AMI SEMICONDUCTOR

Peripheral Imaging Corporation

PI403MC-A6
400DPI CIS Module
Engineering Data Sheet

Key Features

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

• 16 dpm resolution, 104 mm scanning length

• Up to 333 µsec/line scanning speed, with 5MHz pixel rate

• Wide dynamic range

• Analog output

• Red LED light source (660 nm)

• Compact size ≅ 14 mm x 19 mm x 120 mm

• Low power

• Light weight

General Description

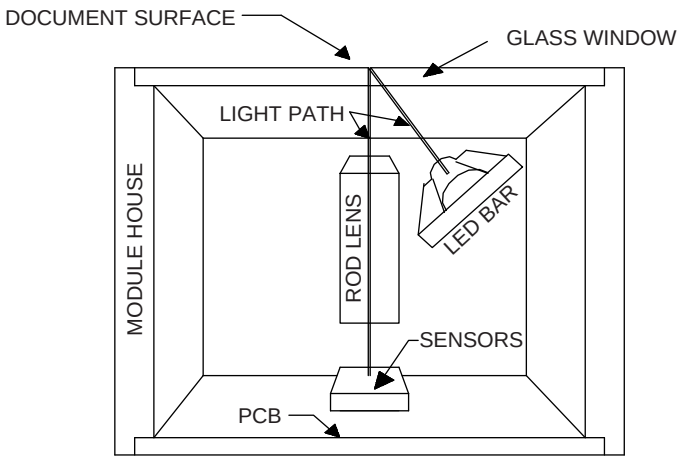
The PI403MC-A6 is a contact imaging sensor, CIS, module, which is composed of 13 PI3022 sensor chips. The PI3022 is a 400 DPI solid-state line imaging array, also a product of Peripheral Imaging Corporation. This imaging device is fabricated using MOS imaging sensor technology for high-speed performance and high sensitivity. The PI403MC-A6 is suitable for scanning A6 size (104 mm) documents with 16 dots per millimeter resolution. Applications include ticket, check and card scanners, variety of mark readers, and other automation equipment.

Functional Description

The PI403MC-A6 imaging array consists of 13 sensors that are cascaded to provide 1664 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 PI403MC-A6 module.

Illumination is by means of an integrated LED light source. All components are housed in a small plastic housing with 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, Module Housing. The cross section of the PI403MC-A6 is shown in Figure 1 and the block diagram in Figure 2.



INSIDE PICTORIAL OF MODULE

Figure 1. PI403MC-A6 Cross Section

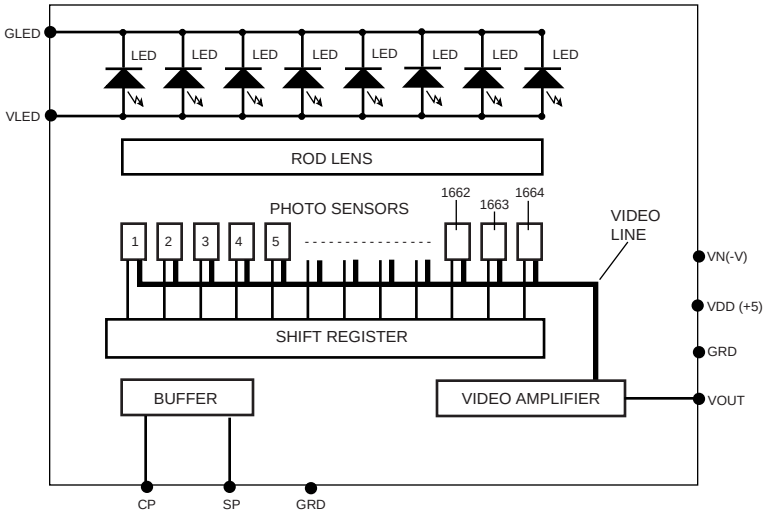


Figure 2. PI403MC-A6 module block diagram.
(See Table 1 below)

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

Absolute Maximum Rating:

Parameter	Symbols	Maximum Rating	Units
Power supply voltage	Vdd	7	V
	Idd	70	ma
	Vn	-15	V
	In	15	ma
	VLED	5.5	V
	ILED	400	ma
Input clock pulse (high level)	Vih	Vdd – 0.5V	V
Input clock pulse (low level)	Vil	-0.6	V

Table 2. Absolute Maximum Rating

Note: Not to recommended for operational 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. Typical Operational Environment for CIS

Electro-Optical Characteristics (25° C)

Parameter	Symbol	Parameter	Units	Note
Number of photo detectors		1664	elements	
Pixel to pixel spacing		63.1	μm	
Line scanning rate	Tint(1)	333	μsec	@ 5.0 MHz clock frequency
Clock frequency(2)	f	5.0	MHz	
Bright output voltage(3)	Video Output	1.0	V	
Bright output nonuniformity(4)	Up	<+/-30	%	
Adjacent pixel nonuniformity(5)	Uadj	<25	%	
Dark nonuniformity(6)	Ud	<100	mV	
Dark output voltage(7)	Vd	<550	mV	
Modulation transfer function(8)	MTF	>50	%	

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

Definition:

(1) Tint: Line scanning rate or integration time. Tint is determined by the interval of two SP, start pulses.
(2) f: main clock frequency,
(3) Vpavg = $\sum$ Vp(n)/1664
(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 output on a black document(O.D.=0.8)
Vdmax: maximum output voltage of black document (O.D.= 0.8)
(7) Vd is the dark level, measured from the reset level.
(8) MTF = [(Vmax - Vmin) / (Vmax + Vmin)] x 100 [%]
Vmax: maximum output voltage at 100 lp/in
Vmin: minimum output voltage at 100 lp/in
(9) O.D. = Optical Density
(10) lp / in: line pair per inch

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		5	5.5	V
	Idd		47	55	ma
	Ivn		6.6	10.0	ma
	ILED		280	350	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	f			5.0	MHz
Clock pulse high duty cycle		25			%
Clock pulse high duration		50			ns
Integration time	Tint*	0.333		5.0	ms
Operating temperature	Top		25	50	^{0}C

Table 5. Recommend Operational Characteristics
* Tint (Min) is the lowest line integration time available with 5.0 MHz clock rate.

Switching Characteristics (25℃)

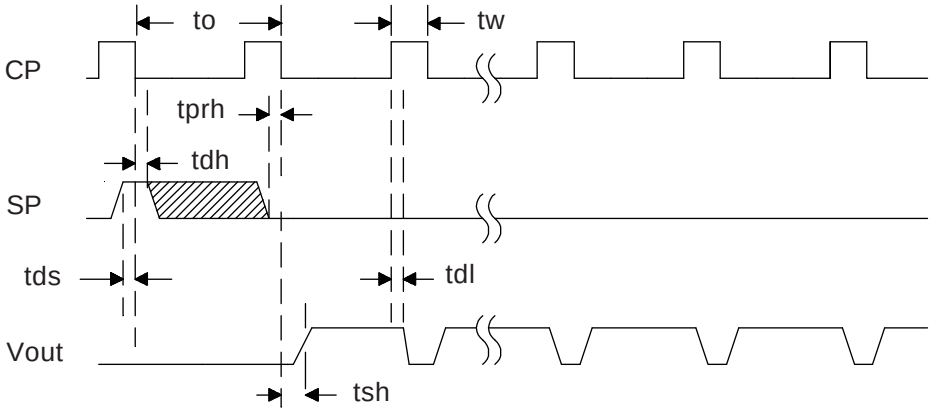


FIGURE 3. MODULE TIMING DIAGRAM

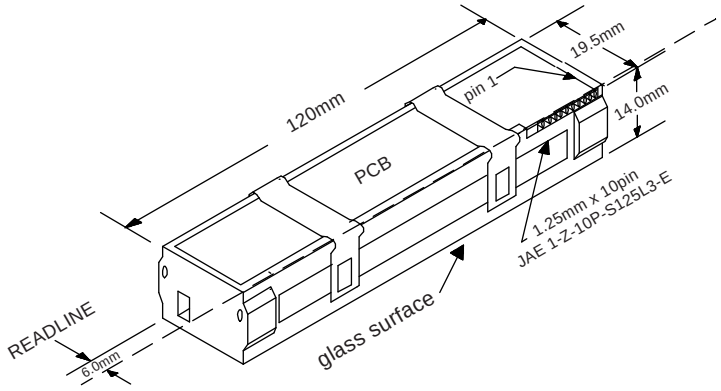
The switching characteristics for the I/O clocks are shown in the above timing diagrams. See timing symbol definitions in the following table.

Item	Symbol	Min.	Typical	Max.	Units
Clock cycle time	to	0.20		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	120			ns

Table 6. Symbol Definitions for the Above Timing Diagram

PI403MC-A6 Module and Its Mechanical Dimensions



Pictorial of the Plastic
Standard A6 Housing Size

Figure 4. Module Housing

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