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(V) Preliminary Specifications
() Final Specifications

Module	15 Inch Color TFT-LCD
Model Name	G150XAN02.0

Customer **Date** **Checked & Approved by** _____ _____	**Approved by** **Date** Sean Lin 2018/09/06 **Prepared by** Jason Hsieh 2018/09/06
	General Display Business Unit / AU Optronics corporation

2. General Description

G150XAN02.0 is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display, a driver circuit, and a backlight system. The screen format is intended to support XGA (1024(H) x 768(V)) screen and 16.2M (RGB 6+2FRC) colors. All input signals are LVDS interface compatible.

G150XAN02.0 is designed for industrial display applications.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	15
Active Area	[mm]	304.128(H) x 228.096(V)
Pixels H x V		1024x3(RGB) x 768
Pixel Pitch	[mm]	0.297 x 0.297
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		AHVA
Nominal Input Voltage VDD	[Volt]	3.3 typ.
Typical Power Consumption	[Watt]	10.2
Weight	[Grams]	920g (max.)
Physical Size	[mm]	326.5(H) x 253.5(V) x 9.0 (D)
Electrical Interface		LVDS
Surface Treatment		Anti-glare, Hardness 3H
Support Color		16.2M colors
Temperature Range Operating Storage (Non-Operating)	 [ºC] [ºC]	 -30 to +85℃ (+85℃ as panel surface temperature) -30 to +85
RoHS Compliance		RoHS Compliance
Light Bar Unit		LED, Non-Replaceable

2.2 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]		400	500	-	1
Uniformity	%	9 Points	75	80	-	1, 2, 3
Contrast Ratio			800	1000	-	4
Cross talk	%		-	--	1.5	5
Response Time	[msec]	Rising	-			6
	[msec]	Falling	-			
	[msec]	Raising + Falling	-	25	30	
Viewing Angle	[degree] [degree]	Horizontal (Right) CR = 10 (Left)	80 80	89 89	- -	7
	[degree] [degree]	Vertical (Upper) CR = 10 (Lower)	80 80	89 89	- -	
Color / Chromaticity Coordinates (CIE 1931)		Red x	0.569	0.619	0.669	
		Red y	0.302	0.352	0.402	
		Green x	0.279	0.329	0.379	
		Green y	0.559	0.609	0.659	
		Blue x	0.100	0.150	0.200	
		Blue y	0.068	0.118	0.168	
		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Color Gamut	%			60	-	

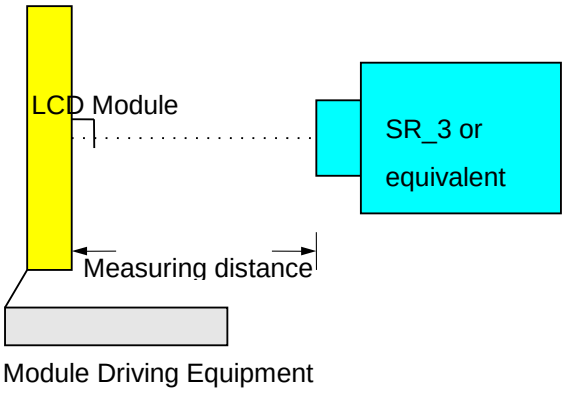
Note 1: Measurement method

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

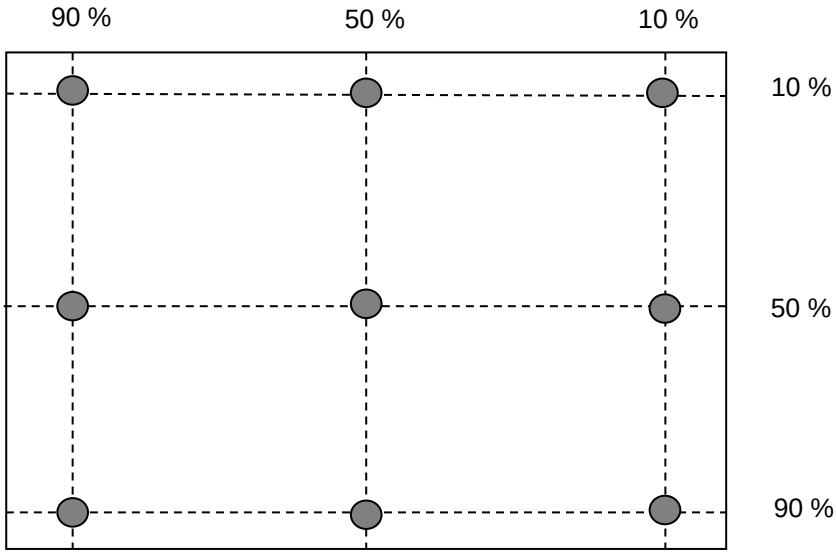
Aperture 1◦ with 50cm viewing distance

Test Point Center

Environment *< 1 lux*



Note 2: Definition of 9 points position (Display active area: 304.128(H) x 228.096(V))



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

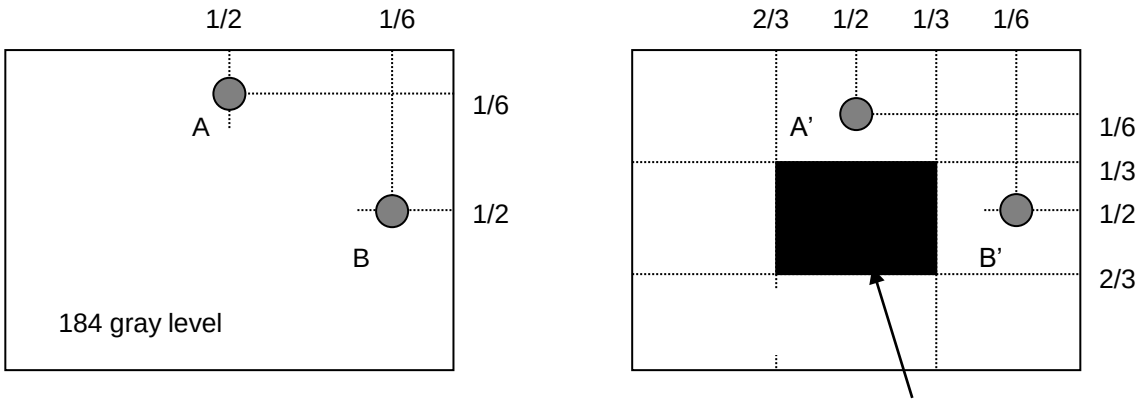
$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4： Definition of contrast ratio (CR):

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

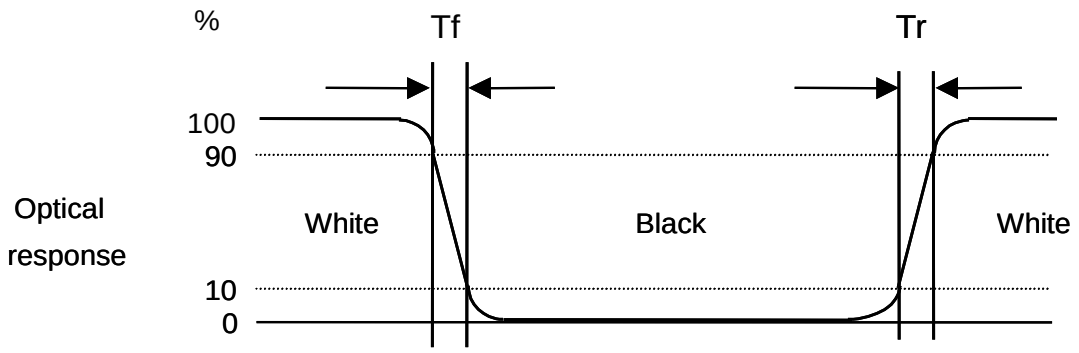
Note 5： Definition of cross talk (CT)

CT = | YB – YA | / YA × 100 (%)
Where
YA = Luminance of measured location without gray level 0 pattern (cd/m2)
YB = Luminance of measured location with gray level 0 pattern (cd/m2)



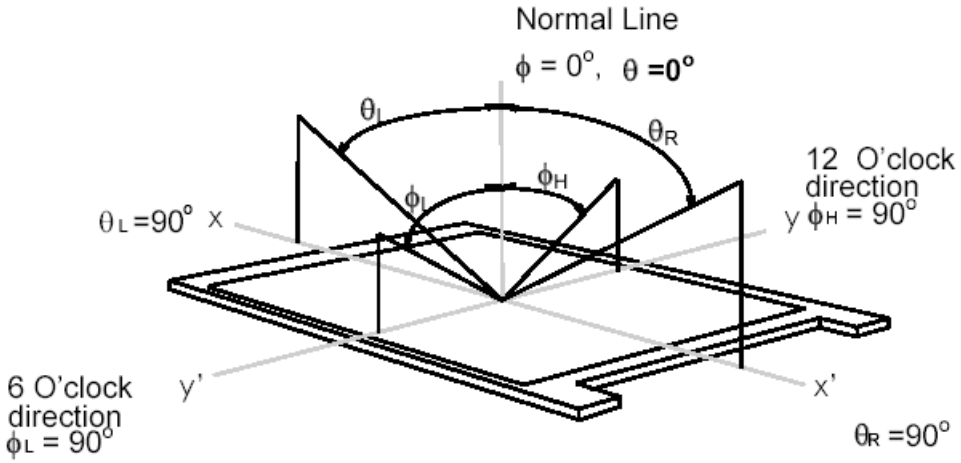
Note 6: Definition of response time:

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.



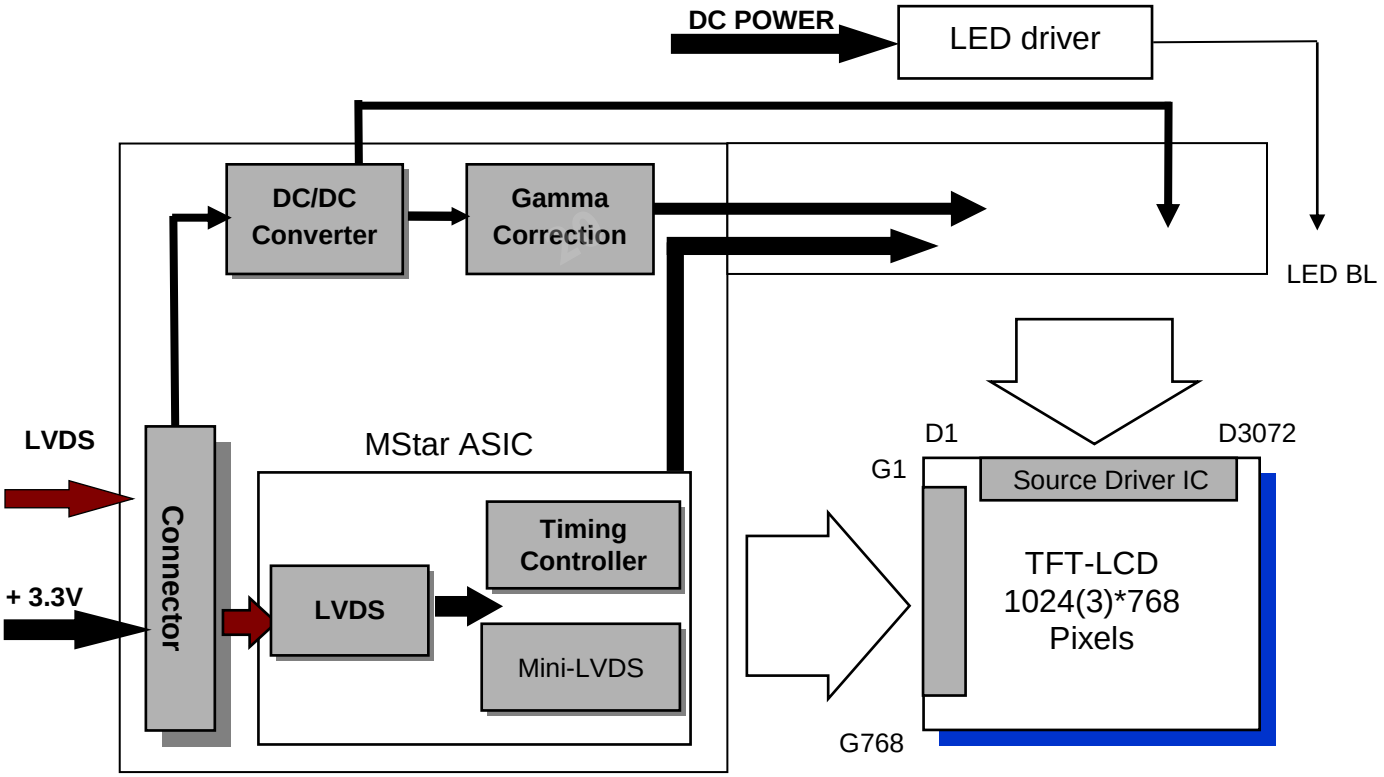
Note 7: Definition of viewing angle

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 15 inch color TFT/LCD module:



MSB240420HD

Mating Type: P240420

Entery 3808K-F05N-12R

H208K-P05N-02B

4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

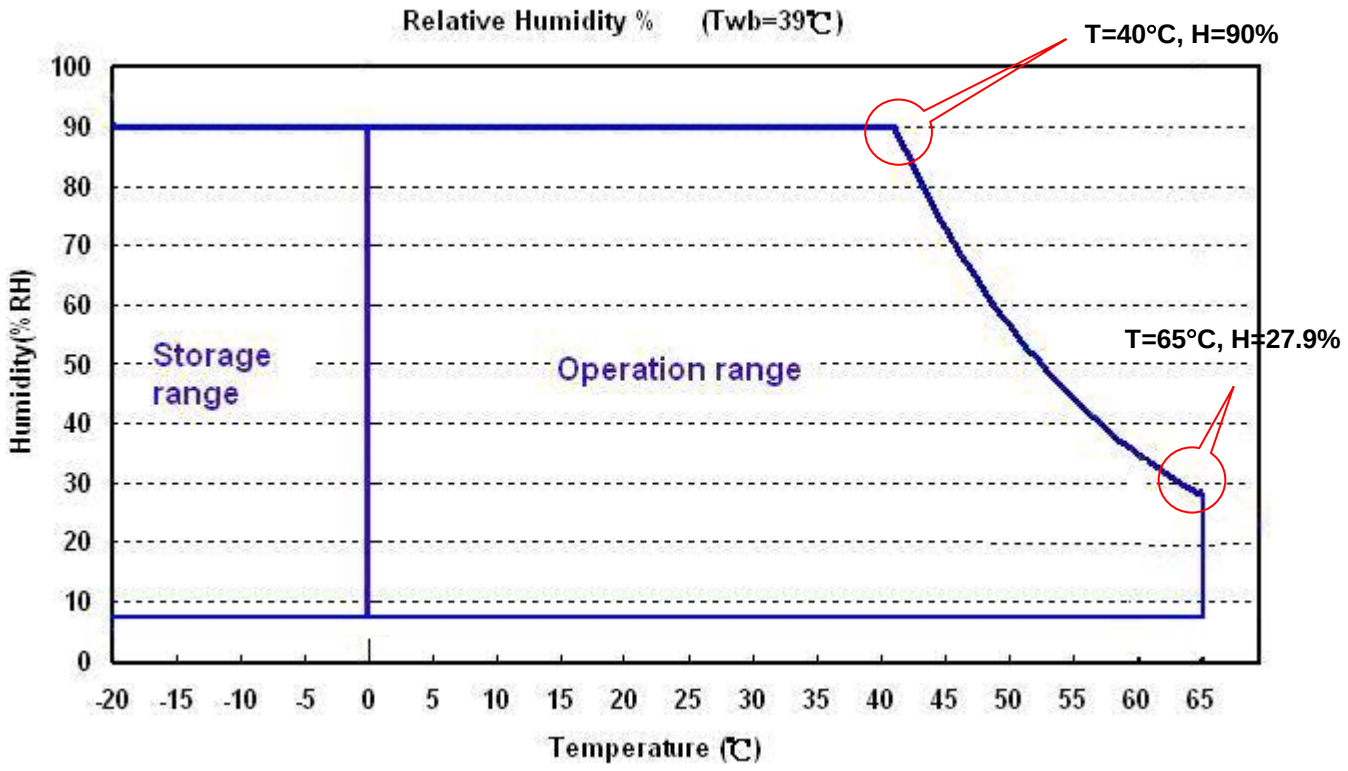
Item	Symbol	Min	Max	Unit
Logic/LCD Drive Voltage	Vin	-0.3	+3.6	[Volt]

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-30	+85*	[°C]
Operation Humidity	HOP	8	90	[%RH]
Storage Temperature	TST	-30	+85	[°C]
Storage Humidity	HST	8	90	[%RH]

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

* 85°C is panel surface temperature



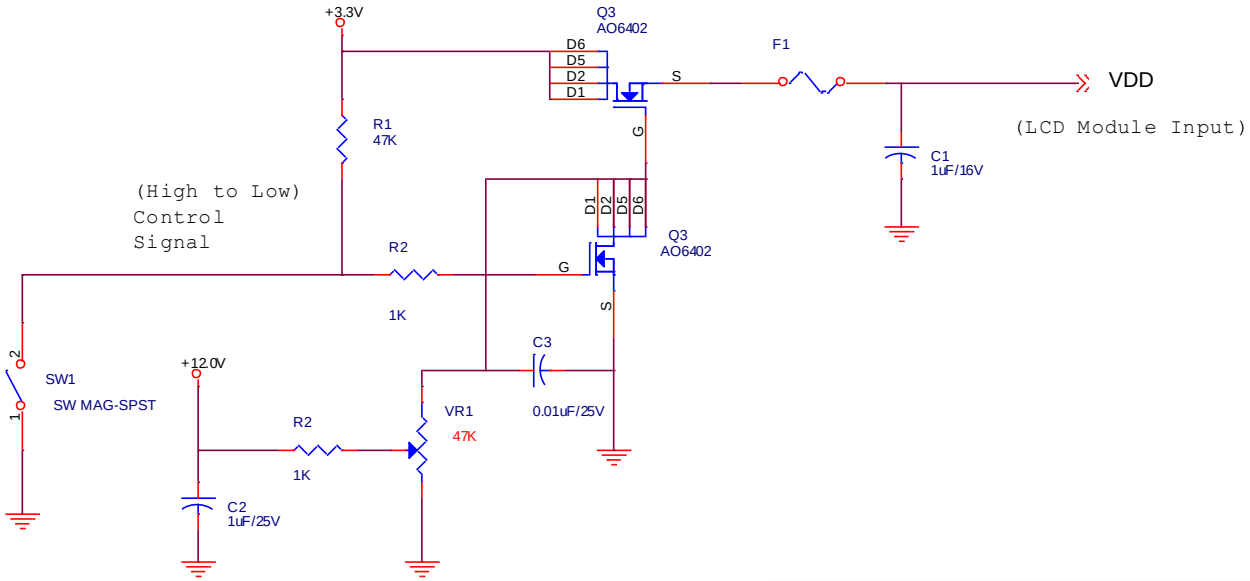
5. Electrical Characteristics

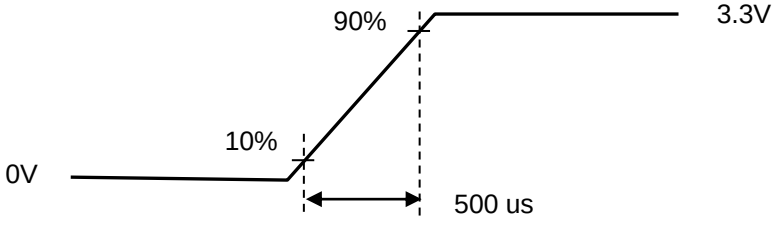
5.1 TFT LCD Module

5.1.1 Power Specification

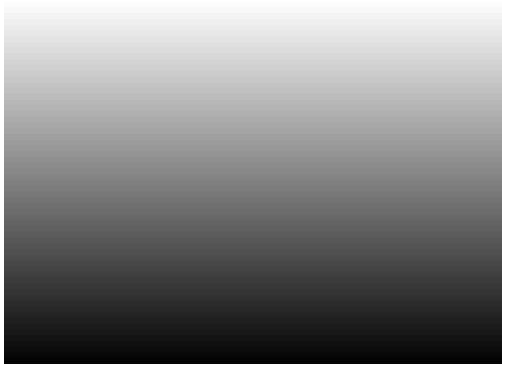
Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	±10%
IDD	VDD Current	-	0.46	0.55	[A]	All White Pattern (VDD=3.3V, at 60Hz)
Irush	LCD Inrush Current			3	[A]	Note 1
PDD	VDD Power	-	1.52	1.82	[Watt]	All White Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement condition:





VDD rising time



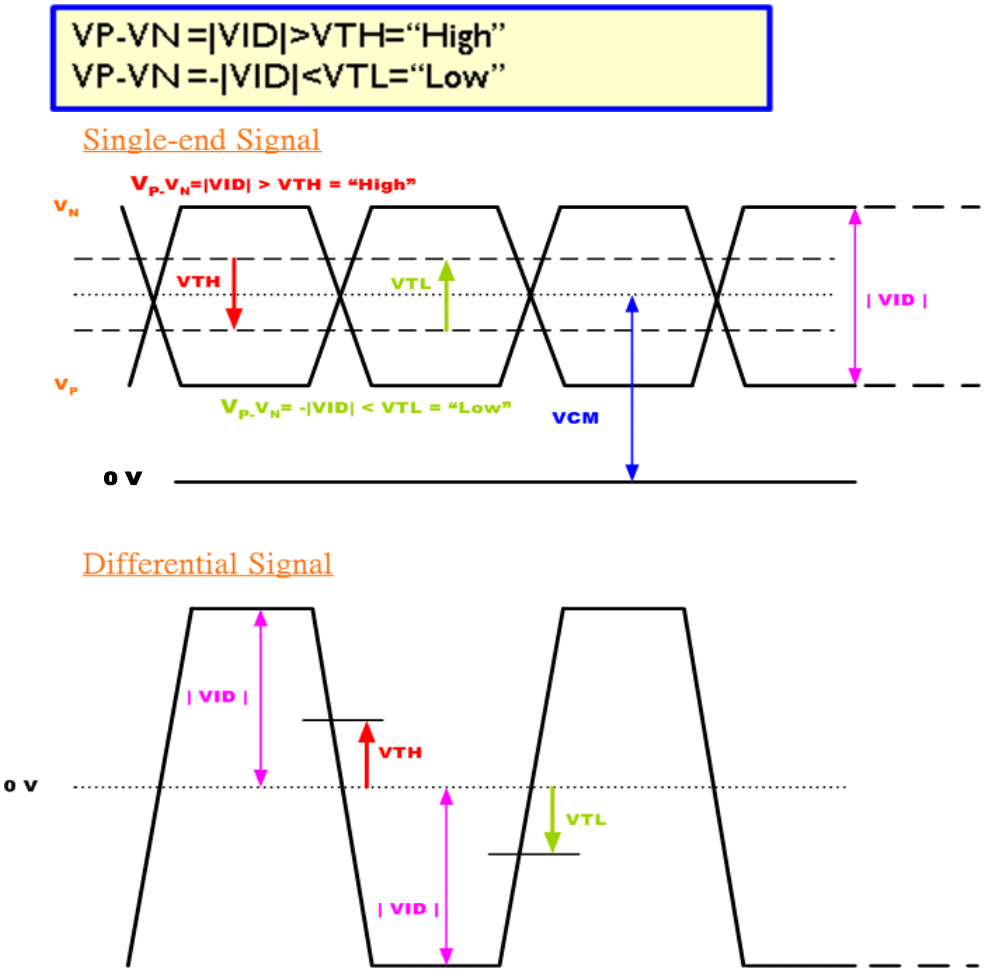
64 Gray pattern

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		600	[mV]	
VICM	Differential Input Common Mode Voltage	1.0	1.2	1.5	[V]	VTH/VTL=±100mV

Note: LVDS Signal Waveform.



5.2 Backlight Unit

5.2.1 Parameter guideline for LED

Following characteristics are measured under stable condition using a LED driving board at 25℃(Room Temperature).

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
Vcc	Input Voltage	10.8	12	13.2	Volt	
Ivcc	Input Current	-	0.72	0.79	A	100% Dimming
P_{LED}	Power Consumption	-	8.68	9.52	Watt	100% Dimming
Irush	Inrush Current			3	A	
$V_{LED\ on/off}$	On Control Voltage	2.5	3.3	5.5	Volt	
	Off Control Voltage			0.5	Volt	
F_{PWM}	PWM Dimming Frequency	200		20k	Hz	
	High Voltage	2.5	3.3	5.5	Volt	
	Low Voltage			0.5	Volt	
	Dimming Duty Cycle	5	-	100	%	
I_F	LED Forward Current		56		mA	Ta = 25°C
Operating Life		50,000			Hrs	Ta = 25°C

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

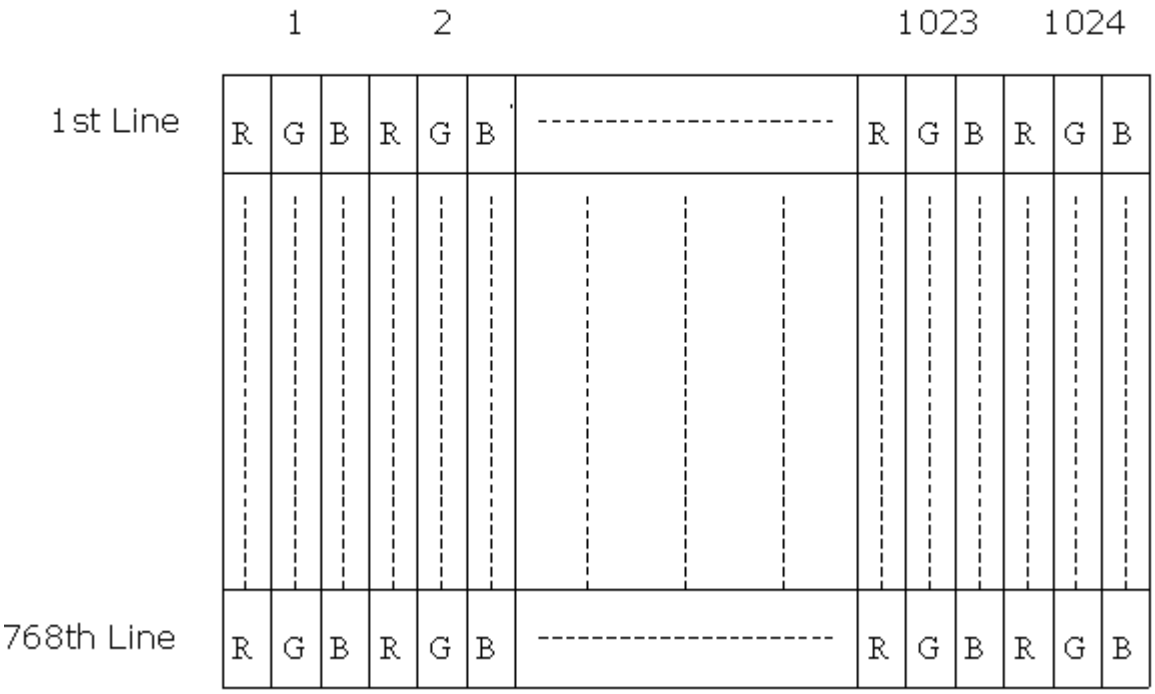
Note 2: If G150XAN02.0 module is driven at high ambient temperature & humidity condition. The operating life will be reduced.

Note 3: Definition of life time: LED brightness becomes 50% of its original value. The minimum life time of LED unit is defined at the condition of IR_{LED} = 60 mA and 25±2℃(Room temperature).

6. Signal Characteristic

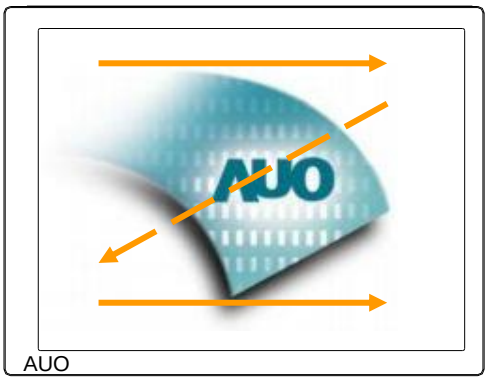
6.1 Pixel Format Image

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.



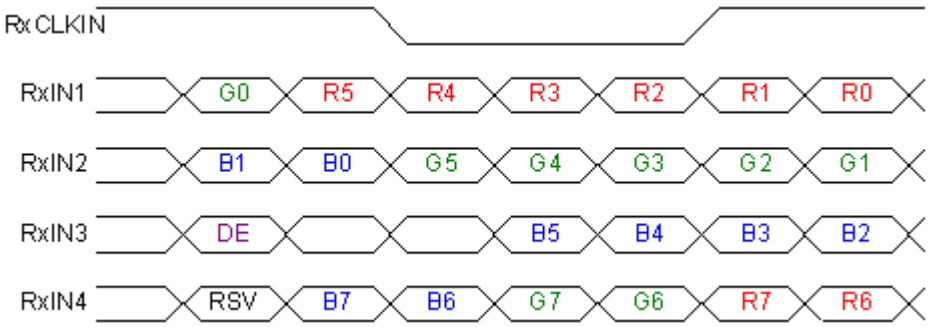
6.3 Signal Description

LVDS is a differential signal technology for LCD interface and high speed data transfer device.

MSB240420E(STM)		
Pin No.	**Symbol**	**Description**
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	NC	No Connect
4	NC	No Connect
5	Rin1-	- LVDS differential data input (R0-R5, G0)
6	Rin1+	+ LVDS differential data input (R0-R5, G0)
7	VSS	Ground
8	Rin2-	- LVDS differential data input (G1-G5, B0-B1)
9	Rin2+	+ LVDS differential data input (G1-G5, B0-B1)
10	VSS	Ground
11	Rin3-	- LVDS differential data input (B2-B5, HS, VS, DE)
12	Rin3+	+ LVDS differential data input (B2-B5, HS, VS, DE)
13	VSS	Ground
14	ClkIN-	- LVDS differential clock input
15	ClkIN+	+ LVDS differential clock input
16	GND	Ground
17	Rin4-	- LVDS differential data input (R6-R7, G6-G7,B6-B7)
18	Rin4+	- LVDS differential data input (R6-R7, G6-G7,B6-B7)
19	VSS	Ground
20	VSS	Ground

Note 1: Input signals shall be in low status when VDD is off.

6.4 The Input Data Format



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

Signal Name	Description	Remark
R7 R6 R5 R4 R3 R2 R1 R0	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 LVDS input MSB: R7 ; LSB: R0
G7 G6 G5 G4 G3 G2 G1 G0	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 LVDS input MSB: G7 ; LSB: G0
B7 B6 B5 B4 B3 B2 B1 B0	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 LVDS input MSB: B7 ; LSB: B0
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.

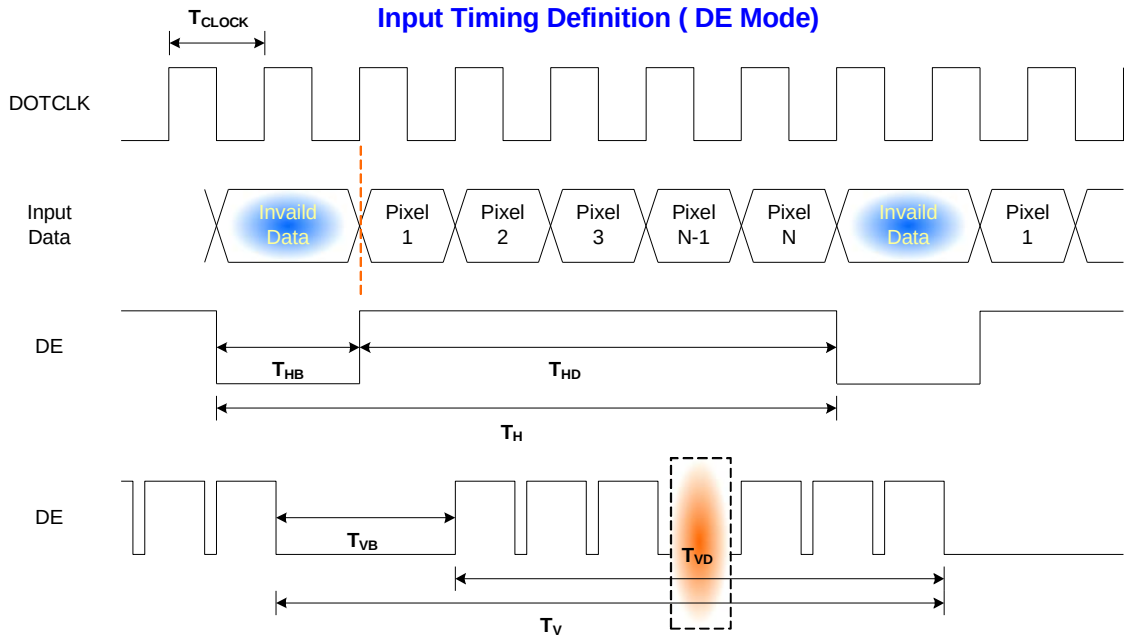
6.5 Interface Timing

6.5.1 Timing Characteristics

Signal	Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock Timing	Clock frequency		1/ T_{Clock}	63	65	67	MHz
Vsync Timing	Vertical Section	Period	T_V	804	806	808	T_{Line}
		Active	T_{VD}	768	768	768	
		Blanking	T_{VB}	36	38	40	
Hsync Timing	Horizontal Section	Period	T_H	1328	1344	1360	T_{Clock}
		Active	T_{HD}	1024	1024	1024	
		Blanking	T_{HB}	304	320	336	
Frame Rate			F	59	60	61	Hz

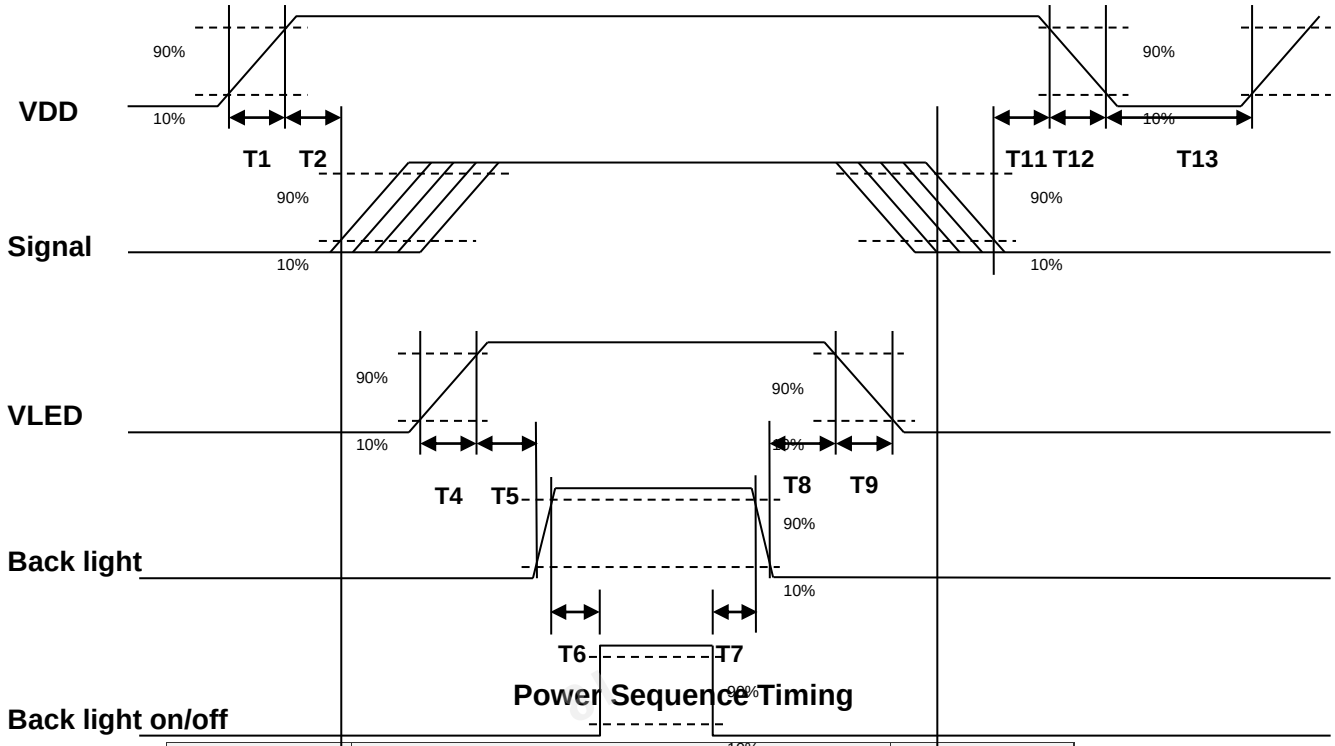
Note: Support DE mode only.
Note : Typical value refer to VESA STANDARD

6.5.2 Input Timing Diagram



6.6 Power ON/OFF Sequence

VDD power and backlight 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 Sequence Timing

Parameter	Value			Unit
	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	-	-	200	[ms]
T10	110	-	-	[ms]
T11	0	16	50	[ms]
T12	-	-	200	[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

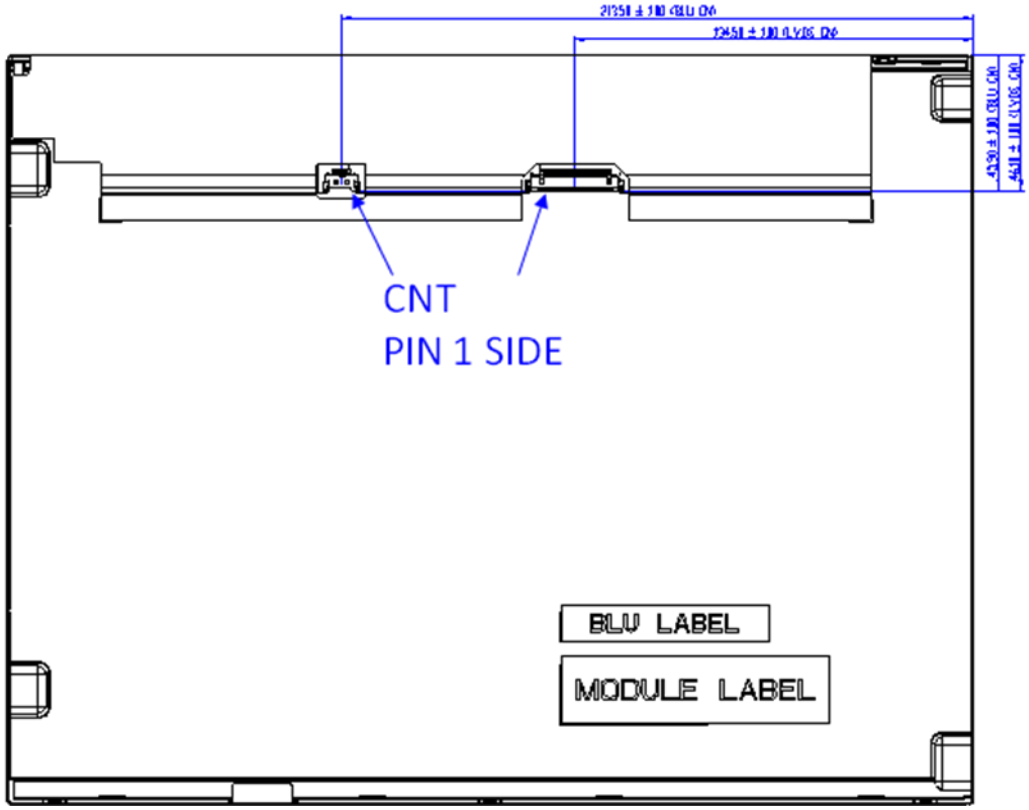
Physical interface is described as for the connector on module. These connectors are capable of accommodating the following signals and will be following components.

7.1 TFT LCD Module: LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM or compatible
Connector Model Number	MSB240420HD or compatible
Adaptable Plug	P240420 or compatible

Pin#	Signal Name	Pin#	Signal Name
1	VDD	2	VDD
3	NC	4	NC
5	Rin1-	6	Rin1+
7	VSS	8	Rin2-
9	Rin2+	10	VSS
11	Rin3-	12	Rin3+
13	VSS	14	ClkIN-
15	ClkIN+	16	GND
17	Rin4-	18	Rin4+
19	VSS	20	VSS

7.1.1 Connector Illustration



7.2 LED Backlight Unit: LED Driver Connector

Connector Name / Designation	LED Connector
Manufacturer	Entery or compatible
Connector Model Number	3808K-F05N-12R or compatible
Mating Model Number	H208K-P05N-02B or compatible

7.3 LED Driver Connector Pin Assignment

Pin#	Symbol	Signal Name
1	Vcc	12V
2	GND	GND
3	Enable	V_{LED} On/Off
4	Dimming	PWM Dimming
5	NC	NC

8. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias	50℃/80%,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	
Shock Test (Non-Operating)	50G,20ms,Half-sine wave,(±X, ±Y, ±Z)	
Vibration Test (Non-Operating)	1.5G, (10~200Hz, P-P) 30 mins/axis (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

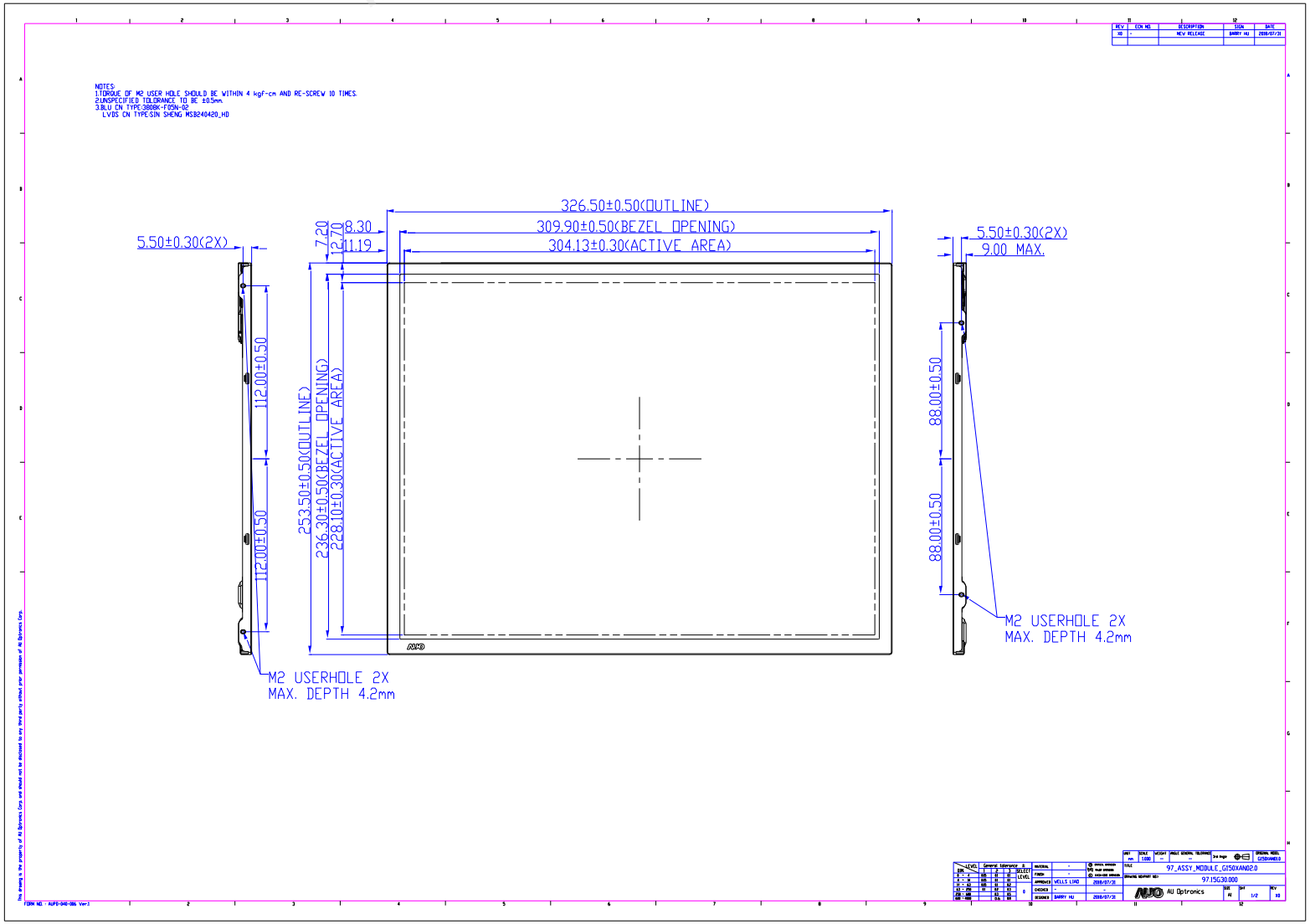
Note1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost Self-recoverable. No hardware failures.

Note 2:

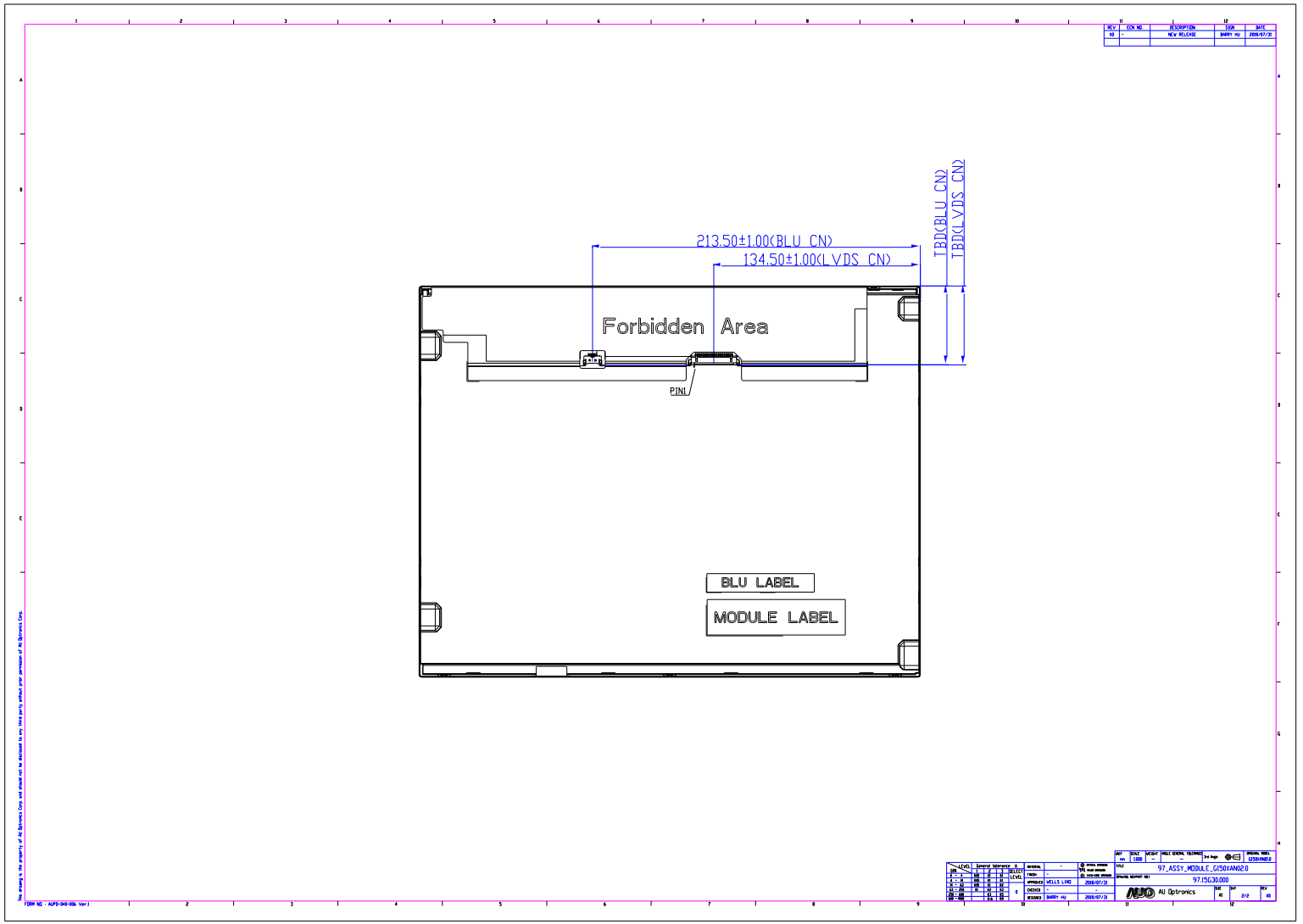
- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test,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

9. Mechanical Characteristics

9.1 LCM Outline Dimension (Front View)

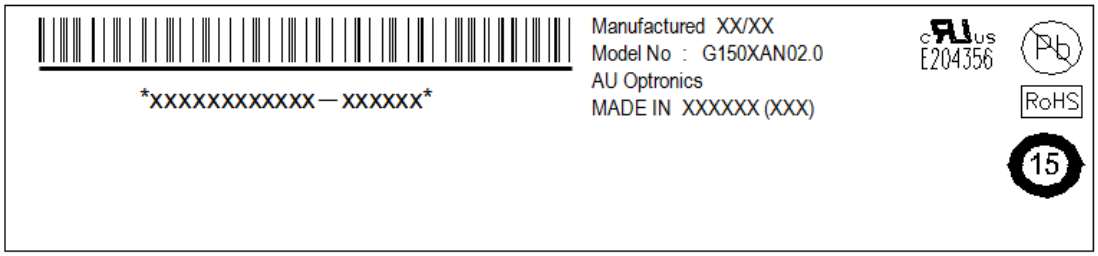


9.2 LCM Outline Dimension (Rear View)



10. Label and Packaging

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

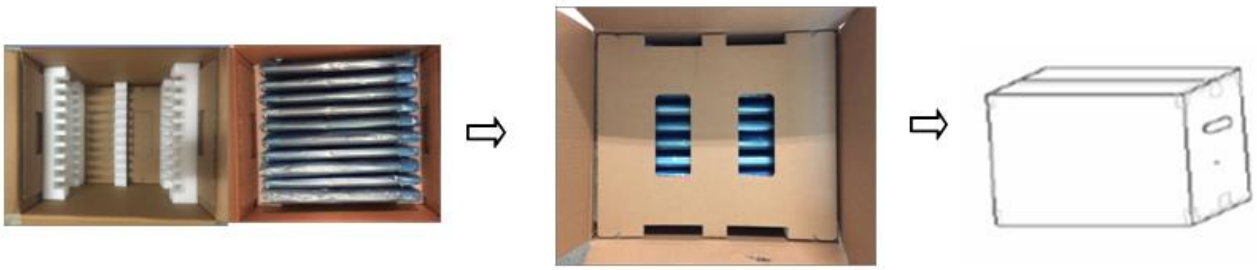


10.2 Carton Package

Max capacity：20 PCS TFT-LCD module per carton
Max weight: 20 kg per carton
Outside dimension of carton: 430mm(L)* 370mm(W)*350mm(H)
Pallet size： 1140 mm * 890 mm * 132mm

Protect film with 4 tape

Put panel into ESD BAG



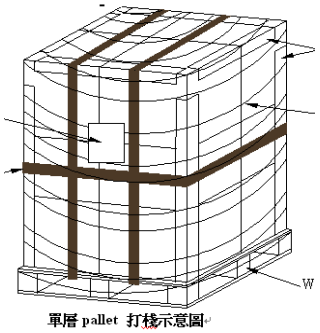
2 pcs Panel face to face , put 2 panel into 1 groove

Put Top Cushion into carton

20pcs/Carton

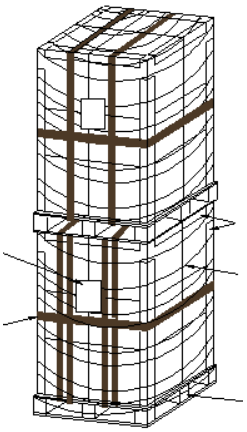
10.3 Palletizing

Module by air_Max: (2 *3) *4 layers，one pallet put 24 boxes，total 480pcs module
Module by sea_Max: (2 *3) *4 layers + (2 *3) *1 layers , two pallet put 30 boxes，total 600pcs module
Module by sea_HQ_Max: (2 *3) *4 layers+(2 *3) *2 layers, two pallet put 36 boxes, total 720pcs module



單層 pallet 打栈示意圖

By air：one pallet



By sea：two pallet

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 60950-1, Second Edition	U.S.A. Information Technology Equipment