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NEW

Imaging plate reader module

C15082

Compact imaging plate reader module with high resolution and high speed

This product is a module optimized for reading of imaging plates (IP) in CR (computed radiography). Fluorescent light generated by irradiating the IP with the excitation laser scanned by the MEMS mirror is then received by the highly sensitive detector MPPC®. This product consists of a laser scan engine, MPPC assembly, and driver circuit, which all built-in a compact housing. These parts are optically adjusted with high precision, resulting in a high S/N ratio and image resolution.

Features

- **High resolution: 12 to 14 LP/mm (high resolution mode)**
  11 to 12 LP/mm (standard mode)
- **High-speed reading: 3.6 s (standard mode)**
- **High S/N ratio**
- **Ultra-compact: 75 × 60 × 34 mm**

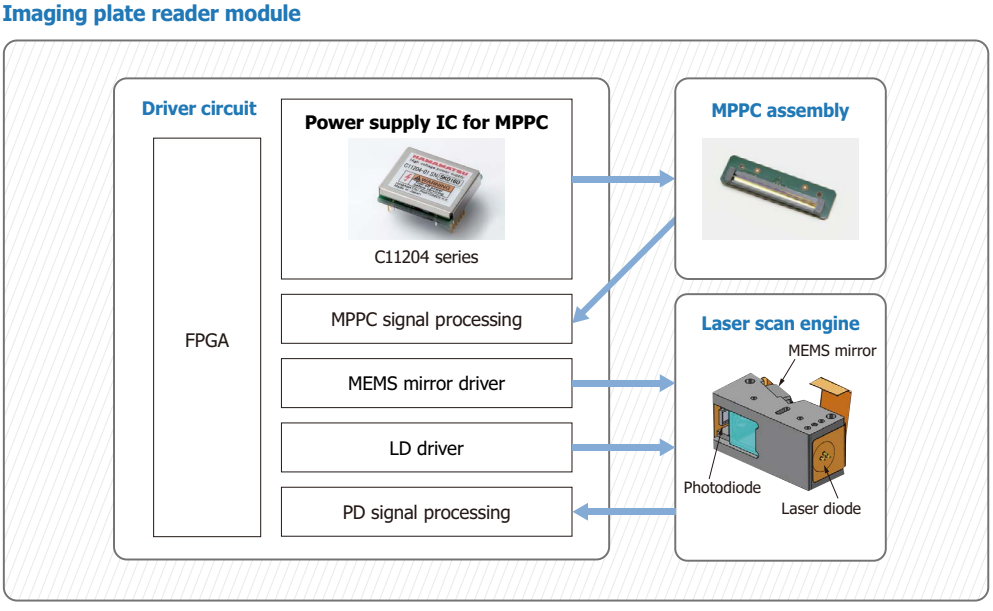
Applications

- **CR scanners**
- **Dental imaging plate scanner**

Structure

Parameter		Specification
Command interface		SPI
Image data	A/D resolution	16 bit
	Output method	Parallel bus

Structure diagram



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Absolute maximum ratings

Parameter		Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Positive power supply	+Vs	-0.2	-	+18	V
	Negative power supply	-Vs	-18	-	+0.2	V
Input signal voltage		VI	-0.5	-	+4.12	V
Operating temperature*1		Topr	0	-	+50	°C
Storage temperature*1		Tstg	-20	-	+60	°C

*1: No dew condensation
When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

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

■ Laser scan engine

Parameter			Symbol	Min.	Typ.	Max.	Unit
Read position*2			-	-	2.5	-	mm
Laser scan width*3			-	32	32.5	33	mm
Laser spot size*3			-	-	40	50	μm
MEMS mirror	Standard mode	Drive frequency	-	-	357	-	Hz
		Drive period	dri_pd	-	2.8	-	ms
	High resolution mode	Drive frequency	-	-	200	-	Hz
		Drive period	dri_pd	-	5	-	ms
Laser	Peak emission wavelength		λp	652	660	665	nm
	Drive method		-		Pulse		-
	Peak power*4		-	100	-	400	mW
	Pulse width		-	-	100	-	ns
	Repetition frequency		-	-	500	1000	kHz

*2: Distance from the bottom of the product housing to the IP
*3: Read position=2.5 mm. Image quality deteriorates if the IP moves out of the read position.
*4: Pulse width=100 ns, duty ratio=20%

■ MPPC assembly

Parameter		Symbol	Min.	Typ.	Max.	Unit
Field of view*5		-	-	1.8 × 38	-	mm
MPPC	Pixel pitch	-	-	50	-	μm
	Photon detection efficiency (λ=400 nm)*6	PDE	-	50	-	%

*5: Directly below the lens (read position=2.5 mm)
*6: Crosstalk and afterpulses are not included.

■ Driver circuit

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage		Vs	DC	±11.5	±12	±12.5	V
Current consumption		+Is	+Vs	-	-	0.5	A
		-Is	-Vs	-	-	0.1	A
Digital input voltage	High level	VIH		2.0	3.3	3.45	V
	Low level	VIL		-0.3	0	0.8	V
Digital output voltage	High level	VOH		2.4	3.3	3.4	V
	Low level	VOL		-	0	0.4	V
Image acquisition sequence start trigger input (DET_TRI) High period		tri_t		10	-	-	ms
Wait time from the detection of the image acquisition sequence start trigger to the start of image acquisition		wait_t	1 cycle=1 dri_pd	100	-	4000	cycle
Output voltage range of the MPPC power supply		-		40	-	58	V
SPI	Clock frequency	-	Duty ratio=50%	-	-	10	MHz
	Time from falling edge of SPI_SS to falling edge of SPI_SCLK	t1		50	-	-	ns
	SPI_SCLK High period	t2		-	50	-	ns
	SPI_SCLK Low period	t3		-	50	-	ns
Parallel bus	Clock frequency	-	Duty ratio=50%	-	1	-	MHz
	Time from rising edge of BUS_LINE to rising edge of BUS_CLK	t4		-	1000	-	ns
	BUS_CLK High period	t5		-	500	-	ns
	BUS_CLK Low period	t6		-	500	-	ns

Function

■ Image acquisition mode

By changing the image acquisition mode, it is possible to change the IP read time and number of pixels.

Mode	Number of pixels H × V	MEMS mirror drive frequency (Hz)	Transport speed*7 (mm/s)	Read time*8 (s)	Theoretical limit to resolution (LP/mm)	Actual resolution (LP/mm)
Standard mode (IP size 0/1/2 compatible)	900 × 1300	357	12.9	3.6	14	11 to 12
Standard mode (IP size 3 compatible)	900 × 1600			4.5		
High resolution mode (IP size 0/1/2 compatible)	1440 × 2080	200	4.5	10.4	23	12 to 14
High resolution mode (IP size 3 compatible)	1440 × 2600			13.0		

*7: The theoretical value needed in order to realize the actual IP aspect ratio.
*8: The read time for each image acquisition mode is calculated with the following formula.

Read time = Number of vertical pixels × Drive frequency of MEMS mirror

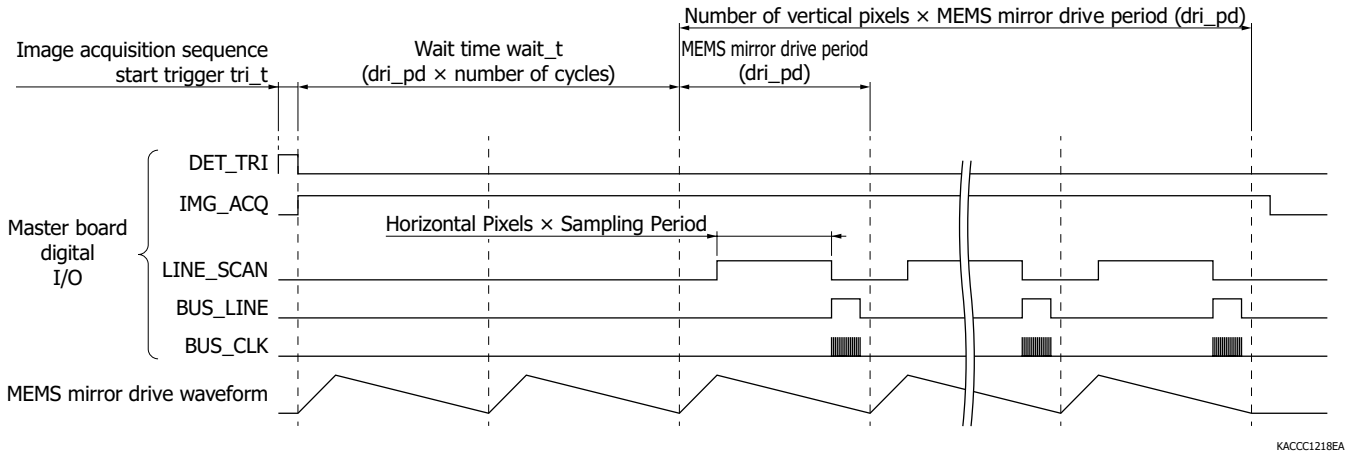
· Calculation example (IP size 0/1/2 compatible, standard mode)
Read time = 1300 pixels × 2.8 ms = 3.6 s

Therefore, this value is an estimate of the time from actual start of image acquisition to image data transfer. This excludes the wait time (wait_t) from the detection of the image acquisition sequence start trigger to the start of image acquisition.

Timing chart

Image acquisition sequence

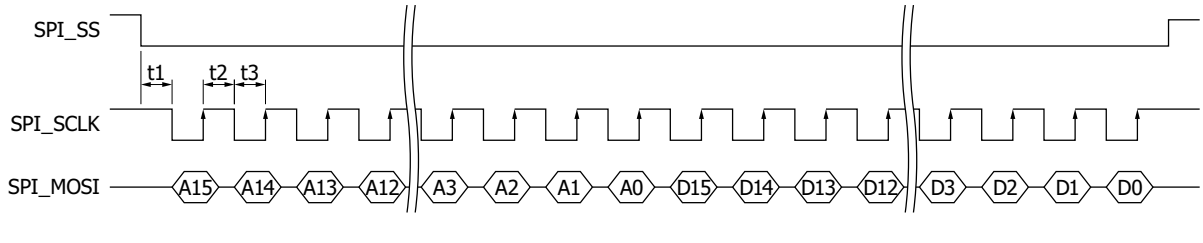
After turning on the power, when no image has been acquired (IMG_ACQ=Low) and SPI communication is possible (SPI_EN=High), once the module receives the image acquisition sequence start trigger (DET_TRI=High), the image acquisition sequence starts automatically in the preset image acquisition mode. After the trigger is detected, actual image acquisition starts after wait time (wait_t), and one line of image data is output by the parallel bus each time the laser scans one line with the MEMS mirror.



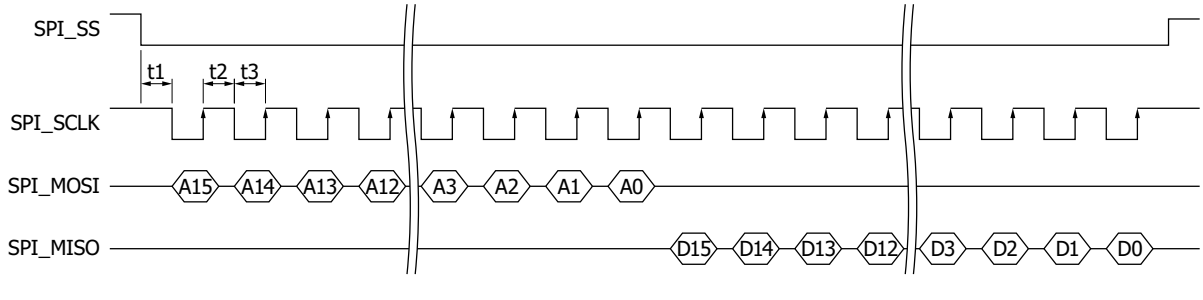
SPI communication

■ SPI communication (Write)

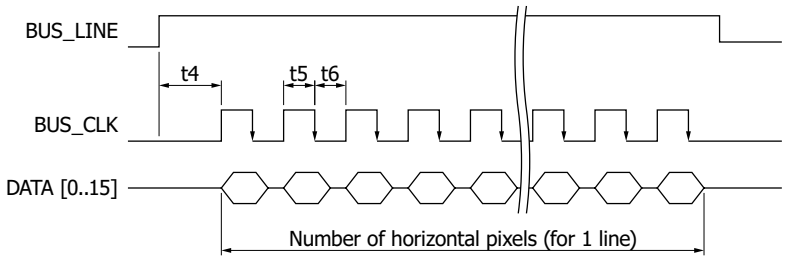
When no image has been acquired (IMG_ACQ=Low) and SPI communication is possible (SPI_EN=High), the external master board can access the FPGA via SPI.



■ SPI communication (Read)



Parallel bus



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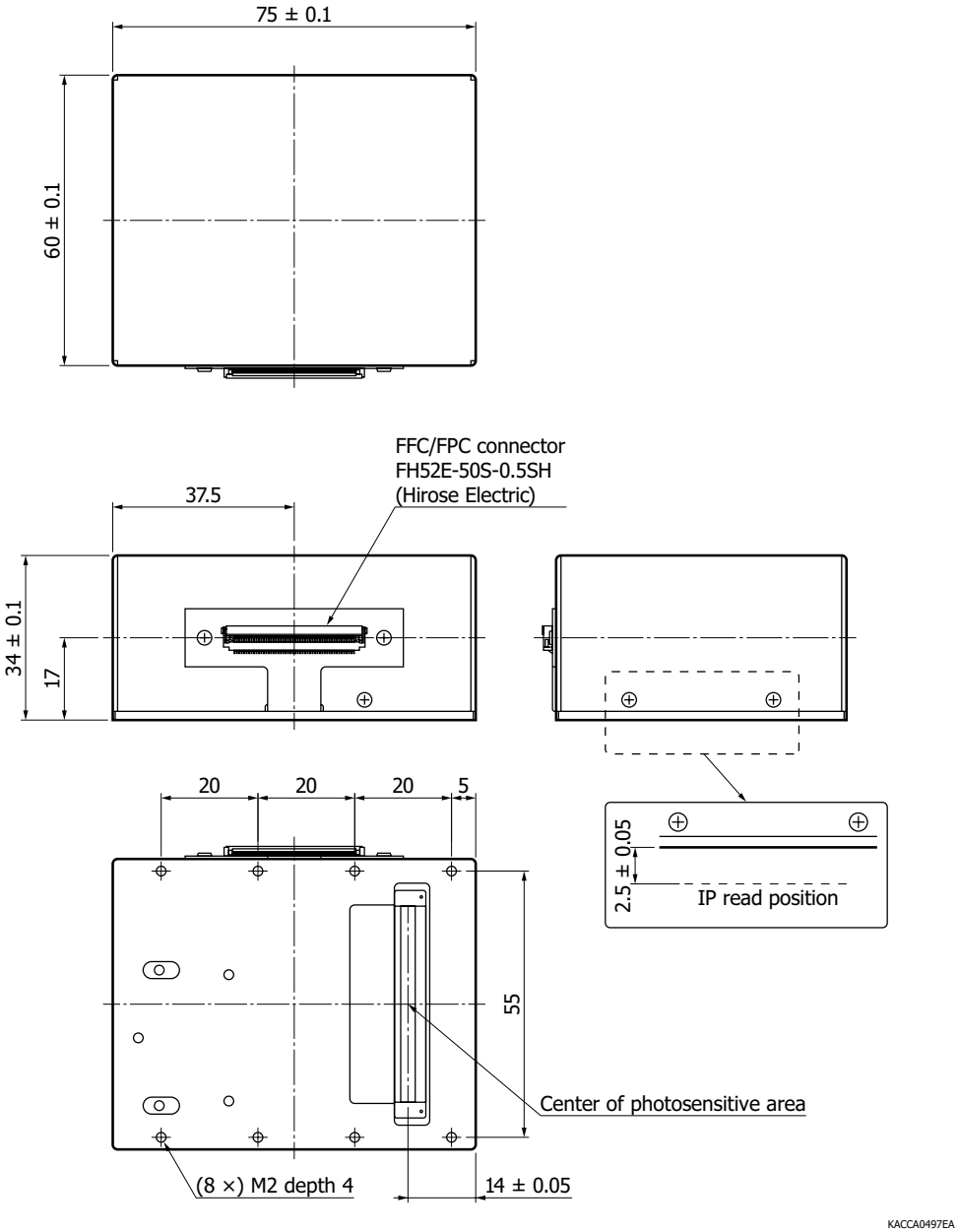
Dimensional outline (unit: mm)



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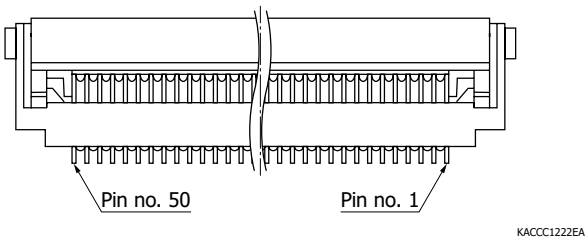
Pin layout

■ FFC/FPC connector (FH52E-50S-0.5SH, Hirose Electric)
Note: Be sure to use FFC/FPC that is compatible with this connector.



Pin no.	Terminal name	Description
1	+Vs	Positive supply voltage (+12 V)
2		
3		
4		
5	GND	Power supply ground
6		
7		
8		
9	-Vs	Negative supply voltage (-12 V)
10		
11		
12		
13	NC	No connection
14		
15		
16	D.GND	Digital ground
17		
18		
19	SPI_SCLK	SPI communication clock input
20	SPI_MOSI	SPI communication serial data input
21	SPI_MISO	SPI communication serial data output
22	SPI_SS	SPI communication slave select input. Negative logic.
23	D.GND	Digital ground
24		
25	DET_TRI	Image acquisition sequence start trigger input. Positive logic. It is pulled down using a 10 kΩ resistor inside the driver circuit.
26	SPI_EN	SPI communication enable output High: SPI communication possible Low: SPI communication impossible

Pin no.	Terminal name	Description
27	IMG_ACQ	Outputs the image acquisition sequence status for a single frame. Outputs High from detection of the image acquisition sequence start trigger (DET_TRI=High) to the image data acquisition is completed.
28	LINE_SCAN	Outputs the image acquisition sequence status for a single line. Outputs a High level signal while acquiring image data for the number of horizontal pixels.
29	BUS_CLK	Parallel bus clock output
30	BUS_LINE	Status output for a single line of image data on the parallel bus
31	HV_STA_MON	Outputs the status monitor of power supply IC for MPPC. Outputs High when any of the following things happen: overcurrent to MPPC, temperature sensor not connected, abnormal temperature from the temperature sensor, or voltage instability.
32	D.GND	Digital ground
33		
34		
35	DATA[0]	Parallel bus 0th bit of image data
36	DATA[1]	Parallel bus 1st bit of image data
37	DATA[2]	Parallel bus 2nd bit of image data
38	DATA[3]	Parallel bus 3rd bit of image data
39	DATA[4]	Parallel bus 4th bit of image data
40	DATA[5]	Parallel bus 5th bit of image data
41	DATA[6]	Parallel bus 6th bit of image data
42	DATA[7]	Parallel bus 7th bit of image data
43	DATA[8]	Parallel bus 8th bit of image data
44	DATA[9]	Parallel bus 9th bit of image data
45	DATA[10]	Parallel bus 10th bit of image data
46	DATA[11]	Parallel bus 11th bit of image data
47	DATA[12]	Parallel bus 12th bit of image data
48	DATA[13]	Parallel bus 13th bit of image data
49	DATA[14]	Parallel bus 14th bit of image data
50	DATA[15]	Parallel bus 15th bit of image data

Accessories

· Instruction manual, command reference

Precautions

■ About static electricity

· Electrostatic countermeasures

Since this product is equipped with a laser and is sensitive to static electricity, it is recommended to wear anti-static gloves or work on an anti-electric mat when handling it.

· Storage environment

Avoid dry, static-prone environments and store in a moderately humid area.

· Contact precautions

Do not touch the terminal parts of the product directly. To prevent damage caused by static electricity, touch the metal parts before contact to discharge static electricity.

■ About vibration

· Vibration countermeasures

Vibrations may affect the scanned image of this product. It is recommended to install it in a stable place and use a material that suppresses vibration.

· Transportation precautions

Place in the dedicated protective case during transport and use a cushioning material to avoid vibration or impact.

Related information

www.hamamatsu.com/sp/ssd/doc_en.html

■ Precautions

· Disclaimer

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