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-480272H3TZQW-T01H**
APPROVED BY	
DATE	

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

AMPIRE CO., LTD.
Building A., 4F., No.116, Sec. 1, Sintai 5th Rd., Xizhi Dist,
New Taipei City 221, 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

RECORD OF REVISION

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2012/10/3	--	New Release	Leo

1. FEATURES

(1) Construction: a-Si TFT-LCD with driving system, White LED Backlight and Touch Panel.

(2) LCD type : Transmissive , Normally White

(3) Number of the Colors : 16.7M colors (R,G,B 8 bit digital each)

(4) RGB Interface 54 pin.

(5) LCD Power Supply Voltage: 3.3V single power input.

(6) EVA for wide viewing angle, no gray inversion

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
Display size (diagonal)	4.3	inch
Resolution	480RGB (W) x 272(H)	dots
Display area	98.7 (W) x57.5 (H)	mm
Pixel pitch	0.198 (W) x 0.198 (H)	mm
Overall dimension	105.5(W) x 67.2(H) x 4.96(D)	mm
Color configuration	R.G.B Vertical stripe	

3. ABSOLUTE MAXIMUM RATINGS

item	Symbol	Values		Unit	Remark
		Min	Max		
Power Supply for logic	VCC	-0.3	5.0	V	GND=0
Operation Temperature (Ambient)	T_{OP}	-20	70	℃	
Storage Temperature (Ambient)	T_{ST}	-30	80	℃	Note 1
LED Forward current	I_f		20	mA	OneLED/Note2
LED Power Dissipation	P_d		64	mW	One LED

*TFT LCD Ratings

Note 1: Hsync, Vsync, DEN, DCLK, R0~R7, G0~G7, B0~B7

Note 2: Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

4. OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Response Time		$T_r + T_f$	$\Theta=\Phi=0°$	-	40		ms	(3)
Contrast ratio		CR		-	250	-	-	(1)
Viewing Angle	Front	θf	$CR \geqq 10$	75	85	-	Deg.	(4)
	Back	θb		75	85	-		
	Left	θl		75	85	-		
	Right	θr		75	85	-		
Luminance		L	$\Theta=\Phi=0°$	-	280	-	cd/m²	(2)
Color chromaticity	White	Wx			0.301			(2)(3)
		Wy			0.339			
Life time		-	25℃		20K		Hour	(5)

NOTE :

Measure Condition:I_L= 20.0mA

Measure Item Definition as follow：

(1)Definition of Contrast Ratio：(Measured by BM-7 (TOPCON) [dark room])

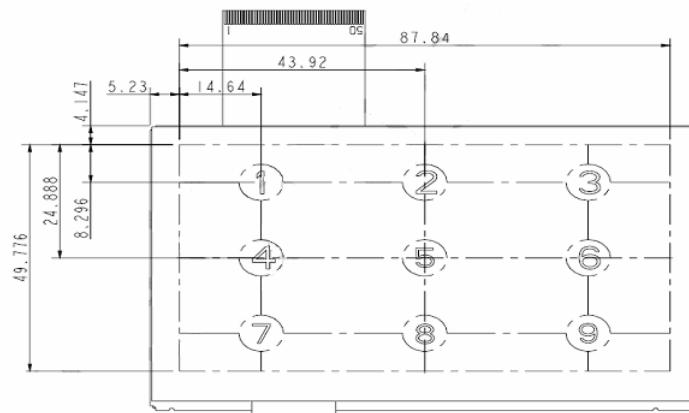Contrast Ratio (CR)= (White) Luminance of ON ÷ (Black) Luminance of OFF

Fig.9-1: Test Point Position

(2) Definition of Center Luminance &Luminance Uniformity：(Measured by BM-7 (TOPCON) [dark room])

Center Luminance：Measure luminance on Point No.5 as figure 9-1.

Luminance Uniformity：Measure maximum luminance (L (MAX))and minimum Luminance (L (MIN)) on the **9** points as figure 9-1.

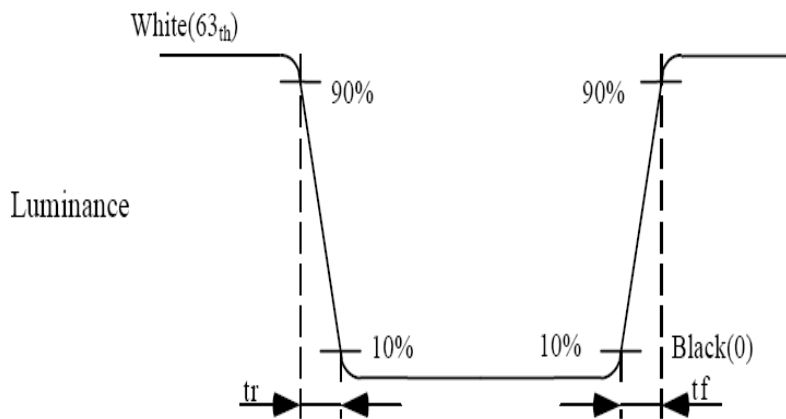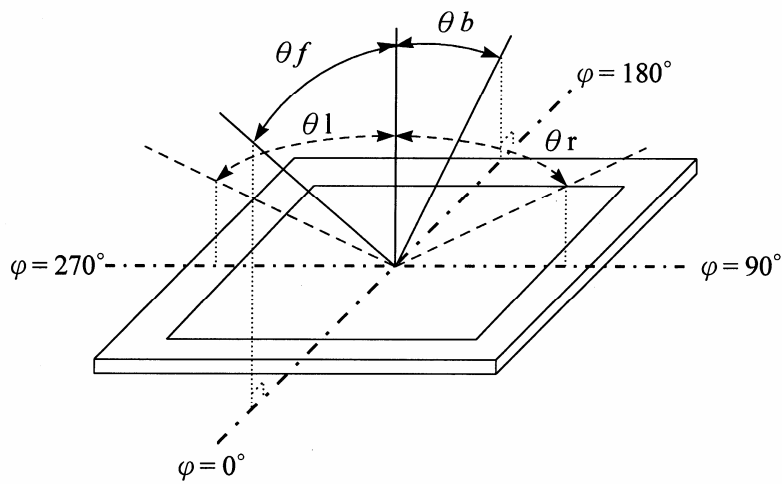L = [L(MIN)/L(MAX)]×100%△

(3) Response Time (White - Black)

Fig.9-2: Definition of Response Time (White - Black)

(4)Definition of Viewing Angle () : (by EZ-CONTRAST (ELDIM) in the dark room.)

(5) Condition: Ta=25℃, continuous lighting

    Life time is estimated data.

    Definitions of failure:
      1. LCM brightness becomes half of the minimum value.
      2. LED doesn't light normally.

5. ELECTRICAL CHARACTERISTICS

LCD driving

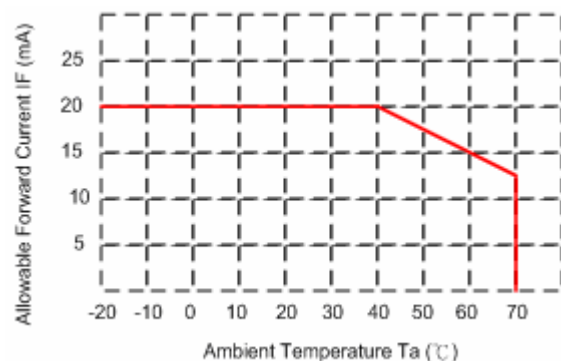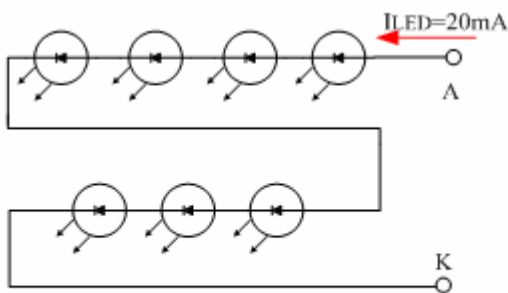| Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power supply voltage		VCC	3.0	3.3	3.6	V	
Input voltage for logic	H Level	V_{IH}	0.8 VDD	--	VDD	V	(1)
	L Level	V_{IL}	0	--	0.2 VDD	V	
Power Supply current		ICC	--	45	--	mA	(2)

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

Note 2: f_V =60Hz, Ta=25℃, Display pattern: All Black

LED back light specification

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Forward voltage	V_f	I_f =18mA		23.1		V
Forward current	I_f	7-chip serial	-	18	20	mA
Uniformity (with L/G)	-	I_f=18mA	75%*1	-	-	
Luminous color	White					
Chip connection	7 chip serial connection					

■ The constant current source is needed for white LED back-light driving. When LCM is operated over 60℃ ambient temperature, the I_{LED} of the LED back-light should be adjusted to 15mA max.

6. Touch Screen Panel Specifications

6.1. Electronic characteristics

Item	Min.	Typ.	Max.	Unit	Note
Terminal Resistance	500		1400	Ω	X(Film side)
	100		700	Ω	Y(Glass side)
Insulation resistance	20			MΩ	DC25V
Linearity			1.5	%	
Rated Voltage			7	V	DC
Transparency		80		%	Non-glare

Note:
Do not operate it with a thing except a polyacetal pen(tip R0.8mm or less) or a finger especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

6.2. Mechanical & Reliability Characteristics

| Item	Min.	Typ.	Max.	Unit	Note
Activation force			250	G	(1)
Durability-surface scratching	Write 100,000			Characters	(2)
Durability-surface pitting	1,000,000			Touches	(3)
Surface hardness	3			H	JIS K5600

Note:
1. Stylus pen Input: R0.8mm polyacetal pen or Finger
2. Measurement for Surface area
   -1,000,000 times or over
   -Writing with R0.8mm plastic stylus pen; writing force 250g in active area.
   -Speed is 60mm/sec
3. 1,000,000 times or over (No damage on film surface)

6.3. Interface

| No.	Symbol	Function
1	XR	Touch Panel Right Signal in X Axis
2	YD	Touch Panel Bottom Signal in Y Axis
3	XL	Touch Panel Left Signal in X Axis
4	YU	Touch Panel Top Signal in Y Axis

7. BLOCK DIAGRAM
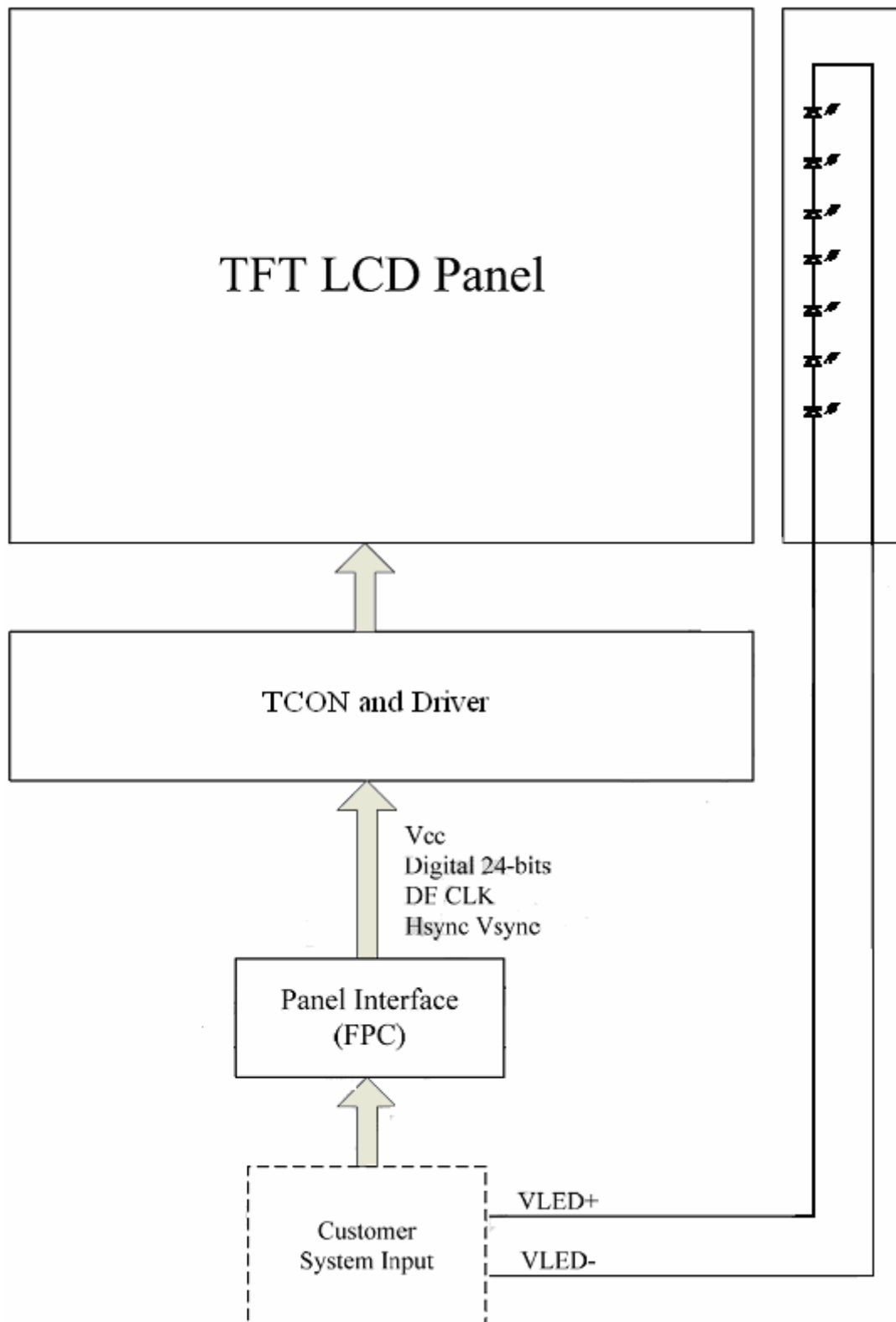
8. TFT LCD Panel FPC Descriptions

Pin no	Symbol	Function
1	VBL-	LED backlight Cathode
2	VBL-	LED backlight Cathode
3	VBL+	LED backlight Anode
4	VBL+	LED backlight Anode
5	GND	Ground
6	DISP	Display ON/OFF DISP=L, standby mode (display OFF). DISP=H, normal display mode (display ON).
7	GND	Ground
8	YD	Touch Panel Bottom Signal in Y Axis
9	XR	Touch Panel Right Signal in X Axis
10	YU	Touch Panel Top Signal in Y Axis
11	XL	Touch Panel Left Signal in X Axis
12	B0	Blue Data Bit 0
13	B1	Blue Data Bit 1
14	B2	Blue Data Bit 2
15	B3	Blue Data Bit 3
16	B4	Blue Data Bit 4
17	B5	Blue Data Bit 5
18	B6	Blue Data Bit 6
19	B7	Blue Data Bit 7
20	G0	Green Data Bit 0
21	G1	Green Data Bit 1
22	G2	Green Data Bit 2
23	G3	Green Data Bit 3
24	G4	Green Data Bit 4
25	G5	Green Data Bit 5
26	G6	Green Data Bit 6
27	G7	Green Data Bit 7
28	R0	Red Data Bit 0
29	R1	Red Data Bit 1
30	R2	Red Data Bit 2
31	R3	Red Data Bit 3
32	R4	Red Data Bit 4
33	R5	Red Data Bit 5
34	R6	Red Data Bit 6

35	R7	Red Data Bit 7
36	HSYNC	Horizontal Sync Input
37	VSYNC	Vertical Sync Input
38	DCLK	Dot Data Clock
39	NC	NC
40	NC	NC
41	VCC	Power Supply(3.3V)
42	VCC	Power Supply(3.3V)
43	GND	Ground
44	R/L	Shift direction control pin for Horizontal R/L=H, STV OUT1 OUT2・・・OUT480 R/L=L, STV OUT480 OUT479・・・OUT1
45	NC	NC
46	U/D	Shift direction control pin for Vertical U/D=H, STV OUT1 OUT2・・・OUT272 U/D=L, STV OUT272 OUT271・・・OUT1
47	NC	NC
48	GND	Ground
49	GND	Ground
50	GND	Ground
51	NC	NC
52	ENB	Data Enable
53	GND	Ground
54	GND	Ground

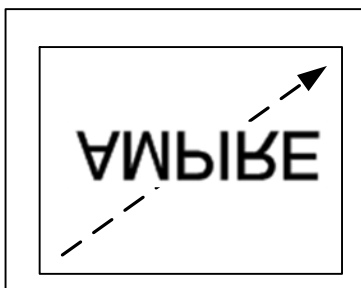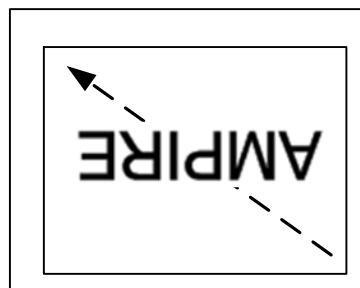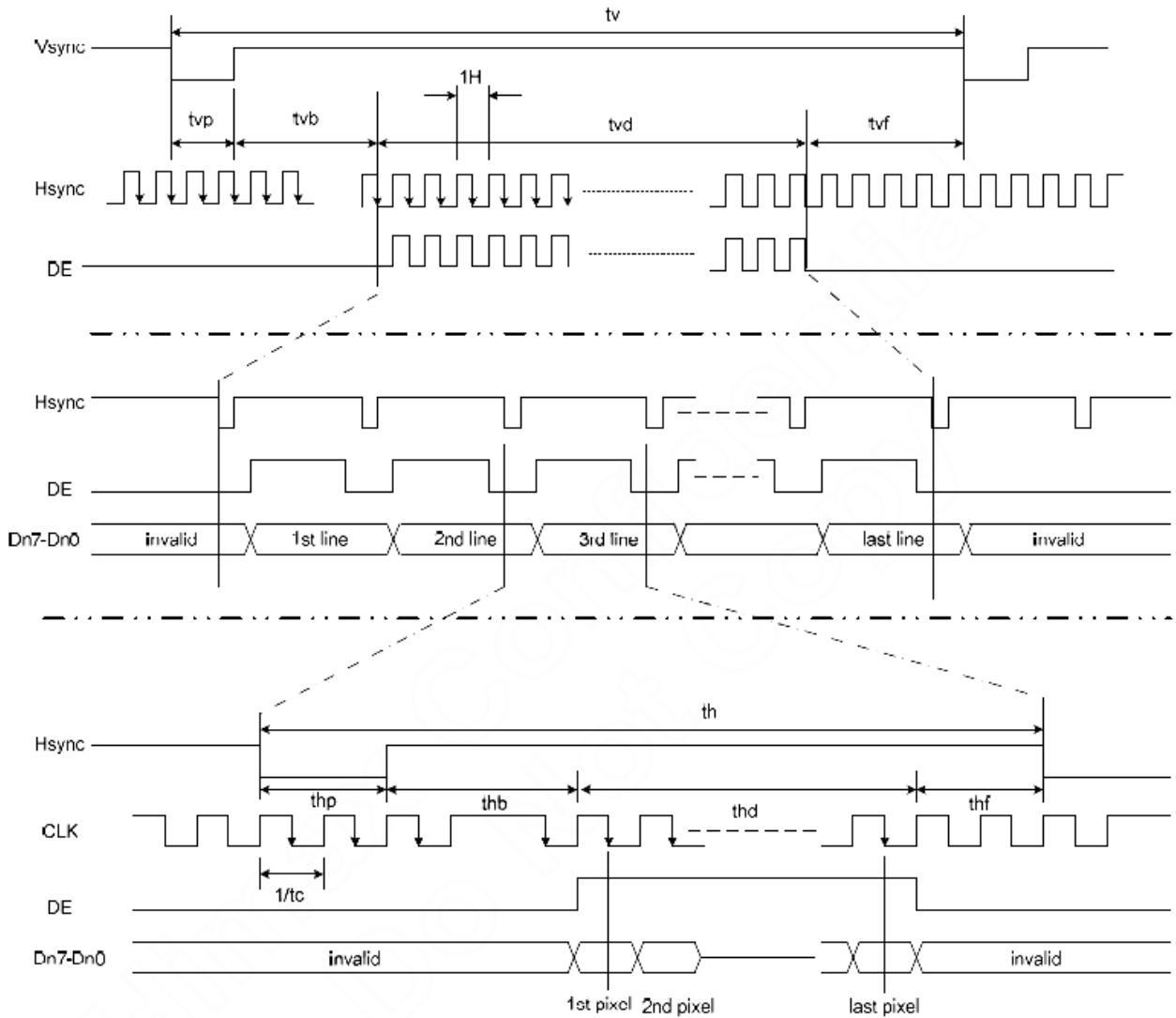| Setting of scan control input		Scanning direction
UD	**R/L**	
GND	GND	Down to Up, Right to Left
VCC	VCC	Up to Down, Left to Right
GND	VCC	Down to Up, Left to Right
VCC	GND	Up to Down, Right to Left

UD : H, LR : H
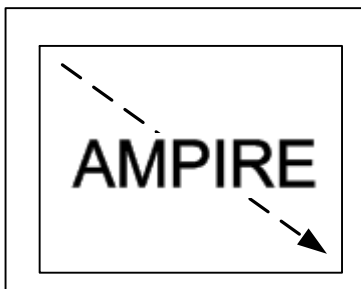
UD : H, LR : L
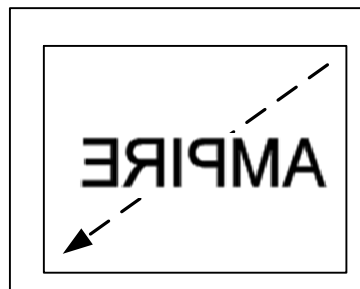
UD : L, LR : H

UD : L, LR : L

9.   INPUT SIGNAL

9.1 Parallel RGB input timing Chart

9.2 Timing Specification

Parallel RGB input timing requirement

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
Clock cycle	$1/t_{c}$ [*1]		9	15	MHz
Hsync cycle	$1/f_{H}$		17.14	-	KHz
Vsync cycle	$1/f_{v}$		59.94	-	Hz
Horizontal Signal					
Horizontal cycle	th [*2]	575	575	605	CLK
Horizontal display period	thd	480	480	480	CLK
Horizontal front porch	thf	2	2	82	CLK
Horizontal pulse width	thp	2	41	41	CLK
Horizontal back porch	thb	2	2	41	CLK
Vertical Signal					
Vertical cycle	tv	285-	286	511	H
Vertical display period	tvd	272	272	272	H
Vertical front porch	tvf	1	2	227	H
Vertical pulse width	tvp	1	10	11	H
Vertical back porch	tvb	1	2	11	H

Note:
1. Unit: CLK=1/ fCLK , H=th
2. Parallel interface. Clock frequency and horizontal signal parameters are tripled in serial interface. The Maximum clock frequency of serial interface is 33MHz
3. thd=480CLK, thf=2CLK, thp=41CLK, thb=2CLK, thf + fhp + ftb > 44

9.3 Timing Chart 2

Input setup timing requirement

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
DISP setup time	t_{diss}	10	-	-	ns
DISP hold time	t_{dish}	10	-		ns
Clock period	PW_{CLK} [*1]	66.7	-	-	ns
Clock pulse high period	PWH [*1]	26.7	-	-	ns
Clock pulse low period	PWL [*1]	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	ns
Hsync hold time	t_{hh}	10	-		ns
Data setup time	t_{ds}	10	-	-	ns
Data hold time	t_{dh}	10	-		ns
DE setup time	t_{des}	10	-	-	ns
DE hold time	t_{deh}	10	-	-	ns
Vsync setup time	t_{vhs}	10	-	-	ns
Vsync hold time	t_{vhh}	10	-	-	ns

Note
1. For parallel interface, maximum clock frequency is 15MHz.
2. tr, tf is defined 10% to 90% of signal amplitude.

9.4 Input setup timing Chart

10. Color Data Assignment

COLOR	INPUT DATA	R7 MSB	R6	R5	R4	R3	R2	R1	R0 LSB	G7 MSB	G6	G5	G4	G3	G2	G1	G0 LSB	B7 MSB	B6	B5	B4	B3	B2	B1	B0 LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
RED	RED(0)	0	0	0	0	0	0	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	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(0)	0	0	0	0	0	0	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	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(0)	0	0	0	0	0	0	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	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	0	0	0	0	0	0	1	0
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

11. Reliability Test Items

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
Storage at High Temperature and Humidity	60°C, 90% RH , 240 hrs	1,2
Thermal Shock Test	-20°C (30min) ~ 70°C (30min) 100 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).

12. USE PRECAUTIONS

12.1 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 benzene 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.

12.2 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. 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.

12.3 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.
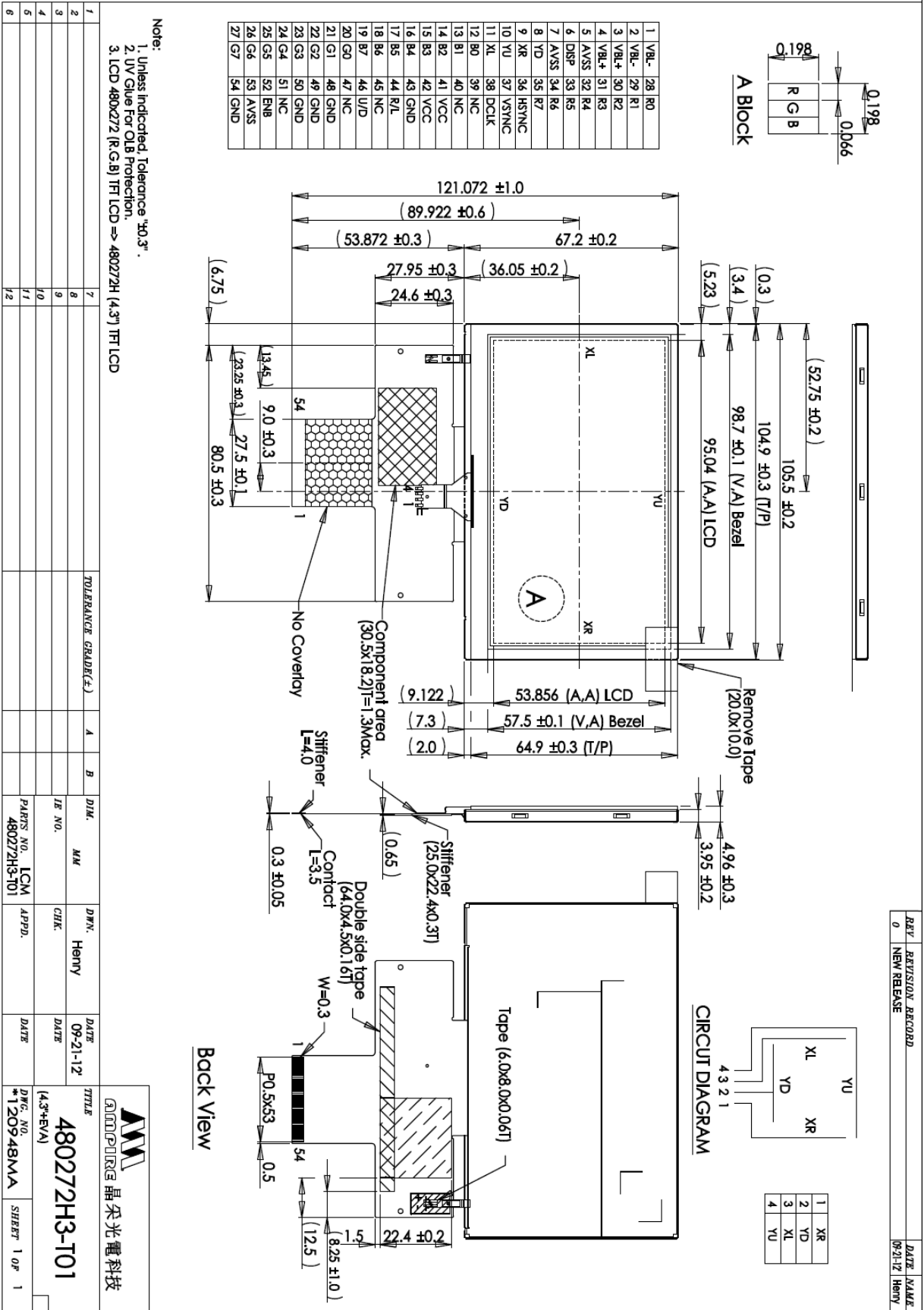3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

12.4　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 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.

12.5　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) 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.

13 OUTLINE DIMENSION