

Preliminary

Contact Image Sensor (CIS) Module

Product Name

M106-A8R1

| Approval | | Notes | | |
|--|--------------|--------------|---------|----------|
| | | | | |
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| | | | | |
| Issued | Nov 11, 2002 | 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 |
|--------------|------|----------------------------|--------|----------|----------|
| | | | | | |

CMOS Sensor Inc.

M106-A8R1 (TR218-085A) 8 dpm Compact Image Sensor (CIS) module

Features:

- 448 x 1 image sensing elements
- 8 dots per millimeter (dpm) resolution
- 56 mm scanning length
- 12.5 mm x 15 mm x 70 mm compact size
- 1 ms/line scanning speed
- Red 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-A8 compact image sensor module is a contact type image sensing module that is composed of a line of LED's as a light source, a long Selfoc rod lens array, and 448 pixels of photo-detector array. Input and output electronic contact is via a 8-pin connector. The cross sectional view of the M106-A8 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 A8 size (56 mm) document. Applications include business card reader, position sensor, mark reader, and other office automation equipment.

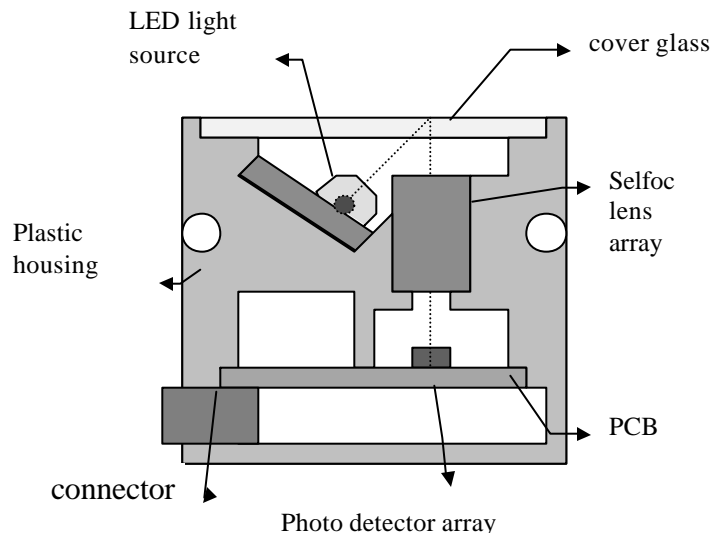


Figure 1. Cross section view of M106-A8.

Functional block diagram:

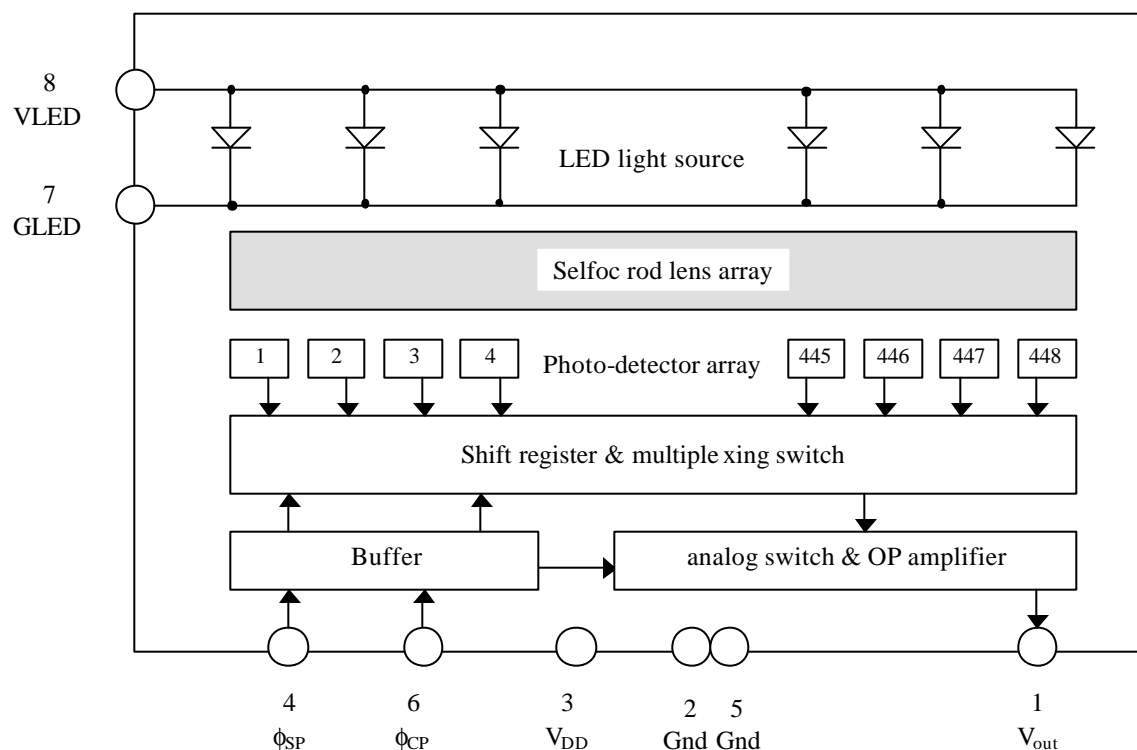


Figure 2 Functional block diagram of M106-A8.

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 | ϕ_{SP} | Start pulse |
| 5 | Gnd | Clock pulse ground; 0 V |
| 6 | ϕ_{CP} | Main clock pulse |
| 7 | GLED | LED power supply ground; 0 V |
| 8 | VLED | LED power supply voltage; 5 V |

Electro-optical characteristics:

at $f = 1$ MHz, $V_{DD} = 5$ V, $T_{int}^{*(1)} = 1$ ms, $\lambda^{*(2)} = 660$ 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. $^{*(11)} = 0.05 \sim 0.1$ | 1.2 | 1.6 | 2.0 | V |
| $U_p^{*(5)}$ | White paper non-uniformity | O.D. $= 0.05 \sim 0.1$ | -30 | | 30 | % |
| $U_{padj}^{*(6)}$ | Adjacent pixel non-uniformity | O.D. $= 0.05 \sim 0.1$ | -25 | | 25 | % |
| $V_d^{*(7)}$ | Analog output voltage at dark paper | light off, O.D. $= 0.8$ | | 0.5 | | 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. λ 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. $U_{padj} = \text{Max} [| (V_p(i) - V_p(i+1)) | / V_p(i)] \times 100\%$
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:

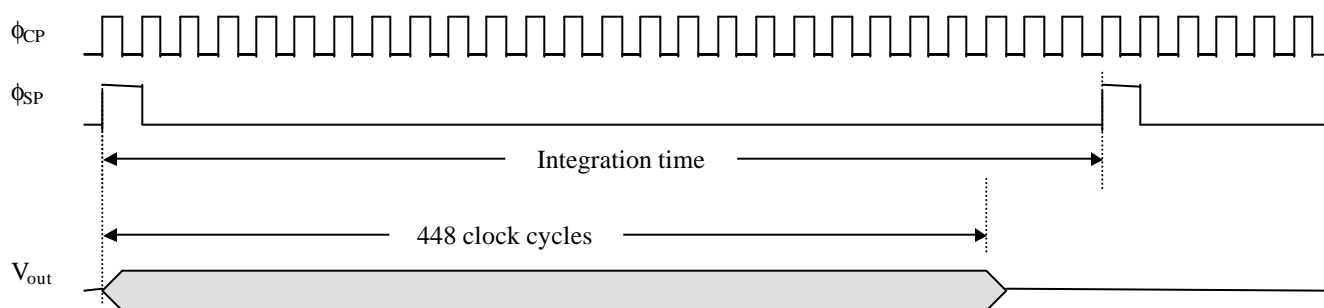
| Parameter Name | Symbol | Max Value | Units |
|----------------------------------|------------------|-----------|-------|
| Power supply voltage | V _{DD} | 6 | V |
| Power supply current | I _{DD} | 40 | mA |
| LED light power supply voltage | V _{LED} | 7 | V |
| LED light power supply current | I _{LED} | 60 | mA |
| Digital input voltage range high | V _{IH} | 5.5 | V |
| Digital input voltage range low | V _{IL} | -0.5 | V |
| Operating temperature | T _a | 0 ~ 50 | C |
| Storage temperature | T _{stg} | -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 _{DD} | 4.75 | 5 | 5.25 | V |
| LED power supply voltage | V _{LED} | 4.75 | 5 | 5.25 | V |
| High level input voltage | V _{IH} | 3.4 | 5 | 5.5 | V |
| Low level input voltage | V _{IL} | -0.5 | 0 | 0.5 | V |
| Clock frequency | F | | 1 | | MHz |
| Clock pulse high duty cycle | | | 25 | | % |
| Clock pulse high duration | T _w | | 0.5 | 1.0 | us |
| Wavelength of light source | λ | | 660 | | nm |
| Operating free-air temperature | T _a | 0 | 25 | 50 | °C |

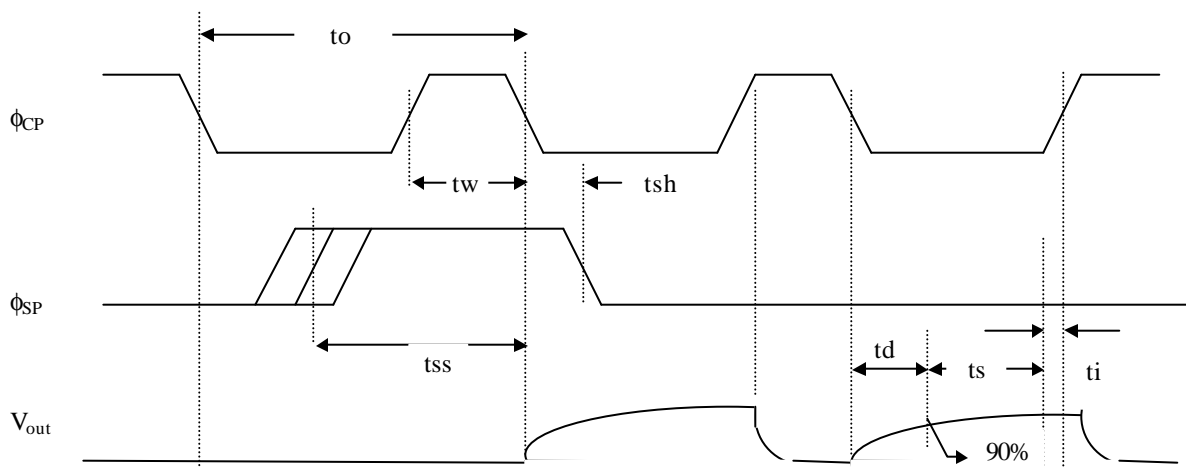
Timing Diagram:



Switching characteristics:

| item | description | Symbol | min. | typ. | max. | unit |
|------|---------------------------|----------|------|------|------|------|
| 1 | clock cycle time | T_o | | 1 | | us |
| 2 | clock pulse duty cycle | | | 25 | | % |
| 3 | clock pulse width | T_w | | 250 | | ns |
| 4 | ϕ_{SP} setup time | T_{ss} | 50 | | | ns |
| 5 | ϕ_{SP} hold time | T_{sh} | 50 | | | ns |
| 6 | Video signal delay time | T_d | | | 500 | ns |
| 7 | Video signal invalid time | T_i | | | 300 | 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 ± 5 °C, | ΔV_p , ΔV_d : the change of V_p , V_d respectively after the life testing. | -30 % < ΔV_p < 10 % -25 mV < ΔV_d < 15mV |
| | Humidity = 20 ~ 80 RH% | | |
| | Time = 2000 hrs | | |
| High Temp Test | Temp = 80 ± 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 ± 5 °C | | |
| | Time = 144 hrs | | |
| Temp/Humidity Test | Temp = 50 ± 5 °C, | ΔV_p : the change of V_p after the life testing. | -30% < ΔV_p < 10% |
| | Humidity = 85 ± 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.

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 μ 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 ϕ_{CP} and Gnd, ϕ_{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-A8R1 configuration and physical dimensions.

