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-1024600KTMQW-04H
APPROVED BY	
DATE	

☐Approved For Specifications
☐ Approved For Specifications & Sample

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2016/11/15	--	New Release	Kokai

1. Features

7 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 7" TFT-LCD panel, LED backlight, LED driver unit and power circuit unit.

(1) Construction: 7" a-Si TFT active matrix, White LED Backlight and power & LED driver.
(2) Resolution (pixel): 1024(R.G.B) X600
(3) Number of the Colors : 16M colors (R , G , B 8 bit digital each)
(4) LCD type : Transmissive , normally White
(5) Interface: LVDS interface 6bit (default), 8bit by jumper setting.
(6) Beside 3.3V power input. AVDD, VGH ,VGL and VCOM are needed for TFT LCD driving.
(7) Viewing Direction: 6 O'clock (The direction it's hard to be discolored)

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
LCD size	7 inch (Diagonal)	
Resolution	1024 x 3(RGB) x 600	dot
Dot pitch	0.05(W) x 0.15(H)	mm
Active area	153.6(W) x 90.0(H)	mm
Module size	165. 5(W) x 104.44(H) x5.0(D)	mm
Surface treatment	Anti-Glare	
Color arrangement	RGB-stripe	
interface	LVDS	
Brightness	1000	cd/m^2
Weight	TBD	g

3. ABSOLUTE MAX. RATINGS

Item	Symbol	Values		UNIT	Note
		Min.	Max.		
Power voltage	VDD	-0.3	5.0	V	
	AVDD	6.5	13.5		
	VGH	-0.3	20.0		
	VGL	-20.0	0.3		
Back-light Forward Current	I_{LED}	--	100	mA	For each LED
Operation temperature	T_{OP}	-20	70	℃	
Storage temperature	T_{ST}	-30	80	℃	

The following values are maximum operation conditions, If exceeded , it may cause faulty operation or damage

4. ELECTRICAL CHARACTERISTICS

4-1 Typical Operation Conditions

Item		Symbol	Values			Unit	Remark
			MIN	TYP	MAX		
Power Voltage		VDD	3.0	3.3	3.6	V	Note 1,2
		AVDD	10.8	11.0	11.2	V	
		VGH	15.7	16.0	16.3	V	
		VGL	-7.1	-6.8	-6.5	V	
		VCOM	4.2	4.3	4.4	V	Note 4
Power Consumption		I_{VDD}	--	16	21	mA	Note 1,2 VDD=3.3V
		I_{AVDD}	--	33	50	mA	AVDD=11.0V
		I_{VGH}	--	0.4	1	mA	VGH=16.0V
		I_{VGL}	--	0.4	1	mA	VGL=-6.8 V
Logic Input Voltage	Input Voltage	V_{IN}	0	-	V_{DD}	V	
	Logic input high voltage	V_{TH}	$0.7V_{DD}$	-	V_{DD}	V	Note 3
	Logic input low voltage	V_{TL}	GND	-	$0.3V_{DD}$	V	Note 3

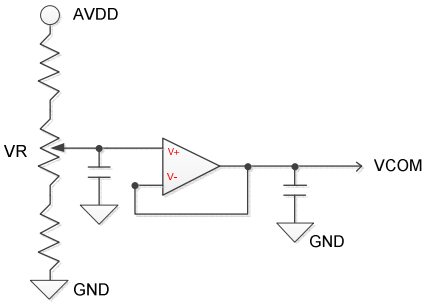
Note 1: Value for Power Board combined panel.

Note 2: VDD setting should match the signals output voltage (refer to Note 3) of customer's system board.

Note 3: RESET, SBYB, DRLB , L/R , U/D, CABCEN1 , CABCEN2.

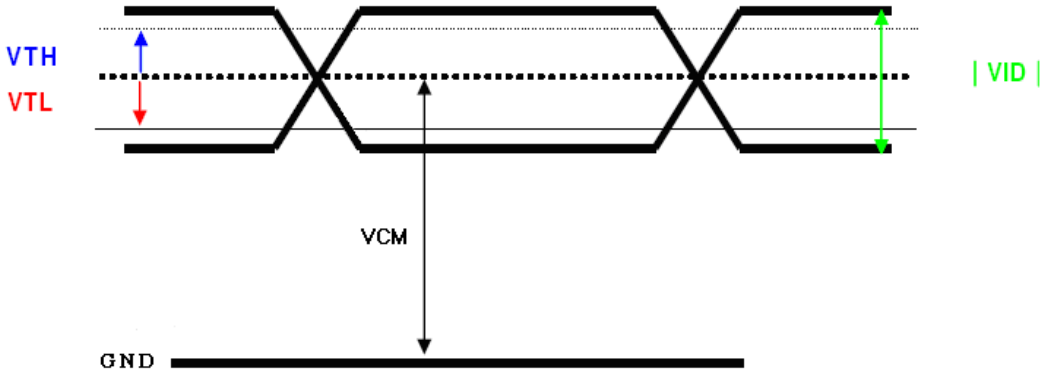
✧ 確定一下此模組中 TTL准位輸入的信號有哪些

Note 4: TYP VCOM is only reference value. It must be optimized according to each LCM. Be sure to use VR and OP buffer on VCOM output. Please adjust VCOM to make the flicker level be minimum for getting excellent image.



4-2 Switching Characteristics of LVDS Receiver

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Differential Input High Threshold	VTH	--	--	100	mV	VCM=1.2V
Differential Input Low Threshold	VTL	-100	--	--	mV	
Input current	IIN	-10	--	+10	uA	
Differential input Voltage	|VID|	0.2	--	0.6	V	
Common Mode Voltage Offset	VCM	$\frac{\|VID\|}{2}$	1.25	$2.4-\frac{\|VID\|}{2}$	V	



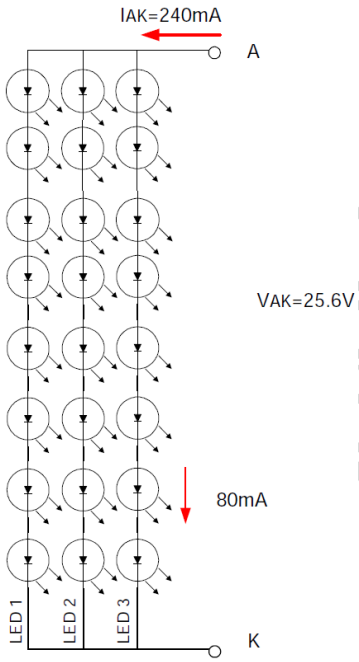
4-3 LED Back-light Unit

4 Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
LED voltage	V_{AK}	24.8	25.6	26.4	V	Note(1)
LED forward Current	I_{AK}	--	240	--	mA	Ta=25℃
LED life time	--	--	50,000	--	Hr	Note(2)

Note (1) The constant current source is needed for white LED back-light driving.
When LCM is operated over 60 deg.C ambient temperature.

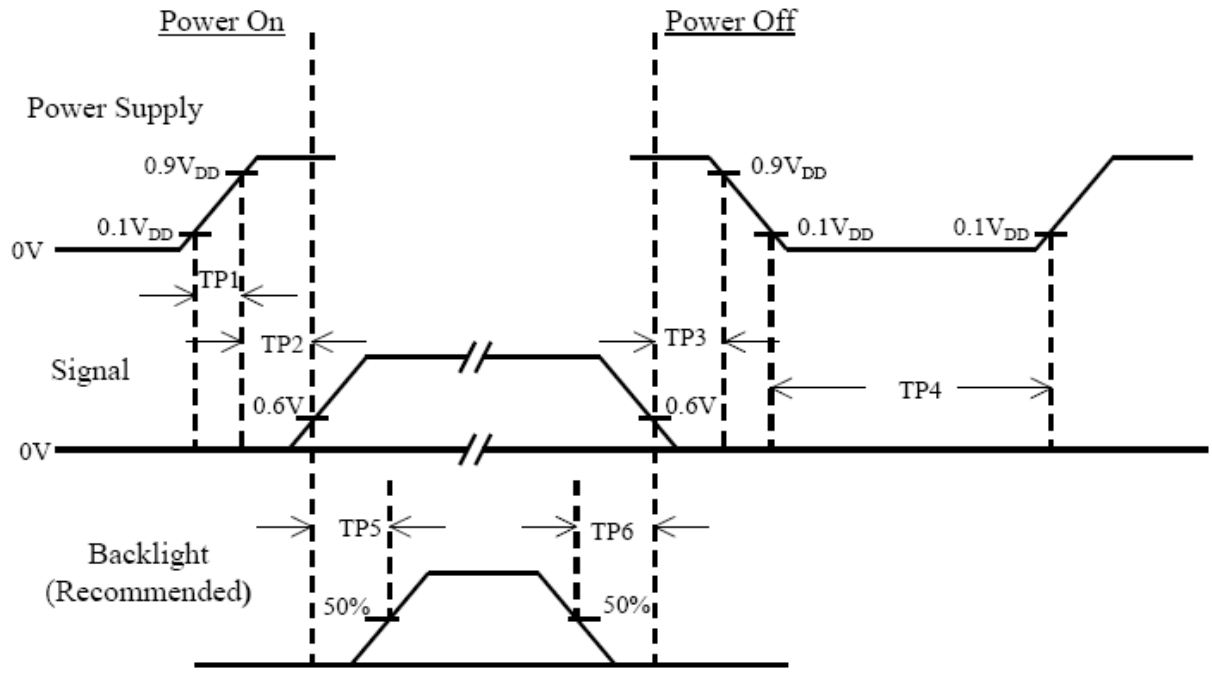
Note (2) Brightness to be decreased to 50% of the initial value.

There are 5 Groups LED shown as below , V_{AK} =25.6V , I_{AK} =240mA.



Brightess to be decreased to 50% of the initial value.

4-4 Power Sequence



Item	Min.	Typ.	Max.	Unit	Remark
TP1	0.5	--	10	msec	
TP2	0	--	50	msec	
TP3	0	--	50	msec	
TP4	500	--	--	msec	
TP5	200	--	--	msec	
TP6	200	--	--	msec	

Note：

(1) The supply voltage of the external system for the module input should be the same as the definition of VDD.

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) In case of VDD = off level, please keep the level of input signal on the low or keep a high impedance.

(4) TP4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

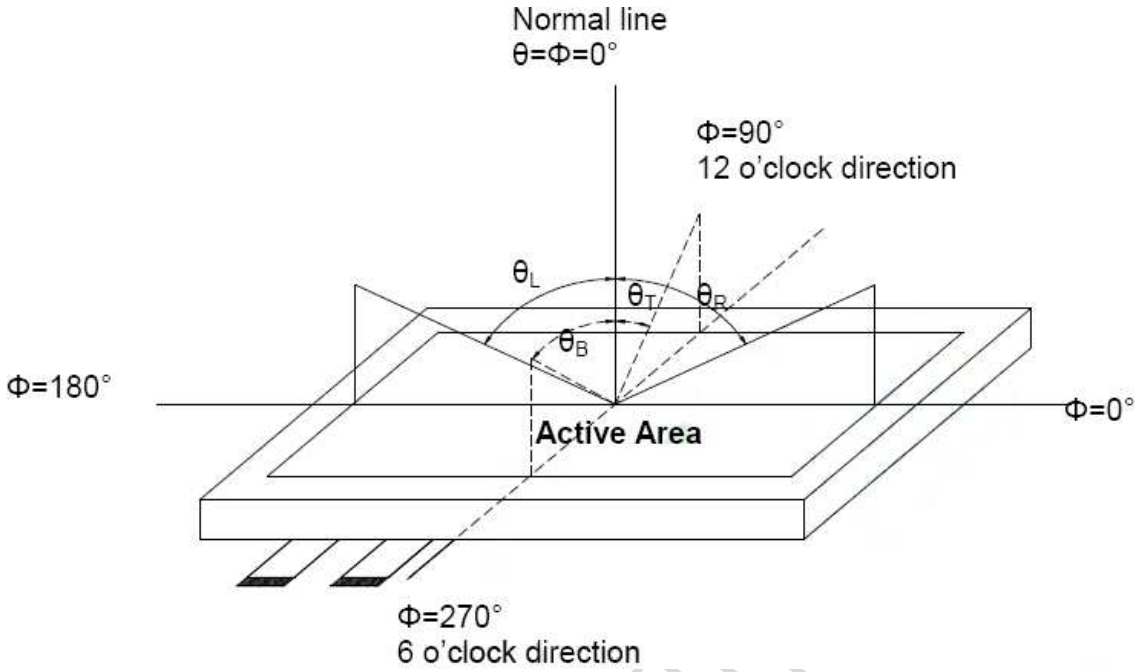
5. Optical Specifications

Item	Symbol	Condition	Values			Unit	Note
			Min.	Typ.	Max.		
Viewing angle (CR≧10)	θ L	Φ = 180° (9 o'clock)	65	75	--	degree	Note1
	θ R	Φ = 0° (3 o'clock)	65	75	--		
	θ T	Φ = 90° (12 o'clock)	60	70	--		
	θ B	Φ = 270° (6 o'clock)	65	75	--		
Response time	TON	Normal θ =Φ=0°	--	20	30	msec	Note3
	TOFF		--	20	30	msec	
Contrast ratio	CR		500	700	--	--	Note4
Color chromaticity	WX		0.249	0.299	0.349	--	Note5 Note6
	WY		0.273	0.323	0.373	--	
Luminance	L		800	1000	--	cd/m^2	Note6

Test Conditions:

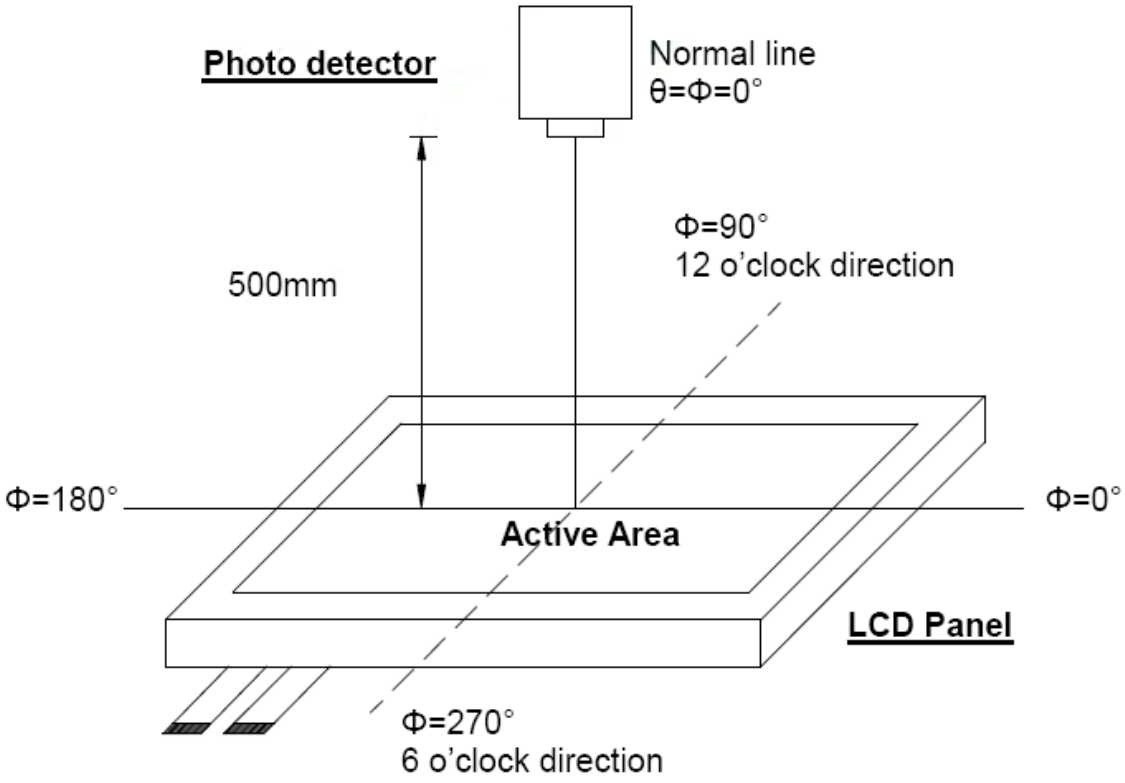
1. VDD = 3.3V, I_{AK} = 240mA (Backlight current), the ambient temperature is 25℃.
2. The test systems refer to Note 2.

Note 1 : Definition of viewing angle range



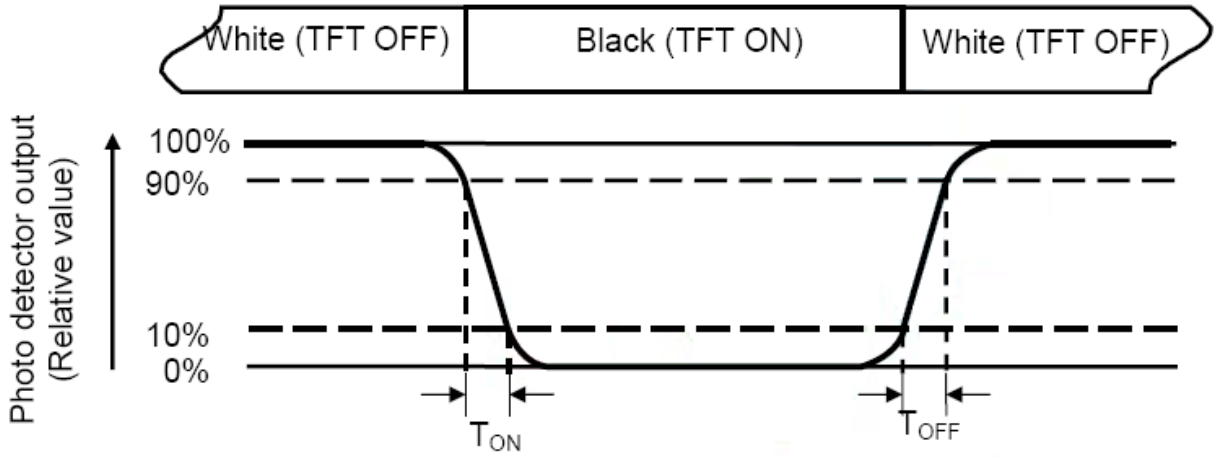
Note 2 : Definition of optical measurement system.

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 3 : Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 4 : Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5 : Definition of color chromaticity (CIE1931)

Color coordinated measured at center point of LCD.

Note 6 : All input terminals LCD panel must be ground when measuring the center area of the panel.

6. INTERFACE

TFT LCD Panel Driving Section

Pin No.	Symbol	I/O	Description	Note
1	VCOM	P	Common Voltage	
2	VDD	P	Power Voltage	
3	VDD	P	Power Voltage	
4	NC	--	No connection	
5	RESET	I	Global reset pin	
6	STBYB	I	Standby mode, Normally pulled high	1
7	GND	P	Ground	
8	RXIN0-	I	- LVDS differential data input	
9	RXIN0+	I	+ LVDS differential data input	
10	GND	P	Ground	
11	RXIN1-	I	- LVDS differential data input	
12	RXIN1+	I	+ LVDS differential data input	
13	GND	P	Ground	
14	RXIN2-	I	- LVDS differential data input	
15	RXIN2+	I	+ LVDS differential data input	
16	GND	P	Ground	
17	RXCLKIN-	I	- LVDS differential clock input	
18	RXCLKIN +	I	+ LVDS differential clcok input	
19	GND	P	Ground	
20	RXIN3-	I	- LVDS differential data input	
21	RXIN3+	I	+ LVDS differential data input	
22	GND	P	Ground	
23	NC	--	No connection	
24	NC	--	No connection	
25	GND	P	Ground	

26	NC	--	No connection	
27	DIMO	O	Backlight CABC controller signal output	
28	SELB	I	6bit/8bit mode select	2
29	AVDD	P	Power for Analog Circuit	
30	GND	P	Ground	
31	NC	P	No connection	
32	NC	P	No connection	
33	L/R	I	Horizontal inversion	4
34	U/D	I	Vertical inversion	4
35	VGL	P	Gate off Voltage	
36	CABCEN1	I	CABC H/W enable	3
37	CABCEN0	I	CABC H/W enable	3
38	VGH	P	Gate ON Voltage	
39	LED+	P	LED Anode	
40	LED+	P	LED Anode	

I : input, O : output, P : power

Note1. STBYB=”1”, normal operation
STBYB=”0”, timing control, source driver will turn off, all output are High-Z

Note2. If LVDS input data is 6 bits, SELB must be set to High.
If LVDS input data is 8bits, SELB must be set to LOW.

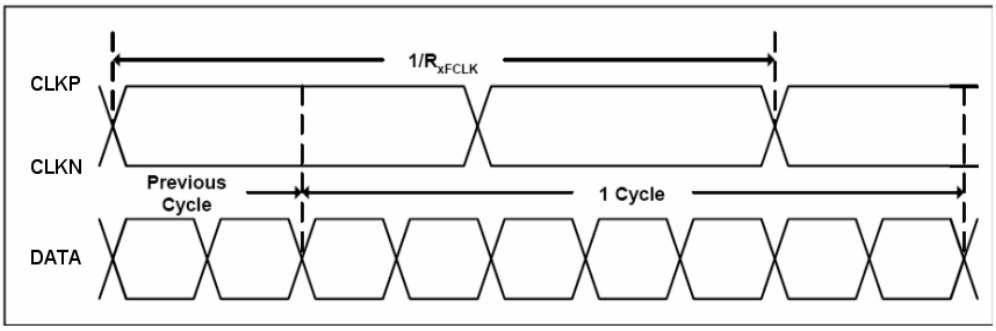
Note3. CABC_EN=”00”, CABC OFF.
CABC_EN=”01”, user interface image.
CABC_EN=”10”, still picture.
CABC_EN=”11”, moving image.
When CABC off, don’t connect DIMO, else connect it to backlight.

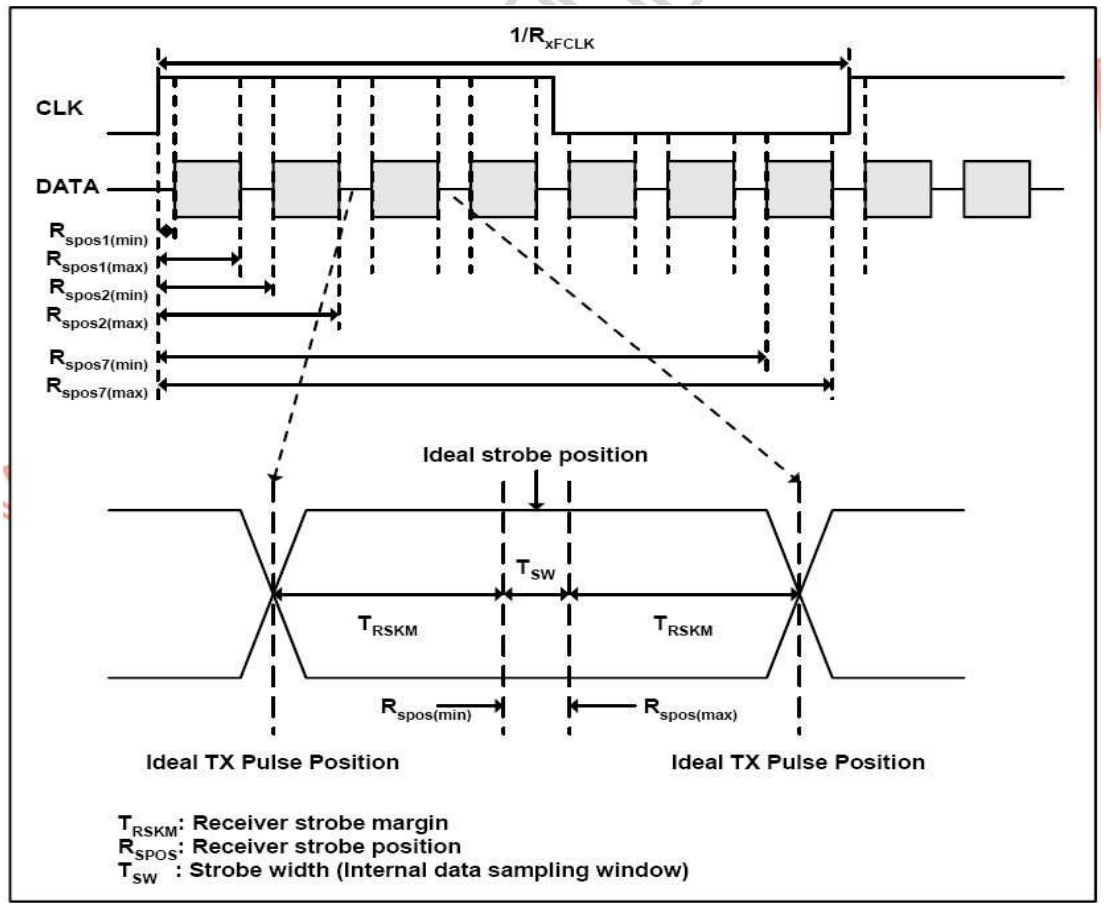
Note4. L/R=”0” set right to left scan direction
L/R=”1” set left to right scan direction.
U/D=”0” set top to bottom scan direction.
U/D=”1” set bottom to top scan direction.

7. TIMING CHARACTERISTICS

7-1 AC Electrical Characteristics

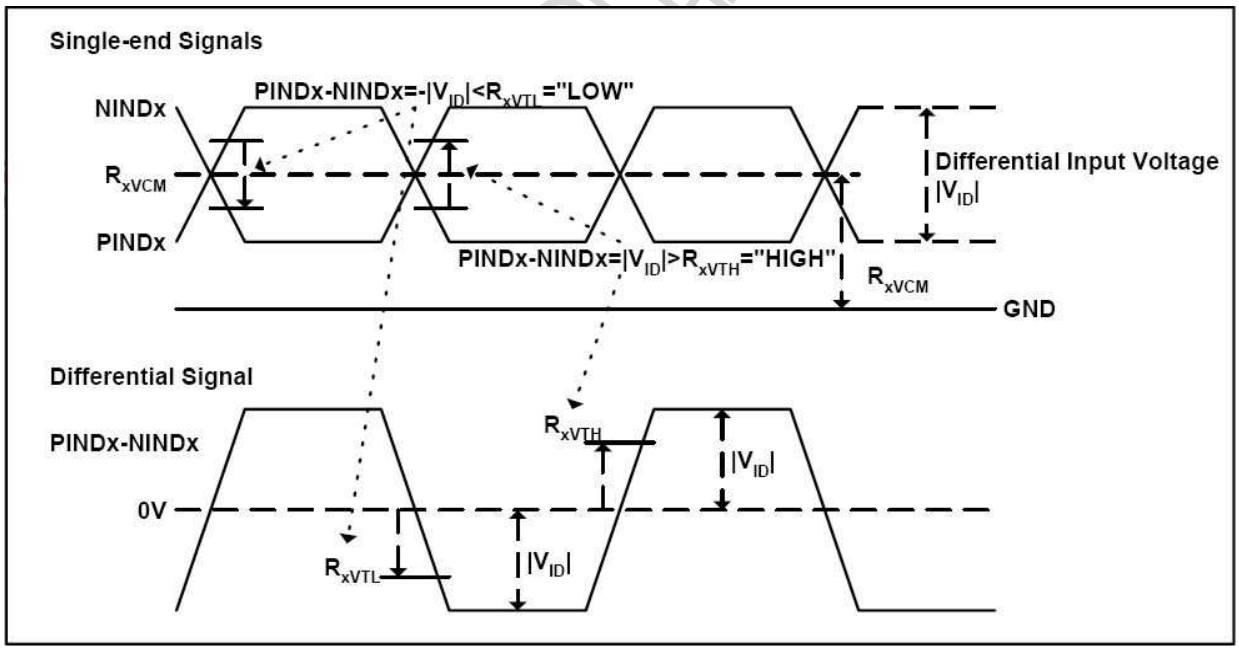
Parameter	Symbol	Values			Unit	Remark
		MIN	TYP	MAX		
Clock frequency	R_{xFCLK}	40.8	51.2	71		
Input data skew margin	T_{RSKM}	500	--	--		
Clock high time	T_{LVCH}	--	$4/(7* R_{xFCLK})$	--		
Clock low time	T_{LVCL}	--	$3/(7* R_{xFCLK})$	--		





7-2 DC Electrical Characteristics

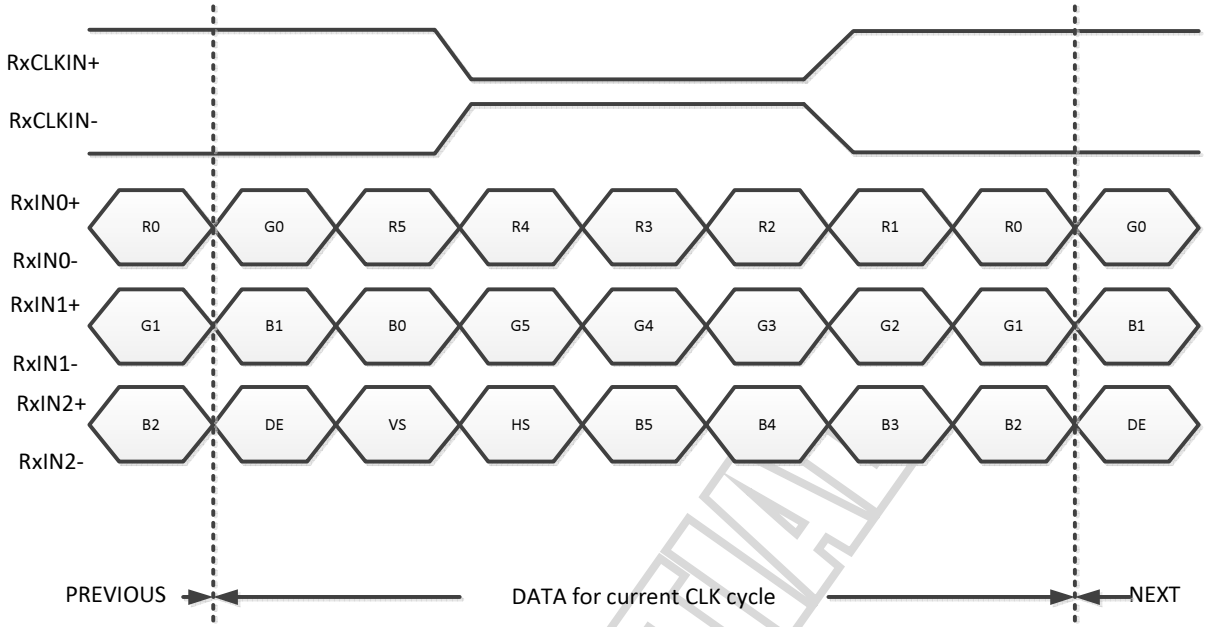
Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Differential input high Threshold voltage	R_{xVTH}	-	-	+0.1	V	R_{XVCM}=1.2V
Differential input low Threshold voltage	R_{xVTH}	-0.1	-	-	V	
Input voltage range (singled-end)	R_{xVIN}	0	-	2.4	V	
Differential input common mode voltage	R_{xVCM}	$\|V_{ID}\|/2$	-	2.4-$\|V_{ID}\|/2$	V	
Differential voltage	$\|V_{ID}\|$	0.2	-	0.6	V	
Differential input leakage current	RV_{xliz}	-10	-	+10	uA	



7-3 Timing

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Clock Frequency	fclk	40.8	51.2	67.2	MHz	Frame rate =60Hz
Horizontal display area	thd		1024		DCLK	
HS period time	th	1114	1344	1400	DCLK	
HS Blanking	thb	90	320	376	DCLK	
Vertical display area	tvd		600		H	
VS period time	tv	610	635	800	H	
VS Blanking	thb	10	35	200	H	

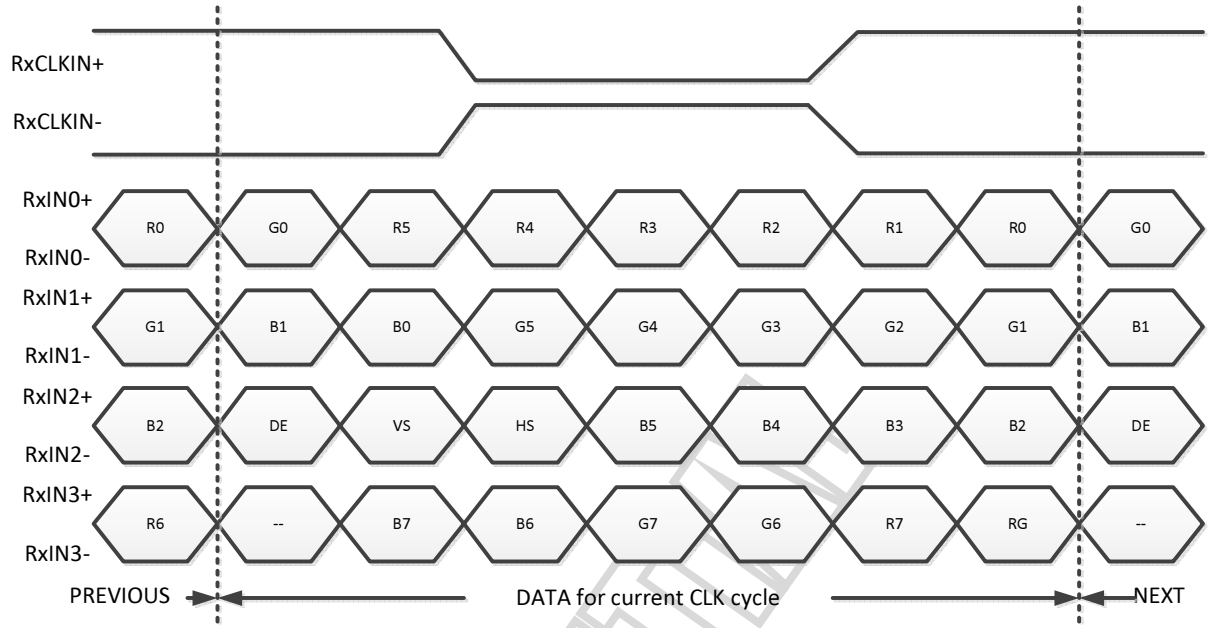
18-BIT LVDS Input Data Format



Note : R/G/B data 6 : MSB, R/G/B data 0 : LSB

Signal Name	Description	Remark
R5 R4 R3 R2 R1 R0	Red Data 5 (MSB) Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB)	Red-pixel Data Each red pixel's brightness data consists of these 6 bits pixel data.
G5 G4 G3 G2 G1 G0	Green Date 5 (MSB) Green Date 4 Green Date 3 Green Date 2 Green Date 1 Green Date 0 (LSB)	Green-pixel Data Each green pixel's brightness data consists of these 6 bits pixel data.
B5 B4 B3 B2 B1 B0	Blue Data 5(MSB) Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB)	Blue-pixel Data Each blue pixel's brightness data consists of these 6 bits pixel data.
RxCLKIN+ RxCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync Signal	
HS	Horizontal Sync Signal	

24-BIT LVDS Input Data Format



Note : R/G/B data 7 : MSB, R/G/B data 0 : LSB

Signal Name	Description	Remark
R7 R6 R5 R4 R3 R2 R1 R0	Red Data 7 (MSB) Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB)	Red-pixel Data Each red pixel's brightness data consists of these 8 bits pixel data.
G7 G6 G5 G4 G3 G2 G1 G0	Green Date 7 (MSB) Green Date 6 Green Date 5 Green Date 4 Green Date 3 Green Date 2 Green Date 1 Green Date 0 (LSB)	Green-pixel Data Each green pixel's brightness data consists of these 8 bits pixel data.
B7 B6 B5 B4 B3 B2 B1 B0	Blue Data 7 (MSB) Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB)	Blue-pixel Data Each blue pixel's brightness data consists of these 8 bits pixel data.
RxCLKIN+ RxCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync Signal	

8. RELIABILITY TEST CONDITIONS

(Note 3)

Item	Test Conditions	Note
High Temperature Storage	Ta = 80℃ 240 hrs	Note 1,4
Low Temperature Storage	Ta = -30℃ 240 hrs	Note 1,4
High Temperature Operation	Ts = 70℃ 240 hrs	Note 2,4
Low Temperature Operation	Ta = -20℃ 240 hrs	Note1,4
Operate at High Temperature and Humidity	+60℃, 90%RH 240 hrs	
Thermal Shock	-30℃ /30 min ~ +80℃ /30 min for a total 100 cycles, Start with cold temperature and end with high temperature	

Note 1 : Ta is the ambient temperature of samples.

Note 2 : Ts is the temperature of panel's surface.

Note 3 : In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 4 : Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

9. General Precautions

9-1 Safety

Liquid crystal is poisonous. Do not put it your month. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

9-2 Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

9-3 Static Electricity

1. Be sure to ground module before turning on power or operation module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

9-4 Storage

1. Store the module in a dark room where must keep at +25±10℃ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

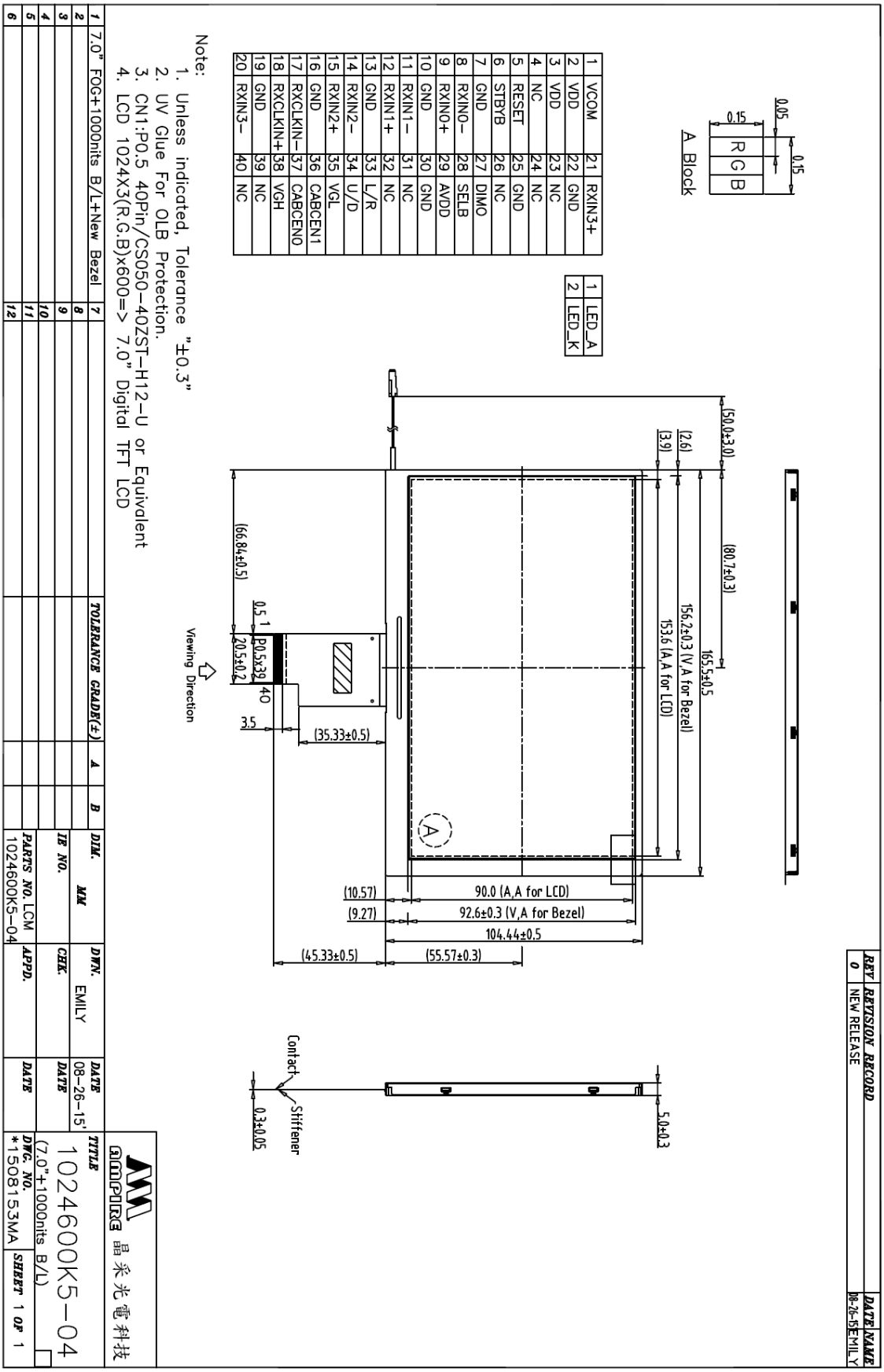
9-5 Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

9-5 Others

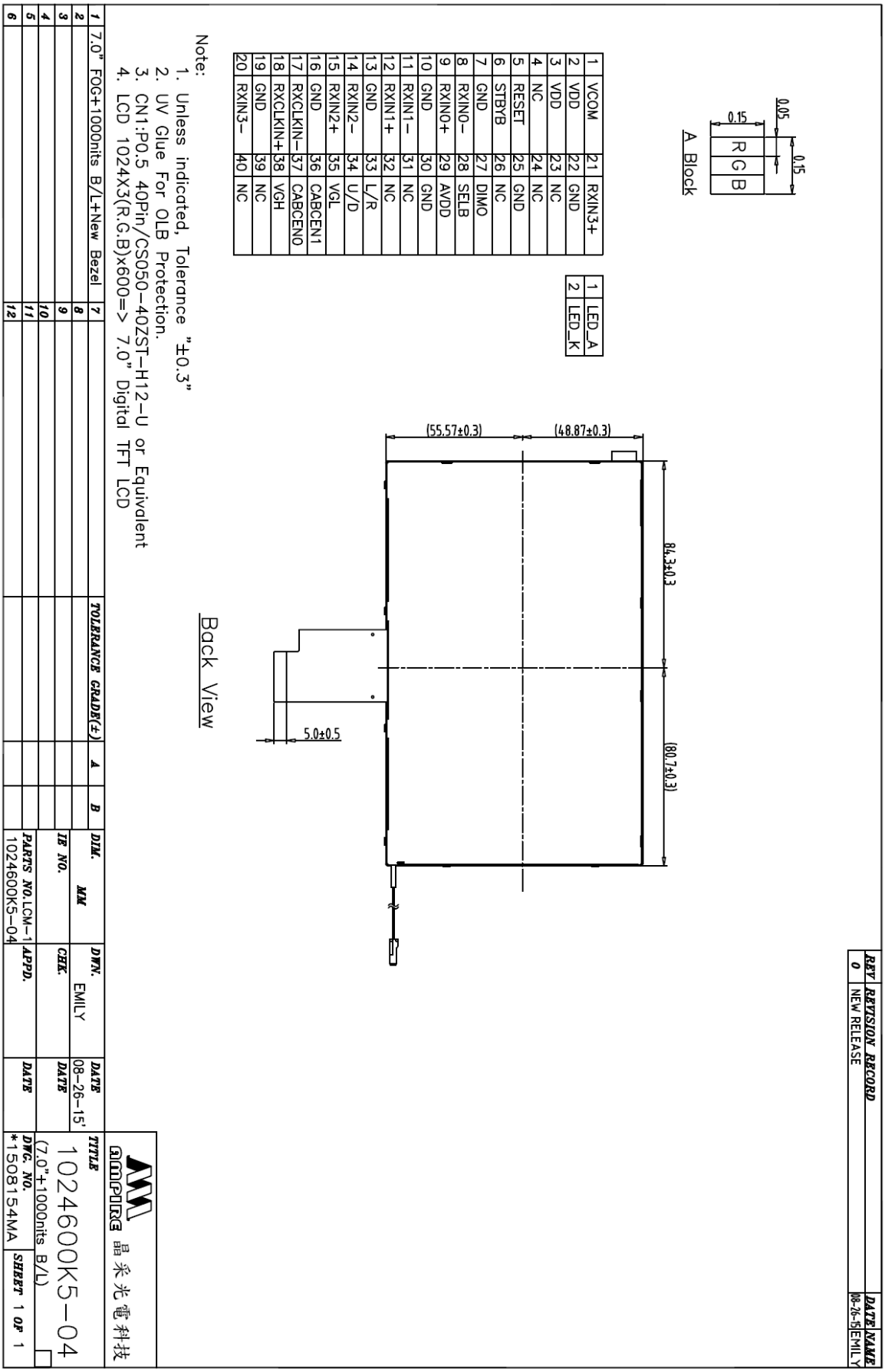
1. AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.

10. OUTLINE DIMENSION



1	VCOM	21	RXIN3+
2	VDD	22	GND
3	VDD	23	NC
4	NC	24	NC
5	RESET	25	GND
6	STBYB	26	NC
7	GND	27	DIMO
8	RXINO−	28	SELB
9	RXINO+	29	AVDD
10	GND	30	GND
11	RXIN1−	31	NC
12	RXIN1+	32	NC
13	GND	33	L/R
14	RXIN2−	34	U/D
15	RXIN2+	35	VGL
16	GND	36	CABCEN1
17	RXCLKIN−	37	CABCEN0
18	RXCLKIN+	38	VGH
19	GND	39	NC
20	RXIN3−	40	NC

1	LED_A
2	LED_K



1	VCOM	21	RXIN3+
2	VDD	22	GND
3	VDD	23	NC
4	NC	24	NC
5	RESET	25	GND
6	STBYB	26	NC
7	GND	27	DIMO
8	RXIN0−	28	SELB
9	RXIN0+	29	AVDD
10	GND	30	GND
11	RXIN1−	31	NC
12	RXIN1+	32	NC
13	GND	33	L/R
14	RXIN2−	34	U/D
15	RXIN2+	35	VGL
16	GND	36	CABCEN1
17	RXCLKIN−	37	CABCEN0
18	RXCLKIN+	38	VGH
19	GND	39	NC
20	RXIN3−	40	NC

1	LED_A
2	LED_K