

# KOE

## JDI Group

TENTATIVE

Kaohsiung Opto-Electronics Inc.

FOR MESSRS : \_\_\_\_\_

DATE : Aug. 31<sup>st</sup>, 2017

### TECHNICAL DATA

## TX26D206VM0BAA(WS)

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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 10.25" HD of 8:3 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	TX26D206VM0BAA
Module Dimensions	259.0(W) mm x 111.4(H) mm x 14.2 (D) mm
LCD Active Area	243.7(W) mm x 91.4(H) mm
Pixel Pitch	0.1269(W) mm x 0.1269 (H) mm
Resolution	1920 x 3(RGB)(W) x 720(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	430g
Interface	2ch-LVDS; 50 pins
Power Supply Voltage	3.3V for LCD; 12V for Backlight
Power Consumption	(TBD)
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	$V_{LED}$	6	21	V	-
Backlight Voltage for PWM	$V_{PWM}$	-0.3	6	V	-
Backlight Voltage for VDC	$V_{DC}$	0	3.3	V	-
Backlight Voltage for EN	$V_{EN}$	-0.3	6	V	-

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

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

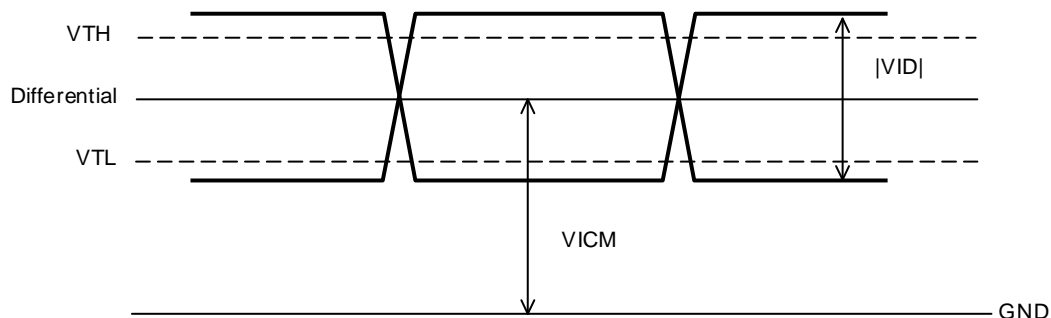
Item	Symbol	Condition	Standard Value			Unit	Remarks
			Min.	Typ.	Max.		
Power supply voltage	$V_{DD}$	-	3.0	3.3	3.6	V	-
Power supply current	$I_{DD}$	Note 1	-	610	-	mA	Note 1,4
Input signal voltage (CMOS)	$V_{IH1}$	-	$0.8V_{DD}$	-	$V_{DD}$	V	Note 2
	$V_{IL1}$	-	$V_{SS}$	-	$0.2V_{DD}$	V	
Allowable Ripple Voltage	VRP	-	-	-	100	mV (p-p)	-
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	VID	-	100	-	600	mV	
Differential Input Common Mode Voltage	$V_{ICM}$	-	1.125	1.2	1.375	V	

Note 1: Measurement pattern: All white.

Power supply voltage: Typ. voltage.

Note 2: Signals of interest is UL / DR.

Note 3: Signal of interest is LVDS.



Note 4: (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

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	$V_{LED}$	$I_{LED}=630\text{mA}$	-	12	-	V	Note 1
LED Forward Current	$I_{LED}$	$3.3V_{DC}$ ; 100% duty	-	630	-	mA	Note 2
		$0.2 V_{DC}$ ; 0% duty	-	60	-		
PWM Signal Voltage	-	High	2.5	3.3	5	V	-
		Low	-	-	0.9		
		Range	0	-	100	%	
EN Voltage	$V_{EN}$	-	2.5	3.3	5.0	V	-
LED Lifetime	-	$I_{LED}=630\text{mA}$	-	70K	-	hrs	Note 3

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

Note 2: Dimming function can be obtained by applying PWM signal from the display interface CN2. The recommended PWM signal is 1K ~ 10KHz with 3.3 V amplitude.

Note 3: The estimated lifetime is specified as the time to reduce 50% brightness by applying 630mA at  $25^\circ\text{C}$ .

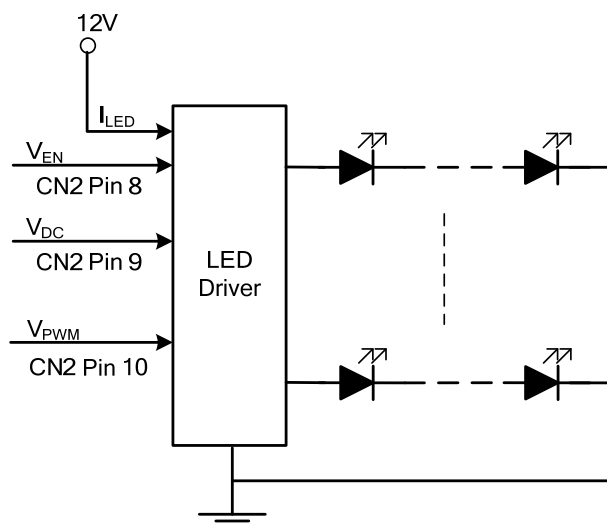


Fig 5.1

## 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 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	-	$\phi = 0^\circ, \theta = 0^\circ,$ $I_{LED} = 630 \text{ mA}$	-	1000	-	cd/m <sup>2</sup>	Note 1
Brightness Uniformity	-		-	-	-	%	Note 2
Contrast Ratio	CR		-	1000	-	-	Note 3
Response Time	$T_r + T_f$	$\phi = 0^\circ, \theta = 0^\circ$	-	20	-	ms	Note 4
NTSC Ratio	-	$\phi = 0^\circ, \theta = 0^\circ$	-	70	-	%	-
Viewing Angle	$\theta_x$	$\phi = 0^\circ, CR \geq 10$	-	85	-	Degree	Note 5
	$\theta_{x'}$	$\phi = 180^\circ, CR \geq 10$	-	85	-		
	$\theta_y$	$\phi = 90^\circ, CR \geq 10$	-	85	-		
	$\theta_{y'}$	$\phi = 270^\circ, CR \geq 10$	-	85	-		
Color Chromaticity	Red	X	-	0.64	-	-	Note 6
		Y	-	0.32	-		
	Green	X	-	0.31	-		
		Y	-	0.61	-		
	Blue	X	-	0.14	-		
		Y	-	0.06	-		
	White	X	-	0.32	-		
		Y	-	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.

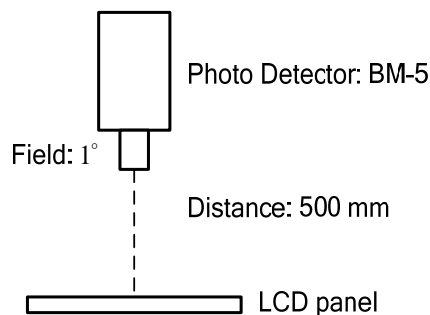


Fig. 6.1

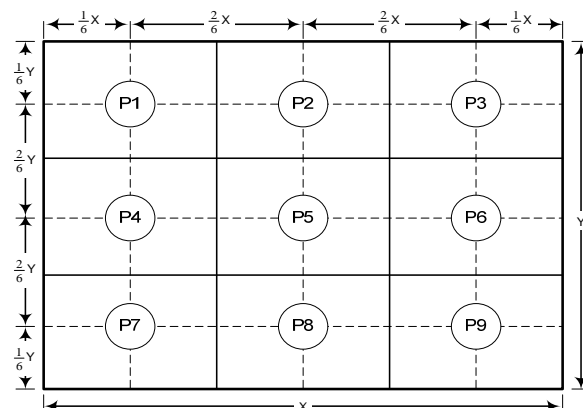


Fig. 6.2

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 falling to 10% brightness.

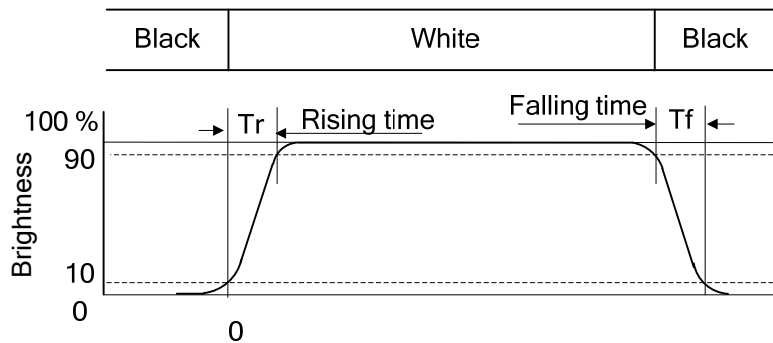


Fig 6.3

Note 5: The definition of viewing angle is shown in Fig. 6.4. Angle  $\phi$  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  $\theta$  is used to represent viewing angles from axis Z toward plane XY.

The display is super wide viewing angle version;  $85^\circ$  viewing angle can be obtained from each viewing direction.

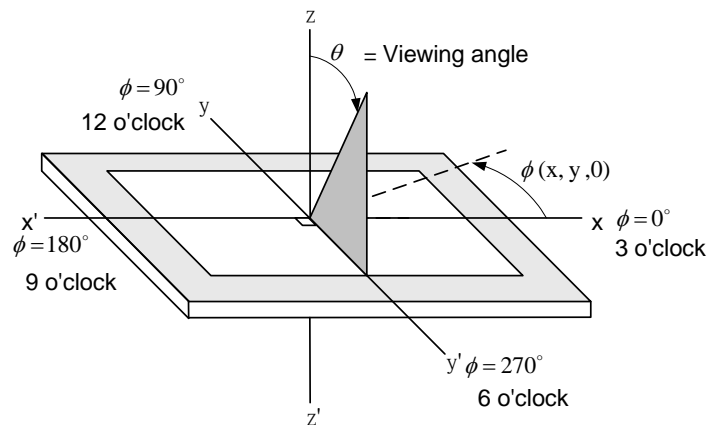
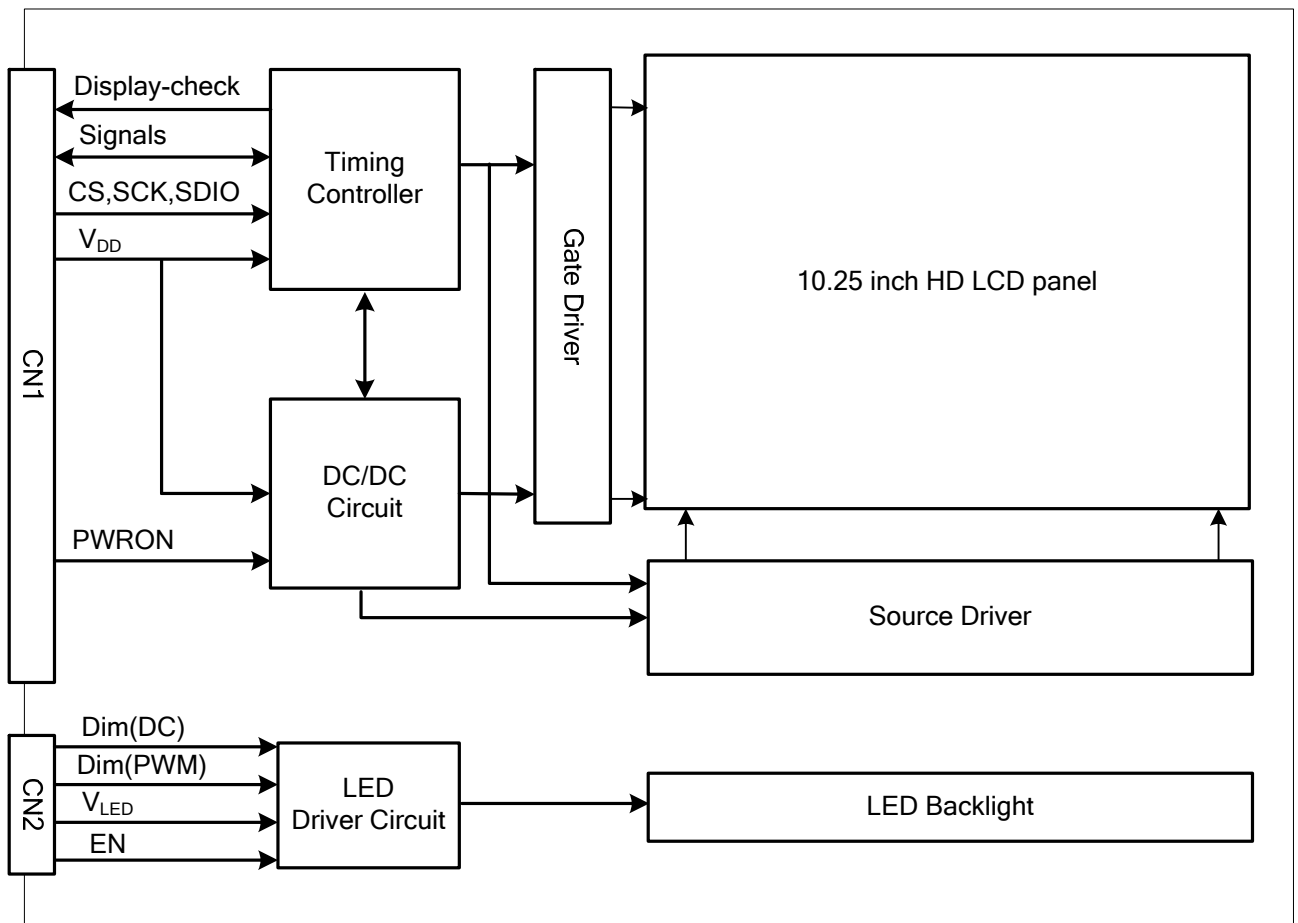


Fig 6.4

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



# 7. BLOCK DIAGRAM



## 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	Note
1	GND	GND (0V)	I	
2	GND	GND (0V)	I	
3	GND	GND (0V)	I	
4	GND	GND (0V)	I	
5	NC	Not connected	-	
6	NC	Not connected	-	3
7	GND	GND (0V)	I	
8	GND	GND (0V)	I	
9	GND	GND (0V)	I	
10	GND	GND (0V)	I	
11	NC	Not connected	-	
12	VDD	+3.3V	I	
13	VDD	+3.3V	I	
14	VDD	+3.3V	I	
15	VDD	+3.3V	I	
16	NC	Not connected	-	
17	UL/DR	Up & Left / Down & Right switching terminal	I	4
18	GND	GND (0V)	I	3
19	NC	Not connected	-	
20	GND	GND (0V)	I	
21	RO0-	-LVDS differential data input, Chan 0-odd	I	
22	RO0+	+LVDS differential data input, Chan 0-odd	I	
23	GND	GND (0V)	I	
24	RO1-	-LVDS differential data input, Chan 1-odd	I	
25	RO1+	+LVDS differential data input, Chan 1-odd	I	
26	GND	GND (0V)	I	
27	RO2-	-LVDS differential data input, Chan 2-odd	I	
28	RO2+	+LVDS differential data input, Chan 2-odd	I	
29	GND	GND (0V)	I	
30	CLKO-	-LVDS clock input(odd)	I	

No	Symbol	Function	I/O	Note
31	CLKO+	+LVDS clock input(odd)	I	
32	GND	GND (0V)	I	
33	RO3-	-LVDS differential data input, Chan 3-odd	I	
34	RO3+	+LVDS differential data input, Chan 3-odd	I	
35	GND	GND (0V)	I	
36	RE0-	-LVDS differential data input, Chan 0-Even	I	
37	RE0+	+LVDS differential data input, Chan 0-Even	I	
38	GND	GND (0V)	I	
39	RE1-	-LVDS differential data input, Chan 1-Even	I	
40	RE1+	+LVDS differential data input, Chan 1-Even	I	
41	GND	GND (0V)	I	
42	RE2-	-LVDS differential data input, Chan 2-Even	I	
43	RE2+	+LVDS differential data input, Chan 2-Even	I	
44	GND	GND (0V)	I	
45	CLKE-	-LVDS clock input(Even)	I	
46	CLKE+	+LVDS clock input(Even)	I	
47	GND	GND (0V)	I	
48	RE3-	-LVDS differential data input, Chan 3-Even	I	
49	RE3+	+LVDS differential data input, Chan 3-Even	I	
50	GND	GND (0V)	I	

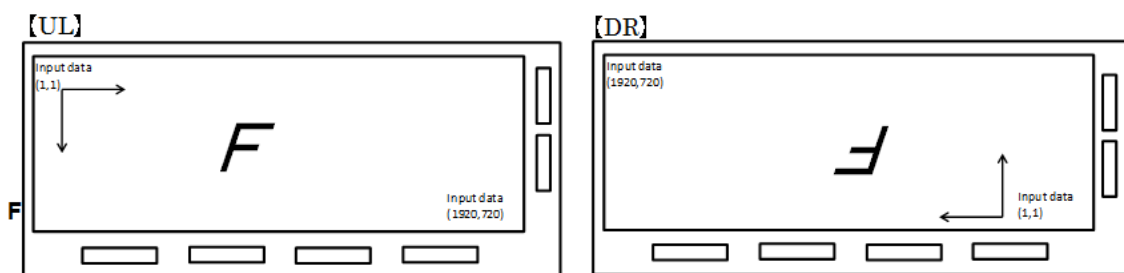
Note 1: Please connection Ground 0V.

Note 2: Not connected terminal should not enter the signal.

Note 3: Reserve terminal means that there is a potential application in the future.

It is GND or NC if LCD does not apply an application.

Note 4: Please change the scanning direction in.



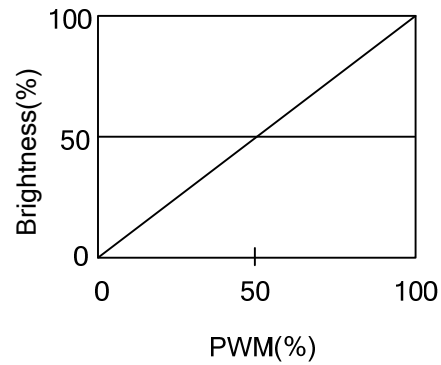
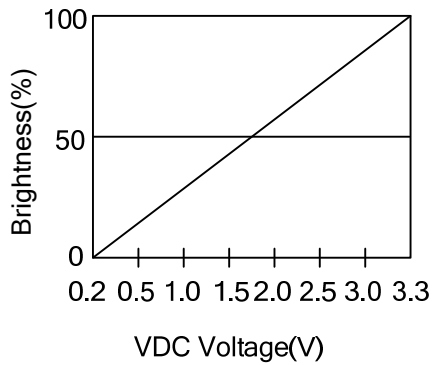
UL / DR: GND

UL / DR: VDD(+3.3V)

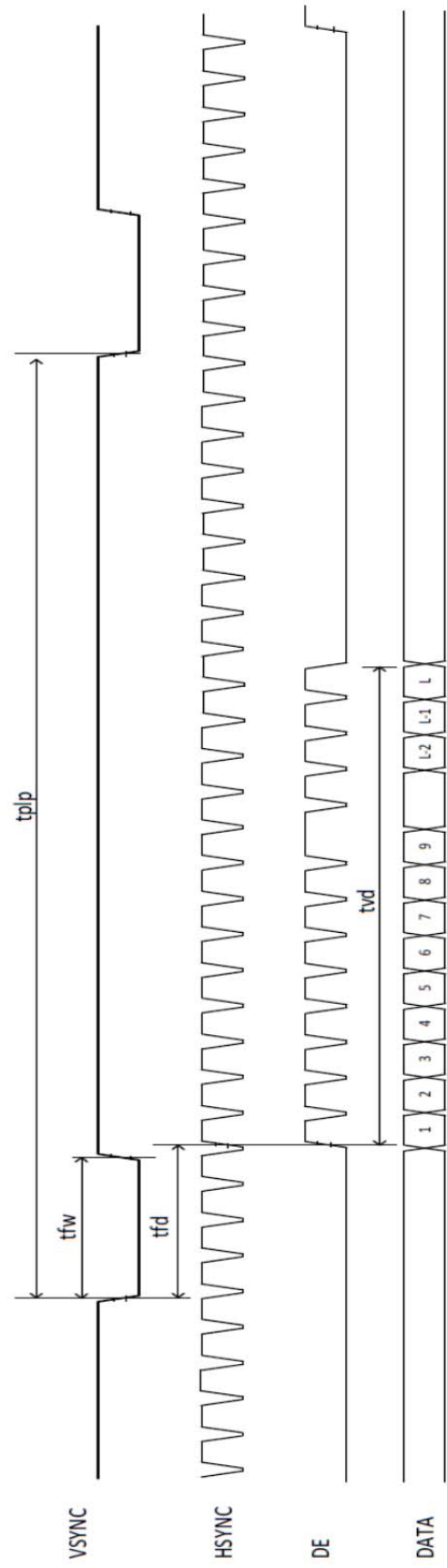
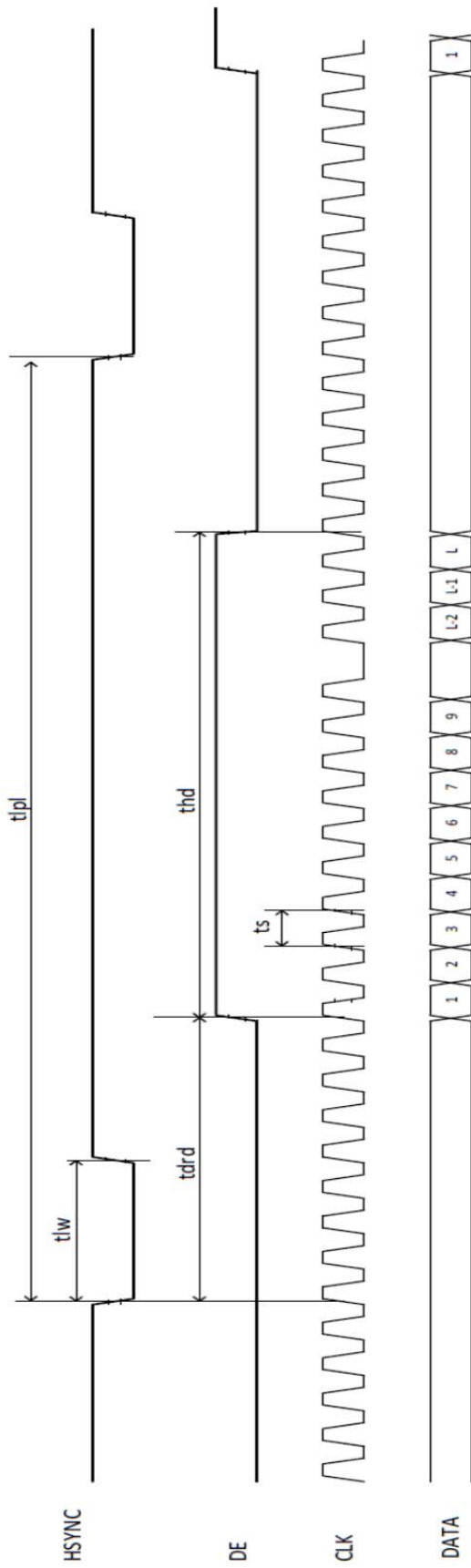
The interface CN2 is SM10B-SRSS-TB(LF)(SN) made by JST and pin assignment is as below:

Connector Name	Pin No.	Symbol	Function
SM10B-SRSS-TB(LF)(SN)	1	$V_{LED(+)}$	Power Supply for LED
	2	$V_{LED(+)}$	Power Supply for LED
	3	$V_{LED(+)}$	Power Supply for LED
	4	NC	No Connected
	5	$V_{LED(-)}$	GND
	6	$V_{LED(-)}$	GND
	7	$V_{LED(-)}$	GND
	8	$V_{EN}$	Backlight On/Off
	9	$V_{DC}$	Brightness dimming
	10	$V_{PWM}$	Brightness dimming

Note 1: The relationship of brightness and Dim control are shown as below.



# 8.2 TIMING CHART



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.

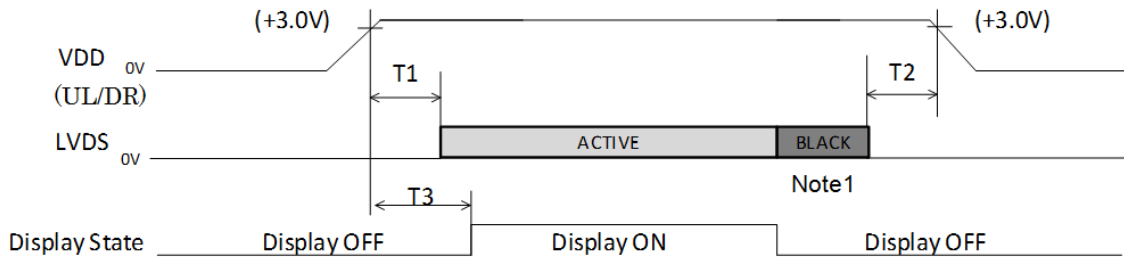
Timing specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
CLK	1/ts	55	57.81	60	MHz	
	-	60	60	60	Hz	
Horizontal Period(1)	tlpl	1240	1288	1481	CLK	
Horizontal Period(2)	tlpl	23	-	-	µs	2
Horizontal Width	tlw	3	-	-	CLK	
Vertical Period	tplp	747	748	800	Line	
Vertical Width	tfw	2	-	-	Line	
Horizontal DE	thd	-	960	-	CLK	
Vertical DE	tfd	-	720	-	Line	
Horizontal Position	tfrd	-	268	-	CLK	
Vertical Position	tfd	-	25	-	Line	

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

Note 2: The performance of LCD might be able not to be satisfied according to the combination of CLK Frequency and Horizontal Period (1). Please keep this specification.

### 8.3 Power ON/OFF sequence



Item	Symbol	Condition	Standard value			Unit	Remarks
			Min.	Typ.	Max.		
Power on sequence	T1		0		TBD	ms	
Power off sequence	T2		0		TBD	ms	
Display on	T3		TBD	TBD	TBD	ms	
Power-off period	T <sub>po</sub>		TBD			ms	

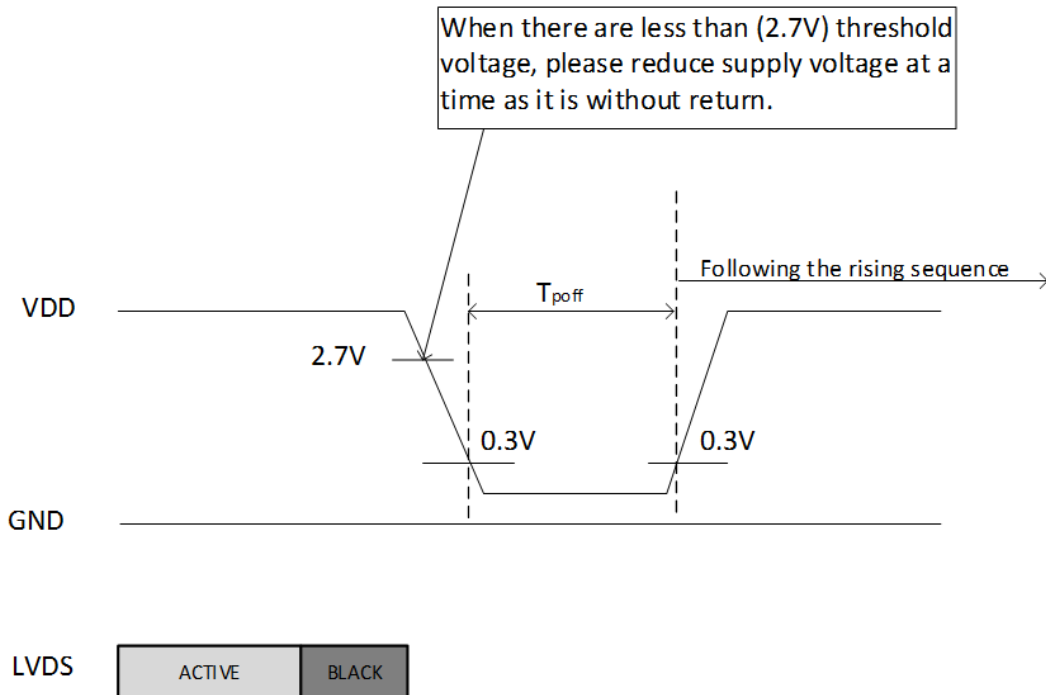
Note 1: Please display the black by 1V or more.

Note 2: When power supply is OFF, logic input must be kept at either VSS level or high impedance

Note 3: The rising speed of all power supplies should be less than 2V/100μs.

Note 4: As for UL/DR, it is a pull-up in the power supply or GND.

### Restart Sequence



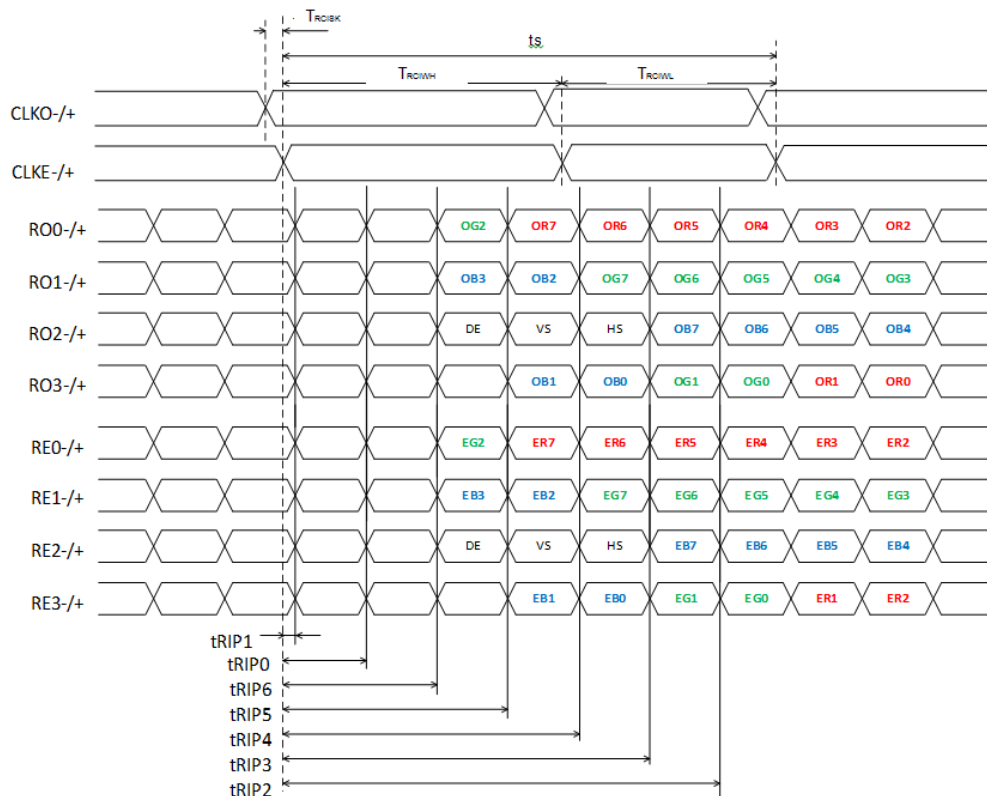
Note 1: Refer to ON/OFF Sequence for the timing of LVDS.

## 8.4 LVDS Sequence

### AC characteristics

Item	Symbol	Condition	Standard value			Unit	Remarks
			Min.	Typ.	Max.		
CLK Low Level Width	TRLWH		0.37 ts	-	0.55 ts	ns	
CLK Hi Level Width	TRCIWL		0.45 ts	-	0.63 ts	ns	
Skew Margin	TRMG		-	-	400	ps	
Ch Skew	TRCISK		-1/14 ts	-	+1/14 ts	CLK	
Posision0	tRIP0		1/7 ts - TRMG	1/7 ts	1/7 ts + TRMG	ns	
Posision1	tRIP1		- TRMG	0	+ TRMG	ns	
Posision2	tRIP2		6/7 ts - TRMG	6/7 ts	6/7 ts + TRMG	ns	
Posision3	tRIP3		5/7 ts - TRMG	5/7 ts	5/7 ts + TRMG	ns	
Posision4	tRIP4		4/7 ts - TRMG	4/7 ts	4/7 ts + TRMG	ns	
Posision5	tRIP5		3/7 ts - TRMG	3/7 ts	3/7 ts + TRMG	ns	
Posision6	tRIP6		2/7 ts - TRMG	2/7 ts	2/7 ts + TRMG	ns	

### LVDS data mapping





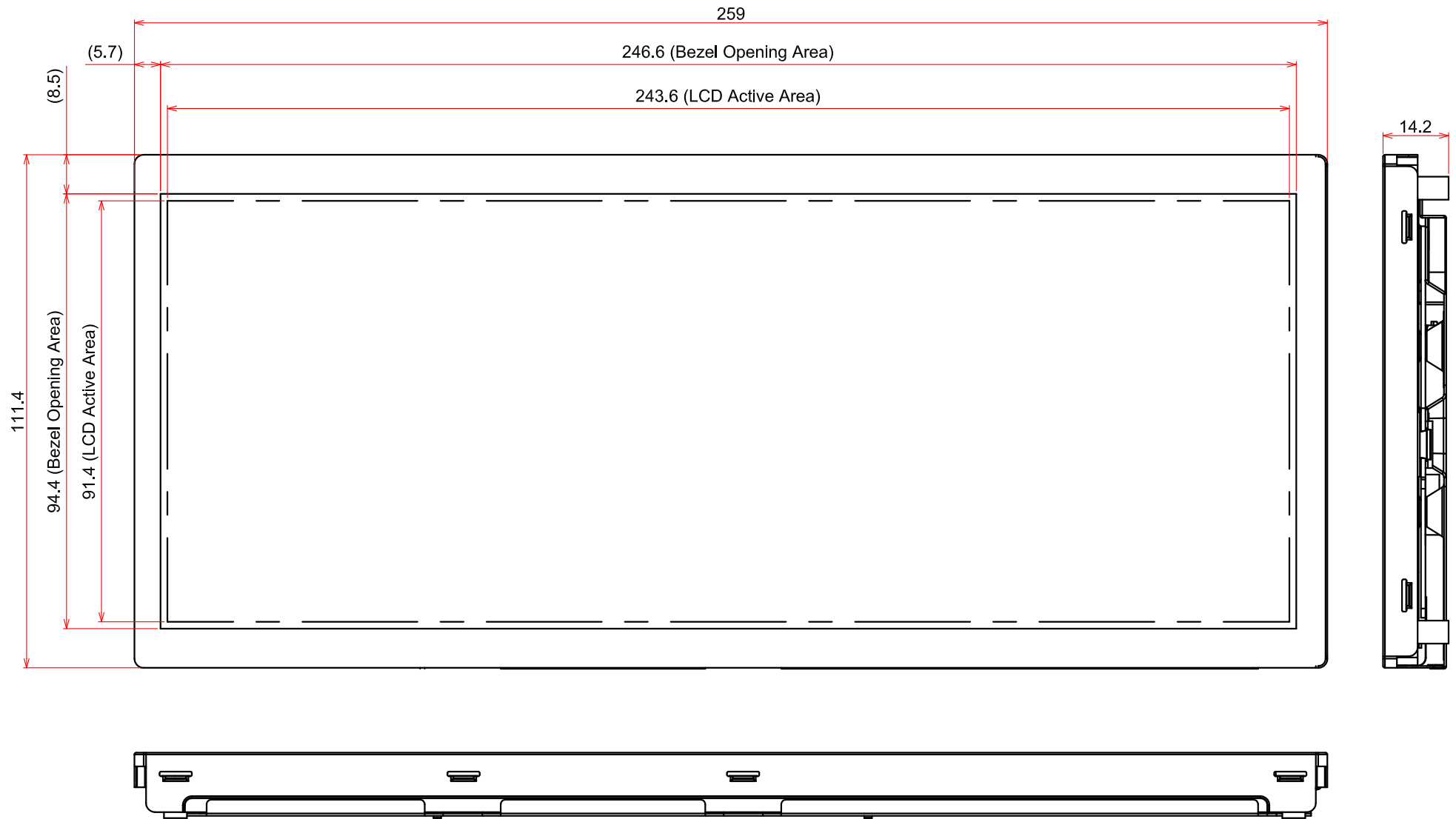
## 8.5 DATA INPUT for DISPLAY COLOR

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	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							
	Green(255)	L	L	L	L	L	L	L	L	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	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							
	Magenta	H	H	H	H	H	H	H	H	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	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							
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							
	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							
	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							
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:							
	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							
	Red(254)	H	H	H	H	H	H	H	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							
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							
	Green(1)	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							
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:							
	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							
	Green(254)	L	L	L	L	L	L	L	L	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	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							
	Blue(1)	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	H	L							
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:							
	Blue(253)	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	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	H	H	H	H	H	H	H	H							

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

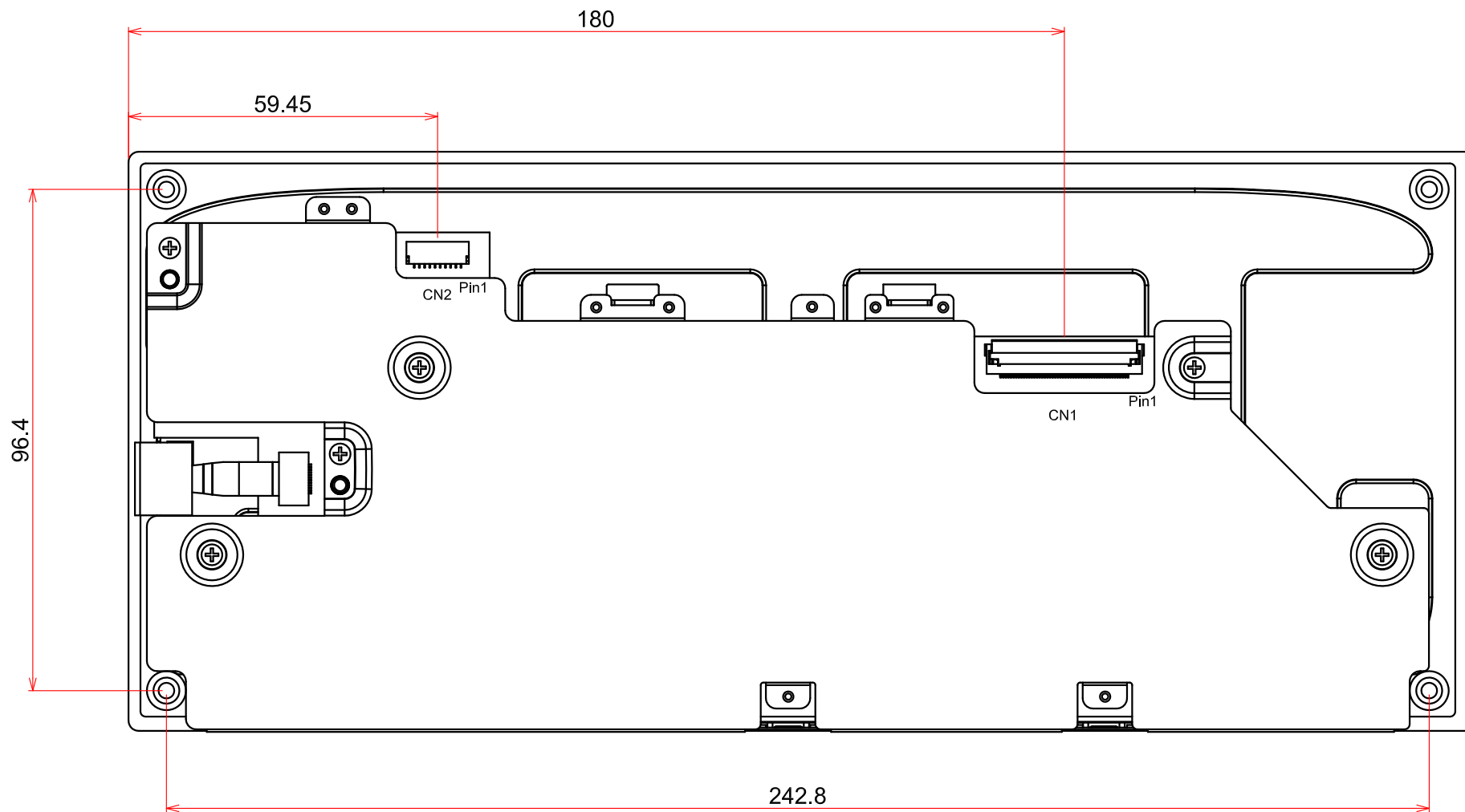
# 9. OUTLINE DIMENSIONS

## 9.1 FRONT VIEW



General Tolerance  $\pm 0.5\text{mm}$   
Scale : NTS  
Unit : mm

# 9.2 REAR VIEW



General Tolerance  $\pm 0.5\text{mm}$   
Scale : NTS  
Unit : mm

# 10. DESIGNATION of LOT MARK

1) The lot mark is showing in Fig.10.1. First 4 digits are used to represent production lot, T represented made in Taiwan, and the last 6 digits are the serial number.

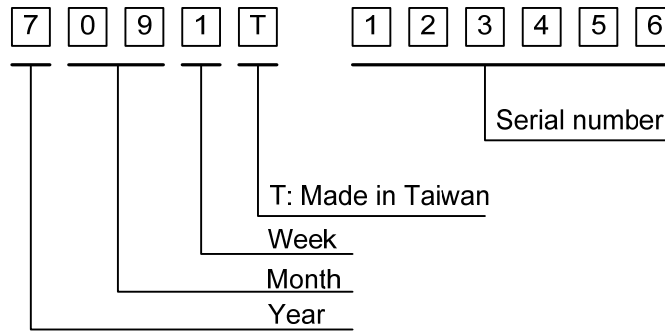


Fig. 10.1

2) The tables as below are showing what the first 4 digits of lot mark are shorted for.

Year	Lot Mark
2017	7
2018	8
2019	9
2020	0
2021	1

Month	Lot Mark	Month	Lot Mark
Jan.	01	Jul.	07
Feb.	02	Aug.	08
Mar.	03	Sep.	09
Apr.	04	Oct.	10
May	05	Nov.	11
Jun.	06	Dec.	12

Week	Lot Mark
1~7 days	1
8~14 days	2
15~21 days	3
22~28 days	4
29~31 days	5

3) The location of the lot mark is on the back of the display shown in Fig. 10.2

Label example:

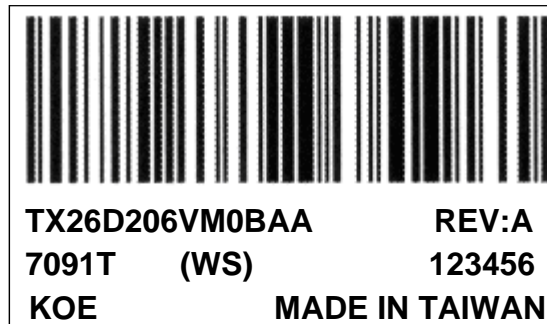


Fig. 10.2