

16" 1/2 SXGA**High brightness color TFT-LCD module****Customer:****Customer Model name:****Model: VM16****Model control code : VM16BS V1****Date: Sep 06th, 2019****Version:****Note: This specification is subject to change without notice****Customer :****Approved by :****Date :****Approved****Prepared****Date:****Date:**

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RECORD OF REVISION

Version and Date	Page	Old description	New description	Remark
0.1 2019/09/06	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

VM16BS V1 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 1/2 SXGA+ (1280(H) x 512(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

- 1000 nits sunlight readable high brightness
- LED backlight
- Wide operation temperature
- RoHS Compliance

2.3 Application

Industrial Application.

2.4 Display Specifications

Items	Unit	Specification
Screen Diagonal	inch	15.9"
Active Area	mm	376.32(H) × 150.5(V)
Pixels H x V	pixels	1280 × 3(RGB) × 512
Pixels Pitch	um	0.294(per one triad) × 0.294
Pixel Arrangement		RGB Vertical stripe
Display mode		TN mode, normally white
White luminance (center)	Cd/m ²	1000 (Typ.)
Contrast ratio		1000:1 (Typ.)
Optical Response Time	msec	5 ms (Typ. on/off)
Normal Input Voltage VDD	Volt	5.0
Power Consumption (VDD Line + LED L Line)	Watt	14.4 (Typ.) (VDD line=2.7W; LED line=11.7 W)
Weight	Grams	TBD (Typ.)
Physical size	mm	396 (H) x 173.6 (V) x 12.3 (D) (Typ)
Electrical Interface		2 Channel LVDS
Support Colors		16.7M colors (RGB 6-bits +Hi-FRC data)
Surface Treatment		Anti-Glare, 3H
Temperature range		
Operating	°C	-10 ~ 50
Storage (Shipping)	°C	-20 ~ 60
RoHS Compliance		RoHS Compliance

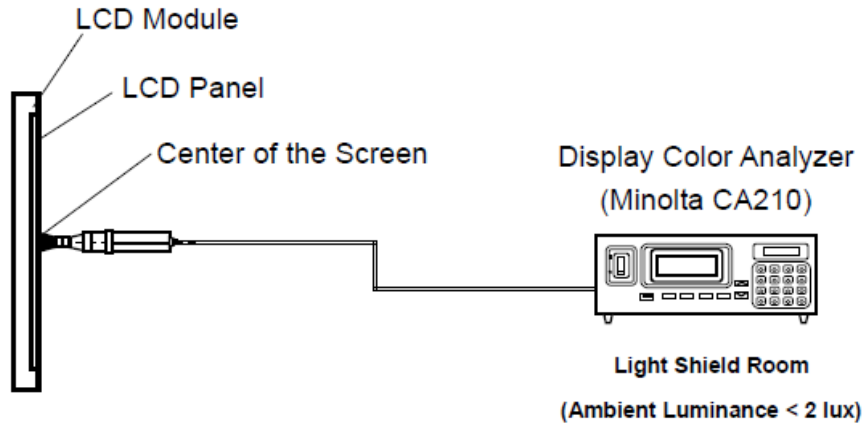
2.5 Optical Characteristics

The following optical characteristics are measured under stable condition at 25 °C

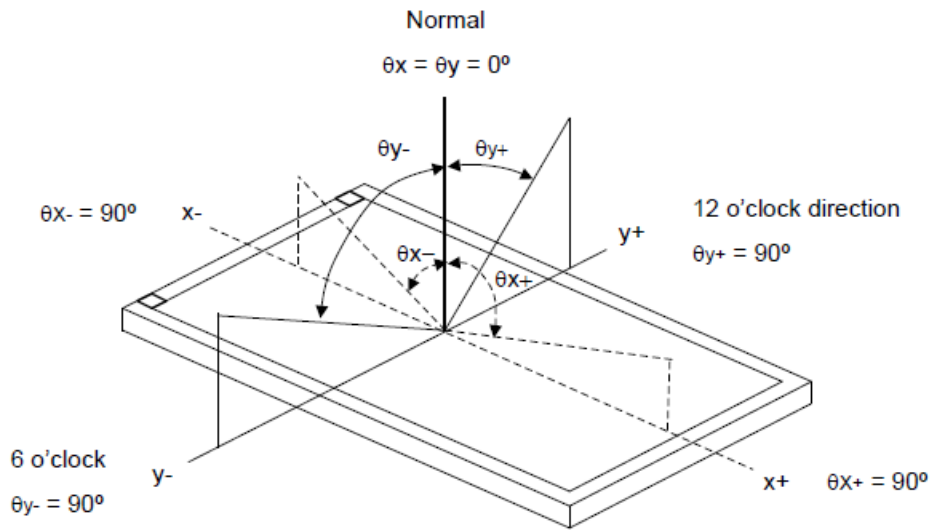
Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right) CR=10 (Left)	160	170		2
		Vertical (Up) CR=10 (Down)	150	160		
Contrast Ratio		Normal Direction	600	1000		3
Response Time	msec	Raising time (T _{rR})		3.6		4
		Falling time (T _{rF})		1.4		
		Raising + Falling		5		
Color / Chromaticity Coordinates (CIE)		Red x	-0.04	0.64	+0.04	5
		Red y		0.35		
		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		800	1000		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.



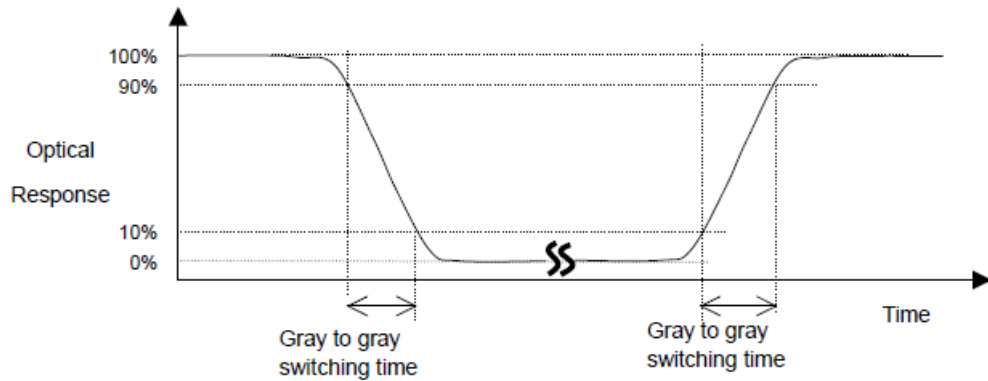
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA210

Note 4: Definition of Response time

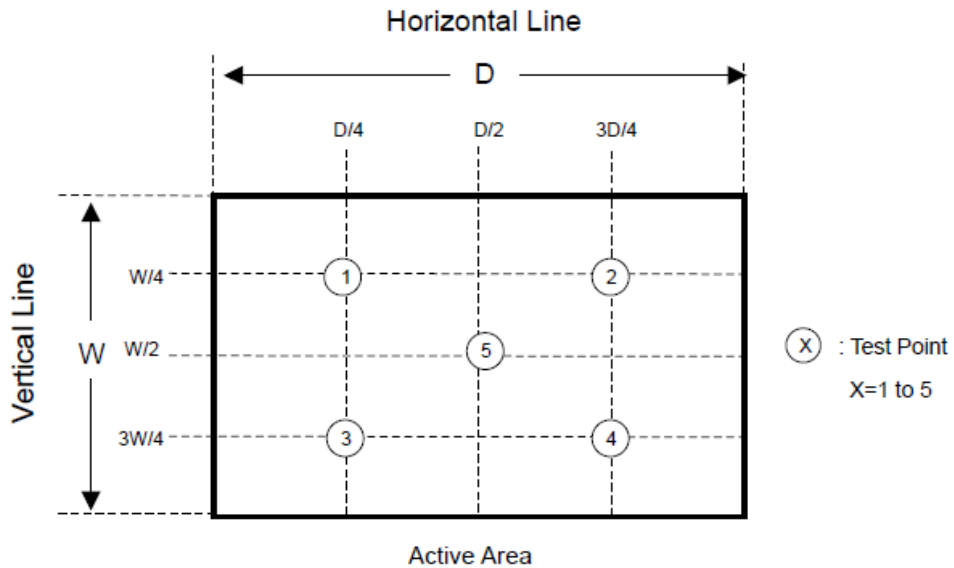
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as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



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

Note 6: Center luminance is measured by Minolta CA210

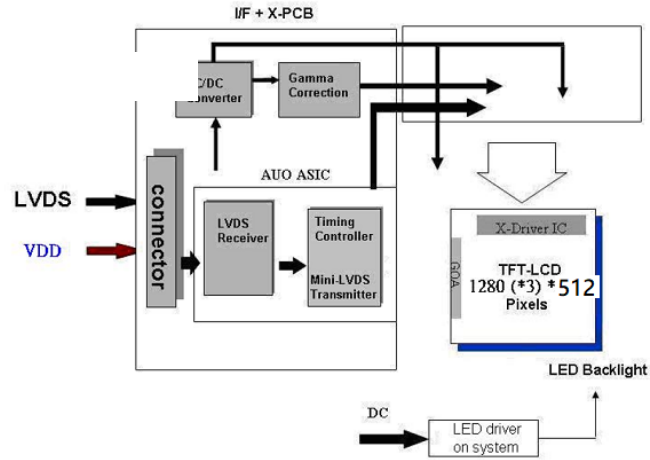
Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210



$$\text{Uniformity} = (\text{Min. Luminance of 5 points}) / (\text{Max. Luminance of 5 points})$$

3. Functional Block Diagram

The following diagram shows the functional block of the 19 inches Color TFT-LCD Module:



I/F PCB Interface:

FI-XB30SSL-HF15 / MSBKT2407P30HB

Mating Type:

FI-X30HL (Locked Type)

FI-X30H (Unlocked 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	V _{in}	-0.3	6	Volt	Note 1, 2

4.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED Current	I _{LED}		640	mA	Note 1, 2

4.3 Absolute Ratings of Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T _{OP}	-10	-	50	°C	Note 3
Operation Humidity	H _{OP}	8		90	%	
Storage temperature	T _{ST}	-20		60	°C	
Storage Humidity	H _{ST}	8		90	%	

Note 1: With in T_a= 25°C

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

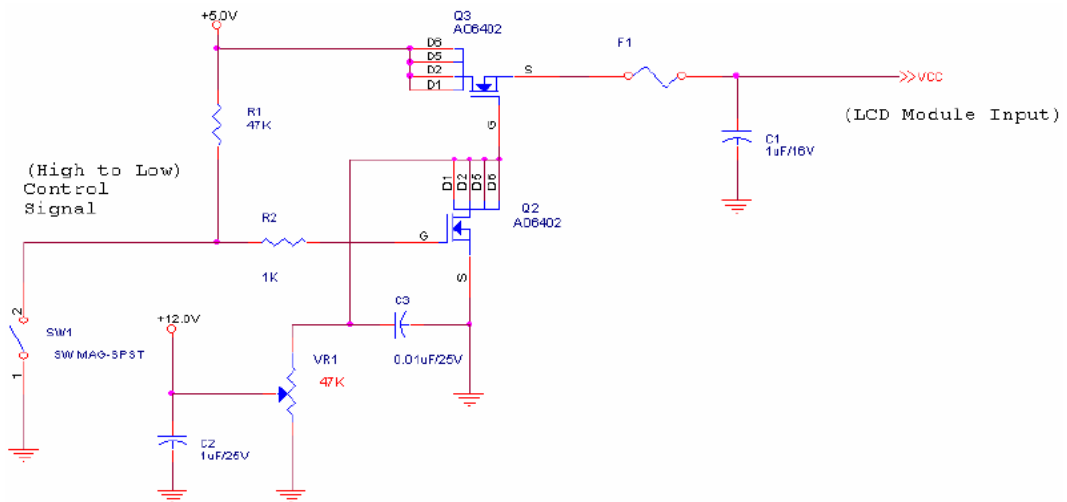
5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are as follows

Symbol	Description	Min	Typ.	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	+/-10%
IDD1	Input Current	-	0.53	0.64	[A]	VDD= 5.0V, All black Pattern at 60 Hz
		-	0.61	0.73	[A]	VDD= 5.0V, All black Pattern at 75 Hz
PDD1	VDD Power	-	2.7	3.2	[Watt]	VDD= 5.0V, All black Pattern at 60 Hz
		-	3.05	3.7	[Watt]	VDD= 5.0V, All black Pattern at 75 Hz
IRush	Inrush Current	-	-	3	[A]	Note 1
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	500	[mV] p-p	VDD= 5.0V, All black Pattern at 75 Hz

Note: Measurement conditions:

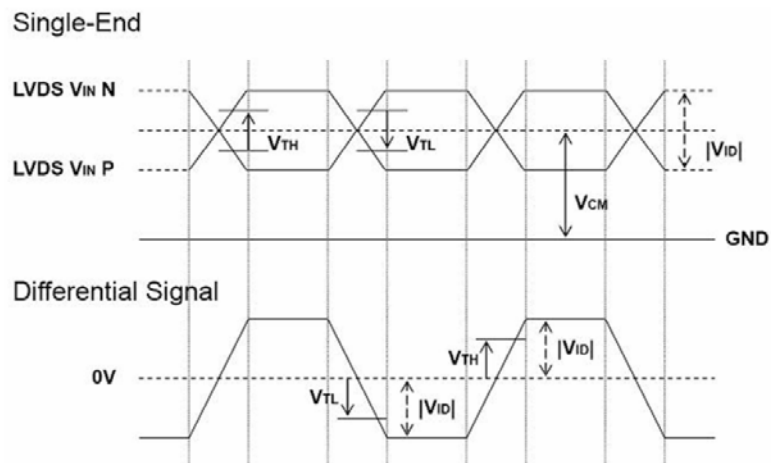


5.1.2 Signal Electrical Characteristics

(1) DC Characteristics of each signal are as following:

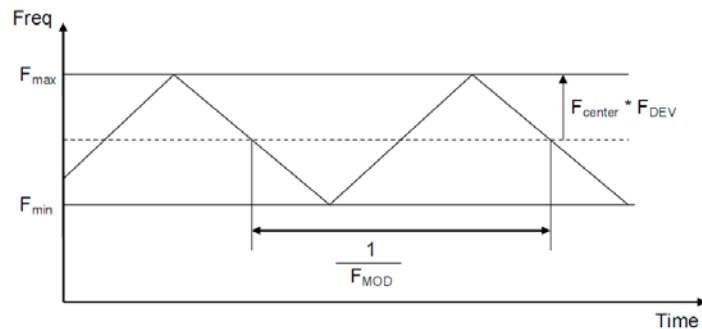
Symbol	Description	Min	Typ	Max	Units	Conditions
V_{TH}	Differential Input High Threshold	-	-	+100	[mV]	$V_{CM} = 1.2V$ Note 1
V_{TL}	Differential Input Low Threshold	-100	-	-	[mV]	$V_{CM} = 1.2V$ Note 1
$ V_{ID} $	Input Differential Voltage	100	-	600	[mV]	Note 1
V_{CM}	Differential Input Common Mode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

Note 1: LVDS Signal Waveform



(2) AC Characteristics

Symbol	Description	Min	Max	Units	Conditions
F_{DEV}	Maximum deviation of input clock frequency during SSC	-	± 3	%	
F_{MOD}	Maximum modulation frequency of input clock during SSC	-	200	KHz	



< Spread Spectrum >

5.2 Backlight Unit

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

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		27.9		[V]	2
LED current (IL)		420		[mA]	2,
BL power consumption		11.7		W	
LED Life Time(LTLED)		50,000		[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°C and typical LED Current at 420 mA .

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

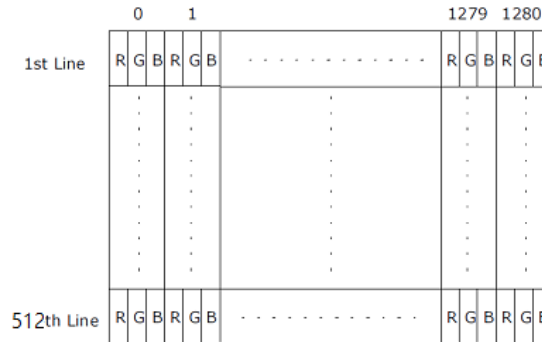
Note 3: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference ($IL \times VL \times 1 = PLED$)

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

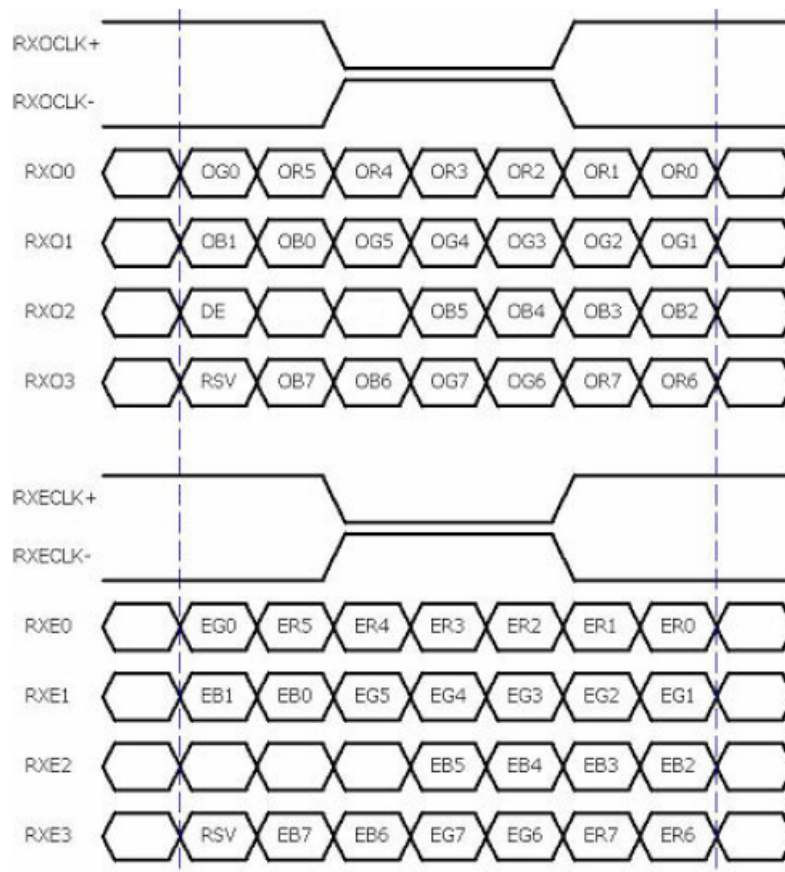
6.1 Pixel Format Image

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



(Note: due to the mechanical tolerance, the display line number is 510~512)

6.2 The Input Data Format



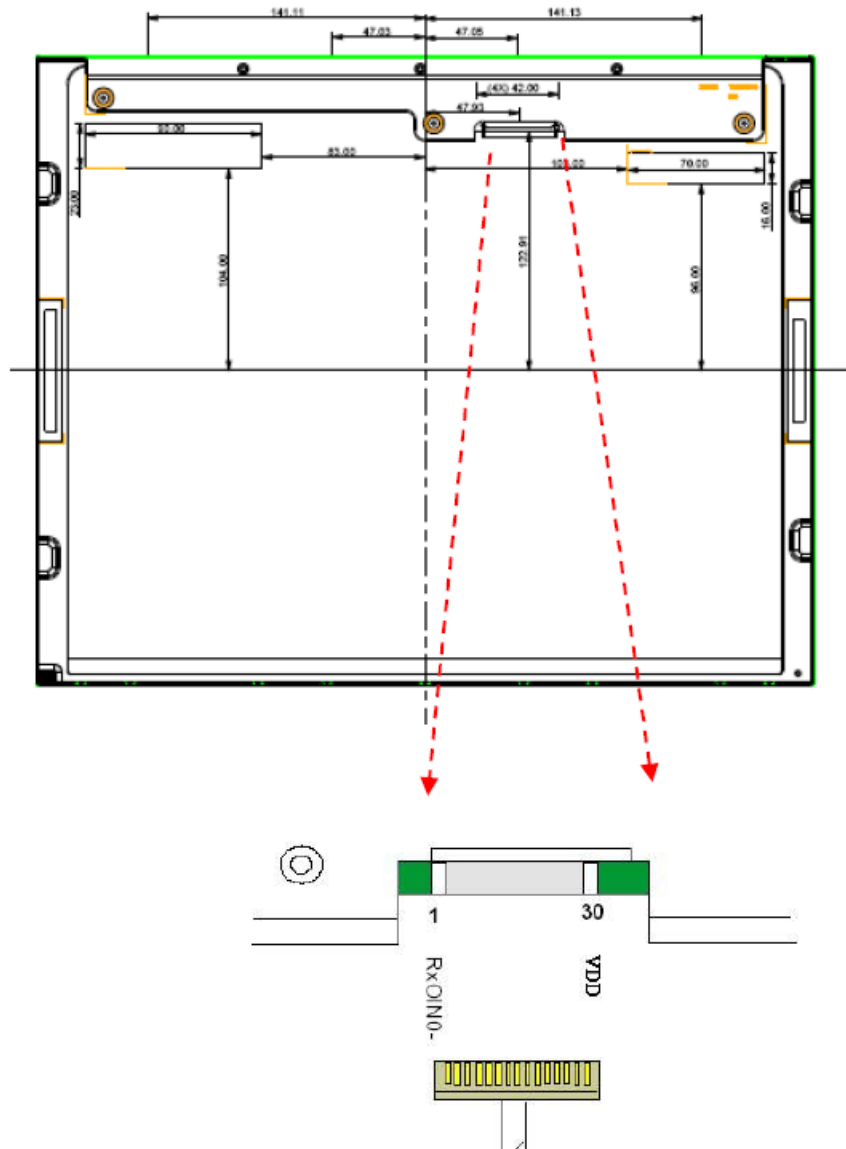
Note 1: R/G/B data 7:MSB, R/G/B data 0:LSB O = "Odd Pixel Data" E = "Even Pixel Data"

6.3 Signal Description

PIN #	SIGNAL NAME	DESCRIPTION
1	RxOIN0-	Negative LVDS differential data input (Odd data)
2	RxOIN0+	Positive LVDS differential data input (Odd data)
3	RxOIN1-	Negative LVDS differential data input (Odd data)
4	RxOIN1+	Positive LVDS differential data input (Odd data)
5	RxOIN2-	Negative LVDS differential data input (Odd data, DSPTMG)
6	RxOIN2+	Positive LVDS differential data input (Odd data, DSPTMG)
7	GND	Power Ground
8	RxOCLK-	Negative LVDS differential clock input (Odd clock)
9	RxOCLK+	Positive LVDS differential clock input (Odd clock)
10	RxOIN3-	Negative LVDS differential data input (Odd data)
11	RxOIN3+	Positive LVDS differential data input (Odd data)
12	RxEIN0-	Negative LVDS differential data input (Even data)
13	RxEIN0+	LVDS differential data input (Even data)
14	GND	Power Ground
15	RxEIN1-	Negative LVDS differential data input (Even data)
16	RxEIN1+	Positive LVDS differential data input (Even data)
17	GND	Power Ground
18	RxEIN2-	Negative LVDS differential data input (Even data)
19	RxEIN2+	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	RxEIN3-	Negative LVDS differential data input (Even data)
23	RxEIN3+	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

Note 1: Input signals of odd and even clock shall be the same timing.

Note1: Start from left side



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

Note3: Please follow VESA.

6.4 Timing Characteristics

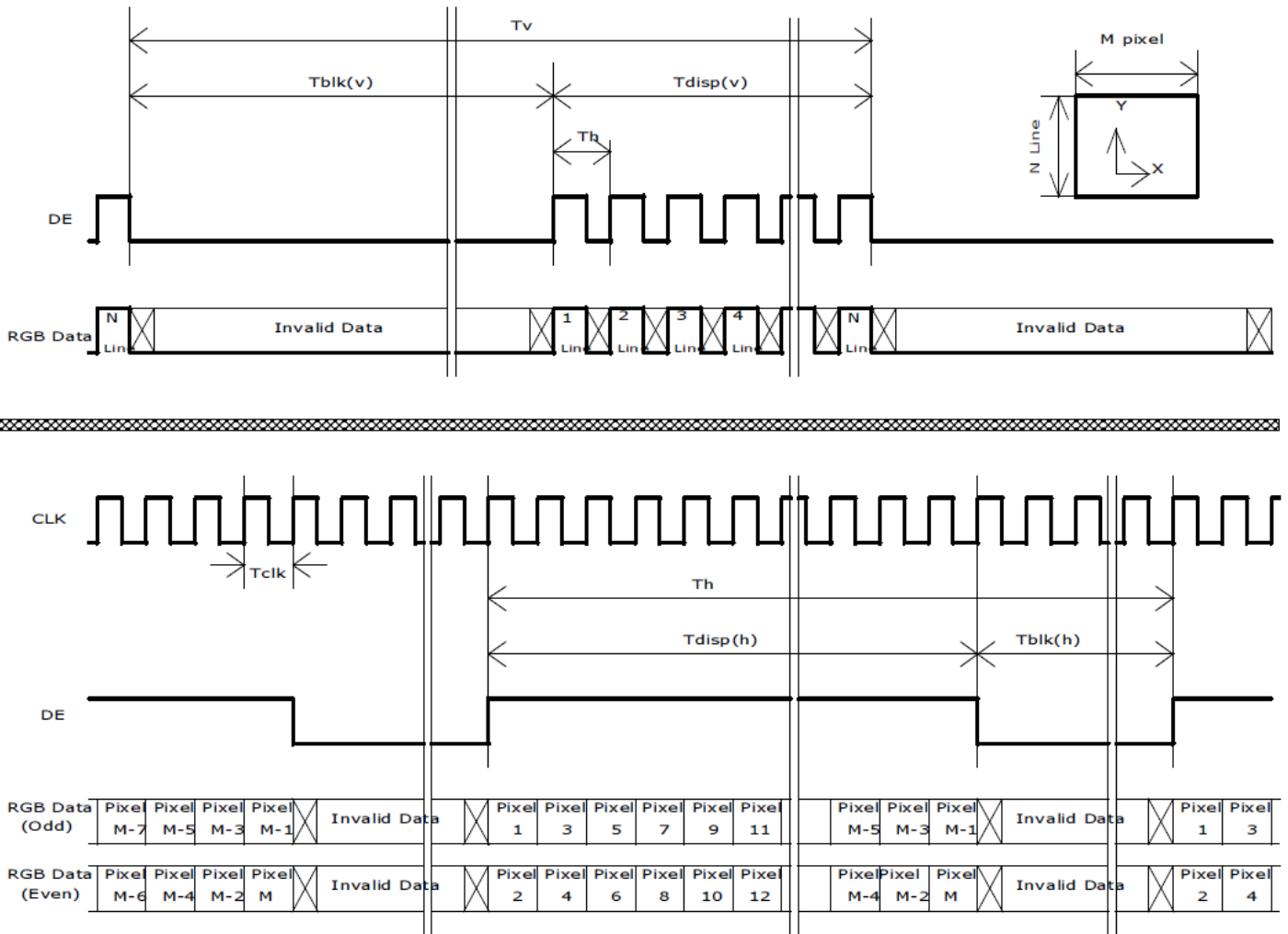
The input signal timing specifications are shown as the following table

Signal	Item	Symbol	Min	Typ	Max	Unit
Vertical Section	Period	Tv	1036	1066	1873	Th
	Active	Tdisp(v)	1024	1024	1024	Th
	Blanking	Tbp(v)+Tfp(v)+PWvs	12	42	849	Th
Horizontal Section	Period	Th	730	844	1320	Tclk
	Active	Tdisp(h)	640	640	640	Tclk
	Blanking	Tbp(h)+Tfp(h)+PWhs	90	204	680	Tclk
Clock	Period	Tclk	14.6	18.5	26.4	ns
	Frequency	Freq	37.8	54	68.4	MHz
Frame rate	Frame rate	F	50	60	76	Hz
Hsync Frequency	Hsync Frequency	HFreq	51.8	64	93.7	KHz

Note:

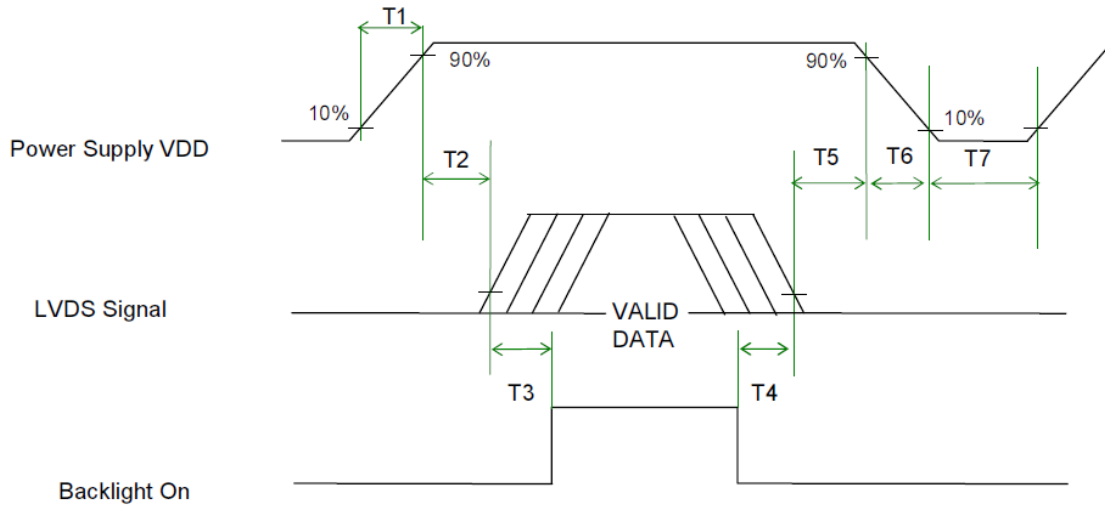
DE Only mode operation.

6.5 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

Parameter	Value			Unit
	Min.	Typ.	Max.	
T1	0.5	-	10	[ms]
T2	0	-	50	[ms]
T3	500	-	-	[ms]
T4	100	-	-	[ms]
T5	0	-	50	[ms] <i>Note 1,2</i>
T6	5	-	100	[ms] <i>Note 1,2</i>
T7	1000	-	-	[ms]

Note1: Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

Note2: During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

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

Connector

Connector Name / Designation	Interface Connector / Interface Card
Manufacturer	P-TWO / STM
Type Part Number	187034-30091 / MSBKT2407P30HB
Mating Housing Part Number	FI-X30HL (Locked Type)

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 (for AUO test only. Do not connect)	26	NC (for AUO test only. Do not connect)
27	NC (for AUO test only. Do not connect)	28	VDD
29	VDD	30	VDD

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= 50°C, 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50°C, 50%RH, 300hours	3
Low Temperature Operation (LTO)	Ta= -10°C, 300hours	
High Temperature Storage (HTS)	Ta= 60°C, 300hours	
Low Temperature Storage (LTS)	Ta= -20°C, 300hours	
Drop Test	Height: 60 cm, package test	
Thermal Shock Test (TST)	-20°C/30min, 60°C/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°C to 60°C, 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.

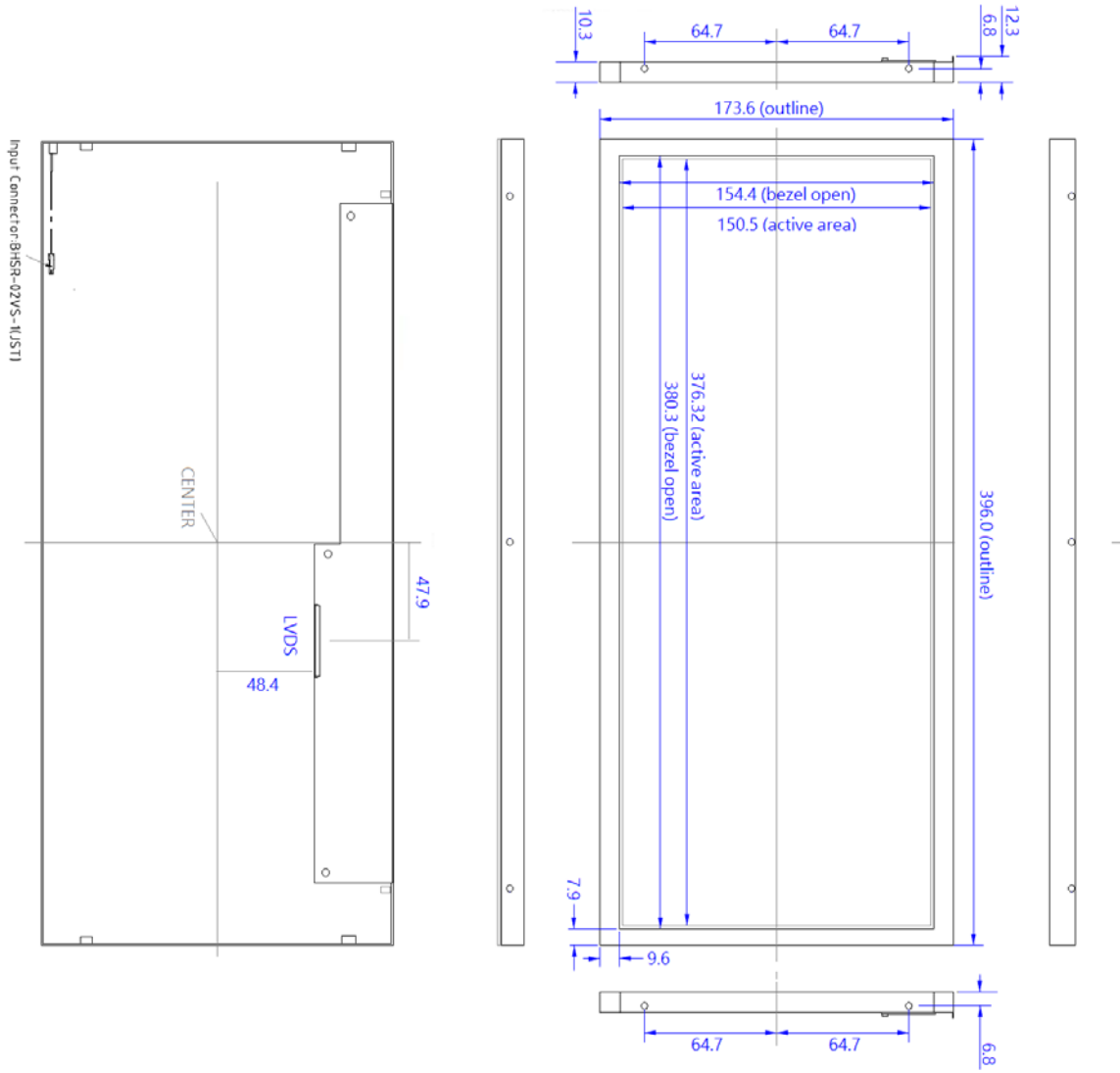
Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

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

9. Shipping Label & Package
(TBD)

(Original panel package)

10. Mechanical Characteristic (TBD)



(LED cable length: 200 mm)