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SPECIFICATION

CUSTOMER ： _____

MODULE NO.: WF121ATIAMLNN0#

APPROVED BY: (FOR CUSTOMER USE ONLY)	**PCB VERSION:** **DATA:**

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

VERSION	DATE	REVISED PAGE NO.	SUMMARY
0	2013.04.12		First issue

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MODEL NO：

DOC. FIRST ISSUE

RECORDS OF REVISION

VERSION	DATE	REVISED PAGE NO.	**SUMMARY**
0	2013.04.12		First issue

Contents

1.Module Classification Information

W	F	121	A	T	I	A	M	L	N	N	0	#
①	②	③	④	⑤	⑥	⑦	⑧	9	10	11	12	13

① Brand：WINSTAR DISPLAY CORPORATION
② Display Type：H→Character Type, G→Graphic Type F→TFT Type
③ Display Size：10.2” TFT
④ Model serials no.
⑤ Backlight Type： F→CCFL, White T→LED, White
S→LED, High Light White

⑥ LCD Polarize Type/ Temperature range/ Gray Scale Inversion Direction
I→Transmissive, W. T, 6:00
L→Transmissive, W.T,12:00

⑦ A：TFT LCD
B：TFT+FR+CONTROL BOARD
C：TFT+FR+A/D BOARD
D：TFT+FR+A/D BOARD+CONTROL BOARD
E：TFT+FR+POWER BOARD
F：TFT+CONTROL BOARD
G：TFT+FR
H：TFT+D/V BOARD
I：TFT+FR+D/V BOARD
J：TFT+POWER BD

⑧ Solution:
A: 128160 B:320234 C:320240 D:480234 E:480272 F: 640480 G: 800480
H:1024600 I:320480 J:240320 K:800600 L:240400 M :1024768

9
10 D: Digital L：LVDS
Interface： N：without control board A：8Bit B：16Bit

11 TS： N：Without TS T：resistive touch panel C：capacitive touch panel
12 Version
13 Special Code #:Fit in with ROHS directive regulations

2. GENERAL DESCRIPTION

2.1 OVERVIEW

The WF121ATIAML0# model is a 12.1” TFT-LCD module with a white LED Backlight Unit and a 20-pin 1ch-LVDS interface. This module supports 1024 x 768 XGA mode and displays 262k/16.2M colors. The converter for the Backlight Unit is built in.

2.2 FEATURES

- Wide viewing angle
- High contrast ratio
- Fast response time
- XGA (1024 x 768 pixels) resolution
- Wide operating temperature
- DE (Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface
- RoHS Compliance
- Lamp Replaceable
- Sunlight Readable

2.3 APPLICATION

- TFT LCD Monitor
- Industrial Application
- Amusement
- Vehicle

2.4 GENERAL SPECIFICATI0NS

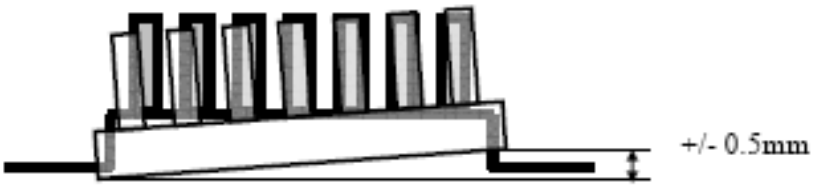
Item	Specification	Unit	Note
Diagonal Size	12.1	inch	(1)
Active Area	245.76(H) x 184.32(V)	mm	
Bezel Opening Area	249.0 x 187.5	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1024 x R.G.B. x 768	pixel	-
Pixel Pitch	0.240(H) x 0.240(V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262k/16.2M	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Glare	-	-
View Direction	12 o’clock		
Gray Scale Inversion Direction	6 o’clock		

2.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	260.2	260.5	260.8	mm	(1)
	Vertical (V)	239.7	204	204.3	mm	
	Depth (D)	8.0	8.5	9.0	mm	
Weight			430	460	g	-
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.			-	(2)

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

(2) Connector mounting position



3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	TOP	-30	+80	ºC	
Storage Temperature	TST	-40	+85	ºC	

3.2 ELECTRICAL ABSOLUTE RATINGS

3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	5.25	V	(1)
Logic Input Voltage	VIN	-0.3	Vcc+0.25	V	(1)

3.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Converter Voltage	Vi	10.8	13.2	V	(1) , (2)
Converter Current	Ii	-	1.0	A	(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 lamp (Refer to 3.2 for further information).

4. ELECTRICAL CHARACTERISTICS

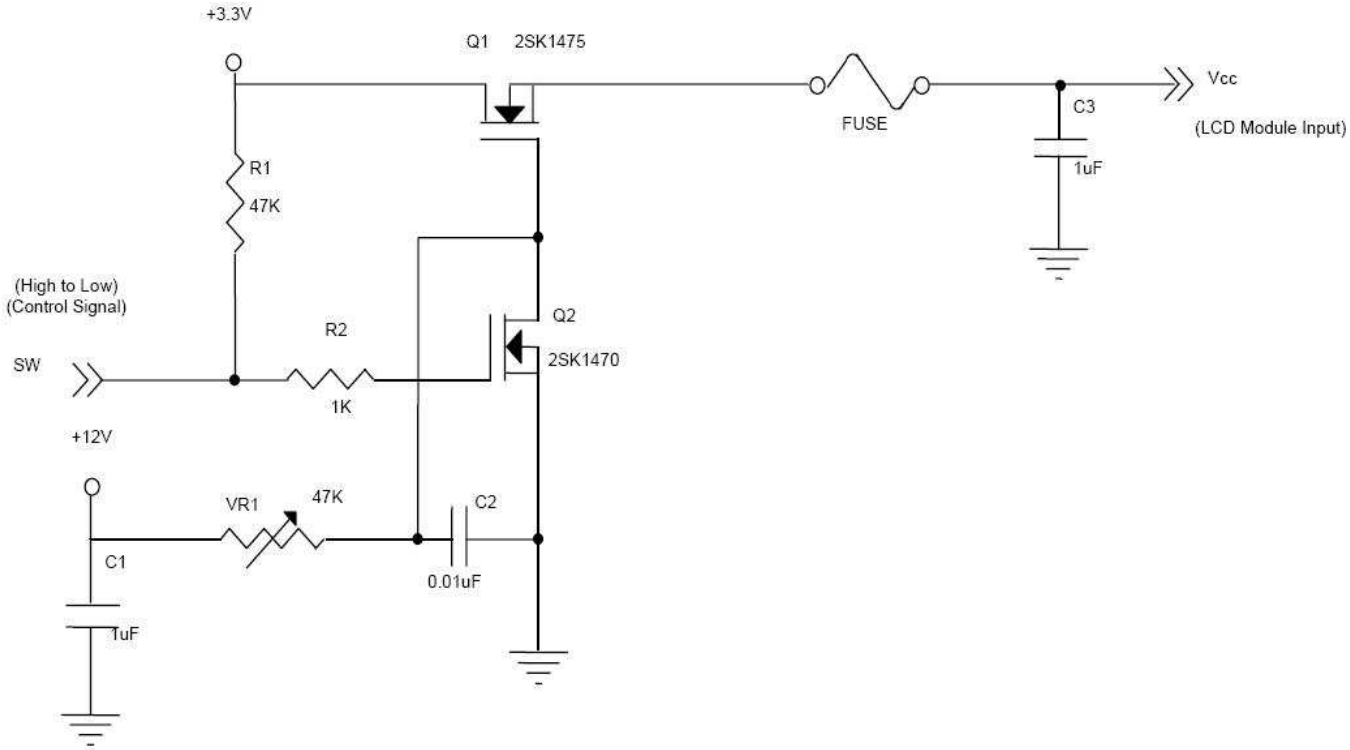
4.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

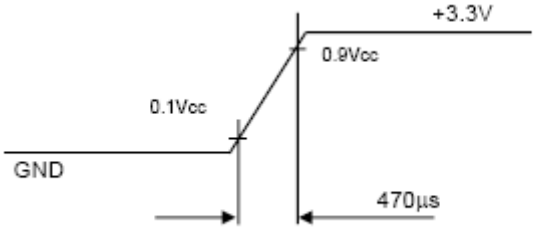
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	at Vcc=3.3V
			4.75	5.0	5.25	V	at Vcc=5.0V
Ripple Voltage		VRP	-	-	100	mV	-
Rush Current		IRUSH	-	-	1.5	A	(2)
Power Supply Current	White	-	-	800	910	mA	(3)a, at Vcc=3.3V
				500	590	mA	(3)a, at Vcc=5.0V
	Black		-	1.1	1.2	A	(3)b, at Vcc=3.3V
				710	782	mA	(3)b, at Vcc=5.0V
LVDS differential input voltage		Vid	-100	-	+100	mV	-
LVDS common input voltage		Vic	-	1.2	-	V	-

Note (1) The module is recommended to operate within specification ranges listed above for normal function.

Note (2) Measurement Conditions:



Vcc rising time is 470μs



Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, fv = 60Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern

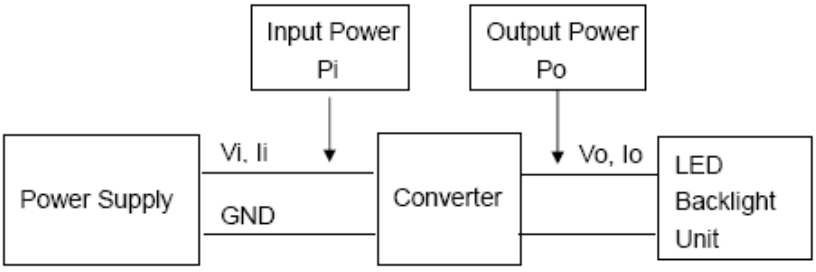
Active Area

4.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

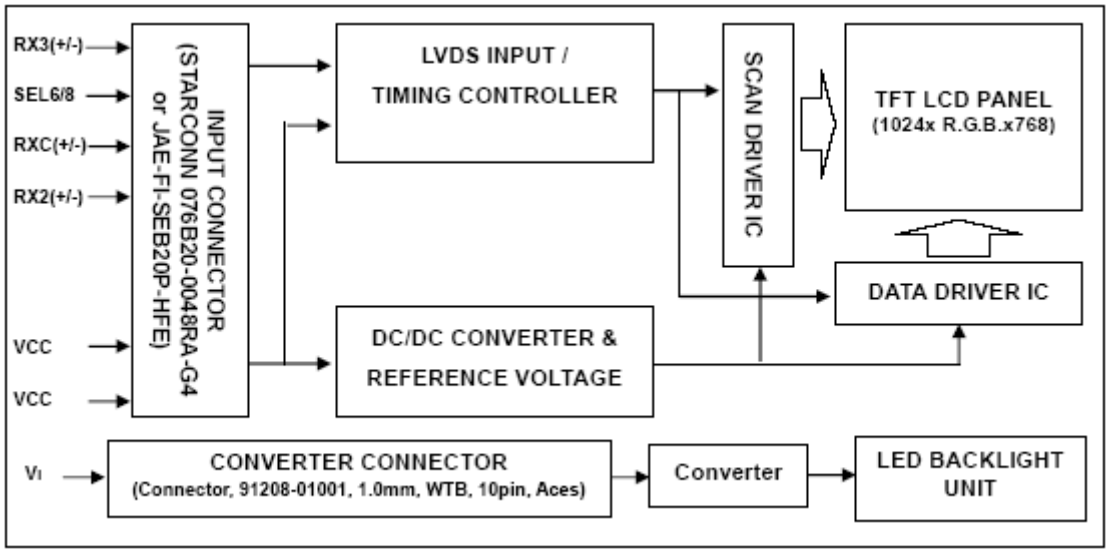
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Voltage	VO	---	24.5	28	VDC	(Duty 100%)
LED Current	IO	---	---	320	mADC	(Duty 100%)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below:
Note (2) PO = IO × VO

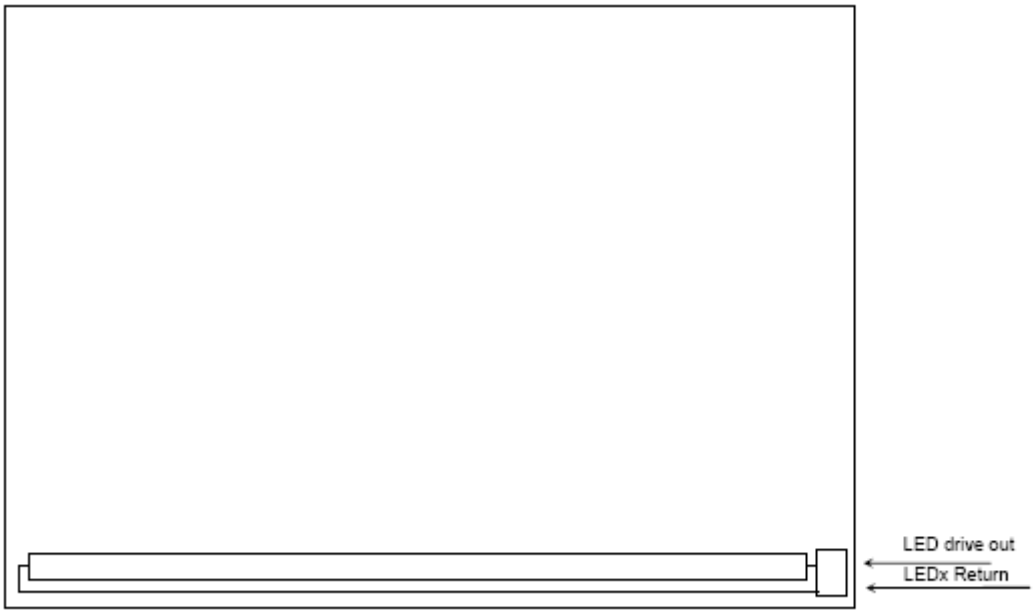


5. BLOCK DIAGRAM

5.1 TFT LCD MODULE



5.2 BACKLIGHT UNIT



6. INPUT TERMINAL PIN ASSIGNMENT

6.1 TFT LCD MODULE

Pin	Name	Description	Remark
1	RX3+	Differential Data Input, CH3 (Positive)	
2	RX3-	Differential Data Input, CH3 (Negative)	
3	NC	NC	
4	SEL68	LVDS 6/8 bit select function control, Low or NC →• 6 bit Input Mode High →8bit Input Mode	Note (4)
5	GND	Ground	
6	RXC+	Differential Clock Input (Positive)	LVDS Level Clock
7	RXC-	Differential Clock Input (Negative)	
8	GND	Ground	
9	RX2+	Differential Data Input , CH2 (Positive)	
10	RX2-	Differential Data Input , CH2 (Negative)	
11	GND	Ground	
12	RX1+	Differential Data Input , CH1 (Positive)	
13	RX1-	Differential Data Input, CH1 (Negative)	
14	GND	Ground	
15	RX0+	Differential Data Input, CH0 (Positive)	
16	RX0-	Differential Data Input, CH0 (Negative)	
17	reLR	Horizontal Reverse Scan Control, Low or NC →Normal Mode. High Horizontal Reverse Scan	Note (4)
18	reUD	Vertical Reverse Scan Control, Low or NC →Normal Mode, High →Vertical Reverse Scan	Note (4)
19	VCC	Power supply	
20	VCC	Power supply	

Note (1) Connector Part No.: STARCONN 076B20-0048RA-G4 or JAE FI-SEB20P-HFE or equivalent.

Note (2) “Low” stands for 0V. “High” stands for 3.3V. “NC” stands for “No Connected”.

6.2 BACKLIGHT UNIT(Converter connector pin)

Pin	Symbol	Description	Remark
1	Vi	Converter input voltage	12V
2	Vi	Converter input voltage	12V
3	Vi	Converter input voltage	12V
4	Vi	Converter input voltage	12V
5	VGND	Converter ground	Ground
6	VGND	Converter ground	Ground
7	VGND	Converter ground	Ground
8	VGND	Converter ground	Ground
9	EN	Enable pin	3.3V
10	ADJ	Backlight Adjust	PWM Dimming

Note (1) Connector Part No.: 91208-01001(ACES) or equivalent

6.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
Gray Scale Of Red	Red(0)/Dark	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	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	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	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	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	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

7. INTERFACE TIMING

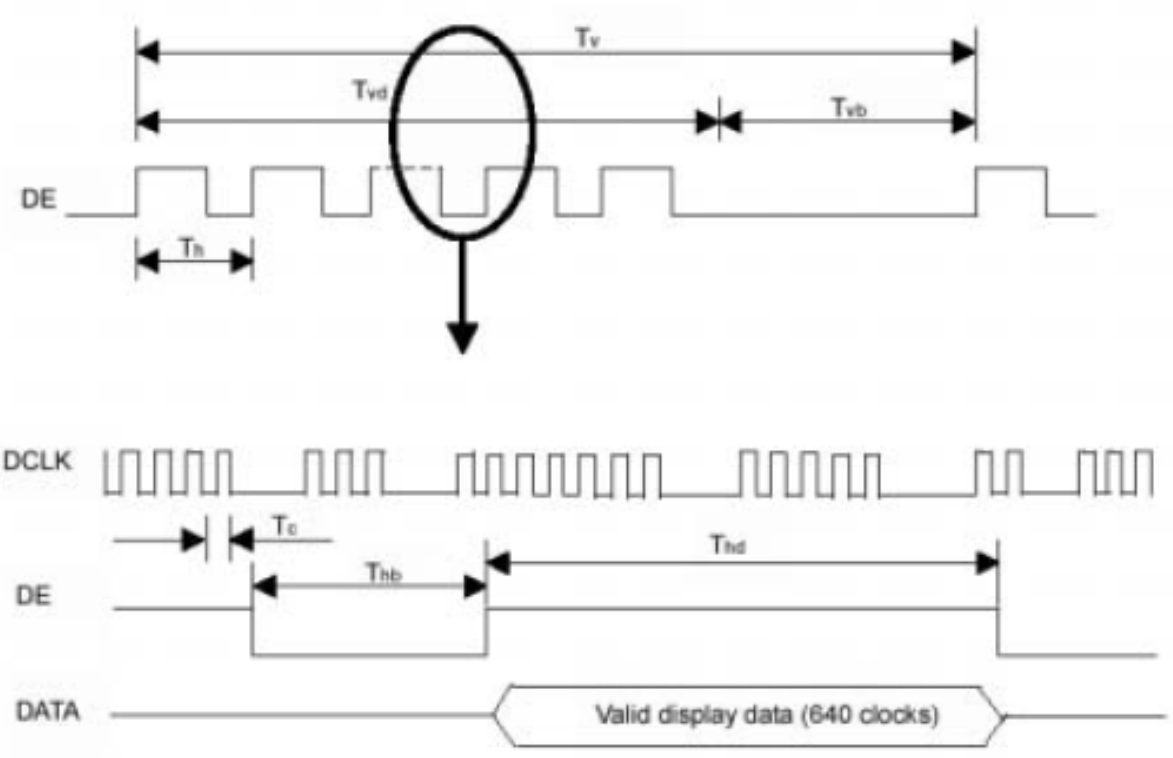
7.1 INPUT SIGNAL TIMING SPECIFICATIONS

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	Fc	57.5	64.9	74.4	MHz	
	Period	Tc	13.4	15.4	17.3	ns	
Vertical Active Display Term	Frame Rate	Fr	56	60	75	Hz	
	Total	Tv	774	806	848	Th	Tv=Tvd+Tvb
	Display	Tvd	768	768	768	Th	
	Blank	Tvb	Tv-Tvd	38	Tv-Tvd	Th	
Horizontal Active Display Term	Total	Th	1240	1344	1464	Tc	Th=Thd+Thb
	Display	Thd	1024	1024	1024	Tc	
	Blank	Thb	Th-Thd	320	Th-Thd	Tc	

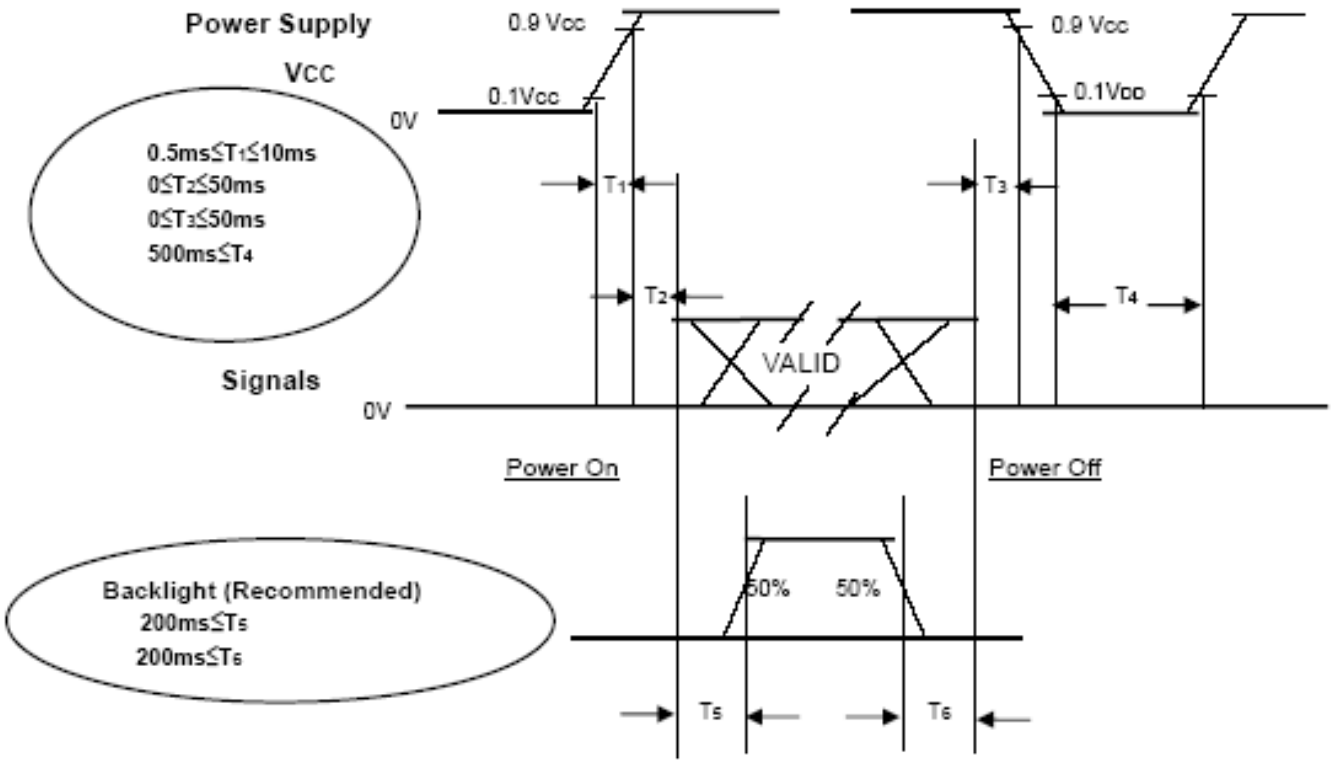
Note：(1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



7.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should follow the conditions shown in the following diagram.



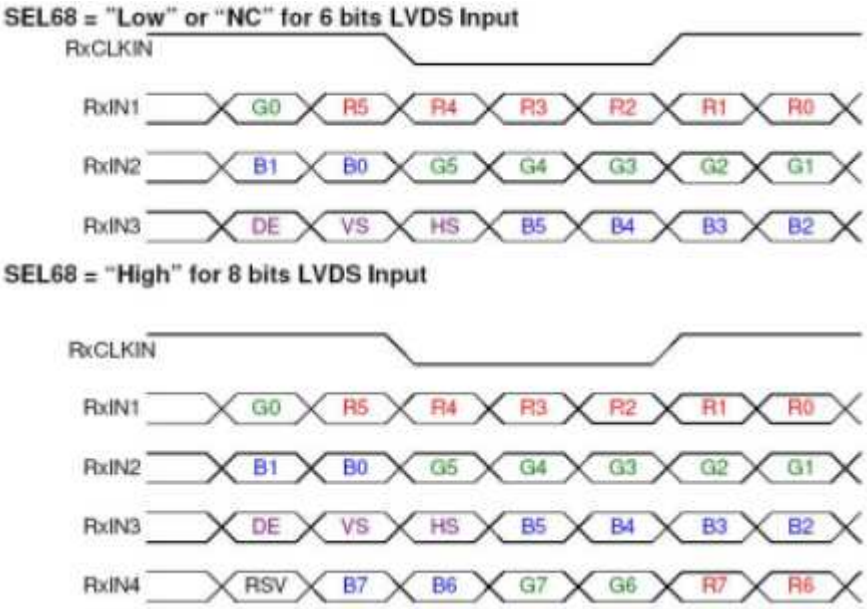
Power ON/OFF Sequence

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

7.3 The Input Data Format



Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB

Note (2) Please follow PSWG

Signal Name	Description	Remark
R7 R6 R5 R4 R3 R2 R1 R0	Red Data 7 (MSB) Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0(LSB)	Red-pixel Data Each red pixel's brightness data consists of these 8 bit pixel data
G7 G6 G5 G4 G3 G2 G1 G0	Green Data 7 (MSB) Green Data 6 Green Data 5 Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0(LSB)	Green-pixel Data Each Green pixel's brightness data consists of these 8 bit pixel data
B7 B6 B5 B4 B3 B2 B1 B0	Blue Data 7 (MSB) Blue Data 6 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2 Blue Data 1 Blue Data 0(LSB)	Blue-pixel Data Each Blue pixel's brightness data consists of these 8 bit pixel data
RXCLKIN+ RXCLKIN-	LVDS Clock input	
DE	Display enable	
CS	Vertical sync	
HS	Horizontal Sync	

Note (3) Output signals from any system shall be low or Hi-Z state when VCC is off

7.4 Scanning Direction

The following figures show the image see from the front view. The arrow indicates the direction of scan.

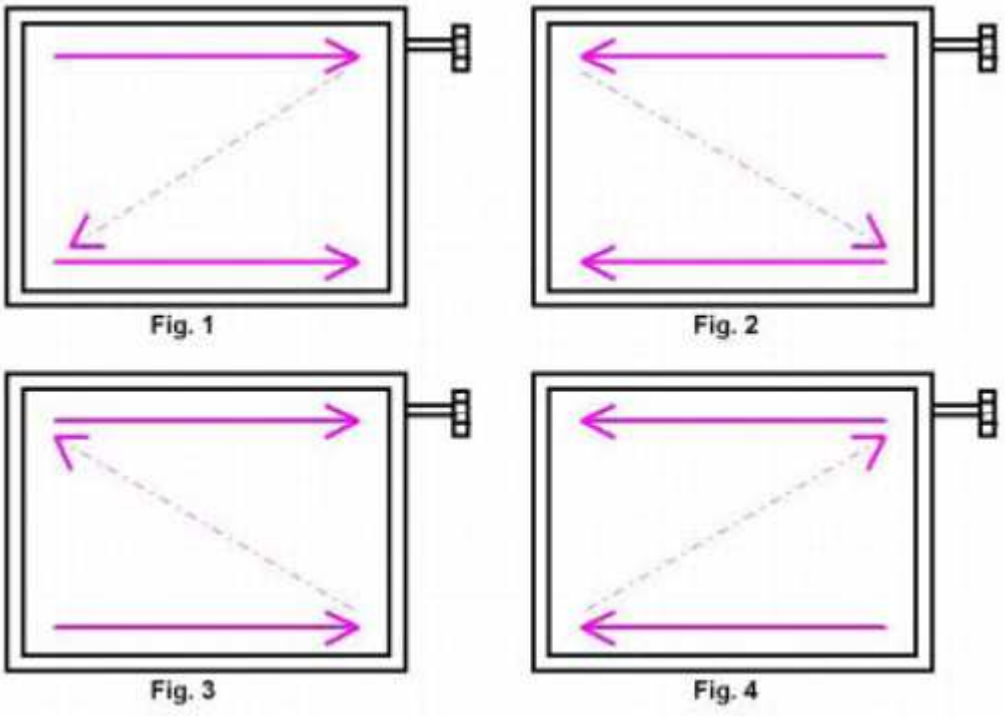


Fig. 1 Normal scan (pin 17, reLR = Low or NC, pin 18, reUD = Low or NC)

Fig. 2 Reverse scan (pin 17, reLR = High, pin 18, reUD = Low or NC)

Fig. 3 Reverse scan (pin 17, reLR = Low or NC, pin 18, reUD = High)

Fig. 4 Reverse scan (pin 17, reLR = High, pin 18, reUD = High)

8. OPTICAL CHARACTERISTICS

8.1 TEST CONDITIONS

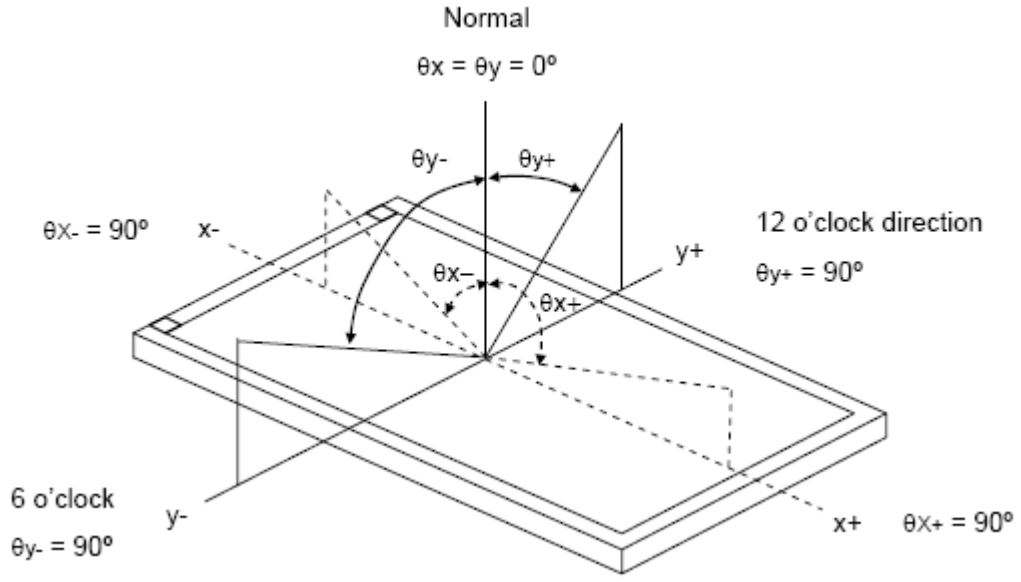
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	˚C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	VCC	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I_L	8.0±0.5	mA
Inverter Driving Frequency	F_L	61±5	KHz
Inverter	Sumida H05-5052		

8.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rx	θx=0°, θY =0° CS-1000	Typ - 0.03	0.595	Typ + 0.03	-	(1), (5)
		Ry			0.339		-	
	Green	Gx			0.317		-	
		Gy			0.531		-	
	Blue	Bx			0.152		-	
		By			0.123		-	
	White	Wx			0.308		-	
		Wy			0.318		-	
Center Luminance of White		L_C		380	500	-	-	(4), (5)
Contrast Ratio		C_R		500	700	-	-	(2), (5)
Response Time		T_R	θx=0°, θY =0°	-	6	11	ms	(3)
		T_F		-	17	22	ms	
White Variation		δW	θx=0°, θY =0°	-	1.25	1.4	-	(5), (6)
Viewing Angle	Horizontal	θx+	CR≥10	70	80	-	Deg.	(1), (5)
		θx-		70	80	-		
	Vertical	θY+		70	80	-		
		θY-		70	80	-		
Contrast Ratio in daylight			Sun lamp	40	60	-	-	(7)

Note (1) Definition of Viewing Angle (θx, θy):



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

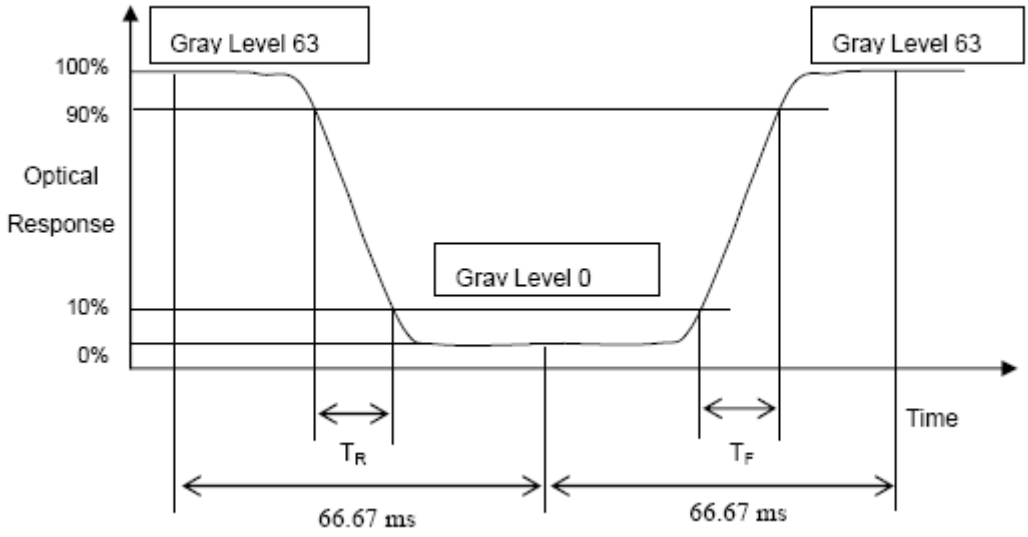
The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0 L63: Luminance of gray level 63

L 0: Luminance of gray level 0 CR = 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 (TR, TF) and measurement method:



Note (4) Definition of Luminance of White (LC):

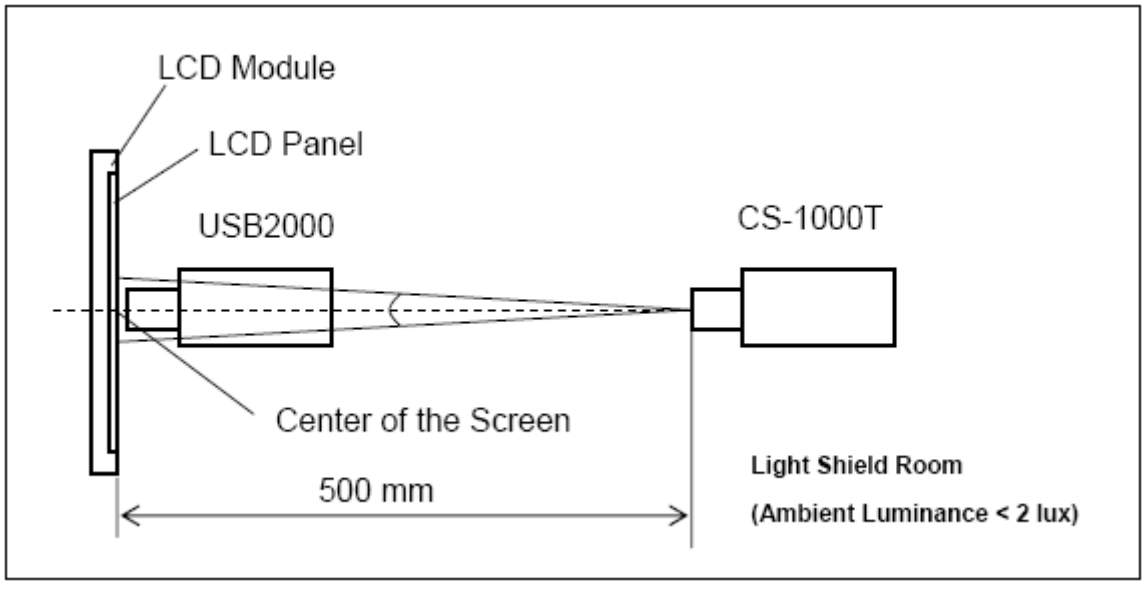
Measure the luminance of gray level 63 at center point

LC = L (5)

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

Note (5) Measurement Setup:

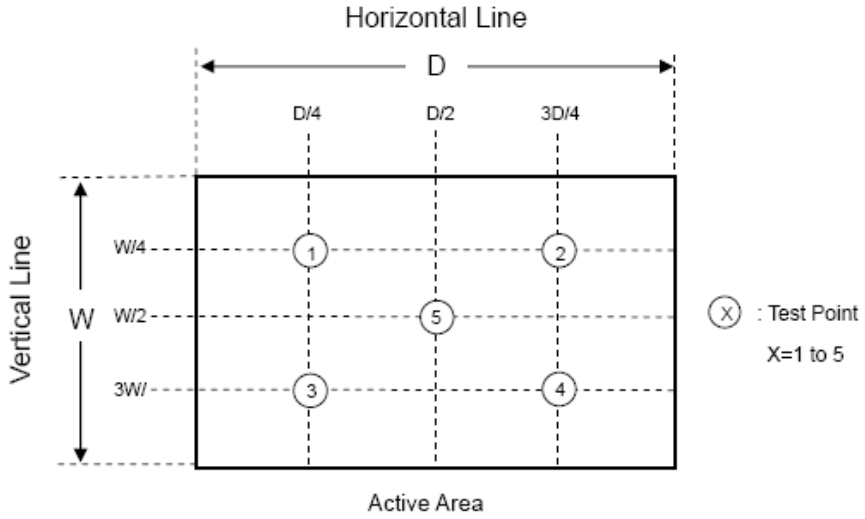
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

$$\delta W = \frac{\text{Maximum [L (1), L (2), L (3), L (4), L (5)]}}{\text{Minimum [L (1), L (2), L (3), L (4), L (5)]}}$$

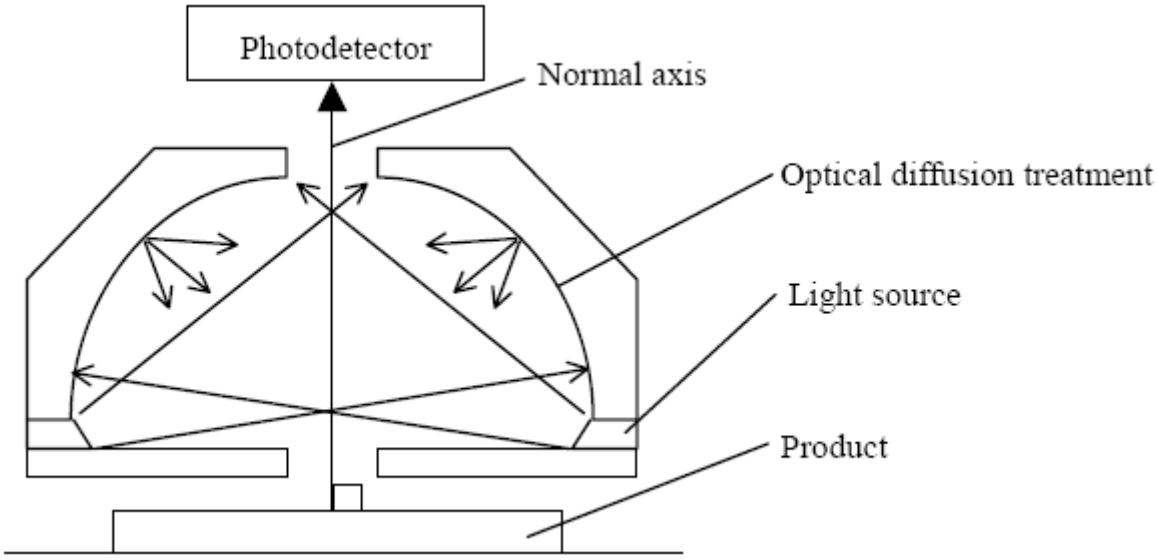


Note (7) Contrast Ratio in daylight:

Measuring method:

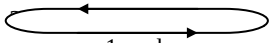
Sun lamp:10000 Lux

Contrast Ratio in daylight=Luminance of white screen/ Luminance of black screen



9.Reliability Test

Content of Reliability Test (Wide temperature, -30℃~80℃)

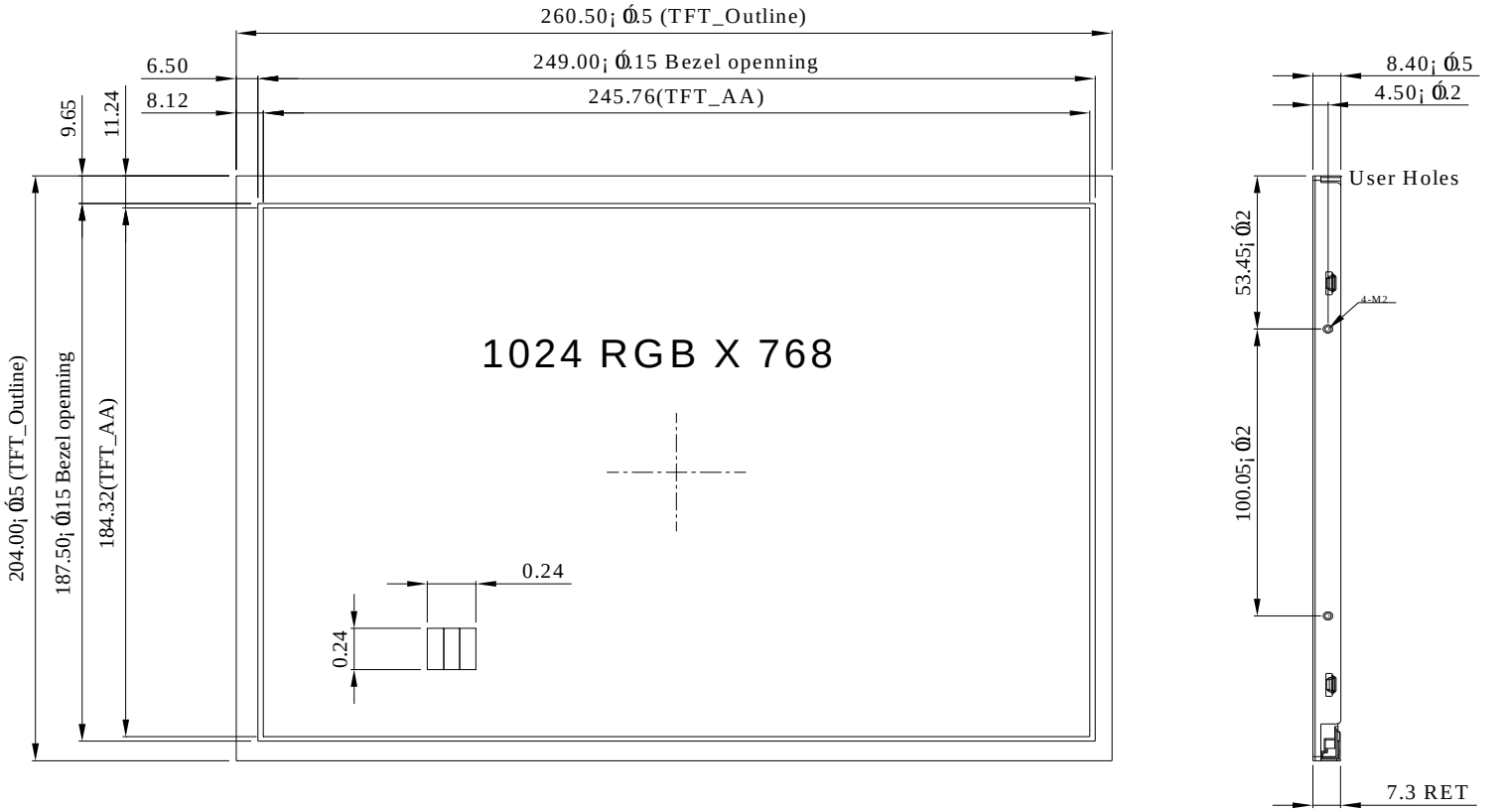
Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Note**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	85℃ 200hrs	2
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-40℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	80℃ 200hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-30℃ 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max For 96hrs under no-load condition excluding the polarizer, Then taking it out and drying it at normal temperature.	60℃,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -30℃ 25℃ 80℃  1 cycle	-30℃/80℃ 10 cycles	——
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 15mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	——

Note1: No dew condensation to be observed.

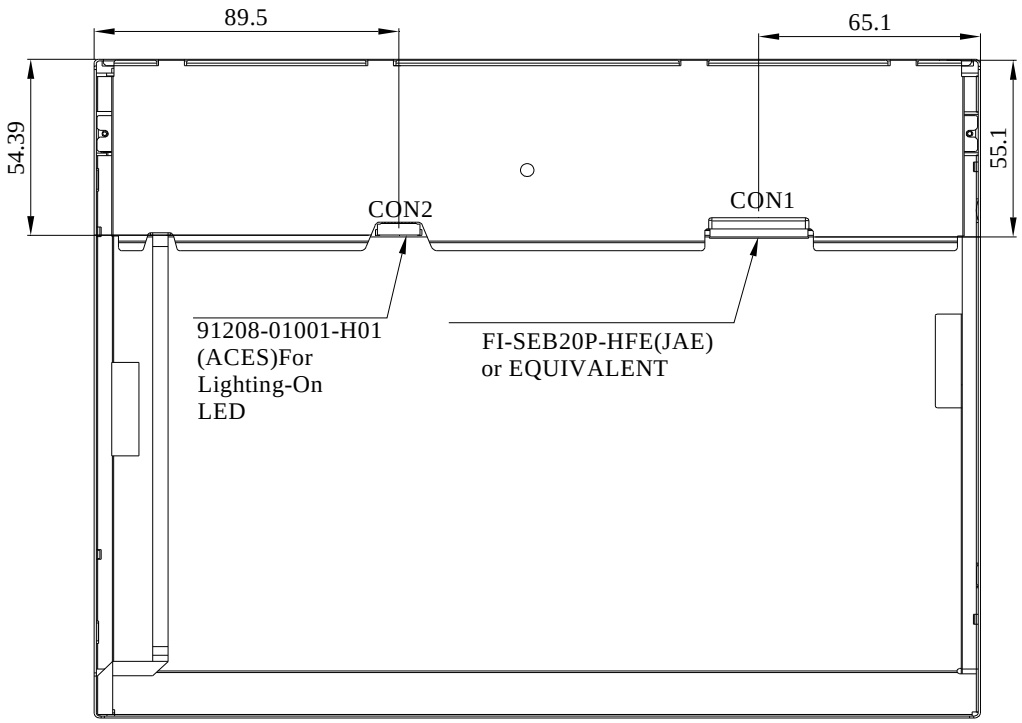
Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: Vibration test will be conducted to the product itself without putting it in a container.

10. Contour Drawing



The non-specified tolerance of dimension is ±0.3mm.



CON1

PIN NO.	SYMBOL
1	RX3+
2	RX3-
3	NC
4	SEL68
5	GND
6	RXC+
7	RXC-
8	GND
9	RX2+
10	RX2-
11	GND
12	RX1+
13	RX1-
14	GND
15	RX0+
16	RX0-
17	reLR
18	reUD
19	VCC
20	VCC

CON2

PIN NO.	SYMBOL
1	Vi
2	Vi
3	Vi
4	Vi
5	VGND
6	VGND
7	VGND
8	VGND
9	EN
10	ADJ

The non-specified tolerance of dimension is ±0.3mm.