

MDT240000	1920x1080	LVDS Interface	TFT Module
Specification			
Version: 1		Date: 28/08/2020	
Revision			
1	26/08/2020	First issue	

Display Features			
Display Size	24"		
Resolution	1920x1080		
Orientation	Landscape		
Appearance	RGB		
Logic Voltage	5.0V		
Interface	LVDS		
Brightness	1500 cd/m ²		
Touchscreen	---		
Module Size	556.00 x 323.20 x 17.00 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 Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display a LED backlight system. The screen format is intended to support Full-HD (1920(H) x 1080(V)) screen and 16.7M colors.

2.2 Features

- High brightness display, 1500nits by LED backlight.
- Long operation lifetime BLU design
- Hi-Tni LC applied
- 1920 x 1080 pixel full HD design
- VA mode extra wide view angle
- RoHS Compliance

2.3 Application

Industrial applications.

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2.4 Display specifications

Items	Unit	Specification
Screen Diagonal	mm	24.0
Active Area	mm	531.36 (H) X 298.89 (V)
Pixels H x V	pixels	1920 x3(RGB) x 1080
Pixels Pitch	um	276.75 (per one triad) x 276.75
Pixel Arrangement		RGB Vertical stripe
Display mode		Normally Black
White luminance (center)	Cd/m ²	1500 (Typ)
Contrast ratio		5000:1 (Typ.)
Optical Response Time	msec	25 ms (Typ. On/off)
Normal Input Voltage VDD	Volt	5.0
Power Consumption (Vcc Line + LED backlight)	Watt	44.88W (VDD line=6.0 W; LED lines= 38.88 W)
Weight	Grams	2130
Physical size	mm	556 (W)×323.2 (H)×17 (D)
Electrical Interface		2-ch LVDS
Support colors		16.7M colors
Surface Treatment		Anti-glare and hard-coating 3H
Temperature range		
Operating	°C	-20 ~ 70 (TFT surface temperature)
Storage	°C	-30 ~ 80
RoHS Compliance		RoHS Compliance



2.5 Optical characteristics

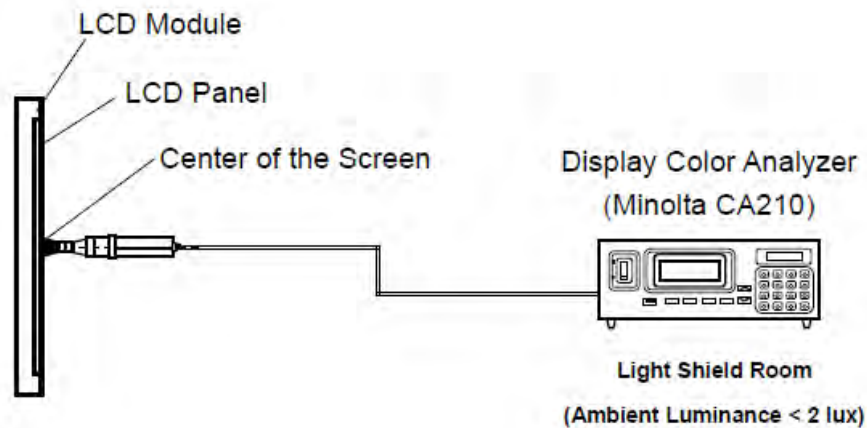
The following optical characteristics are measured under stable condition at 25 °C

Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right)	75	89		2
		CR=10 (Left)	75	89		
		Vertical (Up)	75	89		
		CR=10 (Down)	75	89		
Contrast Ratio		Normal Direction	3000	5000		3
Response Time	msec	Raising + Falling		25	50	4
Color / Chromaticity Coordinates (CIE)		Red x	-0.05	0.643	+0.05	5
		Red y		0.339		
		Green x		0.329		
		Green y		0.624		
		Blue x		0.155		
		Blue y		0.048		
Color coordinates (CIE) White		White x		0.313		
		White y		0.329		
Center Luminance	Cd/m ²		1200	1500		6
Luminance Uniformity	%		70	75		7
Crosstalk (in 60 Hz)	%				1.5	
Flicker	dB				-20	

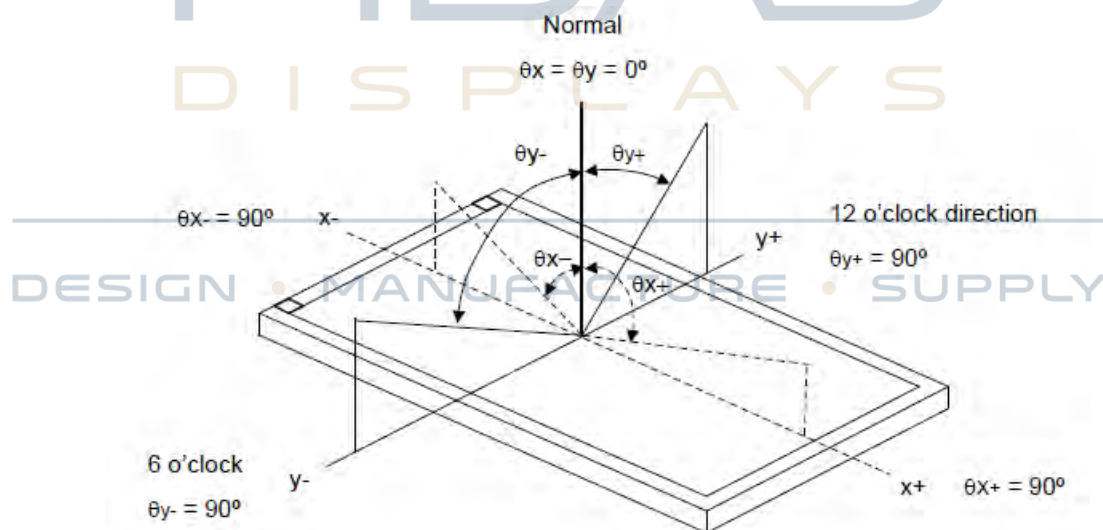


Note 1: Measurement method

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.



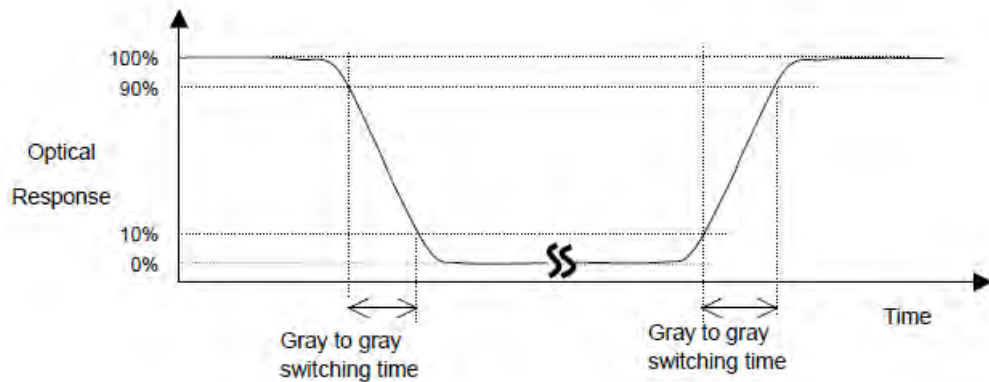
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA210

Note 4: Definition of Response time

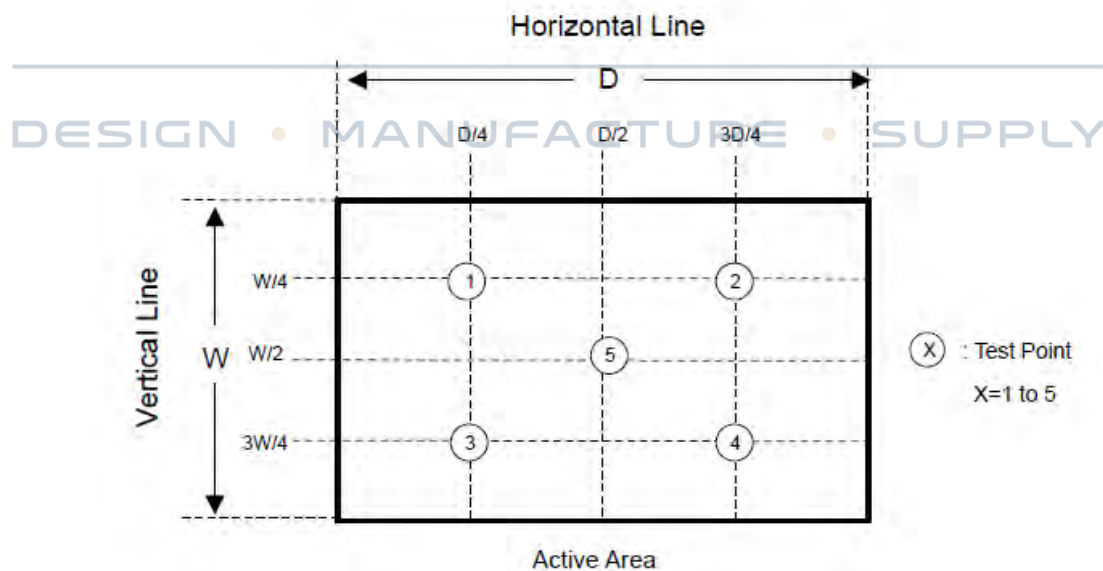
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as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



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

Note 6: Center luminance is measured by Minolta CA210

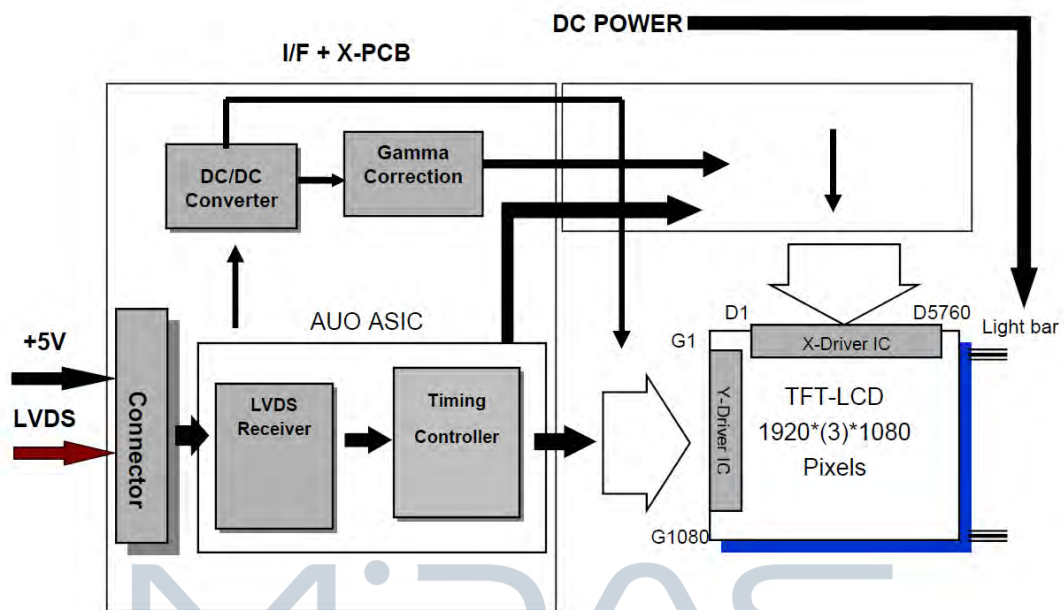
Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210



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



3. Function block diagram



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

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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

4.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED bar input current			960	mA	

4.3 Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T _{OS}	-20	-	70	°C	Note 3
Operation Humidity	H _{OP}	10		85	%	
Storage temperature	T _{ST}	-30		80	°C	
Storage Humidity	H _{ST}	5		90	%	

Note 1: With in T_a= 25°C

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

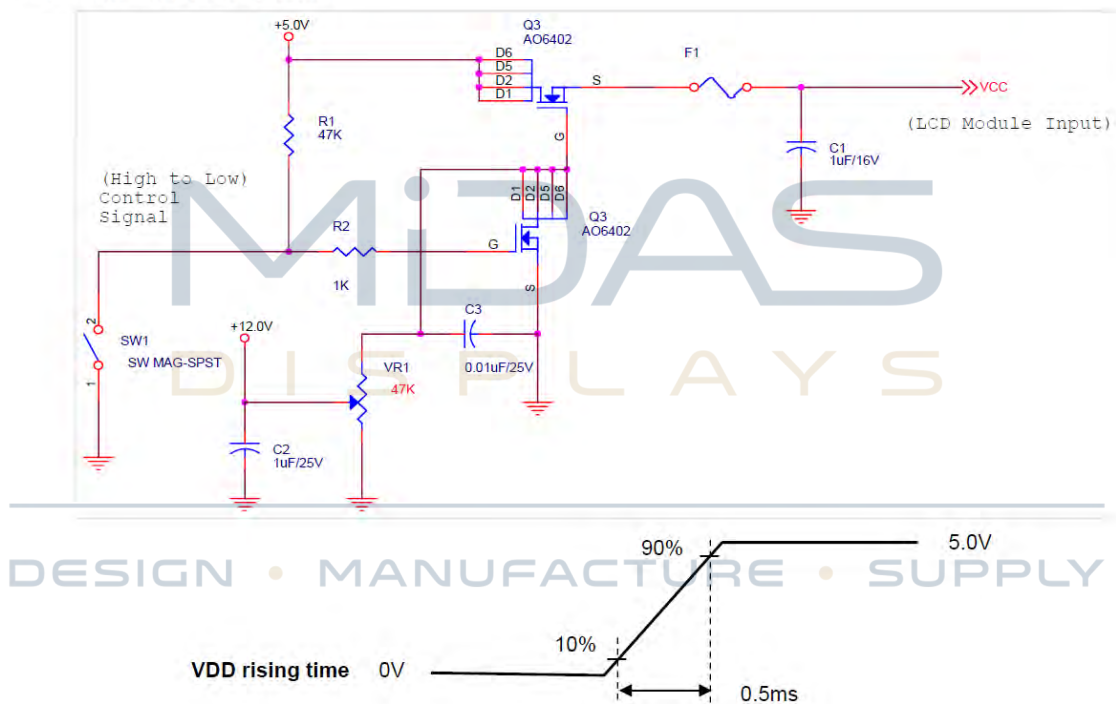
Note 3: For quality performance, please refer to IIS (Incoming Inspection Standard).

5. Electrical characteristics

5.1 LCD electronics specification

Symbol	Parameter	Min	Typ	Max	Units	Remark
VDD	Logic/LCD Drive Voltage	4.5	5.0	5.5	[Volt]	± 10%
IDD	VDD Current	-	900	1200	[mA]	VDD= 5.0V, All White Pattern At 60Hz
I _{rush}	LCD Inrush Current	-	-	3	[A]	Note 1
PDD	VDD Power	-	4.5	6	[Watt]	VDD= 5.0V, All White Pattern At 60Hz

Note 1: Measurement condition:



5.2 Backlight unit

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		36		[V]	2
LED current (IL)		540		[mA]	2
LED power (PL)		38.88		[W]	
LED lite time (MTBF)		70,000		[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°C and typical LED Current at 540 mA

Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference ($IL \times VL \times 2 = PLED$)

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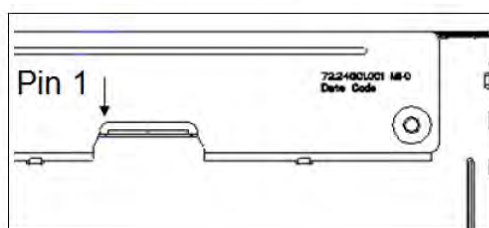
5.3 Interface connector

5.3.1 TFT connector(CN1)

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-	Negative LVDS differential data input (Even data)
16	RXinE1+	Positive 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 contact
26	NC	No contact
27	VDD	Power +5V
28	VDD	Power +5V
29	VDD	Power +5V
30	VDD	Power +5V

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



5.3.2 Backlight connector(CN2 、CN3)

Recommended connector : JOIN TEK JT1025-1021 (BHSR-02VS-1 manufactured by JST)

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

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6. Signal characteristics

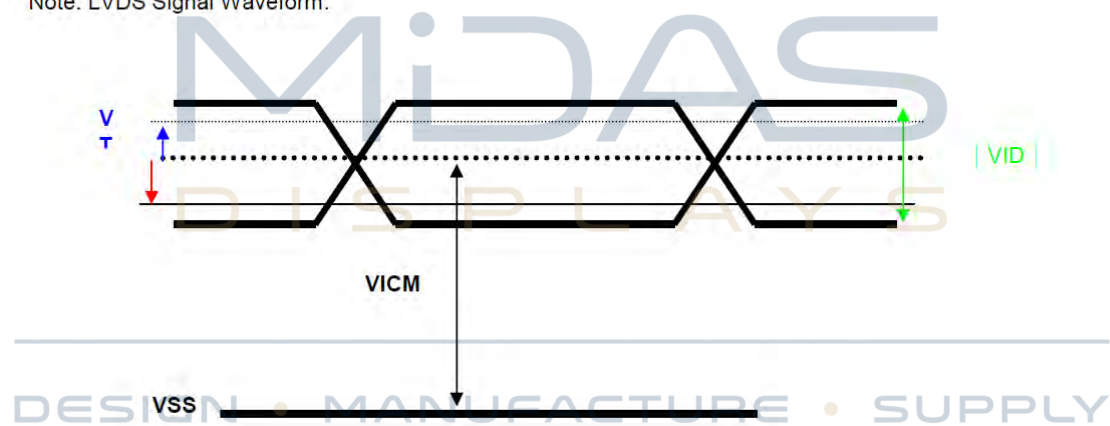
6.1 LVDS input signal specifications

6.1.1 Signal electrical characteristics

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

Symbol	Item	Min.	Typ.	Max.	Unit	Remark
V _{TH}	Differential Input High Threshold	-	-	100	[mV]	V _{CM} =1.2V
V _{TL}	Differential Input Low Threshold	-100	-	-	[mV]	V _{CM} =1.2V
V _{ID}	Input Differential Voltage	100	400	600	[mV]	
V _{ICM}	Differential Input Common Mode Voltage	0.3	-	1.25	[V]	V _{TH} /V _{TL} =±100mV

Note: LVDS Signal Waveform.



6.2 Pixel format image

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

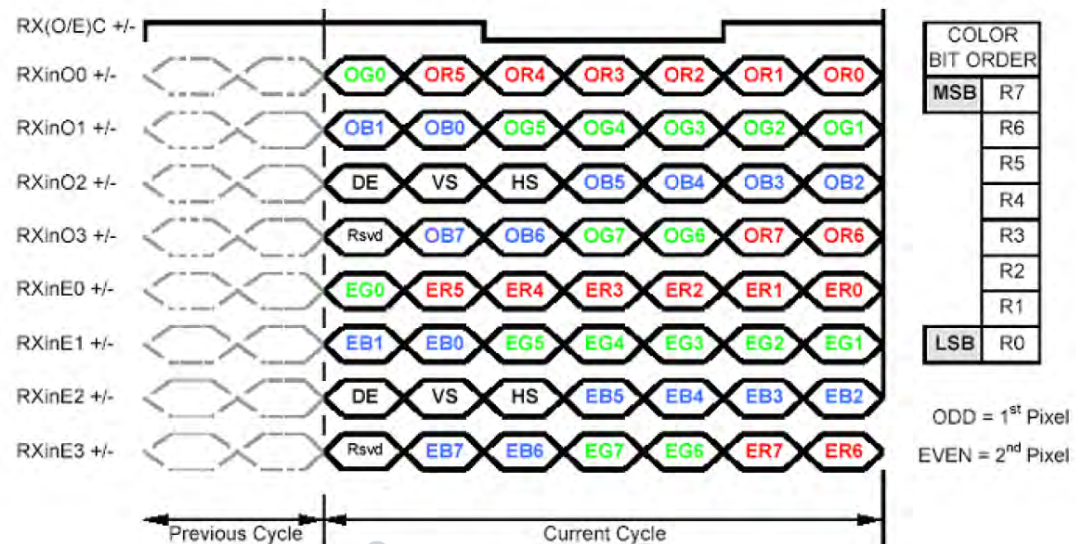
	1			2															1919			1920		
1st Line	R	G	B	R	G	B	· · · · · · · · · · · · · · · ·												R	G	B	R	G	B
	·	·	·	·	·	·	·												·	·	·	·	·	·
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1080 Line	R	G	B	R	G	B	· · · · · · · · · · · · · · · ·												R	G	B	R	G	B

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6.3 The input data format



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

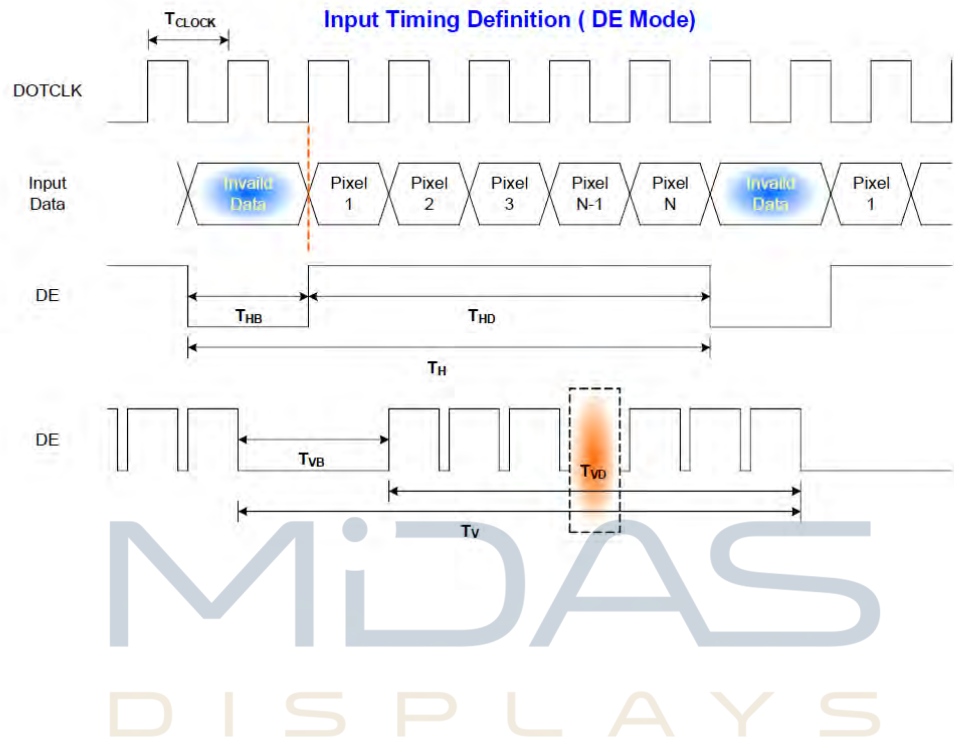
6.4 Interface timing

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_{vp}	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.

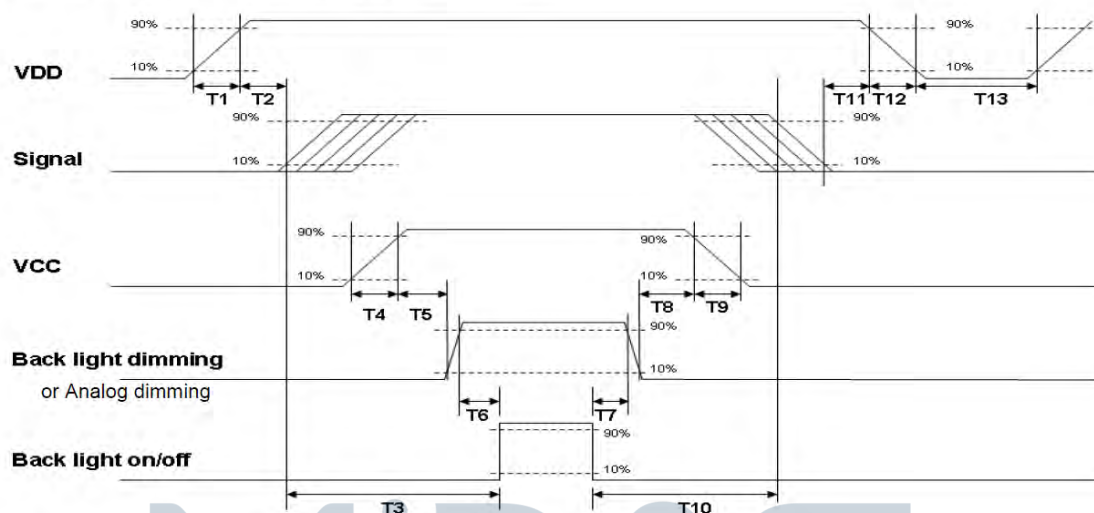
6.4.2 Input timing diagram



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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. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta=40°C, 80%RH, 240hours	
High Temperature Operation (HTO)	Ts= 70°C, 240hours	3
Low Temperature Operation (LTO)	Ta= -20°C, 240hours	
High Temperature Storage (HTS)	Ta= 80°C, 240hours	
Low Temperature Storage (LTS)	Ta= -30°C, 240hours	
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.

9. Mechanical Characteristics

