



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-320240NTMQW-30H-D(R)</b>
<b>Approved by</b>	
<b>Date</b>	

- ☐ Preliminary Specification  
☒ Formal Specification

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This Specification is subject to change without notice.

## RECORD OF REVISION

Revision Date	Page	Contents	Editor
2021/09/28	--	New Release	Jessica
2021/11/15	21	Remove screen saver description	Jessica
2021/12/24	3,22,23	Update drawings	Jessica

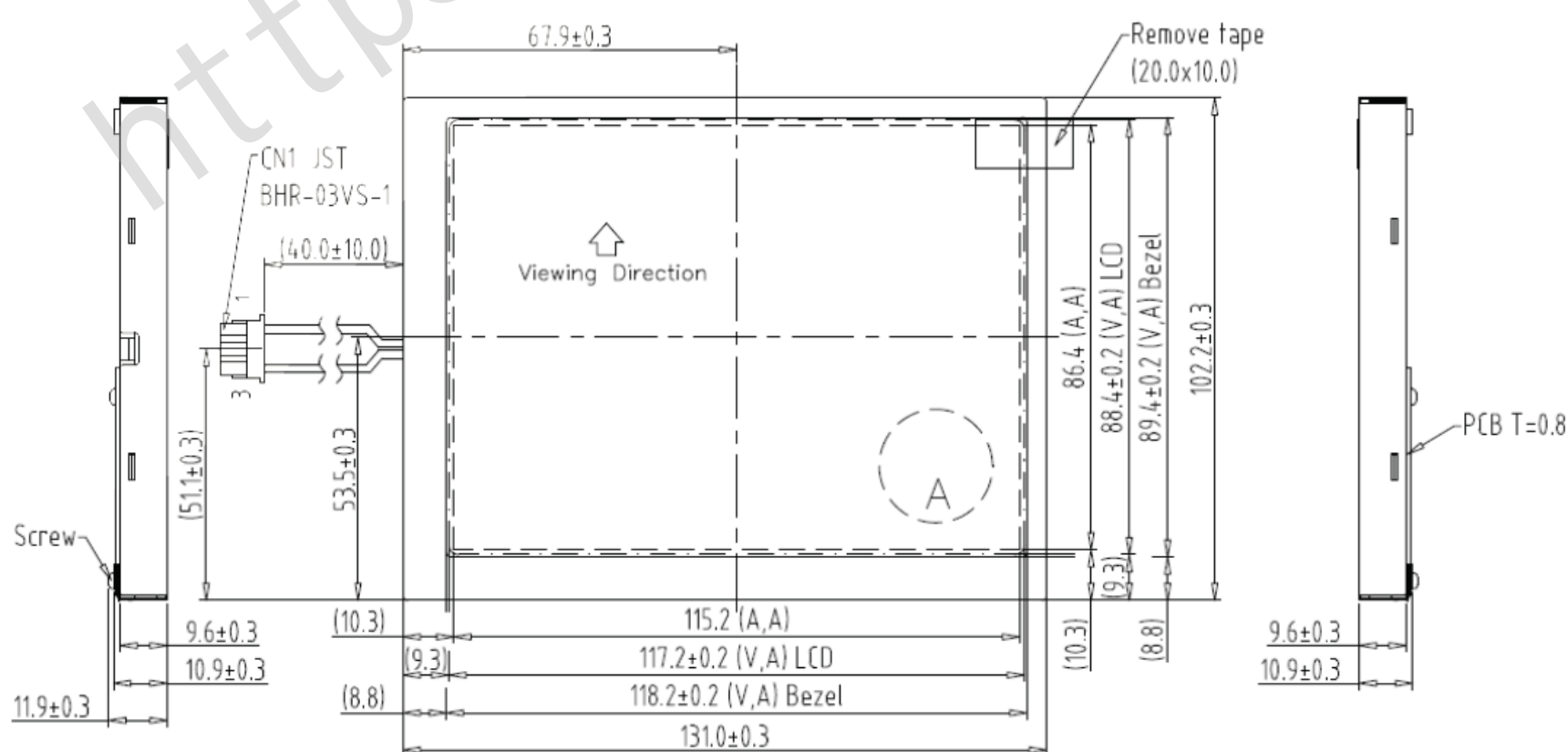
## 1 Features

5.7 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module.  
This module is composed of a 5.7" TFT-LCD panel, a driver circuit and backlight unit.

- (1) Construction: 5.7" a-Si color TFT-LCD, White LED Backlight and PCB.
- (2) Resolution (pixel): 320(R.G.B) X240
- (3) Number of the Colors : 262K colors ( R , G , B 6 bit digital each)
- (4) LCD type : Transmissive Color TFT LCD ( normally White)
- (5) Interface: 40 pin. DE only mode support.
- (6) Power Supply Voltage: 3.3V single power input. Built-in power supply circuit.
- (7) Viewing Direction: 6 O'clock ([gray inversion](#))
- (8) [New PCBA](#)

## 2 Physical Specifications

Item	Specifications	Unit
Display resolution(dot)	960 (W) x 240(H)	mm
Screen size	5.7(Diagonal)	mm
Pixel size	120 (W) x 360 (H)	um
Color configuration	R.G.B stripe	
Weight	T.B.D	mg
Backlight unit	LED	



### 3 Electrical specification

#### 3.1 Absolute max. ratings

##### 3.1.1 Electrical Absolute max. ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	VDD	VSS=0	-0.3	6.0	V	
Input voltage	Vin		-0.3	VDD+0.3	V	Note(1)

Note(1) Hsync, Vsync, DEN, DCLK, R0~R5, G0~G5, B0~B5

##### 3.1.2 Environmental Absolute max. ratings

Item	Operating		Storage		Remark
	MIN	MAX	MIN	MAX	
Temperature	-20	70	-30	80	Note(2)(3)(4)(5)(6)(7)
Humidity	Note(1)		Note(1)		
Corrosive Gas	Not Acceptable		Not Acceptable		

Note(1) Ta ≤ 40°C : 85% RH max

Ta > 40°C: Absolute humidity must be lower than the humidity of 85%RH at 40°C

Note(2) For storage condition Ta at -30°C < 48h , at 80°C < 100h

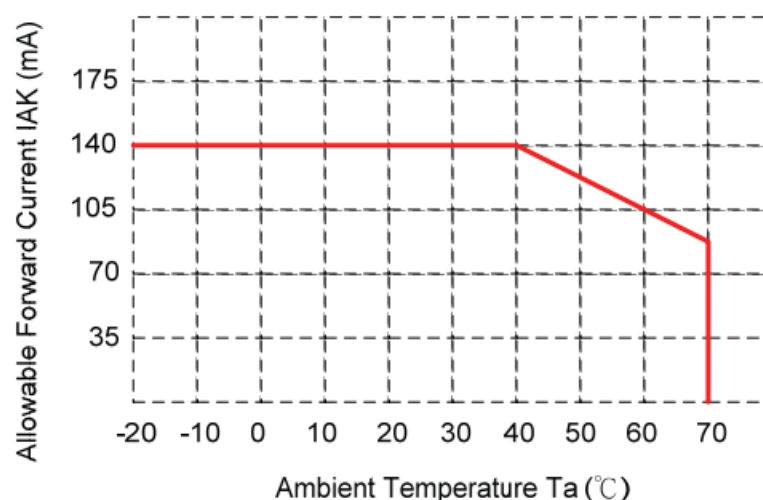
For operating condition Ta at -20°C < 100h

Note(3) Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note(4) The response time will be slower at low temperature.

Note(5) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25°C

Note(6) When LCM is operated over 40°C ambient temperature, the IAK of the LED back-light should be follow :



Note(7) This is panel surface temperature, not ambient temperature.

Note(8) When LCM is operated over than 40°C, the life time of the LED back-light will be reduced.

## 3.2 Electrical characteristics

### 3.2.1 DC Electrical characteristic of the LCD

Typical operating conditions (VSS=0V)

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply		VDD	3.0	3.3	3.6	V	
Input Voltage for logic	H Level	V <sub>IH</sub>	0.7 VDD	-	VDD	V	Note(1)
	L Level	V <sub>IL</sub>	0	-	0.3 VDD	V	
Power Supply current		IDD		45	55	mA	Note(2)

Note(1) Hsync, Vsync, DEN, DCLK, R0~R5, G0~G5, B0~B5

Note(2) f<sub>V</sub> =60Hz , Ta=25°C , Display pattern : All Black

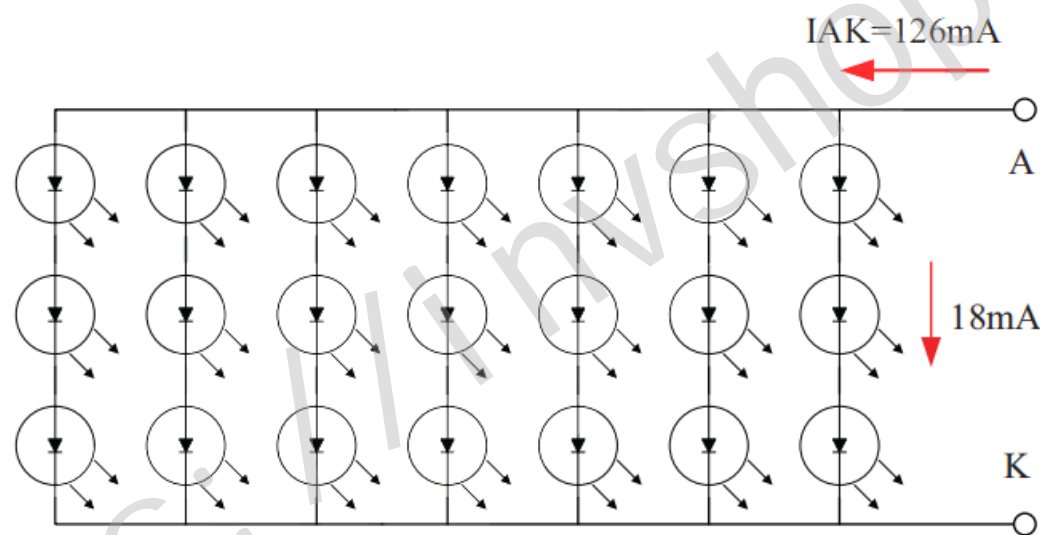


### 3.2.2 Electrical characteristic of LED Back-light

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
LED voltage	VAK	8.4	9.6	10.8	V	IAK=140mA Ta=25°C
LED forward current	IAK	--	126	140	mA	Ta=25°C
	IAK	--	84	105	mA	Ta=60°C
LED life time	--	--	30K	--	hours	Note(1)

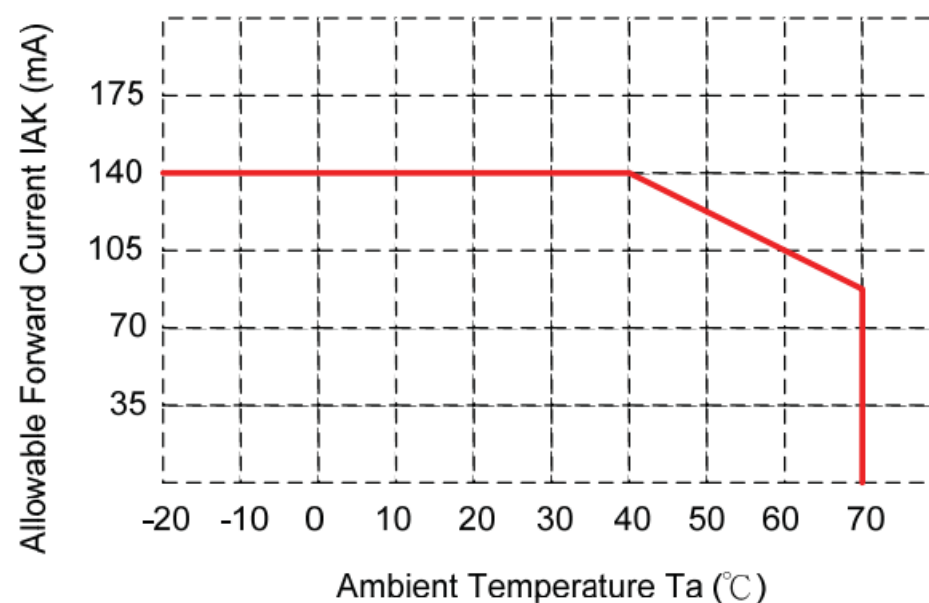
Note(1) End of Life shall be determined by the time when any of the following is satisfied under continuous lighting at 25°C and IAK = 126mA.

- Intensity drops to 50% of the Initial Value (Min. Luminance)
- Based on LED
- It is an estimative value



Note(2) The constant current source is needed for white LED back-light driving.

Note(3) When LCM is operated over 60°C ambient temperature, the IAK of the LED back-light should be adjusted to 105mA max



### 3.3 AC Timing characteristic of the LCD

#### 3.3.1 Timing condition

Signal	Parameter		Symbol	Min.	Typ.	Max.	Unit.	Remark
DCLK	DCLK period		<b>TOSC</b>	-	156	-	ns	
	Frequency		<b>FOSC</b>	-	6.4	-	MHz	
	DCLK High plus width		<b>TCH</b>	-	78	-	ns	
	DCLK Low plus width		<b>TCL</b>	-	78	-	ns	
RGB DATA	Data setup time		<b>TSU</b>	12	-	-	ns	
	Data hold time		<b>THD</b>	12	-	-	ns	
Hsync	Hsync period		<b>TH</b>	-	408	-	<b>TOSC</b>	
	Hsync pulse width		<b>THS</b>	5	30	-	<b>TOSC</b>	
	Back-Porch		<b>THB</b>		38		<b>TOSC</b>	
	Front-Porch		<b>THF</b>		20		<b>TOSC</b>	
	Hsync rising time		<b>TCr</b>	-	-	700	ns	
	Hsync falling time		<b>TCf</b>	-	-	300	ns	
Vsync	Vsync period	NTSC		-	262.5	-	<b>TH</b>	
		PAL		-	312.5	-	<b>TH</b>	
	Vsync pulse width		<b>TVS</b>	1	3	5	<b>TH</b>	
	Back-Porch	NTSC	<b>TVB</b>		15		<b>TH</b>	
		PAL			23		<b>TH</b>	
	Display Period		<b>TVD</b>		240		<b>TH</b>	
	Front Porch	NTSC	<b>TVF</b>		4.5		<b>TH</b>	
		PAL			46.5		<b>TH</b>	
	Vsync rising time		<b>TVr</b>	-	-	700	ns	
	Vsync falling time		<b>TVf</b>	-	-	1.5	μs	
	Vsync falling to Hsync rising time for odd field		<b>THVO</b>	1	-	-	<b>TOSC</b>	
	Vsync falling to Hsync falling time for even field		<b>THVE</b>	1	-	-	<b>TOSC</b>	
DEN	Vsync-DEN time	NTSC	<b>TVSE</b>	-	18	-	<b>TH</b>	
		PAL	<b>TVSE</b>	-	26	-	<b>TH</b>	
	Hsync-DEN time		<b>THE</b>	36	68	88	<b>TOSC</b>	
	DEN plus width		<b>TEP</b>	-	320	-	<b>TOSC</b>	

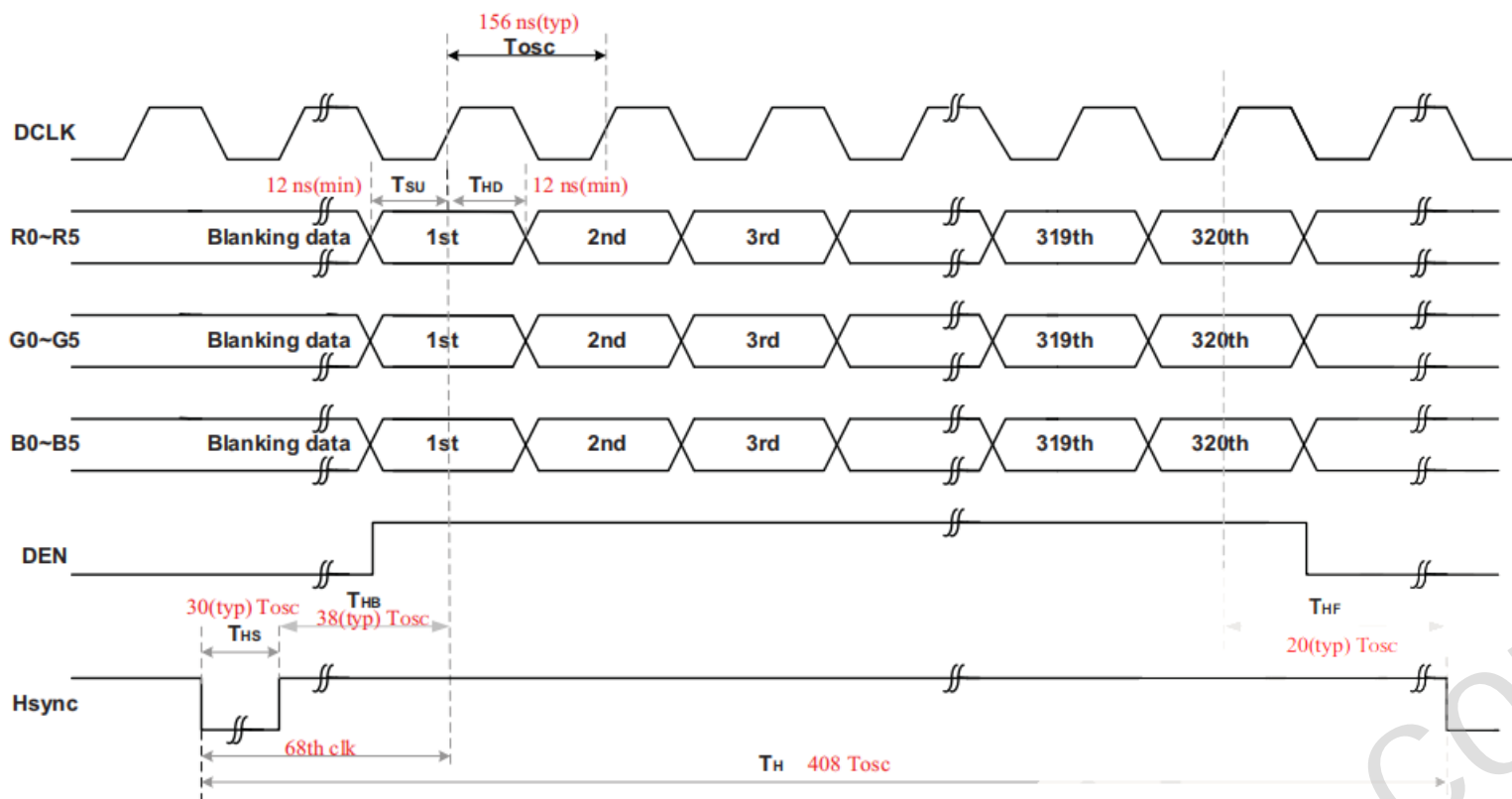
Note(1) DEN is definition of above timing for Hsync and Vsync.

Note(2) No matter when Hsync and Vsync is inputted, the LCM can be drove only DEN Signal. DEN should be set to low level when it is not input.

Note(3) The Dummy Enable is needed in the end of frame. Please set the LCD controller timing to 241 lines.

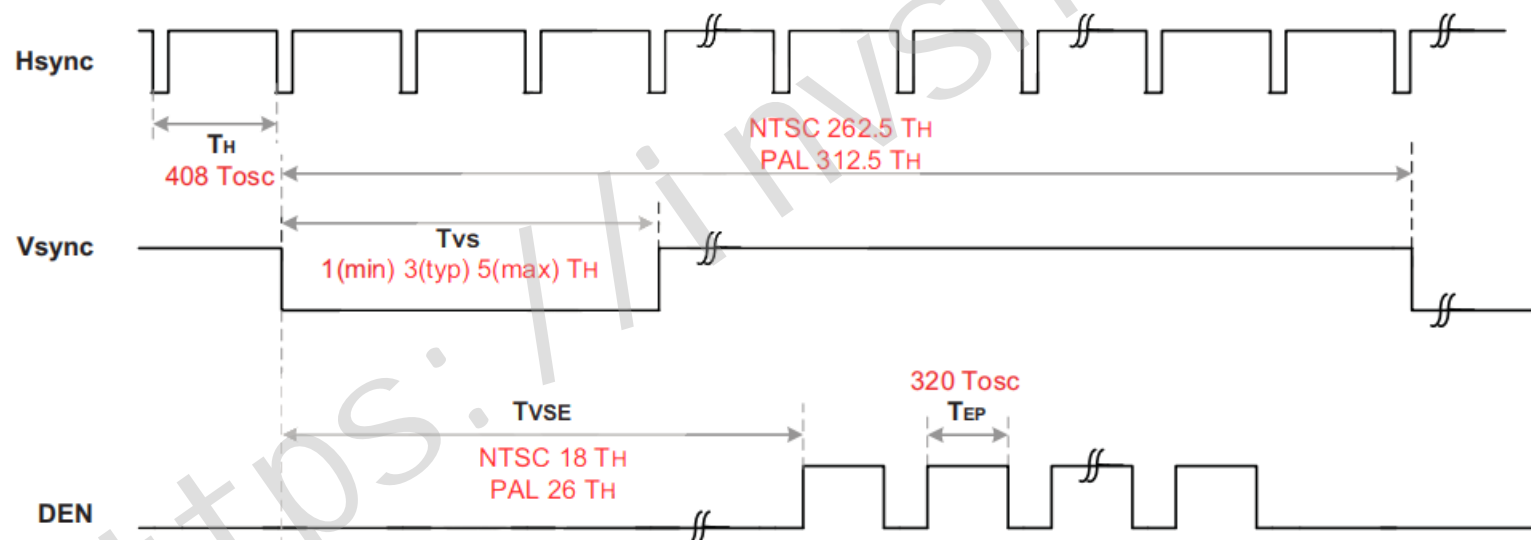
## ● Horizontal display timing

Note: Data is latched rising edge trigger of CLK.

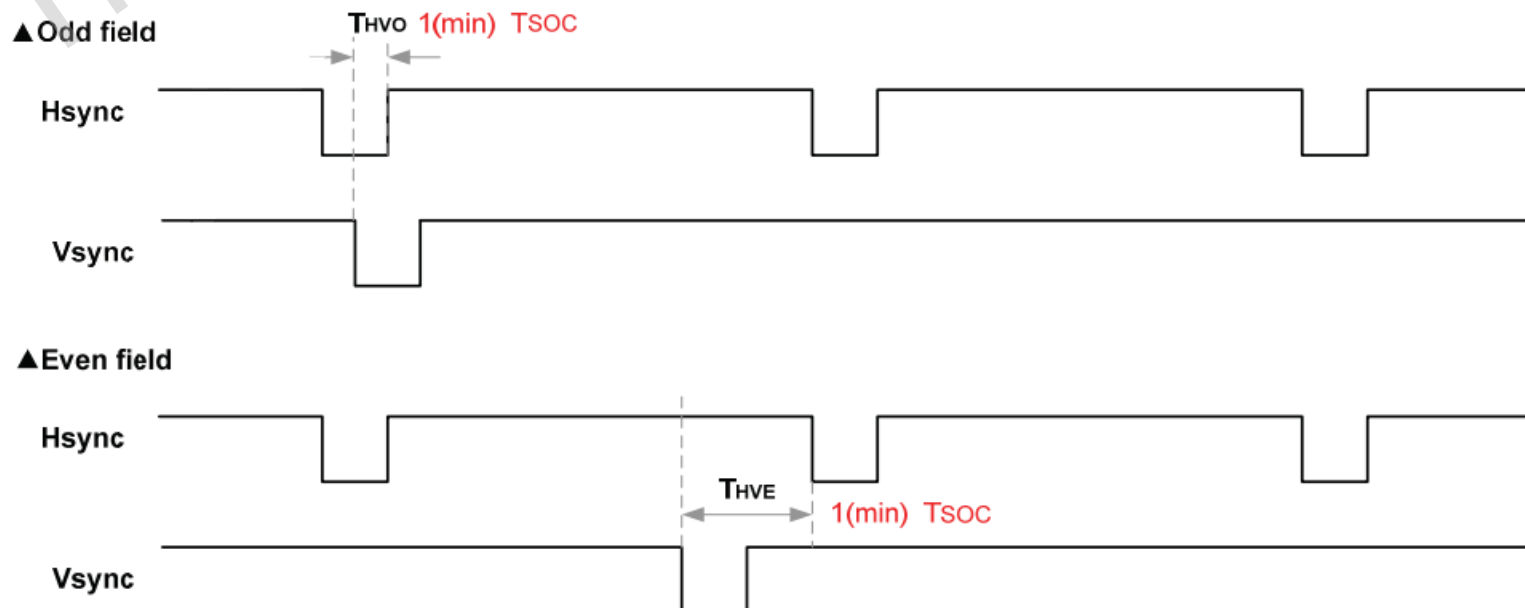


If DEN is fixed to low, the SYNC mode is used. Otherwise DE mode is used.  
When SYNC mode is used, 1st data start from 68th CLK after Hsync falling

## ● Vertical display timing

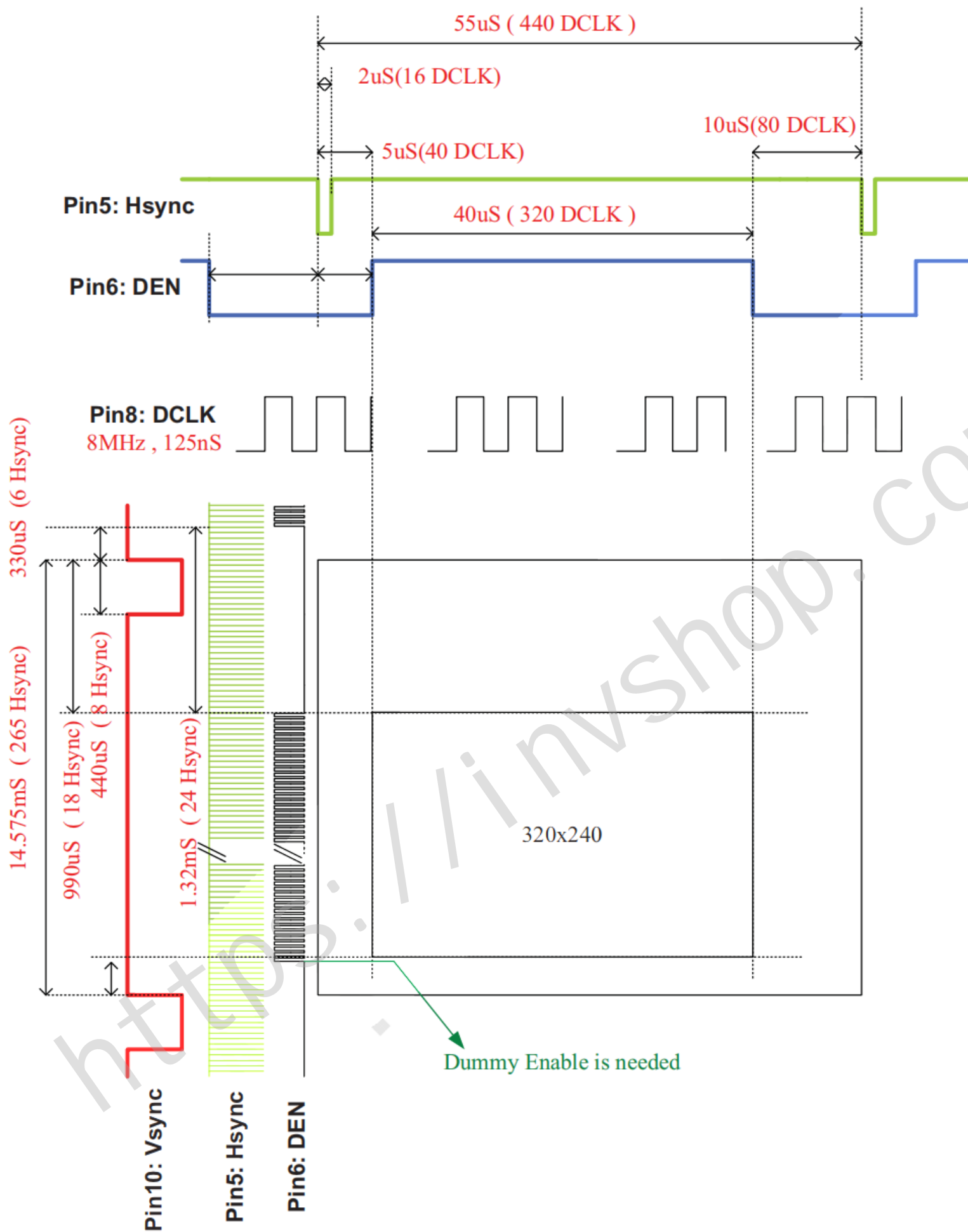


## ● Hsync and Vsync timing





## Recommend Driving Timing:



## 4 Optical specification

### 4.1 Optical characteristic of the LCD

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time	Rise	$T_r$	$\Theta=0^\circ$	-	15	30	ms	Note 1,2,3,5
	Fall	$T_f$		-	35	50	ms	
Contrast ratio		CR	At optimized viewing angle	200	350	-		Note 1,2,4,5
Viewing Angle	Top		$CR \geq 10$	60	70	-	deg.	Note 1,2,5,6
	Bottom			40	50	-		
	Left			60	70	-		
	Right			60	70	-		
Brightness		$Y_L$	IAK=126mA, 25°C	427.5	450	-	cd/m <sup>2</sup>	Note 7
			IAK=140mA, 25°C	475	500	-	cd/m <sup>2</sup>	
Red chromaticity		XR	$\Theta=0^\circ$ $\Theta=0^\circ$	Typ. -0.05	0.640	Typ. +0.05		Note 7 For reference only. These data should be update according the prototype.
		YR			0.344			
Green chromaticity		XG			0.298			
		YG			0.583			
Blue chromaticity		XB			0.132			
		YB			0.137			
White chromaticity		XW			0.312			
		YW			0.329			

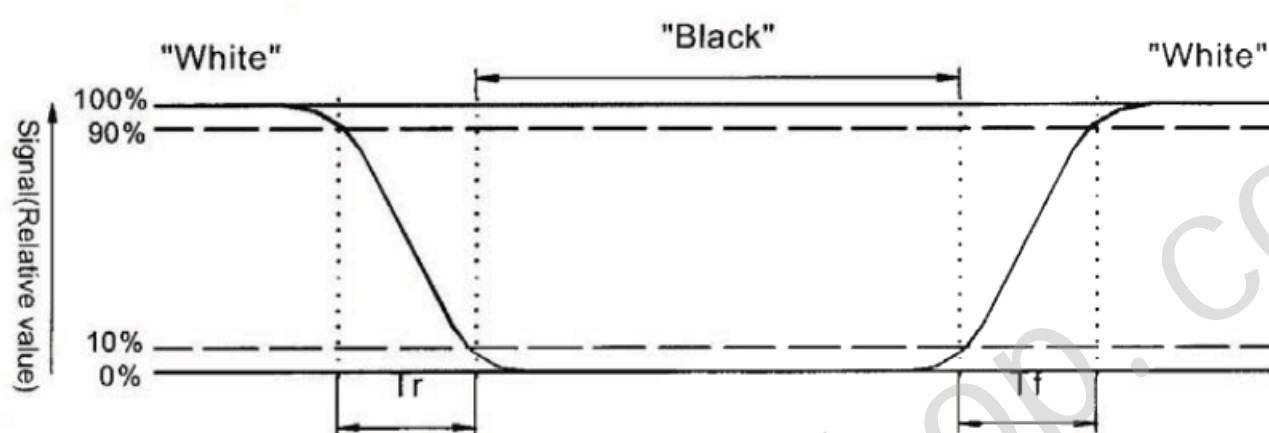
It's for reference only. These data should be update according the prototype.

Note(1) Ambient temperature=25°C, and lamp current IAK=140mA. To be measured in the dark room.

Note(2) To be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7, after 10 minutes operation.

Note(3) Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white” (falling time) and from “white” to “black” (rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note(4) Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector Output when LCD is at "Black" state}}$$

Note(5) White  $V_i = V_{i50} + 1.5V$

Black  $V_i = V_{i50} + 2.0V$

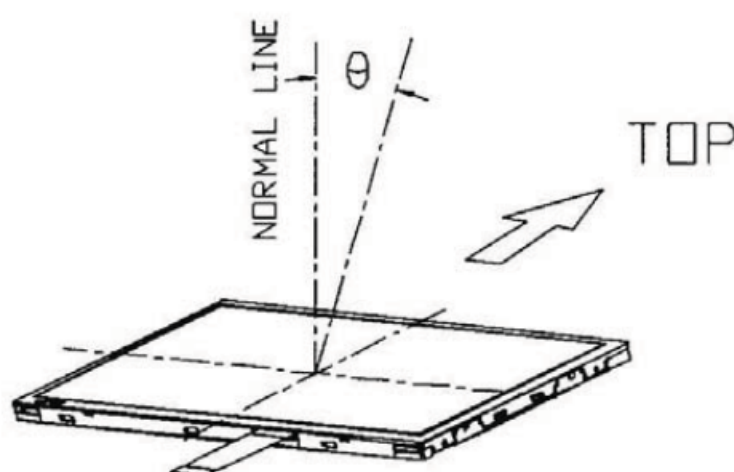
“ $\pm$ ”. It means that the analog input signal swings in phase with  $V_{COM}$  signal.

“ $\mp$ ”. It means that the analog input signal swings out of phase with  $V_{COM}$  signal.

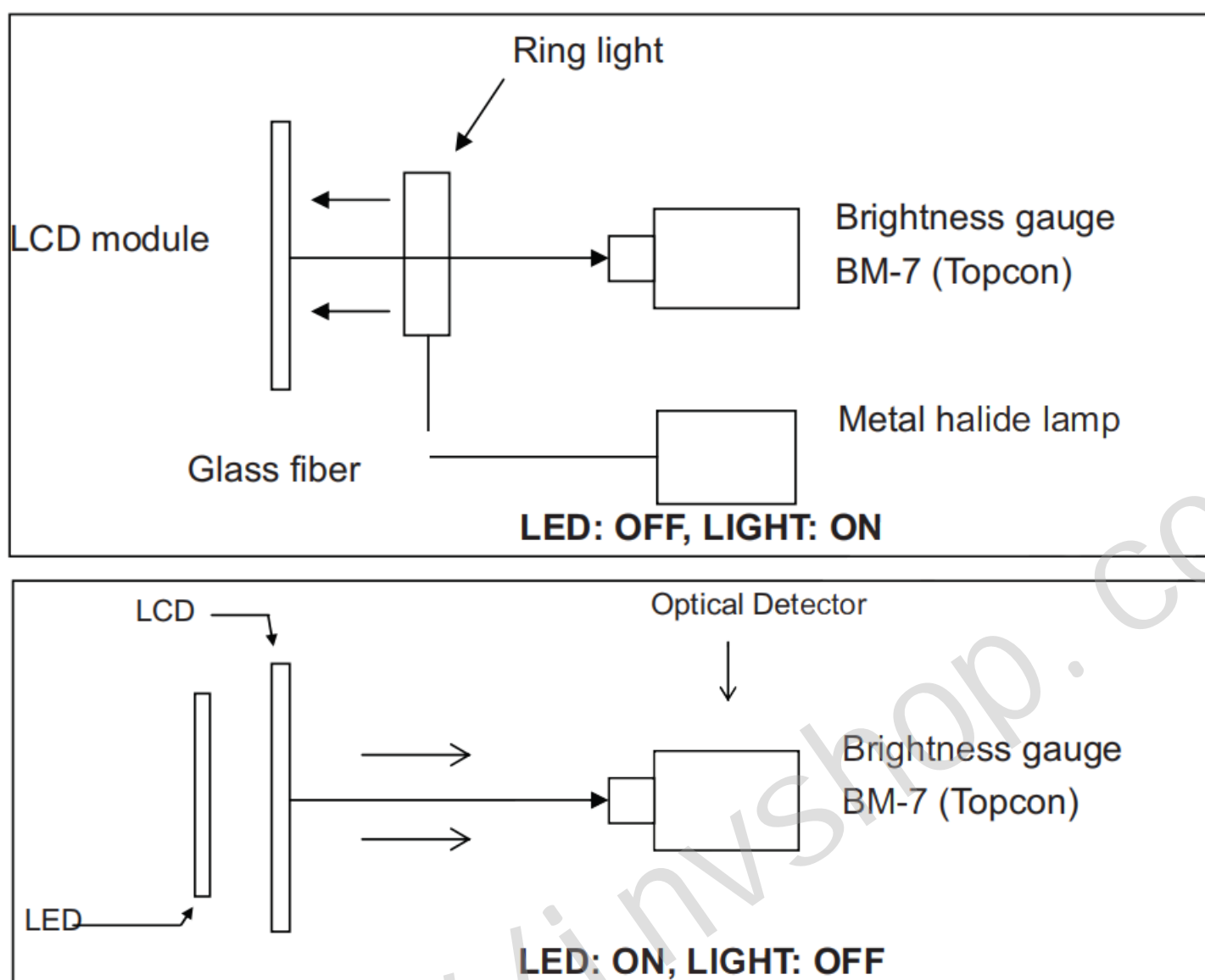
$V_{i50}$ : The analog input voltage when transmission is 50%. The 100%

Transmission is defined as the transmission of LCD panel when all the Input terminals of module are electrically opened.

Note(6) Definition of viewing angle, Refer to figure as below.



Note(7) Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.



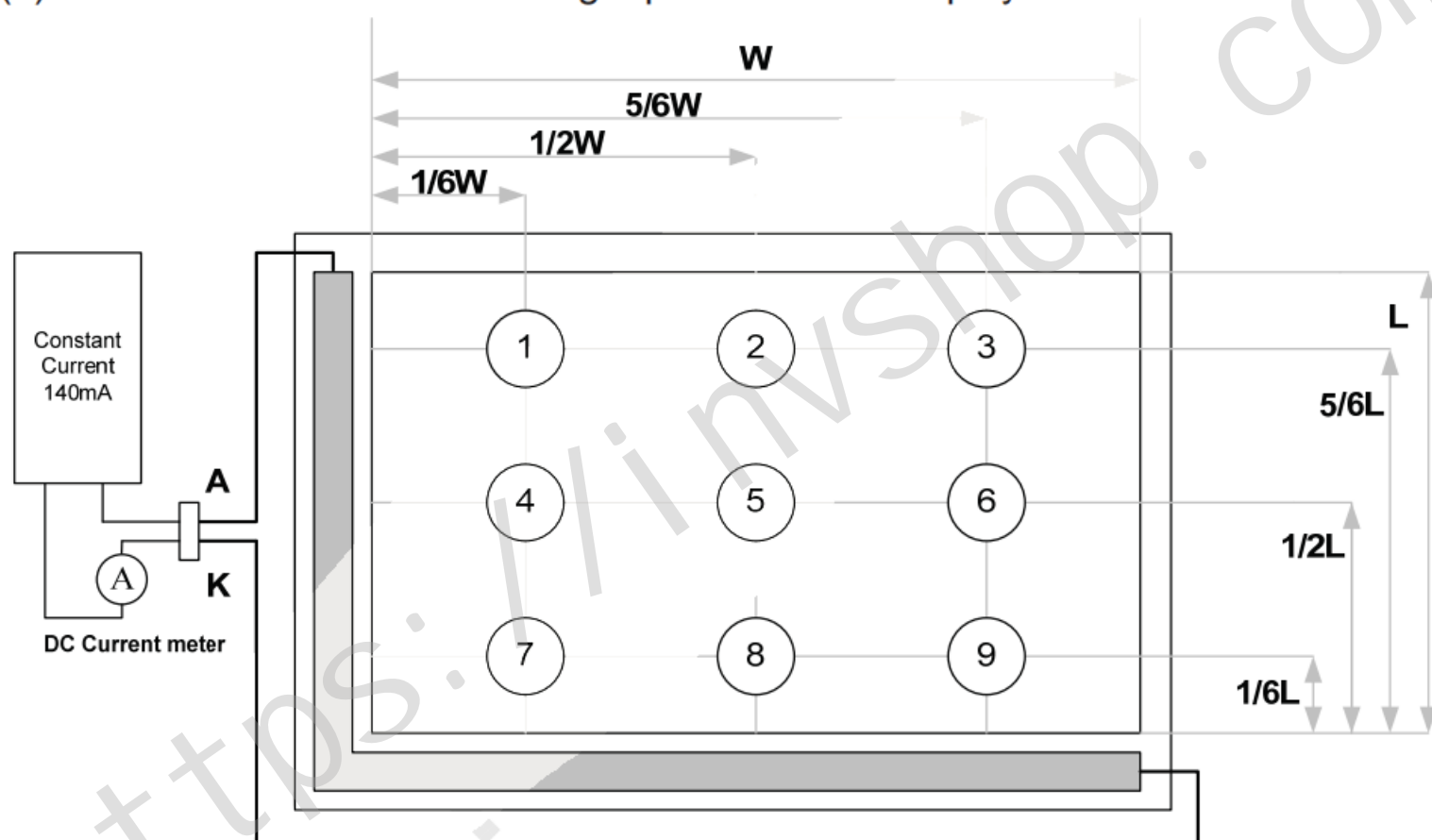
## 4.2 Optical characteristic of the LED Back-light

Item	Min.	Typ.	Max.	Unit	Condition
Bare Brightness	3500	--	--	Cd/m2	IAK =140mA, Ta=25°C
AVG. X of 1931 C.I.E.	0.28	0.31	0.34	--	IAK =140mA, Ta=25°C
AVG. Y of 1931 C.I.E.	0.28	0.31	0.34	--	IAK =140mA, Ta=25°C
Brightness Uniformity	80	--	--	%	IAK =140mA, Ta=25°C

It's for reference only. These data should be update according the prototype.

Note(1) Measurement after 10 minutes from LED operating.

Note(2) Measurement of the following 9 places on the display.



Note(3) The Uniformity definition

$$(\text{Min Brightness} / \text{Max Brightness}) \times 100\%$$



## 5 Interface specifications

### 5.1 Driving signals for the TFT panel

JAE: FA5B040HF1R3000 (Suitable FPC: t=0.3+/-0.03mm, 0.5+/-0.03mm pitch)

Pin no	Symbol	I/O	Description	Remark
1~4	VDD		Power supply for the logic (3.3V)	
5	NC	I	No connection Can be OPEN fixed to VDD or GND.	
6	DEN	I	Input data enable control	
7	VSS		GND	
8	DCLK	I	Clock signal. Latching data at the rising edge.	
9	VSS		GND	
10	NC	I	No connection Can be OPEN fixed to VDD or GND.	
11	VSS		GND	
12	B5	I	Blue data	
13	B4	I		
14	B3	I		
15	VSS		GND	
16	B2	I	Blue data	
17	B1	I		
18	B0	I		
19	VSS		GND	
20	G5	I	Green data	
21	G4	I		
22	G3	I		
23	VSS		GND	
24	G2	I	Green data	
25	G1	I		
26	G0	I		
27	VSS		GND	
28	R5	I	Red data	
29	R4	I		
30	R3	I		
31	VSS		GND	
32	R2	I	Red data	
33	R1	I		
34	R0	I		



## 7 Displayed Color and Input Data

	Color & Gray Scale	DATA SIGNAL																	
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(0)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(0)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(61)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(31)	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(1)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(0)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(61)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(31)	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(1)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(0)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(31)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(0)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

## 8 Quality and Reliability

### 8.1 Test Conditions

- (1) Tests should be conducted under the following conditions :

Ambient temperature:  $25 \pm 5^{\circ}\text{C}$

Humidity :  $60 \pm 25\% \text{ RH.}$

### 8.2 Sampling Plan

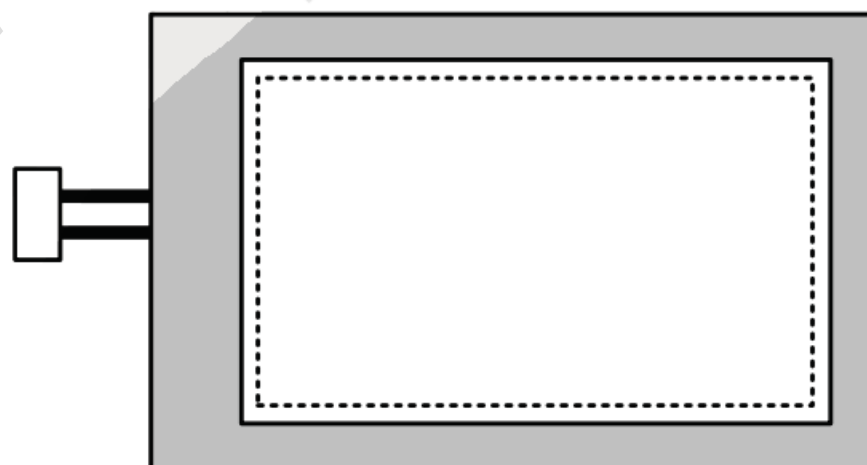
- (1) Sampling method shall be in accordance with MIL-STD-105E, level II, normal single sampling plan.


### 8.3 Acceptable Table Quality Level

- (1) A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

### 8.4 Appearance

- (1) An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under fluorescent light. The inspection area of LCD panel shall be within the range of following limits.



 Zone A ( Active Area)

 Zone B ( Viewing Area)

## 8.5 Reliability

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C , t=96 hrs	
Low Temperature Operation	-20±3°C , t=96 hrs	
High Temperature Storage	80±3°C , t=96 hrs	1,2
Low Temperature Storage	-30±3°C , t=96 hrs	1,2
Thermal Shock Test	-20°C ~ 25°C ~ 70°C 30 min. 5 min. 30 min. ( 1 cycle ) Total 5 cycle	1,2
Humidity Test	40 °C, Humidity 90%, 96 hrs	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 inspired after 1 hour storage in normal conditions (15~35°C, 45~65%RH).

Note(3) The module shouldn't be tested over one condition, and all the tests are independent.

Note(4) All reliability tests should be done without the protective film.

Definitions of life end point:

- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of initial value.



## 9 Use Precautions

### 9.1 Handling precautions

- (1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
- (2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
- (3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
- (4) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

### 9.2 Installing precautions

- (1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx.  $1\text{M}\Omega$  and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
- (2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
- (3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
- (4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

### 9.3 Storage precautions

- (1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.
- (2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
- (3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

### 9.4 Operating precautions

- (1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.
- (2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.
- (3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC drive voltage.
- (4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.
- (5) Make certain that each signal noise level is within the standard (L level: 0.2V<sub>dd</sub> or less and H level: 0.8V<sub>dd</sub> or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.
- (6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.
- (7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.
- (8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk occurs when the regularized display is maintained. Also, crosstalk is affected by the LC drive voltage. Design the contents of the display, considering crosstalk.

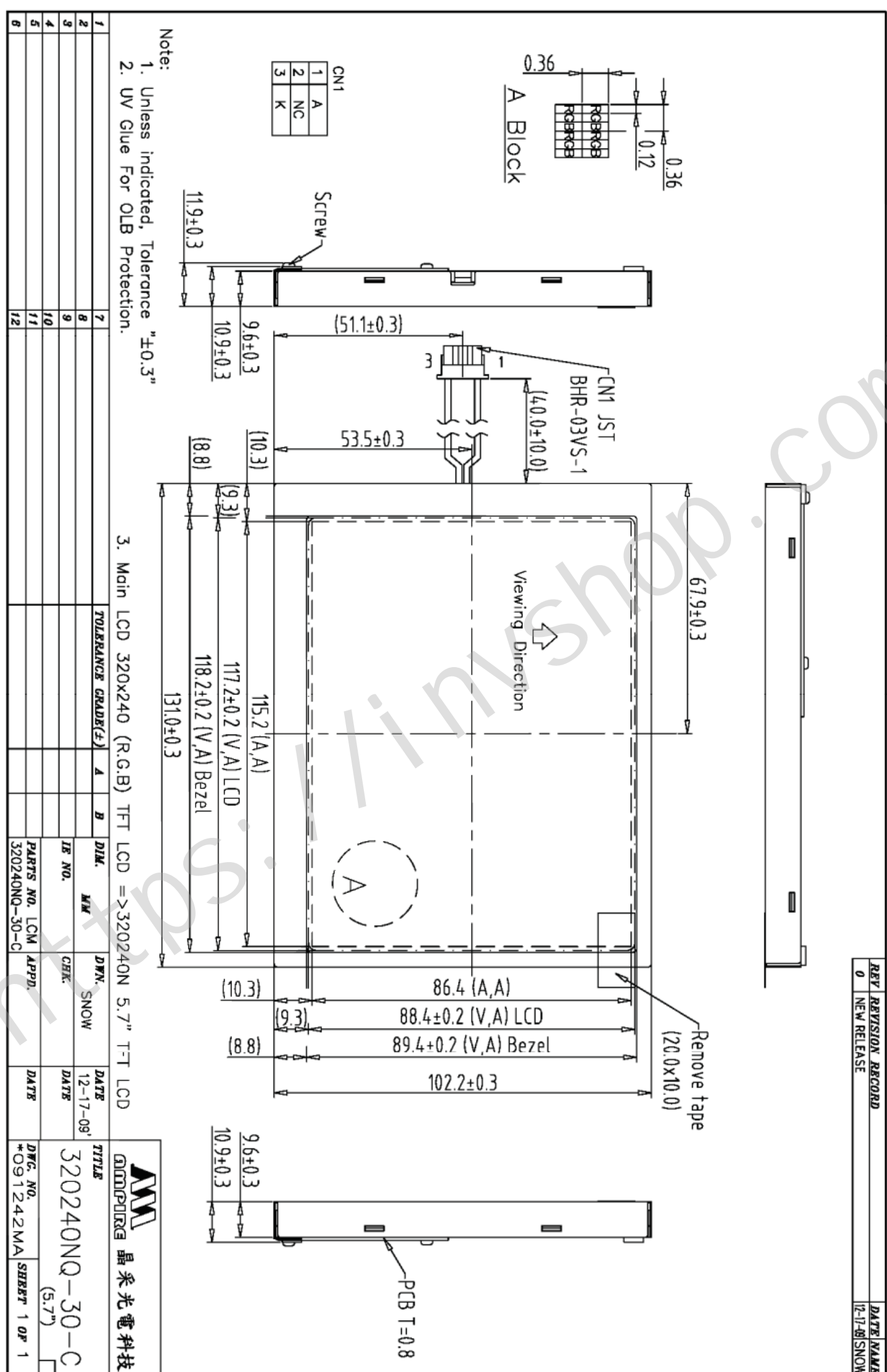
### 9.5 Other

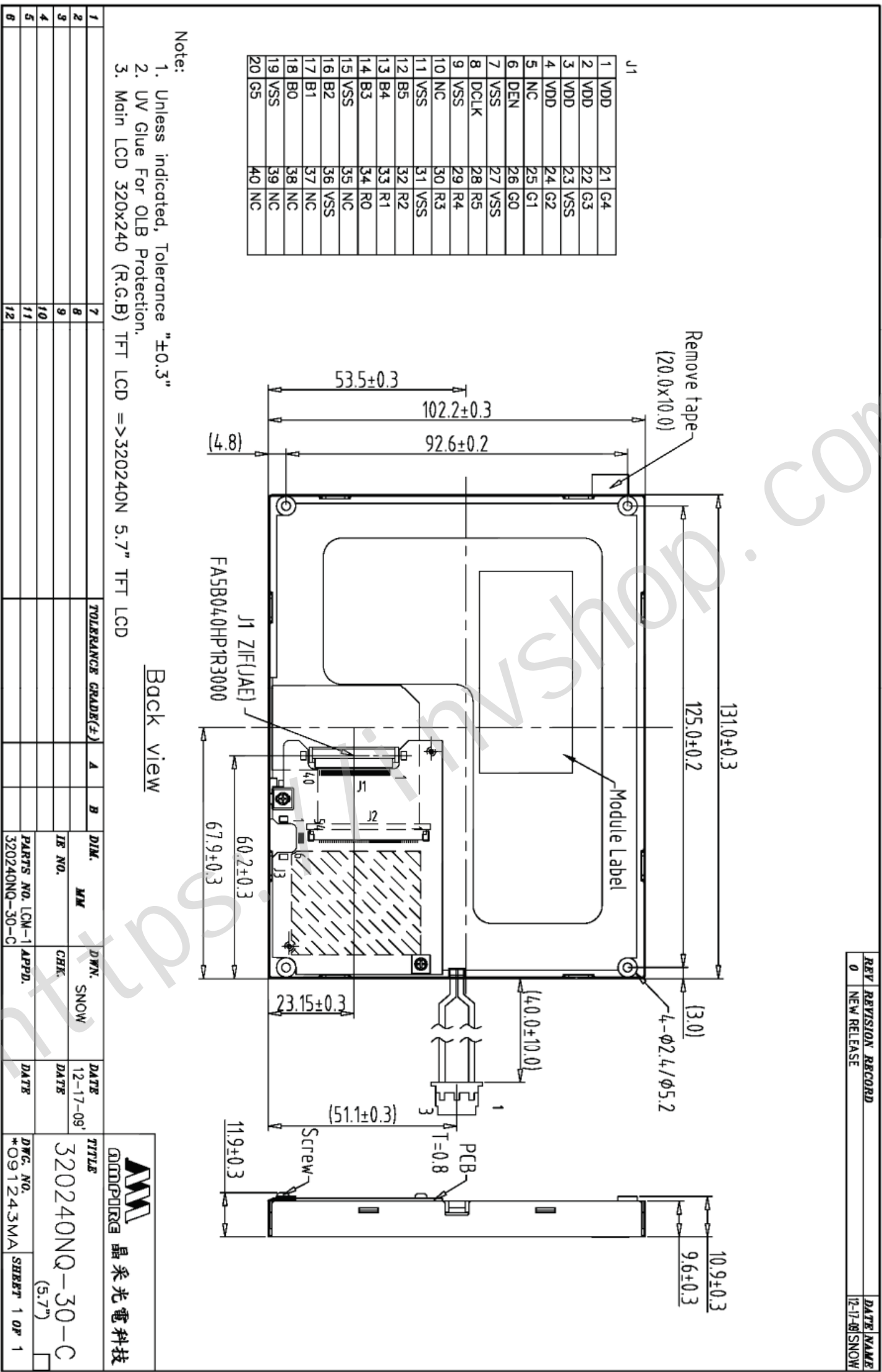
- (1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.
- (2) AMIPRE will provide one year warranty for all products and three months warrantee for all repairing products.

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## 10 Outline Dimension







## Date: 2021/12/24

AMPIRE CO., LTD.