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**MODEL: RV612FBM-N00**

Issue Date : 2019/8/21

( \* )Preliminary Specifications

( )Final Specifications

	<i>Drafter By</i>	
	<i>Approved By</i>	
<i>Customer</i>	<i>Signature</i>	

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# 1. GENERAL DESCRIPTION

## 1.1 OVERVIEW

This specification applies to the 61.2 inch Color TFT-LCD Module HPX612V0. This LCD module has a TFT active matrix type liquid crystal panel 3840x540 pixels, and diagonal size of 61.2 inch. This module supports 3840\*2160 mode. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 10-bit gray scale signal for each dot. The HPX612V0 has been designed to apply the V-BY-ONE interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

## 1.2 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Screen Size	61.2	Inch	-
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	3840x R.G.B. x 540	Pixel	
Pixel Number	0.40075(H) x 0.40075(W)	mm	
Pixel Arrangement	RGB vertical stripe	-	
Display Colors	16.7 millions	Color	
Transmissive Mode	Normally Black	-	
Surface Treatment	Hard coating (3H), AG (Haze 1%)	-	
Luminance, White	900 (typical)	cd/m2	
Color Gamut	72% of NTSC(Typ.)	-	
Power Consumption	Total 67.92W (Max.) @ cell 8.52W (Max.), BL 59.4W (Max.)		(1)

Note(1) The specified power consumption: Total=cell(reference 4.3.1)+BL(reference 4.3.3)

# 2. MECHANICAL SPECIFICATIONS

Item	Min	Typ.	Max	Unit	Note
Module Size	Horizontal(H)	Typ.-1	1565.8	Typ.+1	mm (1)
	Vertical (V)	Typ.-1	251.3	Typ.+1	
	Thickness (T)	Typ.-1	27.1	Typ.+1	
Bezel Area	Horizontal	Typ.-0.5	1542.88	Typ.+0.5	mm
	Vertical	Typ.-0.5	220.4	Typ.+0.5	mm
Active Area	Horizontal	-	1538.88	-	mm
	Vertical	-	216.4	-	mm
Weight	-	10	-	Kg	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

# 3. ABSOLUTE MAXIMUM RATINGS

### 3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	TST	-20	+60	°C	(1)
Operating Ambient Temperature	TOP	0	+50	°C	(1),(2)

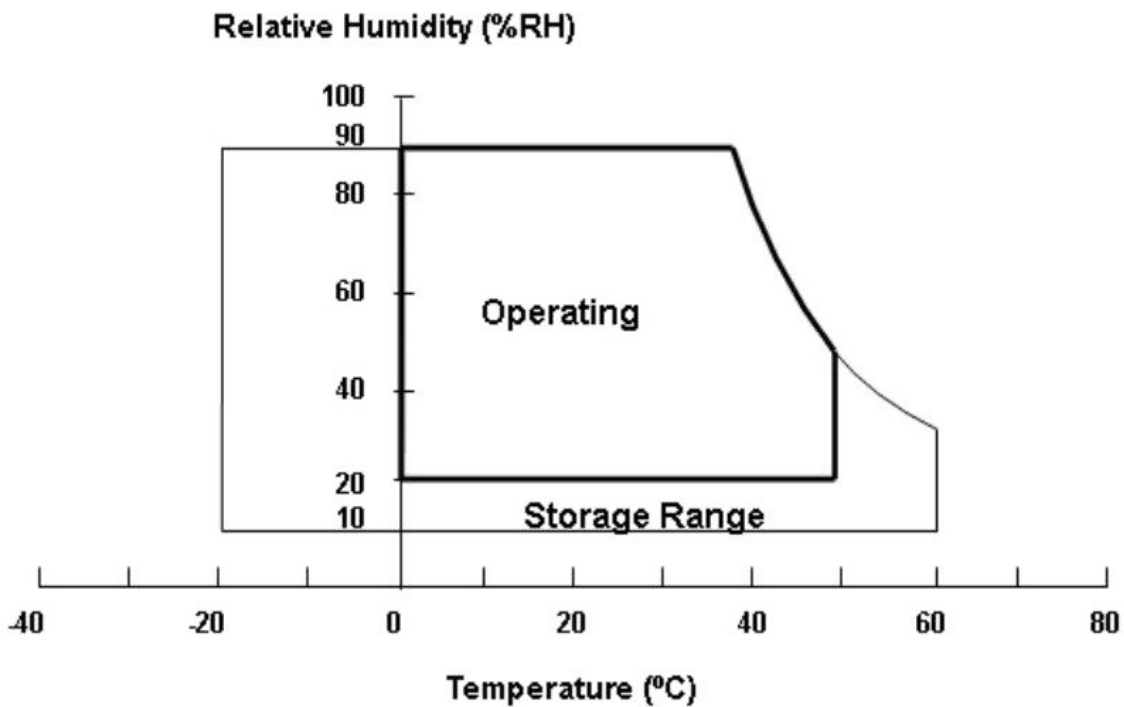
Note (1)

(a) 90 %RH Max. ( $T_a \leq 40$  °C).

(b) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40$  °C).

(c) No condensation.

Note (2) The temperature of panel surface should be 0 °C min. and 60 °C max.



### 3.2 ELECTRICAL ABSOLUTE RATINGS

#### 3.2.1 BACKLIGHT UNIT

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Forward Current Per Input Pin	$I_F$	-	-	61.11	mA	(1),(2)
LED Pulse Forward Current Per Input Pin	$I_P$	-	-	1100	mA	(1),(2)

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for input pin of LED light bar at  $T_a = 25 \pm 2$  °C (Refer to 4.3.3 and 4.3.4 for further information).

## 4. ELECTRICAL SPECIFICATIONS

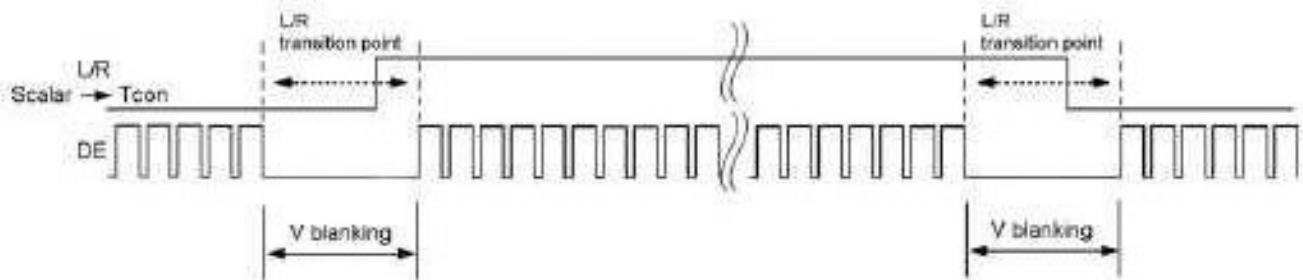
## 4.1 FUNCTION BLOCK DIAGRAM

## 4.2 INTERFACE CONNECTIONS

Matting connector : FI-RE51HL (JAE)

Pin	Name	Description	Note
1	V <sub>in</sub>	Power input (+12V)	
2	V <sub>in</sub>	Power input (+12V)	
3	V <sub>in</sub>	Power input (+12V)	
4	V <sub>in</sub>	Power input (+12V)	
5	V <sub>in</sub>	Power input (+12V)	
6	V <sub>in</sub>	Power input (+12V)	
7	V <sub>in</sub>	Power input (+12V)	
8	V <sub>in</sub>	Power input (+12V)	
9	N.C.	No Connection	(9)
10	GND	Ground	
11	GND	Ground	
12	GND	Ground	
13	GND	Ground	
14	GND	Ground	
15	L/R_O	Output signal for Glasses Left Right signal,	(4)
16	L/R	Input signal for Left/Right synchronous signal.	(2)
17	N.C.	No Connection	(9)
18	SDA	I2C Data signal	(10)
19	SCL	I2C Clock signal	(10)
20	WP	Write Protection (0V~0.7V/Open→Disable, 2.7V~3.3V→Enable) (for Auto-Vcom)	
21	N.C.	No Connection	(9)
22	LD_EN	Local Dimming Mode Enable.	(3) (5)
23	N.C.	No Connection	(9)
24	N.C.	No Connection	(9)
25	HTPDN	Hot plug detect output. Open drain.	
26	LOCKN	Lock detect output, Open drain.	
27	GND	Ground	
28	RX0N	1ST Pixel Negative V-by-One differential data input in area A. Lane 0	(1)
29	RX0P	1ST Pixel Positive V-by-One differential data input in area A. Lane 0	
30	GND	Ground	
31	RX1N	2ND Pixel Negative V-by-One differential data input in area A. Lane 1	(1)
32	RX1P	2ND Pixel Positive V-by-One differential data input in area A. Lane 1	
33	GND	Ground	
34	RX2N	3RD Pixel Negative V-by-One differential data input in area A. Lane 2	(1)
35	RX2P	3RD Pixel Positive V-by-One differential data input in area A. Lane 2	
36	GND	Ground	
37	RX3N	4TH Pixel Negative V-by-One differential data input in area A. Lane 3	(1)
38	RX3P	4TH Pixel Positive V-by-One differential data input in area A. Lane 3	
39	GND	Ground	
40	RX4N	5TH Pixel Negative V-by-One differential data input in area A. Lane 4	(1)
41	RX4P	5TH Pixel Positive V-by-One differential data input in area A. Lane 4	
42	GND	Ground	
43	RX5N	6TH Pixel Negative V-by-One differential data input in area A. Lane 5	(1)
44	RX5P	6TH Pixel Positive V-by-One differential data input in area A. Lane 5	
45	GND	Ground	
46	RX6N	7TH Pixel Negative V-by-One differential data input in area A. Lane 6	(1)
47	RX6P	7TH Pixel Positive V-by-One differential data input in area A. Lane 6	
48	GND	Ground	
49	RX7N	8TH Pixel Negative V-by-One differential data input in area A. Lane 7	(1)
50	RX7P	8TH Pixel Positive V-by-One differential data input in area A. Lane 7	
51	GND	Ground	

### 4.3 ELECTRICAL CHARACTERISTICS



Note (3) Local dimming enable selection. (Default: enable)

L= Connect to GND, H=Connect to +3.3V or Open

LD_EN	Note
L	Local Dimming Disable
H or Open	Local Dimming Enable

LD\_EN enable pin should be set in power on stage.

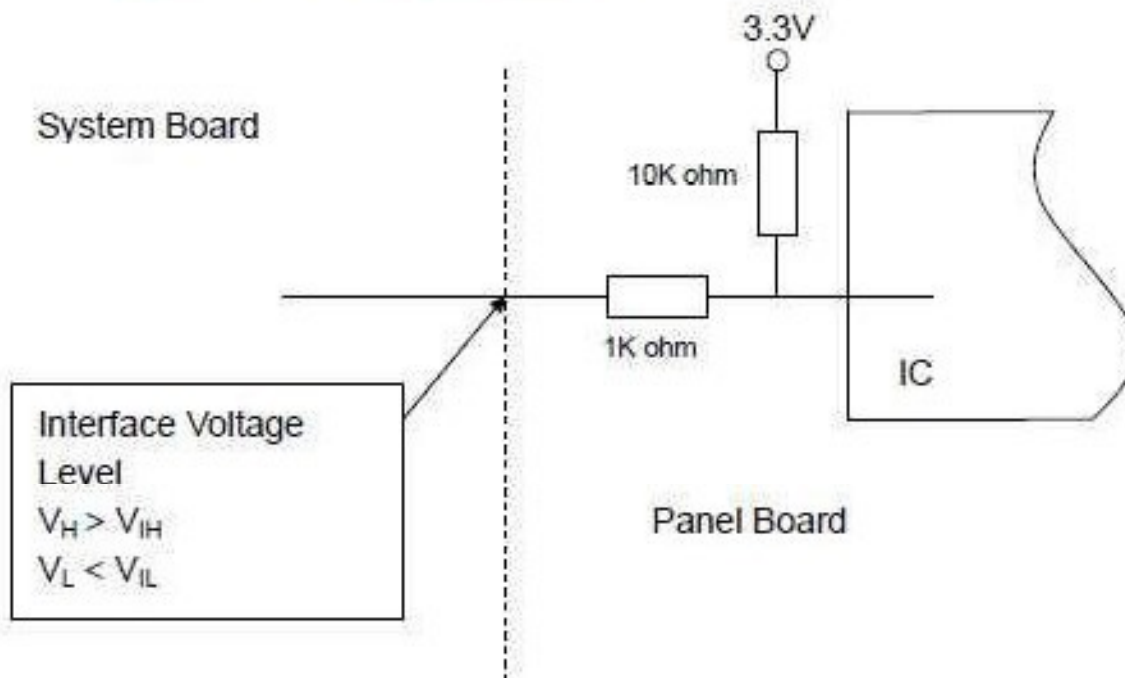
Backlight should be turned off in the period of changing original setting after power on.

Note (4) The definition of L/R\_O signal as follows

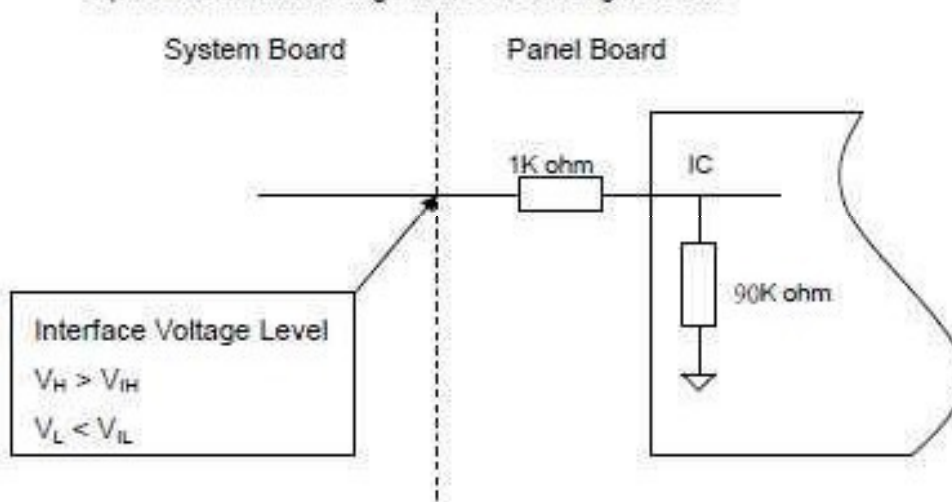
L= 0V , H= +3.3V

L/R_O	Note
L	Right glass turn on
H	Left glass turn on

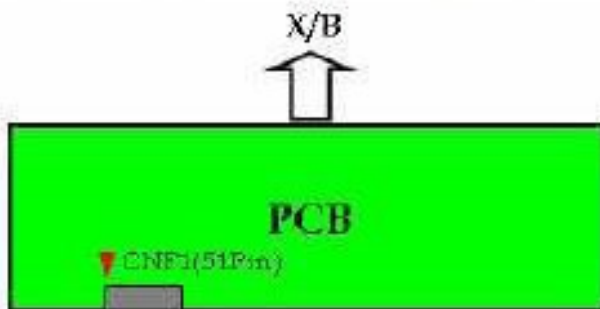
Note (5) Interface optional pin has internal scheme as following diagram. Customer should keep the interface voltage level requirement which including Panel board loading as below.



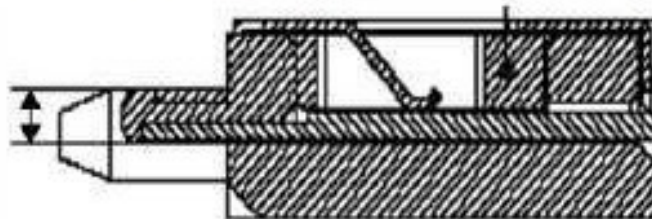
Note (6) Interface optional pin has internal scheme as following diagram. Customer should keep the interface voltage level requirement which including Panel board loading as below.



Note (7) V-by-One HS connector pin order defined as follows



Note (8) V-by-One connector mating dimension range request is 0.93mm~1.0mm as below



Note (9) Reserved for internal use. Please leave it open.

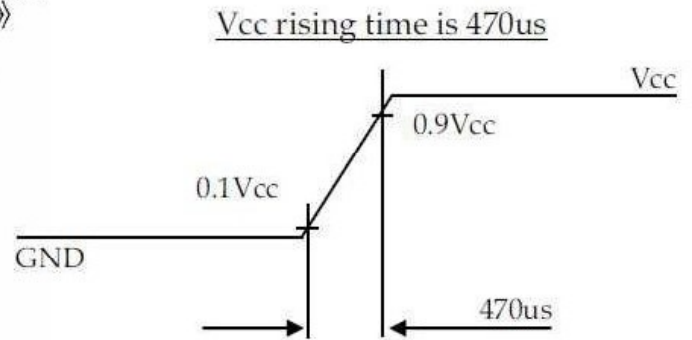
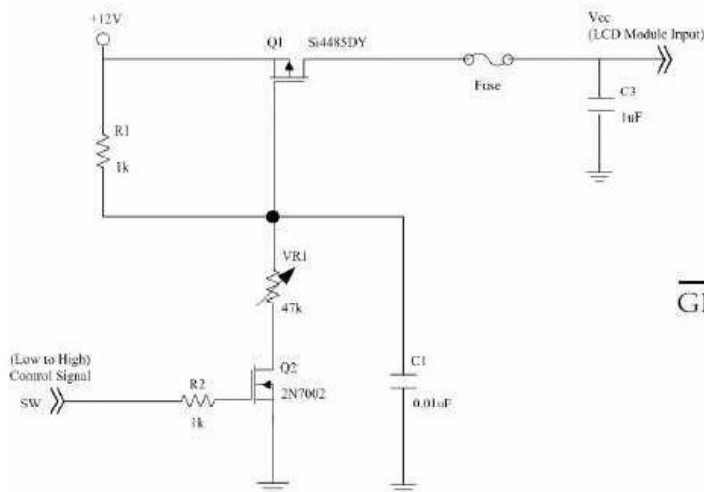
Note (10) The detail setting such as I2C command or timing requirement in FHD/QFHD is specified in INX application note. It's important and necessary to follow the specification either in product SPEC or application note, otherwise it may lead to abnormal or no display. INX application note would be provided by INX in the design-in stage.



### 4.3.1 LCD ELETRONICS SPECIFICATION

(Ta = 25 °C)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
C-PWB Power	Supply Voltage <sup>1)</sup>	V <sub>CC</sub>	10.8	12.0	13.2	V
	Current Dissipation <sup>2)</sup>	I <sub>CC</sub>	-	0.71	3.24	A
	Inrush Current <sup>3)</sup>	I <sub>RUSH</sub>	-	8.81	-	A
Permissible Input Ripple Voltage	V <sub>RP</sub>	-	-	600	mVpp	V <sub>CC</sub> = +12.0V
Differential Input High Threshold <sup>4)</sup>	V <sub>RTH</sub>	-	-	50	mV	
Differential Input Low Threshold <sup>4)</sup>	V <sub>RTL</sub>	-50	-	-	mV	
Unit Interval <sup>4)</sup>	UI	250	-	625	ps	
Input Signal Rate <sup>4)</sup>	F <sub>bit</sub>	2.68	2.97	3.00	Gbps	
Differential Input Allowable Intra-pair Skew <sup>5)</sup>	tRISK_INTRA	-	-	0.3	UI	
Differential Input Allowable Inter-pair Skew <sup>5)</sup>	tRISK_INTER	-	-	5	UI	
Differential Input Spread Spectrum modulation range <sup>6)</sup>	F <sub>bit_ss</sub>	F <sub>bit</sub> -0.5%	-	F <sub>bit</sub> +0.5%	Gbps	
Differential Input Spread Spectrum modulation frequency <sup>6)</sup>	F <sub>ss</sub>	-	-	30	kHz	
Differential Input Spread Spectrum Profile slope <sup>6)</sup>	F <sub>ss_slope</sub>	-	-	0.06	%/µs	
Input Low Voltage <sup>7)</sup>	V <sub>IL</sub>	0	-	0.4	V	
Input High Voltage <sup>7)</sup>	V <sub>IH</sub>	2.3	-	3.3	V	
Terminal Resistor	R <sub>t</sub>	-	100	-	Ohm	Differential Input



Note (3) The specified power supply current is under the conditions at V<sub>CC</sub> = 12.0 V, Ta = 25 ± 2 °C, fv = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



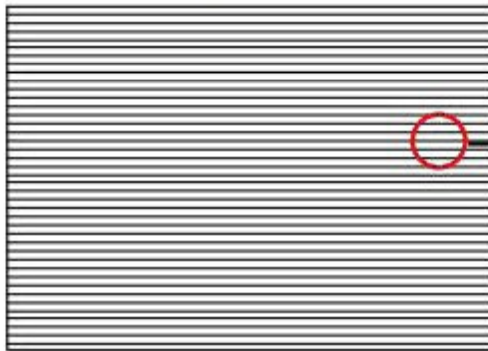
Active Area

b. Black Pattern



Active Area

c. Horizontal Stripe



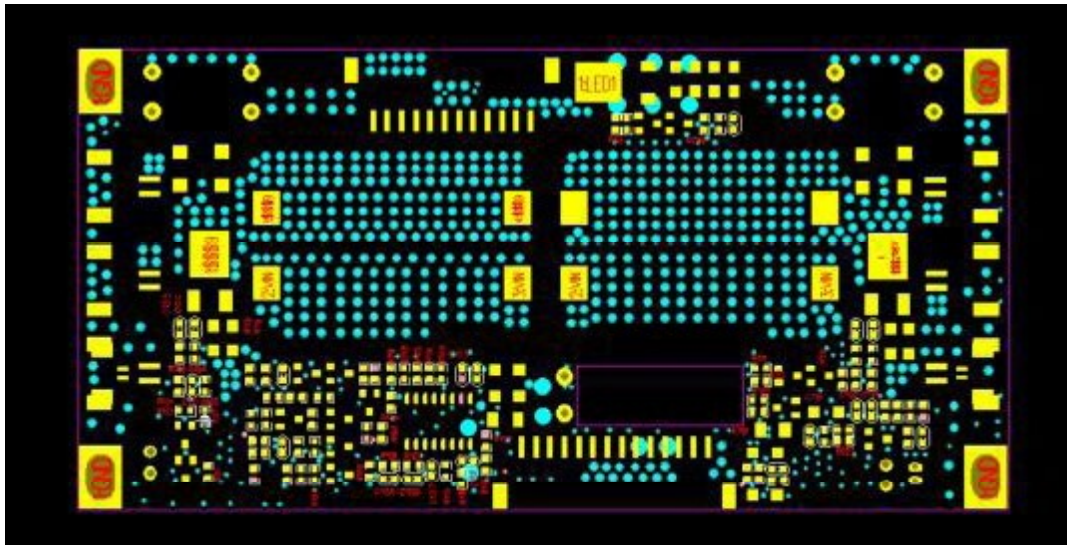
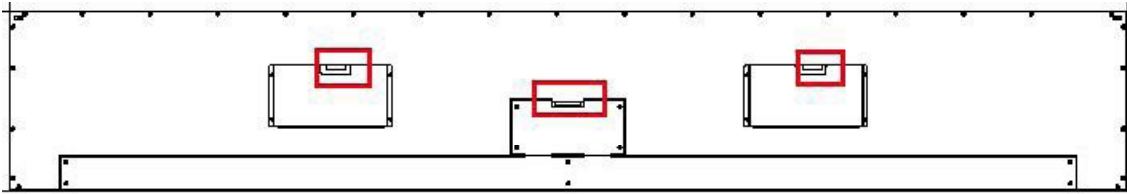
#### 4.3.2 BACKLIGHT UNIT

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Input Voltage Per Input Pin	VPIN	-	-	54	V	(1)
LED Light Bar Current Per Input Pin	IPIN	-	-	550	mA	(1),(2) Duty=100%
LED Life Time	LLED	-	50000	-	Hrs	(3)
Power Consumption	PBL	-	-	59.4	W	(1)

Note (1) LED light bar input voltage and current are measured by utilizing a true RMS multimeter as shown below:

Note (2)  $PBL(Typ) = IPIN(Typ) \times VPIN(Typ) \times (2)$ ,  $PBL(Max)=IPIN(TYP) \times VPIN(Max) \times (2)$  , LED light bar circuit is (9)Series, (9)Parallel.

Note (3) The lifetime of LED is defined as the time when LED packages continue to operate under the conditions at  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$  and  $I = 65 \text{ mA}$  (per chip) until the brightness becomes  $\cong 50\%$  of its original value.



CON1 Pin	Symbol	Description
1	VCC	Operating Voltage Supply, +24V DC regulated
2	VCC	Operating Voltage Supply, +24V DC regulated
3	VCC	Operating Voltage Supply, +24V DC regulated
4	VCC	Operating Voltage Supply, +24V DC regulated
5	VCC	Operating Voltage Supply, +24V DC regulated
6	GND	Ground and Current Return
7	GND	Ground and Current Return
8	GND	Ground and Current Return
9	GND	Ground and Current Return
10	GND	Ground and Current Return
11	NC	Not connect
12	BL ON/OFF	BLU On-Off control: High/Open (2~5.5V) : BL On ; Low (0~0.8V/GND) : BL Off
13	ADJ	External PWM (10~100% Duty, open for 0%)
14	NC	Not connect

Item	Symbol		Value			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	Vin		22.8	24	25.2	V	
On/Off voltage	V <sub>BLON</sub>	ON	2.5	-	5.5	V	
		OFF	0	-	0.8	V	
External PWM Control Voltage	V <sub>PWM</sub>	HIGH	3.3	-	5.5	V	
		LOW	0	-	0.8	V	
External PWM Duty Ratio	D <sub>PWM</sub>		10	-	100	%	100% for max. Brightness 10% for min.brightness
External PWM Frequency	F <sub>PWM</sub>		180	200	220	Hz	

#### 4.4 DISPLAY TIMMING SPECIFICATIONS

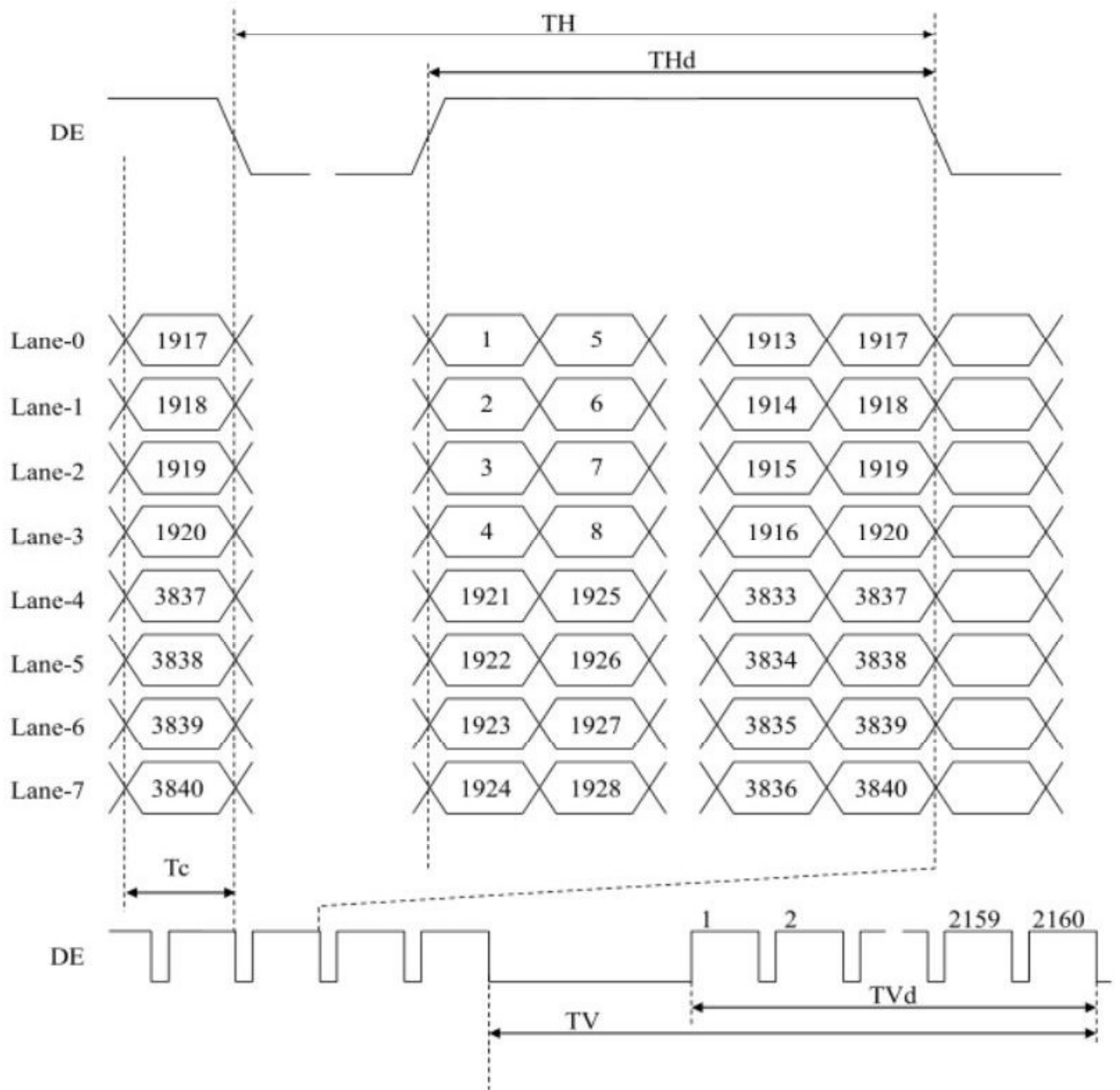
The input signal timing specifications are shown as the following table and timing diagram.

Timing diagram of V-by-One® input signals is shown in below figure.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/Tc	67	74.25	75	MHz	
Data Enable Signal	Horizontal Period	TH	530	550	702	clock	
			7.07	7.41	-	μs	
	Horizontal Period (High)	THd	480	480	480	clock	
	Vertical Period	TV	2240	2250	2872	line	
			47	60	60.32	Hz	
Vertical Period (High)	TVd	2160	2160	2160	line		

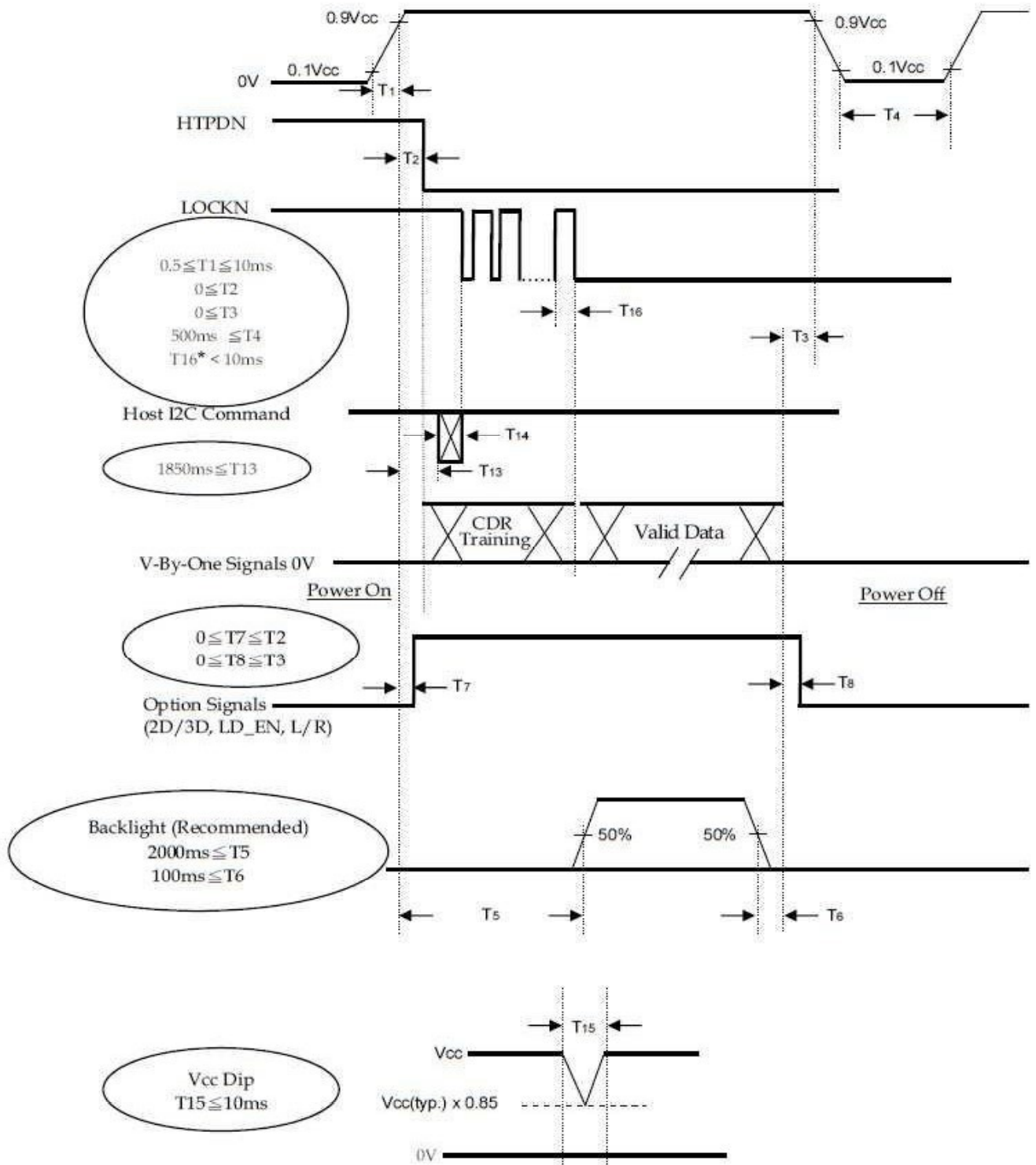
- When the vertical period is very long, flicker and etc. may occur.
- Turn off the module after it shows the black screen.
- Make sure that a length of vertical period should become of an integral multiple of a horizontal length of period. Otherwise, the screen may not display properly.
- As for your final setting of driving timing, we will conduct operation check test at our side, please inform your final setting.

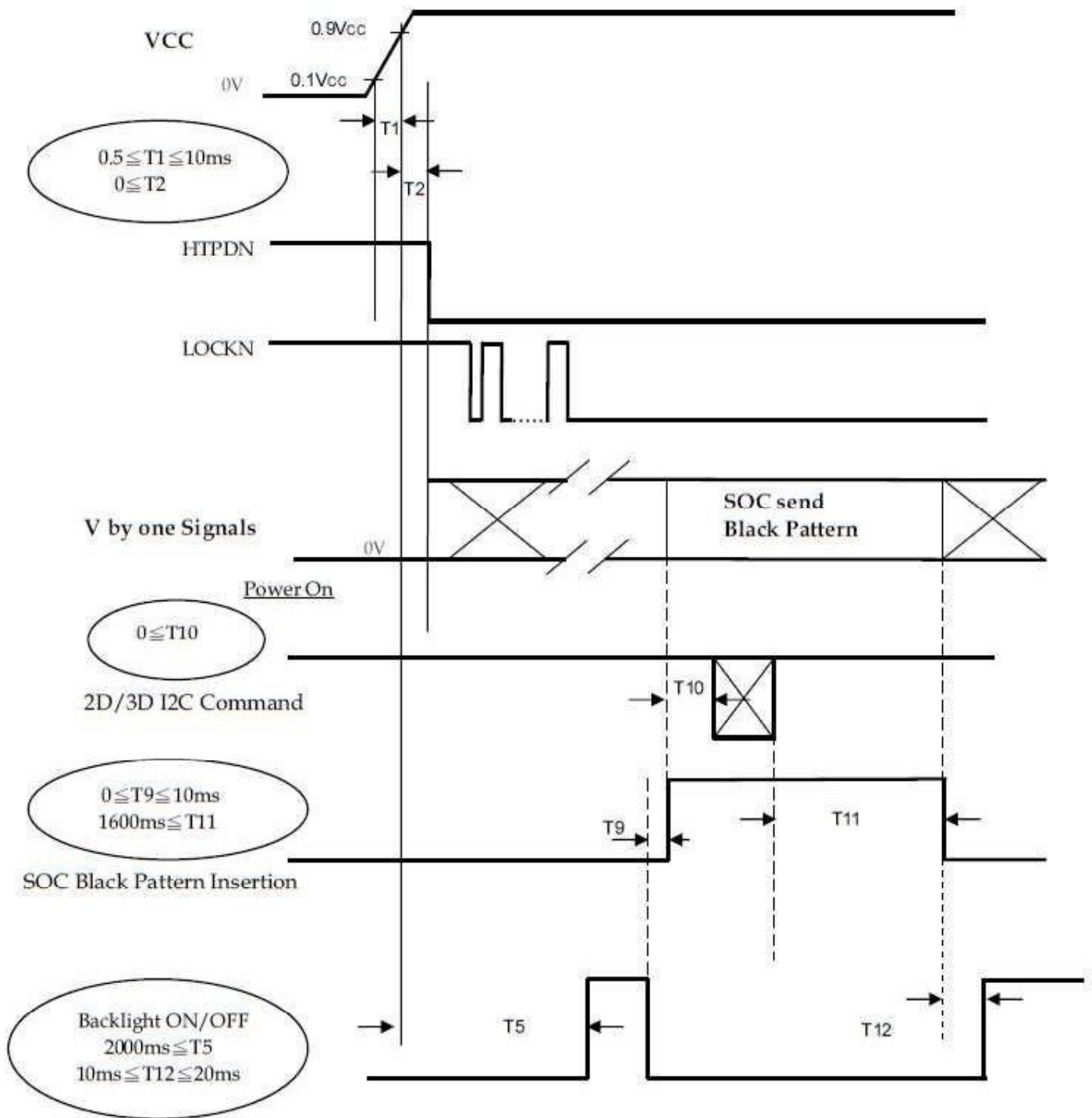
# V-by-One signal data mapping



## 4.5 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.





## 5. OPTICAL CHARACTERISTICS

### 5.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10 %R	%RH
Vertical Frame Rate	Fr	60	Hz
Supply Voltage	Vcc	12±1.2	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current Per Input Pin	IPIN	-	mA
PWM Duty Ratio	D	100	%

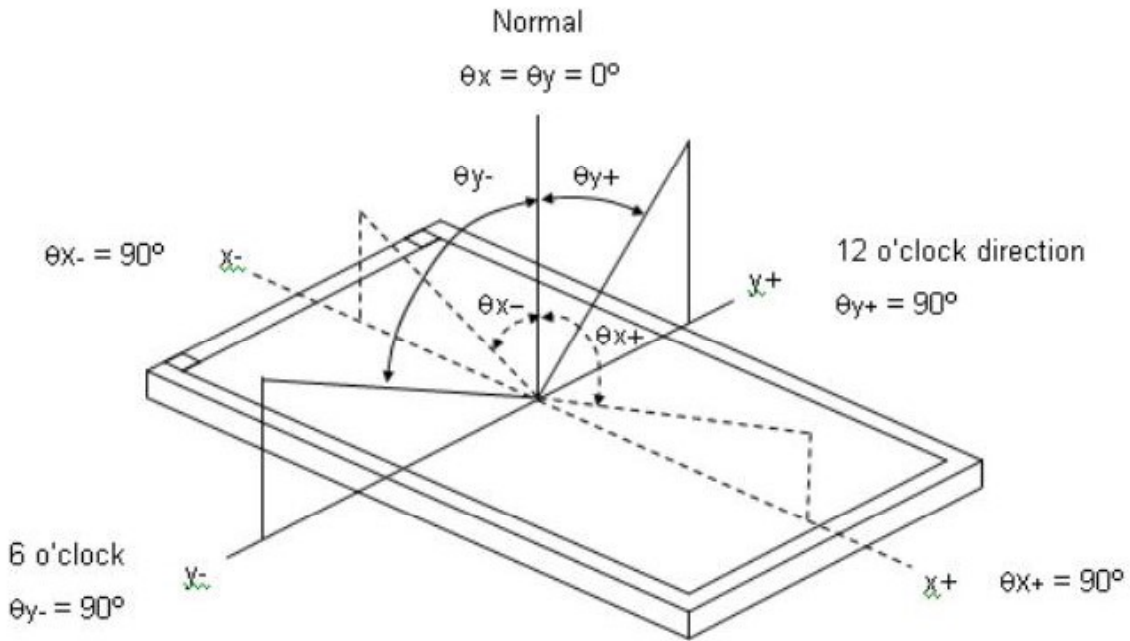
### 5.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 5.2. The following items should be measured under the test conditions described in 5.1 and stable environment shown in Note (5).

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Color Chromaticity (CIE)	Red	Rcx	Normal $\theta_x=0^\circ$ , $\theta_y=0^\circ$  Viewing Angle	Typ – 0.03	0.642	Typ + 0.03	-	
		Rcy			0.332			
	Green	Gcx			0.300			
		Gcy			0.603			
	Blue	Bcx			0.151			
		Bcy			0.603			
	White	Wcx			0.285			
		Wcy			0.297			
Center Luminance of White (Center of Screen)	LC		700	900	-	cd/m2	(4),(5)	
Contrast Ratio	CR		700	1000	-	-	(2),(5)	
Response Time	G-to-G	$\theta_x=0^\circ$ , $\theta_y=0^\circ$	-	8	-	ms	(3)	
White variation	$\delta W$	$\theta_x=0^\circ$ , $\theta_y=0^\circ$	75	80		-	(5),(6)	
Viewing Angle	Horizontal	$\theta_x$	CR $\geq$ 10	-	89	-	Deg.	(1),(5)
	Vertical	$\theta_y$		-	89	-		
Viewing Angle	Horizontal	$\theta_x$		-	89	-	Deg.	(1),(5)
	Vertical	$\theta_y$		-	89	-		

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):





Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

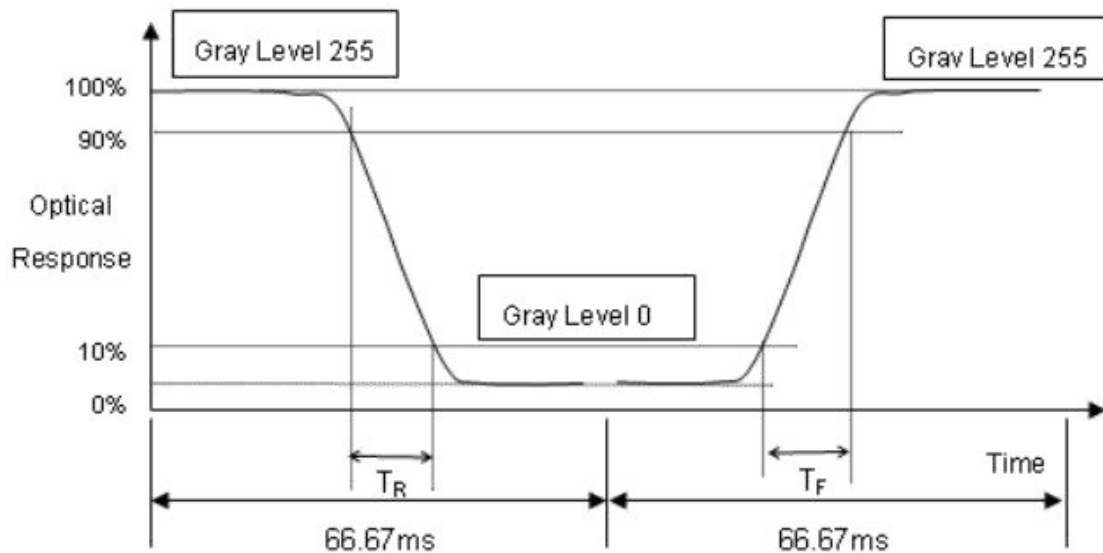
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time ( $T_R$ ,  $T_F$ ):



Note (4) Definition of Luminance of White ( $L_c$ ):

Measure the luminance of gray level 255 at center point

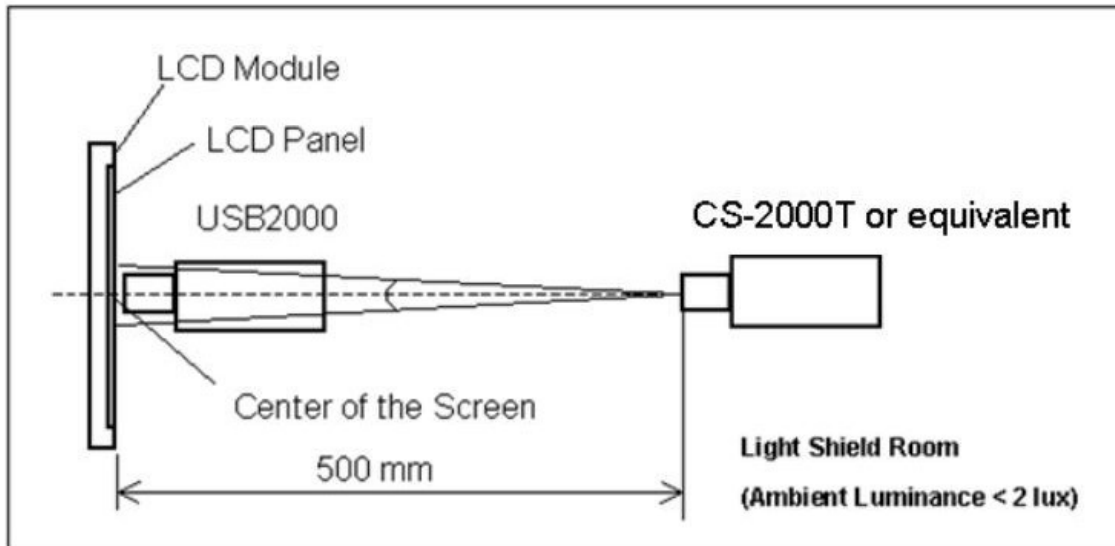
$$L_c = L (5)$$

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should

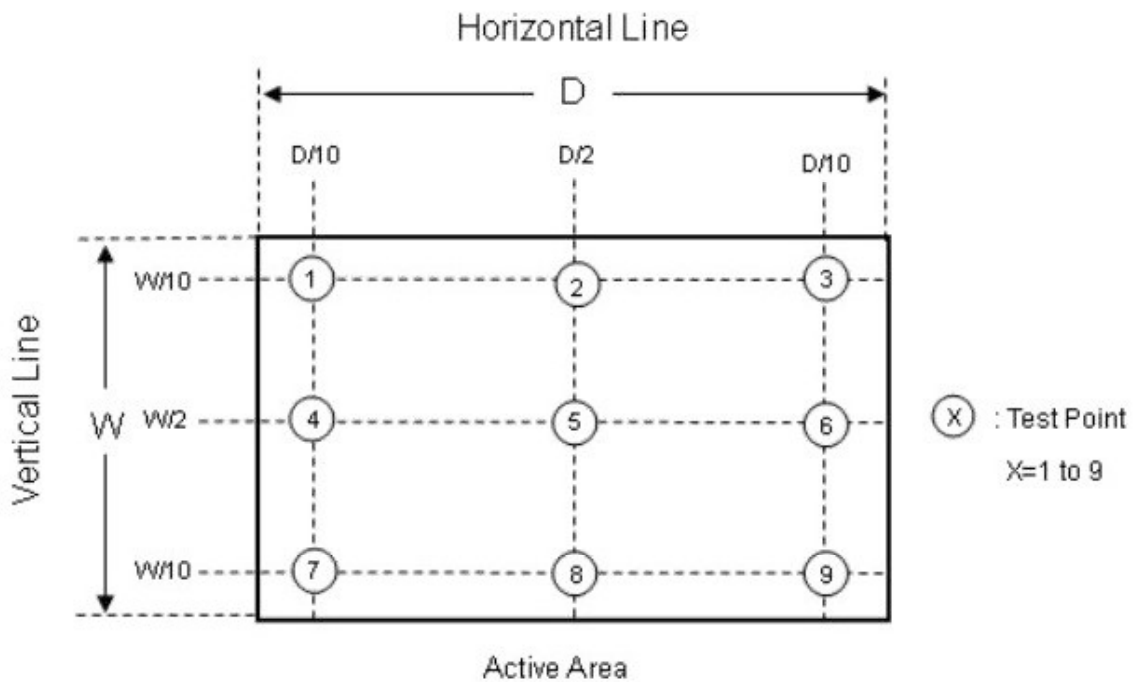
be executed after lighting Backlight for 40 minutes in a windless room.



Note (6) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 255 at 9 points

$$\delta W = (\text{Minimum } [L(1) \sim L(9)] / \text{Maximum } [L(1) \sim L(9)]) * 100\%$$



## 6. RELIABILITY TEST ITEM

Item	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50°C , 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 50°C , 240hours	
Low Temperature Operation (LTO)	Ta= 0°C , 240hours	
High Temperature Storage (HTS)	Ta= 60°C , 240hours	
Low Temperature Storage (LTS)	Ta= -20°C , 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 G Wave: Sine	

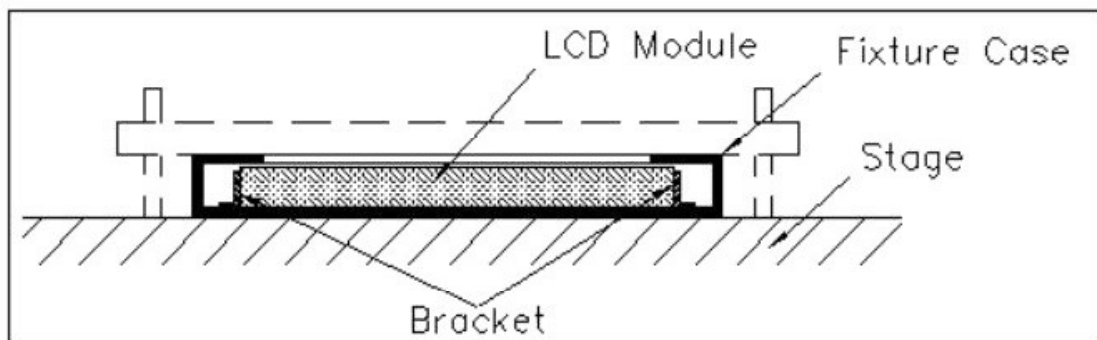
	Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : $\pm X, \pm Y, \pm Z$ .(one time for each Axis)	
Thermal Shock Test (TST)	-20°C /30min , 60°C / 30min , 100 cycles	
On/Off Test	25°C ,On/10sec , Off /10sec , 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: $\pm 8KV, 150pF(330\Omega)$ Air Discharge: $\pm 15KV, 150pF(330\Omega)$	
Altitude Test	Operation:10,000 ft / 24hours Non-Operation:30,000 ft / 24hours	

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



## 7. PACKGING

TBD.

## 8. MODULE LABEL

TBD.

## 9. PRECAUTIONS

### 9.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

- 
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
  - (5) Do not pull the I/F connector in or out while the module is operating.
  - (6) Do not disassemble the module.
  - (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
  - (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
  - (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
  - (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly.

## 9.2 STORAGE PRECAUTIONS

- (1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0°C to 35°C and relative humidity of less than 70%
- (2) Do not store the TFT – LCD module in direct sunlight
- (3) The module should be stored in dark place. It is prohibited to apply sunlight or fluorescent light in storing

## 9.3 OPERATION PRECAUTIONS

- (1) The LCD product should be operated under normal condition.  
Normal condition is defined as below :  
Temperature : 20±15°C  
Humidity: 65±20%  
Display pattern : continually changing pattern(Not stationary)
- (2) If the product will be used in extreme conditions such as high temperature, high humidity, high altitude, display pattern or operation time etc... It is strongly recommended to contact CMI for application engineering advice. Otherwise, its reliability and function may not be guaranteed.

## 9.4 SAFETY PRECAUTIONS

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

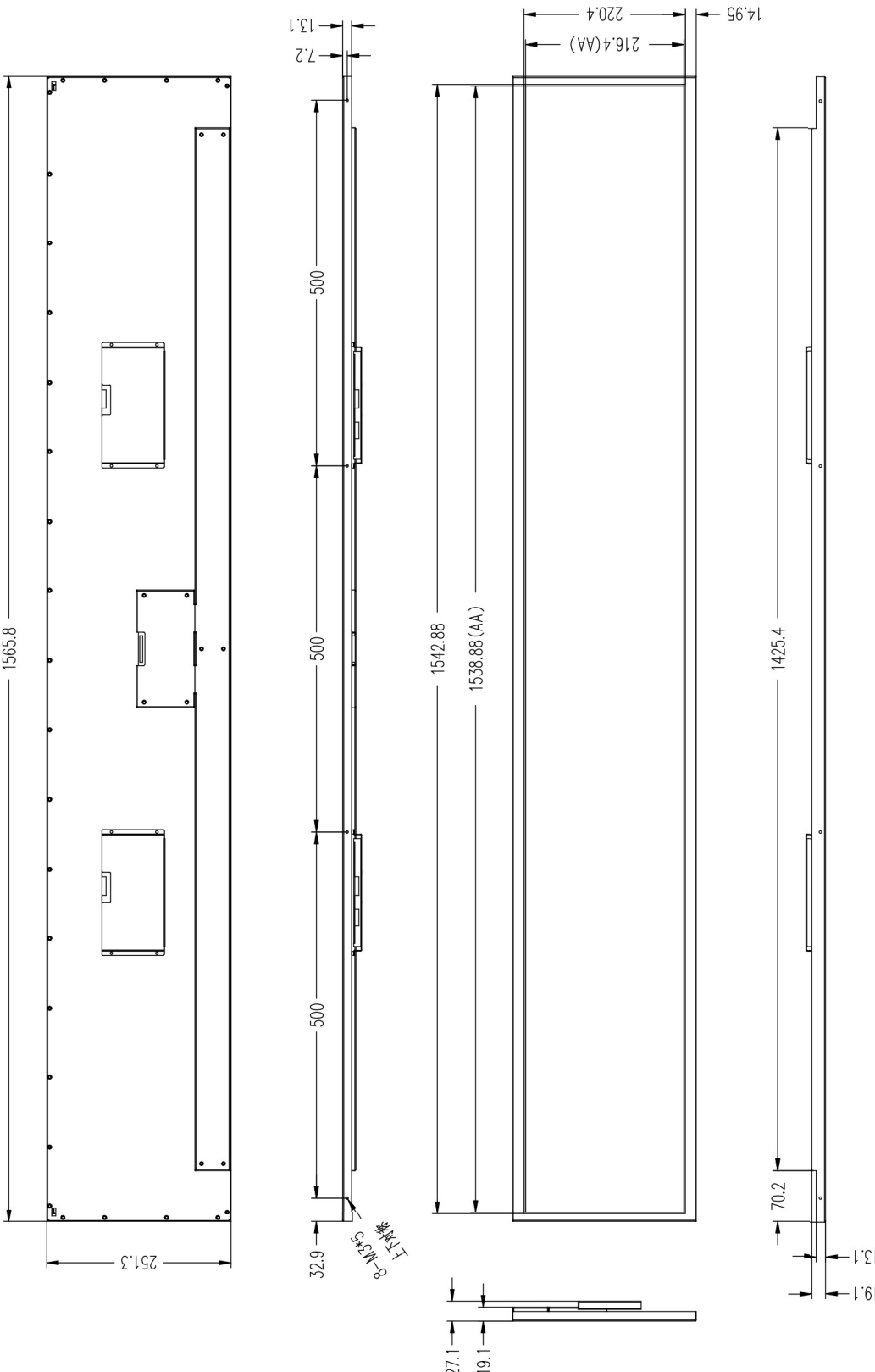
## 9.5 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

- (1) UL60950-1 or updated standard.
- (2) IEC60950-1 or updated standard.

## 9.6 OTHER

When fixed patterns are displayed for a long time, remnant image is likely to occur.



NOTE:

- 1. 表面不许划伤，碰伤，去油污
- 2. 未标注尺寸公差按GB1804-IT12级，孔距公差为±0.10

版次	A0	材料	/	表面处理	镀涂	机型号	代号
更改人	胡	日期	2019/8/21	零/部件名称	/	料号	/
数量		设计		零/部件图号	/	等级	标记
制图		审核		料号		重量	比例
标准化		批准		等级		重量	比例
							第1张/共1张