

Diagonal 59.8 mm (Type 3.73) CMOS Solid-state Image Sensor with Square Pixels for X-ray detectors

Description

IMX711-AABY is a CMOS image sensor for X-ray measurement for scientific instrumentation with 384 horizontal pixels and 728 vertical pixels, for a total of approximately 280k pixels. It has a 650 μm thick FZ substrate as a photodetector and detects X-rays by direct conversion. It also has 48 channels of high-speed communication (2.88 Gbps/ch) with an embedded clock. The maximum frame rate is 26.1 k frames/s in all-pixel scan mode by adopting a unique column A/D converter circuit, in-pixel CDS, and pipeline operation.

Applications:

X-ray and electron beam detectors for scientific instrumentation. For 12 keV X-rays, the saturation signal level is 1800 photons/frame (at Mode-C Cont/HDR), the saturation count rate is 30 M cps (Mode-C Cont) or 600 M cps (at Mode-C HDR), and the noise is 0.018 photons (at Mode-C Cont/HDR), making it possible to detect 1 photon while supporting a high saturation count rate.

Features

- ◆ Stacked structure (photodiode (FZ substrate: 650 μm) + signal processing chip) CMOS image sensor
- ◆ Input clock frequency 84.76 MHz, differential input
- ◆ 4-wire serial communication circuit
- ◆ SLVS-EC high-speed serial data output (2.88 Gbps) 48 lanes
- ◆ In-pixel CDS
- ◆ 12 bit A/D converter
- ◆ A/D converter automatic switching circuit (coarse / fine)
- ◆ Built-in PLL
- ◆ Gain selection function (High Gain / Middle Gain / Low Gain)
- ◆ Built-in automatic gain selection digital logic circuit (High Gain / Middle Gain)
- ◆ Variable-speed global shutter function
- ◆ Maximum frame rate in all-pixel scan mode: 26.1 k frames/s
- ◆ Maximum frame rate in 1/8 ROI mode: 117.5 k frames/s
- ◆ 1/2 ROI function
- ◆ 1/4 ROI function
- ◆ 1/8 ROI function
- ◆ A/D multisampling function
- ◆ SLVS-EC 16 lane time division readout function
- ◆ Thermometer (Not a calibration value)
- ◆ Pixel circuit output without pixel connection
- ◆ OTP (One Time Programmable Read Only Memory)

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Device Structure

- ◆ CMOS image sensor
- ◆ Image size Diagonal 59.8 mm (Type 3.73)
27.879 mm (H) × 52.853 mm (V)
- ◆ Number of active pixels 384 (H) × 728 (V) – 16 * 279,536 pixels
* 16 pixels are designed without photodiodes.
- ◆ Unit cell size 72.6 μm (H) × 72.6 μm (V)
- ◆ Substrate material Silicon
- ◆ Sensor thickness 650 μm
- ◆ Package Chip Size Package (CSP) : 30.357 mm (H) × 69.738 mm (V)
Total 302 pins with 4 connectors
Connector Part Numbers (Qty)
FX11B-100S/10-SVP (2), FX11LB-100S/10-SV (1), SM02B-BHSS-1-TB (1)

Image Sensor Characteristics

(Tj = 20 °C)

Item		Symbol	Minimum	Typical	Maximum
Peak Signal	High gain	PSH	65 ke-	-	-
	Middle gain	PSM	6.2 Me-	-	-
	Low gain	PSL	31.4 Me-	-	-
Conversion Gain	High gain	CGH	30.9 e- / LSB	36.4 e- / LSB	41.9 e- / LSB
	Middle gain	CGM	2878 e- / LSB	3386 e- / LSB	3894 e- / LSB
	Low gain	CGL	15086 e- / LSB	17748 e- / LSB	20410 e- / LSB
Noise average	High gain	NAH	-	34 e-rms ^{*1} 22 e-rms ^{*2}	60 e-rms
	Middle gain	NAM	-	-	5300 e-rms
	Low gain	NAL	-	-	27800 e-rms

*1: Averaged from measured values of active pixels

*2: Averaged from measured values of active pixels when using A/D multisampling (16 times)

Basic Drive Mode

Drive mode	Gain	Number of active pixels	Maximum frame rate [frames/s]	Output interface	ADC [bit]	Gain flag [bit/pixel]
Mode-A	High gain	279,536	26.1 k	SLVS-EC	12	0
Mode-A Multisampling 16 times			1.6 k			
Mode-C Cont. Mode-C HDR	Automatic gain selection (High / Middle)		17.4 k			2
Mode-C XFEL	High gain Middle gain Low gain		5.0 k			

X-ray sensitivity characteristics

