( ) Preliminary Specifications
(V) Final Specifications

Module	**10.1”(10.01”) WXGA 16:10 Color TFT-LCD**
Model Name	B101EAN01.4 (H/W: 0A)
Note ( )	***LED Backlight without driving circuit design***

Customer	**Date**	**Approved by**	**Date**
	MM/DD/YYYY	YW Lee	10/02/2013
Checked & Approved by	**Date**	**Prepared by**	**Date**
	MM/DD/YYYY	NC Yeh	10/04/2013
Note: This Specification is subject to change without notice.		**NBBU Marketing Division AU Optronics corporation**	

Contents

Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.1 2013/07/23	All	First Edition for Customer		
0.2 2013/0806	15	PWM Input Frequency 10K(Max)	PWM Input Frequency 20K(Max)	
0.3 2013/08/19	19		Exchange pin 28 and 34.	
	24		Change PCBA Pin 1 Location	
0.4 2013/10/02	4 6 10 18 28	Update RGB 6-bits data driver with Hi-FRC Add color R\G\B Conditions Update Backlight input signal characteristics Update pin assignment LCM Outline Dimension		

1. Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.
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 nor modify the Module Assembly.
8) Do not press the reflector sheet at the back of the module to any directions.
9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
11) After installation of the TFT Module into an enclosure (Notebook PC Bezel, for example), do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.
12) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
13) Disconnecting power supply before handling LCD modules, it can prevent electric shock, DO NOT TOUCH the electrode parts, cables, connectors and LED circuit part of TFT module that a LED light bar build in as a light source of back light unit. It can prevent electrostatic breakdown.

2. General Description

B101EAN01.4 is a Color Active Matrix Liquid Crystal Display composed of a TFT LCD panel, a driver circuit, and LED backlight system. The screen format is intended to support the 16:10 WXGA, 1280(H) x800(V) screen and 16.7M colors (RGB 6-bits data driver with Hi-FRC). All input signals are LVDS interface compatible.

B101EAN01.4 is designed for a display unit of notebook style personal computer and industrial machine.

2.1 General Specification

The following items are characteristics summary on the table at 25 ℃ condition:

Items	Unit	Specifications			
Screen Diagonal	[mm]	255.85 (10.07W")			
Active Area	[mm]	216.96(H) x 135.6(V)			
Pixels H x V		1280 x 3(RGB) x 800			
Pixel Pitch	[mm]	0.1695 X 0.1695			
Pixel Format		R.G.B. Vertical Stripe			
Display Mode		AHVA, Normally Black			
White Luminance (I_{LED}=21mA) **(Note: ILED is LED current)**	[cd/m^2]	350 typ. (5 points average) 300 min. (5 points average)			
Luminance Uniformity		1.25 max. (5 points)			
Contrast Ratio		800 typ			
Response Time	[ms]	30 Typ.			
Nominal Input Voltage VDD	[Volt]	3.3V			
Power Consumption	[Watt]	3.1W Max (TBD)			
Weight	[Grams]	140g Max			
Physical Size **Include bracket**	[mm]		Min.	Typ.	Max.
		Length	227.6	227.9	228.02
		Width	147.5	147.8	148.1
		Thickness Panel Side		2.4	2.6
		Thickness PCBA Side		4.4	4.6
Electrical Interface		1 channel LVDS			
Glass Thickness	[mm]	0.25/0.25			
Surface Treatment		Anti-Glare, Hardness 3H			
Support Color		16.7M colors			

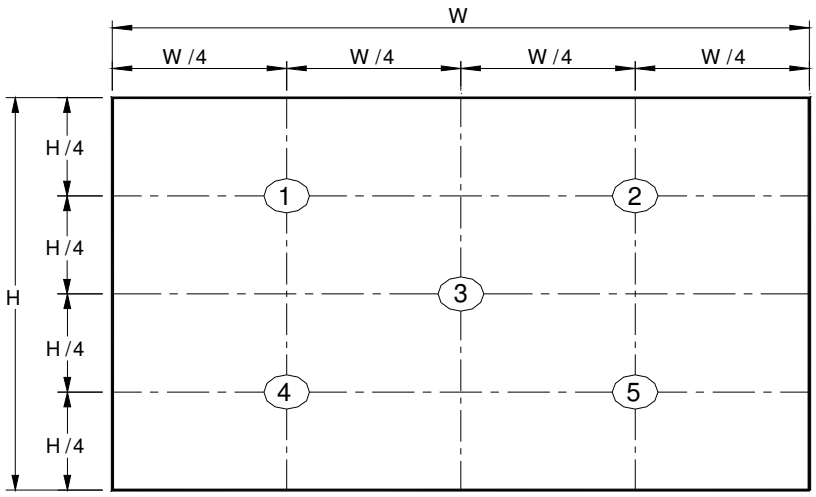
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 0 to +50 -20 to +60
RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

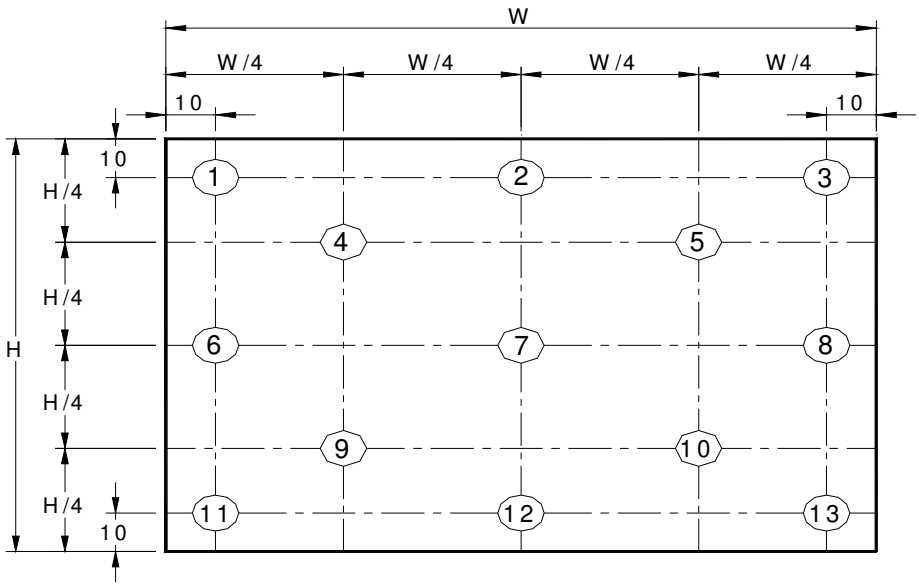
The optical characteristics are measured under stable conditions at 25℃ (Room Temperature) :

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance I_{LED}=21mA			5 points average	300	350	-	cd/m^2	1, 4, 5.
Viewing Angle		θ_R θ_L	Horizontal (Right) CR = 10 (Left)	- -	85 85	- -	degree	4, 9
		ϕ_H ϕ_L	Vertical (Upper) CR = 10 (Lower)	- -	85 85	- -		
Luminance Uniformity		δ_{5P}	5 Points	-	-	1.25		1, 3, 4
Luminance Uniformity		δ_{13P}	13 Points	-	-	1.50		2, 3, 4
Contrast Ratio		CR		600	800	-		4, 6
Cross talk		%				-		4, 7
Response Time		T_{RT}	Rising + Falling	-	30	38	msec	4, 8
Color / Chromaticity Coodinates	Red	Rx	CIE 1931	0.568	0.598	0.628		4
		Ry		0.314	0.344	0.374		
	Green	Gx		0.296	0.326	0.356		
		Gy		0.554	0.584	0.614		
	Blue	Bx		0.124	0.154	0.184		
		By		0.1	0.13	0.16		
	White	Wx		0.283	0.313	0.343		
		Wy		0.299	0.329	0.359		
NTSC		%		-	50	-		

Note 1: 5 points position (Ref: Active area)



Note 2: 13 points position (Ref: Active area)



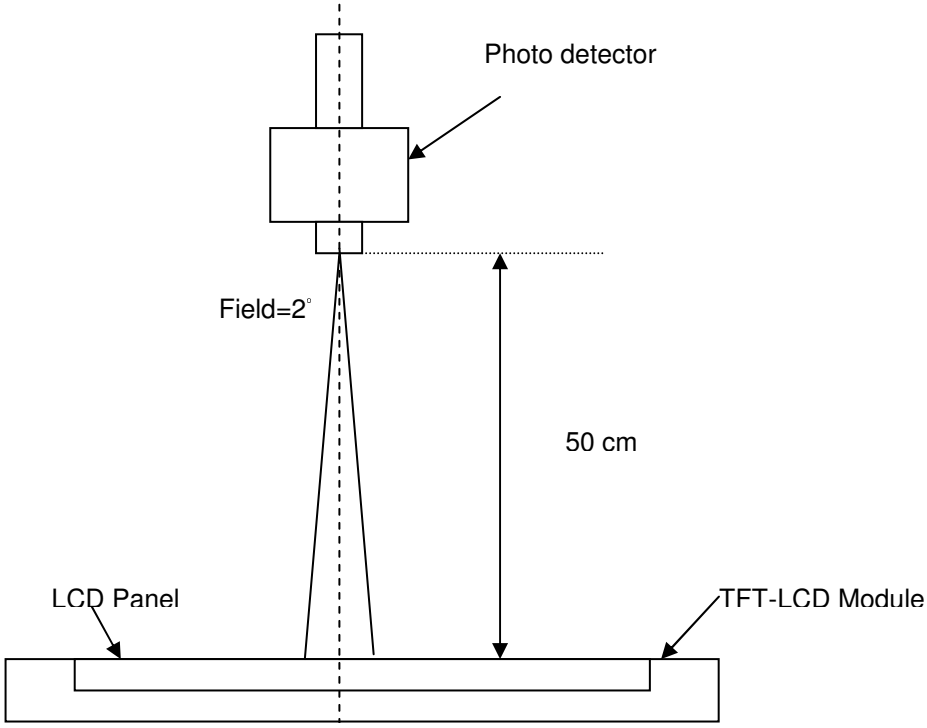
Note 3: The luminance uniformity of 5 or 13 points is defined by dividing the maximum luminance values by the minimum test point luminance

$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

$$\delta_{W13} = \frac{\text{Maximum Brightness of thirteen points}}{\text{Minimum Brightness of thirteen points}}$$

Note 4: Measurement method

The LCD module should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a stable, windless and dark room, and it should be measured in the center of screen.



Note 5： Definition of Average Luminance of White (Y_L):

Measure the luminance of gray level 63 at 5 points，Y_L = [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / 5

L (x) is corresponding to the luminance of the point X at Figure in Note (1).

Note 6： Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the “White” state}}{\text{Brightness on the “Black” state}}$$

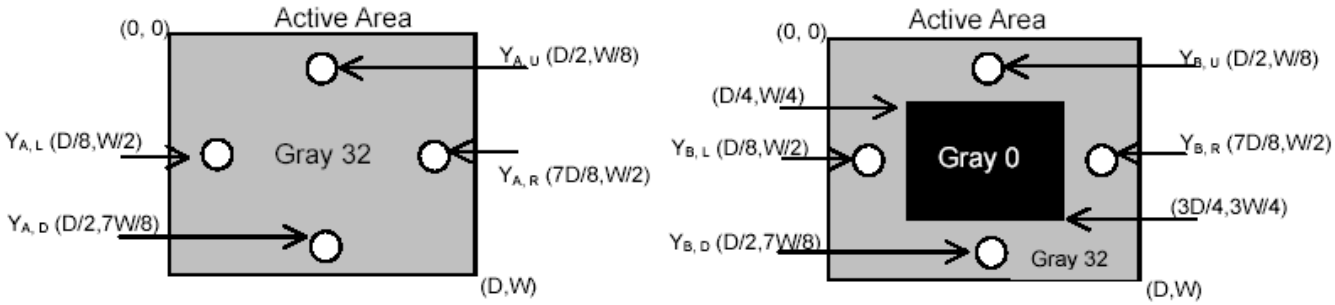
Note 7： Definition of Cross Talk (CT)

$CT = | Y_B - Y_A | / Y_A \times 100\ (\%)$

Where

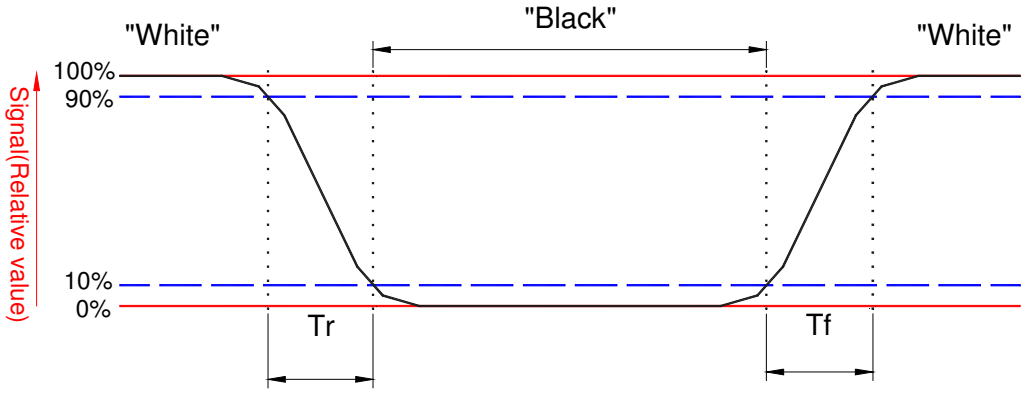
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



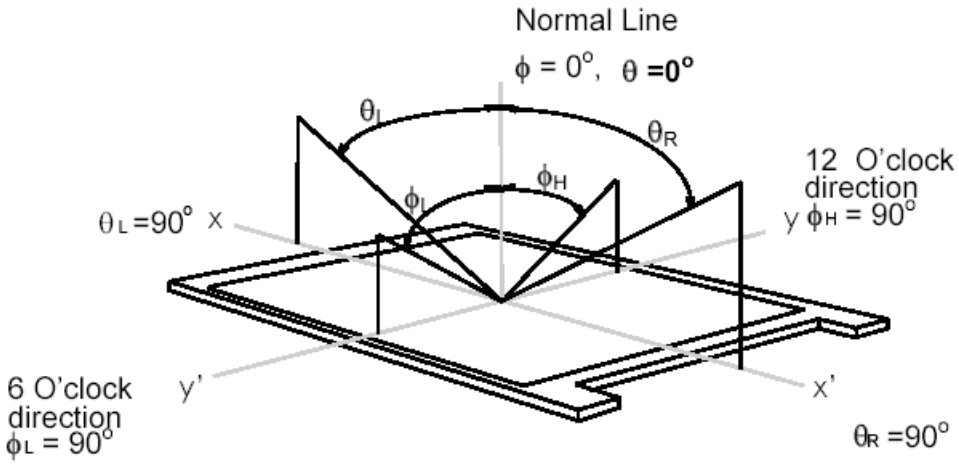
Note 8: Definition of response time:

The output signals of BM-7 or equivalent are measured when the input signals are changed from “Black” to “White” (falling time) and from “White” to “Black” (rising time), respectively. The response time interval between the 10% and 90% of amplitudes. Refer to figure as below.



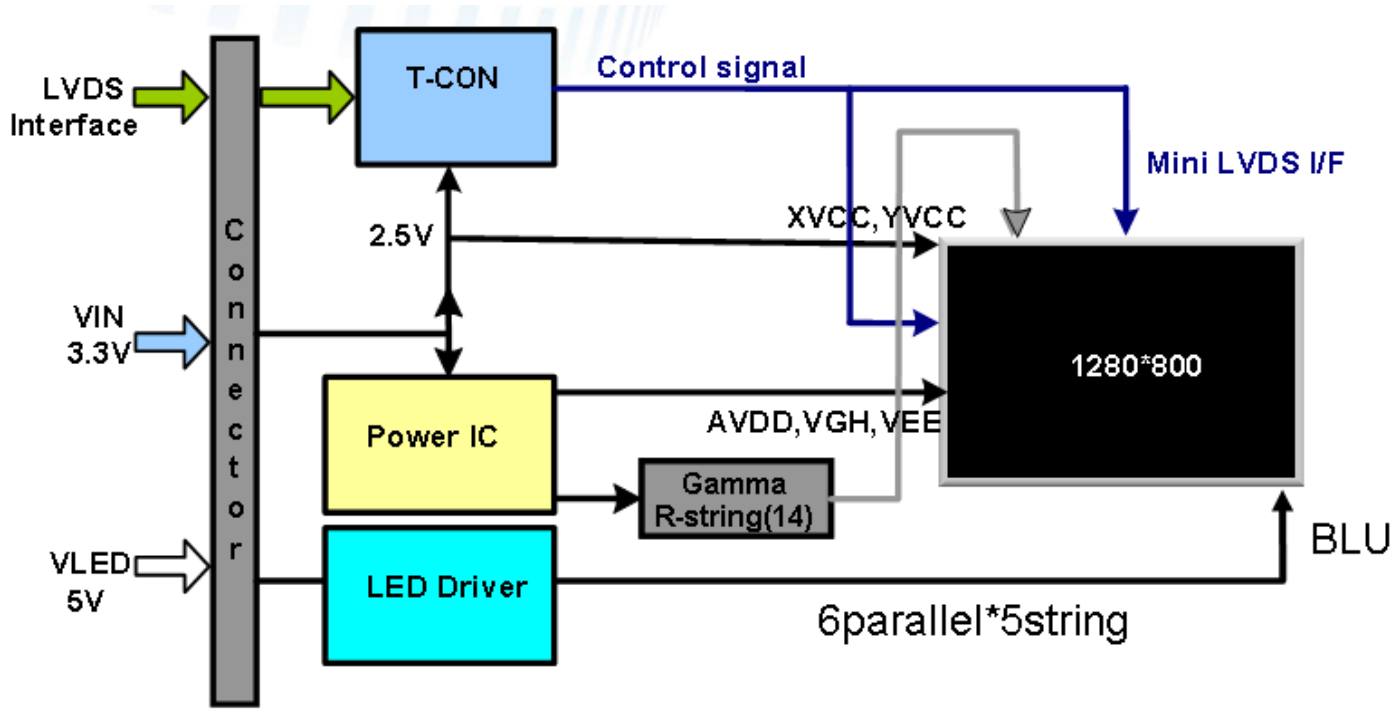
Note 9. Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≧10, at the screen center, over a 180° horizontal and 180° vertical range (off-normal viewing angles). The 180° viewing angle range is broken down as follows; 90° (θ) horizontal left and right and 90° (Φ) vertical, high (up) and low (down). The measurement direction is typically perpendicular to the display surface with the screen rotated about its center to develop the desired measurement viewing angle.



3. Functional Block Diagram

The following diagram shows the functional block of the 10.1 inches wide Color TFT/LCD 40 Pin one channel Module



4. Absolute Maximum Ratings

An absolute maximum rating of the module is as following:

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive	Vin	-0.3	+4.0	[Volt]	Note 1,2

4.2 Absolute Ratings of Environment

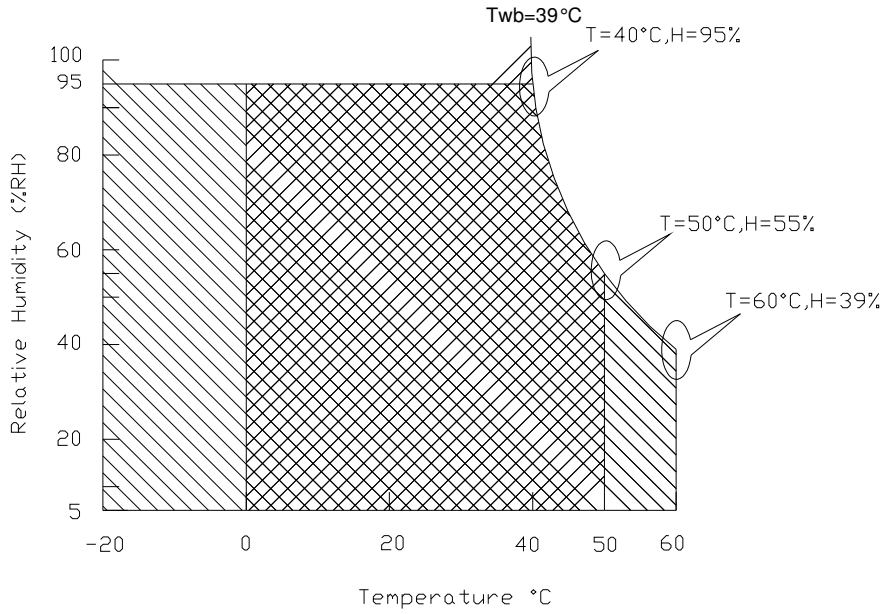
Item	Symbol	Min	Max	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	Note 4
Operation Humidity	HOP	5	95	[%RH]	Note 4
Storage Temperature	TST	-20	+60	[°C]	Note 4
Storage Humidity	HST	5	95	[%RH]	Note 4

Note 1: At Ta (25℃)

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: LED specification refer to section 5.2

Note 4: For quality performance, please refer to AUO IIS (Incoming Inspection Standard).



Operating Range Storage Range +

5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

Input power specifications are as follows;

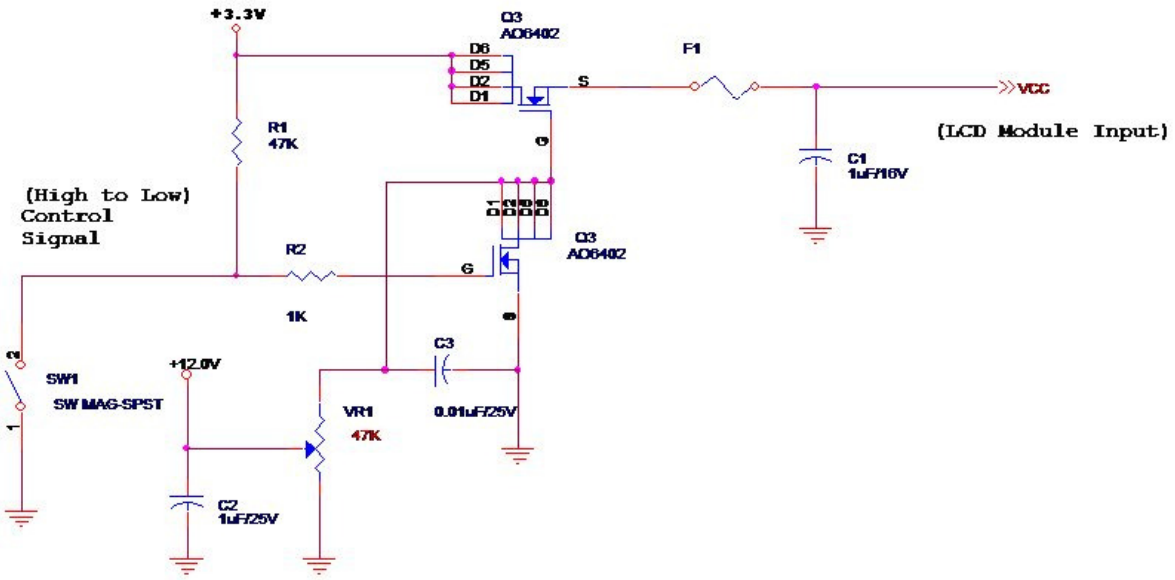
The power specification are measured under 25℃ and frame frenquency under 60Hz

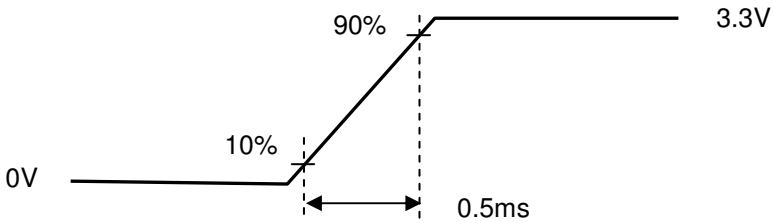
Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
PDD	VDD Power	-	-	0.8	[Watt]	Note 1
IDD	IDD Current	-	-	242	[mA]	Note 1
IRush	Inrush Current	-	-	1500	[mA]	Note 2
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	

Note 1 : Maximum Measurement Condition：Black Pattern at 3.3V driving voltage. ($P_{max}=V_{3.3} \times I_{black}$)

Typical Measurement Condition : Mosaic Pattern

Note 2：Measure Condition





Vin rising time

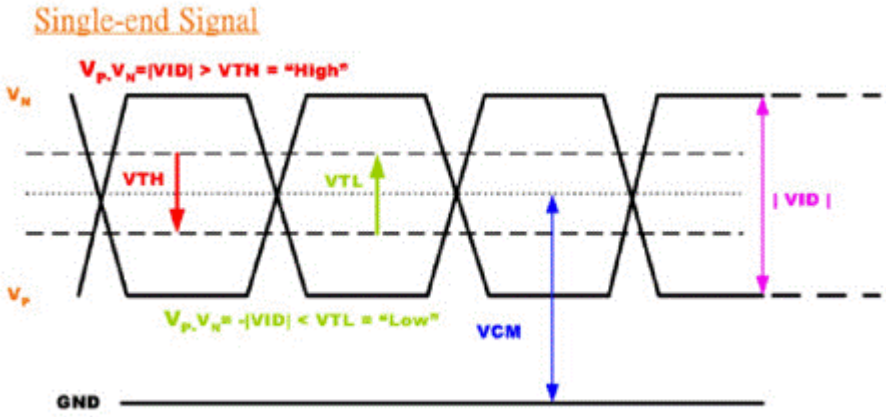
5.1.2 Signal Electrical Characteristics

Input signals shall be low or High-impedance state when VDD is off.

Signal electrical characteristics are as follows;

Parameter	Condition	Min	Max	Unit
V_{TH}	Differential Input High Threshold (Vcm=+1.2V)	---	100	[mV]
V_{TL}	Differential Input Low Threshold (Vcm=+1.2V)	-100	----	[mV]
$\|V_{ID}\|$	Differential Input Voltage	100	600	[mV]
V_{CM}	Differential Input Common Mode Voltage	1.125	1.375	[V]

Note: LVDS Signal Waveform



5.2 Backlight Unit

5.2.1 LED characteristics

Parameter	Symbol	Min	Typ	Max	Units	Condition
Backlight Power Consumption	PLED	-	-	2.3 (TBD)	[Watt]	(Ta=25℃), Note 1 Vin =12V
LED Life-Time	N/A	15,000	-	-	Hour	(Ta=25℃), Note 2 I_F=21 mA

Note 1: Calculator value for reference P_{LED} = VF (Normal Distribution) * IF (Normal Distribution) / Efficiency

Note 2: The LED life-time define as the estimated time to 50% degradation of initial luminous.

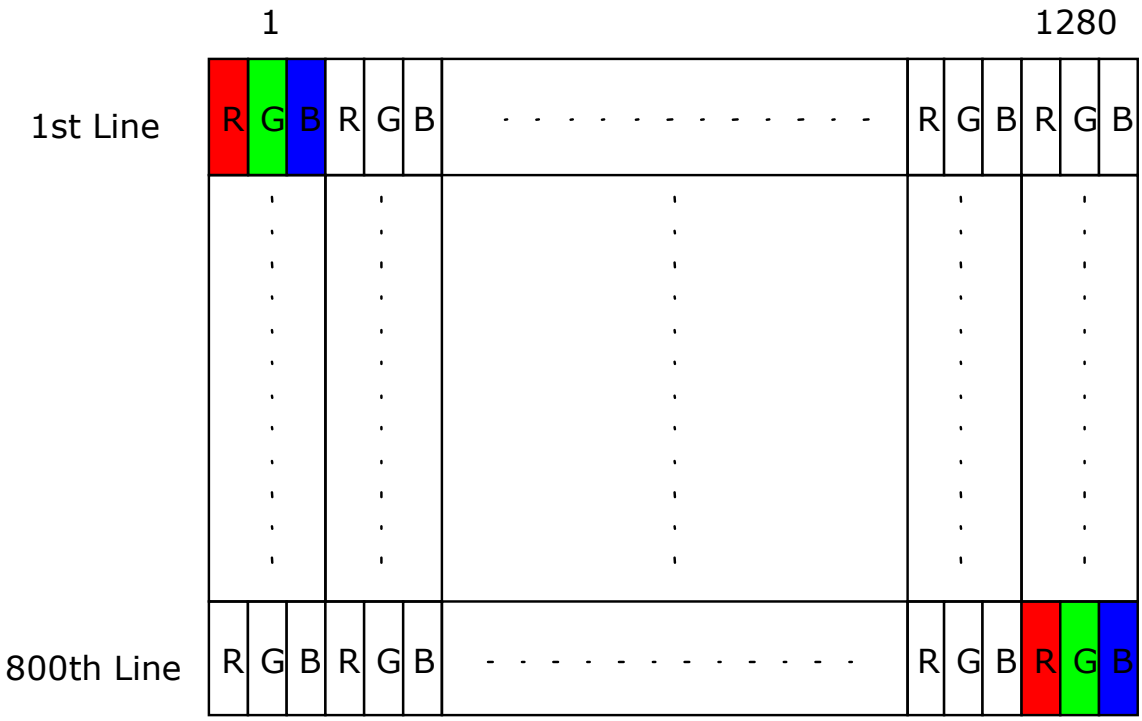
5.2.2 Backlight input signal characteristics

Parameter	Symbol	Min	Typ	Max	Units	Remark
LED Power Supply	VLED	5	--	12	[Volt]	Define as Connector Interface (Ta=25℃)
LED Enable Input High Level	VLED_EN	1.8	-	-	[Volt]	
LED Enable Input Low Level		-	-	0.5	[Volt]	
PWM Logic Input High Level	VPWM_EN	1.8	-	-	[Volt]	
PWM Logic Input Low Level		-	-	0.5	[Volt]	
PWM Input Frequency	FPWM	200	1K	10K	Hz	
PWM Duty Ratio	Duty	5	-	100	%	

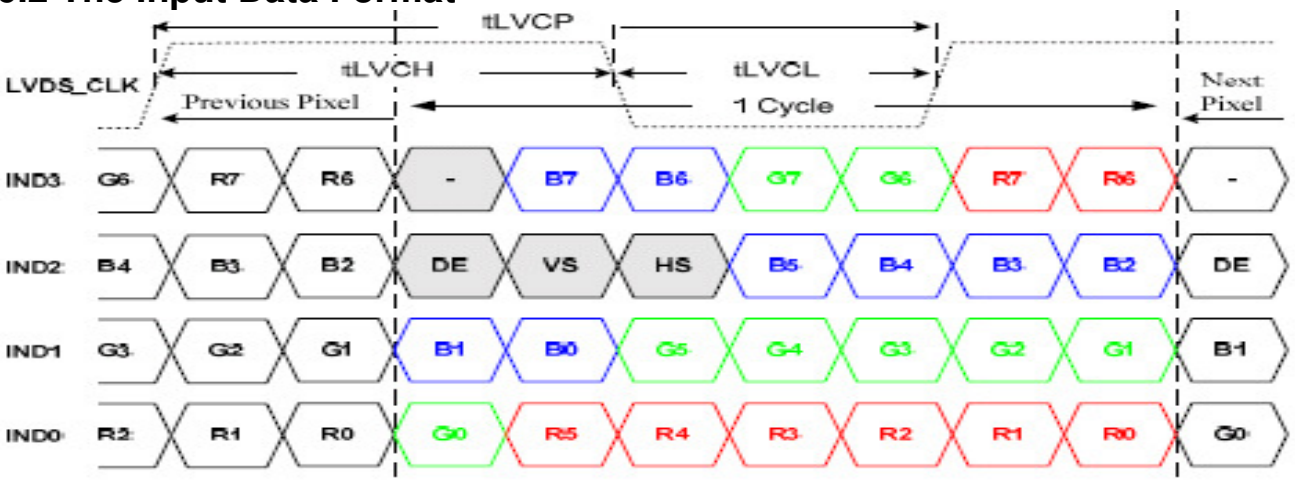
6. Signal Interface Characteristic

6.1 Pixel Format Image

Following figure shows the relationship of the input signals and LCD pixel format.



6.2 The Input Data Format



Signal Name	Description	
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 bits 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 bits 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 bits pixel data.
RxCLKIN	Data Clock	The signal is used to strobe the pixel data and DE signals. All pixel data shall be valid at the falling edge when the DE signal is high.
DE	Display Timing	This signal is strobed at the falling edge of RxCLKIN. When the signal is high, the pixel data shall be valid to be displayed.
VS	Vertical Sync	The signal is synchronized to RxCLKIN .
HS	Horizontal Sync	The signal is synchronized to RxCLKIN .

Note: Output signals from any system shall be low or High-impedance state when VDD is off.

6.3 Integration Interface Requirement

6.3.1 Connector Description

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components.

Connector Name / Designation	For Signal Connector
Manufacturer	E&T
Type / Part Number	6718K-Y40N-00L

6.3.2 Pin Assignment

LVDS is a differential signal technology for LCD interface and high speed data transfer device.

	Signal Name	Description
1	NC	No function
2	VDD	Power supply 3.3V
3	VDD	Power supply 3.3V
4	TEST 1	do not connection(For AUO test reserve)
5	TEST 2	do not connection(For AUO test reserve)
6	TEST 3	do not connection(For AUO test reserve)
7	TEST 4	do not connection(For AUO test reserve)
8	Rin 0-	-LVDS different data input (R0~R5,G0)
9	Rin 0+	+LVDS different data input (R0~R5,G0)
10	VSS	Ground
11	Rin 1-	-LVDS different data input (G1~G5,B0,B1)
12	Rin 1+	+LVDS different data input (G1~G5,B0,B1)
13	VSS	Ground
14	Rin 2-	-LVDS different data input (B2~B5,HS,VS)
15	Rin 2+	+LVDS different data input (B2~B5,HS,VS)
16	VSS	Ground
17	CLKIN-	-LVDS different clock
18	CLKIP+	+LVDS different clock
19	VSS	Ground
20	Rin 3-	-LVDS different data input (R6,R7,G6,G7,B6,B7)
21	Rin 3+	+LVDS different data input (R6,R7,G6,G7,B6,B7)

22	VSS	Ground
23	LED_GND	Ground
24	LED_GND	Ground
25	LED_GND	Ground
26	NC	No function
27	LED PWM	PWM control signal for LED driver
28	NC	No function
29	CABC_EN	CABC enable input
30	NC	No function
31	LED	LED supply power(5~12V)
32	LED	LED supply power(5~12V)
33	LED	LED supply power(5~12V)
34	LED_EN	LED driver IC enable signal
35	NC	No function
36	NC	No function
37	NC	No function
38	NC	No function
39	NC	No function
40	NC	No function

6.3.3 LED Connector Description

Physical interface is described as for the connector on module.

These connectors are capable of accommodating the following signals and will be following components.

Connector Name / Designation	For Signal Connector
Manufacturer	STM
Type / Part Number	MSK24036P10

6.4 LVDS Interface Timing

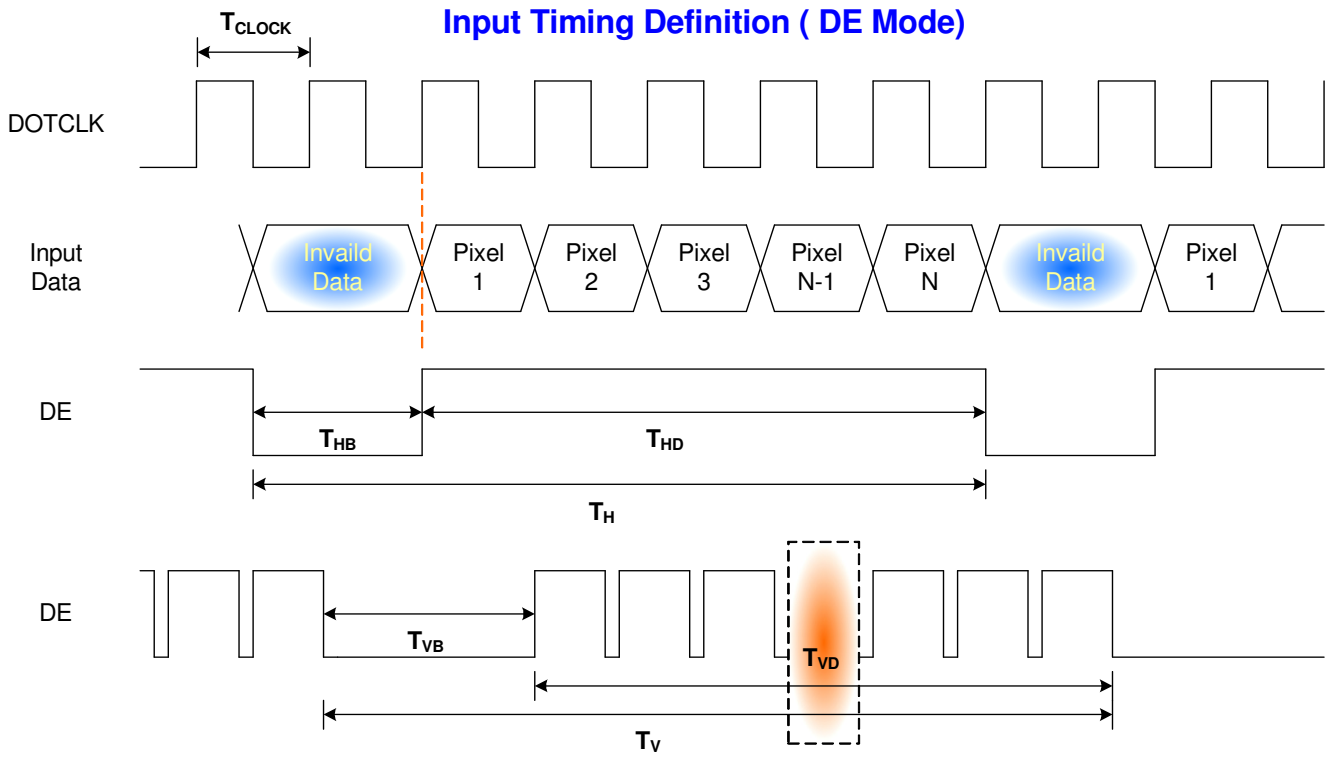
6.4.1 Timing Characteristics

Basically, interface timings should match the 1280x800 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		---	---	60	---	Hz
Clock frequency		1/ T_{Clock}	64	68.93	85	MHz
Vertical Section	Period	T_V	808	816	1023	T_{Line}
	Active	T_{VD}	800			
	Blanking	T_{VB}	8	16	223	
Horizontal Section	Period	T_H	1310	1408	2047	T_{Clock}
	Active	T_{HD}	1280			
	Blanking	T_{HB}	30	128	767	

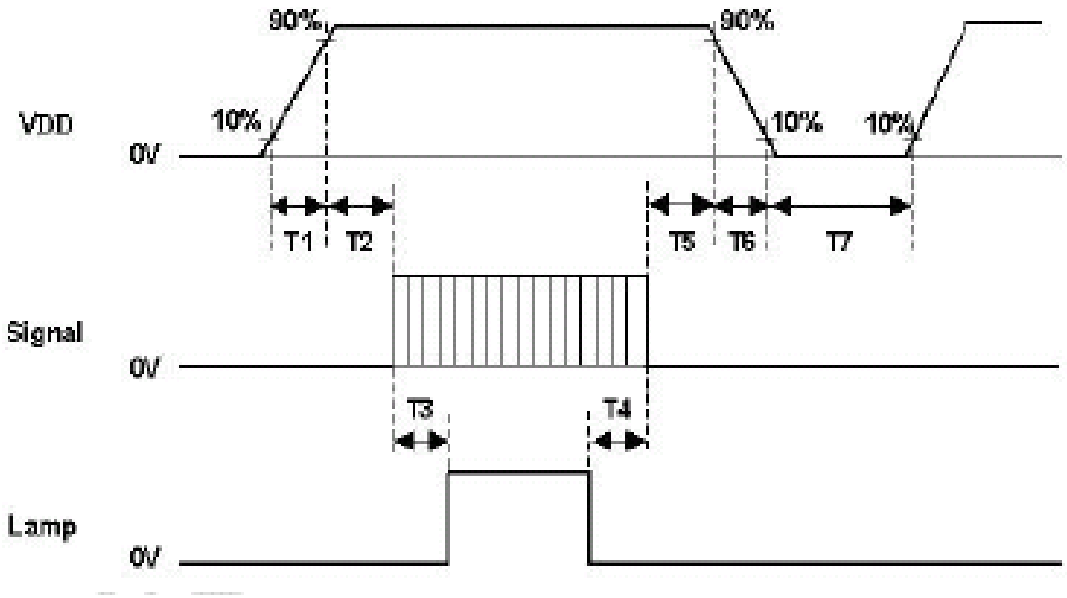
Note : DE mode only

6.4.2 Timing diagram



6.5 Power ON/OFF Sequence

Power on/off sequence is as follows. Interface signals and LED on/off sequence are also shown in the chart. Signals from any system shall be Hi-Z state or low level when VDD is off



Power Sequence Timing			
Parameter	Value		Units
	Min.	Max.	
T1	0.5	10	ms
T2	0	50	
T3	200	-	
T4	200	-	
T5	0	50	
T6	0	10	
T7	500	-	

7. Panel Reliability Test

7.1 Vibration Test

Test Spec:

- Test method: Non-Operation
- Acceleration: 1.5 G
- Frequency: 10 - 500Hz Random
- Sweep: 30 Minutes each Axis (X, Y, Z)

7.2 Shock Test

Test Spec:

- Test method: Non-Operation
- Acceleration: 220 G , Half sine wave
- Active time: 2 ms
- Pulse: X,Y,Z .one time for each side

7.3 Reliability Test

Items	Required Condition	Note
Temperature Humidity Bias	Ta= 40℃, 90%RH, 300h	
High Temperature Operation	Ta= 50℃, Dry, 300h	
Low Temperature Operation	Ta= 0℃, 300h	
High Temperature Storage	Ta= 60℃, 35%RH, 300h	
Low Temperature Storage	Ta= -20℃, 50%RH, 250h	
Thermal Shock Test	Ta=-20℃to 60℃, Duration at 30 min, 100 cycles	
ESD	Contact : ±8 KV Air : ±15 KV	Note 1

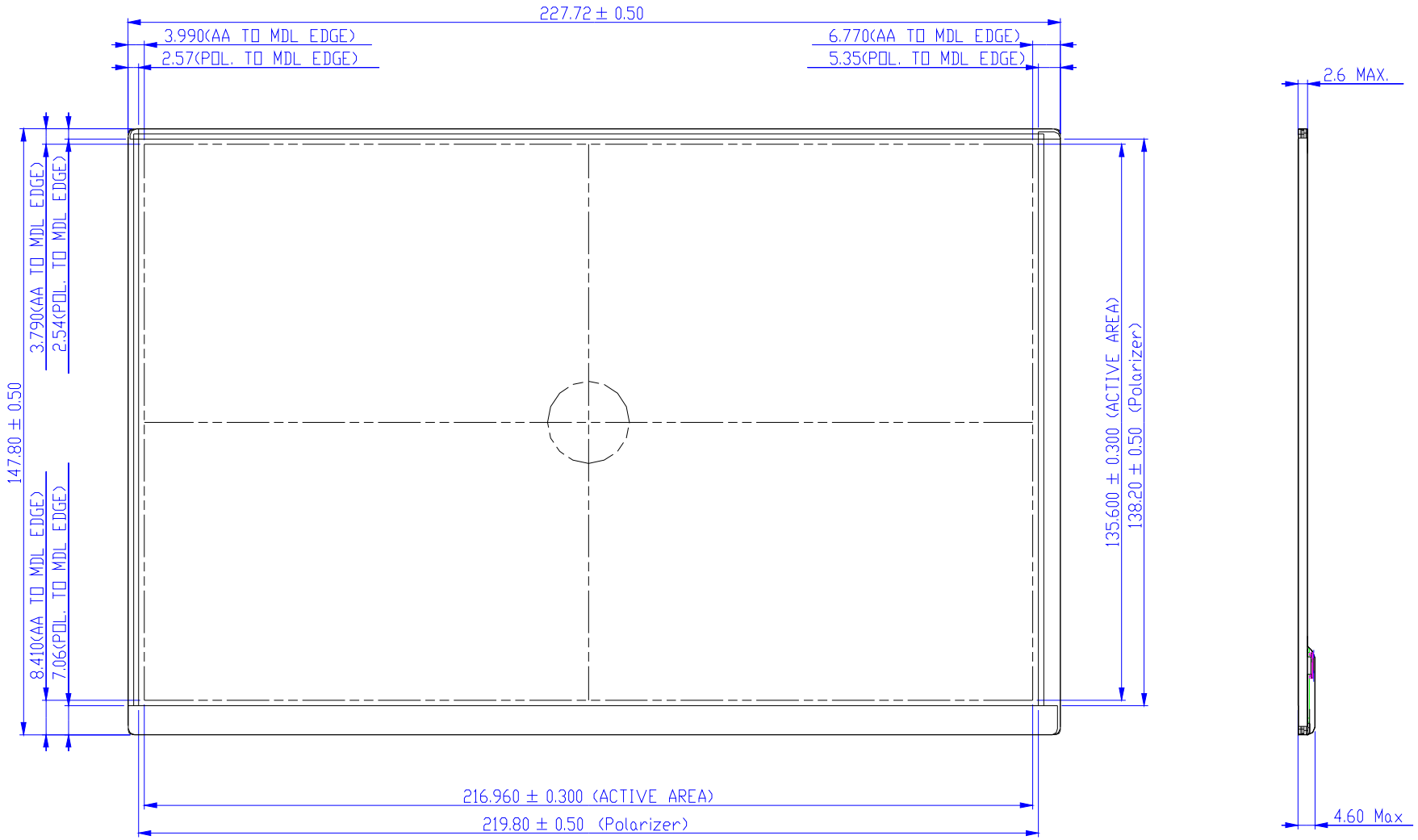
Note1: According to EN 61000-4-2 , ESD class B: Some performance degradation allowed. Self-recoverable. No data lost, No hardware failures.

Remark: MTBF (Excluding the LED): 30,000 hours with a confidence level 90%

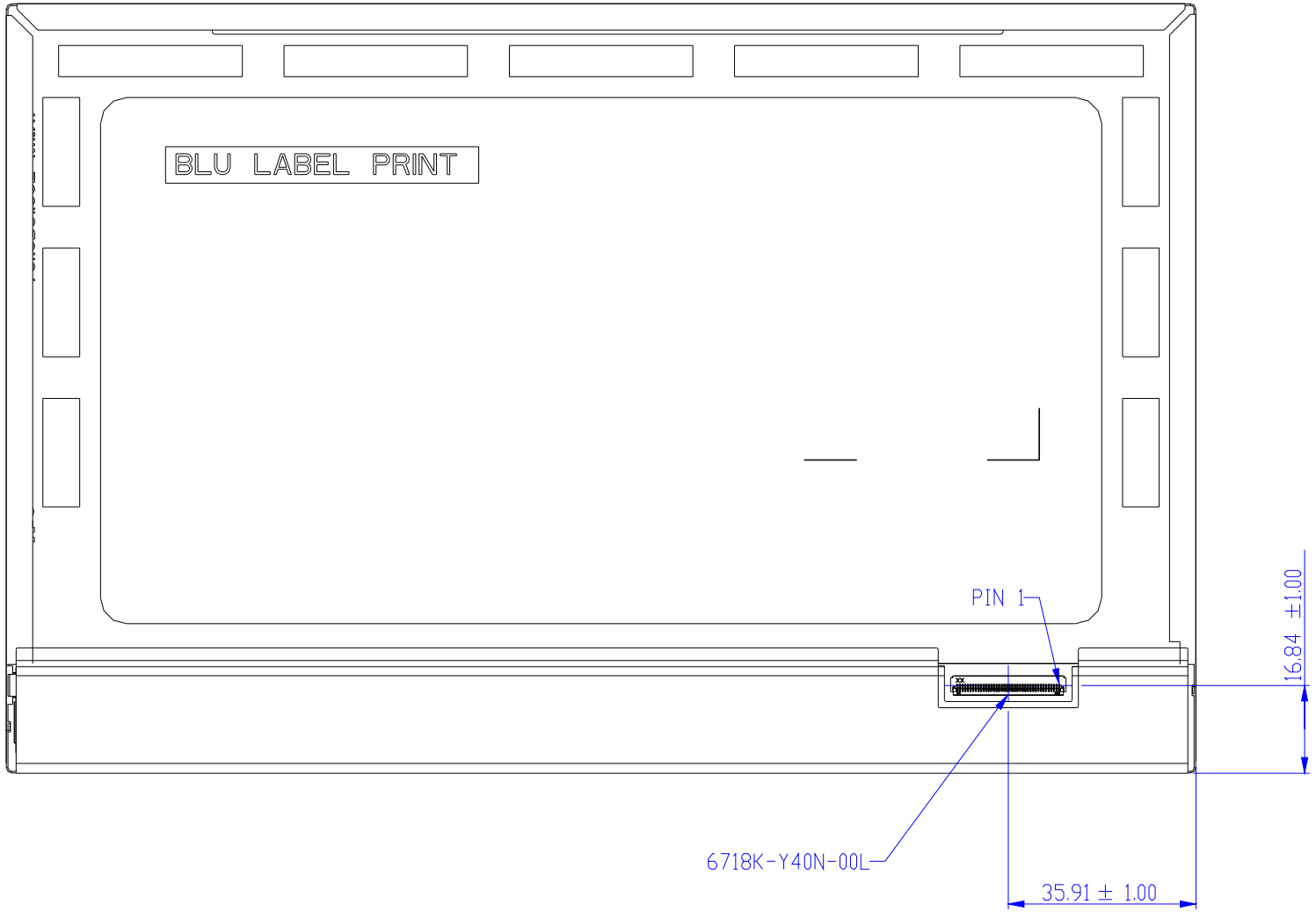
8. Mechanical Characteristics

8.1 LCM Outline Dimension

Front View

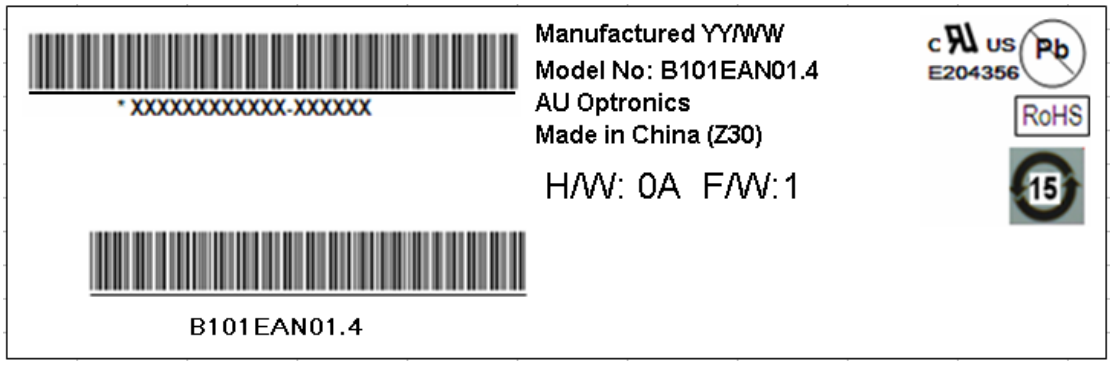


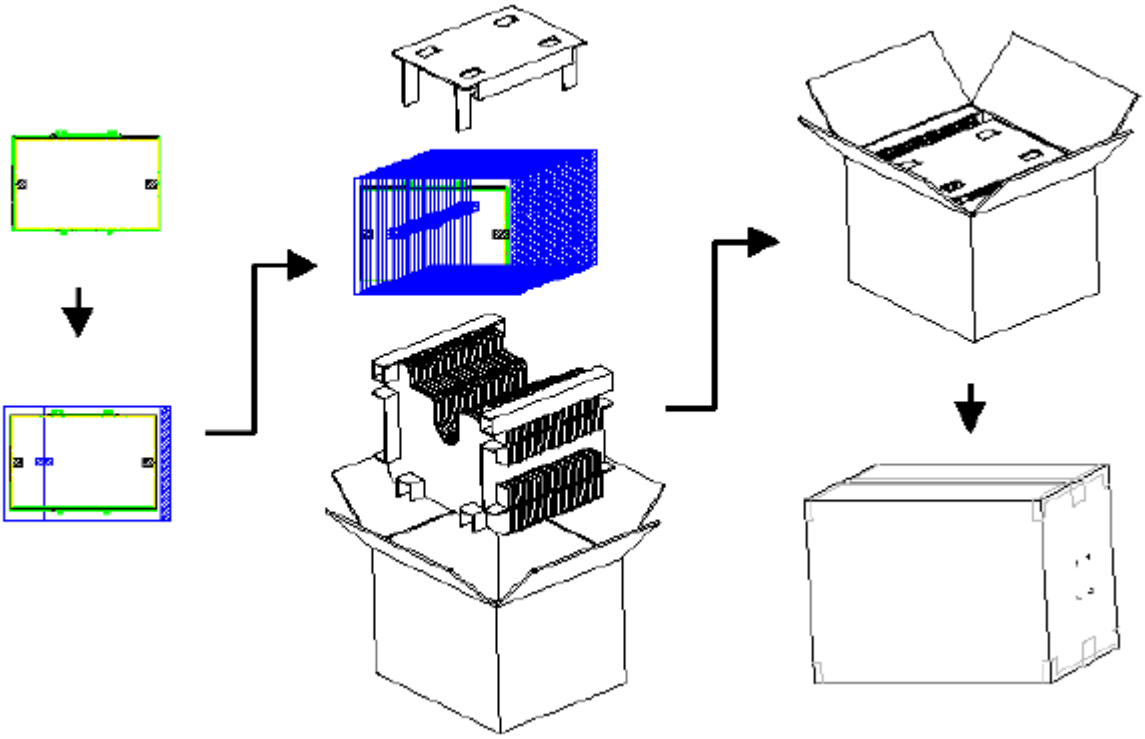
Back View



9. Shipping and Package

9.1 Shipping Label Format





9.2 Shipping Package of Palletizing Sequence