( ) Preliminary Specifications
(V) Final Specifications

Module	24.0 Inch Color TFT-LCD
Model Name	G240HVT01.0
Note ( )	G/G P-cap touch TTL module

Customer	**Date**	**Approved by**	**Date**
	07/03/2018		07/27/2018
Checked & Approved by		**Prepared by**	
			07/27/2018
Note: This Specification is subject to change without notice.		Audio-Video Business Unit / AU Optronics corporation	

Contents

Record of Revision

Version and Date	Page	Old description	New Description
0.1 2018/01/02	All	First Preliminary Edition	
2018/01/26	6	Touch Power Consumption = 500mW	Touch Power Consumption = 750mW
		TP Transmittance: 87+/- 2	TP Transmittance: 87+/- 3
	15	Touch Panel Power Supply: min/typ./max =4.75/5/5.25	Touch Panel Power Supply: min/typ./max =4.5/5/5.5
		Normal mode Current consumption @Report rate 100Hz: typ./max = 150/NA	Normal mode Current consumption @Report rate 100Hz: typ./max = 140/150
	23	TP connector Manufacturer: Energy Industrial co. LTD	TP connector Manufacturer: Entery Industrial co. LTD
	24	Reliability Test Vibration test/Shock test/ Altitude Test	Reliability Test Remove Vibration test/Shock test/Altitude Test
2018/07/03	6	Linearity: Center ±2 Edge:±5	Linearity: Center ±2 Edge:±2.5
	27		Total solution Outline Dimension (Rear View)
2018/07/27	6		TP Thickness: 3.8mm ± 0.3 mm (Cover_2.9mm,sensor_0.7mm,OCR_0.2mm)

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) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
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 Reflector edge. Instead, press at the far ends of the LED Reflector 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 without flammability grade are used in the TFT-LCD module. The TFT-LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950-1 or UL60950-1), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time.
14) Continuous operating TFT-LCD Module under high temperature environment may accelerate LED light bar exhaustion and reduce luminance dramatically.
15) The data on this specification sheet is applicable when TFT-LCD module is placed in landscape position.
16) Continuous displaying fixed pattern may induce image sticking. It's recommended to use screen saver or moving content periodically if fixed pattern is displayed on the screen.

2. General Description

This specification applies to the 24.0 inch-wide Color a-Si TFT-LCD Module G240HVT01.0.The display supports the FHD - 1920(H) x 1080(V) screen format and 16.7M colors (RGB 8-bits data) with touch function. All input signals are LVDS interface and this module contains with an LED driver for backlight.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	24.0
Active Area	[mm]	531.36 (H) x 298.89 (V)
Pixels H x V		1920(x3) x 1080
Pixel Pitch	[um]	276.75 (per one triad) ×276.75
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		VA, Normally Black
White Luminance (Center)	[cd/m^2]	260
Contrast Ratio		5000: 1
Optical Response Time	[msec]	25
Touch Input Mode		Muti Finger
Nominal Input Voltage VDD	[Volt]	+5.0 V
LCD Power Consumption	[Watt]	23.3 (max) (Cell: 6 + BL: 17.3)
Weight	[Grams]	3665 (Typ.), 3750 (Max)
Physical Size	[mm]	556.0(W) X 323.2(H) X 20.6 (D) Typ.
Electrical Interface		Dual channel LVDS
Surface Treatment		AS Coating, 7H
Support Color		16.7M colors (true 8-bit)
Temperature Range Operating Storage (Non-Operating)	 [^{o}C] [^{o}C]	 -20 to +70 -30 to +80
RoHS Compliance		RoHS Compliance

2.2 General Touch Characteristics

Item		Unit	Specifications
TP Thickness		[mm]	3.8mm ± 0.3 mm (Cover_2.9mm, sensor_0.7mm & OCR_0.2mm)
Cover Lens	O.D.	[mm]	556.0x 323.2
	Thickness	[mm]	2.9
C/L Visual Area		[mm]	NA
Sensor Glass	O.D.	[mm]	554 x 321.2
	Thickness	[mm]	0.7
TP Active Area		[mm]	535.296 x 302.904
Total Weight		g	1770 (max.)
Chemical Strength		Mpa	≧400
Surface Hardness		H	≧7
Interface			USB 1.1 full speed
Single / Multi-touch Accuracy		[mm]	Center: ±2 Edge ±2.5
Linearity		[mm]	Center ±2 Edge:±2.5
The smallest distance between 2 points		[mm]	15
Channel (X * Y)			96 * 56
Report Rate (points /sec)		[Hz]	>100
Power Consumption		[mW]	750 (Max)
Operating System			Support windows 7
Transmittance		%	87+/- 3
Surface Treatment			AS Coating

2.3 Optical Characteristics

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

Item	Unit	Conditions	Min.	Typ.	Max.	Note
White Luminance	[cd/m2]	I_F= 45 mA	210	260	-	1
Uniformity	%	9 Points	75	80	-	1, 2, 3
Contrast Ratio			3000	5000	-	4
Cross talk	%		-	-	1.5	5
Response Time	[msec]	Rising	-	16	-	6
		Falling	-	9	-	
		Rising + Falling	-	25	50	
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	75 75	89 89	- -	7
	[degree] [degree]	Vertical (Upper) CR = 10 (Lower)	75 75	89 89	- -	
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.593	0.643	0.693	
		Red y	0.289	0.339	0.389	
		Green x	0.279	0.329	0.379	
		Green y	0.574	0.624	0.674	
		Blue x	0.105	0.155	0.205	
		Blue y	0.000	0.048	0.098	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Color Gamut	%			72	-	

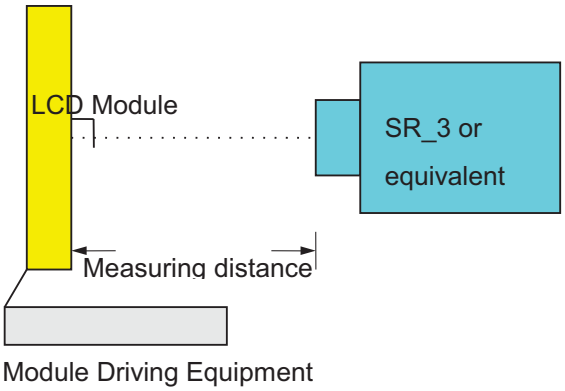
Note 1: Measurement method

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

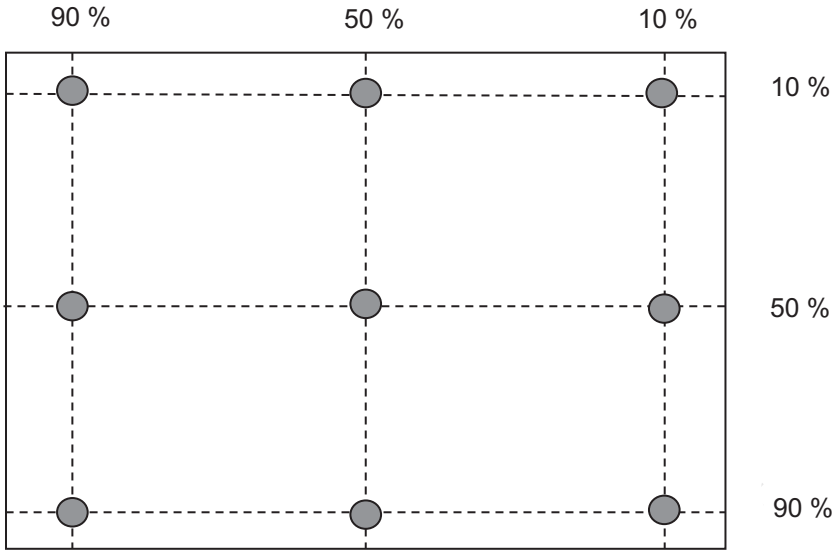
Aperture 2◦ with 50cm viewing distance

Test Point Center

Environment *< 1 lux*



Note 2: Definition of 9 points position. Display active area:



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

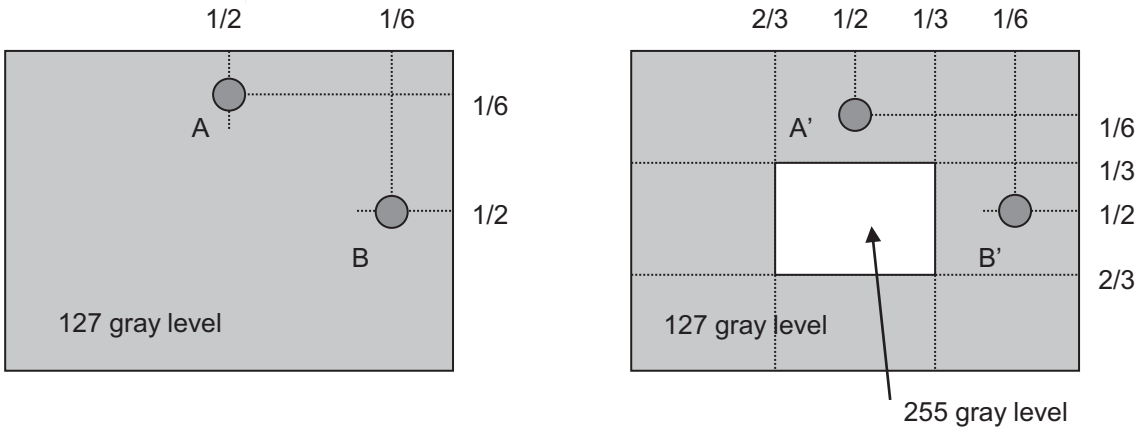
$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4： Definition of contrast ratio (CR):

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

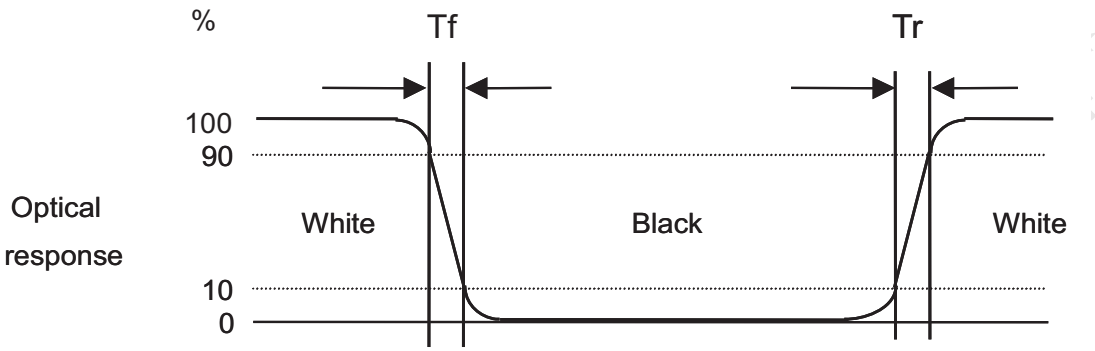
Note 5： Definition of cross talk (CT)

CT = | YB – YA | / YA × 100 (%)
Where
YA = Luminance of measured location without gray level 255 pattern (cd/m2)
YB = Luminance of measured location with gray level 255 pattern (cd/m2)



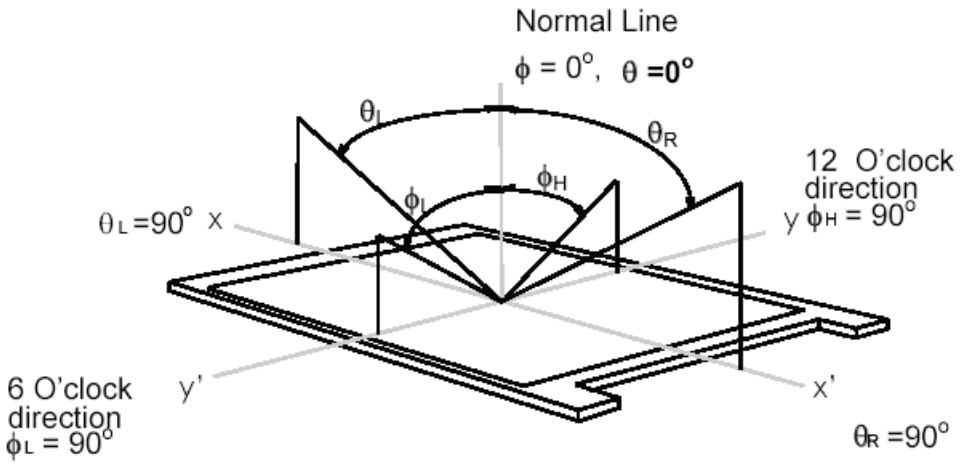
Note 6: Definition of response time:

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



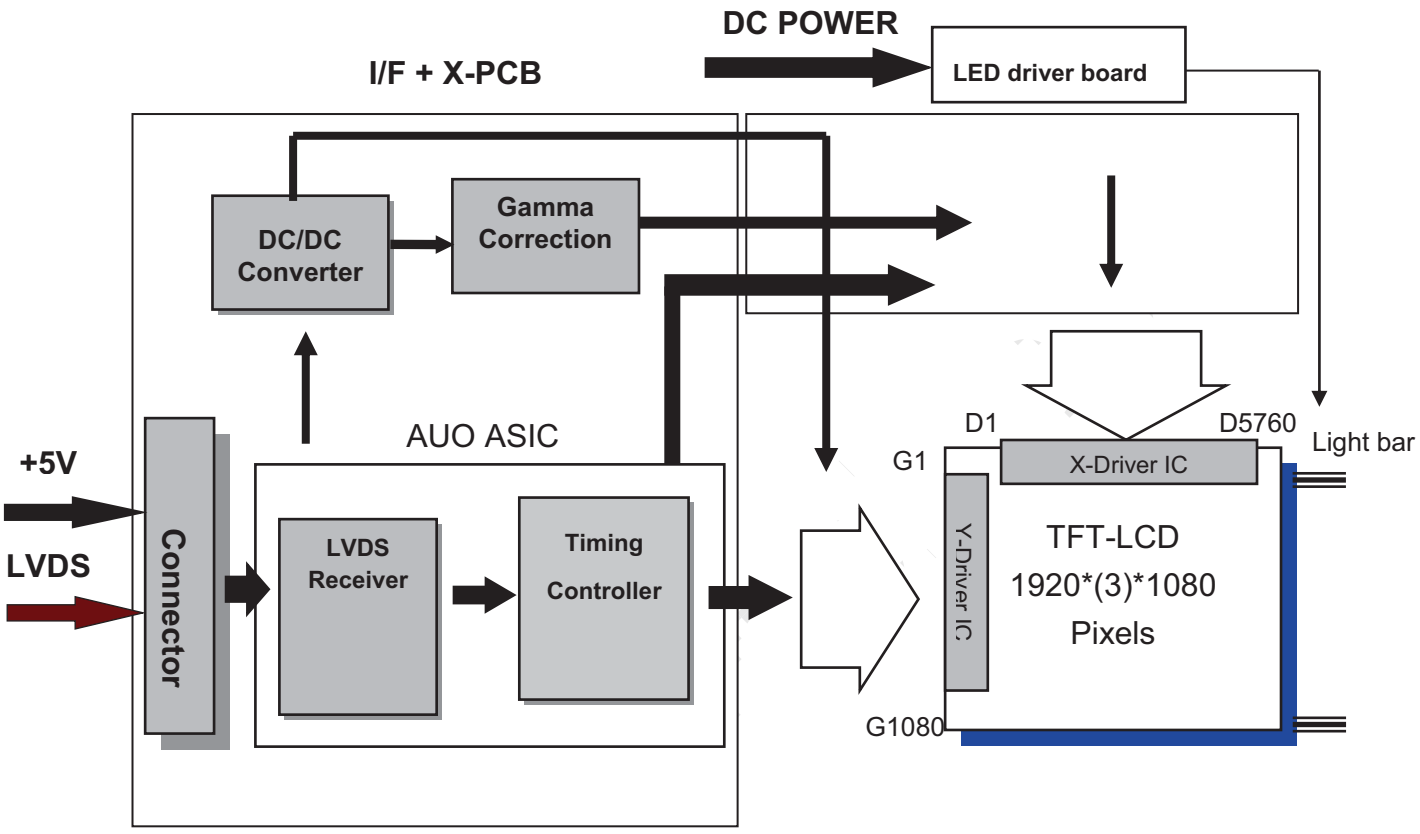
Note 7: Definition of viewing angle

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 24 inches wide Color TFT-LCD Module:



LVDS Connector: JAE (FI-XB30SRL-HF11) or equivalent.
LED Connector: Sin Sheng (MS24049HJ) or equivalent.

4. Absolute Maximum Ratings

4.1 TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	0	5.5	[Volt]	***Note 1,2***

4.2 Backlight Unit

Item	Symbol	Min	Max	Unit	Conditions
LED Input Voltage	Vcc	10.8	13.2	[Volt]	***Note 1,2***

4.3 TTS Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	-20	70	[°C]	***Note 3***
Operation Humidity	HOP	5	90	[%RH]	
Storage Temperature	TST	-30	80	[°C]	
Storage Humidity	HST	5	90	[%RH]	

Note 1: With in Ta (25℃)
Note 2: Permanent damage to the device may occur if exceeding maximum values
Note 3: For quality perfermance, please refer to AUO IIS(Incoming Inspection Standard).

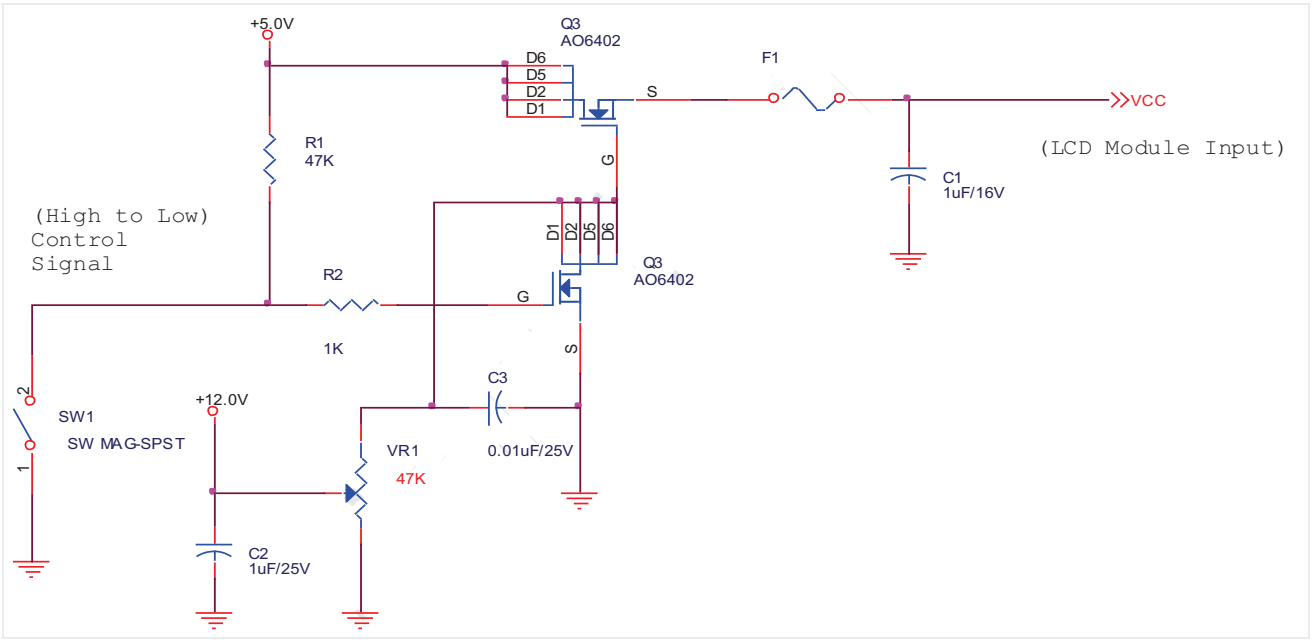
5. Electrical Characteristics

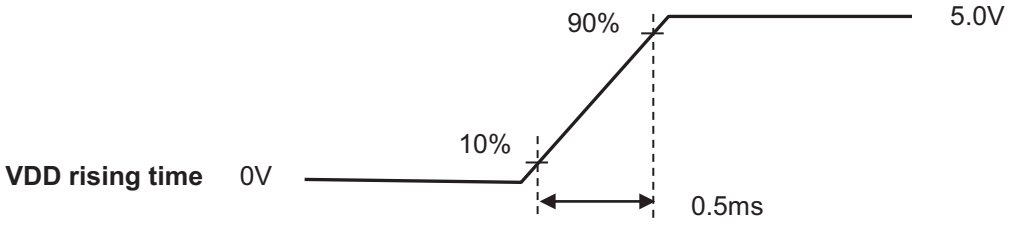
5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	±10%
IDD	VDD Current	-	900	1200	[mA]	VDD= 5.0V, All White Pattern At 60Hz
Irush	LCD Inrush Current	-	-	3	[A]	Note 1
PDD	VDD Power	-	4.5	6	[Watt]	VDD= 5.0V, All White Pattern At 60Hz

Note 1: Measurement condition:



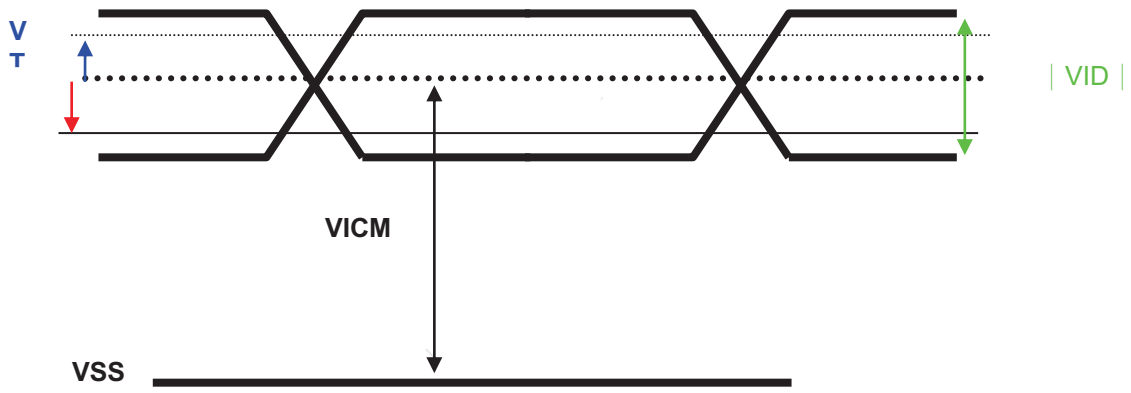


5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off.

Symbol	Item	Min.	Typ.	Max.	Unit	Remark
VTH	Differential Input High Threshold	-	-	100	[mV]	VCM=1.2V
VTL	Differential Input Low Threshold	-100	-	-	[mV]	VCM=1.2V
| VID |	Input Differential Voltage	100	400	600	[mV]	
VICM	Differential Input Common Mode Voltage	0.3	-	1.25	[V]	VTH/VTL=±100mV

Note: LVDS Signal Waveform.



5.2 Backlight Unit

5.2.1 LED Driver

Following characteristics are measured under stable condition at 25℃(Room Temperature).

Symbol	Parameter	Min	Typ	Max	Units	Remark
Vcc	Input Voltage	10.8	12	13.2	Volt	
Ivcc	Input Current	-	1.2	-	A	100% Dimming
PLED	Power Consumption		14.4	17.3	Watt	100% Dimming
Irush	Inrush Current	-	4	5	A	
BL_EN	On Control Voltage	3	-	5.5	Volt	
	Off Control Voltage	0	-	0.5	Volt	
FPWM	PWM Dimming Frequency	200	-	20K	Hz	
	High Voltage	3.0	3.3	5.5	Volt	
	Low Voltage	0	-	0.5	Volt	
	Dimming Duty Cycle	10	-	100	%	
I_F	LED Forward Current		45		mA	Ta = 25°C
LTLED	LED Life Time	50,000	-	-	Hrs	**Note 4**

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

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

Note 3: LED light bar structure: (7 strings x 10pcs / string =70pcs LED)

Note 4: 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_F = 45 mA and 25±2°C (Room Temperature).

5.3 Touch Sensor

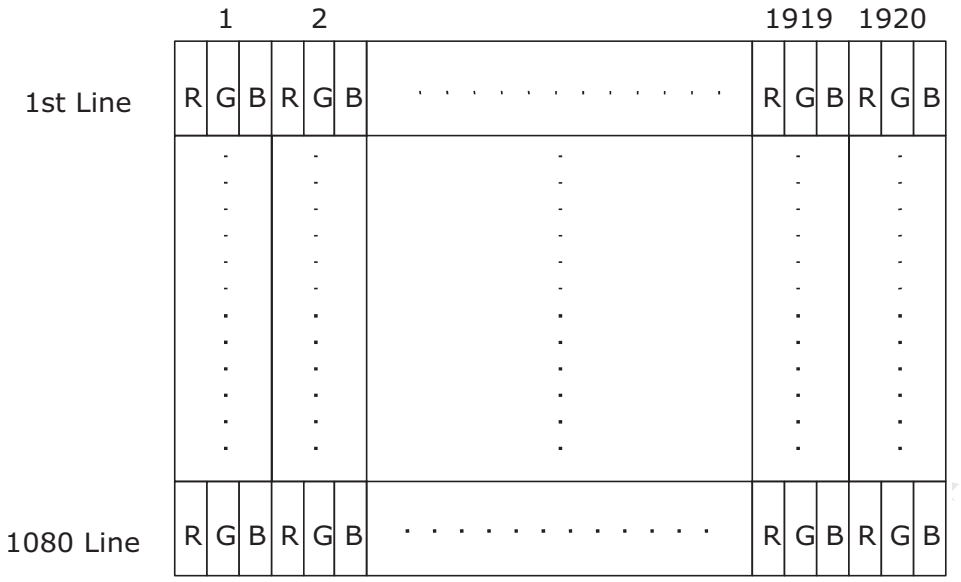
5.3.1 Power Specification

Items	Symbol	Specifications			Unit	Notes
		Min.	Typ.	Max.		
Touch Panel Power Supply	VTSP	4.5	5	5.5	V	
Input voltage	VIH	VDDx0.65	-	VDD+0.5	V	VDD= 5.0V
	VIL	-0.5	-	VDDx0.3	V	VDD= 5.0V
Normal mode Current consumption @ Report rate 100Hz	INORMAL		140	150	mA	

6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.

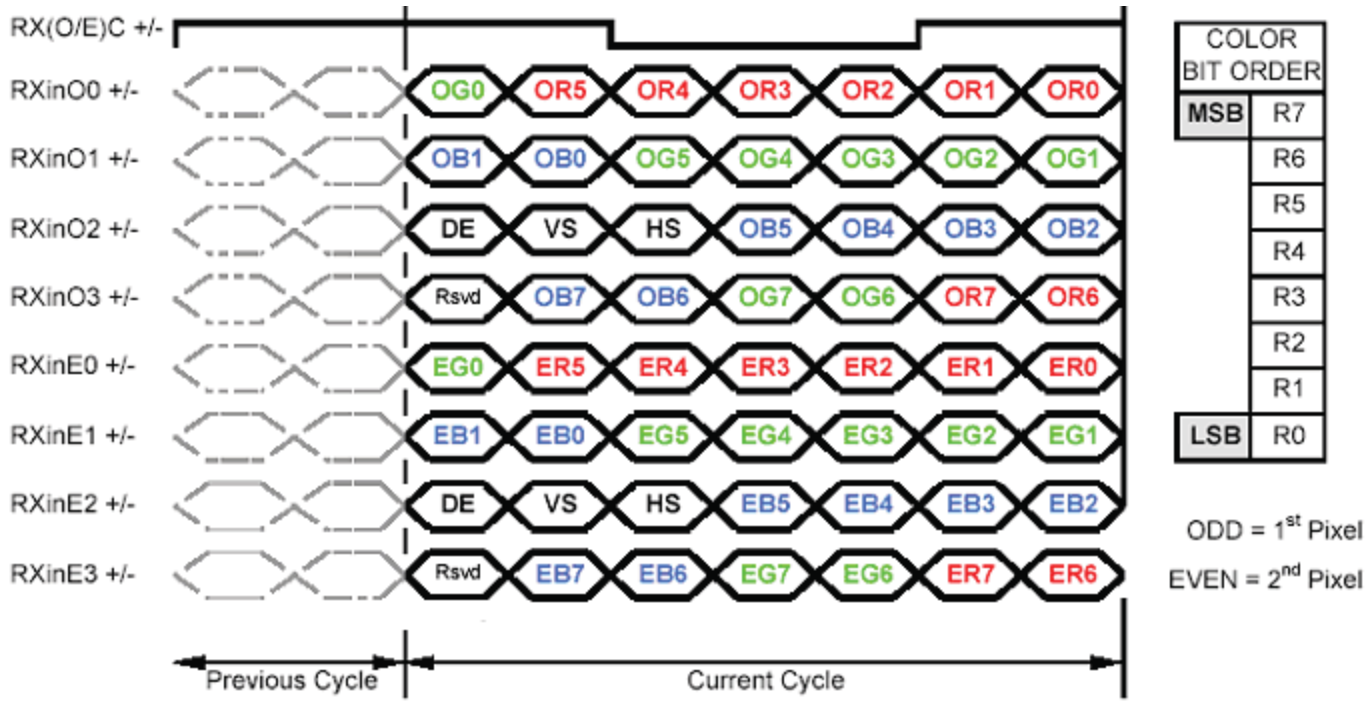


6.2 Signal Description

The module using a pair of LVDS receiver SN75LVDS82(Texas Instruments) or compatible. LVDS is a differential signal technology for LCD interface and high speed data transfer device. Transmitter shall be SN75LVDS83(negative edge sampling) or compatible. The first LVDS port(RxOxxx) transmits odd pixels while the second LVDS port(RxExxx) transmits even pixels.

PIN #	SIGNAL NAME	DESCRIPTION
1	RXinO0-	Negative LVDS differential data input (Odd data)
2	RXinO0+	Positive LVDS differential data input (Odd data)
3	RXinO1-	Negative LVDS differential data input (Odd data)
4	RXinO1+	Positive LVDS differential data input (Odd data)
5	RXinO2-	Negative LVDS differential data input (Odd data, H-Sync, V-Sync, DSPTMG)
6	RXinO2+	Positive LVDS differential data input (Odd data, H-Sync, V-Sync, DSPTMG)
7	GND	Power Ground
8	RxOCLKIN-	Negative LVDS differential clock input (Odd clock)
9	RxOCLKIN+	Positive LVDS differential clock input (Odd clock)
10	RXinO3-	Negative LVDS differential data input (Odd data)
11	RXinO3+	Positive LVDS differential data input (Odd data)
12	RXinE0-	Negative LVDS differential data input (Even data)
13	RXinE0+	Positive LVDS differential data input (Even data)
14	GND	Power Ground
15	RXinE1-	Negative LVDS differential data input (Even data)
16	RXinE1+	Positive LVDS differential data input (Even data)
17	GND	Power Ground
18	RXinE2-	Negative LVDS differential data input (Even data)
19	RXinE2+	Positive LVDS differential data input (Even data)
20	RxECLKIN-	Negative LVDS differential clock input (Even clock)
21	RxECLKIN+	Positive LVDS differential clock input (Even clock)
22	RXinE3-	Negative LVDS differential data input (Even data)
23	RXinE3+	Positive LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No contact (For AUO test only)
26	NC	No contact (For AUO test only)
27	VDD	Power +5V
28	VDD	Power +5V
29	VDD	Power +5V
30	VDD	Power +5V

6.3 The Input Data Format



Note1: 8-bits signal input.
Note2: L:NS alike H:Thine alike

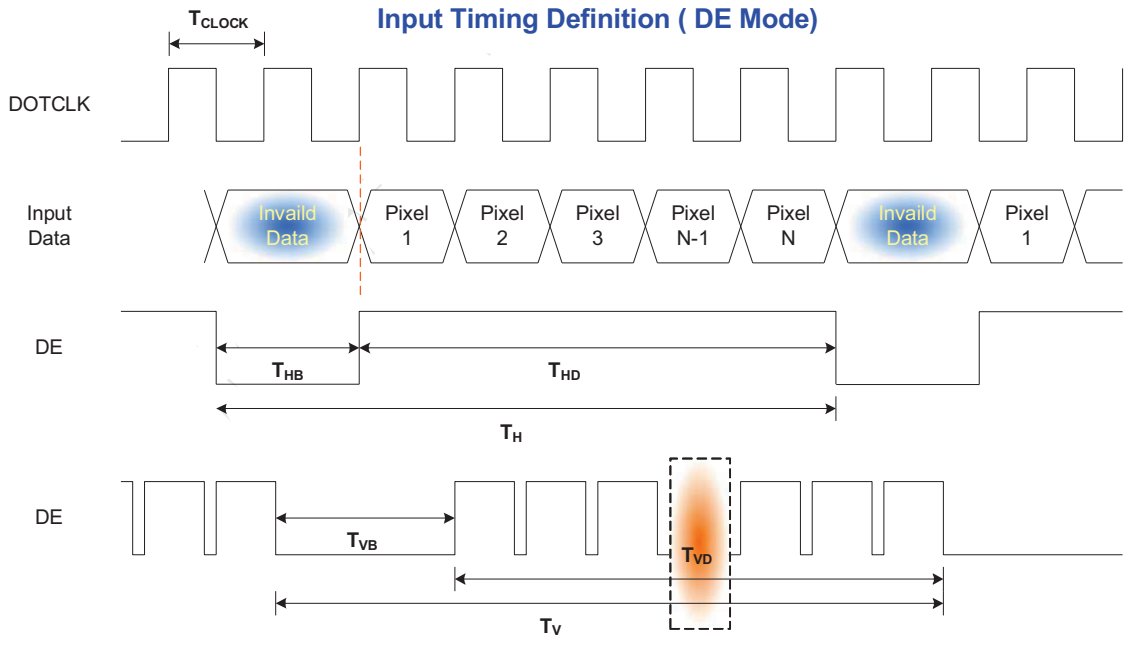
6.4 Interface Timing

6.4.1 Timing Characteristics

Signal	Item	Symbol	Min	Typ	Max	Unit
Clock	Frequency	1/ T_{Clock}	40	72	83	MHz
Frame Rate	Frequency	1/Tv	50	60	75	Hz
Vertical Section	Period	T_V	1088	1120	2047	T_line
	Active	T_{VD}	1080	1080	1080	
	Blanking	T_{VB}	8	40	967	
Horizontal Section	Period	T_H	1034	1060	2047	T_clock
	Active	T_{HD}	960	960	960	
	Blanking	T_{HB}	74	100	1087	

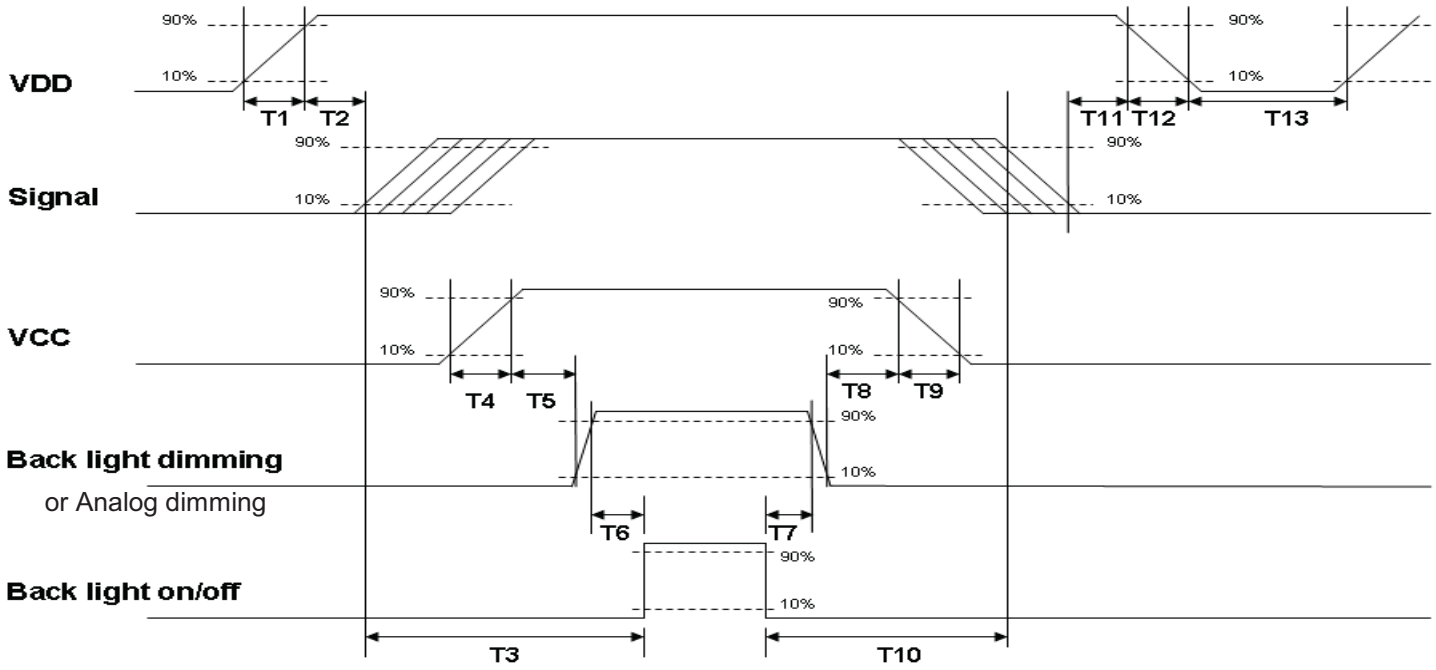
Note: DE mode only.

6.4.2 Input Timing Diagram



6.5 Power ON/OFF Sequence

VDD power and B/L on/off sequence is as below. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.



Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
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]

The above on/off sequence should be applied to avoid abnormal function in the display. Please make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

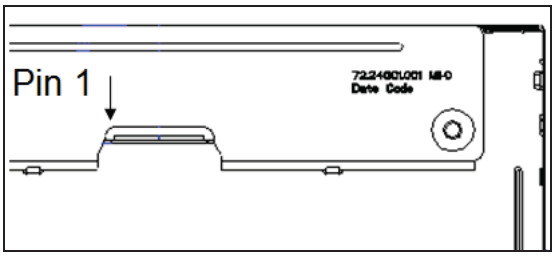
7. Connector & Pin Assignment

Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

7.1 TFT LCD Module: LVDS Connector

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	JAE or compatible
Type Part Number	JAE (FI-XB30SRL-HF11) or equivalent.
Mating Housing Part Number	FI-X30HL (JAE) or compatible

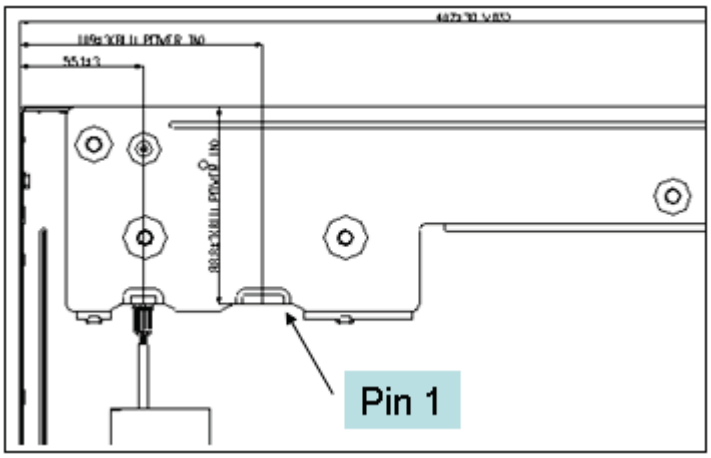
Pin#	Signal Name	Pin#	Signal Name
1	RxOIN0-	2	RxOIN0+
3	RxOIN1-	4	RxOIN1+
5	RxOIN2-	6	RxOIN2+
7	GND	8	RxOCLKIN-
9	RxOCLKIN+	10	RxOIN3-
11	RxOIN3+	12	RxEIN0-
13	RxEIN0+	14	GND
15	RxEIN1-	16	RxEIN1+
17	GND	18	RxEIN2-
19	RxEIN2+	20	RxECLKIN-
21	RxECLKIN+	22	RxEIN3-
23	RxEIN3+	24	GND
25	NC	26	NC
27	VDD	28	VDD
29	VDD	30	VDD



7.2 Backlight Unit: LED Connector

Connector Name / Designation	LED Connector
Manufacturer	Sin Sheng or compatible
Connector Model Number	MS24049HJ
Mating Housing Part Number	P24049 or compatible

PIN #	SIGNAL NAME	DESCRIPTION
1	V12	Input voltage, 12V
2	V12	Input voltage, 12V
3	V12	Input voltage, 12V
4	---	NC
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	BL_EN	Back light enable, 3~5.5 V
9	BL_DIM_P	Back light dimming, 3~5.5 V



7.3 Touch Driver Connector

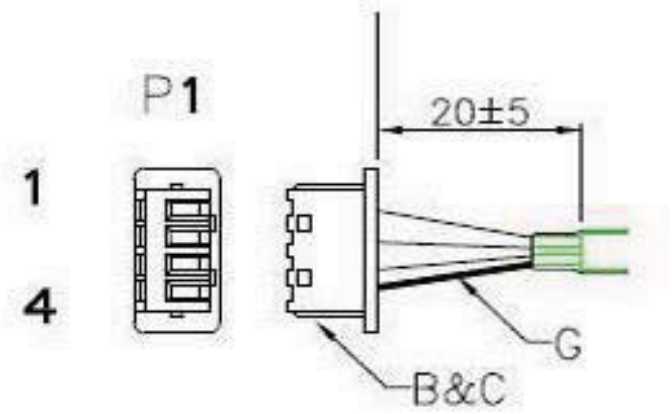
7.3.1 Touch Driver Connector

Connector Name / Designation	TP Connector
Manufacturer	Entery Industrial co. LTD
Type / Part Number	3802K-Q04N-01R

7.3.2 Pin Assignment

Pin#	Symbol	Signal Name
1	VDD	Power 5V
2	D-	USB D-
3	D+	USB D+
4	GND	Ground

7.3.3 Connector Illustration



PIN ASSIGNMENT

P1	4		3	2	1
P2	4		3	2	1
訊號	GND	GND	D+	D-	VDD
COLOR	編織+地	黑	綠	白	紅

8. Reliability Test Criteria

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 70℃, 300hours	
Low Temperature Operation (LTO)	Ta= -20℃, 300hours	
High Temperature Storage (HTS)	Ta= 80℃, 300hours	
Low Temperature Storage (LTS)	Ta= -30℃, 300hours	
Drop Test	Height: 46 cm, package test	
Thermal Shock Test (TST)	-20℃/30min, 60℃/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point.	*1*
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point.	

Note 1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost Self-recoverable. No hardware failures.

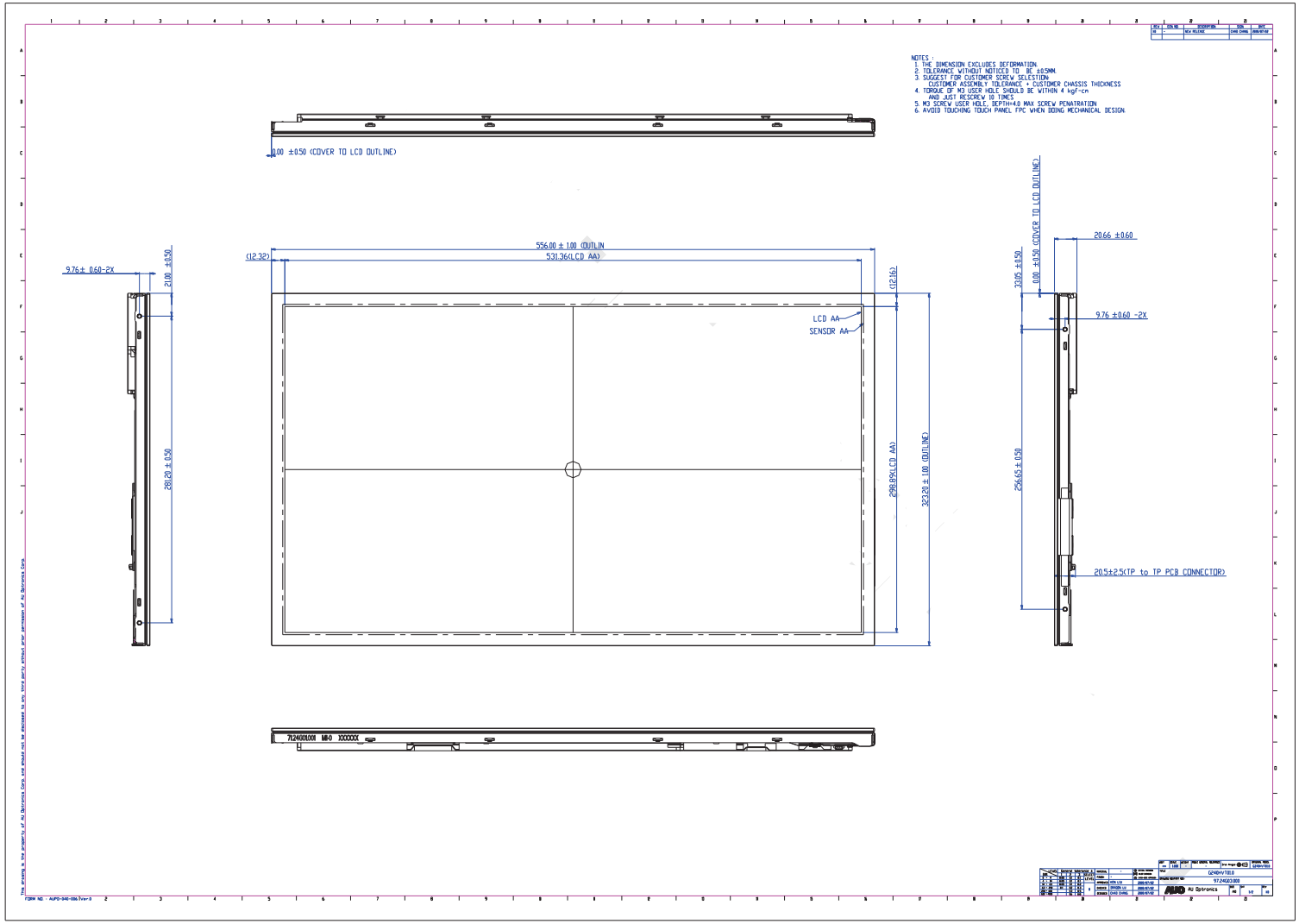
Note2:

1. Water condensation is not allowed for each test items.
2. Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
3. The reliability test is performed only to examine the TFT-LCD module capability.
4. To inspect TFT-LCD module after reliability test, please store it at room temperature and room humidity for 24 hours at least in advance.
5. No function failure occurs.

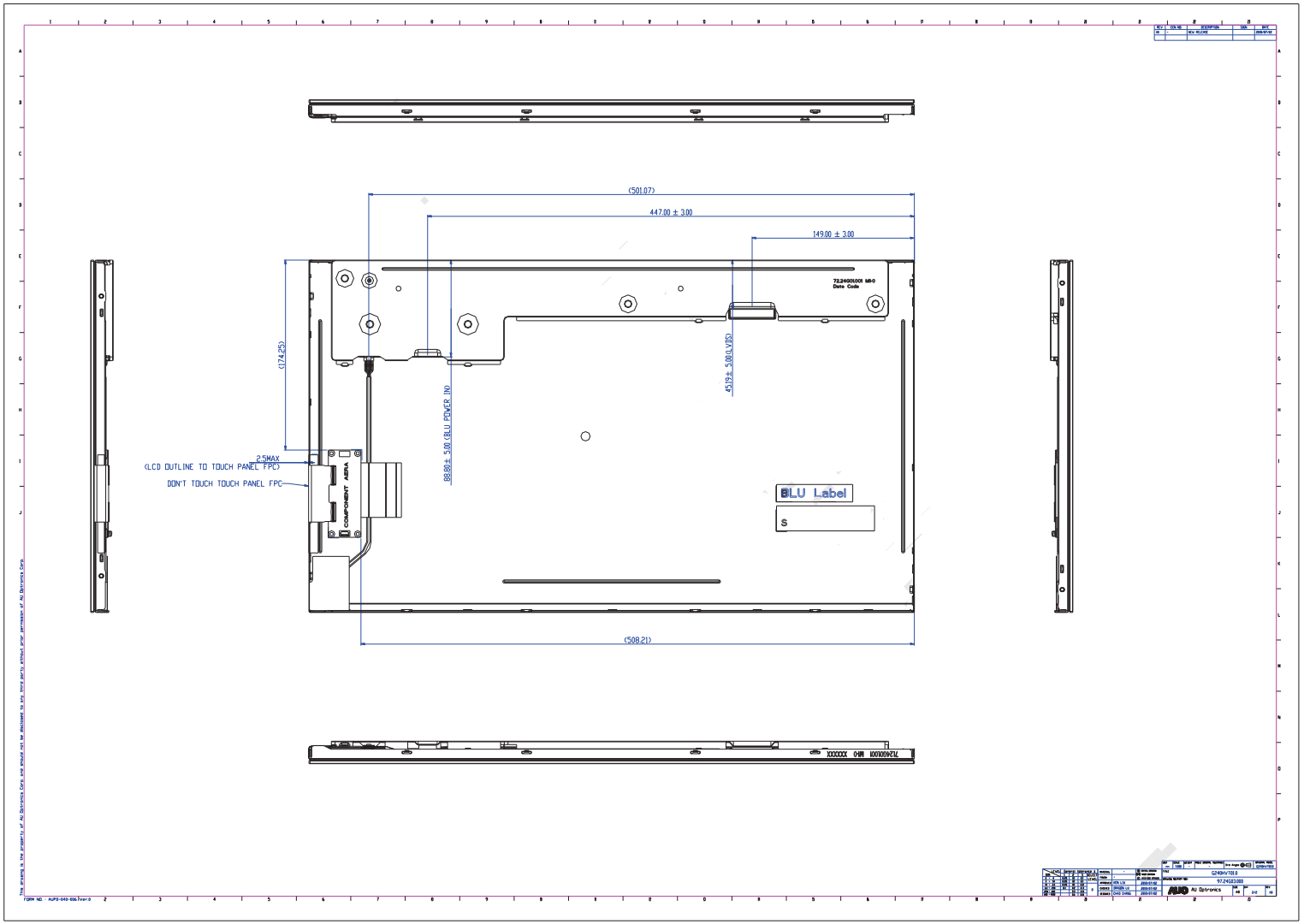
Items		Condition	
Touch panel	Ball Drop Test	540g, 110 cm (center,point)	
	Hardness	7H	Loading: 500g, Position: VA area of test sample

9. Mechanical Characteristics

9.1 Total solution Outline Dimension (Front View)

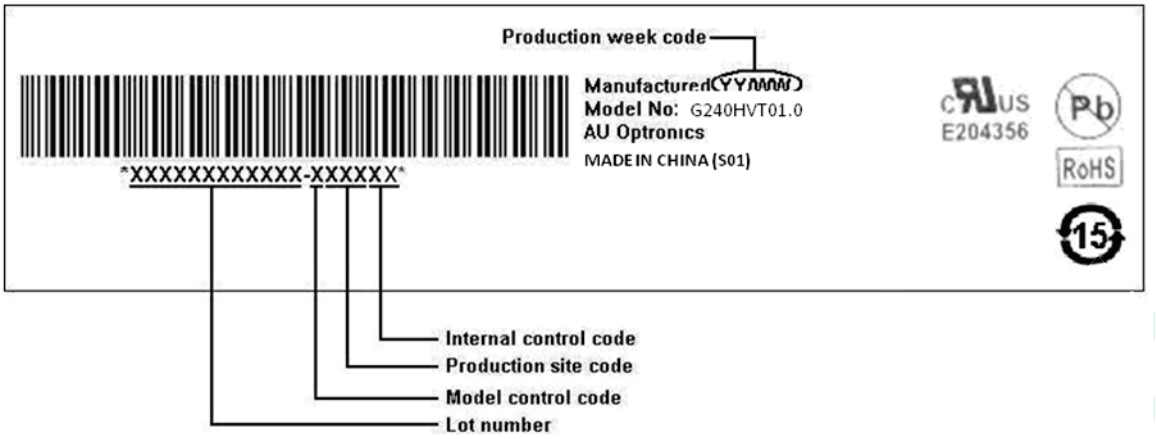


9.2 Total solution Outline Dimension (Rear View)

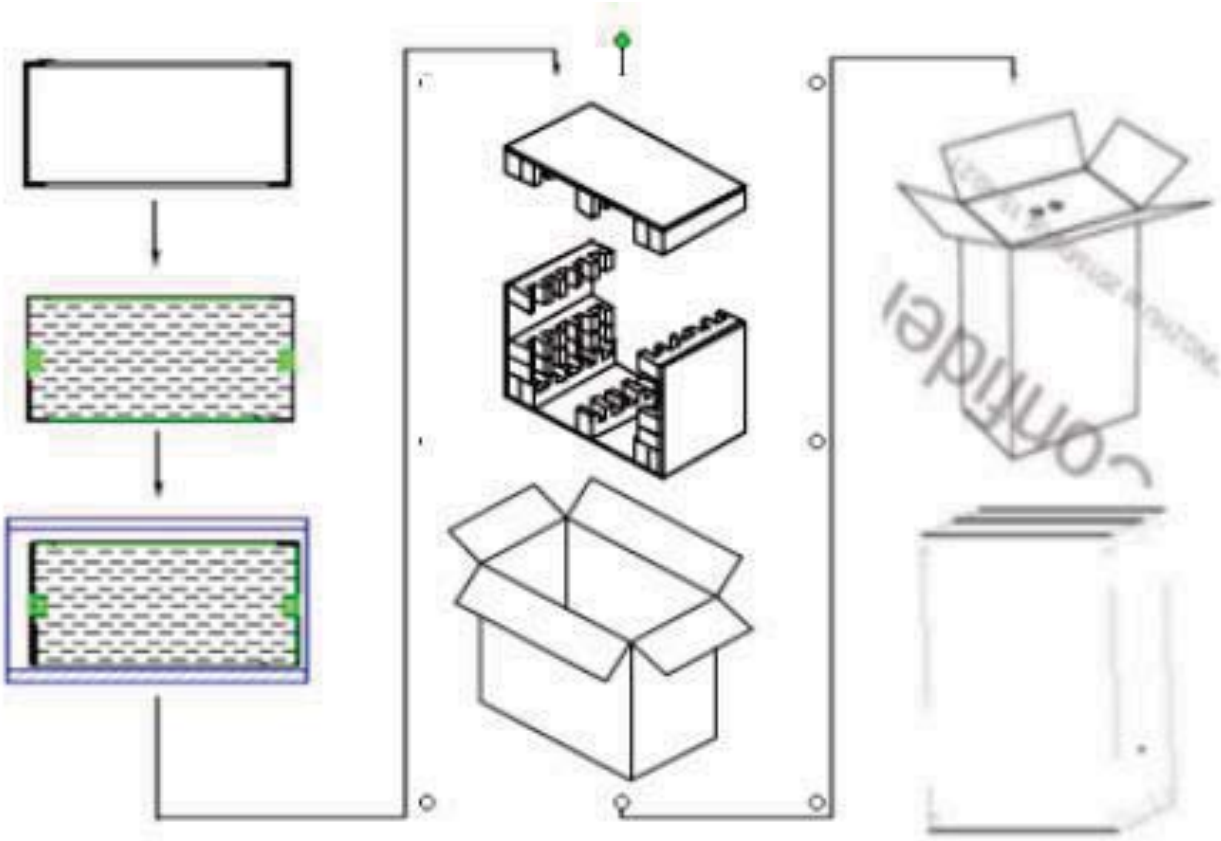


10. Label and Packaging

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



10.2 Carton Package



10.3 Palletizing

Max capacity：5 TFT-LCD module per carton
Max weight: 19kg per carton
Outside dimension of carton:404mm(L)* 235mm(W)*653mm(H)
Pallet size：820 mm * 1000mm * 132mm (M15)

Box stacked

Module by air：(2 *4) *2 layers，one pallet put 16 boxes，total 80pcs module
Module by sea：(2 *4) *2 layers , one pallet put 16 boxes，total 80 pcs module
Module by sea_HQ：(2 *4) *2 layers+(2 *4) *1 layers, two pallet put 24boxes, total 120 pcs module