

KOE

JDI Group

Kaohsiung Opto-Electronics Inc.

FOR MESSRS : _____

DATE : Aug. 6th, 2021

TECHNICAL DATA

TX18D216VM0BAA

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ACCEPTED BY: _____

PROPOSED BY: Oblack Tsai

2. RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 7" WVGA of 16:9 format LTPS 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	TX18D216VM0BAA
Module Dimensions	167.7(W) mm x 109.5(H) mm x (12.2) (D) mm
LCD Active Area	152.4(W) mm x 91.44(H) mm
Pixel Pitch	0.1905(W) mm x 0.1905 (H) mm
Resolution	800 x 3(RGB)(W) x 480(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	219 g
Interface	LVDS; 20 pins
Power Supply Voltage	3.3V for LCD; 12V for Backlight
Power Consumption	0.23 W for LCD; TBD W for Backlight
Viewing Direction	Super Wide Version (In-Plane Switching)

4. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remarks
Supply Voltage	V _{DD}	-0.3	4.0	V	-
Input Voltage of Logic	V _I	-0.3	V _{DD} +0.3	V	Note 1
Operating Temperature	T _{op}	-40	85	°C	Note 2
Storage Temperature	T _{st}	-40	90	°C	Note 2
Backlight Input Voltage	V _{LED}	-	14	V	-

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

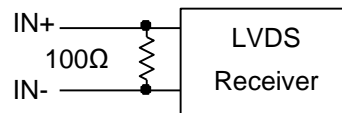
5. ELECTRICAL CHARACTERISTICS

5.1 LCD CHARACTERISTICS

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-	3.0	3.3	3.6	V	-
Differential Input Voltage for LVDS Receiver Threshold	V_I	"H" level	-	-	+100	mV	Note 1
		"L" level	-100	-	-		
Power Supply Current	I_{DD}	$V_{DD}=3.3\text{V}$	-	70	-	mA	Note 2
Frame Frequency	f_{Frame}	-	-	60	65	Hz	
CLK Frequency	f_{CLK}	-	31.5	33.3	36	MHz	

Note 1: VCM 1.2V is common mode voltage of LVDS transmitter and receiver. The input terminal of LVDS transmitter is terminated with 100Ω .



Note 2: An all white check pattern is used when measuring I_{DD} . f_{Frame} is set to 60 Hz. Moreover, (TBD) fuse is applied in the module for I_{DD} . For display activation and protection purpose, power supply is recommended larger than (TBD)A to start the display and break fuse once any short circuit occurred.

5.2 BACKLIGHT CHARACTERISTICS

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	V_{LED}	-	-	12.0	-	V	Note 1
LED Forward Current (PWM Control)	I_{LED}	100% duty	-	TBD	-	mA	Note 2
		0% duty	-	TBD	-		
LED lifetime	-	$I_{LED} = \text{TBD mA}$	-	100K	-	hrs	Note 3

Note 1: As Fig. 5.1 shown, LED current is constant, TBD mA, controlled by the LED driver when applying 12V.

Note 2: Dimming function can be obtained by applying PWM signal from the display interface CN2. The recommended PWM signal is 1K ~ 10K Hz.

Note 3: The estimated lifetime is specified as the time to reduce 50% brightness by applying TBD mA at 25°C.

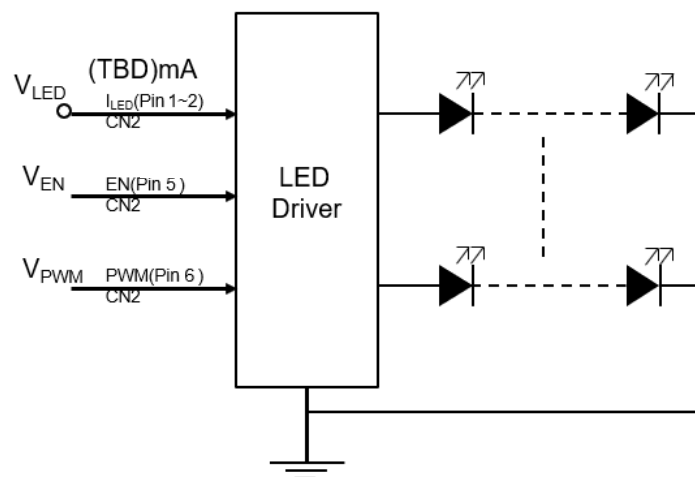


Fig 5.1

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 less than 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	-	$\phi = 0^\circ, \theta = 0^\circ,$ $I_{LED} = \text{TBD mA}$	900	1200	-	cd/m ²	Note 1
Brightness Uniformity	-		70	-	-	%	Note 2
Contrast Ratio	CR		700	1000	-	-	Note 3
Response Time	$T_r + T_f$	$\phi = 0^\circ, \theta = 0^\circ$	-	30	40	ms	Note 4
NTSC Ratio	-	$\phi = 0^\circ, \theta = 0^\circ$	-	70	-	%	-
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	0.60	0.65	0.70	-	Note 6
		Y	0.27	0.32	0.37		
	Green	X	0.27	0.32	0.37		
		Y	0.56	0.61	0.66		
	Blue	X	0.10	0.15	0.20		
		Y	0.01	0.06	0.11		
	White	X	0.26	0.31	0.36		
		Y	0.28	0.33	0.38		

Note 1: The brightness is measured from the center point of the panel, 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 in active area measured by BM-5 as shown in Fig. 6.2.

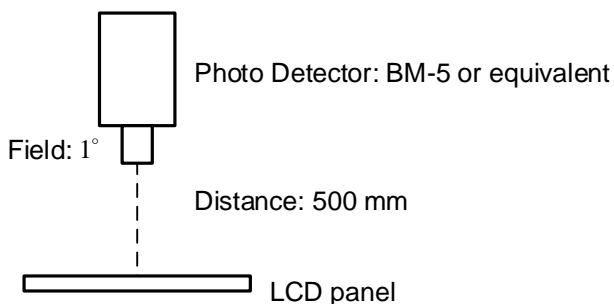


Fig 6.1

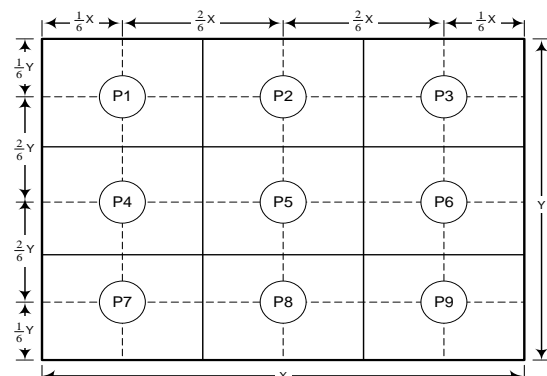


Fig 6.2

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 falling to 10% brightness.

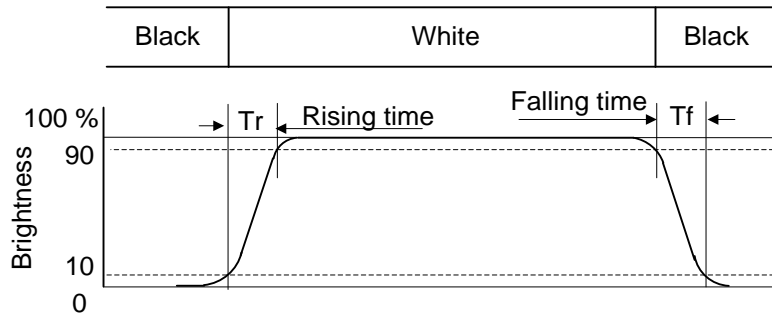


Fig.6.3

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, so that the best optical performance can be obtained from every viewing direction.

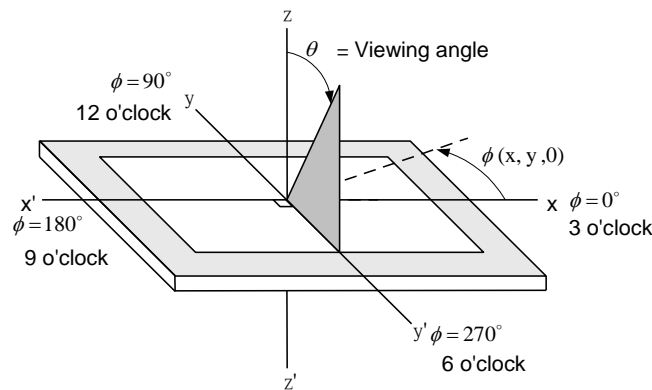
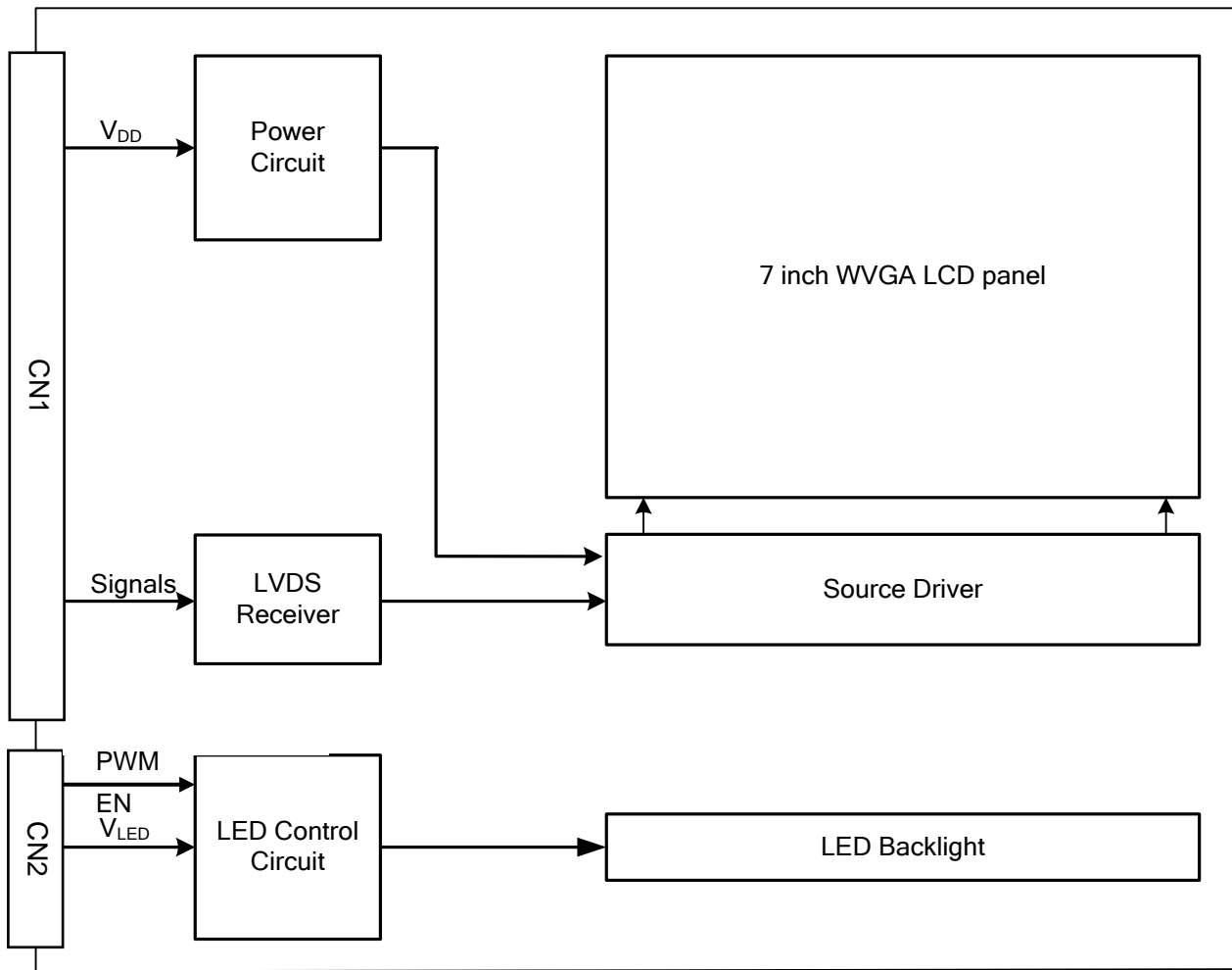


Fig 6.4

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

7. BLOCK DIAGRAM



Note 1: Signals are CLK and pixel data pairs.

8. LCD INTERFACE

8.1 INTERFACE PIN CONNECTIONS

The display interface connector (CN1) is FI-SEB20P-HF13E-E1500 made by JAE and pin assignment is as below:

Pin No.	Symbol	Signal	Pin No.	Symbol	Signal
1	V _{DD}	3.3V Power Supply	11	LVD2N	B4~B7, DE,
2	V _{DD}		12	LVD2P	
3	GND	GND	13	GND	GND
4	GND	GND	14	LVCLKN	Pixel Clock
5	LVD0N	R2~R7, G2	15	LVCLKP	
6	LVD0P		16	GND	GND
7	GND	GND	17	LVD3N	R0~R1, G0~G1, B0~B1
8	LVD1N	G3~G7, B2~B3	18	LVD3P	
9	LVD1P		19	NC	No connection
10	GND	GND	20	SC	Note 2

Note 1: IN n- and IN n+ (n=0, 1, 2), CLK IN- and CLK IN+ should be wired by twist-pairs or side-by-side FPC patterns, respectively.

Note 2: Scan direction is available to be switched as below.



Normal : Low or Default

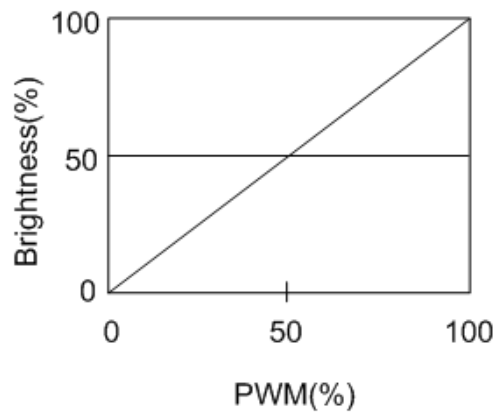


Reverse : High

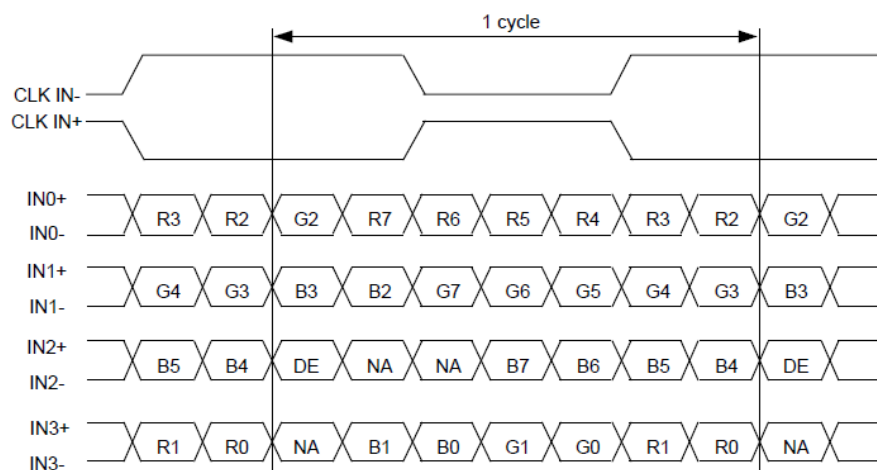
The backlight connector (CN2) is FI-S6P-HFE, and pin assignment is as below:

Pin No.	Signal	Function
1	V _{LED+}	Power Supply for LED
2	V _{LED+}	Power Supply for LED
3	V _{LED-}	GND
4	V _{LED-}	GND
5	BLEN	Backlight Enable
6	PWM	Brightness dimming (Note 3)

Note 3: Normal brightness: 100% PWM duty; 0% to 100% PWM duty.



.2 LVDS DATA FORMAT



DE: Display Enable

8.3 TIMING CHART

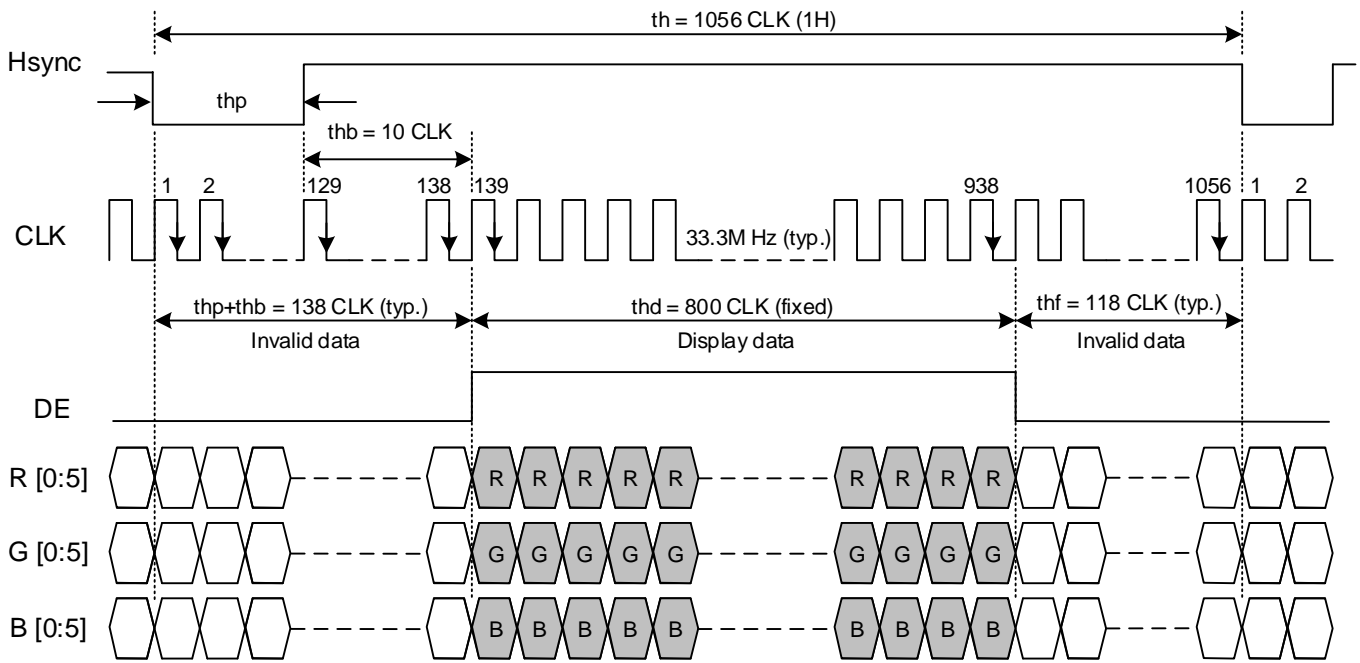


Fig. 8.1 Horizontal Timing

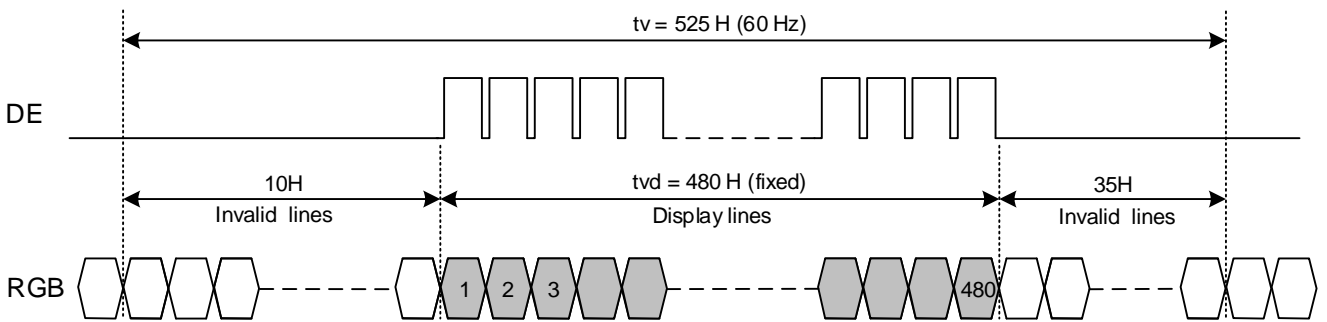


Fig. 8.2 Vertical Timing

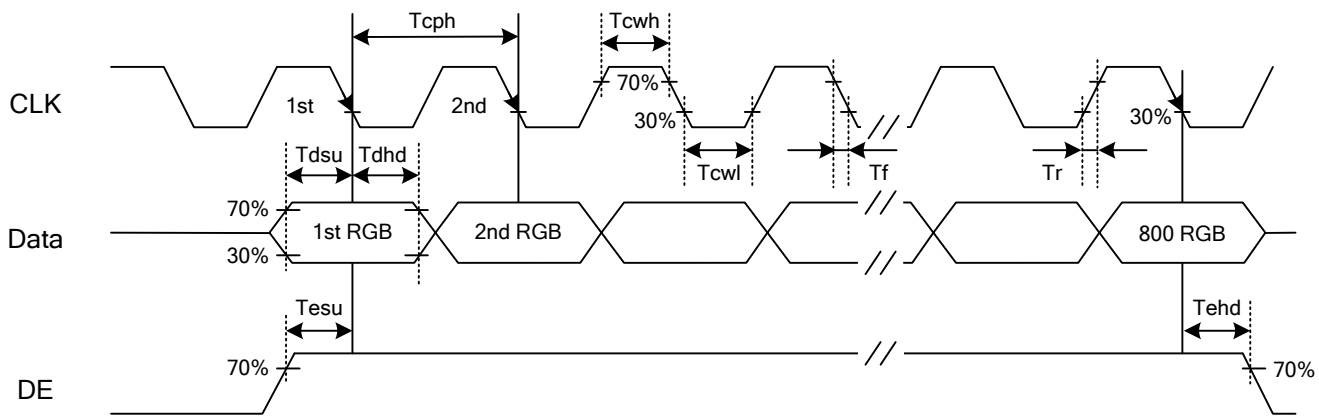


Fig. 8.3 Setup & Hold Time

8.4 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}) = 60Hz to define. If 60 Hz is not the aim to set, less than 65 Hz for f_{Frame} is recommended to apply for better performance by other parameter combination as the definitions in section 5.1.

A. Horizontal and Vertical Timing

Item		Symbol	Min.	Typ.	Max.	Unit
Horizontal	CLK Frequency	fclk	31.5	33.3	36	MHz
	Display Data	thd	800			CLK
	Cycle Time	th	1000	1056	1144	
Vertical	Display Line	tvd	480			H
	Cycle Time	tv	525			

Note 1: The rise and fall times (t_r , t_f) of CLK is equal or less than 3ns.

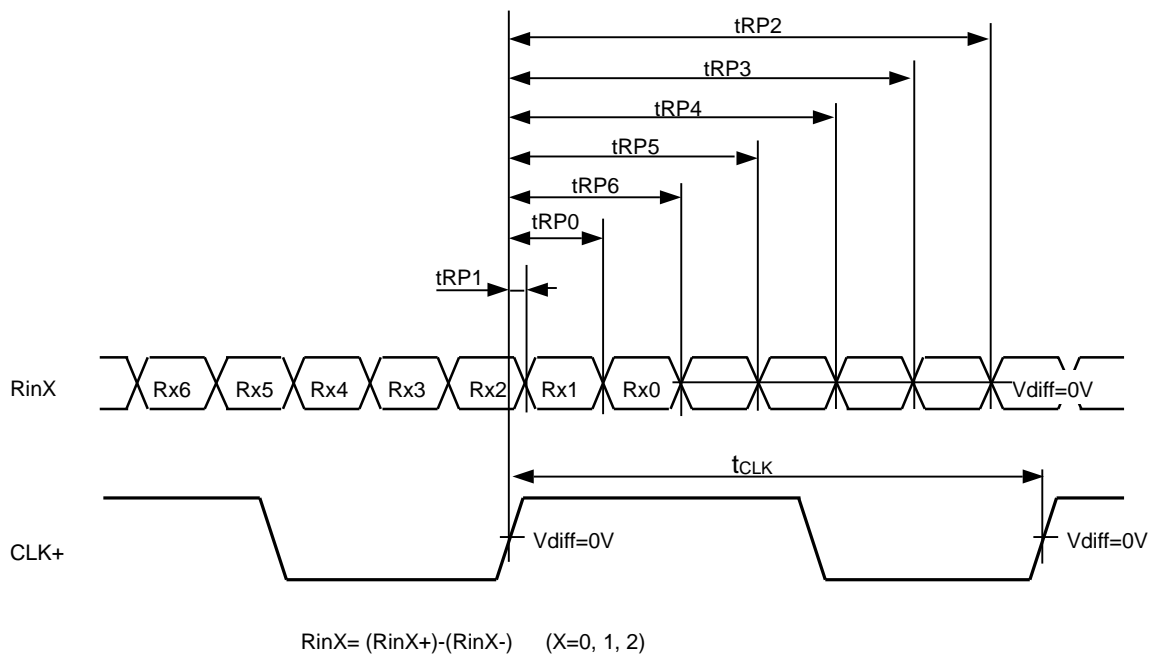
Other signals are equal or less than 10ns.

Note 2: For timing of input signals, they are set using 30% and 70% of V_{DD} as the base reference

B. CLOCK AND DATA INPUT TIMING

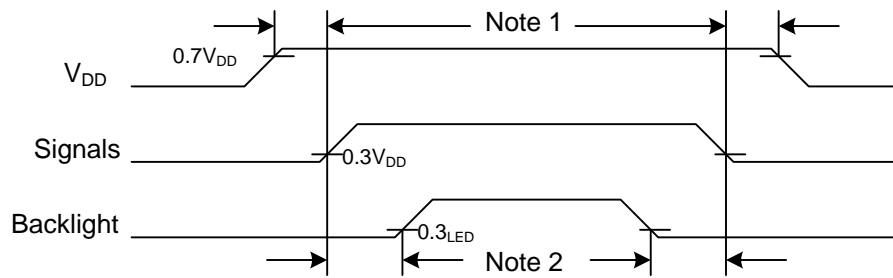
Item		Symbol	Min.	Typ.	Max.	Unit
CLK	High Time	Tcwh	12	-	-	ns
	Low Time	Tcwl	12	-	-	
Data	Setup Time	Tdsu	7	-	-	
	Hold Time	Tdhd	6	-	-	
DE	Setup Time	Tesu	8	-	-	
	Hold Time	Tehd	8	-	-	

8.5 LVDS RECEIVER TIMING



	Item	Symbol	Min.	Typ.	Max.	Unit
CLK	Cycle frequency	$1/t_{CLK}$	31.5	33.3	36	MHz
RinX (X=0,1,2)	0 data position	tRP0	$1/7 * t_{CLK} - 0.49$	$1/7 * t_{CLK}$	$1/7 * t_{CLK} + 0.49$	ns
	1st data position	tRP1	-0.49	0	+0.49	
	2nd data position	tRP2	$6/7 * t_{CLK} - 0.49$	$6/7 * t_{CLK}$	$6/7 * t_{CLK} + 0.49$	
	3rd data position	tRP3	$5/7 * t_{CLK} - 0.49$	$5/7 * t_{CLK}$	$5/7 * t_{CLK} + 0.49$	
	4th data position	tRP4	$4/7 * t_{CLK} - 0.49$	$4/7 * t_{CLK}$	$4/7 * t_{CLK} + 0.49$	
	5th data position	tRP5	$3/7 * t_{CLK} - 0.49$	$3/7 * t_{CLK}$	$3/7 * t_{CLK} + 0.49$	
	6th data position	tRP6	$2/7 * t_{CLK} - 0.49$	$2/7 * t_{CLK}$	$2/7 * t_{CLK} + 0.49$	

8.6 POWER 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.

8.7 DATA INPUT for DISPLAY COLOR

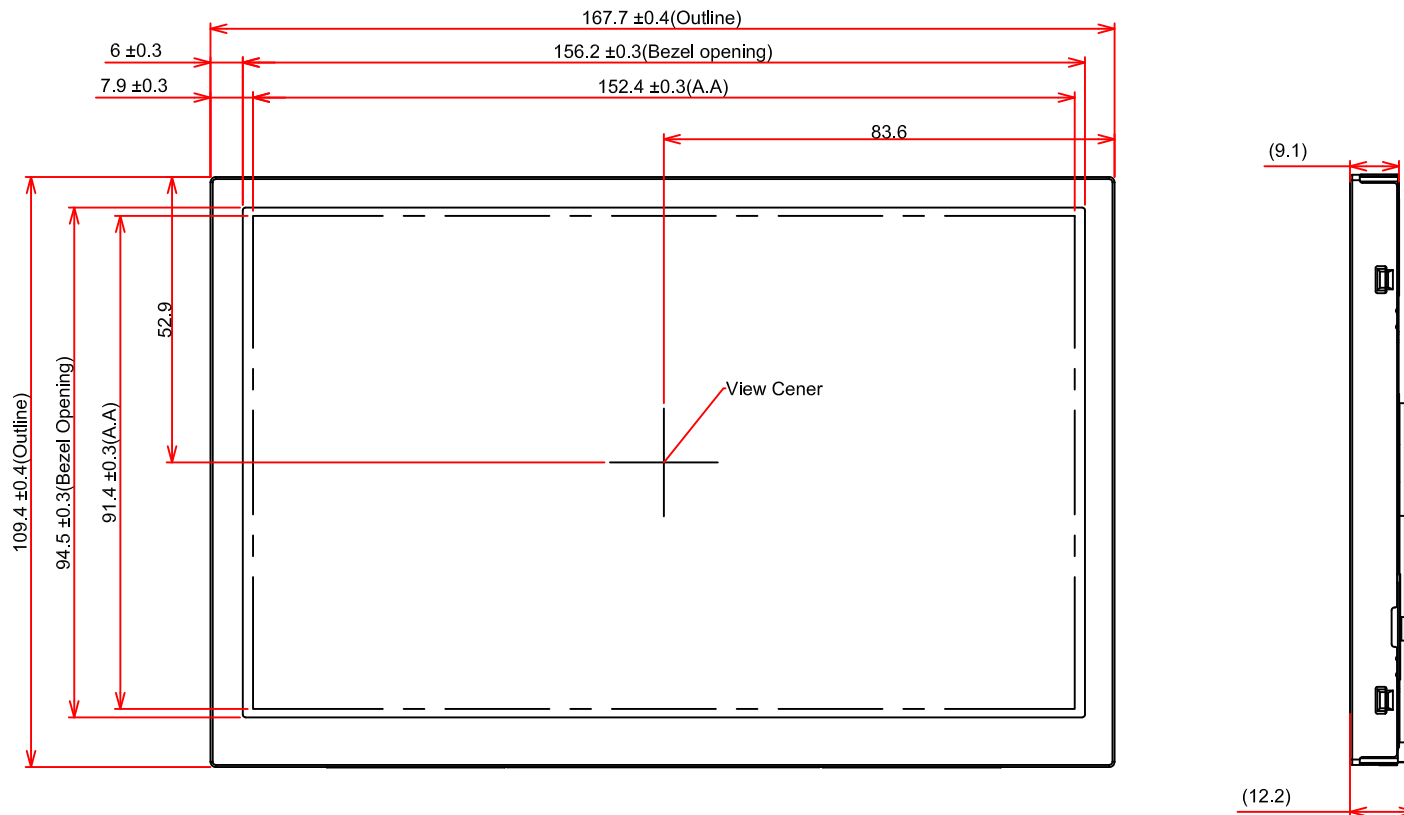
Input color		Red Data								Green Data								Blue Data													
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0						
		MSB								LSB								MSB								LSB					
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0							
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1							
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1							
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1							
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0							
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1							
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
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	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0							
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0							
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	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0							
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0							
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0							
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1							
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0							
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	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1							
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0							
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1							

Note 1: Definition of gray scale : Color(n) Number in parenthesis indicates gray scale level. Larger number corresponds to brighter level.

Note 2: Data Signal : 1 : High, 0 : Low

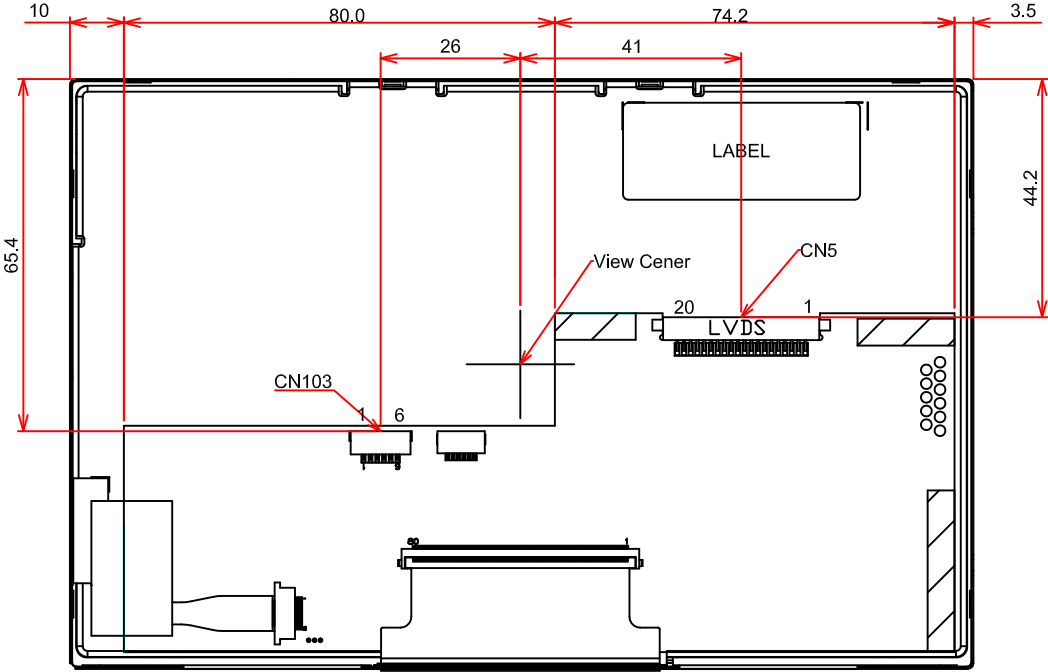
9. OUTLINE DIMENSIONS

9.1 FRONT VIEW



General Tolerance: ± 0.5 mm
Scale : NTS
Unit : mm

9.2 REAR VIEW



General Tolerance: ±0.5mm
 Scale : NTS
 Unit : mm