13.9” Stretched, 1280 x 398

High brightness color TFT-LCD module

Customer:

Model control code：VM14BS V3

Date: April. 20th, 2021

Version: 01

Note: This specification is subject to change without notice

Customer：
Approved by ：
Date：

Approved	**Prepared**
Date:	**Date:**

Contents

RECORD OF REVISION

Version and Date	Page	Old description	New description	Remark
0.1 2021/04/20	All	First Edition for customer		

1. HANDLING 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) Do not press the reflector sheet at the back of the module to any directions.
9) In case if a Module has to be put back into the packing container slot after once it was taken out from the container, do not press the center of TFTLCD panel.
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, 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.

2. General Description

2.1, Overview

VM14BS V3 is a Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display, a driver circuit, and a backlight system. The display supports the SXGA+ (1280(H) x 398(V)) screen format and 16.7M colors (RGB 6-bits+Hi-RFC data).All input signals are 2 Channel LVDS interface compatible.

2.2 Features

- 2000 nits high brightness
- LED backlight and driver built-in (Option)
- Wide operation temperature
- RoHS Compliance

2.3 Application

Industrial applications

2.4 Display Specifications

Items	Unit	Specification
Screen Diagonal	inch	13.9” (353.9 mm)
Active Area	mm	337.92 (H) × 105.15(V)
Pixels H x V	pixels	1280 × 3(RGB) × 398
Pixels Pitch	um	0.264(per one triad) × 0.264
Pixel Arrangement		RGB Vertical stripe
Display mode		TN mode, normally white
White luminance (center)	Cd/m^2	2000 (Typ.)
Contrast ratio		1000 (Typ.)
Optical Response Time	msec	5 ms (Typ. on/off)
Normal Input Voltage VDD	Volt	5.0
Power Consumption (VCC Line + LED L Line)	Watt	13.15(Typ.) (LED driver is not included)
Weight	Grams	TBD (Typ.)
Physical size	mm	358.5(H) x 131.3(V) Typ. x 1.3 (D,TBD) Max. (LED driver is not included)
Electrical Interface		2 Channel LVDS
Support Colors		16.7M colors (RGB 6-bits +Hi-FRC data)
Surface Treatment		Anti-Glare, 3H
Temperature range Operating Storage (Shipping)	 ^0C ^0C	 -10 ~ 50 -20 ~ 60
RoHS Compliance		RoHS Compliance

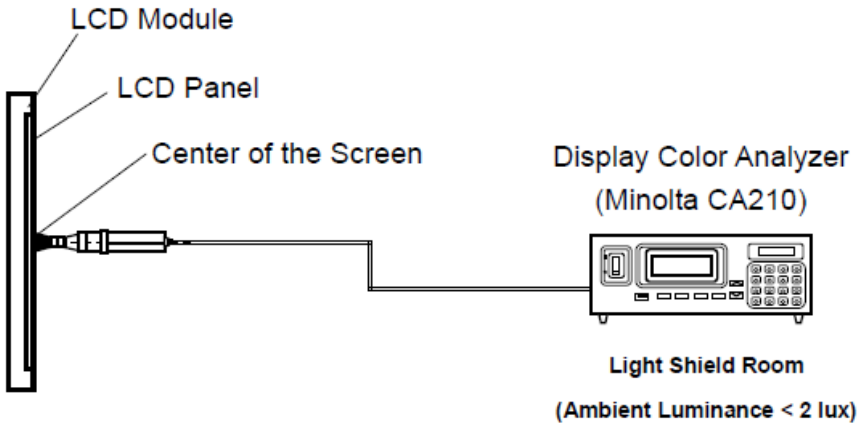
2.5 Optical Characteristics

The following optical characteristics are measured under stable condition at 25 ^{0}C

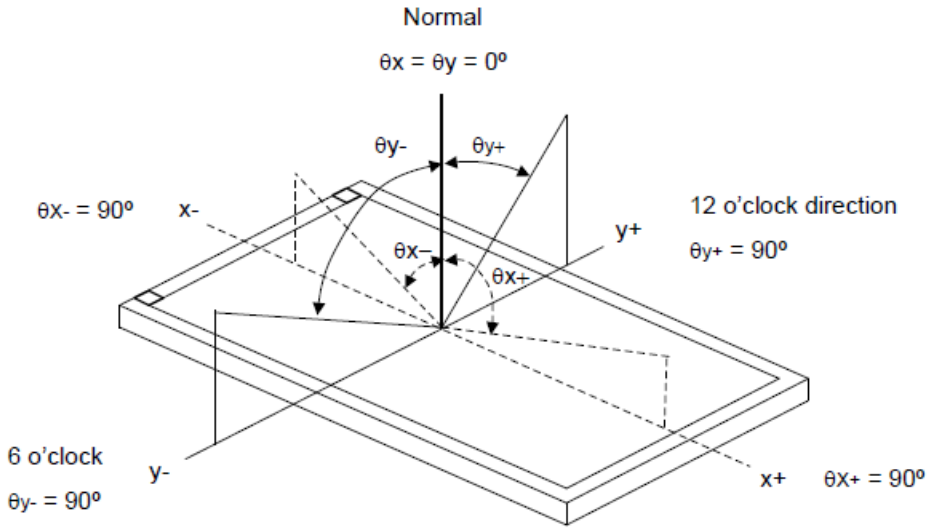
Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right) CR=10 (Left)	160	170		2
		Vertical (Up) CR=10 (Down)	150	160		
Contrast Ratio		Normal Direction		1000		3
Response Time	msec	Raising time (T_{rR})		3.5		4
		Falling time (T_{rF})		1.5		
		Raising + Falling		5		
Color / Chromaticity Coordinates (CIE)		Red x	-0.05	0.64	+0.05	5
		Red y		0.33		
		Green x		0.32		
		Green y		0.63		
		Blue x		0.15		
		Blue y		0.06		
Color coordinates (CIE) White		White x		0.31		
		White y		0.34		
Center Luminance	Cd/m^2		1600	2000		6
Luminance Uniformity	%			70		7
Crosstalk (in 60 Hz)	%				1	
Flicker	dB				-20	

Note 1: Measurement method

The LCD module should be stabilized at given temperature for 0.5 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



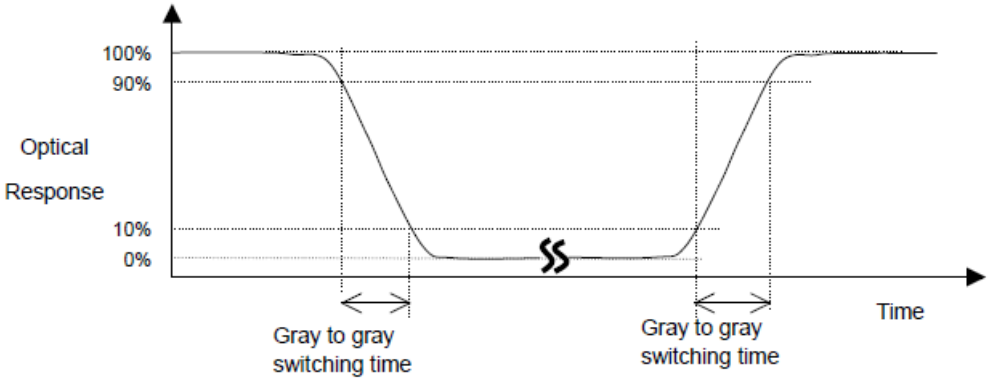
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA210

Note 4: Definition of Response time

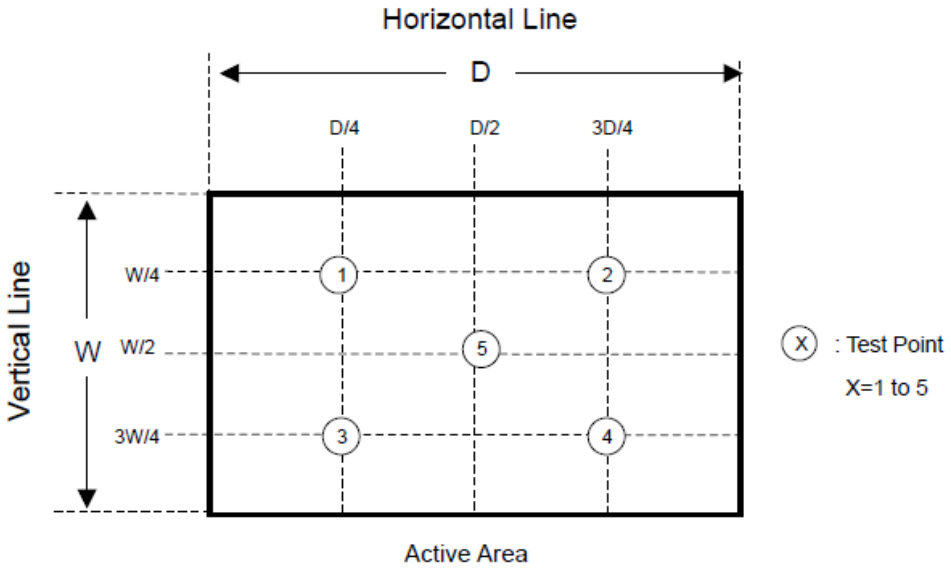
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.



Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA210

Note 6: Center luminance is measured by Minolta CA210

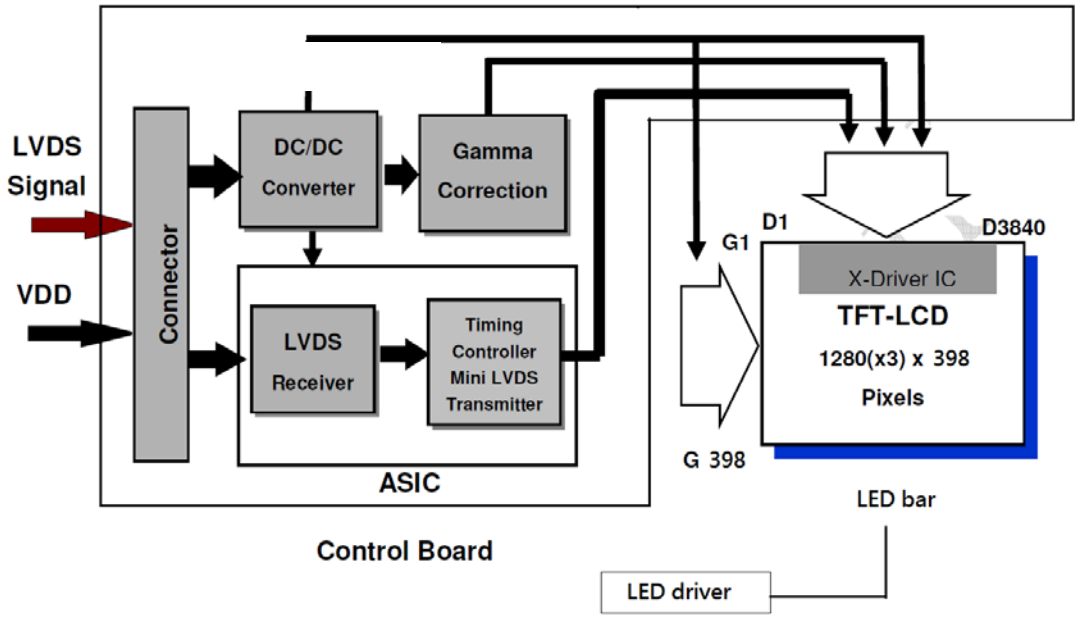
Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210



Uniformity = (Min. Luminance of 5 points) / (Max. Luminance of 5 points)

3. **Functional Block Diagram**

The following diagram shows the functional block of the 13.9 inches Color TFT-LCD Module:



PCBA Connector:

TFT-LCD Connector	Manufacturer	P-TWO	STM	JAE
	Part Number	AL230F-A0G1D-P	MSCKT2407P30HB	FI-XB30SSRLAHF16
Mating Connector	Manufacturer	JAE		
	Part Number	FI-X30HL (Locked Type)		

4. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

4.1 TFT LCD Module

Items	Symbol	Min	Max	Unit	Conditions
Logic/ LCD drive voltage	Vin	-0.3	6	Volt	Note 1, 2

4.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED Current	I LED		840	mA	Note 1, 2

4.3 Absolute Ratings of Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T_{OP}	-10	-	50	^{0}C	Note 3
Operation Humidity	H_{OP}	8		90	%	
Storage temperature	T_{ST}	-20		60	^{0}C	
Storage Humidity	H_{ST}	8		90	%	

Note 1: With in Ta= 25℃

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

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

5. Electrical characteristics

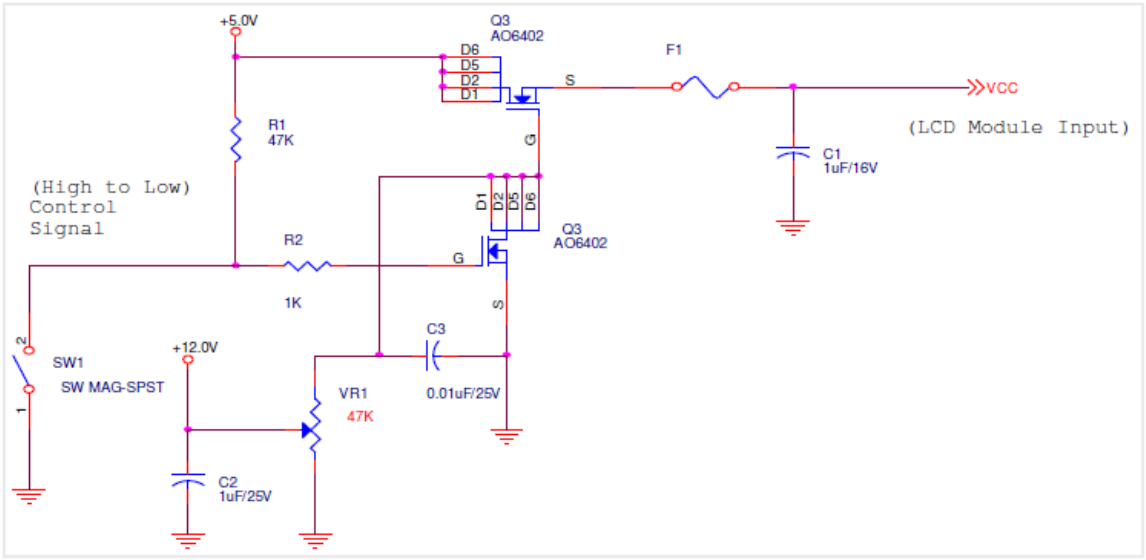
5.1 TFT LCD Module

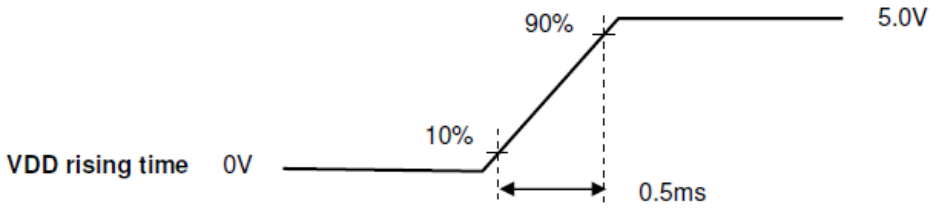
5.1.1 Power Specification

Input power specifications are as follows

Symbol	Parameter	Min	Typ.	Max	Unit	Conditions
VCC	Logic/ LCD Drive Voltage	4.5	5.0	5.5	Volt	+/- 10%
ICC	Input current		0.6	0.72	A	VCC=5V, All black pattern.
PCC	VCC power		3.0		W	VCC=5V, All black pattern.
IRush	Inrush current			3	A	

Note: Measurement conditions:





5.1.2 Signal Electrical Characteristics

Input signals shall be low or Hi-Z state when Vin is off

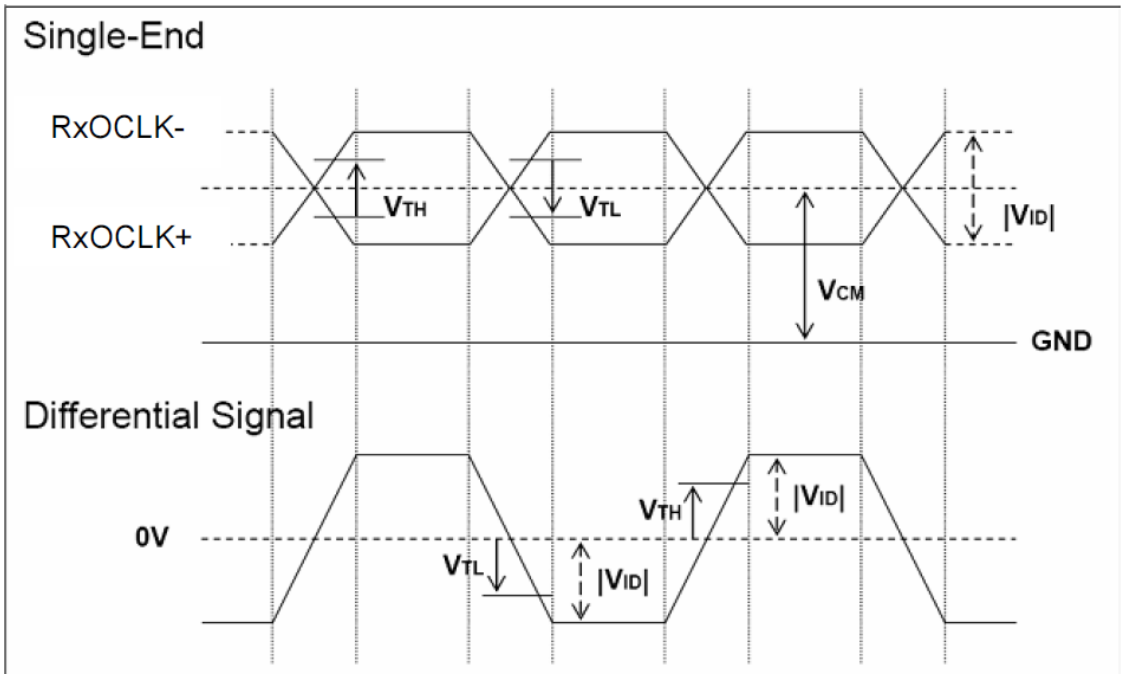
It is recommended to refer the specifications of SN75LVDS82DGG (Texas Instruments) in detail.

Characteristics of each signal are as following:

Symbol	Description	Min	Typ	Max	Units	Condition
V_{TH}	LVDS Differential Input High Threshold	-	-	+100	[mV]	V_{CM} = 1.2V
V_{TL}	LVDS Differential Input Low Threshold	-100	-	-	[mV]	V_{CM} = 1.2V
$\lvert V_{ID} \rvert$	LVDS Differential Input Voltage	100	-	600	[mV]	
V_{CM}	LVDS Common Mode Voltage	+1.0	+1.2	+1.5	[V]	V_{TH}-V_{TL} = 200mV

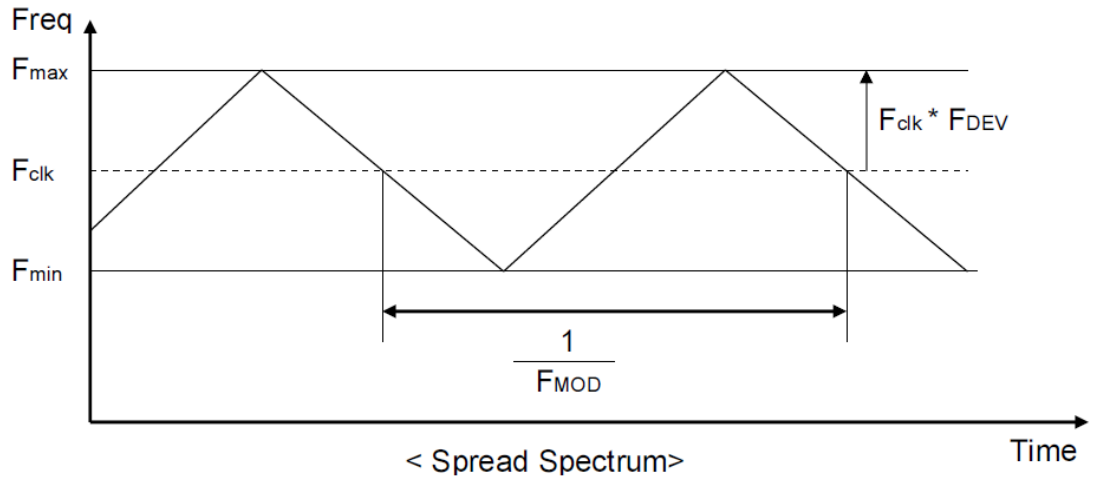
LVDS Signal Waveform:

Use RxOCLK- & RxOCLK+ as example



AC Characteristics:

Symbol	Description	Min	Max	Unit	Remark
F_{DEV}	Maximum deviation of input clock frequency during Spread Spectrum	-	± 3	%	
F_{MOD}	Maximum modulation frequency of input clock during Spread Spectrum	-	200	KHz	



Fclk: LVDS Clock Frequency

5.2 Backlight Unit

Parameter guideline is under stable conditions at 25℃ (Room Temperature):

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		29		[V]	2
LED current (IL)		350		[mA]	2,
LED power (PL)		10.15		W	
LED Life Time(LTLED)		100,000		[Hour]	1

Note 1: The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ and typical LED Current at 350 mA .

Note 2: The LED driving condition is defined for each LED module.

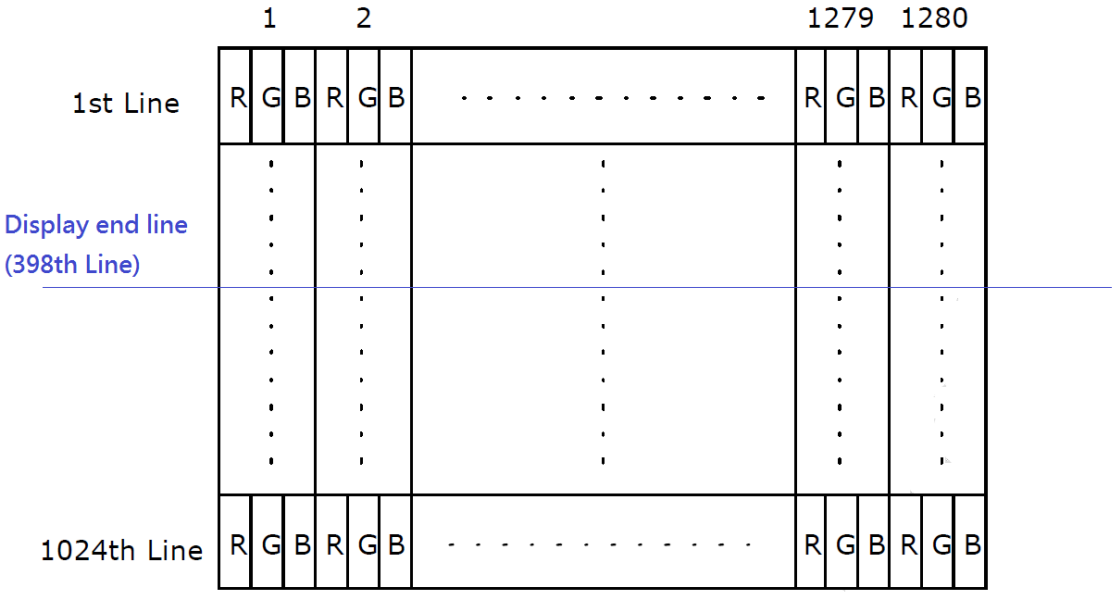
Note 3: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference (IL x VL x 1= PLED)

Note 4: LED Light Bar Connector is used for the integral backlight system. The recommended model is BHSR-02VS-1 manufactured by JST

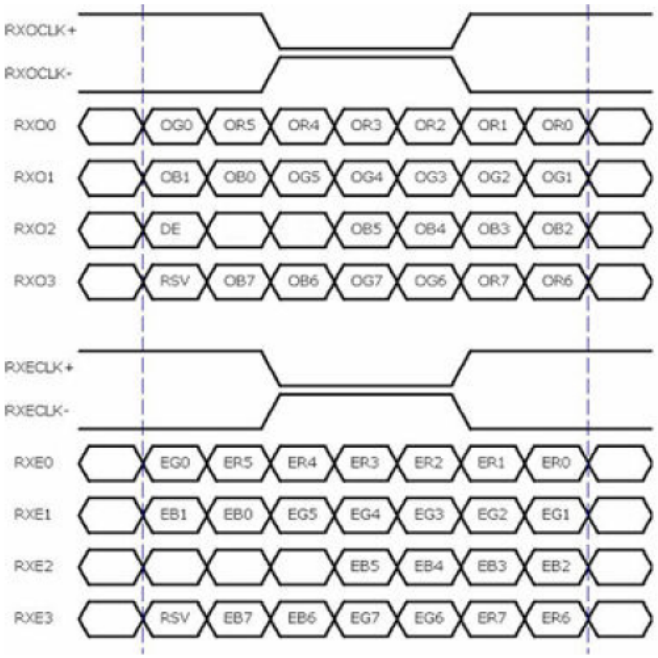
6. Signal Characteristic

6.1 Pixel Format Image

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



6.2 The Input Data Format



8 Bit Color Bit Order			
MSB	R7	G7	B7
	R6	G6	B6
	R5	G5	B5
	R4	G4	B4
	R3	G3	B3
	R2	G2	B2
	R1	G1	B1
LSB	R0	G0	B0

a. O = “Odd Pixel Data” E = “Even Pixel Data”

b. Refer to 3.4.1 LCD pixel format, the 1st data is 1 (Odd Pixel Data), the 2nd data is 2 (Even Pixel Data) and the last data is 1280 (Even Pixel Data).

6.3 Color versus Input Data

The following table is for color versus input data (8bit). The higher the gray level, the brighter the color.

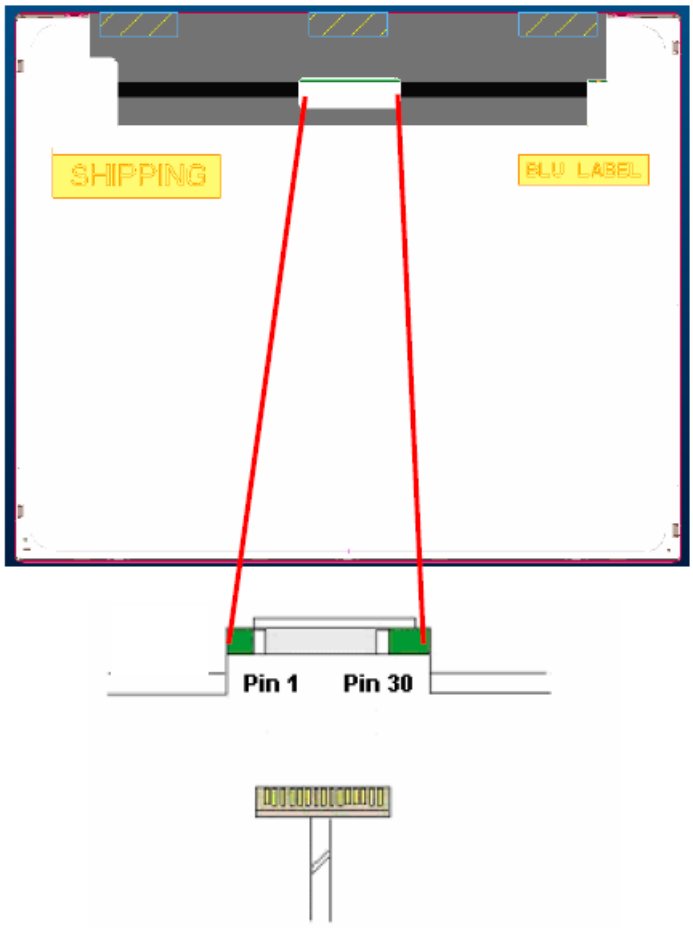
Color	Gray Level	Color Input Data																								Remark
		RED data (MSB:R7, LSB:R0)								GREEN data (MSB:G7, LSB:G0)								BLUE data (MSB:B7, LSB:B0)								
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	
Black	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
White	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Gray 127	-	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	
Red	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Green	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
Blue	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	

6.3 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 #	Symbol	Description	Remark
1	RxO0-	Negative LVDS differential data input (Odd data)	
2	RxO0+	Positive LVDS differential data input (Odd data)	
3	RxO1-	Negative LVDS differential data input (Odd data)	
4	RxO1+	Positive LVDS differential data input (Odd data)	
5	RxO2-	Negative LVDS differential data input (Odd data)	
6	RxO2+	Positive LVDS differential data input (Odd data)	
7	GND	Ground	
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)	
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)	
10	RxO3-	Negative LVDS differential data input (Odd data)	
11	RxO3+	Positive LVDS differential data input (Odd data)	
12	RxE0-	Negative LVDS differential data input (Even data)	
13	RxE0+	Positive LVDS differential data input (Even data)	
14	GND		
15	RxE1-	Negative LVDS differential data input (Even data)	
16	RxE1+	Positive LVDS differential data input (Even data)	
17	GND		
18	RxE2-	Negative LVDS differential data input (Even data)	
19	RxE2+	Positive LVDS differential data input (Even data)	
20	RxECLK-	Negative LVDS differential clock input (Even clock)	
21	RxECLK+	Positive LVDS differential clock input (Even clock)	
22	RxE3-	Negative LVDS differential data input (Even data)	
23	RxE3+	Positive LVDS differential data input (Even data)	
24	GND	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 Supply Input Voltage	
29	VDD	Power Supply Input Voltage	
30	VDD	Power Supply Input Voltage	

Note1: Start from left side



Note2: Input signals of odd and even clock shall be the same timing.

Note3: Please follow PSWG.

6.4 Timing Characteristics

6.4.1 Timing Characteristics

Basically, interface timings described here is not actual input timing of LCD module but output timing of SN75LVDS82DGG (Texas Instruments) or equivalent.

Symbol	Description		Min.	Typ.	Max.	Unit	Remark
Tv	Vertical Section	Period	1036	1066	1873	Th	
Tdisp (v)		Active	1024	1024	1024	Th	
Tblk (v)		Blanking	12	42	849	Th	
Fv		Frequency	50	60	76	Hz	
Th	Horizontal Section	Period	730	844	1320	Tclk	
Tdisp (h)		Active	640	640	640	Tclk	
Tblk (h)		Blanking	90	204	680	Tclk	
Fh		Frequency	37.8	54	68.4	KHz	***Note 3-3***
Tclk	LVDS Clock	Period	50	60	76	ns	1/Fclk
Fclk		Frequency	51.8	64	93.7	MHz	***Note 3-4***

Note: The equation is listed as following. Please don't exceed the above recommended value.

Fh (Min.) = Fclk (Min.) / Th (Min.);

Fh (Typ.) = Fclk (Typ.) / Th (Typ.);

Fh (Max.)= Fclk (Max.) / Th (Min.);

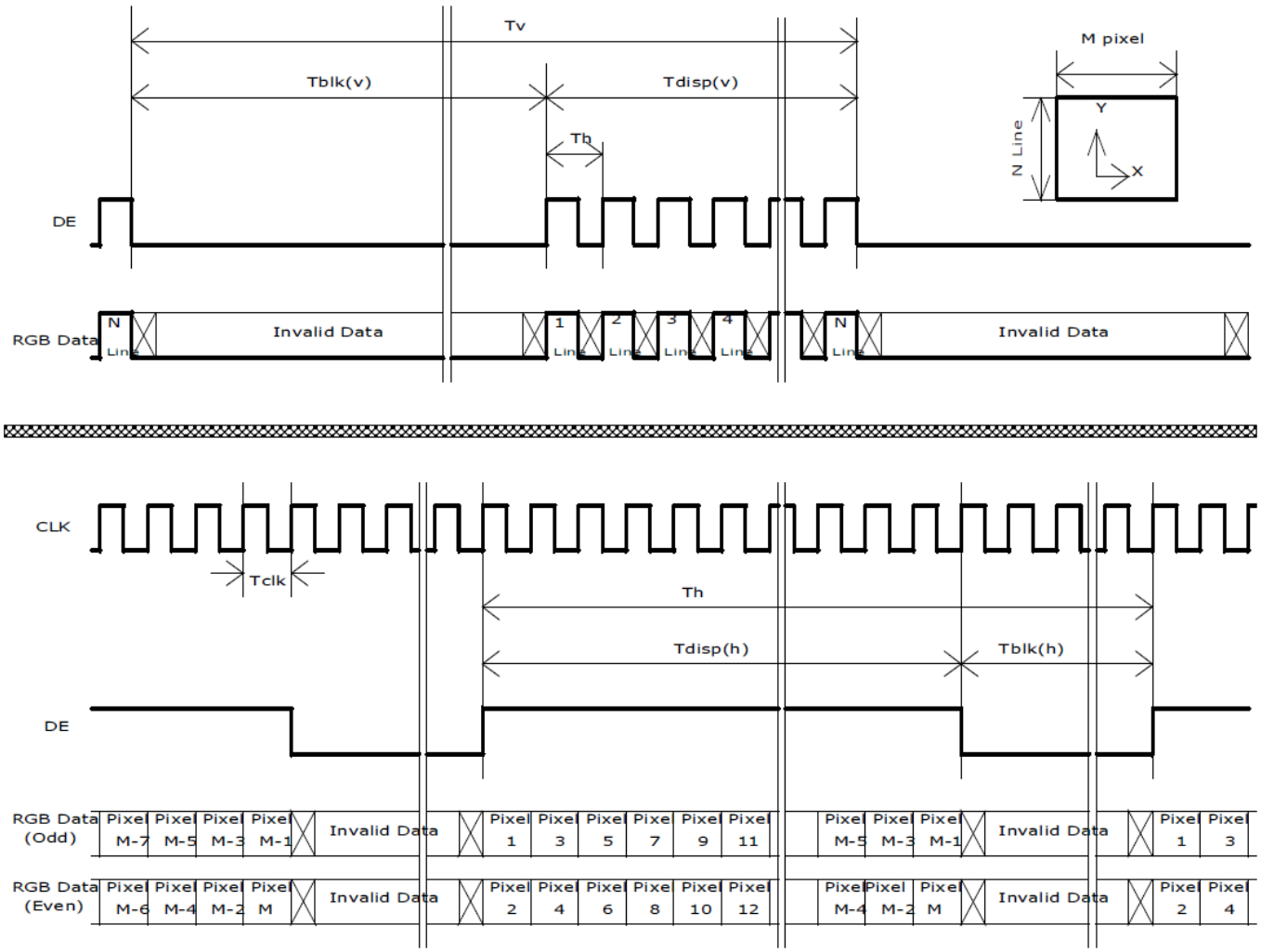
Note: The equation is listed as following. Please don't exceed the above recommended value.

Fclk (Min.) = Fv (Min.) x Th (Min.) x Tv (Min.);

Fclk (Typ.) = Fv (Typ.) x Th (Typ.) x Tv (Typ.);

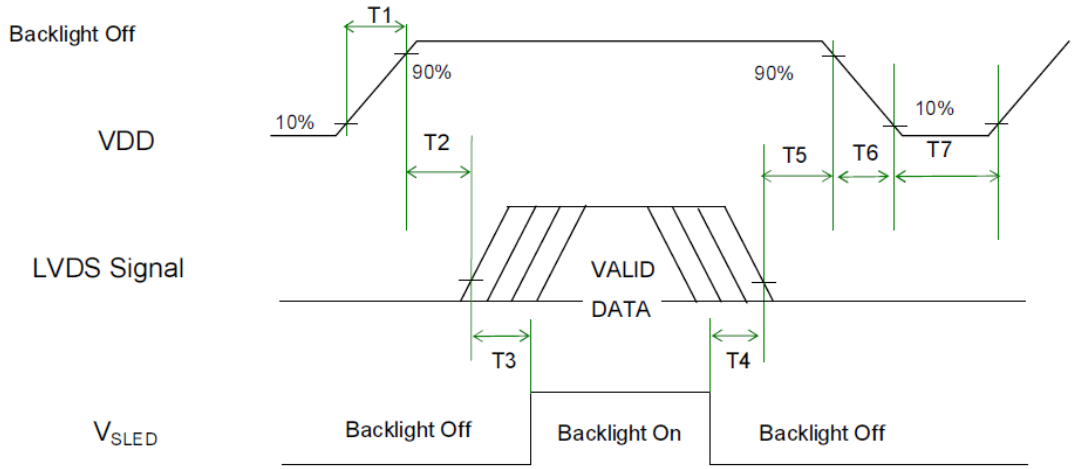
Fclk (Max.) = Fv (Max.) x Th (Typ.) x Tv (Typ.);

6.4.2 Timing Diagram



6.5 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

Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
T1	0.5	-	10	[ms]	
T2	0	-	50	[ms]	
T3	500	-	-	[ms]	
T4	100	-	-	[ms]	
T5	0		50	[ms]	***Note 3-5*** ***Note 3-6***
T6	0	-	150	[ms]	***Note 3-6***
T7	1000	-	-	[ms]	

Note: The values of the table are follow PSWG.

7.0 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

7.1.1 Connector

Connector Name / Designation	Interface Connector / Interface card
Manufacturer	JAE / P-TWO
Type Part Number	FI-XB30SSLA-HF15 / AL230T-A0G1D-P
Mating Housing Part Number	JAE FI-X30HL

7.1.2 Pin Assignment

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	VCC
29	VCC	30	VCC

7.2 Backlight Unit: LED Connector

Pin No.	Symbol	I/O	Function	Remark
1	VLED+	P	Power for LED backlight anode	White
2	VLED-	P	Power for LED backlight cathode	Black

LED Light Bar Connector is used for the integral backlight system. The recommended model is BHSR-02VS-1 manufactured by JST.

8. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 40℃, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50℃, 50%RH, 300hours	3
Low Temperature Operation (LTO)	Ta= -10℃, 300hours	
High Temperature Storage (HTS)	Ta= 60℃, 300hours	
Low Temperature Storage (LTS)	Ta= -20℃, 300hours	
Thermal Shock Test (TST)	-20℃/30min, 60℃/30min, 100 cycles	1
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 9 points, 25 times/ point.	2
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 9 points, 25 times/ point.	2

Note 1: 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 -20℃ to 60℃, 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.

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

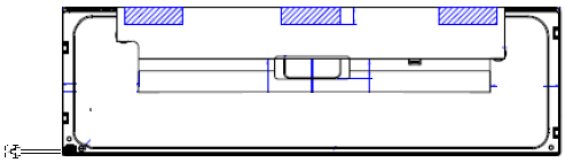
Note 3: The test items are tested by open frame type chassis.

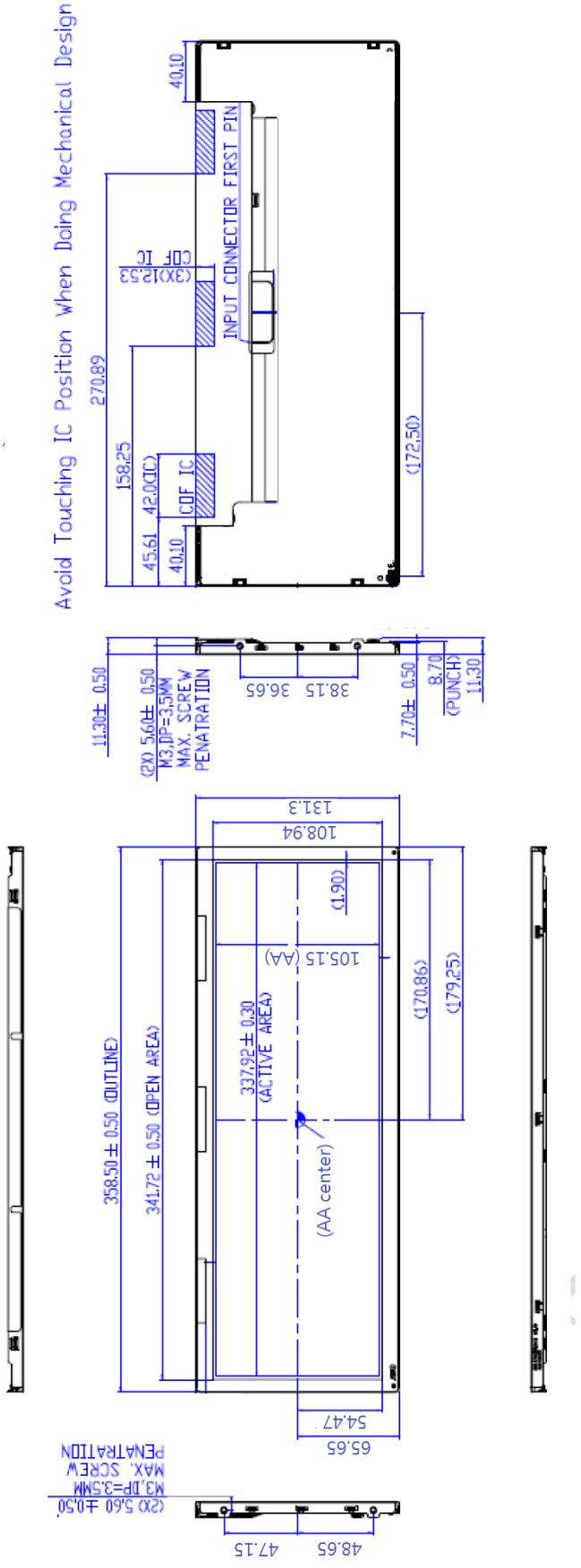
9. Shipping Label & Package

(TBD)

10. Mechanical Characteristic

(Note: the LED cable length=200 mm)




Avoid Touching IC Position When Doing Mechanical Design
40.10
INPUT CONNECTOR FIRST PIN
COF IC
(3X)12.53
270.89
158.25
42.0(IC)
COF IC
45.61
40.10
(172.50)
11.30± 0.50
(2X) 5.60± 0.50
M3.DP=3.5MM
MAX. SCREW
PENATRATION
38.15
36.65
7.70± 0.50
8.70
(PUNCH)
11.30
131.3
108.94
(1.90)
105.15 (AA)
337.92± 0.30
(ACTIVE AREA)
(170.86)
(179.25)
358.50 ± 0.50 (OUTLINE)
341.72 ± 0.50 (OPEN AREA)
(AA center)
54.47
65.65
PENATRATION
MAX. SCREW
M3.DP=3.5MM
(2X) 5.60 ±0.50
47.15
48.65