

PRODUCT SPECIFICATION **FOR LCD MODULE**

Revision: 1.0

Model No: LS29I01-L-V1

Module Type: COG+FPC+B/L

APPROVED SIGNATURE

- Approved Product Specification only
- Approved Product Specification and Samples

<u>Prepared By</u>	<u>Checked By</u>	<u>Approved By</u>

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1. General Description

This specification applies to the 2.9 inch Color TFT-LCD model LS29I01-L-V1. This Open Cell Unit has a TFT active matrix type liquid crystal panel with 1920 x 618 pixels and 8-bit 2 channel LVDS interface; which can display up to 167 million colors.

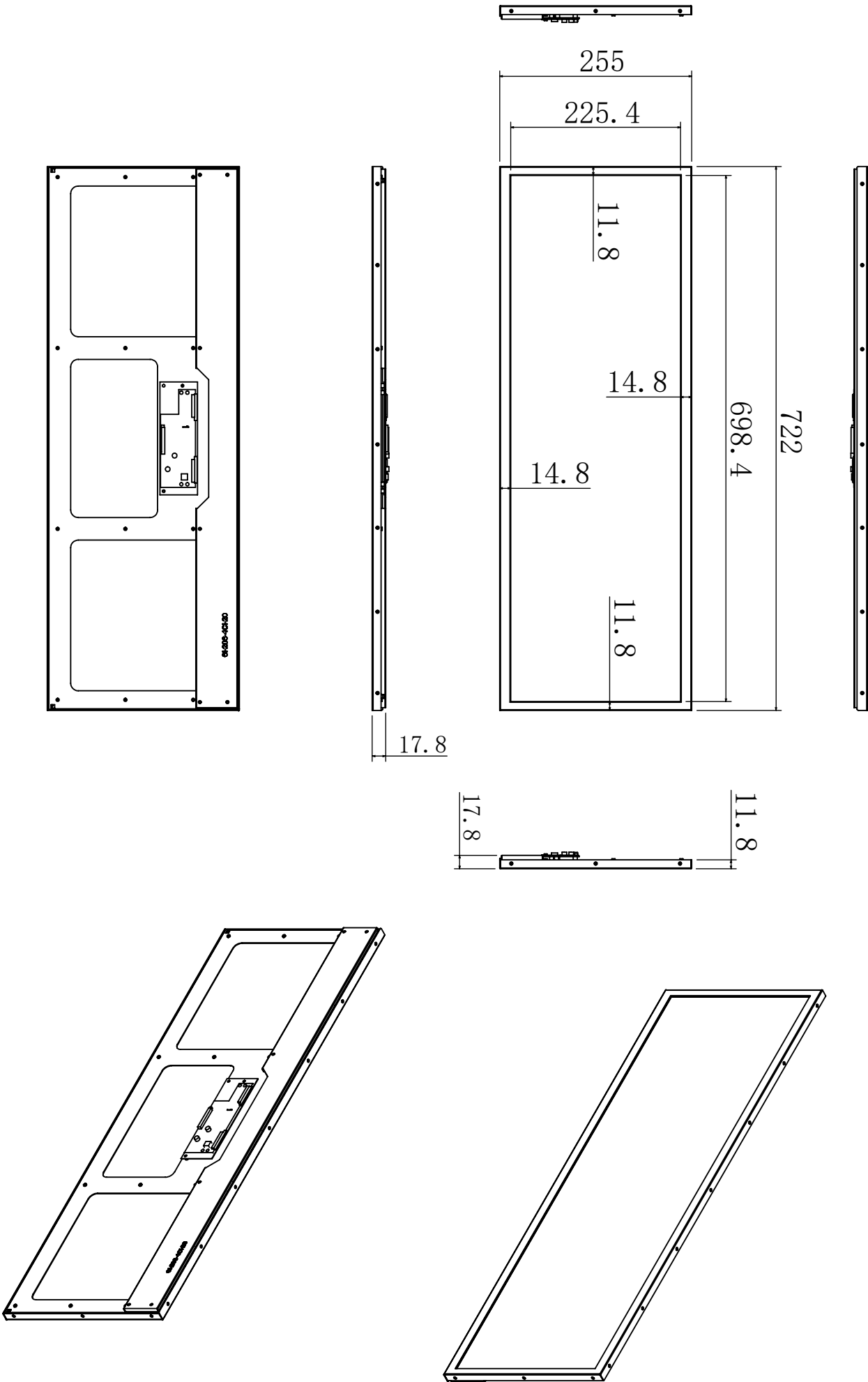
2. Physical Features

Display Mode	TFT-LCD Module
	Active matrix TFT, Transmissive type
Display Format	Graphic 1920(RGB)×618 Dot-matrix
Input Data	LVDS
Viewing Direction (Grayscale Inversion)	Free (IPS)

3. Mechanical Specification

Item	Specification	Unit
Module size (H×V×D)	77.2 ×25.5 ×1.8	mm
Number of dots	1920(RGB) ×618	pixel
Active area (H×V)	69.8×22.5.4	mm

4. Outline Dimension



5. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit or the unrecoverable damage on the device.

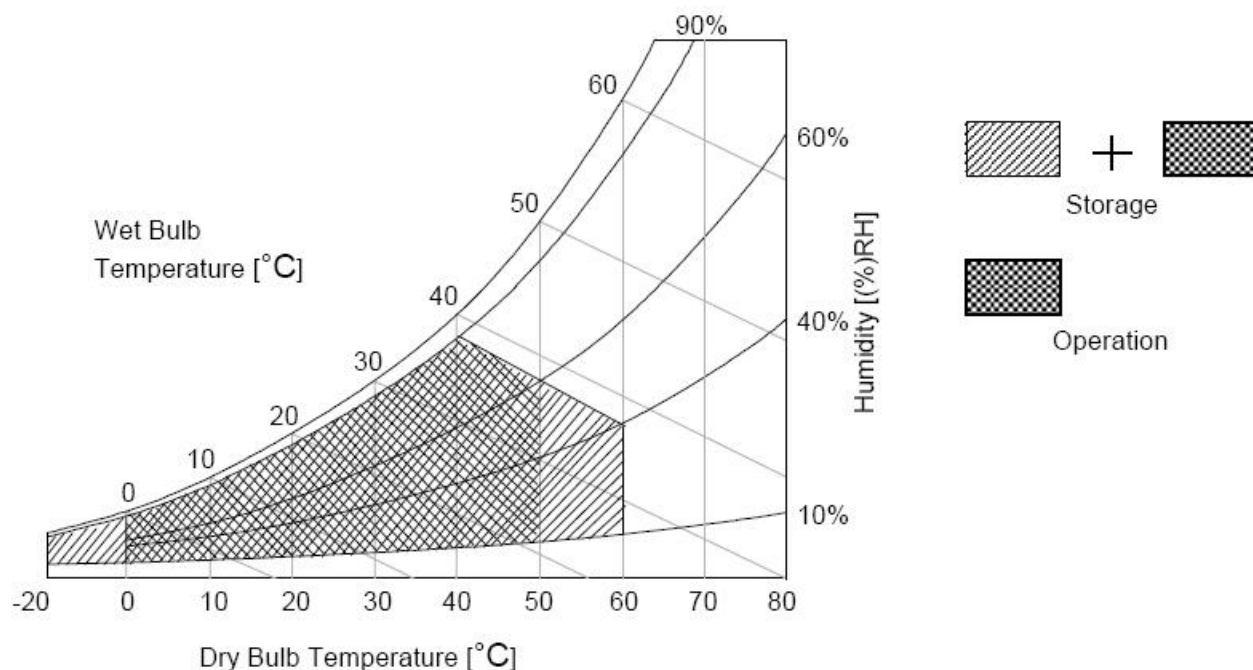
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	V_{DD}	-0.3	14	[Volt] _{DC}	Note 1
Input Voltage of Signal	V_{in}	-0.3	4	[Volt] _{DC}	Note 1
Operating Temperature	TOP	0	+50	[°C]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[°C]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note 2
Panel Surface Temperature	PST		65	[°C]	Note 3

Note 1: Duration:50 msec.

Note 2 : Maximum Wet-Bulb should be 39°C and No condensation.

The relative humidity must not exceed 90% non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C.

Note 3: Surface temperature is measured at 50°C Dry condition



6. Electrical Characteristics

The Open Cell Unit requires power input which is employed to power the LCD electronics and to drive the TFT array and liquid crystal.

Item		Symbol	Min.	Typ.	Max	Unit	Note
Power Supply Input Voltage		V_{DD}	10.8	12	13.2	V	1
Power Supply Input Current	Black pattern	I_{DD}	-	0.34	0.41	A	2
	White pattern		-	0.36	0.43	A	
	H-strip pattern		-	0.5	0.6	A	
Power Consumption	Black pattern	P_C	-	4.08	4.92	Watt	
	White pattern		-	4.32	5.16	Watt	
	H-strip pattern		-	6	7.2	Watt	
Inrush Current		I_{RUSH}	--	-	4	A	3

Note1. The ripple voltage should be fewer than 10% of V_{DD} and min. V_{DD} (including ripple min.) must be over 10.8V at any time..

Note2. Test Condition:

- (1) $V_{DD} = 12V$, (2) $F_v = 60Hz$, (3) $F_{clk} = 74.25MHz$, (4) Temperature = 25 °C
(5) Power dissipation check pattern. (Only for power design)

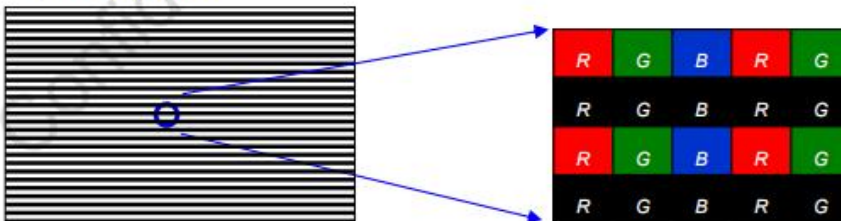
a. Black pattern



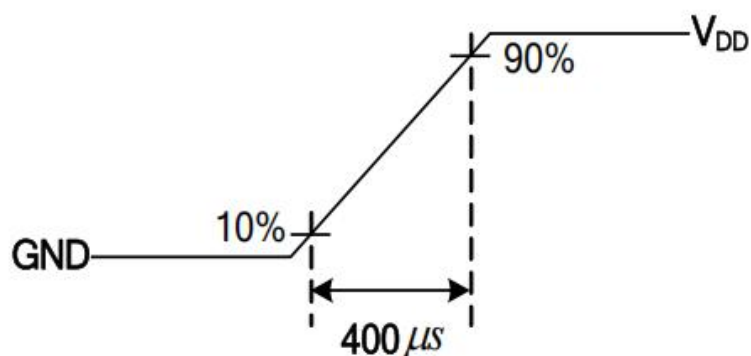
b. White pattern



c. H-Strip pattern



Note3. Measurement condition : Rising time = 400us

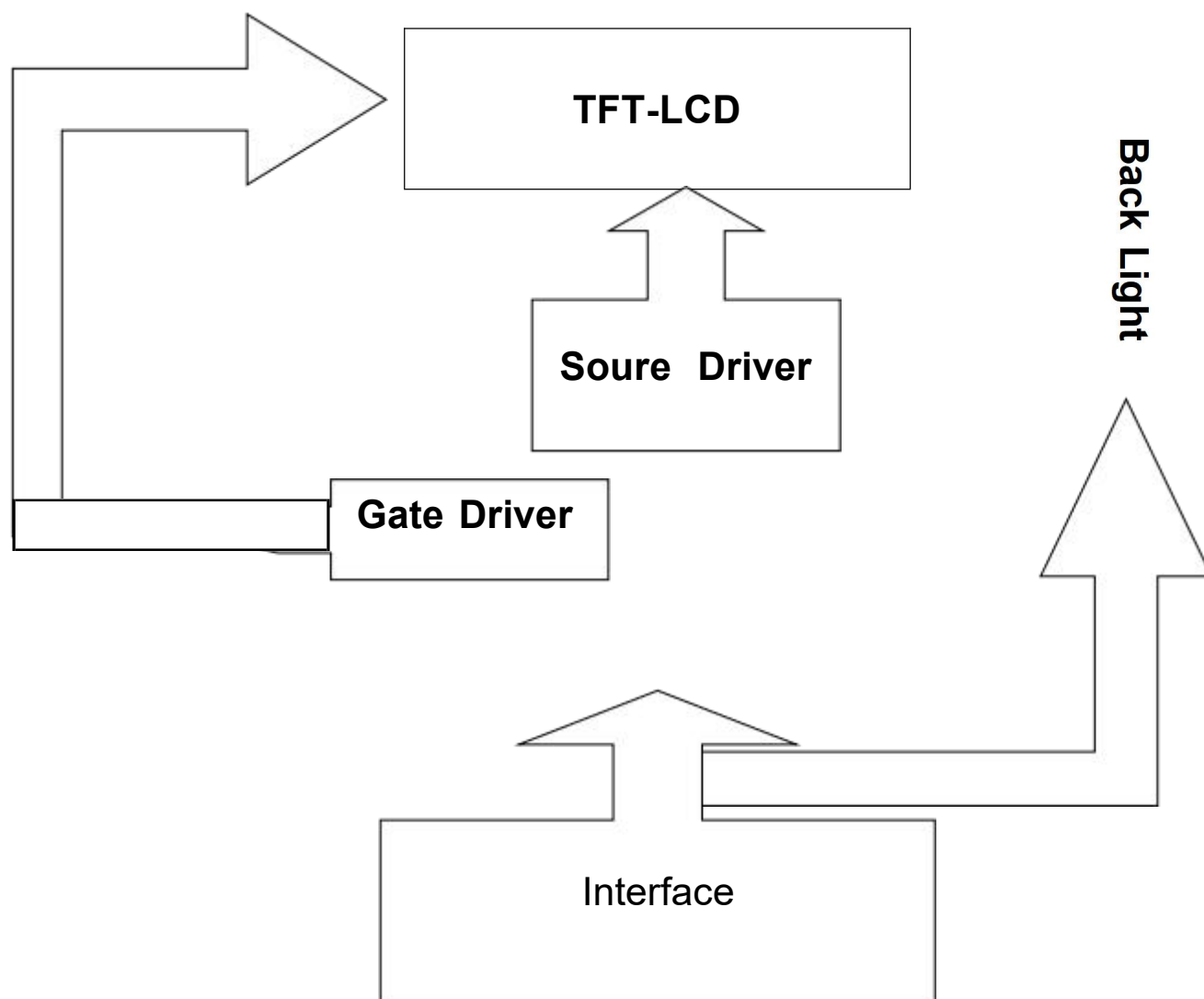


6.1 Back-Light Unit

Parameter		Min.	Typ.	Max.	Unit
LED Light Bar Input Voltage	VPIN	-	55	65	V
LED Light Bar Input Current	IPIN	-	400	480	mA
LED Power Consumption	PBL	-	22	-	W
LED Life-Time	-	-	30000	/	Hrs
LCM Luminance	L		500		cd/m2

7. Module Function Description

7-1. Block Diagram Of LCM



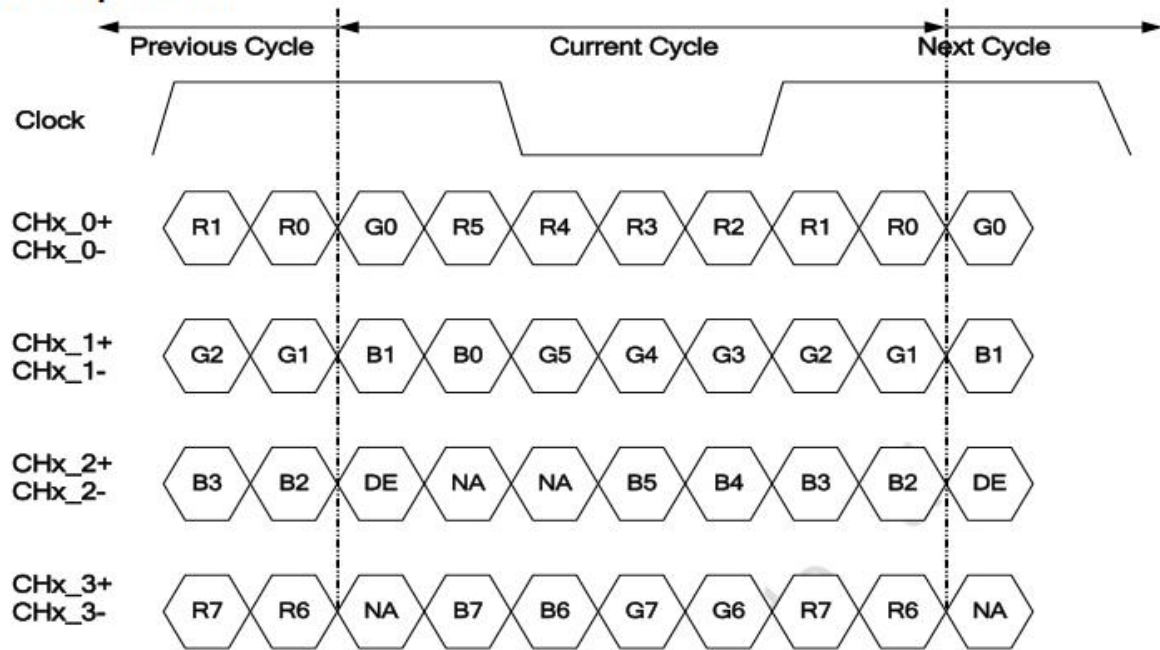
7-2. Pin Description

■ LCD connector: JAE FI-RTE51SZ-HF, Starconn 115E51-0000RA-M3-R

PIN	Symbol	Description	Note	PIN	Symbol	Description	Note
1	N.C.	No Connection	2	26	GND or N.C.	Ground or No Connection	7
2	SCL	I2C Clock	3,4	27	N.C.	No Connection	2
3	WP	Write Protection	3,5	28	CH2_0-	LVDS Channel 2, Signal 0-	
4	SDA	I2C Data	3,4	29	CH2_0+	LVDS Channel 2, Signal 0+	
5	N.C.	No Connection	2	30	CH2_1-	LVDS Channel 2, Signal 1-	
6	N.C.	No Connection	2	31	CH2_1+	LVDS Channel 2, Signal 1+	
7	LVDS_SEL	LVDS data format selection	3,6	32	CH2_2-	LVDS Channel 2, Signal 2-	
8	N.C.	No Connection	2	33	CH2_2+	LVDS Channel 2, Signal 2+	
9	N.C.	No Connection	2	34	GND	Ground	
10	N.C.	No Connection	2	35	CH2_CLK-	LVDS Channel 2, Clock -	
11	GND	Ground		36	CH2_CLK+	LVDS Channel 2, Clock +	
12	CH1_0-	LVDS Channel 1, Signal 0-		37	GND	Ground	
13	CH1_0+	LVDS Channel 1, Signal 0+		38	CH2_3-	LVDS Channel 2, Signal 3-	
14	CH1_1-	LVDS Channel 1, Signal 1-		39	CH2_3+	LVDS Channel 2, Signal 3+	
15	CH1_1+	LVDS Channel 1, Signal 1+		40	N.C.	No Connection	2
16	CH1_2-	LVDS Channel 1, Signal 2-		41	N.C.	No Connection	2
17	CH1_2+	LVDS Channel 1, Signal 2+		42	GND	Ground	
18	GND	Ground		43	GND	Ground	
19	CH1_CLK-	LVDS Channel 1, Clock -		44	GND	Ground	
20	CH1_CLK+	LVDS Channel 1, Clock +		45	GND	Ground	
21	GND	Ground		46	GND	Ground	
22	CH1_3-	LVDS Channel 1, Signal 3-		47	N.C.	No Connection	2
23	CH1_3+	LVDS Channel 1, Signal 3+		48	V _{DD}	Power Supply Input Voltage	
24	N.C.	No Connection	2	49	V _{DD}	Power Supply Input Voltage	
25	N.C.	No Connection	2	50	V _{DD}	Power Supply Input Voltage	
				51	V _{DD}	Power Supply Input Voltage	

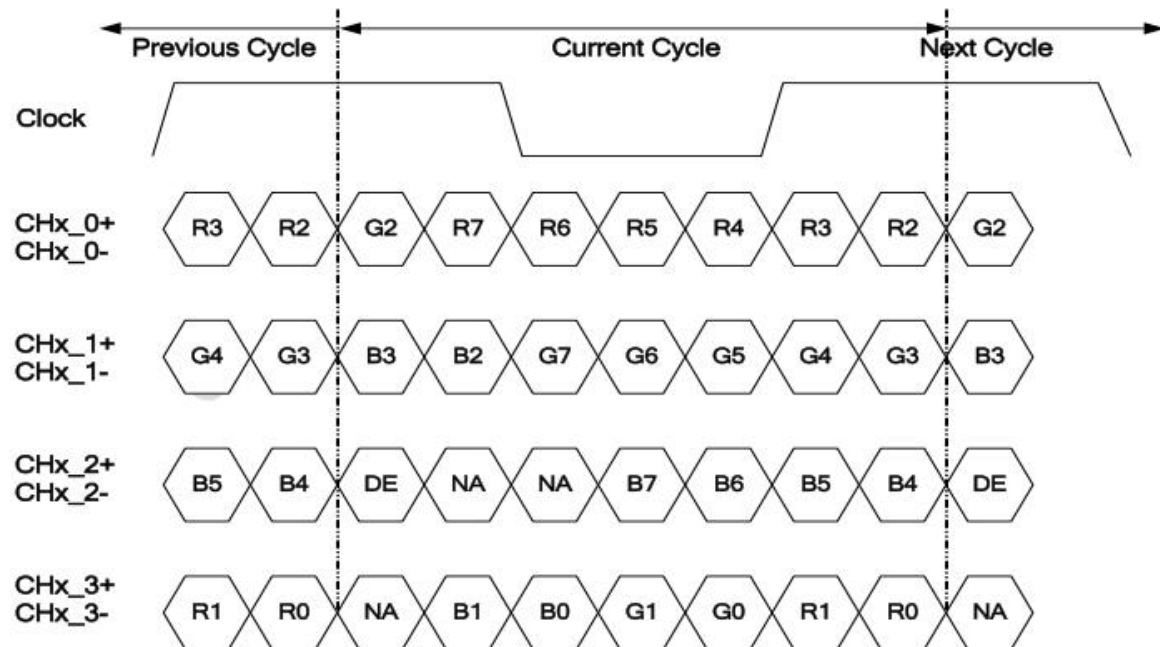
7-3 Timing Characteristics

■ LVDS Option NS



Note: x = 1, 2, 3, 4...

■ LVDS Option JEIDA



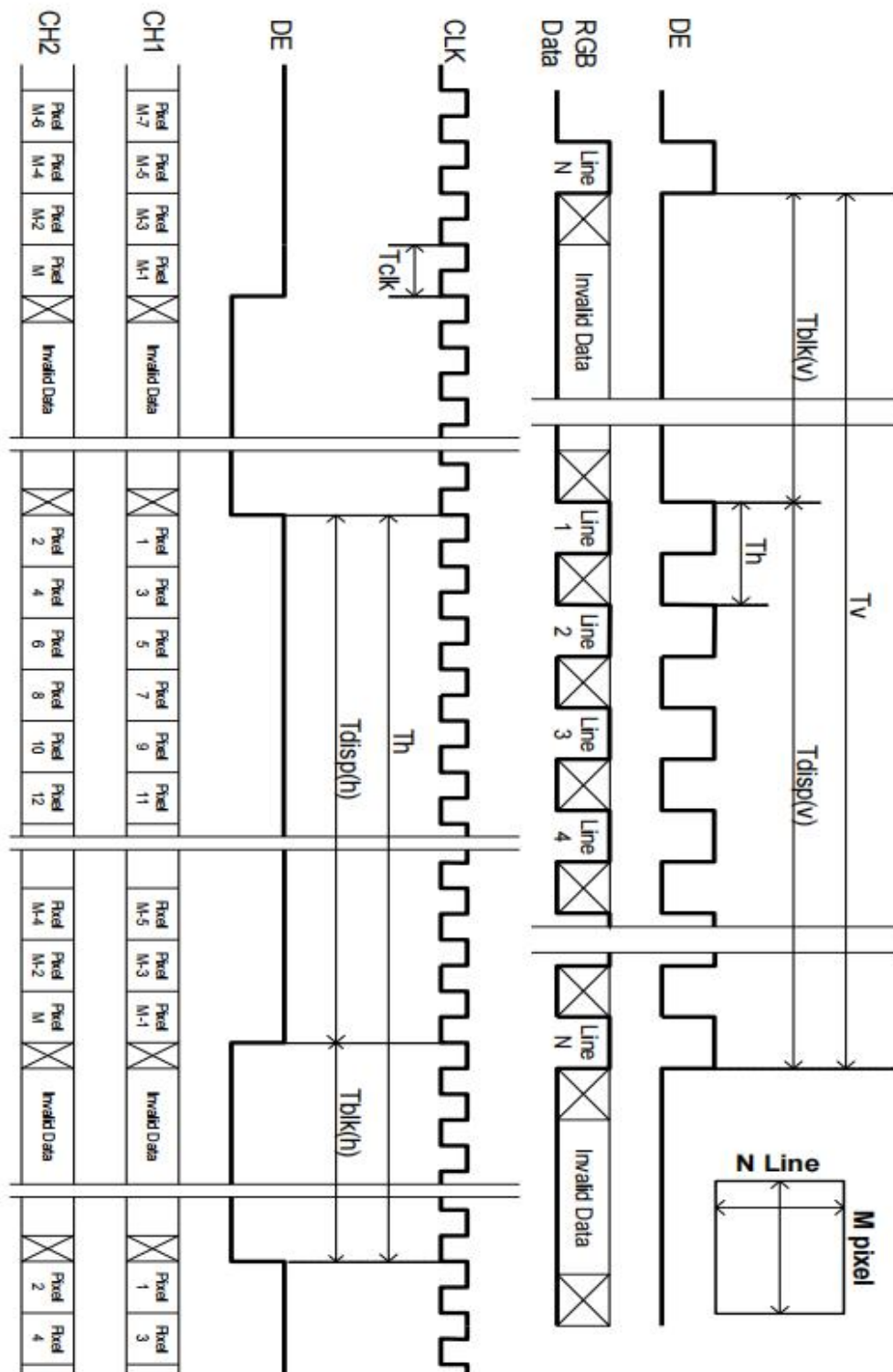
Note: x = 1, 2, 3, 4...

This is the signal timing required at the input of the user connector. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

Timing Table (DE only Mode)

Signal	Item	Symbol	Min.	Typ.	Max	Unit
Vertical Section	Period	Tv	1100	1125	1480	Th
	Active	Tdisp (v)	1080			
	Blanking	Tblk (v)	20	45	400	Th
Horizontal Section	Period	Th	1030	1100	1325	Tclk
	Active	Tdisp (h)	960			
	Blanking	Tblk (h)	70	140	365	Tclk
Clock	Frequency	Fclk=1/Tclk	53	74.25	82	MHz
Vertical Frequency	Frequency	Fv	47	60	63	Hz
Horizontal Frequency	Frequency	Fh	60	67.5	73	KHz

The timing diagrams of the input timing



Note1. Display position is specific by the rise of DE signal only.

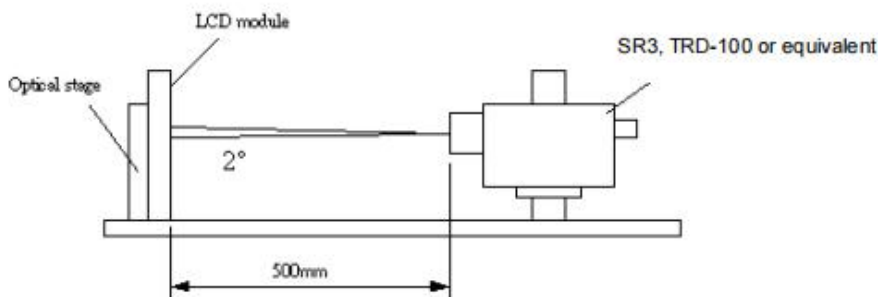
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

Note2. Vertical display position is specified by the rise of DE after a "Low" level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of 1st DE is displayed at the top line of screen

8. Electro-Optical Characteristics

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 45 minutes in a dark environment at 25°C. The values specified are measured on the center of active area and at an approximate distance 500 mm from the LCD surface at a viewing angle of ϕ and θ equal to 0°.

Fig.1 presents additional information concerning the measurement equipment and method.



Parameter	Symbol	Condition	Values			Unit	Notes
			Min.	Typ.	Max		
Contrast Ratio	CR	SR3, TRD-100	3000	4000	--		1, 2
Response Time (G to G)	T_r		--	8	16	ms	3
Color Chromaticity		With SR3 Standard light source "C"	Typ.-0.03				4
Red	R_x			0.666	Typ.+0.03		
	R_y			0.325			
Green	G_x			0.268			
	G_y			0.597			
Blue	B_x			0.139			
	B_y			0.098			
White	W_x			0.290			
	W_y			0.338			
Viewing Angle		SR3					1, 5
x axis, right($\phi=0^\circ$)	θ_r		85	89	--	degree	
x axis, left($\phi=180^\circ$)	θ_l		85	89	--	degree	
y axis, up($\phi=90^\circ$)	θ_u		85	89	--	degree	
y axis, down ($\phi=270^\circ$)	θ_d		85	89	--	degree	

1. Light source here is the BLU of AUO module (film structure: two diffuser sheets).

2. Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance at center location of all white pixels}}{\text{Surface Luminance at center location of all black pixels}}$$

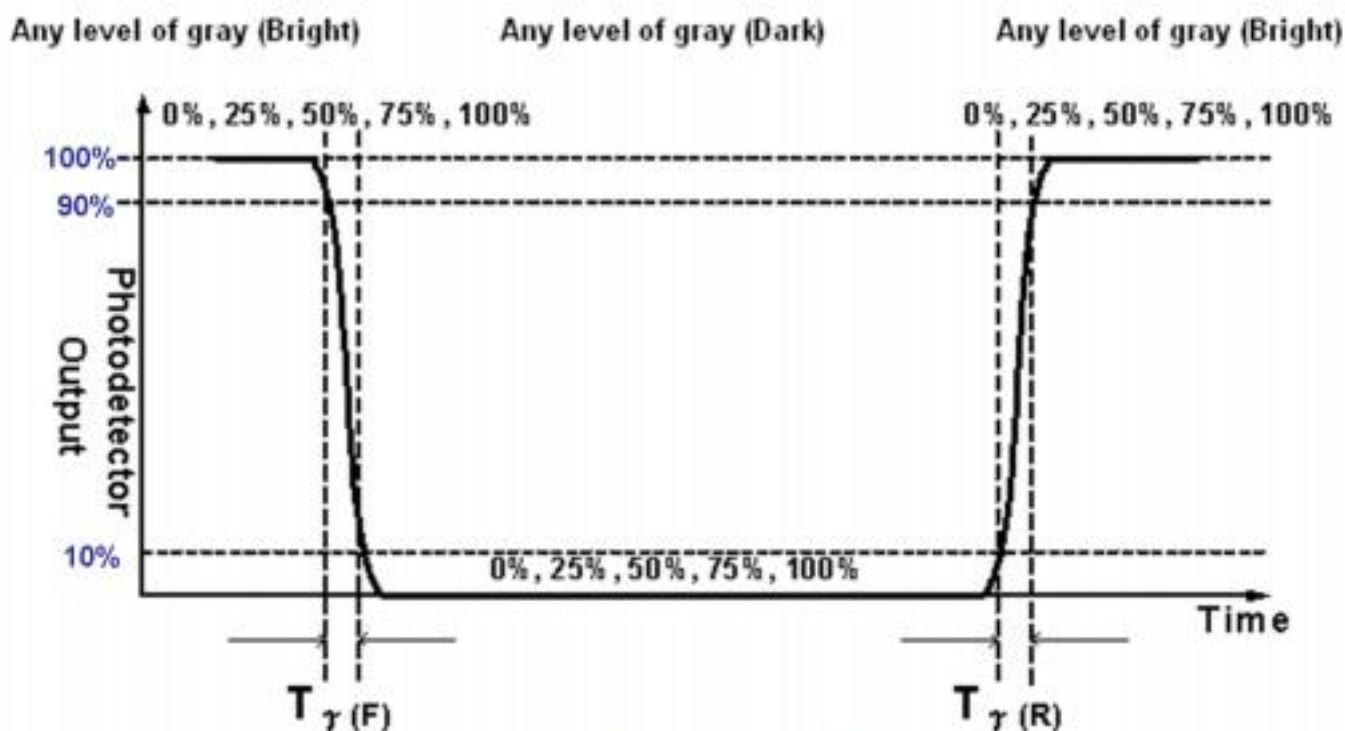
3. Response time T_{γ} is the average time required for display transition by switching the input signal for five luminance ratio (0%,25%,50%,75%,100% brightness matrix) and is based on Frame rate = 60Hz to optimize.

Measured Response Time		Target				
		0%	25%	50%	75%	100%
Start	0%		0% to 25%	0% to 50%	0% to 75%	0% to 100%
	25%	25% to 0%		25% to 50%	25% to 75%	25% to 100%
	50%	50% to 0%	50% to 25%		50% to 75%	50% to 100%
	75%	75% to 0%	75% to 25%	75% to 50%		75% to 100%
	100%	100% to 0%	100% to 25%	100% to 50%	100% to 75%	

T_{γ} is determined by 10% to 90% brightness difference of rising or falling period. (As illustrated)

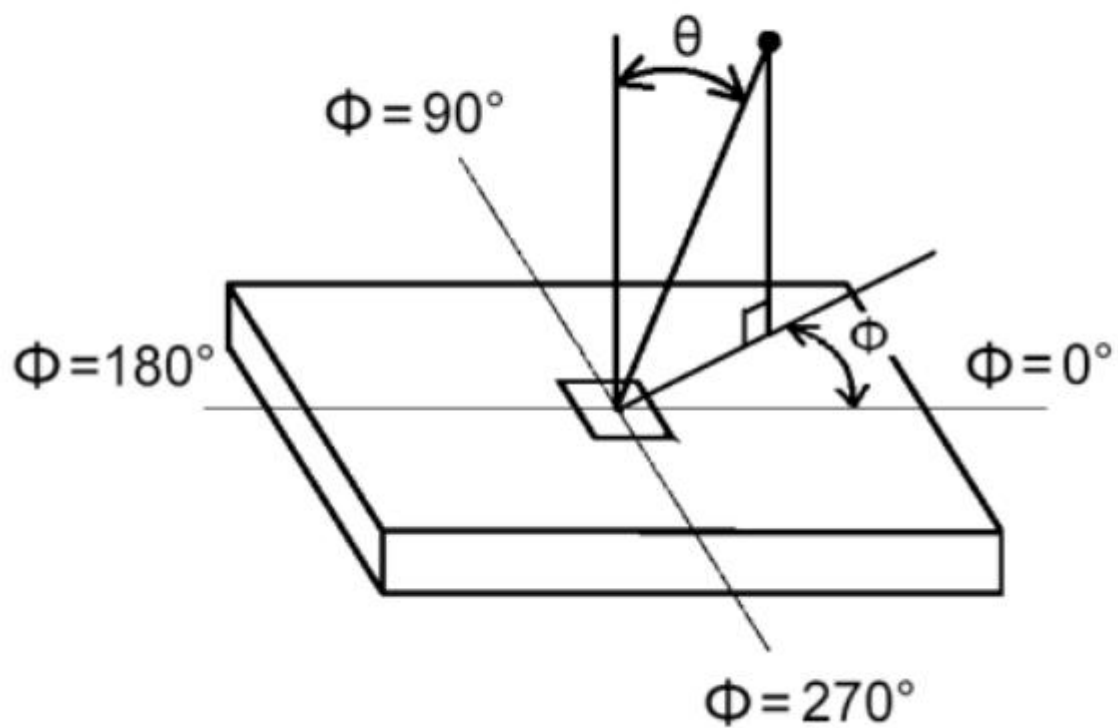
The response time is defined as the following figure and shall be measured by switching the input signal for "any level of gray(bright)" and "any level of gray(dark)".

FIG.3 Response Time



4. Light source here is the standard light source "C" which is defined by CIE and driving voltages are based on suitable gamma voltages. The calculating method is as following :
- Measure the "Module" and "BLU" optical spectrums (W, R, G, B).
 - Calculate cell spectrum from "Module" and "BLU" spectrums.
 - Calculate color chromaticity by using cell spectrum and the spectrum of standard light source "C".
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG4.

FIG.4 Viewing Angle



9.Records Of Version

Version	Revise Date	Page	Content
00		ALL	New released