



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-1024600H1TMQW-50H
APPROVED BY	
DATE	

☐ Approved For Specifications

☐ Approved For Specifications & Sample

AMPIRE CO., LTD.

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2019/07/31	-	New Release	Tank

1. GENERAL DESCRIPTION

1.1 Introduction

This is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back light system. This TFT LCD has a 10.1 (16:9) inch diagonally measured active display area with WVGA (1024 horizontal by 600 vertical pixel) resolution.

1.2 Features

- 10.1" (16:9 diagonal) Inch configuration.
- 16.2M color by 6 bit +Hi-FRC input

1.3 General information

Item	Specifications	unit
Outline Dimension	235.0 x 143.0 x 5.3(typ)	mm
Display area	222.72(H) x 125.28(V)	mm
Number of Pixel	1024 RGB (H) x 600(V)	Pixels
Pixel pitch	0.2175(H) x 0.2088(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display mode	Normally white	
Surface treatment	Antiglare,	
Back-light	White LED	

1.4 Mechanical information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	234.7	235.0	235.3	mm
	Vertical (V)	142.7	143.0	143.3	mm
	Depth (D)	--	4.5	4.8	mm

2. ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	V_{DD}	-0.3	5.0	V	
	V_{GH}	-0.3	30.0	V	
	V_{GL}	-20.0	0.3	V	
	AV_{DD}	6.5	13.5	V	
	V_I	-0.3	$V_{DD} + 0.3$	V	
Logic Signal Input Level	V_{DD}	-0.3	5.0	V	

2.1.2 Backlight unit

Item	Symbol	Typ.	Max.	Unit	Note
LED current	I_L	140	-	mA	(1)(2)(3)
LED voltage	V_L	19.2	20.4	V	(1)(2)(3)
LED reverse voltage	V_R	--	5	V	
LED forward current	I_F		20	mA	

Note:

- (1) Permanent damage may occur to the LCD module if beyond this specification.
Functional operation should be restricted to the conditions described under normal operating conditions.
- (2) $T_a = 25 \pm 2^\circ\text{C}$
- (3) Test Condition: LED current 140 mA. The LED lifetime could be decreased if operating I_L is larger than 140mA.

2.2 Environment Absolute Rating

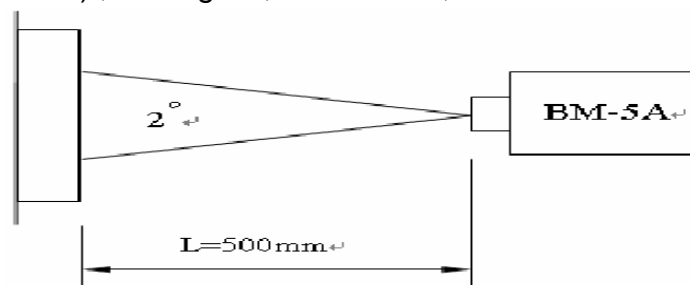
Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-20	70	$^\circ\text{C}$	
Storage Temperature	T_{st}	-30	80	$^\circ\text{C}$	

3. OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast ratio		CR	Point - 5 $\Theta = \Phi = 0^\circ$	400	500	--	--	(1)(2)(3)
Luminance		L _w		400	500	-	cd/m ²	(1)(3)
Luminance Uniformity		ΔL		70	80	-	%	(1)(3)
Response Time (White – Black)		T _r + T _f		--	16	32	ms	(1)(3)(5)
Viewing Angle	Vertical	Θ	CR \geq 10 Point – 5	120	150	-	Deg.	(1)(2)(4)
	Horizontal	Φ		130	160	-		
Color chromaticity	Red	R _x	Point - 5 $\Theta = \Phi = 0^\circ$	0.555	0.605	0.655	--	(1)(3)
		R _y		0.277	0.327	0.377		
	Green	G _x		0.236	0.286	0.336		
		G _y		0.476	0.526	0.576		
	Blue	B _x		0.100	0.150	0.200		
		B _y		0.095	0.145	0.195		
	White	W _x		0.263	0.313	0.363		
		W _y		0.279	0.329	0.379		

NOTE :

- (1) Measure conditions : 25°C \pm 2°C , 60 \pm 10%RH under 10Lux , in the dark room by BM-7TOPCON) ,viewing 2° , VCC=3.3V , VDD=3.3V



- (2) Definition of Contrast Ratio :

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

- (3) Definition of Luminance :

Definition of Luminance Uniformity

Measure white luminance on the point 5 as figure9-1

Measure white luminance on the point 1 ~ 9 as figure9-1

$$\Delta L = [L(\text{MIN}) / L(\text{MAX})] \times 100\%$$

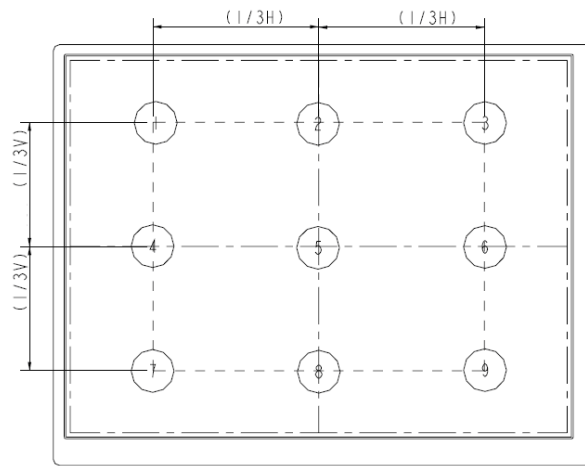


Fig9-1 Measuring point

(4) Definition of Viewing Angle(Θ, Φ), refer to Fig9-2 as below :

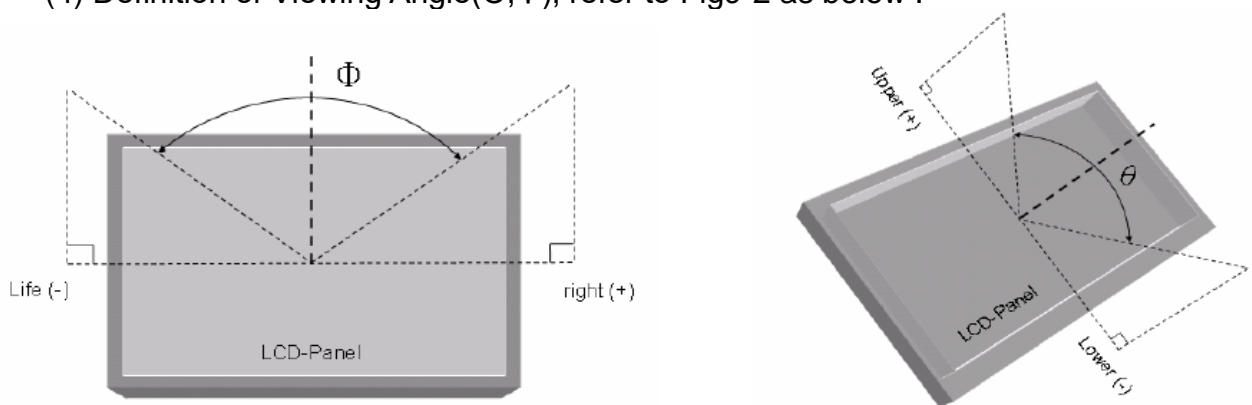


Fig9-2 Definition of Viewing Angle

(5) Definition of Response Time.(White – Black)

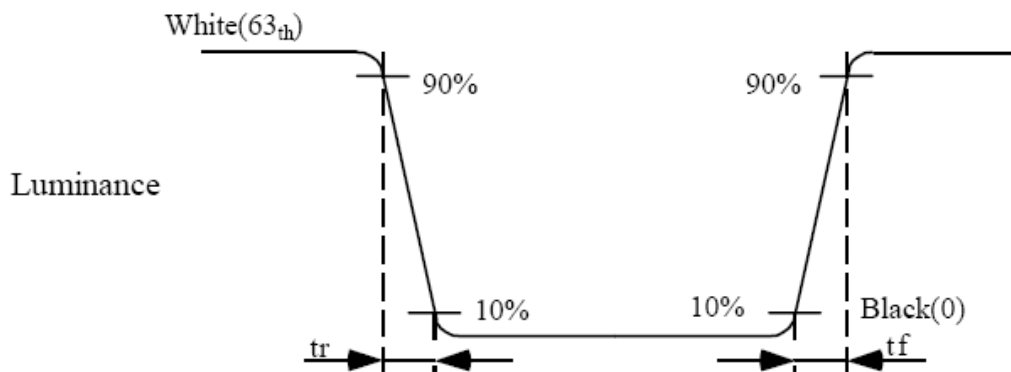


Fig9-3 Definition of Response Time(White-Black)

(6) End of Life shall be determined by the time when any of the following is satisfied under continuous lighting at 25°C

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

4. Pin Definition

4.1 TFT Module

FPC connector is used for electronics interface.

The recommended model is 089K60-000100-G2-R (STARCONN).

Pin No.	Signal	Description	Note
1	GND	Ground	
2	AVDD	Power for Analog Circuit	
3	VDD	Power Voltage for digital circuit	
4	GND	Ground	
5	VCOM	Common Voltage	
6	VDD	Power Voltage for digital circuit	
7	GND	Ground	
8	V14	Gamma correction voltage reference	
9	V13	Gamma correction voltage reference	
10	V12	Gamma correction voltage reference	
11	V11	Gamma correction voltage reference	
12	V10	Gamma correction voltage reference	
13	V9	Gamma correction voltage reference	
14	V8	Gamma correction voltage reference	
15	GND	Ground	
16	VDD	Power Voltage for digital circuit	
17	GND	Ground	
18	RXIN3+	+ LVDS differential data input	
19	RXIN3-	- LVDS differential data input	
20	GND	Ground	
21	RXCLKIN+	+ LVDS differential clock input	
22	RXCLKIN-	- LVDS differential clock input	
23	GND	Ground	
24	RXIN2+	+ LVDS differential data input	
25	RXIN2-	- LVDS differential data input	
26	GND	Ground	
27	RXIN1+	+ LVDS differential data input	
28	RXIN1-	- LVDS differential data input	
29	GND	Ground	
30	RXIN0+	+ LVDS differential data input	
31	RXIN0-	- LVDS differential data input	
32	GND	Ground	
33	GND	Ground	

34	Reset	Global reset pin.Active low to enter reset state. Suggest to connecting with RC reset circuit for stability. Normally pull high.(R=10KΩ · C=0.1uF)	Note1
35	STBYB	Standby mode, Normally pulled high STBYB = "1", normal operation STBYB = "0", timing controller, source driver will turn off, all output are High-Z	
36	SHLR	Left or right display control	Note2
37	VDD	Power Voltage for digital circuit	
38	UPDN	Up/down display control	Note2
39	GND	Ground	
40	AVDD	Power for Analog Circuit	
41	VCOM	Common Voltage	
42	DITH	Dithering function enable control.Normally pull low. DITHER = "1" , LVDS input data is 8 bits DITHER = "0" , LVDS input data is 6 bits	Note3
43	GND	Ground	
44	VDD	Power Voltage for digital circuit	
45	GND	Ground	
46	V7	Gamma correction voltage reference	
47	V6	Gamma correction voltage reference	
48	V5	Gamma correction voltage reference	
49	V4	Gamma correction voltage reference	
50	V3	Gamma correction voltage reference	
51	V2	Gamma correction voltage reference	
52	V1	Gamma correction voltage reference	
53	GND	Ground	
54	VDD	Power Voltage for digital circuit	
55	SELB	6bit/8bit mode select SELB = "0" , LVDS input data is 8 bits SELB = "1" , LVDS input data is 6 bits	Note3
56	VGH	Gate ON Voltage	
57	VDD	Power Voltage for gate digital circuit	
58	VGL	Gate OFF Voltage	
59	GND	Ground	
60	GND	Please connect to GND (Bist function reserved for HSD test)	

Note1 :

Global reset pin: Active low to enter reset mode. Suggest connecting with an RC reset circuit for stability. Normally pull high. (R=10K_Ω, C=0.1μF)

Note: If RC is not added, users must follow the rule, T2 > 15ms on page 18 item 6.5 power on/off sequence.

Note2 :

When L/R="0", set right to left scan direction.

When L/R="1", set left to right scan direction.

When U/D="0", set top to bottom scan direction.

When U/D="1", set bottom to top scan direction.

Note3 :

If LVDS input data is 6 bits, SELB must be set to High; DITH must be set to Low. (262K Colors)

If LVDS input data is 8 bits, SELB must be set to Low; DITH must be set to High.
(16.2M Colors)

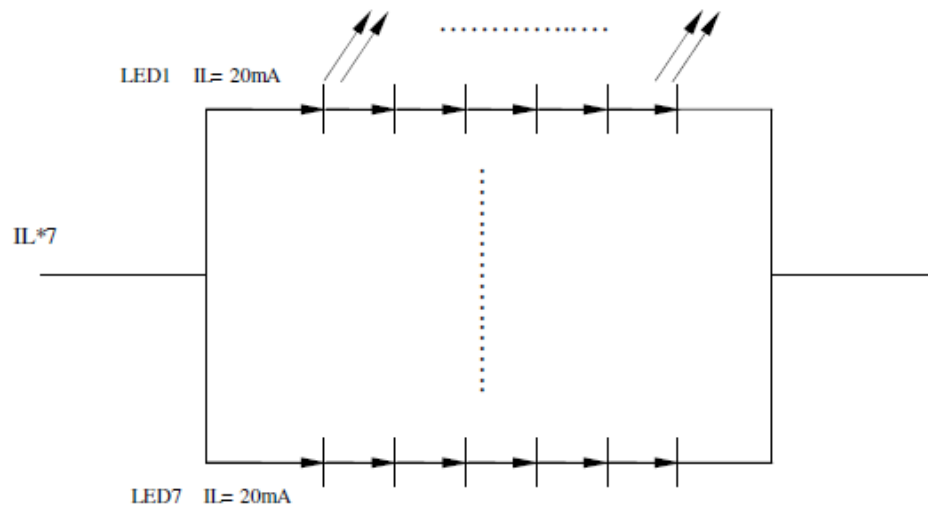
5 Back-Light Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Current	I_F	--	140	--	mA	Ta=25
LED Voltage	V_F	17.7	19.2	20.4	Volt	
LED Life-Time	N/A	20,000	30,000	--	Hour	Ta=25 $I_F=20\text{mA}$ Note (2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=140mA. The LED lifetime could be decreased if operating IL is larger than 140mA. The constant current driving method is suggested.

Note (3) LED Light Bar Circuit



6 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VDD	3.0	3.3	3.6	V	
	VGH	14.55	15.0	15.45	V	
	VGL	-7.35	-7	--6.65	V	
	AVDD	9.8	10	10.2	V	
VCOM	VCOMin	3.7	4	4.3	V	Note (1)
Input signal voltage	ViH	0.7 VDD	-	VDD	V	Note (2)
	ViL	0	-	0.3 VDD	V	
Input GAMMA voltage	V1		9.720		V	Note (3)
	V2		9.424		V	
	V3		7.747		V	
	V4		7.317		V	
	V5		6.957		V	
	V6		6.442		V	
	V7		5.646		V	
	V8		4.6659		V	
	V9		3.9627		V	
	V10		3.1560		V	
	V11		2.6740		V	
	V12		2.1612		V	
	V13		0.5672		V	
	V14		0.2795		V	
Current of power supply	IDD	-	22	-	mA	VDD =3.3V
	IADD	-	26	-	mA	AVDD=10V
	IGH	-	0.36	-	mA	VGH=15V
	IGL	-	0.85	-	mA	VGL=-7V
	Ivcom	-	0.001	--	mA	Vcom= 4 V

Note (1): Please adjust VCOM to make the flicker level minimum.

Note (2) : DITH、SELB、SHLR、UPDN

Note (3): The voltage of there pins must be:

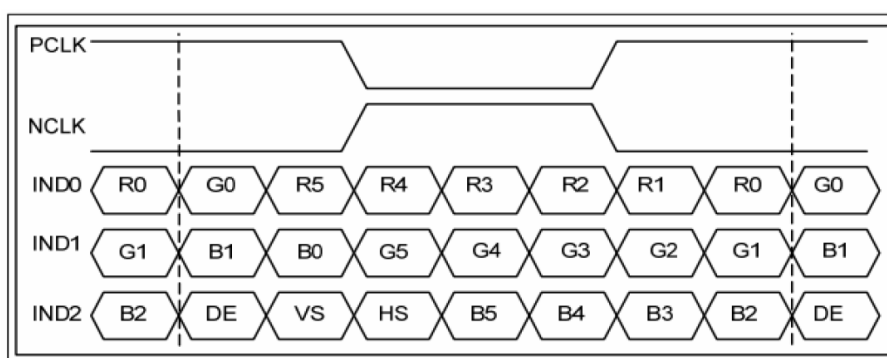
AGND+.0.2<V14<V13<V12<V11<V10<V9<V8<V7<V6<V5<V4<V3<V2<V1<AVDD-0.2

6.2 Switching Characteristics for LVDS Receiver

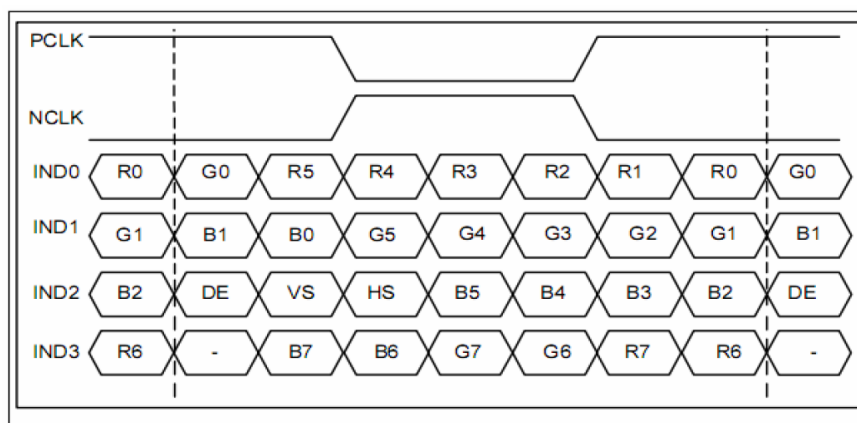
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	V _{th}	—	—	100	mV	V _{CM} =1.2V
Differential Input Low Threshold	V _{tl}	-100	—	—	mV	
Input Current Differential input Voltage	I _{IN}	-10	—	+10	uA	
	V _{ID}	0.1	—	0.6	V	
Common Mode Voltage Offset	V _{CM}	0.7	1.2	1.6	V	

6.3 Bit LVDS input

6.3.1 6bit LVDS input



6.3.2 8Bit LVDS input

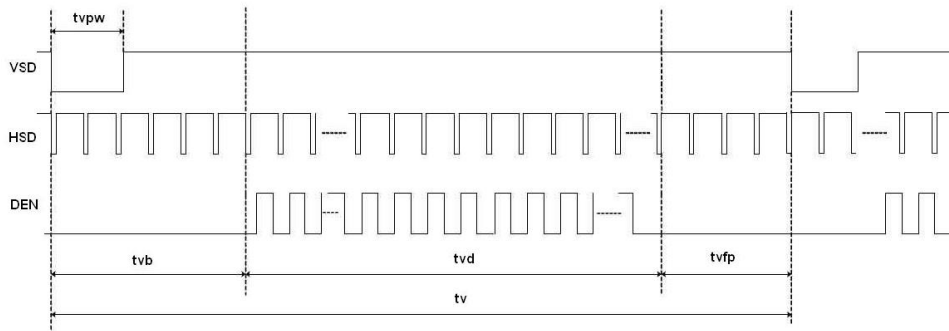


6.4 Interface Timing (DE mode)

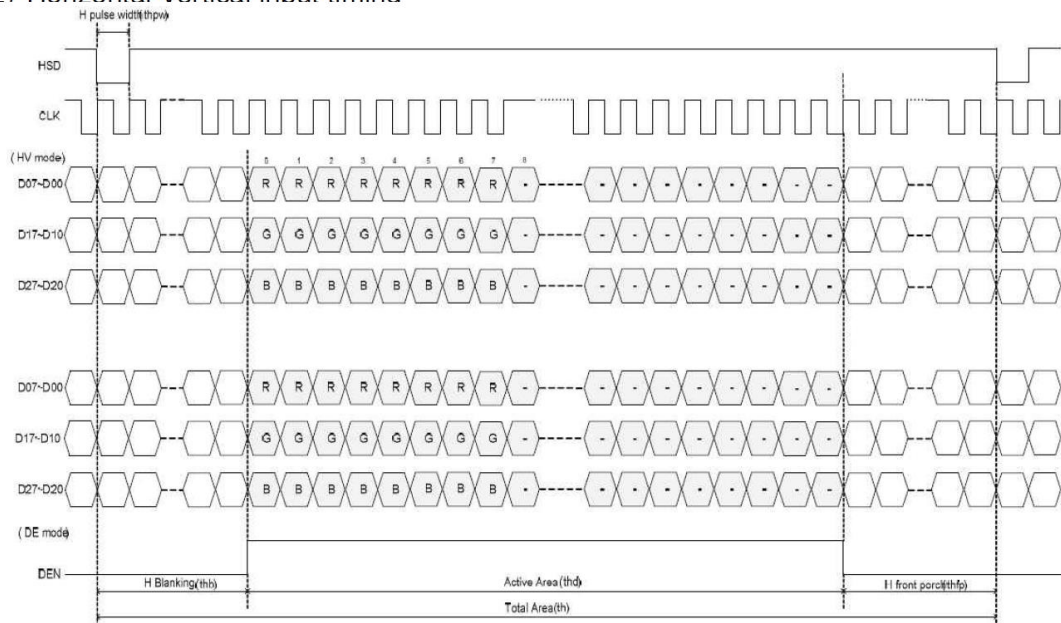
Item	Symbol	Min.	Typ.	Max.	Unit
Frame Rate	--	55	60	65	Hz
Frame Period	t1	610	635	800	line
Vertical Display Time	t2	600	600	600	line
Vertical Blanking Time	t3	10	35	200	line
1 Line Scanning Time	t4	1164	1344	1400	clock
Horizontal Display Time	t5	1024	1024	1024	clock
Horizontal Blanking Time	t6	140	320	376	clock
Clock Rate	t7	42.6	51.2	72.8	MHz

Timing Diagram of Interface Signal (DE mode)

(1) Vertical input timing

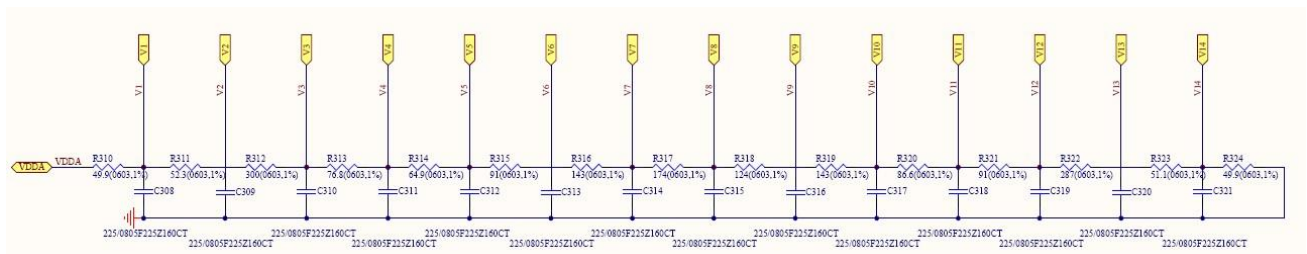


(2) Horizontal Vertical input timing



6.6 Gamma circuit

設計預估	R310	R311	R312	R313	R314	R315	R316	R317	R318	R319	R320	R321	R322	R323	R324
	VDDA	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14
電阻	49.9	52.3	300	76.8	64.9	91	143	174	124	143	86.6	91	287	51.1	49.9
電壓	10	9.720	9.427	7.746	7.316	6.952	6.442	5.641	4.666	3.971	3.170	2.684	2.174	0.566	0.280



7. 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
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).

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.

8. General Precautions

8-1 Safety

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

8-2 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.

8-3 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.

8-4 Storage

1. Store the module in a dark room where must keep at $+25\pm 10^{\circ}\text{C}$ 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.

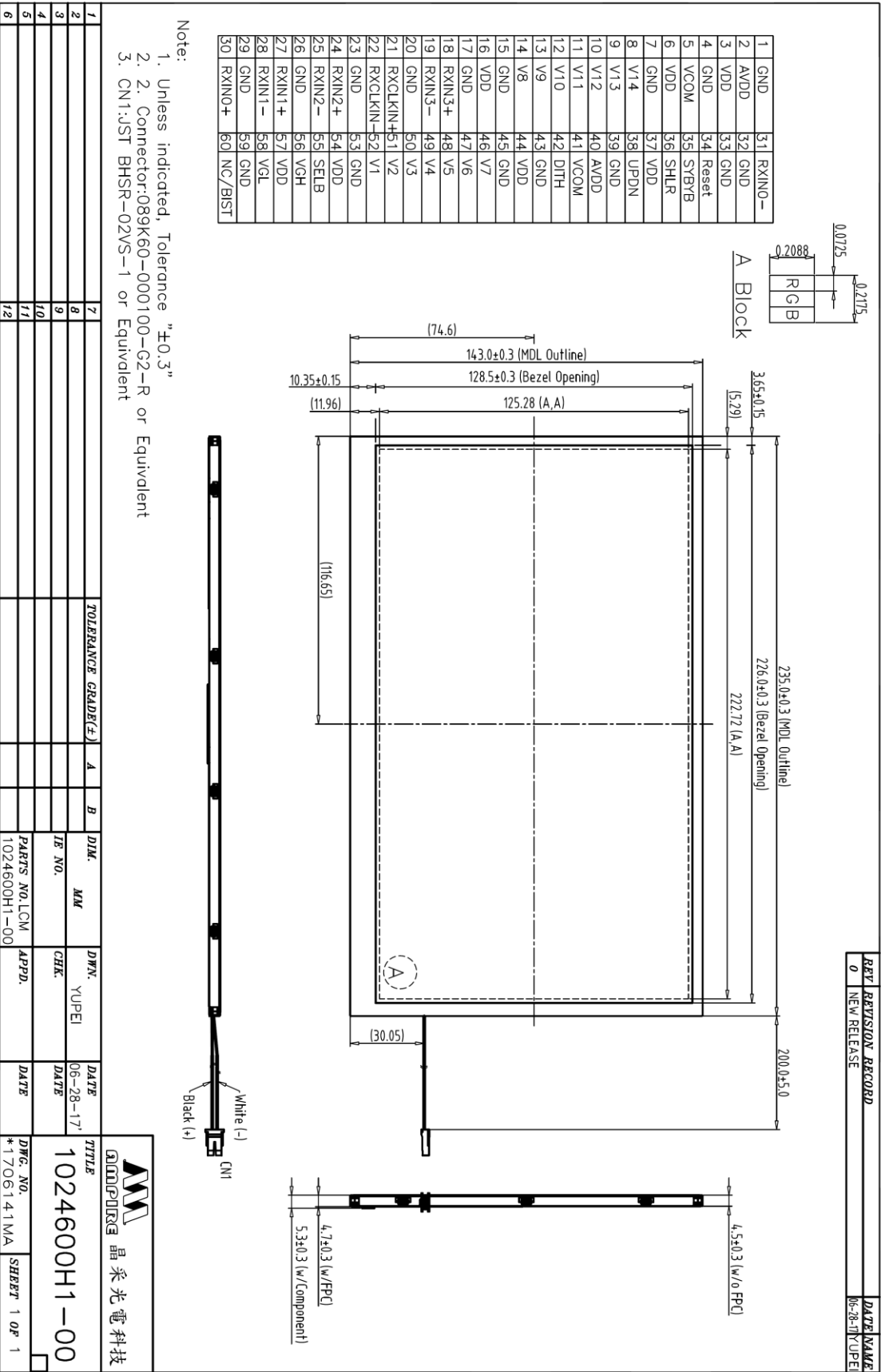
8-5 Cleaning

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

8-6 Others

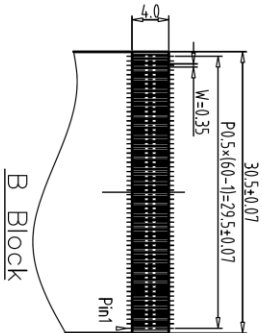
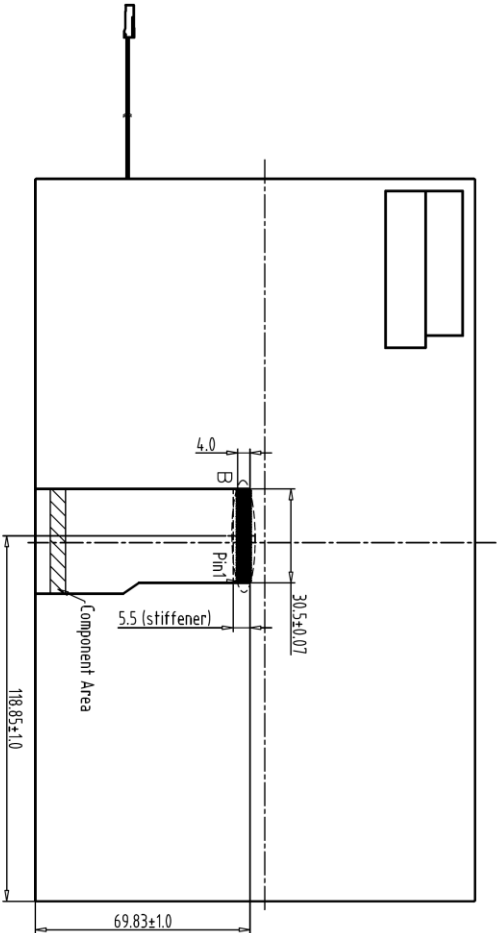
1. AMIPRE will provide one year warrantee for all products and three months warrantee for all repairing products.
2. Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver

9. OUTLINE DIMENSION



REV	REVISION RECORD	DATE	NAME
0	NEW RELEASE	06-28-17	YUPEI

1	GND	31	RXIN0-
2	AVDD	32	GND
3	VDD	33	GND
4	GND	34	Reset
5	VCOM	35	SYBYB
6	VDD	36	SHLR
7	GND	37	VDD
8	V14	38	UPDN
9	V13	39	GND
10	V12	40	AVDD
11	V11	41	VCOM
12	V10	42	DTH
13	V9	43	GND
14	V8	44	VDD
15	GND	45	GND
16	VDD	46	V7
17	GND	47	V6
18	RXIN3+	48	V5
19	RXIN3-	49	V4
20	GND	50	V3
21	RXCLKIN+51	V2	
22	RXCLKIN-52	V1	
23	GND	53	GND
24	RXIN2+	54	VDD
25	RXIN2-	55	SELB
26	GND	56	VGH
27	RXIN1+	57	VDD
28	RXIN1-	58	VGL
29	GND	59	GND
30	RXIN0+	60	NC/BIST



Back View

Note:

1. Unless indicated, Tolerance "±0.3"
2. Connector:089K60-000100-G2-R or Equivalent
3. CN1:JST BHSR-02VS-1 or Equivalent

1	2	7	7	TOLEANCE GRADE(±)	A	B	DIK.	MM	DWV.	YUPEI	DATE	DATE	TITLE	DWG. NO.	SHEET
2	3	8	9				IE NO.		CHK.		06-28-17		1024600H1-00	*1706142MA	1 OF 1
4	5	10	11				PARTS NO.	LCM-1	APPD.		DATE				
6		12					1024600H1-00								



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