

产 品 规 格 书

Product Specification

Model Name (产品名称)		<u>TFT-LCD Module</u>	
Part Number (产品型号)		<u>JT244FHI30R3L01</u>	
Item (项目)	Prepared (拟制)	Checked (审核)	Approved (批准)
Signature (签名)	赖依		
Date (日期)	2024-06-17		
Note (备注)			
Customer: (客户)			
		Signature (签名)	
		Date (日期)	

Revision Record

Version	Issued Date	Page	Old Description	New Description
01	2024-06-17	\	Initial release	\
02	2024-07-12	24	Drawing change	
03	2024-08-12	24	Drawing change	
04	2024-09-26	24	Drawing change	

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1 Handling Precautions

- 1) Since polarizer is easily damaged, do not touch or press the surface of polarizer with hand.
- 2) Be sure to turn off power supply when inserting or disconnecting from input connector.
- 3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- 4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- 5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
- 6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
- 7) Do not open or modify the Module Assembly.
- 8) Do not press the reflector sheet at the back of the module to any directions.
- 9) In case a TFT-LCD Module has to be put back into the packing container slot after once it was taken out from the container, do not press the center of the LED lightbar edge. Otherwise the TFT-LCD Module may be damaged.
- 10) Insert or pull out the interface connector, be sure not to rotate nor tilt it of the TFT-LCD Module.
- 11) Do not twist nor bend the TFT -LCD Module even momentary. It should be taken into consideration that no bending/twisting forces are applied to the TFT-LCD Module from outside. Otherwise the TFT-LCD Module may be damaged.
- 12) Please avoid touching COF position while you are doing mechanical design.
- 13) When storing modules as spares for a long time, the following precaution is necessary:
Store them in a dark place. Do not expose the module to sunlight or fluorescent light.
Keep the temperature between 5°C and 35°C at normal humidity.
- 14) Do not apply the same pattern for a long time, it will enhance relevant defect.

2 General Description

This specification applies to the 24.4 inch-FHD color a-Si TFT-LCD Module. The display supports the FHD - 1920(H) x 540(V) screen format and 16.7M colors (RGB 8-bit data input). The light source of this TFT-LCD module is W-LED. All input signals are 2-channel LVDS interface and this module doesn't contain a driver for backlight.

2.1 Display Characteristics

The following items are characteristics summary on the table under 25°C condition:

Items	Specification	Unit	Note
Active Screen Size	24.4	inch	
Number of Pixels	1920*540	Pixel	
Display Area	597.6(H) x 168.1(V)	mm	
Bezel Opening	601.6(H) x 172.1(V)	mm	
Outline Dimension	615.6(H) x 196.1(V) x 13.2(D)	mm	
Luminance, White	300 (Center 1 point, Typ.)	cd/m ²	
Power Supply Input Voltage	12 (Typ)	V	Backlight
Power Supply Voltage	5.0 (Typ)	V	OC
Power Consumption	Total = 19.2 (Typ.)	W	LCD Open Cell = 4.65 W(Typ.) Backlight = 14.55 W(Typ.)
Contrast Ratio	3000 : 1	--	
Response time	20 (Typ.)(G to G)	ms	
Color temperature	9523	K	
Weight	1.65(Typ)	Kg	
Operating Temperature	0 ~ 50		
Storage Temperature	-20 ~ 60		

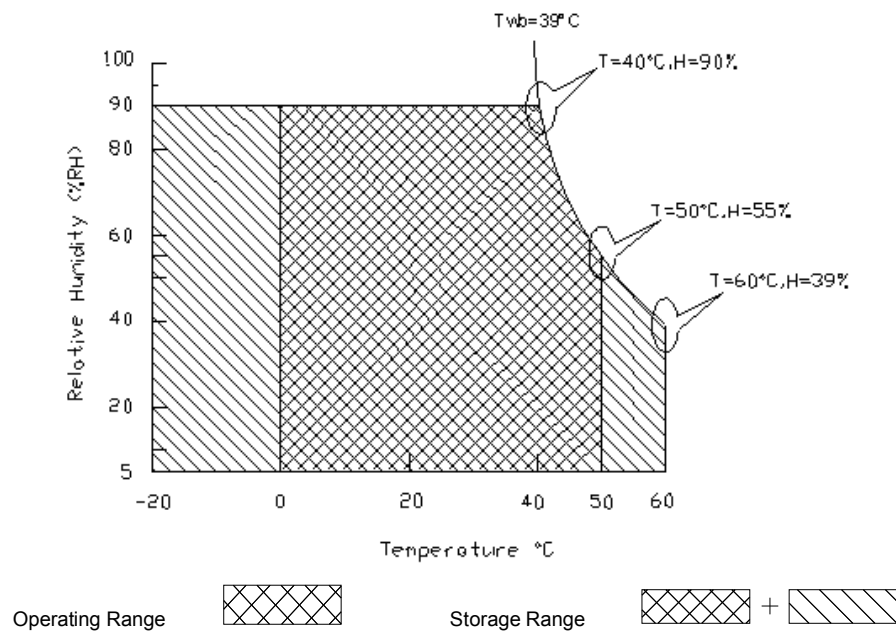
2.2 Absolute Ratings of Environment

Permanent damage may occur if exceeding the following maximum rating.

Symbol	Description	Min.	Max.	Unit	Remark
TOP	Operating Temperature	0	+50	[°C]	Note 2-1
TGS	Glass surface temperature (operation)	0	+65	[°C]	Note 2-1 Function judged only
HOP	Operation Humidity	5	90	[%RH]	Note 2-1
TST	Storage Temperature	-20	+60	[°C]	
HST	Storage Humidity	5	90	[%RH]	

Note 2-1: Temperature and relative humidity range are shown as the below figure.

1. 90% RH Max ($T_a \leq 39^\circ\text{C}$)
2. Max wet-bulb temperature at 39°C or less. ($T_a \leq 39^\circ\text{C}$)
3. No condensation



2.3 Optical Characteristics

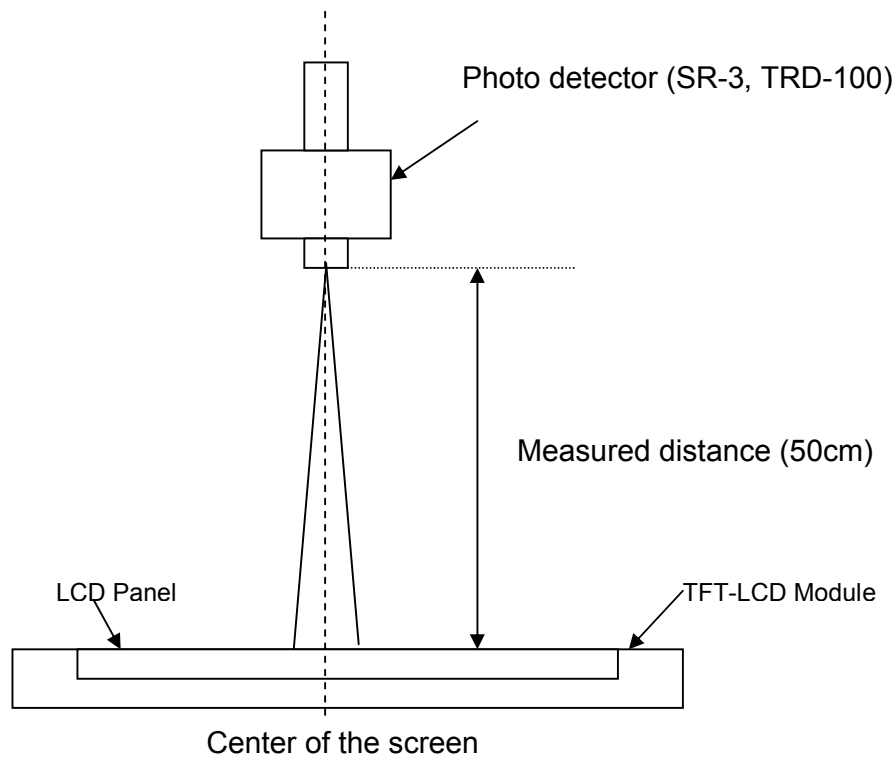
The optical characteristics are measured on the following test condition.

Test Condition:

1. Equipment setup: Please refer to **Note 2-2**.
2. Panel Lighting time: 30 minutes
3. VDD=5V, Fv=60Hz, Ta=25 °C

Symbol	Description		Min.	Typ.	Max.	Unit	Remark
L _w	White Luminance (Center of screen)		-	300	330	[cd/m ²]	Note 2-2 By SR-3
L _{uni}	Luminance Uniformity (9 points)		-	75	-	[%]	Note 2-3 By SR-3
CR	Contrast Ratio (Center of screen)		1800	3000	-	-	Note 2-4 By SR-3
θ _R	Horizontal Viewing Angle (CR=10)	Right	75	89	-	[degree]	Note 2-5 By SR-3
θ _L		Left	75	89	-		
Φ _H	Vertical Viewing Angle (CR=10)	Up	75	89	-		
Φ _L		Down	75	89	-		
T _{rR}	Response Time	Raising Time	-	7	17	[msec]	Note 2-6 By TRD-100
T _{rF}		Falling Time		5	7		
T _{rR} + T _{rF}		Raising + Falling		12	24		
R _x	Color Coordinates (CIE 1931)	Red x	-	0.6343	0.6518	-	By SR-3
R _y		Red y	-	0.3246	0.3181		
G _x		Green x	-	0.3184	0.3257		
G _y		Green y	-	0.6097	0.6063		
B _x		Blue x	-	0.1446	0.1434		
B _y		Blue y	-	0.0517	0.0534		
W _x		White x	-	0.2743	0.2793		
W _y		White y	-	0.2845	0.2956		
CT	Crosstalk		-	-	1.5	[%]	Note 2-7 By SR-3
NTSC	standard 72%		-	71.89	73.59	[%]	

Note 2-2: Equipment setup :

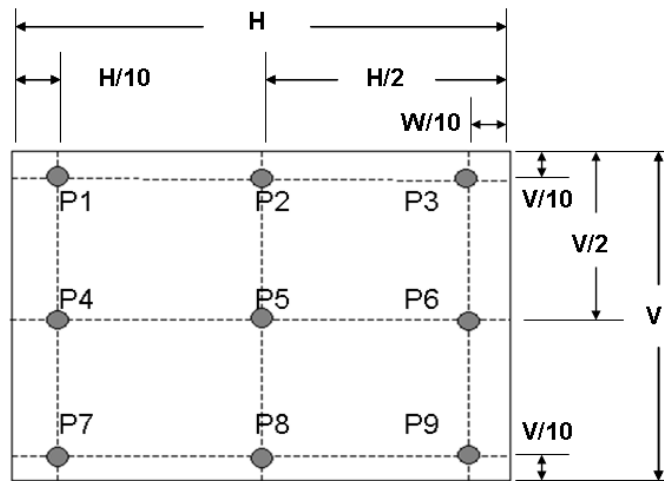


Note 2-3: Luminance Uniformity Measurement

Definition:

$$\text{Luminance Uniformity} = \frac{\text{Minimum Luminance of 9 Points (P1 ~ P9)}}{\text{Maximum Luminance of 9 Points (P1 ~ P9)}}$$

a. Test pattern: White Pattern



Note 2-4: Contrast Ratio Measurement

Definition:

$$\text{Contrast Ratio} = \frac{\text{Luminance of White pattern}}{\text{Luminance of Black pattern}}$$

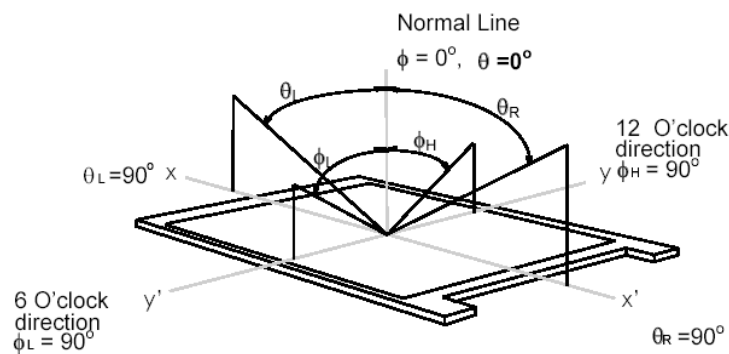
a. Measured position: Center of screen (P5) & perpendicular to the screen ($\theta = \Phi = 0^\circ$)

Note 2-5: Viewing angle measurement

Definition: The angle at which the contrast ratio is greater than 10 & 5 .

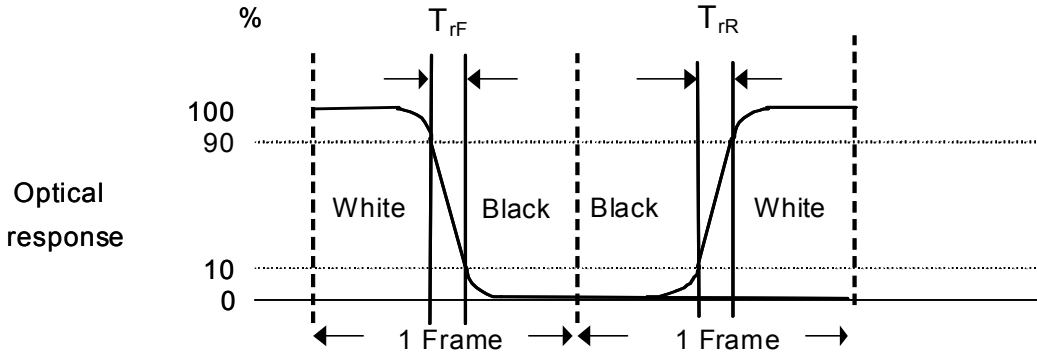
a. Horizontal view angle: Divide to left & right (θ_L & θ_R)

Vertical view angle: Divide to up & down (Φ_H & Φ_L)



Note 2-6: Response time measurement

The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time, T_{rR}), and from “Full White” to “Full Black” (falling time, T_{rF}), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes.



$$T_{rR} + T_{rF} = 12 \text{ msec (typ.)}$$

Note 2-7: Crosstalk measurement

Definition:

$$CT = \text{Max. } (CT_H, CT_V);$$

Where

a. Maximum Horizontal Crosstalk :

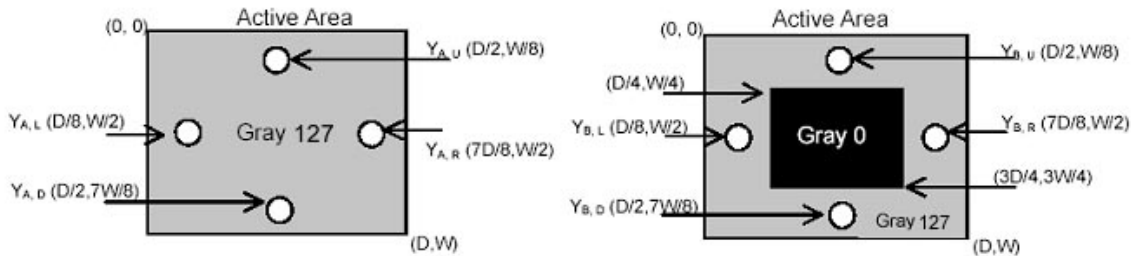
$$CT_H = \text{Max. } (|Y_{BL} - Y_{AL}| / Y_{AL} \times 100\%, |Y_{BR} - Y_{AR}| / Y_{AR} \times 100\%);$$

Maximum Vertical Crosstalk:

$$CT_V = \text{Max. } (|Y_{BU} - Y_{AU}| / Y_{AU} \times 100\%, |Y_{BD} - Y_{AD}| / Y_{AD} \times 100\%);$$

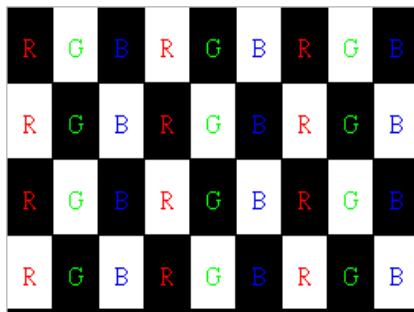
b. Y_{AU} , Y_{AD} , Y_{AL} , Y_{AR} = Luminance of measured location without Black pattern

Y_{BU} , Y_{BD} , Y_{BL} , Y_{BR} = Luminance of measured location with Black pattern



Note 2-8: Flicker measurement

a. Test pattern: It is listed as following.



Gray level = L0



Gray level = L127

R: Red, G: Green, B: Blue

b. Measured position: Center of screen (P5) & perpendicular to the screen
($\theta = \Phi = 0^\circ$)

2.4 Mechanical Characteristics

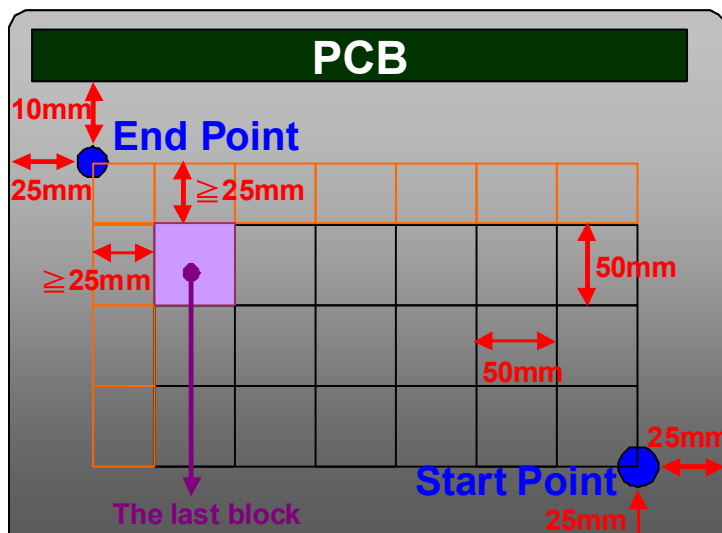
Symbol	Description	Min.	Max.	Unit	Remark
P _{bc}	Backside Compression	2.5	-	[Kgf]	Note 2-9

Note 2-9: Test Method:

The point is at a distance from right-downside 25mm x 25mm defined as the Start Point of Measure Points, and the point is at a distance 25mm from left-side & around 10mm from PCB defined as the End Point.

Align 50mm x 50mm block from Start Point on the Bezel Back, and the corners of each block are Measure Points.

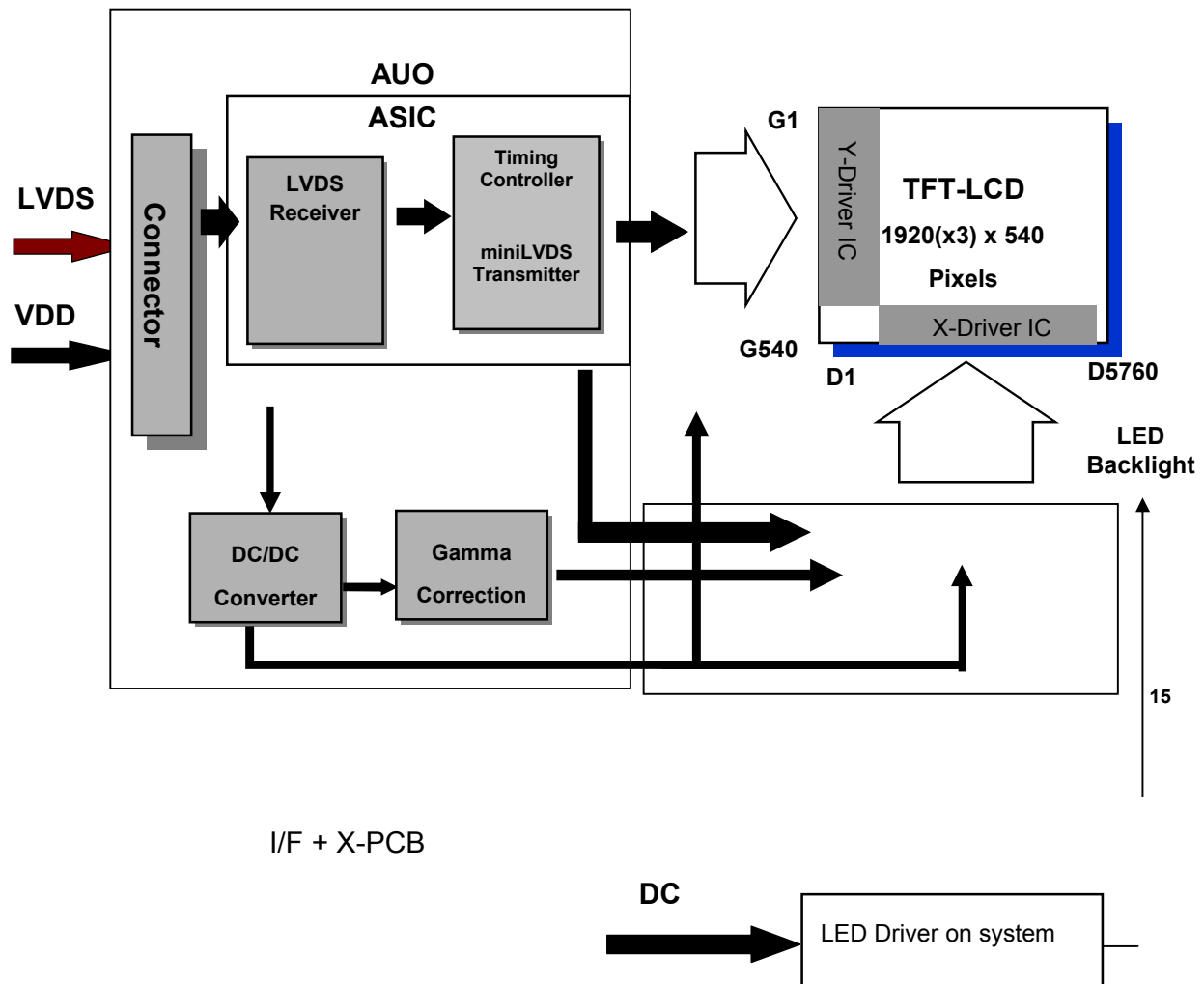
If the distance from the last block to each side of the End Point ≥ 25 mm, add other blocks to make sure that most area of Bezel Back can be measured.



3 TFT-LCD Module

3.1 Block Diagram

The following shows the block diagram of the 24.4 inch Color TFT-LCD Module.



3.2 Interface Connection

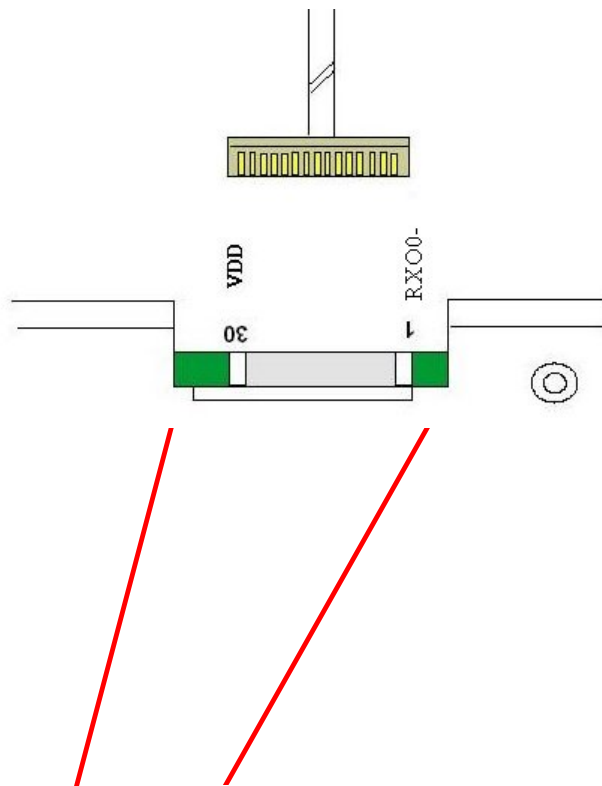
3.2.1 Connector Type

TFT-LCD Connector	Manufacturer	P-TWO	STM	STARCONN
	Part Number	AL230F-A0G1D-P	MSCKT2407P30HB	093G30-02001A-M4
Mating Connector	Manufacturer	JAE or Compatible		
	Part Number	FI-X30HL (Locked Type)		

3.2.2 Connector Pin Assignment

PIN #	SIGNAL NAME	DESCRIPTION
1	RX00-	Negative LVDS differential data input (Odd data)
2	RX00+	Positive LVDS differential data input (Odd data)
3	RX01-	Negative LVDS differential data input (Odd data)
4	RX01+	Positive LVDS differential data input (Odd data)
5	RX02-	Negative LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG)
6	RX02+	Positive LVDS differential data input (Odd data, H-Sync,V-Sync,DSPTMG)
7	GND	Power Ground
8	RX0CLK-	Negative LVDS differential clock input (Odd clock)
9	RX0CLK+	Positive LVDS differential clock input (Odd clock)
10	RX03-	Negative LVDS differential data input (Odd data)
11	RX03+	Positive LVDS differential data input (Odd data)

12	RXE0-	Negative LVDS differential data input (Even data)
13	RXE0+	Positive LVDS differential data input (Even data)
14	GND	Power Ground
15	RXE1-	Negative LVDS differential data input (Even data)
16	RXE1+	Positive LVDS differential data input (Even data)
17	GND	Power Ground
18	RXE2-	Negative LVDS differential data input (Even data)
19	RXE2+	Positive LVDS differential data input (Even data)
20	RXECLK-	Negative LVDS differential clock input (Even clock)
21	RXECLK+	Positive LVDS differential clock input (Even clock)
22	RXE3-	Negative LVDS differential data input (Even data)
23	RXE3+	Positive LVDS differential data input (Even data)
24	GND	Power Ground
25	NC	No contact
26	NC	No contact
27	NC	No contact
28	VDD	+5.0V Power Supply
29	VDD	+5.0V Power Supply
30	VDD	+5.0V Power Supply



3.3 Electrical Characteristics

3.3.1 Absolute Maximum Rating

Permanent damage may occur if exceeding the following maximum rating.

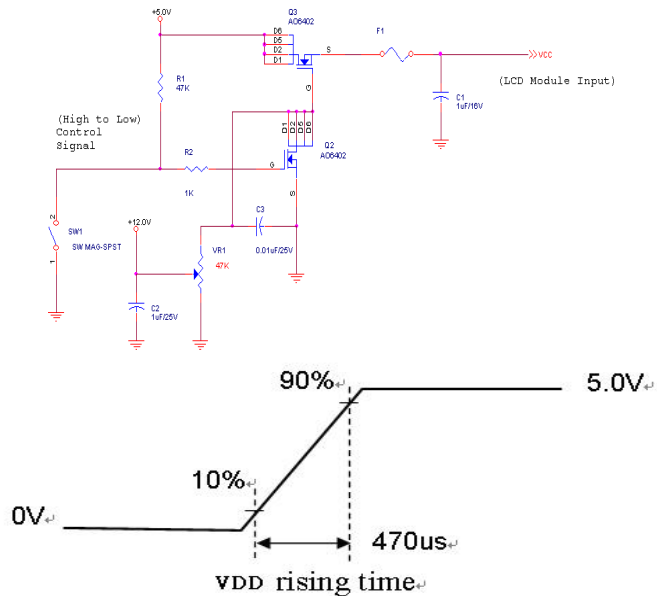
Symbol	Description	Min	Max	Unit	Remark
VDD	Power Supply Input Voltage	GND-0.3	6.0	[Volt]	Ta=25°C

3.3.2 Recommended Operating Condition

Symbol	Description	Min	Typ	Max	Unit	Remark
VDD	Power supply Input voltage	4.5	5.0	5.5	[Volt]	
IDD	Power supply Input Current (RMS)	-	0.93	1.22	[A]	VDD= 5.0V, All white Pattern at 60 Hz
			1.22	1.46	[A]	VDD= 5.0V, All white Pattern at 75 Hz
PDD	VDD Power Consumption	-	4.65	5.58	[Watt]	VDD= 5.0V, All white Pattern at 60 Hz
			6.10	7.30	[Watt]	VDD= 5.0V, All white Pattern at 75 Hz
IRush	Inrush Current	-	-	3.0	[A]	Note 3-1
VDDrp	Allowable VDD Ripple Voltage	-	-	500	[mV]	VDD= 5.0V, All white Pattern at 75 Hz

Note 3-1: Inrush Current measurement:

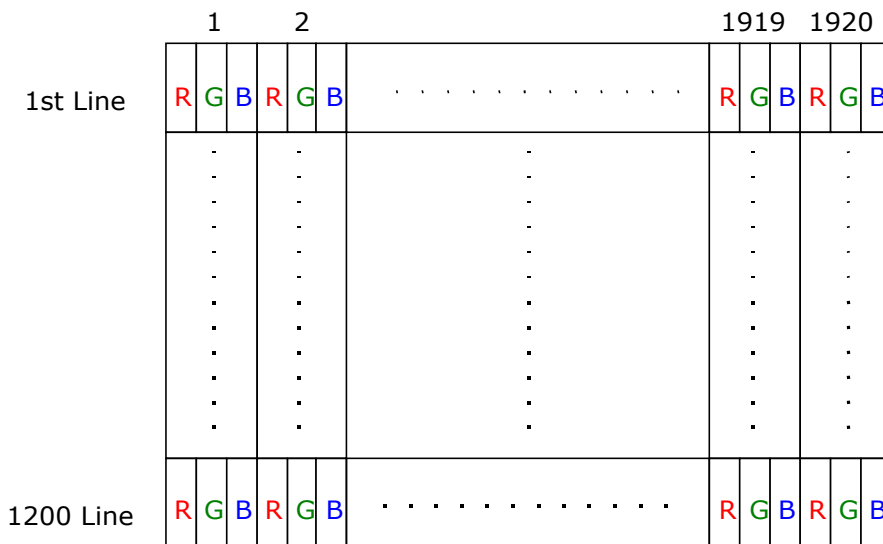
Test circuit:



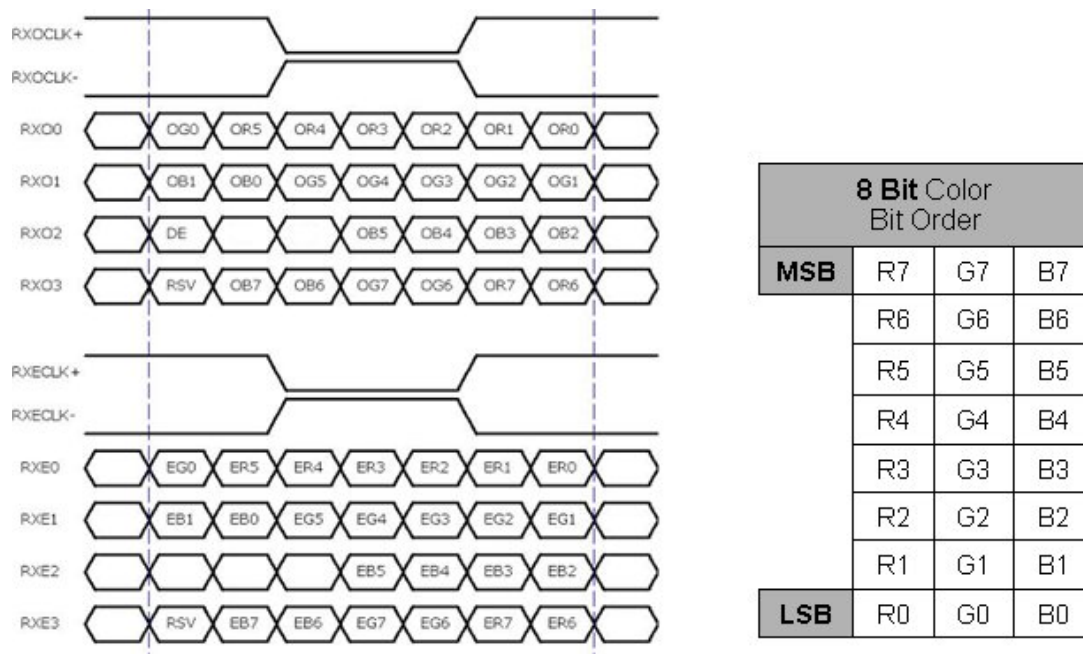
The duration of VDD rising time: 470us.

3.4 Signal Characteristics

3.4.1 LCD Pixel Format



3.4.2 LVDS Data Format



Note 3-2:

- a. O = "Odd Pixel Data" E = "Even Pixel Data"
- b. Refer to 3.4.1 LCD pixel format, the 1st data is 1 (Odd Pixel Data), the 2nd data is 2 (Even Pixel Data) and the last data is 1920 (Even Pixel Data).

3.4.3 Color versus Input Data

The following table is for color versus input data (8bit). The higher the gray level, the brighter the color.

Color	Gray Level	Color Input Data																								Remark
		RED data (MSB:R7, LSB:R0)								GREEN data (MSB:G7, LSB:G0)								BLUE data (MSB:B7, LSB:B0)								
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0	
Black	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	1	1	1	1	1	
Gray 127	-	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	
Red	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Green	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
Blue	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
	L255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	

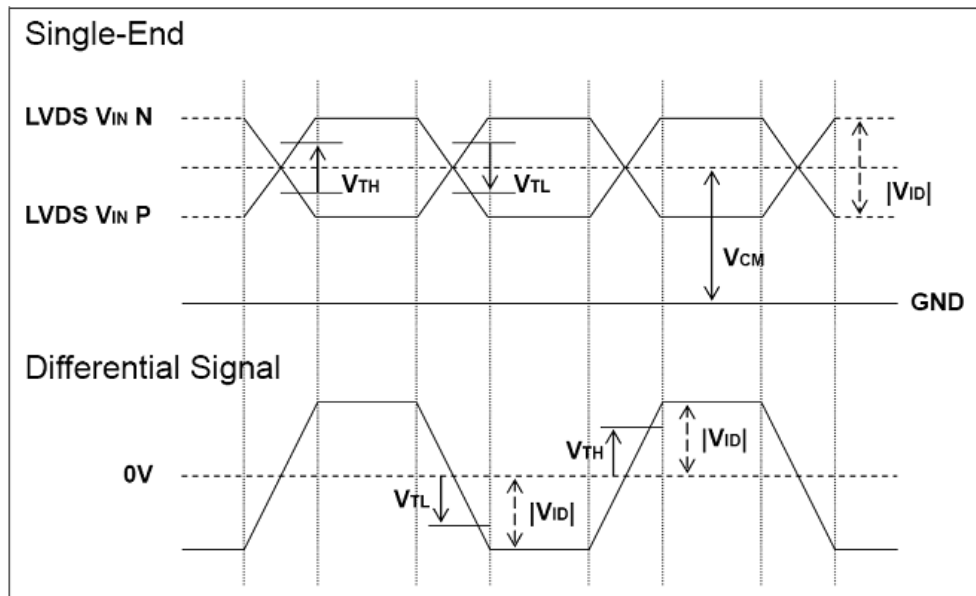
3.4.4 LVDS Specification

a. DC Characteristics:

Symbol	Description	Min	Typ	Max	Units	Condition
V_{TH}	LVDS Differential Input High Threshold	-	-	+100	[mV]	$V_{CM} = 1.2V$
V_{TL}	LVDS Differential Input Low Threshold	-100	-	-	[mV]	$V_{CM} = 1.2V$
$ V_{ID} $	LVDS Differential Input Voltage	100	-	600	[mV]	
V_{CM}	LVDS Common Mode Voltage	+1.0	+1.2	+1.5	[V]	$V_{TH}-V_{TL} = 200mV$

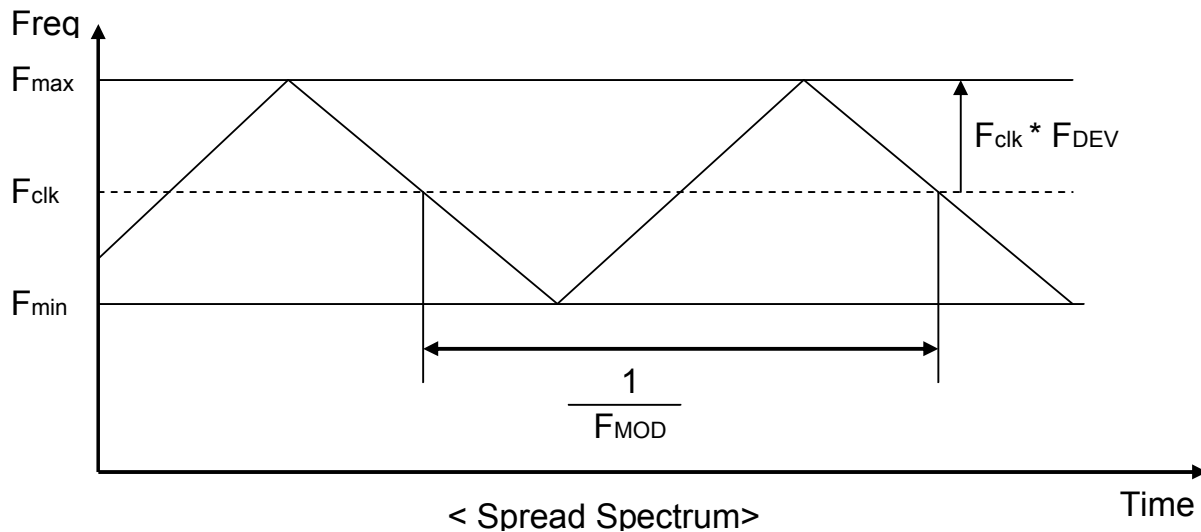
LVDS Signal Waveform:

Use RxOCLK- & RxOCLK+ as example.



b. AC Characteristics:

Symbol	Description	Min	Max	Unit	Remark
F_{DEV}	Maximum deviation of input clock frequency during Spread Spectrum	-	± 3	%	
F_{MOD}	Maximum modulation frequency of input clock during Spread Spectrum	-	200	KHz	



F_{clk}: LVDS Clock Frequency

3.4.5 Input Timing Specification

It only support DE mode, and the input timing are shown as the following table.

Symbol	Description		Min.	Typ.	Max.	Unit	Remark
T _v	Vertical Section	Period	1092	1130	1793	Th	
T _{disp (v)}		Active	1080	1080	1080	Th	
T _{blk (v)}		Blanking	12	50	713	Th	
F _v		Frequency	50	60	76	Hz	
T _h	Horizontal Section	Period	1004	1050	1100	Tclk	
T _{disp (h)}		Active	960	960	960	Tclk	
T _{blk (h)}		Blanking	44	90	140	Tclk	
F _h		Frequency	55	68	90	KHz	Note 3-3
T _{clk}	LVDS Clock	Period	11.1	14.0	18.2	ns	1/F _{clk}
F _{clk}		Frequency	54.8	71.2	90.0	MHz	Note 3-4

Note 3-3: The equation is listed as following. Please don't exceed the above recommended value.

$$F_h (\text{Min.}) = F_{\text{clk}} (\text{Min.}) / T_h (\text{Min.});$$

$$F_h (\text{Typ.}) = F_{\text{clk}} (\text{Typ.}) / T_h (\text{Typ.});$$

$$F_h (\text{Max.}) = F_{clk} (\text{Max.}) / T_h (\text{Min.});$$

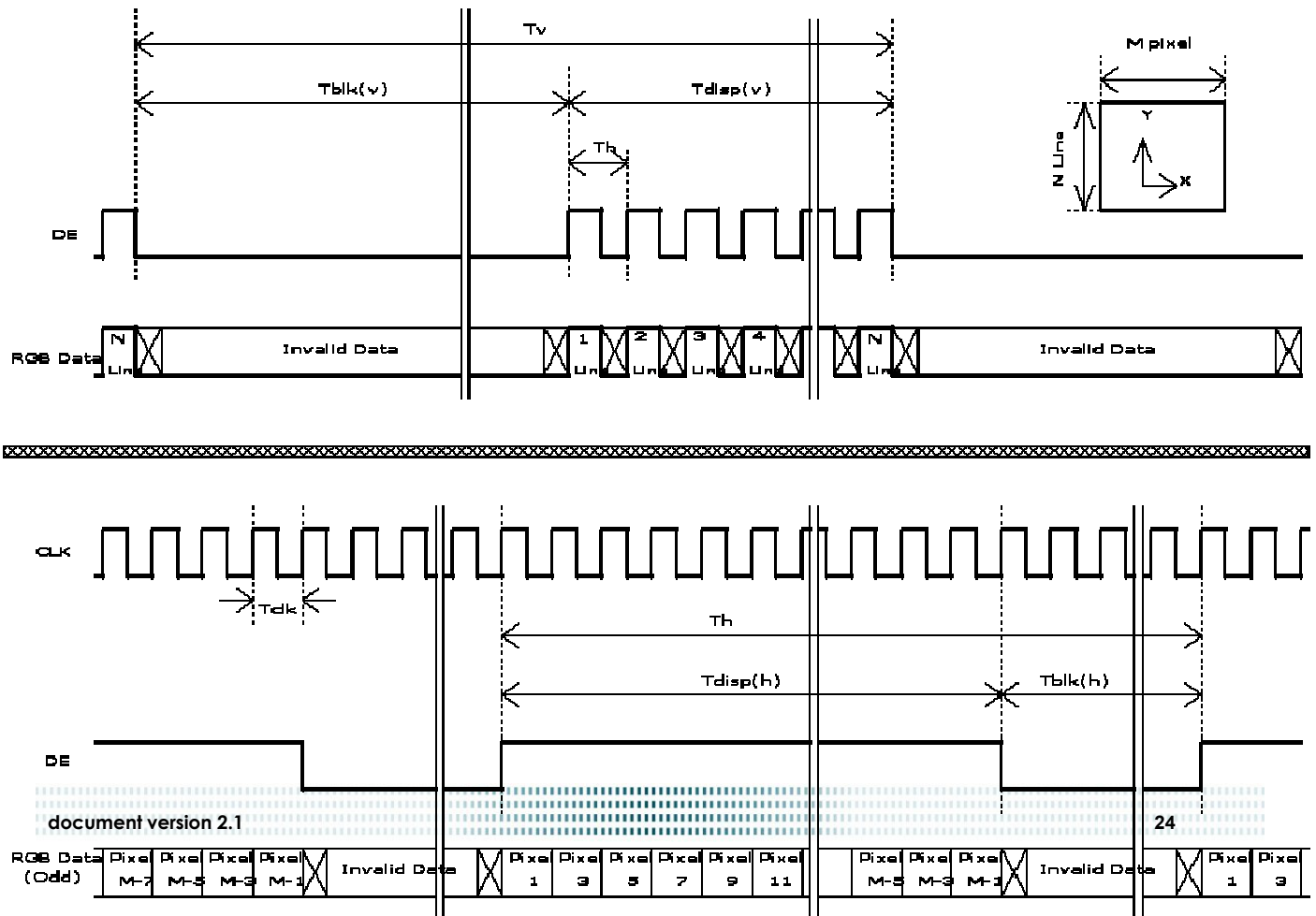
Note 3-4: The equation is listed as following. Please don't exceed the above recommended value.

$$F_{clk} (\text{Min.}) = F_v (\text{Min.}) \times T_h (\text{Min.}) \times T_v (\text{Min.});$$

$$F_{clk} (\text{Typ.}) = F_v (\text{Typ.}) \times T_h (\text{Typ.}) \times T_v (\text{Typ.});$$

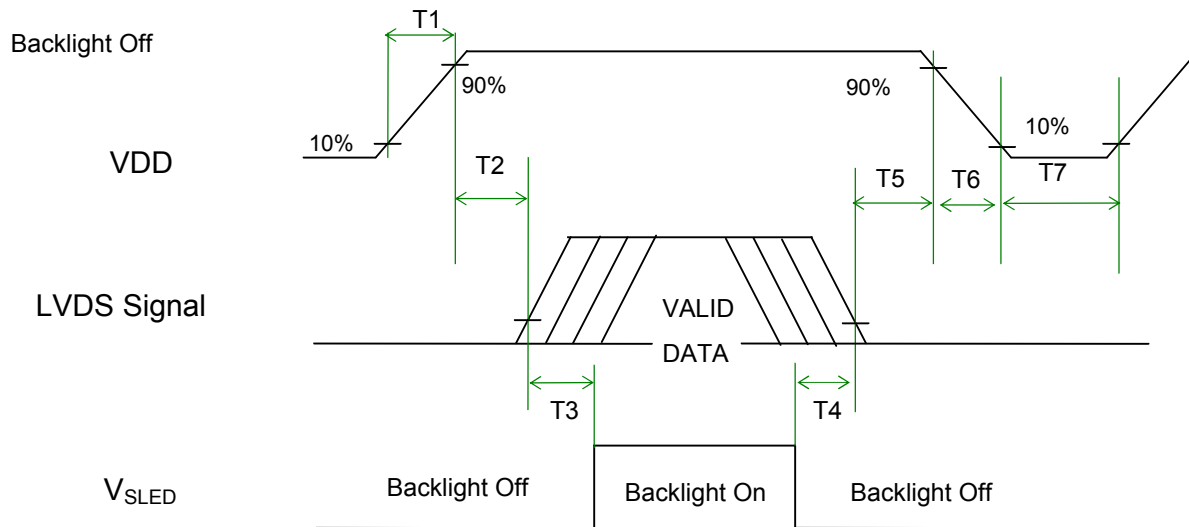
$$F_{clk} (\text{Max.}) = F_v (\text{Max.}) \times T_h (\text{Typ.}) \times T_v (\text{Typ.});$$

3.4.6 Input Timing Diagram



3.5 Power ON/OFF Sequence

VDD power, LVDS signal and backlight on/off sequence are as following. LVDS signals from any system shall be Hi-Z state when VDD is off.



Power Sequence Timing

Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
T1	0.5	-	10	[ms]	
T2	0	-	50	[ms]	
T3	500	-	-	[ms]	
T4	100	-	-	[ms]	
T5	0		50	[ms]	Note 3-5 Note 3-6
T6	0	-	200	[ms]	Note 3-6 Note 3-7
T7	1000	-	-	[ms]	

Note 3-5 : Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

Note 3-6 : During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

Note 3-7 : Voltage of VDD must decay smoothly after power-off. (customer system decide this value)

4. Backlight Unit

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Light Bar Input Voltage Per Input Pin	V _{PIN}	-	50.2	51.5	V	Duty 100%
LED Light Bar Input Current Per Input Pin	I _{PIN}	-	290	320	mA	Note1,2,
LED Power Consumption	P _{BL}	-	14.55	16.48	W	Note 3
LED Life-Time	-	30,000	50000		Hrs	Note 4

LED bar consists of 72 LED packages,(9parallel*8strings)*parallel

Note1: There are one light bar ,and the specified current is input LED chip 100% duty current

Note2: The sense current of each input pin is 290mA

Note3: $P_{BL} = \text{Input pins} \times V_{P_{IN}} \times I_{P_{IN}}$

Note4: The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at I_{PIN}=290mA on condition of continuous operating at 25 ± 2 °C

5 Reliability Test

AUO reliability test items are listed as following table. (Bare Panel only)

Items	Condition	Remark
Temperature Humidity Bias (THB)	Ta= 50°C , 80%RH, 300hours	
High Temperature Operation (HTO)	Ta= 50°C , 50%RH, 300hours	
Low Temperature Operation(LTO)	Ta= 0°C , 300hours	
High Temperature Storage (HTS)	Ta= 60°C , 300hours	
Low Temperature Storage (LTS)	Ta= -20°C , 300hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Random Frequency: 10 - 200 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 20 ms Direction: ±X, ±Y, ±Z (one time for each Axis)	
Thermal Shock Test (TST)	-20°C/30min, 60°C/30min, 100 cycles	Note 5-1
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 15KV, 150pF(330Ω) 1sec, 8 points, 25 times/ point.	Note 5-2
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 8 points, 25 times/ point.	
Altitude Test	Operation:18,000 ft Non-Operation:40,000 ft	

Note 5-1: a. A cycle of rapid temperature change consists of varying the temperature from -20°C to 60°C , and back again. Power is not applied during the test.

b. After finish temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

Note 5-2: EN61000-4-2, ESD class B: Certain performance degradation allowed

No data lost

Self-recoverable

No hardware failures.

6 Mechanical Drawing

