Contact Image Sensor (CIS) Module	
Product Name	**M206-A6M**

Approval			Notes	
CMOS Sensor Inc. 20045, Stevens Creek Blvd., Suite 1A Cupertino, CA., 95014 Tel: (408) 366-2898 Fax: (408) 366-2841	Approved	Checked	Designed	
		Sam Lin	Chang Lin Xiao	
Issued	July 1, 2005	Revision no.		
All specifications of this device are subject to change without notice.				

Revision control sheet

Revision No.	Date	Item of change and content	Reason	Approved	Designed

Features:

- Resolution selectable: 300 dpi / 600dpi resolution
- Very high speed scanning rate: 0.1 ms / line / color for 300 dpi resolution
                                                    0.2 ms / line / color for 600 dpi resolution
- Three different LED light source: Ultra violet, Red, and infrared light
- Dual light source structure: -45 degree and +45 degree angle against document
- Optical scanning length: 102.2 mm
- Low power supply: 3.3 V
- Video output: two video output
- Pixel readout rate: 16 Mega-pixel/sec
- Dimension: 17 mm (H) x 19 mm (W) x 115 mm (L)

Description:

The M206-A6M is a very high speed, linear Contact Image Sensor (CIS) module. The module built in three different LED (ultra violate, red, and infrared) light source. In order to prevent the shading problem on the conventional CIS module, a dual light source structure is used.   One light source is –45 degree against the document, the other is +45 degree against the document. It is suitable to read the currency for ATM or vending machine applications.

Figure 1 shows a cross sectional view of the M206-A6M module. It consists of a three different LED light sources to illuminate the document, a one-to-one erect graded index micro lens array to focus the document image on the photo-detector array, an array of linear CMOS image sensors to convert the image to an electronic signal, a cover glass to protect the sensor array from dust, a 12-pin connector for input/output connections. The module dimensions are 19 mm in width and 17 mm in height and 115 mm in length. Figure 2 shows a block diagram of the M206-A6M module.
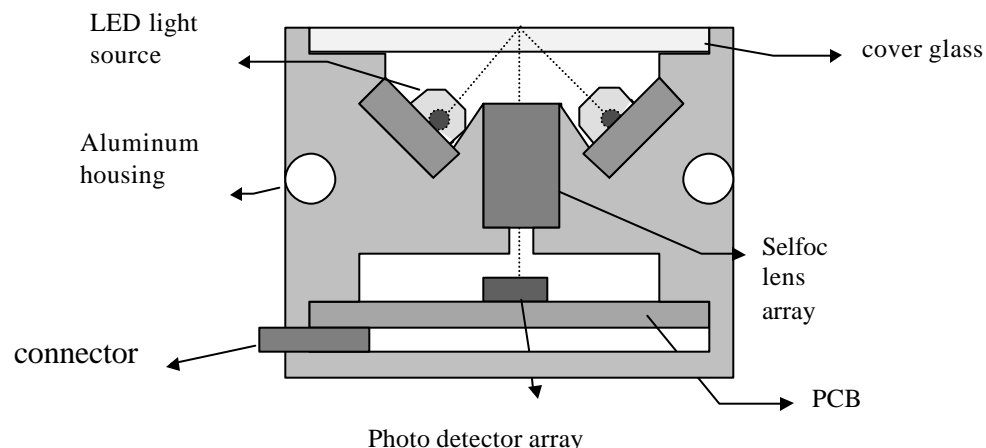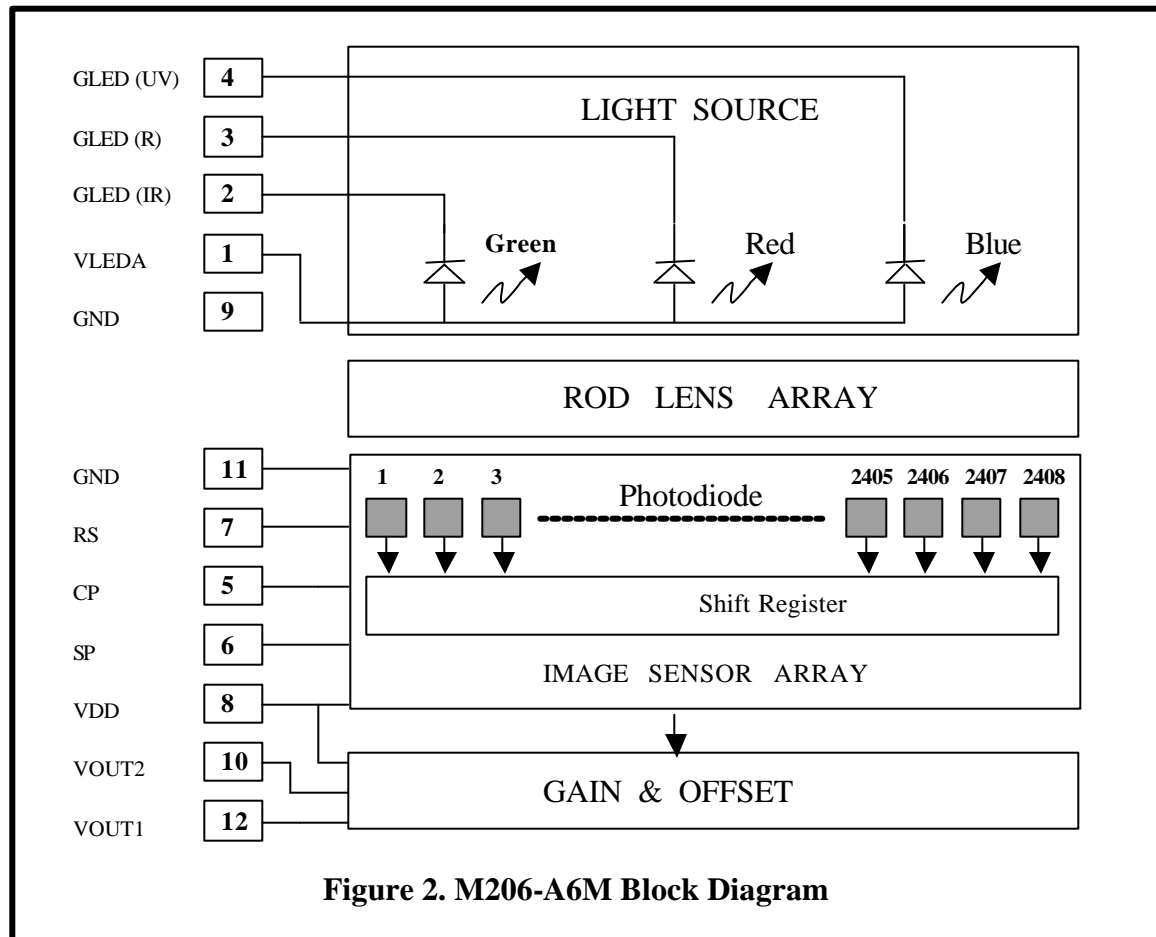

Figure 1. Cross section view of M206-A6M.

Functional block diagram:

Figure 2. M206-A6M Block Diagram

VOUT1: pixel #1 to #1032
VOUT2: pixel # 1033 to # 2408

Pin description:

Table 1. The pin out description of the M206-A6M CIS module.

Pin #	Symbol	Direction	Name and function
1	VLEDA	Input	Common Anode for LED light source (+12 V)
2	GLED (IR)	Input	Cathode for Infrared LED light source
3	GLED (R)	Input	Cathode for Red LED light source
4	GLED (UV)	Input	Cathode for Ultra Violet LED light source
5	CP	Input	Clock pulse
6	SP	Input	Start pulse
7	RS	Input	300 dpi / 600 dpi resolution selectable
8	VDD	Input	Module power (+3.3 Volts)
9	GND	Input	Ground (0 Volts)
10	VOUT2	Output	Second stage video output signal
11	GND	Input	Ground (0 Volts)
12	VOUT1	Output	First stage video output signal

PERFORMANCE CHARACTERISTICS

 (All shipped modules are tested under the following test conditions)

Table 2. Operating Conditions and Typical Output Response (25 ºC) for 300 dpi resolution
Test Conditions: VDD=3.3 V, VLED = 12V

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Line scanning rate	Tint		0.1		ms / line	1
Clock frequency	Tclk		4.0		MHz	
Pixel output frequency	Fpix		8.0		MHz	
Bright signal output (IR)	Vpcmax			2.3	V	2
Bright signal output (R)	Vpcmax			2.3	V	2
Bright signal output (UV)	Vpcmax			1.1	V	2
Bright output no-uniformity	Upc			20	%	3
Minimum output of dark signal	Vdmin	1.0			V	4
Dark output non-uniformity	Ud			0.2	V	5
Modulation transfer function At red	MTF	20			%	6

TERMS AND DEFENITIONS

The parameters of the test conditions in Table 2 are defined as:

1   Tint is the integration time or line scanning time. Tint is determined by the interval between two start pulses (SP).

2. Vpc(n) is the effective output signal of every pixel and is defined by:

$$Vpc(n) = Vp(n) - Vd(n)$$

Vp(n) is the output signal of the nth pixel using a white image target with 0.05 Optical Density (OD).

Vd(n) is the output signal of the nth pixel in the black target.

.   Dark output is obtained at black target by turning on the LED.

Vpcavg is defined by

$$Vpcavg = \sum_{n=1}^{m} [Vpc(n)];$$

Where n = 1, 2, ..., m;

3. Upc is the white output non-uniformity with dark signal subtracted and is defined by:

$$Upc = ((Vpcmax - Vpcmin) / (Vpcmax)) \times 100\%$$

Vpcmax = MAX[Vpc(n)]; is the maximum effective output signal
Vpcmin = MIN[Vpc(n)]; is the minimum effective output signal
Where n = 1, 2, ..., m

4. Vdmin is the minimum output signal in the dark and is defined by:

$$Vdmin = MIN [Vd(n)];$$

Where n = 1, 2, ..., m;

5. Ud is the dark output non-uniformity and is defined by:

$$Ud = Vdmax - Vdmin$$

Vdmax = MAX[Vd(n)]; is the maximum dark output signal
Vdmin = MIN[Vd(n)]; is the minimum dark output signal

6. Figure 4 shows a typical output response of the module using a MTF image target. Modulation Transfer Function is defined by:

$$MTF = MIN\{ [(Vmax - Vmin) / (Vmax + Vmin)] \} \times 100\%$$

Vmax is the maximum output signal using the MTF image target with
 Correspond to dark signal (Vd) subtracted
Vmin is the minimum output signal using the MTF image target
Correspond to dark signal (Vd) subtracted
MTF image target is 5.75 lp/mm

Note:

1. All parameter is measured at 300 dpi resolution and VOUT1
2. Dark compensation is achieved by subtracting the dark level of every pixel.
3. For the best performance, two points correction (dark and white) is strongly recommended.

Figure 3. Output Signal Waveform in the Dark and White

Figure 4. Output Signal with MTF test target
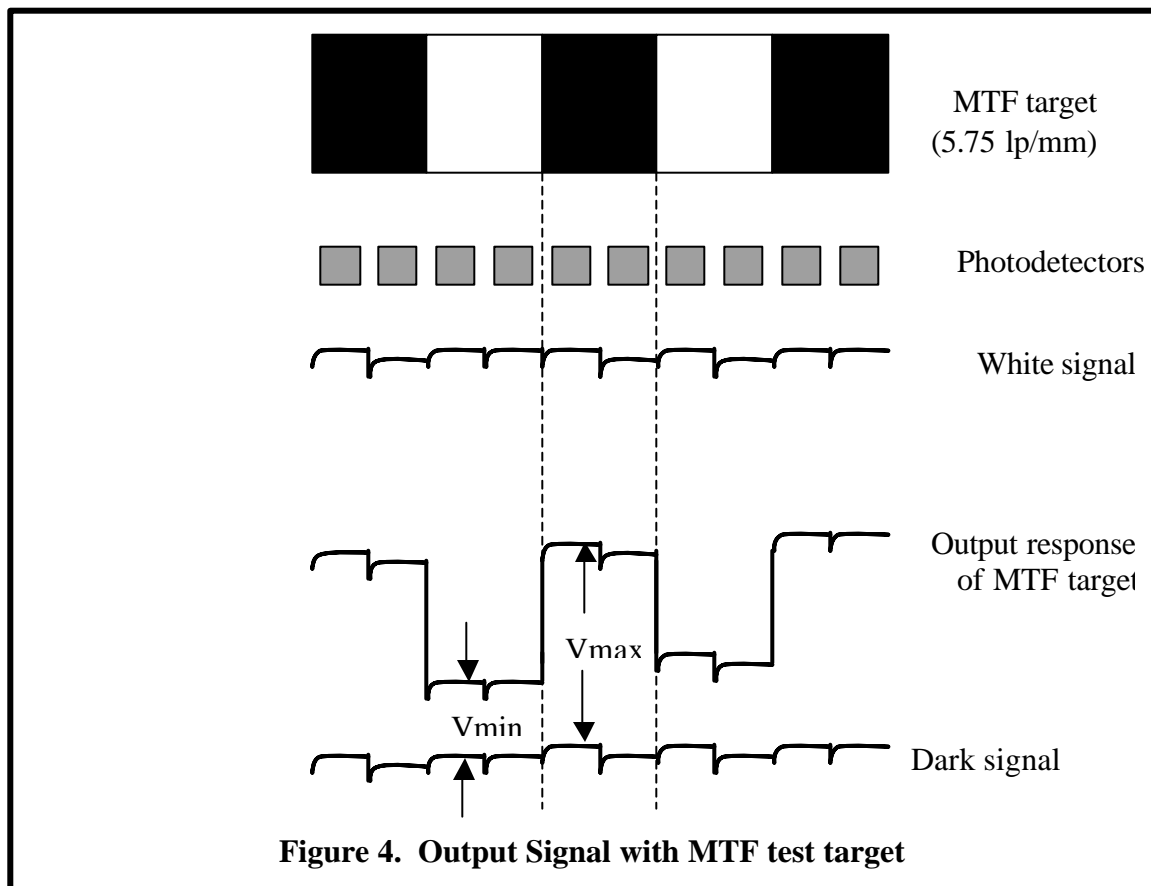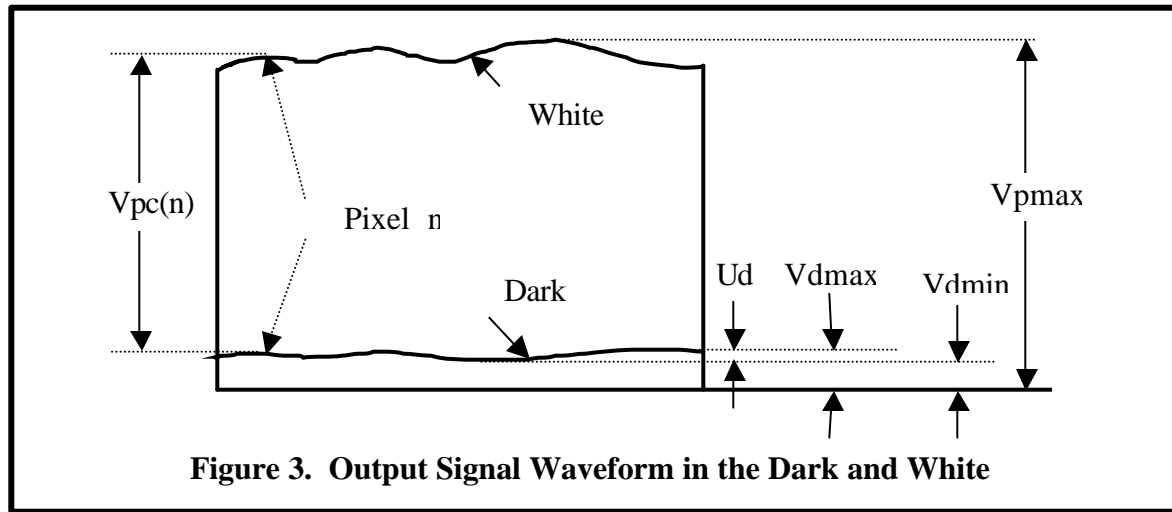
ELECTRICAL   REQUIREMENTS

Table 3. Absolute Maximum Ratings

Parameter	Symbol	Max	Min	Unit
Power supply voltage	VDD	3.6		V
Power supply current	IDD	10		mA
LED power supply voltage	VLED	12.5		V
LED power supply current	ILED	300		MA
Input voltage		VDD + 0.5	-0.5	V
Output voltage		VDD + 0.5	-0.5	V
Operating temperature	Top	50	0	℃
Storage temperature	Tstg	75	-25	℃
Operating humidity	Hop	90	10	RH %
Storage humidity	Hstg	90	10	RH %

Table 4. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	VDD		3.3		V
LED power supply voltage	VLED		12.0	12.5	V
High-level input voltage	Vih	VDD-0.7		VDD+0.4	V
Low-level input voltage	Vil	0		0.7	V
Clock frequency	Tclk		4		MHz
Clock duty cycle			50		%
Integration time	Tint		0.1		ms
Operating humidity	Hop	10		85	RH %
Operating temperature	Top	0	25	50	℃

Table 5. LED Light Source Characteristics (IF=20mA, 25 ℃)

Parameter	Peak emission wavelength (λ_P)	Spectral line half width ($\Delta\lambda$)
Infrared LED	940 nm	20 nm
Red LED	635 nm	15 nm
Ultra Violet LED	390 nm	10 nm

TIMING DIAGRAM
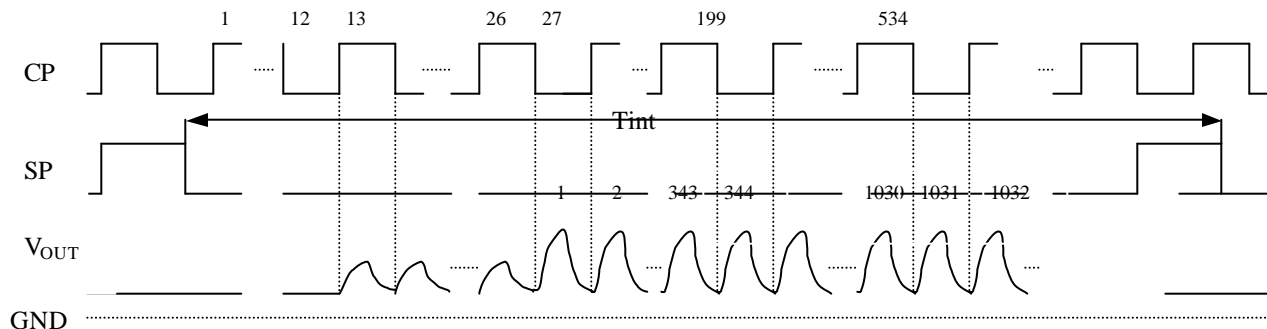


Figure 5.   Timing diagram of the M206-A6M module.

Table 6. Timing Requirements and Switching Characteristics (Vdd=5V and 25ºC)

Parameter	Symbol	Min	Typ	Max	Unit
Clock Frequency	tclk		4		MHz
Clock Pulse width	tw		125		Ns
Clock Duty	Tw/to		50		%
SP Setup Time	tst	50		to-tw	ns
SP Hold Time	tht	50		to-tw	ns
Signal Delay Time	td		50		ns

Figure 5 shows the module timing. Refer to table 6 for timing parameters. Notice the M206-A6M output data is twice the clock frequency. The new pixel data is available after every clock transition. Due to parasitic capacitance, the data does not instantaneously change to its final value. This makes it necessary to delay the read until the value has time to stabilize. Normally the data is sampled at 0.75 * tclkh and 0.75 * tclkl after the clock transition. Some experimentation may be necessary, dependent upon the application.

Figure 6. Timing Diagram for Switching Characteristics

Figure 7. ADC Timing Diagram
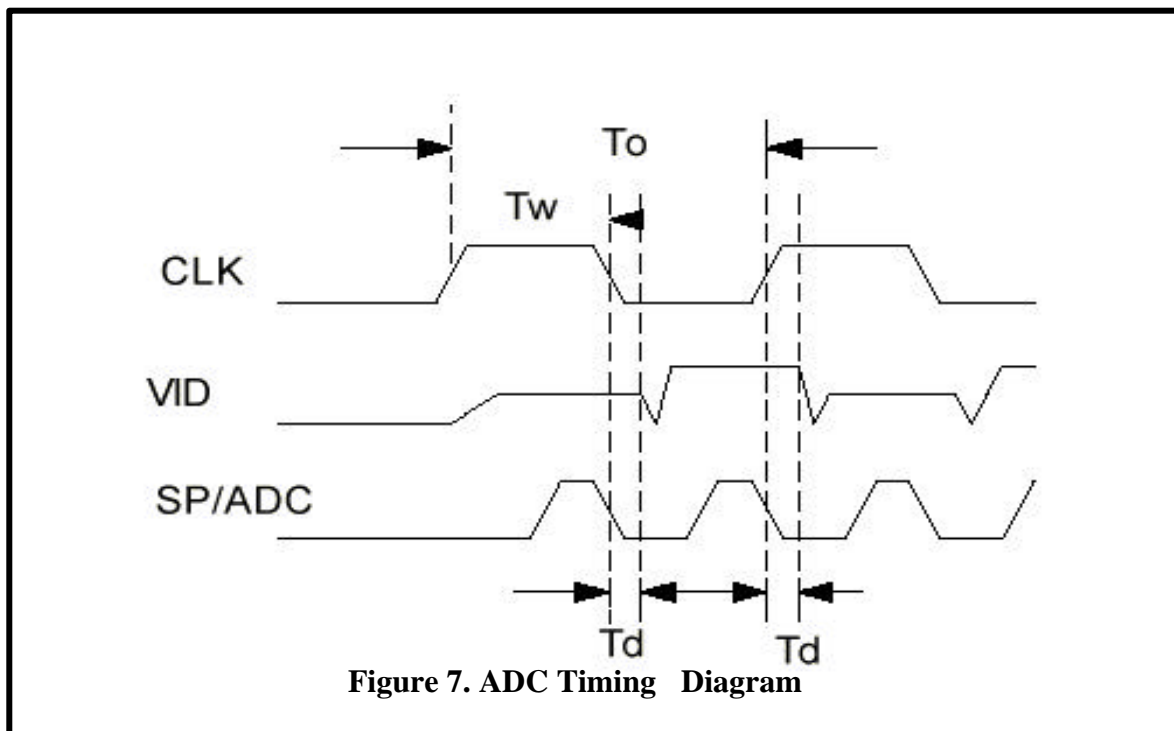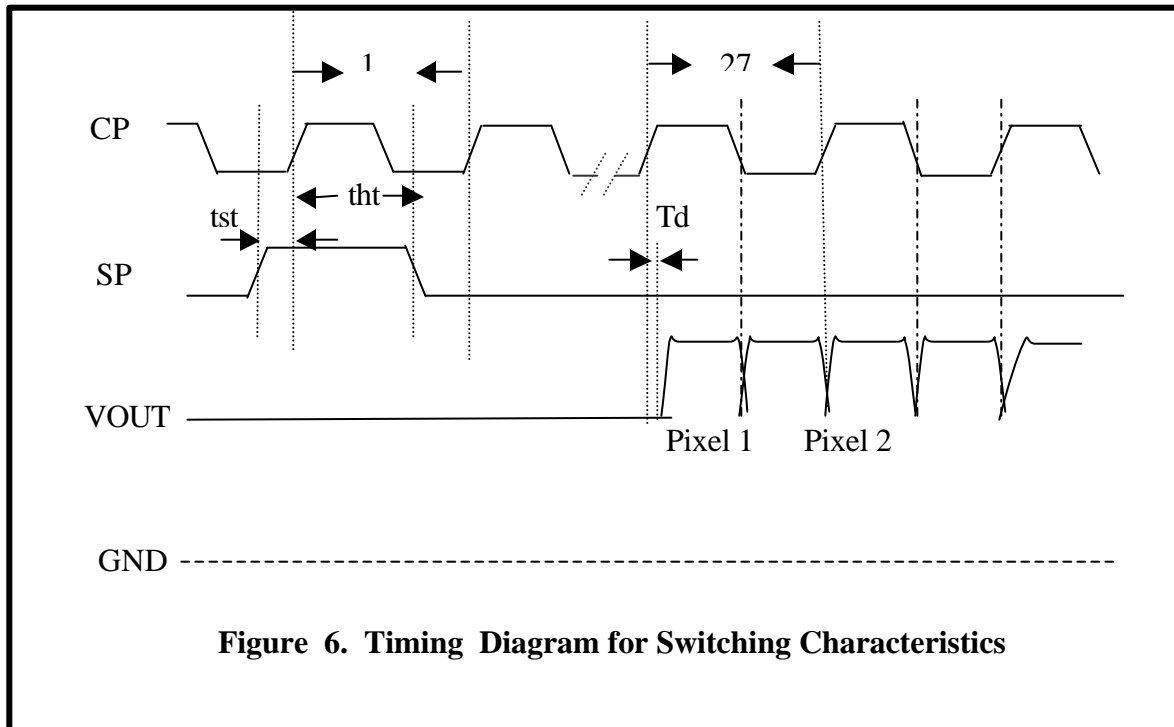
MACHINAL PROPERTIES AND DIMENSION

Table 7. Mechanical Properties and Dimensions

Parameter	
Number of photo-detectors	2408 elements
Effective number of photo-detectors	2408 pixels (1 to 2408) VOUT1: pixel # 1 ~ # 1032 VOUT2: pixel # 1033 ~ # 2408
Pixel-to-pixel spacing	42.25 μm
300 dpi resolution	Pixel #1 add #2; #3 add #4, …
Optical readable length	102.2 mm
Module height	17 mm
Module width	19 mm
Module length	115 mm
Connector	12 pin

Application Information

A Driver timing diagram
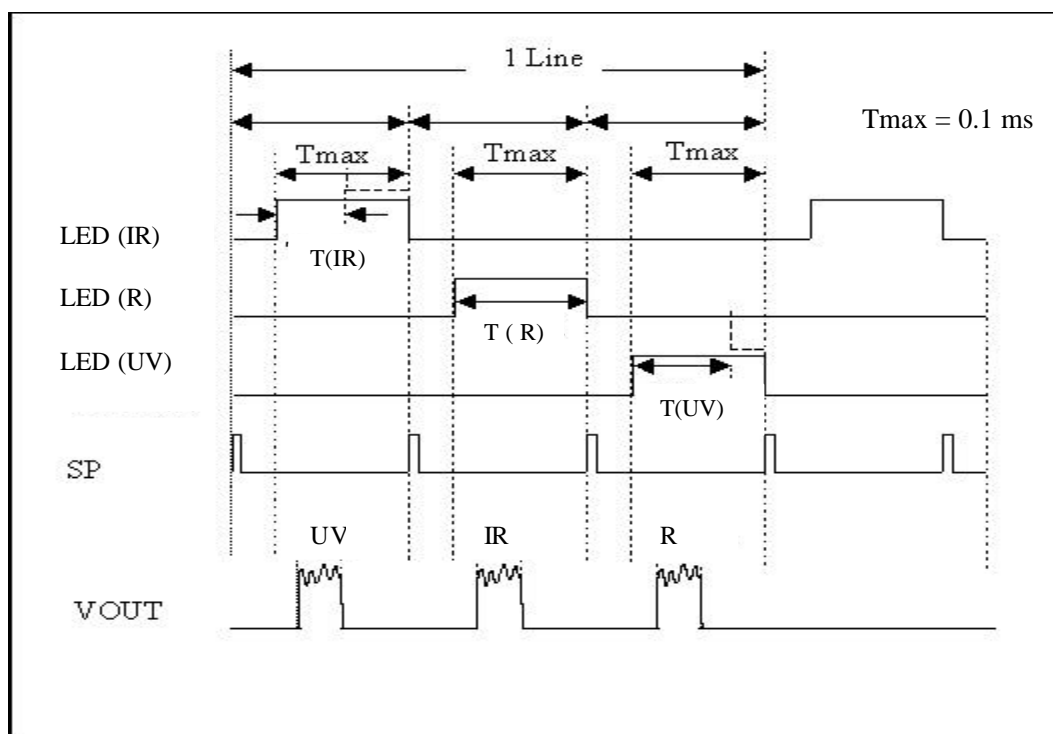
Figure 8 shows functional timing for the color mode operation. In this mode all three LEDs are pulsed. The following instruction is used to set the output signal level for the three colors. First the current of the three LEDs are set. Then the pulse width of the three colors are set to maximum (Tblue=Tred=Tgreen=Tmax). Then, the output signal is measured and the video signal with the least amplitude is recorded and the pulse width is kept. Then, the pulse width of the other two colors is reduced until the output signal of all three video output signals are at the

same level. For example, The UV LED pulse is set to Tmax, and infrared and red LED pulse width is reduced as shown in Figure 8.

D   A/D interface

There are several ways for the output signal to interface with A/D converter, as illustrated below. Method A is the simplest and Method C provides the best performance.
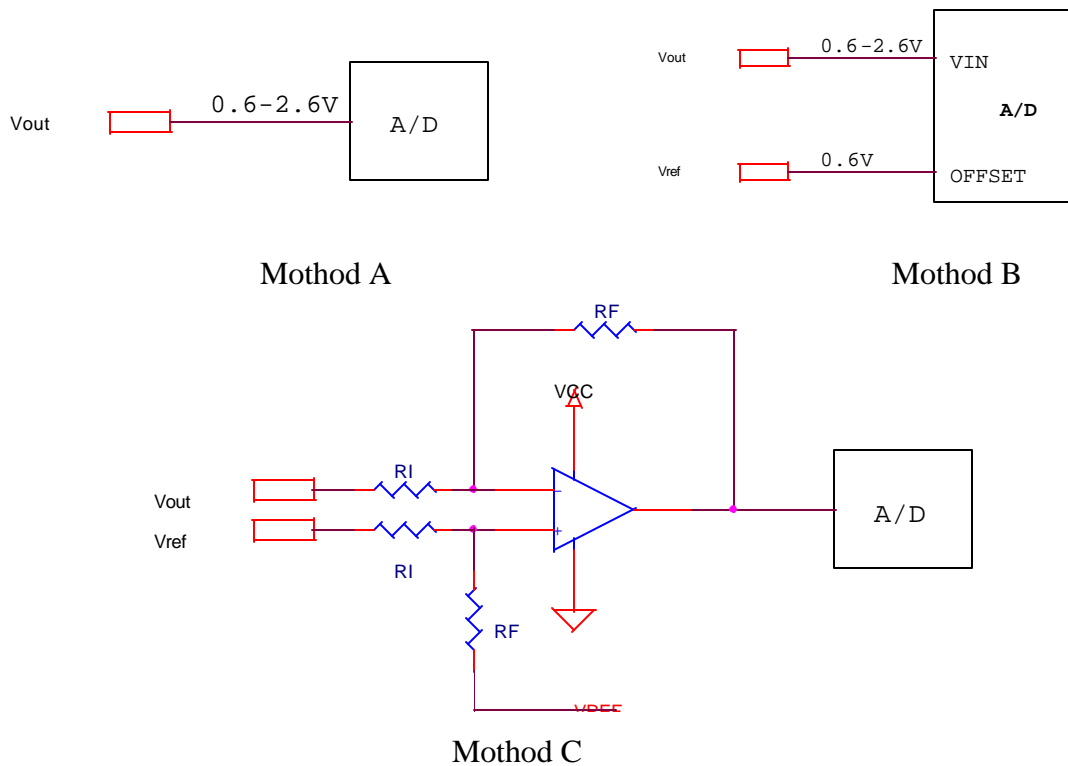
Vout   0.6-2.6V   A/D

Mothod A

Vout   0.6-2.6V   VIN
                    A/D
Vref   0.6V   OFFSET

Mothod B

RF

VCC

Vout   RI

Vref   RI

RF

VREF

A/D

Mothod C

Fiure 9. A/D interface

QUALITY ASSURANCE

Table 8. Reliability Test

No.	Item	Conditions
1	High Temperature Burn-In	80°C, 100 h, operating
2	High Temperature High Humidity	75°C, 90 %RH, 100 h, non-operating
3	Low Temperature	-25°C,100 h, non-operating
4	Thermal Shock	-25°C <> 25°C <> 75°C, 10 cycles, non-operating 30 min 5 min 30 min
5	Vibration	10~55~10 Hz, Amplitude=2 mm, X, Y, Z directions 1 h each, non-operating
6	Free Drop	80 cm, 6 sides, once for each side, packing
7	ESD	200 pF, 200V, R=0 Ω, once for each terminal, non-operating
8	Power Supply On /Off	5000 times, operating

PRECAUTIONS BEFORE USE

- **Extracting / Inserting the Connector**
  The maximum number of times that the connector should be extracted and connected is 10. If the connector is inserted and extracted repeatedly more than 10 times, the connector "burrs" may possibly erode and damage the connector.

- **Dirty Glass Surface**
  The glass surface should be kept clean. Do not wipe the glass surface with your hand. Do not use the CIS module in a dust-polluted environment. If the glass surface becomes dirty, carefully wipe the surface gently with a clean cloth soaked in alcohol.

- **Stable Operation**
  1. The connector pins should not be touched with bare hand or electrostatic charged materials.
  2. Noise Suppression
     2.1 Insert a low frequency noise suppressing capacitor (100μF) between the power supply VDD (+5V) and GND. A high frequency noise suppressing capacitor is already integrated into the printed circuit board.
     2.2 Make sure that the module connecting cable is 30 cm or shorter in length. Twisted cable pairs are recommended for CP/GND, VOUT/GND and VLED/GLED.
  3. Latch-up
     If the supply voltage is higher than the absolute maximum ratings, latch-up may cause severe electrical damage to the module. If the supply current variation changes very

rapidly or the power supply is turned on and off very frequently, make sure that the voltage on each terminal does not exceed the maximum value.
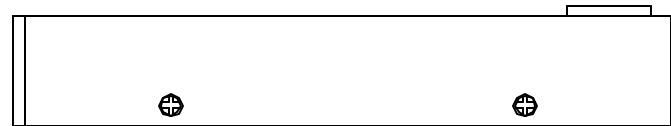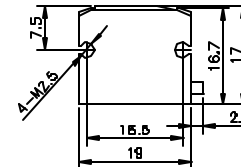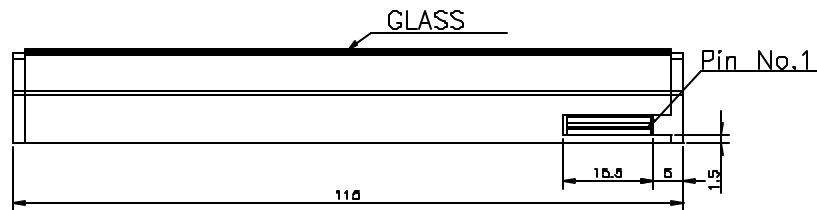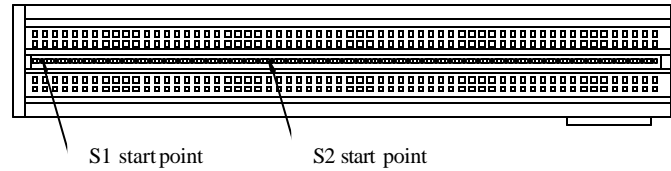
- **Dust**

The module is housed in an air tight structure to protect it from dust. Disassembly or the removal of any component may permit dust to enter into the module.

S1 start point   S2 start point

GLASS

Pin No.1

7.5

16.7   17

4-M2.5

15.5

2.3

15.5   5

1.5

110

19

VOUT1 SENSOR 1 TO 1032
VOUT2 SENSOR 1033 TO 2048

CONNECTOR PIN PITCH=1mm

Pin No.	Symbol
1	VLED(+12V)
2	GIR
3	GR
4	GP
5	CP
6	SP
7	RS
8	VDD(+3.3V)
9	GND
10	VOUT2
11	GND
12	VOUT1

Attachment: the configuration and the physical dimensions (unit: mm) of the M206-A6M.