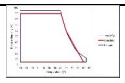
( ) Preliminary Specifications
(v) Final Specifications

Module	7 Inch Color TFT-LCD
Model Name	A070VTN06.4

Customer	**Date**	**Approved by**	**Date**
		Grace Hung	2018/05/21
Checked & Approved by	**Date**	**Prepared by**	**Date**
		Ryan Chen	2018/05/21
Customer's sign back page		General Display Business Division / AU Optronics corporation	

Contents

Record of Revision

Version	Date (yyyy/m/d)	Page	Old description	New Description
0.1	May 31, 2017	All	First draft specification	
0.2	Oct 18 2017	6		Modify LED light bar I_L & Response Time
		11		
		12		Modify 5.1.1 power Specification table (symbol name)
		13		Modify LED light bar I_L & P_{LED}
		14		Modify scanning direction drawing
		15/16		Modify 6.3.1 pin assignment table (pin name)
		18		Modify colors in terms & 6.4 input data table (signal name)
		21		Modify 6.5.3 AC Electrical Characteristics
1.0		All	**Final spec version**	

1. Operating Precautions

1) Since front polarizer is easily damaged, please be cautious and not to scratch it.
2) Be sure to turn off power supply when inserting or disconnecting from input connector.
3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or soft cloth.
5) Since the panel is made of glass, it may be broken or cracked if dropped or bumped on hard surface.
6) To avoid ESD (Electro Static Discharde) damage, be sure to ground yourself before handling TFT-LCD Module.
7) Do not open nor modify the module assembly.
8) Do not press the reflector sheet at the back of the module to any direction.
9) In case if a module has to be put back into the packing container slot after it was taken out from the container, do not press the center of the LED light bar edge. Instead, press at the far ends of the LED light bar edge softly. Otherwise the TFT Module may be damaged.
10) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
11) TFT-LCD Module is not allowed to be twisted & bent even force is added on module in a very short time. Please design your display product well to avoid external force applying to module by end-user directly.
12) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
14) The data on this specification sheet is applicable when LCD module is placed in landscape position.
15) Continuous displaying fixed pattern may induce image sticking. It’s recommended to use screen saver or shuffle content periodically if fixed pattern is displayed on the screen.

2. General Description

This specification applies to the Color Active Matrix Liquid Crystal Display A070VTN06.4 composed of a TFT-LCD display, and power supply circuit, and a LED backlight system. The screen format is intended to support.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25 °C condition:

Items	Unit	Specifications
Screen Diagonal	[inch]	7.0
Active Area	[mm]	154.08(H) × 85.92(V)
Resolution		800 RGB (H) × 480(V)
Pixel Pitch	[mm]	0.1926 (H) x 0.179(V)
Pixel Arrangement		RGB Strip
Display Mode		Normally White
Nominal Input Voltage DVDD	[Volt]	3.3 (typ,)
Power Consumption	[Watt]	1.86W (max.)
Weight	[Grams]	150g (typ.+/-10g)
Physical Size	[mm]	164.9(H) × 100(V) × 5.7(D) (typ.)
Electrical Interface		Parallel RGB
Surface Treatment		Anti-Glare, 3H
Support Color		16.2M Colors
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 -30 ~ +80 -30 ~ +80
RoHS Compliance		Yes

2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25°C (Room Temperature):

Item	Unit	Conditions		Min.	Typ.	Max.	Note
White Luminance	cd/m^2	I_L=54mA(center point)		400	500		1
Uniformity	%	9 points		70	75		2,3
Contrast Ratio	--			400	500		4
Response Time	msec	Rising					5
		Falling					
		Rising + Falling			25	50	
Viewing Angle	degree	Horizontal CR >= 10	(Right)	55	75		6
			(Left)	55	75		
		Vertical CR >= 10	(Upper)	35	55		
			(Lower)	55	65		
Color / Chromaticity Coordinates (CIE 1931)	--	Red x		0.535	0.585	0.635	
		Red y		0.311	0.361	0.411	
		Green x		0.28	0.33	0.38	
		Green y		0.532	0.582	0.632	
		Blue x		0.103	0.153	0.203	
		Blue y		0.022	0.072	0.122	
		White x		0.26	0.31	0.36	
		White y		0.28	0.33	0.38	
Color Gamut	%				50		

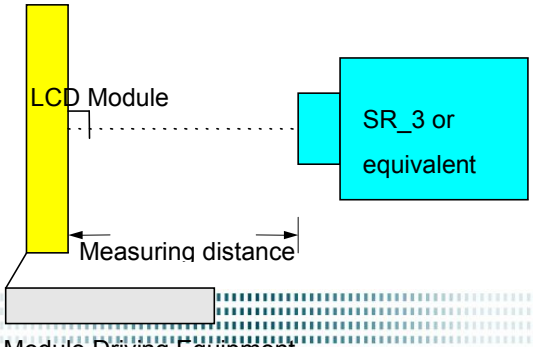
Note 1: Measurement method

Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

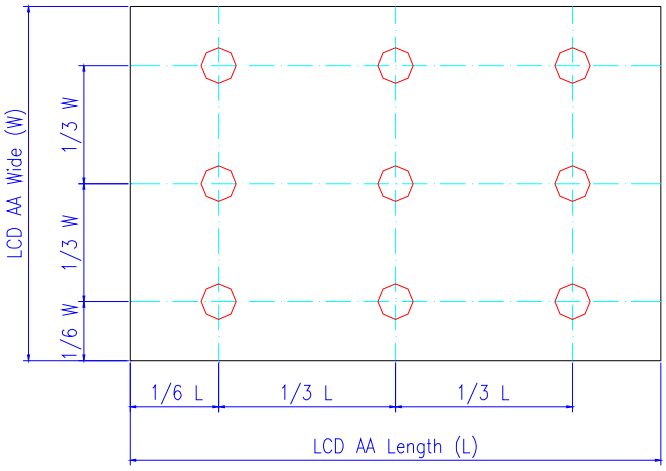
Aperture 1□with 50cm viewing distance

Test Point Center

Environment *< 1 lux*



Note 2: Definition of 9 points position



Note 3: The luminance uniformity of 9 points is defined by dividing the minimum luminance values by the maximum test point luminance

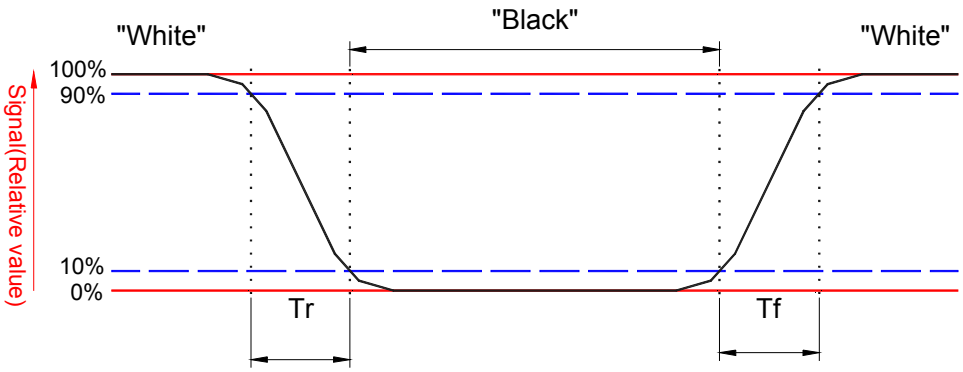
$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4: Definition of contrast ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the “White” state}}{\text{Brightness on the “Black” state}}$$

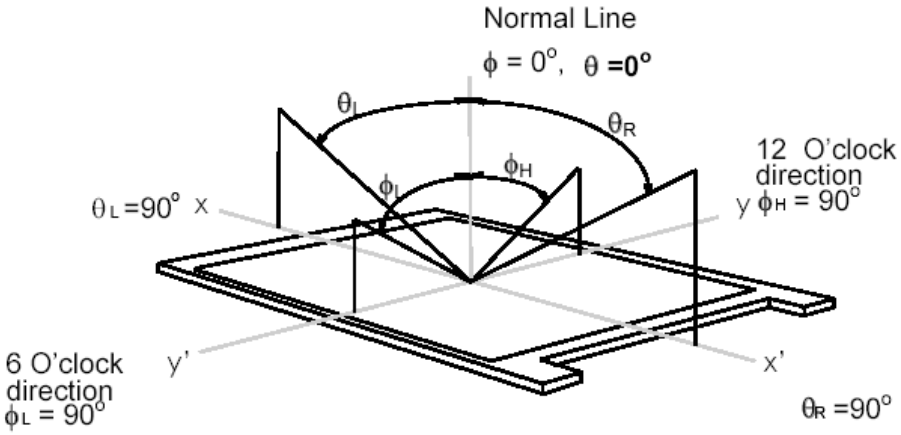
Note 5: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “White” to “Black” (rising time) and from “Black” to “White” (falling time), respectively. The response time interval is between 10% and 90% of amplitudes. Please refer to the figure as below.



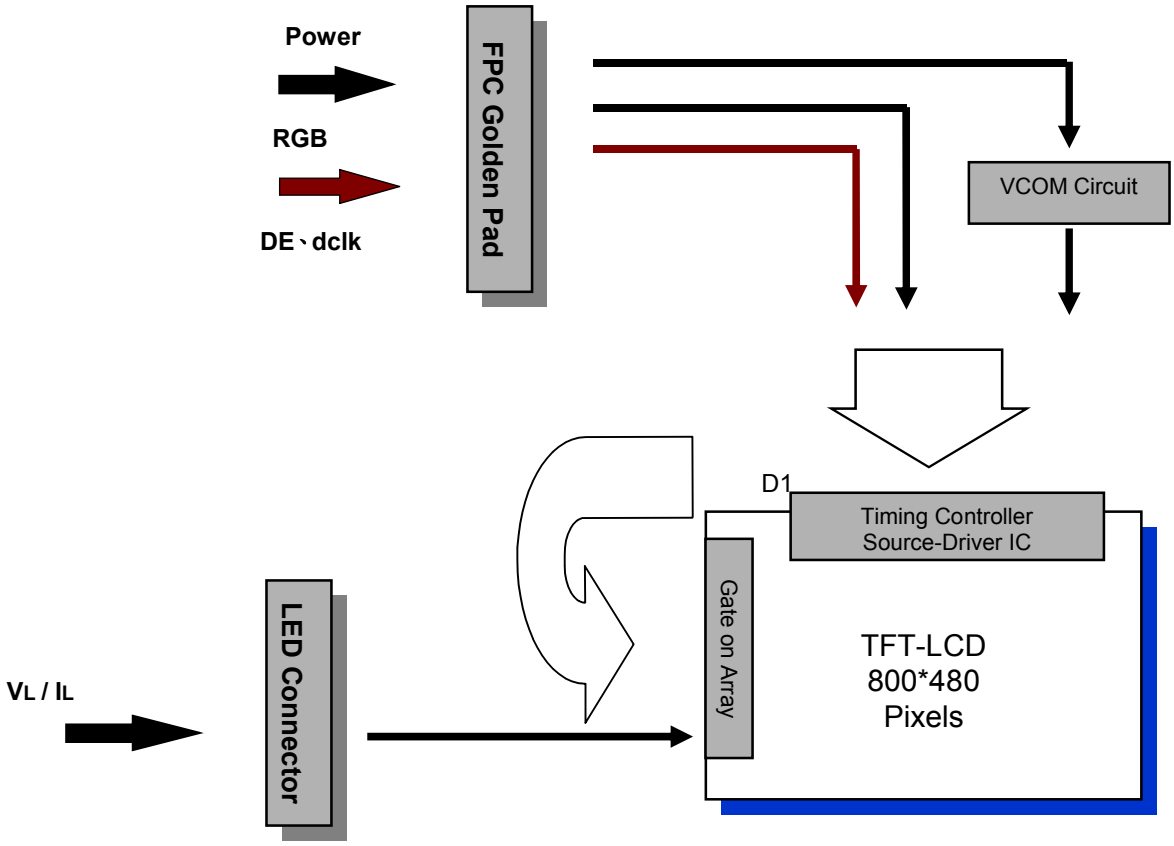
Note 6: Definition of viewing angle

Viewing angle is the measurement of contrast ratio □10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as below: 90° (θ) horizontal left and right, and 90° (Φ) vertical high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated to its center to develop the desired measurement viewing angle.



3. Functional Block Diagram

The following diagram shows the functional block of the 7 inch color TFT/LCD module:



4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Items	Symbol	Values		Unit	Condition
		Min.	Max.		
Power Voltage	DVDD	-0.3	5	V	Note 1,2
	AVDD	6.5	13.5	V	Note 1,2
	VGH	-0.3	40	V	Note 1,2
	VGL	-20	0.3	V	Note 1,2
	VGH－VGL	-	40	V	Note 1,2

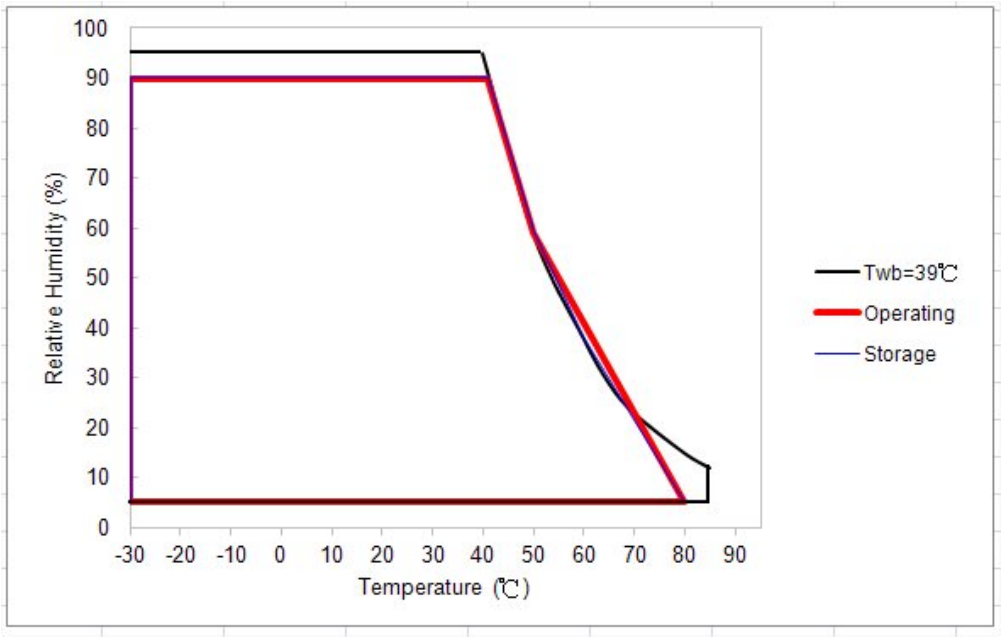
Note 1: Functional operation should be restricted under ambient temperature. (25℃).

Note 2: Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the electrical characteristics chapter.

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-30	80	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-30	80	[°C]
Storage Humidity	HST	5	90	[%RH]

Note: Maximum Wet-Bulb should be 39 °C and no condensation.


100
90
80
70
60
50
40
30
20
10
0
Relative Humidity (%)
-30 -20 -10 0 10 20 30 40 50 60 70 80 90
Temperature (℃)
Twb=39℃
Operating
Storage

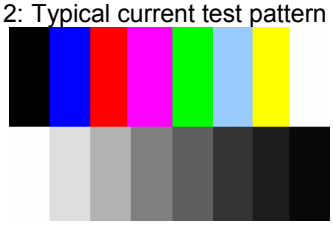
5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes
Power supply		DVDD	3.0	3.3	3.6	V	Note 2
		I_{DVDD}	-	9.8	14.0	mA	
		AVDD	10.2	10.4	10.6	V	Note 2
		I_{AVDD}	-	13.1	20.0	mA	
		VGH	15.3	16.0	16.7	V	Note 2
		I_{VGH}	-	0.2	1.0	mA	
		VGL	-7.7	-7.0	-6.3	V	Note 2
		I_{VGL}	-	-0.2	-1.0	mA	
Input signal voltage	H Level	VIH	0.7*DVDD	-	DVDD	V	Note 1
	L Level	VIL	0	-	0.3×DVDD	V	

Note 1: Digital Data
Note 2: Typical current test pattern



5.2 Backlight Unit

5.2.1 Parameter guideline for LED

Following characteristics are measured under a stable condition using an inverter at 25℃ (Room Temperature):

LED Light bar

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
I_L	LED Supply Current		**54**		[mA]	Ta = 25°C, Note 2
V_L	LED Supply Voltage		**9.3**	**10.2**	[Volt]	Ta =25°C Note 2/3
P_{LED}	LED Power Consumption			**1.66**	[Watt]	Ta = 25°C Note 3/4/5
L_L	LED Life Time	**50,000**			Hrs	Ta = 25°C, Note 6, Note 7

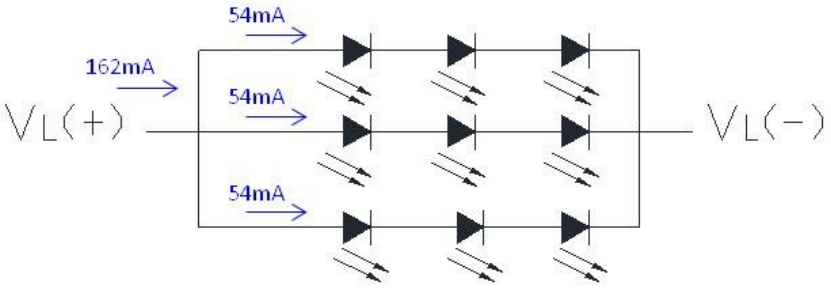
Note 1: Ta means ambient temperature of TFT-LCD module.

Note 2: I_L, V_L are defined for one channel LED. There are three LED channel in back light unit.

Note 3: LED backlight is **9** LEDs (**3** strings, **3**pcs for each string)

Note 4: The LED supply power is for 3 strings of LED

Note 5: The voltage capacity of LED driver IC must be over max. of LED Voltage.



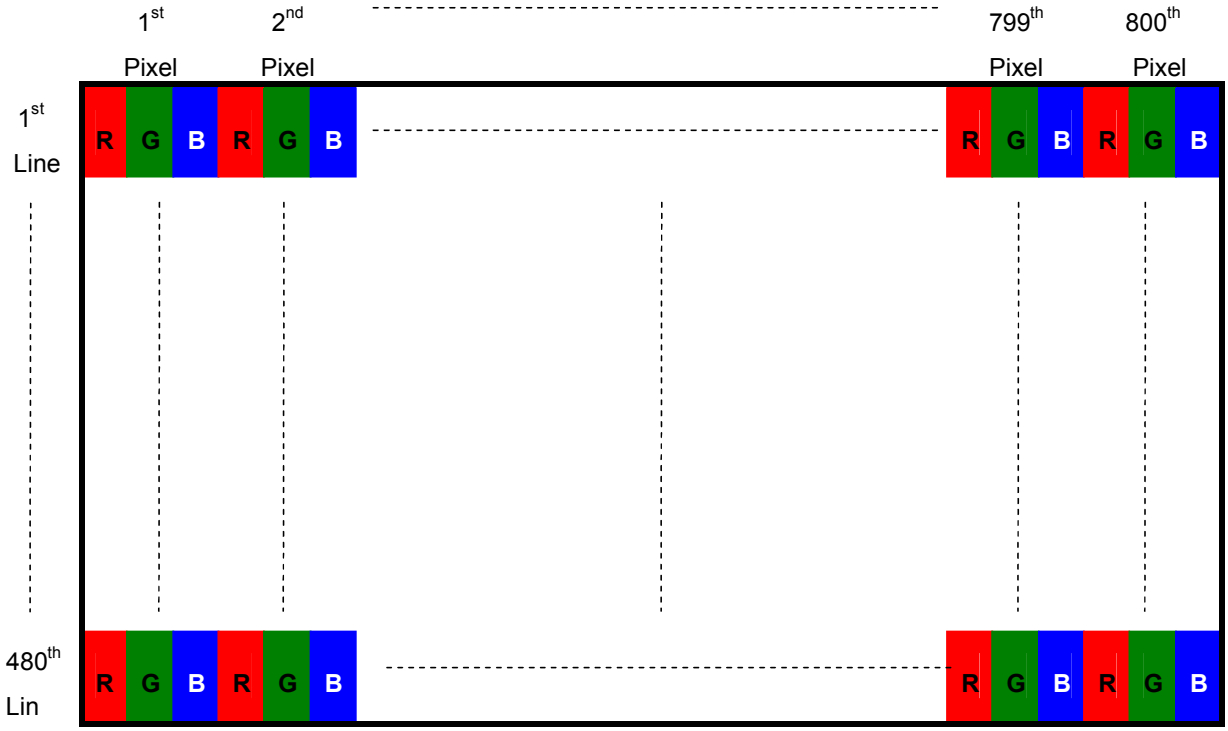
Note 6: Definition of life time: Brightness becomes to 50% of its original value.
The minimum life time of LED unit is on the condition of I_L and 25±2°C (Room Temperature).

Note 7: If A070VTN06.4 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduce.

6. Signal Characteristic

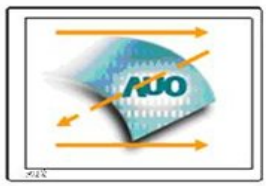
6.1 Pixel Format Image

Following figure shows the relationship between input signal and LCD pixel format.

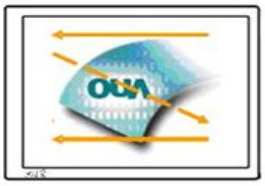


6.2 Scanning Direction

The following figures show the image seen from the front view. The arrow indicates the direction of scan.

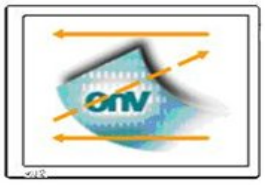


U/D = LOW ; L/R = HIGH



U/D = LOW ; L/R = LOW

U/D = HIGH ; L/R = HIGH



U/D = HIGH ; L/R = LOW

6.3 Signal Description

6.3.1 TFT LCD Module:

Pin Assignment

No.	Pin Name	I/O	Description	Remarks
1	VL(+)	P	Power for LED backlight(Anode)	
2	VL(+)	P	Power for LED backlight(Anode)	
3	VL(-)	P	Power for LED backlight(Cathode)	
4	VL(-)	P	Power for LED backlight(Cathode)	
5	GND	P	Power ground	
6	NC	-	NO connection	
7	DVDD	P	Power for Digital Circuit	
8	MODE	I	DE/SYNC mode select	Note 1
9	DE	I	Data Input Enable	
10	VSYNC	I	Vertical Sync Input	
11	HSYNC	I	Horizontal Sync Input	
12	DB7	I	Blue data(MSB)	
13	DB6	I	Blue data	
14	DB5	I	Blue data	
15	DB4	I	Blue data	
16	DB3	I	Blue data	
17	DB2	I	Blue data	
18	DB1	I	Blue data	Note 2
19	DB0	I	Blue data(LSB)	Note 2
20	DG7	I	Green data(MSB)	
21	DG6	I	Green data	
22	DG5	I	Green data	
23	DG4	I	Green data	
24	DG3	I	Green data	
25	DG2	I	Green data	
26	DG1	I	Green data	Note 2
27	DG0	I	Green data (LSB)	Note 2
28	DR7	I	Red data(MSB)	
29	DR6	I	Red data	
30	DR5	I	Red data	
31	DR4	I	Red data	
32	DR3	I	Red data	
33	DR2	I	Red data	
34	DR1	I	Red data	Note 2

35	DR0	I	Red data (LSB)	Note 2
36	GND	P	Power ground	
37	DCLK	I	Sample clock	Note 3
38	GND	P	Power ground	
39	L/R	I	Left / right selection	Note 4,5
40	U/D	I	UP / down selection	Note 4,5
41	VGH	P	Gate ON Voltage	
42	VGL	P	Gate OFF Voltage	
43	AVDD	P	Power for Analog Circuit	
44	RESET	I	Global reset pin	Note 6
45	NC	-	NO connection	
46	NC	-	NO connection	
47	DITHB	I	Dithering function	Note 7
48	GND	P	Power ground	
49	NC	-	NO connection	
50	NC	-	NO connection	

*** I: Input signal; P: Power source Connector: FH12A-50S-0.5SH (Hirose)

Note 1: DE/SYNC mode select. Normally pull high.

When select DE mode, MODE="1"

When select SYNC mode, MODE="0"

Note 2: When input 18 bits RGB data, the two low bits of R, G and B data must be grounded.

Note 3: Data shall be latched at the falling edge of DCLK.

Note 4: Selection of scanning mode

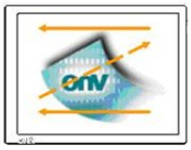
Scan direction input control		Descriptions
U/D	L/R	
GND	DVDD	From up to down, and left to right.
DVDD	GND	From down to up, and right to left.
GND	GND	From up to down, and right to left.
DVDD	DVDD	From down to up, and left to right.

Note 5: Definition of scanning direction. Refer to the figure as below:

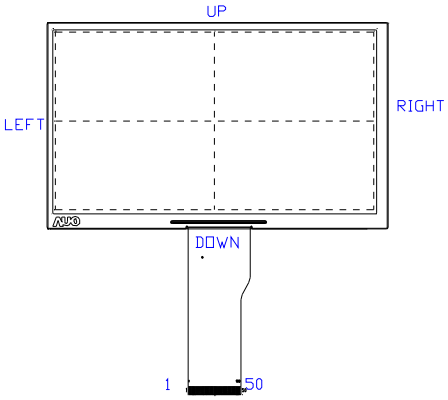
U/D = LOW ; L/R = HIGH

U/D = LOW ; L/R = LOW

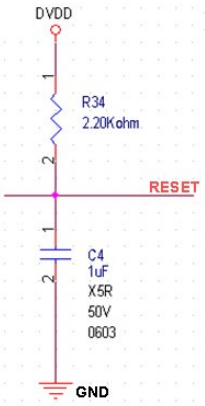
U/D = HIGH ; L/R = HIGH



U/D = HIGH ; L/R = LOW



Note 6: Global reset pin. Active low to enter reset state. Suggest to connect with an RC (R=2.2K ohm, C=1uF) reset circuit for stability. Normally pull high.

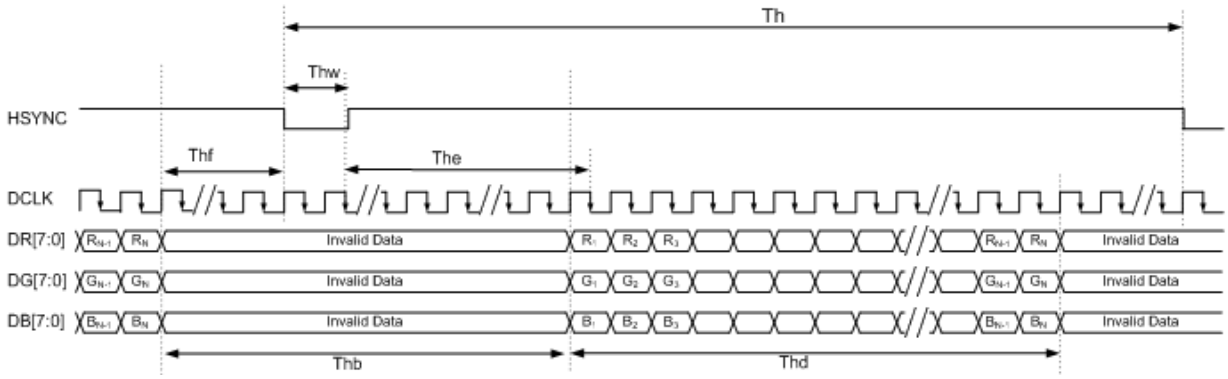


Active Low

6.4 The Input Data Format

This product displays 16.2M colors in terms of the 252 grey levels on RGB respectively. The following table demonstrates the display of input data.

Signal Name	Description	Remark
DR7 DR6 DR5 DR4 DR3 DR2 DR1 DR0	Red Data 7 Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0	Red-pixel Data For 8Bits RGB input MSB: R7 ; LSB: R0
DG7 DG6 DG5 DG4 DG3 DG2 DG1 DG0	Green Data 7 Green Data 6 Green Data 5 Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0	Green-pixel Data For 8Bits RGB input MSB: G7 ; LSB: G0
DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0	Blue Data 7 Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0	Blue-pixel Data For 8Bits RGB input MSB: B7 ; LSB: B0



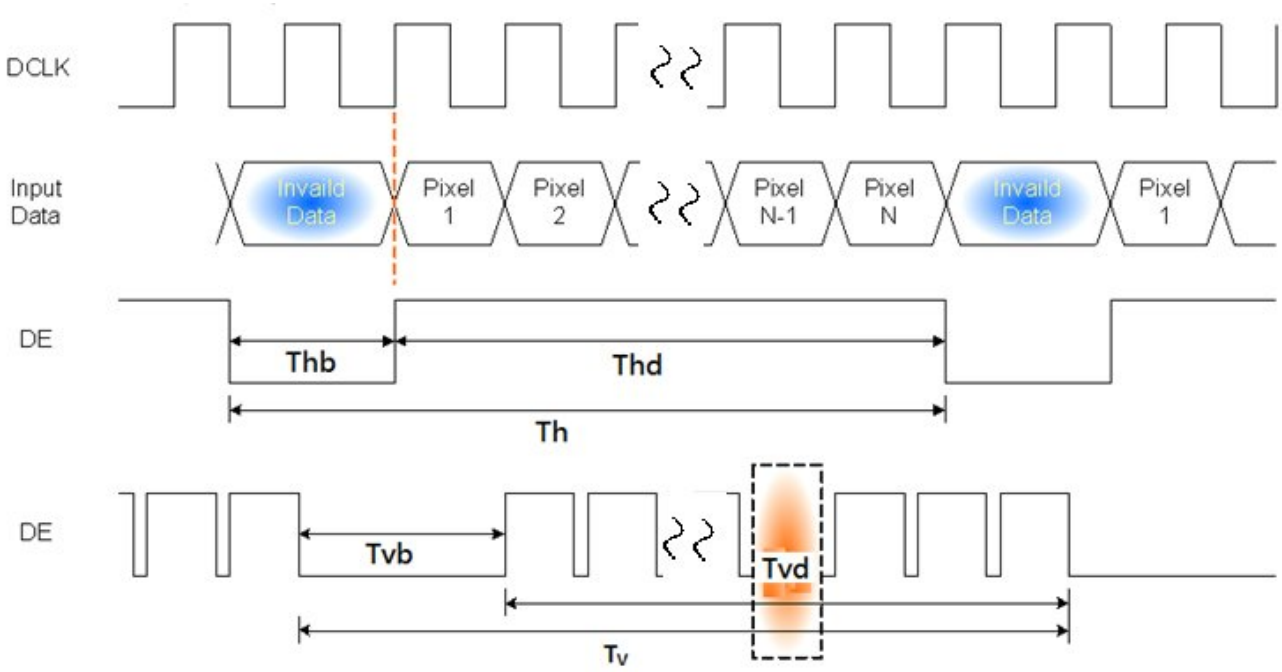
6.5 Interface Timing

6.5.1 DE MODE

Input Timing Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Clock frequency	DCLK	26.4	33.3	46.8	MHz
Frame rate	-	-	60	70	Hz
Horizontal Signal					
Horizontal display area	T_{hd}		800		DCLK
Horizontal period area	T_h	862	1056	1200	DCLK
Horizontal blanking area	T_{hb}	62	256	400	DCLK
Vertical Signal					
Vertical display area	T_{vd}		480		Th
Vertical period area	T_v	510	525	650	Th
Vertical blanking area	T_{vb}	30	45	170	Th

Input Timing Diagram

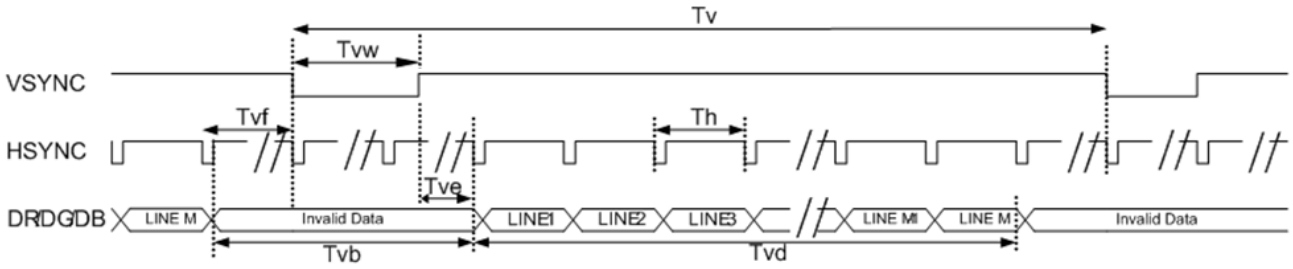


6.5.2 SYNC MODE

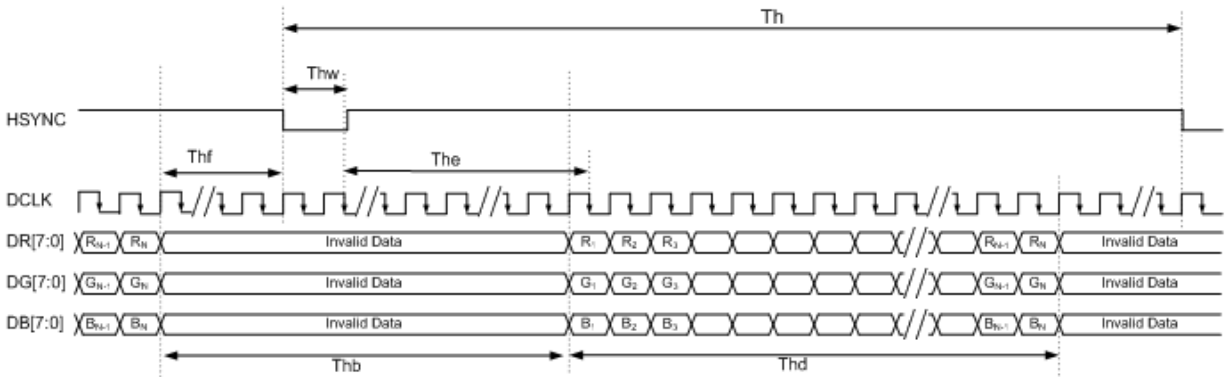
Input Timing Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Clock frequency	DCLK	-	29.2	46.5	MHz
Frame rate	-	-	60	70	Hz
Horizontal Signal					
Horizontal display area	Thd		800		DCLK
Horizontal period area	Th	908	928	1088	DCLK
Horizontal blanking area	Thb	108	128	288	DCLK
Horizontal pulse width	Thw	1	48	87	DCLK
Horizontal back porch	The	88	88	88	DCLK
Horizontal front porch	Thf	20	40	200	DCLK
Vertical Signal					
Vertical display area	Tvd		480		Th
Vertical period area	Tv	517	525	712	Th
Vertical blanking area	Tvb	42	45	232	Th
Vertical pulse width	Tvw	3	3	3	Th
Vertical back porch	Tve	32	32	32	Th
Vertical front porch	Tvf	5	13	200	Th

Vertical Input Timing Diagram



Horizontal Input Timing Diagram

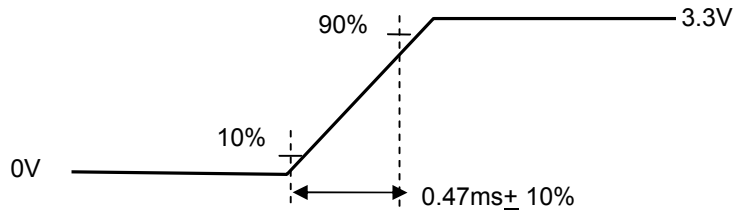


6.5.3 AC Electrical Characteristics

Input Timing Characteristics

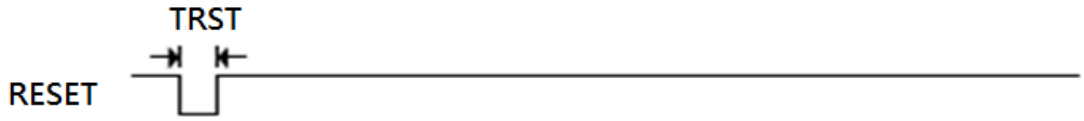
Parameter	Symbol	Min	Typ	Max	Unit
HSYNC setup time	Thst	8	-	-	ns
HSYNC hold time	Thhd	8	-	-	ns
VSYNC setup time	Tvst	8	-	-	ns
VSYNC hold time	Tvhd	8	-	-	ns
Data setup time	Tdsu	8	-	-	ns
Data hold time	Tdhd	8	-	-	ns
DE setup time	Tesu	8	-	-	ns
DVDD power on slew rate	TPOR	-	-	20	ms
RESET pulse width	TRST	1	-	-	ms
DCLK cycle time	Tcph	20	-	-	ns
DCLK pulse duty	Tcwh/Tcwl	40	50	60	%

DVDD power on slew rate

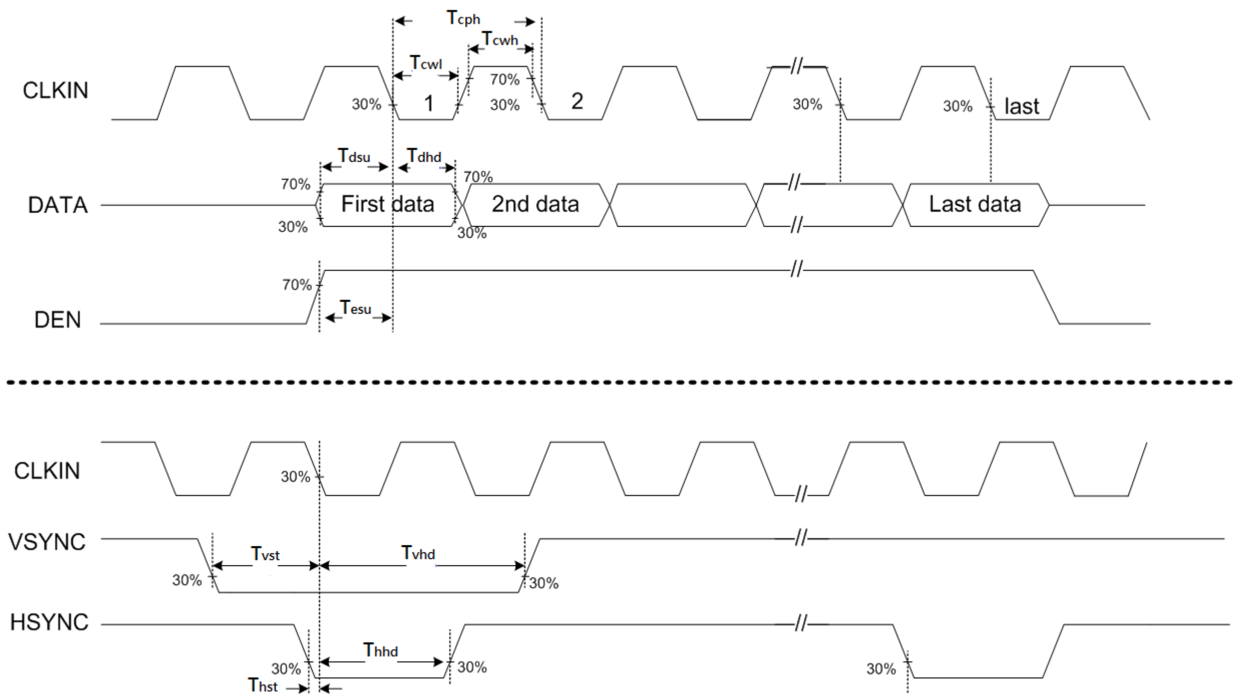


RESET pulse width

VDD rising time T_{POR}



DCLK and Data Input Timing Diagram



6.6 Power ON/OFF Sequence

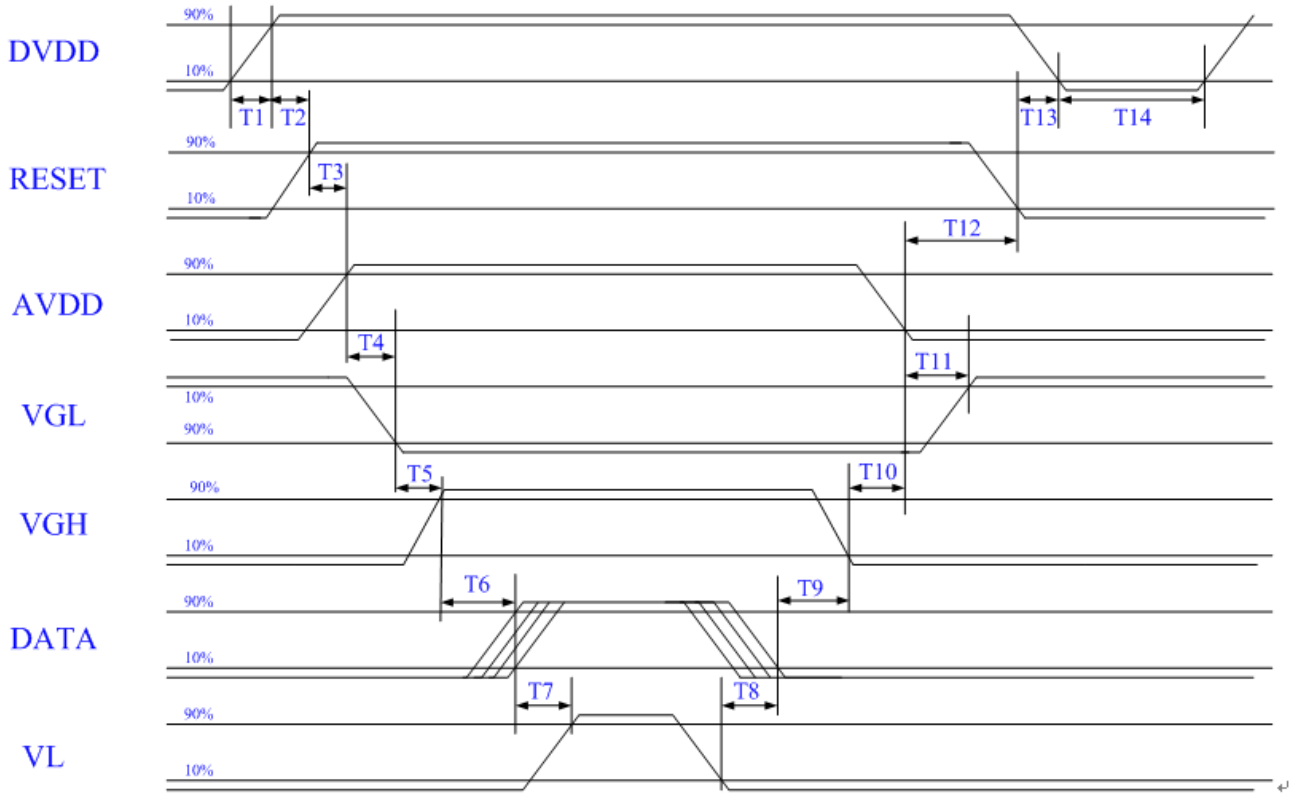
The LCD adopts high voltage driver IC, so it could be permanently damaged under using wrong power on/off sequence procedure. The suggested LCD power on/off sequence is shown as below:

Power on sequence:

DVDD→ RESET → AVDD→ VGL → VGH → Digital input (Data/DCLK/DE) → BLKEN

Power off sequence:

BLKEN →Digital input (Data/DCLK/DE) → VGH → AVDD→ VGL → RESET→ DVDD



Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	20	ms
T2	1	-	10	ms
T3	20	-	800	ms
T4	10	-	20	ms
T5	0	-	20	ms
T6	10	-	30	ms
T7	100	-	-	ms
T8	100	-	-	ms
T9	10	-	30	ms
T10	10	-	20	ms
T11	10	-	20	ms
T12	20	-	400	ms
T13	1	-	10	ms
T14	1000	-	-	ms

7. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias	60°C / 90%, 240Hrs	Operation
High Temperature Operation	80°C, 240Hrs	
Low Temperature Operation	-30°C, 240Hrs	
High temperature Storage	80°C, 240Hrs	
Low temperature Storage	-30°C, 240Hrs	
Thermal Shock Test	-30°C ~ 80°C /100 cycles 1Hrs/cycle	Non-operation
Shock Test (Non-Operating)	100G, 6ms, ±X,±Y,±Z, 6 directions 3 times for each direction	
Vibration Test (Non-Operating)	Frequency range:10~55Hz / Stoke:1.5mm / Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X, Y, Z (6 hours for total)	JISC7021,A10 Condition A
ESD	Contact : ± 4KV/ operation, Class B Air : ± 8KV / operation, Class B	Note 1

Note1: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost

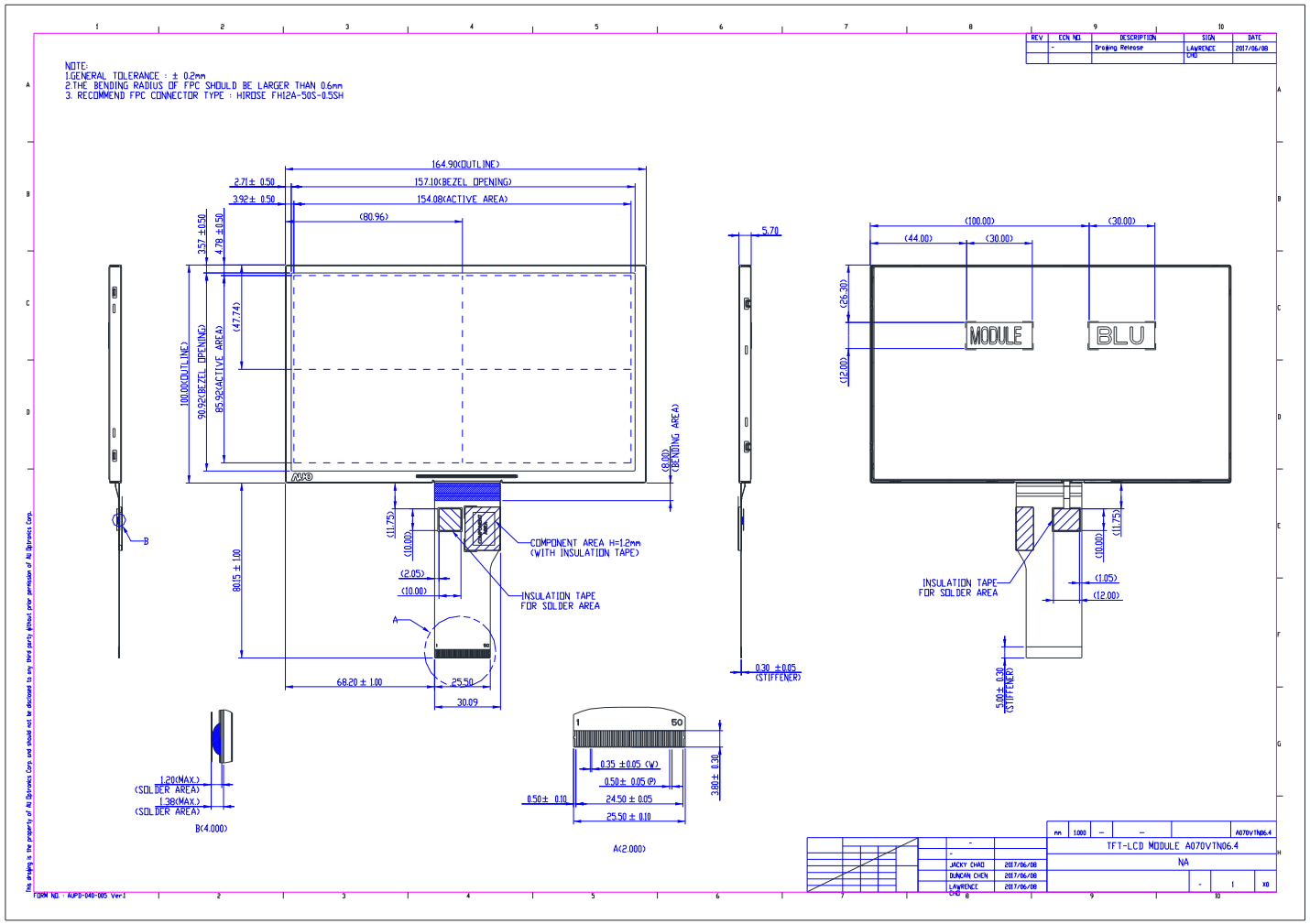
. Self-recoverable. No hardware failures.

Note2:

- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.

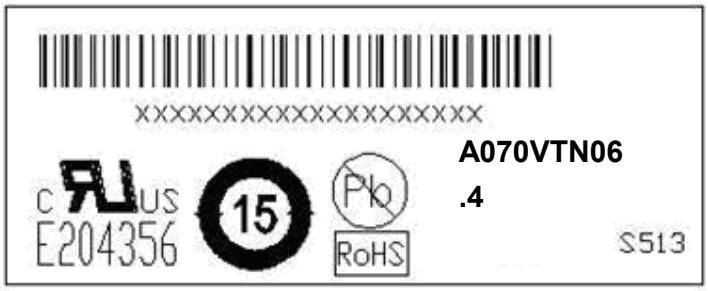
8. Mechanical Characteristics

8.1 LCM Outline Dimension



9. Label and Packaging

9.1 Shipping Label (on the rear side of TFT-LCD display)



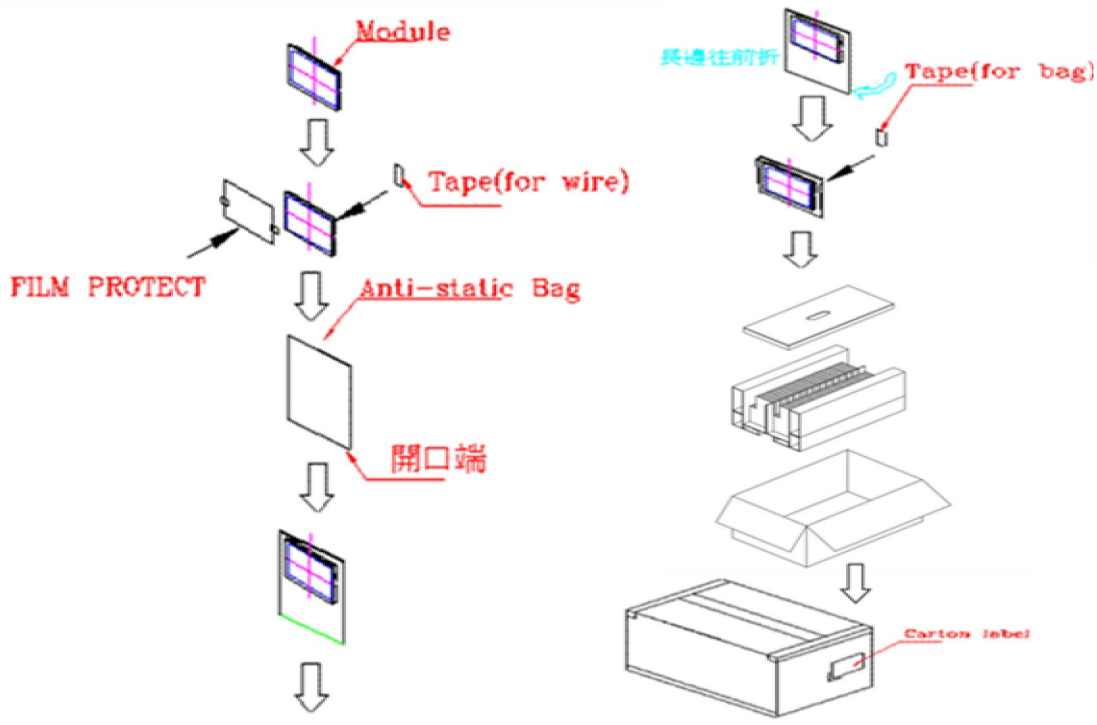
9.2 Carton Package

Max capacity: 56 TFT-LCD module per carton

Max weight: 10.4 kg per carton

Outside dimension of carton: 520mm(L)*340mm(W)*250mm(H)

Pallet size: 1070 mm * 1070mm * 135 mm



Box stacked_Max

Module by air：(2 *3) *5 layers，one pallet put 30 boxes，total 1680pcs module

Module by sea：(2 *3) *5 layers, one pallet put 30 boxes，total 1680pcs module

Module by sea_HQ：(2 *3) *5 layers, one pallet put 30 boxes，total 1680pcs module

10 Safety

10.1 Sharp Edge Requirements

There will be no sharp edges or comers on the display assembly that could cause injury.

10.2 Materials

10.2.1 Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible AUO toxicologist.

10.2.2 Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process.

The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

10.3 Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

10.4 National Test Lab Requirement

The display module will satisfy all requirements for compliance to:

UL 60950-1 second edition	U.S.A. Information Technology Equipment