

FOR MESSRS : _____

DATE : Dec. 11th, 2023

TECHNICAL DATA

TX40D202VM0BAB

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ACCEPTED BY : _____

PROPOSED BY : *Max Lee*

2. RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 15.6" FHD of 16:9 format amorphous silicon TFT. The pixel format is vertical stripe and sub pixels are arranged as R (red), G (green), B (blue) sequentially. This display is RoHS compliant, COG (chip on glass) technology and LED backlight are applied on this display.

Part Name	TX40D202VM0BAB
Module Dimensions	367.86(W) mm x 219.51(H) mm x 14.71 (D) mm
LCD Active Area	344.16(W) mm x 193.59(H) mm
Pixel Pitch	0.1792(W) mm x 0.1792 (H) mm
Resolution	1920 x 3(RGB)(W) x 1080(H) dots
Color Pixel Arrangement	R, G, B Vertical stripe
LCD Type	Transmissive Color TFT; Normally Black
Display Type	Active Matrix
Number of Colors	16.7M Colors (8-bit RGB)
Backlight	Light Emitting Diode (LED)
Weight	668g
Interface	2ch-LVDS; 50 pins
Power Supply Voltage	5.0V for LCD; 30V for Backlight
Power Consumption	1.5W for LCD , 23.5W for Backlight
Viewing Direction	Super Wide Version

4. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remarks
Supply Voltage	V_{DD}	-0.3	6.0	V	-
Input Voltage of Logic	V_I	-0.3	$V_{DD} + 0.3$	V	Note 1
Operating Temperature	T_{op}	-30	85	°C	Note 2
Storage Temperature	T_{st}	-40	90	°C	Note 2
LED Forward Current	I_F	-	200	mA	-

Note 1: The rating is defined for the signal voltages of the interface such as CLK and data pairs.

Note 2: The maximum rating is defined as above based on the chamber temperature, which might be different from ambient temperature after assembling the panel into the application. Moreover, some temperature-related phenomenon as below needed to be noticed:

- Background color, contrast and response time would be different in temperatures other than 25°C.
- Operating under high temperature will shorten LED lifetime.

5. ELECTRICAL CHARACTERISTICS

5.1 OPERATING CONDITIONS

$T_a = 25\text{ }^{\circ}\text{C}$, $V_{SS} = 0\text{V}$

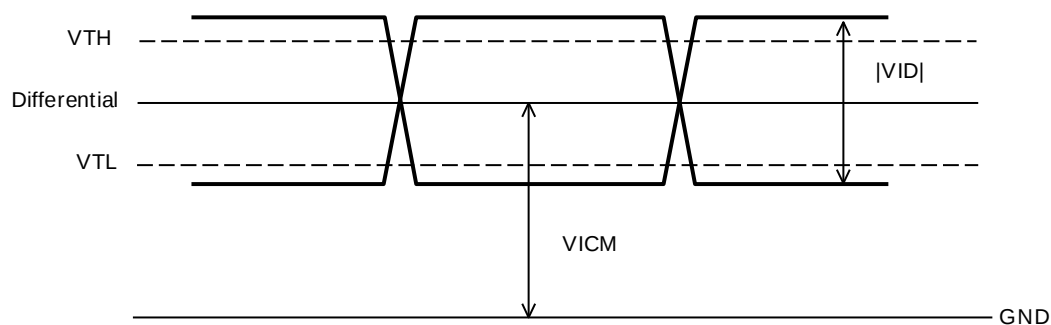
Item	Symbol	Condition	Standard Value			Unit	Remarks
			Min.	Typ.	Max.		
Power Supply Voltage	V_{DD}	-	4.7	5.0	5.0	V	-
Power Supply Current	I_{DD}	Note 1	-	313	-	mA	Note 1,4
Allowable Ripple Voltage	VRP	-	-	-	100	mV (p-p)	Note 2
Differential Input High Threshold	VTH	$V_{ICM}=1.2\text{V}$	-	-	100	mV	Note 3
Differential Input Low Threshold	VTL	$V_{ICM}=1.2\text{V}$	-100	-	-	mV	
Input Differential Voltage	$ V_{ID} $	-	200	400	600	mV	
Differential Input Common Mode Voltage	V_{ICM}	-	$V_{ID}/2$	1.2	$2.25-(V_{ID}/2)$	V	

Note 1: Measurement pattern: All white.

Power supply voltage: Typ. voltage.

Note 2: Applied pin is $\{V_{DD}\}$

Note 3: Signal of interest is LVDS.



Note 5: (TBD) fuse is applied in the module for I_{DD} . For display activation and protection purpose, power supply is recommended larger than (TBD) to start the display and break fuse once any short circuit occurred.

5.2 BACKLIGHT CHARACTERISTICS

$T_a = 25\text{ }^{\circ}\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	V_{LED}	$I_{LED}=98\text{mA}$	-	30	-	V	Note 1
LED Forward Current	I_{LED}	Per string	-	98	-	mA	-
LED Lifetime	-	$I_{LED}=98\text{mA}$	-	70K	-	hrs	Note 2

Note 1: Fig. 5.1 shows the LED backlight circuit.

Note 2: The estimated lifetime is specified as the time to reduce 50% brightness.

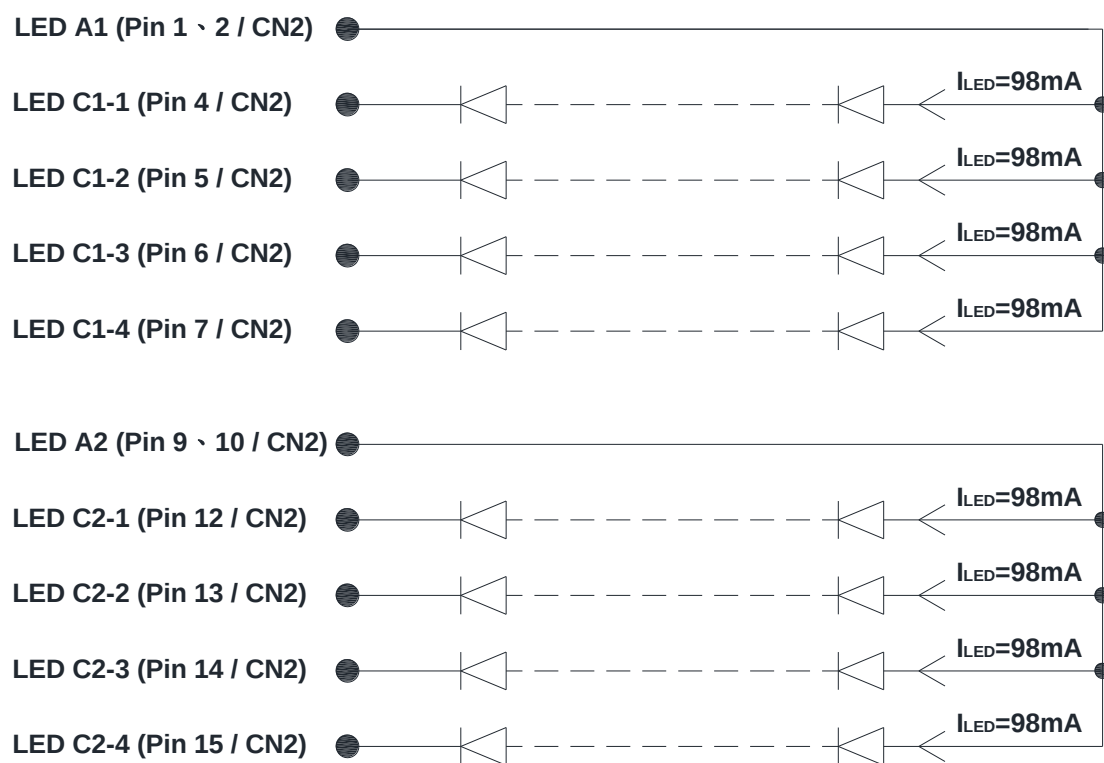


Fig 5.1

6. OPTICAL CHARACTERISTICS

The optical characteristics are measured based on the conditions as below:

- Supplying the signals and voltages defined in the section of electrical characteristics.
- The backlight unit needs to be turned on for 30 minutes.
- The ambient temperature is 25 °C .
- In the dark room around 100 lx, the equipment has been set for the measurements as shown in Fig 6.1.

$$T_a = 25\text{ }^{\circ}\text{C}, f_{Frame} = 60\text{ Hz}, V_{DD} = 3.3\text{V}$$

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Brightness of White		-	$\phi = 0^{\circ}, \theta = 0^{\circ},$ $I_{LED} = 98\text{ mA}$	1200	1500	-	cd/m ²	Note 1
Brightness Uniformity		-		70	-	-	%	Note 2
Contrast Ratio		CR		700	1200	-	-	Note 3
Response Time		$T_r + T_f$	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	30	-	ms	Note 4
NTSC Ratio		-	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	80	-	%	-
Viewing Angle		θ_x	$\phi = 0^{\circ}, CR \geq 10$	-	85	-	Degree	Note 5
		$\theta_{x'}$	$\phi = 180^{\circ}, CR \geq 10$	-	85	-		
		θ_y	$\phi = 90^{\circ}, CR \geq 10$	-	85	-		
		$\theta_{y'}$	$\phi = 270^{\circ}, CR \geq 10$	-	85	-		
Color Chromaticity	Red	X	$\phi = 0^{\circ}, \theta = 0^{\circ}$	0.62	0.67	0.72	-	Note 6
		Y		0.26	0.31	0.36		
	Green	X		0.22	0.27	0.32		
		Y		0.57	0.62	0.67		
	Blue	X		0.10	0.15	0.2		
		Y		0.04	0.09	0.14		
	White	X		0.24	0.29	0.34		
		Y		0.26	0.31	0.36		

Note 1: The brightness is measured from the panel center point, P5 in Fig. 6.2, for the typical value.

Note 2: The brightness uniformity is calculated by the equation as below:

$$\text{Brightness uniformity} = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \times 100\%$$

which is based on the brightness values of the 9 points measured by BM-5 as shown in Fig. 6.2.

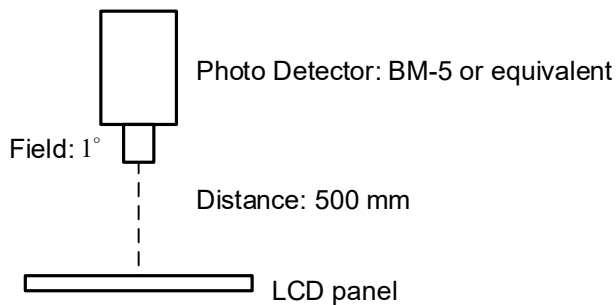


Fig. 6.1

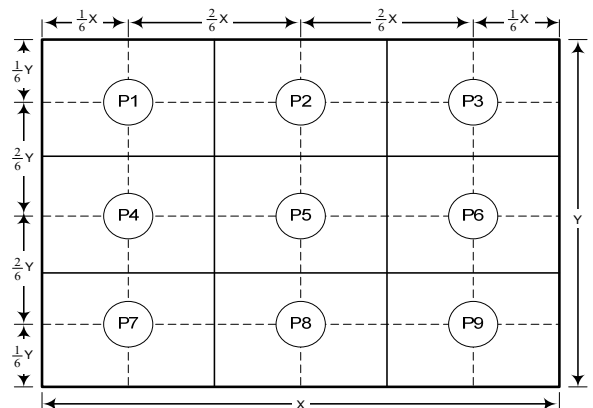


Fig. 6.2

Note 3: The Contrast Ratio is measured from the center point of the panel, P5, and defined as the following equation:

$$CR = \frac{\text{Brightness of White}}{\text{Brightness of Black}}$$

Note 4: The definition of response time is shown in Fig. 6.3. The rising time is the period from 10% brightness to 90% brightness when the data is from black to white. Oppositely, Falling time is the period from 90% brightness rising to 10% brightness.

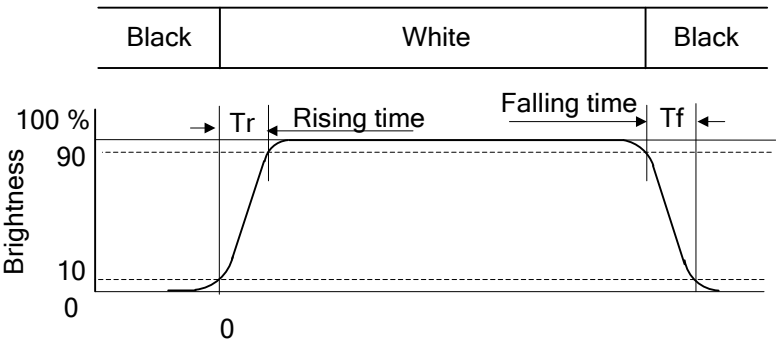


Fig 6.3

Note 5: The definition of viewing angle is shown in Fig. 6.4. Angle ϕ is used to represent viewing directions, for instance, $\phi = 270^\circ$ means 6 o'clock, and $\phi = 0^\circ$ means 3 o'clock. Moreover, angle θ is used to represent viewing angles from axis Z toward plane XY.

The display is super wide viewing angle version; 85° viewing angle can be obtained from each viewing direction.

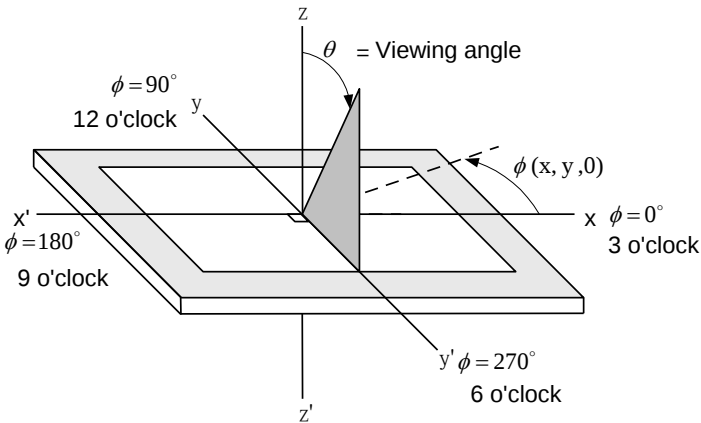
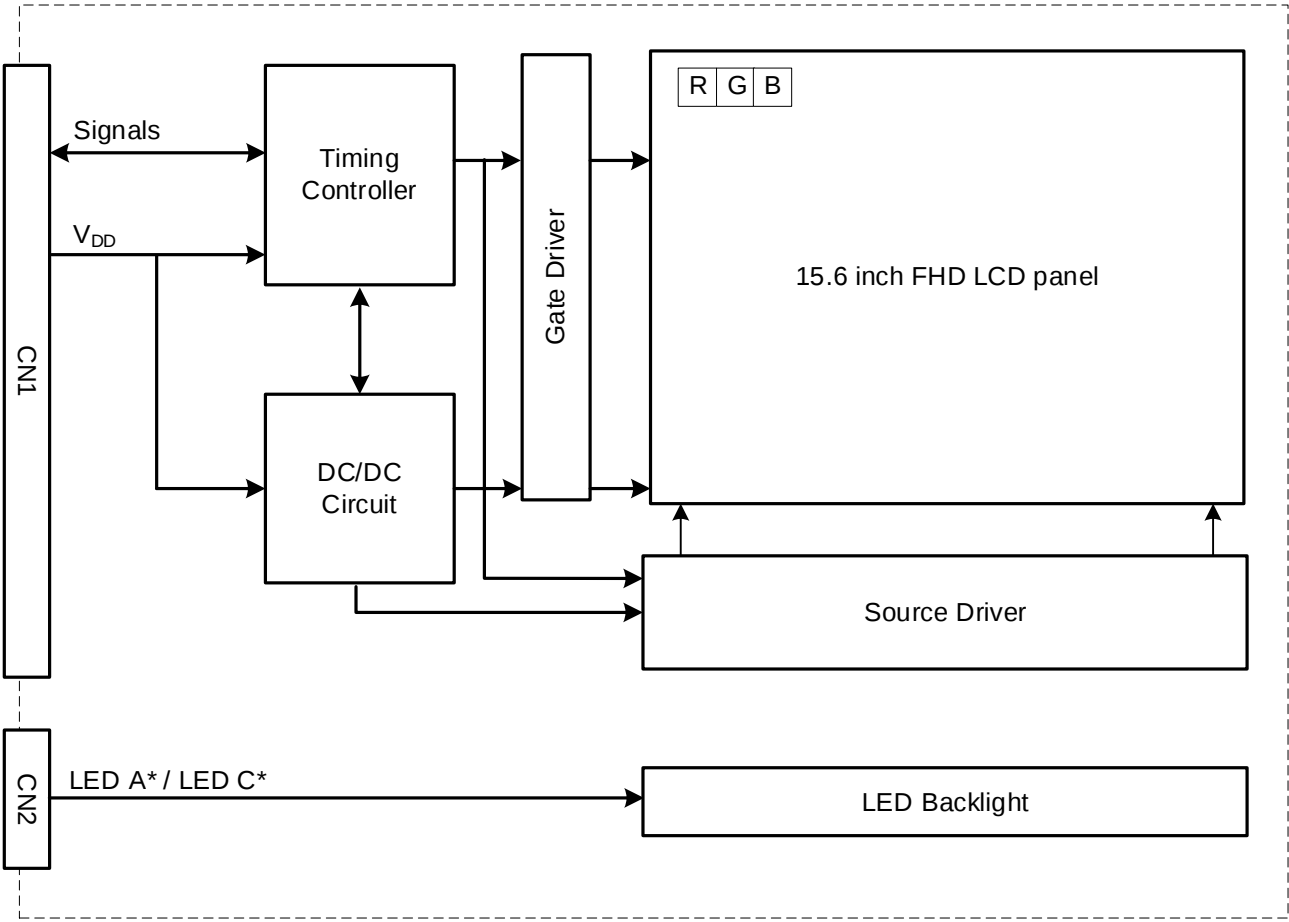


Fig 6.4

Note 6: The color chromaticity is measured from the center point of the panel, P5, as shown in Fig. 6.2.

7. BLOCK DIAGRAM



Note1: Signals are EN,CLK and pixel data pairs.

8. LCD INTERFACE

8.1 INTERFACE PIN CONNECTIONS

The display interface connector CN1 is FH28-50S-0.5SH (Hirose), and Pin assignment is as below:

No	Symbol	Function	I/O
1	GND	GND (0V)	I
2	NC	Not connected	-
3	VDD	+5.0V Power Supply for Logic	I
4	VDD		
5	VDD		
6	NC	Not connected	-
7	GND	GND (0V)	I
8	GND		
9	GND		
10	ORXIN0 -	-LVDS differential data input, Chan 0-odd	I
11	ORXIN0+	+LVDS differential data input, Chan 0-odd	I
12	ORXIN1-	-LVDS differential data input, Chan 1-odd	I
13	ORXIN1+	+LVDS differential data input, Chan 1-odd	I
14	ORXIN2-	-LVDS differential data input, Chan 2-odd	I
15	ORXIN2+	+LVDS differential data input, Chan 2-odd	I
16	ORXCLKIN-	-LVDS clock input(odd)	I
17	ORXCLKIN+	+LVDS clock input(odd)	I
18	ORXIN3 -	-LVDS differential data input, Chan 3-odd	I
19	ORXIN3 +	+LVDS differential data input, Chan 3-odd	I
20	ERXIN0-	-LVDS differential data input, Chan 0-Even	I
21	ERXIN0+	+LVDS differential data input, Chan 0-Even	I
22	ERXIN1-	-LVDS differential data input, Chan 1-Even	I
23	ERXIN1+	+LVDS differential data input, Chan 1-Even	I
24	ERXIN2-	-LVDS differential data input, Chan 2-Even	I
25	ERXIN2+	+LVDS differential data input, Chan 2-Even	I
26	ERXCLKIN-	-LVDS clock input(Even)	I
27	ERXCLKIN+	+LVDS clock input(Even)	I
28	ERXIN3-	-LVDS differential data input, Chan 3-Even	I
29	ERXIN3+	+LVDS differential data input, Chan 3-Even	I
30	GND	GND (0V)	I

No	Symbol	Function	I/O
31	NC	Not connected	-
32	NC		-
33	EN	Enable input (3.3V)	I
34	NC	Not connected	-
35	NC		
36	NC		
37	NC		
38	GND	GND (0V)	I
39	GND		
40	NC	Not connected	I
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

The interface CN2 is SM15B-SRSS-TB(LF)(SN) made by JST and pin assignment is as below:

Connector Name	Pin No.	Symbol	Function
SM15B-SRSS-TB(LF)(SN)	1	V _{LED} A1	LED Anode Terminal (1)
	2	V _{LED} A1	LED Anode Terminal (1)
	3	NC	Not connected
	4	VLED C1-1	LED Cathode Terminal1 (1)
	5	VLED C1-2	LED Cathode Terminal2 (1)
	6	VLED C1-3	LED Cathode Terminal3 (1)
	7	VLED C1-4	LED Cathode Terminal4 (1)
	8	NC	Not connected
	9	V _{LED} A2	LED Anode Terminal (2)
	10	V _{LED} A2	LED Anode Terminal (2)
	11	NC	Not connected
	12	VLED C2-1	LED Cathode Terminal1 (2)
	13	VLED C2-2	LED Cathode Terminal2 (2)
	14	VLED C2-3	LED Cathode Terminal3 (2)
	15	VLED C2-4	LED Cathode Terminal4 (2)

8.2 TIMING CHART

Horizontal timing

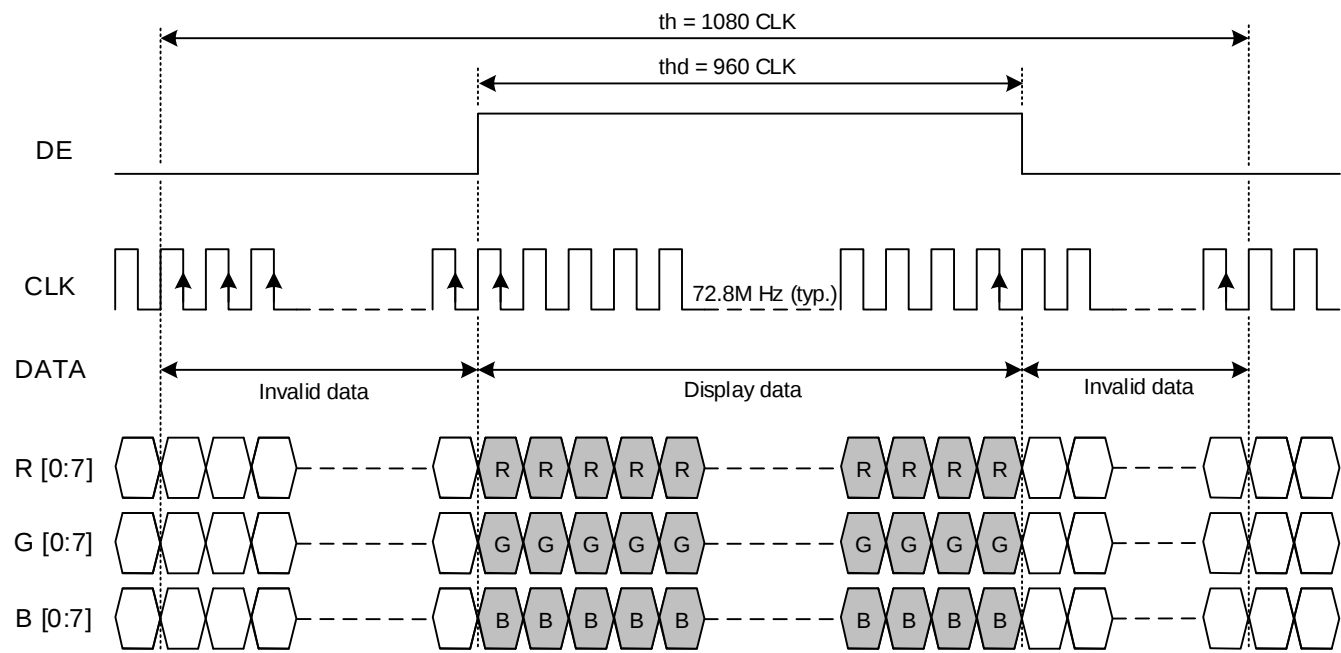


Fig. 8.1 Horizontal Timing of Synchronous Mode

Vertical timing

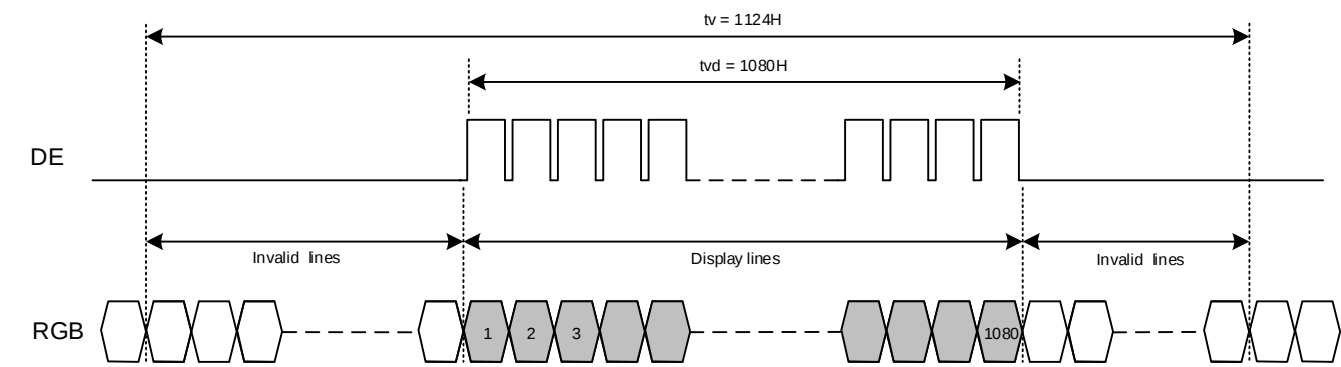


Fig. 8.2 Vertical Timing of Synchronous Mode

8.3 TIMING TABLE

The column of timing sets including minimum, typical, and maximum as below are based on the best optical performance, frame frequency (f_{Frame}) = 60 Hz to define.

Item		Symbol	Min.	Typ.	Max.	Unit
Clock	CLK Frequency	fclk	-	72.8	-	M Hz
Hsync	Display Data	thd	1080			DCLK
	Cycle Time	thp	120			
	Display Line	tvd	1080			
	Cycle Time	tvp	44			
	Frame Frequency	f _{Frame}	-	60	-	Hz

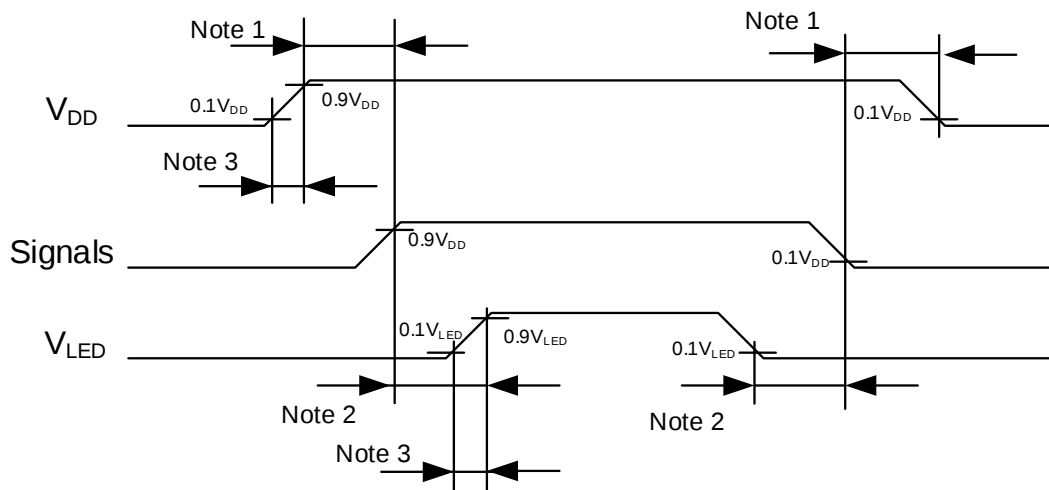
Note 1: For 2-port input, horizontal display period has the notation of the half of 1920.

LVDS data format (VESA format)



Item		Symbol	Min.	Typ.	Max.	Unit
CLK	Cycle frequency	1/tCLK	-	72.8	-	MHz
RinX (X=0,1,2,3)	0 data position	tRP0	1/7* tCLK -0.3	1/7* tCLK	1/7* tCLK +0.3	ns
	1st data position	tRP1	-0.3	0	+0.3	
	2nd data position	tRP2	6/7* tCLK -0.3	6/7* tCLK	6/7* tCLK +0.3	
	3rd data position	tRP3	5/7* tCLK -0.3	5/7* tCLK	5/7* tCLK +0.3	
	4th data position	tRP4	4/7* tCLK -0.3	4/7* tCLK	4/7* tCLK +0.3	
	5th data position	tRP5	3/7* tCLK -0.3	3/7* tCLK	3/7* tCLK +0.3	
	6th data position	tRP6	2/7* tCLK -0.3	2/7* tCLK	2/7* tCLK +0.3	

8.5 Power ON/OFF sequence



Note 1: In order to avoid any damages, V_{DD} has to be applied before all other signals. The opposite is true for power off where V_{DD} has to be remained on until all other signals have been switch off. The recommended time period is 1 second.

Note 2: In order to avoid showing uncompleted patterns in transient state. It is recommended that switching the backlight on is delayed for 1 second after the signals have been applied. The opposite is true for power off where the backlight has to be switched off 1 second before the signals are removed.

Note 3: In order to avoid high Inrush current, V_{DD} rising time need to set more than 0.5ms.

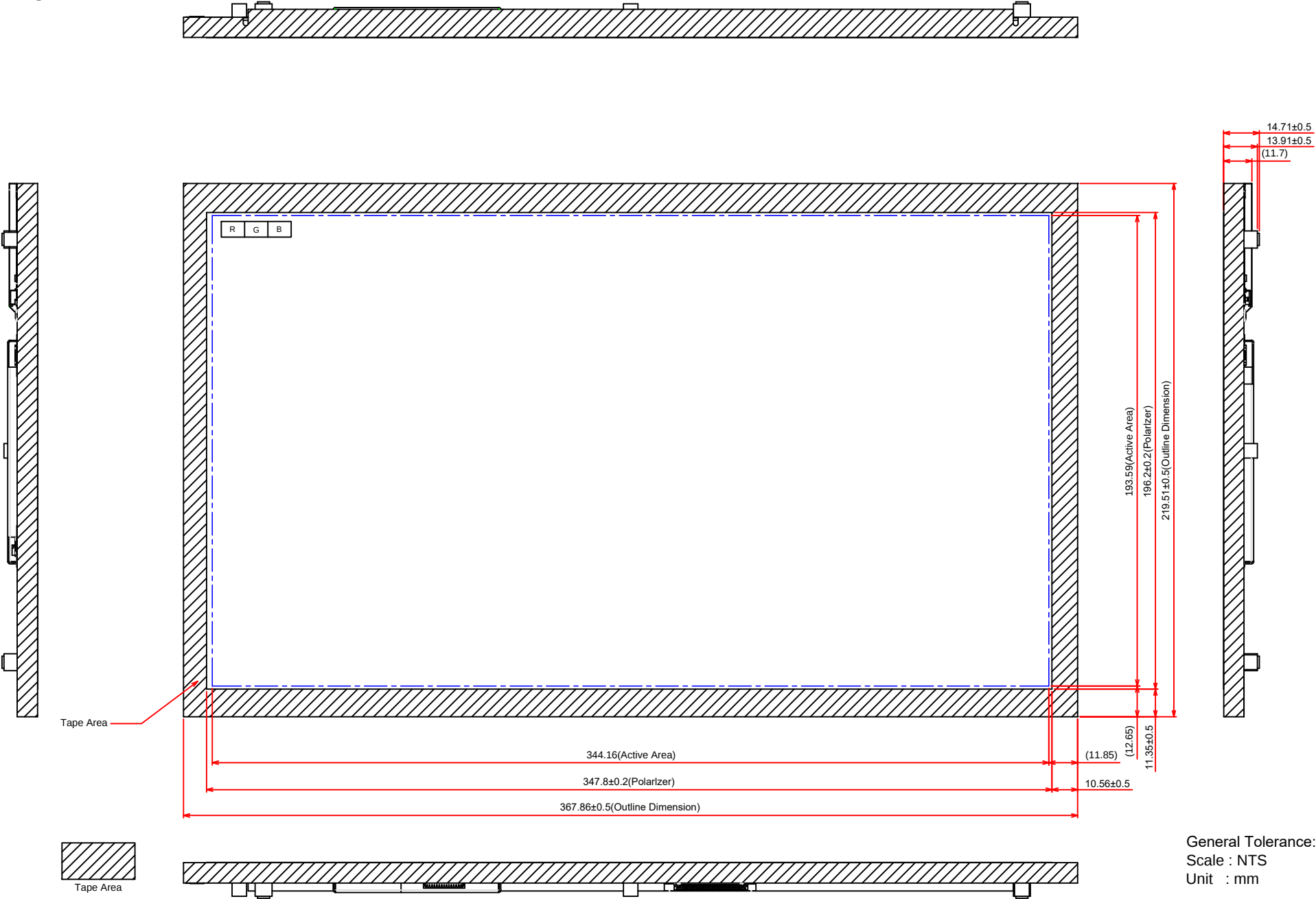
8.6 DATA INPUT for DISPLAY COLOR

Input color		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB								LSB								MSB							
Basic Color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Red(255)	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Green(255)	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L
	Blue(255)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H
	Cyan	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
	Magenta	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Red(1)	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Red(2)	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Red(254)	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Red(255)	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Green(1)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L
	Green(2)	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L
	Green(254)	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L
	Green(255)	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L
Blue	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	Blue(1)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H
	Blue(2)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H
	Blue(254)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L
	Blue(255)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H

Note 1: Color (n) --- 'n' indicates gray scale step.

9. OUTLINE DIMENSIONS

9.1 FRONT VIEW



9.2 REAR VIEW

