AMI SEMICONDUCTOR

Peripheral Imaging Corporation

PI226M-A4 CIS Module
200DPI CIS Sensor
Engineering Data Sheet

Key Features

• Light source, lens, and sensor are integrated into a single module

• 8 dpm resolution, 216 mm scanning length

• Electrically 347µsec/line scanning speed possible with optional light sources

• YELLOW-GREEN LED light source, limits the typical line scan to 695 µsec @ 2.5 MHz

• Wide dynamic range

• Analog output

• Compact size ≅ 14 mm x 19 mm x 232 mm

• Low power

• Light weight

General Description

The PI226M-A4 is a CIS module. It is a contact image sensor, using MOS image sensor technology for high-speed performance and high sensitivity. The PI226M-A4 is suitable for scanning A4 size (216 mm) documents with 8 dots per millimeter resolution. Applications include fax machines, game systems, variety of mark readers, and other automation equipment requiring document scanners.

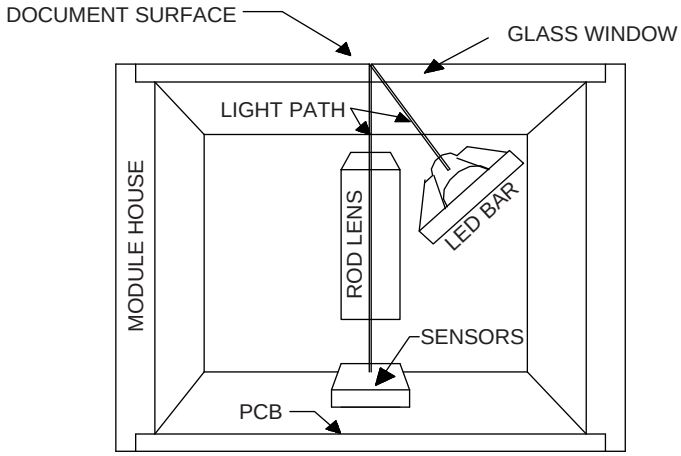
Functional Description

The PI226M-A4 imaging array consists of 27 sensors, PI3020 produced by Peripheral Imaging Corp, that are cascaded to provide 1728 photo-detectors with their associated multiplex switches, and a digital shift register that controls its sequential readout. Mounted in the module is one-to-one graded indexed micro lens array that 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 PI226M-A4 module.

Illumination is by means of an integrated Yellow-Green LED light source. 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, protects the imaging array, micro lens assembly, and LED light source from dust. I/O to the module is the 10-pin connector located on one end of the module. For pin 1 location, see Figure 4, The Overall View of the Module House.

The cross section of the PI226M-A4 is shown in Figure 1 and the block diagram in Figure 2.



INSIDE PICTORIAL OF MODULE

Figure 1. PI226M-A4 Cross Section

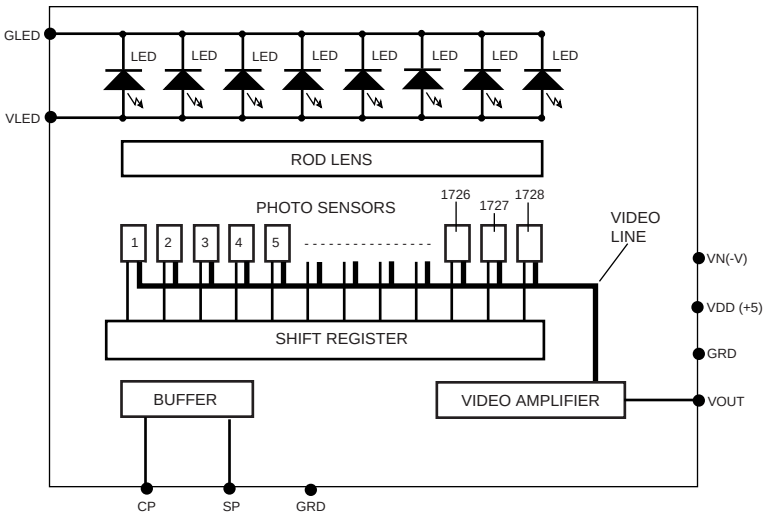


Figure 2. PI226M-A4 module block diagram
(See Table 1 for pin-out designation)

Pin Number	Symbol	Names and Functions
1	Vout	Analog Video Output
2	Gnd	Ground; 0V
3	Vdd (+5V)	Positive power supply
4	Vn (-5V to –12V)	Negative power supply
5	Gnd	Ground; 0V
6	SP	Shift register start pulse
7	Gnd	Ground; 0V
8	CP	Sampling clock pulse
9	GLED	Ground for the light source; 0V
10	VLED	Supply for the light source

Table 1. Pin configuration

Parameter	Symbols	Maximum Rating	Units
Power supply voltage	Vdd	7	V
	Idd	60	mA
	Vn	-15	V
	In	7	mA
	VLED	6.0	V
	ILED	1.2	A
Input clock pulse (high level)	Vih	Vdd	V
Input clock pulse (low level)	Vil	-0.5	V

Table 2. Absolute Maximum Ratings
Note, these are the maximum ratings and are not to be used in prolonged conditions.

Operating Environment

Operating temperature	Top	0 to 50	^{0}C
Operating humidity	Hop	10 to 85	%
Storage temperature	Tstg	-25 to+75	^{0}C
Storage humidity	Hstg	5 to 95	%

Table 3. Operating Environment

Table 4. Electro-optical characteristics at 25° C.

Parameter	Symbol	Parameter	Units	Note
Number of photo detectors		1728	elements	
Pixel to pixel spacing		125	µm	
Line scanning rate	Tint(1)	695	µsec	@ 2.5 MHz clock frequency
Clock frequency(2)	fclk	2.5	MHz	
Bright output voltage	Vpavg	1.0 +/-0.1	Volts	
Bright output nonuniformity(4)	Up	<|+/-30|	%	
Adjacent pixel nonuniformity(5)	Uadj	<25	%	
Dark nonuniformity(6)	Ud	<75	mV	
Dark output voltage(6)	Vd	<200	mV	
Modulation transfer function(7) (8)	MTF	>40	%	

Definition:

(1) Tint: Line scanning rate or integration time. Tint is determined by the interval of two SP, start pulses. This integration time of 695 µsec typically set at the factory for Yellow-Green LED. The minimum integration time of 347us is available at 5.0 MHz pixel rate, but it will require optional light sources.
(2) fclk: main clock frequency,
(3) Vpavg = $\sum$ Vp(n)/1728
(4) Up = [(Vpmax - Vpavg) / Vpavg] x 100% or [(Vpavg - Vpmin) / Vpavg] x 100%
(5) Upadj = MAX[| (Vp(n) - Vp(n+l) | / Vp(n)] x 100%
Upadj is the nonuniformity in percent between adjacent pixels.
(6) Ud = Vdmax – Vdmin
Vd = the average dark output level.
Vdmin is the minimum output on a black document (LED is turned off)
Vdmax: maximum output voltage of black document (LED is turned off)
(7) MTF = [(Vmax - Vmin) / (Vmax + Vmin)] x 100 [%]
Vmax: maximum output voltage at 50 lp/in
Vmin: minimum output voltage at 50 lp/in
(8) lp / in: line pairs per inch

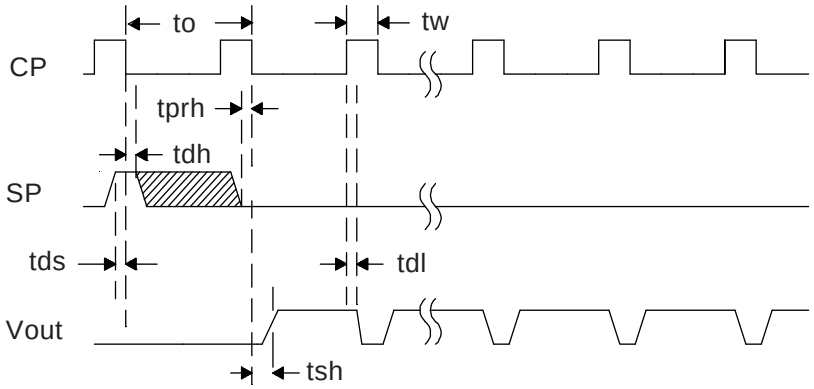
Table 5. Recommended Operating Conditions (25 ℃)

Item	Symbol	Min	Mean	Max	Units
Power Supply	Vdd	4.5	5.0	5.5	V
	Vn.	-4.5	-5	-12	
	VLED	4.5	5	5.5	V
	Idd	25	30	35	ma
	Ivn	4.0	4.0	5.0	ma
	ILED	350	560	790	ma
Input voltage at digital high	Vih	Vdd-1.0	Vdd-.5	Vdd	V
Input voltage at digital low	Vil	0		0.8	V
Clock frequency (1)	fclk			3.0	MHz
Clock pulse high duty cycle		25			%
Clock pulse high duration		82			ns
Integration time(1)	Tint	0.576		5.0	ms
Operating temperature	Top		25	50	^{0}C

Note:

(1) Electrically, including the image sensors, the circuits will operate above 5.5 MHz. However, with the Yellow-Green light option, the light exposure limits the operation to a maximum of 3.0MHz, hence the integration time, Tint of 0.576 ms.

Switching Characteristics (25℃)



MODULE TIMING DIAGRAM

Figure 3. Timing Diagram

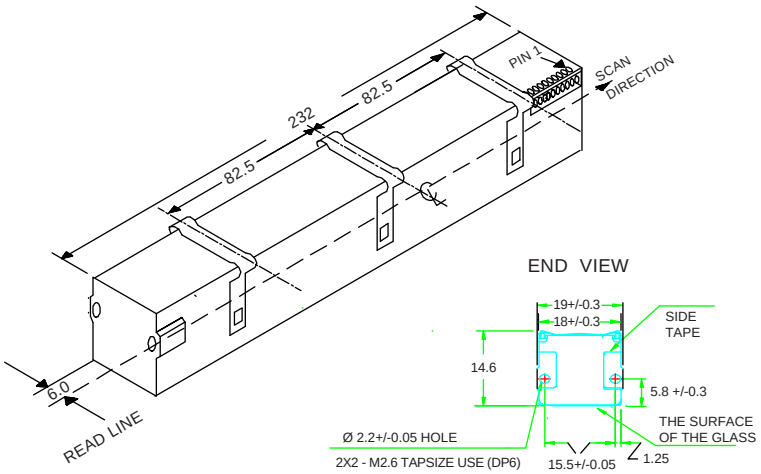
The switching characteristics for the I/O clocks are in the above diagrams. See timing symbol definitions in the following Table 6.

Item	Symbol	Min.	Typical	Max.	Units
Clock cycle time	to	0.333		4.0	μs

Clock pulse width	tw	82			ns
Clock duty cycle		25		75	%
Prohibit crossing time of Start Pulse	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

Table 6. Symbol Definitions for the Above Timing Diagram

PI226M-A4 Module and Its Mechanical Dimensions



MECHANICAL STRUCTURE

Figure 4. Overall View of the Module House

This is an overview drawing of the module. A full size drawing is available upon request.