

CCD area image sensor

S7199-01

Front-illuminated FFT-CCDs for X-ray imaging



S7199-01 is a family of FFT-CCD image sensors specifically designed for X-ray imaging. FOS (Fiber Optic plate with Scintillator) that converts X-ray into visible-light is mounted on a CCD chip, which enables S7199-01 to acquire the X-ray imaging. Two CCD chips of symmetric from side to side are mounted closely for realizing the possible minimum dead space in between. The effective photosensitive length of about 150 mm in total is realized; each chip has 1536×128 channels, and $48 \times 48 \mu\text{m}$ is a pixel size. Even a X-ray image of moving object can be taken by taking a unique operation method of TDI, which can also be useful for a non-destructive inspection where the object moves on a belt conveyer.

The each chip of S7199-01 has an effective pixel size of $48 \times 48 \mu\text{m}$ and is available in active area of $73.728 \text{ (H)} \times 6.144 \text{ (V)} \text{ mm}^2$.

Features

- $1536 \text{ (H)} \times 128 \text{ (V)}$ pixel format
- Pixel size: $48 \times 48 \mu\text{m}$
- Buttable structure of 2 chips
- Coupled with FOS for X-ray imaging
- TDI (Time Delay Integration) operation
- 100 % fill factor
- Wide dynamic range
- Low dark signal
- Low readout noise
- MPP operation

Applications

- General X-ray imaging
- Non-destructive inspection
- Dental panorama

■ Selection guide

Type No.	Cooling	Number of total pixels	Number of active pixels	Active area [mm (H) × mm(V)]
S7199-01	Non-cooled	1536×128	1536×128	73.728×6.144

Note) As an input window, FOS is suited to S7199-01.

■ General ratings

Parameter	Specification
CCD structure	Full frame transfer or TDI
Fill factor	100 %
Number of active pixels	$1536 \text{ (H)} \times 128 \text{ (V)}^{*1}$
Pixel size	$48 \text{ (H)} \times 48 \text{ (V)} \mu\text{m}$
CCD active area	$73.728 \text{ (H)} \times 6.144 \text{ (V)} \text{ mm}^{*1}$
X-ray sensitive area	$146 \times 6 \text{ mm}$
Vertical clock phase	2 phase
Horizontal clock phase	2 phase
Output circuit	Two-stage MOSFET source follower with load resistance
X-ray resolution	4 to 6 Lp/mm at 60 keVp, 10 m Roentgen
Reliability	100,000 shots at 60 kVp, 10 m Roentgen
Package	40 pin ceramic package
Window	FOS (Fiber Optic plate with Scintillator)

*1: Number of active pixels per chip. Two chips are used.

■ Electrical and optical characteristics (Ta=25 °C, unless otherwise noted)

Parameter		Symbol	Remark	Min.	Typ.	Max.	Unit
Saturation output voltage		Vsat		-	Fw × Sv	-	V
Full well capacity	Vertical	Fw		-	1200	-	ke ⁻
	Horizontal			-	1200	-	
	Summing			-	1200	-	
CCD node sensitivity		Sv	*2	0.8	1.2	-	μV/e ⁻
Dark current (MPP mode)		DS	*3	-	8	24	ke ⁻ /pixel/s
Readout noise		Nr	*4	-	60	120	e ⁻ rms
Dynamic range		DR	*5	20,000	-	-	
X-ray response non-uniformity		XRNU	*6, *7	-	±10	±30	%
Blemish	Point defects *8	-				White spots	-
	Black spots					10	
	Cluster defects		*9	-	-	0	
	Column defects		*10	-	-	0	
X-ray resolution		ΔR		4	6	-	Lp/mm

*2: V_{OD}=15 V.

*3: Dark current doubles for every 5 to 7 °C.

*4: -40 °C, operating frequency is 2 MHz.

*5: Dynamic range = Full well capacity / Readout noise

*6: X-ray irradiation of 60kVp, measured at half of the full well capacity.

*7: XRNU (%) = Noise / Signal × 100

Noise: Fixed pattern noise (peak to peak)

Measuring region that is within 146.0 mm (H) × 6.0 mm (V) (refer to dimensional outline)

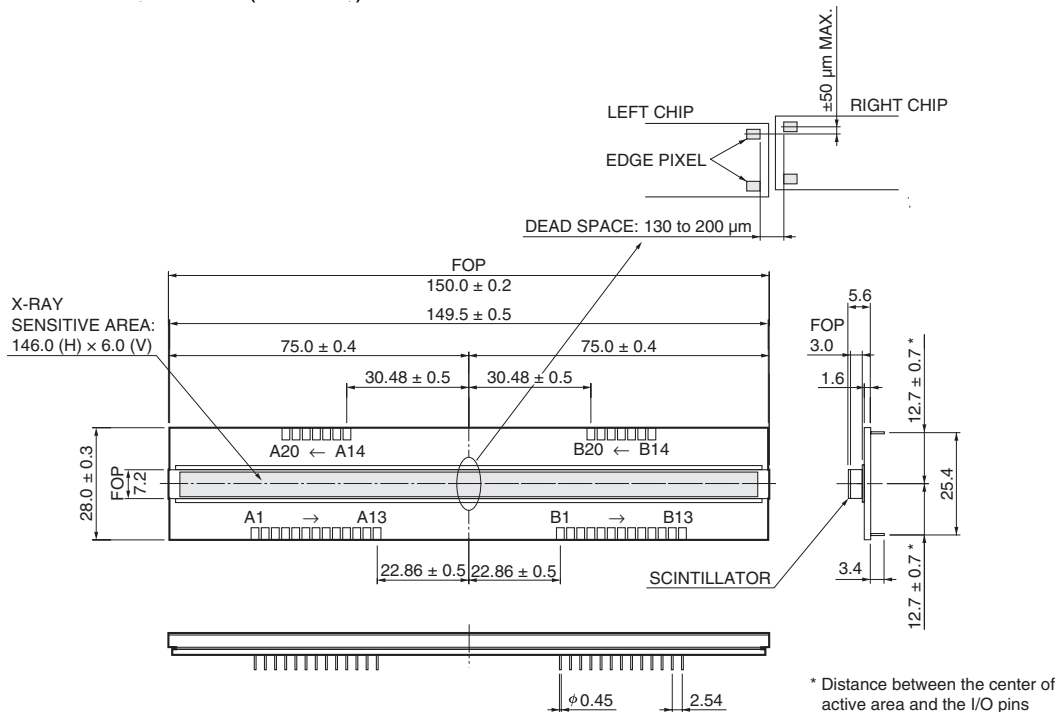
*8: White spots > 20 times of typ. dark signal (8 ke⁻/pixel/s).

Black spots > 50 % reduction in response relative to adjacent pixels, measured at half of the full well capacity.

*9: continuous 2 to 9 point defects.

*10: continuous >10 point defects.

■ Dimensional outline (unit: mm)



KMPD0129EA

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