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-156A04-DUC2510-G020
APPROVED BY	
DATE	

☐ Preliminary Specification
■ Formal Specification

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APPROVED BY	CHECKED BY	ORGANIZED BY
Patrick	Lawlite	Kokai

This Specification is subject to change without notice.

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2023/8/21	--	New Release	Kokai
2023/10/23	8	Update LED connector & interface	Tank
	20,21	Update drawing	

1. Features

15.6 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) module. This module is composed of a 15.6” TFT-LCD panel and LED backlight and LED driving board.

(1) Construction: 15.6” a-Si TFT active matrix, White LED Backlight.
(2) Resolution (pixel): 1920(R.G.B) X 1080
(3) Number of the Colors : 16.7M colors (R , G , B 8 bit digital each)
(4) LCD type :IPS with Normally Black
(5) Touch panel

PHYSICAL SPECIFICATIONS

Item	Specifications	unit
LCD size	15.6 inch (Diagonal)	
Resolution	1920 x (RGB) x 1080	dot
Pixel Pitch	0.17925 (H) X 0.17925 (V)	mm
Active area	344.16(W) x 193.59(H)	mm
Module size	392.23(W) x 241.54(H) x 14.17(D)	mm
Color arrangement	RGB-stripe	
Contrast Ratio	1000:1	
Brightness	850	cd/m^2

2 ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	VALUES		UNIT	REMARK
		MIN	MAX		
Logic Supply Voltage	VDD	-0.3	4.0	V	
Operation Temperature	T_{op}	-30	85	℃	
Storage Temperature	T_{st}	-30	85	℃	

Note (1) Ta =25±2℃

3.0 ELECTRICAL SPECIFICATIONS

3.1 LCD ELECTRONICS SPECIFICATION

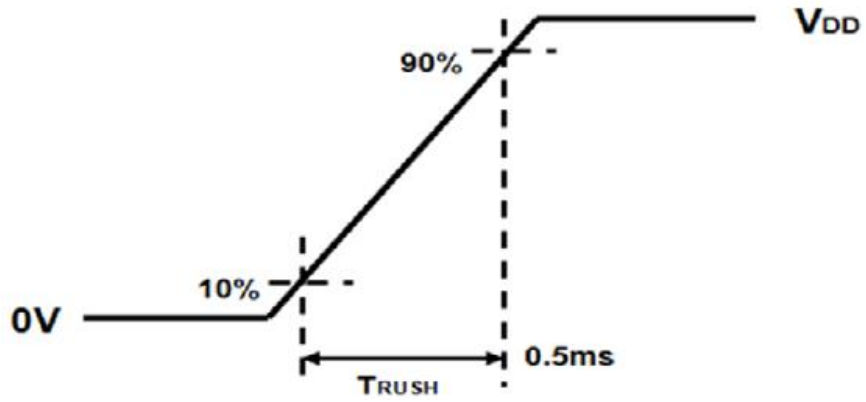
Parameter		Symbol	Value			Unit	Note
			Min	Typ.	Max.		
Power Supply Voltage		VDD	3.0	3.3	3.6	V	(1),(2)
Ripple Voltage		VRP	-	-	200	mV	(1),(3)
Rush Current		IRUSH	-	-	1.5	A	(1),(4)
VDD Current	White Pattern	IDD	-	-	0.454	A	(1),(3)
VDD Power Consumption	White Pattern	PDD	-	-	1.5	W	

Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25℃ , Humidity: 55± 10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified VDD current and power consumption are measured under the VDD = 3.3 V, FV = 60 Hz condition and White Pattern.

Note (4) The figures below is the measuring condition of VDD. Rush current can be measured when TRUSH is 0.5 ms.

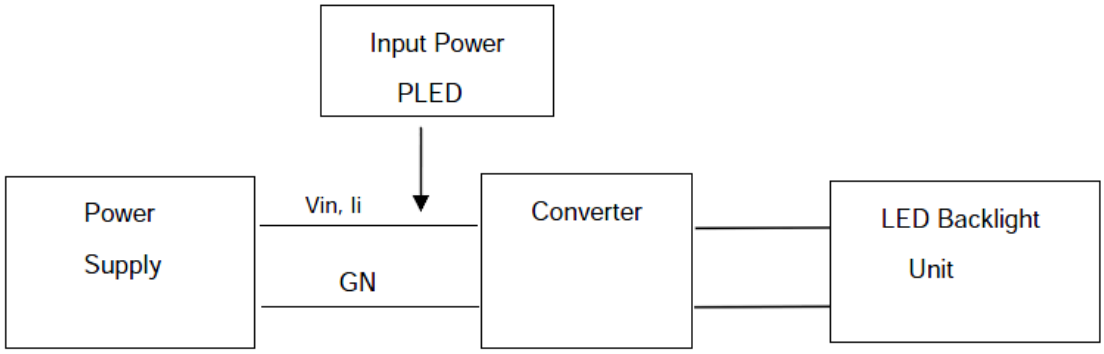


3.2 LED DRIVER ELECTRONICS SPECIFICATION

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Power Supply Voltage		LED_Vin	10.8	12.0	13.2	V	
Converter Power Supply Current		Ii			2	A	@LED_Vin= 12V Duty=100%
Power Consumption		P_{LED}			26.3	W	@ LED_Vin = 12V Duty=100%
EN Control Level	Backlight on	LED_EN	1.5	-	5.5	V	
	Backlight off		0		0.5		
PWM Control Level	PWM High Level	LED_PWM	1.2	-	5.5	V	
	PWM Low Level		0	-	0.5		
PWM Control Duty Ratio		PWM	10	--	100	%	
PWM Control Frequency		f_{PWM}	100	-	1000	Hz	
LED Life Time		L_L	50,000			Hrs	(2)

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at Ta = 25±2℃ and Duty 100% until the brightness becomes ≦ 50% of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift.



4. Interface

4.1 LVDS Interface

Item	Description
Manufacturer / Type	STM MSBKT2407P30HB
Mating Receptacle / Type (Reference)	JAE FI-X30HL(Locked Type)

Pin	Name	Description
1	RxO0-	Negative LVDS differential data input (Odd data)
2	RxO0+	Positive LVDS differential data input (Odd data)
3	RxO1-	Negative LVDS differential data input (Odd data)
4	RxO1+	Positive LVDS differential data input (Odd data)
5	RxO2-	Negative LVDS differential data input (Odd data)
6	RxO2+	Positive LVDS differential data input (Odd data)
7	GND	Ground
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)
10	RxO3-	Negative LVDS differential data input (Odd data)
11	RxO3+	Positive LVDS differential data input (Odd data)
12	RxE0-	Negative LVDS differential data input (Even data)
13	RxE0+	Positive LVDS differential data input (Even data)
14	GND	Ground
15	RxE1-	Negative LVDS differential data input (Even data)
16	RxE1+	Positive LVDS differential data input (Even data)
17	GND	Ground
18	RxE2-	Negative LVDS differential data input (Even data)
19	RxE2+	Positive LVDS differential data input (Even data)
20	RxECLK-	Negative LVDS differential clock input (Even clock)
21	RxECLK+	Positive LVDS differential clock input (Even clock)
22	RxE3-	Negative LVDS differential data input (Even data)
23	RxE3+	Positive LVDS differential data input (Even data)
24	GND	Ground
25	Bist	LCD Panel Self Test Enable(3.3V Typ.) For Ampire use, When it is not used, Connecting to GND or Floating is recommended
26	SDA	I2C-Compatible Serial-Data Input. Floating is recommended in the Costumer
27	SCL	I2C-Compatible Serial-Data Input. Floating is recommended in the Costumer
28	VDD	Power Supply Input Voltage(3.3V)
29	VDD	Power Supply Input Voltage(3.3V)
30	VDD	Power Supply Input Voltage(3.3V)

4.2 LED Driver Interface

Item	Description
Manufacturer / Type	STM/MSB24038P8A(P1.25x8pin)

Pin	Name	Description
1	VLED	LED power supply(12V Typ)
2	VLED	LED power supply(12V Typ)
3	VLED	LED power supply(12V Typ)
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	VLED_EN	Backlight On/Off (3.3V Typ)
8	VPWM_EN	System PWM signal imput for dimming (3.3V Typ)

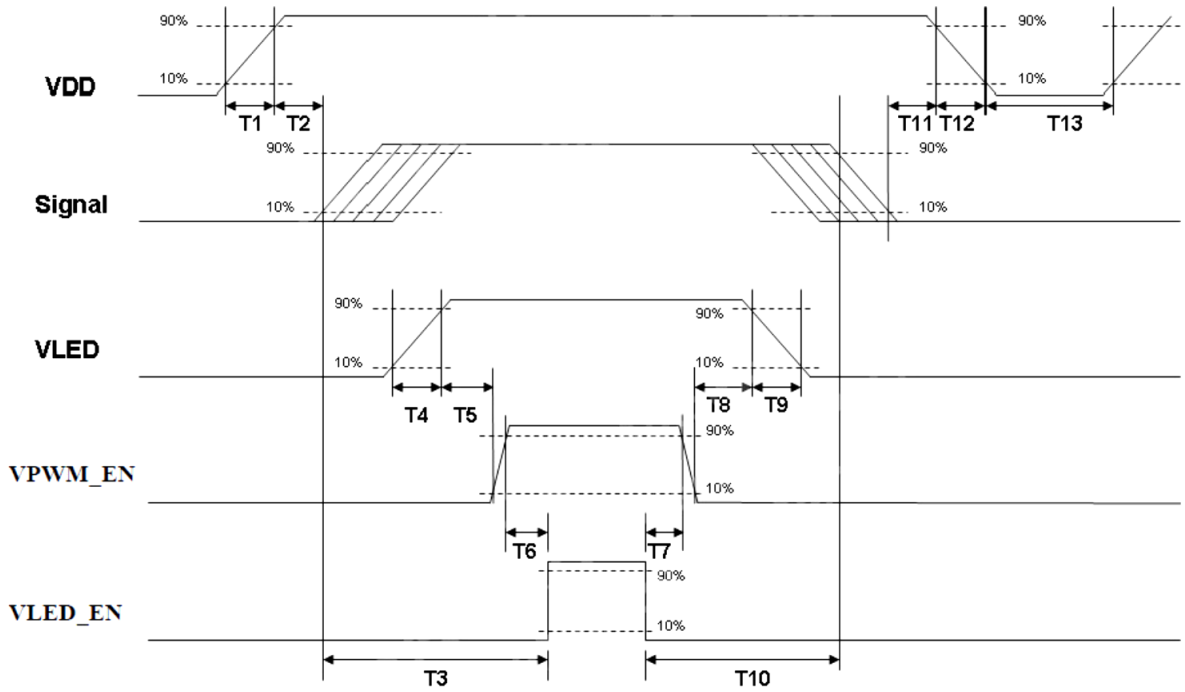
4.3 DISPLAY TIMING SPECIFICATIONS

Parameter	Symbol	Min.	Typ.	Max.	Unit
LVDS Clock Frequency	Fclk	(69.5)	(70.5)	(73)	MHz
V Total Time	VT	(1104)	(1116)	(1080+A)	Clocks
VActive Time	VA		1080		-
H Total Time	HT	(1050)	(1052)	(960+B)	Lines
H Active Time	HA		960		-
Frame Rate	FV	-	(60)	-	Hz

Note (1) SCC can only be driven to 2%

Note (2) The maximum clock frequency=[(960+B)*(1080+A)*60]<73MHz

4.4 POWER ON/OFF SEQUENCE



Power Sequencing Requirements

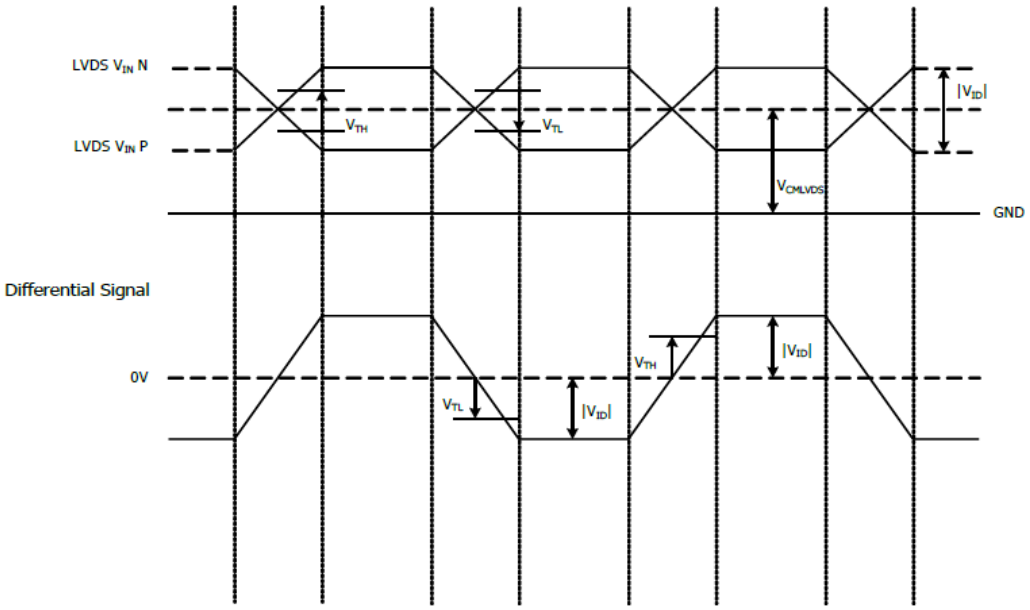
Parameter	Min.	Typ.	Max.	Unit
T1	0.5	-	10	ms
T2	30	40	50	ms
T3	200	-	-	ms
T4	0.5	-	10	ms
T5	10	-	-	ms
T6	10	-	-	ms
T7	0	-	-	ms
T8	10	-	-	ms
T9	-	-	10	ms
T10	110	-	-	ms
T11	0	16	50	ms
T12	-	-	10	ms
T13	1000	-	-	ms

4.5 LVDS INPUT SIGNAL SPECIFICATIONS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	Vth	-	-	+100	mV	VCM=1.2V
Differential Input Low Threshold	Vtl	-100	-	-	mV	VCM=1.2V
Magnitude Differential Input Voltage	|VID|	100	-	600	mV	-
Common Mode Voltage	VCM	0.7		1.6	V	-

Note (1) Input signals shall be low or Hi- resistance state when VDD is off.

Note (2) All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

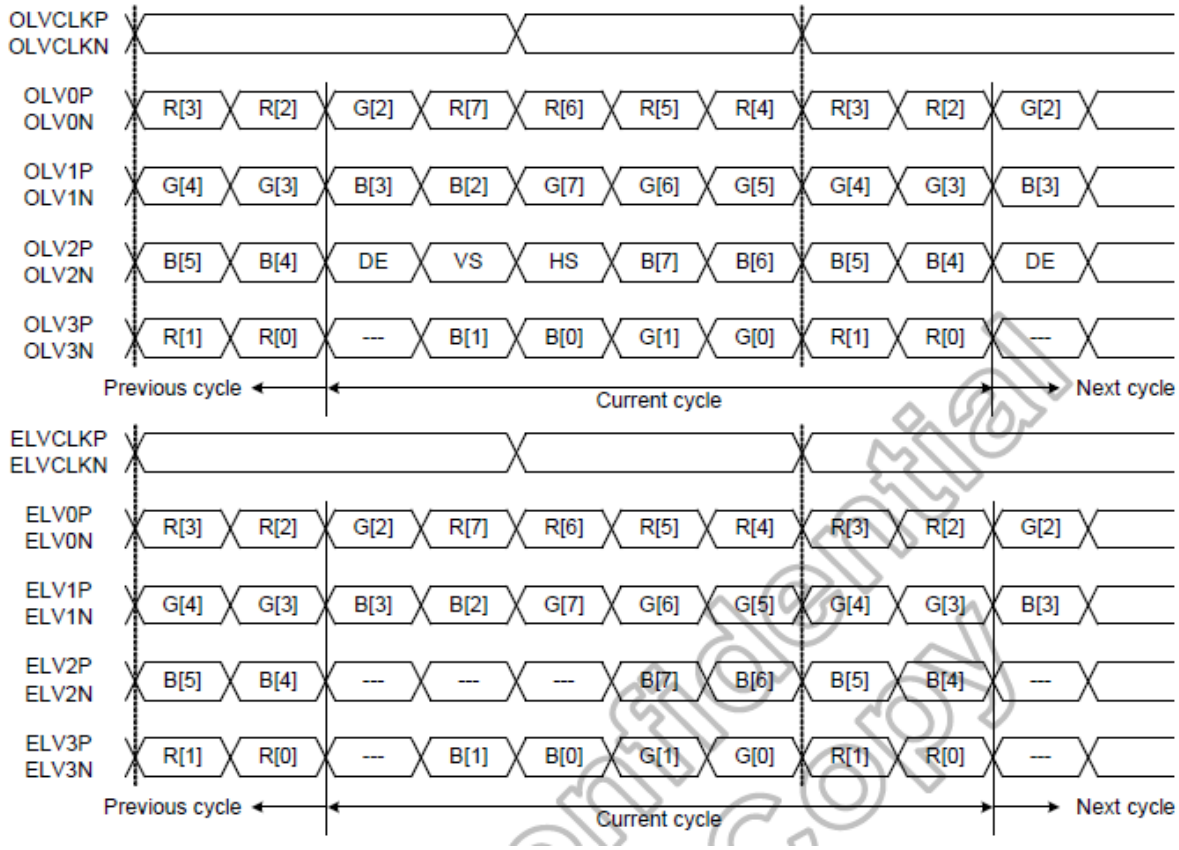


LVDS AC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Period	TLVCP	-	(T)	-	ns
Clock High Time	TLVCH	-	(4T/7)	-	ns
Clock Low Time	TLVCL	-	(3T/7)	-	ns

Note：T=1/Fclk

Data Mapping

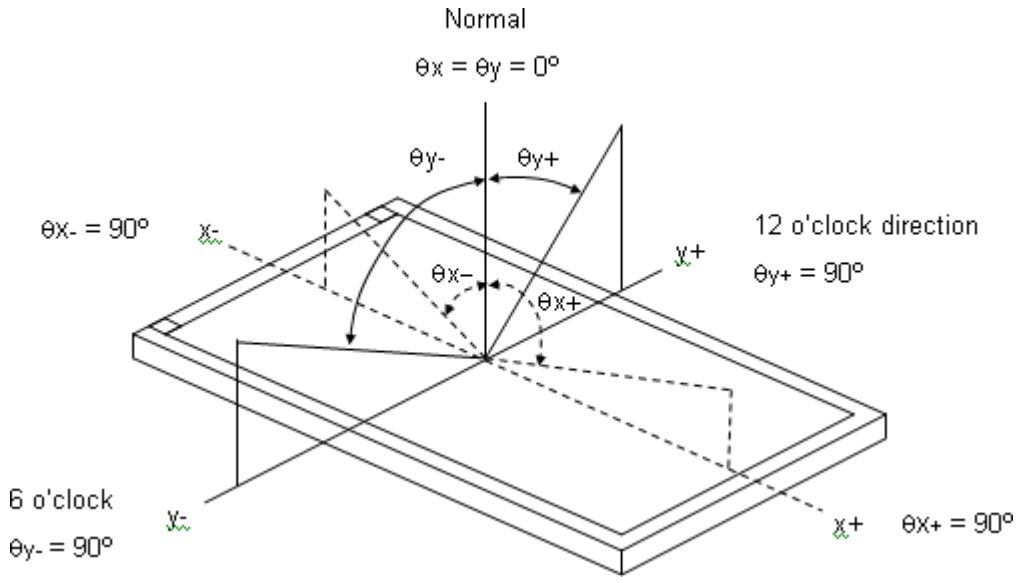


5.0 Optical Specifications

The optical characteristics are measured under stable conditions as following notes

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	θ_x=0°, θ_Y =0° CS-2000	Typ – 0.05	T.B.D	Typ + 0.05	-	(1), (5)
		Ry			T.B.D			
	Green	Gx			T.B.D			
		Gy			T.B.D			
	Blue	Bx			T.B.D			
		By			T.B.D			
	White	Wx			0.313			
		Wy			0.329			
Center Luminance of White		L_C		680	850	-	cd/m^2	(4), (5)
Contrast Ratio		CR		700	1000	-	-	(2), (5)
Response Time		$T_{R+}T_F$	θ_x=0°, θ_Y =0°	-	25	35	ms	(3)
NTSC			θ_x=0°, θ_Y =0°	-	72	-	%	(5), (6)
Luminance Uniformity			9 Points	75	80		%	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR ≧ 10	80	85	---	Deg.	(1), (5)
		θ_x-		80	85			
	Vertical	θ_Y+		80	85			
		θ_Y-		80	85	---		

Note (1) Definition of Viewing Angle (θx, θy):



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

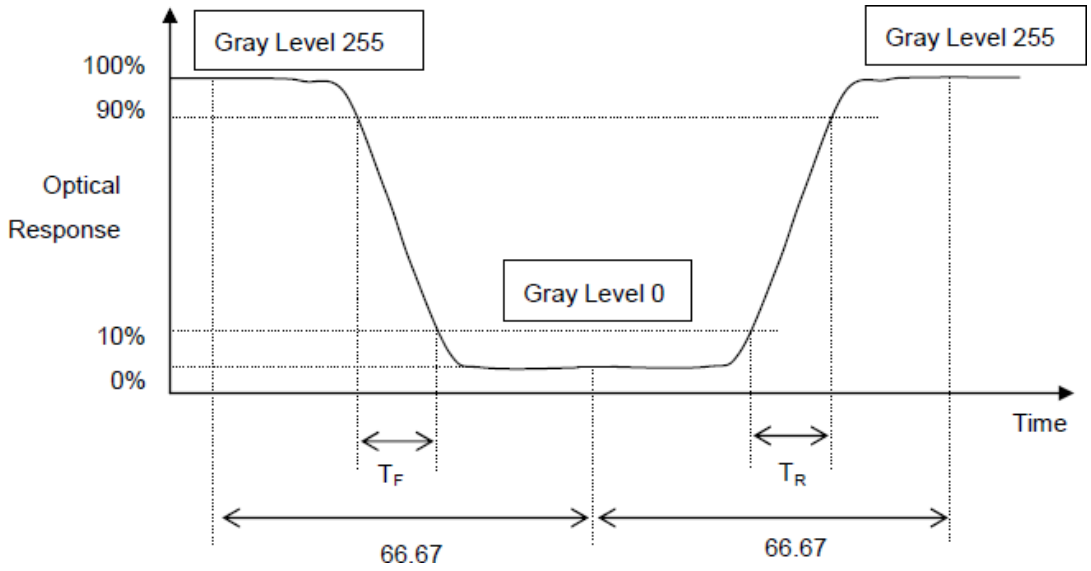
The contrast ratio can be calculated by the following expression. Contrast Ratio (CR) = L255 / L0

L255: Luminance of gray level 255 L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



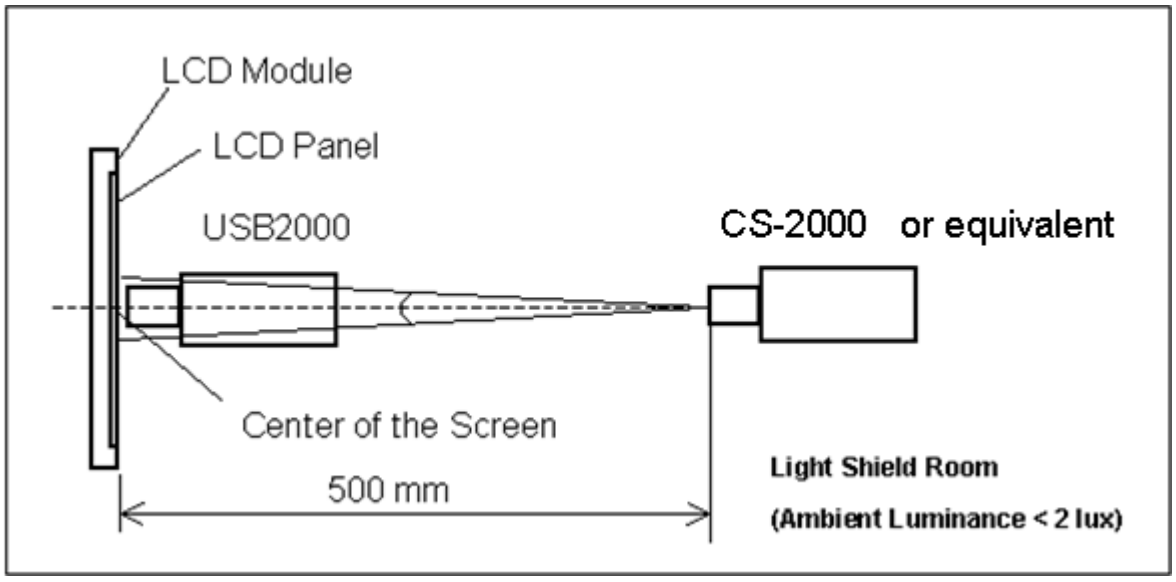
Note (4) Definition of Luminance of White (L_C):

Measure the luminance of gray level 255 at center point L_C = L (5)

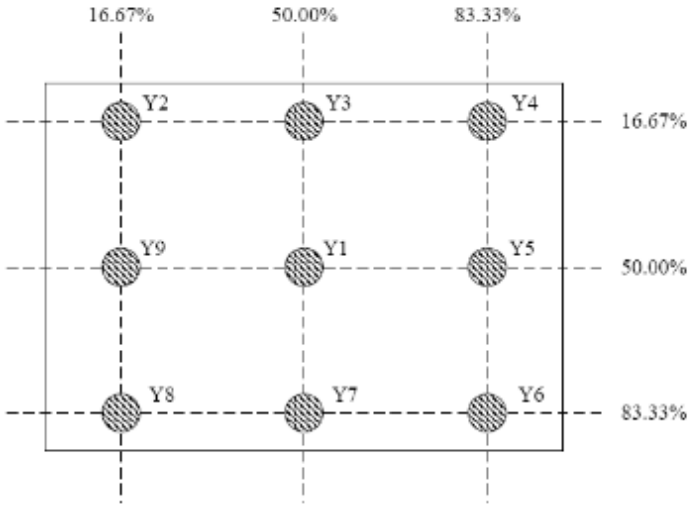
L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.



Note (6) Definition of White Variation



$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

6.0 Touch panel electrical specification

6.1 Electrical characteristics

ITEM	SPECIFICATION
Type	Projective Capacitive 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. 200 points/sec
Control IC	**ILI2510**

ITEM	Symbol	MIN	TYP	MAX	UNIT
Touch panel power supply	VDD	4.75	5	5.25	V
Touch panel power supply current at Normal operation mode	I_{VDD}	--	45(Reference)	--	mA
Touch panel power supply current at USB suspend mode	I_{VDD}	--	TBD	--	uA

6.2 Interface

Pin No.	Symbol	Function
1	VCC 5V	USB POWER 5V
2	D+	USB Data+
3	D-	USB Data-
4	NC	No connection
5	NC	No connection
6	GND	Ground

7. RELIABILITY TEST CONDITIONS

Test Item	Test Conditions	Note
High Temperature Operation	85±3°C , t=240 hrs	
Low Temperature Operation	-30±3°C , t=240 hrs	
High Temperature Storage	85±3°C , t=240 hrs	1,2
Low Temperature Storage	-30±3°C , t=240 hrs	1,2
Thermal Shock Test	-20°C ~ 60°C 30 m in. ~ 30 min. (1 cycle) Total 100cycle	1,2
Storage Humidity Test	40 °C, Humidity 60%, 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 more than one condition, and all the test conditions are independent.

Note 4 : All the reliability tests should be done without protective film on the module.

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 Handling Precautions

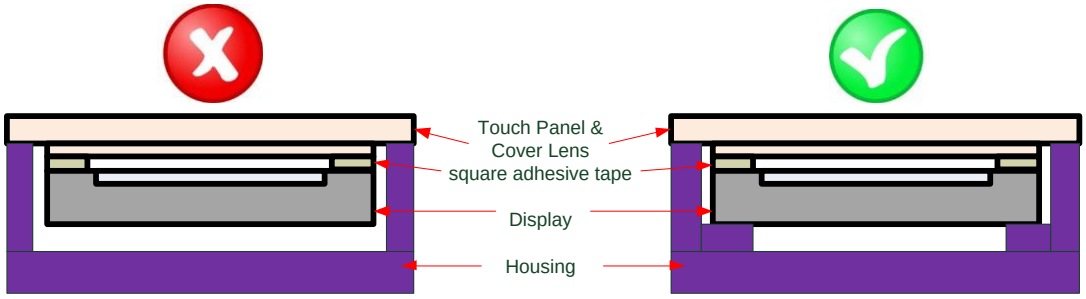
1. Display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
   — Isopropyl alcohol
   — Ethyl alcohol
   Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
   — Water
   — Ketone
   — Aromatic solvents
6. Do not attempt to disassemble the LCD Module.
7. If the logic circuit power is off, do not apply the input signals.
8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
   a. Be sure to ground the body when handling the LCD Modules.
   b. Tools required for assembly, such as soldering irons, must be properly ground.
   c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
   d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

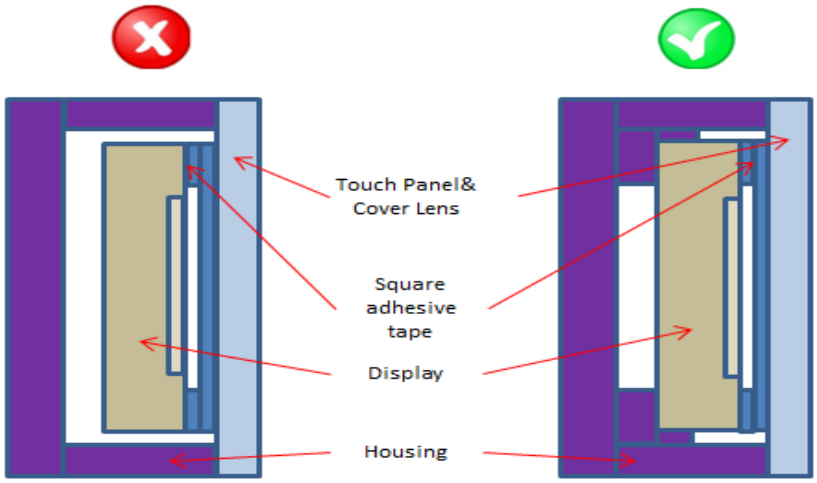
8.2 Storage precautions

1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:
   Temperature : 0℃ ～ 40℃
   Relatively humidity: ≤80%
3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

8.3 Mechanism precautions

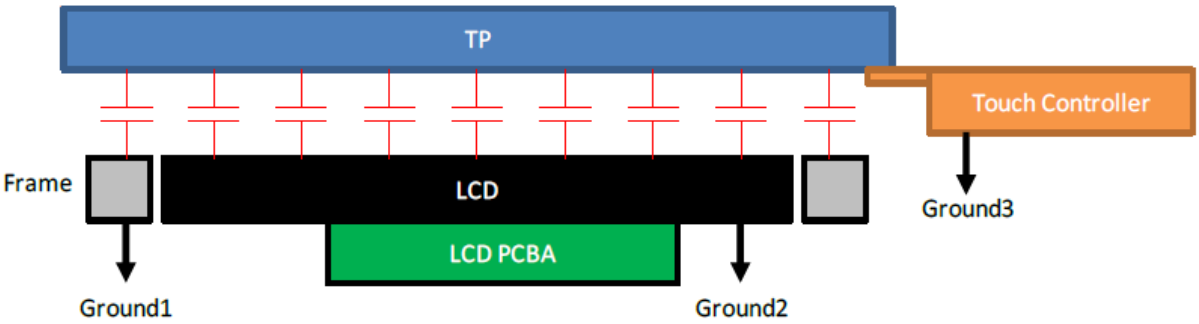
The square adhesive tape which is between the touch panel and display can't provide well supporting in the long term and high ambient temperature condition. Whether upright or horizontal position the support holder which is in the back side of the display is needed. Do not let the display floating.





8.4 General Precautions

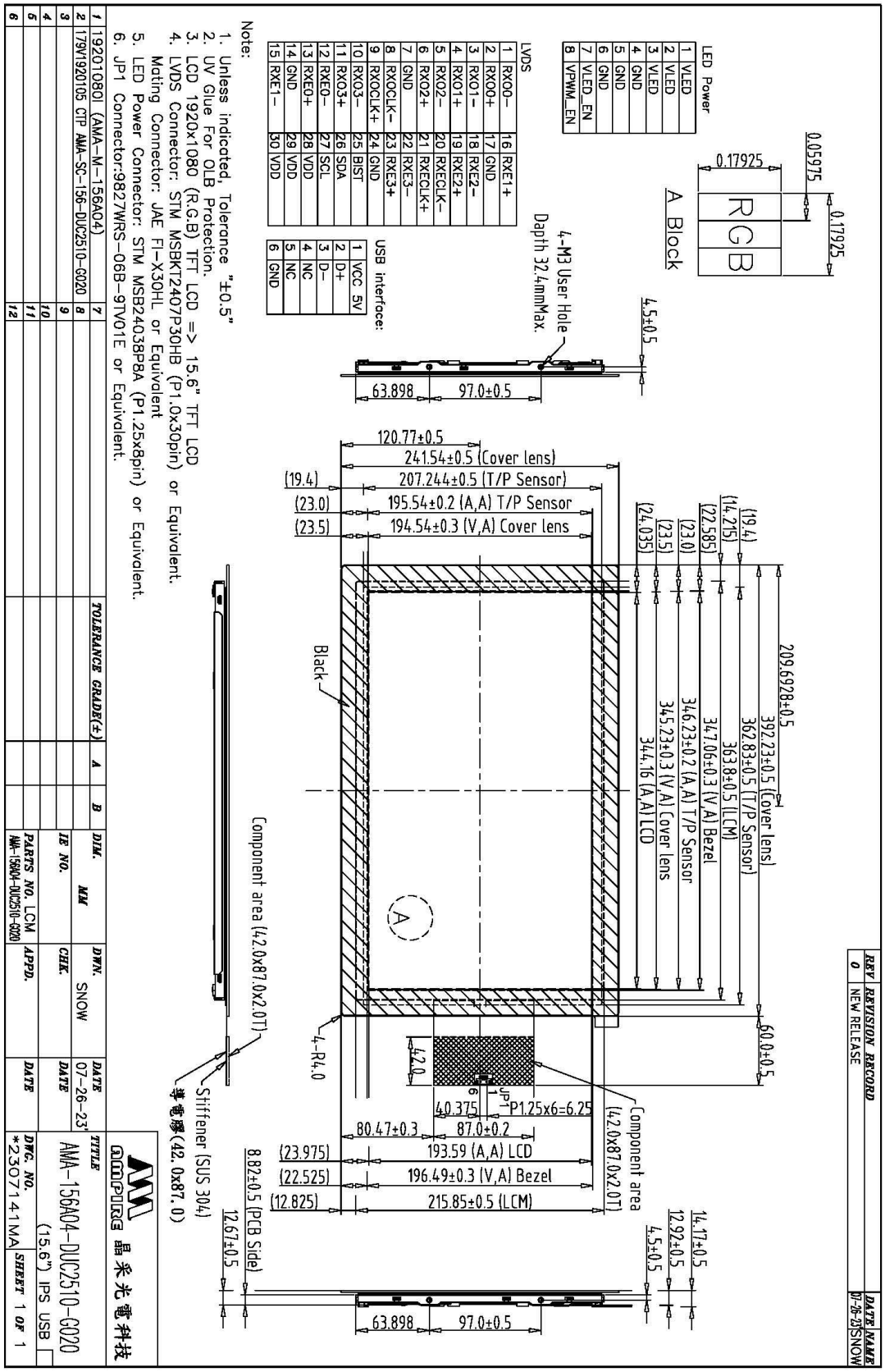
1. Do not keep the LCD at the same display pattern continually. The residual image will happen and it will damage the LCD. Please use screen saver.
2. TP needs to work in environment with stable stray capacitance. In order to minimize the variation in stray capacitance, all conductive mechanical parts 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. The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

9. OUTLINE DIMENSION



REV	REVISION RECORD	DATE	NAME
0	NEW RELEASE	07-26-23	SNOW

LED Power

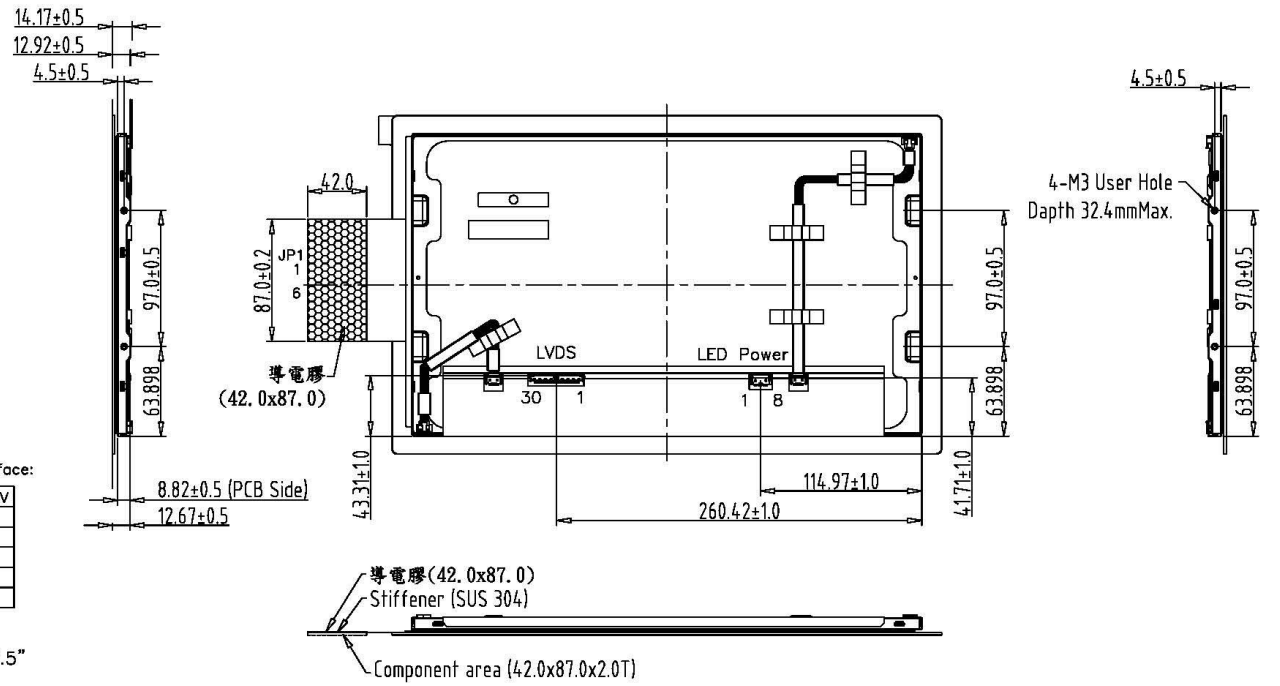
1	VLED
2	VLED
3	VLED
4	GND
5	GND
6	GND
7	VLED_EN
8	VPWM_EN

LVDS

1	RXO0−	16	RXE1+
2	RXO0+	17	GND
3	RXO1−	18	RXE2−
4	RXO1+	19	RXE2+
5	RXO2−	20	RXECLK−
6	RXO2+	21	RXECLK+
7	GND	22	RXE3−
8	RXOCLK−	23	RXE3+
9	RXOCLK+	24	GND
10	RXO3−	25	BIST
11	RXO3+	26	SDA
12	RXE0−	27	SCL
13	RXE0+	28	VDD
14	GND	29	VDD
15	RXE1−	30	VDD

USB interface:

1	VCC 5V
2	D+
3	D−
4	NC
5	NC
6	GND



Back view

Note:

1. Unless indicated, Tolerance "±0.5"
2. UV Glue For OLB Protection.
3. LCD 1920x1080 (R.G.B) TFT LCD => 15.6" TFT LCD
4. LVDS Connector: STM MSBKT2407P30HB (P1.0x30pin) or Equivalent.
   Mating Connector: JAE FI−X30HL or Equivalent
5. LED Power Connector: STM MSB24038P8A (P1.25x8pin) or Equivalent.
6. JP1 Connector:9827WRS−06B−9TV01E or Equivalent.

1	192010801 (AMA−M−156A04)	7		TOLERANCE GRADE(±)	A	B	DIM. MM	DWN. SNOW	DATE 07−26−23	TITLE AMA−156A04−DUC2510−G020 (15.6") IPS USB	
2	179V1920105 CTP AMA−SC−156−DUC2510−G020	8									
3		9					IE NO.	CHK.	DATE		
4		10									
5		11					PARTS NO. LCM−1 AMA−156A04−DUC2510−G020	APPD.	DATE	DWG. NO. *2307142MA	SHEET 1 OF 1
6		12									

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10. Packing

T.B.D.