



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-320240L9HZQW-00H-B
Approved by	
Date	

- Preliminary Specification
 Formal Specification

AMPIRE CO., LTD.

**4F., No.116, Sec. 1, Xintai 5th Rd., Xizhi Dist., New Taipei
City221, Taiwan (R.O.C.)**

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
Patrick	Mark	Tank

*This specification is subject to change without notice.

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2021/03/23	--	New Release	Tank
2021/03/26	3	Update Physical Specifications	Tank
	11	Update Note(2)	
	15	Update Parallel RGB Input Timing Table	

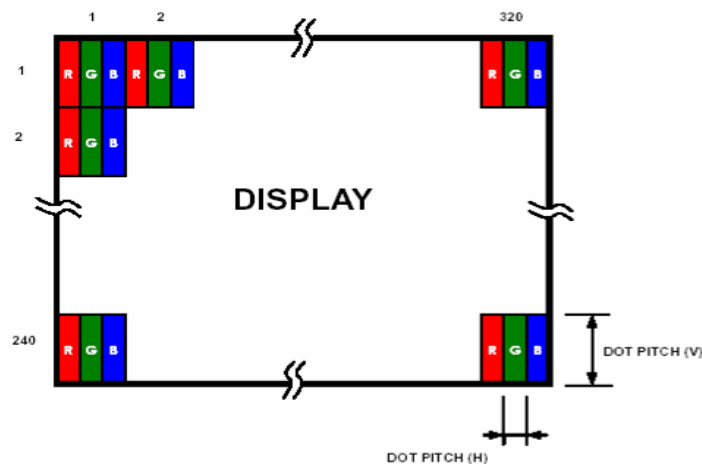
1 Features

3.5 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 3.5" TFT-LCD panel, a driver circuit and backlight unit.

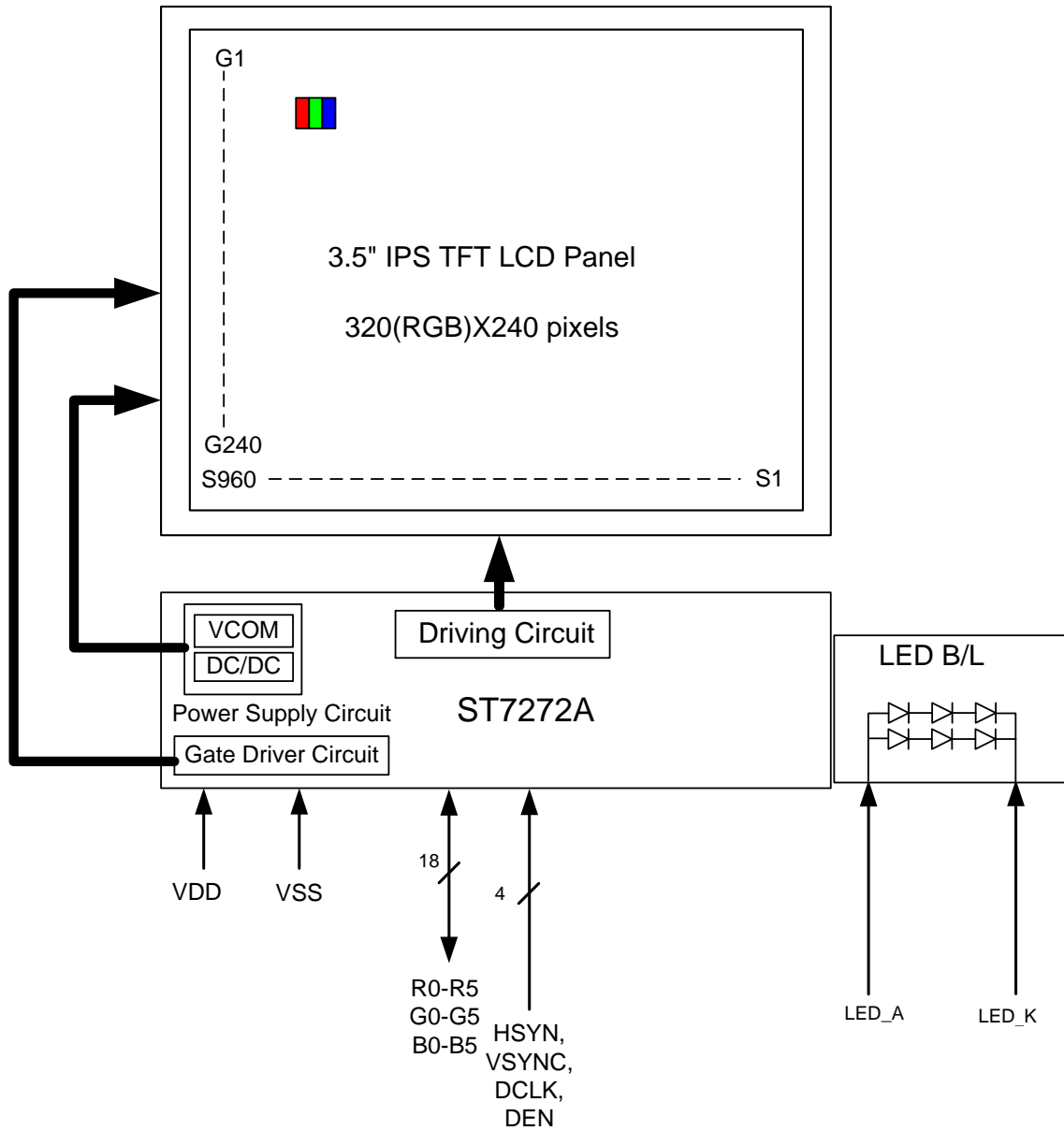
- 1.1 Construction: 3.5" IPS TFT-LCD, White LED Backlight.
- 1.2 Resolution (Pixel): 320(R.G.B) X240.
- 1.3 Number of the Colors: 262K colors (R, G, B 6 bit digital each).
- 1.4 LCD type: Transmissive Color TFT LCD (**Normally Black**).
- 1.5 View Angle: **Wide view angle**
- 1.6 18-Bit RGB Interface.
- 1.7 Interface: 40 pin.
- 1.8 Support SYNC Mode.
- 1.9 Power Supply Voltage: 3.3V single power input. Built-in power supply circuit.
- 1.10 LED Type Backlight.
- 1.11 LCD Driver IC: **ST7272A**

2 Physical Specifications

Item	Specifications	Unit
Display Resolution	320(W) x 240(H)	dot
Active Area	70.08 x 52.56	mm
Screen Size	3.5 (Diagonal)	inch
Pixel Pitch	0.219 (W) x 0.219 (H)	mm
Color Configuration	R.G.B – stripe	
Overall Dimension	77.8 (W) x 66.0 (H) x 4.4 (T)	mm
Input Interface	Digital 18-bits RGB	
Backlight Unit	White LED	
Display Mode	Normally Black / Transmissive	
Brightness	350	cd/m ²



3 Functional Block Diagram



4 Basic Display Color and Gray Scale

	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	0	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	0	1	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	0	1	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	0	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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

5 Electrical Specification

5.1 Absolute Max. Ratings

5.1.1 Electrical Absolute Max. Ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power Voltage	VDD	V _{SS} =0	-0.3	4.0	V	
Input Voltage	V _{IN}		-0.3	4.0	V	Note 1

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

5.1.2 Environmental Absolute Max. Ratings

Item	Operating		Storage		Remark
	MIN	MAX	MIN	MAX	
Temperature	-20	70	-30	80	Note2,3,4,5,6,7
Humidity	Note1		Note1		
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 < 240h, at 80°C < 240h

For Operating condition Ta at -20°C < 240h

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.

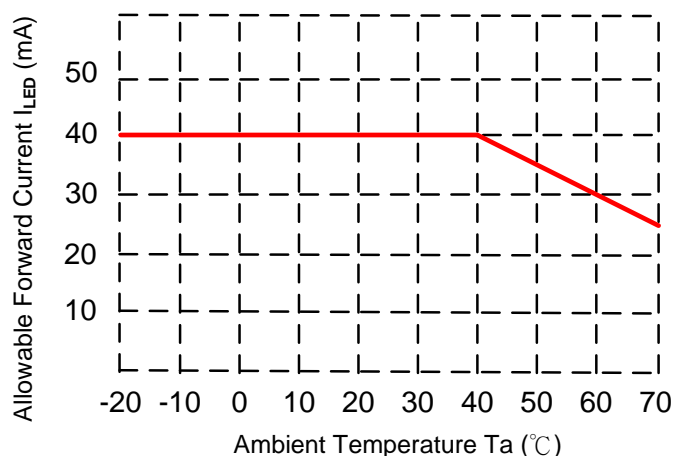
Note 5: Only operation is guaranteed at operating temperature.

Contrast, Response Time, another display quality are evaluated at +25°C

Note 6: This is panel surface temperature, not ambient temperature.

Note 7: When LCM is operated over 40°C ambient temperature,

The I_{LED} of the LED back-light should be follow:



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

5.2 Electrical Characteristics

5.2.1 DC Electrical Characteristic of the LCD

Typical Operating Conditions ($V_{SS} = 0V$)

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply	V_{DD}	3.0	3.3	3.6	V	
Input Voltage for Logic	H Level	$0.7 * V_{DD}$	-	V_{DD}	V	Note 1
	L Level	V_{SS}	-	$0.3 * V_{DD}$	V	
Power Supply Current	I_{DD}	-	T.B.D	-	mA	Note 2

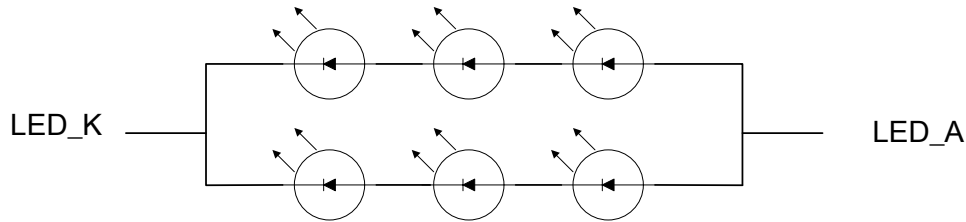
Note1: Hsync, Vsync, DEN, DCLK, R0~R5, G0~G5, B0~B5

Note2: Frame Rate=60Hz, $T_a = 25^{\circ}C$, Display Pattern: All White

5.2.2 Electrical Characteristic of LED Back-Light

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conduction
LED Voltage	V_{LED}	8.4	9.9	11.4	V	$I_{LED} = 40\text{mA}$ $T_a = 25^\circ\text{C}$
LED Forward Current	I_{LED}	--	40	--	mA	$T_a = 25^\circ\text{C}$
	I_{LED}	--	30	--	mA	$T_a = 60^\circ\text{C}$
LED Life Time		--	T.B.D.	-	Hrs	$I_{LED} = 40\text{mA}$, $T_a = 25^\circ\text{C}$

Note 1: The figure below shows the connection of backlight LED.



Note 2: Optical performance should be evaluated at $T_a = 25^\circ\text{C}$ only.

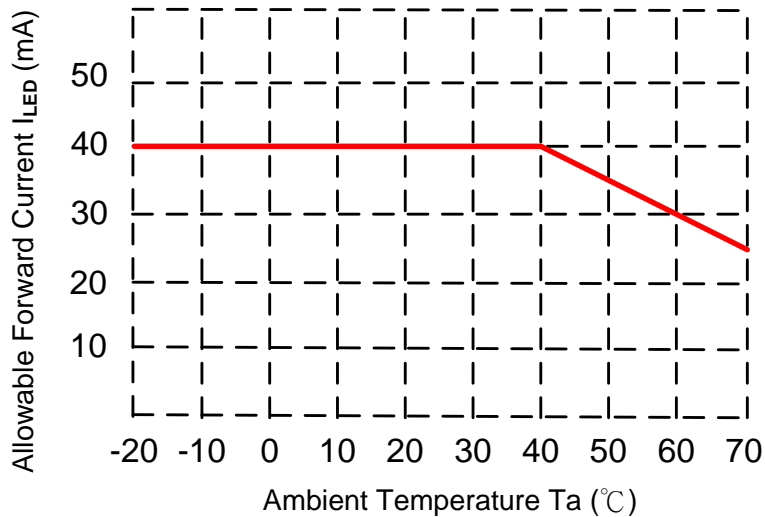
Note 3: IF LED is driven by high current, high ambient temperature & humidity condition, The life time of LED will be reduced.

Note 4: Operating life means brightness goes down to 50% initial brightness.

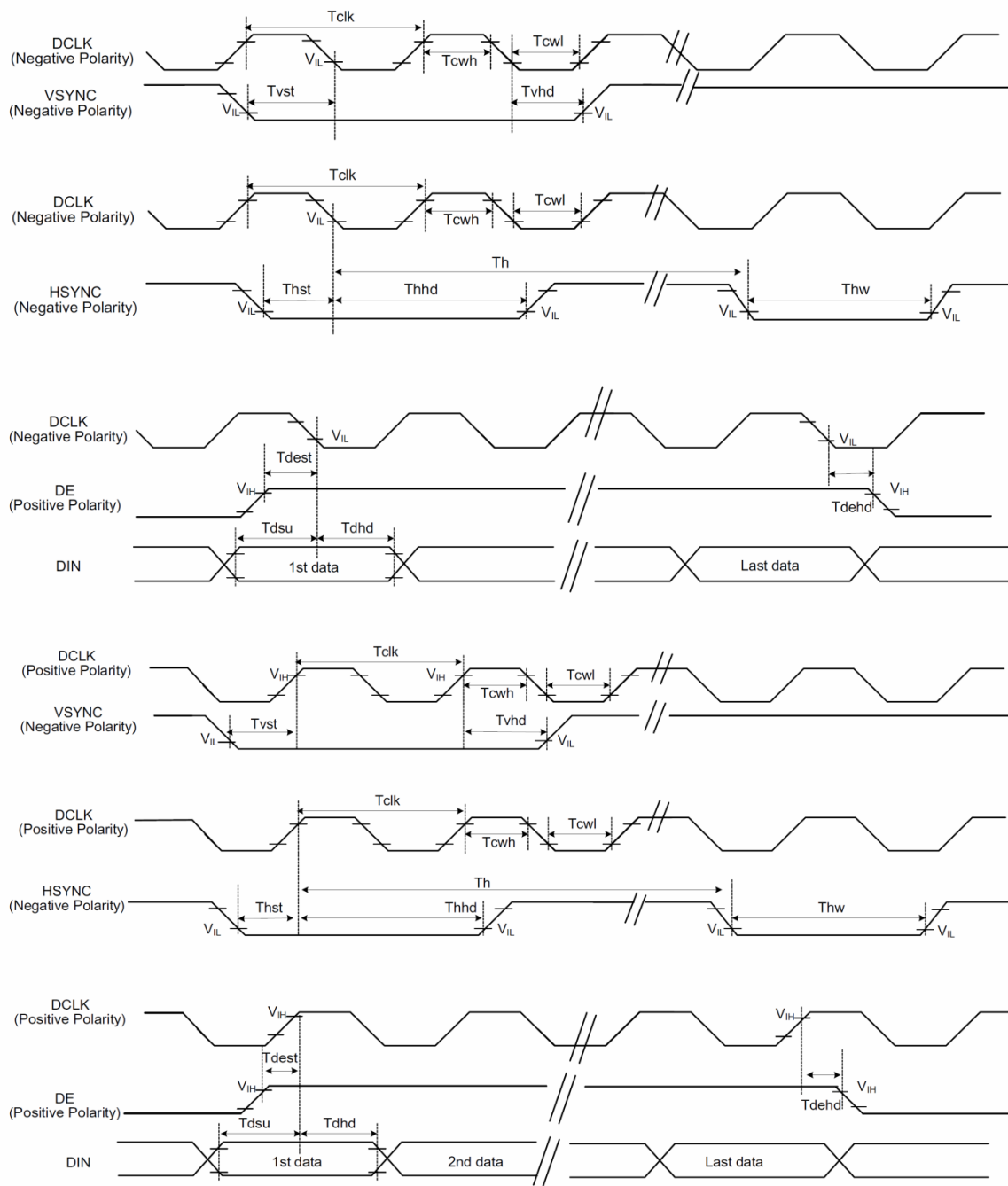
Typical operating life time is estimated data.

Note 5: The constant current source is needed for white LED back-light driving.

Note 6: When LCM is operated over 60°C ambient temperature, the I_{LED} of the LED back-light should be adjusted to 30mA max.



5.3 System Bus Timing for the RGB interface of the TFT LCD controller



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	T_{clk}	40	50	60	%	
HSYNC Width	T_{hw}	2	-	-	DCLK	
VSYNC Setup Time	T_{vst}	12	-	-	ns	
VSYNC Hold Time	T_{vhhd}	12	-	-	ns	
HSYNC Setup Time	T_{hst}	12	-	-	ns	
HSYNC Hold Time	T_{hhhd}	12	-	-	ns	
Data Setup Time	T_{dsu}	12	-	-	ns	
Data Hold Time	T_{dhd}	12	-	-	ns	
DE Setup Time	T_{dest}	12	-	-	ns	
DE Hold Time	T_{dehd}	12	-	-	ns	

6 Optical Specification

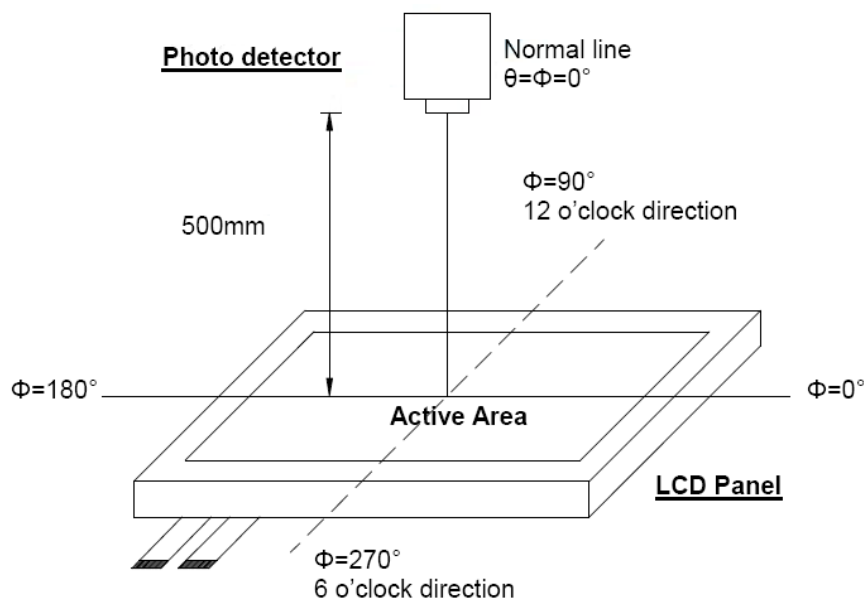
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast	CR		640	800	—		(1)(4)
Response Time	T_{R+T_F}		—	30	40	msec	(1)(5)
White Luminance (Center)	Y_L		280	350	—	cd/m ²	(1)(2)(6)
Color Chromaticity (CIE1931)	White		W_x	-0.05	0.317	+0.05	
		W_y	0.339				
	Red	R_x	T.B.D.				
		R_y	T.B.D.				
	Green	G_x	T.B.D.				
		G_y	T.B.D.				
	Blue	B_x	T.B.D.				
		B_y	T.B.D.				
Viewing Angle	Hor.	Θ_L	CR>10	75	85	—	
		Θ_R		75	85	—	
	Ver.	Θ_U		75	85	—	
		Θ_D		75	85	—	

Measuring Condition

- Measuring Surrounding : Dark Room
- Ambient Temperature : 25±3°C
- 15min Warm-up Time.

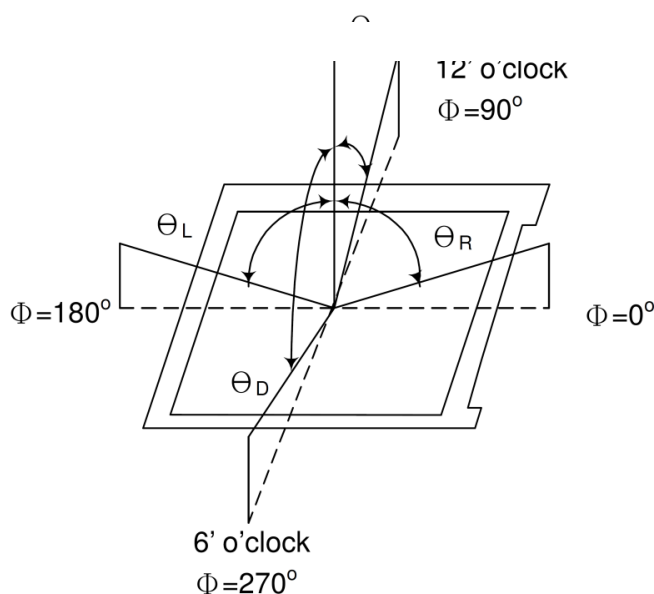
Note(1) Measurement Setup:

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° / Height: 500mm.)



Note(2) The LED input parameter setting as: PWM: duty 100 % or $I_{LED} = 40\text{mA}$

Note(3) Definition of Viewing Angle:

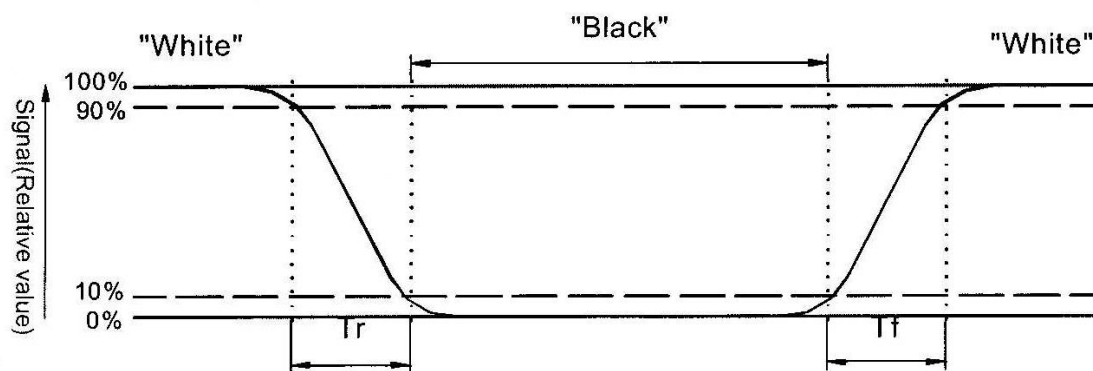


Note(4) Definition of Contrast Ratio (CR)

Measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note(5) Definition of Response Time (T_R & T_F)

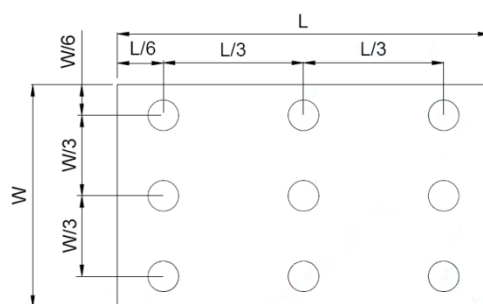


Note(6) Definition of Brightness Luminance

Active area is divided into 9 measuring areas (Refer to bellow figure).
 Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{\min}}{B_{\max}}$$

L ----- Active area length W ----- Active area width



B_{\max} : The measured maximum luminance of all measurement position.

B_{\min} : The measured minimum luminance of all measurement position.

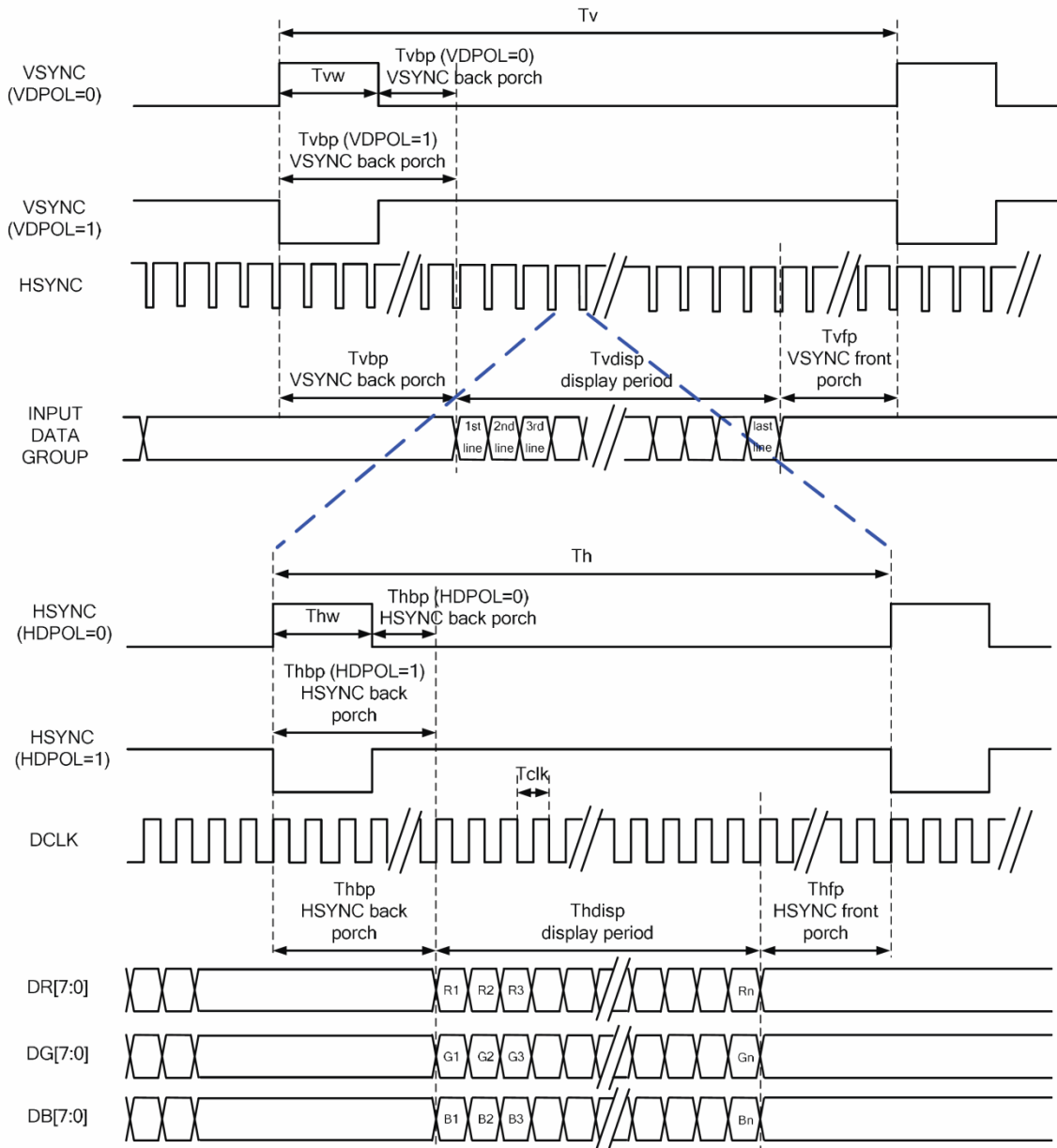
7 Interface

TFT LCD Panel FPC Descriptions

Pin no	Symbol	I/O	Description	Remark
1~4	V _{DD}	P	Power supply for the logic (3.3V)	
5	Hsync	I	Horizontal sync input in digital RGB mode	
6	DEN	I	Keep this Pin No Connection.	
7	V _{SS}	P	Ground	
8	DCLK	I	Clock signal. Latching data at the rising edge.	
9	V _{SS}	P	Ground	
10	Vsync	I	Vertical sync input in digital RGB mode.	
11	V _{SS}	P	Ground	
12	B5	I	Blue data	
13	B4	I		
14	B3	I		
15	V _{SS}	P	Ground	
16	B2	I	Blue data	
17	B1	I		
18	B0	I		
19	V _{SS}	P	Ground	
20	G5	I	Green data	
21	G4	I		
22	G3	I		
23	V _{SS}	P	Ground	
24	G2	I	Green data	
25	G1	I		
26	G0	I		
27	V _{SS}	P	Ground	
28	R5	I	Red data	
29	R4	I		
30	R3	I		
31	V _{SS}	P	Ground	
32	R2	I	Red data	
33	R1	I		
34	R0	I		
35	NC	I	No Connection	
36	V _{SS}	P	Ground	
37	YU / A1	I	1.Backlight AK pin (without touch panel function) 2.Touch Panel Control Pin (Backlight AK are driven by LED Driver circuit)	
38	XL / A2	I		
39	YD / K1	I		
40	XR / K2	I		

8 Interface Protocol

8.1 Parallel RGB SYNC Mode



8.2 Parallel RGB Input Timing Table

Parallel 24-bit RGB Input Timing (PVDD=VDD=VDDI= 3.3V, AGND= 0V, TA=25°C)

Parallel 24-bit RGB Input Timing Table							
Item	Symbol	Min.	Typ.	Max.	Unit	Note	
DCLK Frequency	Fclk	5	6	8	MHz		
DCLK Period	Tclk	125	167	200	ns		
HSYNC	Period Time	Th	325	371	438	DCLK	
	Display Period	Thdisp	-	320	-	DCLK	
	Back Porch	Thbp	3	43	43	DCLK	SYNC mode back porch control by H_BLANKING[7:0] setting Thbp= H_BLANKING[7:0]
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	43	DCLK	
VSYNC	Period Time	Tv	244	260	289	HSYNC	
	Display Period	Tvdisp	-	240	-	HSYNC	
	Back Porch	Tvbp	2	12	12	HSYNC	SYNC mode back porch control by V_BLANKING[7:0] setting Tvbp= V_BLANKING[7:0]
	Front Porch	Tvfp	2	8	37	HSYNC	
	Pulse Width	Tvw	2	4	12	HSYNC	

Note: It is necessary to keep Tvbp =12 and Thbp =43 in sync mode. DE mode is unnecessary to keep it.

9 Reliability Test Conditions

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C , t=240 hrs	
Low Temperature Operation	-20±3°C , t=240 hrs	
High Temperature Storage	80±3°C , t=240 hrs	1,2
Low Temperature Storage	-30±3°C , t=240 hrs	1,2
Thermal Shock Test	-10°C ~ 60°C 30 m in. ~ 30 min. (1 cycle) Total 100cycle	1,2
Storage Humidity Test	60 °C, Humidity 90%, 240 hrs	1,2
Vibration Test (Packing)	Sweep frequency : 10 ~ 50 ~ 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)

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 the initial value.

10 Use Precautions

10.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

10.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. AMPIRE does not warrant the module, if customers disassemble or modify the module.

10.3 Breakage of LCD Panel

1. If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.
2. If liquid crystal contacts mouth or eyes, rinse out with water immediately.
3. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
4. Handle carefully with chips of glass that may cause injury, when the glass is broken.

10.4 Electric Shock

1. Disconnect power supply before handling LCD module.
2. Do not pull or fold the LED cable.
3. Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

10.5 Absolute Maximum Ratings and Power Protection Circuit

1. Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.
2. Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
3. It's recommended to employ protection circuit for power supply.

10.6 Operation

1. Do not touch, push or rub the polarizer with anything harder than HB pencil lead.
2. Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.
3. When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
4. Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may cause deformation or color fading.
5. When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzene or other adequate solvent.

10.7 Mechanism

Please mount LCD module by using mounting holes arranged in four corners tightly.

10.8 Static Electricity

1. Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.
2. Because LCD modules use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

10.9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

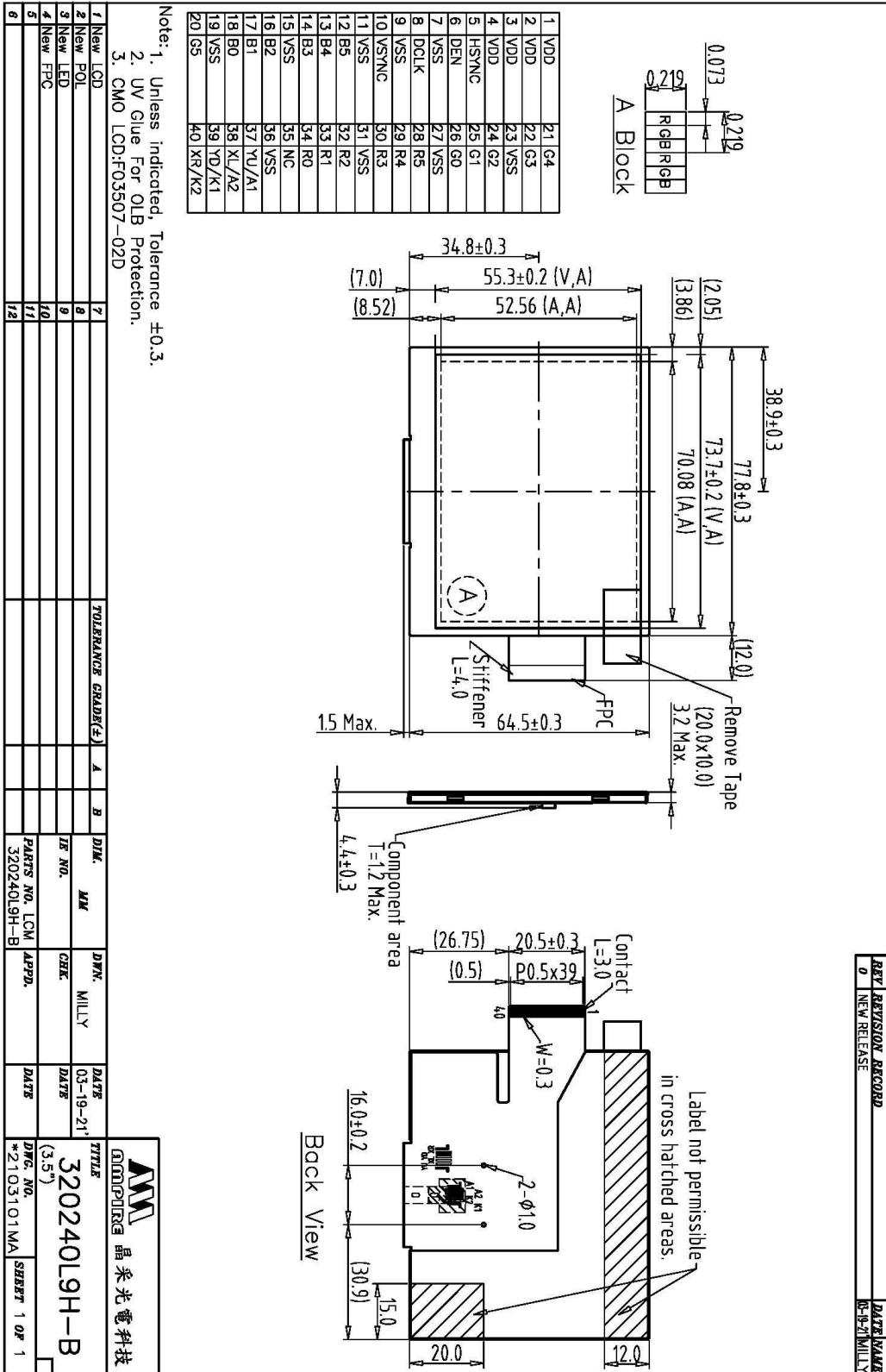
10.10 Disposal

When disposing LCD module, obey the local environmental regulations.

10.11 Others

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.

11 Outline Dimension



Note: 1. Unless indicated, Tolerance ± 0.3 .
 2. UV Glue For OLB Protection.
 3. CMO LCD:F03507-02D

1	New LOD	7	TOLERANCE GRAD(F)	A	B	DIM.	MM	DWN.	MILLY	DATE
2	New POL	8				JE NO.		CHEK.		DATE
3	New LED	9				PARTS NO. LCM		APPD.		DATE
4	New FPC	10				320240L9H-B				
5		11								
6		12								

AMM 晶采光电科技
 QINDIPTR3
320240L9H-B
 (3.5")
 DWG. NO. *2103101MA
 SHEET 1 OF 1

REV	REVISION RECORD	DATE	NAME
0	NEW RELEASE	15-10-21	MILLY