Preliminary

Contact Image Sensor (CIS) Module

Product Name	**M208-A6**

Approval	Notes

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Approved	Checked	Designed

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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.

M208-A6

(TR612-093)

600 dpi, A6 size, Contact Image Sensor (CIS) module

Features:

- 2496 x 1 image sensing elements
- 600 dots per inch (dpi) resolution
- 105.6 mm scanning length
- 13 mm x 18 mm x 120 mm compact size
- No residual image
- Red LED light source
- light weight
- single 5 V power supply
- Good linearity: 1 ± 5%
- high integration for light source, lens and sensor
- 10 pin connector for input and output

Description:

The M208-A6 contact image sensor (CIS) module is a contact type image sensing module that is composed of a red LED's as a light source, a long Selfoc rod lens array, and 2496 photo-detector array. Input and output electronic contact is via a 10-pin connector. The cross sectioned view of the M208-A6 CIS module is shown in figure 1. Figure 2, on the following page, is a block diagram of the module.

The module is suitable for scanning A6 size (104 mm) documents with 600-dpm resolution. Applications include 600 dpi color scanner, document scanner, and other office automation (OA) equipment.

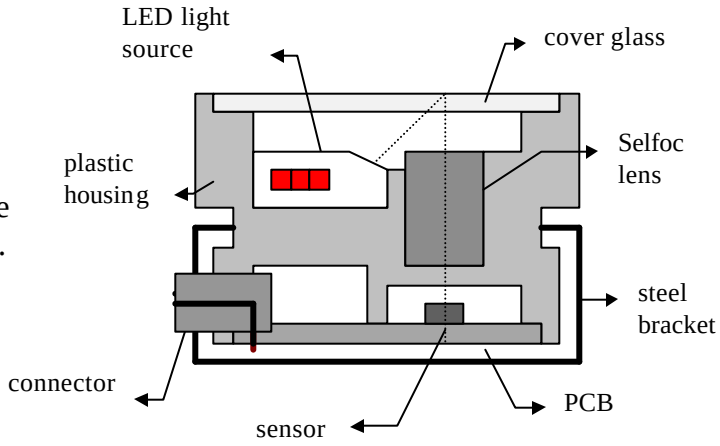

Figure 1. Cross section view of the M208-A6 CIS module.

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Functional block diagram:

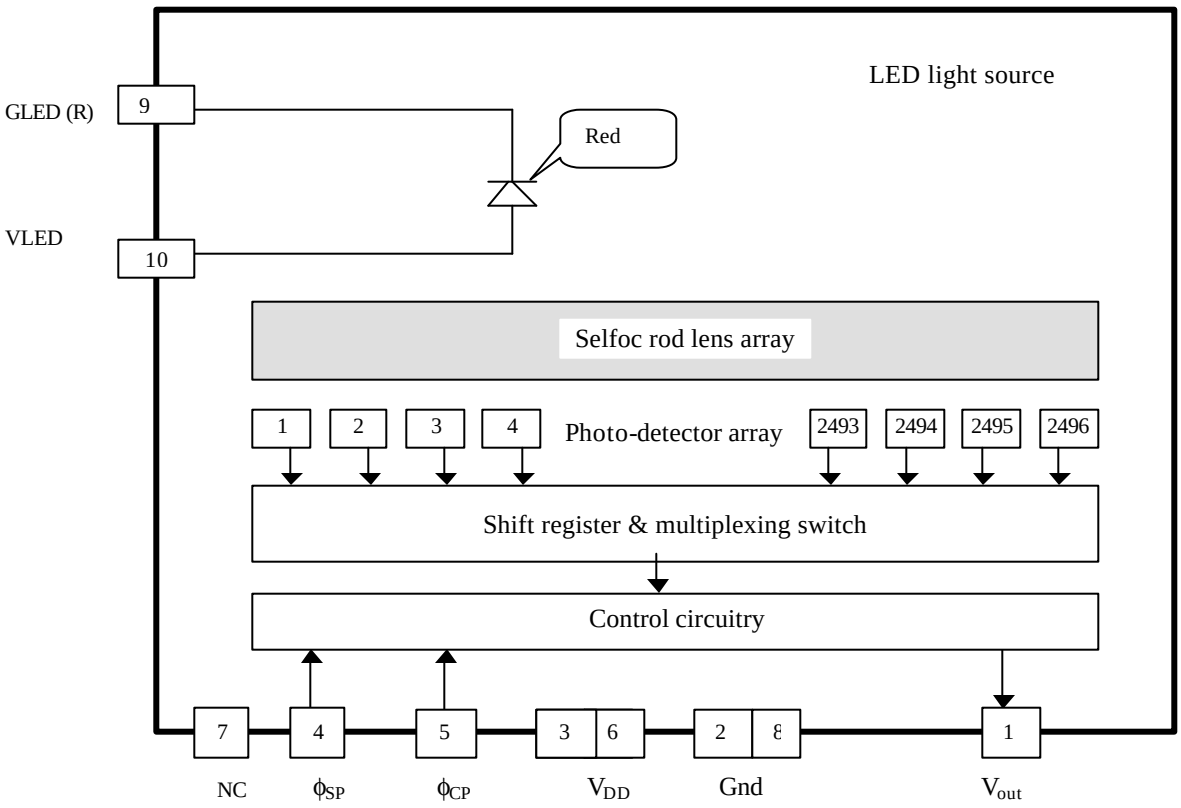


Figure 2. M208-A6 CIS module block diagram.

Pin description:

Pin #	Symbol	Description
1	V_{out}	Analog video output signal
2	Gnd	Ground; 0 V
3	V_{DD}	power supply voltage; + 5 V
4	ϕ_{SP}	Start pulse
5	ϕ_{CP}	Main clock pulse
6	V_{DD}	power supply voltage; + 5 V
7	NC	Not connection
8	Gnd	Ground; 0 V
9	GLED	Cathode of Red LED light source; 0 V
10	VLED	Common Anode of the LED light source; 5 V

Table 1. The pin out description of the M208-A6 CIS module.

Electro-optical characteristics:

Table 2. Operating conditions and typical electro-optical characteristics of the M208-A6 CIS module in B/W mode. [under testing condition of f = 1 MHz, V_{DD} = 5 V, VLED = 5 V, Ta[*(1)] = 25 °C]

Symbol	Parameter	Test conditions	min.	typ	max	unit
ϕ_{CP}	Clock frequency			1.0		MHz
F[*(2)]	Pixel readout rate			2.0		MHz
T_{int}[*(3)]	Line scanning rate			2		ms/line
V_{pc}[*(4)]	Analog output voltage at white paper	O.D.[*(9)] = 0.05 ~ 0.1	0.8			V
U_{pc}[*(5)]	White paper non-uniformity	O.D. = 0.05 ~ 0.1			50	%
V_d[*(6)]	Analog output voltage at dark paper	light off, O.D. = 0.8	0.03		0.4	V
U_d[*(7)]	Dark signal non-uniformity	light off, O.D. = 0.8			0.3	V
MTF[*(8)]	Modulation transfer function (Green)	at 5.7 lp/mm[*(10)]	20			%

Definition:

1. Ta is ambient temperature.
2. F is a pixel readout rate. It is double of the clock frequency.
3. T_{int} is an integration time or line scanning time. In the B/W operation mode, it is determined by the interval between two start pulses. For the color operation mode, T_{int} is at least three times that of the B/W mode.
4. Vpc(n) is the effective output signal of each pixel. It is defined by:
   Vpc = Vp(n) – Vd(n)
   Vp (n) is the output signal of nth pixel in the white paper.
   Vd (n) is the output signal of nth pixel in the dark paper.
5. Upc is a pixel - pixel photo response non-uniformity within whole module.
   Upc = [(Vpcmax - Vpcmin) / Vpcmax] x 100%
   Vpcmax = MAX [Vpc(n)]; it is the maximum effective output signal.
   Vpcmin = MIN [Vpc(n)]; it is the minimum effective output signal.
6. Vdmin is the minimum output signal in the dark and defined by:
   Vdmin = MIN [Vd(n)];
   where n = 1, 2, 5184 pixels on the whole module.
7. Ud is the dark output non-uniformity and defined by:
   Ud = Vdmax – Vdmin
   Where Vdmax = MAX[Vd(n)]; it is the maximum dark output signal.
   Vdmin = MIN [Vd(n)]; it is the minimum dark output signal.
8. MTF is a output response of the module using a MTF image target and defined by:
   MTF = MIN {[(Vmax - Vmin) / (Vmax + Vmin)]} x 100%
   where Vmax is the maximum output voltage using a MTF image target.
   Vmin is the minimum output voltage using a MTF image target.
   MTF image target is 5.75 lp/mm
9. O.D. = optical density of the paper.
10. lp / mm = line pair per millimeter

Absolute maximum ratings:

Power supply voltage, V_{DD}	6.5 V
Power supply current, I_{DD}	100 mA
LED power supply current, ILED	80 mA
Digital input voltage range (high), Vih	V_{DD} + 0.5 V
Digital input voltage range (low), Vil	- 0.5 V
Digital input current range, Iih	-20 mA to 20 mA
Operating free-air temperature range, Ta	0 °C ~ 50 °C
Storage temperature range, Tstg	-25 °C ~ 70 °C
Storage humidity range, Hstg	10 ~ 90 % RH

‡ 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.

Table 3. 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	VLED		5		V
High level input voltage	V_{ih}	V_{DD} – 0.7		V_{DD}	V
Low level input voltage	V_{iL}	0		0.7	V
Clock frequency	f	5	1		MHz
Clock pulse high duty cycle			50		%
Clock pulse high duration	tw		0.5		Us
Sensor integration time	t_{int}		2		ms
Operating humidity	Hop	10		85	% RH
Operating free-air temperature	Ta	0		50	°C

Table 4. LED light source characteristics (I_F = 20 mA, 25 °C):

Parameter	Peak emission wavelength	Spectral line half width (Δλ)
Red LED	640 nm	20 nm

Figure 3. Timing Diagram:

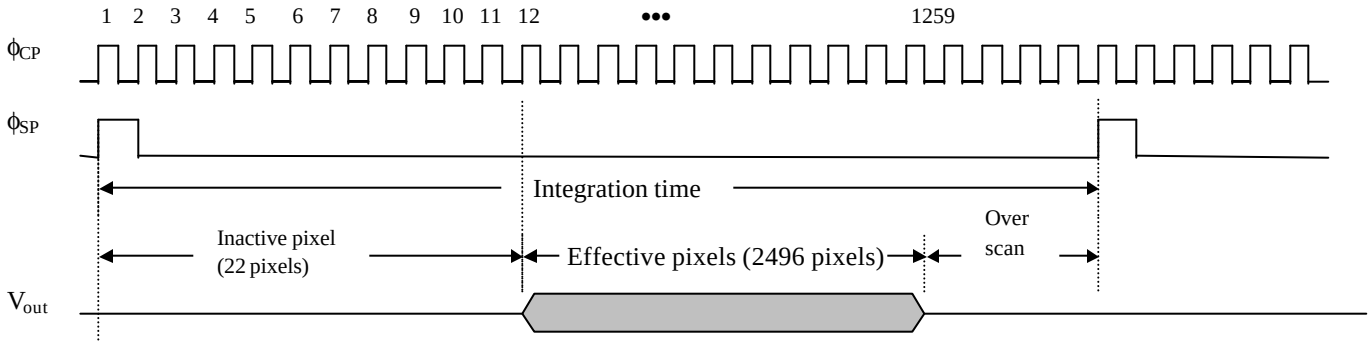
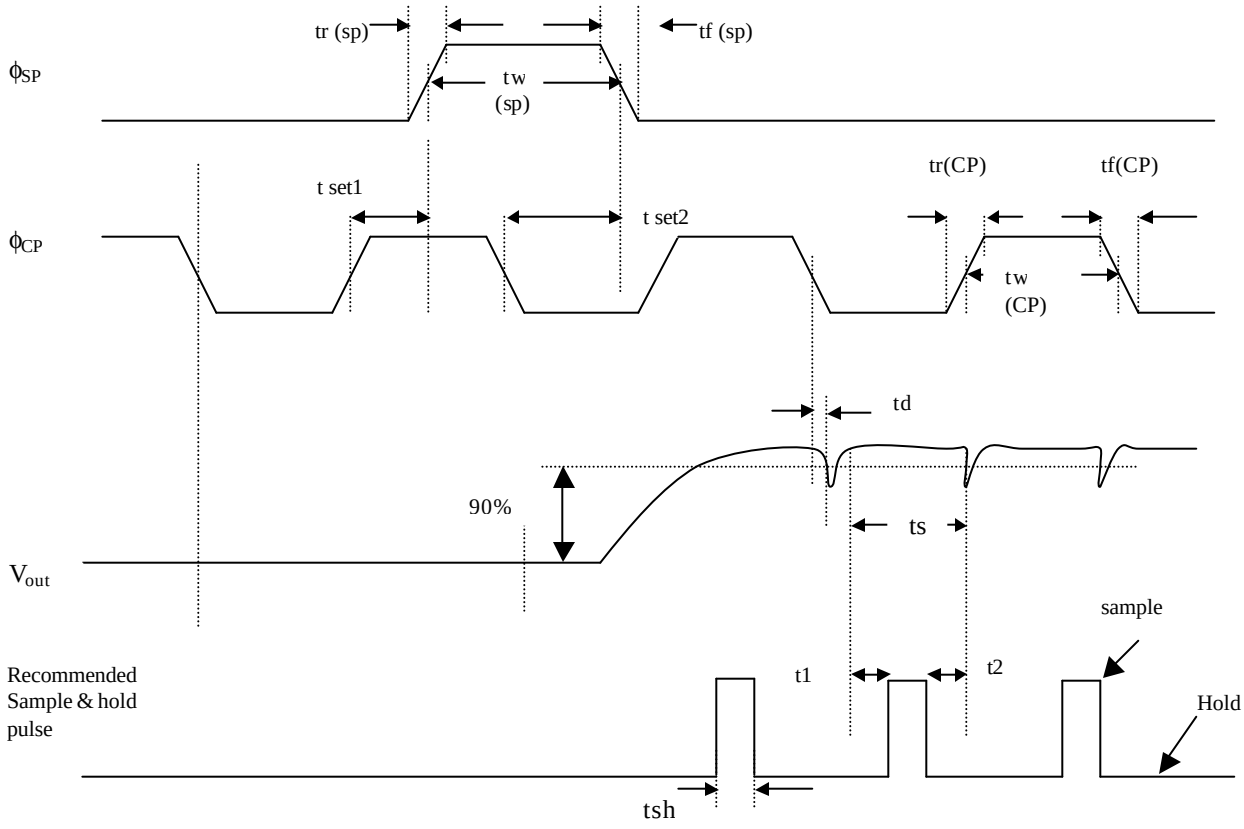


Table 5. Switching characteristics:

item	Description	symbol	min.	Typ.	Max.	unit
1	Clock frequency	f (CP)		1	1.5	MHz
2	Clock pulse width	tw (CP)	475	500	525	ns
3	Clock pulse duty cycle		45	50	55	%
4	Clock pulse rise time	tr (CP)	0		1/(20*f(CP)	ns
5	Clock pulse fall time	tf (CP)	0		1/(20*f(CP)	ns
6	Start pulse width	tw (SP)	1020			ns
7	Start pulse rise time	tr (SP)	0		1/(20*f(CP)	ns
8	Start pulse fall time	tf (SP)	0		1/(20*f(CP)	ns
9	ϕ_{SP} setup time	tset1	-150		50	ns
10	ϕ_{SP} hold time	tset2	20			ns
11	Video signal delay time	td		50		ns
12	Video signal stable time	ts	100			ns
13	Sample & hold pulse	tsh		(¼)tw(CP)		ns
14	Rise time to S/H	t1	0	50		ns
15	Fall time to S/H	T2	0	50		ns

Figure 4. Switching waveforms:



Reliability tests:

Item	Test condition	Time	Criterion
High temp / high humidity operation	T = 45 °C, 90% RH	500 H	
High temp. operation	T = 50 °C	500 H	
Low temp. operation	T = 0 °C	500 H	ΔVp = -30 ~ 10 (%)
High temp. storage	T = 60 °C	1000 H	
High temp. / high humidity storage	T = 50 °C, 90% RH	1000 H	ΔVd = - 25 ~ 15 (mV)
Low temp. storage	T = - 30 °C	1000 H	
Temp. cycle at high humidity	-10 ~ 50 °C / 90% RH	10 cycle	No physical
Temp. cycle	-30 °C ~ RT ~ 50 °C 1 H 1 H	20 cycle	Distoration and damage
Vibration test	3G, 10 ~ 100 Hz, 5 min. RT, X, Y, Z	60 min each	
Drop test	60 G, 5 ~ 10 msec ±X, ±Y, ±Z	2 times	
ESD	R = 0 Ω, 200 pF, ±200 V	Once every pin	

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, or 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.

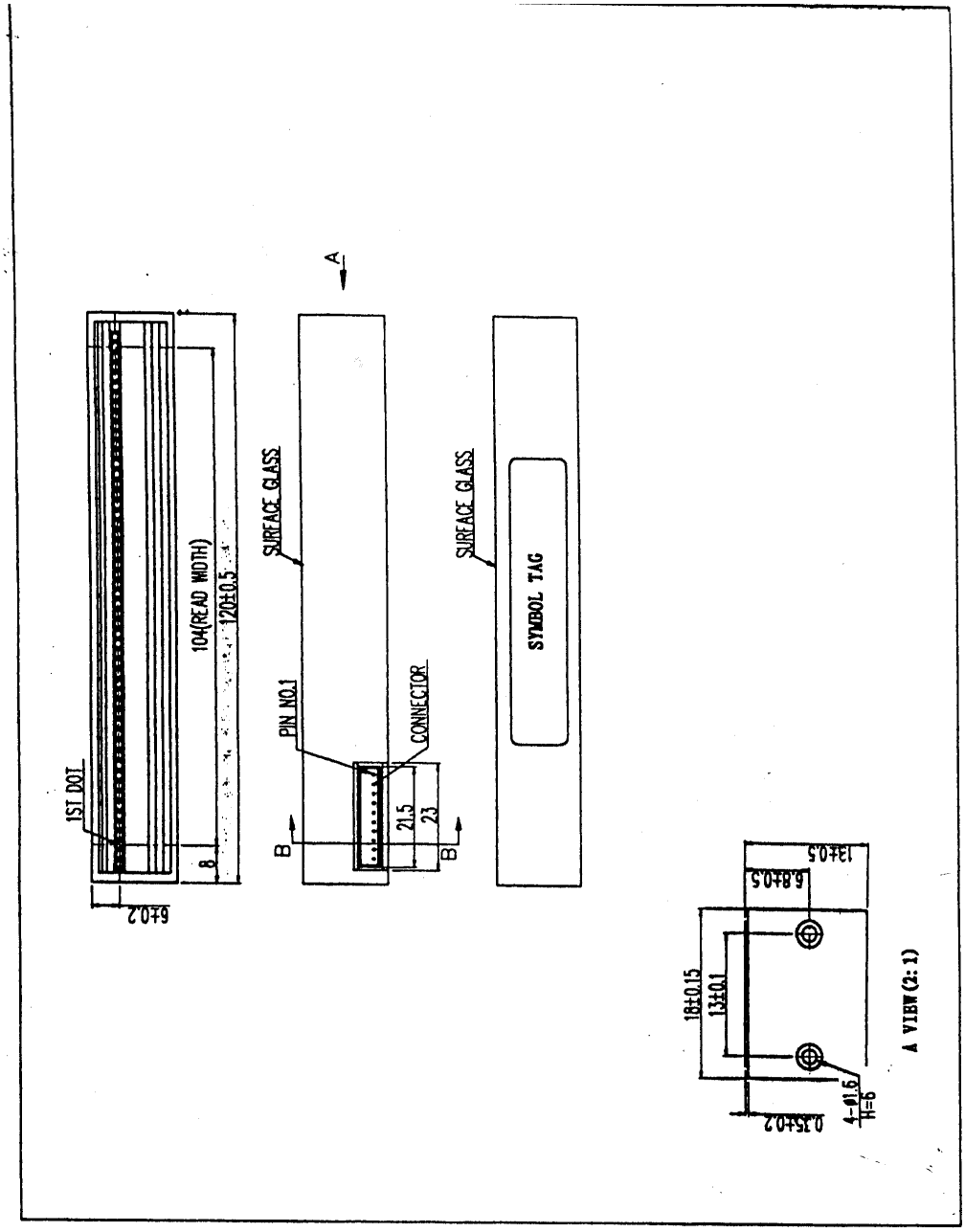
4. Stable operation
   4.1 The connector pins should not be touched by bare hand or Electro-statically charged material.

   4.2 Noise:
   a. Insert a low frequency noise suppressing capacitor (100 μF) 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".

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

M206-A6 configuration and physical dimensions.



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