Product Specification

AU OPTRONICS CORPORATION

B156RW01 V0

(V) Preliminary Specifications

(   ) Final Specifications

Module	15.6" HD+(15.55) Color TFT-LCD with LED Backlight design
Model Name	B156RW01 V0 (H/W:1A)
Note (🔆)	*LED Backlight with driving circuit design*

Customer	Date
Checked & Approved by	**Date**

Note: This Specification is subject to change without notice.

Approved by	Date
Prepared by	

**NBBU Marketing Division /
AU Optronics corporation**

Contents

Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.1 2009/01/13	All	First Edition for Customer		

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 electrostic breakdown.

2. General Description

B156RW01 V0 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 HD+ (1600(H) x 900(V)) screen and 262k colors (RGB 6-bits data driver) with LED backlight driving circuit. All input signals are LVDS interface compatible.

B156RW01 V0 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]	394.87 15.6"(15.55)			
Active Area	[mm]	344.16 X 193.59			
Pixels H x V		1600x3(RGB) x 900			
Pixel Pitch	[mm]	0.215X0.215			
Pixel Format		R.G.B. Vertical Stripe			
Display Mode		Normally White			
White Luminance **(ILED=20mA)** **(Note: ILED is LED current)**	[cd/m^2]	250 typ. (5 points average) 215 min. (5 points average)			
Luminance Uniformity		1.25 max. (5 points) 1.53 max. (13 points)			
Contrast Ratio		400:1			
Response Time	[ms]	8 typ/12max			
Nominal Input Voltage VDD	[Volt]	+3.3 typ.			
Power Consumption(Include Logic and BLU power)	[Watt]	7.5 max. @ 250nits 2.4 max. @ 60nits			
Weight	[Grams]	460 max.			
Physical Size **without inverter, bracket.**	[mm]		Min.	Typ.	Max.
		Length	-	-	359.8
		Width	-	-	210
		Thickness	-	-	5.7
Electrical Interface		2 channel LVDS			
Glass Thickness	[mm]	0.5			
Surface Treatment		Glare, Hardness 3H, Reflection <=5%			
Support Color		262K colors (RGB 6-bit)			
Temperature Range Operating Storage (Non-Operating)	[℃] [℃]	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}=20mA			5 points average	215	250	-	cd/m²	1, 4, 5.
Viewing Angle		θ_R θ_L	Horizontal (Right) CR = 10 (Left)	- -	70 70	- -	degree	4, 9
		ψ_H ψ_L	Vertical (Upper) CR = 10 (Lower)	- -	60 60	- -		
Luminance Uniformity		δ_{5P}	5 Points	-	-	1.25		1, 3, 4
Luminance Uniformity		δ_{13P}	13 Points	-	-	1.53		2, 3, 4
Contrast Ratio		CR		-	400	-		4, 6
Cross talk		%				TBD		4, 7
Response Time		T_r	Rising	-	TBD	-	msec	4, 8
		T_f	Falling	-	TBD	-		
		T_{RT}	Rising + Falling	-	8	12		
Color / Chromaticity Coodinates	Red	Rx	CIE 1931	-	TBD	-		4
		Ry		-	TBD	-		
	Green	Gx		-	TBD	-		
		Gy		-	TBD	-		
	Blue	Bx		-	TBD	-		
		By		-	TBD	-		
	White	Wx		0.283	0.313	0.343		
		Wy		0.299	0.329	0.359		
NTSC		%		-	60	-		

Note 1: 5 points position (Ref: Active area)
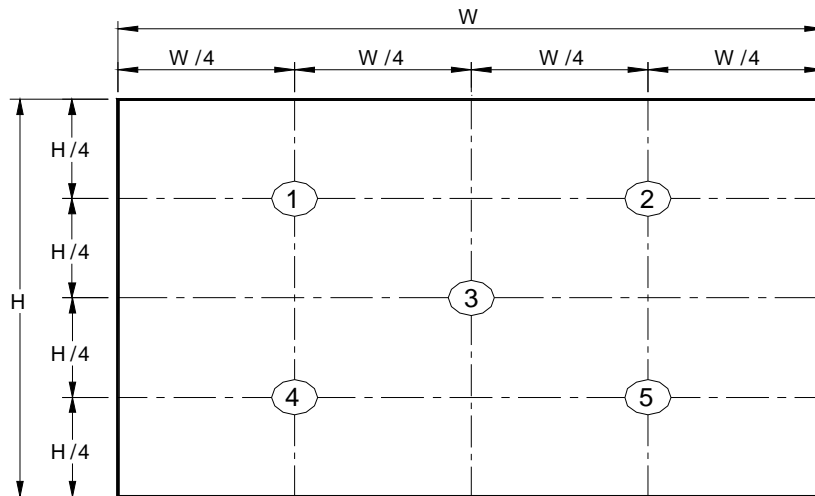
Note 2: 13 points position (Ref: Active area)
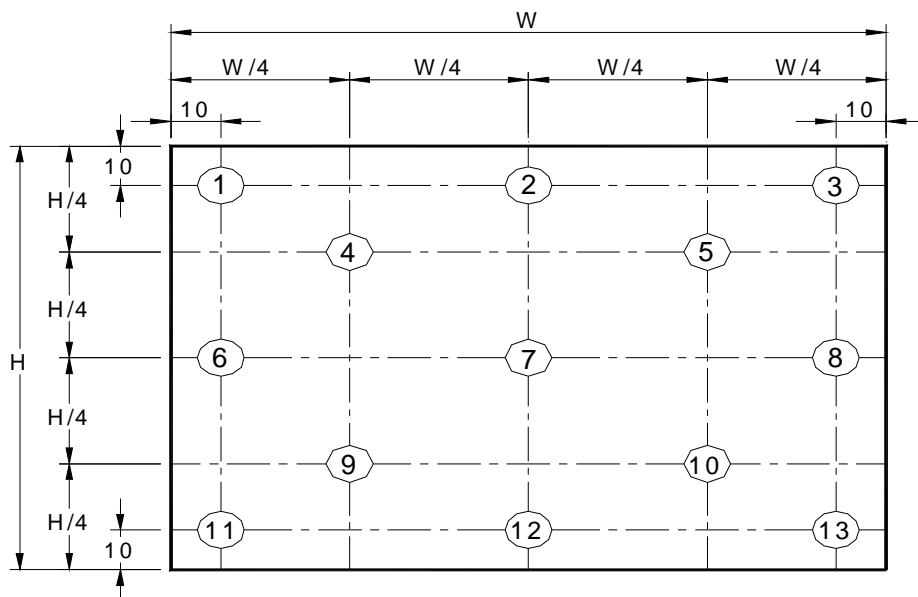
Note 3: The luminance uniformity of 5 or13 points is defined by dividing the maximum luminance values by the minimum test point luminance

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

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

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.

Photo detector

Field=2°

50 cm

LCD Panel

TFT-LCD

Center of the screen
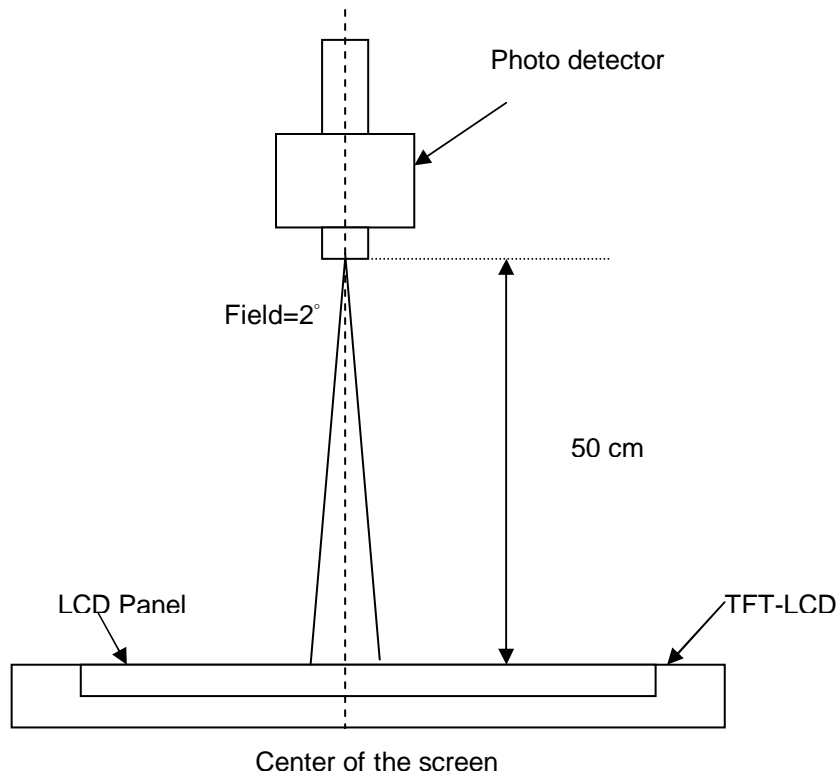
Note 5 : Definition of Average Luminance of White (Y_L):

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.

$$\text{Contrast ratio (CR)}= \frac{\text{Brightness on the "White" state}}{\text{Brightness on the "Black" state}}$$
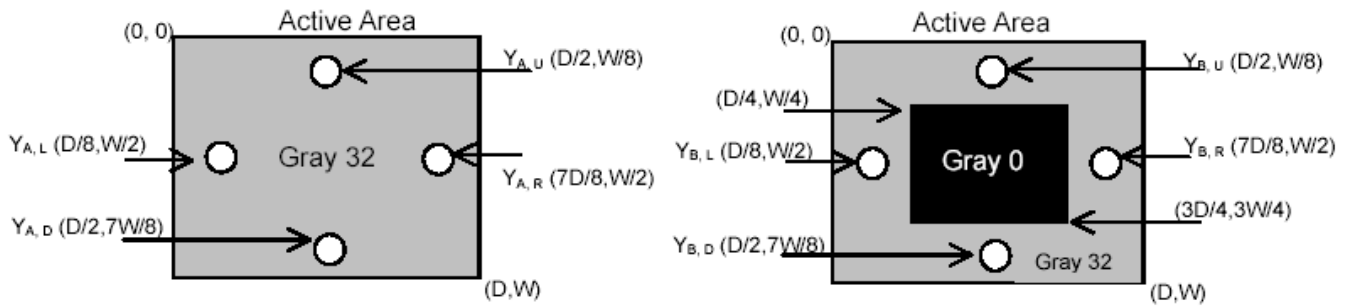
Note 7 : Definition of Cross Talk (CT)

CT = | Y_B – Y_A | / Y_A × 100 (%)

Where

Y_A = Luminance of measured location without gray level 0 pattern (cd/m2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m2)

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.
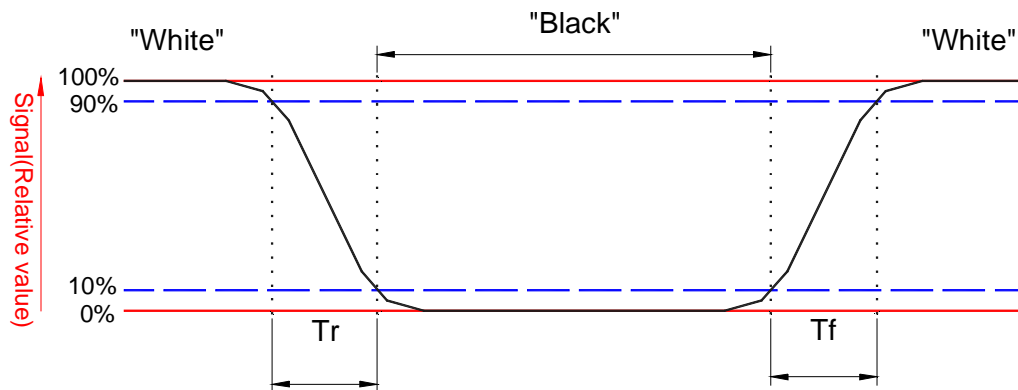
Note 9. Definition of viewing angle

Viewing angle is the measurement of contrast ratio ≧ 10, at the screen center, over a 180° horizontal an d 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.
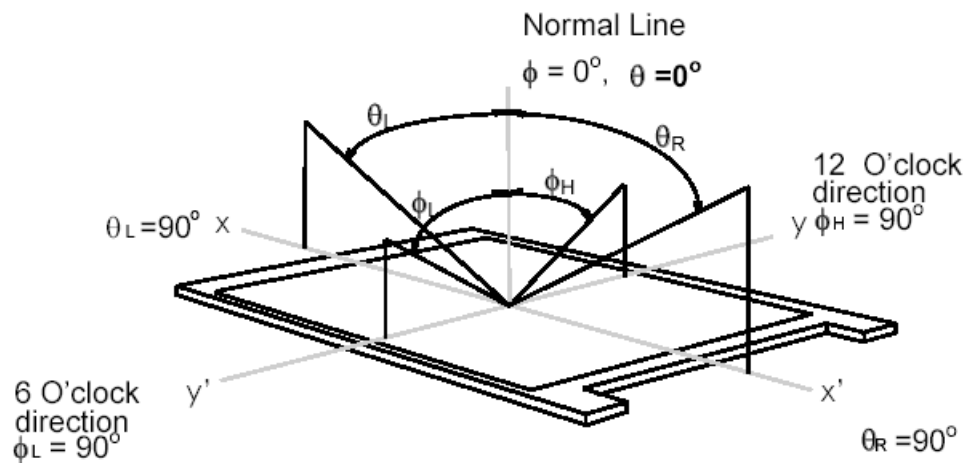
3. Functional Block Diagram

The following diagram shows the functional block of the 15.6 inches wide Color TFT/LCD 40 Pin (One CH/connector Module)
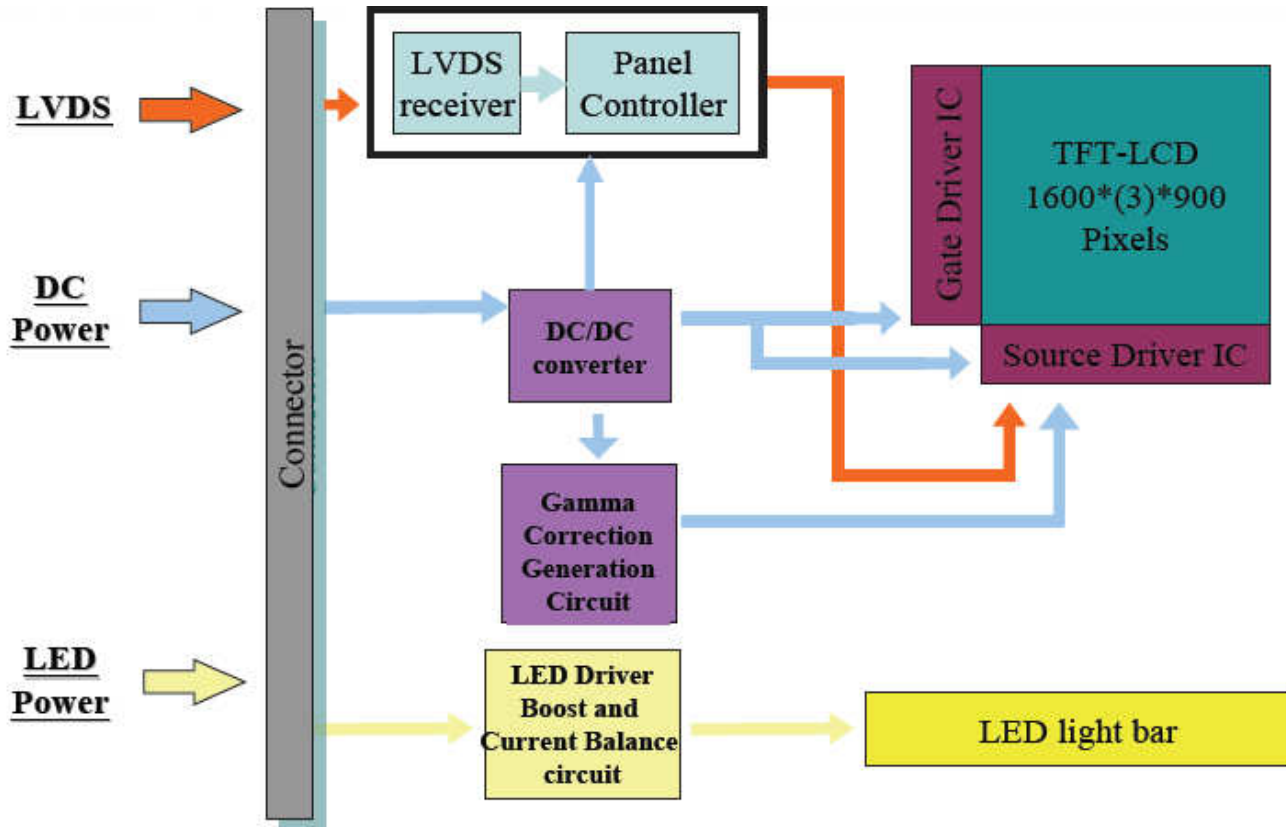
4. Absolute Maximum Ratings

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).
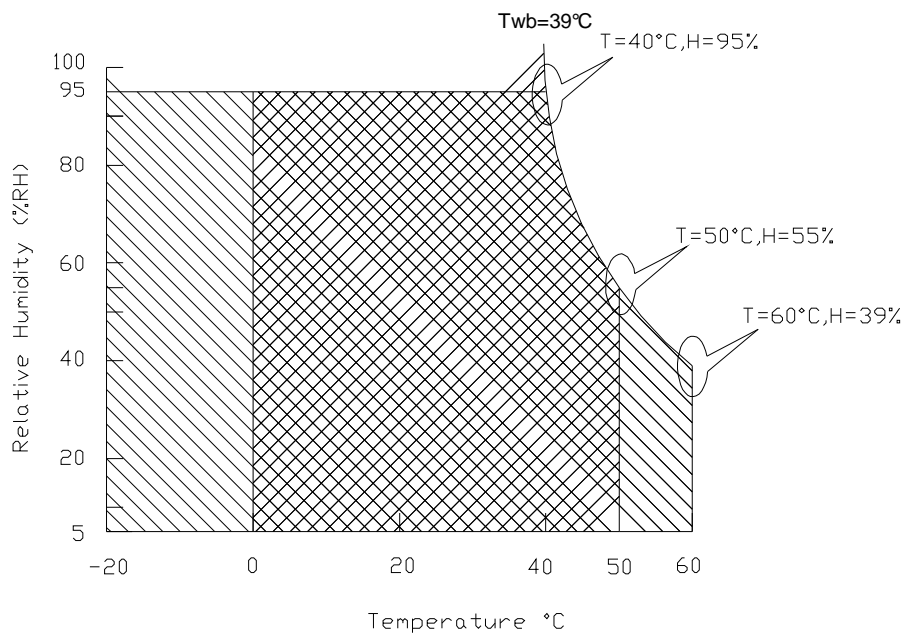
Operating Range [XXXXX]   Storage Range   [XXXXX] + [\\\\\]

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
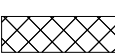
Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
PDD	VDD Power	-	-	TBD	[Watt]	Note 1/2
IDD	IDD Current	-	-	TBD	[mA]	Note 1/2
IRush	Inrush Current	-	-	TBD	[mA]	Note 3
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	TBD	[mV] p-p	

Note 1 : Maximum Measurement Condition : Black Pattern

Note 2 : Typical Measurement Condition: Mosaic Pattern

Note 3 : Measure Condition
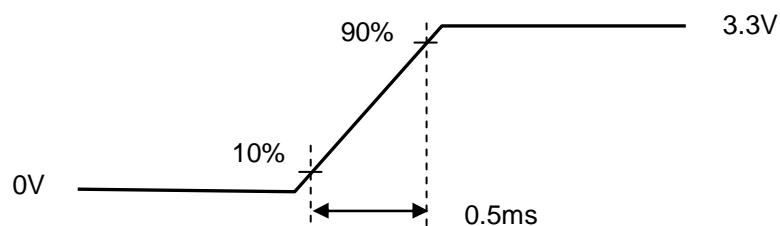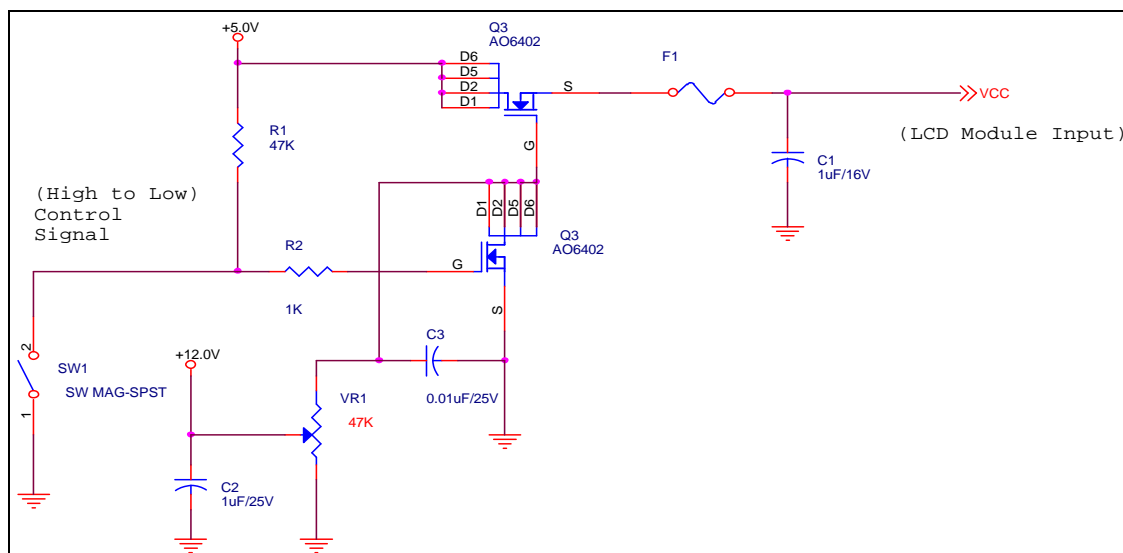
Vin rising time

5.1.2 Signal Electrical Characteristics

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

It is recommended to refer the specifications of THC63LVDF84A (Thine Electronics Inc.) in detail.

Signal electrical characteristics are as follows;

Parameter	Condition	Min	Max	Unit
Vth	Differential Input High Threshold (Vcm=+1.2V)	-	100	[mV]
Vtl	Differential Input Low Threshold (Vcm=+1.2V)	-100	-	[mV]
Vcm	Differential Input Common Mode Voltage	1.125	1.375	[V]

Note: LVDS Signal Waveform
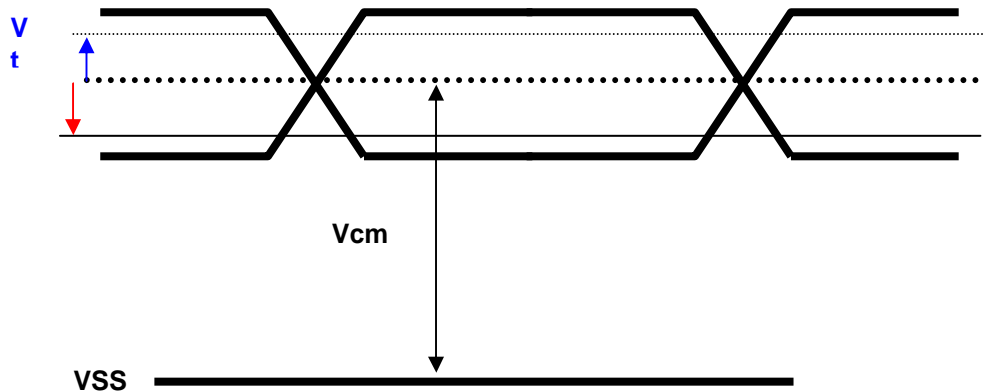
5.2 Backlight Unit

LED Parameter guideline for LED driving selection (Ref. Remark 1)

Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Forward Voltage	V_F	3.0	3.2	3.4	[Volt]	(Ta=25℃)
LED Forward Current	I_F		20	30	[mA]	(Ta=25℃)
LED Power consumption	P_{LED}		5.5		[Watt]	(Ta=25℃) Note 1
LED Life-Time	N/A	10,000	-	-	Hour	(Ta=25℃) I_F=20 mA Note 2
Output PWM frequency	F_{PWM}	100	200	20K	Hz	
Duty ratio	--	5	--	100	%	

Note 1: Calculator value for reference $I_F × V_F = P$

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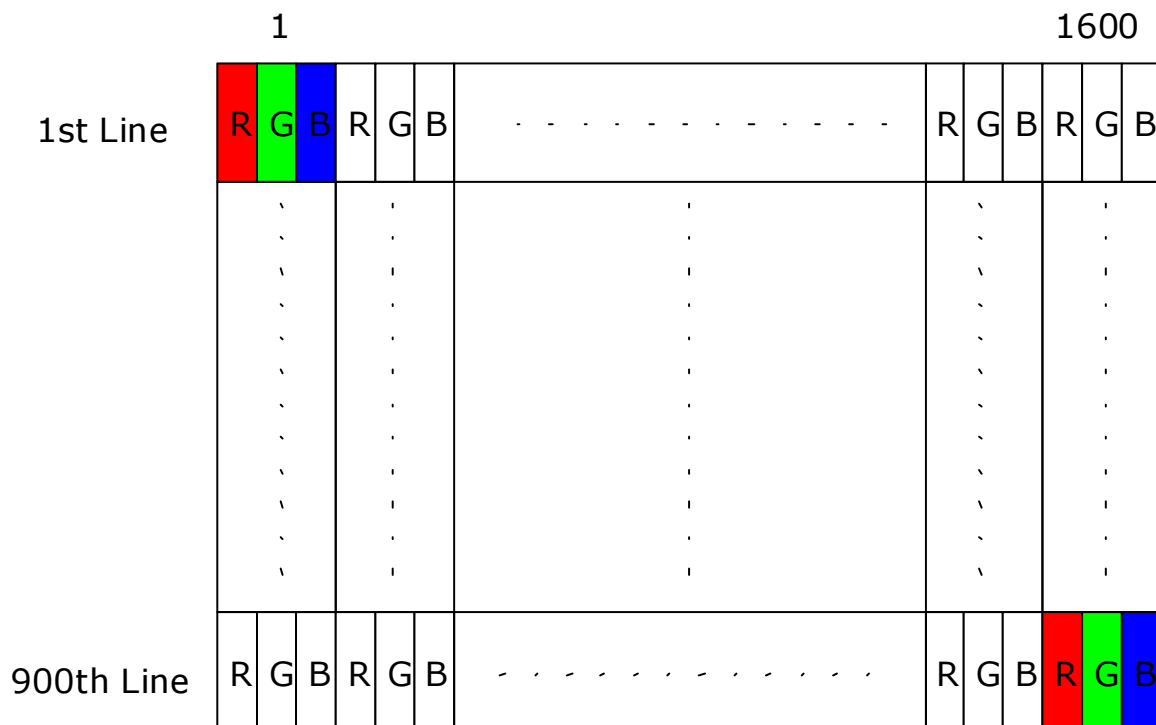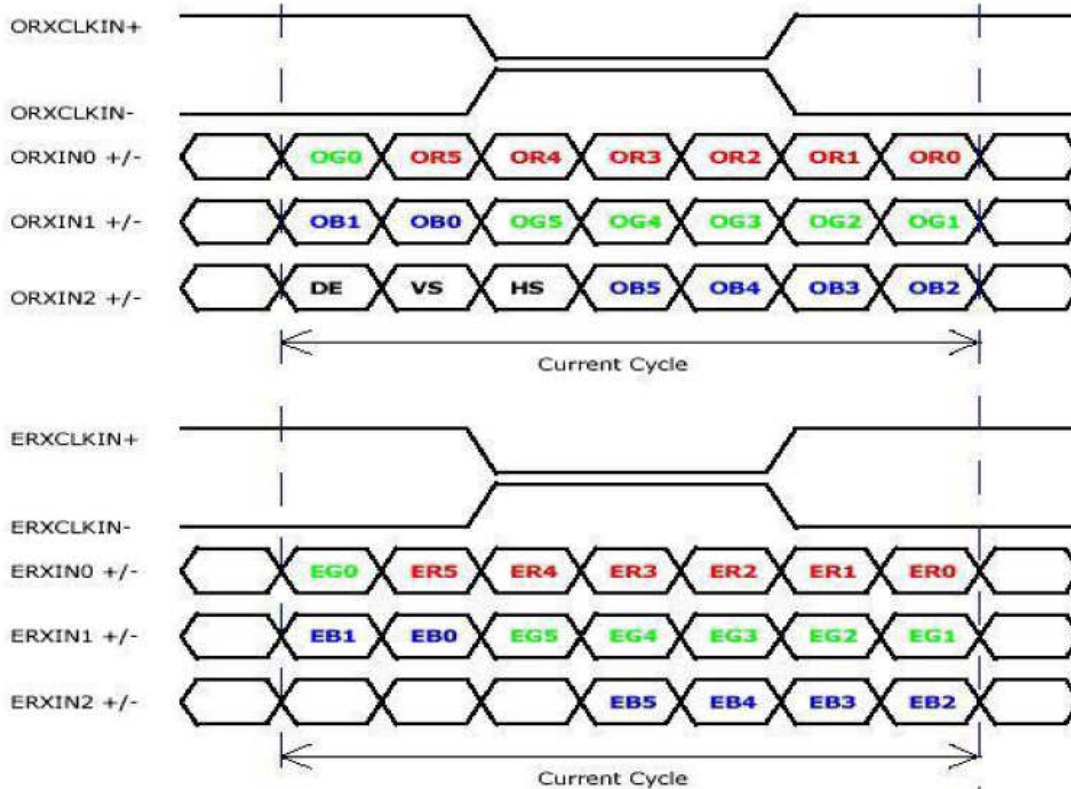
6. Signal Characteristic

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	
R5 R4 R3 R2 R1 R0 Red-pixel Data	Red Data 5 (MSB) 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 6 bits pixel data.
G5 G4 G3 G2 G1 G0 Green-pixel Data	Green Data 5 (MSB) 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 6 bits pixel data.
B5 B4 B3 B2 B1 B0 Blue-pixel Data	Blue Data 5 (MSB) 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 6 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 and Pin Assignment

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

Pin	Signal	Description
1	NC	No Connection (Reserve)
2	AVDD	PowerSupply,3.3V(typical)
3	AVDD	PowerSupply,3.3V(typical)
4	DVDD	DDC 3.3Vpower
5	NC	No Connection (Reserve)
6	SCL	DDCClock
7	SDA	DDCData
8	Odd_Rin0-	-LVDSdifferential data input(R0-R5,G0)
9	Odd_Rin0+	+LVDSdifferential data input(R0-R5,G0)
10	GND	Ground
11	Odd_Rin1-	-LVDSdifferential data input(G1-G5,B0-B1)
12	Odd_Rin1+	+LVDSdifferential data input(G1-G5,B0-B1)
13	GND	Ground
14	Odd_Rin2-	-LVDSdifferential data input(B2-B5,HS,VS,DE)
15	Odd_Rin2+	+LVDSdifferential data input(B2-B5,HS,VS,DE)
16	GND	Ground
17	Odd_ClkIN-	-LVDSdifferential clock input
18	Odd_ClkIP+	+LVDSdifferential clock input
19	GND	Ground–Shield
20	Even_Rin0-	-LVDSdifferential data input(R0-R5,G0)
21	Even_Rin0+	+LVDSdifferential data input(R0-R5,G0)
22	GND	Ground
23	Even_Rin1-	-LVDSdifferential data input(G1-G5,B0-B1)
24	Even_Rin1+	+LVDSdifferential data input(G1-G5,B0-B1)
25	GND	Ground
26	Even_Rin2-	-LVDSdifferential data input(B2-B5,HS,VS,DE)
27	Even_Rin2+	+LVDSdifferential data input(B2-B5,HS,VS,DE)
28	GND	Ground
29	Even_ClkIN-	-LVDSdifferential clock input
30	Even_ClkIP+	+LVDSdifferential clock input
31	VLED_GND	LED Ground
32	VLED_GND	LED Ground
33	VLED_GND	LED Ground
34	NC	No Connection (Reserve)

35	PWM	System PWM Signal Input
36	LED_EN	LED enable pin(+3.3V Input)
37	NC	No Connection (Reserve)
38	VLED	LED Power Supply 7V-21V
39	VLED	LED Power Supply 7V-21V
40	VLED	LED Power Supply 7V-21V

Note1: Start from right side

Connector

IPEX-20455-040E-12

GND **40**   **1** NC
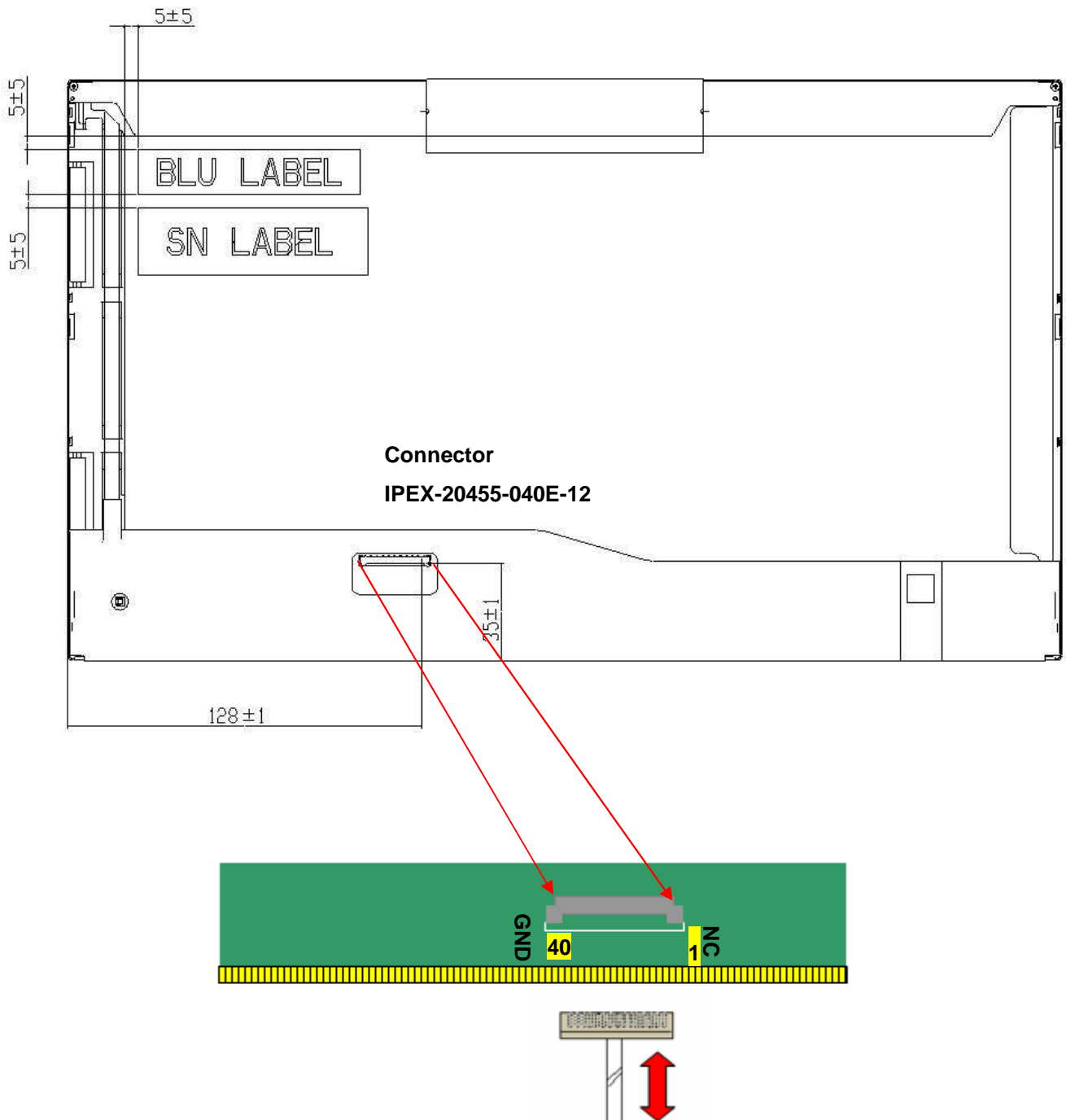
Note2: Input signals shall be low or High-impedance state when VDD is off.

internal circuit of LVDS inputs are as following.

The module uses a 100ohm resistor between positive and negative data lines of each receiver input

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Signal Input

Pin No.

LVDS Receiver

8	RxIN0-
9	RxIN0+
11	RxIN1-
12	RxIN1+
14	RxIN2-
15	RxIN2+
17	RxCLKIN-
18	RxCLKIN+
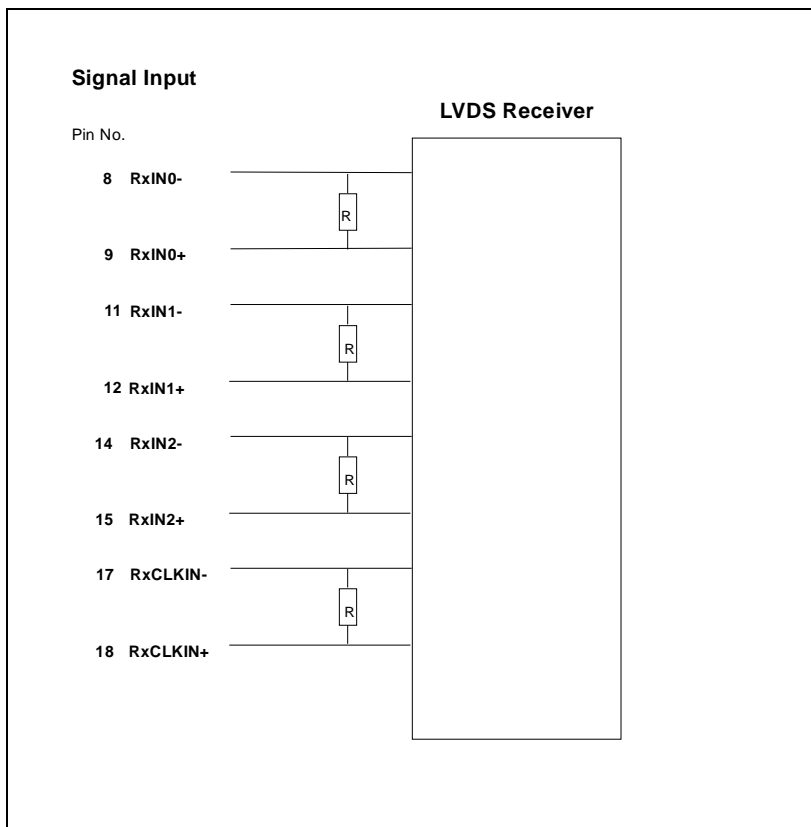
6.4 Interface Timing

6.4.1 Timing Characteristics

Basically, interface timings should match the 1600x900 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		-	50	60	-	Hz
Clock frequency		1/ T_{Clock}	-	59.4	72	MHz
Vertical Section	Period	T_V	908	916	2047-	T_{Line}
	Active	T_{VD}		900		
	Blanking	T_{VB}	8	16	-	
Horizontal Section	Period	T_H	830	1080	2047-	T_{Clock}
	Active	T_{HD}		800		
	Blanking	T_{HB}	30	280	-	

Note : DE mode only

6.4.2 Timing diagram

Input Timing Definition (DE Mode)
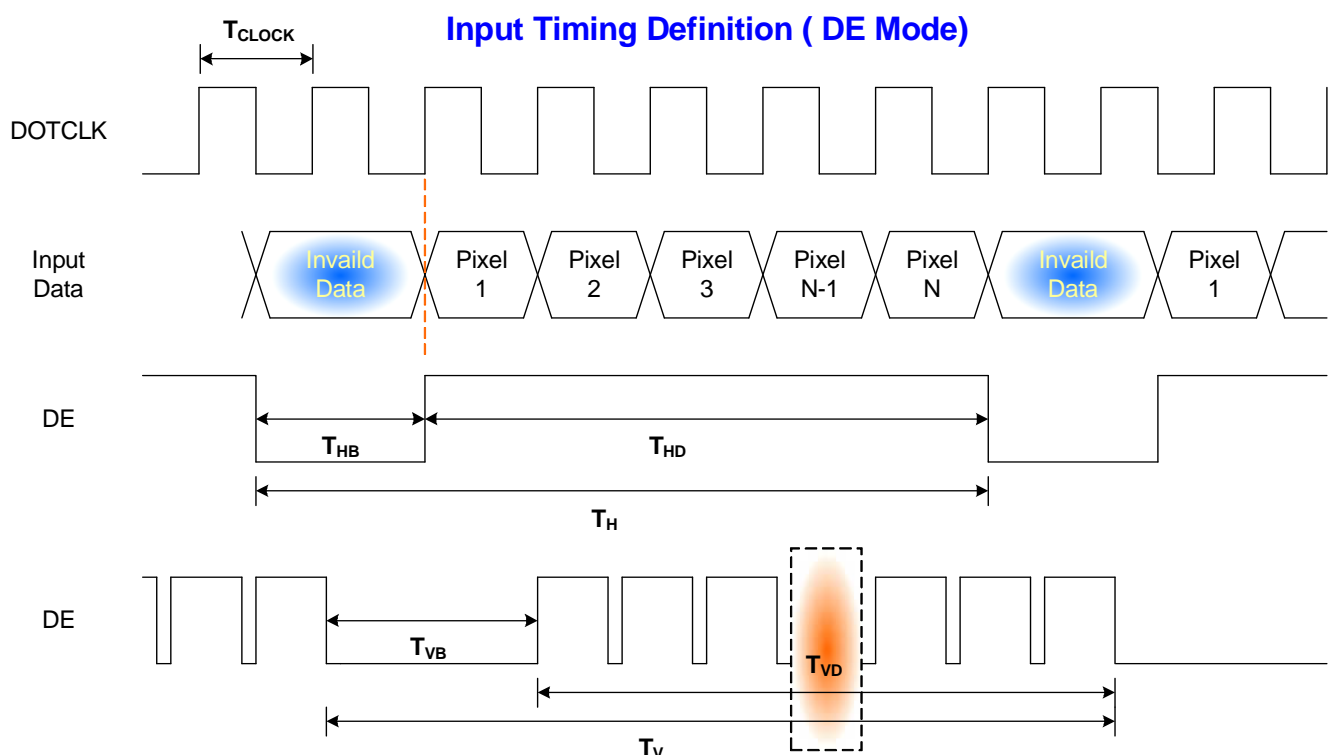
6.5 Power ON/OFF Sequence

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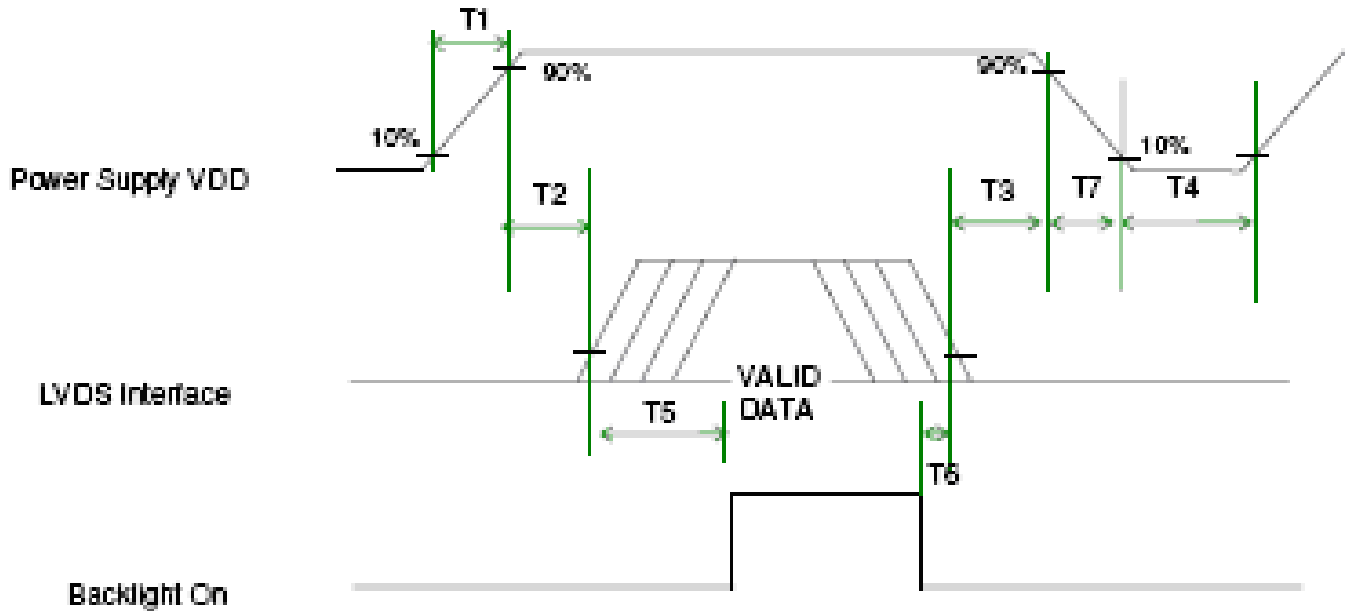
Power Sequence Timing

Parameter	Value			Units
	Min.	Typ.	Max.	
T1	0.5	-	10	
T2	0	-	50	
T3	0	-	50	
T4	400	-	-	ms
T5	200	-	-	
T6	200	-	-	
T7	0	-	10	

LED on/off sequence is as follows. Interface signals are also shown in the chart.
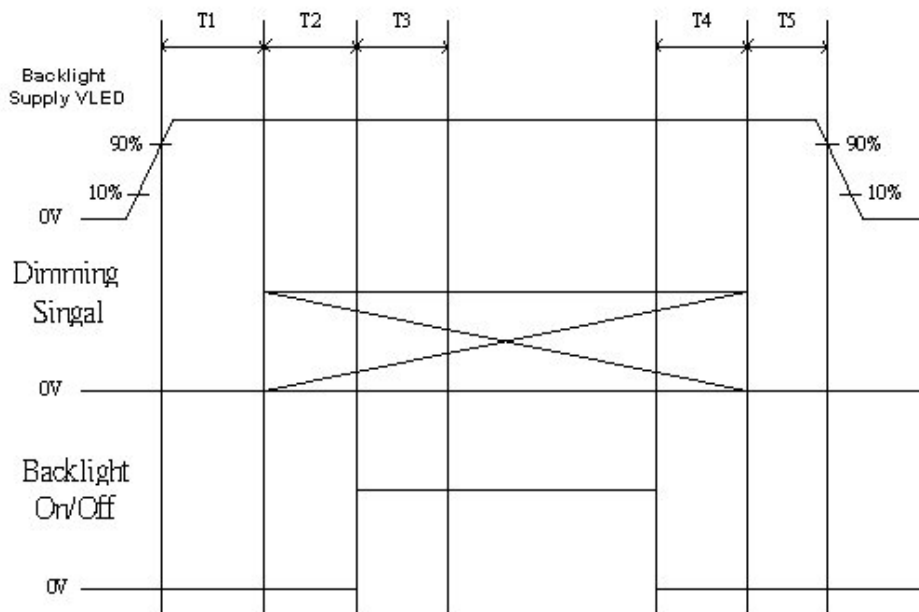
Symbol	Values			Unit
	Min	Typ	Max	
T1	10	---	---	
T2	10	---	---	
T3	50	---	---	ms
T4	0	---	---	
T5	10	---	---	

Note: The duty of LED dimming signal should be more than 20% in T2 and T3.

7. 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.

7.1 TFT LCD Module

Connector Name / Designation	For Signal Connector
Manufacturer	IPEX or compatible
Type / Part Number	IPEX-20455-040E-12 or compatible
Mating Housing/Part Number	IPEX-20453-040T-11 or compatible

8. LED Driving Specification

8.1 Connector Description

It is a intergrative interface and comibe into LVDS connector. The type and mating refer to section 7.

8.2 Pin Assignment

Ref. to 6.3

9. Vibration and Shock Test

9.1 Vibration Test

Test Spec:

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

9.2 Shock Test Spec:

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

10. Reliability

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

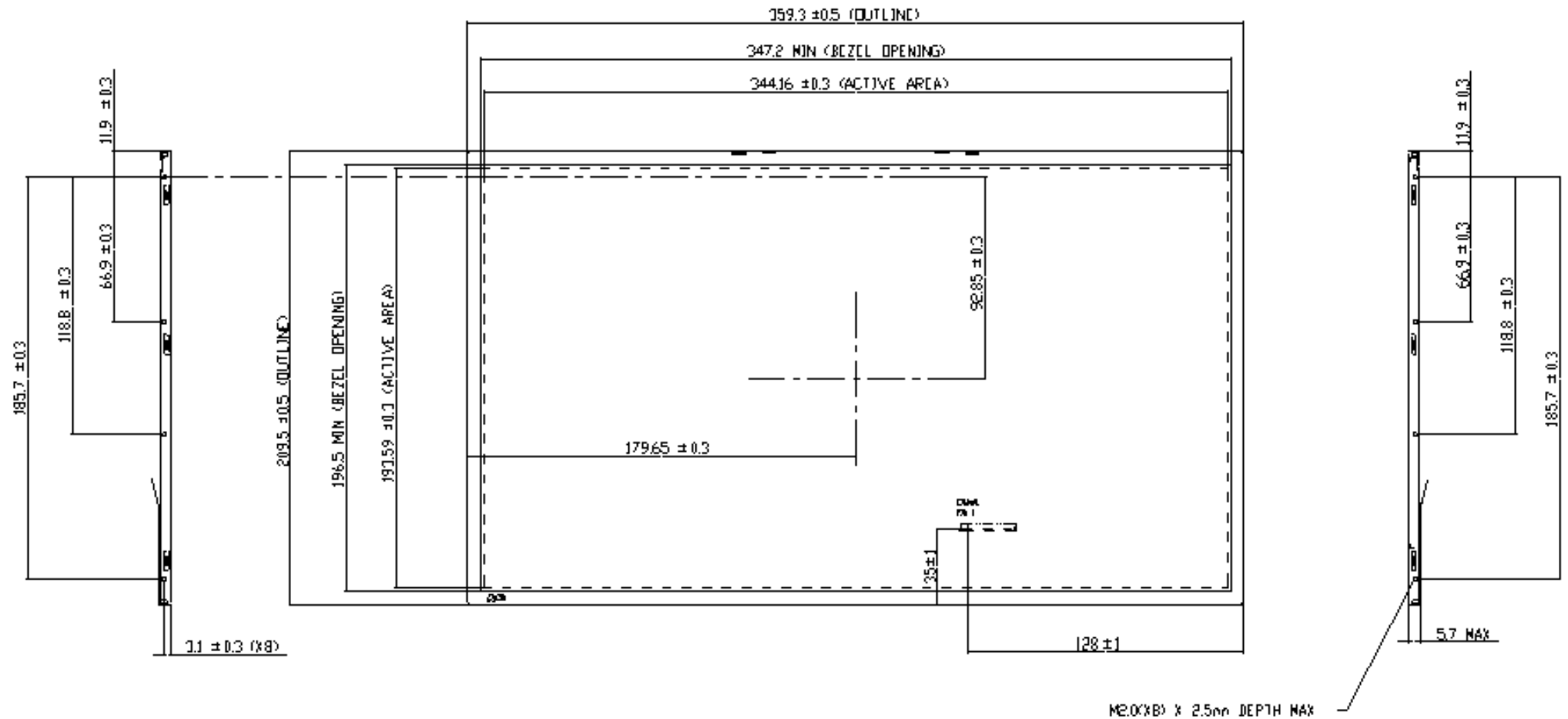**Note1:** According to EN 61000-4-2 , ESD class B: Some performance degradation allowed. No data lost

. Self-recoverable. No hardware failures.

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

11. Mechanical Characteristics

11.1 LCM Outline Dimension

BLU LABEL

SN LABEL

35±1

128±1
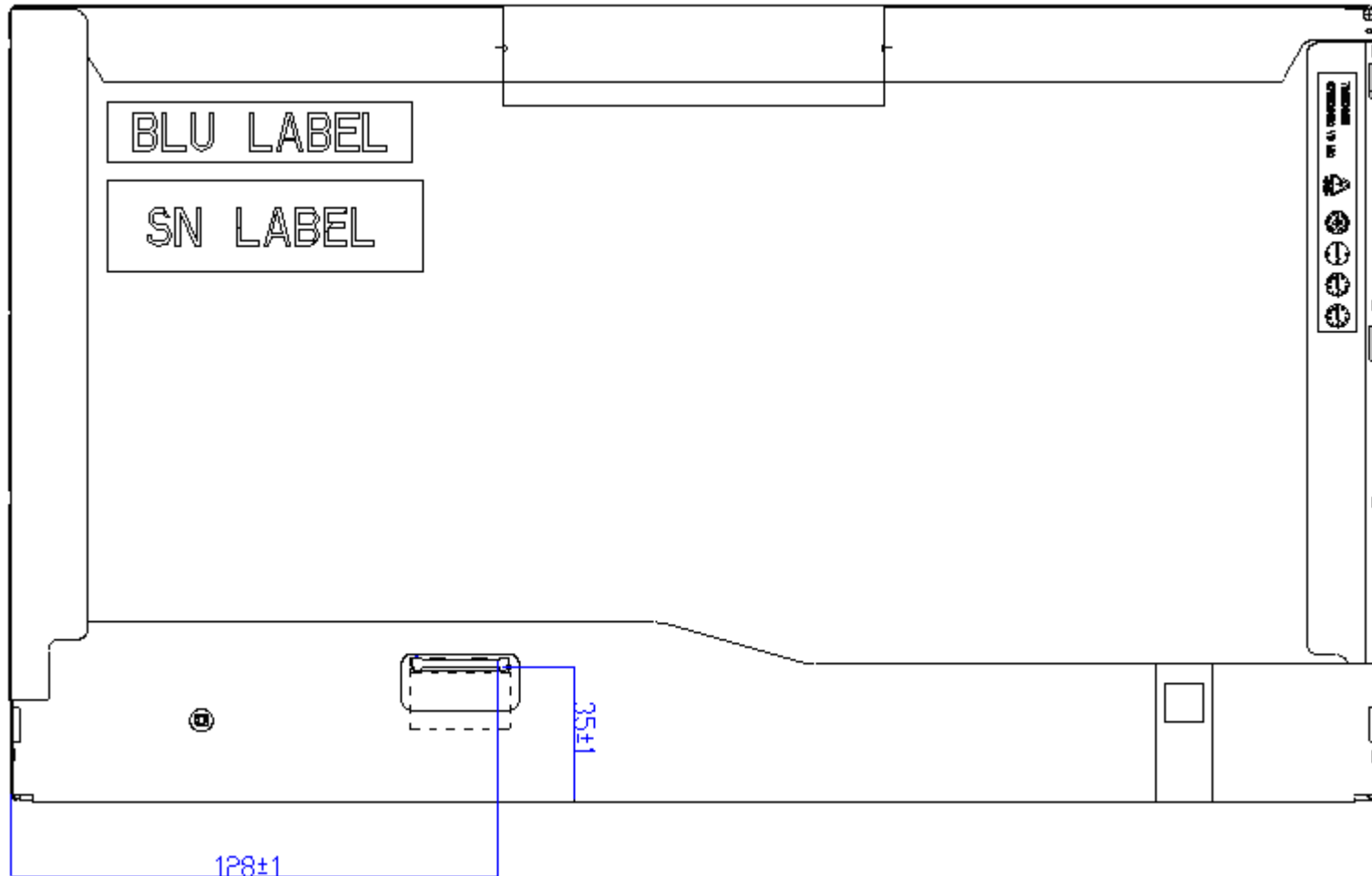
Note: Prevention IC damage, IC positions not allowed any overlap over these areas.

11.2 Screw Hole Depth and Center Position

Screw hole minimum depth, from side surface = 2.5 mm Max. (See drawing)

Screw hole center location, from front surface = 3.1 ± 0.3mm (See drawing)
Screw Torque: Maximum 2.5 kgf-cm
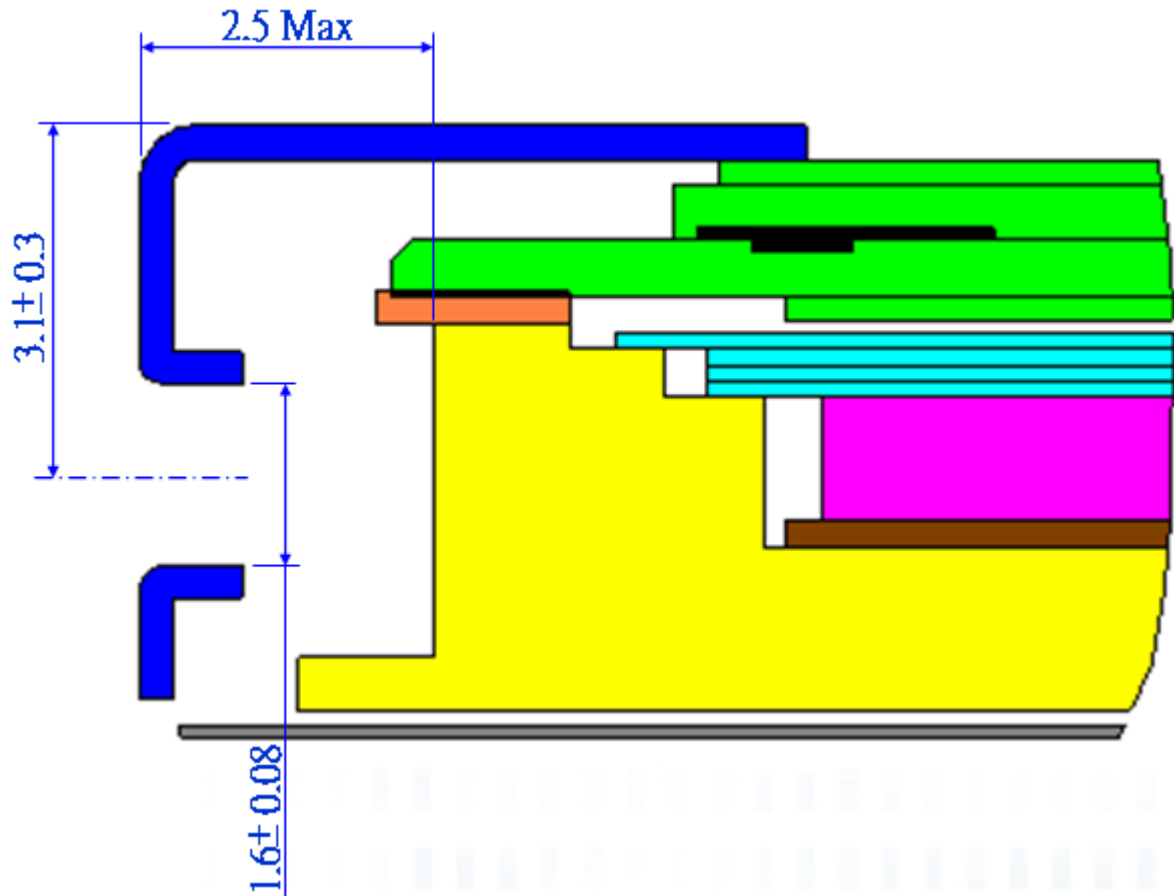
12. Shipping and Package

12.1 Shipping Label Format

Week code

Model name

Manufactured MM/WW
Model No: B156RW01   V.0
AU Optronics
MADE IN CHINA(S03)
H/W: 1A F/W:1

XXXXXXXXXXXX-XXXXXX

H/W

12.2 Carton package(TBD)

12.3 Shipping package of palletizing sequence
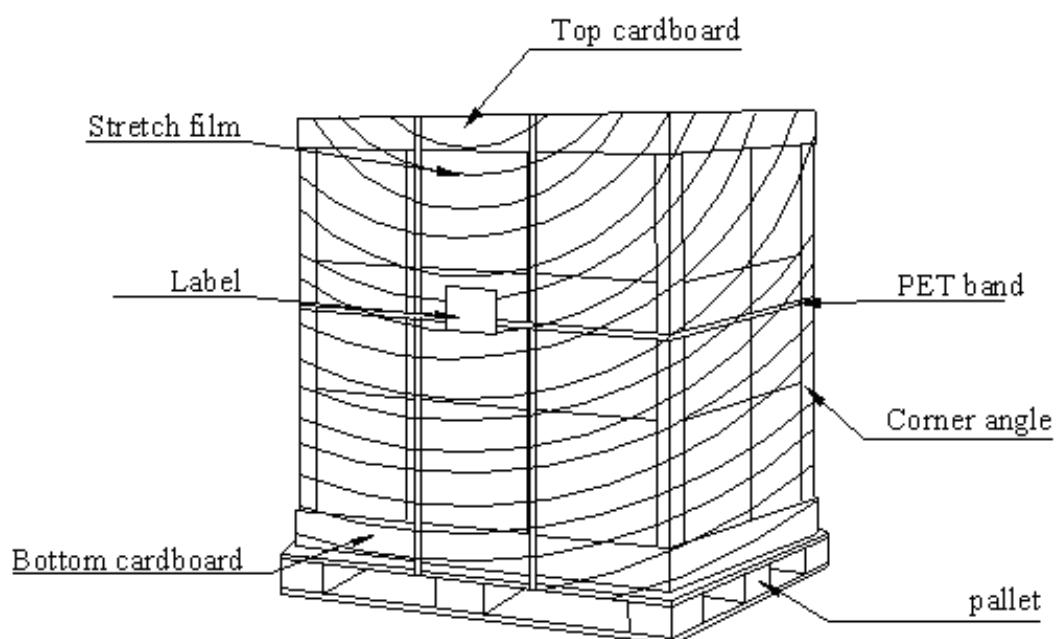
13. Appendix: EDID description (TBD)

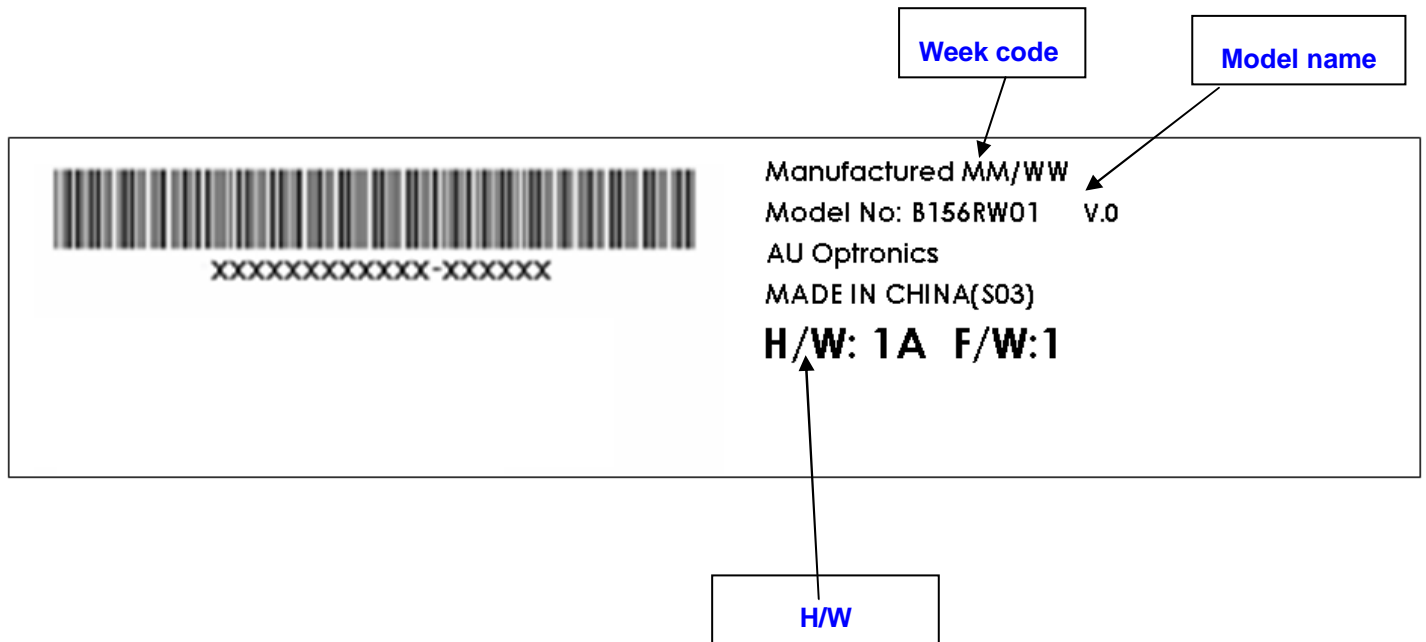| Address	FUNCTION	Value	Value	Value	Note
HEX					
00					
01					
02					
03					
04					
05					
06					
07					
08					
09					
0A					
0B					
0C					
0D					
0E					
0F					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
1A					
1B					
1C					
1D					
1E					
1F					
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37					
38					
39					
3A					
3B					
3C					
3D					
3E					
3F					
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