

Preliminary

Contact Image Sensor (CIS) Module

Product Name

M118-232C3

Approval		Notes		
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Issued	2010-01-13	Revision no.	V1.1	
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.

M118-232C3
400/200 dpi, A4 size, Contact
Image Sensor (CIS) module

Feature:

- 3456 x 1 image sensing elements
- 400/200 dots per inch (dpi) resolution
- 216 mm scanning length
- 18 mm x 11 mm x 232 mm compact size
- Red, Green, Blue LED light source
- light weight
- 5V power supply
- Good linearity
- high integration for light source, lens and sensor
- 12 pin connector for input and output

Description:

The M118-232C3 contact image sensor (CIS) module is a contact type image sensing module that composed of a line of LED light source, a long Selfoc rod lens array, and 3456 photo-detector array. Input and output electronic contact is via a 12-pin connector. The cross section view of the M118-232C3 CIS module is shown in figure 1. Figure 2 shows a block diagram of the M118-232C3 module. The module is suitable for scanning A4 size (216 mm) documents with 400/200 dpi resolution. Applications include Ticket, check & card scanner, mark readers & other automation equipment.

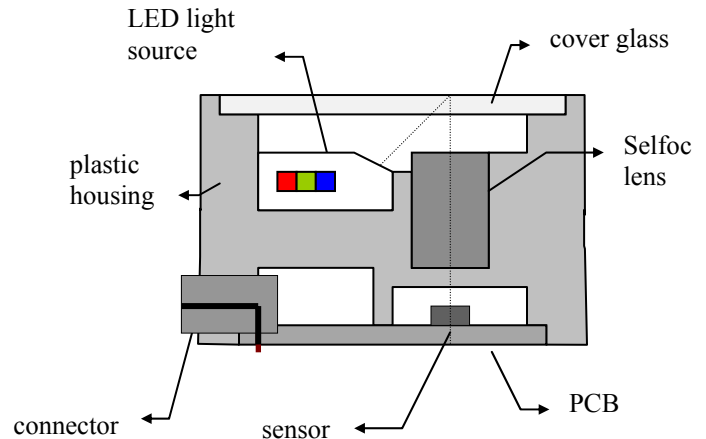


Figure 1. Cross section view of the M118-232C3 CIS module.

Functional block diagram:

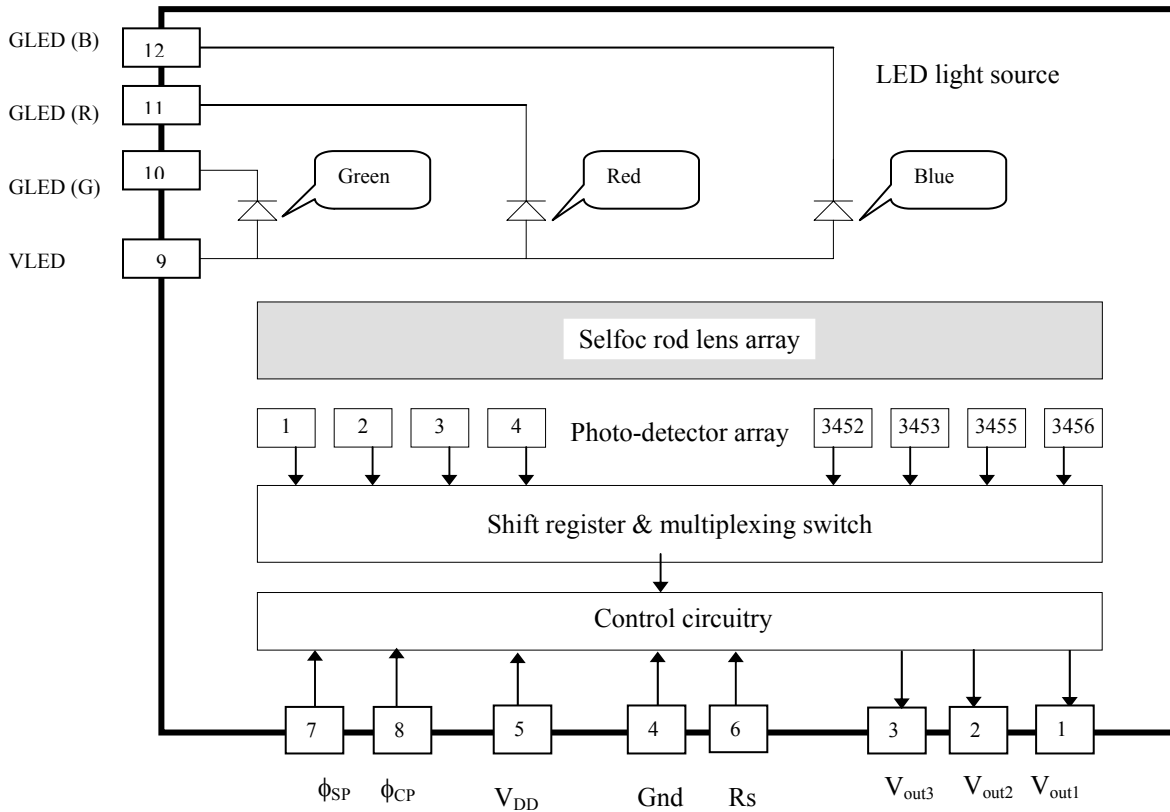


Figure 2. M118-232C3 color CIS module block diagram.

Pin Assignment description:

Pin #	Symbol	Description
1	V_{out1}	Analog video output signal 1
2	V_{out2}	Analog video output signal 2
3	V_{out3}	Analog video output signal 3
4	Gnd	Ground; 0 V
5	V_{DD}	power supply voltage; 5 V
6	Rs	Resolution select: Vdd 200dpi Gnd 400dpi
7	ϕ_{SP}	Start pulse
8	ϕ_{CP}	Main clock pulse
9	VLED	Common Anode of the LED light source
10	GLED (G)	Cathode of Green LED light source
11	GLED (R)	Cathode of Red LED light source
12	GLED (B)	Cathode of Blue LED light source

Table 1. The bonding pad description of the M118-232C3 CIS module.

Electro-optical characteristics:

Table 2. Operating conditions and typical electro-optical characteristics
(testing condition : f = 5MHz, 200dpi, ILED = 20 mA (red), 20 mA (green), 20 mA (blue), Ta^{*(1)} = 25 °C)

Symbol	Parameter	Test conditions	min.	typ	max	unit
ϕ_{CP}	Clock frequency			5	8	MHz
$T_{int}^{*(3)}$	Line scanning rate			0.125		ms/line
$R-V_{pc}^{*(4)}$	Red output voltage at white paper	O.D. ^{*(9)} = 0.05 ~ 0.1	1			V
$G-V_{pc}^{*(4)}$	Green output voltage at white paper	O.D. ^{*(9)} = 0.05 ~ 0.1	1			
$B-V_{pc}^{*(4)}$	Blue output voltage at white paper	O.D. ^{*(9)} = 0.05 ~ 0.1	1			
$U_{pc}^{*(5)}$	White paper non-uniformity	O.D. = 0.05 ~ 0.1			40	%
$V_d^{*(6)}$	Analog output voltage at dark paper	light off, O.D. = 0.8			0.4	V
$U_d^{*(7)}$	Dark signal non-uniformity	light off, O.D. = 0.8			0.2	V
MTF ^{*(8)}	Modulation transfer function (Green)	at 3.7 lp/mm ^{*(10)}	30			%
			15			%
			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 internal of two start pulses. For the color operation mode, T_{int} is at least three times that of the B/W mode.
4. V_{pc}(n) is the effective output signal of each pixel. It is defined by:
 $V_{pc} = V_p(n) - V_d(n)$
 V_p(n) is the output signal of nth pixel in the white paper.
 V_d(n) is the output signal of nth pixel in the dark paper.
5. U_{pc} is a pixel - pixel photo response non-uniformity within whole module.
 $U_{pc} = [(V_{pcmax} - V_{pcmin}) / V_{pcmax}] \times 100\%$
 V_{pcmax} = MAX [V_{pc}(n)]; it is the maximum effective output signal.
 V_{pcmin} = MIN [V_{pc}(n)]; it is the minimum effective output signal.
6. V_{dmin} is the minimum output signal in the dark and defined by:
 $V_{dmin} = \text{MIN} [V_d(n)];$
 where n = 1, 2, 5184 pixels on the whole module.
7. U_d is the dark output non-uniformity and defined by:
 $U_d = V_{dmax} - V_{dmin}$
 Where V_{dmax} = MAX[V_d(n)]; it is the maximum dark output signal.
 V_{dmin} = MIN [V_d(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:
 $MTF = \text{MIN} \{[(V_{max} - V_{min}) / (V_{max} + V_{min})]\} \times 100\%$
 where V_{max} is the maximum output voltage using a MTF image target.
 V_{min} 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}	150 mA
LED power supply current, I_{LED}	40 mA
Digital input voltage range (high), V_{ih}	$V_{DD} + 0.5$ V
Digital input voltage range (low), V_{il}	- 0.5 V
Digital input current range, I_{ih}	-20 mA to 20 mA
Operating free-air temperature range, T_a	0 °C ~ 50 °C
Storage temperature range, T_{stg}	-25 °C ~ 70 °C
Storage humidity range, H_{stg}	10 ~ 90 % RH

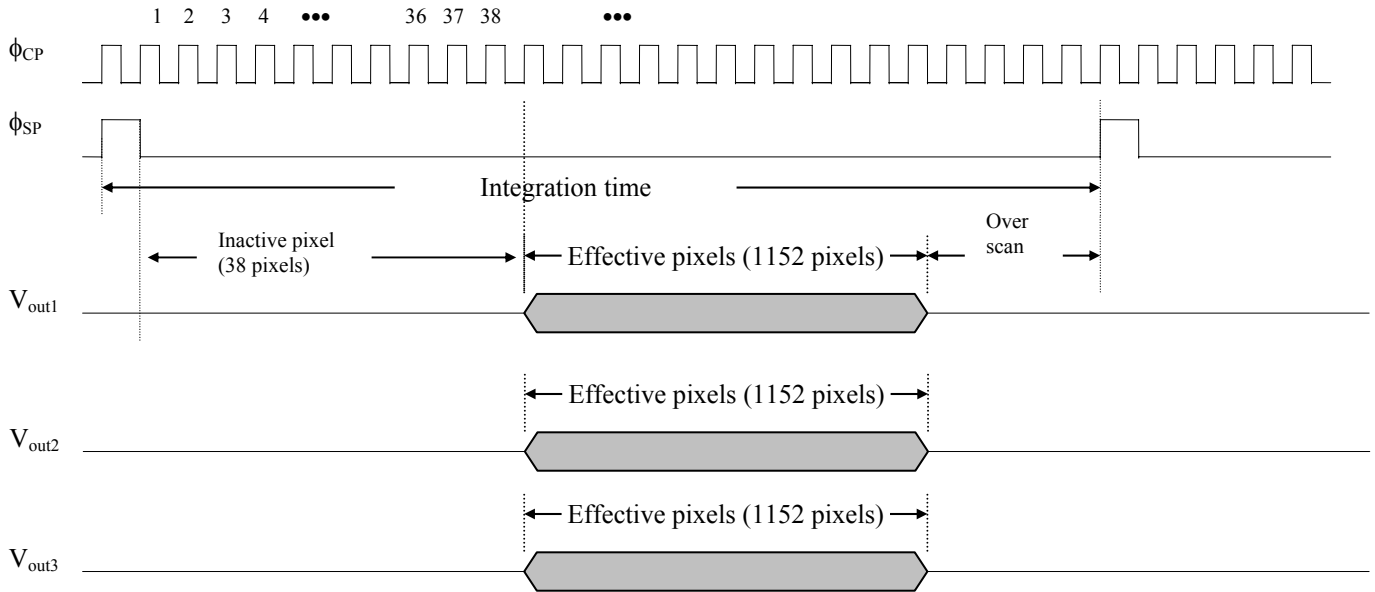
‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress rating only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute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

Table 4. Recommend operating conditions:

Item	Symbol	Min.	Typ.	Max.	Unit
Positive power supply voltage	V_{DD}	4.75	5	5.25	V
LED power supply current	I_{LED}		20	40	mA
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	8	MHz
Clock pulse high duty cycle			50		%
Clock pulse high duration	tw		0.1		us
Sensor integration time (color) for 200dpi (B/W)	t_{int}		0.375 0.125		ms
Operating humidity	Hop	10		85	% RH
Operating free-air temperature	T_a	0		50	°C

Figure 3. Timing Diagram:

(1) 400dpi mode



(2) 200dpi mode

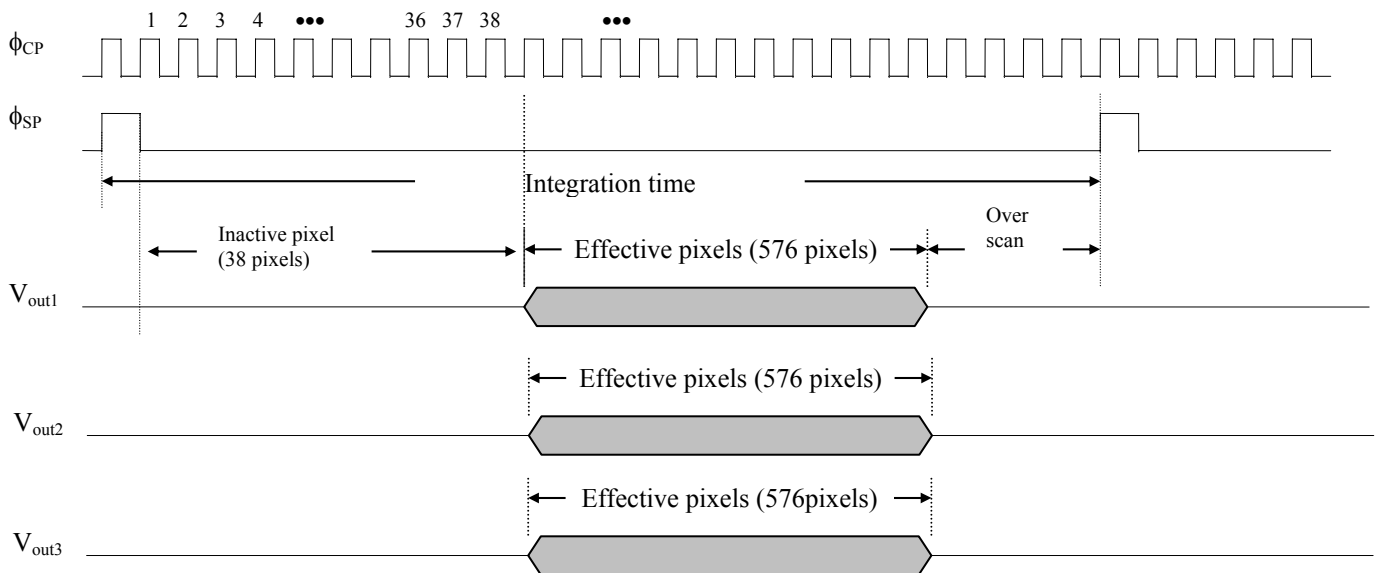
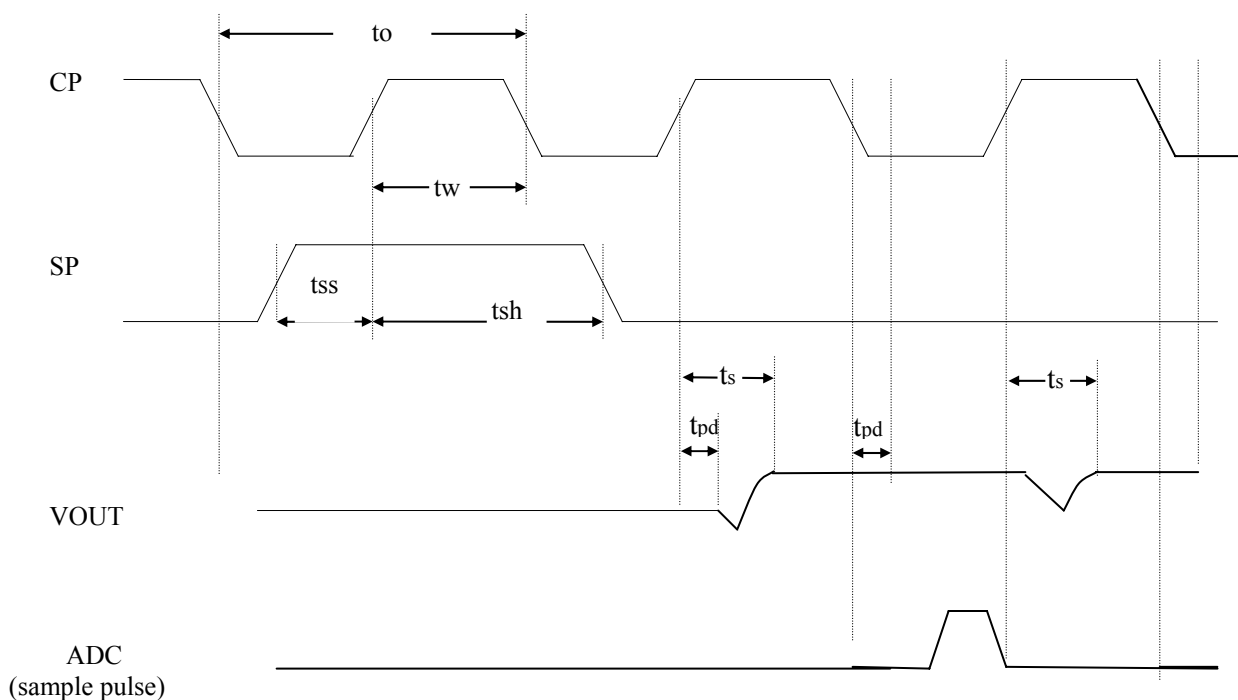


Table 5. Switching Characteristics

Item	Description	Symbol	Min	Typ.	Max	Unit
1	Clock cycle time	t_o		0.5		μs
2	Clock pulse duty cycle: t_w / t_o			50		%
3	Clock pulse width	t_w		100		ns
4	ϕ_{Sp} setup time	t_{ss}	50			ns
5	ϕ_{Sp} hold time	t_{sh}	50			ns
6	Video digital delay time	t_{pd}		50		ns
8	Video signal stable time	t_s		200		ns

Figure 4. Switching Waveforms



Application:

1. LED control circuitry:

The Red, Green and Blue color of LED must be driven by the current. The following circuitry is a simplified circuit to drive the LED array.

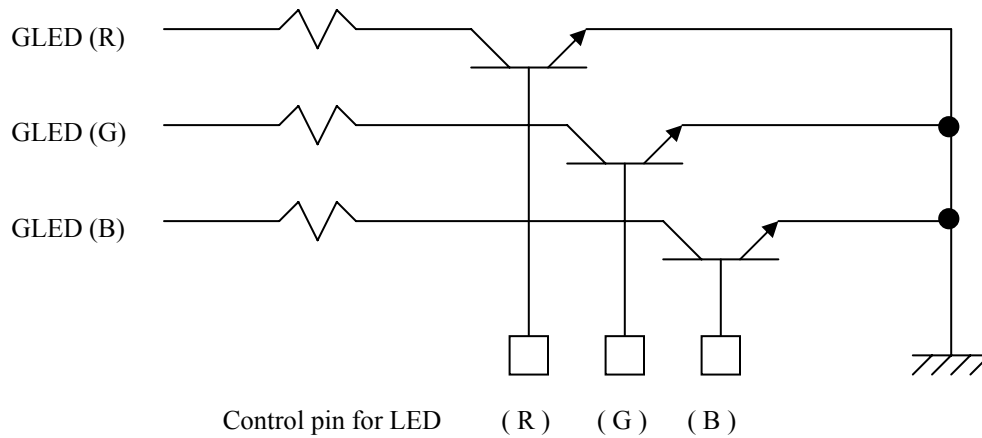


Figure 5. A reference circuitry of LED light source.

2. LED characteristics:

(Table 6)

Item		Specifications			Unit	Condition
		Min.	Typ.	Max.		
Power of Illuminance IV	Red	1.1	—	6.4	$\mu\text{w}/\text{m}^2$	IF=20mA
	Green	1.7	—	8.3		
	Blue	1.5	—	8.6		
Uniformity of Illuminance ΔIV	Red	—	—	25	%	
	Green	—	—	25		
	Blue	—	—	25		
Peak Wave Length λ_p	Red	—	630	—	nm	IF=20mA
	Green	—	520	—		
	Blue	—	465	—		
Half Width $\Delta\lambda$	Red	—	20	—	nm	IF=20mA
	Green	—	40	—		
	Blue	—	30	—		
Dominant Wave Length λ_d	Red	610	—	630	V	IF=20mA
	Green	510	—	540		
	Blue	460	—	480		
Forward Voltage 1 VF1	Red		2.2		V	IF=20mA
	Green		3.5			
	Blue		3.6			
Forward Voltage 2 VF2	Red	1.5	—	3.2	V	IF=50mA
	Green	2.8	—	4.7		
	Blue	2.8	—	4.7		
Forward Voltage 3 VF3	Green	2.0	—	—	V	IF=0.5mA
	Blue	2.0	—	—		
Reverse Current IR	Red	—	—	50	μA	VR=5V
	Green	—	—	5		
	Blue	—	—	5		

1. Driver timing diagram:

1.1 Color mode operation:

The CIS module used for the color mode of operation is shown in figure 6. In this mode of operation, three LED light sources are pulsed. The following instruction is used to set the output signal level for three different color light source.

- 1.1.1 The currents of three LED are set within the spec as described in Table 6.
- 1.1.2 The pulse width of three color LED is set to Maximum ($T_{red} = T_{green} = T_{blue} = T_{max}$).
- 1.1.3 Measured the output voltage for three different color of LED.
- 1.1.4 Keep the smallest signal and pulse width on that color of LED as a reference. For example, the output signal is 1 V, 0.8 V and 1.2 V for R, G, and B color of LED, respectively. Then choose Green LED as a reference LED and 0.8 V as a reference voltage.
- 1.1.5 Reduced the pulse width of other two LED until the output signal is the same as a reference voltage. For example, the green LED pulse is set to T_{max} and the red and blue LED pulse is reduced as shown in figure 6.

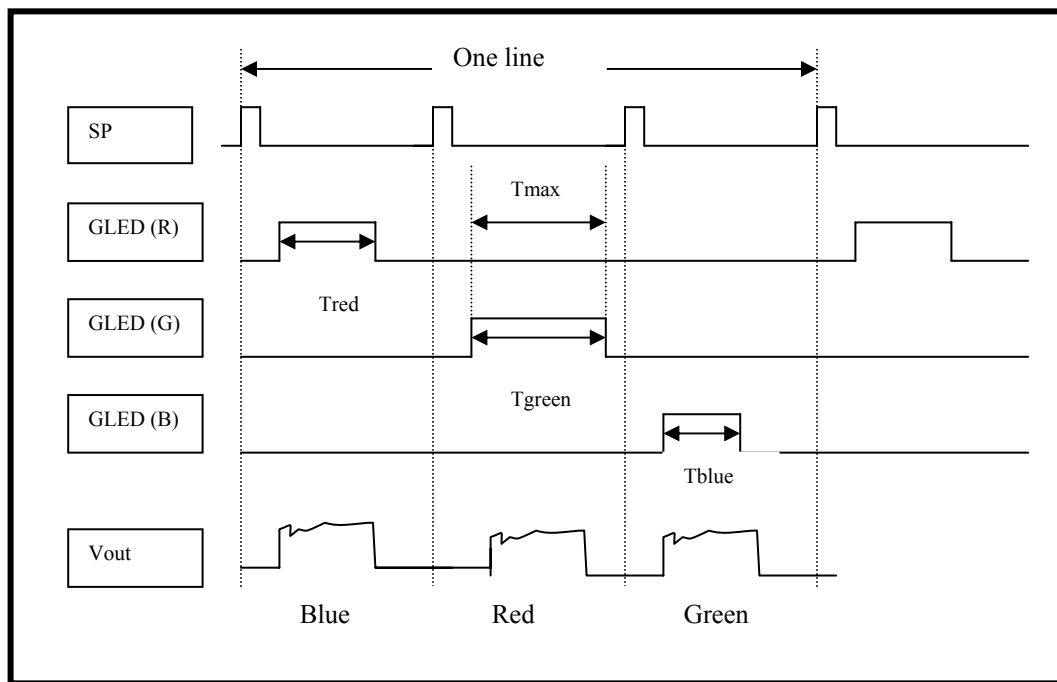


Figure 6. Timing diagram of the CIS module for color mode of operation.

1.2 B/W mode with white light source operation:

The CIS module used for the B/W mode of operation is shown in figure 7. In this mode of operation, three LED light sources need to apply a continuous current. The following instruction is used to set the output signal level for three different color light source.

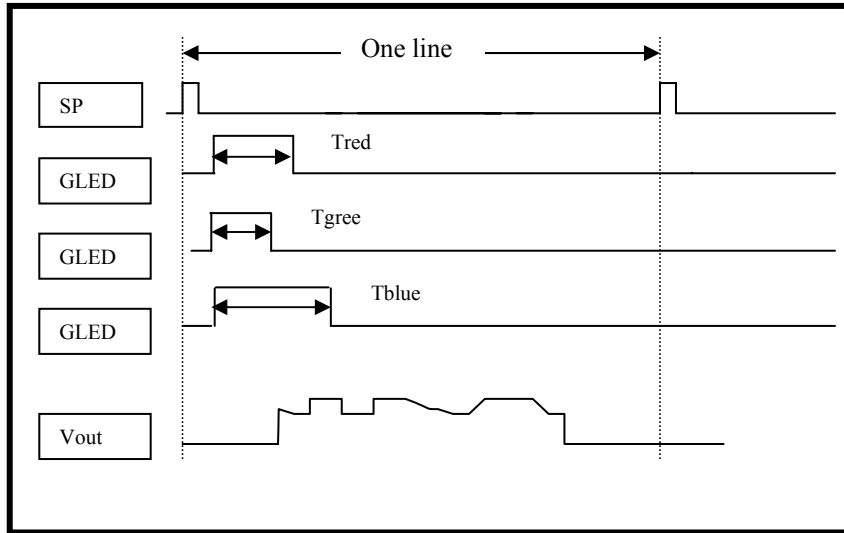


Figure 7. Timing diagram of the CIS module for B/W mode with white light source.

1.3 B/W mode with Mono-color light source operation:

The CIS module used for the B/W mode of operation with Mono-color light source is shown in figure 8.

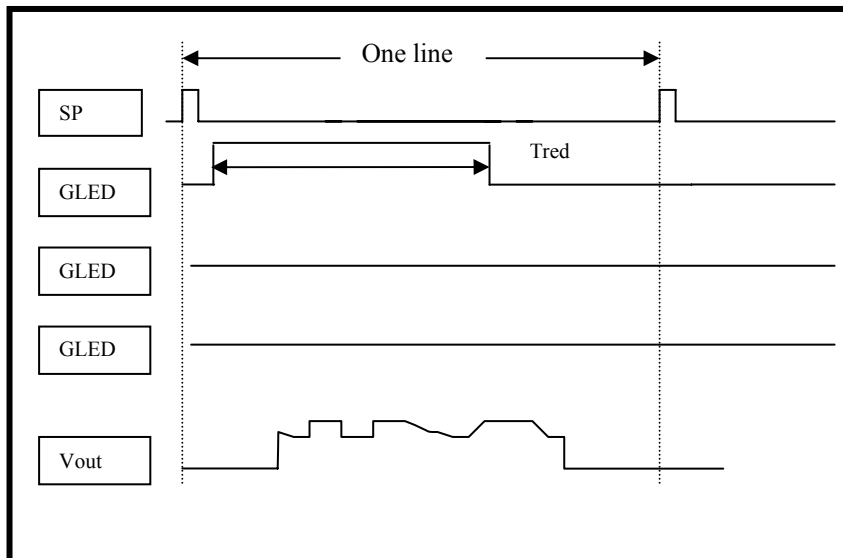


Figure 8. Timing diagram of the CIS module for B/W mode with Mono-color light source

Reliability tests:

Item	Test condition	Time	Criterion
High temp / high humidity operation	T = 45 °C, 90% RH	500 H	$\Delta V_p = -30 \sim 10 (\%)$ $\Delta V_d = -25 \sim 15 (mV)$ No physical Distortion and damage
High temp. operation	T = 50 °C	500 H	
Low temp. operation	T = 0 °C	500 H	
High temp. storage	T = 60 °C	1000 H	
High temp. / high humidity storage	T = 50 °C, 90% RH	1000 H	
Low temp. storage	T = -30 °C	1000 H	
Temp. cycle at high humidity	-10 ~ 50 °C / 90% RH	10 cycle	
Temp. cycle	-30 °C ~ RT ~ 50 °C 1 H 1 H	20 cycle	
Vibration test	3G, 10 ~ 100 Hz, 5 min. RT, X, Y, Z	60 min each	
Drop test	60 G, 5 ~ 10 msec $\pm X, \pm Y, \pm Z$	2 times	
ESD	R = 0 Ω , 200 pF, $\pm 200 V$	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, soak a cloth lightly 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 be removed, otherwise dust may enter the unit. When using the side holes to fix the sensor, insert 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 when 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)

M118-232C3 configuration and physical dimensions.

