(V) Preliminary Specifications
(   ) Final Specifications

Module	15 Inch Color TFT-LCD
Model Name	G150XVN01.2

Customer	Date

Checked & Approved by	Date

Customer's sign back page

Approved by	Date
Crystal Hsieh	2017/9/1

Prepared by	Date
Wennie Lee	2017/9/1

General Display Business Division / AU Optronics corporation

2. General Description

This specification applies to the Color Active Matrix Liquid Crystal Display G150XVN01.2 composed of a TFT-LCD display, a driver and power supply circuit, and a LED backlight system. The screen format is intended to support

LED driving board for backlight unit is included in G150XVN01.2.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25 ^{o}C condition:

Items	Unit	Specifications
Screen Diagonal	[inch]	15.0"
Active Area	[mm]	304.128 (H) x 228.096 (V)
Resolution		1024 x 768
Pixel Pitch	[mm]	0.297 (per one triad) x 0.297
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		VA, Normally Black
Nominal Input Voltage VDD	[Volt]	+3.3
Power Consumption	[Watt]	TBD
Weight	[Grams]	910(Typ) ±10%
Physical Size	[mm]	326.5 (H) x 253.5 (V) x 9.6(D) (typ)
Electrical Interface		one channel LVDS
Surface Treatment		Hard-coating (3H), Anti-Glare treatment
Support Color		16.2M / 262K colors

Temperature Range
    Operating
    Storage (Non-Operating)
	[^{o}C]
	[^{o}C]
		-10 to +70 (Tgs)
		-30 to +70 (Ta)

RoHS Compliance		Yes

2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25 ^{o}C (Room Temperature):

| Item	Unit	Conditions		Min.	Typ.	Max.	Note
White Luminance	cd/m^2	I$_{LED}$=70mA(center point)		320	400	-	1
Uniformity	%	5 points		75	-	-	2,3
Contrast Ratio	--			900	1500	-	4
Response Time	msec	Rising		-	20	-	5
		Falling		-	15	-	
		Rising + Falling		-	35	-	
Viewing Angle	degree	Horizontal CR >= 10	(Right)	70	88	-	6
			(Left)	70	88	-	
		Vertical CR >= 10	(Upper)	70	88	-	
			(Lower)	70	88		
Color / Chromaticity Coordinates (CIE 1931)	--	Red x		TBD	TBD	TBD	
		Red y		TBD	TBD	TBD	
		Green x		TBD	TBD	TBD	
		Green y		TBD	TBD	TBD	
		Blue x		TBD	TBD	TBD	
		Blue y		TBD	TBD	TBD	
		White x		TBD	TBD	TBD	
		White y		TBD	TBD	TBD	
Color Gamut	%			-	72	-	

Note 1: Measurement method

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

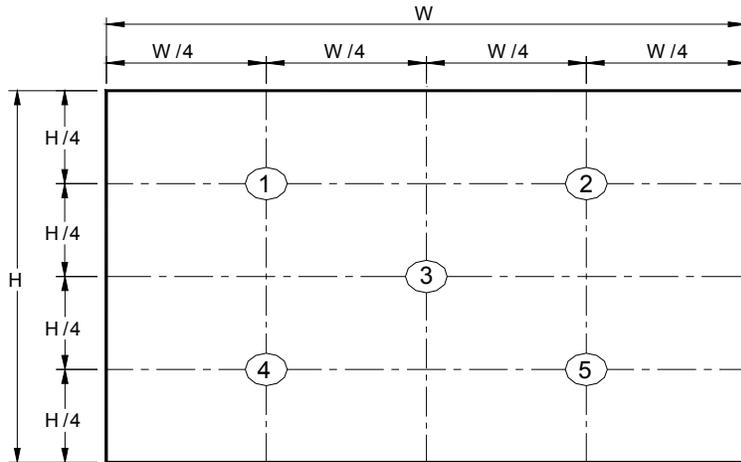Aperture   1° with 50cm viewing distance

Test Point   Center

Environment   *< 1 lux*
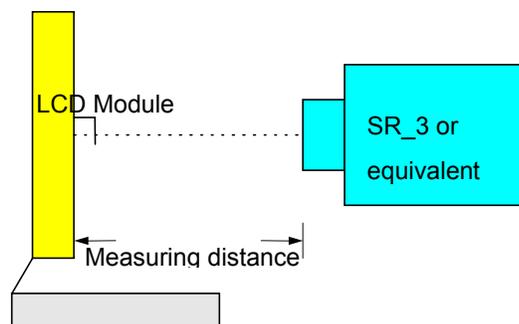
Note 2: Definition of 5 points position

Note 3: The luminance uniformity of 5 points is defined by dividing the minimum luminance values by the maximum test point luminance

$$\delta_{W5} = \frac{\text{Minimum Brightness of five points}}{\text{Maximum Brightness of five points}}$$

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" (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.
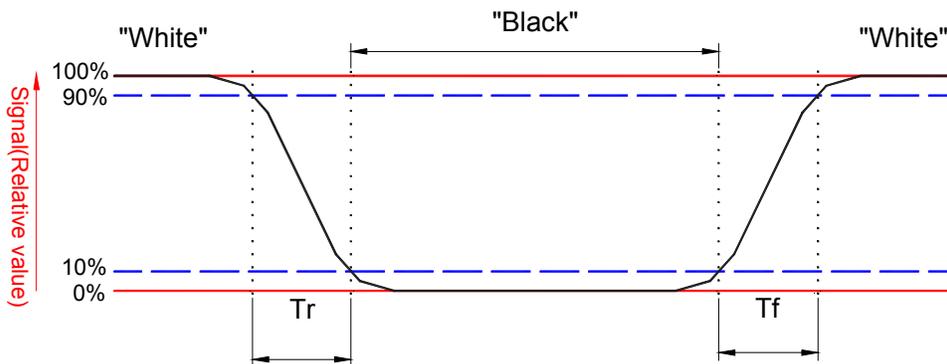
Note 6: Definition of viewing angle

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.
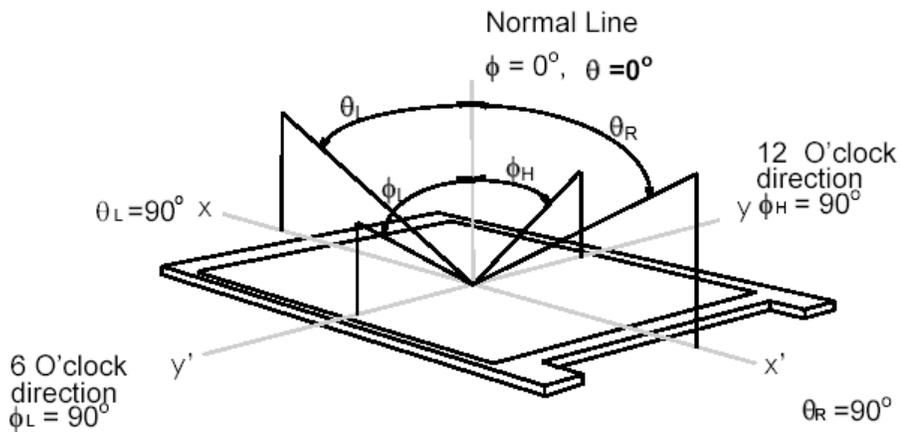
3. Functional Block Diagram

The following diagram shows the functional block of the 15 inch color TFT/LCD module:
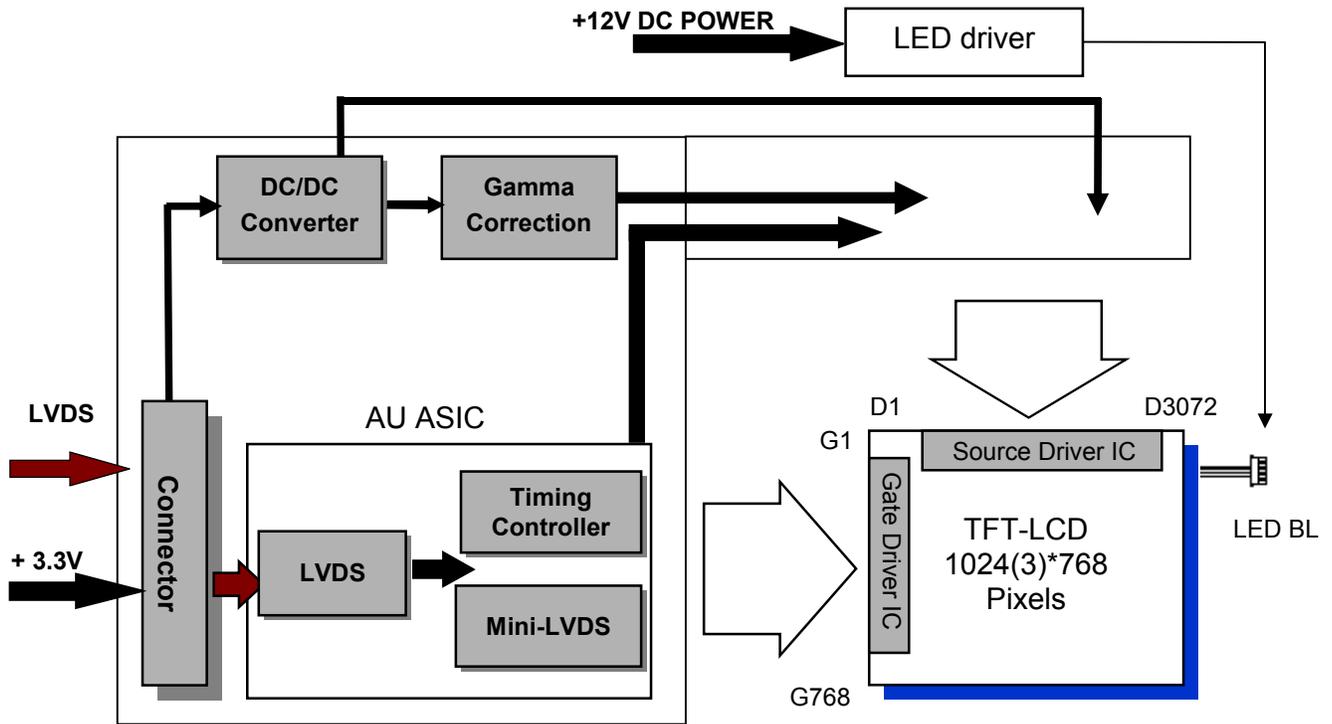
4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit
Logic/LCD drive Voltage	Vin	-0.3	+4.0	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature(Tgs)	TOP	-10	+70	[^{o}C]
Operation Humidity	HOP	5	95	[%RH]
Storage Temperature	TST	-30	+70	[^{o}C]
Storage Humidity	HST	5	95	[%RH]

Note 1: Maximum Wet-Bulb should be 39 ^{o}C and no condensation.

Note: 2: Function Judged only
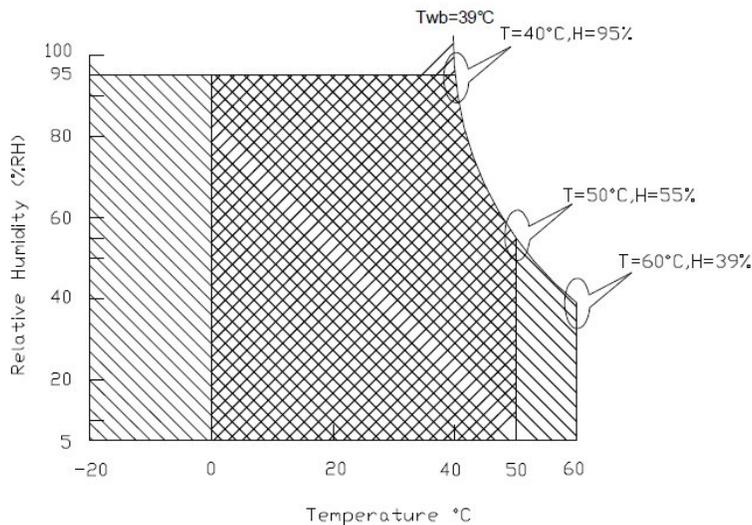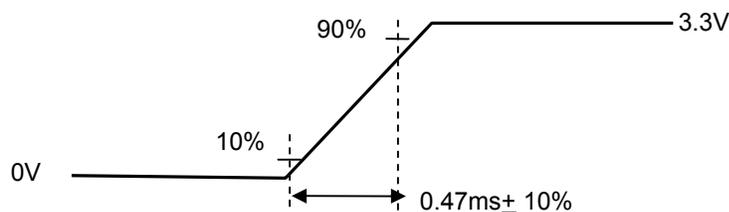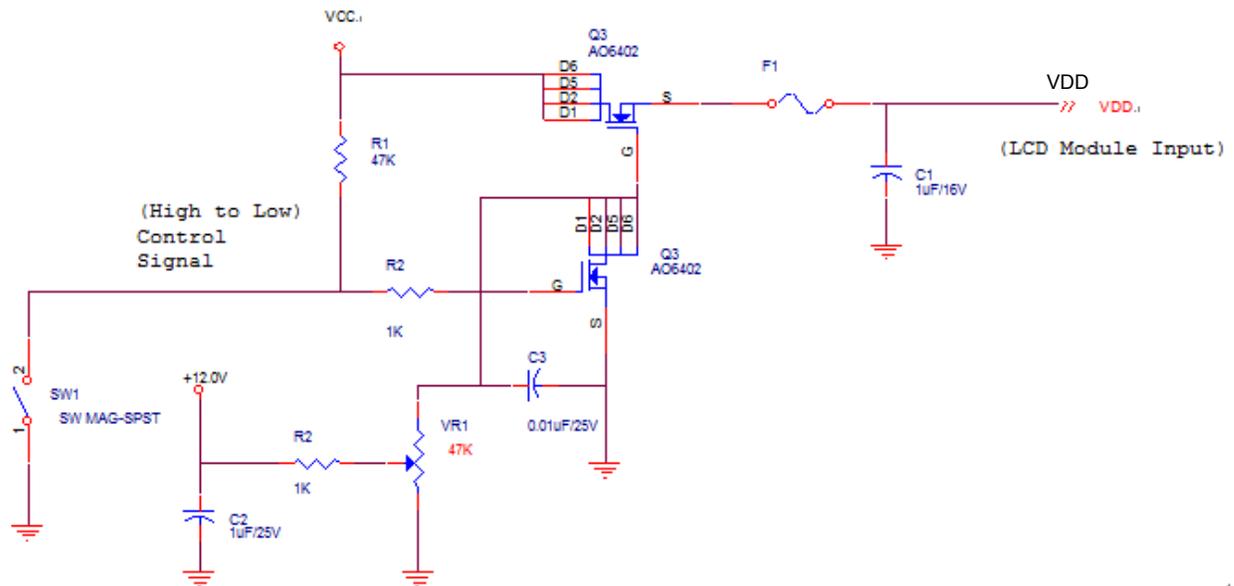
5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are shown as follows;

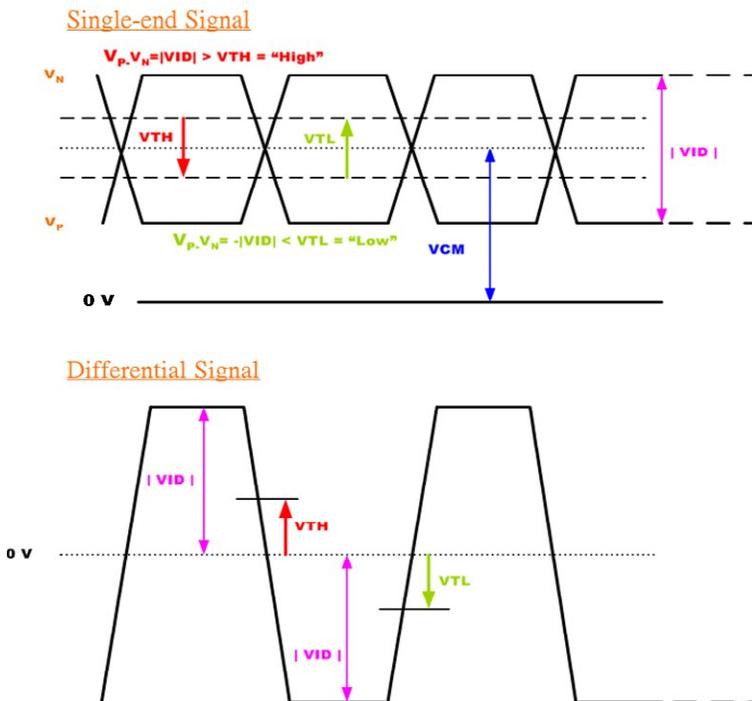| Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
IDD	VDD Current		TBD	TBD	[mA]	All White Pattern (VDD=3.3V, at 60Hz)
Irush	LCD Inrush Current			2	[A]	Note 1
PDD	VDD Power		TBD	TBD	[Watt]	All White Pattern (VDD=3.3V, at 60Hz)
VDDrp	Allowable Logic/LCD Drive Ripple Voltage			500	[mV] p-p	All Black Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement condition:

VDD rising time

5.1.2 LVDS DC Signal Electrical Characteristics

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	+1.1		+1.45	[V]	VTH/VTL=+-100mV

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

Note: LVDS Signal Waveform.

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 characteristics

Symbol	Parameter	Min	Typ	Max	Units	Condition
PLED	Backlight Power Consumption	--	--	TBD	[Watt]	No Backlight Unit
LTLED	LED Life-Time	50,000	--	--	Hour	No Backlight Unit

Note 1: Calculator value for reference P_{LED} = V_F (Normal Distribution) * I_F (Normal Distribution)*LED Qty

Note 2: The LED life-time define as the estimated time to 50% degradation of initial luminous.

Backlight input signal characteristics

Symbol	Parameter	Min	Typ	Max	Units	Remark
VLED (Note 1)	LED Power Supply	10.8	12	13.2	[Volt]	Define as Connector Interface (Ta=25℃)
VLED_EN	LED Enable Input High Level	2.5	--	5.5	[Volt]	
	LED Enable Input Low Level	--	--	0.7	[Volt]	
VPWM_EN	PWM Logic Input High Level	2.5	--	5.5	[Volt]	
	PWM Logic Input Low Level	--	--	0.7	[Volt]	
FPWM	PWM Input Frequency *1	200	1K	20K	Hz	
Duty	PWM Duty Ratio	5	--	100	%	

Note1: Measured on panel VLED

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6. Signal Characteristic

6.1 Pixel Format Image

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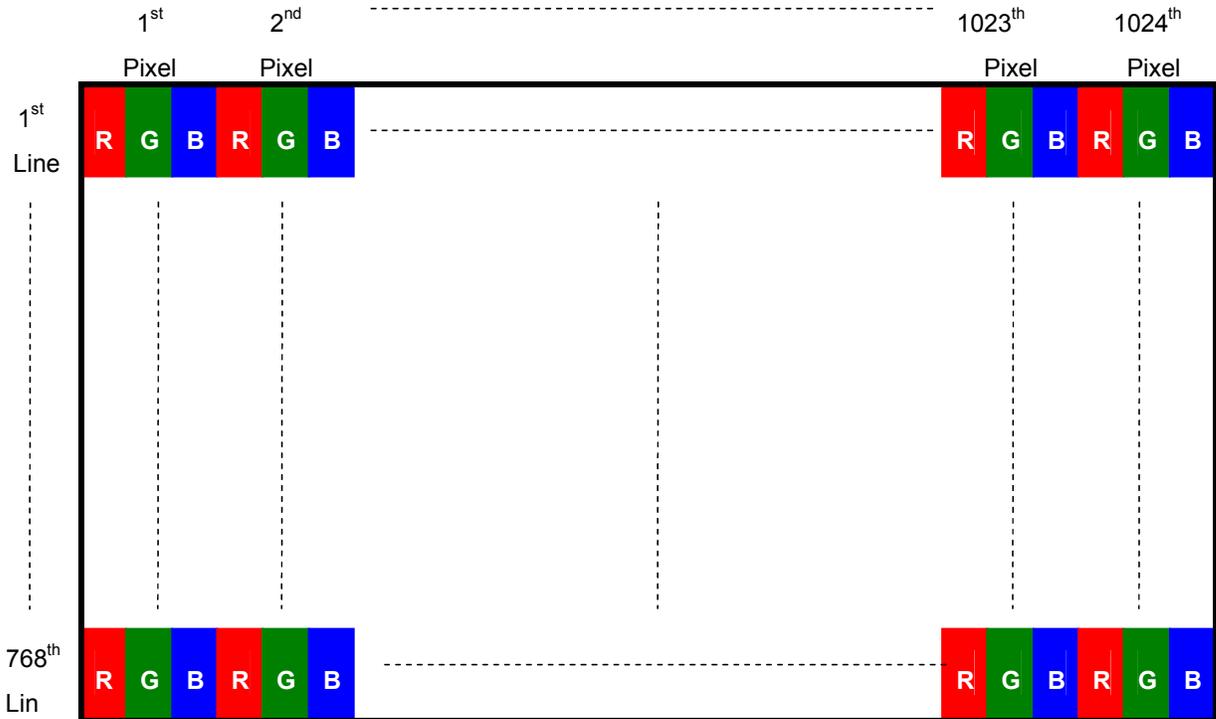
6.2 Scanning Direction

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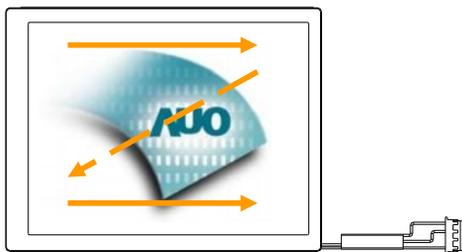

Fig. 1 Normal scan (Pin4, DPS = Low or NC)

6.3 Signal Description

The module uses a LVDS receiver embedded in AUO's ASIC. LVDS is a differential signal technology for LCD interface and a high-speed data transfer device.

6.3.1 TFT LCD Module: LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	HIROSE
Connector Model Number	DF14H-30P-1.25H(57)
Adaptable Plug	DF14-30S-1.25C

Pin no	Symbol	Function	Remark
1	GND	Ground	
2	GND	Ground	
3	VCC	LED BL Power Supply, 12V	
4	VCC	LED BL Power Supply, 12V	
5	GND	Ground	
6	ON/OFF	LED BL ON/OFF (H:ON, L:OFF)	
7	PWM	LED BL PWM dimming	
8	GND	Ground	
9	VDD	LCD Power Supply, 3.3V	
10	VDD	LCD Power Supply, 3.3V	
11	GND	Ground	
12	GND	Ground	
13	Rin0-	- LVDS differential data CH0 input	
14	Rin0+	+ LVDS differential data CH0 input	
15	GND	Ground	
16	Rin1-	- LVDS differential data CH1 input	
17	Rin1+	+ LVDS differential data CH1 input	
18	GND	Ground	
19	Rin2-	- LVDS differential data CH2 input	
20	Rin2+	+ LVDS differential data CH2 input	
21	GND	Ground	
22	ClkIN-	- LVDS differential clock input	
23	ClkIN+	+ LVDS differential clock input	
24	GND	Ground	
25	Rin3-	- LVDS differential data CH3 input	
26	Rin3+	- LVDS differential data CH3 input	
27	GND	Ground	

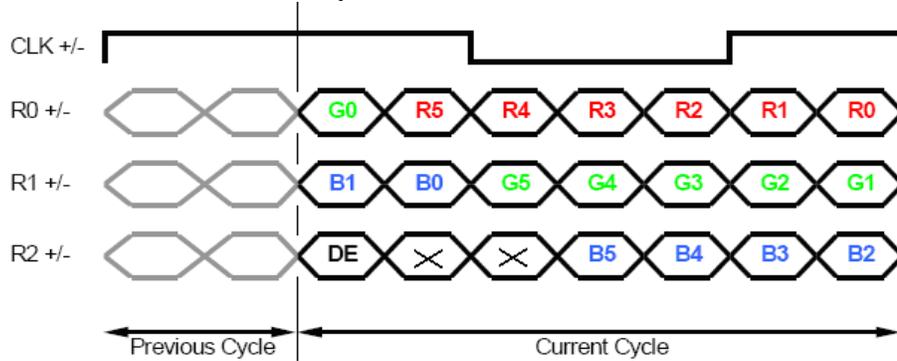| 28	RL/UD	H: 180 degree rotation/ L: Normal mode	
29	SELLVDS	L: 8 bit / H: 6bit	
30	GND	Ground	

Note 1: Input signals shall be low or High-impedance state when VDD and VCC are off.

Note 2: High stands for "3.3V", Low stands for "0V", NC means "No Connection".
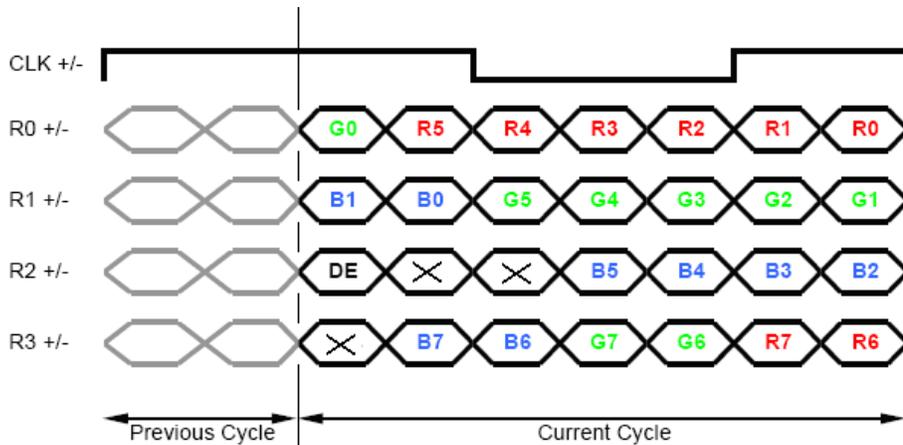
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Pin 1

Connector
Insert Direction

BLU LABEL
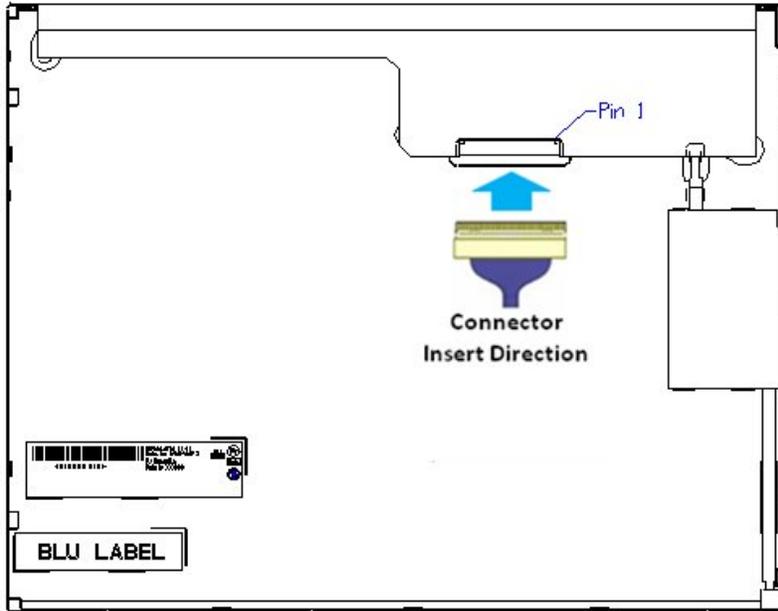
6.4 The Input Data Format

SEL LVDS = "H" for 6 bits LVDS Input

SEL LVDS = "L" or NC for 8 bits LVDS Input

Note1: Please follow PSWG.
Note2: R/G/B data 7:MSB, R/G/B data 0:LSB

6.5 Interface Timing

6.5.1 Timing Characteristics

Signal		Symbol	Min.	Typ.	Max.	Unit
Clock Frequency		$1/T_{Clock}$	50	65	80	MHz
Vertical Section	Period	T_V	776	806	990	T_{Line}
	Active	T_{VD}	768	768	768	
	Blanking	T_{VB}	8	38	222	
Horizontal Section	Period	T_H	1094	1344	1720	T_{Clock}
	Active	T_{HD}	1024	1024	1024	
	Blanking	T_{HB}	70	320	696	
Frame Rate		F	49	60	75	Hz

Note : DE mode.

6.5.2 Input Timing Diagram
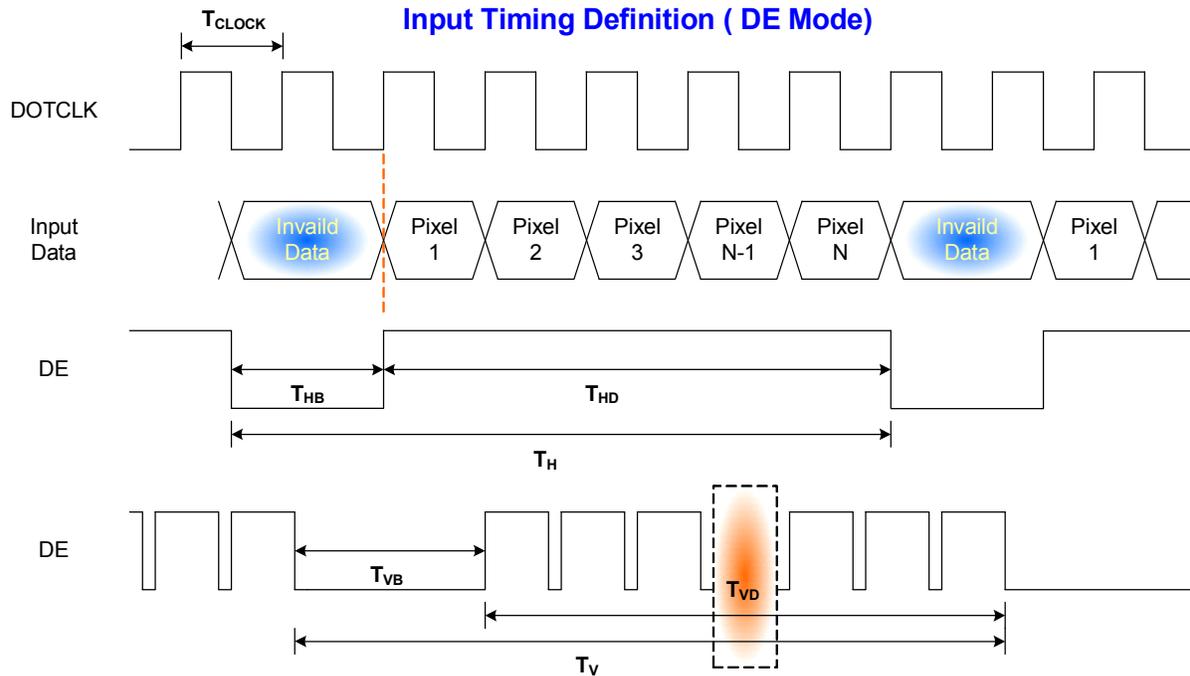
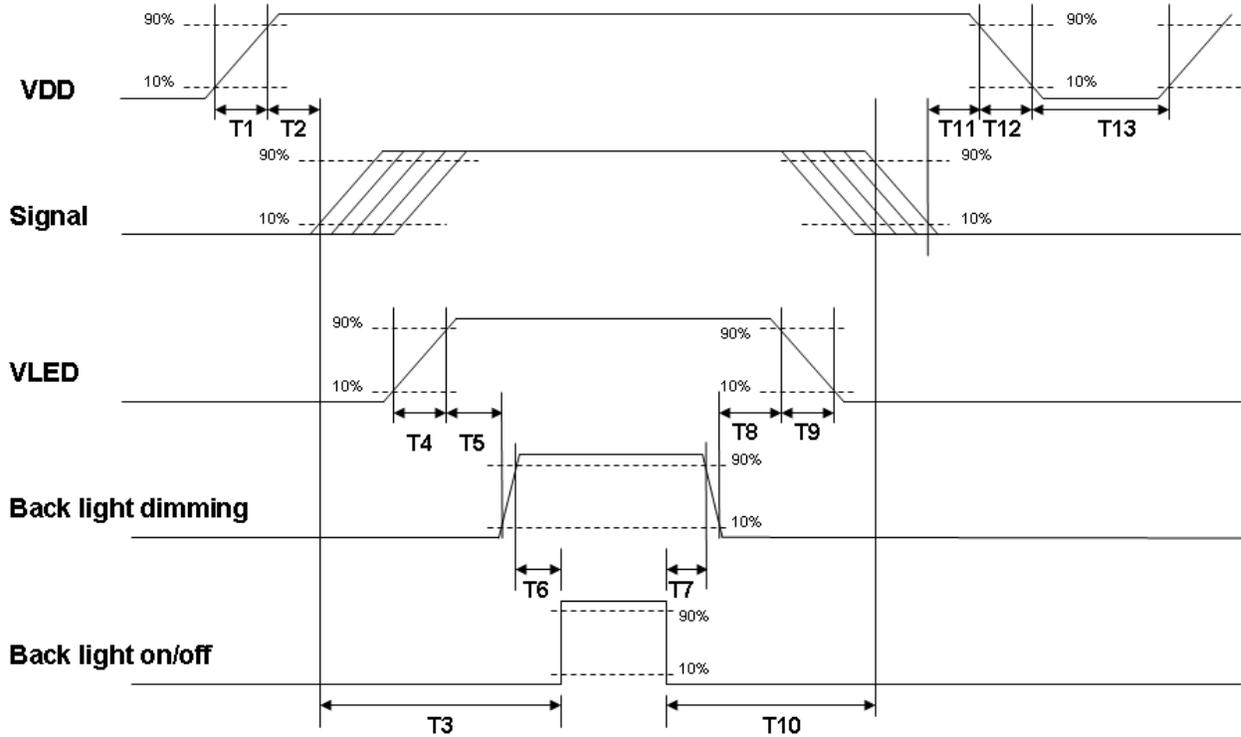## 6.6 Power ON/OFF Sequence

VDD power and lamp 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	220			[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. Reliability Test Criteria

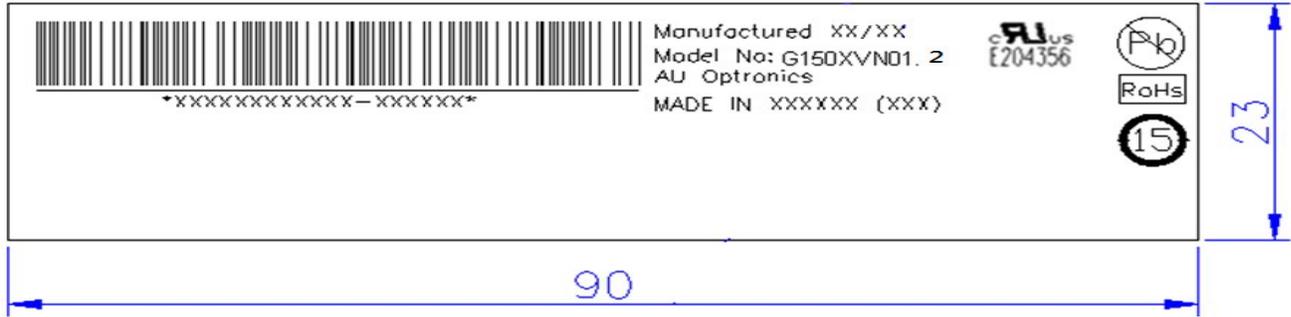| Items	Required Condition	Note
Temperature Humidity Bias	40 ^{o}C /95%, 300Hr	
High Temperature Operation	70 ^{o}C, 300Hr (center point of panel surface)	
Low Temperature Operation	-10 ^{o}C, 300Hr	
Hot Storage	70 ^{o}C, 300 hours	
Cold Storage	-30 ^{o}C, 300 hours	
Thermal Shock Test	-30 ^{o}C /30 min ,70 ^{o}C /30 min ,50cycles, 40 ^{o}C minimun ramp rate	
Shock Test (Non-Operating)	50G,20ms,Half-sine wave,(+-X,+-Y,+-Z)	
Vibration Test (Non-Operating)	1.5G, 10~200~10Hz, Sine wave 30mins/axis, 3 direction (X, Y, Z)	
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	
ESD	Contact : ± 8KV/ operation, Class B Air : ± 15KV / 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:

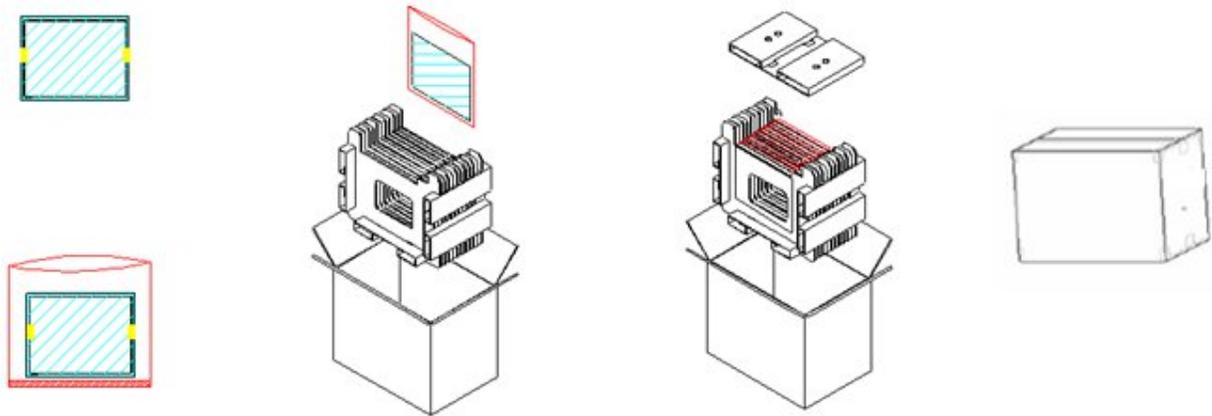- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test,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

8. Mechanical Characteristics

8.1 LCM Outline Dimension

326.50 ± 0.50 (Module Outline_X)
307.20 ± 0.30 (Bezel Opening_X)
304.128(Active Area)
163.25 ± 0.30
9.65
(9.65)
126.5 ± 0.30
38.75 ± 0.20
(210.15)
(62.84)
CN1

Active Area Center

253.50 ± 0.50 (Module Outline_Y)
231.10 ± 0.30 (Bezel Opening_Y)
228.096(Active Area)
224.00 ± 0.30
176.00 ± 0.30

2-5.50 ±0.30 (2X)
14.75 ±0.20
11.20
11.20

4-M3 Screw
9.5(Typ.)

60.15G13.001-M10

BLU LABEL

Note:
1. CN1- LVDS INTERFACE CONNECTOR TO BE DF14H-30P-1_25H.
2. USER HOLE MAXIMUM INSERTION DEPTH IS 3.0mm.
3. TORQUE OF M3 USER HOLE SHOULD BE WITHIN 4 kgf-cm AND RE-SCREW 10 TIMES.
4. UNSPECIFIED TOLERANCE TO BE ±0.5mm .

9. Label and Packaging

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

9.2 Carton Package

Max capacity：10 TFT-LCD module per carton

Max weight: 12.5 kg per carton

Outside dimension of carton: 410mm(L)* 278mm(W)*360mm(H)

Pallet size： 1140 mm * 830 mm * 135mm

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