(V) Preliminary Specifications

(   ) Final Specifications

Module	10.4 Inch Color TFT-LCD
Model Name	G104VN01 V1

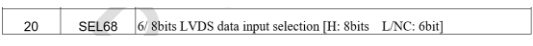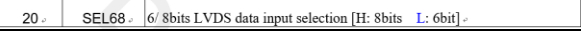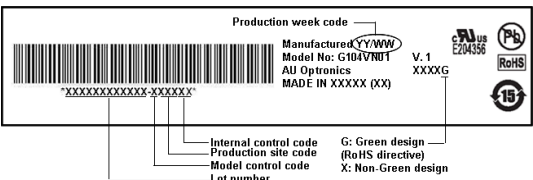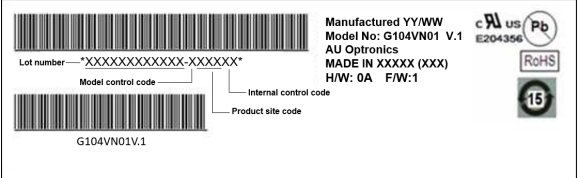| Customer	Date	Approved by	Date
Checked & Approved by		**Prepared by**	
		Danny Liao	2022/01/12
Note: This Specification is subject to change without notice.		General Display Business Division / AU Optronics corporation	

Contents

Record of Revision

Version and Date	Page	Old description	New Description
0.0 2009/02/03	All	First Edition	
1.0 2009/05/14	6	Color / Chromaticity Coordinates(Red x y, Green x y, Blue x y): TBD	Add Min., Typ., Max.
	13	Parameter guideline for LED backlight	Add VF, IF, PLED
	13	Dimming Duty cycle Min: TBD	Dimming Duty cycle Min: 5
	19	Connector & Pin Assignment	Add LED Backlight Unit (CN4): Light bar Connector
	21	LCM Outline Dimension (Front View)	Remove the 4 screw hole
	22	LCM Outline Dimension (Rear View)	Add CN4 drawing
	23	Label and Packaging	Add Shipping Label, Carton Package
1.1 2009/07/21	5	Weight 390g(typ.)	Weight 350g(typ.)
1.2 2010/02/04	16	The input data format	Update SEL68 input data format
	5	Weight 390g(typ.)	Weight 350g(typ.)
2.0 2010/10/14	13	Inrush Current Max:1.5A	Remove condition for Inrush current
	17	Note1: Frame rate is 60Hz	Frame rate: Min.:50, Typ.:60, Max.:75 Hz
	18	Power On/Off Sequence	Modify Power On/Off Sequence
3.0 2011/07/25	22	LCM Outline Dimension (Front View)	Corrected the figure of AA area
	23	LCM Outline Dimension (Rear View)	Corrected the figure of AA area
4.0 2014/04/10	15	6.3 TFT-LCD Interface Signal Description Pin 17 / 18	6.3 TFT-LCD Interface Signal Description Pin 17 / 18: modify information and add fig.
5.0 2021/12/22	5	Power consumption: 5.4W	Power consumption: 5.2W
	5	Weight: 350 (typ.)	Weight: 355 (typ.)
	6	Color / Chromaticity (Red x y, Green x y, Blue x y)	Update Color / Chromaticity (Red x y, Green x y, Blue x y)
	9	Functional Block Diagram	Update Functional Block Diagram
	11	LCD Input Current: 280 mA	LCD Input Current: 120 mA
	11	LCD Power consumption: 0.924 Watt	LCD Power comsumption:0.396 Watt
	13	Ivcc: 0.37A, Pled:4.44W	Ivcc: 0.4A, Pled:4.8W
	15	20 SEL68 6/ 8bits LVDS data input selection [H: 8bits L/NC: 6bit]	Remove NC condition for pin 20 20 SEL68 6/ 8bits LVDS data input selection [H: 8bits L: 6bit]
	19	CN2: 3808K-F05N-02R or compatible	CN2: MSB24038P5D or compatible
	19	CN3: 3808K-F03N-02R or compatible	CN3: MSB24038P3D or compatible
	22	LCM Outline Dimension (Rear View)	Update LCM Outline Dimension (Rear View)
	23		Revise shipping label figure

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 Discharge) 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 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 or UL1950), or be applied exemption.
13) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
14) Continuous operating TFT-LCD display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
15) The data on this specification sheet is applicable when LCD module is placed in landscape position.
16) 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 G104VN01 V1 composed of a TFT-LCD display, a driver and power supply circuit, and a LED backlight system.

The screen format is intended to support VGA (640(H) x 480(V)) screen and 16.2M (RGB 8-bits) or 262k colors (RGB 6-bits).

LED driving board for backlight unit is included in G104VN01 V1 and the LED unit is replaceable.

All input signals are LVDS interface and compatible with G104SN02 V1.

G104VN01 V1 designed with wide viewing angle; wide temperature and long life LED backlight is well suited for industial applications.

G104VN01 V1 is a RoHS product.

This model is designed for HMI application.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	10.4
Active Area	[mm]	211.2 (H) x 158.4 (V)
Pixels H x V		640 x 3(RGB) x 480
Pixel Pitch	[mm]	0.33 x 0.33
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		TN, Normally White
Nominal Input Voltage VDD	[Volt]	3.3 (typ.)
Typical Power Consumption	[Watt]	5.2W All black pattern
Weight	[Grams]	355 (typ.)
Physical Size	[mm]	243.0(H) x 176.6(V) x 8.0(D) (typ.)
Electrical Interface		1 channel LVDS
Surface Treatment		Anti-glare, Hardness 3H
Support Color		16.2M / 262K colors

Temperature Range
    Operating
    Storage (Non-Operating)
	[ºC]
	[ºC]
		-30 to +85
		-30 to +85

RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

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

| Item	Unit	Conditions	Min.	Typ.	Max.	Remark
White Luminance	[cd/m2]	I$_F$= 80mA/1 LED Line (center point)	330	450	-	Note 1
Uniformity	%	5 Points	75	-	-	Note 2, 3
Contrast Ratio			500	700	-	Note 4
Response Time	[msec]	Rising	-	20	30	Note 5
	[msec]	Falling	-	10	20	
	[msec]	Raising + Falling	-	30	50	
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	70 70	80 80	- -	Note 6
	[degree] [degree]	Vertical (Upper) CR = 10 (Lower)	50 70	60 80	- -	
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.558	0.608	0.658	
		Red y	0.301	0.351	0.401	
		Green x	0.299	0.349	0.399	
		Green y	0.515	0.565	0.615	
		Blue x	0.109	0.159	0.209	
		Blue y	0.105	0.155	0.205	
		White x	0.26	0.31	0.36	
		White y	0.28	0.33	0.38	
Color Gamut	%		-	45	-	

Note 1: Measurement method

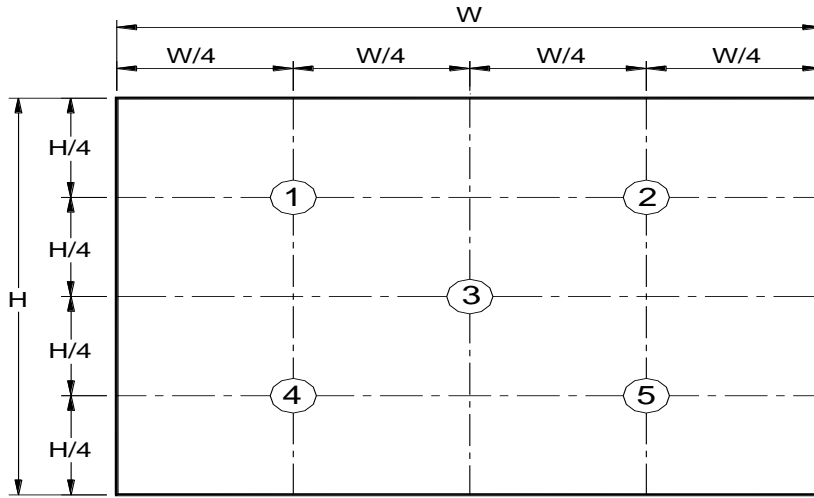Equipment Pattern Generator, Power Supply, Digital Voltmeter, Luminance meter (SR_3 or equivalent)

Aperture   1∘ with 50cm viewing distance

Test Point   Center

Environment   < 1 *lux*

LCD Module

SR_3 or equivalent

Measuring distance

Module Driving Equipment
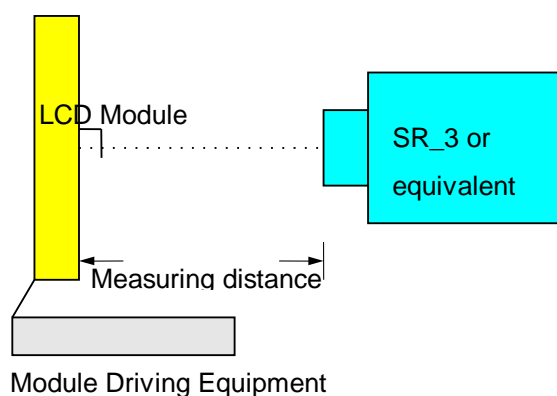
Note 2: Definition of 5 points position (Display active area: 211.2mm (H) x 158.4mm (V))

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

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

Note 4: Definition of contrast ratio (CR):

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

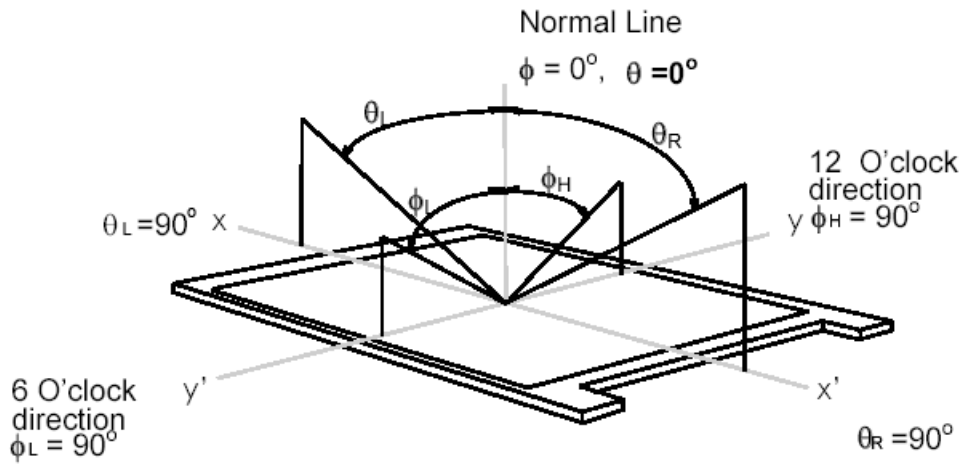Note 5: Definition of response time:

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.
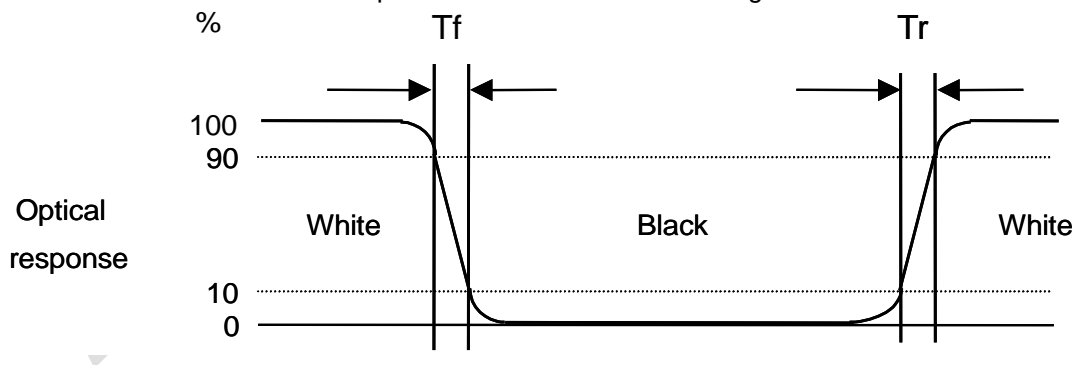
Note 6: Definition of viewing angle

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.

Normal Line
$\phi = 0^o$, $\theta = 0°$

θ_L θ_R

ϕ_H

$\theta_L = 90^o$ X ϕ_L

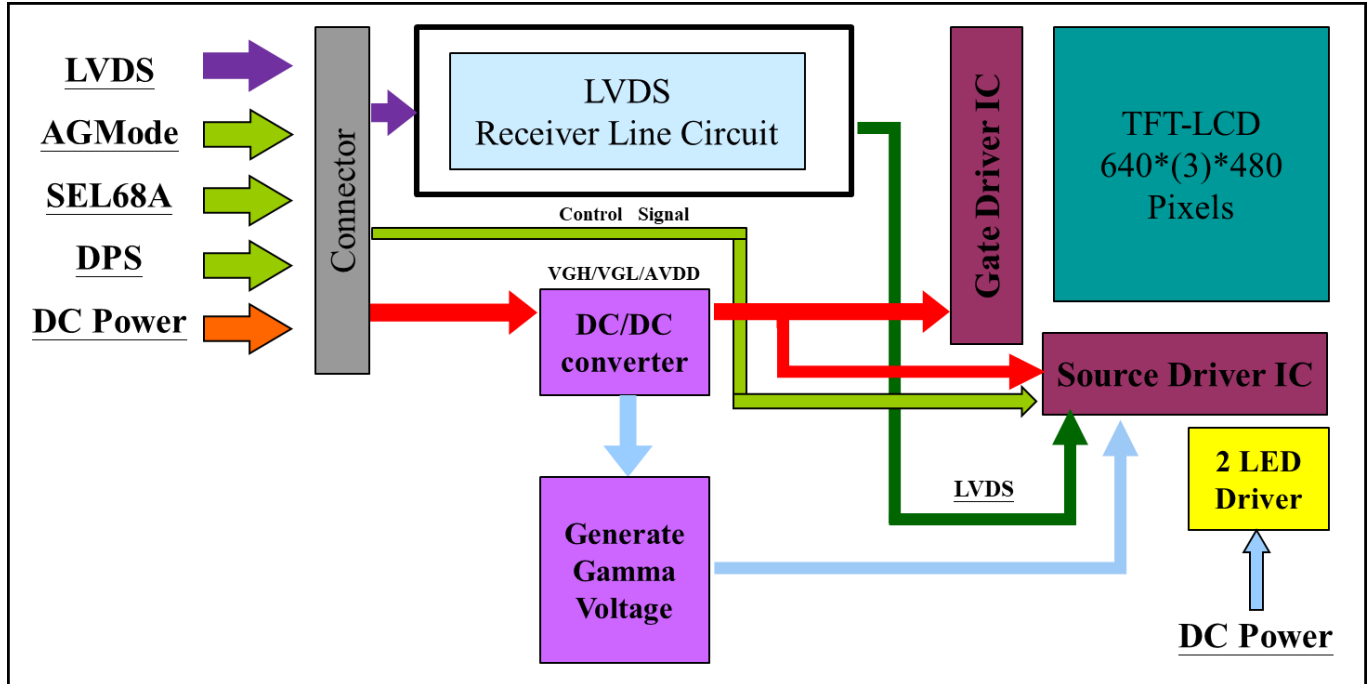12 O'clock direction
y $\phi_H = 90^o$

6 O'clock direction
$\phi_L = 90^o$ y'

x'

$\theta_R = 90^o$

3. Functional Block Diagram

The following diagram shows the functional block of the 10.4 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	Vin	-0.3	+4.0	[Volt]

4.2 Absolute Ratings of Environment

| Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-30	+85	[ºC]
Operation Humidity	HOP	5	95	[%RH]
Storage Temperature	TST	-30	+85	[ºC]
Storage Humidity	HST	5	95	[%RH]

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

5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Input Voltage	3.0	3.3	3.6	[Volt]	
I$_{VDD}$	LCD Input Current	-	120	-	[mA]	VDD=3.3V at 60 HZ, all Black Pattern
P$_{VDD}$	LCD Power consumption	-	0.396	-	[Watt]	VDD=3.3V at 60 HZ, all Black Pattern
I$_{rush\ LCD}$	LCD Inrush Current	-	-	1.5	[A]	Note 1; VDD=3.3V Black Pattern, Rising time=470us
VDD$_{rp}$	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	VDD=3.3V at 60 HZ, all Black Pattern

Note 1: Measurement condition:

VDD rising time
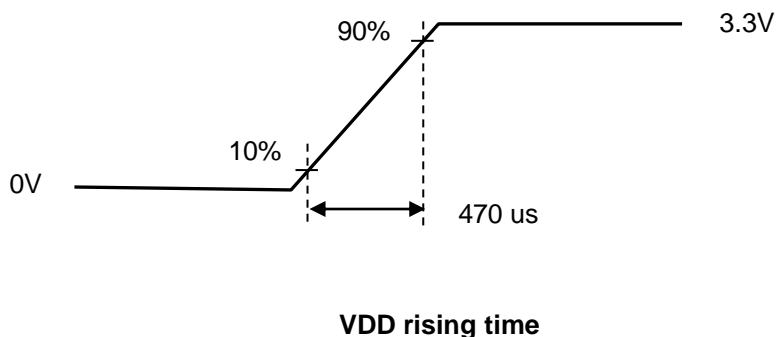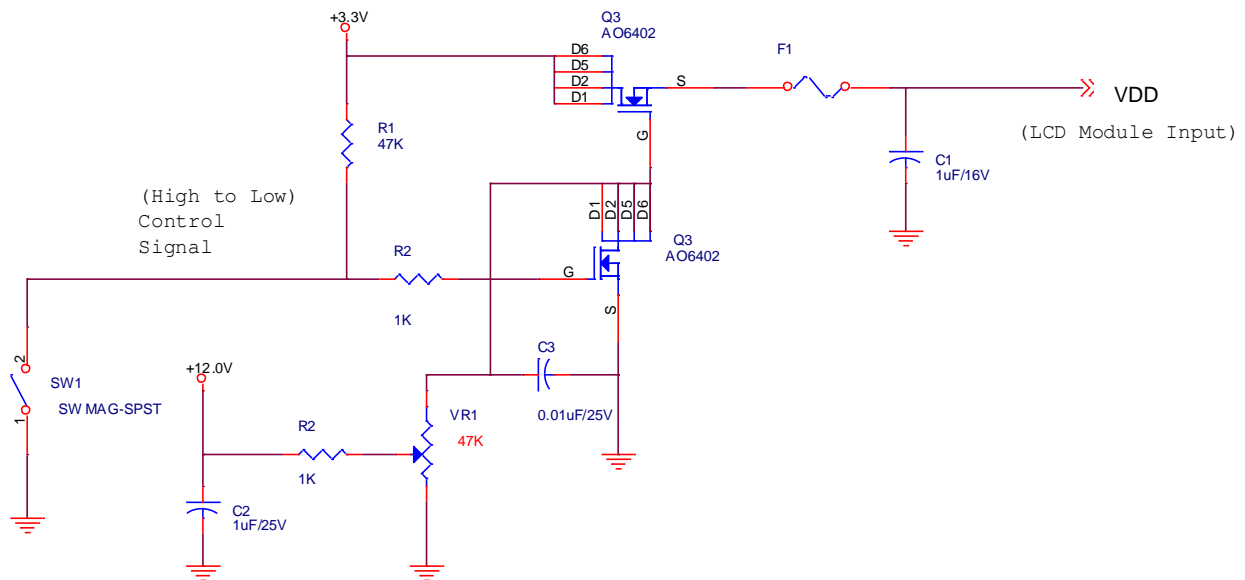
5.1.2 Signal Electrical Characteristics

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

Note: LVDS Signal Waveform.
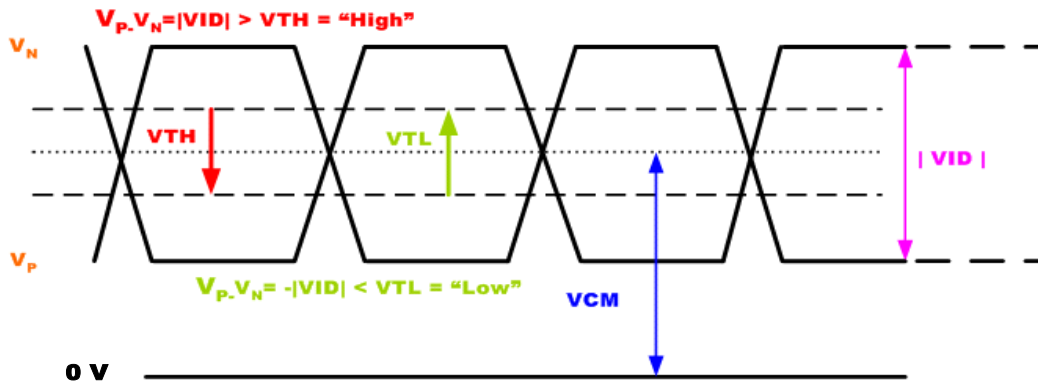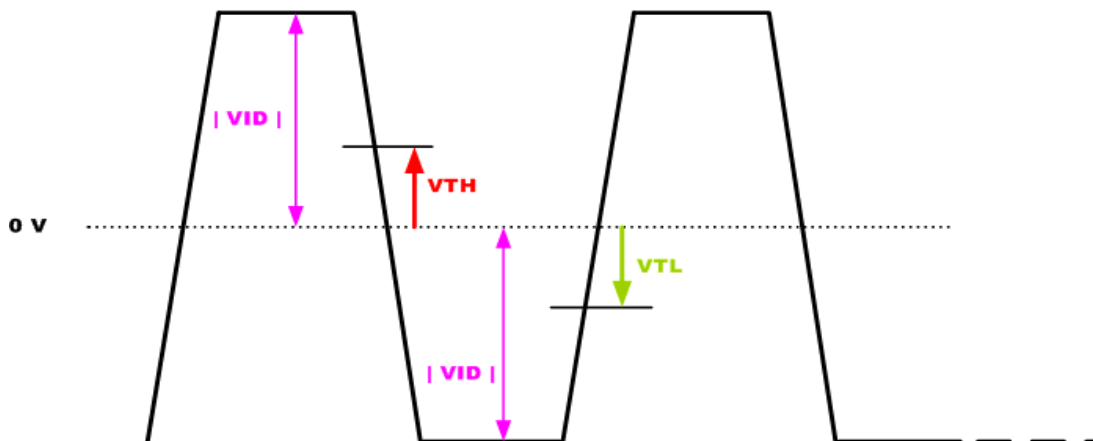
5.2 Backlight Unit

5.2.1 Parameter guideline for LCD

Following characteristics are measured under a stable condition using a inverter at 25℃. (Room

Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VCC	Input Voltage	10.8	12	12.6	[Volt]	
I_{VCC}	Input Current	-	0.4	-	[A]	100% PWM Duty
P_{LED}	Power Consumption	-	4.8	-	[Watt]	100% PWM Duty
F_{PWM}	Dimming Frequency	200	-	20K	[Hz]	
	Swing Voltage	3	3.3	5.5	[Volt]	
	Dimmung duty cycle	5	-	100	%	
I_F	LED Forward Current	-	80	-	[mA]	Ta = 25ºC
V_F	LED Forward Voltage	-	28	-	[Volt]	I_F = 80mA, Ta = -30ºC
		-	25.5	29.2	[Volt]	I_F = 80mA, Ta = 25ºC
		-	24.8	-	[Volt]	I_F = 80mA, Ta = 85ºC
P_{LED}	LED Power Consumption	-	4.1	-	[Watt]	
Operation Life		50,000	-	-	Hrs	I_F=80mA, Ta= 25ºC

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

Note 2: VCC, I_{VCC}, $I_{rush\ LED}$, P_{VCC} are defined for LED backlight.(100% duty of PWM dimming)

Note 3: I_F, V_F are defined for one channel LED. There are two LED channel in back light unit.

Note 4: If G104SN02 V2 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

Note 5: Operating life means brightness goes down to 50% initial brightness. Minimum operating life time is estimated data.

6. Signal Characteristics

6.1 Pixel Format Image

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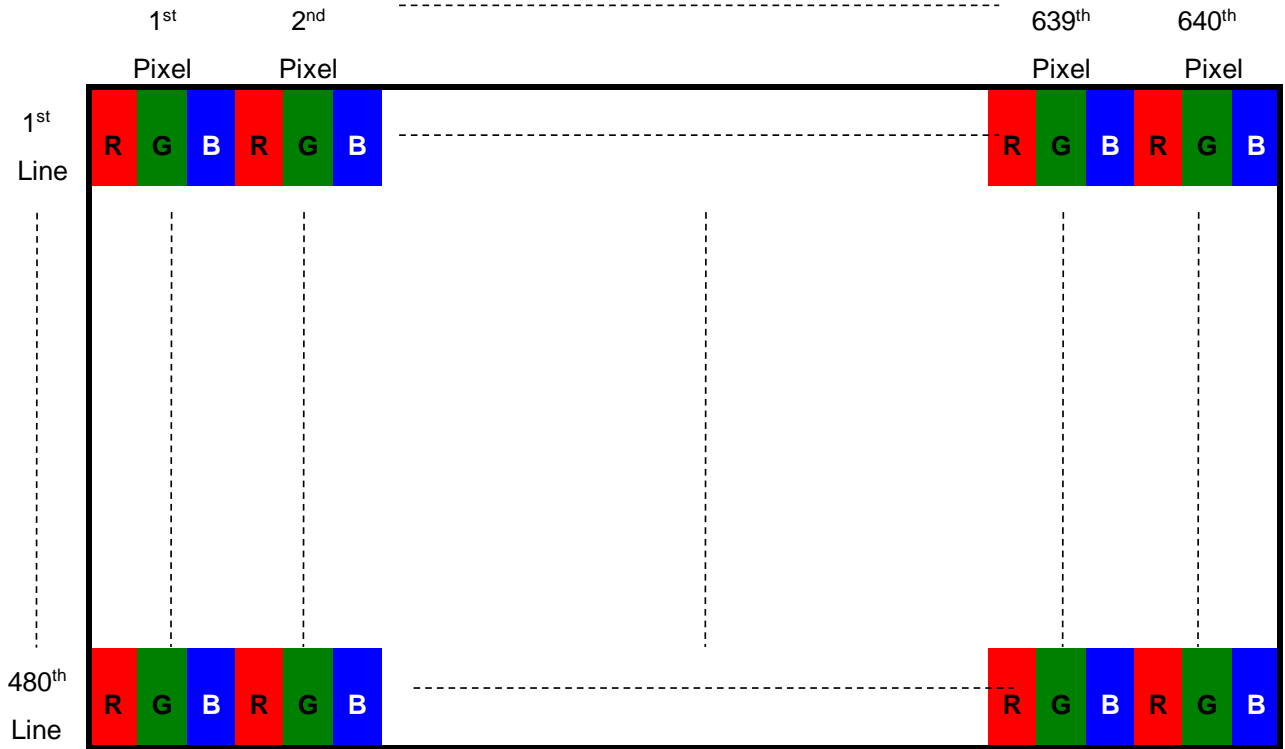
6.2 Scanning Direction

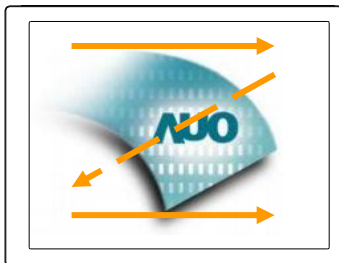The following figures show the image seen from the front view. The arrow indicates the direction of scan.
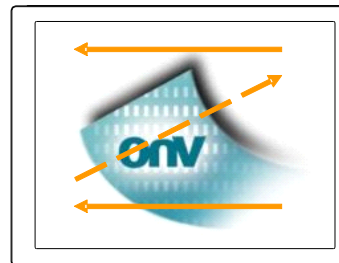

Fig. 1 Normal scan (Pin4, DPS = Low or NC)

Fig. 2 Reverse scan (Pin4, DPS = High)

6.3 TFT-LCD Interface Signal Description

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

Input Signal Interface		
Pin No.	**Symbol**	**Description**
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	GND	Ground
4	DPS	Reverse Scan Function [H: Enable; L/NC: Disable]
5	RxIN0-	LVDS receiver signal channel 0
6	RxIN0+	LVDS Differential Data Input (R0, R1, R2, R3, R4, R5, G0)
7	GND	Ground
8	RxIN1-	LVDS receiver signal channel 1
9	RxIN1+	LVDS Differential Data Input (G1, G2, G3, G4, G5, B0, B1)
10	GND	Ground
11	RxIN2-	LVDS receiver signal channel 2
12	RxIN2+	LVDS Differential Data Input (B2, B3, B4, B5, HS, VS, DE)
13	GND	Ground
14	RxCLKIN-	LVDS receiver signal clock
15	RxCLKIN+	
16	GND	Ground
17	RxIN3-	LVDS receiver signal channel 3, Pin17:VDD & PIN18: GND for 6 bit LVDS Input
18	RxIN3+	LVDS Differential Data Input (R6, R7, G6, G7, B6, B7, RSV)
19	RSV	Reserved for AUO internal test. Please treat it as NC.
20	SEL68	6/ 8bits LVDS data input selection [H: 8bits L: 6bit]

Note 1: Input Signals shall be in low status when VDD is off.
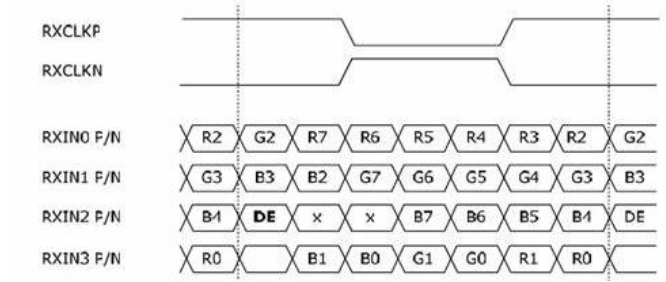Note 2: High stands for "3.3V", Low stands for "0V", NC stands for "No Connection".
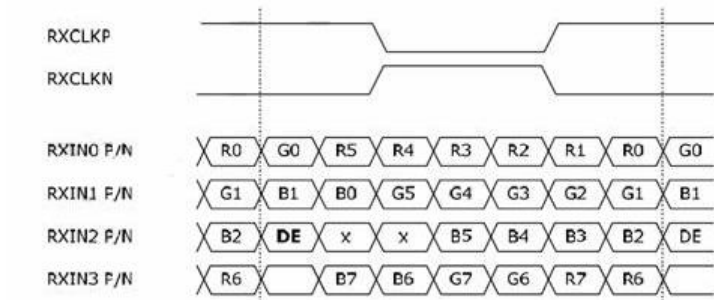Note 3: RSV stands for "Reserved".
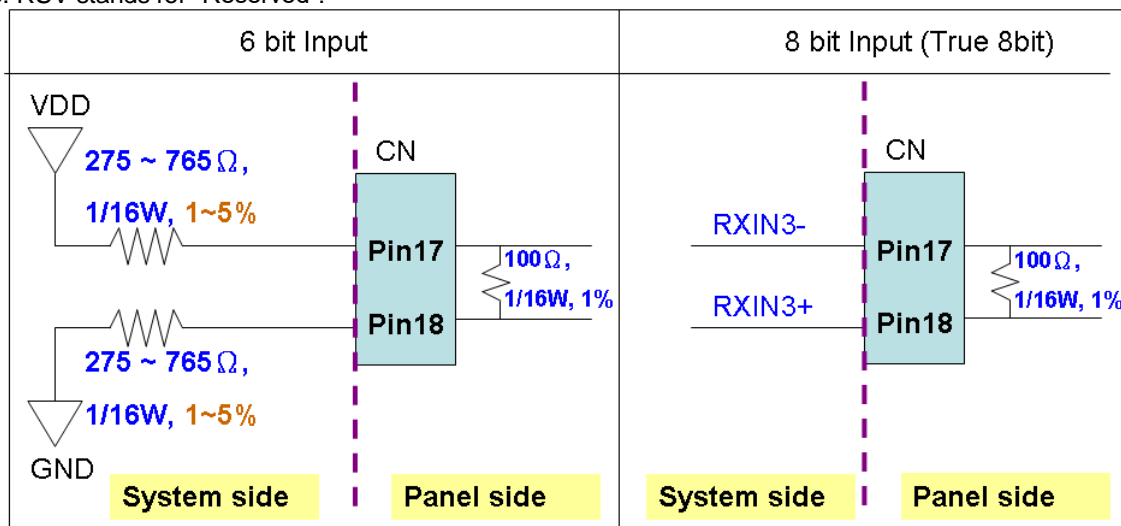
6.4 The Input Data Format

6.4.1 SEL68

SEL68 ="Low" or "NC" for 6 bits LVDS Input

SEL68 = "High" for 8 bits LVDS Input

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

Signal Name	Description	Remark
R7	Red Data 7	Red-pixel Data
R6	Red Data 6	
R5	Red Data 5	For 8Bits LVDS input
R4	Red Data 4	MSB: R7 ; LSB: R0
R3	Red Data 3	
R2	Red Data 2	For 6Bits LVDS input
R1	Red Data 1	MSB: R5 ; LSB: R0
R0	Red Data 0	
G7	Green Data 7	Green-pixel Data
G6	Green Data 6	
G5	Green Data 5	For 8Bits LVDS input
G4	Green Data 4	MSB: G7 ; LSB: G0
G3	Green Data 3	
G2	Green Data 2	For 6Bits LVDS input
G1	Green Data 1	MSB: G5 ; LSB: G0
G0	Green Data 0	
B7	Blue Data 7	Blue-pixel Data
B6	Blue Data 6	
B5	Blue Data 5	For 8Bits LVDS input
B4	Blue Data 4	MSB: B7 ; LSB: B0
B3	Blue Data 3	
B2	Blue Data 2	For 6Bits LVDS input
B1	Blue Data 1	MSB: B5 ; LSB: B0
B0	Blue Data 0	
RxCLKIN	LVDS Data Clock	
DE	Data Enable Signal	When the signal is high, the pixel data shall be valid to be displayed.

Note: Output signals from any system shall be low or Hi-Z state when VDD is off.

6.5 TFT-LCD Interface Timing

6.5.1 Timing Characteristics

Signal		Symbol	Min.	Typ.	Max.	Unit
Clock Frequency		1/ T_{Clock}	20	25.2	28.33	MHz
Vertical Section	Period	T_V	495	525	560	T_{Line}
	Active	T_{VD}	--	480	--	
	Blanking	T_{VB}	15	45	80	
Horizontal Section	Period	T_H	770	800	900	T_{Clock}
	Active	T_{HD}	--	640	--	
	Blanking	T_{HB}	130	160	260	
Frame Rate		F	50	60	75	Hz

Note: DE mode.

6.5.2 Input Timing Diagram
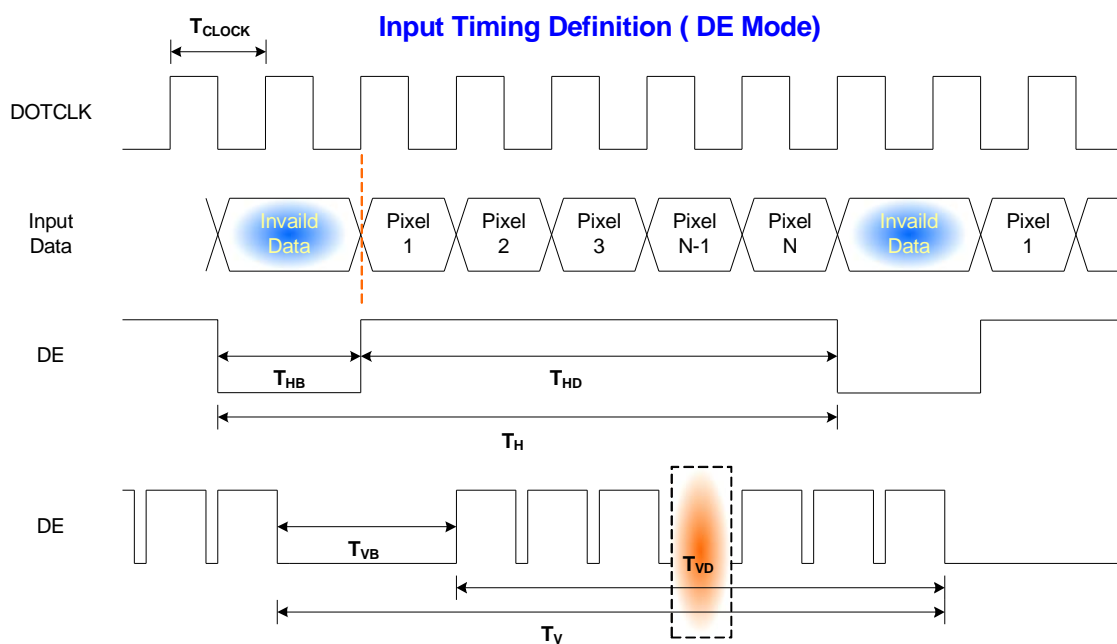
6.6 Power ON/OFF Sequence

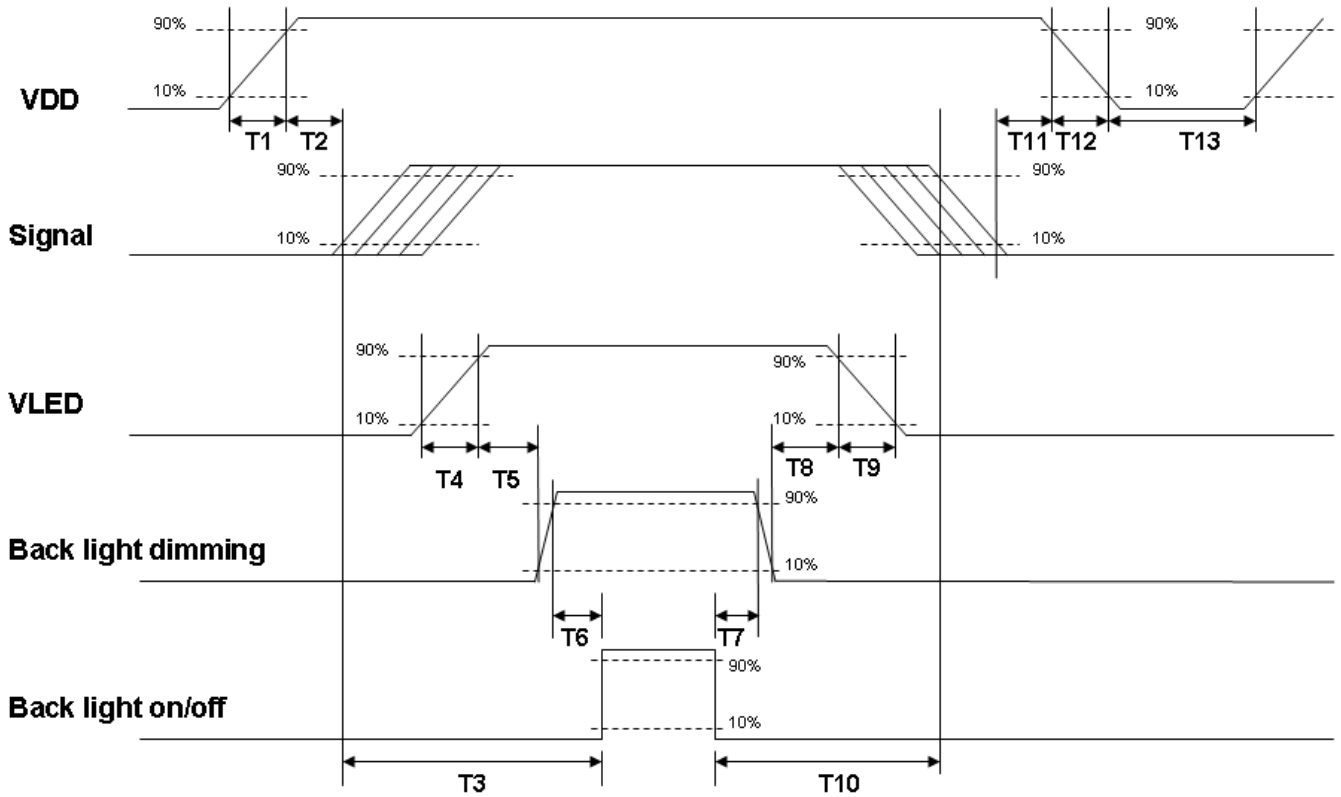VDD power and lamp on/off sequence is as below. Interface signals are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off.

Power ON/OFF sequence timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	30	40	50	[ms]
T3	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 Signal (CN1): LCD Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM or compatible
Connector Model Number	MSB24013P20HA or compatible
Adaptable Plug	P24013P20 or compatible

Pin No.	Symbol	Pin No.	Symbol
1	VDD	2	VDD
3	GND	4	DPS
5	RxIN0-	6	RxIN0+
7	GND	8	RxIN1-
9	RxIN1+	10	GND
11	RxIN2-	12	RxIN2+
13	GND	14	RxCKIN-
15	RxCKIN+	16	GND
17	RxIN3-	18	RxIN3+
19	RSV	20	SEL68

7.2 LED Backlight Unit (CN2): Backlight Connector

Connector Name / Designation	Lamp Connector
Manufacturer	STM or compatible
Connector Model Number	MSB24038P5D or compatible
Mating Model Number	H208K–P05N-02B or compatible

Pin No.	symbol	description
Pin1	VCC	12V input
Pin2	GND	GND
Pin3	On/OFF	5V-ON,0V-OFF
Pin4	Dimming	PWM
Pin5	NA	

7.3 LED Backlight Unit (CN4): Light bar Connector

Connector Name / Designation	Lamp Connector
Manufacturer	ENTERY or compatible
Connector Model Number	H208K–P03N-02B or compatible
Mating Model Number(CN3)	MSB24038P3D or compatible

Pin No.	symbol	description	Color
Pin1	H	LED anode	Red
Pin2	L	LED cathode	White
Pin3	L	LED cathode	Black

8. Reliability Test Criteria

| Items	Required Condition	Note
Temperature Humidity Bias	40℃, 90%RH, 300 hours	
High Temperature Operation	85℃, 300 hours	
Low Temperature Operation	-30℃, 300 hours	
Hot Storage	85℃, 300 hours	
Cold Storage	-30℃, 300 hours	
Thermal Shock Test	-20℃/ 30 min, 60℃/ 30 min, 100cycles,　40℃　minimun ramp rate	
Hot Start Test	85℃ /　1Hr min. power on/off per 5 minutes, 5 times	
Cold Start Test	-30℃ /　1Hr min. power on/off per 5 minutes, 5 times	
Shock Test (Non-Operating)	50G, 20ms, Half-sine wave, (±X, ±Y, ±Z)	
Vibration Test (Non-Operating)	1.5G, (10~200Hz, Sine wave) 30 mins/axis, 3 direction (X, Y, Z)	
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	
ESD	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point Air Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point	Note 1
EMI	30-230 MHz, limit 40 dBu V/m, 230-1000 MHz, limit 47 dBu V/m	

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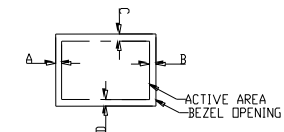
Self-recoverable. No hardware failures.

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.
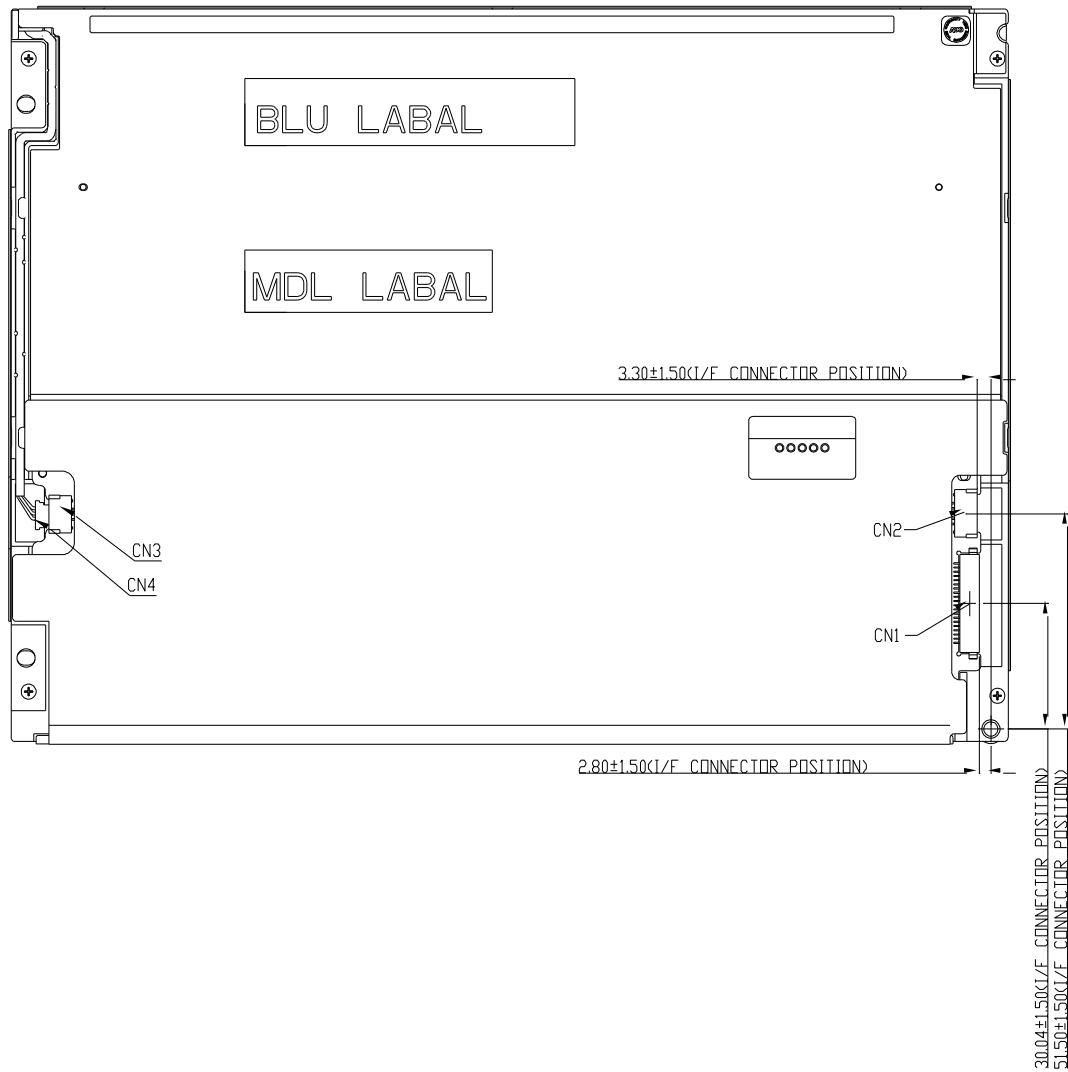
9. Mechanical Characteristics

9.1 LCM Outline Dimension (Front View)
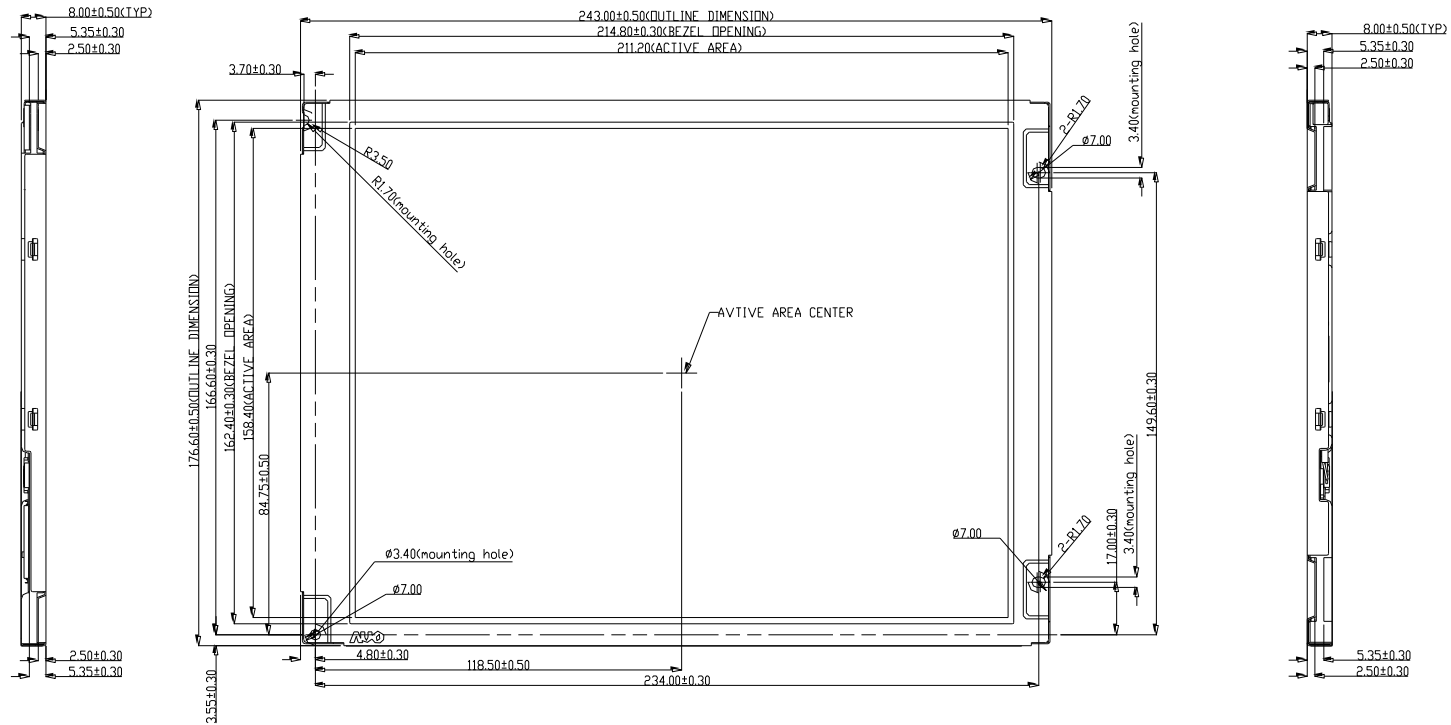
NOTE:
1. BLIGQUITY TOLERANCE OF DISPLAY AREA SHOWN AS RIGHT:
   X-DIRECTION: IA-BI<=1.0mm
   Y-DIRECTION: IC-DI <= 1.0mm
2. CN1: THE INTERFACE CONNECTOR IS MSB24013P20HA
3. CN2: THE LED CONNECTOR IS 3808K-F05N-02R
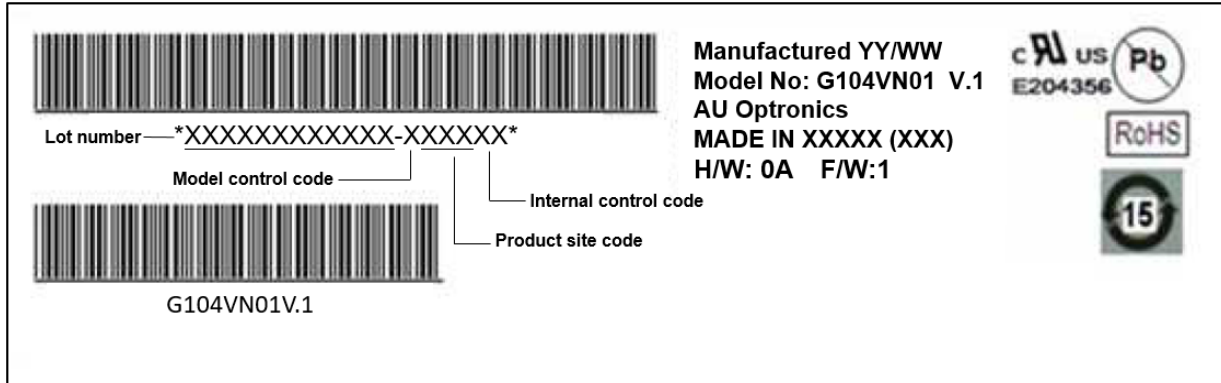4. TOLERANCE IS ±0.5mm IF NOT SPECIFIED.

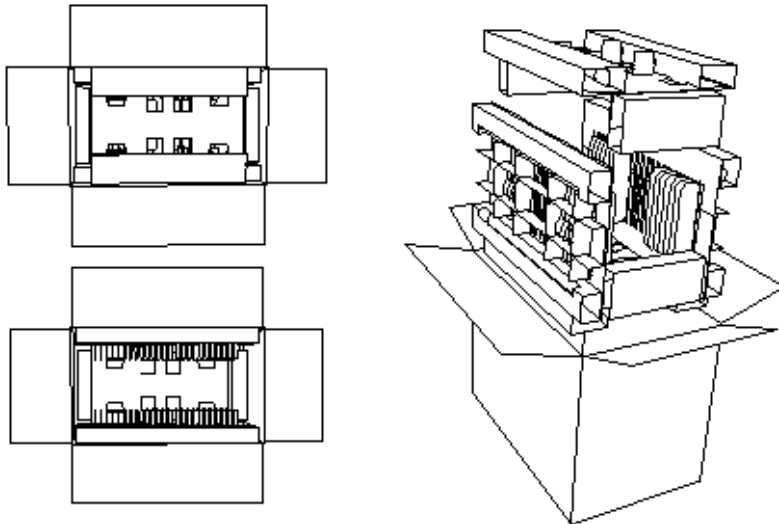## 9.2 LCM Outline Dimension (Rear View)

BLU LABAL

MDL LABAL

3.30±1.50(I/F CONNECTOR POSITION)

CN3
CN4

CN2

CN1

2.80±1.50(I/F CONNECTOR POSITION)

30.04±1.50(I/F CONNECTOR POSITION)
51.50±1.50(I/F CONNECTOR POSITION)

10. Label and Packaging

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

Lot number —— *XXXXXXXXXXXX-XXXXXX*

Model control code

Internal control code

Product site code

G104VN01V.1

Manufactured YY/WW
Model No: G104VN01 V.1
AU Optronics
MADE IN XXXXX (XXX)
H/W: 0A   F/W:1

c℞us
E204356

Pb

RoHS

15

10.2 Carton Package

Note:
1. Max. Capacity: 20pcs LCD Modules / per carton
2. Max. Weight: 10 kg / per carton
3. The outside dimension of carton is 483(L) mm x 285(W) mm x 355(H) mm

11 Safety

11.1 Sharp Edge Requirements

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

11.2 Materials

11.2.1 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.

11.2.2 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.

11.3 Capacitors

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

11.4 National Test Lab Requirement

The display module will satisfy all requirements for compliance to:

UL 1950, First Edition   U.S.A. Information Technology Equipment