

MDT215002	1920x1080	LVDS Interface	TFT Module
Specification			
Version: 1		Date: 16/01/2021	
Revision			
1	14/01/2021	First issue	

Display Features			
Display Size	21.5"		
Resolution	1920x1080		
Orientation	Landscape		
Appearance	RGB		
Logic Voltage	5V		
Interface	LVDS		
Brightness	2500 cd/m ²		
Touchscreen	---		
Module Size	495.60 x 292.20 x 44.80 mm		
Operating Temperature	-20°C ~ +70°C	Created By	Checked By
Pinout	30 way connector	CL	TSB
Pitch	1.00 mm	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.

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 momentarily. 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 21.5 inch-FHD Color a-Si TFT-LCD. The display supports the FHD - 1920(H) x 1080(V) screen format and 16.7M colors (6-bit +Hi-FRC). The light source of this TFT-LCD module is W-LED. All input signals are 2-channel LVDS interface and related 24V LED driver for backlight included.

2.2 Features

- Sunlight readable high brightness display, 2500nits
- LED backlight by long operation life design
- Wide operation temperature (Hi-Tini LC)
- WUXGA (1920x1080 pixels) full HD resolution
- RoHS Compliance

2.3 Application

Industrial applications.

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2.4 Display specifications

Items	Unit	Specification
Screen Diagonal	mm	21.5 inch
Active Area	mm	476.64 (H) X 268.11 (V)
Pixels H x V	pixels	1920 x3(RGB) x 1080
Pixels Pitch	um	248.25 (per one triad) x 248.25
Pixel Arrangement		RGB Vertical stripe
Display mode		Normally Black
White luminance (center)	Cd/m ²	2500 (Typ)
Contrast ratio		1000:1 (Typ.)
Optical Response Time	msec	14 ms (Typ. On/off)
Normal Input Voltage VDD	Volt	5.0
Power Consumption (Vcc Line + LED backlight)	Watt	79.82W (VDD line=3.5 W; LED lines= 76.32 W)
Weight	Grams	TBD
Physical size	mm	495.6 (W)×292.2(H)×44.8(D, with driver)
Electrical Interface		LVDS
Support colors		16.7M colors
Surface Treatment		Anti-glare and hard-coating 3H
Temperature range		
Operating	°C	-20 ~ 70 (TFT surface)
Storage	°C	-30 ~ 80
RoHS Compliance		RoHS Compliance



2.5 Optical characteristics

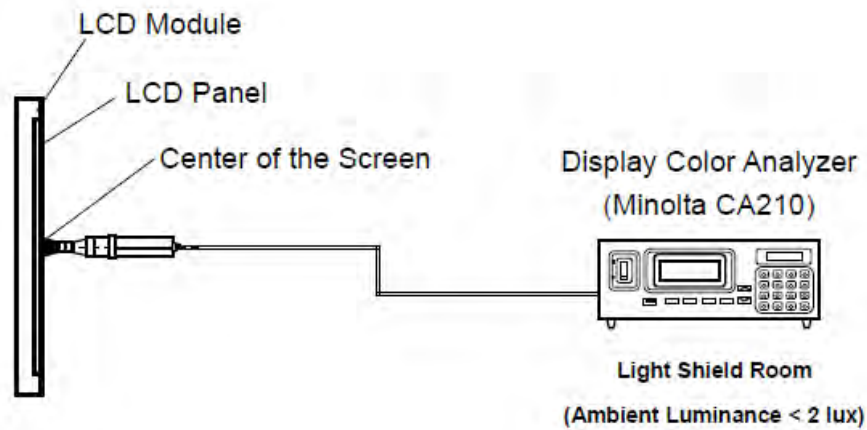
The following optical characteristics are measured under stable condition at 25 °C

Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right)	85	89		2
		CR=10 (Left)	85	89		
		Vertical (Up)	85	89		
		CR=10 (Down)	85	89		
Contrast Ratio		Normal Direction	700	1000		3
Response Time	msec	Raising + Falling		14	25	4
Color / Chromaticity Coordinates (CIE)		Red x	-0.05	TBD	+0.05	5
		Red y		TBD		
		Green x		TBD		
		Green y		TBD		
		Blue x		TBD		
		Blue y		TBD		
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	

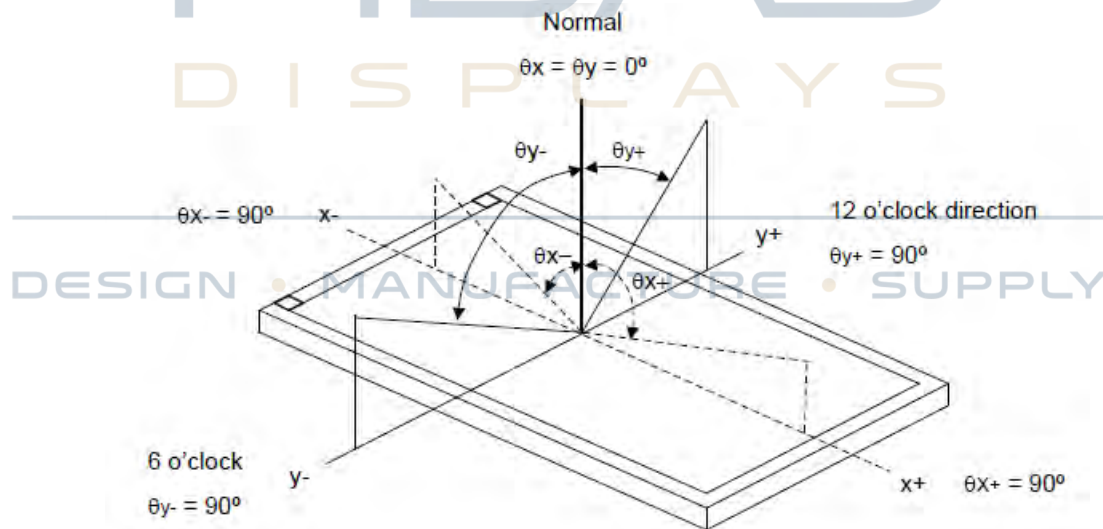


Note 1: Measurement method

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.



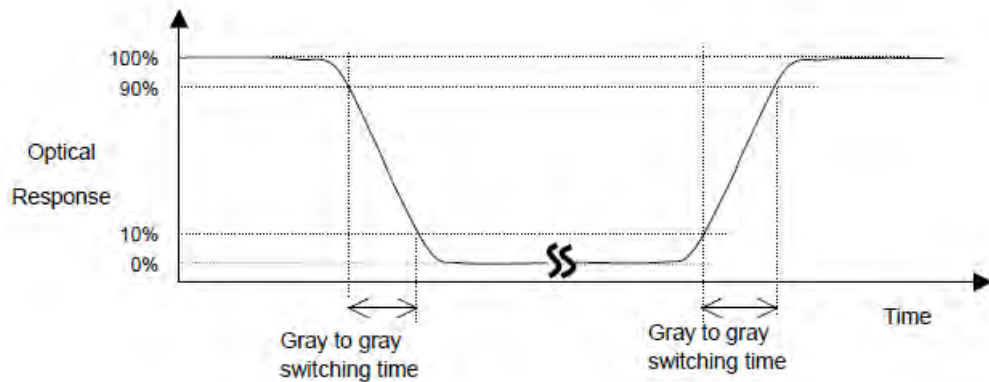
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA210

Note 4: Definition of Response time

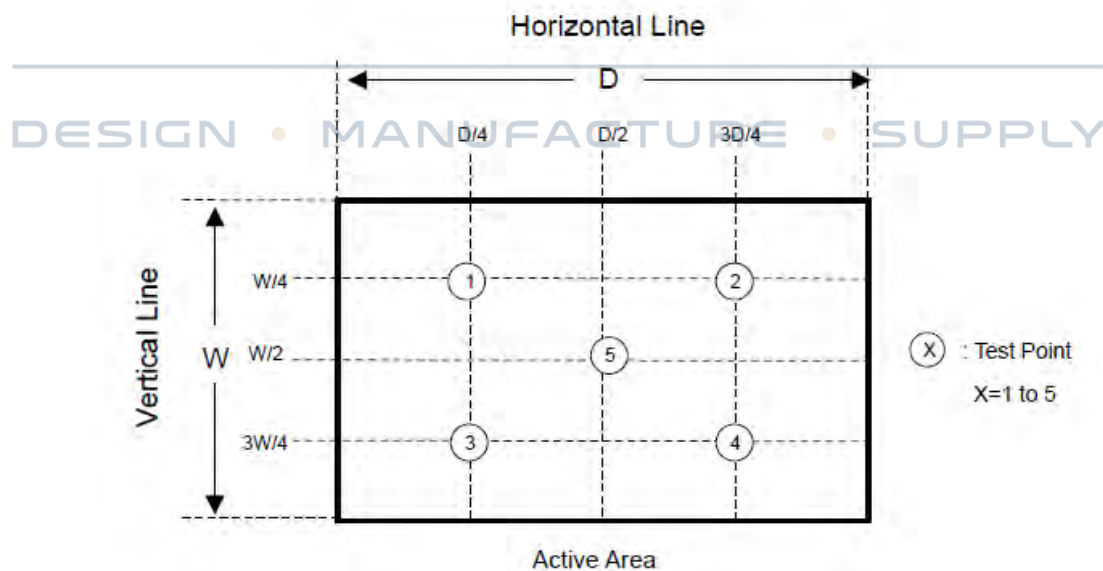
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as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



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

Note 6: Center luminance is measured by Minolta CA210

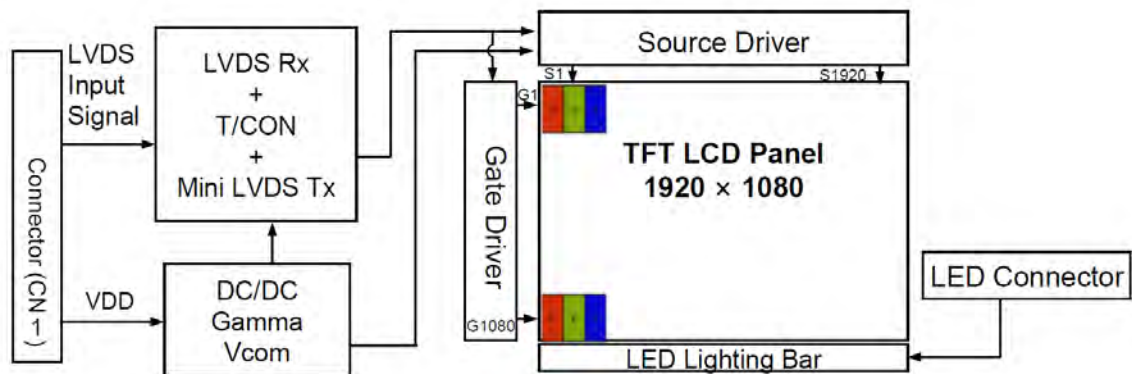
Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210



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



3. Function block diagram



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4. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

4.1 TFT LCD module

Items	Symbol	Min	Max	Unit	Conditions
Power supply voltage	V_{DD}	-0.3	5.5	Volt	Note 1, 2
Logic supply voltage	V_{IN}	$V_{SS}-0.3$	$V_{DD}+0.3$	Volt	Note 1, 2

4.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
BLU input voltage			26.4	V	

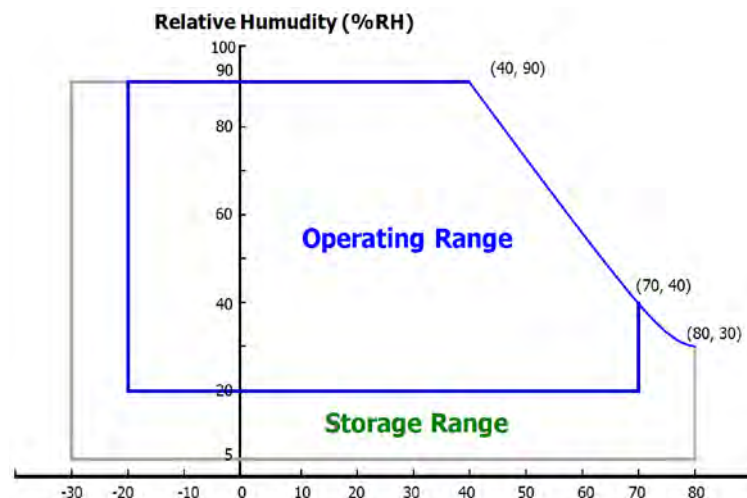
4.3 Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T_{OS}	-20	-	70	$^{\circ}\text{C}$	Note 3
Operation Humidity	H_{OP}	10		85	%	
Storage temperature	T_{ST}	-30		80	$^{\circ}\text{C}$	
Storage Humidity	H_{ST}	5		90	%	

Note 1: With in $T_a = 25^{\circ}\text{C}$

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

[Ta = 25 ± 2 °C]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	4.5	5.0	5.5	V	Note 1
Power Supply Current	I _{DD}	-	700	1200	mA	
In-Rush Current	I _{RUSH}	-	-	3	A	Note 2
Permissible Input Ripple Voltage	V _{RF}	-	-	300	mV	V _{DD} = 5.0V
High Level Differential Input Threshold Voltage	V _{IH}	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V _{IL}	-100	-	-	mV	
Differential input voltage	V _{ID}	200	-	600	mV	
Differential input common mode voltage	V _{cm}	1.0	1.2	1.5		V _{IH} = 100mV, V _{IL} = -100mV
LED Voltage	V _L	-	3.0	3.3	V	
LED Channel Voltage	V _L	-	51	56.1	V	Duty 100%
LED Channel Current	I _L		90		mA	Duty 100%, Each channel
LED Lifetime		30000	-	-	Hrs	I _L = 90 mA, Note 4
Power Consumption	P _D	-	3.5	5.4	W	
	P _{BL}	-	18.36	20.2	W	I _L = 90mA, Note 3
	P _{total}	-	21.86	25.6	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for VDD=5.0V, Frame rate=60Hz. Test Pattern of power supply current

- a) Typ : Color Bar pattern
- b) Max : Gray Level 255 Pattern

2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %

3. Calculated value for reference (V_L × I_L) × 4(channel) excluding driver loss. (LED Light bar: 17S4P)

4. The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at IPIN=90mA on condition of continuous operating at 25 ± 2 °C

5.2 Backlight unit

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks (Test Condition)
Input Specification						
Input Voltage	V_{in}	21.6	24.0	26.4	V _{DC}	Input voltage: 24 V _{DC}
Input Current	I_{in}		3.18		A _{DC}	
BLU power	P_{BLU}		76.32		W	
On/Off control	ON/OFF	3.3	-	5.0	V _{DC}	ON STATE
		-	0	0.8		OFF STATE
Dimming (Analog)	DIM		3.3	5.0	V _{DC}	Min. Brightness
			0			Max. Brightness
Dimming (PWM)	DIM	-	3.3	5.0	V _{DC}	High level
		-	0	-		Low level
		10		100	%	Dimming range
		200	300	500	Hz	Dimming frequency
BLU lifetime	MTBF		50,000		hr	

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5.3 Interface connector

5.3.1 TFT connector(CN1)



- CN1 Module Side Connector : UJU IS100-L30O-C23 or MSBKT2407P30
User Side Connector : JAE FI-X30H

Pin No	Symbol	Function	Remark
1	RXO0-	Negative Transmission data of Pixel 0 (ODD)	
2	RXO0+	Positive Transmission data of Pixel 0 (ODD)	
3	RXO1-	Negative Transmission data of Pixel 1 (ODD)	
4	RXO1+	Positive Transmission data of Pixel 1 (ODD)	
5	RXO2-	Negative Transmission data of Pixel 2 (ODD)	
6	RXO2+	Positive Transmission data of Pixel 2 (ODD)	
7	GND	Power Ground	
8	RXOC-	Negative Transmission Clock (ODD)	
9	RXOC+	Positive Transmission Clock (ODD)	
10	RXO3-	Negative Transmission data of Pixel 3 (ODD)	
11	RXO3+	Positive Transmission data of Pixel 3 (ODD)	
12	RXE0-	Negative Transmission data of Pixel 0 (EVEN)	
13	RXE0+	Positive Transmission data of Pixel 0 (EVEN)	
14	GND	Power Ground	
15	RXE1-	Negative Transmission data of Pixel 1 (EVEN)	
16	RXE1+	Positive Transmission data of Pixel 1 (EVEN)	
17	GND	Power Ground	
18	RXE2-	Negative Transmission data of Pixel 2 (EVEN)	
19	RXE2+	Positive Transmission data of Pixel 2 (EVEN)	
20	RXEC-	Negative Transmission Clock (EVEN)	
21	RXEC+	Positive Transmission Clock (EVEN)	
22	RXE3-	Negative Transmission data of Pixel 3 (EVEN)	
23	RXE3+	Positive Transmission data of Pixel 3 (EVEN)	
24	GND	Power Ground	Note 1
25	NC	Not connection, this pin should be open	
26	NC	Not connection, this pin should be open	
27	NC	Not connection	
28	VDD	Power Supply: +5V	
29	VDD		
30	VDD		

Note 1 : This pin should be connected with GND.

5.3.2 Backlight connector(CN2)

CviLux CI0114M1HR0 or equivalent

Pin NO	Symbol	Description
1	VIN	DC +24V
2	VIN	DC +24V
3	VIN	DC +24V
4	VIN	DC +24V
5	VIN	DC +24V
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground
11	NC	No connected
12	ON / OFF	OFF=0V; ON=+5V
13	DIMM	20~100%
14	NC	No connected

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5.4 Data input format



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6. Signal Timing specification

6.1 DE mode

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	63	74.25	88	MHz
	High Time	-	-	4/7Tc	-	
	Low Time	-	-	3/7Tc	-	
Frame Period		Tv	1100	1125	1200	line
			55	60	65	Hz
			15.38	16.67	18.18	ms
Vertical Display Period		Tvd	-	1080	-	line
One line Scanning Period		Th	1050	1100	1120	clocks
Horizontal Display Period		Thd	-	960	-	clocks

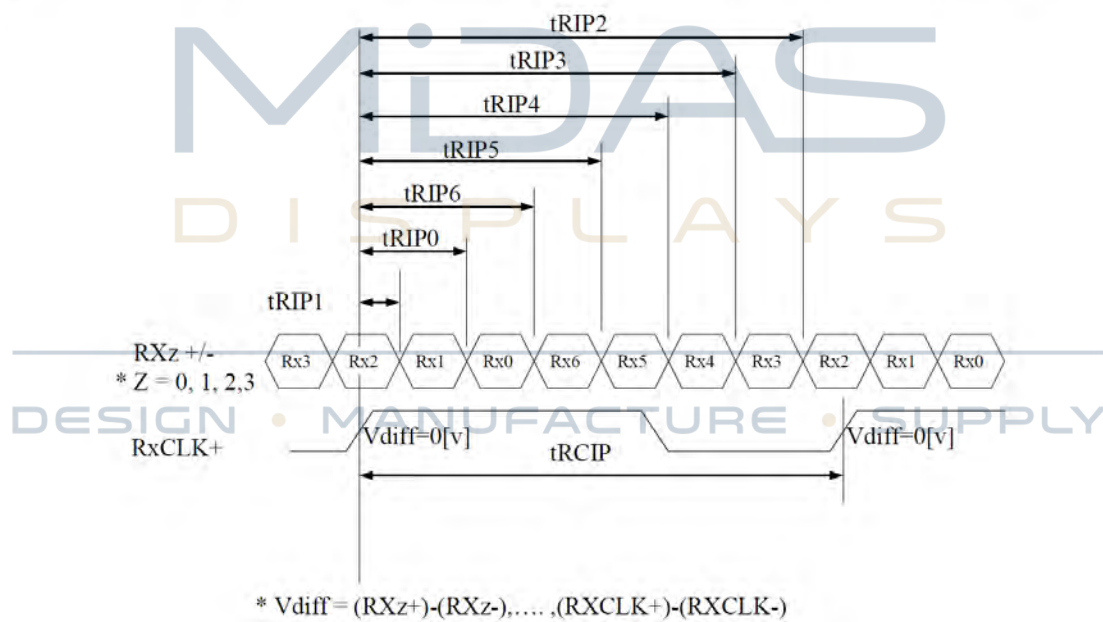
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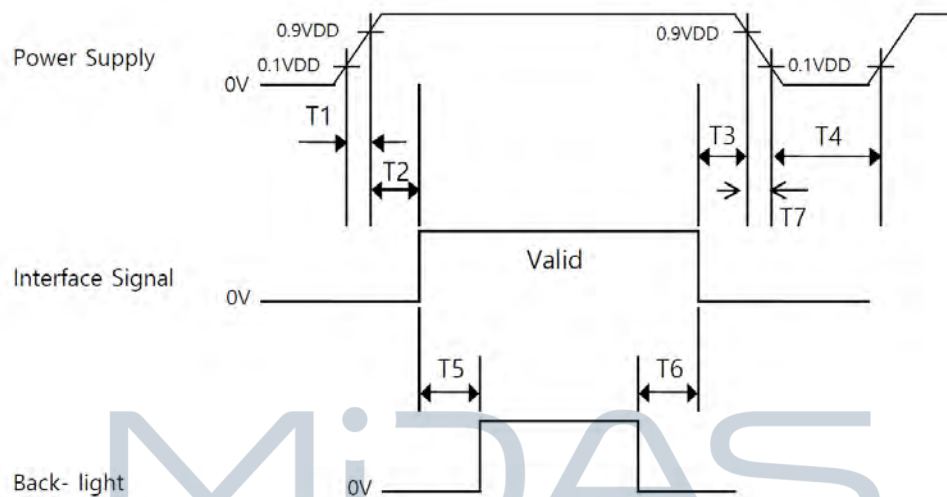
6.2 LVDS Rx interface timing parameter

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.76	13.46	16.15	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 × tRCIP/7-0.4	2 × tRCIP/7	2 × tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 × tRCIP/7-0.4	3 × tRCIP/7	3 × tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 × tRCIP/7-0.4	4 × tRCIP/7	4 × tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 × tRCIP/7-0.4	5 × tRCIP/7	5 × tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 × tRCIP/7-0.4	6 × tRCIP/7	6 × tRCIP/7+0.4	nsec	



7. Power ON/OFF sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



- $0.5 \text{ ms} \leq T1 \leq 10 \text{ ms}$
- $0 \leq T2 \leq 50 \text{ ms}$
- $0 \leq T3 \leq 50 \text{ ms}$
- $1 \text{ sec} \leq T4$
- $200 \text{ ms} \leq T5$
- $200 \text{ ms} \leq T6$

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Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on.
3. Back Light must be turn on after power for logic and interface signal are valid.
4. T7 decreases smoothly, there is none re-bouncing voltage.
5. During changing the resolution or mode changing, the logic power/ back-light/interface signal should be turned off as shown above; after the changing, power on as shown above.

8. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta=40°C, 80%RH, 48hours	
High Temperature Operation (HTS)	Ta= 70°C, 48hours	3
Low Temperature Operation (LTO)	Ta= -20°C, 48hours	
High Temperature Storage (HTS)	Ta= 80°C, 48hours	
Low Temperature Storage (LTS)	Ta= -30°C, 48hours	
Thermal Shock Test (TST)	-20°C/30min, 60°C/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: $\pm 8KV$, 150pF(330 Ω) 1sec, 9 points, 25 times/ point.	
	Air Discharge: $\pm 15KV$, 150pF(330 Ω) 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 -10°C to 50°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: TFT surface.

10. Mechanical Characteristics

