晶采光電科技股份有限公司
AMPIRE CO., LTD.

SPECIFICATIONS   FOR
LCD   MODULE

CUSTOMER	
CUSTOMER PART NO.	
AMPIRE PART NO.	**AM-320240NSTNQW-16H**
APPROVED BY	
DATE	

☐ **Approved For Specifications**
☐ **Approved For Specifications & Sample**

AMPIRE CO., LTD.
4F., No.116, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)
221 新北市 汐止區 新台五路一段 116 號 4 樓(東方科學園區 A 棟)
TEL:886-2-26967269 , FAX:886-2-26967196 or 26967270

APPROVED BY	CHECKED BY	ORGANIZED BY

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2015/03/18	--	New Release	Sharon
2016/09/23	5	Led Dice Manufacturer	
	20	Backlight Testing	Raymond

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: 33 pin
(6) Power Supply Voltage: 3.3V single power input. Built-in power supply circuit.
(7) Viewing Direction: 12 O'clock (Gray Inversion)

2   Physical specifications

Item	Specifications	Unit
Display resolution(dot)	960 (W) x 240(H)	mm
Active area	115.2 (W) x 86.4 (H)	mm
Screen size	5.7(Diagonal)	mm
Pixel size	120 (W) x 360 (H)	um
Color configuration	R.G.B stripe	
Overall dimension	144.0(W)x104.6(H)x13.0(D)	mm
Weight	T.B.D	g
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	VCC	VSS=0	-0.3	6.0	V	
Input voltage	V_{in}		-0.3	VCC+0.3	V	Note 1

Note1:Hsync, Vsync, ENAB, CK, R0~R5, G0~G5, B0~B5

3.1.2 Environmental Absolute max. ratings

Item	OPERATING		STORAGE		Remark
	MIN	MAX	MIN	MAX	
Temperature	-30	80	-30	80	Note2,3,4,5,7
Humidity	Note1		Note1		
Corrosive Gas	Not Acceptable		Not Acceptable		

Note1 : Ta <= 40℃ : 85% RH max

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

Note2 : For storage condition Ta at -30℃ < 48h , at 80℃ < 100h

For operating condition Ta at -30℃ < 100h

Note3 : Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note4 : The response time will be slower at low temperature.

Note5 : Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25℃

3.2 Electrical characteristics

3.2.1 DC Electrical characteristic of the LCD

Typical operating conditions (VSS=0V)

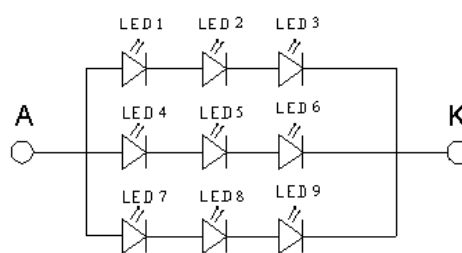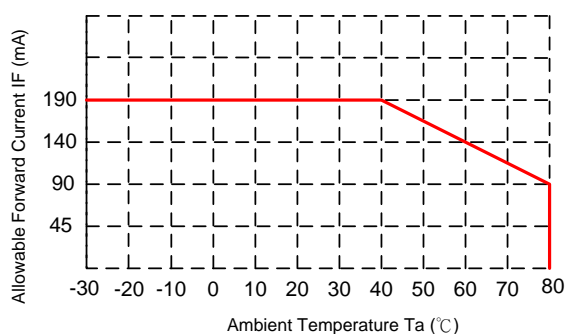| Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply		VCC	3.0	3.3	3.6	V	
Input Voltage for logic	H Level	V_{IH}	0.7 VCC	-	VCC	V	Note 1
	L Level	V_{IL}	0	-	0.3 VCC	V	
Power Supply current		ICC		45	55	mA	Note 2

Note1: Hsync, Vsync, DEN, DCLK, R0~R5, G0~G5, B0~B5

Note2: f_v =60Hz , Ta=25℃ , Display pattern : All Black

### 3.2.2 Electrical characteristic of LED Back-light

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
LED voltage	V_{AK}	--	9.9	--	V	I_{LED}=190mA, Ta=25°C
LED forward current	I_{LED}	--	190	--	mA	Ta=25°C
	I_{LED}	--	90	--	mA	Ta=80°C
Brightness Uniformity			75		%	I_{LED}=190mA, Ta=25°C
Life time	--	--	50,000	--	Hr	(Note 1)

■ The constant current source is needed for white LED back-light driving.

LED DICE: NICHIA NSSW123NBT

Note 1: Estimated data, I_{LED} =190mA, Ta=25°C
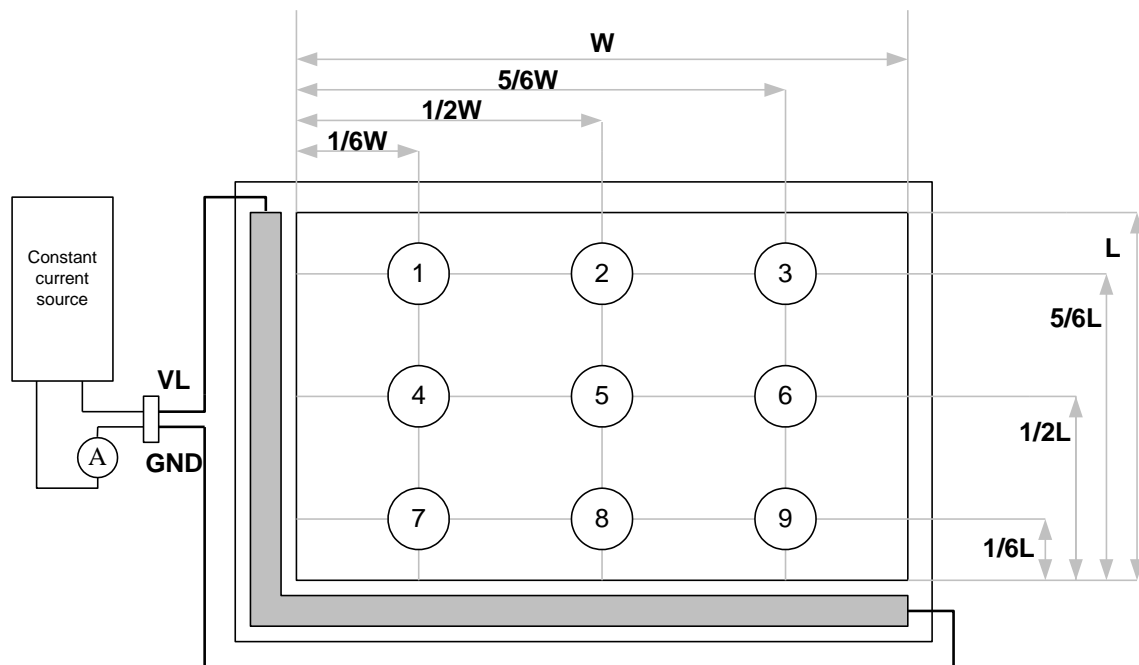
Note2: The Uniformity definition

(Min Brightness / Max Brightness) x 100%
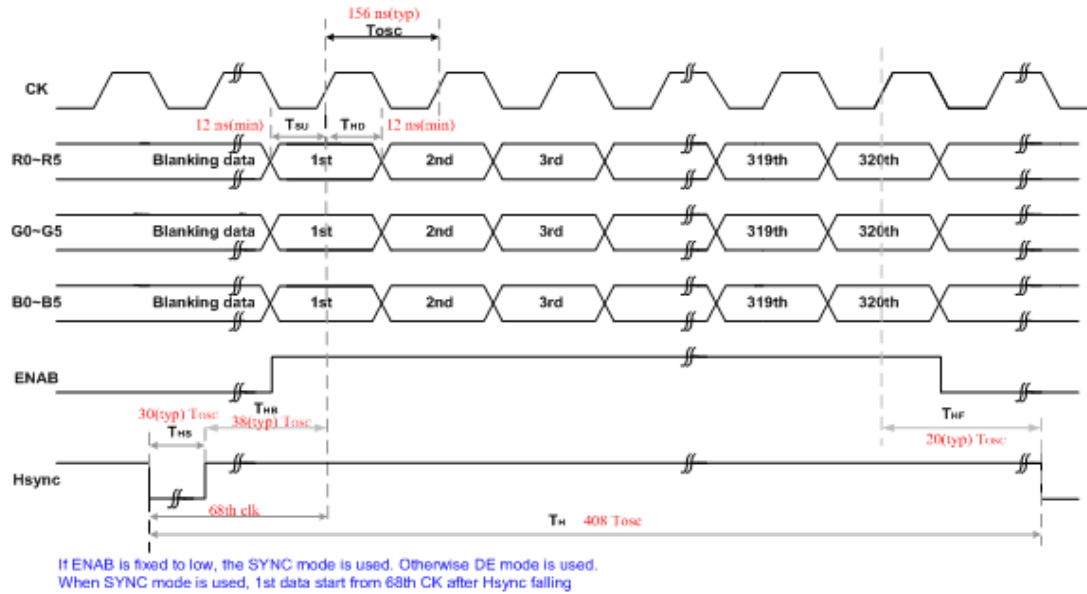
3.3 AC Timing characteristic of the LCD

a. Timing condition

Signal	Parameter		Symbol	Min.	Typ.	Max.	Unit.	Remark
DCLK	DCLK period		T_{OSC}	-	156	-	ns	
	Frequency		F_{OSC}	-	6.4	-	MHz	
	DCLK High plus width		T_{CH}	-	78	-	ns	
	DCLK Low plus width		T_{CL}	-	78	-	ns	
RGB DATA	Data setup time		T_{SU}	12	-	-	ns	
	Data hold time		T_{HD}	12	-	-	ns	
Hsync	Hsync period		T_H	-	408	-	T_{OSC}	
	Hsync pulse width		T_{HS}	5	30	-	T_{OSC}	
	Back-Parch		T_{HB}		38		T_{OSC}	
	Front-Parch		T_{HF}		20		T_{OSC}	
	Hsync rising time		T_{Cr}	-	-	700	ns	
	Hsync falling time		T_{Cf}	-	-	300	ns	
Vsync	Vsync period	NTSC		-	262.5	-	T_H	
		PAL		-	312.5	-	T_H	
	Vsync pulse width		T_{VS}	1	3	5	T_H	
	Back-Porch	NTSC	T_{VB}		15		T_H	
		PAL			23		T_H	
	Display Period		T_{VD}		240		T_H	
	Front Porch	NTSC	T_{VF}		4.5		T_H	
		PAL			46.5		T_H	
	Vsync rising time		T_{Vr}	-	-	700	ns	
	Vsync falling time		T_{Vf}	-	-	1.5	μs	
	Vsync falling to Hsync rising time for odd field		T_{HVO}	1	-	-	T_{OSC}	
	Vsync falling to Hsync falling time for even field		T_{HVE}	1	-	-	T_{OSC}	
ENAB	Vsync-DEN time	NTSC	T_{VSE}	-	18	-	T_H	
		PAL	T_{VSE}	-	26	-	T_H	
	Hsync-DEN time		T_{HE}	36	68	88	T_{OSC}	
	DEN plus width		T_{EP}	-	320	-	T_{OSC}	

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

- Horizontal display timing

Note: Data is latched rising edge trigger of CLK.

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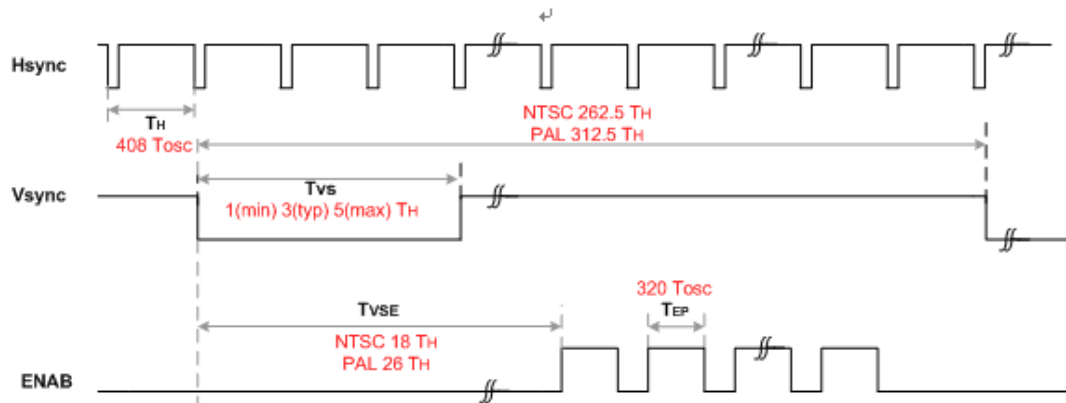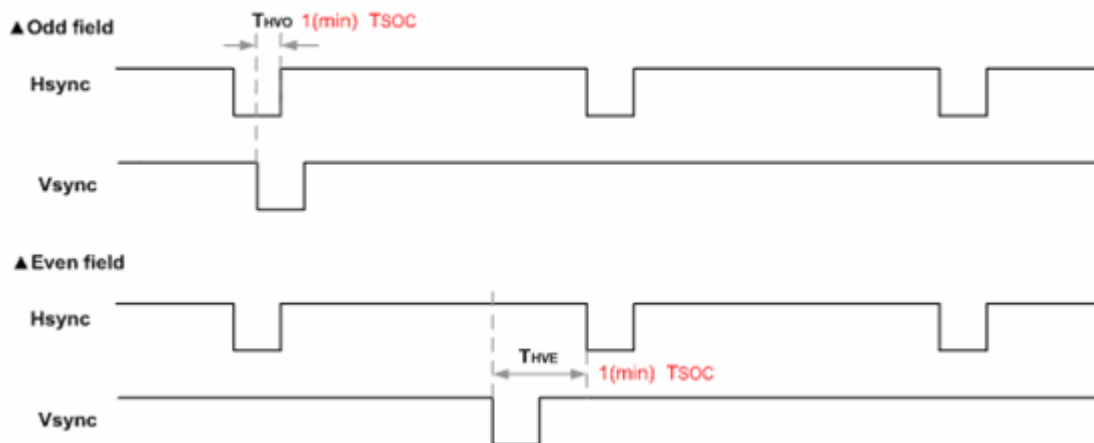When SYNC mode is used, 1st data start from 68th CK after Hsync falling

- Vertical display timing

  - Vertical display timing

- Hsync and Vsync timing

4 Optical specification

4.1 Optical characteristic of the LCD

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time	Rise	T_r	$\Theta=0°$	-	15	30	ms	Note 1,2,3,5
	Fall	T_f		-	35	50	ms	
Contrast ratio		CR	At optimized viewing angle		170	-		Note 1,2,4,5
Viewing Angle	Top		CR$\geqq$10	-	55	-	deg.	Note1,2, 5,6
	Bottom			-	35	-		
	Left			-	70	-		
	Right			-	70	-		
Brightness		Y_L	I_{LED}190mA ,25℃	640	800	--	cd/m^2	Note 7
Red chromaticity		X_R	$\Theta=0°$ $\Theta=0°$	0.572	0.622	0.672		Note 7 For reference only. These data should be update according the prototype.
		Y_R		0.316	0.366	0.416		
Green chromaticity		X_G		0.307	0.357	0.407		
		Y_G		0.510	0.560	0.610		
Blue chromaticity		X_B		0.091	0.141	0.191		
		Y_B		0.045	0.095	0.145		
White chromaticity		X_W		0.277	0.327	0.377		
		Y_W		0.298	0.348	0.398		

( ) For reference only. These data should be update according the prototype.

Note 1: Ambient temperature=25℃, and LED current I_{LED}=190 mA.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.
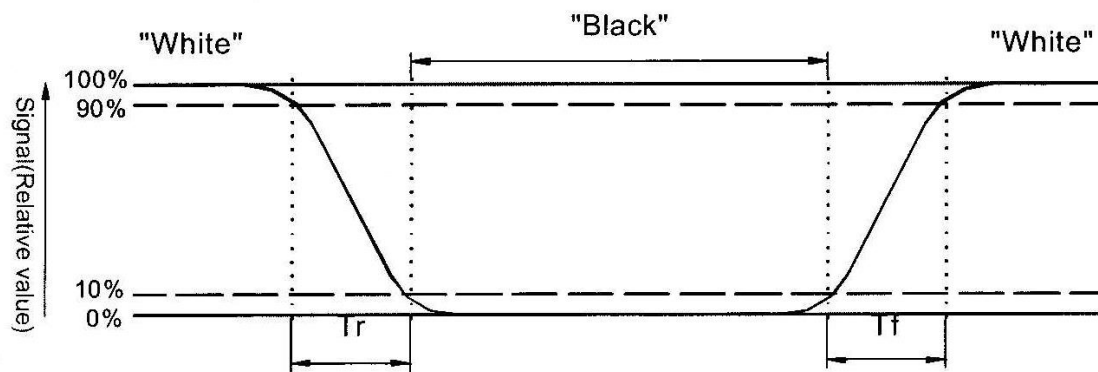
Note 4. Definition of contrast ratio:

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 $V_i = V_{i50} + 2.0V$

"±"means that the analog input signal swings in phase with V_{COM} signal.

"$\mp$" 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.
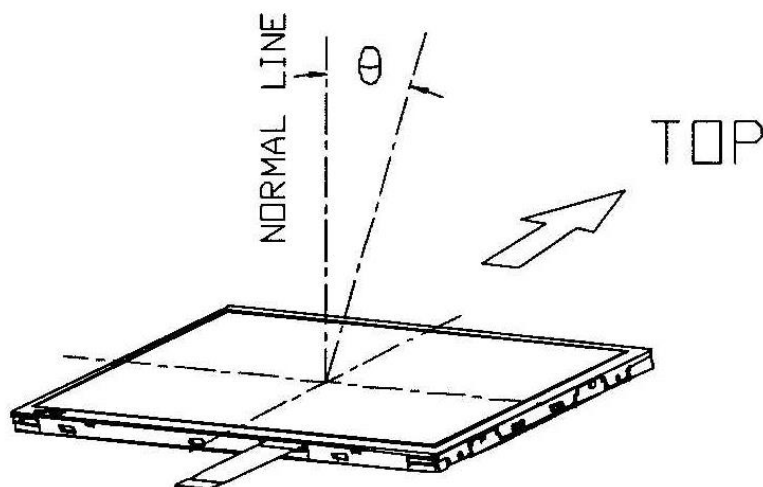
Note 7.Measured at the center area of the panel when all the input terminals of
LCD panel are electrically opened.

Ring light

LCD module

Brightness gauge
BM-7 (Topcon)

Metal halide lamp

Glass fiber

LED: OFF, LIGHT: ON

LCD

Optical Detector

Brightness gauge
BM-7 (Topcon)

LED

LED:ON, LIGHT:OFF
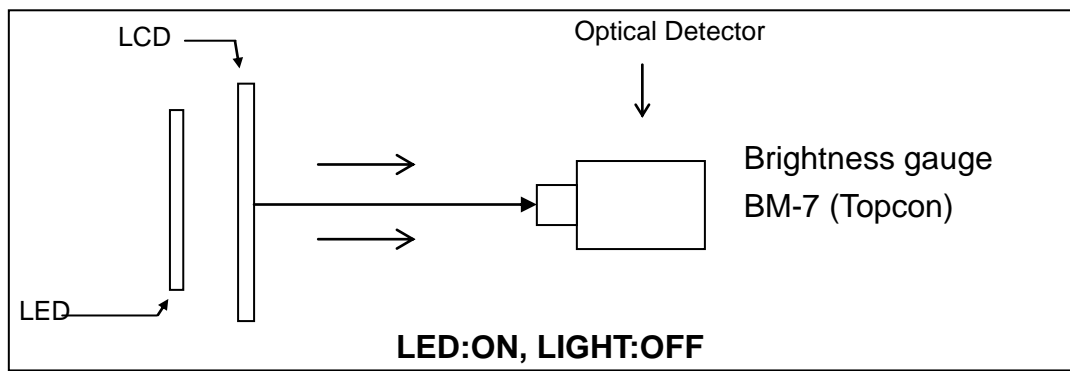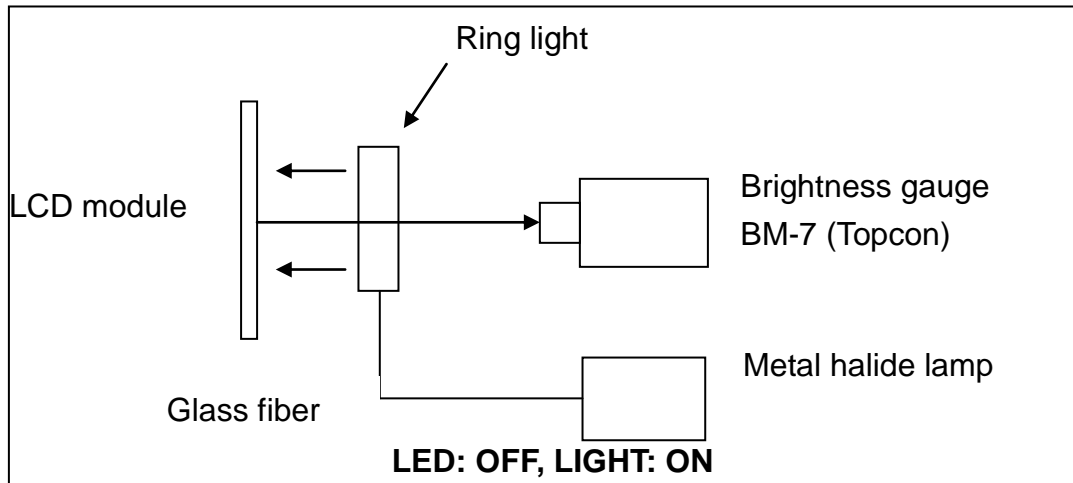
5 Interface specifications

5.1 Driving signals for the TFT panel

Pin no	Symbol	I/O	Description	Remark
1	GND	P	Ground	
2	CK	I	Clock signal. Latching data at the rising edge	
3	Hsync	I	Horizontal sync input in digital RGB mode	
4	Vsync	I	Vertical sync input in digital RGB mode	
5	GND	P	Ground	
6	R0	I		
7	R1	I		
8	R2	I	Red data	
9	R3	I		
10	R4	I		
11	R5	I		
12	GND	P	Ground	
13	G0	I		
14	G1	I		
15	G2	I	Green data	
16	G3	I		
17	G4	I		
18	G5	I		
19	GND	P	Ground	
20	B0	I		
21	B1	I		
22	B2	I	Blue data	
23	B3	I		
24	B4	I		
25	B5	I		
26	GND	I	Ground	
27	ENAB	I	Input data enable control	
28	VCC	P	+3.3V Power Supply	
29	VCC	P		
30	NC	-	No connection	
31	NC	-	No connection	
32	NC	-	Not use	
33	GND	P	Ground	

6 BLOCK DIAGRAM
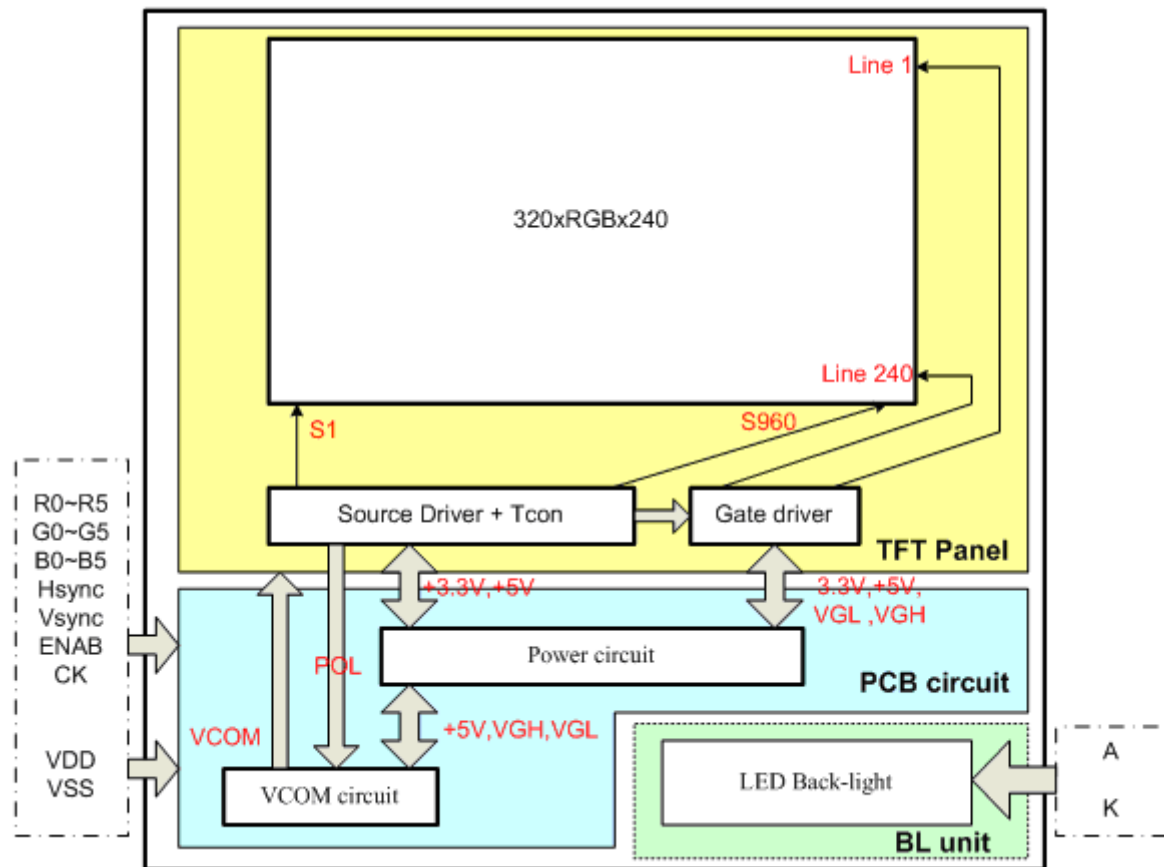
7 DISPLAYED COLOR AND INPUT DATA

	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(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(63)	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(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	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(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	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(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	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(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	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(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	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(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

8 RELIABILITY

Test Item	Test Conditions	Note
High Temperature Operation	80°C , t=240 hrs	
Low Temperature Operation	-30°C , t=240 hrs	
High Temperature Storage	80°C , t=240 hrs	1,2
Low Temperature Storage	-30°C , t=240 hrs	1,2
Thermal Shock Test	-30°C ~ 25°C ~ 70°C 30 m in. 5 min. 30 min. (1 cycle) Total 10 cycle	1,2
Storage Humidity Test	60 °C, Humidity 90%, 240 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 inspected after 1 hour storage in normal conditions (15-35°C , 45-65%RH).

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 the initial value.

USE PRECAUTIONS

9 HANDLING PRECAUTIONS

(1) A LCD module is a fragile item and should not be subjected to strong mechanical shocks.

(2) Avoid applying pressure to the module surface. This will distort the glass and cause a change in color.

(3) Under no circumstances should the position of the bezel tabs or their shape be modified.

(4) Do not modify the display PCB in either shape or positioning of components.

(5) Do not modify or move location of the zebra or heat seal connectors.

(6) The device should only be soldered to during interfacing. Modification to other areas of the board should not be carried out.

(7) In the event of LCD breakage and resultant leakage of fluid do not inhale, ingest or make contact with the skin. If contact is made rinse immediately.

(8) When cleaning the module use a soft damp cloth with a mild solvent, such as Isopropyl or Ethyl alcohol. The use of water, ketone or aromatic is not permitted.

(9) Prior to initial power up input signals should not be applied.

(10) Protect the module against static electricity and observe appropriate anti-static precautions.

9.1 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. 1MΩ 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.

9.2 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.

9.3 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 dive 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: 0.2Vdd or less and H level: 0.8Vdd 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.
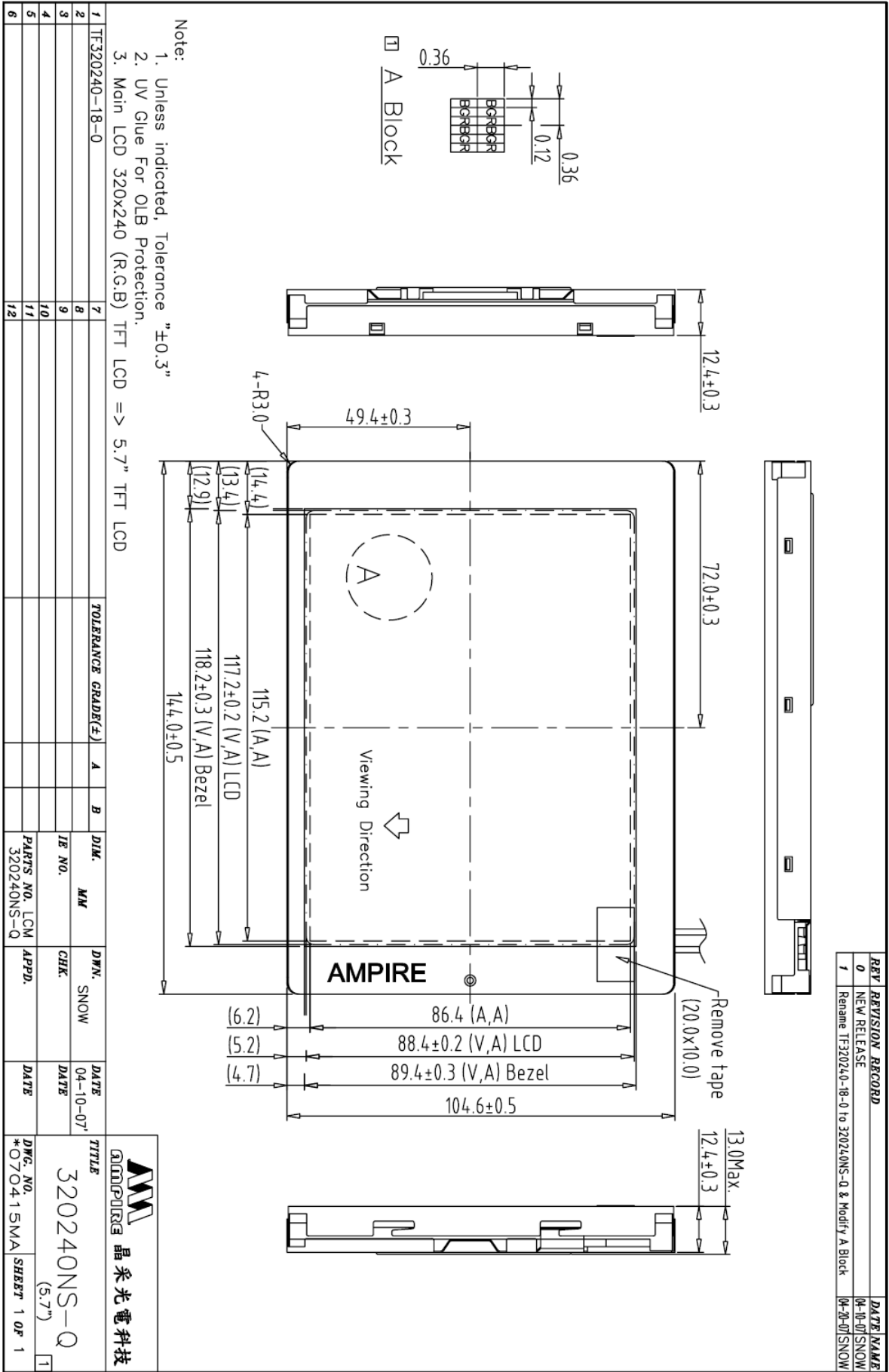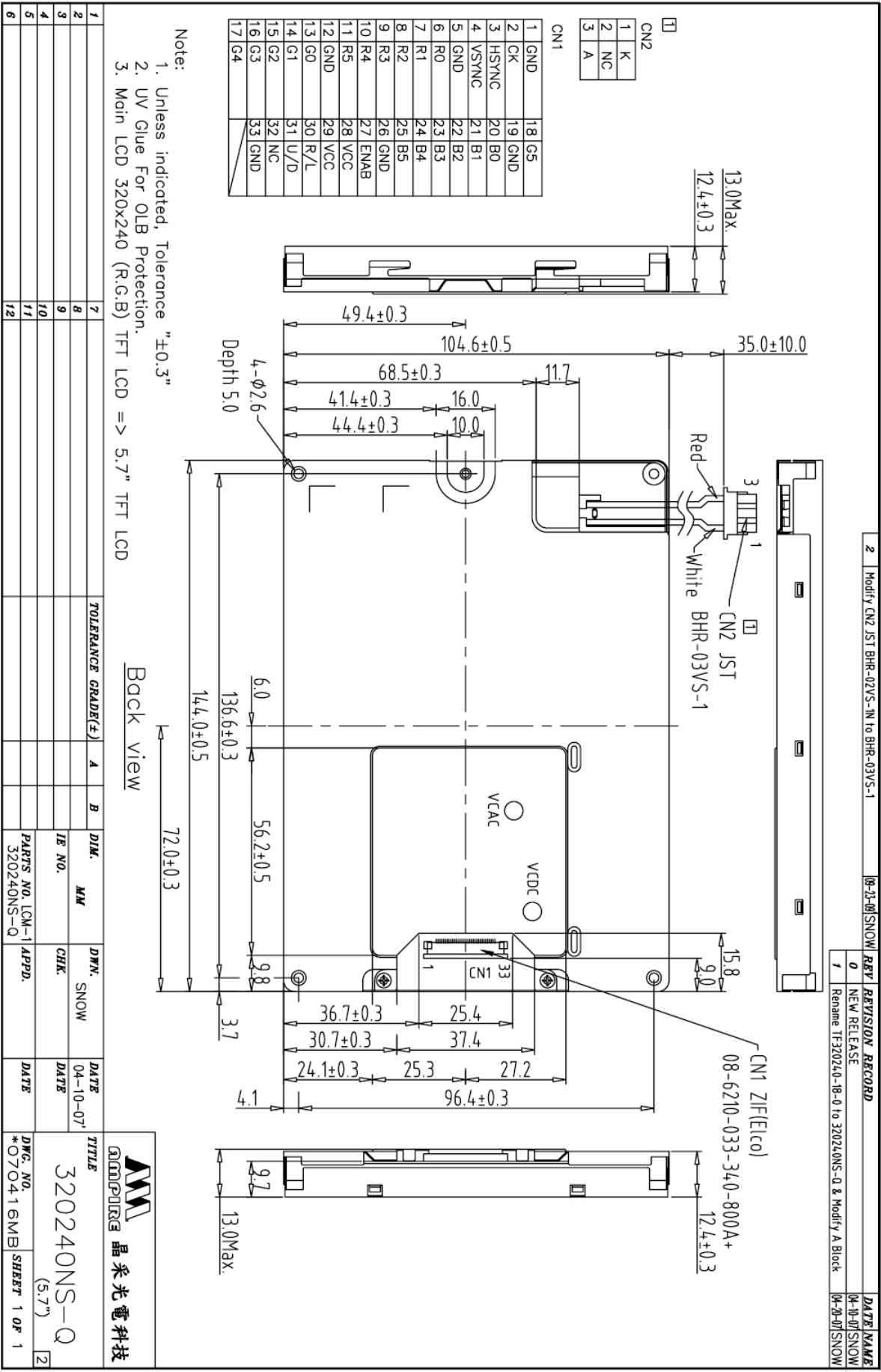
7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.

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.

9.4 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) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.

3) AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.

10 OUTLINE DIMENSION

Note:
1. Unless indicated, Tolerance "±0.3"
2. UV Glue For OLB Protection.
3. Main LCD 320x240 (R.G.B) TFT LCD => 5.7" TFT LCD

A Block

0.36
0.12
0.36

BGRBGR
BGRBGR
BGRBGR

12.4±0.3

4-R3.0
49.4±0.3
72.0±0.3

(14.4)
(13.4)
(12.9)
115.2 (A,A)
117.2±0.2 (V,A) LCD
118.2±0.3 (V,A) Bezel
144.0±0.5

A

Viewing Direction

AMPIRE

Remove tape
(20.0x10.0)

(6.2) 86.4 (A,A)
(5.2) 88.4±0.2 (V,A) LCD
(4.7) 89.4±0.3 (V,A) Bezel
104.6±0.5

13.0Max.
12.4±0.3

		TOLERANCE GRADE(±)	A	B	DIM.	MM	DMN.	DATE
1	7	TF320240-18-0			IE NO.		CHK. SNOW	DATE 04-10-07'
2	8							
3	9							
4	10							
5	11				PARTS NO. LCM	32024ONS-Q	APPD.	DATE
6	12							

TITLE: 32024ONS-Q (5.7")
DWG. NO. *0704l5MA
SHEET 1 OF 1

AMPIRE 晶采光電科技

CN2

1	K
2	NC
3	A

CN1

1	GND	18	G5
2	CK	19	GND
3	HSYNC	20	B0
4	VSYNC	21	B1
5	GND	22	B2
6	R0	23	B3
7	R1	24	B4
8	R2	25	B5
9	R3	26	GND
10	R4	27	ENAB
11	R5	28	VCC
12	GND	29	VCC
13	G0	30	R/L
14	G1	31	U/D
15	G2	32	NC
16	G3	33	GND
17	G4		

Note:
1. Unless indicated, Tolerance "±0.3"
2. UV Glue For OLB Protection.
3. Main LCD 320x240 (R.G.B) TFT LCD => 5.7" TFT LCD

Back view

CN2 JST BHR-03VS-1

CN1 ZIF(Elco)
08-6210-033-340-800A+

TITLE 32024NS-Q (5.7")

DWG. NO. *0704416MB SHEET 1 OF 1

PARTS NO. LCM-1
32024NS-Q

DMN. SNOW DATE 04-10-07'

AMPIRE 晶采光電科技

Backlight Testing(Reference Only)
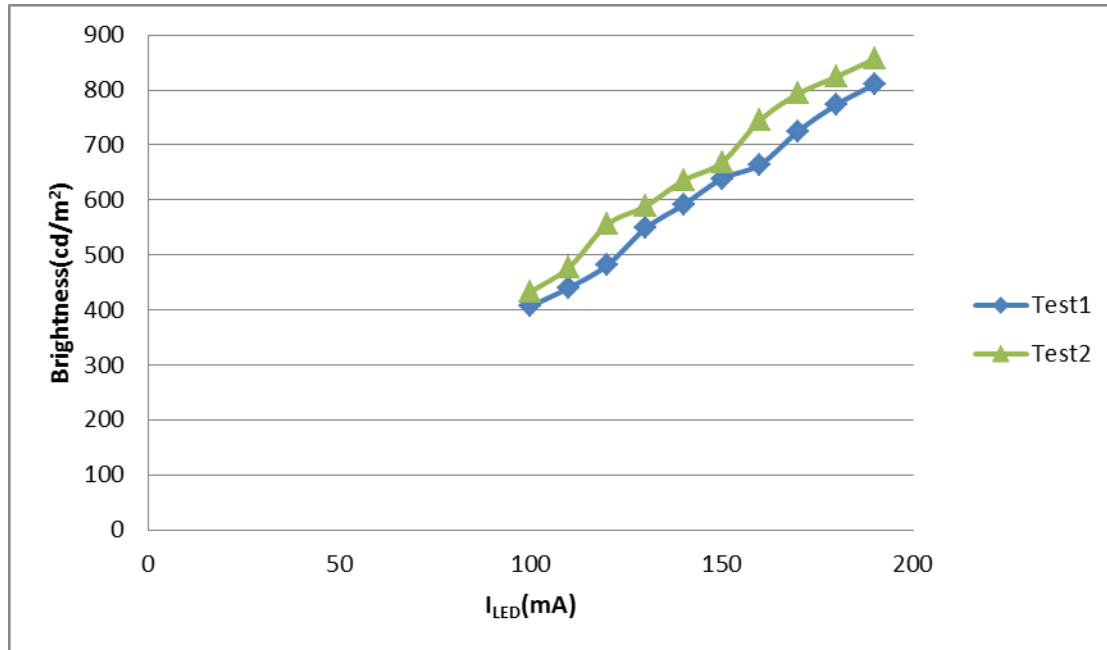
I$_{LED}$(mA)	Test1		Test2	
	Brightness(cd/m2)	Voltage(V)	Brightness(cd/m2)	Voltage(V)
100	406.8	8.6	433.4	8.5
110	440.4	8.7	477.5	8.6
120	481.4	8.7	555.3	8.7
130	548.4	8.8	588.6	8.7
140	591.6	8.9	635.7	8.8
150	638.6	9	668.5	8.8
160	664.4	9.1	745.3	9
170	725.3	9.2	793.2	9
180	773.5	9.2	824.3	9.1
190	810.5	9.3	856.6	9.1

Measuring Instrument:

Power Supply：GWInstek SPS-3610
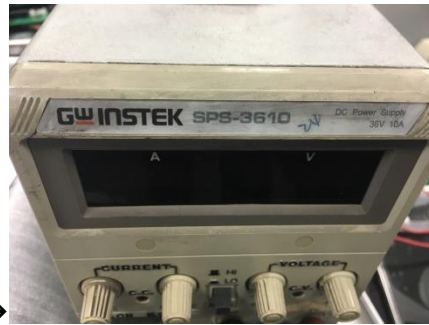
Model→

Backlight Measuring Instrument：Konica Minolta CA-310

Model↓