晶采光電科技股份有限公司
AMPIRE CO., LTD.

/SIMPLEPLUS Touch Displays

Specifications for LCD module

Customer	
Customer part no.	
Ampire part no.	**AMA-050A04-DI2117A-G020**
Approved by	
Date	

☐ **Preliminary Specification**
☐ **Approved Specification**

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2019/03/21	--	New Release	Raymond
2019/10/01		Update OP of module	Raymond

1. Features

5 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This TFT LCD has a 5.0 (5:3) inch diagonally measured active display area with 800x480 (800 horizontal by 480 vertical pixels) resolution. This module is composed of a 5” TFT-LCD panel, backlight unit and Capacitive Touch Panel.

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

(2) LCD type : IPS

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

(4) Interface: 24 Bit TTL RGB interfaces. 45 pin.

(5) LCD Power Supply Voltage: 3.3V single power input, built-in power supply circuit.

(6) Capacitive Touch Panel

2. Physical Specifications

Item	Specifications	unit
Display size (diagonal)	5.0	inch
Resolution	800 (W) x RGB x 480 (H)	dot
Pixel pitch	0.135 (W) x 0.135 (H)	mm
Color configuration	R.G.B Vertical stripe	
Display Mode	Normally Black	

3. Absolute Maximum Ratings

3.1 Electrical Absolute max. ratings

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power voltage	VCC	GND=0	-0.3	4.0	V	
Logic Input Voltage Range	VIN	GND=0	-0.3	VCC +0.3	V	Note(1)

Note(1) HD, VD, DENA, DCLK, R0~R7, G0~G7, B0~B7.

Note(2) The following are maximum values which, if exceeded, may cause operation or damage to the unit.

3.2 Environmental Absolute Maximum Ratings

Item	Operating		Storage		Remark
	Min.	Max.	Min.	Max.	
Temperature	-30	80	-30	80	Note(2),(3) ,(4),(5),(6),(7)
Humidity	Note(1)		Note(1)		
Corrosive Gas	Not Acceptable		Not Acceptable		

Note(1) Ambient temperature Temp. <= 60℃ : 90% RH max

Note(2) For storage condition Ta at -30℃ < 240h , at 80℃ < 240h

Note(3) For operating condition Ta at -30℃ < 100h , at 80℃ < 240h

Note(4) Background color changes slightly depending on ambient temperature. This phenomenon is reversible.

Note(5) The response time will be slower at low temperature.

Note(6) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25℃

Note(7) When LCM panel is operated over 60℃ (center of the panel surface temperature), the IAK of the LED back-light should be adjusted to 150mA

Note(8) This is center of the panel surface temperature, not ambient temperature.

Note(9) At 25℃

4. Optical Characteristics

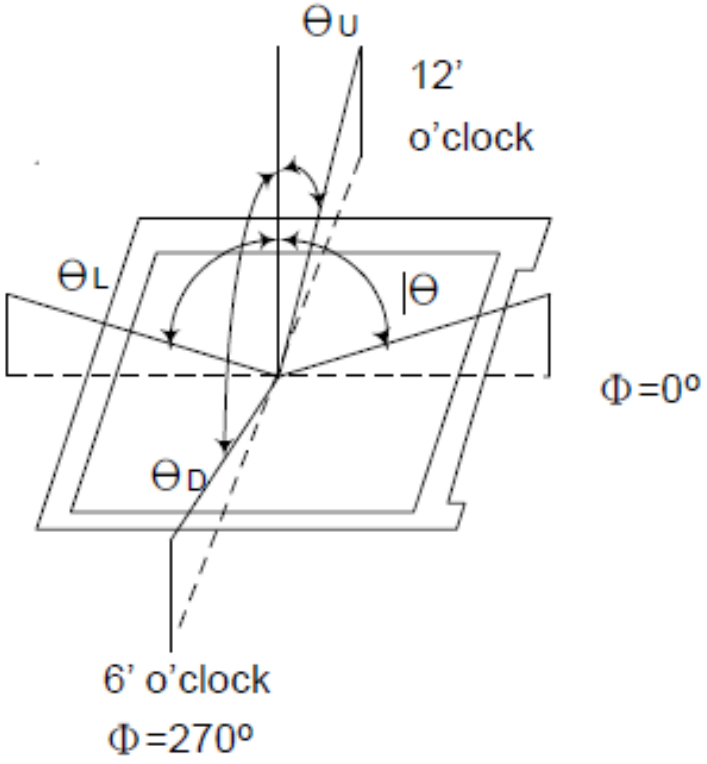
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle	Hor.	θ U	CR≧10	75	85	--	deg.	(1),(4)
		θ D		75	85	--		
	Ver.	θ L		75	85	--		
		θ R		75	85	--		
Contrast ratio		CR	Θ=Φ=0°	800	1000	--	--	(1),(2)
Response Time		$T_R + T_F$	Θ=Φ=0°	--	30	40	msec	(1),(3)
Color Gamut		(%)		45	50	--	%	
Color chromaticity	Red	Rx	Θ=Φ=0°	Typ. -0.05	TBD	Typ. +0.05	--	(1),(4),(5)
		Ry			TBD			
	Green	Gx			TBD			
		Gy			TBD			
	Blue	Bx			TBD			
		By			TBD			
	White	Wx			0.35			
		Wy			0.40			
Luminance (IAK=200mA)		L	Θ=Φ=0°	**680**	**850**	--	cd/m^2	(1),(6)
Luminance Uniformity		ΔL	Θ=Φ=0°	70	-	-	%	(7)

Measuring Condition

Ta=25°C. To be measured on the center area of panel after 10 minutes operation. LED Back-light IAK=200mA.

- Measuring surrounding：Dark room
- Ambient temperature：25±2℃
- 15min. Warm-up time.

Note(1) Definition of Viewing Angle

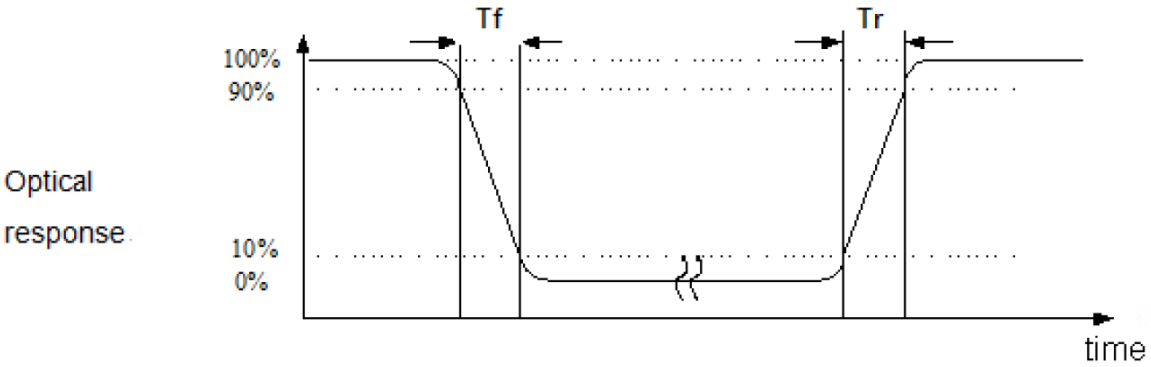


Note(2) Definition of Contrast Ratio (CR) :

Contrast ratio is calculated with the following formula.

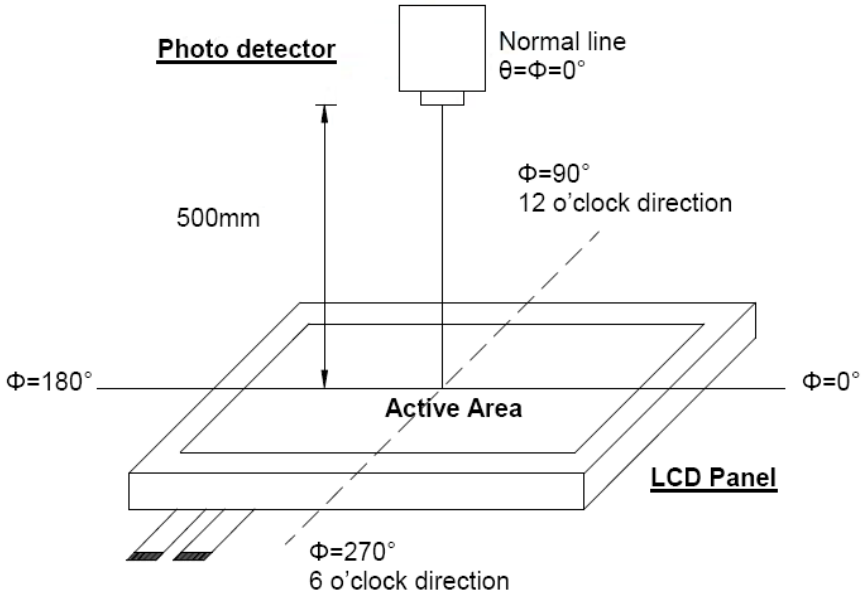
$$\text{Contrast Ratio(CR)} = \frac{Photo\ detector\ output\ \ when\ LCD\ is\ at\ \text{"White"}\ state}{Photo\ detector\ output\ \ when\ LCD\ is\ at\ \text{"Black"}\ state}$$

Note(3) Definition of Response Time : Sum of TR and TF



Note(4) Definition of optical 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.)

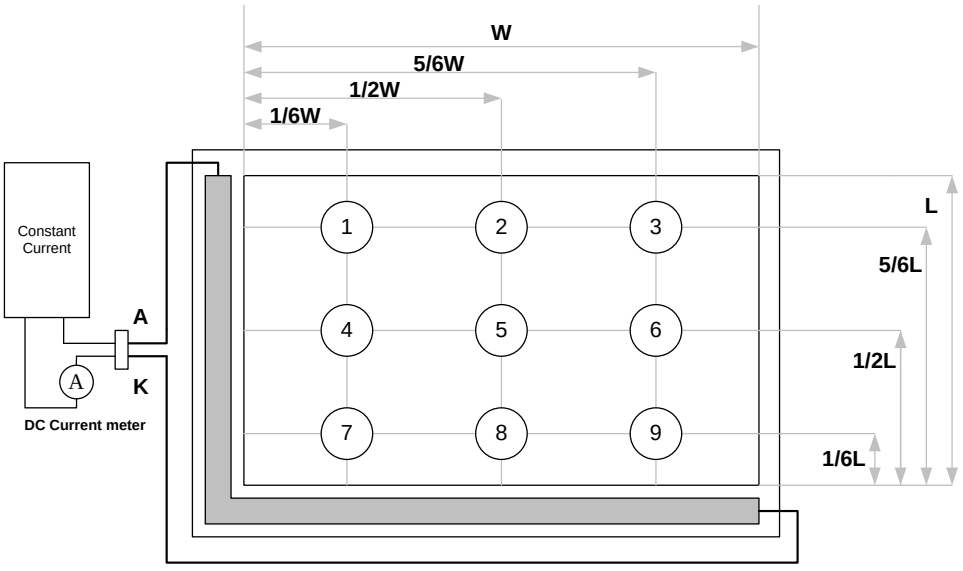


Note(5) Definition of color chromaticity (CIE1931)

Color coordinated measured at center point of LCD.

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

Note(6) Luminance is measured at point 5 of the display.



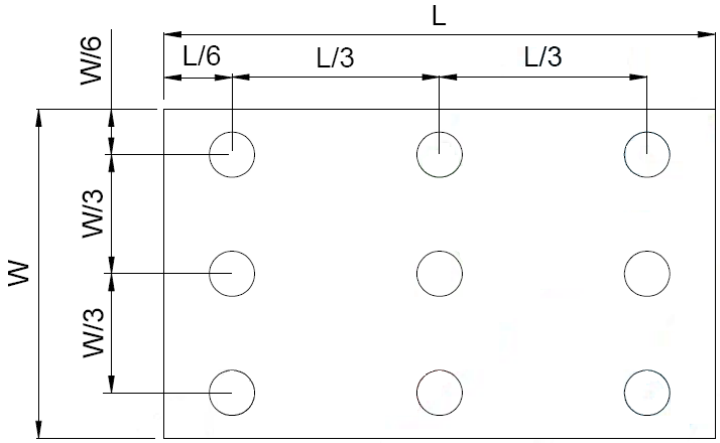
Note(7) Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to bellow figure).

Every measuring point is placed at the center of each measuring area.

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

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



Bmax: The measured maximum luminance of all measurement position.

Bmin: The measured minimum luminance of all measurement position.

5. Electrical Characteristics

5.1 DC Characteristics

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Power supply voltage		VCC	3.3	--	3.6	V	
Input voltage for logic	H Level	V_{IH}	0.7* VCC	--	VCC	V	(1)
	L Level	V_{IL}	GND	--	0.3* VCC	V	
Power Supply current		ICC	--	TBD	--	mA	(2)

Note(1) HD, VD, DENA, DCLK, and R0~R7, G0~G7, B0~B7, DISP.

Note(2) fV =60Hz , Ta=25℃ , Display pattern : All Black

Note(3) *:Will be reference only

5.2 Electrical Characteristic Of LED Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED Forward Voltage	VAK	7.8	9.0	10.2	V	IAK=200mA, Ta=25℃
LED Forward Current	IAK	--	200	--	mA	Ta=25℃
LED life time			50k	-	Hrs.	IAK=200mA, Ta=25℃

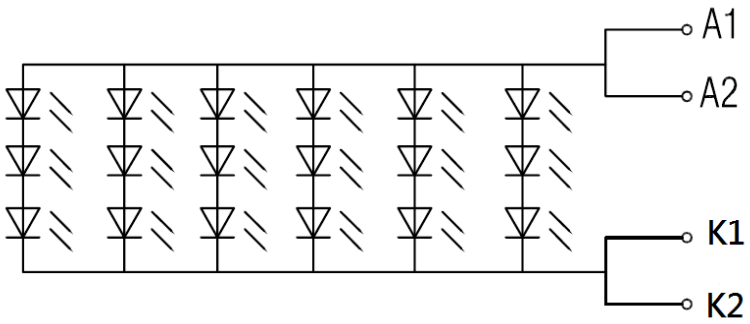
Note(1) Ta means ambient temperature of TFT-LCD module.

Note(2) If the module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

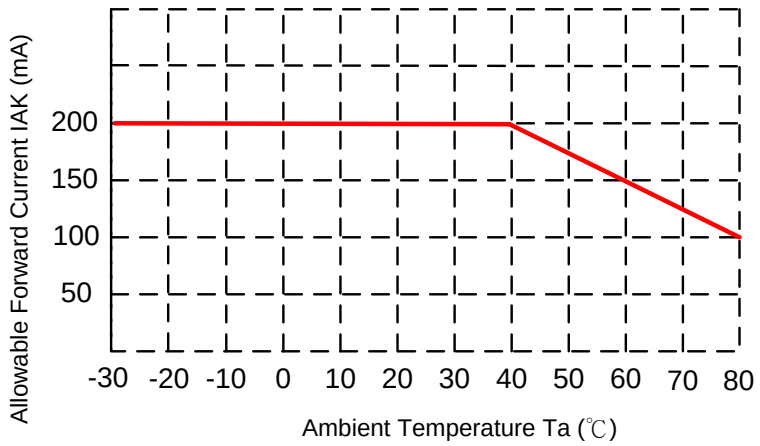
Note(3) The constant current source is needed for LED back-light driving.

Note(4) Operating life means brightness goes down to 50% minimum brightness. LED life time is estimated data. Ta=25℃

Note(5) The structure of LED B/L shows as below.



Note(6) When LCM is operated over 60℃ ambient temperature, the IAK of the LED backlight should be adjusted to 150mA max



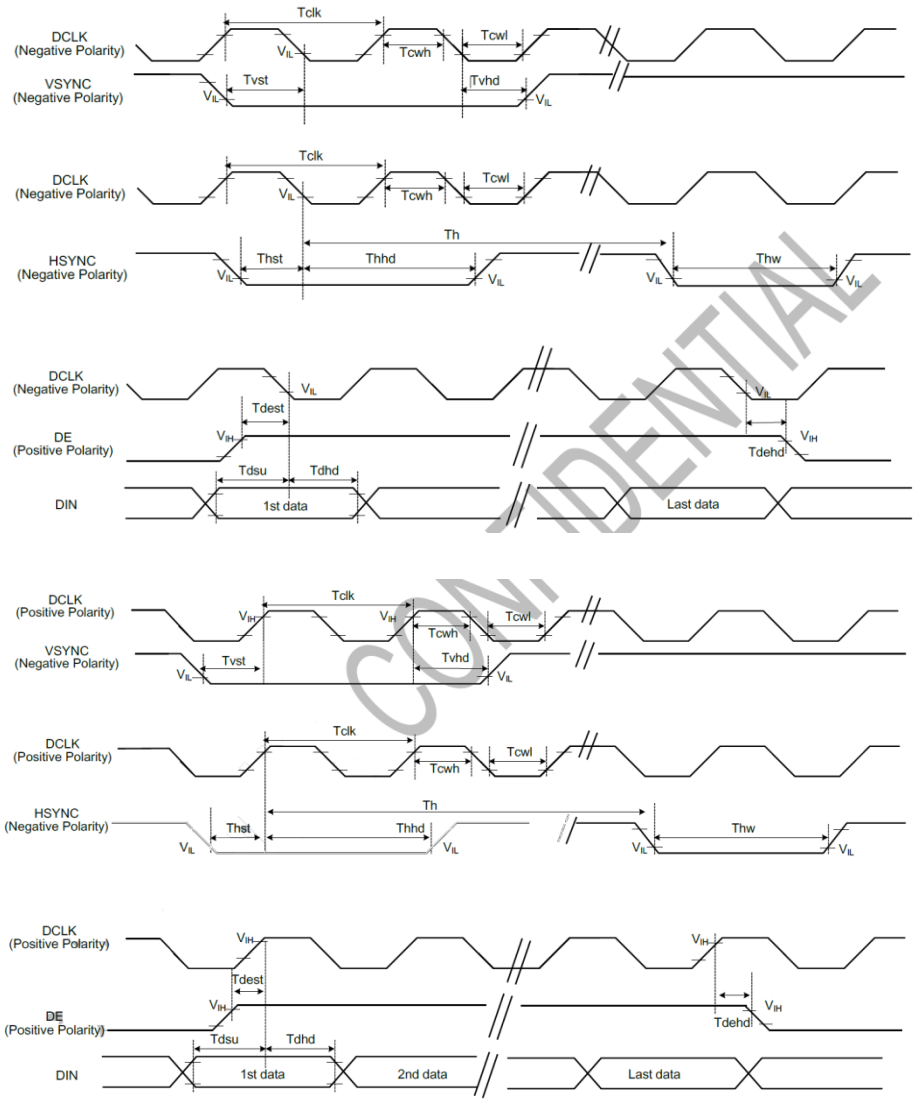
6. Interface Pin Assignment

Pin No	Symbol	Function
1	GND	Power Ground
2	GND	Power Ground
3	VCC	3.3V Power Supply for LCD
4	VCC	3.3V Power Supply for LCD
5	R0	Red Data 0 (LSB)
6	R1	Red Data 1
7	R2	Red Data 2
8	R3	Red Data 3
9	R4	Red Data 4
10	R5	Red Data 5
11	R6	Red Data 6
12	R7	Red Data 7 (MSB)
13	G0	Green Data 0 (LSB)
14	G1	Green Data 1
15	G2	Green Data 2
16	G3	Green Data 3
17	G4	Green Data 4
18	G5	Green Data 5
19	G6	Green Data 6
20	G7	Green Data 7 (MSB)
21	B0	Blue Data 0 (LSB)
22	B1	Blue Data 1
23	B2	Blue Data 2
24	B3	Blue Data 3
25	B4	Blue Data 4
26	B5	Blue Data 5
27	B6	Blue Data 6
28	B7	Blue Data 7(MSB)
29	GND	Power Ground
30	DCLK	Clock Signals
31	DISP	Display on/off (High: on, Low :off)
32	HD	Horizontal SYNC signal.

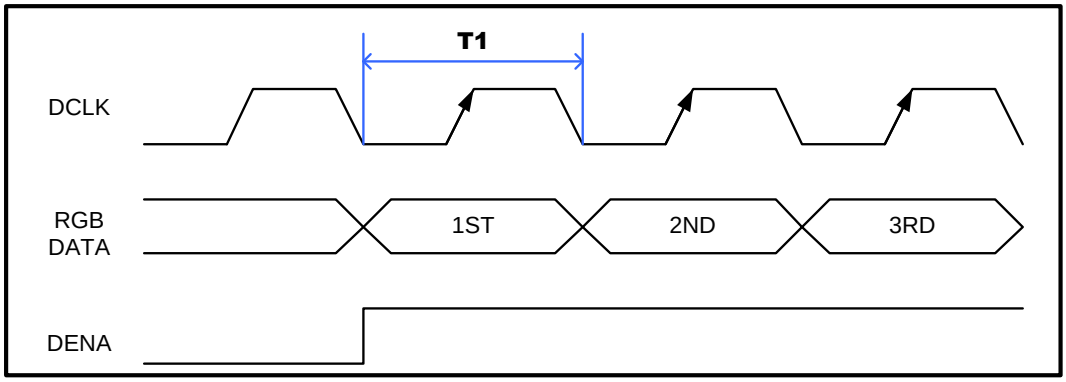
33	VD	Vertical SYNC signal
34	DENA	Data Enable signal (to settle the viewing area)
35	NC	No Connect
36	NC	No Connect
37	NC	No Connect
38	NC	No Connect
39	SC	No function. Scan direction selectable by jumper.
40	GND	Power Ground
41	GND	Power Ground
42	LED_K	LED cathode
43	LED_A	LED anode
44	LED_K	LED cathode
45	LED_A	LED anode

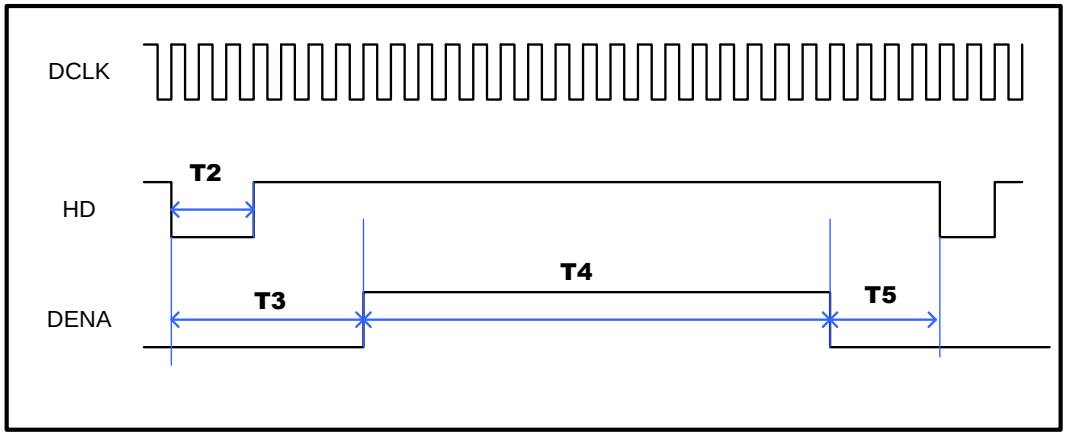
7. Interface Timing

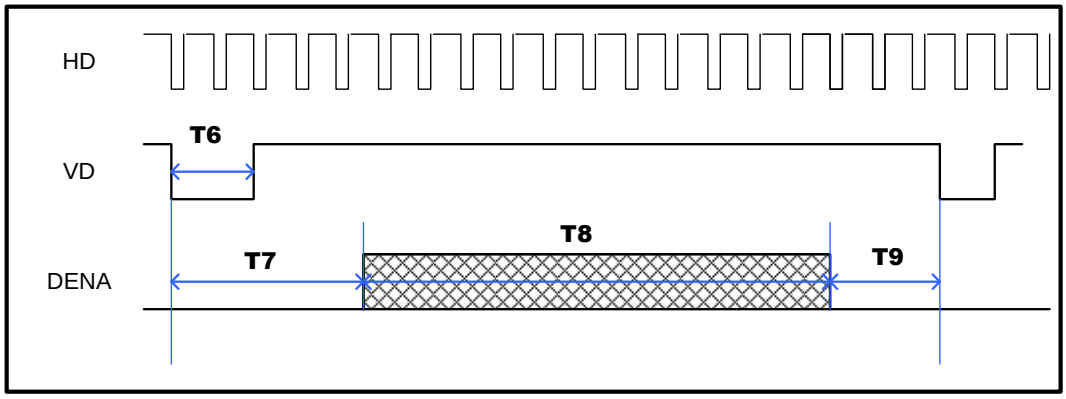
Timing for RGB Interface



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLK Pulse Duty	Tcw	40	50	60	%	
HSYNC Width	Thw	2	-	-	DCLK	
HSYNC Period	Th	55	60	65	us	
VSYNC Setup Time	Tvst	12	-	-	ns	
VSYNC Hold Time	Tvhd	12	-	-	ns	
HSYNC Setup Time	Thst	12	-	-	ns	
HSYNC Hold Time	Thhd	12	-	-	ns	
Data Setup Time	Tdsu	12	-	-	ns	
Data Hold Time	Tdhd	12	-	-	ns	
DE Setup Time	Tdest	12	-	-	ns	
DE Hold Time	Tdehd	12	-	-	ns	

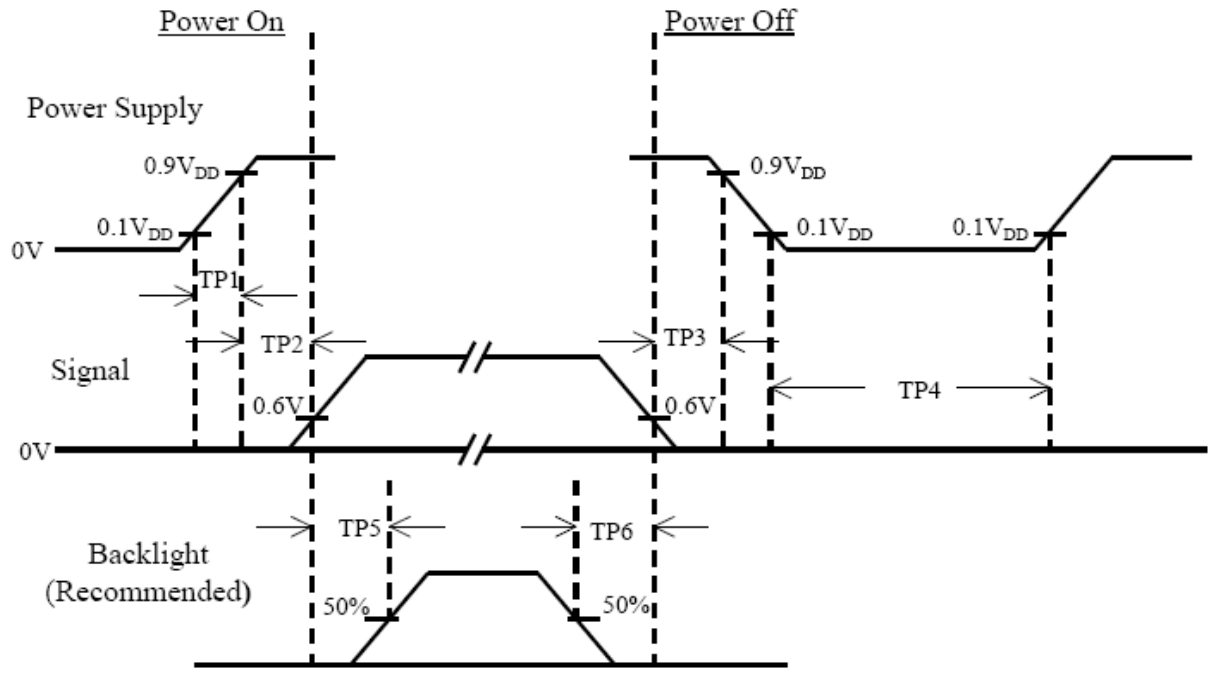






Item	Symbol	Min.	Typ.	Max.	Unit
Clock Frequency	1/T1	23	25	27	MHz
HSYNC Pulse Wide	T2	2	8	8	clocks
HSYNC Back Porch	T3	4	8	48	Clocks
HSYNC Front Porch	T5	4	8	48	Clocks
Horizontal Display Period	T4		800		Clocks
Horizontal total Period	T3+T4+T5	808	816	896	Clocks
VSYNC Pulse Wide	T6	2	4	8	Lines
VSYNC Back Porch	T7	4	8	12	Lines
VSYNC Front Porch	T9	4	8	12	Lines
Vertical Display Period	T8		480		Lines
Vertical total Period	T7+T8+T9	488	496	504	Lines

8. Power On/Off 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 VCC.

Note(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.

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

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

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

9. Displayed Color and Input Data

Data Signal

COLOR		INPUT DATA																							
		R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB							LSB	MSB							LSB	MSB							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(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(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(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(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(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(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

10. TOUCH PANEL ELECTRICAL SPECIFICATION

10.1. Basic Characteristic

ITEM	SPECIFICATION
Interface Type	Projective Capacitive Multi-Touch Panel
Activation	Two-fingers or Single-finger
X/Y Position Reporting	Absolute Position
Touch Force	No contact pressure required
Calibration	No need for calibration
Report Rate	Approx 100 points/sec
Interface	**I2C**
Control IC	**ILI2117A**

10.2. Optical Characteristic

ITEM	SPECIFICATION
Transmittance	85% (min)

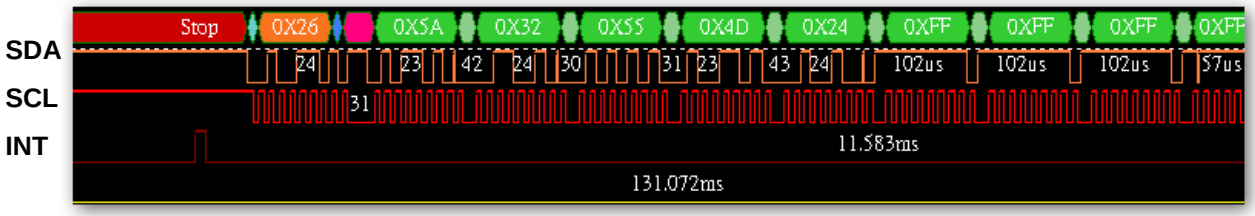
10.3. Electrical Characteristic

ITEM	SPECIFICATION
I2C Interface	Power & signal Input 3.3V

10.4. Interface Pin Assign

Pin	Name	Description
1	SCL	I2C Clock
2	SDA	I2C Data
3	VDD	Power 3.3V
4	RESET	Active “Low”
5	INT	Active “Low”
6	GND	Power GND

10.5. I2C AC Waveform



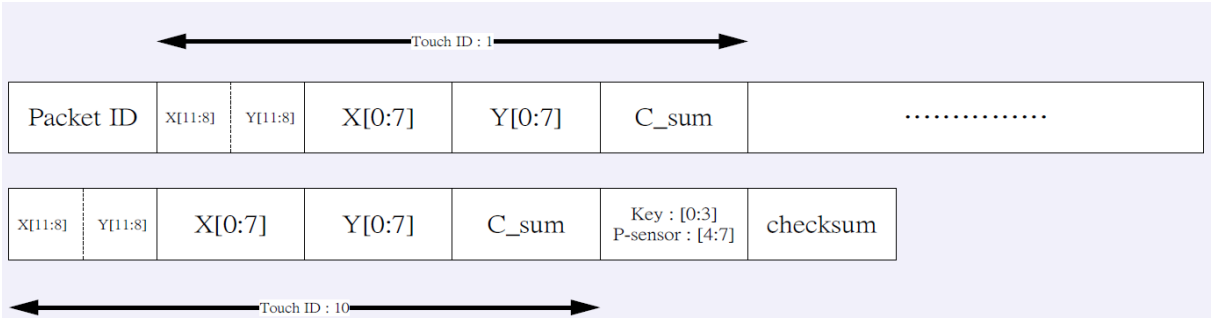
10.6. I2C Characteristics

1. Slave address: 0x26

2. Clock: up to 400 kHz
3. Packet length : 43 byte
4. Finger_i touch end: The data which belongs to finger_i is 0xFF
5. Position_X[11:0] and Position_Y[11:0] are ranging from 0~2047
6. Touch end: all data is 0xFF except for packet ID (0x5A) and checksum.
7. C_sum : total delta_C of each finger touch

10.7. Data Format

Slave Address	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x26(r)	Packet ID (0x5A)	X00[11:8] Y00[11:8]	X00[7:0]	Y00[7:0]	C_sum	X01[11:8] Y01[11:8]	X01[7:0]	Y01[7:0]
	C_sum	X02[11:8] Y02[11:8]	X02[7:0]	Y02[7:0]	C_sum	X03[11:8] Y03[11:8]	X03[7:0]	Y03[7:0]
	C_sum	X04[11:8] Y04[11:8]	X04[7:0]	Y04[7:0]	C_sum	X05[11:8] Y05[11:8]	X05[7:0]	Y05[7:0]
	C_sum	X06[11:8] Y06[11:8]	X06[7:0]	Y06[7:0]	C_sum	X07[11:8] Y07[11:8]	X07[7:0]	Y07[7:0]
	C_sum	X08[11:8] Y08[11:8]	X08[7:0]	Y08[7:0]	C_sum	X09[11:8] Y09[11:8]	X09[7:0]	Y09[7:0]
	C_sum	Key[3:0]	Checksum					



11. Reliability Test Conditions

Test Item	Test Conditions	Note

High Temperature Operation	80±3°C , t=240 hrs	
Low Temperature Operation	-30±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 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 inspired after 1 hour storage in normal conditions (15~35℃, 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 initial value.

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 benzine 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.

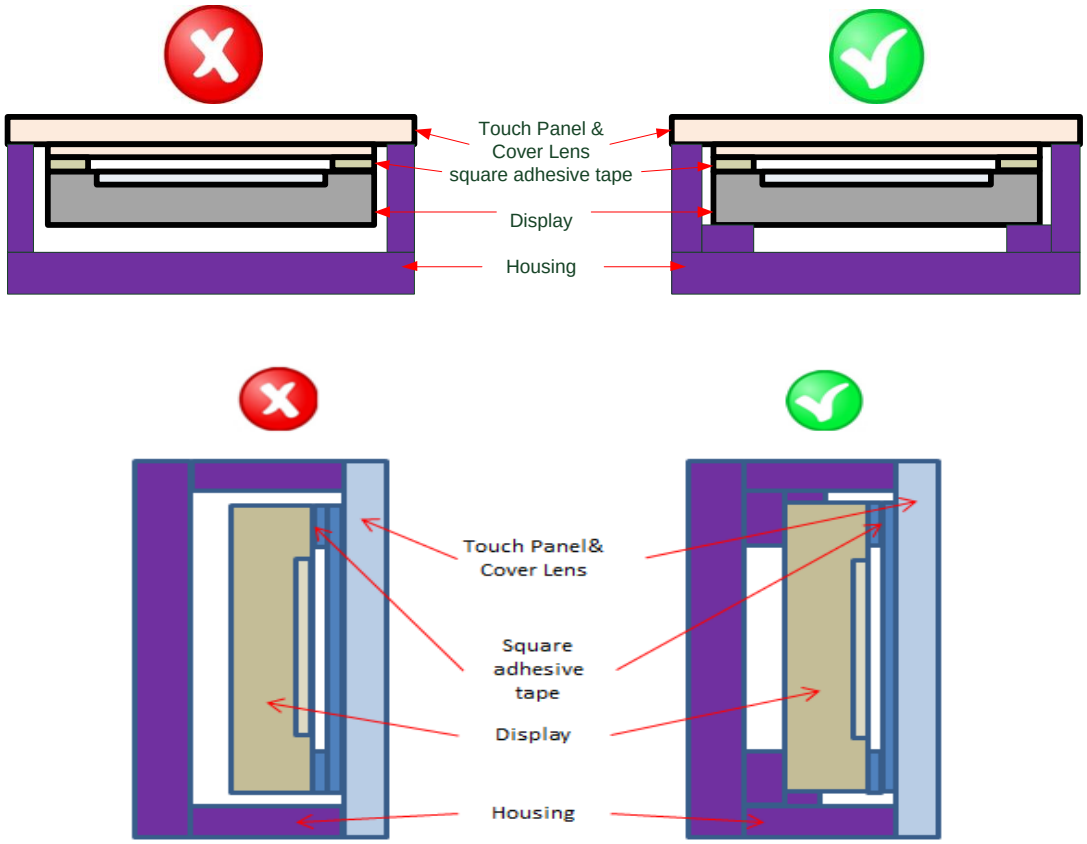
(6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.

(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 Mechanism precautions

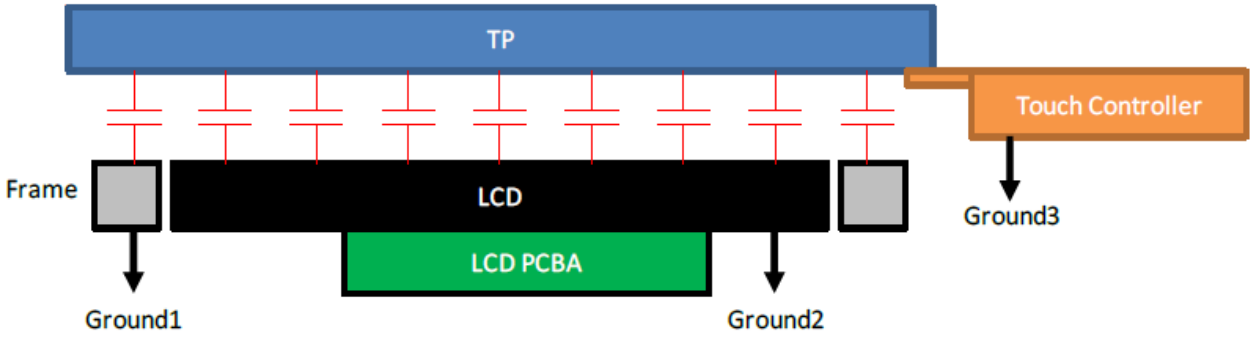
The square adhesive tape which is between the touch panel and display can't provide well supporting in the long term and high ambient temperature condition. Whether upright or horizontal position the support holder which is in the back side of the display is needed. Do not let the display floating.



12.6 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) TP needs to work in environment with stable stray capacitance. In order to minimize the variation in stray capacitance, all conductive mechanical parts must not be floating. Intermittent floating any conductive part around the touch sensor may cause significant stray capacitance change and abnormal touch function. It is recommended to keep all conductive parts having same electrical potential as the GND of the touch controller module.

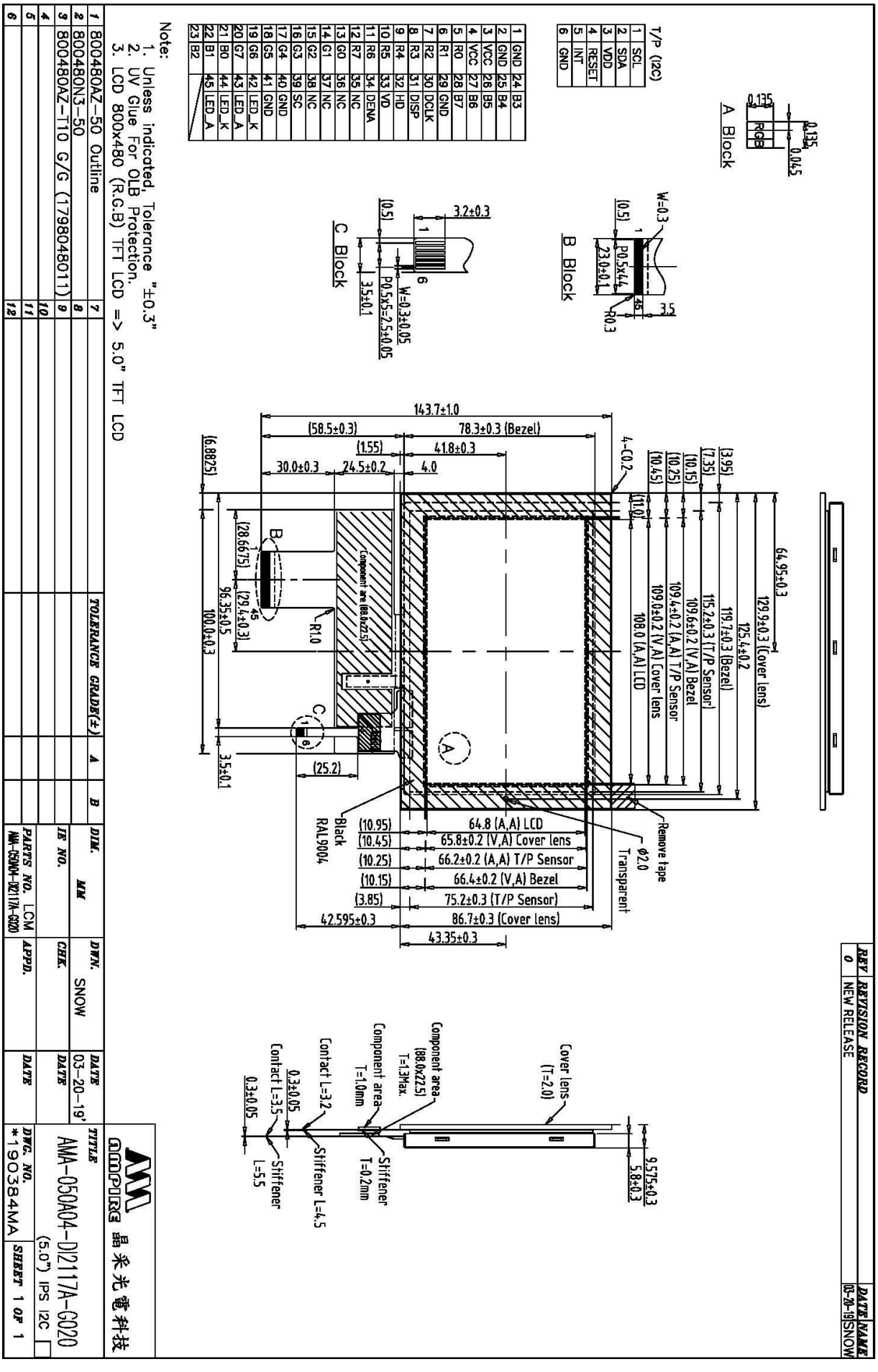


GND1, GND2 and GND3 should be connected together to have the same ground

(3) 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.

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

13. Outline Dimension

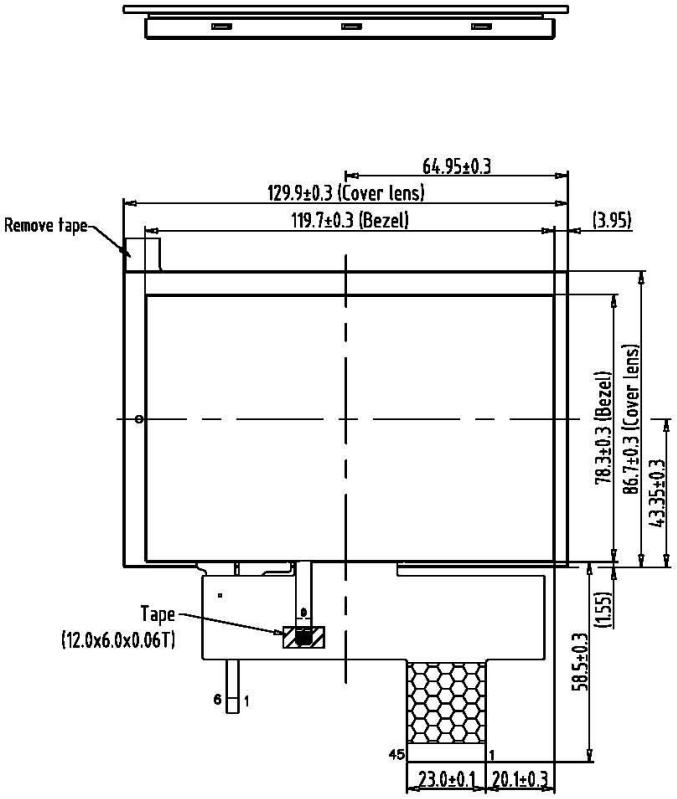


REV	REVISION RECORD	DATE	NAME
0	NEW RELEASE	03-20-19	SNOW

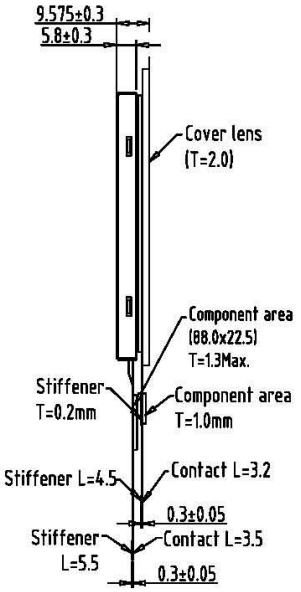
T/P (I2C)

1	SCL
2	SDA
3	VDD
4	RESET
5	INT
6	GND

1	GND	24	B3
2	GND	25	B4
3	VCC	26	B5
4	VCC	27	B6
5	R0	28	B7
6	R1	29	GND
7	R2	30	DCLK
8	R3	31	DISP
9	R4	32	HD
10	R5	33	VD
11	R6	34	DENA
12	R7	35	NC
13	G0	36	NC
14	G1	37	NC
15	G2	38	NC
16	G3	39	SC
17	G4	40	GND
18	G5	41	GND
19	G6	42	LED_K
20	G7	43	LED_A
21	B0	44	LED_K
22	B1	45	LED_A
23	B2		



Back view



Note:

1. Unless indicated, Tolerance "±0.3"
2. UV Glue For OLB Protection.
3. LCD 800x480 (R.G.B) TFT LCD => 5.0" TFT LCD

1	800480AZ-50 Outline	7		TOLERANCE GRADE(±)	A	B	DIM. MM	DWN. SNOW	DATE 03-20-19'	TITLE AMA-050A04-DI2117A-G020 (5.0") IPS I2C
2	800480N3-50	8					IE NO.	CHK.	DATE	
3	800480AZ-T10 G/G (1798048011)	9					PARTS NO. LCM-1 AMA-050A04-DI2117A-G020	APPD.	DATE	DWG. NO. *190385MA SHEET 1 OF 1
4		10								
5		11								
6		12								

AMPIRE 晶采光電科技

AMPIRE CO., LTD.

Date: 2019/10/01