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晶采光電科技股份有限公司  
**AMPIRE CO., LTD.**

## SPECIFICATIONS FOR LCD MODULE

<b>CUSTOMER</b>	
<b>CUSTOMER PART NO.</b>	
<b>AMPIRE PART NO.</b>	<b>AM-480640BTZQW-A0</b>
<b>APPROVED BY</b>	
<b>DATE</b>	

**Approved For Specifications**

**Approved For Specifications & Sample**

**AMPIRE CO., LTD.**

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APPROVED BY	CHECKED BY	ORGANIZED BY

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**RECORD OF REVISION**

<b>Revision Date</b>	<b>Page</b>	<b>Contents</b>	<b>Editor</b>
2016/06/27	-	New Release	Mark

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**1. PHYSICAL SPECIFICATIONS**

Item	Specifications	Remark
LCD size	3.5 inch(Diagonal)	
Driver IC	HX8363A	
Display resolution	480 (W) × 3(RGB) x 640(H) dots	
Interface	LVDS	
Pixel pitch	0.0372 x0.1116 mm	
Active area	53.568 (W) x 71.424 (H) mm	
Module size	61.8 (W) x 88.5 (H) × 9.6 (D) mm	
Display Mode	AIFF/Transmissive/Normally Black	
Color arrangement	RGB vertical stripe	
Viewing Direction	Wide viewing	
Luminance	500	
Weight	TBD	

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**2. ABSOLUTE MAXIMUM RATINGS**

Item	Symbol	Min.	Max.	Unit
Supply Voltage	VCC	-0.3	4.6	V
Operating Temperature	T <sub>OP</sub>	-10	60	°C
Storage Temperature	T <sub>ST</sub>	-20	70	°C
Storage Humidity	HD	20	90	%RH

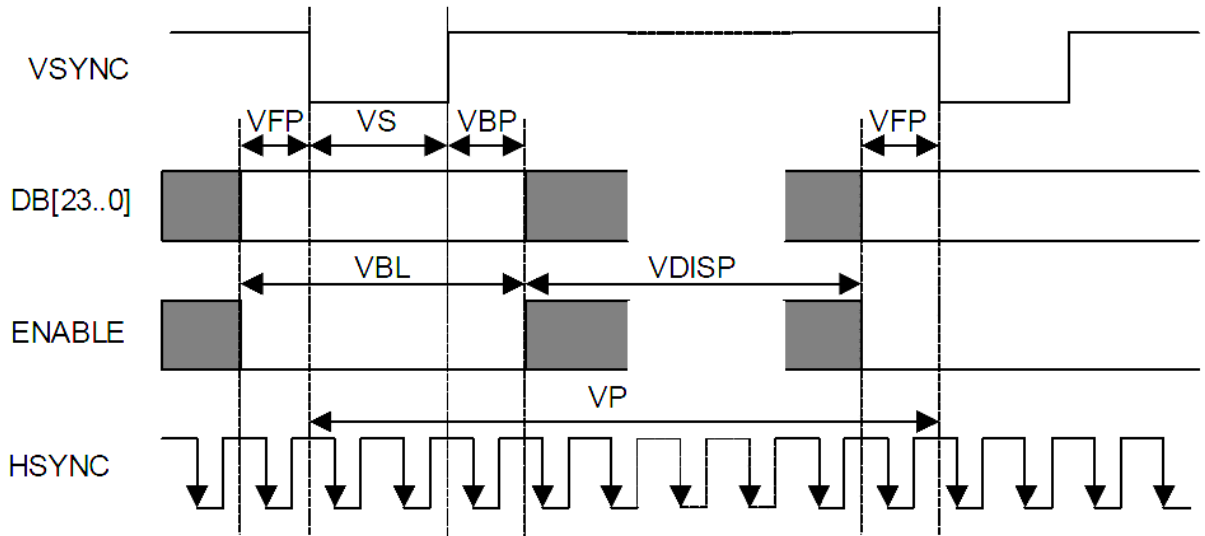
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# 3. Timing Characteristics

## 3.1 RGB Interface Timing Characteristics

Vertical Timings for RGB I/F



Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical cycle	VP	-	646	-	650	Line
Vertical low pulse width	VS	-	2	-	4	Line
Vertical front porch	VFP	-	2	-	4	Line
Vertical back porch	VBP	-	2	-	4	Line
Vertical data start point	-	VS+VBP	4	-	8	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	-	10	Line
Vertical active area	-	VDISP	-	640	-	Line
Vertical Refresh rate	VRR	-	50	-	70	Hz

Note: (1) Signal rise and fall times are equal to or less than 20 ns.

(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.

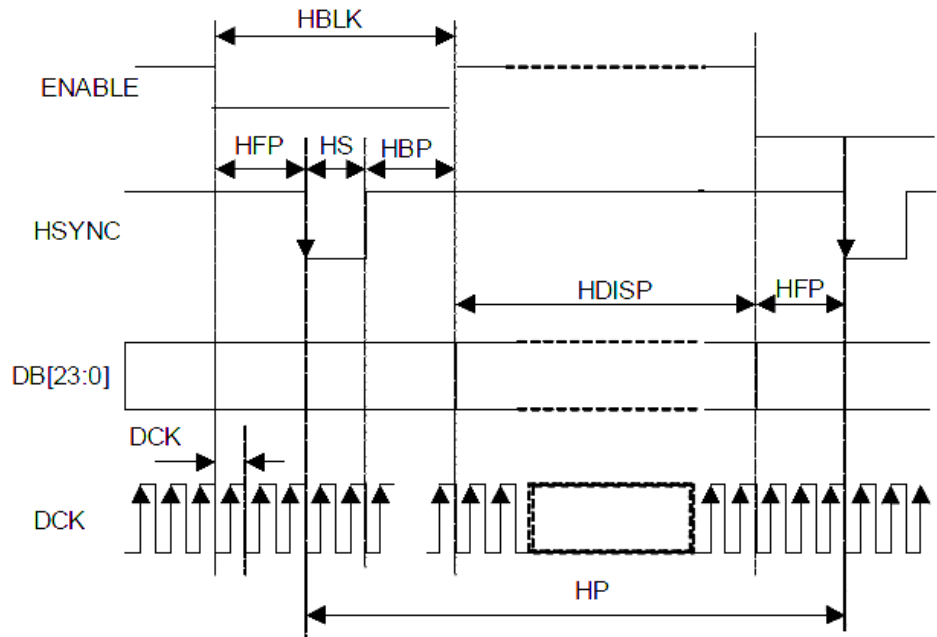
(3) Data lines can be set to "High" or "Low" during blanking time – Don't care.

(4) VRR must keep from 50Hz to 70Hz when adjust other items

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**Horizontal Timings for RGB I/F**



Item	Sym bol	Condition	Min.	Typ.	Max.	Unit
HS cycle	HP	Note 3	504	-	568	DCK
HS low pulse width	HS	-	5	-	78	DCK
Horizontal back porch	HBP	-	5	-	78	DCK
Horizontal front porch	HFP	-	5	-	78	DCK
Horizontal data start point		HS+HBP	19	-	83	DCK
			700	-	-	ns
Horizontal blanking period	HBLK	HS+HBP+HFP	24	-	88	DCK
Horizontal active area	HDISP	-	-	480	-	DCK
Pixel clock frequency When RGB I/F is running	DCK	VRR = Min. 50 Hz – Max. 70 Hz	21.6	-	34.3	MHz
			29.1	-	46.2	ns

Note: (1) Signal rise and fall times are equal to or less than 20 ns.

(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.

(3) HP is multiples of eight DCK.

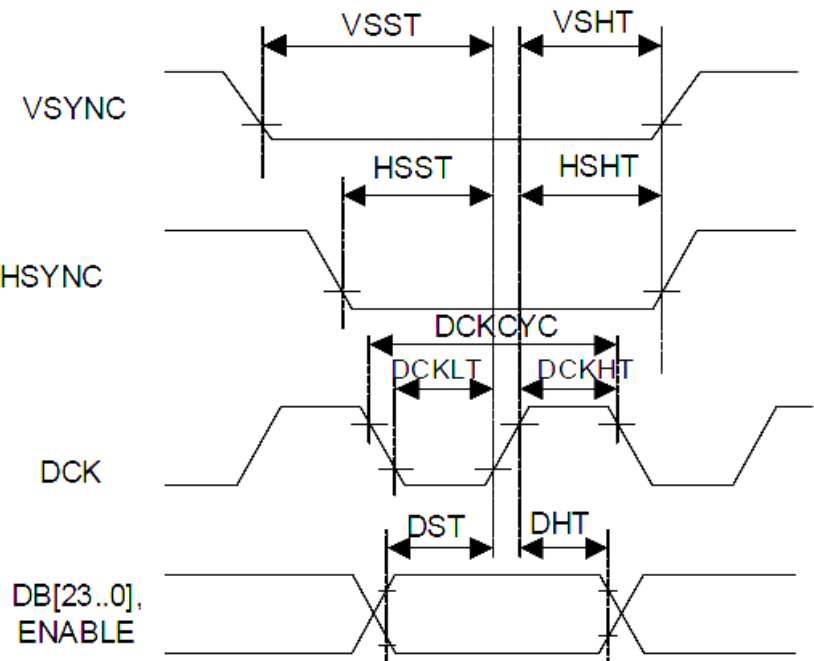
(4) Data lines can be set to "High" or "Low" during blanking time – Don't care.

(5) DCK must keep from 21.6Hz to 34.3Hz when adjust other items.

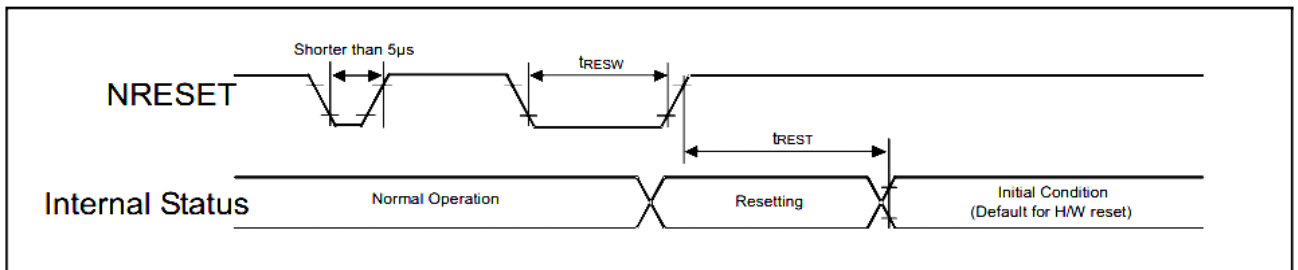
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**General Timings for RGB I/F**



**3.2 Reset Timing Characteristics**



Symbol	Parameter	Related pins	Min.	Typ.	Max.	Note	Unit
t <sub>RESW</sub>	Reset low pulse width <sup>(1)</sup>	NRESET	10	-	-	-	µs
t <sub>REST</sub>	Reset complete time <sup>(2)</sup>	-	5	-	-	When reset is applied during Sleep In mode	ms
		-	120	-	-	When reset is applied during Sleep Out mode	ms

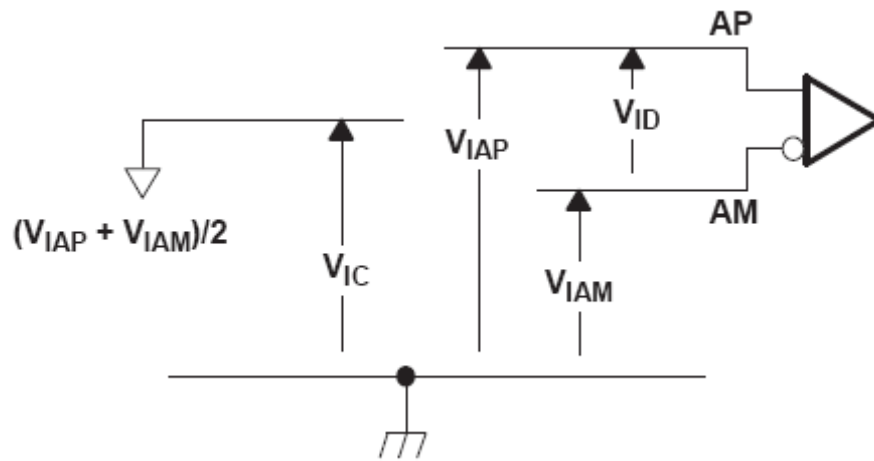
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## 4. ELECTRICAL CHARACTERISTICS

### 4.1 LVDS input

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	3	3.3	3.6	V
$I_{CC}$	Current of Supply voltage		100		mA
$V_{IH}$	High-level input voltage (SHTDN)	2			V
$V_{IL}$	Low-level input voltage (SHTDN)			0.8	V
$ V_{ID} $	Magnitude differential input voltage	0.1		0.6	V
$V_{IC}$	Common-mode input voltage	$\frac{ V_{ID} }{2}$		$2.4 - \frac{ V_{ID} }{2}$	V





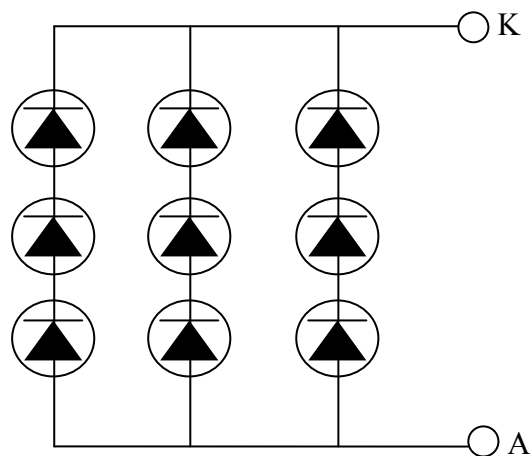
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## 5. Backlight Unit

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Driver Power Voltage	$V_{LED}$	5	--	7.5	V	
LED Driver Current Consumption	$I_{LED}$	151	--	194	mA	$V_{LED}=5V$ $V_{ADJ}=3.3V$ (duty 100%)
		100	--	125	mA	$V_{LED}=7.5V$ $V_{ADJ}=3.3V$ (duty 100%)
ADJ signal frequency	$f_{PWM}$	10	--	100	kHz	
ADJ signal logic level High	$V_{IH}$	2V	--	$V_{LED}$	V	
ADJ signal logic level Low	$V_{IL}$	0	--	0.4	V	
LED voltage	$V_{AK}$	8.4	--	10.8	V	$I_{LED}$ 90mA $T_a=25^{\circ}C$
LED current	$I_{AK}$	--	90	--	mA	$T_a=25^{\circ}C$
LED Life Time	-	--	50K	--	Hour	Note (1)
Luminance uniformity		--	80		%	Note (2)

Note (1) Brightness to be decreased to 50% of the initial value.

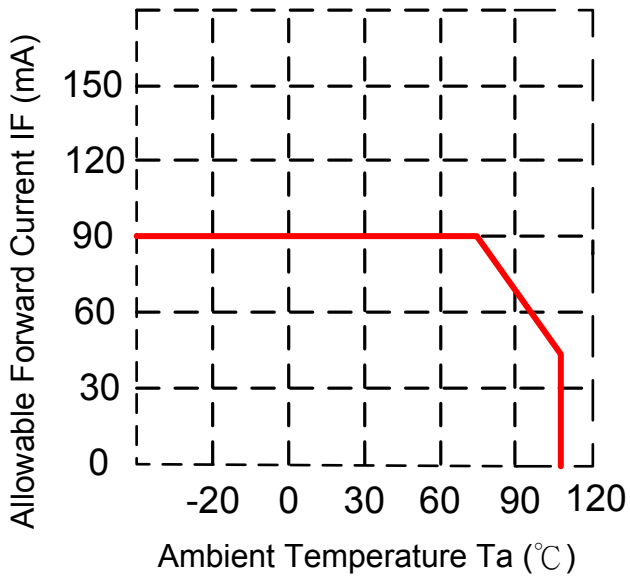


LED Light Bar Circuit

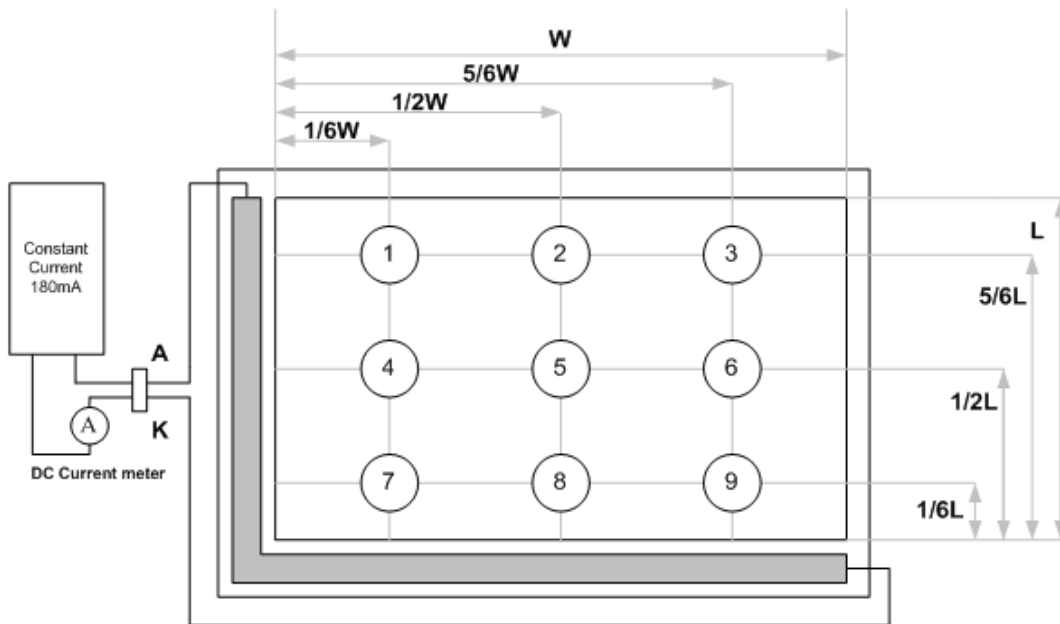
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Note (2): Luminance is measured at point 5 of the display.



Note 6: Definition of Luminance Uniformity

$$\Delta L = [L (\text{min.}) \text{ of } 9 \text{ points} / L (\text{max.}) \text{ of } 9 \text{ points}] \times 100\%$$

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## 6. Interface

PIN NO.	PIN NAME	DESCRIPTION
1	VCC	Power supply
2	VCC	Power supply
3	GND	Ground
4	GND	Ground
5	RXIN0-	-LVDS differential data input
6	RXIN0+	+LVDS differential data input
7	GND	Ground
8	RXIN1-	-LVDS differential data input
9	RXIN1+	+LVDS differential data input
10	GND	Ground
11	RXIN2-	-LVDS differential data input
12	RXIN2+	+LVDS differential data input
13	GND	Ground
14	CLK-	-LVDS differential data input
15	CLK+	+LVDS differential data input
16	GND	Ground
17	VLED	LED Power Supply
18	VLED	LED Power Supply
19	GND	Ground
20	ADJ	PWM Signal for LED Dimming Control

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**7. Optical Specifications**

Item	Symbol	Specifications			Unit	Note
		Min.	Typ.	Max.		
Contrast ratio	Cr ( $\Theta=0^\circ$ )	-	300	-		Note1
Response time (25°C)	T <sub>r</sub> +T <sub>f</sub>	-	30	50	ms	
Viewing angle (Cr≥ 10)*	Θ21	60	80	-	deg	
	Θ22	60	80	-		
	Θ12	60	80	-		
	Θ11	60	80	-		
Chromaticity of LCM	Red	x	-0.05	0.643	+0.05	Chromaticity measuring machine: CFT-01. <b>Reference Only</b>
		y		0.333		
	Green	x		0.304		
		y		0.578		
	Blue	x		0.141		
		y		0.137		
	White	x		0.314		
		y		0.346		
Color gamut of CF (NTSC%)	S		58.2		%	
Luminance	L	400	500	-	Cd/m <sup>2</sup>	
Luminance uniformity	-	-	80	-	%	

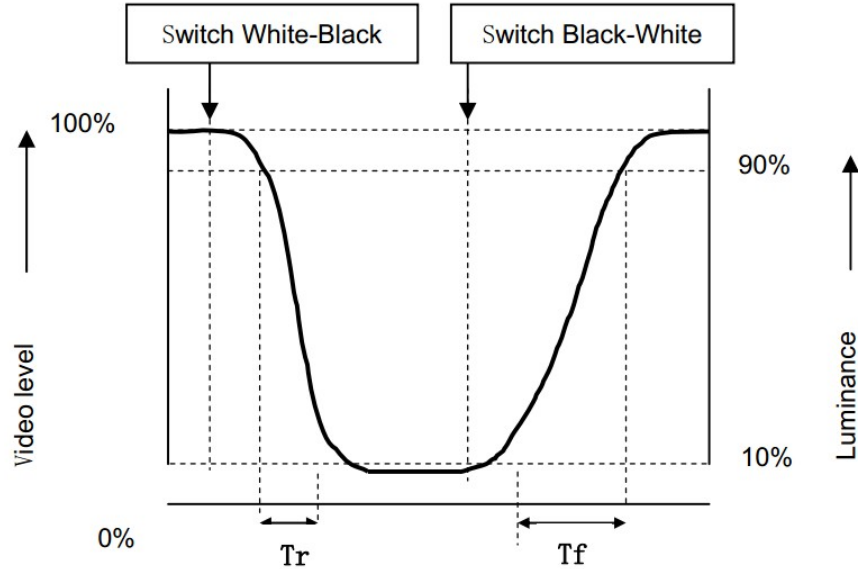
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**7.1 Definitions and measuring methods**

**[1] Response Time(Tr、 Tf)**

The rise time 'Tr' is defined as the time for luminance to change from 90% to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.

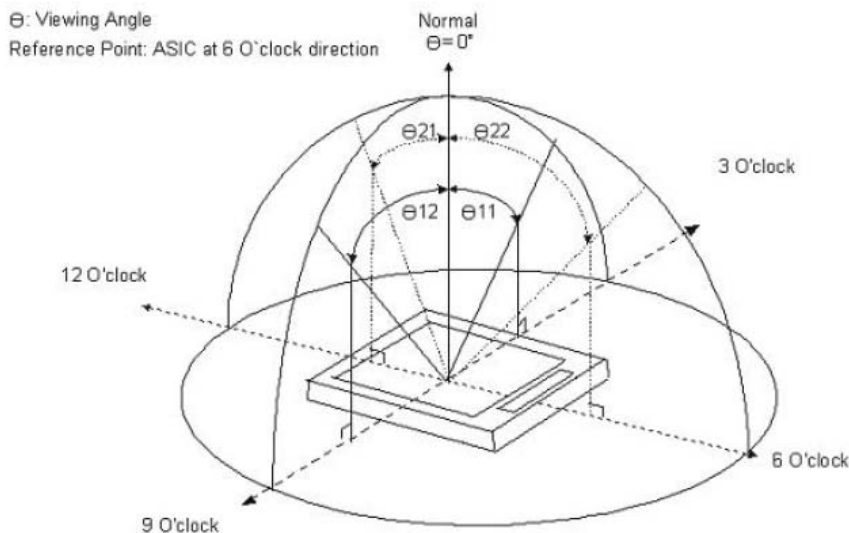


**[2] Contrast ratio (Cr)**

The contrast ratio (Cr), measured on a module, is the ratio between the luminance (L\_w) in a full white area (R=G=B=1) and the luminance (L\_d) in a dark area (R=G=B=0):

$$Cr = \frac{L_w}{L_d}$$

**[3] Viewing angle diagram**



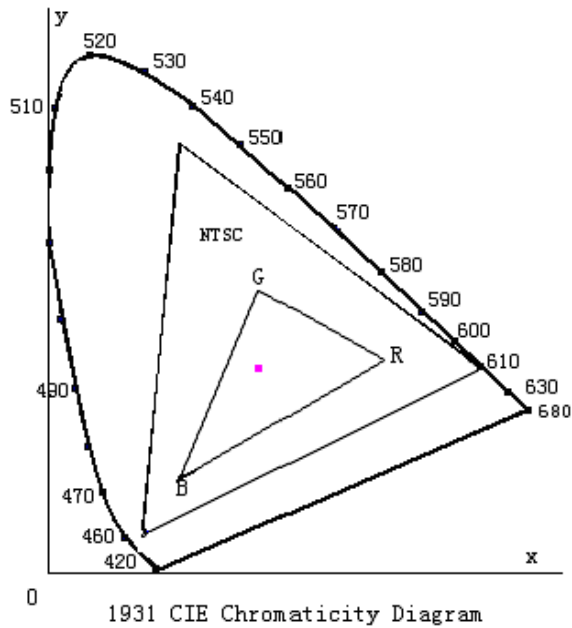
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**[4] Definition of color gamut**

Measuring machine:CFT-01. NTSC'S Primaries: R(x,y)、G(x,y)、 B(x,y).



**CIE chromaticity diagram**

$$\text{Color gamut: } S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$$

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**8. Reliability Test Items**

Test Item	Test Conditions	Note
High Temperature Operation	60±3°C , t=120 hrs	
Low Temperature Operation	-10±3°C , t=120 hrs	
High Temperature Storage	70±3°C , t=120 hrs	1,2
Low Temperature Storage	-20±3°C , t=120 hrs	1,2
Storage at High Temperature and Humidity	60°C, 90% RH , 120 hrs	1,2
Thermal Shock Test	-20°C (30min) ~ 70°C (30min) 50 cycles	1,2
Vibration Test (Packing)	Sweep frequency : 10 ~ 55 ~ 10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axis Duration : 30min/each axis	2

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions  
(15-35°C , 45-65%RH).

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## **9. Handling Precautions**

### **9.1 Mounting method**

The LCD panel of SC LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

### **9.2 Caution of LCD handling and cleaning**

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

### **9.3 Caution against static charge**

The LCD module uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to V<sub>dd</sub> or V<sub>ss</sub>, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### **9.4 Packing**

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity



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### **9.5 Caution for operation**

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%Rh or less is required.
- Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver.

### **9.6 Storage**

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by anything else.  
[It is recommended to store them as they have been contained in the inner container at the time of delivery from us]

### **9.7 Safety**

- It is recommendable to crush damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water
- Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver.

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**10. OUTLINE DIMENSION**

**REV. REVISION RECORD**

REV	REVISION	DATE	NAME
0	NEW RELEASE	06-16-15	SNOW
1	Rename TF480640-03A-0 to 480640B-A0	11-17-15	SNOW
2	Delete A K (cable to FPC)	11-23-15	SNOW

Back view

**Table 1: Pin Configuration**

Pin No.	Pin Name
1	VCC
2	VCC
3	GND
4	GND
5	RXIND-
6	RXIND+
7	GND
8	RXINI-
9	RXINI+
10	GND
11	RXIN2-
12	RXIN2+
13	GND
14	CRIN-
15	CRIN+
16	GND
17	VLED
18	VLED
19	GND
20	ADJ

**Table 2: Manufacturing Information**

ITEM NO.	DESCRIPTION	DATE
1	TF480640-03A-0	
2		
3		
4		
5		
6		

**Table 3: Tolerance and Part Details**

ITEM NO.	TOLERANCE	GRADE(±)	A	B	DIAM.	MM	DRAW.	SNOW	DATE
1									
2									
3									
4									
5									
6									

**Table 4: Part and Drawing Information**

ITEM NO.	PARTS NO.	LCM	APPD.	DATE
1	480640B-A0			
2				
3				
4				
5				
6				

**Table 5: Title Block**

<p>晶采光電科技</p>	<p>480640B-A0</p> <p>LVDS IPS (3.5") 12</p>
<p>DWG. NO. *1508113MA</p>	<p>SHEET 1 OF 1</p>