( ) Preliminary Specifications
(V) Final Specifications

Module	21.3" QXGA Color TFT-LCD
Model Name	G213QAN01.0

Customer	**Date**	**Approved by**	**Date**
		Crystal Hsieh	5/10, 2017
Checked & Approved by	**Date**	**Prepared by**	**Date**
		Michelle Liau	5/10, 2017
Customer's sign back page		General Display Business Division / AU Optronics corporation	

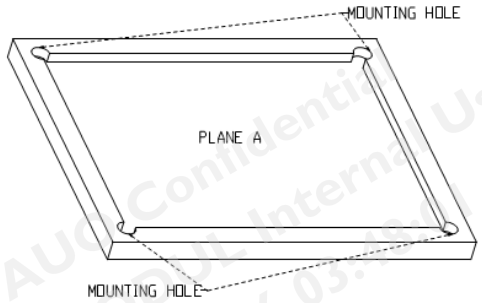
Contents

Record of Revision

Version	Date (yyyy/m/d)	Page	Old description	New Description
1.0	May. 2017	All	Final draft specification	

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) Avoid stressing front bezel position when doing mechanical design. This product must be installed by using mounting holes without undue such as bending or twist. Also do not add undue stress to any portion, ex: near bezel area. Bending or twist may cause this display mura or light leakage. Recommended installing method: The plane “A” is defined from one mounting hole to other mounting holes. Plane A must be the same plane within +/-0.3 mm.



13) 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.
14) Severe temperature condition may result in different luminance, response time and lamp ignition voltage.
15) Continuous operating TFT-LCD display under low temperature environment may accelerate lamp exhaustion and reduce luminance dramatically.
16) The data on this specification sheet is applicable when LCD module is placed in landscape position.
17) 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

G213QAN01.0 is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD panel, a driver circuit, and a backlight system. The screen format is intended to support the QXGA (2048(H) x 1536(V)) screen and 1.073B colors (10 bits). All input signals are 4port-LVDS interface compatible

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	21.3”
Active Area	[mm]	433.152 (H) x 324.864 (V)
Resolution		2048(*3) x 1536
Pixel Pitch	[mm]	0.2115 (per one triad) x 0.2115
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		Normally Black
Nominal Input Voltage VDD	[Volt]	+12.0 V (typ,)
Power Consumption	[Watt]	Logic : 5.04W (max.) @White Patten BL power : 50.40W (max.)
Weight	[Grams]	3200 (Typ) +/-320g
Physical Size	[mm]	457 (H) x 350 (V) x 22.3 (D) (Typ)
Electrical Interface		4port-LVDS
Surface Treatment		Anti-Glare treatment
Support Color		1.073B colors (True 10 Bit)
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 0 to +60 -20 to +60
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/m2	ILED=85mA(center point)		640	800	-	1
Uniformity	%	9 points		80	-	-	2,3
Contrast Ratio	-	-		1000	1400	-	4
Response Time	msec	Rising		-	13	18	5
		Falling		-	12	17	
		Rising + Falling		-	25	35	
Viewing Angle	degree	Horizontal CR >= 10	(Right)	85	89	-	6
			(Left)	85	89	-	
		Vertical CR >= 10	(Upper)	85	89	-	
			(Lower)	85	89	-	
Color / Chromaticity Coordinates (CIE 1931)	-	Red x		0.626	0.656	0.686	
		Red y		0.296	0.326	0.356	
		Green x		0.270	0.300	0.330	
		Green y		0.570	0.600	0.630	
		Blue x		0.120	0.150	0.180	
		Blue y		0.030	0.060	0.090	
		White x		0.269	0.299	0.329	
		White y		0.285	0.315	0.345	
Color Gamut	%			-	72	-	

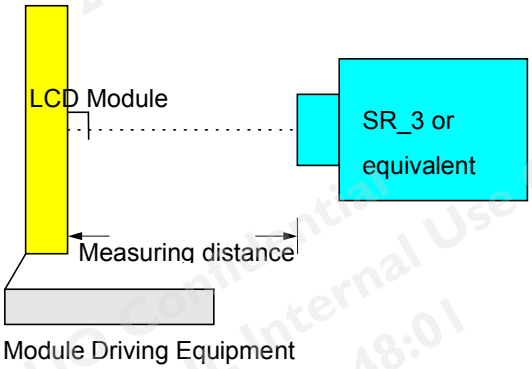
Note 1: Measurement method

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

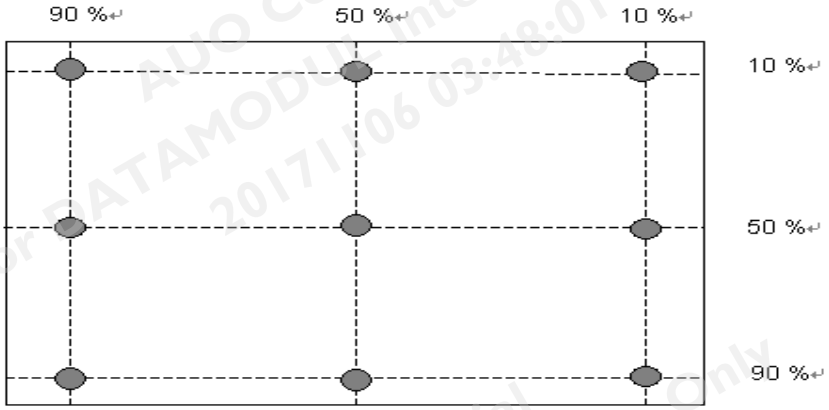
Aperture 1° with 50cm viewing distance

Test Point Center

Environment *< 1 lux*



Note 2: Definition of 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

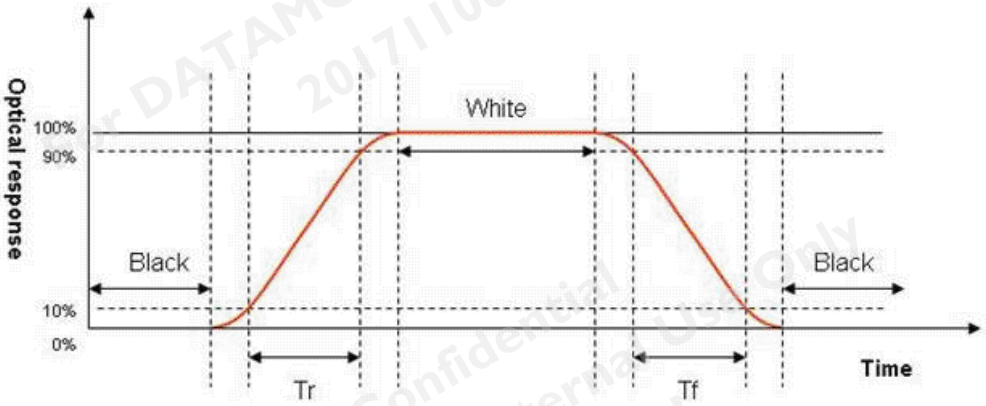
$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4: Definition of contrast ratio (CR):

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

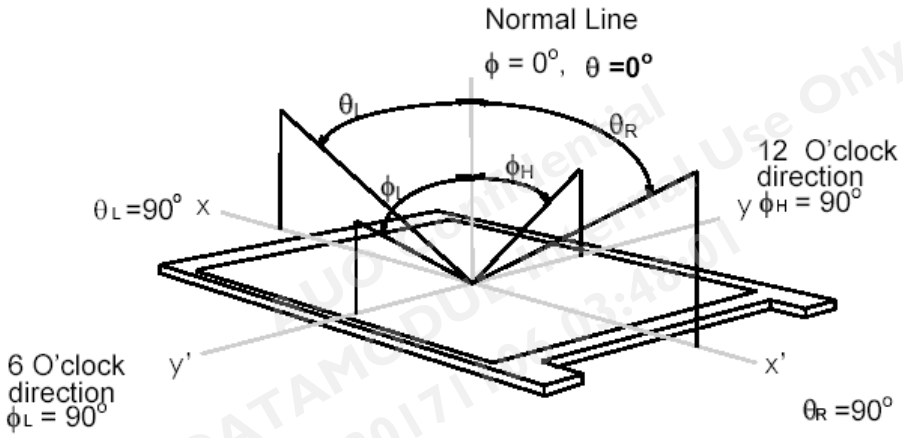
Note 5: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “White” to “Black” (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.



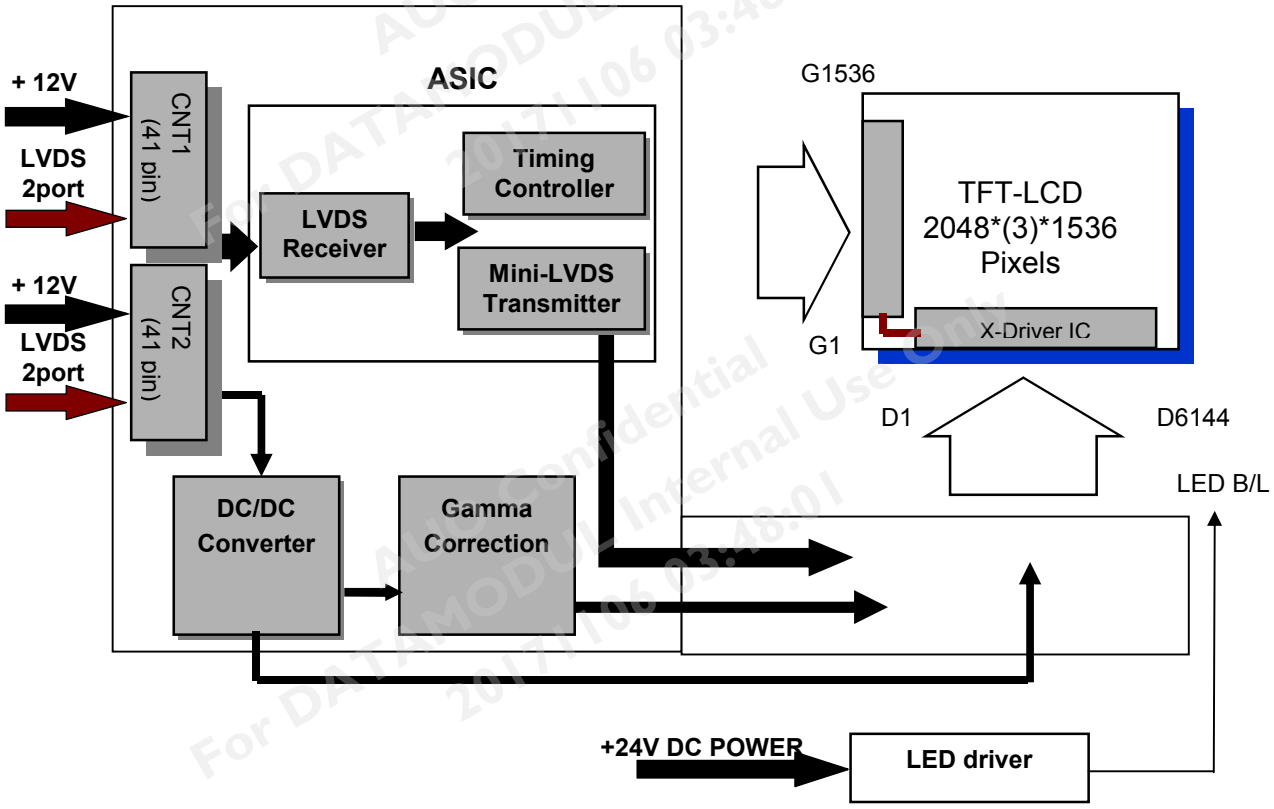
Note 6: Definition of viewing angle

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 21.3 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	VCC	-0.3	+23	[Volt]

4.2 Absolute Ratings of Environment

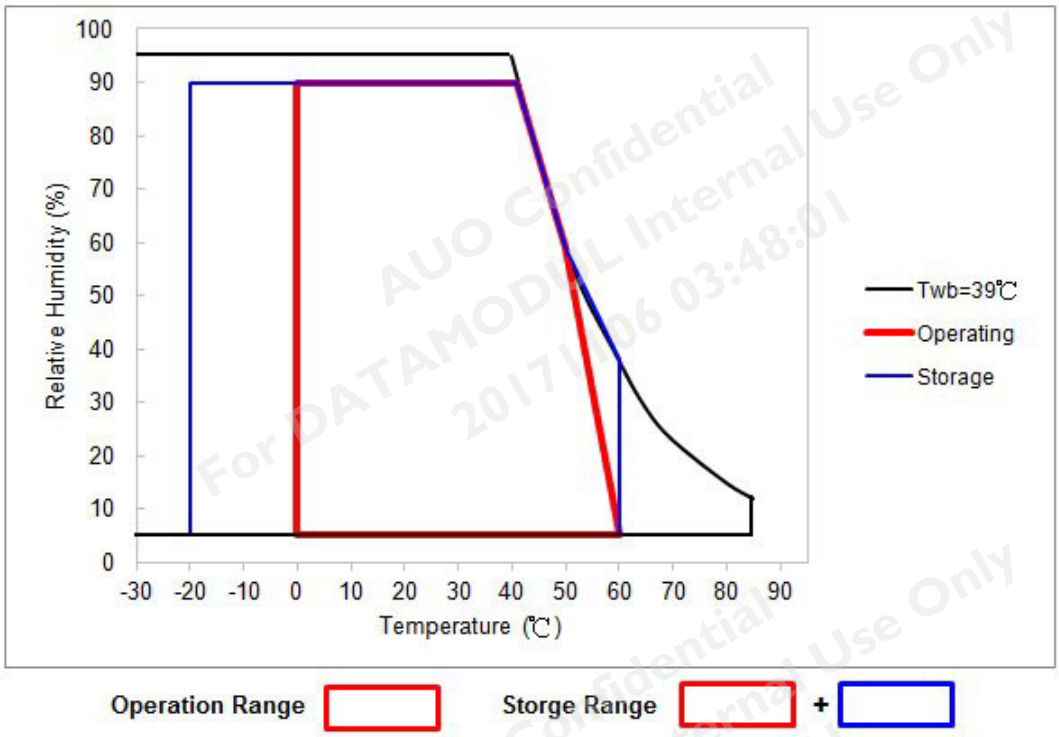
Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	0	+60	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-20	+60	[°C]
Storage Humidity	HST	5	90	[%RH]

Note 1: With in Ta = 25℃ and maximum Wet-Bulb should be 39 °C and no condensation.

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality performance, please refer to AUO IIS (Incoming Inspection Standard).

Note 4: Operation Temperature + 60°C is defined as panel surface termperature.



5. Electrical Characteristics

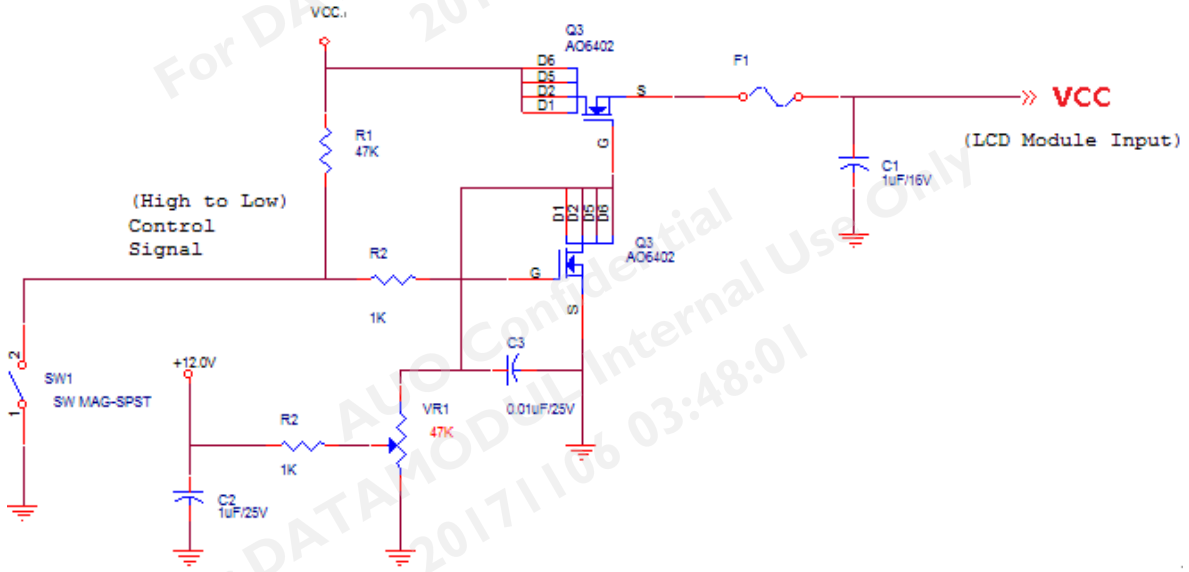
5.1 TFT LCD Module

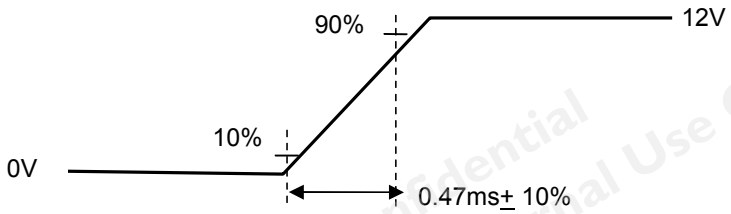
5.1.1 Power Specification

Input power specifications are shown as follows;

Symbol	Parameter	Min	Typ	Max	Units	Remark
VCC	Logic/LCD Drive Voltage	10.8	12.0	13.2	[Volt]	+/-10%
ICC	VCC Current		0.35	0.42	[mA]	All White Pattern (VCC=12V, at 60Hz)
IRush	LCD Inrush Current		2.7	3.4	[A]	Note 1
PCC	VCC Power		4.20	5.04	[Watt]	All White Pattern (VCC=12V, at 60Hz)
VCCrp	Allowable Logic/LCD Drive Ripple Voltage			300	[mV] p-p	All White Pattern (VCC=12V, at 60Hz)

Note 1: Measurement condition:





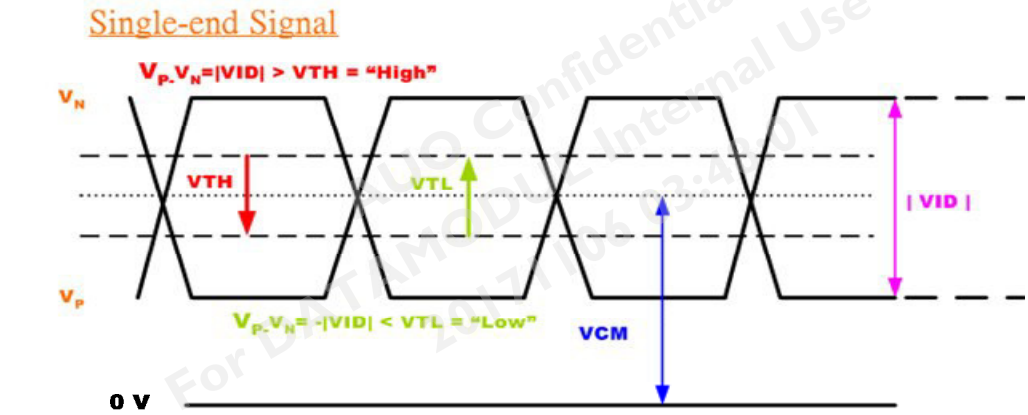
VCC rising time

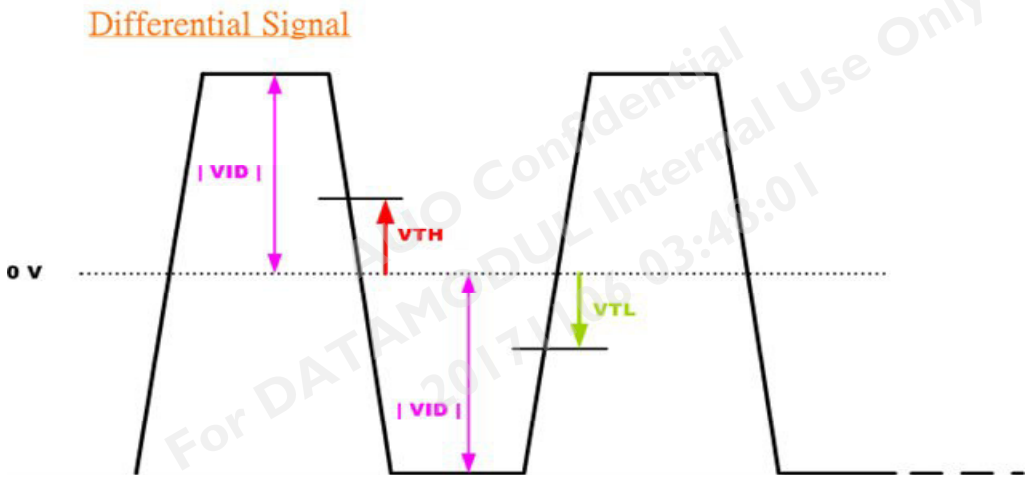
5.1.2 LVDS DC Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VCC 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=+-200mV

Note: LVDS Signal Waveform.





5.2 Backlight Unit

5.2.1 LED Backlight Unit : Driver Connector

Connector Name / Designation	Lamp Connector
Manufacturer	JST
Connector Model Number	S14B-PH-SM6-K-TB(HF)
Mating Model Number	PHR-14

Pin No.	Symbol	Description
Pin1	VDD	Power +24V
Pin2	VDD	Power +24V
Pin3	VDD	Power +24V
Pin4	VDD	Power +24V
Pin5	VDD	Power +24V
Pin6	GND	GND
Pin7	GND	GND
Pin8	GND	GND
Pin9	GND	GND
Pin10	GND	GND
Pin11	NC	Do not connect
Pin12	EN	Enable(0V:disable, 2.5~5V:Enable)
Pin13	Analog Control Voltage	Analog Control Voltage 0~3V
Pin14	Dimming	PWM; duty 10%~ 100%

Note:

Two kind types for adjusting brightness: PWM and Analog.

If pin 13 or pin 14 not use, please do not connect.

5.2.2 Parameter guideline for LED

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

Backlight input signal characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VDD	Input Voltage	21.6	24.0	26.4	[Volt]	+/-10%
IVDD	Input Current	-	1.9	2.1	[A]	100% PWM Duty
PVDD	Power Consumption	-	45.6	50.4	[Watt]	100% PWM Duty
Irush LED	Inrush Current	-	-	6	[A]	at rising time=470us
Analog Control	Input Voltage	0	-	3	V	
FPWM	Dimming Frequency	-	0.2	20	[kHz]	
	Swing Voltage	2.5	3.3	5	V	
	Dimming Duty Cycle	10	-	100	%	
IF	LED Forward Current	-	85	-	mA	Ta = 25℃
VF	LED Forward Voltage	-	3.2	3.6	Volt	IF =85 mA, Ta = 25℃
PLED	LED Power Consumption	-	43.0	48.0	Watt	IF =85 mA, Ta = 25℃ Two Light Bar (Total LED Power)
LED Lifetime		50,000	-	-	Hrs	IF=85 mA, Ta= 25℃

Note1: Measured on panel VLED

Note 2: Ta means ambient temperature of TFT-LCD module.

Note 3: VDD, IVDD, PVDD , Irush LED are defined for LED B/L.(100% duty of PWM dimming)

Note 4: IF, VF , PLED are defined for LED Light Bar.

Note 5: If G213QAN01.0 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

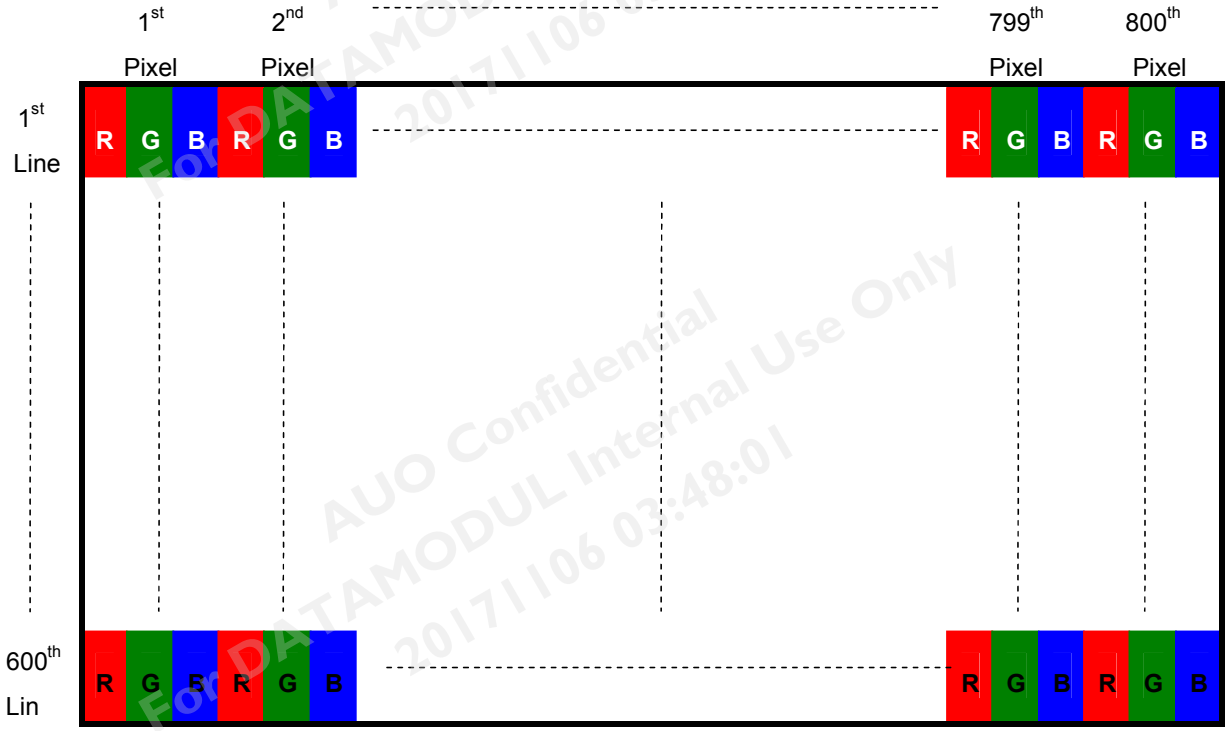
Note 6: LED life means brightness goes down to 50% initial brightness of LED Part. The minimum life time of LED unit is on the condition of IF = 85mA and 25±2℃(Room temperature).

Note 7: Two kind types for adjusting brightness: PWM and Analog.

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

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

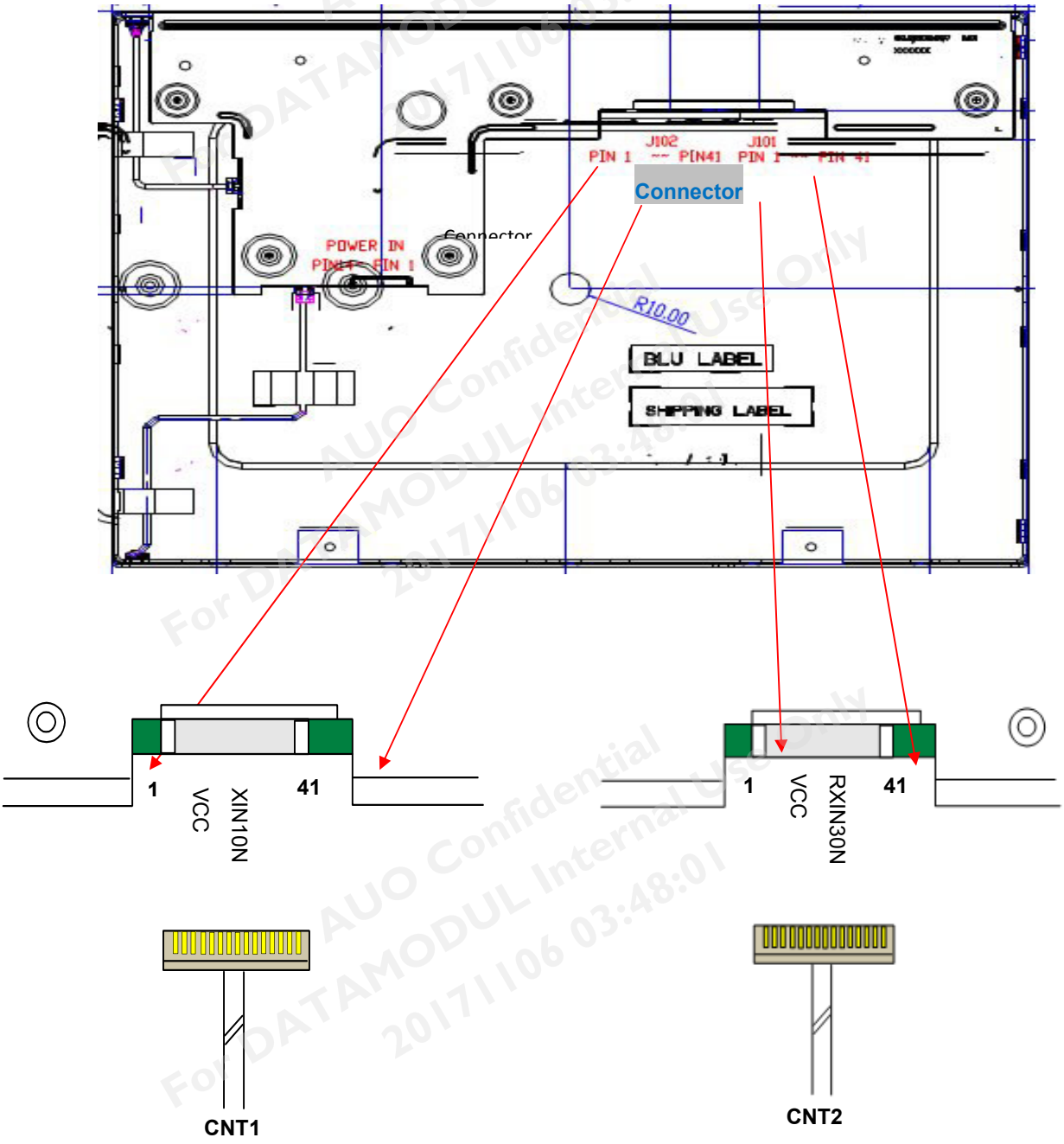
Connector Name / Designation	Signal Connector
Manufacturer	HIROSE
Connector Model Number	FX15SC-41S-0.5SH (HIROSE)
Adaptable Plug	FX15S-41P-C (HIROSE)

Module Connector - CNT1

Pin no	Symbol	Pin no	Symbol
Pin1	VCC	Pin22	RXIN34_N
Pin2	VCC	Pin23	RXIN34_P
Pin3	VCC	Pin24	GND
Pin4	VCC	Pin25	RXIN40_N
Pin5	VCC	Pin26	RXIN40_P
Pin6	GND	Pin27	RXIN41_N
Pin7	GND	Pin28	RXIN41_P
Pin8	GND	Pin29	GND
Pin9	GND	Pin30	RXIN42_N
Pin10	RXIN30_N	Pin31	RXIN42_P
Pin11	RXIN30_P	Pin32	R4_CLKN
Pin12	RXIN31_N	Pin33	R4_CLKP
Pin13	RXIN31_P	Pin34	GND
Pin14	GND	Pin35	RXIN43_N
Pin15	RXIN32_N	Pin36	RXIN43_P
Pin16	RXIN32_P	Pin37	RXIN44_N
Pn17	R3_CLKN	Pin38	RXIN44_P
Pin18	R3_CLKP	Pin39	GND
Pin19	GND	Pin40	NC
Pin20	RXIN33_N	Pin41	NC
Pin21	RXIN33_P		

Module Connector – CNT2

Pin no	Symbol	Pin no	Symbol
Pin1	VCC	Pin22	RXIN34_N
Pin2	VCC	Pin23	RXIN34_P
Pin3	VCC	Pin24	GND
Pin4	VCC	Pin25	RXIN40_N
Pin5	VCC	Pin26	RXIN40_P
Pin6	GND	Pin27	RXIN41_N
Pin7	GND	Pin28	RXIN41_P
Pin8	GND	Pin29	GND
Pin9	GND	Pin30	RXIN42_N
Pin10	RXIN30_N	Pin31	RXIN42_P
Pin11	RXIN30_P	Pin32	R4_CLKN
Pin12	RXIN31_N	Pin33	R4_CLKP
Pin13	RXIN31_P	Pin34	GND
Pin14	GND	Pin35	RXIN43_N
Pin15	RXIN32_N	Pin36	RXIN43_P
Pin16	RXIN32_P	Pin37	RXIN44_N
Pn17	R3_CLKN	Pin38	RXIN44_P
Pin18	R3_CLKP	Pin39	GND
Pin19	GND	Pin40	NC
Pin20	RXIN33_N	Pin41	NC
Pin21	RXIN33_P		



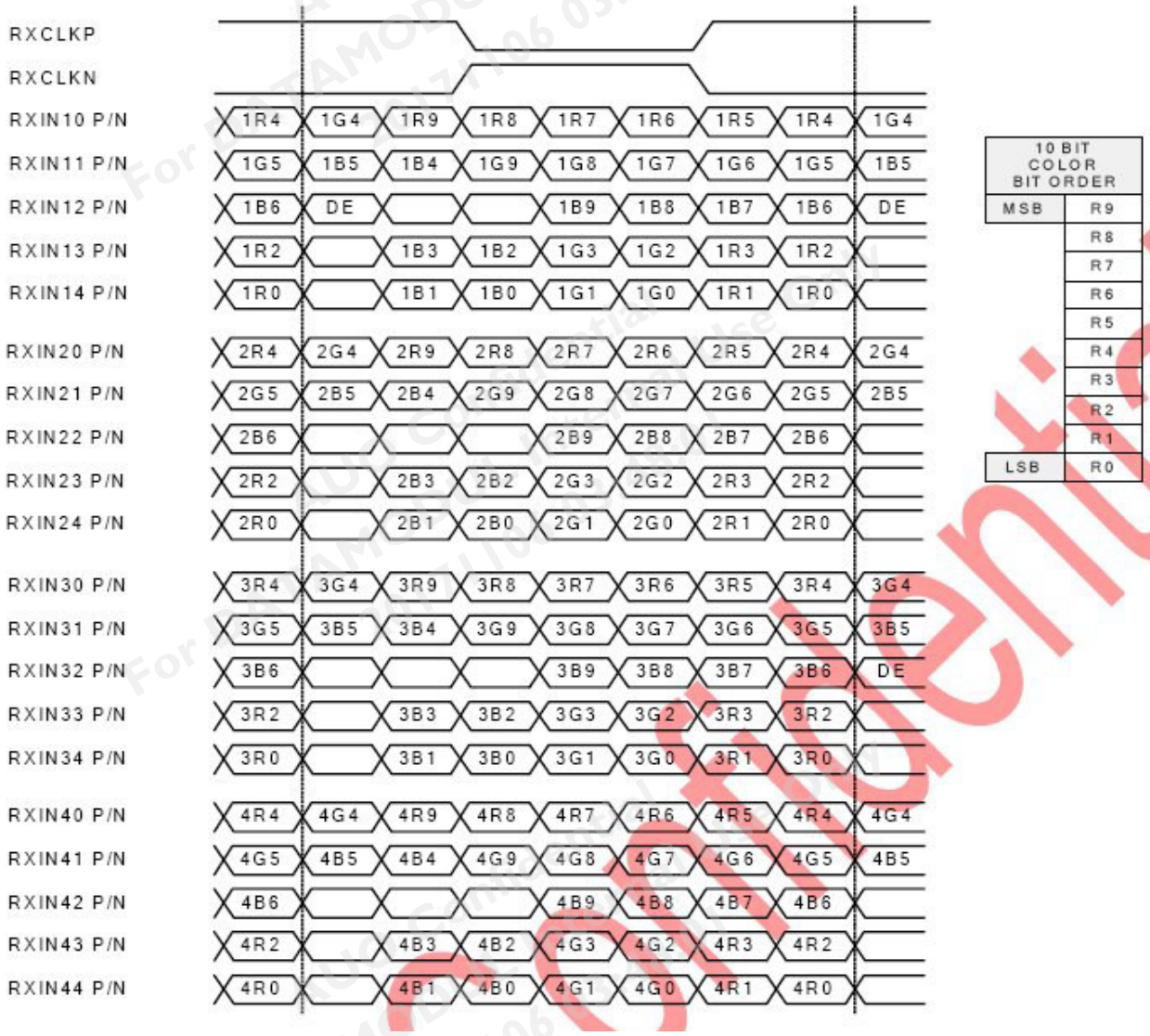
Note1: 41pin start from left side of connector.

Note2: Input signals of port 1 to port 4 clocks shall be the same timing.

Note3: Please follow VESA.

6.4 The Input Data Format

Data Mapping of JEIDA Format



LVDS Data Mapping of JEIDA Format for Quad Channel

Note1: Normally DE mode only

Note2: Please follow VESA.

Note3: 10-bit in

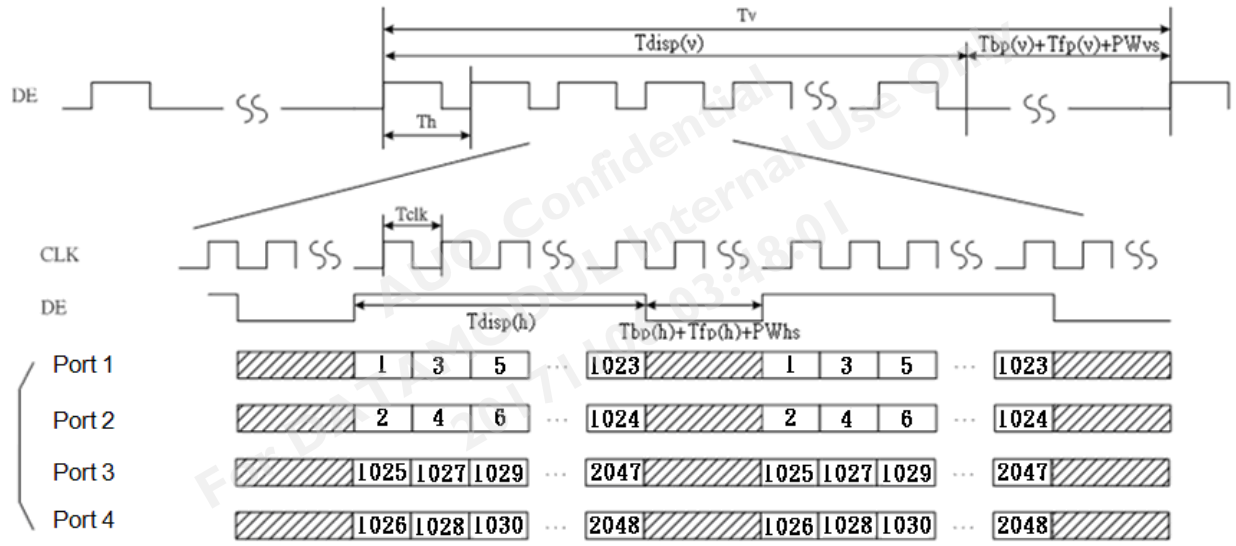
6.5 Interface Timing

6.5.1 Timing Characteristics

Signal		Symbol	Min.	Typ.	Max.	Unit
Vertical Section	Period	T_V	1547	1612	1628	Th
	Active	T_{VD}	1536	1536	1536	
	Blanking	T_{VB}	11	76	92	
Horizontal Section	Period	T_H	640	672	700	Tclk
	Active	T_{HD}	512	512	512	
	Blanking	T_{HB}	128	160	188	
Clock	Period	Tclk	1515	1538	1667	ns
	Frequency	Freq	49.5	64.9	79.7	MHz
Frame Rate		F	50	60	70	Hz

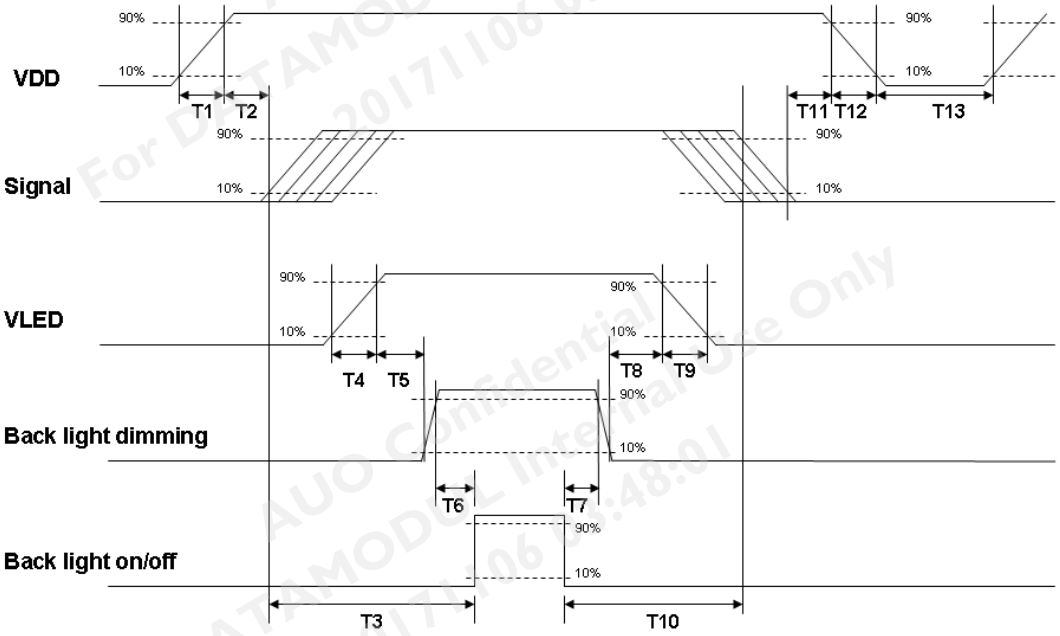
Note : DE mode.

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	0		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	60 °C /75%,300Hr	1
High Temperature Operation	60 °C, 300Hr (center point of panel surface)	1
Low Temperature Operation	0 °C, 300Hr	1
Hot Storage	60 °C, 300 hours	
Cold Storage	-20 °C, 300 hours	
Thermal Shock Test	-20 °C /30 min ,60 °C /30 min ,100cycles	2
Shock Test (Non-Operating)	Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: ±X, ±Y, ±Z (one time for each Axis)	
Vibration Test (Non-Operating)	Acceleration: 1.5 G Wave: Random Frequency: 10 - 200Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	
ESD (Electrostatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 9 points, 25 times/ point. Air Discharge: ± 15KV, 150pF(330Ω) 1sec 9 points, 25 times/ point.	3
Altitude Test	Operation:10,000 ft Non-Operation:30,000 ft	

Note1: Luminance: 450nits at luminance control.

Note2: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20oC to 60oC, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

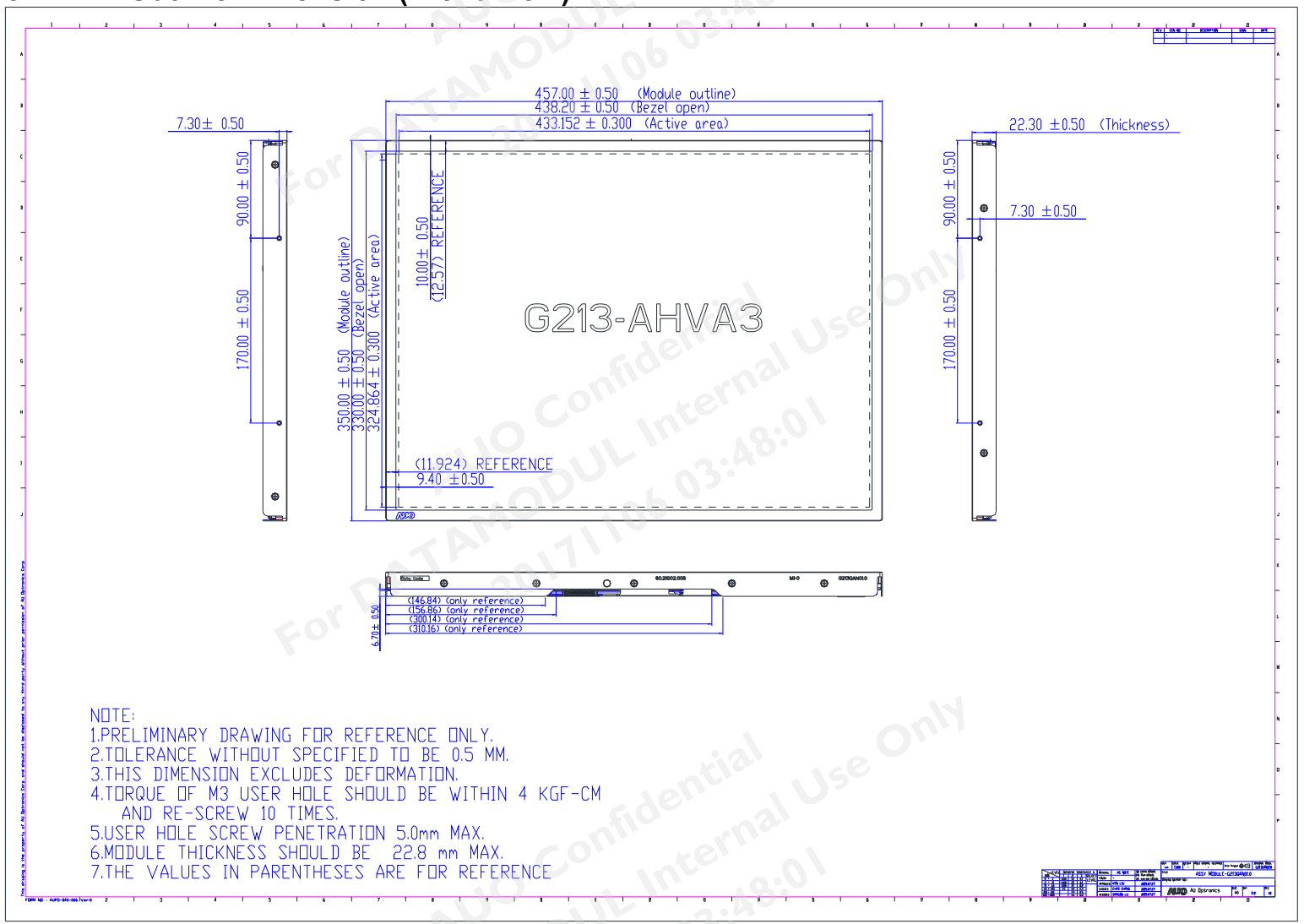
Note3: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 4:

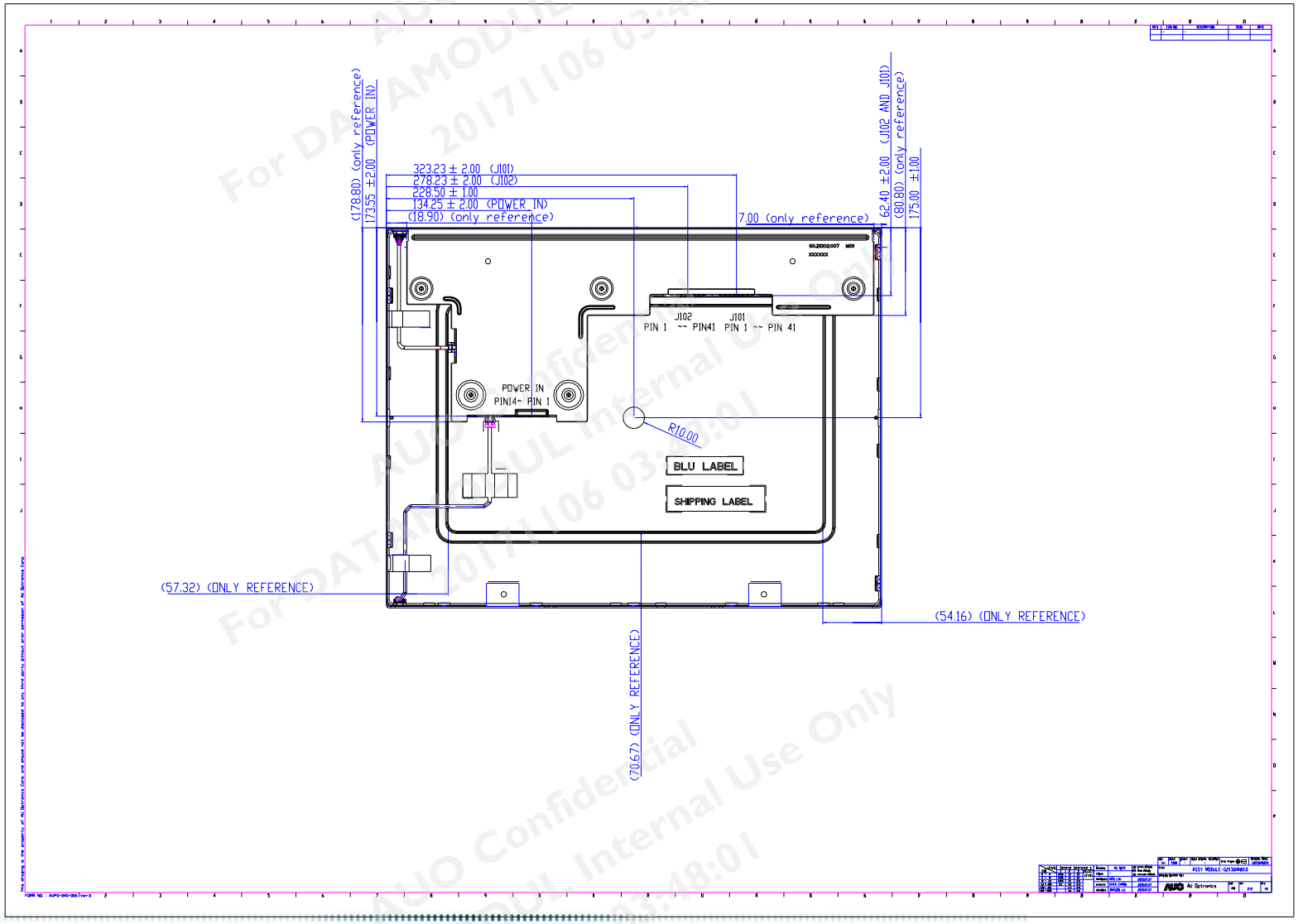
- Water condensation is not allowed for each test items.
- Each test is done by new TFT-LCD module. Don't use the same TFT-LCD module repeatedly for reliability test.
- The reliability test is performed only to examine the TFT-LCD module capability.
- To inspect TFT-LCD module after reliability test,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

8. Mechanical Characteristics

8.1 LCM Outline Dimension (Front View)

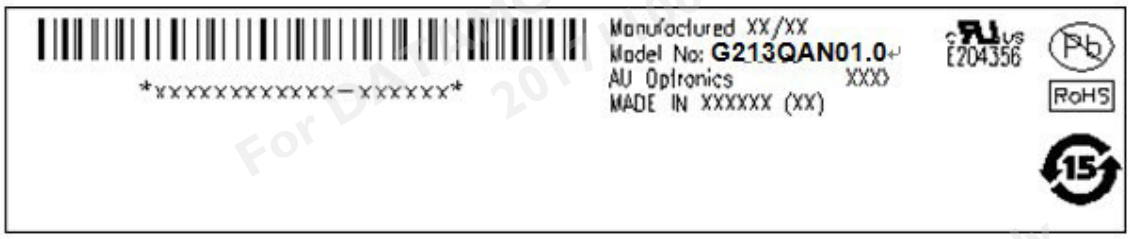


8.2 LCM Outline Dimension (Rear View)



9. Label and Packaging

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



Note 1: For Pb Free products, AUO will add for identification.

Note 2: For RoHS compatible products, AUO will add for identification.

Note 3: For China RoHS compatible products, AUO will add for identification.

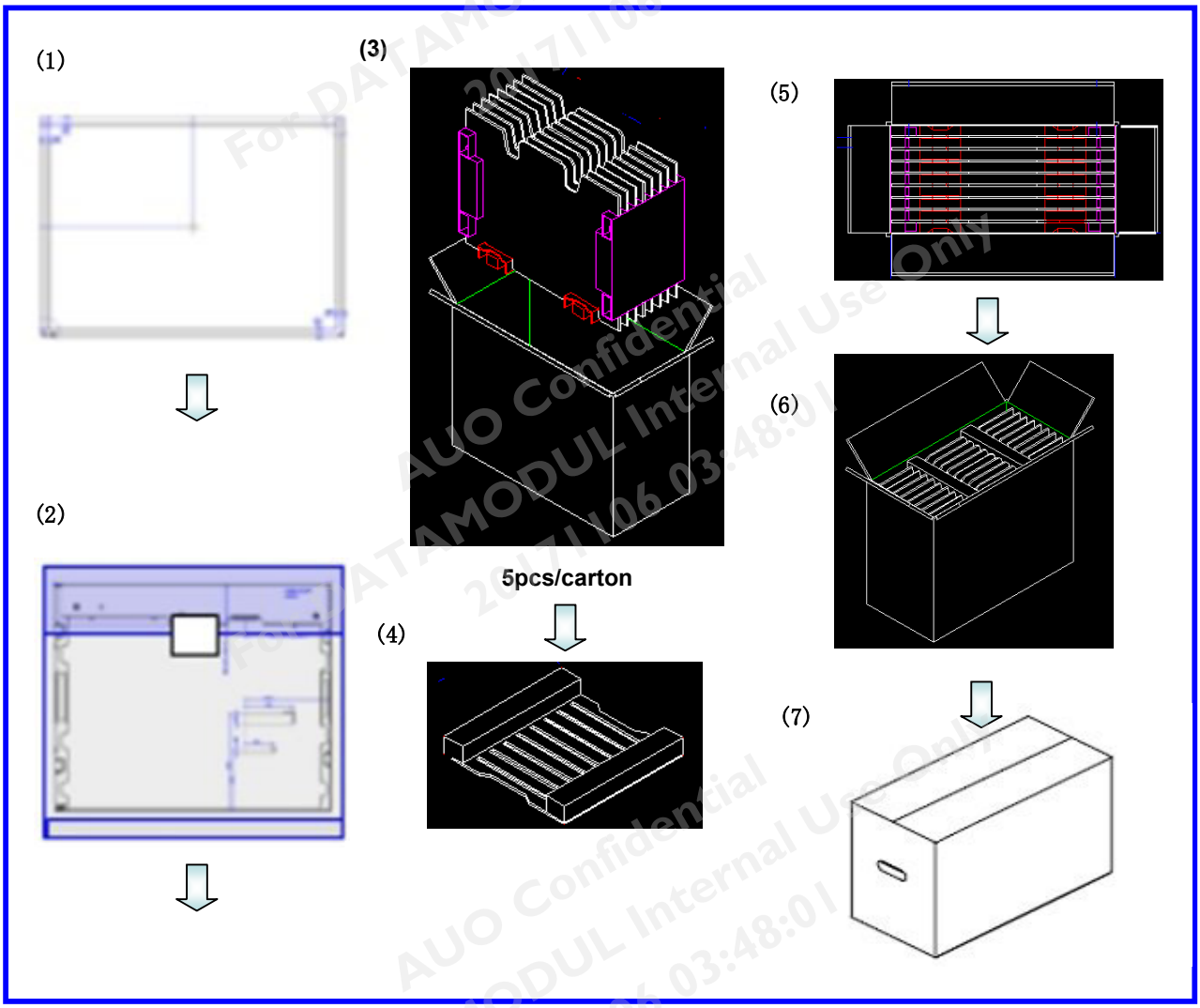
Note 4: The Green Mark will be presented only when the green documents have been ready by AUO Internal Green Team.

9.2 Carton Package

Packaging material

FILM PROTECT
BAG ANTI-STATIC
TAPE
TAPE CREPED PAPER
PACKING CARTON
LABEL SPEC
LABEL CARTON.
CUSHION PACKING

Packing instruction



Max capacity：5 TFT-LCD module per carton

Max weight: 18.5kg per carton

Outside dimension of carton: 550mm(L)* 264mm(W)*432mm(H)

Pallet size： 1140 mm * 1060 mm * 132mm

Box Stacked

Module by air：(2 *4) *3 layers，one pallet put 24 boxes，total 120 pcs module

Module by sea：One pallet (2 *4) *3 layers + One pallet (2 *4) *1 layers, total 160pcs module

Module by sea_HQ：One pallet (2 *4) *3 layers + One pallet (2 *4) *2 layers, total 200pcs 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