1.0 General Description

The AMIS-710256-A6 (PI256MC-A6-R) is a two-color contact imaging sensor (CIS) module. The module can operate from a single 5V supply. It has two +5V inputs. One supply is for both LED light sources and the other is for the module's circuit. The module contains 13 sequentially cascaded AMIS-720233 (PI3033) sensor chips. The AMIS-720233 is a 200 dots per inch (dpi) solid-state line imaging array, also a product of AMI Semiconductor. This imaging device is fabricated using MOS imaging sensor technology for its high-speed performance and high sensitivity. The AMIS-710256-A6 is suitable for scanning A6 size (104mm) documents with eight dots per millimeter (dpm) resolution. Applications include ticket, check and card scanners, a variety of mark readers and other automation equipment.

2.0 Key Features

- Low power-single power supply at 5.0V
- Light source, lens and sensor are integrated into a single module
- 8dpm resolution, 104mm scanning length
- High speed page scan - up to 167μsec/line @ 5MHz pixel rate
- Wide dynamic range
- Analog output
- Two color LED light source: yellow-green (YG) and red
- Compact size ≅ 14mm x 19mm x 120mm
- Light weight

3.0 Functional Description

The AMIS-710256-A6 consists of 13 imaging array sensors, which are cascaded to provide 832 photo-detectors. Each sensor contains its associated multiplex switches and a digital shift register, which controls its sequential readout. Each sensor also contains a chip select switch. The chip select switches are 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. The AMIS-710256-A6 module is the single supply with two color LED features (see Figure 1).

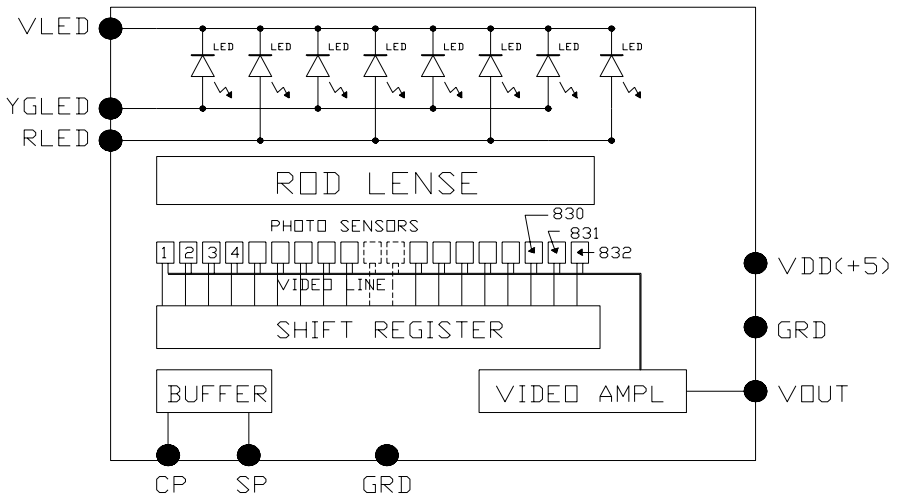

Figure 1: AMIS-710256-A6 Module Block Diagram

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).

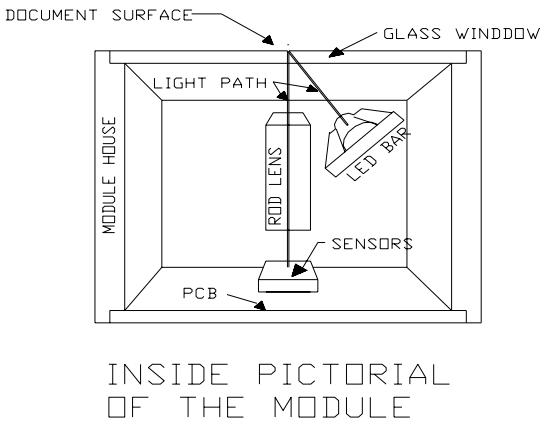

Figure 2: AMIS-710256-A6 Cross Sectional View

This pictorial cross section shows the LED bar light source and its illumination path. The light on the document reflects images of the document. The reflected images focus through the micro lens onto the image sensing line of the chips, where 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 plays a minor role in the depth-of-focus because it lies in the optical path.

4.0 Pin Out Description

There is one connector located at the end of the module. The outline of the module's housing in Figure 4 illustrates the connector location. With the module window facing down on the 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 single row of ten pins with a 1.25mm pin space. It is a JAE 1L-Z-10P-S125T3-E. Its I/O designation is provided in Table 1. The location of Pin 1 is indicated on the module outline.

Table 1: I/O Designation

Pin Number	Symbol	Names and Functions
1	Vout	Analog video output
2	Gnd	Ground (0V)
3	Vdd	Positive power supply (+5V)
4	YGLED	Return for Yellow-Green LED light source (0V)
5	Gnd	Ground (0V)
6	SP	Shift register start pulse
7	Gnd	Ground (0V)
8	CP	Sampling clock pulse
9	RLED	Return for red LED light source (0V)
10	VLED	Supply for the light source (+5V)

5.0 Absolute Maximum Rating

Table 2 depicts 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	50	mA
	VLED	6.0	V
	ILED	YG = 650 Red = 200	mA 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		832	Elements	
Pixel-to-pixel spacing		125	μm	
Line scanning rate	Tint(1)	170	μsec	@ 5MHz clock frequency
Clock frequency(2)	Fclk	5	MHz	
Bright output voltage(3)	Video output	1.0	V	Specified for tint=170μsec
Bright output non-uniformity(4)	Up	<+/-30	%	
Adjacent pixel non-uniformity(5)	Uadj	<25	%	
Dark non-uniformity(6)	Ud	<100	mV	
Dark output voltage	Vd	200<Vd<250	mV	
Modulation transfer function(7)	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).

(2) Fclk: main clock frequency applied to into the module. It is also equal to the pixel frequency.

(3) Vpavg = $\sum$ Vp(n)/832; where Vp(n) is the n^{th} pixel voltage value

(4) Up is defined as follows: Upmax= [(Vpmax - Vpavg) / Vpavg] x 100% and Upmin= [(Vpavg - Vpmin) / Vpavg] x 100%; where Upmax is determined by the highest n^{th} video pixel, Vp(n), and Vpmin is determined by minimum pixel, Vp(n), then Up is selected from the largest of the two values |Upmax| or |Upmin|.

(5) Upadj is between two adjacent pixel's non-uniformity and defined as follows:
Upadj = MAX[| (Vp(n) - Vp(n+l) | / Vp(n)] x 100%

(6) Ud = Vdmax – Vdmin
Vdmin is the minimum output in the dark
Vdmax is the maximum output voltage in the light

(7) MTF = [(Vmax - Vmin) / (Vmax + Vmin)] x 100 [%]. Depth of focus (DOF), range is defined with the MTF. MTF is measured at the glass surface to approximately 0.4mm from the glass surface, and is > 40% with its peaks at approximately the mid-point, 0.2mm.
Vmax: maximum output voltage at 50lp/inch (at 1/2 of the optical Nyquest frequency)
Vmin: minimum output voltage at 50lp/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	30	35	40	ma
	RLED	55	80	100	ma
	GLED	250	450	630	ma
Input voltage at digital high	Vih	Vdd-1.0	Vdd-0.5	Vdd	V
Input voltage at digital low	Vil	0		0.6	V
Clock frequency(1)	Fclk		5.0	5.5	MHz
Clock pulse high duty cycle(2)		25			%
Clock pulse high duration(3)		50			ns
Integration time(3)	Tint	0.167		5.0	ms
Operating temperature (4)	Top		25	50	°C

Notes:

(1) The module will operate at 5.5MHz but its performance cannot be guaranteed.
(2) The clock duty cycle is defined as the ratio of the high level duration divided by the duration of the clock period.
(3) The tint (min.) is the lowest line integration time available at a 5.0MHz clock rate.
(4) Vavg and the dark level output signal over the operational temperature (see Section 9).

9.0 Video Signal Output over the Operational Temperature

Table 6 specifies the typical video output over the operating temperature range. Using either the Red LED light or the Yellow-Green LED light, the maximum output is at the lowest temperature and it decreases to its minimum value at the highest temperature. Accordingly, the output voltages are given as percentage differences from their mid-point value, 25°C. Since the dark level changes with the same characteristics, it is also specified as a deviation from the midpoint, except when the deviation is in mV.

Table 6: Vout over Operational Temperature

Average Output at 0°C	Average Output at 25°C	Average Output at 50°C
+12.2%	Vpavg under Red light	-6.0% under Red light
+25%	Vpavg under Yellow-Green light	-25%
<1.0mV	Vd (dark level)	>-1.0mV

10.0 Switching Characteristics (25°C)

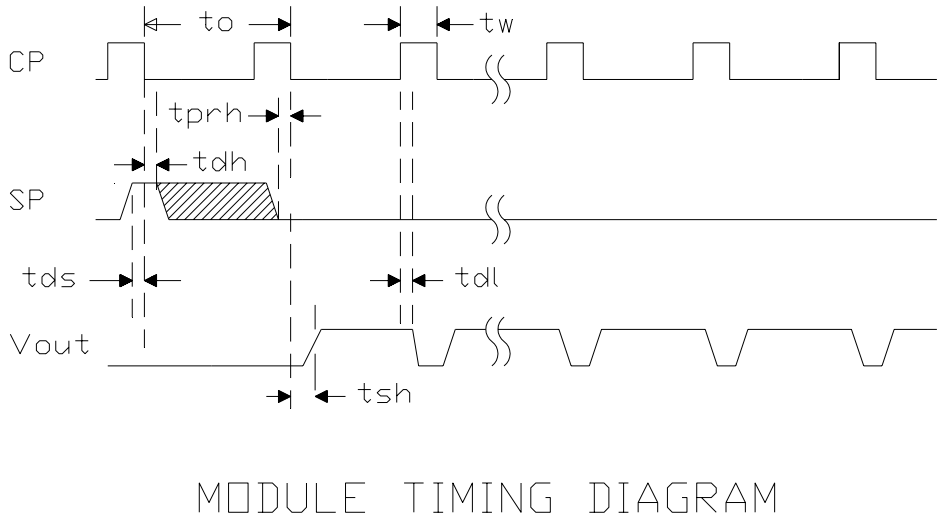

Figure 3: Clock and Start Pulse Timing Diagram

The switching characteristics for the I/O clocks are shown in Figure 3. Its corresponding timing symbol definitions are given in Table 7.

Table 7: Symbol Definitions for Figure 3 (Timing Diagram)

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 delay time	tdl	50			ns
Signal settling time	tsh	120			ns

11.0 AMIS-710256-A6 Module Mechanical Dimensions

The sketch of this module is provided as a pictorial of the module size and structure. A detailed drawing is available upon request.

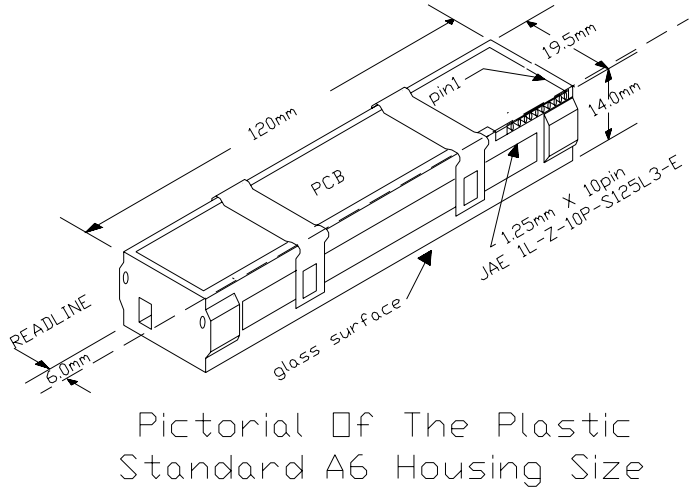

Figure 4: PI257MC-A6 Module Mechanical Outline

12.0 Company or Product Inquiries

For more information about AMI Semiconductor, our technology and our product, visit our Web site at: http://www.amis.com

North America
Tel: +1.208.233.4690
Fax: +1.208.234.6795

Europe
Tel: +32 (0) 55.33.22.11
Fax: +32 (0) 55.31.81.12