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MDT156005	1366 x 768	LVDS Interface	TFT Module
Specification			
Version: 1		Date: 15/06/2022	
Revision			
1	13/06/2022	First issue	

Display Features	
Display Size	15.6"
Resolution	1366 x 768
Orientation	Landscape
Appearance	RGB
Logic Voltage	3.3V
Interface	LVDS
Brightness	2500 cd/m^2
Touchscreen	---
Module Size	363.8 x 215.9 x 9.07 mm
Operating Temperature	-30°C ~ +85°C
Pinout	30 way FFC
Pitch	1.0 mm

RoHS compliant

Created By	Checked By
RV	WE
Box Quantity	Weight / Display
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Display Accessories	
Part Number	**Description**
MDIB-CC1	Interconnect board for standard pitch pinouts to fine pitch wires. Providing pinouts for 2.54 pinout. 1.27, 1, 0.845, 0.8, 0.7, 0.65, 0.62, 0.6, 0.5 & 0.3 pads.
MCIB14/16	HDMI-to-LVDS interface board, with voltage generation.

Optional Variants	
Appearances	**Voltage**

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) 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.

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2. General Description

2.1 Overview

This specification applies to the Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display a LED backlight system. The screen format is intended to support (1366(H) x 768(V)) HD mode screen and 16.7M colors.
LED driving board for backlight unit is not included.

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2.2 Features

- Sunlight readable display, 2500nits by LED backlight.
- 100K Hrs backlight life design
- Wide viewing angle
- Low power consumption
- Wide operation temperature
- RoHS Compliance

2.3 Application

Industrial Application

2.4 Display specifications

Items	Unit	Specification
Screen Diagonal	inch	15.6
Active Area	mm	344.232 (H) x 193.536 (V)
Pixels H x V	pixels	1366 x3(RGB) x 768
Pixels Pitch	um	252 (per one triad) x 252
Pixel Arrangement		RGB Vertical stripe
Display mode		TN mode, normally White
White luminance (center)	Cd/m^2	2500 (Typ.)
Contrast ratio		800 (Typ.)
Optical Response Time	msec	10 ms (Typ. on/off)
Normal Input Voltage Vcc	Volt	3.3
Power Consumption (Vcc Line + LED backlight)	Watt	19.56 W (Vcc line=0.66W , LED line=18.9 W)
Weight	Grams	480 max.
Physical size	mm	363.8(H) x 215.9(V) x 9.07(D)
Electrical Interface		One Chanel LVDS
Support Colors		16.7 M colors
Surface Treatment		Anti-Glare, 3H
Temperature range Operating Storage (Shipping)	 ^0C ^0C	 -30~ 85 (TFT surface) -30 ~ 85
RoHS Compliance		RoHS Compliance

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2.5 Optical characteristics

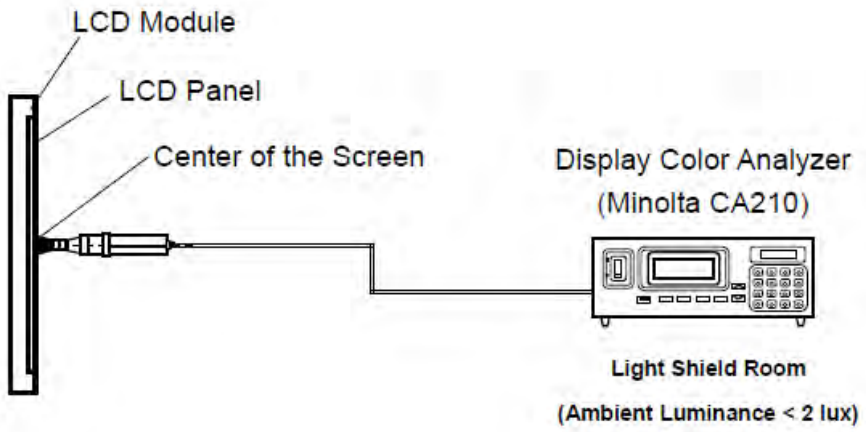
The following optical characteristics are measured under stable condition at 25 ^{0}C

Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right)	75	85		2
		CR=10 (Left)	75	85		
		Vertical (Up)	40	50		
		CR=10 (Down)	70	80		
Contrast Ratio		Normal Direction	500	800		3
Response Time	msec	Raising + Falling		10		4
Color / Chromaticity Coordinates (CIE)		Red x	-0.05	0.620	+0.05	5
		Red y		0.350		
		Green x		0.324		
		Green y		0.620		
		Blue x		0.153		
		Blue y		0.104		
Color coordinates (CIE) White		White x		0.313		
		White y		0.329		
Center Luminance	Cd/m^2		2000	2500		6
Luminance Uniformity	%		70	75		7
Crosstalk (in 60 Hz)	%				1.5	
Flicker	dB				-20	

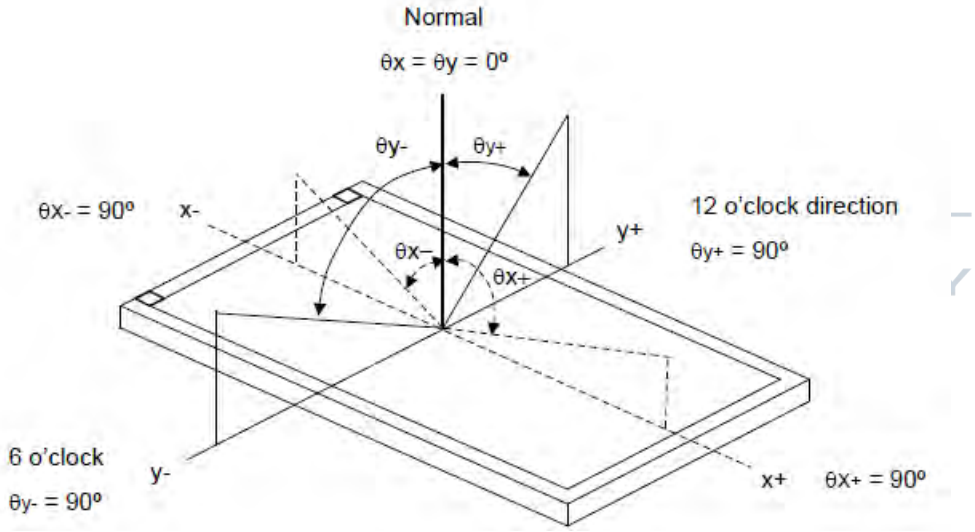
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Note 1: Measurement method

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.



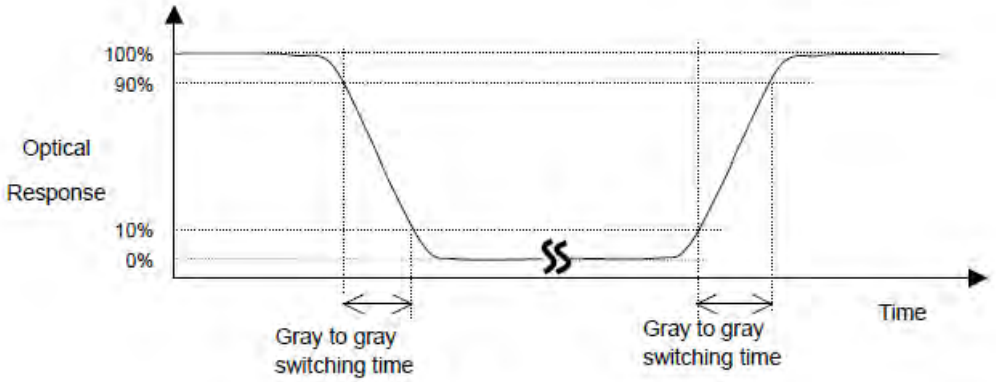
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA 210

Note 4: Definition of Response time

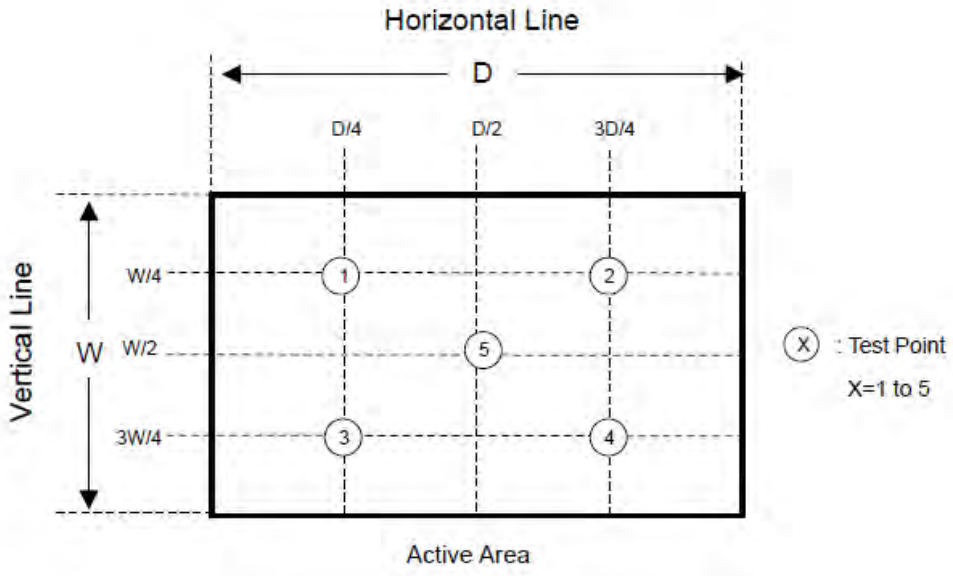
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as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



Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA 210

Note 6: Center luminance is measured by Minolta CA 210

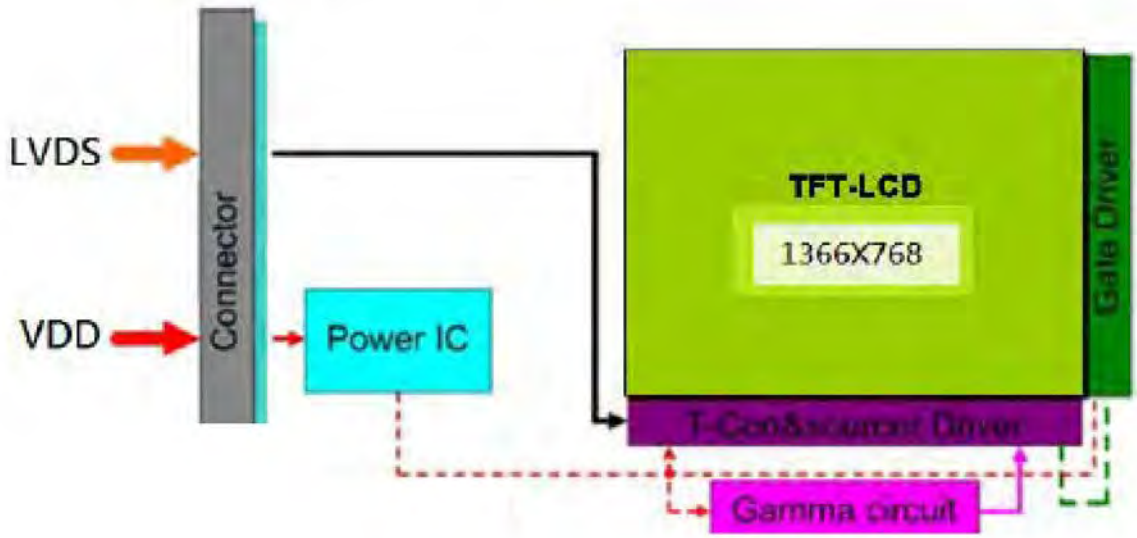
Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA 210



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

3. Functional Block Diagram

The following diagram shows the functional block of the 15.6 inches Color TFT-LCD Module:



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3.1 Interface connections

LVDS I/O PIN ASSIGNMENT

Pin no	Symbol	Function	Rmark
1	Reserved	No Connection	
2	Reserved	No Connection	
3	Reserved	No Connection	
4	GND	Ground	
5	RXIN0-	- LVDS Differential Data Input, CH0	
6	RXIN0+	+ LVDS Differential Data Input, CH0	
7	GND	Ground	
8	RXIN1-	- LVDS Differential Data Input, CH1	
9	RXIN1+	+ LVDS Differential Data Input, CH1	
10	GND	Ground	
11	RXIN2-	- LVDS Differential Data Input, CH2	
12	RXIN2+	+ LVDS Differential Data Input, CH2	
13	GND	Ground	
14	RXCLKIN-	- LVDS Differential Clock Input, CH3	
15	RXCLKIN+	+ LVDS Differential Clock Input, CH3	
16	GND	Ground	
17	RXIN3-	- LVDS Differential Data Input, CH3	
18	RXIN3+	+ LVDS Differential Data Input, CH3	
19	GND	Ground	
20	Reserved	No Connection	
21	Reserved	No Connection	
22	Reserved	No Connection	
23	GND	Ground	
24	GND	Ground	
25	GND	Ground	
26	VDD	Power +3.3V	
27	VDD	Power +3.3V	
28	VDD	Power +3.3V	
29	VDD	Power +3.3V	
30	VDD	Power +3.3V	

Note (1) Input Signals shall be in low status VDD is off.

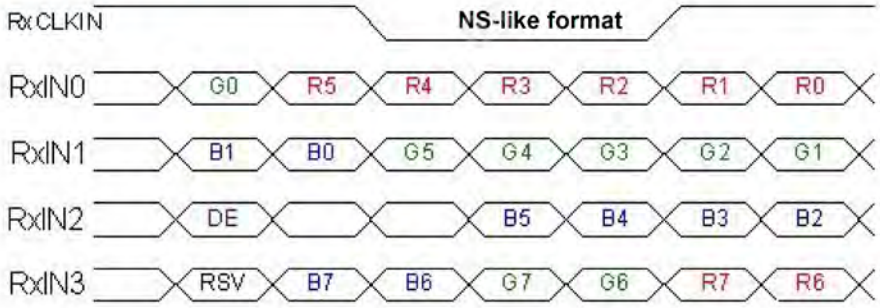
Note (2) High stands for 3.3V, Low stands for 0V, NC means No Connctor.

Note (3) RSV means Reserved.

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3.2 The input data format

LVDS Input format



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 Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0	Red-pixel Data For 8Bits LVDS input MSB: R7 ; LSB: R0
G7 G6 G5 G4 G3 G2 G1 G0	Green Data 7 Green Data 6 Green Data 5 Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0	Green-pixel Data For 8Bits LVDS input MSB: G7 ; LSB: G0
B7 B6 B5 B4 B3 B2 B1 B0	Blue Data 7 Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0	Blue-pixel Data For 8Bits LVDS input MSB: B7 ; LSB: B0
RxCLKIN	LVDS Data Clock	
DE	Data Enable Signal	When the signal is high, the pixel data shall be valid to be displayed.

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

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 input voltage	V_{DD}	-0.3	+4.0	Volt	

4.2 Backlight Unit

Items	Symbol	Min	Max	Unit	Conditions
LED Current	I_{LED}	--	840	mA	Note 1, 2

4.3 Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T_{OP}	-30	-	85	^{0}C	Note 3
Operation Humidity	H_{OP}	5		90	%	
Storage temperature	T_{ST}	-30		85	^{0}C	
Storage Humidity	H_{ST}	5		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).

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5. Electrical Characteristics

5.1 TFT LCD module

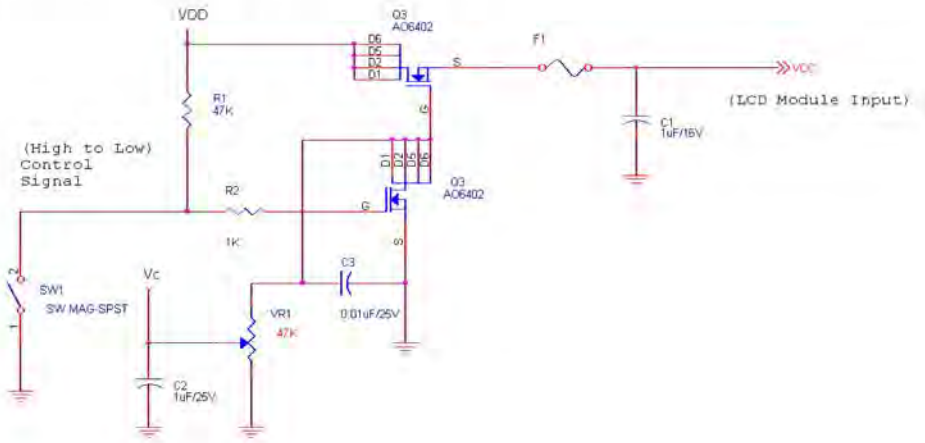
5.1.1 Power Specification

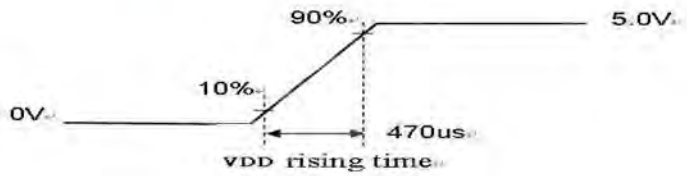
Input power specifications are as following:

Symbol	Parameter	Min	Typ	Max	Unit	Conditions
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	+/-10%
IDD	VDD Current ,Input Current	-	0.20	0.24	[A]	VDD= 3.3V, All Black Pattern At 60Hz *Note 1
IRush	LCD Inrush Current	-	-	2.0	[A]	*Note 2
PDD	VDD Power	-	0.66	0.79	[Watt]	VDD= 3.3V, All Black Pattern At 60Hz
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	VDD= 3.3V, All Black Pattern At 60Hz

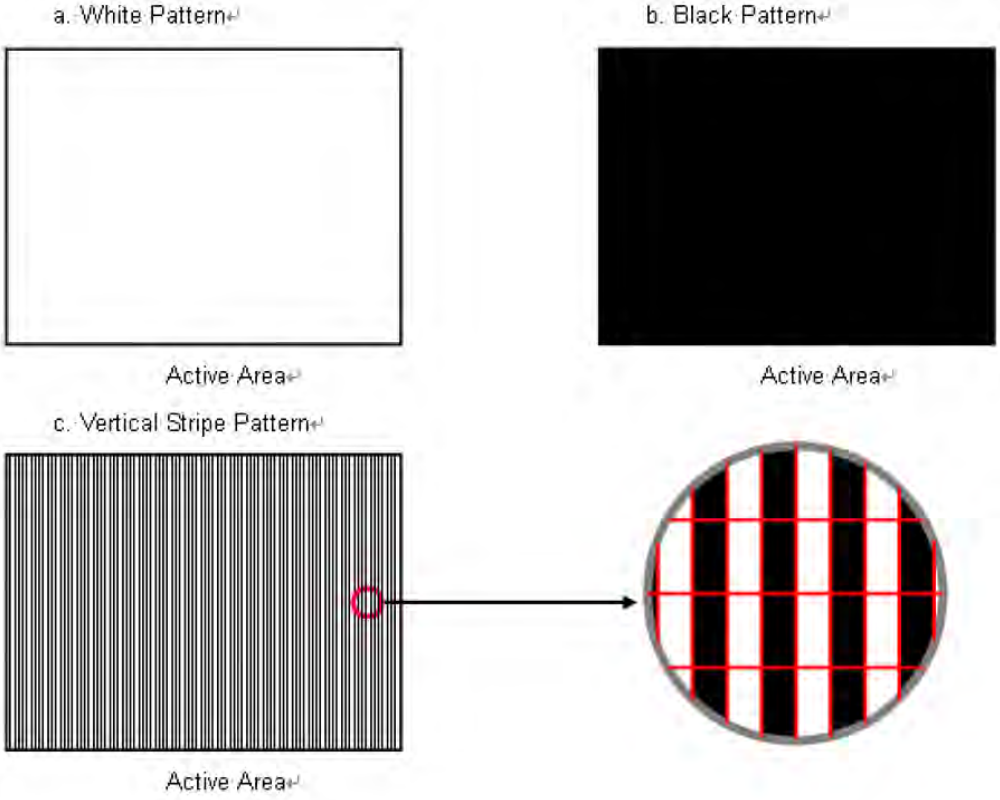
Note 1: Current fuse is built in a module. Current capacity of power supply for VDD should be larger than 2A design value, so that the fuse can be opened at the trouble of electrical circuit of module.

Note 2: Measurement conditions:
The duration of rising time of power input is 470 us.





Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 ± 2 °C, Fr = 75Hz, whereas a power dissipation check pattern below is displayed.



Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition

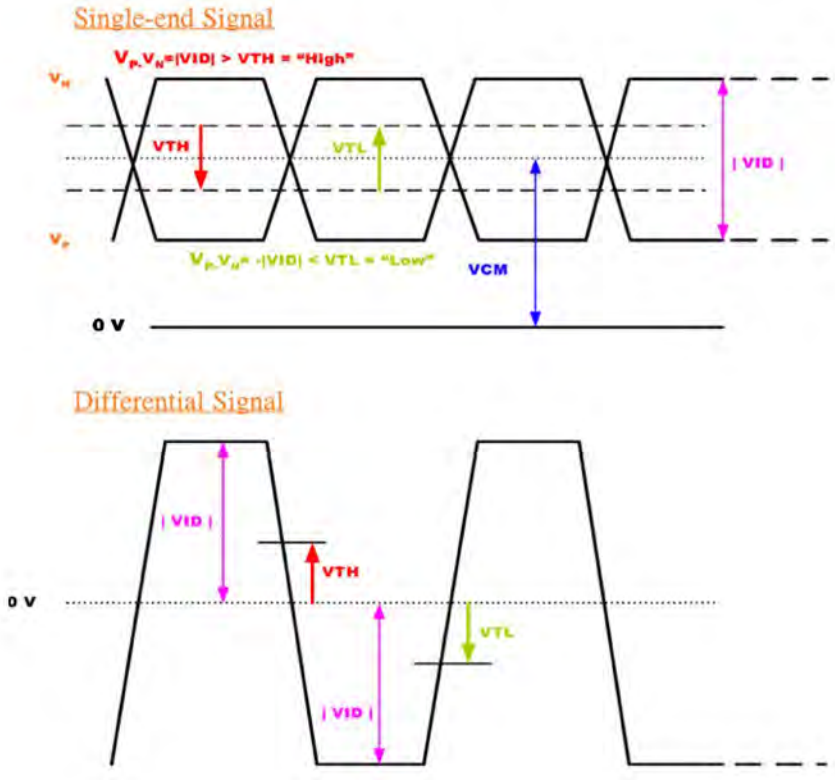
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5.1.2 LVD signal DC electrical characteristics

Symbol	Parameter	Min	Typ	Max	Units	Condition
VTH	Differential Input High Threshold	-	+50	+100	[mV]	VICM = 1.2V
VTL	Differential Input Low Threshold	-100	-50	-	[mV]	VICM = 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 (Max)

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

Note : LVDS Signal Waveform



5.2 Backlight unit

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

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		27		[V]	2
LED current (IL)		350		[mA]	2,
LED Power (PL)		18.9		[W]	
LED Life Time(LTLED)		100,000		[Hour]	1

Note 1: The “LED lift 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 (Long lifetime mode).

LED Light bar connector (CN2、CN3)

Recommended connector : BHSR-02VS-1 manufactured by JST

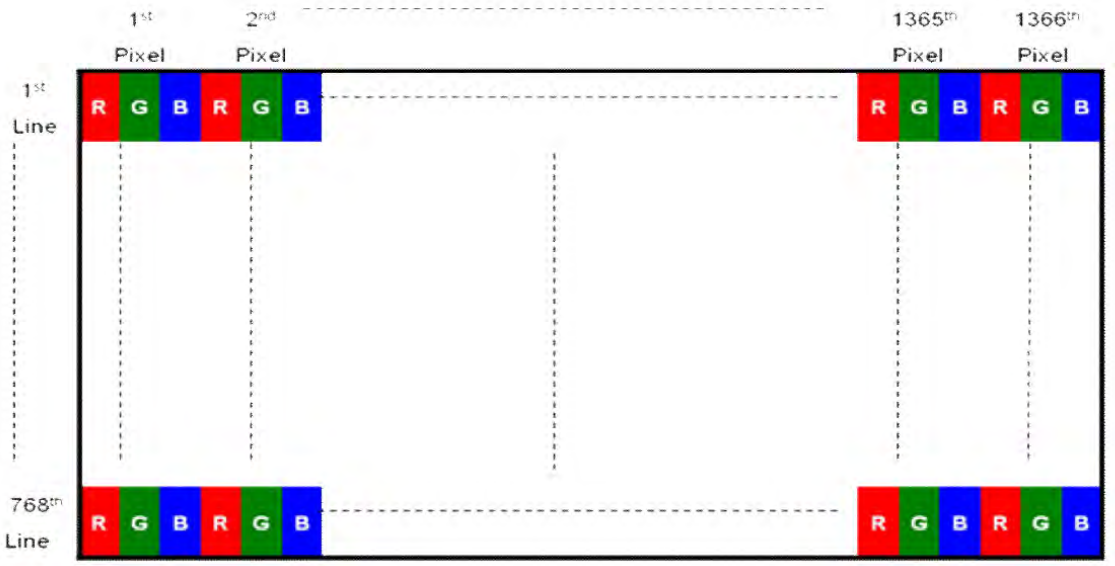
Pin no	Symbol	I/O	Description	Remark
1	VLED+	P	Backlight LED anode	Red
2	VLED-	P	Backlight LED cathode	Black

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6. Signal characteristic

6.1 Pixel format image

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



TFT LCD Module: LVDS Connector

Connector Name / Designation	Signal Connector
Manufacturer	JAE / STM
Connector Model Number	FI-XB30SSL-HF15 / MSBKT2407P30HB or compatible
Adaptable Plug	FI-X30HL (Locked Type) or compatible

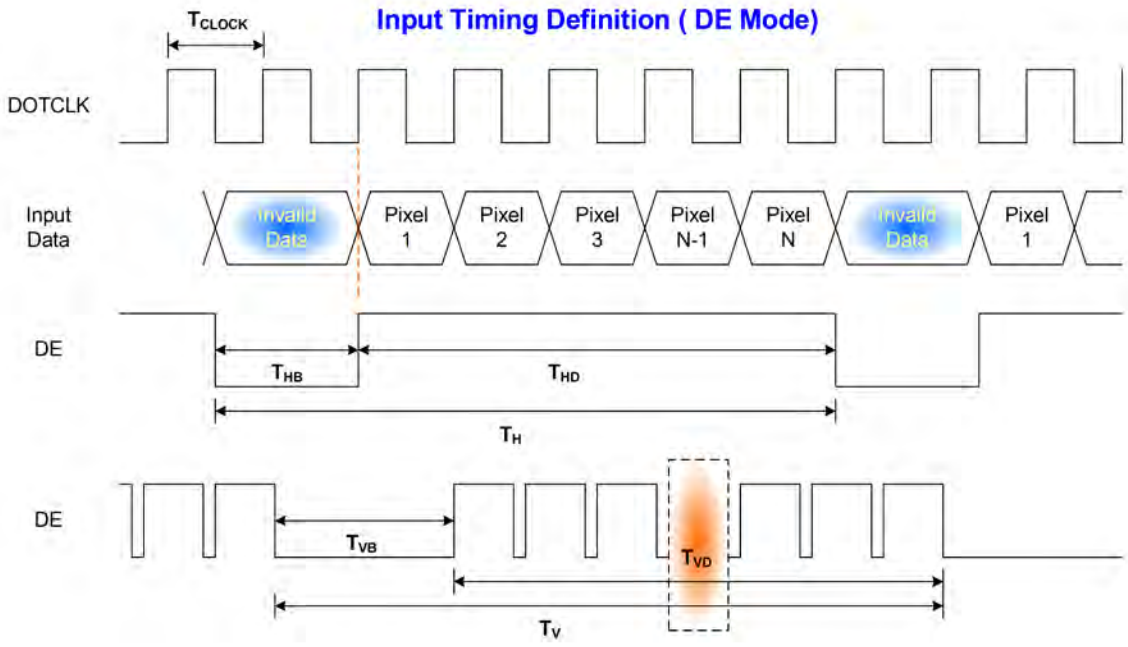
6.2 Display timing specifications

Signal		Symbol	Min	Typ	Max	Unit
Clock Frequency		1/ T_{Clock}	60	76	90	MHz
Vertical Section	Period	T_V	1446	1566	1936	T_{Line}
	Active	T_{VD}	1366	1366	1366	
	Blanking	T_{VB}	80	200	570	
Horizontal Section	Period	T_H	778	806	888	T_{Clock}
	Active	T_{HD}	768	768	768	
	Blanking	T_{HB}	10	38	120	
Frame Rate		F	50	60	75	Hz

Note: 1. The maximum Frame Rate < 90MHz / [(V_Period)*(H_Period)]

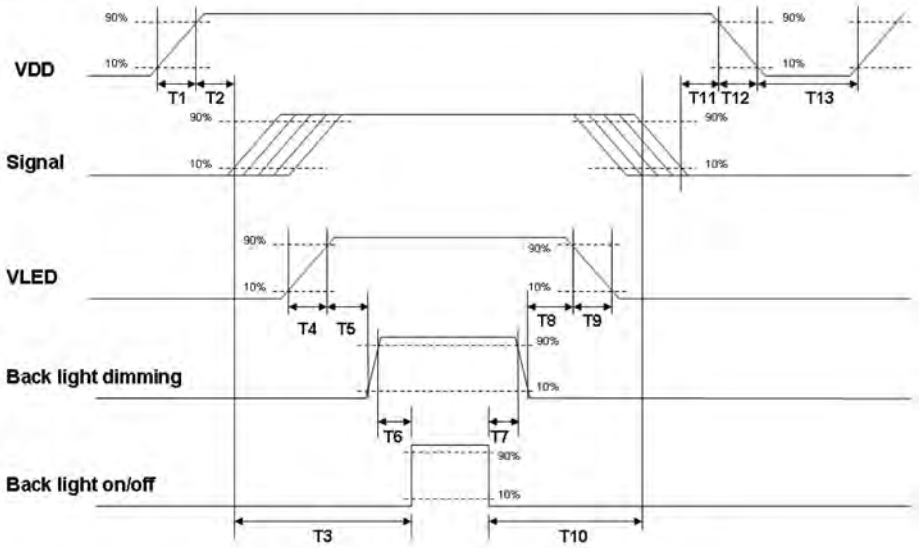
2. Support DE mode only.

3. Typical value refer to VESA STANDARD



6.3 Power ON/OFF for LCD

VDD power and LED on/off sequence are as follows. 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	0	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	0.5	16	50	[ms]
T12	-	-	100	[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

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50℃, 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 85℃, 240hours	3
Low Temperature Operation (LTO)	Ta= -30℃, 240hours	
High Temperature Storage (HTS)	Ta= 85℃, 240hours	
Low Temperature Storage (LTS)	Ta= -30℃, 240hours	
Thermal Shock Test (TST)	-10℃/30min, 60℃/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 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.	

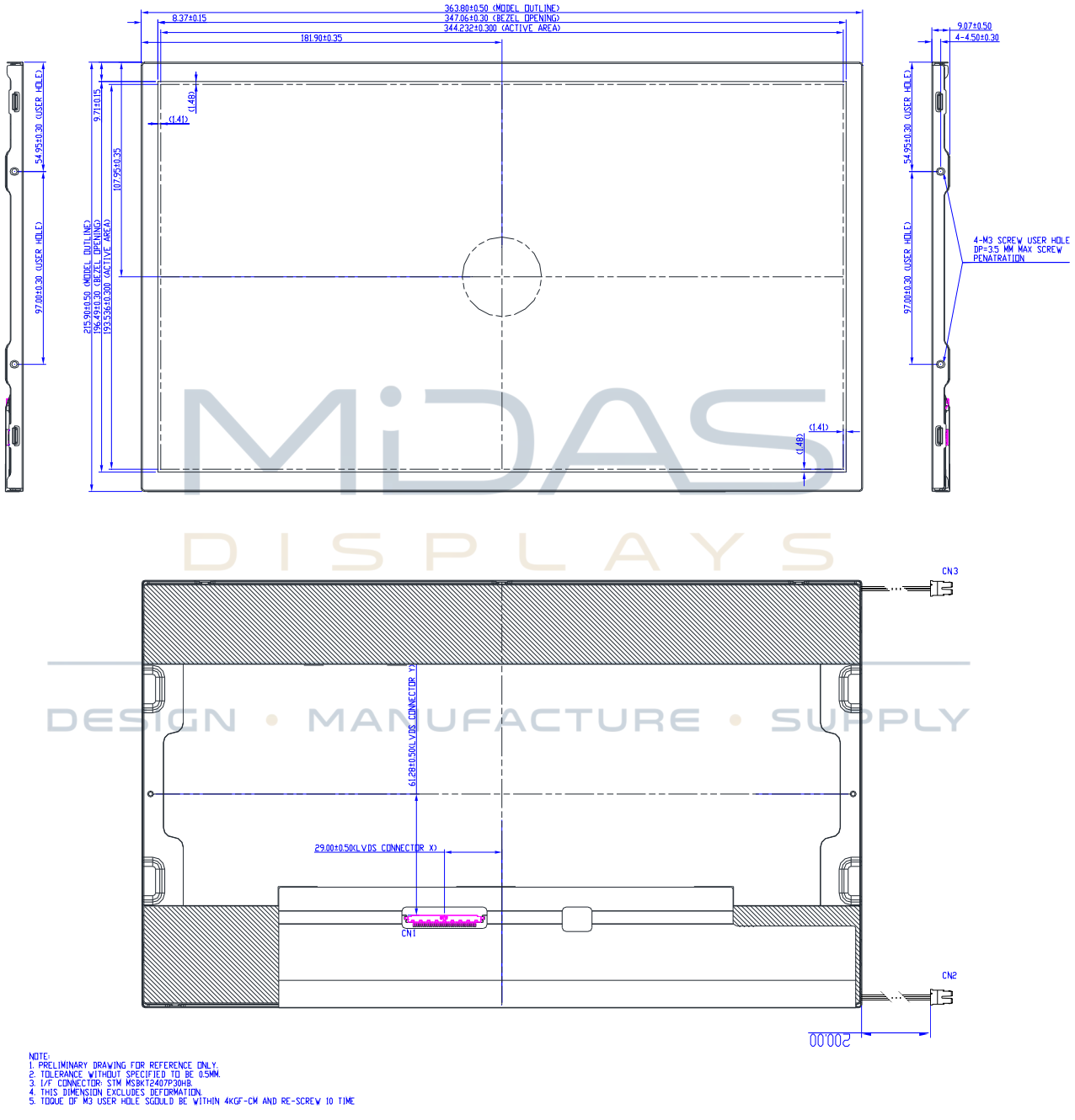
Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20℃ to 60℃, and back again. Power is not applied during the test. After temperature cycling, the unit is placed 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.

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9. Mechanical Characteristics



NOTE:
1. PRELIMINARY DRAWING FOR REFERENCE ONLY.
2. TOLERANCE WITHOUT SPECIFIED TO BE 0.5MM.
3. I/F CONNECTOR: STM MSBKT2407P30HB.
4. THIS DIMENSION EXCLUDES DEFORMATION.
5. TOQUE OF M3 USER HOLE SGOULD BE WITHIN 4KGF-CM AND RE-SCREW 10 TIME

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