Japan Display Inc.

FOR MESSRS : _____ DATE: Feb. 24th,2025

TECHNICAL DATA

LAM043N145A

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ACCEPTED BY: _____ PROPOSED BY: Alex Lee

2. RECORD OF REVISION

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3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 4.3” WQVGA 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	LAM043N145A
Module Dimensions	104.4(W) mm x 66.1(H) mm x 5.9(D) mm (Without mounting pillar)
LCD Active Area	95.0(W) mm x 53.9(H) mm
Pixel Pitch	0.066 x3(RGB) (W)mm x0.198 (H) mm
Resolution	480x3(RGB)(W) x 272(H) dots
Color Pixel Arrangement	R, G, B Vertical stripe
LCD Type	Transmissive Color TFT; Normally Black
Polarizer surface	Antiglare
Display Type	Active Matrix
Number of Colors	16.7M Colors (8-bit RGB)
Backlight	Light Emitting Diode(LED)
Weight	70g (typ.)
Interface	CMOS; 68 pins
Power Supply Voltage	3.3V for LCD; 13.5V for backlight.
Viewing Direction	Super Wide Version (In Plane Switching)

4. ABSOLUTE MAXIMUM RATINGS

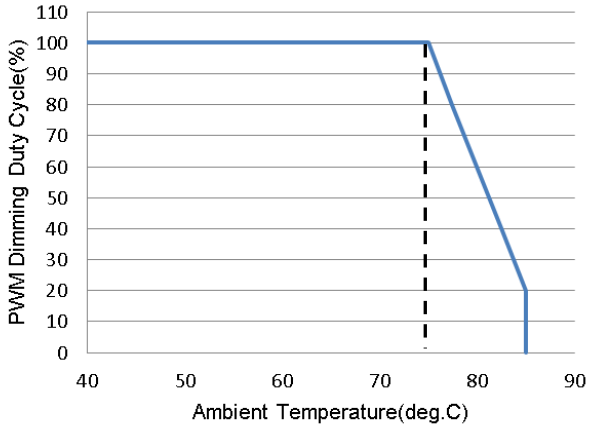
Item	Symbol	Min.	Max.	Unit	Remarks
Input voltage	VB+	-0.3	23	V	-
+3.3V power supply voltage	VCC	-0.3	4.0	V	-
Input signal voltage 1	Vi1	-0.3	7.0	V	Note 1, 4
Input signal voltage 2	Vi2	-0.3	VCC+0.3	V	Note 2
Operating temperature (ambient temperature)	TOP	-40	85	deg.C	No dew condition Note 3
Storage Temperature	TST	-40	85		

Note 1: BL_PWM

Note 2: HD, DEN, VD, NCLK, R0-R7, G0-G7, B0-B7, HRV, VRV, PON

Note 3: Module temperature is apt to increase while it's driving due to the heat of backlight etc. Design carefully not to exceed +85deg.C at every point of LCD surface that should come to contact with any other equipment. In operation temperature range, only LCD operation is assured. Contrast, response time, or other LCD characteristics are specified in the condition of ambient temperature: Ta=+25deg.C.

Note 4: PWM dimming shall operate at Ta≧75deg.C (See the following figure)



Ambient Temperature vs. PWM Dimming Duty Cycle

(Reference data as LCD module alone)

5. ELECTRICAL CHARACTERISTICS

5.1 LCD CHARACTERISTICS

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	VCC	-	3.0	3.3	3.6	V	-
Permissive Voltage Ripple	-	-	-	-	100	mVp-p	
Power Supply Current	ICC	VCC-VSS =3.3V	-	23	60	mA	Note 2
Input signal Voltage	VIH2	"H" level	0.7VCC	-	VCC	V	Note 1
	VIL2	"L" level	VSS	-	0.7		
Frame Frequency	f_{Frame}	-	50	50	60	Hz	-
CLK Frequency	f_{CLK}	-	9.34	9.70	11.19	MHz	

Note 1: The rating is defined for the signal voltages of the interface such as HD, DEN, VD, NCLK, R0-R7, G0-G7, B0-B7, HRV, VRV, PON.

Note 2: An all white pattern is used when measuring ICC, f_{Frame} is set to 50 Hz.

5.2 BACKLIGHT CHARACTERISTICS

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	VB+	IB+=140mA	7	13.5	18	V	Note 1
LED Forward Current (PWM Control)	IB+	100% duty	-	140	400	mA	Note 2
PWM Signal Voltage	VIH1	"H" level	2.1	3.3	-	V	Note 2
	VIL1	"L" level	VSS	-	0.4		
LED Lifetime	-	IB+=140mA	-	50K	-	hrs	Note 4

Note 1: As Fig. 5.1 shown, LED current is constant, 140 mA, controlled by the LED driver when applying 13.5V.

Note 2: Dimming function can be obtained by applying PWM signal from the display interface, The recommended PWM signal is 150 ~ 250 Hz.

Note 3: The estimated lifetime is specified as the time to reduce 50% brightness by applying 140mA at 25°C.

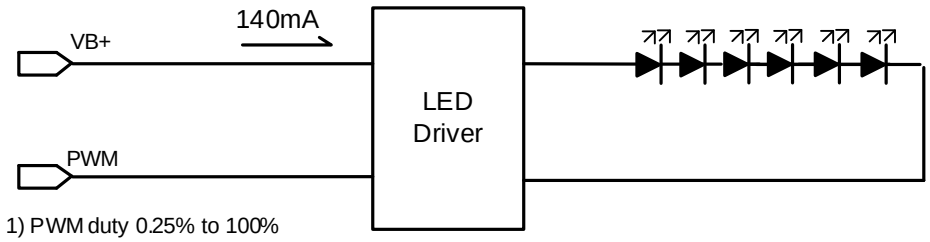


Fig 5.1

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 around 100 lx, the equipment has been set for the measurements as shown in Fig 6.1.

$T_a = 25\ ^{\circ}C,\ f_{Frame} = 50\ Hz,\ VCC = 3.3V$

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Brightness of White		-	IB+= 140mA $\phi = 0^{\circ}, \theta = 0^{\circ}$	960	1200	-	cd/m^2	Note 1
Brightness Uniformity		-		75	-	-	%	Note 2
Contrast Ratio		CR		-	1000	-	-	Note 3
Response Time		Tr + Tf	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	30	40	ms	Note 4
NTSC Ratio		-	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	60	-	%	-
Viewing Angle		θx	$\phi = 0^{\circ}, CR \geq 10$	70	80	-	Degree	Note 5
		$\theta x'$	$\phi = 180^{\circ}, CR \geq 10$	70	80	-		
		θy	$\phi = 90^{\circ}, CR \geq 10$	70	80	-		
		$\theta y'$	$\phi = 270^{\circ}, CR \geq 10$	70	80	-		
Color Chromaticity	Red	X	$\phi = 0^{\circ}, \theta = 0^{\circ}$	0.58	0.63	0.68	Note 6	Note 6
		Y		0.26	0.31	0.36		
	Green	X		0.28	0.33	0.38		
		Y		0.57	0.62	0.67		
	Blue	X		0.11	0.16	0.21		
		Y		0.07	0.12	0.17		
	White	X		0.26	0.31	0.36		
		Y		0.28	0.33	0.38		

Note 1: The brightness is measured from 9 point average value of the panel, P5 in Fig. 6.2, for the typical value.

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

$$\text{Brightness uniformity} = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \text{ X100\%}$$

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

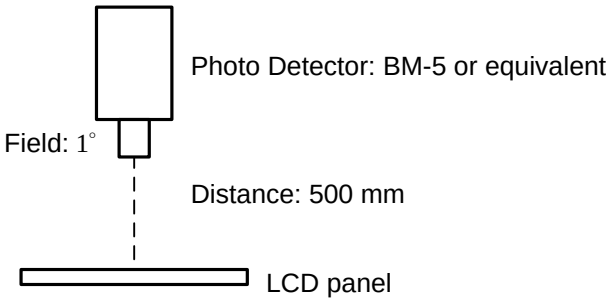


Fig 6.1

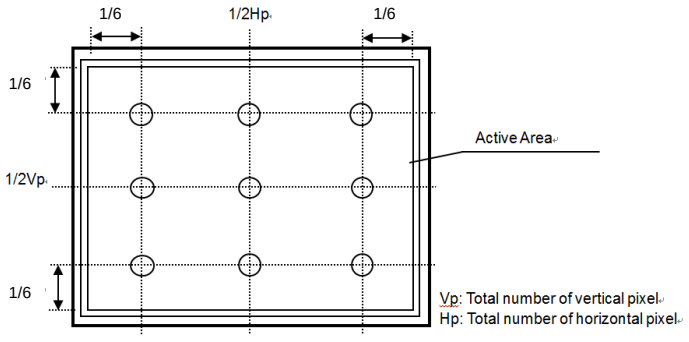


Fig 6.2

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.

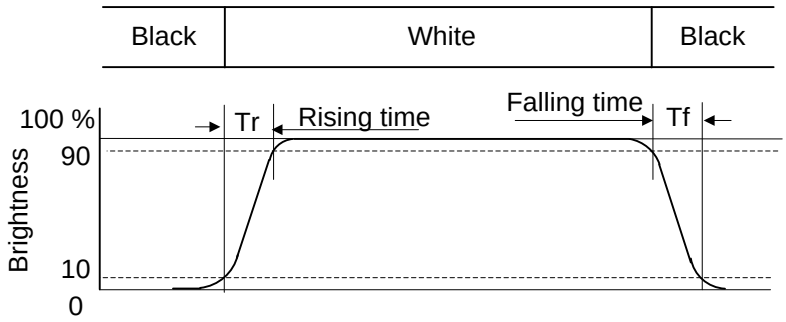


Fig 6.3

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.

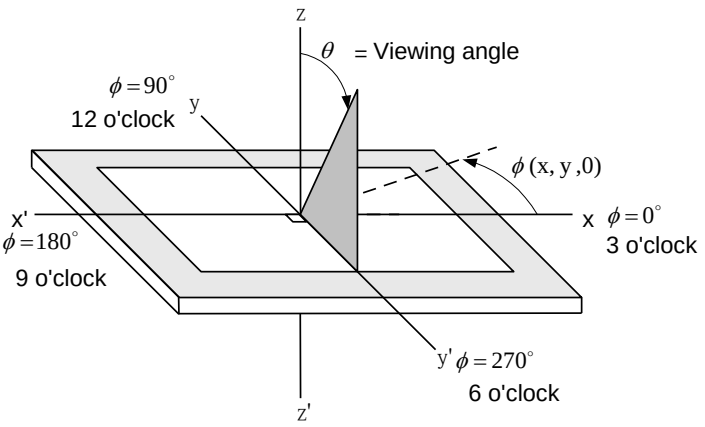
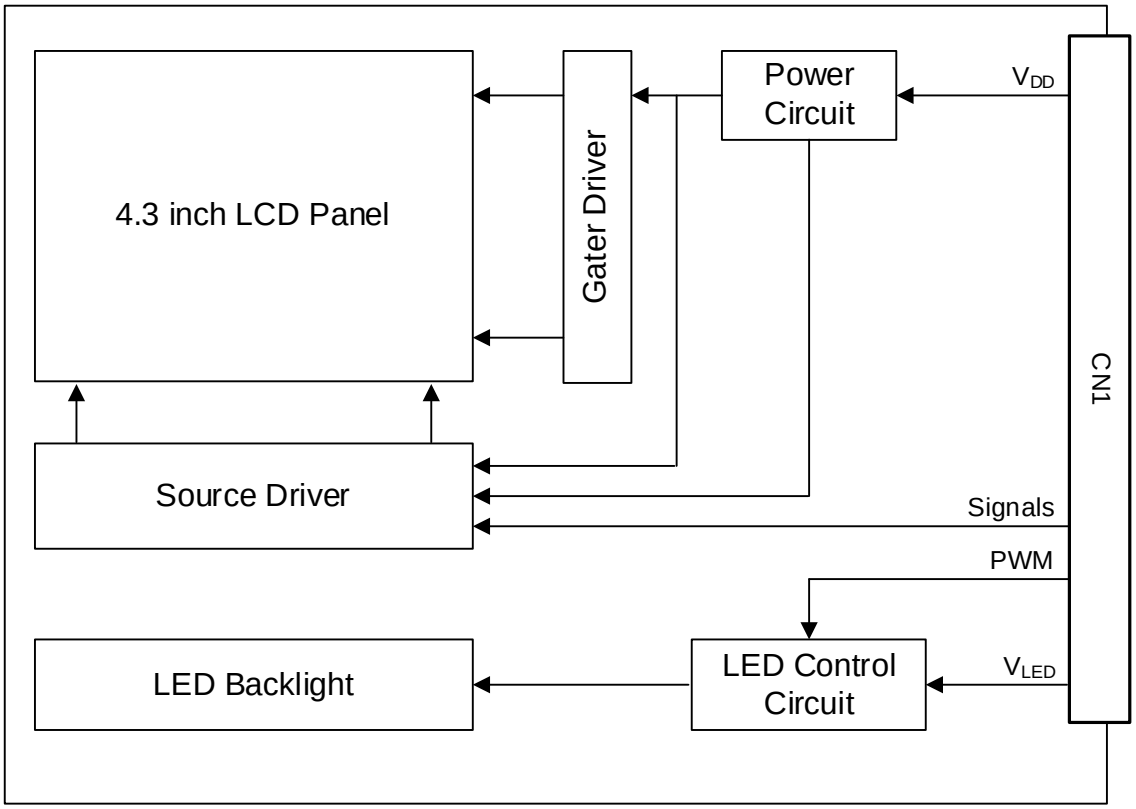


Fig 6.4

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 a DEN, VD, HD, NCLK and RGB data bus.

8. LCD INTERFACE

8.1 INTERFACE PIN CONNECTIONS

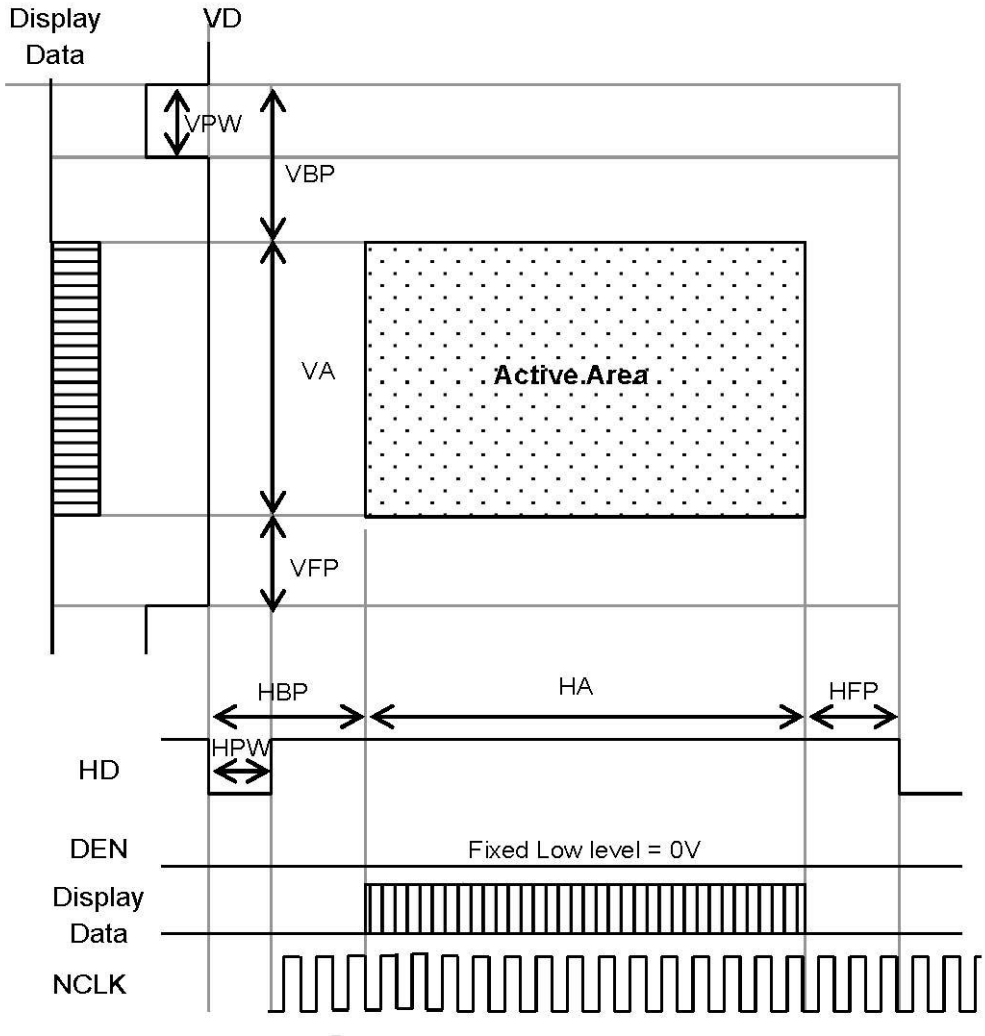
The display interface connector is FH41-068S-0.5SH(0.5) made by HIROSE ELECTRIC or equivalent.

The pin assignment of LCD interface is as below:

Pin No.	Signal	Function	Pin No.	Signal	Function
1	TEST	Continuity to Pin 68	35	R0	(RGB I/F) Red Data (LSB)
2	GND	GND	36	GND	GND
3	GND	GND	37	GND	GND
4	GND	GND	38	G7	(RGB I/F) Green Data (MSB)
5	GND	GND	39	G6	(RGB I/F) Green Data
6	GND	GND	40	G5	(RGB I/F) Green Data
7	N.C	No connection	41	G4	(RGB I/F) Green Data
8	VB+	Power Supply Voltage for Backlight	42	G3	(RGB I/F) Green Data
9	VB+	Power Supply Voltage for Backlight	43	G2	(RGB I/F) Green Data
10	N.C	No connection	44	G1	(RGB I/F) Green Data
11	GND	GND	45	G0	(RGB I/F) Green Data (LSB)
12	GND	GND	46	GND	GND
13	N.C	No connection	47	GND	GND
14	BL_{PWM}	Input Signal for Backlight Dimming	48	B7	(RGB I/F) Blue Data (MSB)
15	N.C	No connection	49	B6	(RGB I/F) Blue Data
16	TEST	Test Pin	50	B5	(RGB I/F) Blue Data
17	TEST	Test Pin	51	B4	(RGB I/F) Blue Data
18	VRV	Vertical Scanning Direction	52	B3	(RGB I/F) Blue Data
19	HRV	Horizontal Scanning Direction	53	B2	(RGB I/F) Blue Data
20	GND	GND	54	B1	(RGB I/F) Blue Data
21	GND	GND	55	B0	(RGB I/F) Blue Data(LSB)
22	N.C	No connection	56	GND	GND
23	VCC	Power Supply Voltage	57	GND	GND
24	VCC	Power Supply Voltage	58	PON	Reset Signal
25	N.C	No connection	59	GND	GND
26	GND	GND	60	GND	GND
27	GND	GND	61	NCLK	Clock Signal
28	R7	(RGB I/F) Red Data (MSB)	62	GND	GND
29	R6	(RGB I/F) Red Data	63	GND	GND
30	R5	(RGB I/F) Red Data	64	VD	Vertical Sync
31	R4	(RGB I/F) Red Data	65	DEN	Horizontal Data Enable
32	R3	(RGB I/F) Red Data	66	HD	Horizontal Sync
33	R2	(RGB I/F) Red Data	67	GND	GND
34	R1	(RGB I/F) Red Data	68	TEST	Continuity to Pin 1

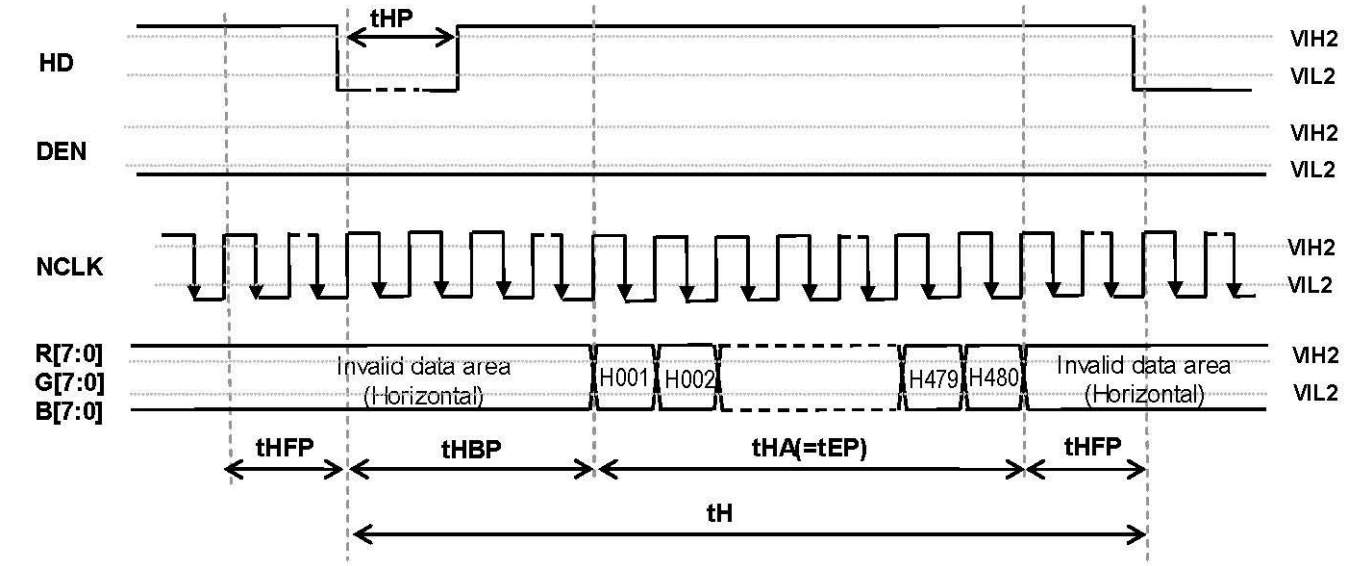
8.2 TIMING CHART

A. GENERAL TIMING DIAGRAM

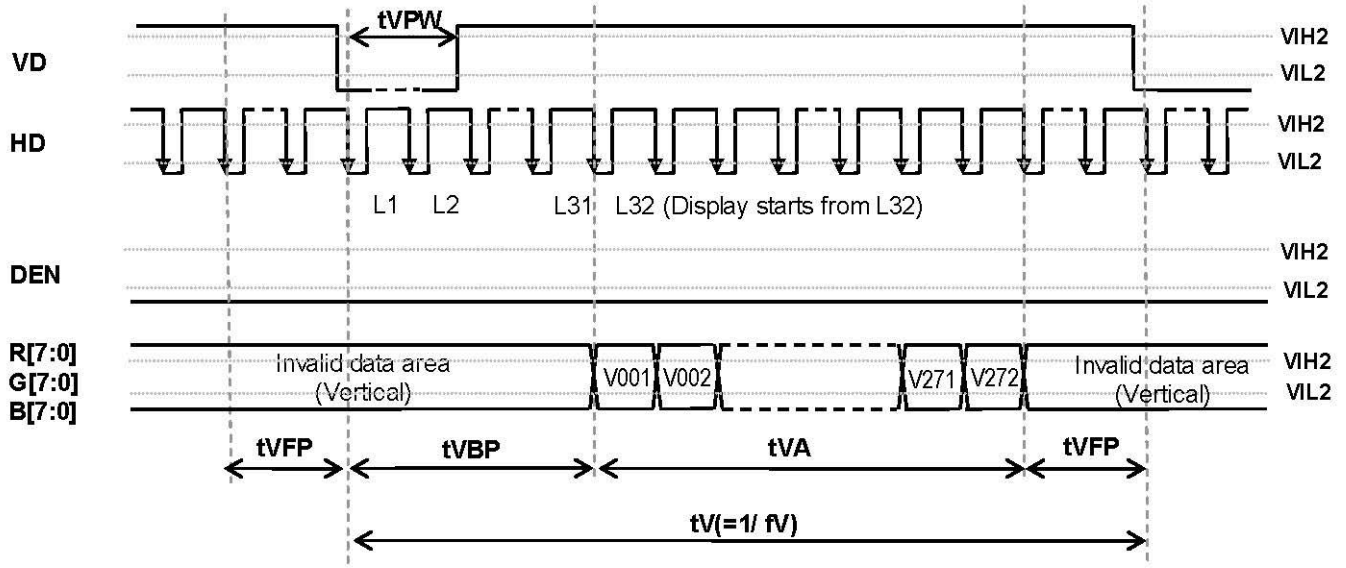


Condition	Description
VPW	Vertical Sync time (VD=L)
VBP	Vertical Back Porch
VA	Vertical Display Active Area
VFP	Vertical Front Porch
HPW	Horizontal Sync time (HD=L)
HBP	Horizontal Back Porch
HA	Horizontal Display Active Area
HFP	Horizontal Front Porch

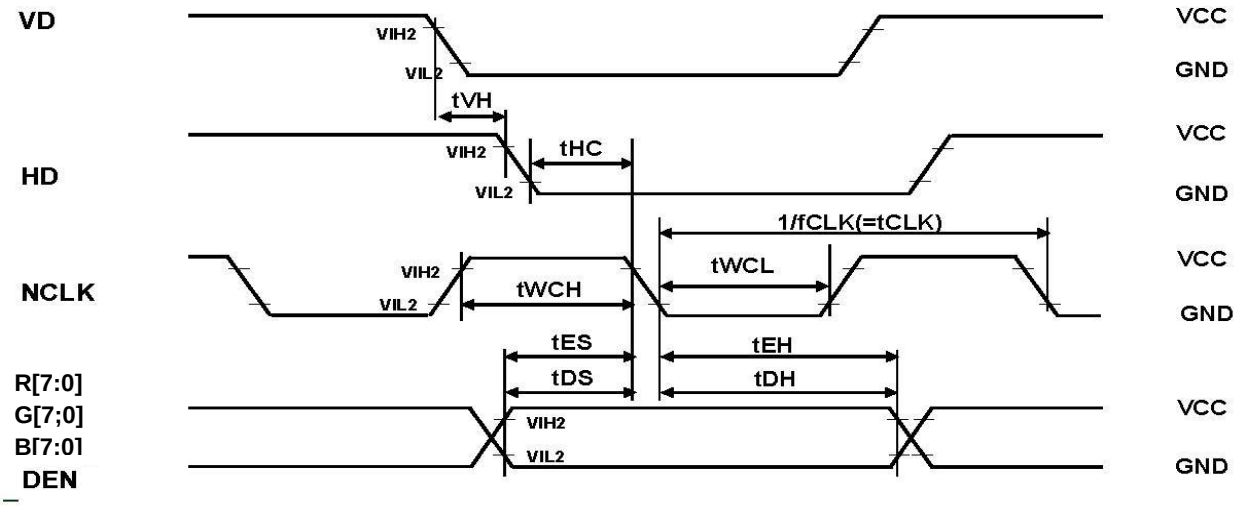
B. TIMING CHART1 (HORIZONTAL)



C. TIMING CHART2 (VERTICAL)



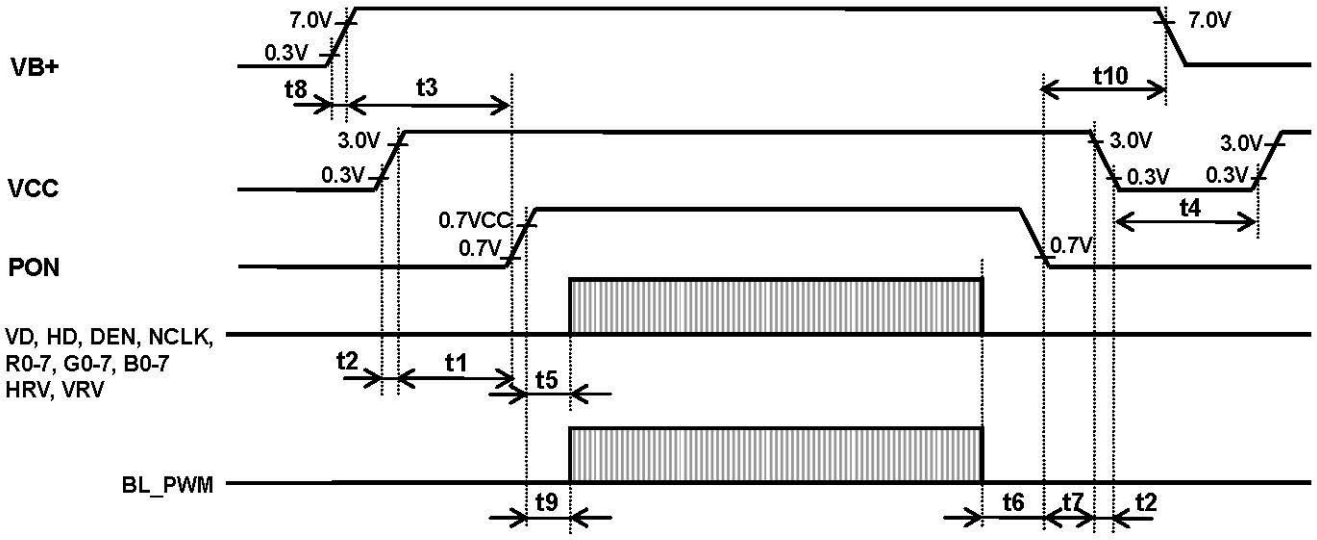
D. TIMING CHART3 (SETUP&HOLD TIME, OTHERS)



8.3 TIMING TABLE

Parameter		Symbol	Min.	Typ.	Max.	Unit	Description
Clock [NCLK]	Frequency	fCLK	8	8.4	11.51	MHz	
	Hi_Time	tWCH	20	-	-	ns	
	Lo_Time	tWCL	20	-	-	ns	
Data [R0-7,G0-7,B0-7]	Setup time	tDS	10	-	-	ns	
	Hold time	tDH	10	-	-	ns	
Horizontal sync. signal [HD]	Cycle	tH(clk)	525	539	598	ck	
	Pulse width	tHPW	5	-	tH-5	ck	
Vertical sync. signal [VD]	Cycle	tV	305	312	321	line	
	Pulse width	tVPW	2	-	TV-2	line	
Frame rate		fV	50	50	60	Hz	
Horizontal display period		tHA	480			ck	Only 480 ck
HD_NCLK phase difference		tHC	(tCLK/2)-8	tCLK/2	(tCLK/2)+8	ns	tCLK=1/fCLK
HD_VD phase difference		tVH	0	-	tH-1	ck	
Vertical front porch		tVFP	2	9	18	line	
Vertical back porch		tVBP	31			line	
Vertical display period		tVA	272			line	
Horizontal front porch		tHFP	2	16	75	ck	
Horizontal back porch		tHBP	43			ck	Only 43 ck

8.4 POWER ON/ OFF SEQUENCE



Symbol	Specification	Description
t1	0 ＜ t1	VCC power ON to PON starts timing.
t2	0.2ms ＜ t2 ≦10ms	VCC rise and fall speed. (for reduce inrush current)
t3	0 ＜ t3	VB+ power ON to PON starts timing.
t4	1000ms ＜ t4	VCC power OFF / ON interval. (for discharge DCDC output voltage)
t5	0 ＜ t5 ≦10ms	PON = High to input signal start timing.
t6	t6 ≦10ms	Input data stop to PON = Low timing.
t7	0 ≦ t7	PON = Low to VCC power OFF timing.
t8	0.5ms ＜ t8 ≦10ms	VB+ rise speed. (for reduce inrush current)
t9	0.2ms ＜ t9	PON = High to BL_PWM signal start timing.
t10	0 ＜ t10	PON OFF to VB+ power OFF timing.

8.5 SCAN DIRECTION

Scan direction is available to be switched as below by setting CN1's VRV & HRV pin.

HRV : H ; VRV : H

HRV : L ; VRV : H

HRV : H ; VRV : L

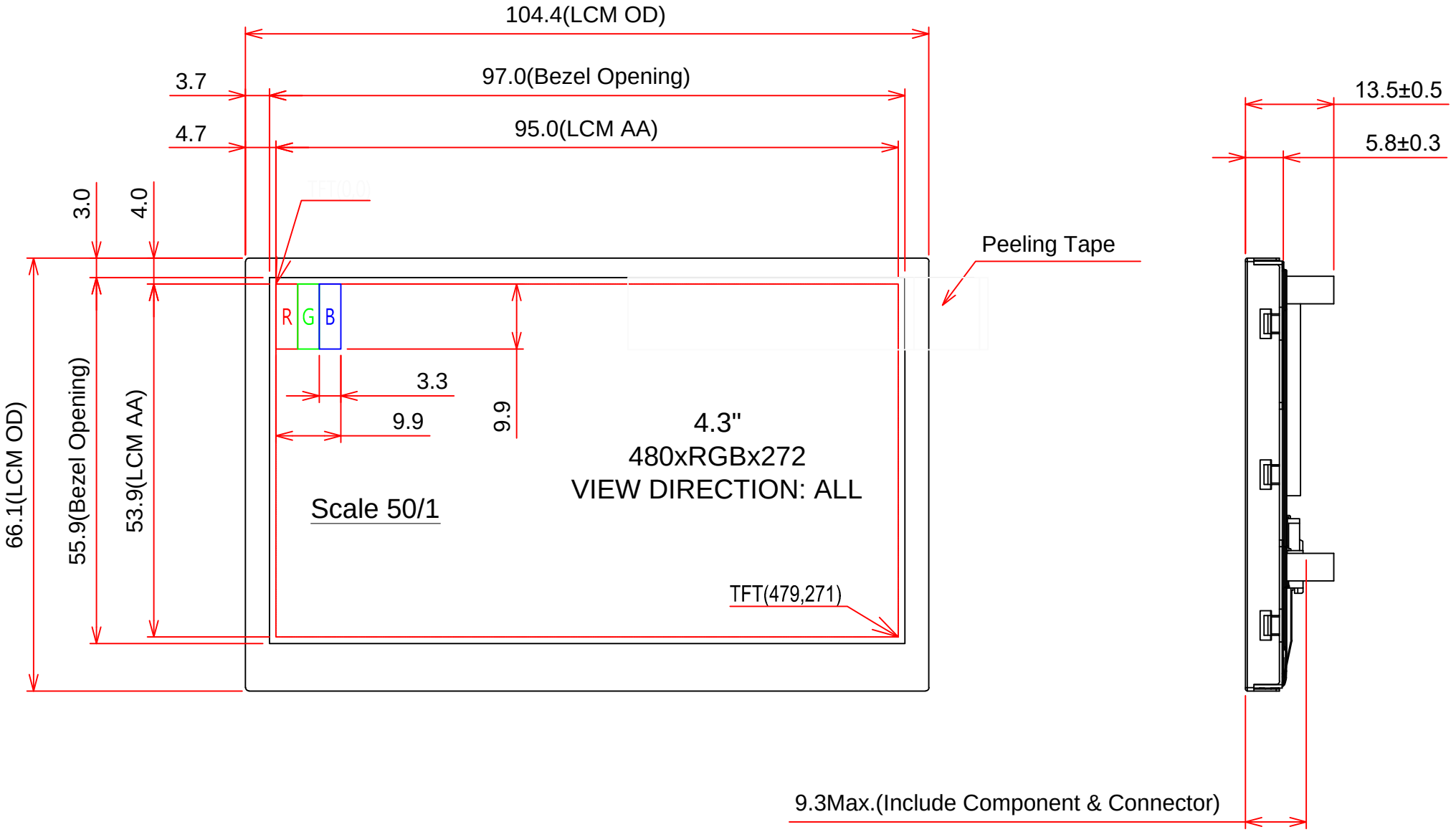
HRV : L ; VRV : L

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							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	L
	Red	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	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	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(254)	H	H	H	H	H	H	H	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	L	H	L	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(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

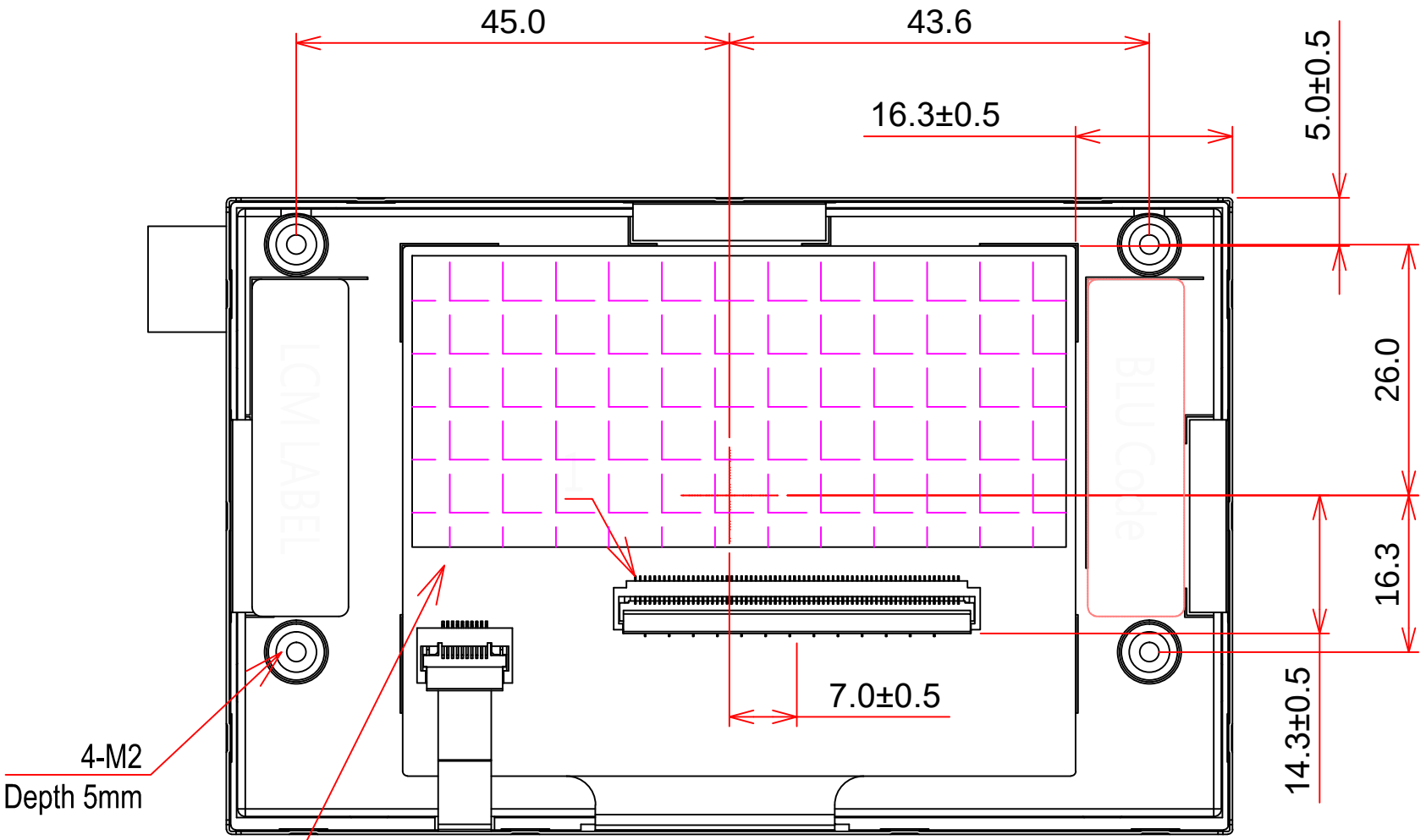
9. OUTLINE DIMENSIONS

9.1 FRONT VIEW



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

9.2 REAR VIEW



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

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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 product of JDI Taiwan, and the last 6 digits are the serial number.

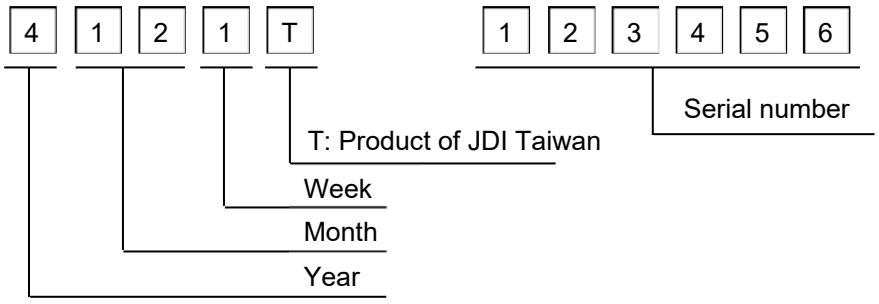

Fig. 10.1

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

Year	Lot Mark
2024	4
2025	5
2026	6
2027	7
2028	8

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) Except letters I and O, revision number will be shown on lot mark and following letters A to Z.

REV.No	ITEM	REMARKS
A	-	-

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

Label example :

Fig. 10.2