is not in BT.656 data format, the function of palette, reticle reveal/hidden/shift, electric zoom, and video mirror cannot be used on the product of LA6230/3230/6110/3110;

(2) All the voltages are supplied to the connector on the imaging module;

(3) The data format of analog video is PAL-M in black-white mode and PAL-D in color mode. But the data format of LA7113's analog video is NTSC only and the pixels of 640*480 in centre are displayed;

(4) The 14Bit or 10Bit LVCMOS digital video is supportable only on the Hirose 60pin connector of module;

(5) LVDS digital video is supportable on the Hirose 60pin connector of module and the A00-16000 or A03-10001 expansion component;

(6) Camera Link digital video is only supportable on the expansion component of A00-11000 or A03-11002;

(7) RS-422 serial communication interface is supportable on the expansion components of A00-16000, A03-10001, A00-11000, A03-11002 and A03-10003;

(8) VGA video is only supportable on the expansion of A03-10003;

(9) The lens of 40mm&F1.0 is used in NETD test.

5. User Interface Description

The Hirose 60PIN connector named DF12-60DS-0.5V(86) is used on the imaging module and power supply interfaces, RS-232 interfaces, UART interfaces, analog video interfaces, BT.656 digital video interfaces, 14Bit or 10Bit LVCMOS digital video interfaces, LVDS digital video interfaces and 4 keys interfaces are contained on the connector.

Among the digital video interfaces, BT.656 digital video(not support on LA7113) use part of the interfaces of LVCOMS digital video and the interfaces of LVDS digital video are independent. The default state of each digital video is off and they can be turned on by the user upper computer software or sending specific commands through serial port. Users can choose different digital data sources depending on their needs and only one digital data source is output at the same time.

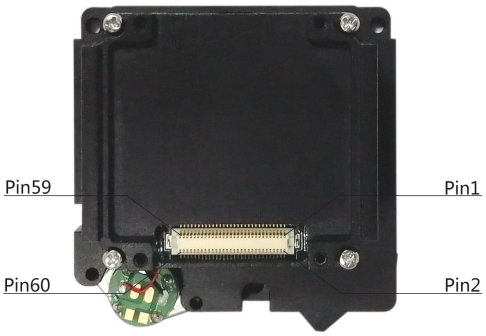


Figure 3 Hirose 60pins user interface (Taking LA7113 for example)

5.1 Hirose 60PINS Connector Definition

Table 4 Hirose 60PINS connector definition

NO.	Name	Type	Description			
1、2、3、4	Power Supply	Power	Power input (1)			
9	3.3V	Output	Power output (TYP. 3.3V/100mA)			
11～14、20、40、55、57	——	——	Not available			
15	RS-232_RX	Input	RS-232 Serial communication interface(2)			
16	RS-232_TX	Output				
17、19	VGND	Power	Ground of analog video(3)			
18	VIDEO	Output	Analog video			
23	DV1	Output	14Bit or 10Bit LVCMOS Digital video (3.3V)	Data	BT.656 (3.3V)	Data
24	DV0			Data LSB		Data signal LSB
25	DV3			Data signal		Data signal
26	DV2			Data signal		Data signal
27	DV5			Data signal		Data signal
28	DV4			Data signal		Data signal
29	DV7			Data signal		Data signal MSB
30	DV6			Data signal		Data signal
31	DV9			Data signal MSB(10bit)		——
32	DV8			Data signal		——
33	DV11			Data signal		——
34	DV10			Data signal		——
35	DV13			Data signal MSB(14bit)		——
36	DV12			Data signal		——
37	Line_Valid			Line valid signal		——
38	Frame_Valid			Frame valid signal		——
39	Clock			Clock signal		Clock signal
44	UART_TX	Output	UART communication interface (3.3V) (2)			
46	UART_RX	Input				

NO.	Name	Type	Description	
48	KEY1	Input	Key interface (2.5V) (3)	C (Correction)
50	KEY2	Input		- (Minus)
52	KEY3	Input		+ (Plus)
54	KEY4	Input		M (Menue)
43	LVDS_DATA1+	Output	LVDS digital video (VCCIO=2.5V)	Data signal
45	LVDS_DATA1-	Output		
47	LVDS_DATA2+	Output		Data signal
49	LVDS_DATA2-	Output		
51	LVDS_SYNC+	Output		Data signal
53	LVDS_SYNC-	Output		
58	LVDS_CLK+	Output		Clock signal
60	LVDS_CLK-	Output		
5、6、7、8、10、21、22、41、42、56、59	GND	Power	Ground of power(4)	

Note:

(1) The typical voltage is 4VDC (LA7113 is 5.5VDC), the setup time of power (10%~90%) < 4ms, peak current > 2.5A, ripple&noise < 40mVp-p, above is the requirement of power supply for imaging module.

(2) All the TX and RX in serial communication interfaces point to the imaging module's sending and receiving.

(3) The logic '0' is valid for KEY1~KEY4, there is no pull-up resistor inside of the module. It is necessary for users to design the pull-up circuit when users design the expansion component themselves and the recommended resistance is 10KΩ.

(4) GND and VGND is short connected inside of the imaging module.

5.2 14bit or 10bit LVCMOS Digital Video

This imaging module can output LVCOMS video of 14bits or 10bits. The signals of LVCMOS video consists of a clock signal(Clock), a line valid signal(Line_Valid), a frame valid signal(Frame_Valid) and 14 bits data signals(DV0~DV13). The format of original data(ORG), non-uniformity correction data(NUC) or denoising data is 14bits which is DV[13:0]. Among them, DV0 is LSB and DV13 is MSB. The format of DRC is 10bits which is DV[9:0]. Among them, DV0 is LSB and DV9 is MSB.

The product of LA6230, LA3230, LA6110 and LA3110 support the function of brightness/contrast adjustment and polarity selection, but not support the function of palette selection, reticle control, electric zoom and image mirroring. The product of LA7113 support the function of brightness/contrast adjustment, polarity selection, reticle control, electric zoom and image mirror, but not support palette selection function.

Table 5 LVCMOS clock frequency

Product model	Clock frequency (clock)
LA3230	6.000MHz
LA6230	20.000MHz
LA3110	6.000MHz
LA6110	18.000MHz
LA7113	25.000MHz

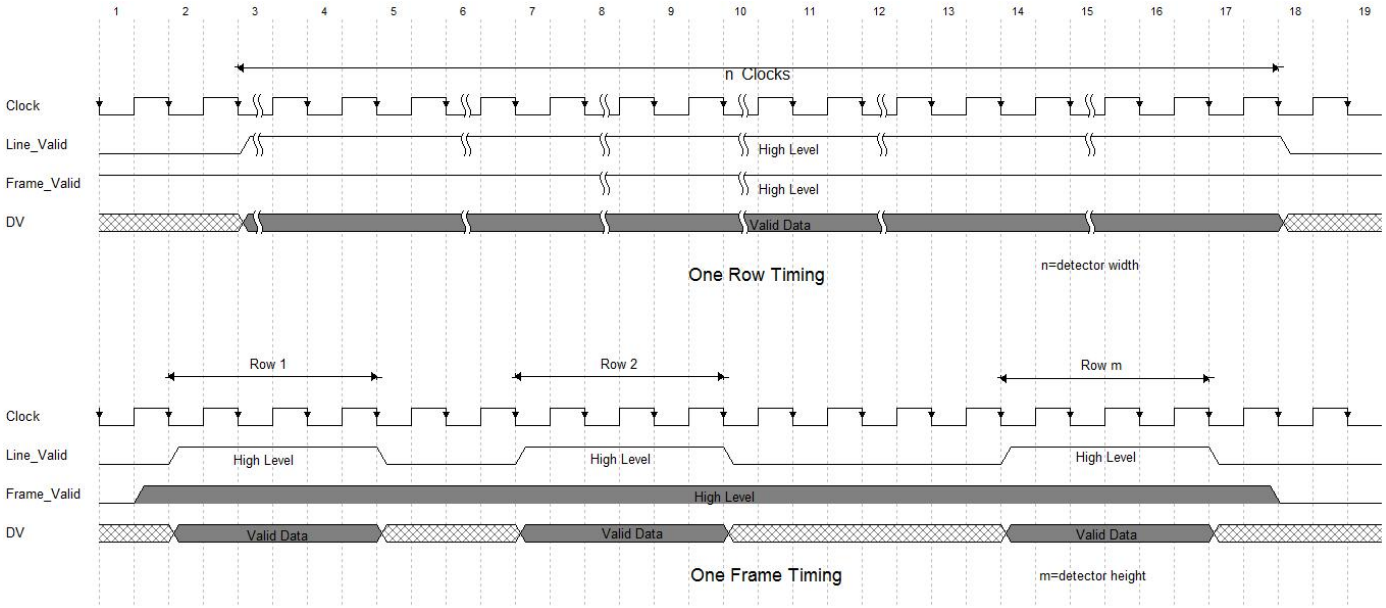


Figure 4 14bit or 10bit LVCMOS digital video timing diagram

Note:

(1) It is recommended to sample the data of DV at the rising edge of Clock;

(2) The logic '1' is valid for Line_Valid、Frame_Valid;

(3) After the Line_Valid turns to be valid and remains n Clocks, the data from line 1 to line n are valid.

5.3 LVDS Digital Video

This imaging module can output LVDS digital video which consists of one clock signal(LVDS_CLK), one synchronizing signal(LVDS_SYNC) and two data signals (LVDS_DATA1 and LVDS_DATA2). The output data can be 14bits or 10bits. When users select the ORG data, NUC data or DNS data as data source, the output data are 14bits. When users select DRC data as data source, the output are 10bits. Each pixel occupies seven clocks and the high 7bits of the 14bits data which are bit[13:7] are transformed by line LVDS_DATA2 and the low 7bits of the 14bits data which are bit[6:0] are transformed by line LVDS_DATA1. LVDS_SYNC is the frame synchronizing signal and "111XXXX" is the flag of frame synchronizing, "11XX1XX" is the flag of pixel valid, "11XX0XX" is the flag of idle state. The sequence of flags are that MSB is in the front. The LVDS digital clock frequency are shown in table 6.

When 10bits LVDS digital video is selected, LA6230, LA3230, LA6110 and LA3110 support the function of brightness/contrast adjustment and polarity selection, but not support the function of palette selection, reticle control, electric zoom and image mirroring. The product of LA7113 support the function of brightness/contrast adjustment, polarity selection, reticle control, electric zoom and image mirror, but not support palette selection function.

Table 6 LVDS Clock frequency

Product model	Clock frequency (LVDS_CLK)
LA3230	42.000MHz
LA6230	140.000MHz
LA3110	42.000MHz
LA6110	126.000MHz
LA7113	175.000MHz

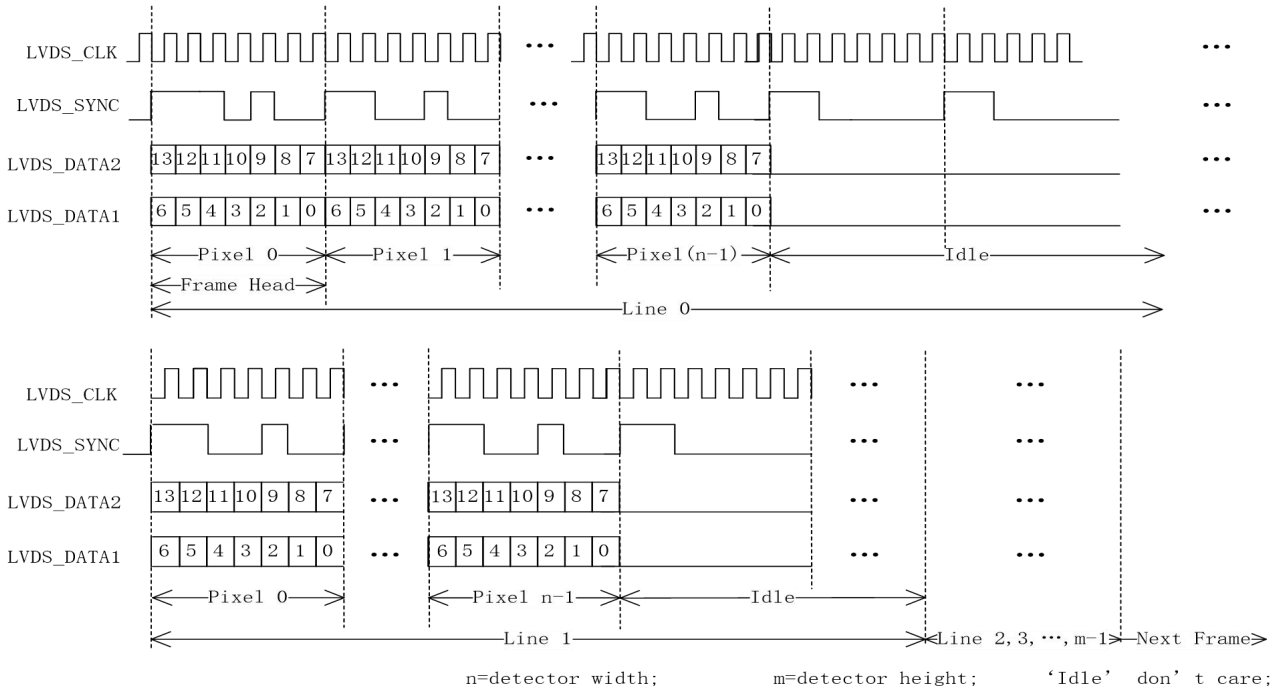


Figure 5 LVDS digital video timing diagram（Taking 14bit、n×m array for example)

5.4 BT.656 Digital Video

The imaging modules of Xcore LA series except for LA7113 support the standard BT.656 digital video. The digital video of BT.656 consists of one clock signal(Clock) and eight data signals(DV0~DV7). The BT.656 digital video supports the functions of brightness/contrast adjustment, polarity selection, palette selection, reticle control, electric zoom and image mirror. And the data source of BT.656 must be the DRC data.

The BT.656 digital video of LA6230、LA3230、LA6110、LA3110 is in PAL and the display width is 720/768 in analog video width. The display height is consistent with that of analog video. (As shown in figure 6) .

Figure 6 Analog video in PAL VS BT.656

5.5 User Expansion Component

There are different optional user expansion components for Xcore LA series high performance uncooled infrared thermal imaging module and can be used to convert interface and expand functions.

Table 7 User expansion components

Model	Expansion Component Figure	Interface	Suitable Thermal Model
A00-16000		Power supply: 5-24V RS232 RS422 Analog video LVDS digital video	LA6110、LA3110、 LA6230、LA3230
A00-11000		Power supply: 5-24V RS232 RS422 Analog video CameraLink digital video	LA6110、LA3110、 LA6230、LA3230
A03-10001		Power supply: 5-24V RS232 RS422 Analog video LVDS digital video	LA7113
A03-11002		Power supply: 5-24V RS232 RS422 Analog video CameraLink digital video	LA7113
A03-10003		Power supply: 5-24V RS232 RS422 Analog video VGA video	LA7113

Note: For details, please refer to the "User Expansion Component Manual".

6. Announcements

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

1. The product should not be made towards the sun directly and other high-intensity radiation sources;
2. The optimal environment temperature for operating is - 20 ℃ to 50 ℃;
3. Do not touch or hit the detector window with hands or other objects;
4. Do not touch the equipment and cables with wet hands;
5. Do not scrub your equipment with diluents;
6. Should not unplug and plug other cables without disconnecting the power supply;
7. Wrong cable should not be connected in case that brings damages to the equipment;
8. Please pay attention to prevent static electricity;
9. Please do not disassemble the equipment. If there is any fault, please contact our company, and professional personnel will carry out maintenance.

7. Supports and Sevices

7.1 Technical Supports

1．Refiting and designing schemes according to users' application requirements；

2．Providing professional and systematic technical training for users and operators;

3．Answering the technical puzzles and design problems during the process of users’ design and use.

7.2 After-sales Sevices

Xsentry IR panoramic monitoring system is developed by our company. It has good after-sales service guarantee such as equipment maintenance. If you have any requirements, please contact us.

8. Company Information

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