

## 1.0 General Description

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The AMIS-710411-A7 (PI411MC-A7) is a contact imaging sensor (CIS) module that can operate from a single 5.0V supply. It is a linear scanning array composed of 11 AMIS-720422 (PI3022) imaging sensor chips. The AMIS-720422 is a 400 dots per inch (dpi) solid-state line imaging sensor chip with 128 photo sensitive elements, which are also a product of AMIS. Eleven of these devices are sequentially cascaded to form the linear scanning array with a total of 1408 photo sensing elements. This imaging device is fabricated using MOS imaging sensor technology for its high-speed performance and high sensitivity. It is designed for scanning A7 size (89mm) documents with 400dpi resolution. Applications include ticket, check and card scanners, a variety of mark readers, and other automation equipment.

## 2.0 Key Features

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- Low power-single power supply at 5.0V
- Light source, lens and sensor are integrated into a single module
- 15.7dpm resolution, 89mm scanning length
- High speed page scan - up to 282 $\mu$ sec/line @ 5MHz pixel rate
- Wide dynamic range
- Analog output
- 660 LED light source
- Compact size  $\cong$  13mm x 25.6mm x 102mm
- Light weight

## 3.0 Functional Description

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The AMIS-710411-A7 consists of 11 imaging array sensors, which are cascaded to provide 1408 photo-detectors. Each sensor has its associated multiplex switches and a digital shift register, which controls its sequential readout. Each sensor also contains a chip select switch so that each following chip is accessed sequentially as its predecessor chip completes its scan. These chips are mounted on a printed circuit board (PCB) along with clock buffers and a video signal amplifier (see Figure 1).

The PCB containing the imaging array is enclosed in a module housing along with a one-to-one graded indexed micro lens array, which focuses the image of the scanned documents onto the sensing line of the sensor chips. The document is illuminated with an LED light source, which is also mounted in the housing (see Figure 2).

The pictorial cross section (Figure 2) shows the LED bar light source and its illumination path. The light on the document reflects images on the document. The reflected images focus through the micro lens onto the image sensing line of the chips where the images are converted to proportional electrical charges. An on board amplifier processes these signal charges into proportional video signal voltages, which are sent out to the output video port.

All components are housed in a small plastic housing and covered with a glass window. This cover glass not only serves to protect all of the critical components within the housing from dust, but along with the micro lens, it determines the depth-of-focus because it lies in the optical path.

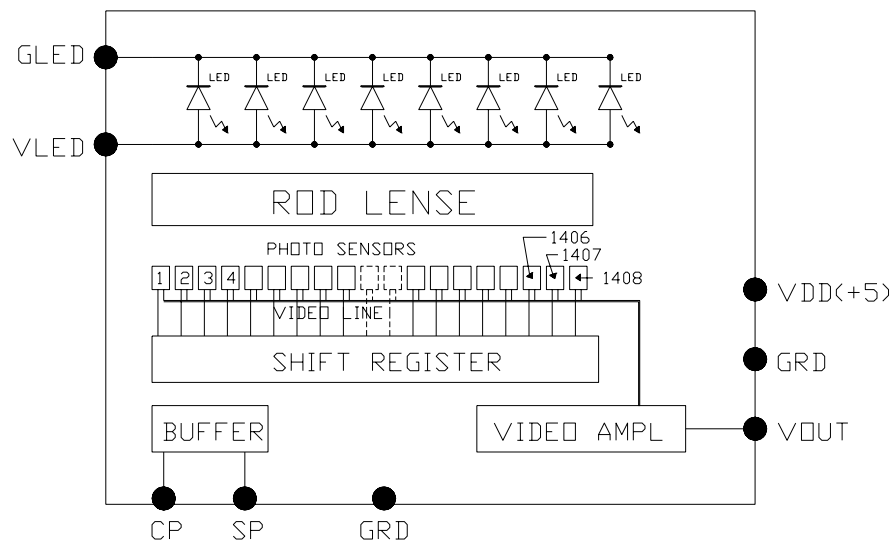


Figure 1: AMIS-710411-A7 Module Block Diagram

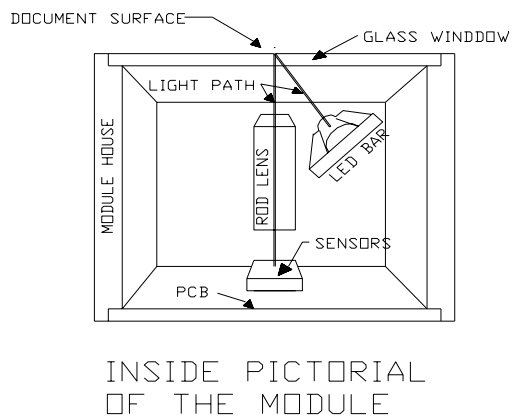


Figure 2: AMIS-710411-A7 Cross Sectional View

## 4.0 Pin Out Description

There is a connector located at the end of the module. The outline of the module in Figure 4 of the mechanical section illustrates the connector location. With the module window facing down on a flat surface, the viewer looking down on backside of the module and the connector's pins facing the viewer, the connector is located on the right-hand end of the module. The connector is a surface-mount-flex input, Molex 52207-0890, 1mm single 10-pin row. Its I/O designation is provided in Table 1. The location of Pin number 1 is found closest to end of the module.

Table 1: I/O Designation

Pin Number	Symbol	Names and Functions
1	Vout	Analog video output
2	Gnd	Ground; 0V
3	Vdd (+5V)	Positive power supply
4	NA	Not used
5	Gnd	Ground; 0V
6	SP	Shift register start pulse
7	Gnd	Ground; 0V
8	CP	Sampling clock pulse
9	GLLED	Ground for the light source
10	VLED	Supply for the light source

## 5.0 Absolute Maximum Rating

Table 2 shows the absolute maximum parameters. These parameters should not be used in prolonged operation.

Table 2: Absolute Maximum Rating

Parameter	Symbols	Maximum Rating	Units
Power supply	Vdd	7.0	V
	Idd	5.7	mA
	VLED	50	V
	ILED	300	mA
Input clock pulse (high)	Vih	Vdd	V
Input clock pulse (low)	Vil	-0.5	V

## 6.0 Operating Environment

Table 3: Operating Environment

Parameter	Symbols	Maximum Rating	Units
Operating temperature	Top	0 to 50	°C
Operating humidity	Hop	10 to 85	%
Storage temperature	Tstg	-25 to 85	°C
Storage humidity	Hstg	5 to 95	%

## 7.0 Electro-Optical Characteristics (25°C)

Table 4: Electro-Optical Characteristics at 25°C

Parameter	Symbol	Parameter	Units	Note
Number of photo detectors		1408	Elements	
Pixel-to-pixel spacing		62	μm	
Line scanning rate <sup>(1)</sup>	Tint	423	μsec	@ 3.33MHz clock frequency
Clock frequency <sup>(2)</sup>	Fclk	3.33	MHz	See Note 2 for 5.0MHz operation
Bright output voltage <sup>(3)</sup>	Video output	1.2 +/-0.05	V	Specified for tint = 423μsec
Bright output non-uniformity <sup>(4)</sup>	Up	<+/-30	%	
Adjacent pixel non-uniformity <sup>(5)</sup>	Uadj	<25	%	
Dark non-uniformity <sup>(6)</sup>	Ud	<75	mV	
Dark output voltage	Vd	200<Vd<300	mV	
Modulation transfer function <sup>(7)</sup>	MTF	>40	%	See Note 7 for MTF & DOF

- Notes:**
- (1) Tint: line scanning rate or integration time. Tint is determined by the interval of two start pulses (SP). See Note 2 for the high scanning speed operation.
  - (2) Fclk: main clock frequency. The call out is at 3.3MHz but electrically the module reliably operates to 5.0MHz. This modification will require adjusting the LED light level and gain adjust.
  - (3)  $V_{pavg} = \sum V_p(n)/1804$
  - (4)  $U_p = [(V_{pmax} - V_p) / V_p] \times 100\%$  or  $[(V_p - V_{pmin}) / V_p] \times 100\%$
  - (5)  $U_{adj} = \text{MAX}[ | (V_p(n) - V_p(n+1)) | / V_p(n) ] \times 100\%$   
Uadj is the non-uniformity percentage pixel to pixel.
  - (6)  $U_d = V_{dmax} - V_{dmin}$   
Vdmin is the minimum output on a black document.  
Vdmax is the maximum output voltage of a black document.
  - (7)  $MTF = [(V_{max} - V_{min}) / (V_{max} + V_{min})] \times 100 \%$ . Depth of focus (DOF) range is defined with the MTF. MTF is the measure at the glass surface.  
Vmax: maximum output voltage at 100lp/inch (At 1/2 of the optical Nyquist frequency)  
Vmin: minimum output voltage at 100lp/inch
  - (8) lp / inch: line pair per inch

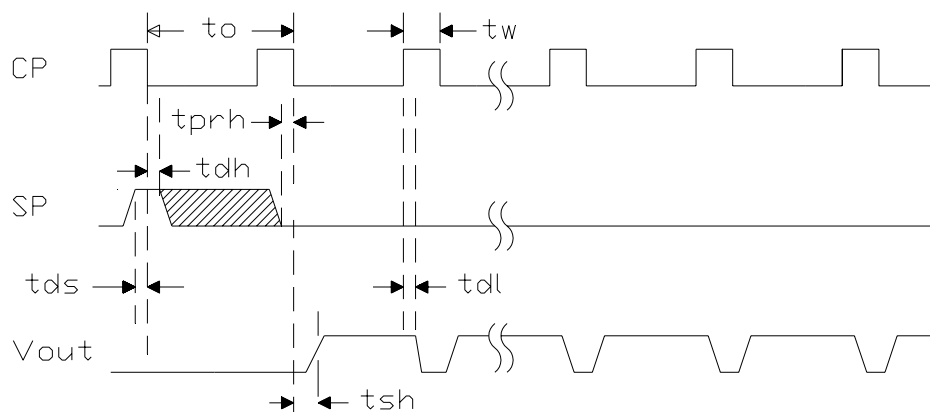
## 8.0 Recommended Operating Conditions (25°C)

Table 5: Recommended Operating Conditions at 25°C

Item	Symbol	Min.	Mean	Max.	Units
Power supply	Vdd	4.5	5.0	5.5	V
	VLED	4.5	5.0	5.5	V
	Idd	28	32	36	ma
	ILED	130	180	235	ma
Input voltage at digital high	Vih	Vdd-1.0	Vdd-.5	Vdd	V
Input voltage at digital low	Vil	0		0.6	V
Clock frequency	Fclk		3.33	5.0	MHz
Clock pulse high duty cycle		25			%
Clock pulse high duration <sup>(1)</sup>		50			ns
Integration time <sup>(2)</sup>	Tint	0.282		5.0	ms
Operating temperature	Top		25	50	°C

- Notes:**
- (1) The clock high duration is at a 5.0MHz maximum clock rate.
  - (2) Tint (minimum) is the minimum line integration time available at a 5.0MHz clock rate. See Note 2 under Table 4.

## 9.0 Switching Characteristics (25°C)



MODULE TIMING DIAGRAM

Figure 3: Clock and Start Pulse Timing Diagram

The switching characteristics for the I/O clocks are shown in Figure 3. Its corresponding timing symbol definitions are given in Table 6.

Table 6: Symbol Definition for Figure 3

Item	Symbol	Min.	Typ.	Max.	Units
Clock cycle time	to	0.2		4.0	μs
Clock pulse width	tw	50			ns
Clock duty cycle		25		75	%
Prohibit crossing time of SP	tprh	15			ns
Data setup time	tds	20			ns
Data hold time	tdh	20			ns
Signal fall delay time	tdl	50			ns
Signal sampling time	tsh	120			ns

## 10.0 AMIS-710411-A7 Module and its Mechanical Dimensions

The sketch of this module is included to provide a pictorial of the module size and structure. A detailed drawing is available upon request.

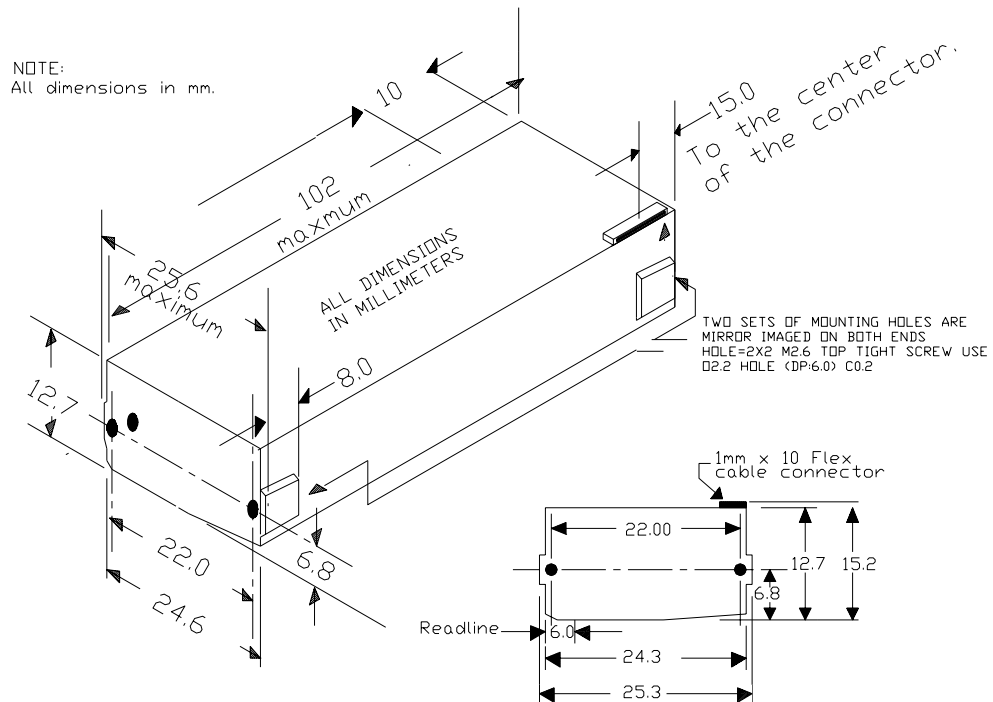


Figure 4: AMIS-710411-A7 Module Mechanical Outline

## 11.0 Company or Product Inquiries

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