CMOS Flat Panel Sensor

Xmaru0505CF ™

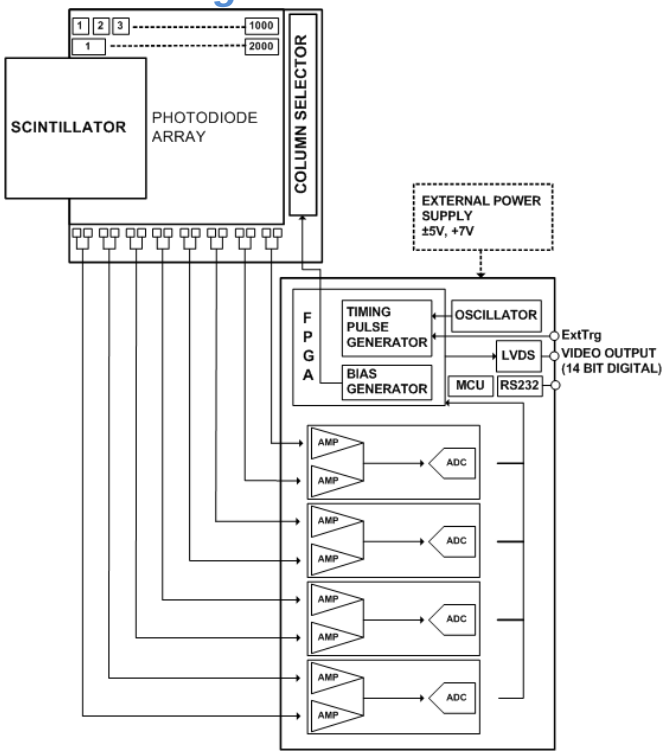
Overview

The Xmaru0505CF sensor is fully adaptable for real-time imaging application of digital x-ray imaging systems with high resolution. CMOS active pixel type sensor makes extremely low noise level and high sensitive performance. Large-area flat panel sensor, ~5x5cm, gives wide application in digital x-ray imaging. 14 bits video out ensures the wide dynamic range. The high physical and functional performance of The Xmaru0505CF gives competitive image quality.

Feature

- **Large-area: 5.4x4.8 cm**
  2249x2000 pixel (single operation)
- **High resolution:**
  ~ 10 lp/mm (Single operation)
- **High-speed frame rate**
  ~ 20 frames/s (2x2 binning)
- **14-bit digital output**
- **High sensitivity**
- **Extremely low electrical noise**

BlockDiagram



Applications

- **Digital radiography**
- **Computed tomography**
  (Micro CT, Dental CT etc.)
- **Non-destructive inspection (off-line)**
  (PCB, BGA etc.)

The Xmaru0505CF is large-area flat panel x-ray detector with one chip CMOS. Due to seamless one chip CMOS, there is no data missing or artifacts. And also we ensure physical reliability of sensor. Xmaru0505CF employs several options for x-ray-to-light converter with FOP+CsI:Tl and FOP+Lanex. The FOP makes much less light blurring against scintillator only. This is the reason why Xmaru0707CF have higher resolution than any other sensors. It also absorbs most of x-ray. The Xmaru0505CF derives with 8 channels. Analog channel can be MUXed to go to 4 dual channel ADC. This characteristic gives the lowest channel variation and fast readout speed with stable signal. The speed is up to 20fps with high resolution. Xmaru0505CF make image with internal or external trigger. Readout speed can be controlled by external trigger in external trigger mode.

General Information

Parameter	Description
Readout	Charge amplifier array
Video output	LVDS 14 bit
Output data rate	32 MHz

Power Supply Information

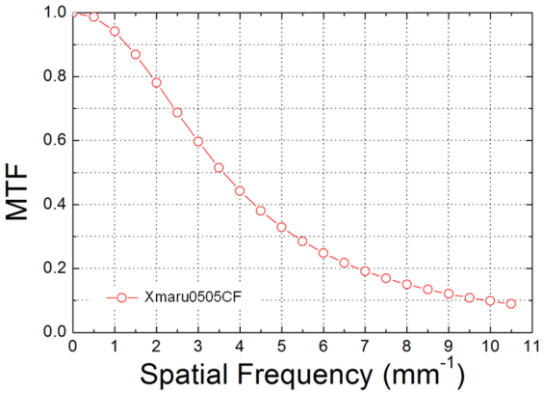
Parameter	Description
Supply Voltage	+5V (±0.2), -5V (±0.2), +12V (±0.2)
Current	3A, 1A, 1A
Input Voltage for Ext. Trg.	0 to 5V

Specification

Parameter	Unit	Specification	
		Single operation*1	2x2 binning
Sensor Type	-	CMOS photodiode array	
X-ray Convertor	-	FOS (FOP+CsI:Tl / FOP+Lanex)	
Dimension (W x L x T)	mm	146 x 215 x 29.8	
Active Area	mm	54 x 48	
Pixel Size	mm	0.024	0.048
Number of Active Pixels	pixels	2249 x 2000	1124 x 1000
Number of Effective Pixels*2	pixels	2240 x 1990	1115 x 990
Frame Rate Internal	fps	5	20
Frame Rate External	fps	~ 5	~ 18
Resolution*3	lp/mm	10	8.5
Noise*4	e-	< 144	
A/D	bits	14	
Sensitivity*5	ADU/μGy*6	> 900	
Dynamic Range	dB	> 68	
Defect Line	lines	Max. 20	
Energy Range	kVp	~ 160 kVp	

*1: Full resolution mode (non binning)
*2: X-ray sensitive area
*3: Spatial resolution @ over MTF 10%
*4: RMS of dark current
*5: Measured @ 80kVp, 8 mm Al filter
*6: μGy is the unit of X-ray exposure (1mR = 8.69 μGy)

Resolution

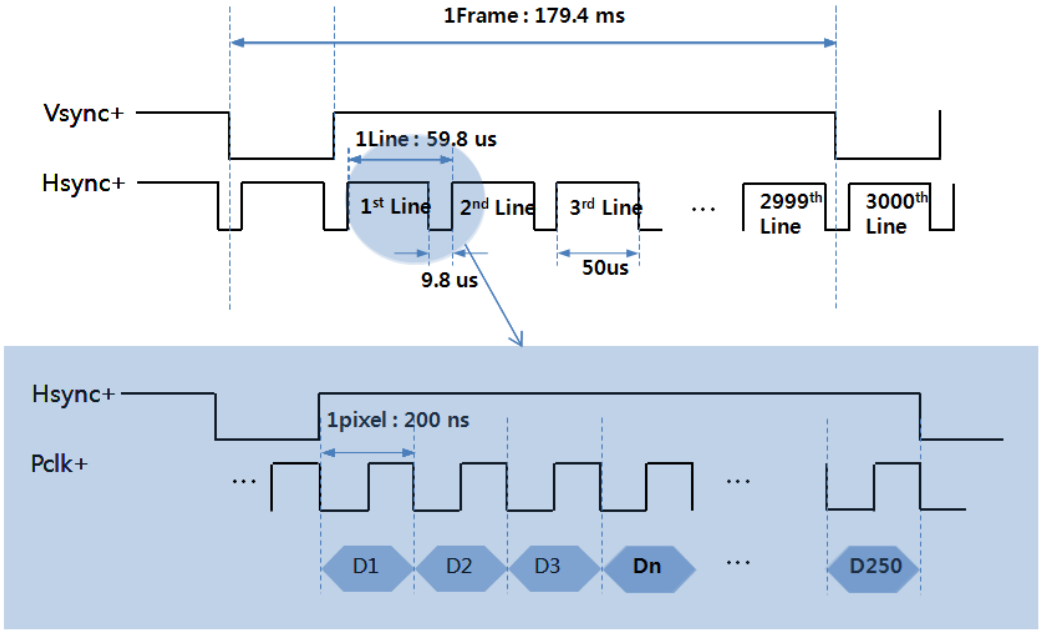


≫Timing Chart

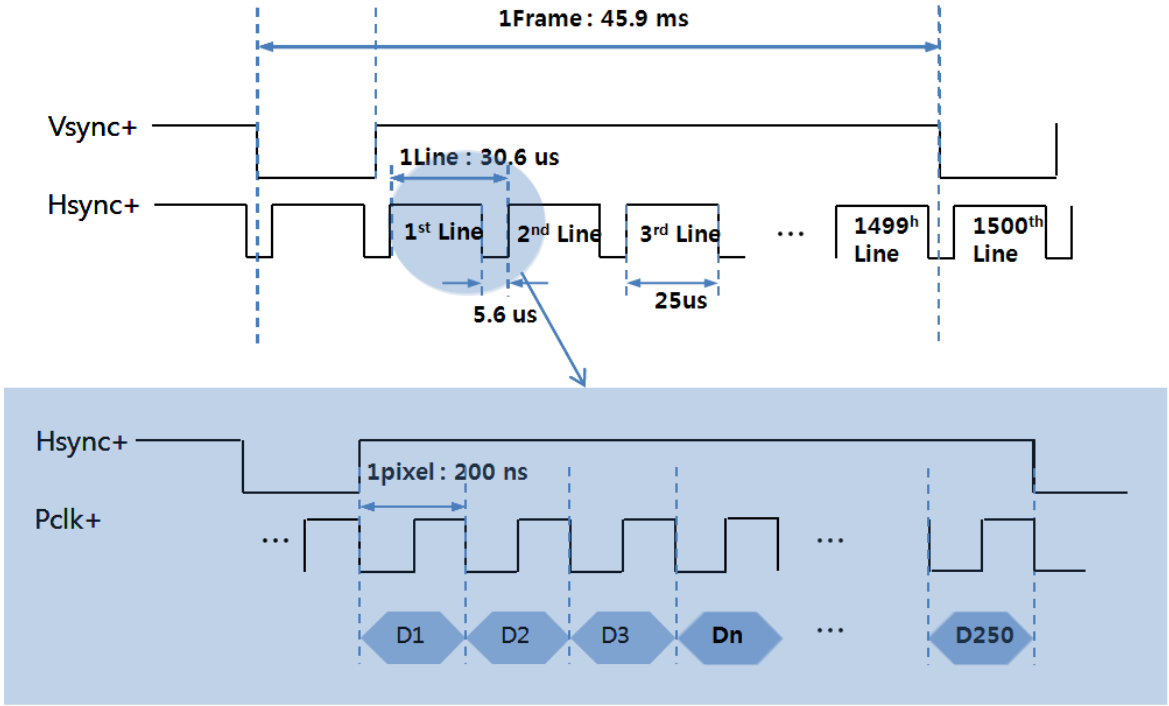
Readout timing of Xmaru0505CF is followings. To acquire image, frame grabber setting or proper camera file should be needed considering timing information of Xmaru0505CF.

◉ Internal mode

-. Normal Mode



-. Binning Mode

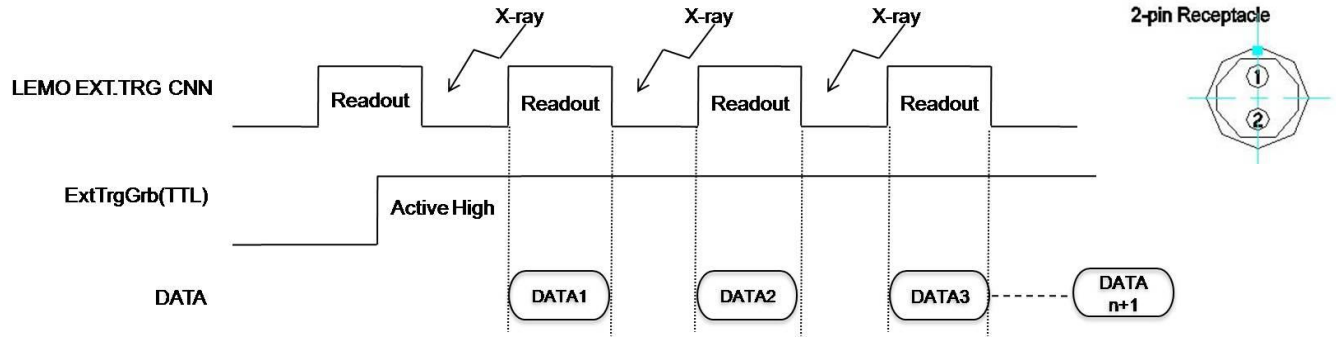


External mode

Xmaru0505CF can be controlled frame rate by input external trigger pulse. Readout sequence in external trigger mode is following. External trigger pulse should be inputted with proper input voltage.

[Table 1] External trigger pin map and derive condition

Mode		Frame Grabber Reception (80 pin)		Ext. Trig. Reception (2 pin)	
		Pin #33 (IntExt_SEL)	Pin #34 (ExtTrgGrb)	Pin #1	Pin #2
Internal Trigger Mode		Low	Input signal is ignored	Input signal is ignored	
External Trigger Mode	Use F/G	High	Pulse signal (TTL)	Open	
	Use Ext. LEMO		High or Open	+ 5V	Pulse

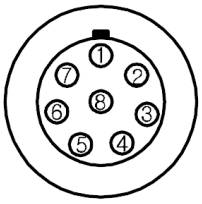


≫System Requirements

To operate Xmaru0505CF with full performance, proper system is required.

- PC: IBM PC with Windows XP OS or Vista OS 32bit.
  RAM should be at least 2GB.
  PCI-E or PCI (at least 66MHz)slot should be at least one .
- Frame grabber card
  16bits or more data acceptable
  LVDS / Camera link interface signal
  You can make the proper camera file through the supplier of F/G card with their own camera file information.
- Power supply: +5V (±0.2V), -5V (±0.2V), +12V (±0.2V)
  The input voltage is described in figures of geometric information.
  See power supply connector pin map (Table2).
  The impedance of power cable should be low enough to avoid voltage drop.
  Low noise power source is recommended to avoid additive noise.
  Please check the ground terminal.
- Frame grabber card cable
  Please use proper F/G cable, matched with F/G connector on Xmaru0505CF.
  See F/G connector pin map (Table 3).
- External trigger cable
  Please use proper Ext. Trg. cable, matched with Ext. Trg. connector on Xmaru0505CF
  See Ext. Trg. cable pin map.

[Table 2] Power supply connector pin map on the sensor side



Model	Pin	Description	Pin	Description
SPB-1R9-308S 8PIN	1	+5VD	5	-5V
	2	+5VD	6	GND
	3	GND	7	+12V
	4	-5V	8	+12V

[Table 3] Video Output connector pin map (Model: PCS-E80LMD+, Company: *Honda connector*)

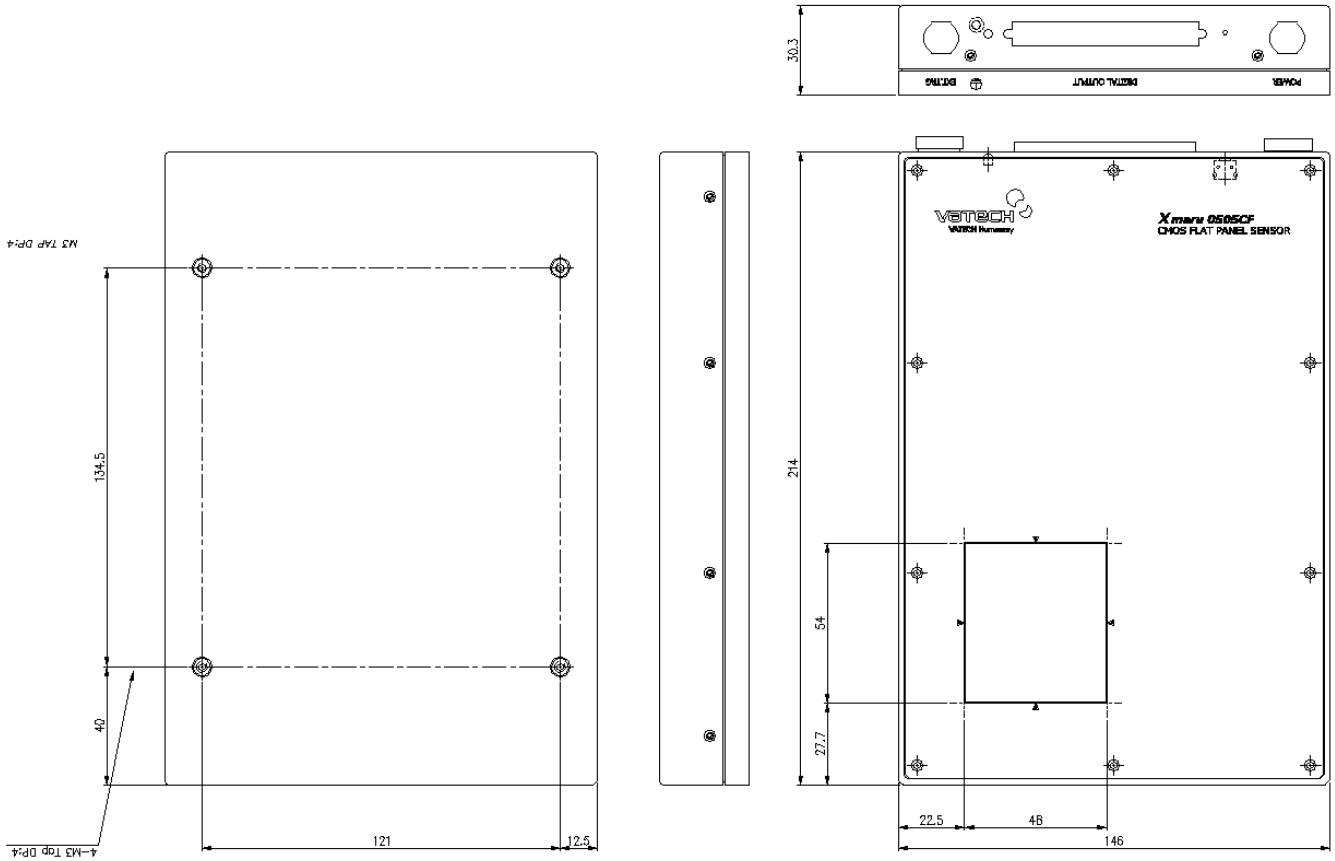
1) Camera Link Connector Pin Map

80Pin	Signal	26Pin	80Pin	Signal	26Pin
41	GND	1	54	SERIAL_IN-	7
42	GND	14	55	SERIAL_OUT-	19
43	TXOUT0-	25	56	SERIAL_OUT+	6
44	TXOUT0+	12	57	IN_TRG_CL-	18
45	TXOUT1-	24	58	IN_TRG_CL+	5
46	TXOUT1+	11	59	BINNING_CL-	17
47	TXOUT2-	23	60	BINNING_CL+	4
48	TXOUT2+	10	61	CAMERA_CNTR3-	16
49	TXCLKOUT-	22	62	CAMERA_CNTR3+	3
50	TXCLKOUT+	9	63	CAMERA_CNTR4+	15
51	TXOUT3-	21	64	CAMERA_CNTR4-	2
52	TXOUT3+	8	65	GND	13
53	SERIAL_IN+	20	66	GND	26

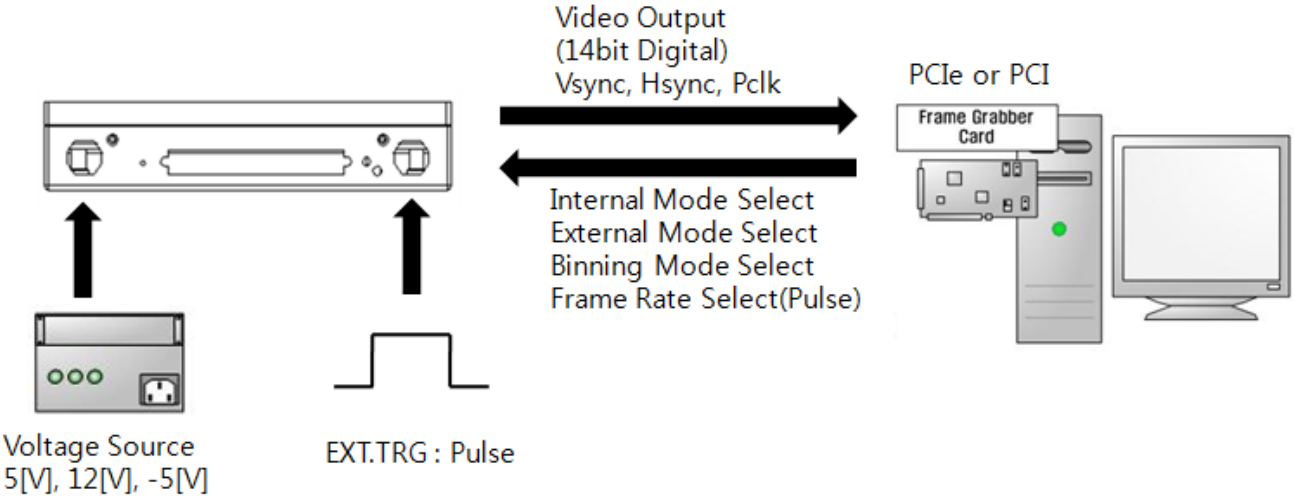
2) LVDS Connector Pin Map

68Pin	Signal	100Pin	68Pin	Signal	100Pin	RS232C 9P
1	A_Data1+(LSB)	1	23	A_Data12+	23	Reserved
2	A_Data1-(LSB)	2	24	A_Data12-	24	Reserved
3	A_Data2+	3	25	A_Data13+	25	Reserved
4	A_Data2-	4	26	A_Data13-	26	Reserved
5	A_Data3+	5	27	A_Data14+(MSB)	27	Reserved
6	A_Data3-	6	28	A_Data14-(MSB)	28	Reserved
7	A_Data4+	7	33	IN_TRG	39	Reserved
8	A_Data4-	8	34	BINNIG_EX	35	Reserved
9	A_Data5+	9	35	F_VSYNC+	41	Reserved
10	A_Data5-	10	36	F_VSYNC-	42	Reserved
11	A_Data6+	11	37	F_HSYNC+	43	Reserved
12	A_Data6-	12	38	F_HSYNC-	44	Reserved
13	A_Data7+	13	39	F_PIXCLK+	49	Reserved
14	A_Data7-	14	40	F_PIXCLK-	50	Reserved
15	A_Data8+	15	70	PCTX	Reserved	2
16	A_Data8-	16	71	PCRX	Reserved	3
17	A_Data9+	17	73	EX_TRG	Reserved	Reserved
18	A_Data9-	18	74	P_EXT_RING	Reserved	9
19	A_Data10+	19	78	MODE_SW_EX	Reserved	Reserved
20	A_Data10-	20	79	GND	99	5
21	A_Data11+	21	80	GND	100	5
22	A_Data11-	22				

Geometric Information



Sensor Connection



CAUTION

Handle the sensor carefully, it may be damaged, if something is hit, dropped. Please do not place the sensor near vibration or shock. The sensor will be malfunction or permanent damaged.

Please keep in mind the usable x-ray energy range (40~160kV). If Xmaru0505CF is exposed over 160kV energy level of x-ray, we cannot ensure full performance and life-time of sensor. Also the warranty will be expired.

Be sure to connect the cables to the proper connectors. Before using, you should check the information and deriving condition of sensor, such as power source and external trigger and digital out cable.

Don’t load object over 20 kg locally on the window surface. Be sure to connect the sensor ground.

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