1.0 General Description

The AMIS-710414-A4 (PI414MC-A4-R) is a contact image sensor (CIS) module, which uses MOS image sensor technology for high-speed performance and high sensitivity. The AMIS-710414-A4 is suitable for scanning A4 size (216mm) documents with 15.8 dots per millimeter (dpm) resolution. Applications include fax machines, game systems, a variety of mark readers, and other automation equipment requiring document scanners.

2.0 Key Features

- Light source, lens and sensor are integrated into a single module
- 15.8dpm resolution, 216mm scanning length
- Dual LED light source, RED and IR, with a line scan time to 180µsec @ 5MHz
- Wide dynamic range
- Analog output
- Compact size ≅ 14.0mm x 19.5mm x 232mm
- Low power
- Light weight

3.0 Functional Description

The AMIS-710414-A4 imaging array consists of 27 AMIS-720642 (PI3042) sensors, produced by AMI Semiconductor, which are cascaded to provide 3456 photo-detectors with their associated multiplex switches and a digital shift register, which controls its sequential readout. Mounted in the module is a one-to-one graded indexed micro lens array, which focuses on the image of the scanned documents then transfers it onto the sensors. The on-board amplifier processes the video signal to produce a sequential stream of video at the output pin of the AMIS-710414-A4 module. These 27 sensors bonded on a printed circuit board (PCB) are grouped into four sub-cascaded sections. Each contiguously cascaded chip section is connected on separate video lines, accordingly providing four video outputs, VOUT1, VOUT2, VOUT3, and VOUT4. Before the signal charges from the four video lines appear at their respective outputs, they are converted to signal voltages by four on-board buffer amplifiers; one for each of its corresponding video sections. The first three sections, VOUT1, VOUT2 and VOUT3 have seven sensor chips, while the VOUT4 has six sensor chips. Since each sensor chip has 128 pixels, there are a total of 3456 pixels (see Figure 1).

Illumination is accomplished by means of integrated LED sources; Red (65nm) and IR (880nm). All components are housed in a small plastic housing, which has a cover glass that acts as the focal point for the object being scanned. In addition, it protects the imaging array, micro lens assembly and LED light source from dust. Inputs and outputs (I/O) to and from the module are facilitated by a 12-pin connector, EBW-PK23-P012L2-3Z, located on one end of the module. For the location of Pin 1, see Figure 4.

The cross section of the AMIS-710414-A4 module is shown in Figure 1 and a block diagram in Figure 2.

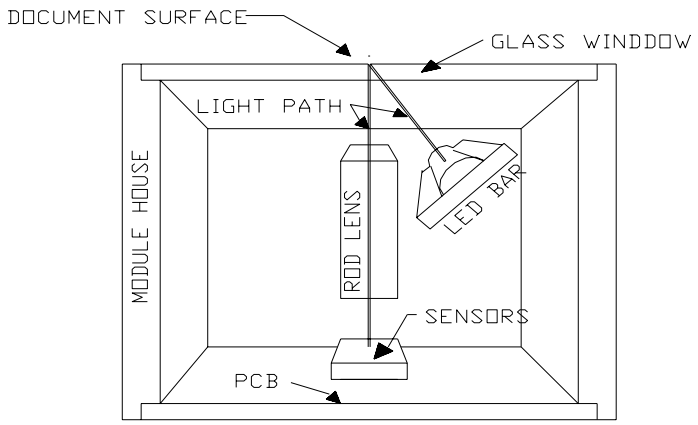


Figure 1: AMIS-710414-A4 Cross Section

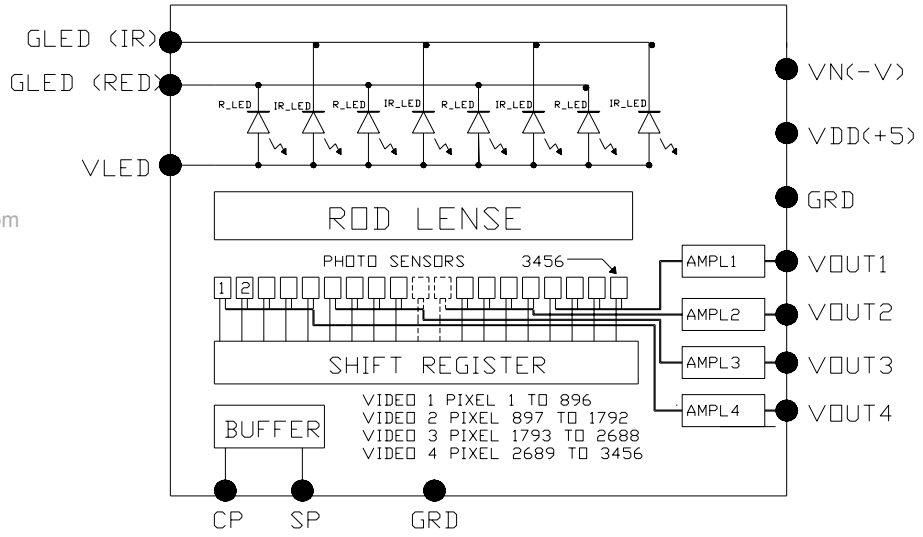


Figure 2: AMIS-710414-A4 Module Block Diagram

4.0 Connector Pin Out Designation

The part number for the connector is EBW-PK23-P012L2-3Z.

Table 1: Pin-out Configuration

Pin Number	Symbol	Names and Functions
1	VOUT1	Analog video output 1
2	VOUT2	Analog video output 2
3	GND	Ground; 0V
4	VOUT 3	Analog video output 3
5	VOUT 4	Analog video output 4
6	Vdd (+5V)	Positive power supply
7	SP (START)	Shift register start pulse
8	GLED IR	Ground for IR light source; 0V
9	CP (CLOCK)	Sampling clock pulse
10	Vn (-5V to -12V)	Negative power supply
11	GLED RED	Ground for the RED light source; 0V
12	VLED	Supply for the light source

5.0 Maximum Ratings

Table 2: Maximum Rating

Parameter	Symbols	Maximum Rating	Units
Power supply voltage	Vdd	7	V
	Idd	100	mA
	Vn	-15	V
	In	35	mA
	VLED IR	5.5	V
	VLED RED	5.5	V
	ILED IR	650	mA
	ILED RED	500	mA
Input clock pulse (high level)	Vih	Vdd	V
Input clock pulse (low level)	Vil	-0.5	V

Note: These are the maximum ratings and are not to be used in a prolonged condition.

6.0 Operating Environment

Table 3: Operating Environment

Parameter	Symbol	Range	Units
Operating temperature	Top	0 to +50	˚C
Operating humidity	Hop	+10 to +85	%
Storage temperature	Tstg	-25 to +75	˚C
Storage humidity	Hstg	+5 to +95	%

7.0 Electro-Optical Characteristics

The tabled values are measured at 25°C.

Table 4: Electro-Optical Characteristics

Parameter	Symbol	Typ.	Units	Note
Total number of photo detectors		3456	Elements	
Section 1, 2 & 3 number of photo detectors		896	Elements	
Section 4 number of detectors		768	Elements	
Pixel-to-pixel spacing		63.5	µm	
Line scanning rate (1)	Tint	180	µsec	@ 5.0MHz clock frequency
Clock frequency (2)	fclk	5.0	MHz	
Bright output voltage (3)	Vpavg	1.1 +/-0.15	V	
Bright output non-uniformity (4)	Up	+/-30	%	
Adjacent pixel non-uniformity (5)	Uadj	<25	%	
Dark non-uniformity (6)	Ud	<150	mV	
Dark output voltage (6)	Vd	<600	mV	
Modulation transfer function (7)	MTF	>40	%	MTF for Red LED
Modulation transfer function (7)	MTF	>30	%	MTF for IR LED

Notes:

(1) Tint is the line scanning rate or integration time. Tint is determined by the interval of two start pulses (SP). The integration time of 180µsec is set at the factory. For additional comments, see Note 1 under Table 5.

(2) fclk: main clock frequency

(3) Vpavg = ∑ Vp(n)/3456

(4) Up = [(Vpmax - Vpavg) / Vpavg] x 100% or [(Vpavg - Vpmin) / Vpavg] x 100%, where Vpmax = maximum pixel amplitude in the line scan and Vpmin = minimum pixel amplitude in the line scan.

(5) Upadj = MAX[| (Vp(n) - Vp(n+l) | / Vp(n)) x 100%
Upadj is the non-uniformity in percent between adjacent pixels, where Vp(n) is the n^{th} pixel in the line scan.

(6) Ud = Vdmax – Vdmin
Vd = the average dark output level
Vdmin is the minimum output on a black document (LED is turned off).
Vdmax: is the maximum output voltage on a black document (LED is turned off).

(7) MTF = [(Vmax - Vmin) / (Vmax + Vmin)] x 100 [%]
Vmax: is the maximum output voltage at 100lp/in (200dpi target) and Vmin: is the minimum output voltage at 100lp/in (200dpi target), where lp / in is the line pairs per inch.

8.0 Recommended Operating Conditions

The tabled values are measured at 25°C.

Table 5: Recommended Operating Conditions

Item	Symbol	Min.	Mean	Max.	Units
Power supply	Vdd	4.5	5.0	5.5	V
	Vn.	-13	-5.0	-4.0	
	VLED IR		5	5.5	V
	VLED Red		5	5.5	V
	ILED IR		500	650	ma
	ILED Red		350	500	ma
	Idd		90	95	ma
	Ivn	4.0	5.0	5.5	ma
Input voltage at digital high	Vih	Vdd-1.0	Vdd-0.5	Vdd	V
Input voltage at digital low	Vil			0.6	V
Clock frequency	Fclk		5.0	5.5	MHz
Clock pulse high duty cycle			25		%
Clock pulse high duration			50		ns
Integration time	Tint		180		µs
Operating temperature	Top		25	50	°C

9.0 Switching Characteristics (25°C)

The switching characteristics (at 25°C) for the I/O clocks are shown in Figure 4. For the timing symbol definitions, see Table 6.

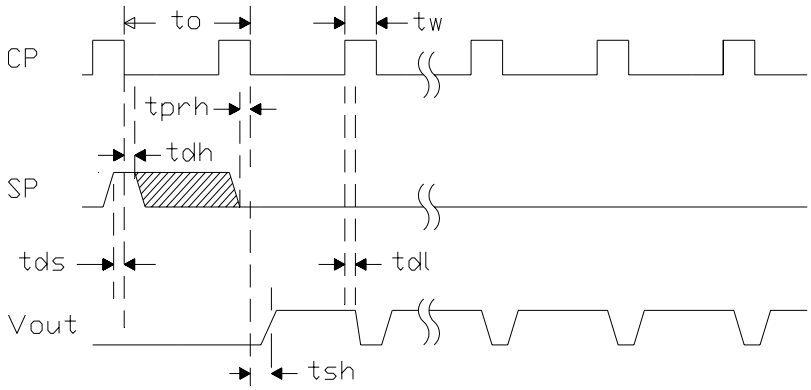


Figure 3: Timing Diagram

Note: Only one video output is shown because all four videos have identical electrical characteristics. The only physical difference between outputs is in the Section 4 output, VOUT4. Section 4 has only six sensor chips, hence its active scan is shorter by 128 pixels.

Table 6: Timing Symbol Definitions for Figure 3 Timing Diagram

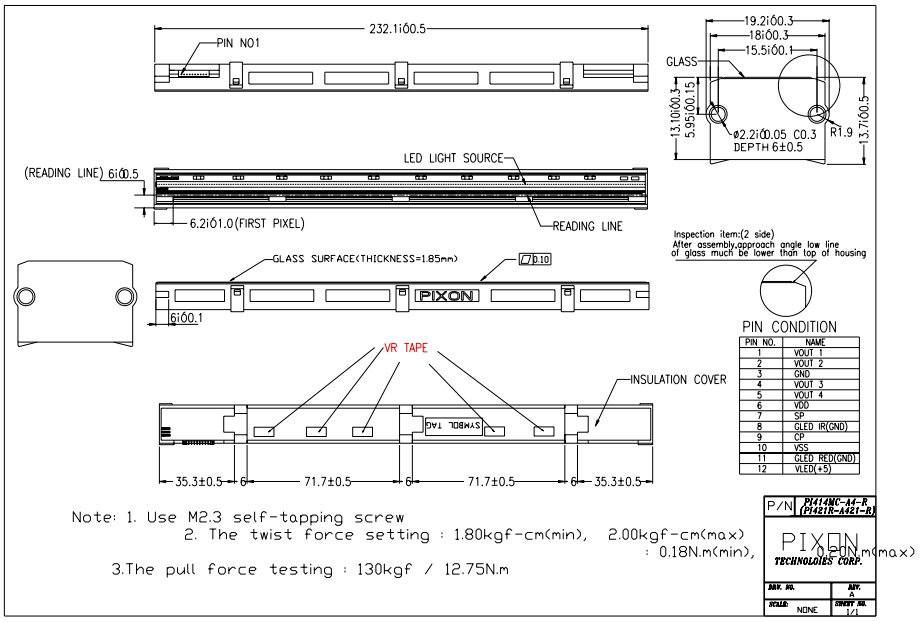
Parameters	Symbol	Min.	Typ.	Max.	Units
Clock cycle time	to	0.20		4.0	µs
Clock pulse width	tw	50			ns
Clock duty cycle		25		75	%
Prohibit crossing time of SP	tprh	0			ns
Data setup time	tds	20			ns
Data hold time	tdh	0			ns
Signal delay time	tdl	20			ns
Signal settling time	tsh	100			ns

Note:

(1) "Prohibit crossing of start pulse" is to indicate that the start pulse should not be active high between any two consecutive high going clock pulse or two consecutive low going clock pulses (see Figure 3). Only one high going clock under the active high start pulse initiates the internal shift register and it must not be active over two high going clocks. All low going clock pulses will not initiate the shift register. To ensure that the start pulse will not be actively high during two consecutive high going clocks, the circuit should be designed to keep the start pulse active only for one high going clock cycle.

10.0 AMIS-710414-A4 Module Mechanical Dimensions

This is an overview drawing of the module.



PIN NO.	NAME
1	VOUT 1
2	VOUT 2
3	GND
4	VOUT 3
5	VOUT 4
6	VDD
7	SP
8	GLED IR(GND)
9	CP
10	VSS
11	GLED RED(GND)
12	VLED(+5)

Figure 4: Overall View of the Module Housing

11.0 Company or Product Inquiries

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