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.	**AMA-156A01-DUC2510-G020**
Approved by	
Date	

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

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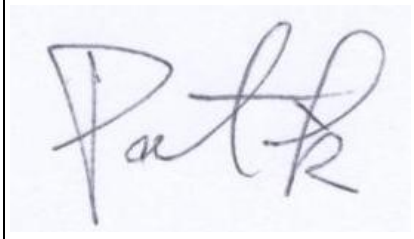
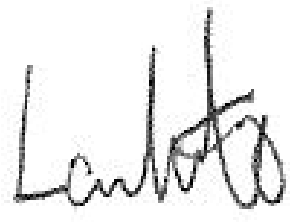
Approved by	Checked by	Organized by
		

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2018/07/16	--	New Release	Jessica
2018/09/17	1	Add Simple Plus Touch Display Logo	Raymond

1.0 General Descriptions

1.1 Introduction

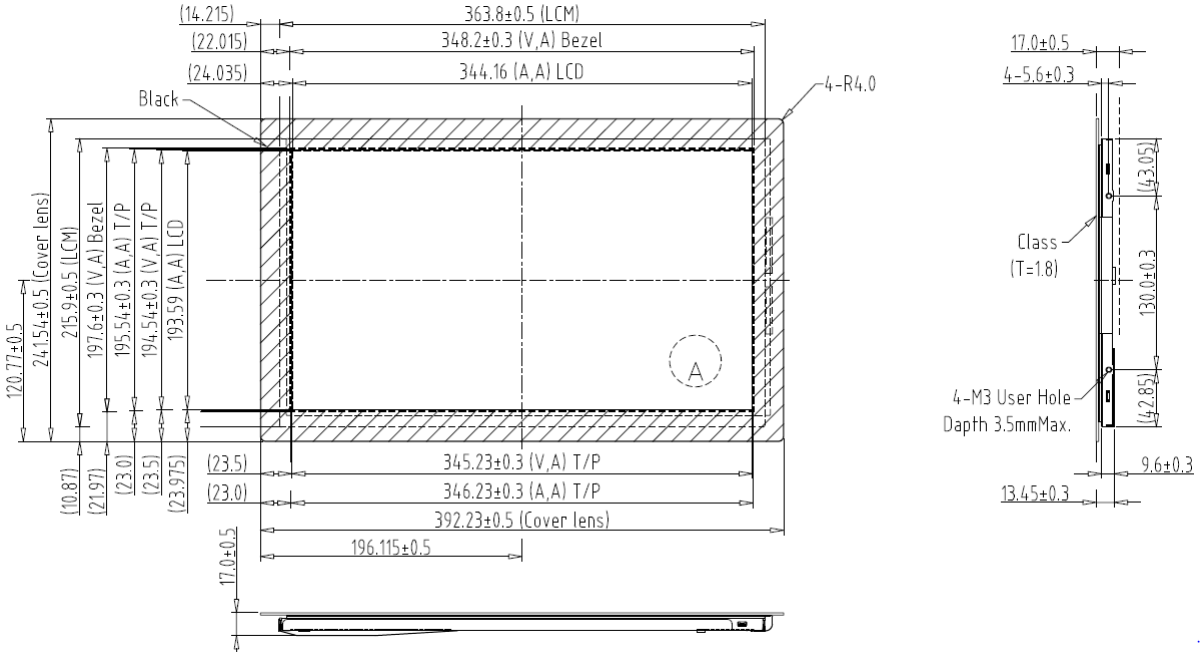
The LCM is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching device. This module has a 15.6 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical Stripe and this module can display 16.7M colors. The TFT-LCD panel used for this module is a low reflection and higher color type.

1.2 Features

- 3.3 V Logic Power
- LVDS (2ch) Interface for 1920 RGB x 1080 resolution
- 16.7M Colors (6bit + HFRC)
- On board LED Driving circuit
- Touch panel

1.3 Product Summary

Items	Specifications	Unit
Screen Diagonal	15.6	Inch
Pixel Format	1920 (H) x RGB x 1080 (V)	-
Pixel Pitch	0.17925 (H) X 0.17925 (V)	mm
Pixel Arrangement	R.G.B. Vertical Stripe	-
Display Mode	Normally Black	-
White Luminance	**850 (Typ.)**	cd /m2
Contrast Ratio	800 : 1 (Typ.)	-
Input Voltage	3.3	V
Support Color	16.7M	-



2.0 Absolute Maximum Ratings

Item	Symbol	Values		Unit.	Remark
		Min.	Max.		
Logic Signal Input Level	VDD	-0.3	+4.0	V	
Operation Temperature	TOP	**-30**	**75**	℃	
Storage Temperature	TST	**-30**	**80**	℃	

Note(1) Permanent damage may occur to the LCD module if you operate beyond this specification. Functional operation should be restricted to the conditions which described under normal operating conditions.

Note(2) Ta =25±2℃

3.0 Electrical Specifications

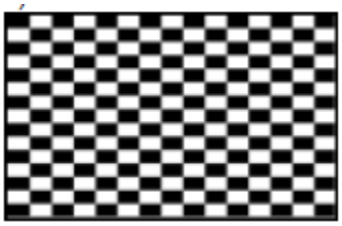
Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	Note 1
Permissible Input Ripple Voltage	V_{RF}	-	-	100	mV	At V_{DD} = 3.3V
Power Supply Current	I_{DD}	-	1.2	-	A	Note 1
Differential Input Voltage	V_{ID}	200	-	600	mV	

Note(1) The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for 3.3V at 25℃.

a) Typ: Mosaic Pattern

b) Max: R/G/B Pattern



Note(2) Calculated value for reference (VLED× ILED)

4.0 Interface Timings

4.1 Timing Characteristics

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	100	141.4	160	MHz
	High Time	Tch	-	*4/7*	-	Tc
	Low Time	Tcl	-	*3/7*	-	Tc
Frame Period		Tv	*1090*	*1100*	*1238*	lines
			-	*60*	-	Hz
			-	*16.7*	-	ms
Vertical Display Period		Tvd	-	*1080*	-	lines
One line Scanning Period		Th	*2080*	*2142*	*2400*	clocks
Horizontal Display Period		Thd	-	*1920*	-	clocks

Note※: This Module can support low frame refresh rate 50Hz & 40Hz.

4.2 Timing diagram

AC Specifications (under normal operating conditions unless otherwise specified)

Figure 2-4 Mode Unstable Scilent Time

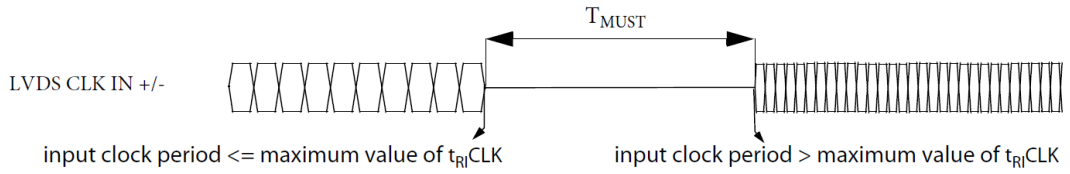
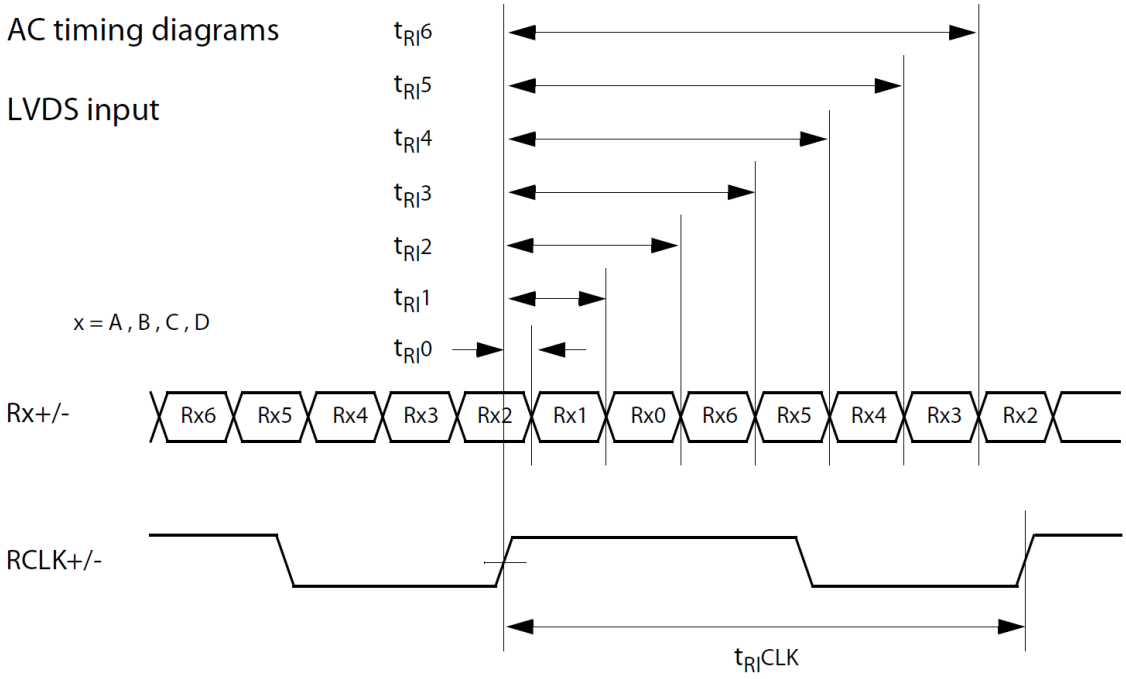


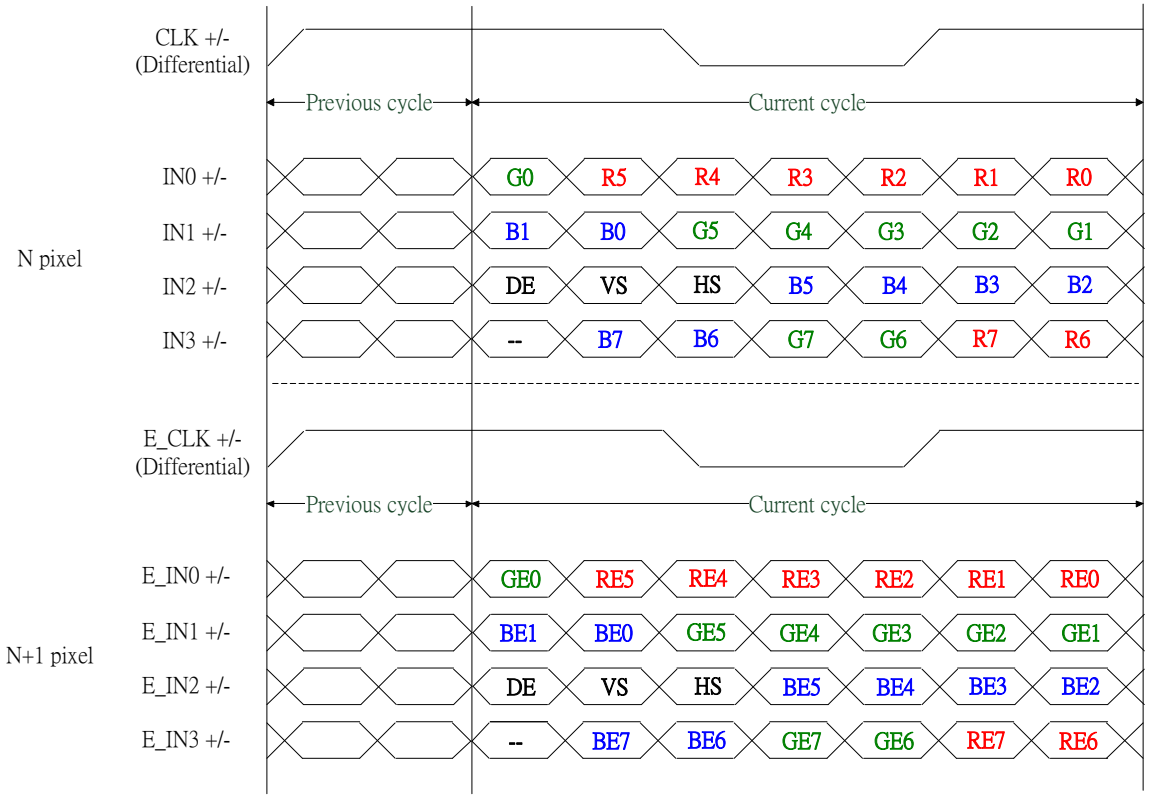
Figure 2-5 LVDS Receiver AC Timing



Symbol	Parameter	Min	Typ	Max	Units
F_{IC}	Input LVDS Clock Frequency	25		85	MHz
T_{ICS}	Input LVDS Clock Skew between any ports			1/5	T_{IC}
T_{ICJ}	Input LVDS Clock Jitter			2	ns
T_{must}	Mode Unstable Silent Time	10			ms
$t_{RI}CLK$	Input CLK period	11.8		40	ns
$t_{RI}0$	Input Data Position 0 ($t_{RI}CLK$ = 11.8ns)	-0.3	0	+0.3	ns

$t_{RI}1$	Input Data Position 1 ($t_{RI}CLK = 11.8ns$)	$\frac{tRICLK}{7} - 0.3$	$\frac{tRICLK}{7}$	$\frac{tRICLK}{7} + 0.3$	ns
$t_{RI}2$	Input Data Position 2 ($t_{RI}CLK = 11.8ns$)	$2\frac{tRICLK}{7} - 0.3$	$2\frac{tRICLK}{7}$	$2\frac{tRICLK}{7} + 0.3$	ns
$t_{RI}3$	Input Data Position 3 ($t_{RI}CLK = 11.8ns$)	$3\frac{tRICLK}{7} - 0.3$	$3\frac{tRICLK}{7}$	$3\frac{tRICLK}{7} + 0.3$	ns
$t_{RI}4$	Input Data Position 4 ($t_{RI}CLK = 11.8ns$)	$4\frac{tRICLK}{7} - 0.3$	$4\frac{tRICLK}{7}$	$4\frac{tRICLK}{7} + 0.3$	ns
$t_{RI}5$	Input Data Position 5 ($t_{RI}CLK = 11.8ns$)	$5\frac{tRICLK}{7} - 0.3$	$5\frac{tRICLK}{7}$	$5\frac{tRICLK}{7} + 0.3$	ns
$t_{RI}6$	Input Data Position 6 ($t_{RI}CLK = 11.8ns$)	$6\frac{tRICLK}{7} - 0.3$	$6\frac{tRICLK}{7}$	$6\frac{tRICLK}{7} + 0.3$	ns

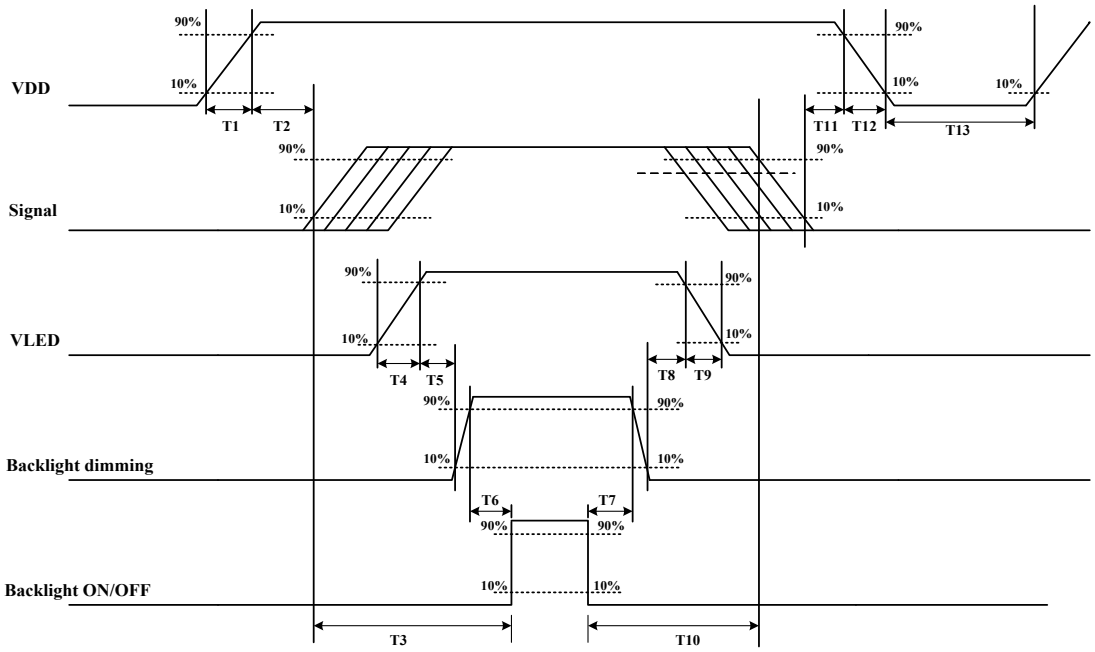
4.3 Timing Diagram of Interface Signal



4.4 Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown below.

VDD power and LED on/off sequence are as follows. Interface signals are also shown in the chart. Signal shall be Hi-Z state or low level when VDD is off.



Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	0	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	0.5	16	50	[ms]
T12	-	-	100	[ms]
T13	1000	-	-	[ms]

5.0 Optical Specifications

The optical characteristics are measured under stable conditions as following notes

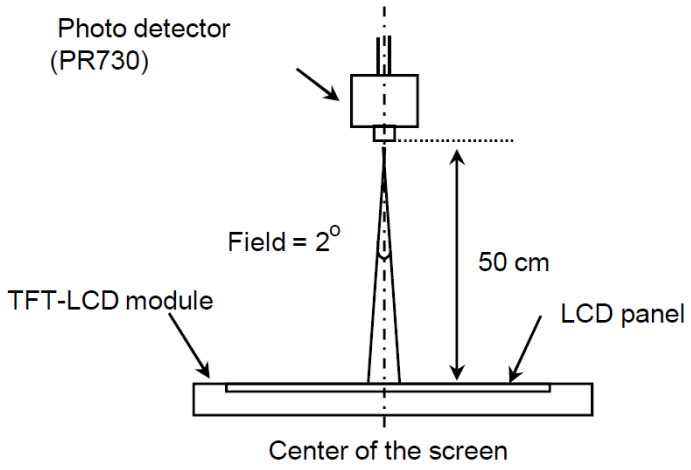
Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle （CR>10）	Horizontal	θ_L	80	85	-	degree	Note1
		θ_R	80	85	-		
	Vertical	θ_T	80	85	-		
		θ_B	80	85	-		
Contrast Ratio	Center		-	800	-	-	Note2
Response Time	Rising + Falling		-	30	35	ms	Note5
Color Chromaticity (CIE1931)	Red	x	Typ. -0.05	0.616	Typ. +0.05	-	Note3
	Red	y		0.339		-	
	Green	x		0.313		-	
	Green	y		0.582		-	
	Blue	x		0.156		-	
	Blue	y		0.134		-	
	White	x		0.313		-	
	White	y		0.329		-	
White Luminance	Center		**680**	**850**	-	cd/m^2	Note4
Luminance Uniformity	9Points		75	-	-	%	Note4
Cross Talk	CT	Θ=0	-	-	2.0	%	Note6

Note(1) Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure1).

Note(2) Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state (see Figure1). Luminance Contrast Ratio (CR) is defined mathematically as CR = Luminance when displaying a white raster / Luminance when displaying a black raster.

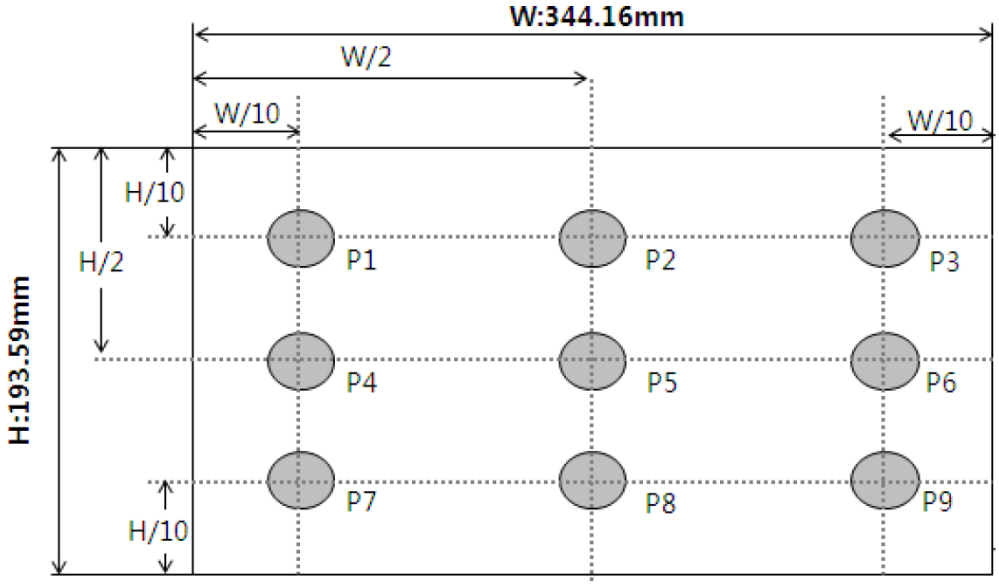
Note(3) Reference only / Standard Front Surface Treatment Measured with green cover glass. The color chromaticity coordinates specified in Table 4 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

Figure 1. Measurement Set Up



Optical characteristics measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



Center Luminance of white is defined as luminance values of center 9 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.

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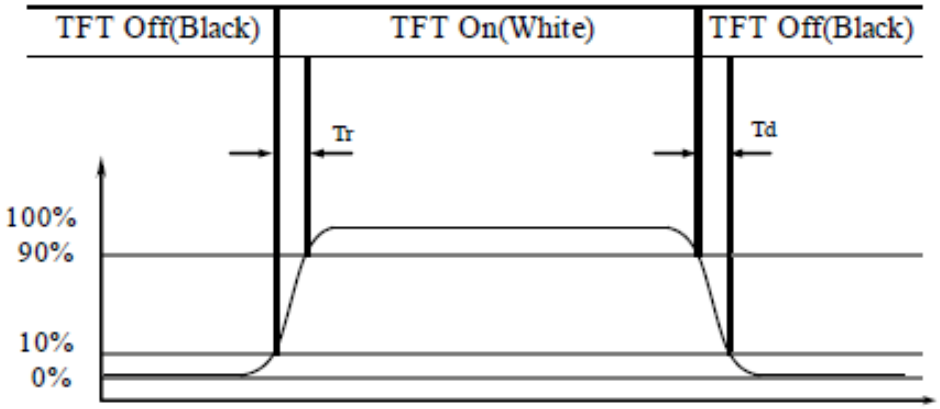
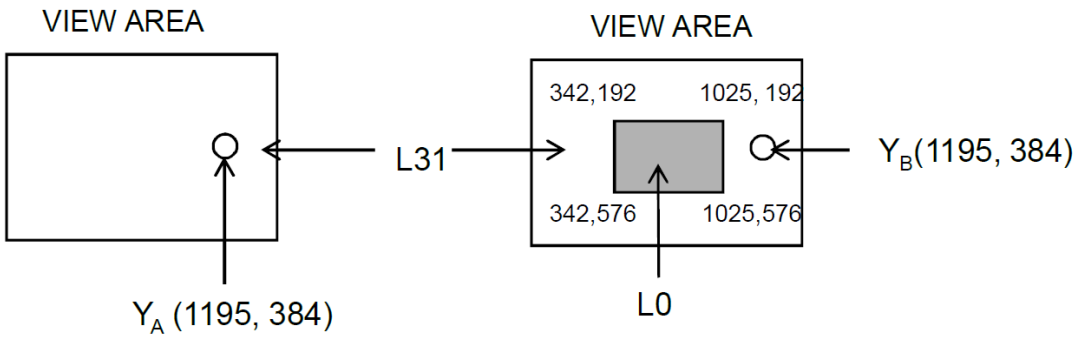
Figure 3. Response Time Testing



Note 5.
The electro-optical response time measurements shall be made as Figure 4 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

Note 6.
Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark (Refer to Figure 4).

Figure 4. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where:

Y_A = Initial luminance of measured area (cd/m^2)

Y_B = Subsequent luminance of measured area (cd/m^2)

The location measured will be exactly the same in both patterns

Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark (Refer to FIGURE 4).

6. Interface Connections

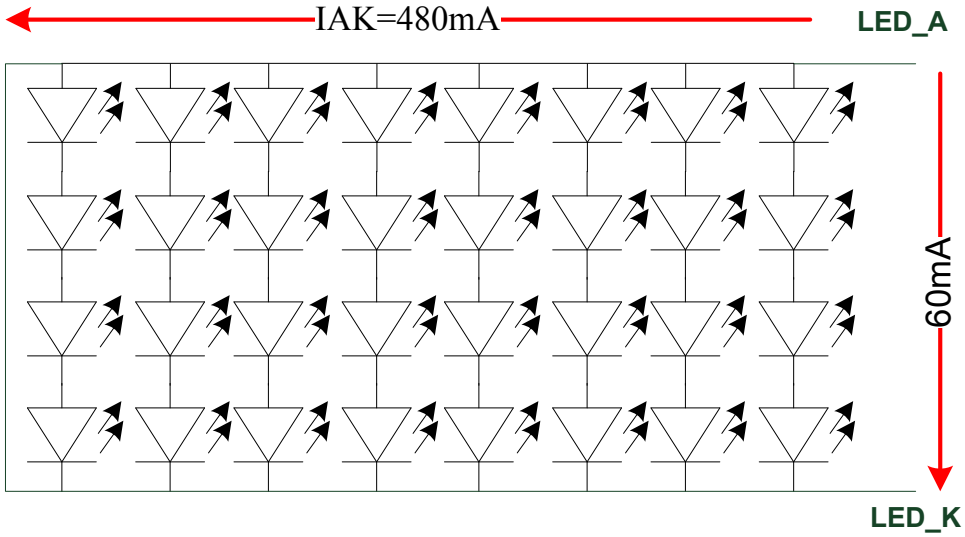
Pin #	Signal Name	Description
1	GND	Ground
2	NC	Not Connect
3	VDD	Power Supply
4	VDD	Power Supply
5	GND	Ground
6	GND	Ground
7	NC	Not Connect
8	NC	Not Connect
9	GND	Ground
10	IN0-	-LVDS differential data input
11	IN0+	+LVDS differential data input
12	IN1-	-LVDS differential data input
13	IN1+	+LVDS differential data input
14	IN2-	-LVDS differential data input
15	IN2+	+LVDS differential data input
16	CLK-	-LVDS differential data input
17	CLK+	+LVDS differential data input
18	IN3-	-LVDS differential data input
19	IN3+	+LVDS differential data input
20	E_IN0-	-LVDS differential data input
21	E_IN0+	+LVDS differential data input
22	E_IN1-	-LVDS differential data input
23	E_IN1+	+LVDS differential data input
24	E_IN2-	-LVDS differential data input
25	E_IN2+	+LVDS differential data input
26	E_CLK-	-LVDS differential data input
27	E_CLK+	+LVDS differential data input
28	E_IN3-	-LVDS differential data input
29	E_IN3+	+LVDS differential data input
30	GND	Ground
31	GND	Ground

32	VLED	LED Power Supply
33	VLED	LED Power Supply
34	VLED	LED Power Supply
35	VLED	LED Power Supply
36	LED_EN	LED Enable Pin：High→Enable
37	LED_PWM	PWM Signal for LED Dimming Control
38	GND	Ground
39	GND	Ground
40	GND	Ground

7. LED Driving Conditions

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
LED Driver voltage	VLED	-	12	-	V	
Power Supply Current For LED Driver	ILED	-	960	-	mA	VLED=12V VADJ=5V (duty 100%)
ADJ Input Voltage	VADJ	-	5	VLED	V	duty=100%
ADJ Dimming Freq.	FADJ	0.1		30	kHz	
LED voltage	VAK	--	24	26.4	V	IAK =480mA Ta=25℃
LED current	IAK	--	480	--	mA	Ta=25℃
		--	360	--	mA	Ta=60℃
LED Life Time	-	--	50K	--	Hour	Note (2)

Note(1) The constant current source is needed for white LED back-light driving. When LCM is operated at 60 deg.C ambient temperature, the IAK of the LED back-light should be adjusted to 360mA max

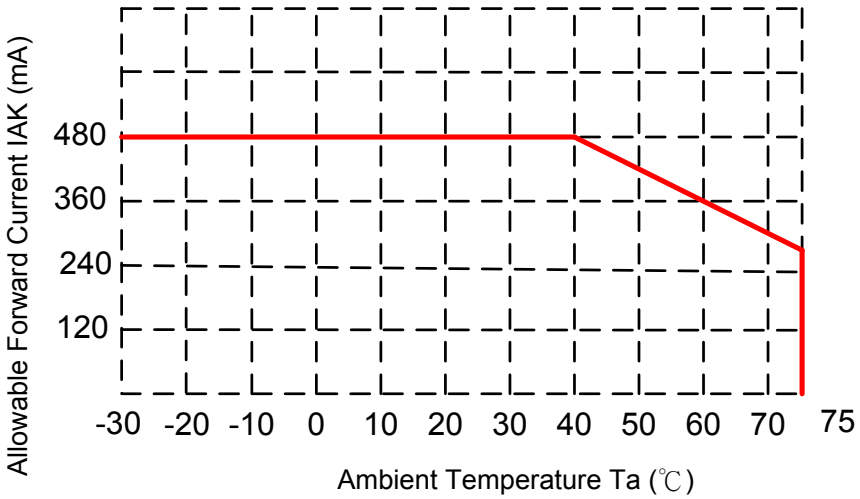


Note(2) Condition: Ta=25℃, continuous lighting

Life time is estimated data. Definitions of failure:

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

When LCM is operated over 40℃ ambient temperature, the IAK should follow :



8.0 Touch panel electrical specification

8.1 Electrical characteristics

Item	Specification
Type	Projective Capacitive Touch Panel
Activation	Multi-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	VCC	4.75	5	5.25	V
Touch panel power supply current at Normal operation mode	IVCC	--	45(Reference)	--	mA
Touch panel power supply current at USB suspend mode	IVCC	--	TBD	--	uA

8.2 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	GND

9.0 Reliability Test

The reliability test items and its conditions are shown below.

Test Item	Test Conditions	Note
High Temperature Operation	75±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 at High Temperature and Humidity	40°C, 90% RH , 240 hrss	1,2
Thermal Shock Test	-30°C (30min) ~ 60°C (30min) , 27 cycles	1,2
Vibration Test (Packing)	Sweep frequency : 10~55~10 Hz/1min Amplitude : 0.75mm Test direction : X.Y.Z/3 axes Duration : 30 min/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.

10. GENERAL PRECAUTION

10.1 Use Restriction

(1) This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

10.2 Disassembling or Modification

(1) Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. AMPIRE does not warrant the module, if customers disassemble or modify the module.

10.3 Breakage of LCD Panel

(1) If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.
(2) If liquid crystal contacts mouth or eyes, rinse out with water immediately.
(3) If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.
Handle carefully with chips of glass that may cause injury, when the glass is broken.

10.4 Electric Shock

(1) Disconnect power supply before handling LCD module.
(2) Do not pull or fold the LED cable.
(3) Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

10.5 Absolute Maximum Ratings and Power Protection Circuit

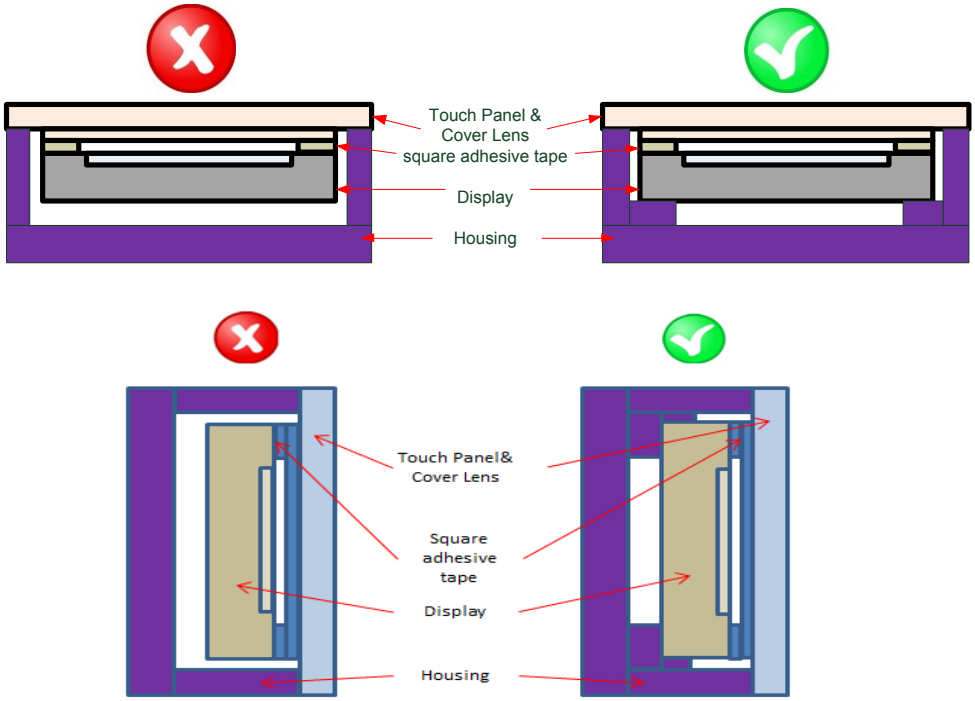
(1) Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.
(2) Please do not leave LCD module in the environment of high humidity and high temperature for a long time.
(3) It's recommended to employ protection circuit for power supply.

10.6 Operation

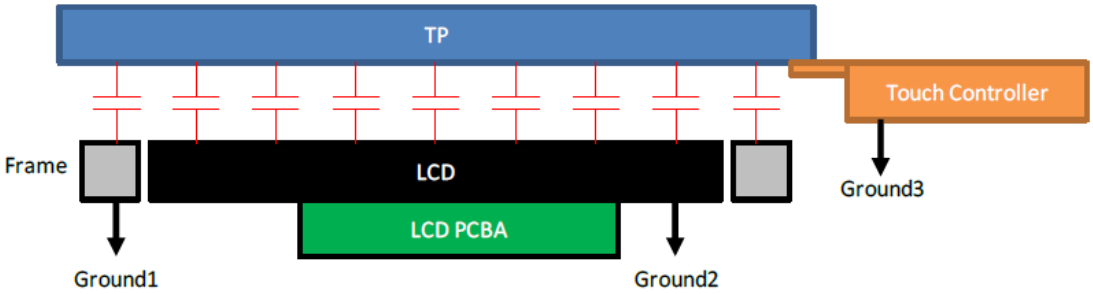
(1) Do not touch, push or rub the polarizer with anything harder than HB pencil lead.
(2) Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.
(3) When the surface is dusty, please wipe gently with absorbent cotton or other soft material.
(4) Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may cause deformation or color fading.
(5) When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzene or other adequate solvent.

10.7 Mechanism

(1) Please mount LCD module by using mounting holes arranged in four corners tightly.
(2) 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.



(3) 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

10.8 Static Electricity

(1) Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

(2) Because LCD modules use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

10.9 Strong Light Exposure

(1) The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

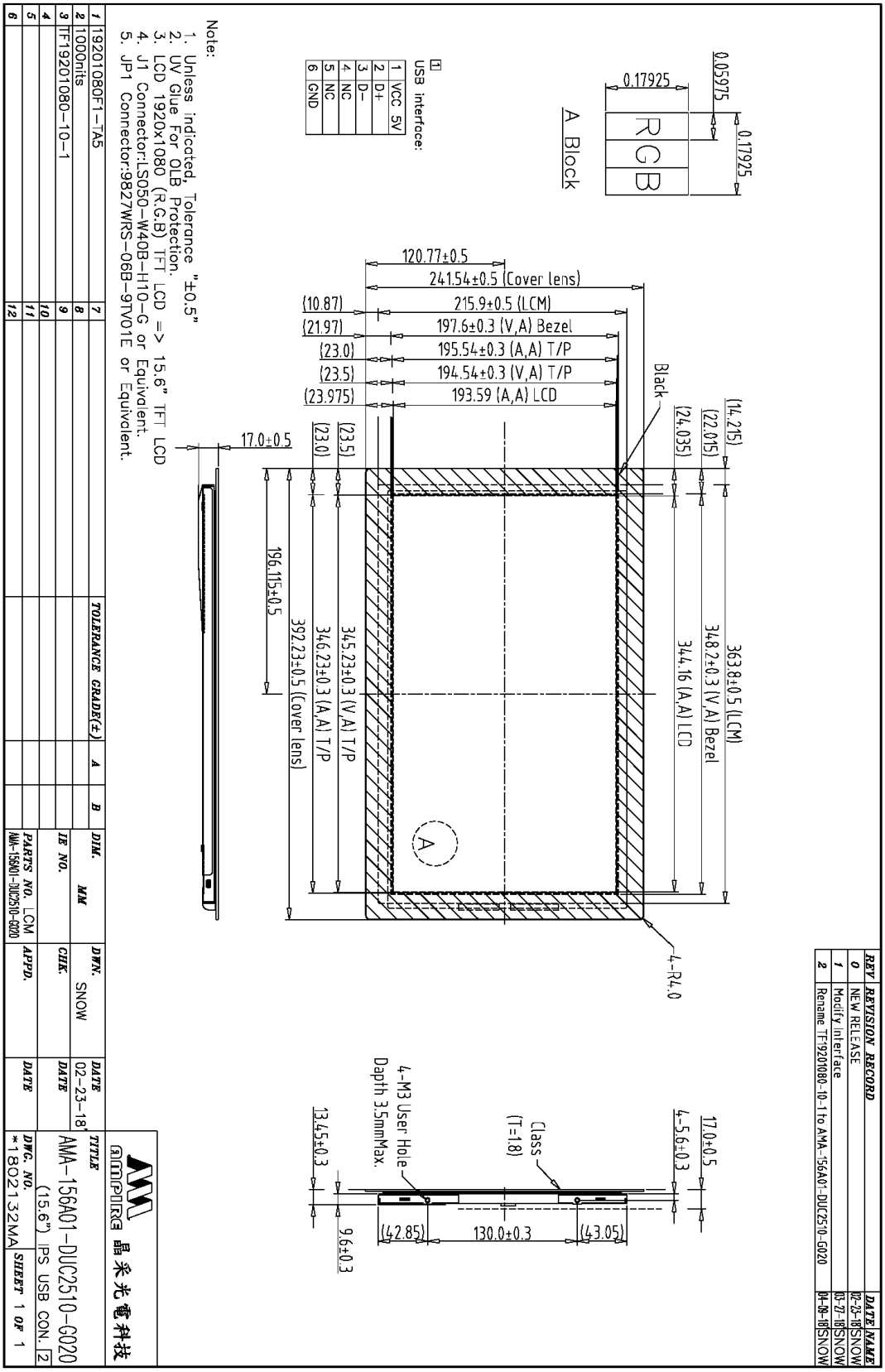
10.10 Disposal

(1) When disposing LCD module, obey the local environmental regulations.

10.11 Others

(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.

11.0 Outline Dimension



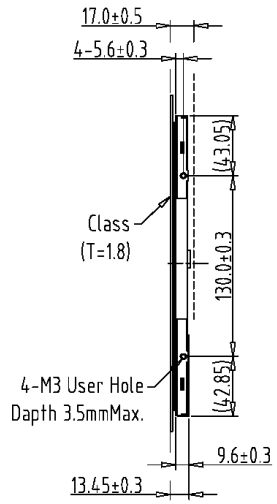
REV	REVISION RECORD	DATE	NAME
0	NEW RELEASE	02-23-18	SNOW
1	Modify Interface	03-27-18	SNOW
2	Rename TF19201080-10-1 to AMA-156A01-DUC2510-G020	04-09-18	SNOW

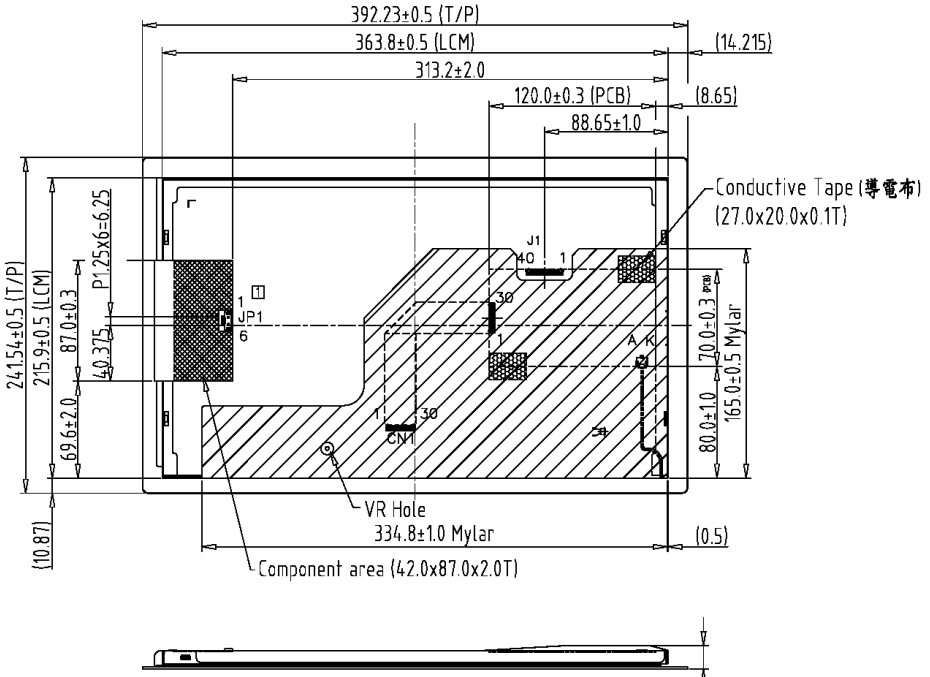
[1]
USB interface:

1	VCC 5V
2	D+
3	D−
4	NC
5	NC
6	GND

J1

1	GND	21	E_IN0+
2	NC	22	E_IN1−
3	VDD	23	E_IN1+
4	VDD	24	E_IN2−
5	GND	25	E_IN2+
6	GND	26	E_CLK−
7	NC	27	E_CLK+
8	NC	28	E_IN3−
9	GND	29	E_IN3+
10	IN0−	30	GND
11	IN0+	31	GND
12	IN1−	32	VLED
13	IN1+	33	VLED
14	IN2−	34	VLED
15	IN2+	35	VLED
16	CLK−	36	LED_EN
17	CLK+	37	LED_PWM
18	IN3−	38	GND
19	IN3+	39	GND
20	E_IN0−	40	GND





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. J1 LVDS Connector:LS050-W40B-H10-G or Equivalent.
5. JP1 Connector:9827WRS-06B-9TV01E or Equivalent.

1	19201080F1-TA5	7		TOLERANCE GRADE(±)	A	B	DIM. MM	DWN. SNOW	DATE 02-23-18
2	1000nits	8					IE NO.	CHK.	DATE
3	TF19201080-10-1	9							
4		10							
5		11					PARTS NO. LCM-1 AMA-156A01-DUC2510-G020	APPD.	DATE
6		12							

ampire 晶采光電科技

TITLE: AMA-156A01-DUC2510-G020 (15.6") IPS USB CON. 2

DWG. NO. *1802133MA | SHEET 1 OF 1