■ **Preliminary Specifications**
□ **Final Specification**

Module	8.4 Inch Color TFT-LCD
Model Name	G084SAN01.0

Customer	**Date**	**Approved by**	**Date**
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Note: This Specification is subject to change without notice.

General Display Business Division /
AUO Display Plus Corporation

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Record of Revision

Version and Date	Page	Old description	New Description
0.0 2024/08/27		NA	First Edition

1. Operating Precautions

1) Since front polarizer is easily damaged, please be cautious 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 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) After installation of the TFT Module into an enclosure (Notebook PC Bezel, for example), do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.
12) 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.
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 LCD module is placed in landscape position.
16) Continuous displaying fixed pattern may induce image sticking. It is 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 8.4 inch color TFT LCD module G084SAN01.0.

G084SAN01.0 designed with wide viewing angle; wide operating temperature and long life LEDs backlight is well suited to be the display units for Industrial Applications.

LED driving board for backlight unit is included in this panel and the structure of the LED units is replaceable.

G084SAN01.0 is built in timing controller and LVDS interface.

The screen format is intended to support the SVGA (800(H) x 600(V)) screen and 16.7M (RGB 8-bits).

G084SAN01.0 is a RoHS product.

2.1 Display Characteristics

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

Items	Unit	Specifications
Screen Diagonal	[inch]	8.4 (213.4mm)
Active Area	[mm]	170.4(H) x 127.8(V)
Pixels H x V		800x3(RGB) x 600
Pixel Pitch	[mm]	0.213x 0.213
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		AHVA, Normally Black
Nominal Input Voltage VDD	[Volt]	3.3 (typ)
Typical Power Consumption	[Watt]	TBD (typ)
Weight	[Grams]	TBD (typ)
Physical Size	[mm]	203.0(W) x 142.5(H) x 8.0(D)
Electrical Interface		1 channel LVDS
Surface Treatment		Anti-glare, Hardness 3H
Support Color		16.7M(8-bit)
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 -30 to +85 (panel surface temperature) -30 to +85
RoHS Compliance		RoHS Compliance

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]	I_F= 50mA (center point)	350	450	-	1
Uniformity	%	9 Points	70	75	-	1, 2, 3
Contrast Ratio			800	1000	-	4
Response Time	[msec]	Rising	-	15	20	5
	[msec]	Falling	-	10	15	
	[msec]	Raising + Falling	-	25	35	
Viewing Angle	[degree]	Horizontal (Right) CR ≧ 10	80	89	-	6
	[degree]	(Left)	80	89	-	
	[degree]	Vertical (Upper) CR ≧ 10	80	89	-	
	[degree]	(Lower)	80	89	-	
Color / Chromaticity Coordinates (CIE 1931)		Red x		TBD		1
		Red y		TBD		
		Green x		TBD		
		Green y		TBD		
		Blue x		TBD		
		Blue y		TBD		
		White x		0.310		
		White y		0.330		
Color Gamut	%		-	45	-	1

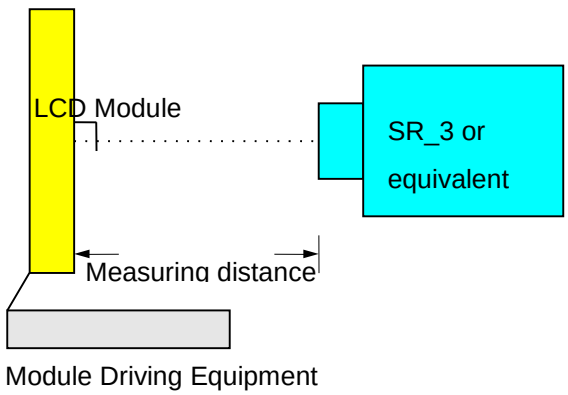
Note 1: Measurement method

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

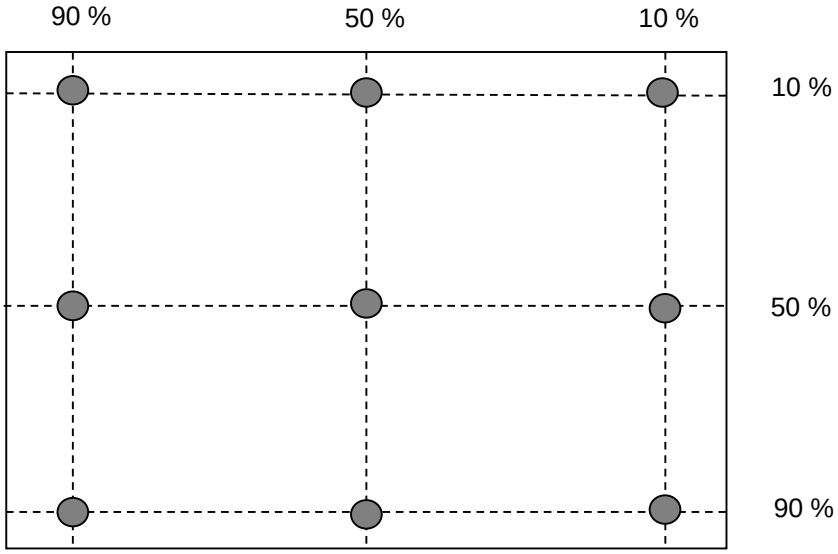
Aperture 1◦ with 50cm viewing distance

Test Point Center

Environment *< 1 lux*



Note 2: Definition of 9 points position (Display active area : 170.4(H) x 127.8(V))



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

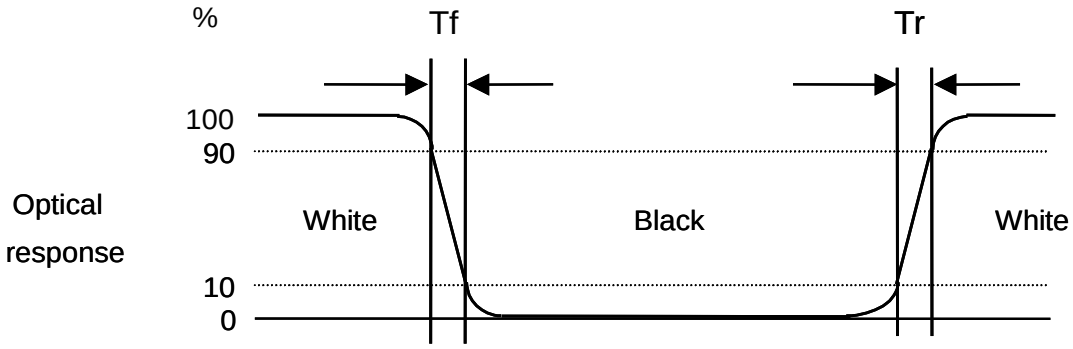
$$\delta_{W9} = \frac{\text{Minimum Brightness of nine points}}{\text{Maximum Brightness of nine points}}$$

Note 4： Definition of contrast ratio (CR):

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

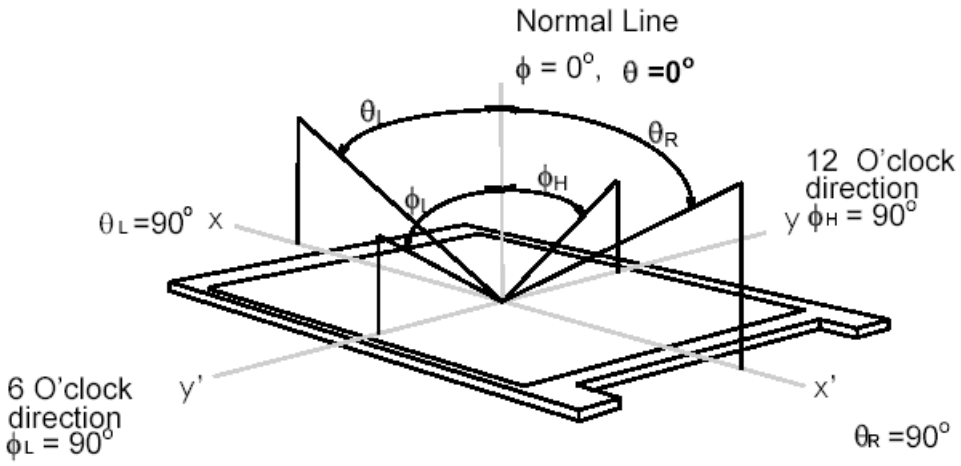
Note 5: Definition of response time:

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.



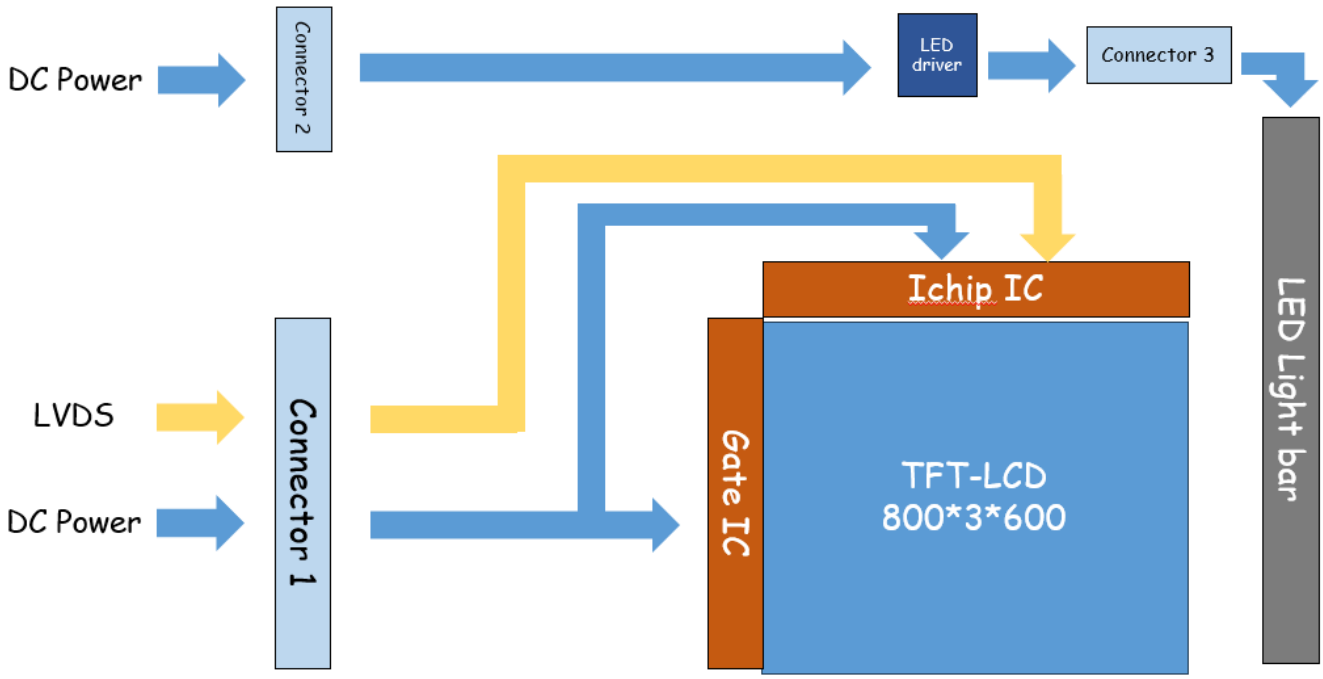
Note 6: Definition of viewing angle

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 8.4 inch color TFT/LCD module:



4. Absolute Maximum Ratings

4.1 Absolute Ratings of TFT LCD Module

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

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit
Operating Temperature	TOP	-30	+80	[°C]
Operation Humidity	HOP	5	90	[%RH]
Storage Temperature	TST	-30	+80	[°C]
Storage Humidity	HST	5	90	[%RH]

Note: Maximum Wet-Bulb should be 390C and no condensation.

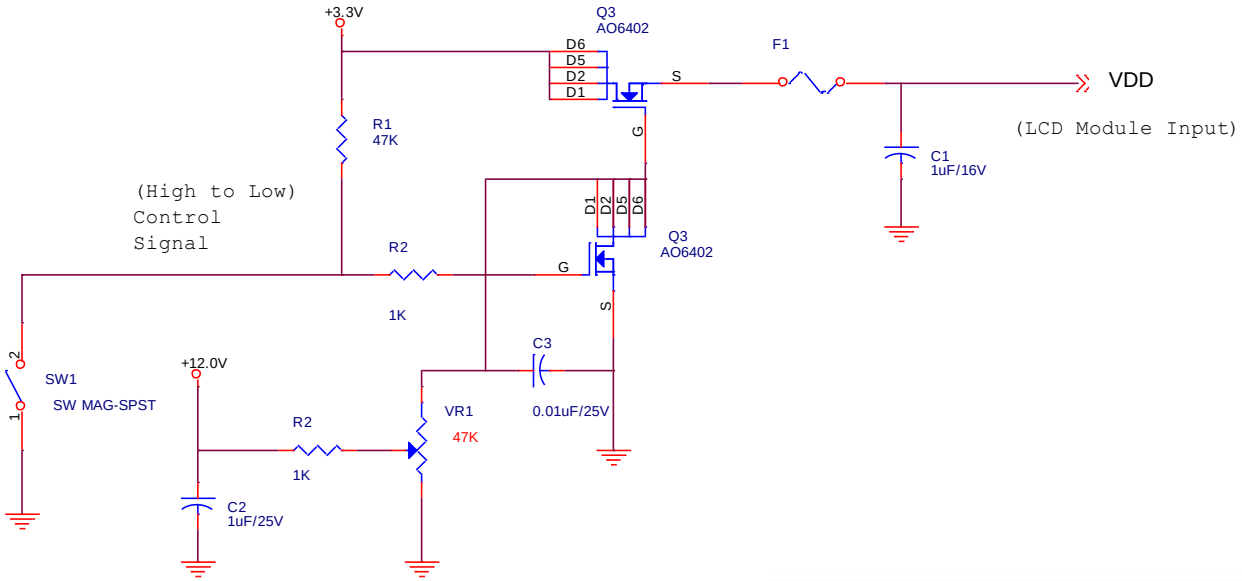
5. Electrical Characteristics

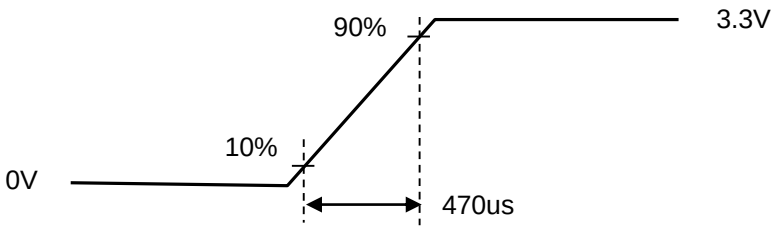
5.1 TFT LCD Module

5.1.1 Power Specification

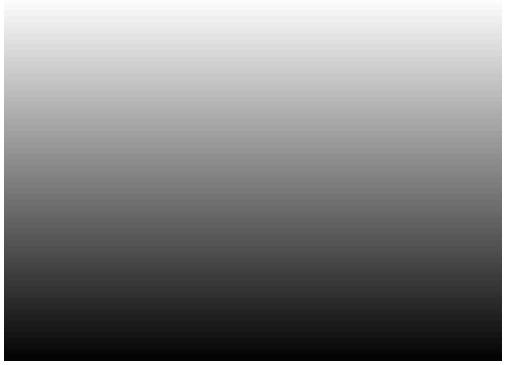
Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	±10%
I_{VDD}	VDD Current	-	100	120	[mA]	64 Gray Bar Pattern (VDD=3.3V, at 60Hz)
P_{VDD}	VDD Power	-	0.3	0.4	[Watt]	64 Gray Bar Pattern (VDD=3.3V, at 60Hz)

Note 1: Measurement condition:





VDD rising time



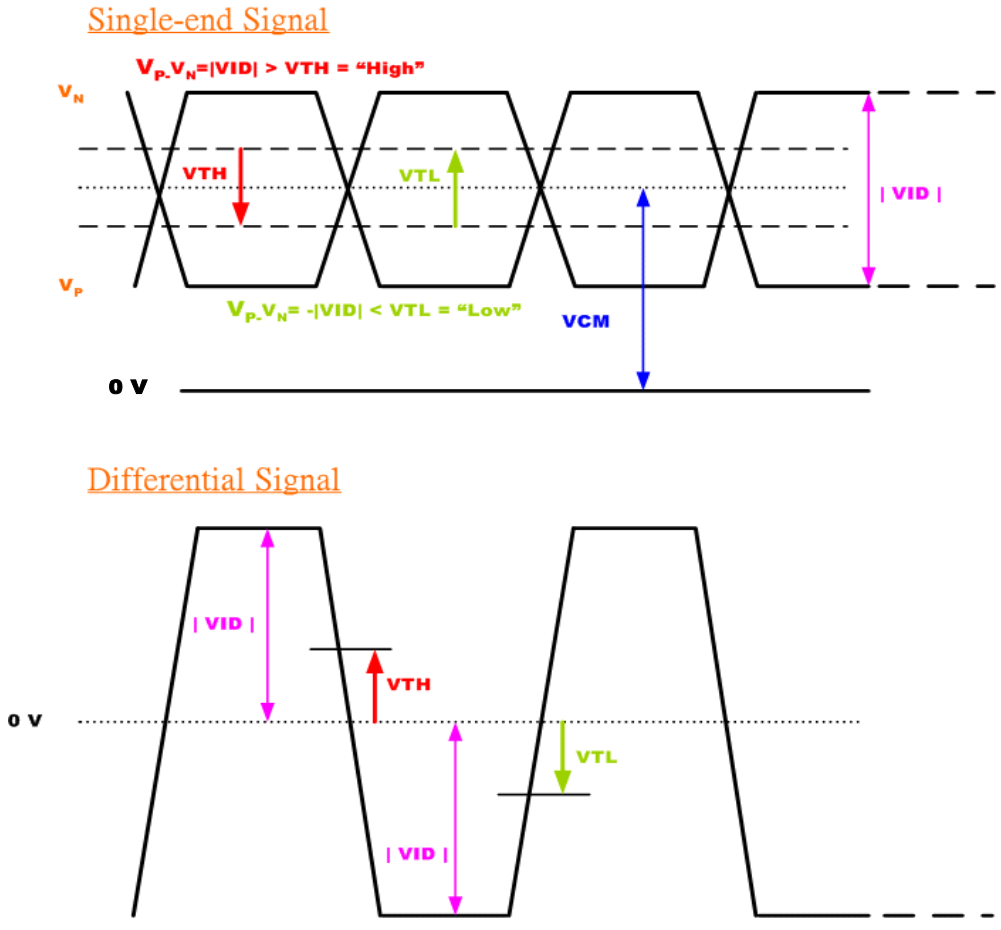
64 Gray pattern

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]	VICM=1.2V
VTL	Differential Input Low Threshold	-100	-	-	[mV]	VICM=1.2V
| VID |	Input Differential Voltage	200	400	600	[mV]	
VICM	Differential Input Common Mode Voltage	1.1		1.6	[V]	VTH/VTL=±100mV

Note: LVDS Signal Waveform.



5.2 Backlight Unit

5.2.1 Parameter guideline for LED backlight

Following characteristics are measured under a stable condition using an inverter at 250C (Room Temperature):

Symbol	Parameter	Min.	Typ.	Max.	Unit	Remark
VCC	Input Voltage	10.8	12	12.6	[Volt]	
I_{VCC}	Input Current	-	TBD	-	[A]	100% PWM Duty
P_{VCC}	Power Consumption	-	TBD	TBD	[Watt]	100% PWM Duty
F_{PWM}	Dimming Frequency	200	-	20K	[Hz]	
	Swing Voltage	3	3.3	5.5	V	
	Dimming Duty Cycle	5	-	100	%	
I_F	LED Forward Current	-	50	-	mA	Ta = 25°C
V_F	LED Forward Voltage		17.7	18.6	Volt	I_F = 50mA, Ta = 25°C
P_{LED}	LED Power Consumption	-	-	1.86	Watt	I_F = 50mA, Ta = 25°C (total power)
Operation Lifetime		50,000			Hrs	I_F = 50mA, Ta = 25°C

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

Note 2: VCC, Ivcc, P_{VCC} , are defined for LED B/L.(100% duty of PWM dimming)

Note 3: I_F, V_F are defined for each channel of LED Light Bar. There are two LED channels (AN1-CA1-CA2) in back light unit.

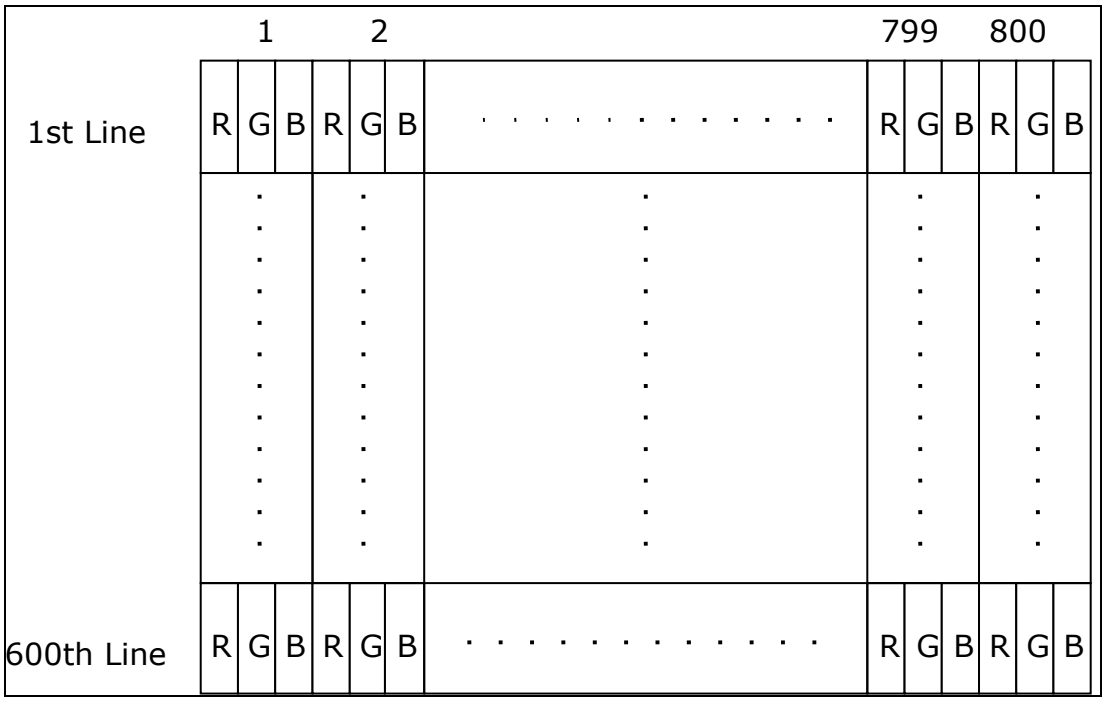
Note 4: If G084SAN01.0 module is driven by high current or at high ambient temperature & humidity condition. The operating life will be reduced.

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

6. Signal Characteristic

6.1 Pixel Format Image

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



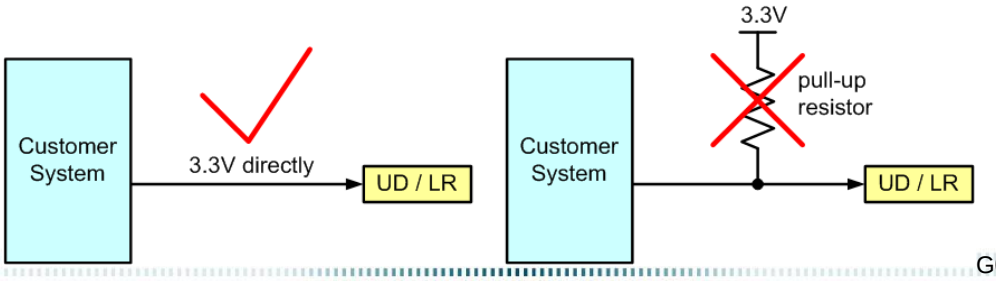
6.2 Signal Description

LVDS is a differential signal technology for LCD interface and high speed data transfer device. The connector pin definition is as below.

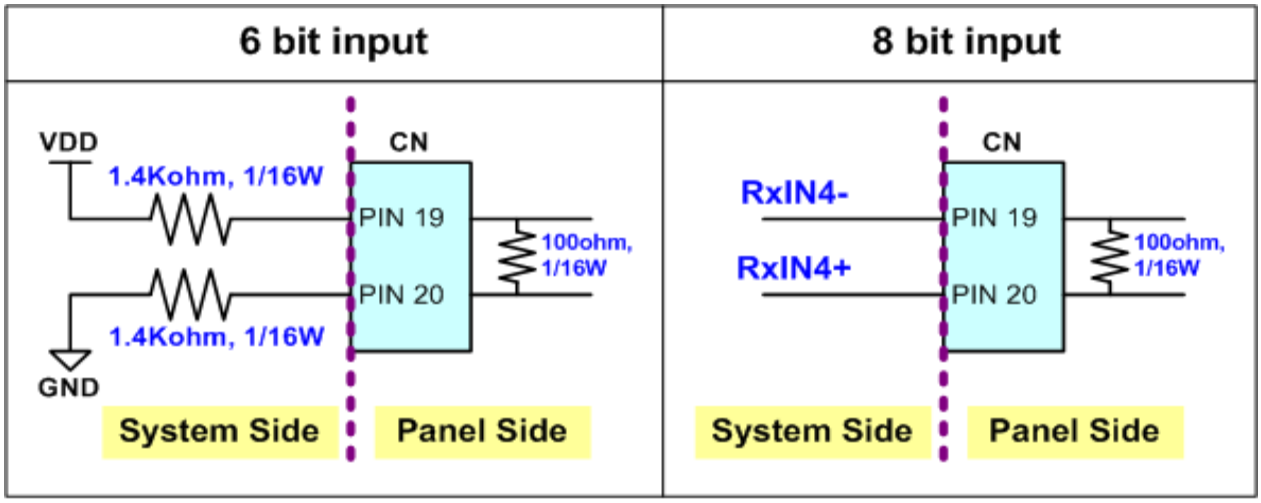
Pin No.	Symbol	Description
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	UD	Vertical Reverse Scan Control, When UD=Low or NC → Normal Mode. When UD=High → Vertical Reverse Scan. Note 1,2
4	LR	Horizontal Reverse Scan Control, When LR=Low or NC → Normal Mode. When LR=High → Horizontal Reverse Scan. Note 1,2
5	RxIN1-	LVDS differential data input Pair 0
6	RxIN1+	
7	GND	Ground
8	RxIN2-	LVDS differential data input Pair 1
9	RxIN2+	
10	GND	Ground
11	RxIN3-	LVDS differential data input Pair 2
12	RxIN3+	
13	GND	Ground
14	RxCLKIN-	LVDS differential Clock input Pair
15	RxCLKIN+	
16	GND	Ground
17	SEL 68	LVDS 6/8 bit select function control, Low or NC → 6 Bit Input Mode. High → 8 Bit Input Mode. Note
18	NC	NC
19	RxIN4-	LVDS differential data input Pair 3. Pin19:VDD & Pin20:GND for 6 Bit Input Mode NOTE 3
20	RxIN4+	

Note 1 : “Low” stands for 0V. “High” stands for 3.3V. “NC” stands for “No Connected.”

Note2 : For reverse scan mode, please connect to 3.3V directly. A pull-up resistor on the input side will cause abnormal reverse scan.



Note3 :



6.3 Scanning Direction

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

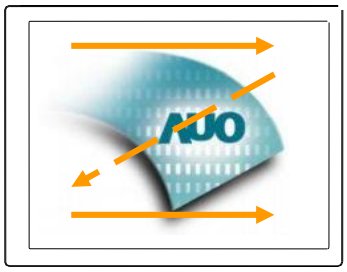


Fig. 1

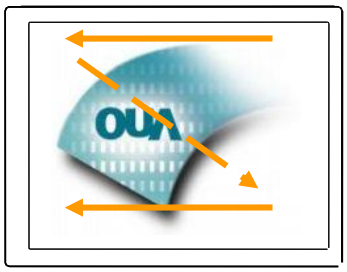


Fig. 2

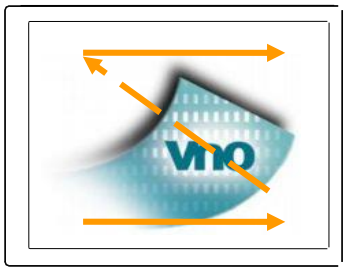


Fig. 3

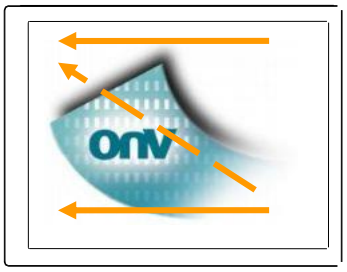


Fig. 4

Fig. 1 Normal scan (Pin3, UD = Low or NC ; Pin4, RL = Low or NC)

Fig. 2 Reverse scan (Pin3, UD = Low or NC ; Pin4, RL = High)

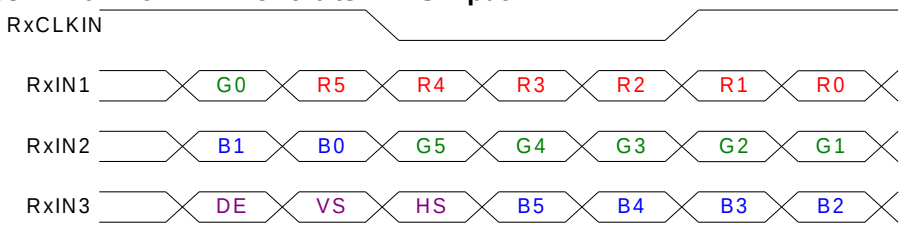
Fig. 3 Reverse scan (Pin3, UD = High ; Pin4, RL = Low or NC)

Fig. 4 Reverse scan (Pin3, UD = High ; Pin4, RL = High)

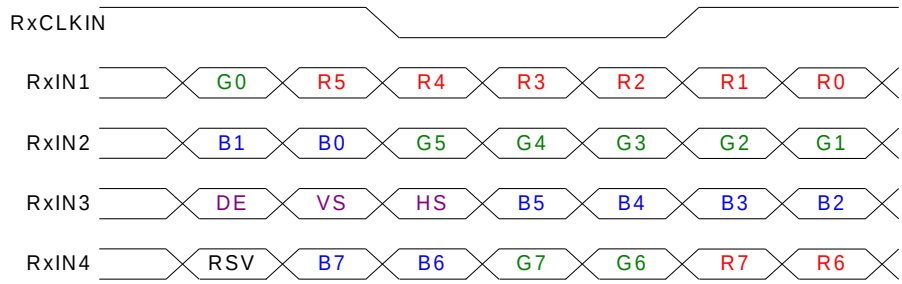
6.4 The Input Data Format

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 R6 R5 R4 R3 R2 R1 R0	Red Data 7 (MSB) Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB)	Red-pixel Data Each red pixel’s brightness data consists of these 8 bits pixel data.
G7 G6 G5 G4 G3 G2 G1 G0	Green Data 7 (MSB) GreenData 6 GreenData 5 GreenData 4 GreenData 3 GreenData 2 GreenData 1 GreenData 0 (LSB)	Green-pixel Data Each green pixel’s brightness data consists of these 8 bits pixel data.
B7 B6 B5 B4 B3 B2 B1 B0	Blue Data 7 (MSB) Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0 (LSB)	Blue-pixel Data Each blue pixel’s brightness data consists of these 8 bits pixel data.
RxCLKIN+ RxCLKIN-	LVDS Clock Input	
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

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

6.5 Interface Timing

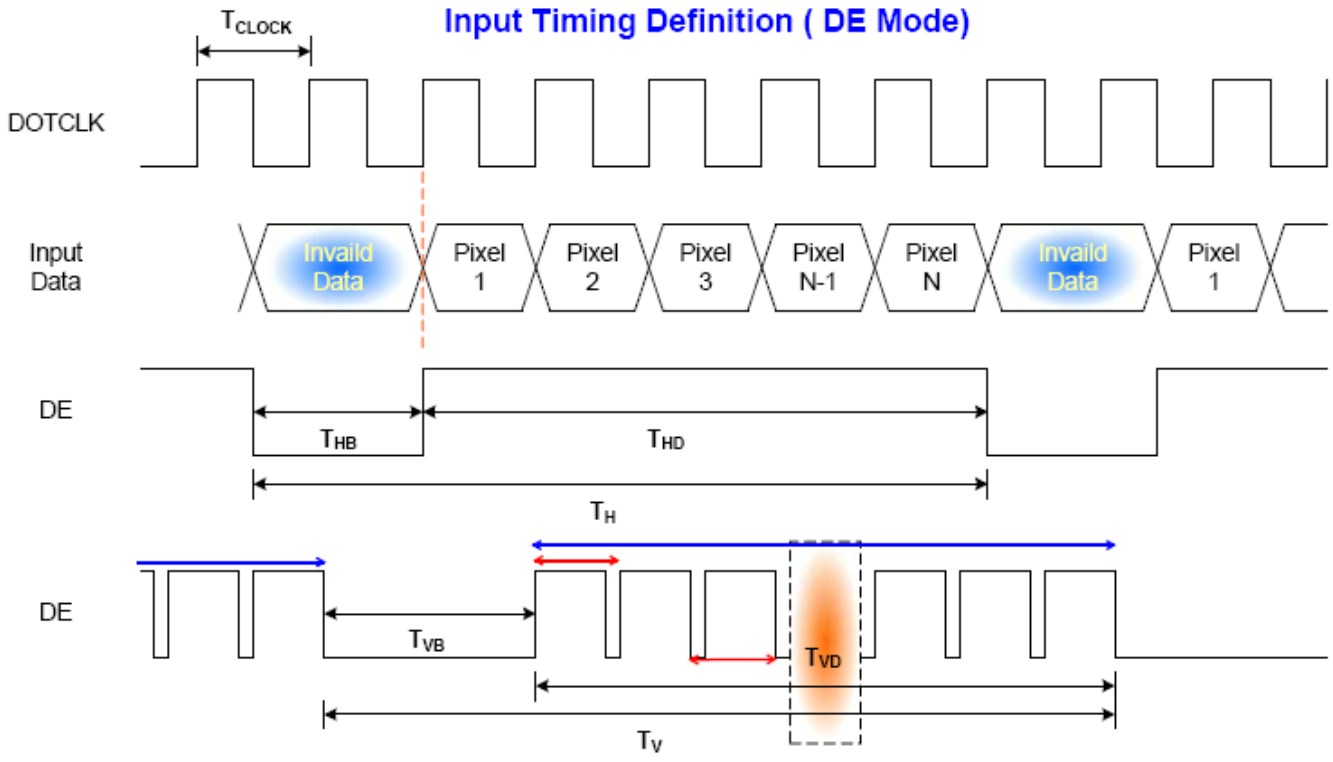
6.5.1 Timing Characteristics

DE mode only

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Clock frequency		1/ T_{Clock}	33.6	39.8	48.3	MHz	
Vertical Section	Period	T_V	608	628	650	T_H	
	Active	T_{VD}	600	600	600		
	Blanking	T_{VB}	8	28	50		
Horizontal Section	Period	T_H	920	1056	1240	T_{Clock}	
	Active	T_{HD}	800	800	800		
	Blanking	T_{HB}	120	256	440		

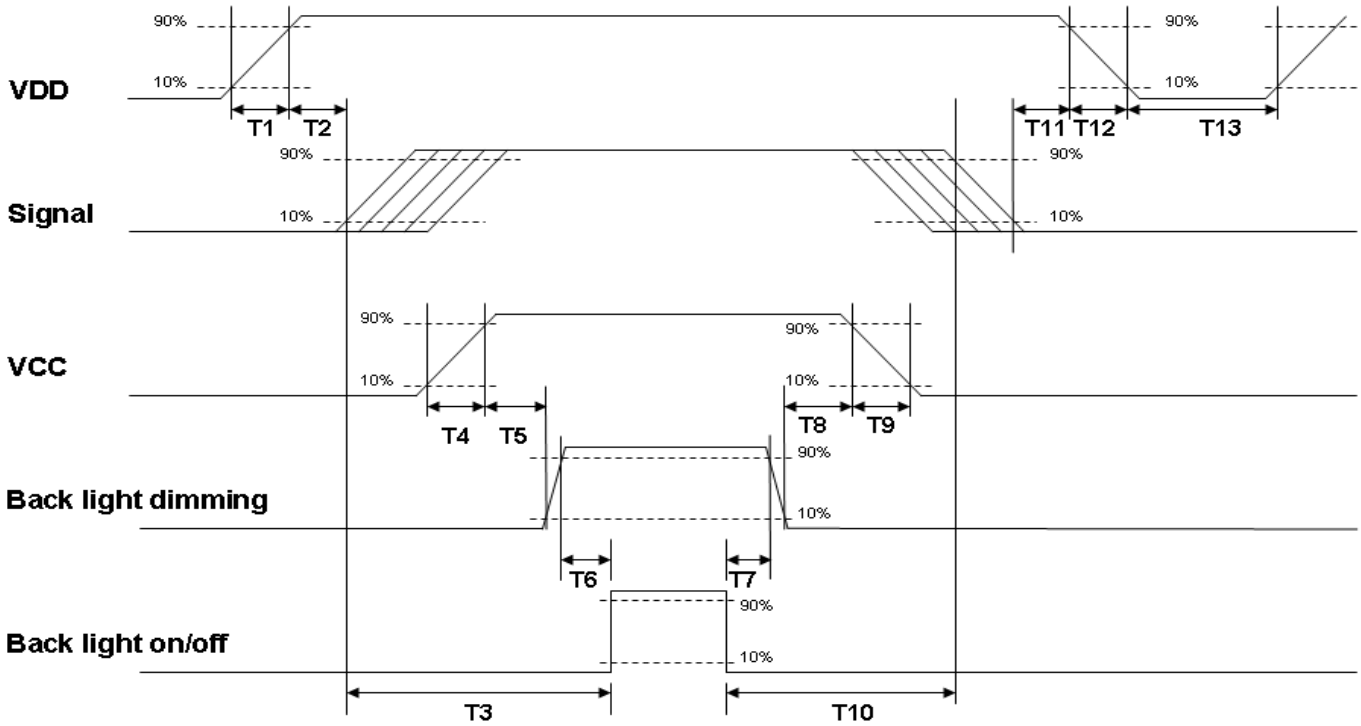
Note: Frame rate is 60 Hz.
Note: DE mode.

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 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): LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	STM or compatible
Connector Model Number	STM -MSB24013P20HA or compatible
Mating Model Number	STM-P24013P20 or compatible

Pin No.	Signal Name	Pin No.	Signal Name
1	VDD	2	VDD
3	UD	4	LR
5	RxIN1-	6	RxIN1+
7	GND	8	RxIN2-
9	RxIN2+	10	GND
11	RxIN3-	12	RxIN3+
13	GND	14	RxCKIN-
15	RxCKIN+	16	GND
17	SEL 68	18	NC
19	RxIN4-	20	RxIN4+

7.2 LED Backlight Unit (CN2): LED Driver Connector

Connector Name / Designation	LED Connector
Manufacturer	STM
Connector Model Number	MSB24038P4D or compatible
Mating Model Number	P24038P4 or compatible.

Pin #	Symbol	Pin Description
1	VCC	12V input
2	GND	GND
3	Display_ON/OFF	+5.0V or +3.3 V:ON, 0V:OFF
4	Dimming	PWM

7.3 LED Light Bar Input Connector (CN3):

Manufacturer	CviLux
Connector Model Number	CI4303M1HRA-NH or compatible
Mating Connecter Model Number	C14303S0000 or compatible

Pin #	Symbol	Pin Description
1	AN1	LED anode
2	CA1	LED cathode
3	CA2	LED cathode

Pin #	Symbol	Cable color
1	AN1	Red
2	CA1	Black
3	CA2	Black

8. Reliability Test Criteria

Items	Required Condition	Note
Temperature Humidity Bias	40^{0}C/90%,300 hours	Note 2
High Temperature Operation	85^{0}C,300 hours	Note 2
Low Temperature Operation	-30^{0}C,300 hours	Note 2
Hot Storage	85^{0}C,300 hours	Note 2
Cold Storage	-30^{0}C,300 hours	Note 2
Thermal Shock Test	-20^{0}C/30 min ,60^{0}C/30 min ,100cycles	Note 2
Shock Test (Non-Operating)	50G,20ms,Half-sine wave,(±X, ±Y, ±Z)	Note 2
Vibration Test (Non-Operating)	1.5G, (10~200Hz, P-P) 30 mins/axis (X, Y, Z)	Note 2
On/off test	On/10 sec, Off/10 sec, 30,000 cycles	Note 2
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

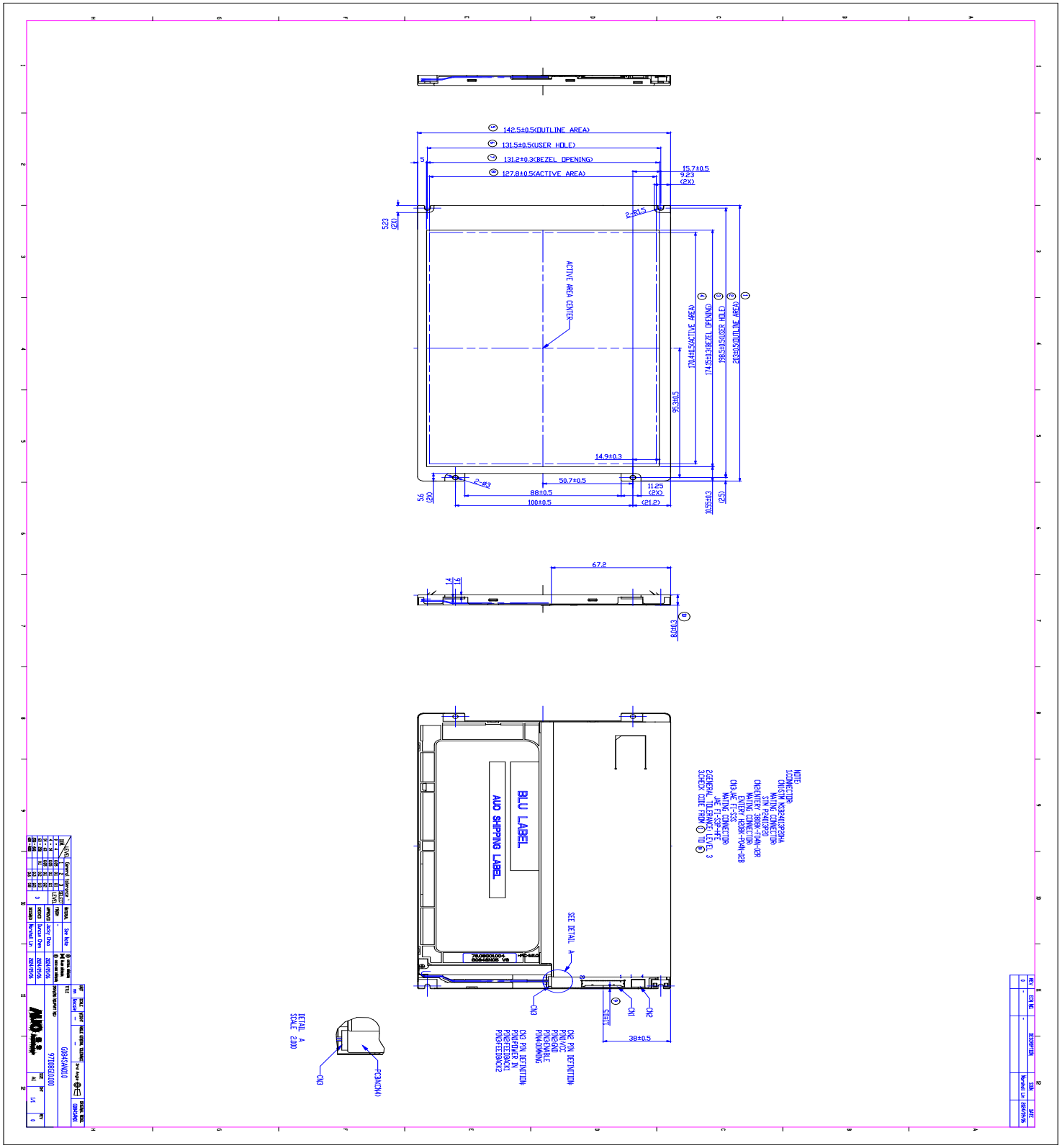
Note1: According to EN61000-4-2, ESD class B: Some performance degradation allowed. No data lost

. Self-recoverable. No hardware failures.

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 functional failure occurs. Mura should be ignored after high temperature reliability test.

9. Mechanical Characteristics



Reminding to check screw's torque value before fastening panel.

10. Label and Packaging

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

10.2 Carton Package TBD

11 Safety

11.1 Sharp Edge Requirements

There will be no sharp edges or corners 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 pRxINted circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be pRxINted on the pRxINted 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