

- Preliminary Specification
- Final Specification

Module	21.5" Color TFT-LCD
Model Name	AG215HA-B10N-NNM-V1

Customer	Date
_____	_____
Checked & Approved by	
_____	_____
<p>Note: This Specification is subject to change without notice.</p>	

Approved by	Date
_____	_____
Prepared by	
_____	_____

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1. Operating Precautions

- 1) Since front polarizer is easily damaged, pay attention 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 other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 7) Do not open or modify the Module Assembly.
- 8) In case if a Module has to be put back into the packing container slot after once it was taken out from the container, take it easily, or the TFT Module may be damaged.
- 9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
- 10) After installation of the TFT Module into an enclosure, 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.
- 11) 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.
- 12) Severe temperature condition may result in different luminance, response time and LED life time.
- 13) The data on this specification sheet is applicable when LCD module is placed in landscape position.
- 14) 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 21.5 inch-wide Color TFT-LCD Module AG215HA-B10N-NNM-V1. The display supports the Full HD - 1920(H) x 1080(V) screen format and 16.7M colors (RGB 8-bits data). All input signals are dual channel LVDS interface.

LED driver board is included. AG215HA-B10N-NNM-V1 is designed for industrial display applications.

2.1 Display Characteristics

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

ITEMS	Unit	SPECIFICATIONS
Screen Diagonal	[mm]	546.86(21.53")
Active Area	[mm]	476.64 (H) x 268.11 (V)
Pixels H x V		1920(x3) x 1080
Pixel Pitch	[um]	248.25 (per one triad) x24.8
Pixel Arrangement		R.G.B. Vertical Stripe
Display Mode		VA Mode, Normally Black
White Luminance (Center)	[cd/m ²]	1000 (Typ.)
Contrast Ratio		5000 (Typ.)
Optical Response Time	[msec]	16 ms (Typ., on/off)
Nominal Input Voltage VDD	[Volt]	+5.0 V
Backlight Input Voltage	[Volt]	+12.0 V
Power Consumption (VDD line + LED line)	[Watt]	VDD: 4.4 + LED: 20.4 = 24.8 (Typ.) (with LED driver board, all white pattern)
Weight	[Grams]	2300 (max.)
Physical Size	[mm]	495.6(W) x 292.2(H) x 17.35(D) Max.
Electrical Interface		Dual channel LVDS
Support Color		16.7M colors (RGB 8 bits)
Surface Treatment		Anti-Glare, 3H
Temperature Range		
Operating	[°C]	0 to +60 (Panel surface
Storage (Shipping)	[°C]	temp.) -20 to +60
RoHS Compliance		RoHS Compliance
TCO Compliance		TCO 5.1 Compliance

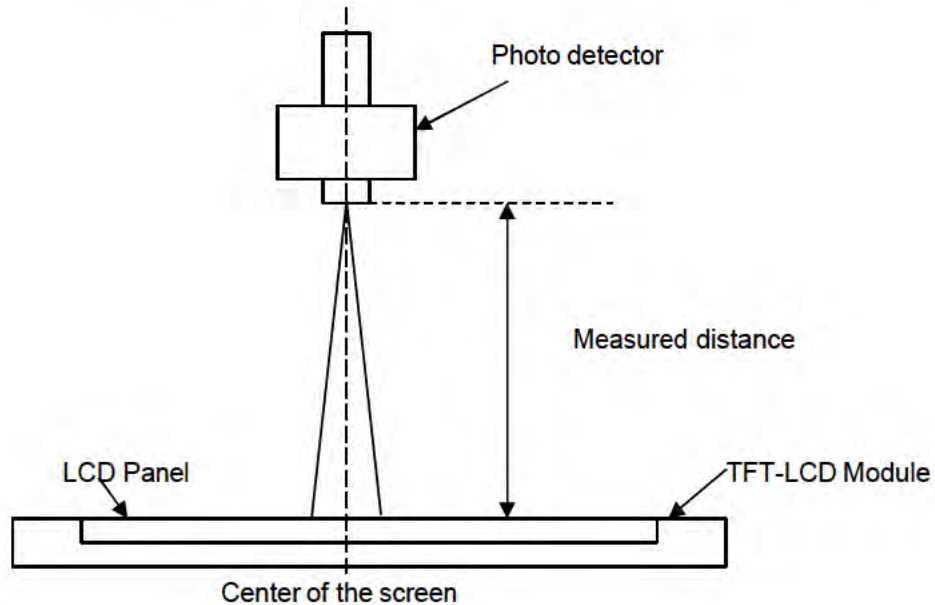
2.2 Optical Characteristics

The optical characteristics are measured under stable conditions at 25°C:

Item	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing Angle	[degree]	Horizontal (Right)	150	178	-	2
		CR = 10 (Left)			-	
		Vertical (Up)	150	178	-	
		CR = 10 (Down)			-	
Contrast ratio		Normal Direction	3000	5000	-	3
Response Time	[msec]	Raising Time (T_{rR})	-	10	12	4
		Falling Time (T_{rF})	-	6	7	
		Raising + Falling	-	16	19	
Color / Chromaticity Coordinates (CIE)		Red x	0.589	0.639	0.689	5
		Red y	0.283	0.333	0.383	
		Green x	0.284	0.334	0.384	
		Green y	0.573	0.623	0.673	
		Blue x	0.105	0.155	0.205	
		Blue y	0.000	0.048	0.098	
Color Coordinates (CIE) White		White x	0.263	0.313	0.363	
		White y	0.279	0.329	0.379	
Central Luminance	[cd/m^2]		900	1000	-	6
Luminance Uniformity	[%]		75	80	-	7
Crosstalk (in 60Hz)	[%]				1.5	8
Flicker	dB				-20	9

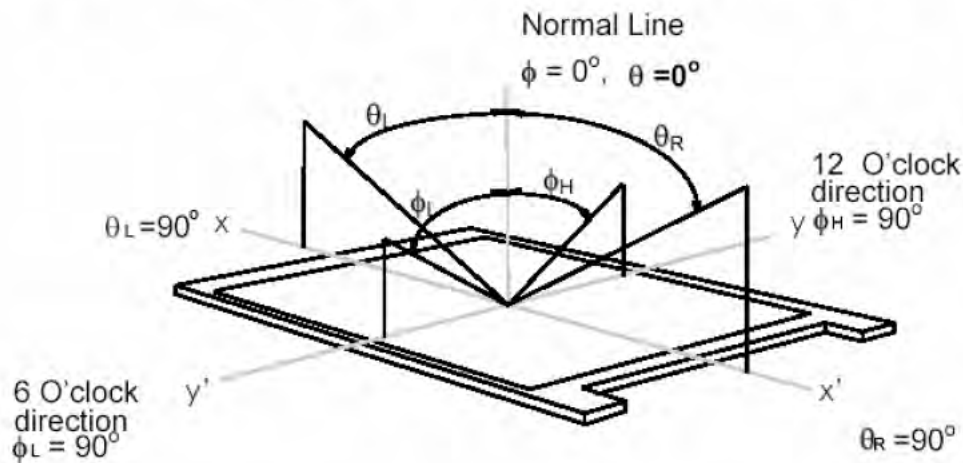
Note 1: Measurement method

Before measuring, the LCD module should be turned on 30 minutes at room temperature. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room.



Note 2: Definition of viewing angle measured by ELDIM (EZContrast 88)

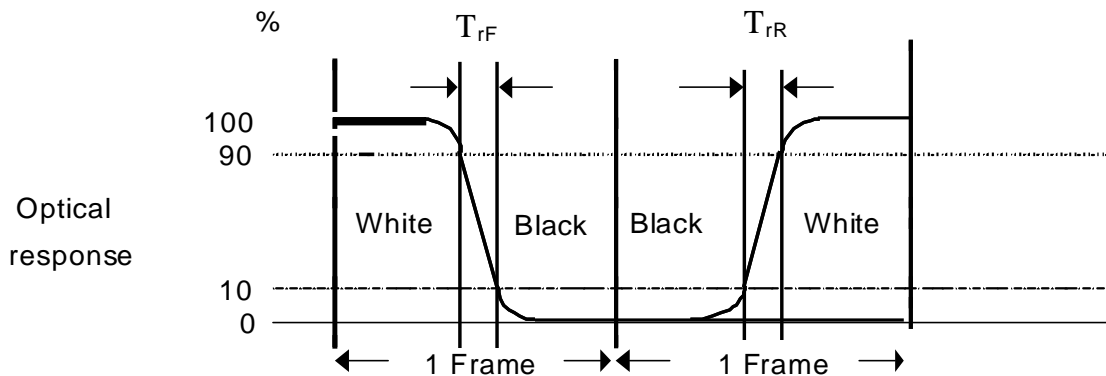
Viewing angle is the measurement of contrast ratio ≥ 10 , at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (è) horizontal left and right and 90° (Ö) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



Note 3: Contrast ratio is measured by TOPCON SR-3

Note 4: Definition of Response time measured by Westar TRD-100A

The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time, T_{rR}), and from “Full White” to “Full Black” (falling time, T_{rF}), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes.

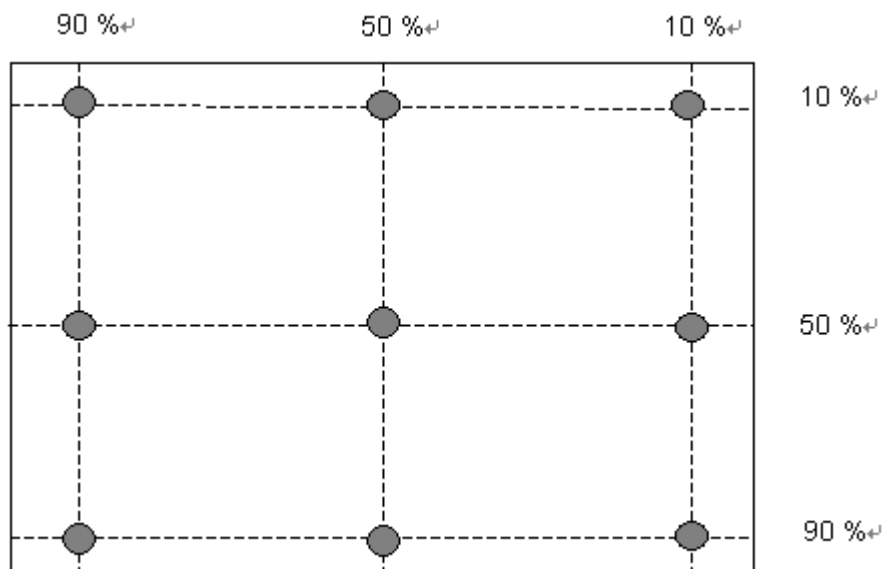


$T_{rR} + T_{rF} = 16$ msec (typ.).

Note 5: Color chromaticity and coordinates (CIE) is measured by TOPCON SR-3

Note 6: Central luminance is measured by TOPCON SR-3

Note 7: Luminance uniformity of these 9 points is defined as below and measured by TOPCON SR-3



$$\text{Uniformity} = \frac{\text{Minimum Luminance in 9 points (1-9)}}{\text{Maximum Luminance in 9 Points (1-9)}}$$

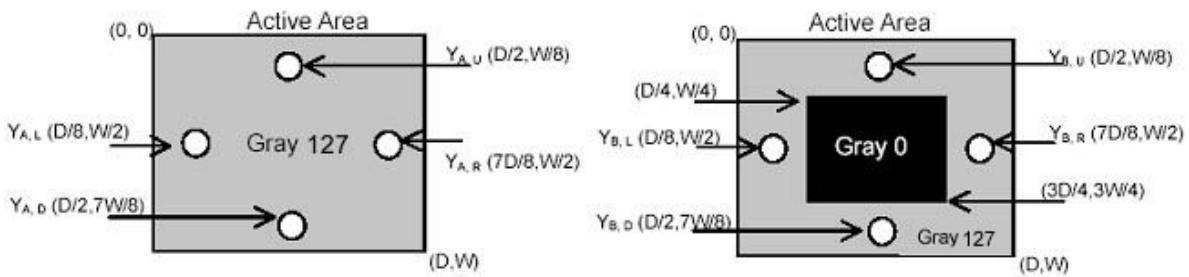
Note 8: Crosstalk is defined as below and measured by TOPCON SR-3

$$CT = |YB - YA| / YA \times 100 (\%)$$

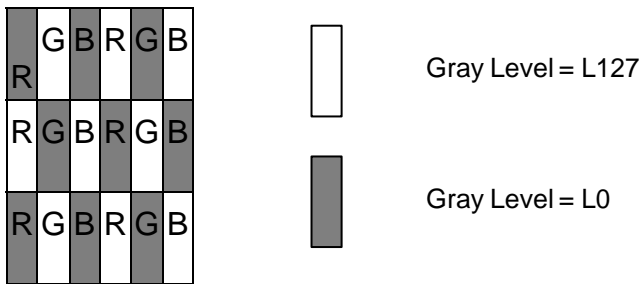
Where

YA = Luminance of measured location without gray level 0 pattern (cd/m²)

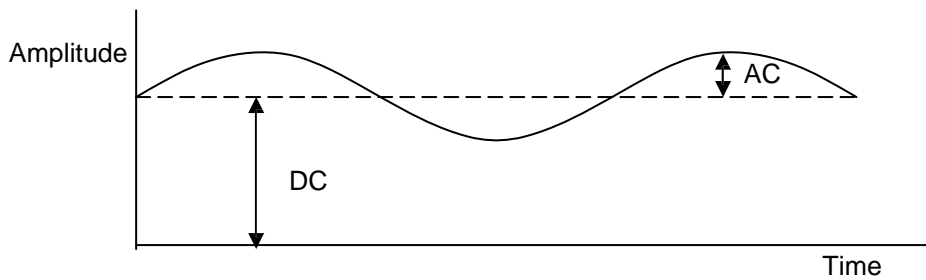
YB = Luminance of measured location with gray level 0 pattern (cd/m²)



Note 9: Test Pattern: Subchecker Pattern measured by TOPCON SR-3



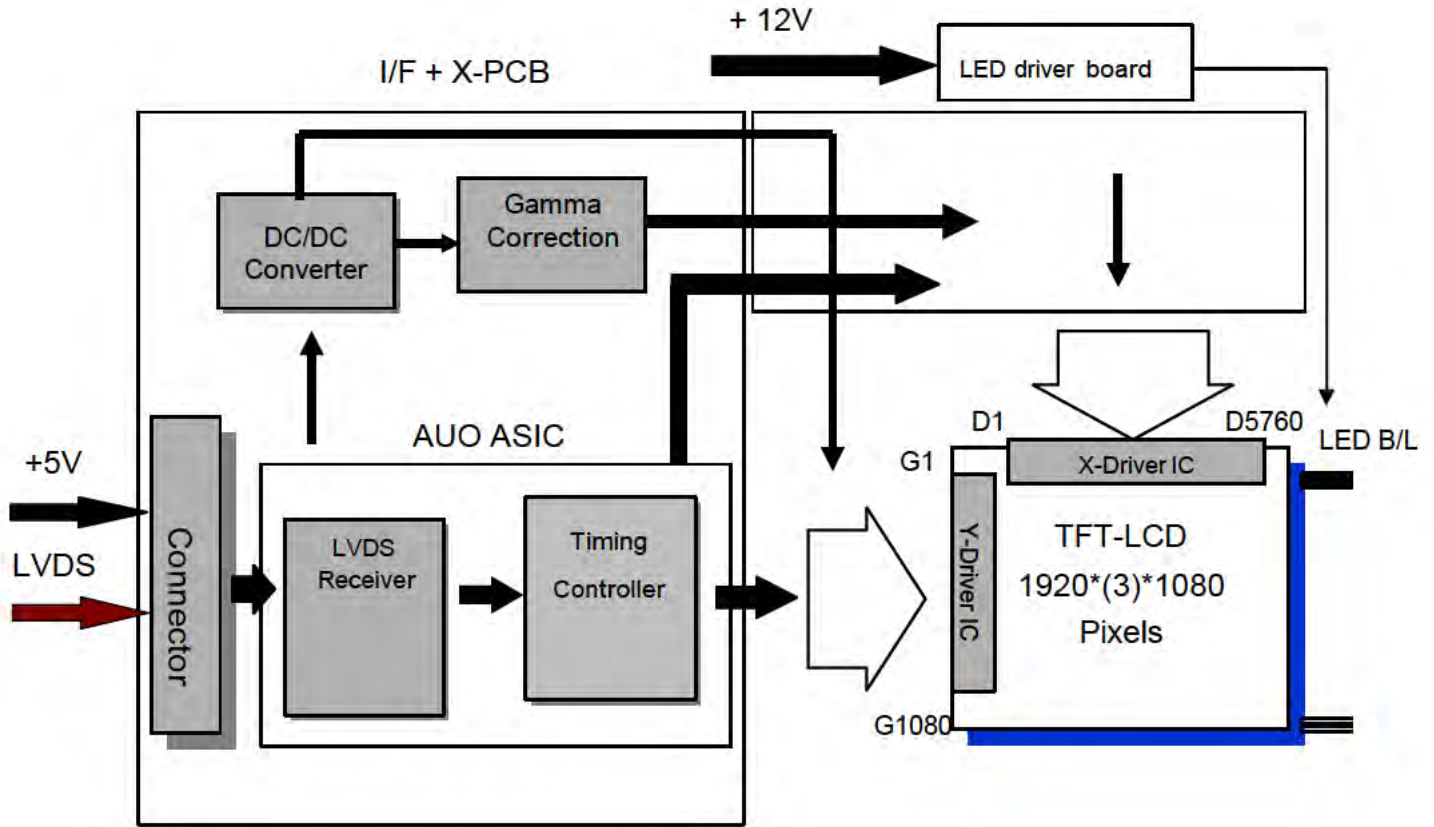
Method: Record dB value with TRD-100



$$\text{Flicker (dB)} = 20 \log \frac{\text{AC Level(at 30 Hz)}}{\text{DC Level}}$$

3. Functional Block Diagram

The following diagram shows the functional block of this model.



LVDS Connector: JAE (FI-XB30SRL-HF11) or equivalent.

4. Absolute Maximum Ratings

4.1 TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	VDD	0	5.5	[Volt]	Note 1,2

4.2 Backlight Unit

Item	Symbol	Min	Max	Unit	Conditions
LED Input Voltage	VLED	10.8	13.2	[Volt]	Note 1,2

4.3 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	0	+60	[°C]	Note 3
Glass Surface Temperature (Operation)	TGS	0	+65	[°C]	Note 3, Note 4
Operation Humidity	HOP	5	90	[%RH]	Note 3
Storage Temperature	TST	-20	+60	[°C]	
Storage Humidity	HST	5	90	[%RH]	

Note 1: With in Ta (25°C)

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

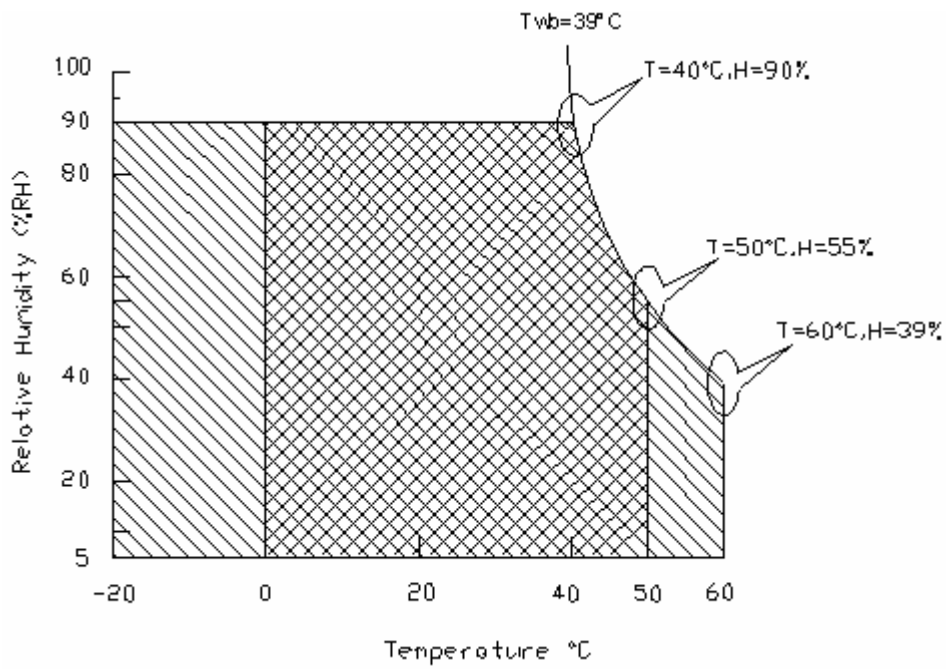
Note 3: For quality performance, please refer to AUO IIS(Incoming Inspection Standard).

1. 90% RH Max (Ta ≤39°C)

2. Max wet-bulb temperature at 39°C or less. (Ta ≤39°C)

3. No condensation.

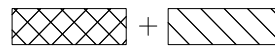
Note4: Function judge only.



Operating Range



Storage Range



5. Electrical Characteristics

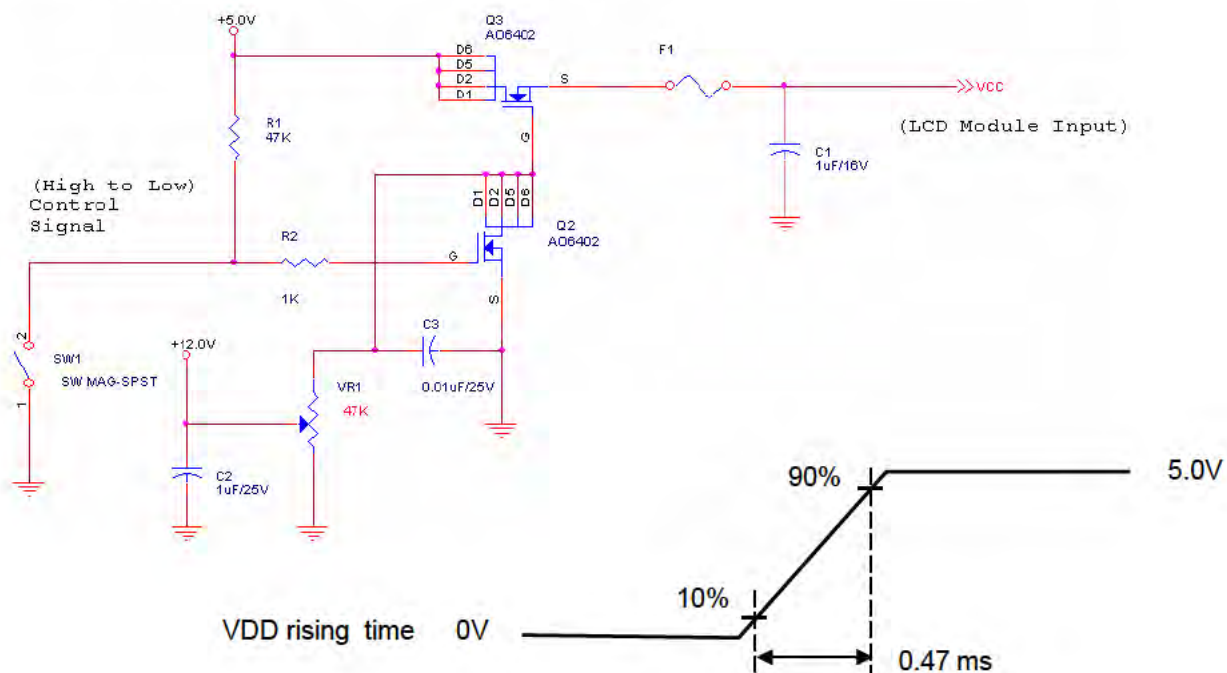
5.1 TFT LCD Module

5.1.1 Power Specification

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	+/-10%
IDD	Input Current	-	0.7	0.8	[A]	VDD= 5.0V, All white pattern, At 60Hz
		-	0.81	0.89	[A]	VDD= 5.0V, All white pattern At 75Hz,
PDD	VDD Power	-	3.5	4.4	[Watt]	VDD= 5.0V, All white pattern, At 60Hz
		-	4.05	4.9	[Watt]	VDD= 5.0V, All white pattern At 75Hz,
IRush	Inrush Current	-	-	3	[A]	Note 1
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	500	[mV] p-p	VDD= 5.0V, All white Pattern At 75Hz

Note 1: Measurement conditions:

The duration of rising time of power input is 470us.

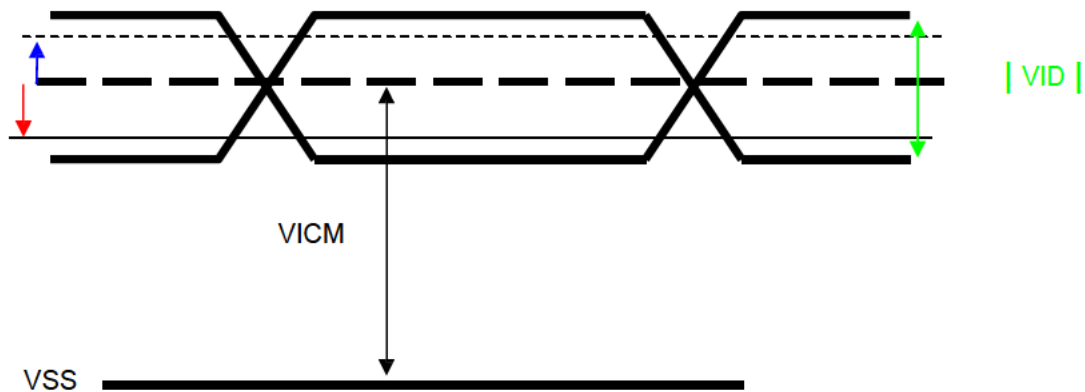


5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when VDD is off. Please refer to specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Symbol	Parameter	Min	Typ	Max	Units	Condition
V_{TH}	Differential Input High Threshold	-	-	+100	[mV]	$V_{CM} = 1.2V$, Note 1
V_{TL}	Differential Input Low Threshold	-100	-	-	[mV]	$V_{CM} = 1.2V$ Note 1
$|V_{ID}|$	Input Differential Voltage	100	-	600	[mV]	Note 1
V_{CM}	Differential Input Common Mode Voltage	+1.0	+1.2	+1.5	[V]	$V_{TH} - V_{TL} = 200MV$ (max) Note 1

Note 1: LVDS Signal Waveform



5.2 Backlight Unit

5.2.1 LED Driver

Following characteristics are measured under stable condition at 25°C (Room Temperature).

Symbol	Parameter	Min	Typ	Max	Unit	Remark
Vcc	Input Voltage	10.8	12	15	Volt	
Ivcc	Input Current	-	65	-	A	100% Dimming
PLED	Power Consumption	-	1.6	-	Watt	100% Dimming
FPWM	PWM Dimming Frequency	200	-	20k	Hz	
	Dimming Voltage	3.3	5		Volt	
	Dimming Duty Cycle	10	-	100	%	
I _F	LED Forward Current	-	1.6		mA	Ta = 25°C, Note1
Operating Life		50000	-	-	Hrs	Ta = 25°C, Note4

Note 1: Ta means ambient temperature.

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

Note 3: LED light bar structure: (1 string x 6pcs LED & 1 string = 6pcs LED)

Note 4: Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

6. Signal Characteristic

6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.

	1			2			...						1919			1920		
1st Line	R	G	B	R	G	B	.....						R	G	B	R	G	B
	-	-	-	-	-	-	-						-	-	-	-	-	-
	-	-	-	-	-	-	-						-	-	-	-	-	-
	-	-	-	-	-	-	-						-	-	-	-	-	-
	-	-	-	-	-	-	-						-	-	-	-	-	-

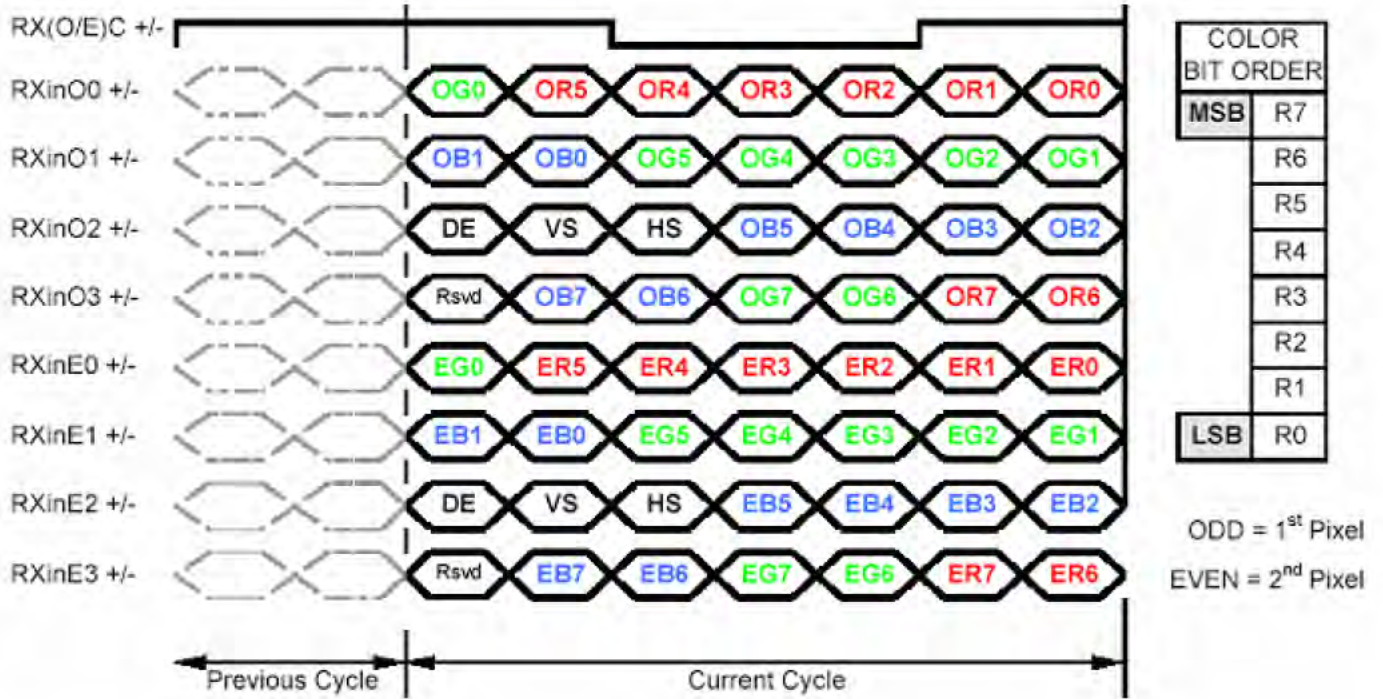
1080 Line	R	G	B	R	G	B	.....						R	G	B	R	G	B

6.2 Signal Description

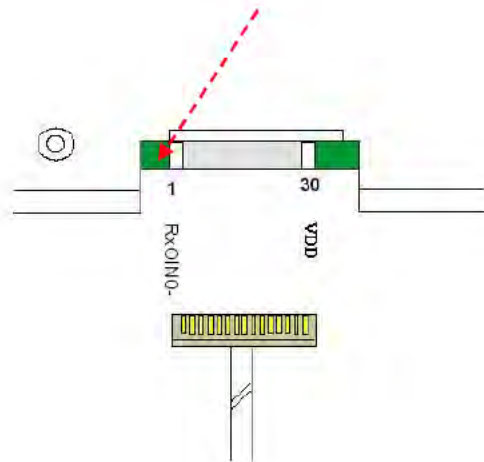
The module using a pair of LVDS receiver SN75LVDS82(Texas Instruments) or compatible. LVDS is a differential signal technology for LCD interface and high speed data transfer device. Transmitter shall be SN75LVDS83(negative edge sampling) or compatible. The first LVDS port(RxOxxx) transmits odd pixels while the second LVDS port(RxExxx) transmits even pixels.

PIN #	SIGNAL NAME	DESCRIPTION
1	RXinO0-	Negative LVDS differential data input (Odd data)
2	RXinO0+	Positive LVDS differential data input (Odd data)
3	RXinO1-	Negative LVDS differential data input (Odd data)
4	RXinO1+	Positive LVDS differential data input (Odd data)
5	RXinO2-	Negative LVDS differential data input (Odd data, H-Sync, V-Sync, DSPTMG)
6	RXinO2+	Positive LVDS differential data input (Odd data, H-Sync, V-Sync, DSPTMG)
7	GND	Power Ground
8	RxOCLKIN-	Negative LVDS differential clock input (Odd clock)
9	RxOCLKIN+	Positive LVDS differential clock input (Odd clock)
10	RXinO3-	Negative LVDS differential data input (Odd data)
11	RXinO3+	Positive LVDS differential data input (Odd data)
12	RXinE0-	Negative LVDS differential data input (Even data)
13	RXinE0+	Positive LVDS differential data input (Even data)
14	GND	Power Ground
15	RXinE1-	Positive LVDS differential data input (Even data)
16	RXinE1+	Negative LVDS differential data input (Even data)
17	GND	Power Ground
18	RXinE2-	Negative LVDS differential data input (Even data)
19	RXinE2+	Positive LVDS differential data input (Even data)
20	RxECLKIN-	Negative LVDS differential clock input (Even clock)
21	RxECLKIN+	Positive LVDS differential clock input (Even clock)
22	RXinE3-	Negative LVDS differential data input (Even data)
23	RXinE3+	Positive LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No connection (for AUO test only. Do not connect)
26	NC	No connection (for AUO test only. Do not connect)
27	NC	No connection (for AUO test only. Do not connect)
28	VDD	Power +5V
29	VDD	Power +5V
30	VDD	Power +5V

6.3 The Input Data Format



Note1: 8-bits signal input.
 Note2: L:NS alike H:Thine alike



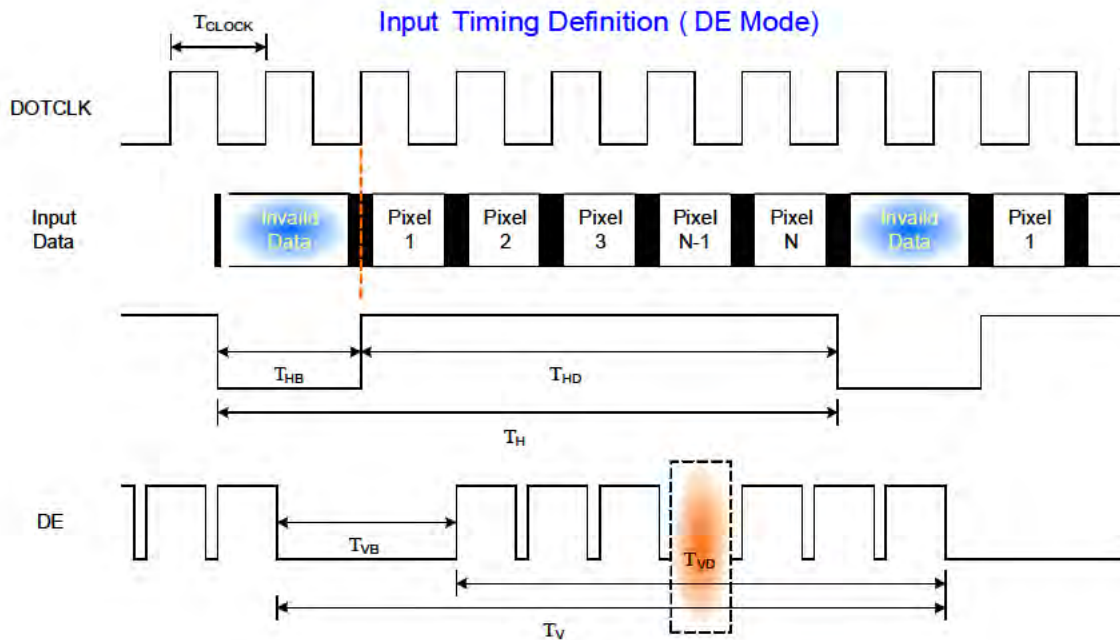
6.4 Interface Timing

6.4.1 Timing Characteristics

Signal	Item	Symbol	Min	Typ	Max	Unit
Clock	Frequency	$1/T_{\text{Clock}}$	40	72	83	MHz
	Frame Rate	Frequency	$1/T_v$	50	60	75	Hz
Vertical Section	Period	T_v	1088	1120	2047	T_line
	Active	T_{vD}	1080	1080	1080	
	Blanking	T_{vB}	8	40	967	
Horizontal Section	Period	T_H	1034	1060	2047	T_clock
	Active	T_{HD}	960	960	960	
	Blanking	T_{HB}	74	100	1087	

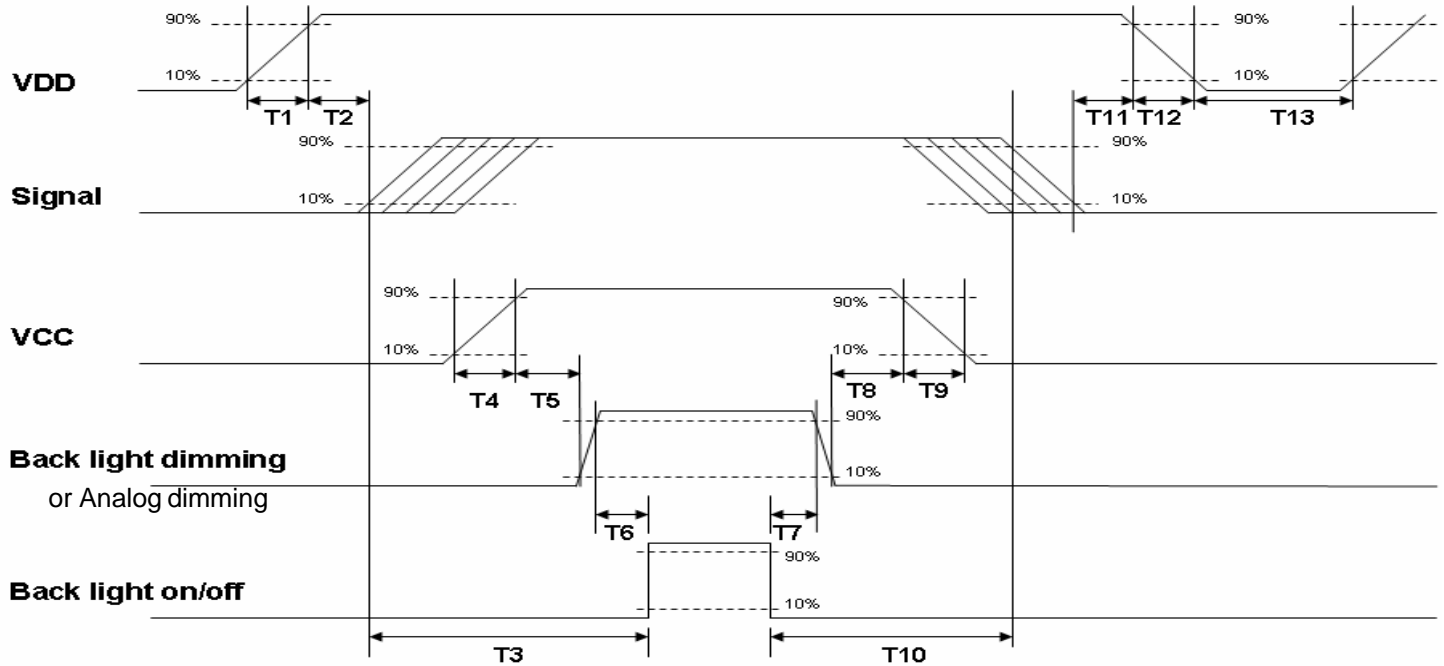
Note: DE mode only.

6.4.2 Input Timing Diagram



6.5 Power ON/OFF Sequence

VDD power and B/L 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 Module: LVDS Connector

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	JAE or compatible
Type Part Number	JAE (FI-XB30SRL-HF11) or equivalent.
Mating Housing Part Number	FI-X30HL (JAE) or compatible

Pin#	Signal Name	Pin#	Signal Name
1	RxOIN0-	2	RxOIN0+
3	RxOIN1-	4	RxOIN1+
5	RxOIN2-	6	RxOIN2+
7	GND	8	RxOCLKIN-
9	RxOCLKIN+	10	RxOIN3-
11	RxOIN3+	12	RxEIN0-
13	RxEIN0+	14	GND
15	RxEIN1-	16	RxEIN1+
17	GND	18	RxEIN2-
19	RxEIN2+	20	RxECLKIN-
21	RxECLKIN+	22	RxEIN3-
23	RxEIN3+	24	GND
25	NC	26	NC
27	NC	28	VDD
29	VDD	30	VDD

7.2 LED Backlight Unit (CN2): LED Driver Connector

Connector Name / Designation	LED Connector
Manufacturer	JST
Connector Model Number	S7B-PH-SM4-TB
Mating Model Number	

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

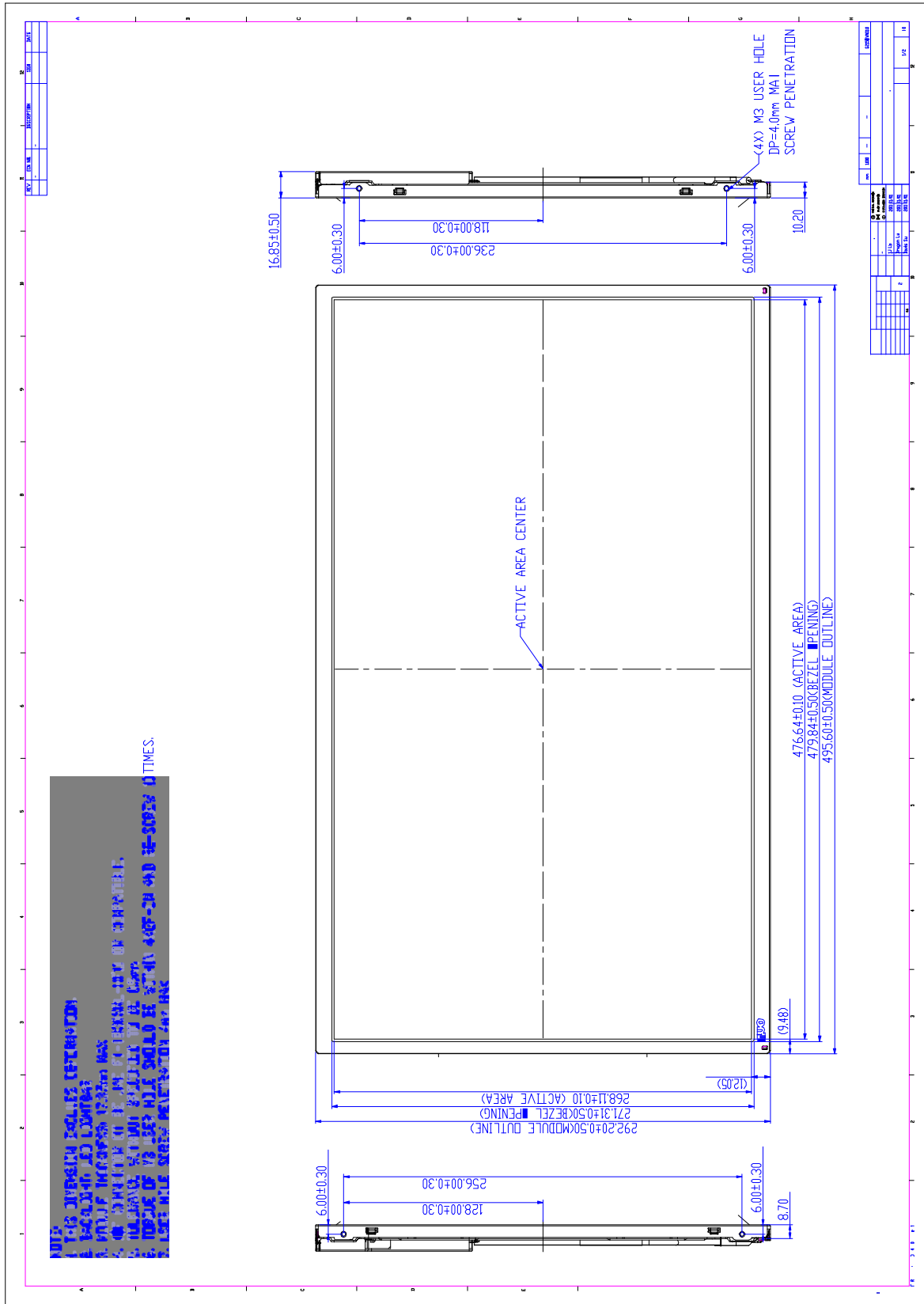
7.3 LED Light Bar Input Connector (CN3):

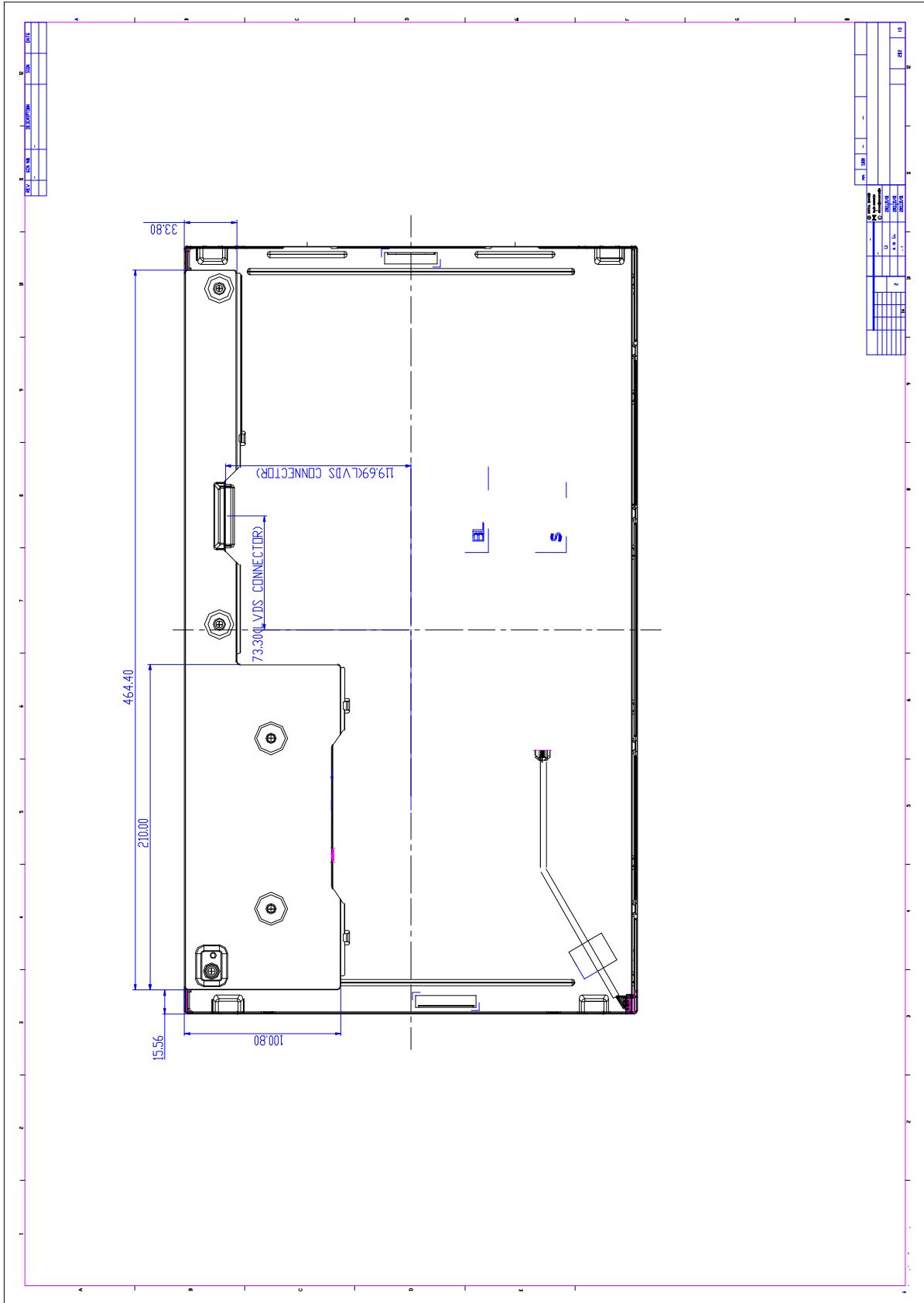
Manufacturer	
Connector Model Number	A20D/HD2-2P
Mating Connector Model Number	S2B-PH-SM4-TB or compatible

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

Pin #	Symbol	Cable color
1	AN1	Red
2	CA1	Black

ì . Mechanical Characteristics





J. LED Driver board Outline Dimension

Dimension : 75(L)*30(W)*8.65(H)mm

