AMI SEMICONDUCTOR

Peripheral Imaging Corporation

PI240MC-A4
200DPI CIS Module
Engineering Data Sheet

Key Features

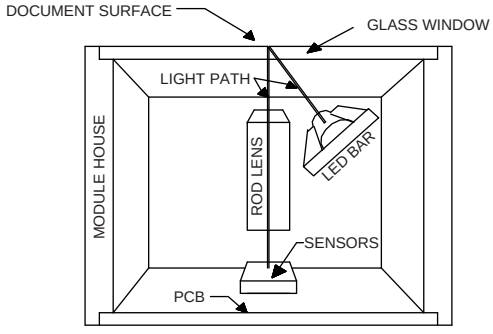
- Inverted Video Signals (magnitude increases in a negative direction)
- Light source, lens, and sensor are integrated into a single module
- 8 dpm resolution
- 216 mm scanning length
- 0.347ms/line scanning speed, operated @ 5.0MHz
- Wide dynamic range Analog output
- 660nm light source
- Compact size: ≈ 14 mm 19.5 mm x 232 mm
- Low power
- Light weight

General Description

The PI240MC-A4 is a contact imaging sensor, CIS, module, which is composed of 1728 PI3020 sensor chips. The PI3020 is a 200 DPI solid-state line imaging array, also a product of Peripheral Imaging Corporation. This imaging device is fabricated using MOS imaging sensor technology for high-speed performance and high sensitivity. The PI240MC-A4 is suitable for scanning A4 size (216 mm) documents with 8 dots per millimeter resolution. Applications include variety of document scanners, variety of mark readers, and other automation equipment.

Functional Description

The PI240MC-A4 imaging array consists of 27 chips 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 the scanned documents to image onto its sensing plane. The on-board amplifier processes the video signal to produce a sequential stream of video at the video output pin of the PI240MC-A4 module.



INSIDE PICTORIAL OF MODULE

Figure 1. PI240MC-A4 Cross Section

Illumination is by means of an integrated LED light source. All components are housed in a small plastic housing which has a cover glass which acts as the focal point for the object being scanned and 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. See Figure 4. The Mechanical Structure. The cross section of the PI240MC-A4 is shown in Figure 1 and the block diagram in Figure 2.

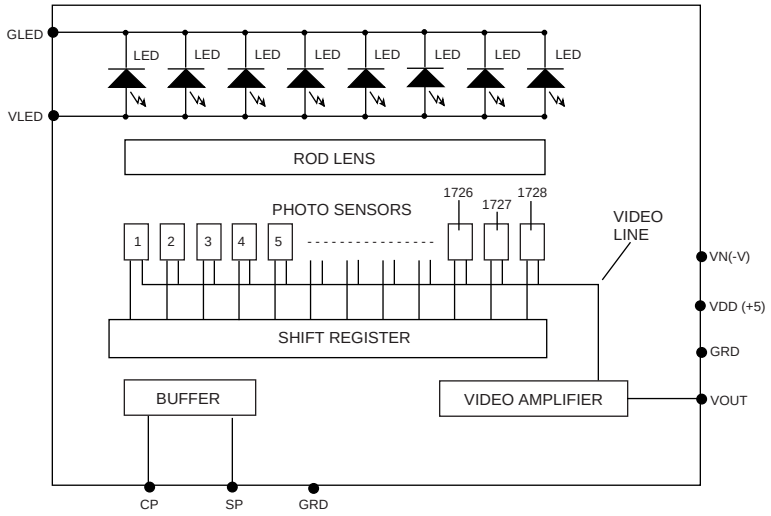


Figure 2. PI240MC-A4 Module Block Diagram

Recommended Operating Conditions (25 °C)

Item	Symbol	Min	Typical	Max	Units
Power Supply	Vdd	4.5	5.0	5.5	V
	Idd	24	30	35	ma
	Vn	-4.5	-5	-15	V
	Ivn	5	6	8	ma
	VLED	4.5	5.0	5.5	V
	ILED	305	430	560	ma
Video Output Level	Vid	0.8	1.0	1.2	V
Input voltage at digital high	Vih	Vdd -1.0	Vdd -0.5	Vdd	V
Input voltage at digital low	Vil	0		0.8	V
Clock frequency	F		3.0	5.0	MHz
Clock pulse high duty cycle		25			%
Clock pulse high duration		50			ns
Integration time	Tint(1)	0.346	0.6	10.0	ms
Operating temperature	Top		25	50	^{0}C

Note (1). Tint is determined by time interval between two start pulses, SP. The longest integration time is determined by the degree of leakage current degradation that can be tolerated by the system. A 10ms maximum is a typical rule-of-thumb hence the experienced CIS user can use his discretion in determining the integration time.

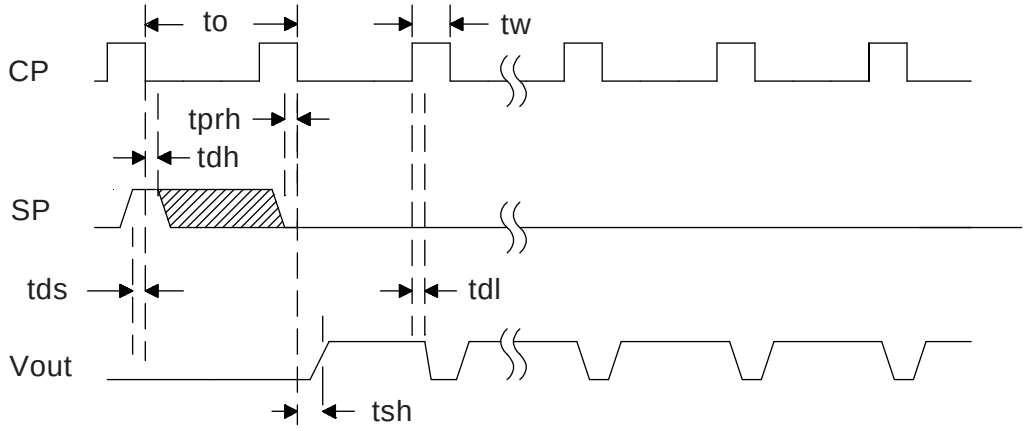
Electro-Optical Characteristics (25° C)

Parameter	Symbol	Parameter	Units	Note
Number of photo detectors		1728	elements	
Pixel-to-pixel spacing		125	µm	
Line scanning rate(1)	Tint	347	µsec	@ 5.0 MHz clock frequency
Clock frequency(2)	freq	5.0	MHz	
Bright output voltage(3)	Vp	1.0	Volts	
Bright output nonuniformity(4)	Up	<+/-30	%	
Adjacent pixel nonuniformity(5)	Uadj	<25	%	
Dark nonuniformity(6)	Ud	<100	mV	
Dark output voltage(6)	Vd	<150	mV	
Modulation transfer function(7)	MTF	>30	%	

Definition:

(1) Tint: line scanning rate or integration time. Tint is determined by the interval of two start pulses (SP).
(2) freq is the main clock 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 of adjacent pixels
(6) Ud = Vdmax - Vdmin
Vd is the voltage amplitude between the output video's reset level and its dark level.
Vdmin is the minimum output with LED light off.
Vdmax: maximum output voltage with the LED light off.
(7) MTF = [(Vmax - Vmin) / (Vmax + Vmin)] x 100 [%]
Vmax: maximum output voltage at 4.0 lp/mm
Vmin: minimum output voltage at 4.0 lp/mm
(8) lp / mm: line pair per mm

Switching Characteristics (25^0C)
Figure 3



MODULE TIMING DIAGRAM

Symbol Definitions for the Above Timing Diagram

Item	Symbol	Min.	Typical	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 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	90			ns

Absolute Maximum Rating:

Parameter	Symbols	Maximum Rating	Units
Power supply voltage	Vdd	10	V
	Idd	30	mA
	Vn	-15	V
	In	15	mA
	VLED	6	V
	ILED	650	ma
Input clock pulse (high level)	Vih	Vdd – 0.5V	V
Input clock pulse (low level)	Vil	-0.5	V

Note (1): These parameters are absolute maximums and should not be used to operate the module.

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	10 to 90	%

Mechanical Considerations

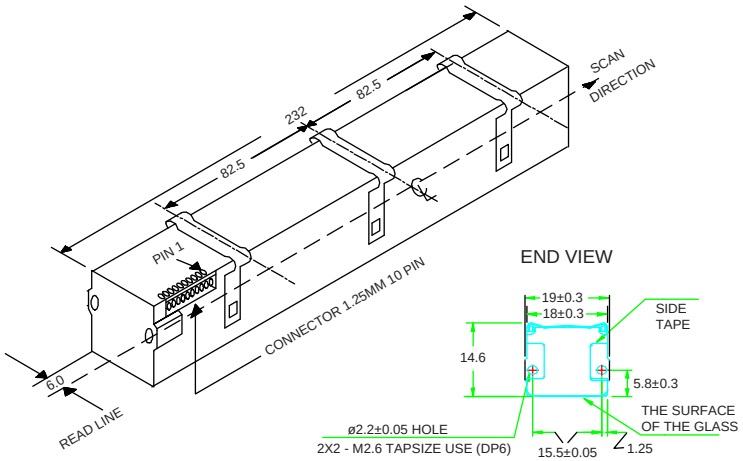
I/O Connector Pin configuration

Connector is a 1.25mm 10 pin JAE IL-Z-10P-S125L3-E. Its location, along with its pin 1 location, are shown in Figure 4 The Mechanical Structure.

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

Module Housing Dimensions

The PI240MC-A4 module outline and its mechanical dimensions are shown. A detailed housing drawing is available upon request.



ALL DIMENSIONS IN MM UNLESS OTHERWISE SPECIFIED

MECHANICAL STRUCTURE
FIGURE 4