

Notice: This is not a final specification.  
Outline, some parametric limits and figures are subject to change.

# COLOR CONTACT IMAGE SENSOR

## LC3R108

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### 1. Description

This specification is applied to LC3R108 Color Contact Image Sensor module (Color CIS).

### 2. Scope

This LC3R108 is a Color CIS consists of a Rod Lens Array, a color LED light source and an array of linear MOS image sensor.

### 3. Outline

Item	Specification	Note
Scanning width	108 mm	
Sensor element density	300DPI	CNT=GND
Effective number of sensor elements	1276 elements (Full 1296elements)	11 <sup>th</sup> to 1286 <sup>th</sup>
Scanning speed	Color(RGB):180×3 μsec/line Black & White: 180 μsec/line	<b>Note 1</b>
Clock speed	8.0 MHz	<b>Note 2</b>
Rod lens array	Two row	
Light source	Red λ <sub>p</sub> = 630nm ± 15nm 60mA Green λ <sub>p</sub> = 520nm ± 15nm 60mA Blue λ <sub>p</sub> = 465nm ± 10nm 60mA	LED At least two LED vendors.
Power supply	+3.3V x 80 mA	
Data output	1 analog output	Synchronous
Block diagram	Figure 5	
Dimensions	Figure 1	

**Note 1)** Clock Speed f must satisfy following status:

$$f > (1296 + 92) / \text{tint}$$

f: Clock speed

tint: Scanning speed

**4. Image Data Output Characteristics (Ta = 25°C )**

The shipment test in SHEC is done on the condition of this table.

**In Color Mode**

Item	Symbol	Specification			Note
		Red	Green	Blue	
DC supply voltage	VDD	+3.3V			Detector, Logic
LED supply voltage	VLED	<3.0V	<5.0V	<5.0V	Constant current
LED supply current	ILED	60mA	60mA	60mA	
White image target		0.05 ~ 0.09 OD			
Timing chart		Figure 7			
Video reference	Vref Dref	700 ~ 900 mV			4.1
Dark output minimum	Vdmin	≥ - 150 mV			4.2
Dark output maximum	Vdmax	≤ + 150 mV			4.3
White output maximum	Vpmax	500 ± 100 mV			4.4 for the lowest output color
White output uniformity	UEp	Less than 50% <b>T.B.D</b>			4.5
MTF		20% MIN	30% MIN	15% MIN	4.6 71.37lppi
Linearity	Gamma	0.95~1.05			
Linearity Uniformity	LU	Less than 7 %			4.7

**In Black and White Mode**

Item	Symbol	Specification			Note
		Red	Green	Blue	
DC supply voltage	VDD	+3.3V			Detector, Logic
LED supply voltage	VLED	0V	<5.0V	0V	
LED supply current	ILED	0mA	60mA	0mA	
White image target		0.05 ~ 0.09 OD			
Timing chart		Figure 9 Figure 11			
Video reference	Vref Dref	700 ~ 900 mV			4.1
Dark output minimum	Vdmin	≥ - 150 mV			4.2
Dark output maximum	Vdmax	≤ + 150 mV			4.3
White output maximum	Vpmax	500 ± 100 mV			4.4 <b>T.B.D</b>
White output saturation	Vpsat	1000mV		<b>T.B.D</b>	4.9
White output uniformity	UEp	Less than 50%		<b>T.B.D</b>	4.5
MTF		30% MIN		<b>T.B.D</b>	4.6 71.37l ppi

The output level of image signal like white and dark and MTF is defined at the point of “ts” which described in section 6.

A test target is set on the reading position as outlined in Figure 1.

#### 4.1 Vref

Video reference voltage.

Vref is outputted from connector pin #4. Vdmin and Vdmax are based on Vref.

#### Dref

Dark reference voltage.

As shown in Figure 4, Dref appears from clock #72 to #79. Dref voltage is almost equal to Vref voltage.

#### 4.2 Vdmin

As shown in Figure 2, Vdmin is the minimum value in the dark output signal (turning off the LED).

Every other parameters are defined by Vdmin as a reference.(See Fig.2)

#### 4.3 Vdmax

As shown in Figure 2, Vdmax is the maximum value in the dark output signal (turning off the LED).

#### 4.4 Vpmax

As shown in Figure 2, Vpmax is the maximum white output signal and is defined by:

$$Vpmax = MAX[Vp(n)]$$

Vp(n) is the output signal of the nth pixel using a white image target.

#### 4.5 UEp

UEp is the white output non-uniformity with dark signal subtracted and is defined by:

$$UEp = ((VEpmax - VEpmi) / (VEpmax)) \times 100\%$$

VEpmax = MAX[VEp(n)]; is the maximum effective output signal

VEpmi = MIN[VEp(n)]; is the minimum effective output signal

VEp(n) is the effective output signal of every pixel and is defined by:

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

#### 4.6 MTF

MTF is defined by:

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

Vmax is the maximum output signal using the MTF test chart.

Vmin is the minimum output signal using the MTF test chart.

VEp is the effective output signal .

#### 4.7 Linearity Uniformity

LUG is measured following procedure and defined;

##### **Step1. Test Target**

The white image target is used as a test target. This target must not be moved while this test is being operated.

##### **Step2. LED adjustment**

Tred, Tgrn, Tblu should be adjusted according to Figure 8 procedure.

##### **Step3. Dark and White correction**

Dark and White correction must be done for every each pixel.

##### **Step4. LED turn on time set**

Tred, Tgrn and Tblu should be changed as following;

Tred/2, Tgrn/2, Tblu/2

##### **Step5. Compute LUG**

LUG should be computed for each color as;

$$LUG = \sqrt{D_{gave} - D_{gextm}}$$

Dgave is the average of Vg(n). Vg(n) should be got more than 8 times sampling.

##### **Step6. LED turn on time set**

Tred, Tgrn and Tblu should be changed as following and compute LUG regarding to Step5;

Tred/4, Tgrn/4, Tblu/4

##### **Step7. LED turn on time set**

Tred, Tgrn and Tblu should be changed as following and compute LUG regarding to Step5;

Tred/8, Tgrn/8, Tblu/8

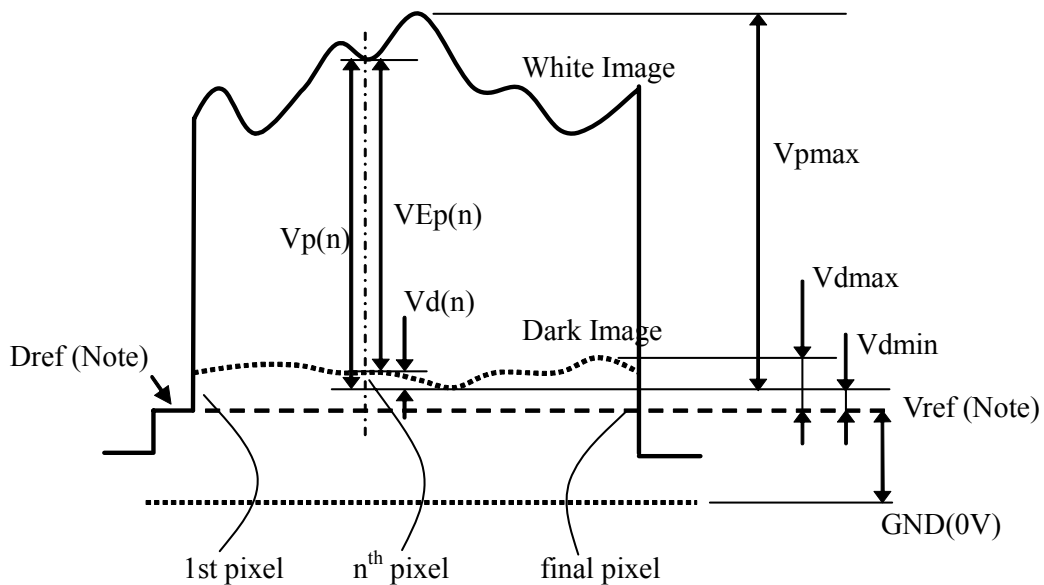
#### 4.8 Correction of Dark and White uniformity

For the best performance two points correction (dark and white) is strongly recommended.

Especially, dark uniformity correction with LED turning off should be done as often as possible to cancel temperature drift.

#### 4.9 Vpsat

Vpsat is the saturation voltage of white output signal which is defined by Vdmin as a reference.



**Note:** Vref or Dref is the reference voltage for video signals. Either of them can be used as the reference voltage. Do not use the GND in stead of Vref or Dref.

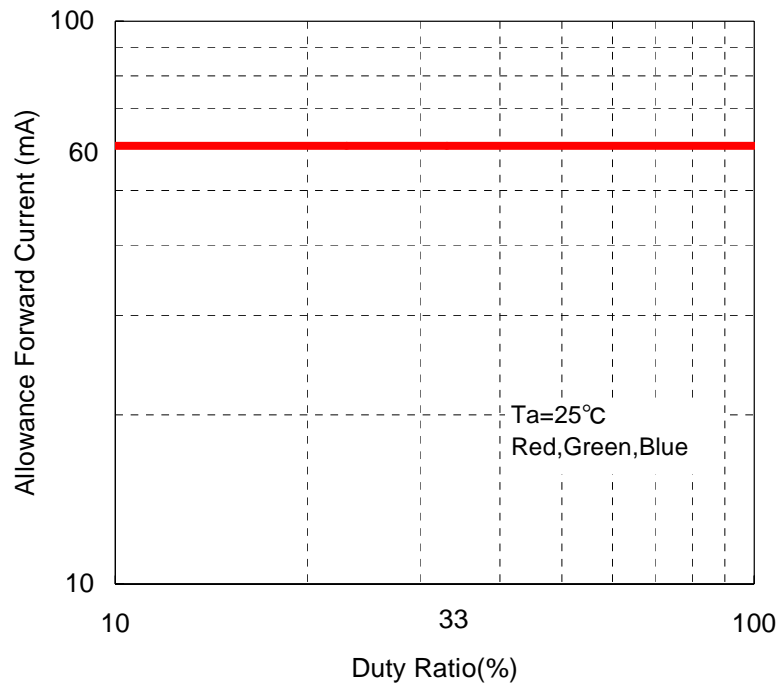
**Figure 2. Output Signals Waveform**

**5.Maximum Rating**

Item	Symbol	Specification	Note
DC supply voltage	VDD	+3.3V ± 0.17V	
Input voltage	VIN	0 ~ VDD+0.3V	SI, CLK
Ambient temperature	Ta	0 ~ +50 °C	Operating
		-20 ~ +60 °C	Non-operating
Ambient humidity		10 ~ 90%RH	Avoid a build up condensation
Maximum operating Temperature		65 °C 30minuts MAX	

**LED**

Parameter	Symbol	Red	Green	Blue	Notes
DC Forward Current	IF	60 mA	60 mA	60 mA	
Pulse Forward Current	IFP	60 mA	60mA	60mA	
DC Reverse Voltage	VR	5 V	5V	5V	



**Figure 3. Duty Ratio vs Allowable Forward Current**

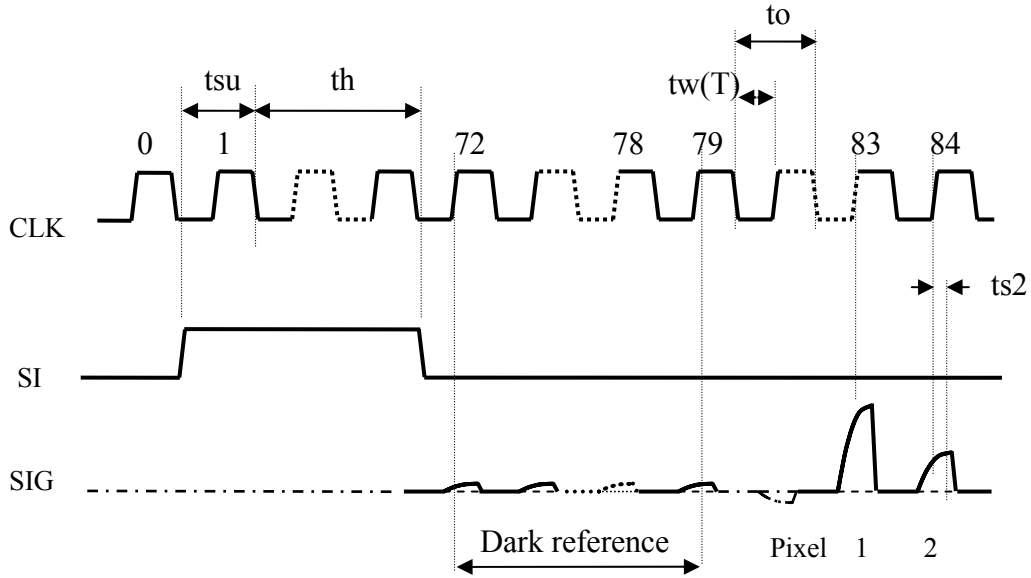
## 6. Electrical Characteristics (Ta = 25 °C)

Item	Symbol	Condition	Specification			Unit
			Min.	Typ.	Max.	
DC Supply Voltage	VDD	GND reference	3.14	3.30	3.47	V
DC Supply Current	IDD	VDD = 3.3V		80	100	mA
LED Forward Voltage	VFred	IF=30mA	1.9	2.1	2.3	V
		IF=40mA	1.9	2.2	2.4	V
		IF=60mA	2.1	2.3	2.5	V
	VFgreen	IF=30mA	3.3	3.6	4.0	V
		IF=40mA	3.4	3.8	4.1	V
		IF=60mA	3.6	4.0	4.4	V
	VFblue	IF=30mA	3.3	3.7	4.1	V
		IF=40mA	3.4	3.8	4.2	V
		IF=60mA	3.6	4.0	4.3	V
Input voltage (Note 1)	VIH	SI,CLK	2.4			V
	VIL				0.5	V
Input Current (Note 1)	IIH	SI,CLK			5	mA
	IIL	VIH=3.3V	-10			μA
Output Impedance	Vref	(Note 3)	50		100	Ohm
	SIG		40	50	80	Ohm
SI setup time	tsu	SI-CLK	60		to	ns
SI hold time	th	SI-CLK	60		5×to	ns
Data output stability time	Ts2	CLK-SIG	20	30	40	ns

**Note 1)** 74HC244 or equivalent is recommended for input signal.

**Note 2)** See Note 1 at Item 3.

**Note 3)** To get a better reference voltage, insert a capacitor between VREF and GND. More than 10uF capacitance is recommendable.



**Figure 4 Timing Diagram**

**7.Reliability**

The following table satisfies the reliability when the CIS is operated continuously under standard operating conditions as specified in section 4.

Item	Variable Amount (%)	Note
White output	Initial level +10% -20%	1000Hr
	Initial level +10% -30%	5000Hr

**8. Precautions before use:**

**8.1 Glass surface**

The Glass surface should be kept clean. Don't wipe the glass surface with hand. If the glass surface gets dirty, wipe the glass surface gently with a clean cloth soaked in alcohol. The glass surface should be wiped very carefully.

**8.2 Extracting / Inserting the connector**

The maximum number of times that the connector should be extracted and connected is 10. If the connector is inserted / extracted more than 10 times, the connector 'burrs' will be eroded, thereby making the connector ineffective.

**8.3 Stable operation**

(1) The connector pins should not be touched by bare hand or electrostatic charge materials.

**(2) Noise**

- a. Insert a low frequency noise suppressing capacitor(100uF) between VDD(+3.3V) and GND. A high frequency noise suppressing capacitor is already integrated into the circuit.
- b. Ensure that the sensor connecting cables are 30cm or less in length. The CLK and GND, SIG and GND and VLED and GLED respectively from form twisted cable pairs.

**(3) Latch up**

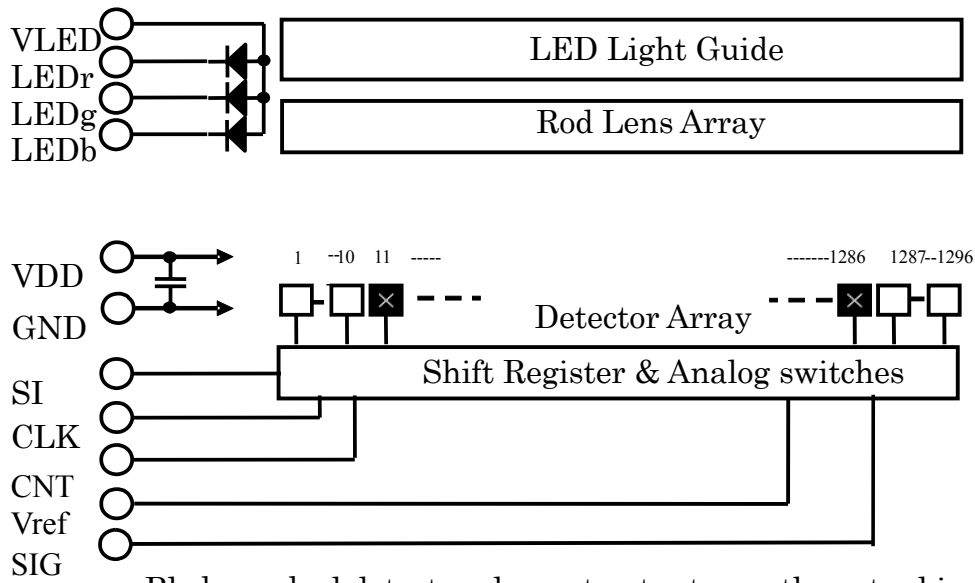
When the supply voltage is higher than the absolute maximum, latch up will cause the sensor to break, even if the voltage is caused by a surge. If the current varies rapidly in the external in the external circuit, or when the power is turned on an off very frequently, ensure that the voltage o each terminal does not exceed the values indicated in below.

**(4) LED circuit**

As shown in Figure.6 LED circuit has not any resistance. Be careful no to connect the LED circuit to power supply directory without current limit resistors.

**(5) Absolute maximum ratio**

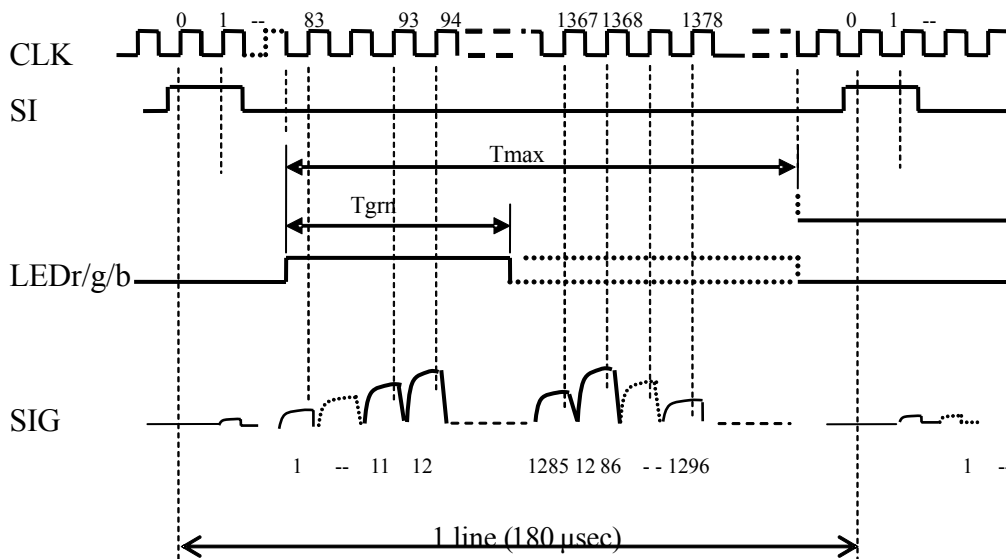
Item	Symbol	Condition	Specification		Unit
			Min	Max	
Supply Voltage	VDD	GND reference	-0.3	+6.5	V
Input voltage	Vin	SI,CLK	GND-0.3	VDD+0.3	V



**Figure 5. Block Diagram**

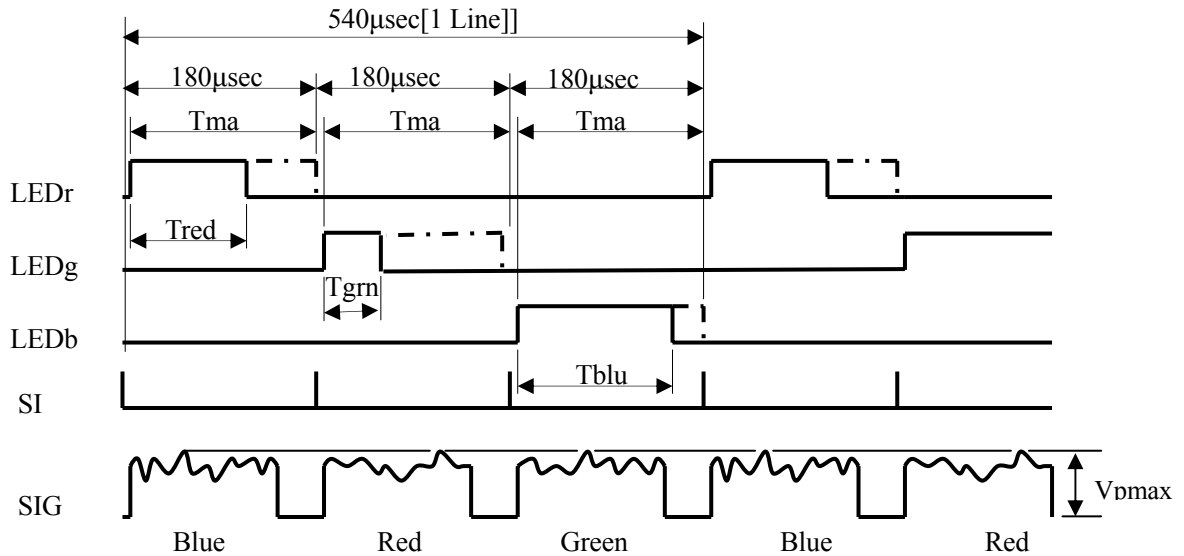
CLK: 8.0MHz (L:duty 50%)

This is the SHEC shipping test condition.



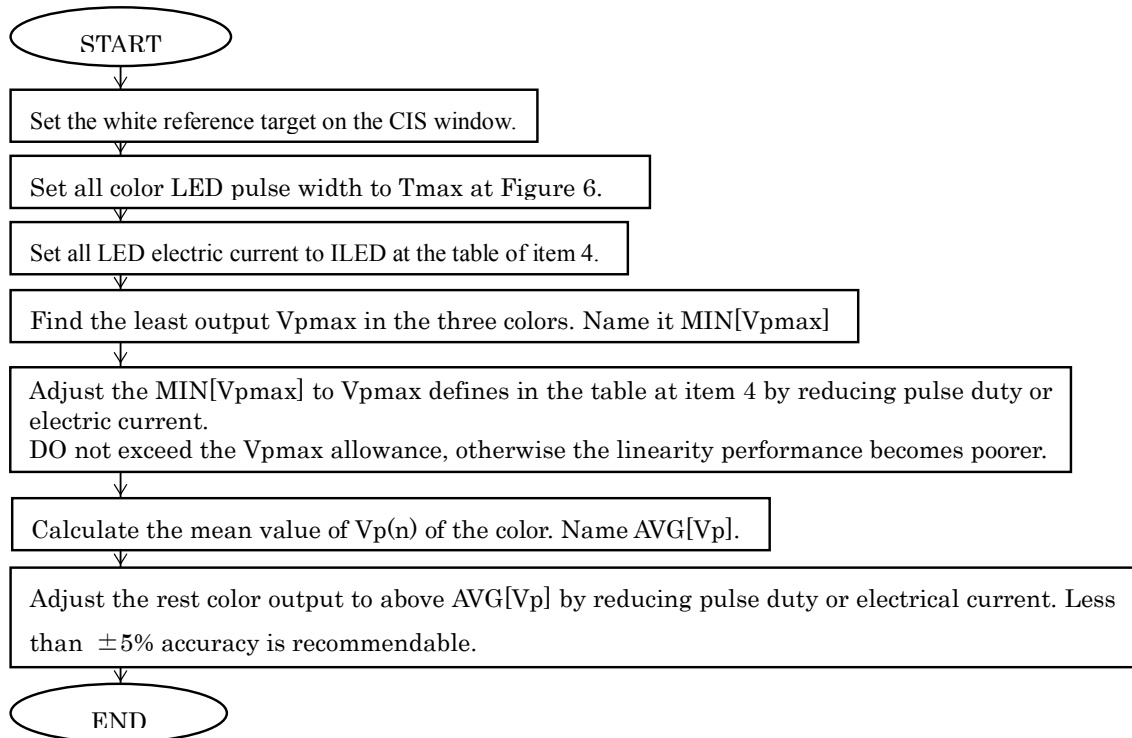
**Note : After 1296th SIG, at least 7 clocks needs.**

**Figure 6. Timing Diagram**

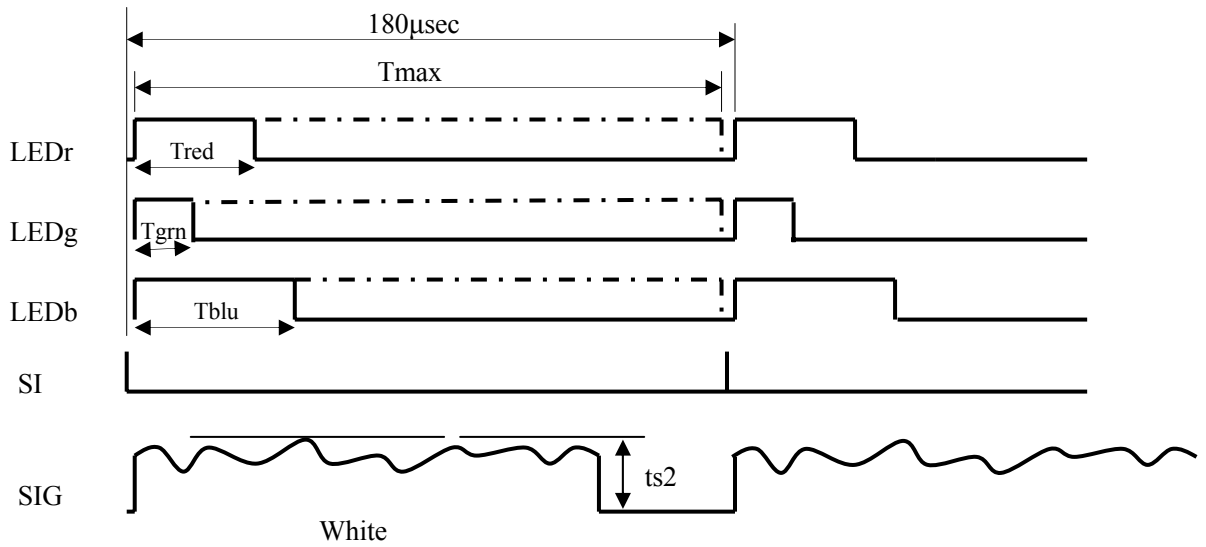


Vpmax and the mean of Vep(n) of all color have to be adjusted to nearly equal. Refer the adjustment flow at Figure 8

**Figure 7. Color Mode Timing Diagram**  
**(This is the SHEC shipping test condition)**

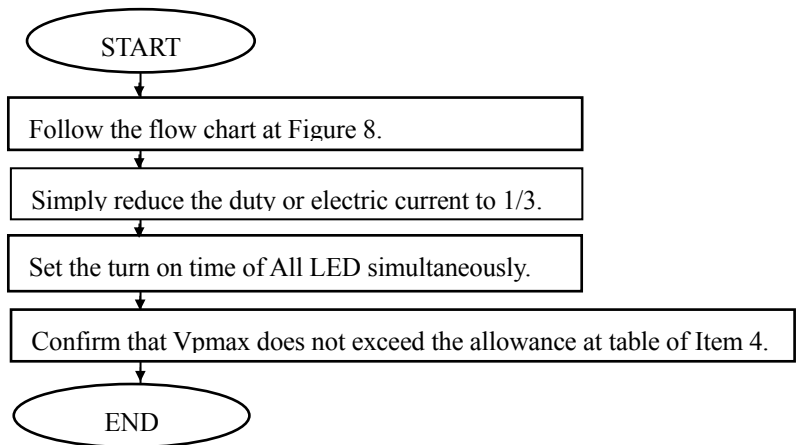


**Figure 8. Flow Chart of Color mode Adjustment (This is the SHEC shipping test condition)**

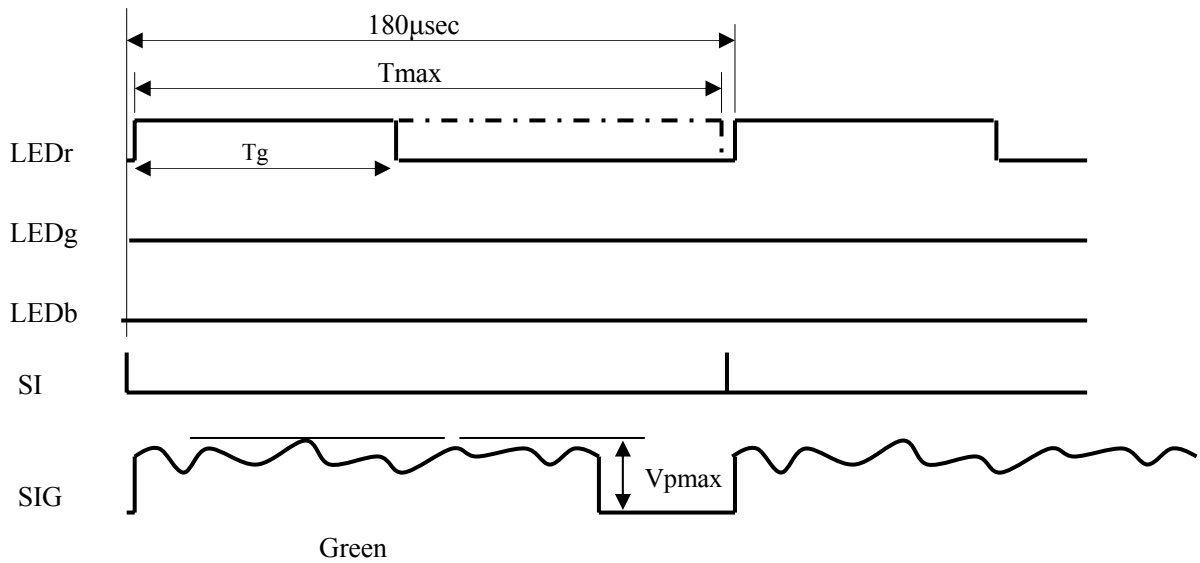


To get better white light source, refer the adjustment flow at Figure 10.

**Figure 9. B&W mode with White Light Source Timing Diagram  
(This is the SHEC shipping test condition)**

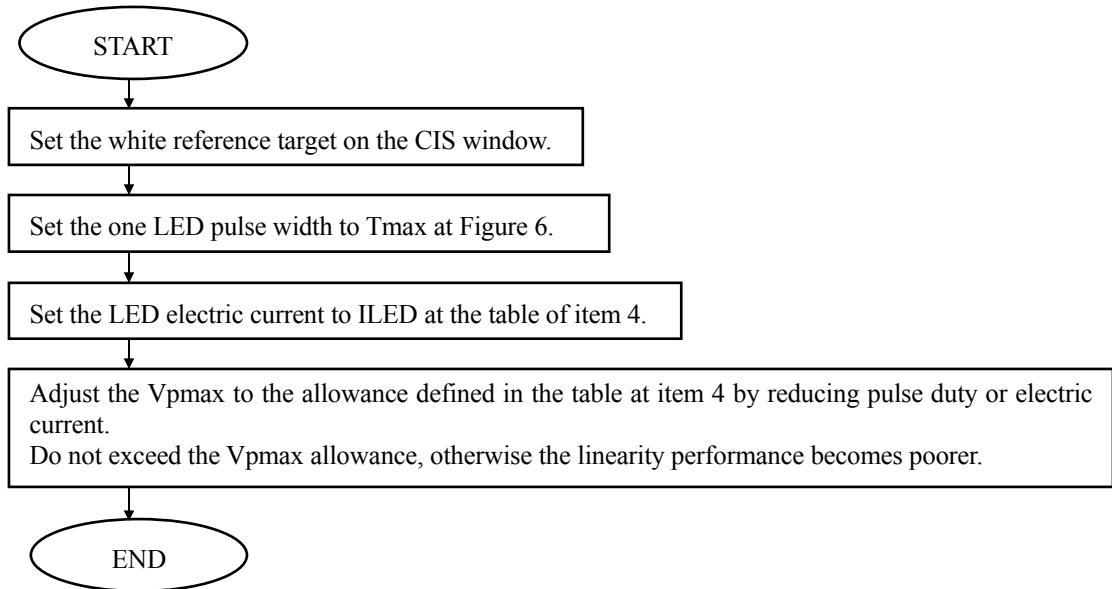


**Figure 10. Flow Chart of B&W mode with White Light Source Adjustment**



This is the example for Green mono-color application. Refer the adjustment flow chart at Figure 12.

**Figure 11. B&W mode with Mono-Color Light Source Timing Diagram**



**Figure 12. Flow chart for Mono-Color Adjustment**

**Figure 13. Typical Performance Curve**

Unless otherwise specified, Ta=25°C

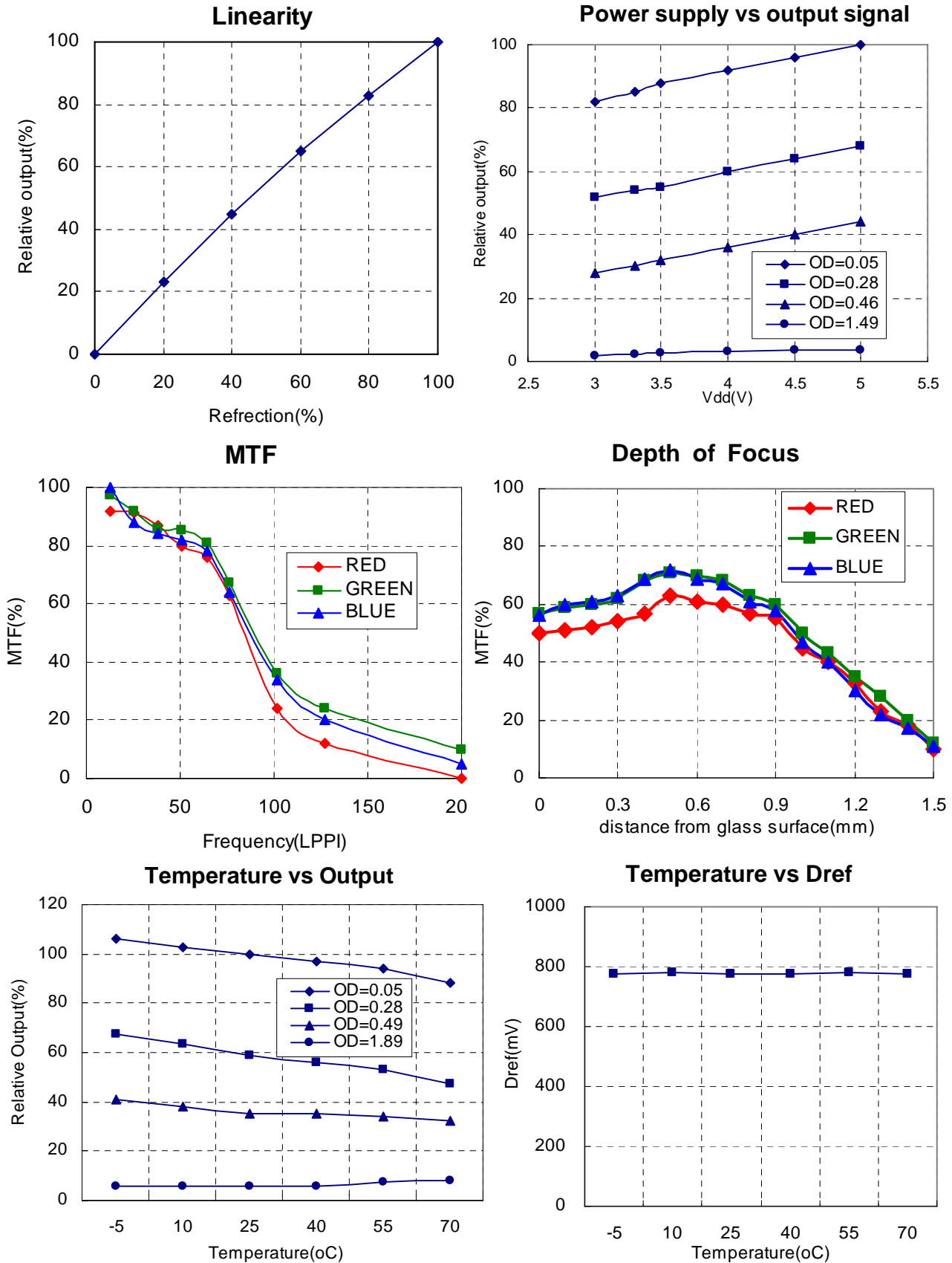


Figure. 1 Dimensions

