

**Preliminary**

<b>Contact Image Sensor (CIS) Module</b>	
Product Name	<b>M106-A9G</b>

Approval		Notes		
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Issued	August 25, 2005	Revision no.		Rev. 1
All specifications of this device are subject to change without notice.				

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## Revision control sheet

Revision No	Date	Item of change and content	Reason	Approved	Designed
Rev 1	8/25/05	Modified from M106-A8	Custom design	Sam Lin	Changlin Xiao

# CMOS Sensor Inc.

## M106-A9G 8 dpm Compact Image Sensor (CIS) module

### Features:

- 320 x 1 image sensing elements
- 8 dots per millimeter (dpm) resolution
- 40 mm scanning length
- 12.5 mm x 15 mm x 70 mm compact size
- 0.25 ms/line scanning speed
- Green LED light source
- high MTF
- light weight
- 5V single power supply
- low power consumption
- one analog output signal
- high integration for light source, lens and sensor
- 8 pin connector for input and output

### Description:

The M106-A9G compact image sensor module is a contact type image sensing module that composed of a line of LED's as a light source, a long Selfoc rod lens array, and 320 pixels of photo-detector array. Input and output electronic contact is via a 8-pin connector. The cross sectional view of the M106-A9G is shown in figure 1. Figure 2, on the following page, is a block diagram of the module.

The module is suitable to scan an A9 size (40 mm) document. Applications include business card reader, position sensor, mark reader, and other office automation equipment.

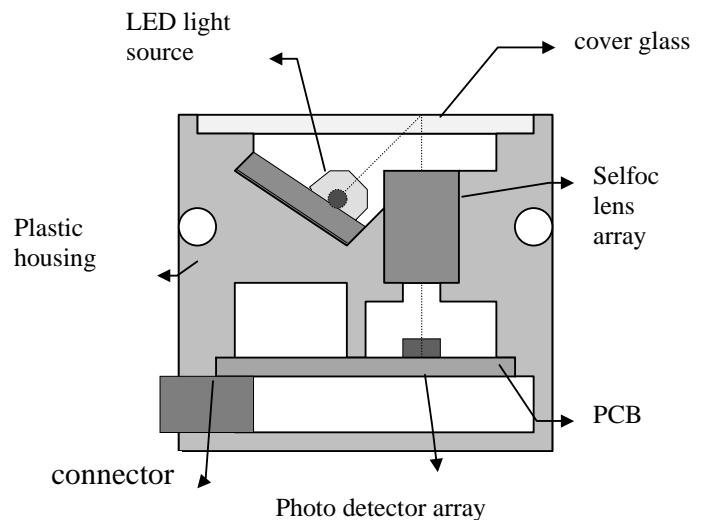


Figure 1. Cross section view of M106-A9G.

## Functional block diagram:

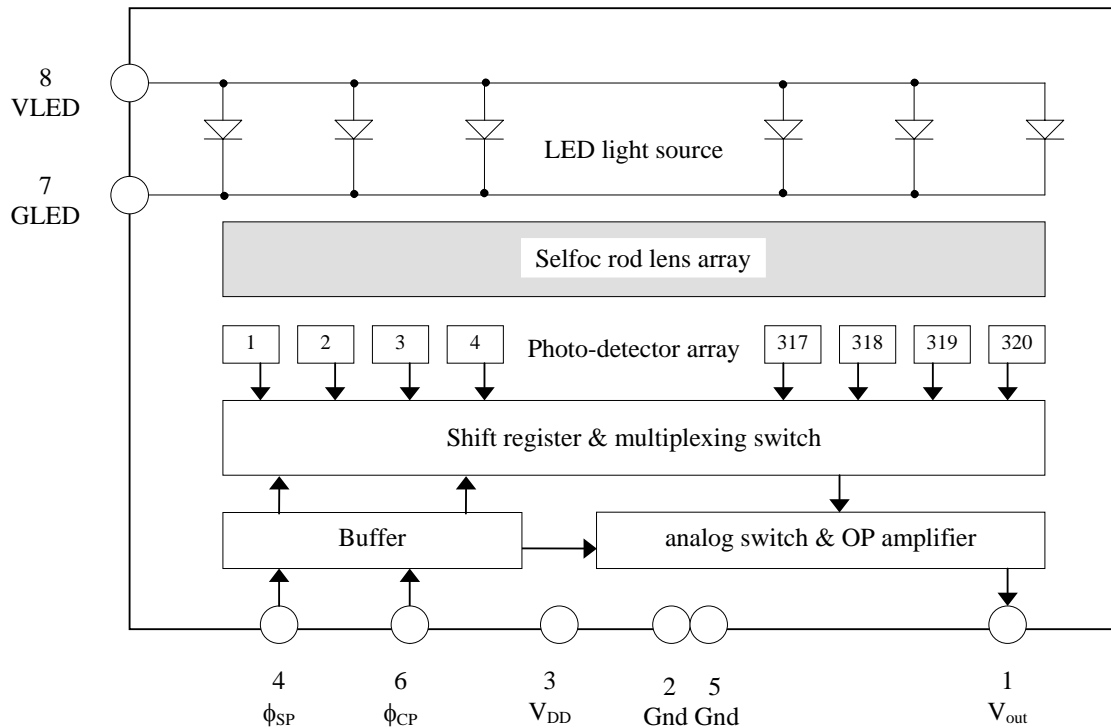


Figure 2 Functional block diagram of M106-A9G.

## Pin Description:

Pin #	Symbol	Description
1	$V_{out}$	Analog video output signal
2	Gnd	Analog video output ground; 0 V
3	$V_{DD}$	Positive power supply voltage; 5 V
4	$\phi_{SP}$	Start pulse
5	Gnd	Clock pulse ground; 0 V
6	$\phi_{CP}$	Main clock pulse
7	GLED	Green LED power supply ground; 0 V
8	VLED	Green LED power supply voltage; 5 V

## Electro-optical characteristics:

at  $f = 2$  MHz,  $V_{DD} = 5$  V,  $T_{int}^{*(1)} = 0.25$  ms,  $\lambda^{*(2)} = 550$  nm,  $T_a^{*(3)} = 25$  °C  
(unless otherwise noted)

symbol	Parameter	test conditions	min.	typ	max	unit
$V_p^{*(4)}$	Analog output voltage at white paper	O.D. $^{*(11)} = 0.05 \sim 0.1$	2.8	3.0	3.2	V
$U_p^{*(5)}$	White paper non-uniformity	O.D. = 0.05 ~ 0.1	-30		30	%
$U_{padj}^{*(6)}$	Adjacent pixel non-uniformity	O.D. = 0.05 ~ 0.1	-25		25	%
$V_d^{*(7)}$	Analog output voltage at dark paper	light off, O.D. = 0.8		0.8		V
$U_d^{*(8)}$	Dark signal non-uniformity	light off, O.D. = 0.8			200	mV
MTF $^{*(9)}$	Modulation transfer function	at 3.85 lp/mm $^{*(12)}$	30			%
$\gamma^{*(10)}$	Linearity		0.85		1.1	

### Definition:

1.  $T_{int}$  is an integration time. It is determined by the interval between two start pulses.
2.  $\lambda$  is a wavelength of the light source.
3.  $T_a$  is ambient temperature.
4.  $V_p = (V_{pmax} + V_{pmin}) / 2$   
where  $V_{pmax}$  is a maximum voltage of whole module on white document.  
 $V_{pmin}$  is a minimum voltage of whole module on white document.
5.  $U_p$  is a pixel - pixel photo response non-uniformity within whole module.  
 $U_p = [(V_{pmax} - V_{pmin}) / V_p] \times 100\%$
6.  $U_{p adj} = \text{Max} [| (V_p(i) - V_p(i+1)) / V_p(i) |] \times 100\%$   
where  $V_p(i)$  is the video signal output of each pixel # i  
 $V_p(i+1)$  is the video signal output of each pixel # (i+1)
7.  $V_d = (V_{dmax} + V_{dmin}) / 2$   
where  $V_{dmax}$  is a maximum dark signal on whole module.  
 $V_{dmin}$  is a minimum dark voltage on whole module.
8.  $U_d = V_{dmax} - V_{dmin}$
9.  $MTF = [(V_{max} - V_{min}) / (V_{max} + V_{min})] \times 100\%$   
where  $V_{max}$  is the maximum output voltage at 3.85 lp/mm document.  
 $V_{min}$  is the minimum output voltage at 3.85 lp/mm document.
10.  $\gamma = \log[(V_2 - V_d) / (V_1 - V_d)] / \log(E_2/E_1)$  or  $\log[(V_2 - V_d) / (V_1 - V_d)] / \log(T_2/T_1)$   
where  $V_1$  is the output voltage of  $E_1$  illumination or  $T_1$  integration time  
 $V_2$  is the output voltage of  $E_2$  illumination or  $T_2$  integration time  
at 10 ~ 90% of saturation conduction.
11. O.D. = optical density of the paper.
12. lp / mm = line pair per millimeter

## Absolute maximum ratings:

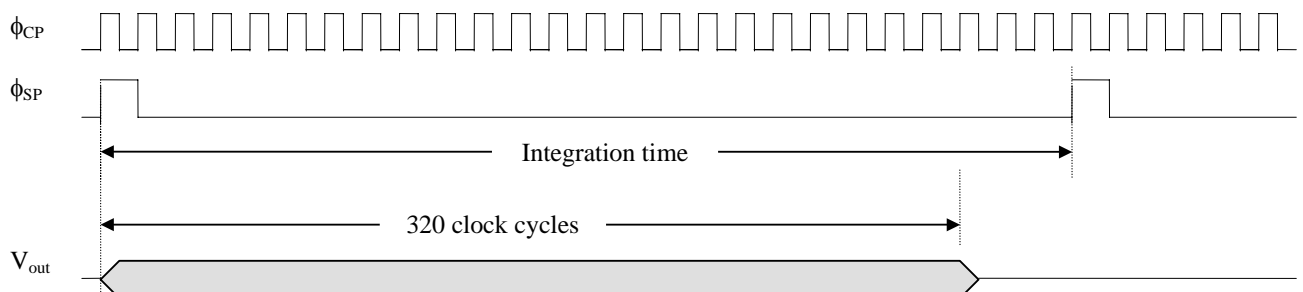
Parameter Name	Symbol	Max Value	Units
Power supply voltage	V <sub>DD</sub>	6	V
Power supply current	I <sub>DD</sub>	5	mA
LED light power supply voltage	V <sub>LED</sub>	7	V
LED light power supply current	I <sub>LED</sub>	400	mA
Digital input voltage range high	V <sub>IH</sub>	5.5	V
Digital input voltage range low	V <sub>IL</sub>	-0.5	V
Operating temperature	T <sub>a</sub>	0 ~ 50	C
Storage temperature	T <sub>stg</sub>	-25 ~ 70	C

≠ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress rating only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## Recommended operating conditions:

Item	Symbol	Min.	Typ.	Max.	Unit
Positive power supply voltage	V <sub>DD</sub>	4.75	5	5.25	V
LED power supply voltage	V <sub>LED</sub>	4.75	5	5.25	V
High level input voltage	V <sub>IH</sub>	3.4	5	5.5	V
Low level input voltage	V <sub>IL</sub>	-0.5	0	0.5	V
Clock frequency	F		2	4	MHz
Clock pulse high duty cycle			25		%
Clock pulse high duration	T <sub>w</sub>		0.125	0.5	us
Wavelength of light source (Green)	λ		550		nm
Operating free-air temperature	T <sub>a</sub>	0	25	50	°C

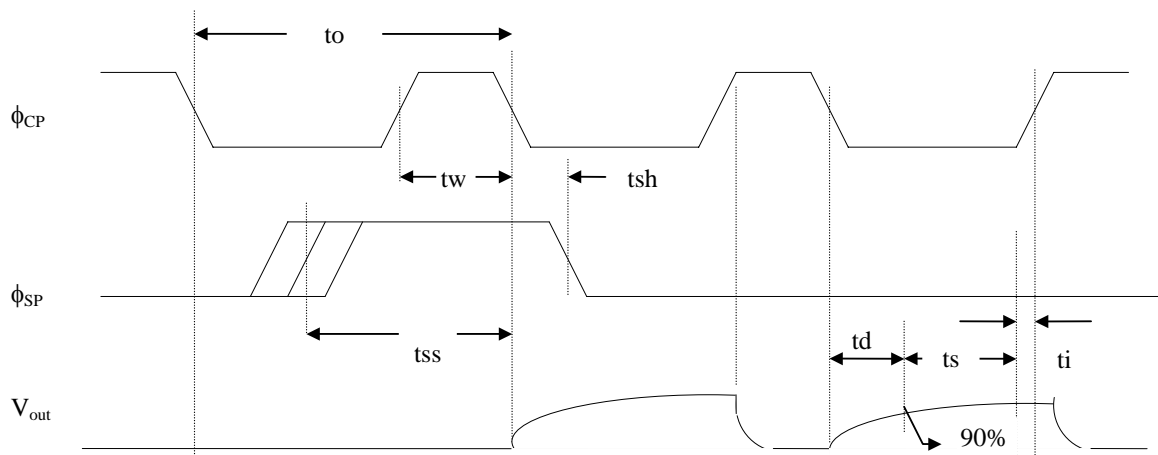
## Timing Diagram:



## Switching characteristics:

item	description	Symbol	min.	typ.	max.	unit
1	clock cycle time	$T_o$		0.5		us
2	clock pulse duty cycle			25		%
3	clock pulse width	$T_w$		125		ns
4	$\phi_{SP}$ setup time	$T_{ss}$	50			ns
5	$\phi_{SP}$ hold time	$T_{sh}$	50			ns
6	Video signal delay time	$T_d$			250	ns
7	Video signal invalid time	$T_i$			50	ns
8	Video signal stable time	$T_s$	100			ns

## Switching waveforms:



## PRODUCT RELIABILITY TESTS

Items of Test	Testing Conditions	Inspection items	Pass Criteria
Life Test	Temp = $25 \pm 5$ °C,	$\Delta V_p$ , $\Delta V_d$ : the change of $V_p$ , $V_d$ respectively after the life testing.	-30 % < $\Delta V_p$ < 10 % -25 mV < $\Delta V_d$ < 15mV
	Humidity = 20 ~ 80 RH%		
	Time = 2000 hrs		
High Temp Test	Temp = $80 \pm 5$ °C	electrical parameters, module structures.	Parameters must be within specs, no change, no damage in module structures
	Time = 144 hrs		
Low Temp Test	Temp = $-30 \pm 5$ °C	electrical parameters, module structures.	Parameters must be within specs, no change, no damage in module structures
	Time = 144 hrs		
Temp/Humidity Test	Temp = $50 \pm 5$ °C,	$\Delta V_p$ : the change of $V_p$ after the life testing.	-30% < $\Delta V_p$ < 10%
	Humidity = $85 \pm 5$ RH%		
	Time = 144 hrs		
Temp Cycling	Temp = -30, 25, 80 °C	Electrical parameters, Module structures.	All electrical parameters must be within the specs. No distortion and damage on module.
	Time = 30, 5, 30 min.		
	Cycles = 10, 50		
Drop Test	Packaged product drops from 1 m height.		
	Perform test for 3 sides.		
Vibration Test	Cycling: 10 ~ 50 ~ 10 Hz		
	Cycle time = 1 min		
	Amp = 2 mm, Time = 1 Hr		

### Precautions before use:

#### 1. Dirty Glass Surface:

The glass surface should be kept clean.

Do not wipe the sensor by hand or use in a dust polluted environment. Should the glass surface become dirty, moisten a cloth with alcohol and wipe the surface gently.

Care should be taken so as not to scratch the surface while wiping it. Any loose dust lying on the sensor surface can be cleaned using an air gun.

#### 2. Dust and the CIS unit

The unit is housed in an air tight structure to protect it from dust. The side plates should not be removed, otherwise dust may enter the unit. When using the side holes to adjust the sensor, turn the screws slowly until tight, so as not to damage the screw hole thread.



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### 3. Extracting / Inserting the connector

The maximum number of times that the connector should be extracted and connected is ten. If the connector is inserted / extracted more than ten times, the connector “burrs” will be eroded, thereby making the connector ineffective.

### 4. Stable operation

4.1 The connector pins should not be touched by bare hand or Electro-statically charged material.

#### 4.2 Noise:

- a. Insert a low frequency noise suppressing capacitor (100  $\mu$ F) between  $V_{DD}$  (+5 V) and Gnd. A high frequency noise suppressing capacitor is already integrated into the circuit.
- b. Ensure that the sensor connecting cables are 30 cm or less in length. The  $\phi_{CP}$  and Gnd,  $\phi_{SP}$  and Gnd respectively from twisted cable pairs.

#### 4.3 Latch Up

When the voltage is higher than the absolute maximum, “latch up” will cause the sensor to break, even if the voltage is caused by a surge. If the current varies rapidly in the external circuit, or if the power is turned off and then on again, ensure that the voltage on each terminal does not exceed the values indicated in “absolute maximum rating”.

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**Attachment:** the configuration and the physical dimensions (unit: mm)

M106-A9G configuration and physical dimensions.

