AMI SEMICONDUCTOR

Peripheral Imaging Corporation

PI200MC-A4
200DPI CIS Module
Engineering Data Sheet

Key Features

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

• 8 dpm resolution, 216 mm scanning length

• 437µsec/line scanning speed @ 4.0MHz clock rate

• Wide dynamic range

• Analog output

• 660 Red LED light source

• Compact size - 20.5 mm x 21.5 mm x 232 mm

• Low power

• Light weight

General Description

The PI200M-A4 is a CIS module. It is a long contact image sensor, using MOS image sensor technology for high-speed performance and high sensitivity. The PI200M-A4 is suitable for scanning A4 size (216 mm) documents with 8 dots per millimeter resolution. Applications include document scanners, mark readers, and other office automation equipment.

Functional Description

The PI200M-A4 imaging array consists of 27 sensors, PI3020 produced by Peripheral Imaging Corp. The sensor is a monolithic chip with an array of 64 photo sensing elements, of which 27 are cascaded to provide 1728 photo-detectors. These cascaded chips are contiguously aligned in a single row and bonded to PCB. See Figure 1, PI200M-A4's

Block Diagram. This configuration allows a stream of sequential video pixels to be read from its output port, i.e., starting from 1st pixel located next to the connector end of the module and continues to and through the last pixel, 1728th. Each chip contains a complete control circuitry. Integrated within monolithic chip is a set of multiplex switches, and a digital shift register to control the chips sequential readout. Additionally, the chips contain a chip selection switch that is interrogated in a sequence as each predecessor chip completes its scanning process.

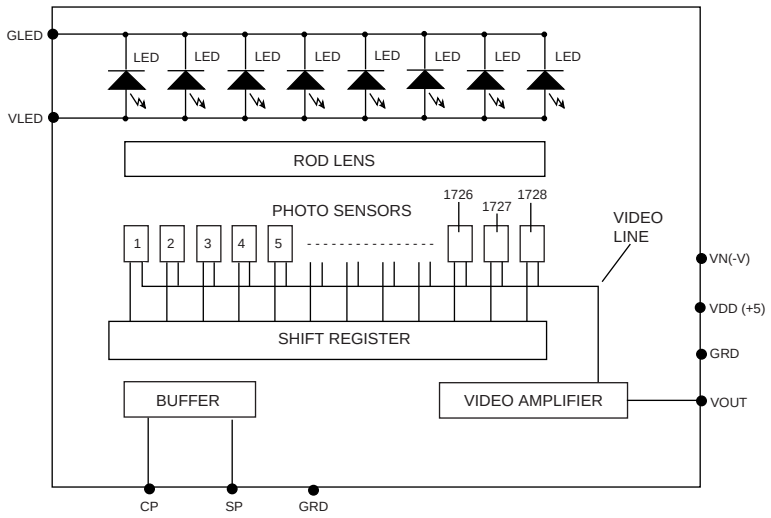


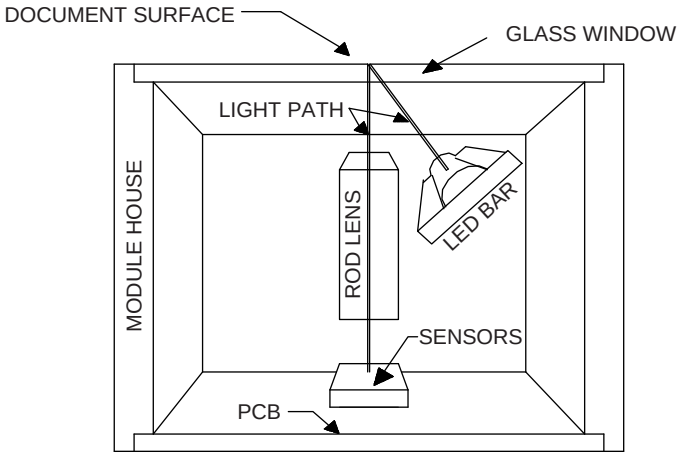
Figure 1. PI200M-A4 Block Diagram

Figure 2, PI200M-A4's Cross Section, shows a mechanical cross section of the module's internal structure. Mounted in the module is number of components. These components function together to provide the module a complete integrated system. The LED light bar illuminates the documents through the window and reflection from the imaged documents is pickup and focused by the one-to-one graded indexed micro lens array.

The lens, through the glass window, focuses the scanned images from the document onto the sensing plane of the sensor chips, which is mounted on the PCB. During the imaging process, the document is passed across the glass window's surface.

The PCB board not only has the sensor chips mounted on it, but it has an on-board amplifier, a clock buffer for both the Start Pulse, SP, and the module's master clock, CP, buffer. This amplifier processes the pixel charges from the image sensor chips and converts them into voltage signal to produce a sequential stream of video at the output pin of the PI200M-A4 module.

All these discussed components are housed in a small plastic housing which has a cover glass, the window. This housing with its sealed windows protects the imaging array, the micro lens assembly, and the LED light source from dust.



INSIDE PICTORIAL OF MODULE

Figure 2. PI200M-A4 Cross Section

Pin Out Description

There is one 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 flat surface, with the viewer looking down on backside of the module, and with the connector's pins facing viewer, the connectors is located on the left hand end of the module. The connector is a 2.0mm dual 8-pin rows with a total of 16 pin connector, part # Berg 88054-X16. Its I/O designation is provided in Table 1. I/O Designation. Pin number 1 location is indicated on the module outline. All of the odd pins are on the bottom row with pin number one on the edge closest to end of module. All of even pins are on the top row with pin 2 located adjacent to the pin 1.

Pin Number	Symbol	Names and Functions
1, 2 , 4 & 8	Gnd	Ground; 0V
3	Vout	Analog Video Output
5 & 6	Vdd (+5V)	Positive power supply
7	SP	Start Clock Pulse
9 &10	Vn (-5V to –12V)	Negative power supply
11 & 12	CP	Sampling clock pulse
13 & 14	GLED	Ground for the light source; 0V
15 & 16	VLED	Supply for the light source

Table 1. I/O Designation

Absolute Maximum Rating:

Parameter	Symbols	Maximum Rating	Units
Power supply voltage	Vdd	7.0	V
	Idd	70	mA
	Vn	-15	V
	In	20	mA
	VLED	5.75	V
	ILED	600	mA
Input clock pulse (high level)	Vih	Vdd	V
Input clock pulse (low level)	Vil	-0.5	V

Table 2. Absolute Maximum Rating

Note, these are the absolute maximums and are not to be used in prolonged operation.

Operating Environment

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

Table 3. Operating Environment

Electro-Optical Characteristics (25° C)

Parameter	Symbol	Parameter	Units	Note
Number of photo detectors		1728	elements	
Pixel to pixel spacing		125	μm	
Line scanning rate(1)	Tint	437	μsec	@ 4MHz clock frequency
Clock frequency(2)	Fclk	4.0	MHz	
Bright output voltage		1.0	Volts	
Bright output(4) nonuniformity	Up	<+/-30	%	
Adjacent pixel(5) nonuniformity	Upadj	<25	%	
Dark nonuniformity(6)	Ud	<50	mV	
Dark output voltage(6)	Vd	<75	mV	
Modulation transfer function(7)	MTF	>30	%	

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

Definition:

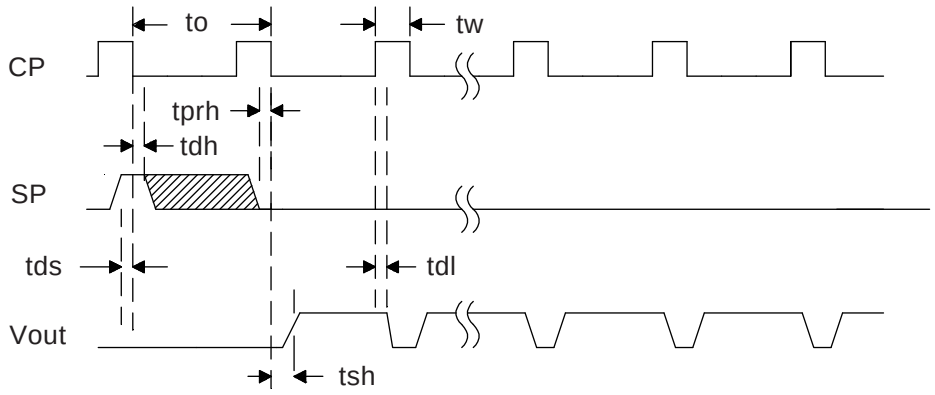
(1) Tint is the line scanning rate or integration time. Tint is determined by the interval between two start pulses (SP).
(2) Fclk is the main clock, CP, frequency.
(3) Vpavg = $\sum$ Vp(n)/1728
(4) Up = [(Vpmax - Vp) / Vp] x 100% or [(Vp - Vpmin) / Vp] x 100%
(5) Upadj = MAX[| (Vp(n) - Vp(n+l) | / Vp(n)] x 100%
Upadj is the nonuniformity percentage pixel to pixel
(6) Ud = Vdmax -Vdmin
Vdmin is the minimum dark output voltage, Vd, with light source off.
Vdmax: maximum dark output voltage, Vd, with light source off.
Vd is measured between the reset level of the video and the dark video signal level. This fixed offset occurs because of the video line is reset to ground after each pixel and before the following pixel. However, because the video signal is amplified and the offset is adjusted to force the average dark video signal near ground, the average dark video signal is only few millivolts from ground and reset level will be below ground.
(7) MTF = [(Vpmax - Vpmin) / (Vpmax + Vpmin)] x 100 [%] is the effective algorithm which is used to make the measurements.
V(p)max: maximum output voltage at 4.0 lp/mm
V(p)min: minimum output voltage at 4.0 lp/mm
(8) lp / mm: line pair per mm

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	V
	VLED	4.5	5	5.5	V
	Idd	42	50	55	ma
	Ivn	5.0		6.0	ma
	ILED	300	450	550	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	Fclk		4.0	5.0	MHz
Clock pulse high duty cycle	Dclk	25			%
Clock pulse high duration	CPH	50(3)			ns
Integration time	Tint	0.347		5.0	ms
Operating temperature	Top		25	50	^{0}C

Table 5. Recommended Operating Conditions (25 ℃)

Switching Characteristics (25℃)



MODULE TIMING DIAGRAM

Figure 3. PI200M-A4 Timing Diagram

Each switch timing characteristics for the I/O clocks are defined in symbolic acronyms. There is a corresponding clock's switching times for each symbol on the timing diagram. These corresponding times for each symbol is given in the following Table 6.

Item	Symbol	Min.	Mean	Max.	Units
Clock cycle time	to	0.20		2.0	μs
Clock pulse width	tw	50			ns
Clock duty cycle		25		75	%
Prohibit crossing time of Start Pulse	tprh	15			ns
Data setup time	tds	10			ns
Data hold time	tdh	35			ns
Signal delay time	tdl	20			ns
Signal settling time	tsh	90			ns

Table 6. Symbol Definitions for the Above Timing Diagram

Mechanical Description

Figure 4 is an overview drawing of the module with approximate dimensions. If a detailed drawing is desired, especially for a design in application, a full size drawing is available upon request.

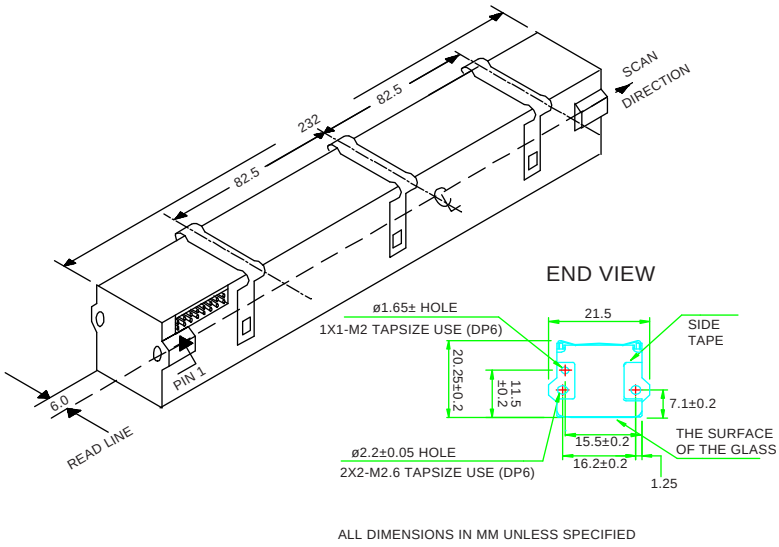


Figure 4. PI200M-A4 Module Outline