




# Product Specification

AU OPTRONICS CORPORATION

## B156RW01 V1

(V) Preliminary Specifications

( ) Final Specifications

<b>Module</b>	<b>15.6”(15.55) HD+ Color TFT-LCD with LED Backlight design</b>
<b>Model Name</b>	B156RW01 V1 (H/W:1A)
<b>Note</b> (  )	<b><i>LED Backlight with driving circuit design</i></b>

<b>Customer</b>	<b>Date</b>
<b>Checked &amp; Approved by</b>	<b>Date</b>
_____	_____

Note: This Specification is subject to change without notice.

<b>Approved by</b>	<b>Date</b>
<b>Prepared by</b>	
_____	_____

**NBBU Marketing Division /  
AU Optronics corporation**



## Contents

<b>1. Handling Precautions .....</b>	<b>4</b>
<b>2. General Description .....</b>	<b>5</b>
2.1 General Specification .....	5
2.2 Optical Characteristics .....	6
<b>3. Functional Block Diagram .....</b>	<b>11</b>
<b>4. Absolute Maximum Ratings .....</b>	<b>12</b>
4.1 Absolute Ratings of TFT LCD Module .....	12
4.2 Absolute Ratings of Environment .....	12
<b>5. Electrical characteristics .....</b>	<b>13</b>
5.1 TFT LCD Module .....	13
5.2 Backlight Unit .....	15
<b>6. Signal Characteristic .....</b>	<b>16</b>
6.1 Pixel Format Image .....	16
6.2 The input data format .....	17
6.3 Integration Interface and Pin Assignment .....	18
6.4 Interface Timing .....	22
<b>7. Connector Description .....</b>	<b>24</b>
7.1 TFT LCD Module .....	24
<b>8. LED Driving Specification .....</b>	<b>25</b>
8.1 Connector Description .....	25
8.2 Pin Assignment .....	25
<b>9. Vibration and Shock Test .....</b>	<b>26</b>
9.1 Vibration Test .....	26
9.2 Shock Test Spec: .....	26
<b>10. Reliability .....</b>	<b>27</b>
<b>11. Mechanical Characteristics .....</b>	<b>28</b>
11.1 LCM Outline Dimension .....	28
11.2 Screw Hole Depth and Center Position .....	30
<b>12. Shipping and Package .....</b>	<b>31</b>
12.1 Shipping Label Format .....	31
12.2 Carton package .....	32
12.3 Shipping package of palletizing sequence .....	32
<b>13. Appendix: EDID description .....</b>	<b>33</b>



# Product Specification

AU OPTRONICS CORPORATION

## Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.1 2009/07/09	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 momentarily. 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

B156RW01 V1 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 V1 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 °C 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 <sup>2</sup> ]	220 typ. (5 points average) 187 min. (5 points average)			
Luminance Uniformity		1.25 max. (5 points) 1.50 max. (13 points)			
Contrast Ratio		400 typ.			
Response Time	[ms]	8 typ/16max			
Nominal Input Voltage VDD	[Volt]	+3.3 typ.			
Power Consumption(Include Logic and BLU power)	[Watt]	6.8 max. (Include Logic and Blu power)			
Weight	[Grams]	460 max.			
Physical Size <b>without inverter, bracket.</b>	[mm]		Min.	Typ.	Max.
		Length	-	359.3	359.8
		Width	-	209.5	210
		Thickness	-	-	5.7
Electrical Interface		2 channel LVDS			
Glass Thickness	[mm]	0.5			
Surface Treatment		Anti-Glare, Hardness 3H,			
Support Color		262K colors ( RGB 6-bit )			
Temperature Range					
Operating	[°C]	0 to +50			
Storage (Non-Operating)	[°C]	-20 to +60			
RoHS Compliance		RoHS Compliance			

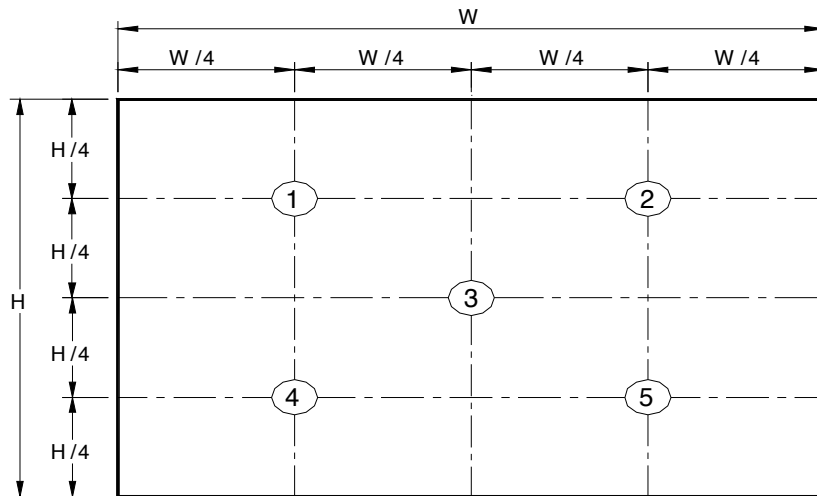


## 2.2 Optical Characteristics

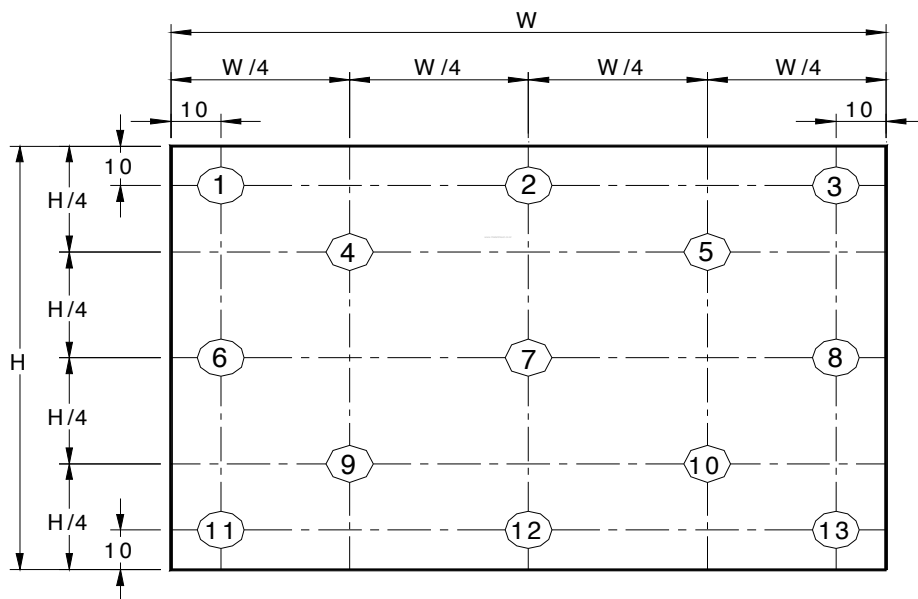
The optical characteristics are measured under stable conditions at 25°C (Room Temperature) :

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance I <sub>LED</sub> =20mA		5 points average	187	220	-	cd/m <sup>2</sup>	1, 4, 5.
Viewing Angle	$\theta_R$ $\theta_L$	Horizontal (Right) CR = 10 (Left)	60 60	70 70	- -	degree	4, 9
	$\psi_H$ $\psi_L$	Vertical (Upper) CR = 10 (Lower)	45 50	60 60	- -		
Luminance Uniformity	$\delta_{5P}$	5 Points	-	-	1.25		1, 3, 4
Luminance Uniformity	$\delta_{13P}$	13 Points	-	-	1.50		2, 3, 4
Contrast Ratio	CR		300	400	-		4, 6
Cross talk	%		-	-	4		4, 7
Response Time	$T_r$	Rising	-	2	-	msec	4, 8
	$T_f$	Falling	-	6	-		
	$T_{RT}$	Rising + Falling	-	8	16		
Color / Chromaticity Coodinates	Red	R <sub>x</sub>	CIE 1931	0.593	0.623	0.653	4
		R <sub>y</sub>		0.321	0.351	0.381	
	Green	G <sub>x</sub>		0.306	0.336	0.366	
		G <sub>y</sub>		0.544	0.574	0.604	
	Blue	B <sub>x</sub>		0.118	0.148	0.178	
		B <sub>y</sub>		0.023	0.053	0.083	
	White	W <sub>x</sub>		0.283	0.313	0.343	
		W <sub>y</sub>		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 or 13 points is defined by dividing the maximum luminance values by the minimum test point luminance

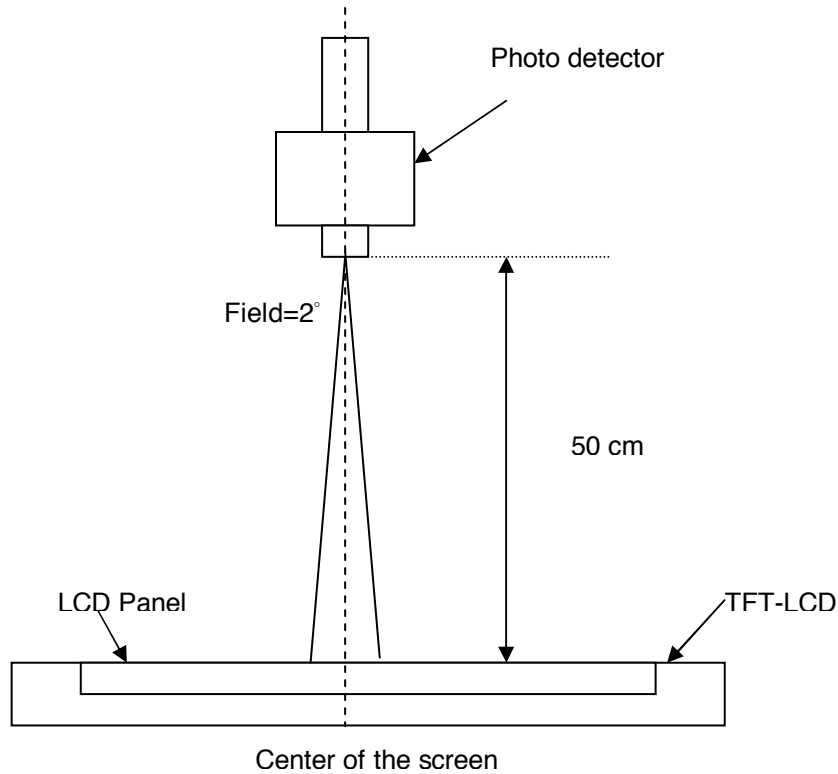
$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

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

**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)

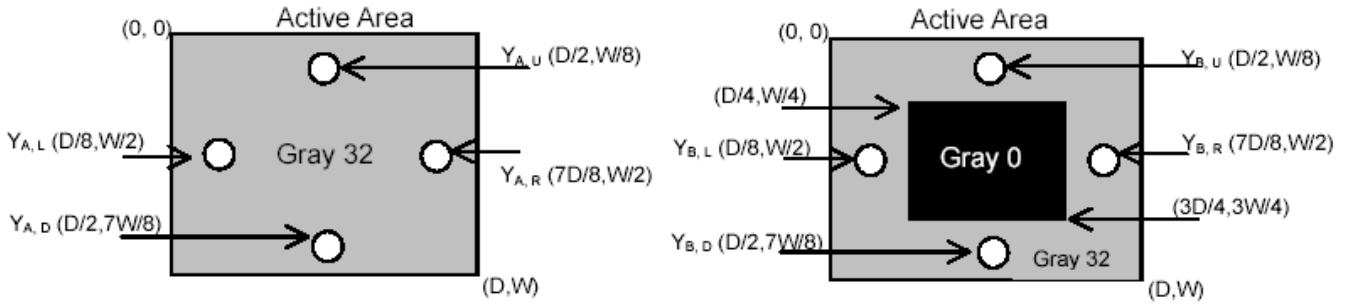
$$CT = | Y_B - Y_A | / Y_A \times 100 (\%)$$

Where

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

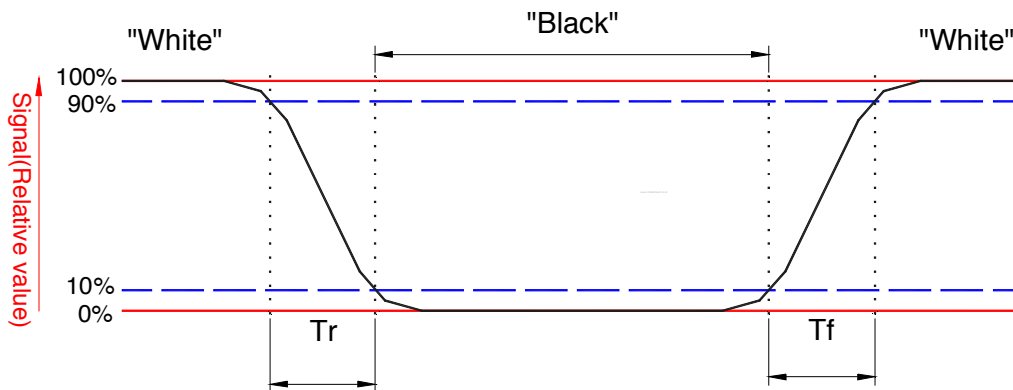
$Y_B$  = Luminance of measured location with gray level 0 pattern ( $cd/m^2$ )





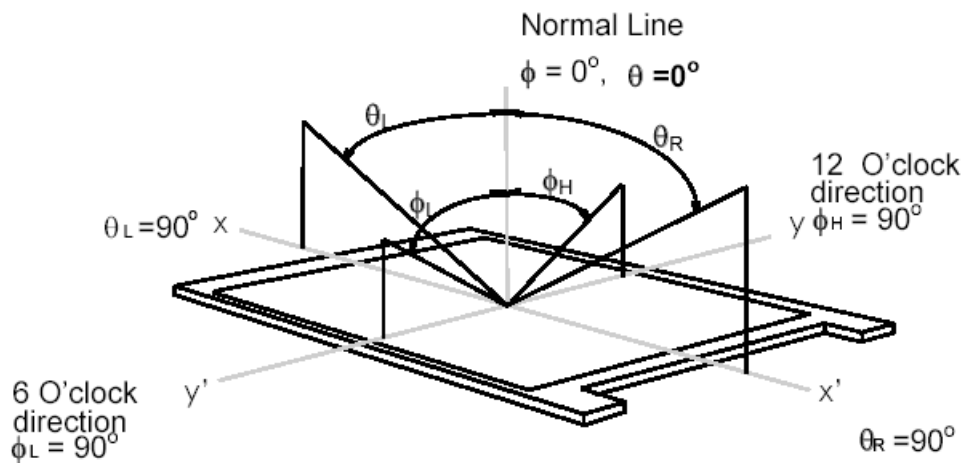
**Note 8:** Definition of response time:

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.



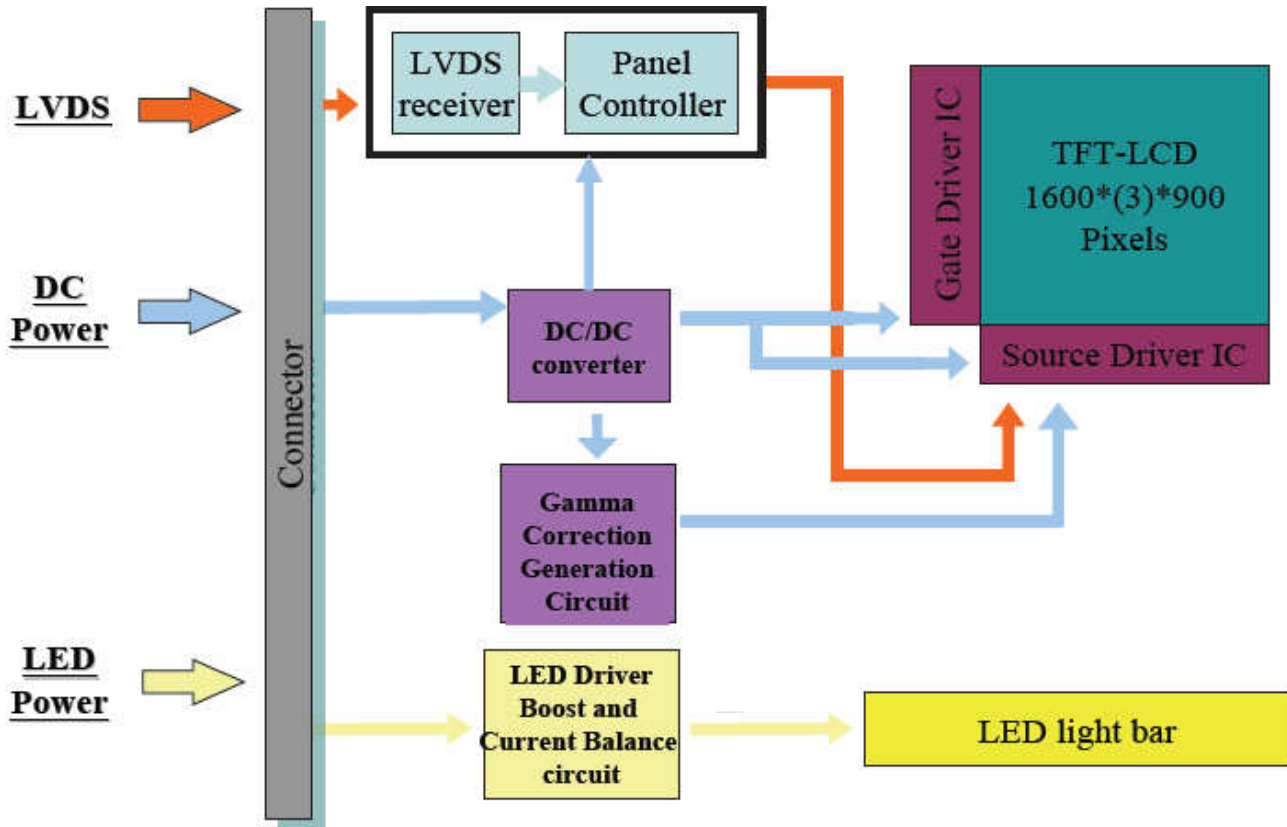
**Note 9.** Definition of viewing angle

Viewing angle is the measurement of contrast ratio  $\geq 10$ , at the screen center, over a  $180^\circ$  horizontal and  $180^\circ$  vertical range (off-normal viewing angles). The  $180^\circ$  viewing angle range is broken down as follows;  $90^\circ$  ( $\theta$ ) horizontal left and right and  $90^\circ$  ( $\phi$ ) 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

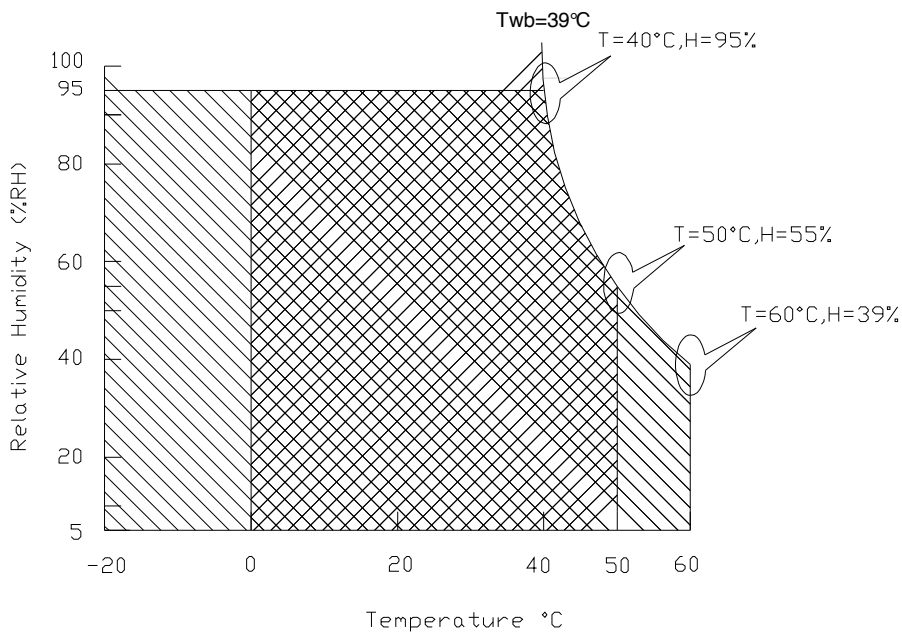
Item	Symbol	Min	Max	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	Note 4
Operation Humidity	HOP	5	95	[%RH]	Note 4
Storage Temperature	TST	-20	+60	[°C]	Note 4
Storage Humidity	HST	5	95	[%RH]	Note 4

Note 1: At Ta (25°C)

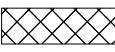

Note 2: Permanent damage to the device may occur if exceed maximum values

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;

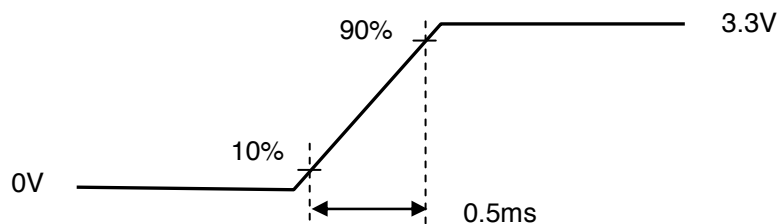
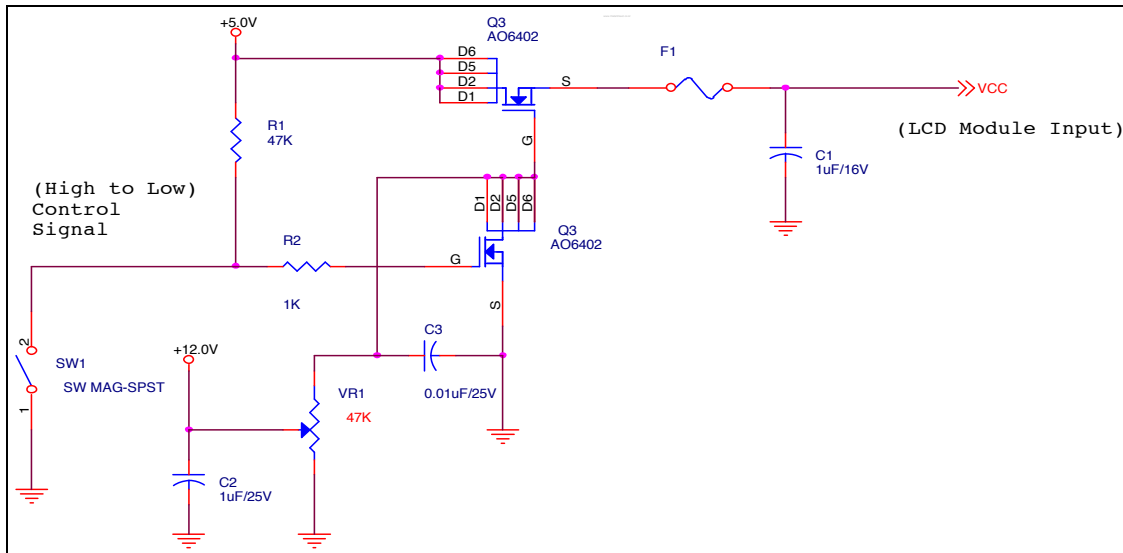
The power specification are measured under 25°C and frame frequency under 60Hz

Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
PDD	VDD Power	-	-	1.7	[Watt]	Note 1/2
IDD	IDD Current	-	-	500	[mA]	Note 1/2
IRush	Inrush Current	-	-	2000	[mA]	Note 3
VDDrp	Allowable Logic/LCD Drive Ripple Voltage	-	-	100	[mV] p-p	

Note 1 : Maximum Measurement Condition : Black Pattern

Note 2 : Typical Measurement Condition: Mosaic Pattern

Note 3 : Measure Condition



Vin rising time

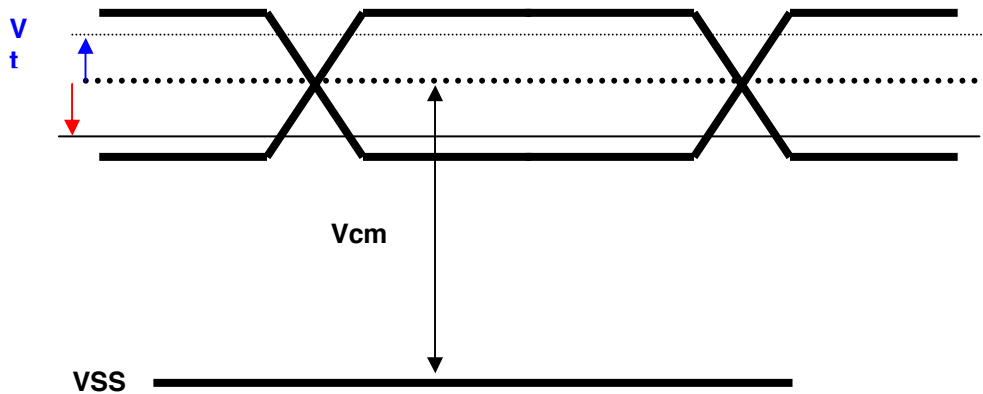
## 5.1.2 Signal Electrical Characteristics

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

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]
Vid	Differential Input Voltage	100	600	[mV]
Vcm	Differential Input Common Mode Voltage	1.125	1.375	[V]

Note: LVDS Signal Waveform





# Product Specification

AU OPTRONICS CORPORATION

## 5.2 Backlight Unit

### 5.2.1 LED Characteristics

Parameter	Symbol	Min	Typ	Max	Units	Condition
Backlight Power consumption	$P_{LED}$	-	4.82	4.88	[Watt]	(Ta=25°C), Note 1 Vin= 12 V or 5V
LED Life-Time	N/A	10,000	-	-	Hour	(Ta=25°C), Note 2 Ic=20 mA

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

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

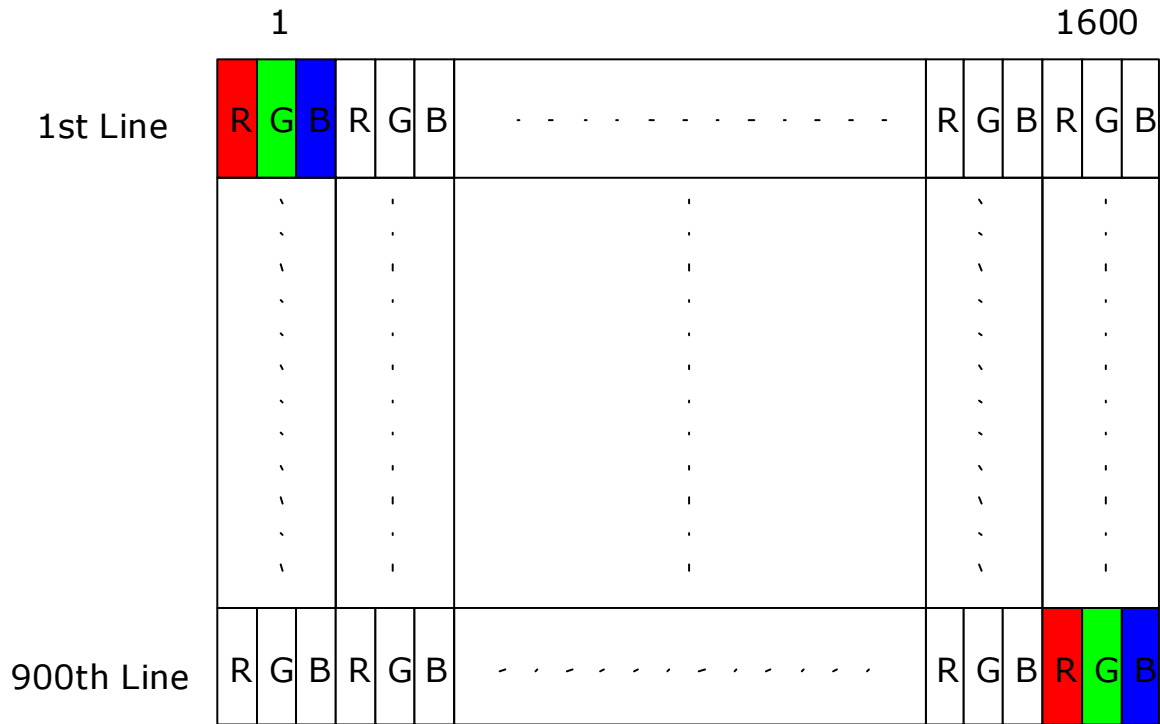
### 5.2.2 Backlight Input signal Characteristics

Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Power Supply	$V_{LED}$	7.0	12.0	21.0	[Volt]	Define as Connector Interface (Ta=25°C)
LED Enable Input High Level	$V_{LED\_EN}$	2.5	-	5.5	[Volt]	
LED Enable Input Low Level		-	-	0.8	[Volt]	
PWM Logic Input High Level	$V_{PWM\_EN}$	2.5	-	5.5	[Volt]	
PWM Logic Input Low Level		-	-	0.8	[Volt]	
PWM Input Frequency	$F_{PWM}$	100	200	20K	Hz	
PWM Duty ratio	Duty	5	-	100	%	

## 6. Signal Characteristic

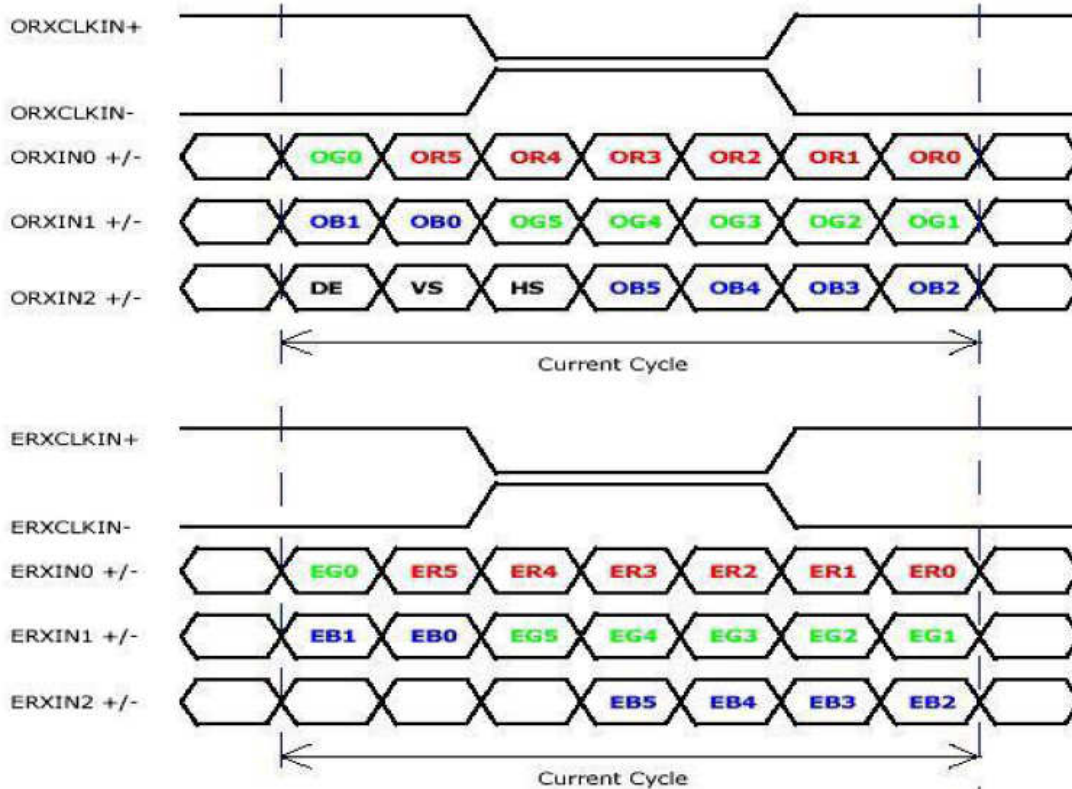
### 6.1 Pixel Format Image

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 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 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 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)

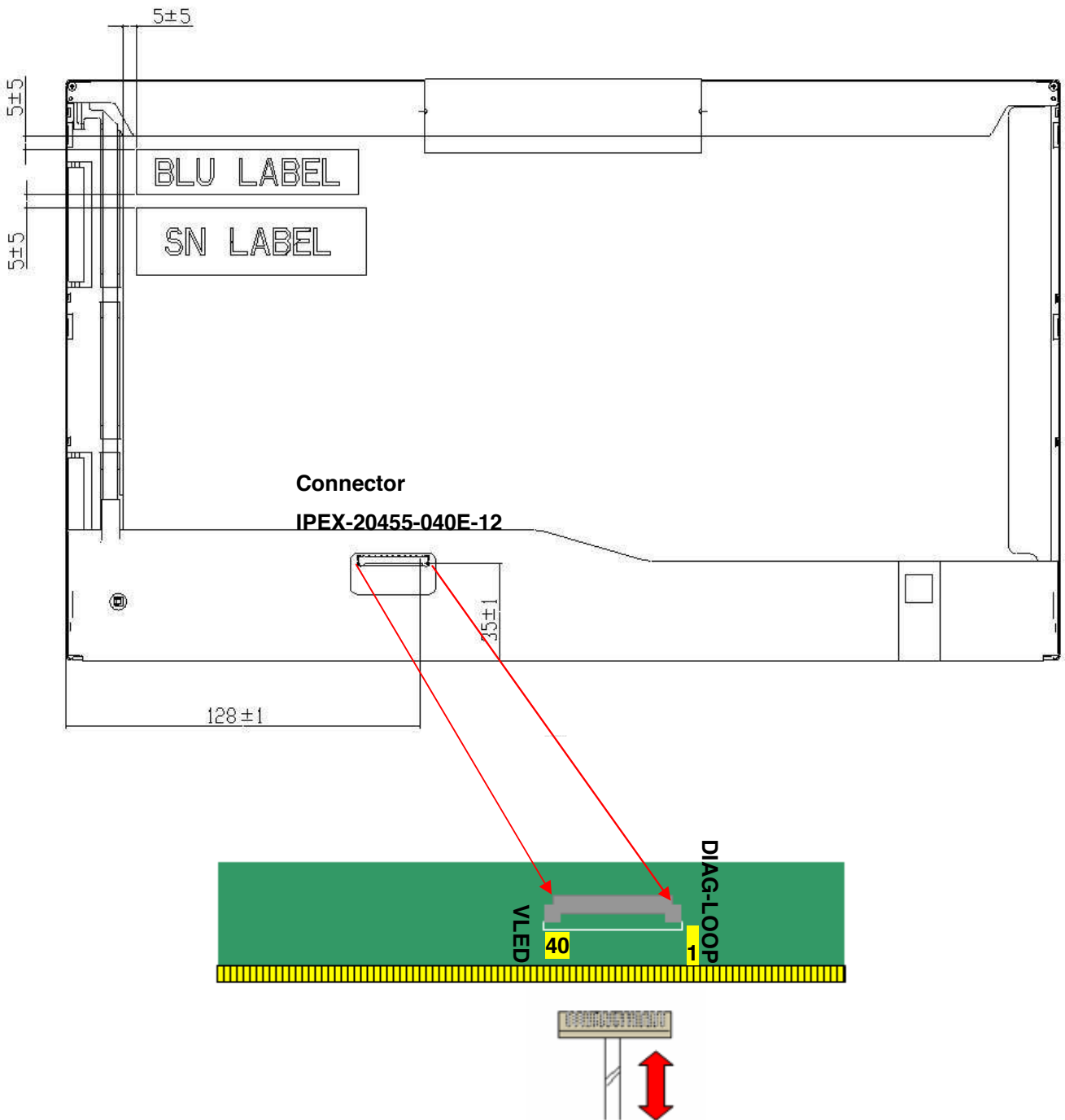


# Product Specification

AU OPTRONICS CORPORATION

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 6V-21V
39	VLED	LED Power Supply 6V-21V
40	VLED	LED Power Supply 6V-21V

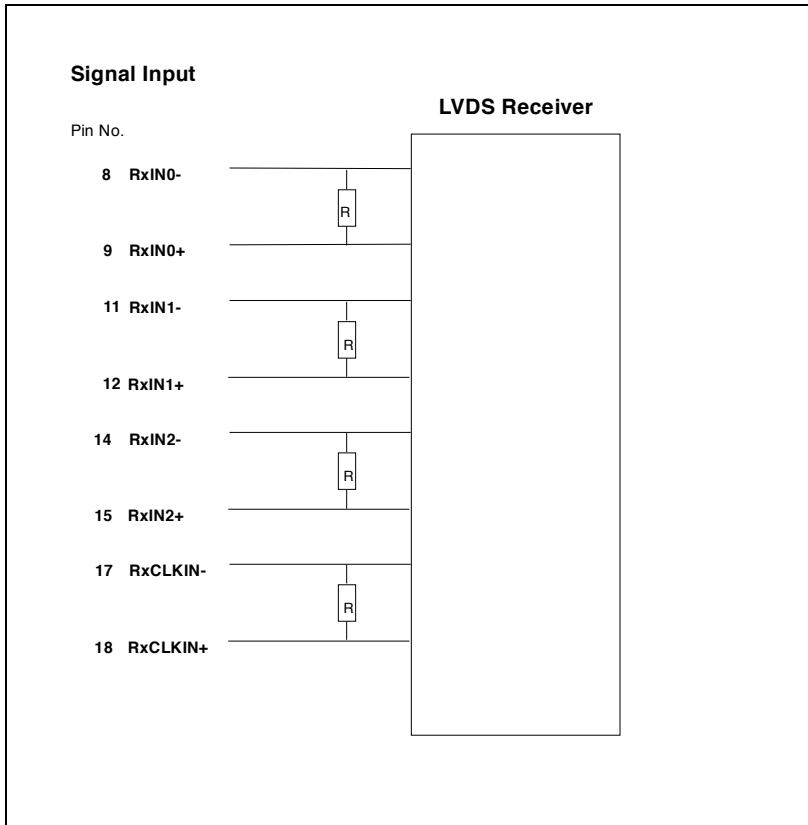
Note1: Start from right side



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



## 6.4 Interface Timing

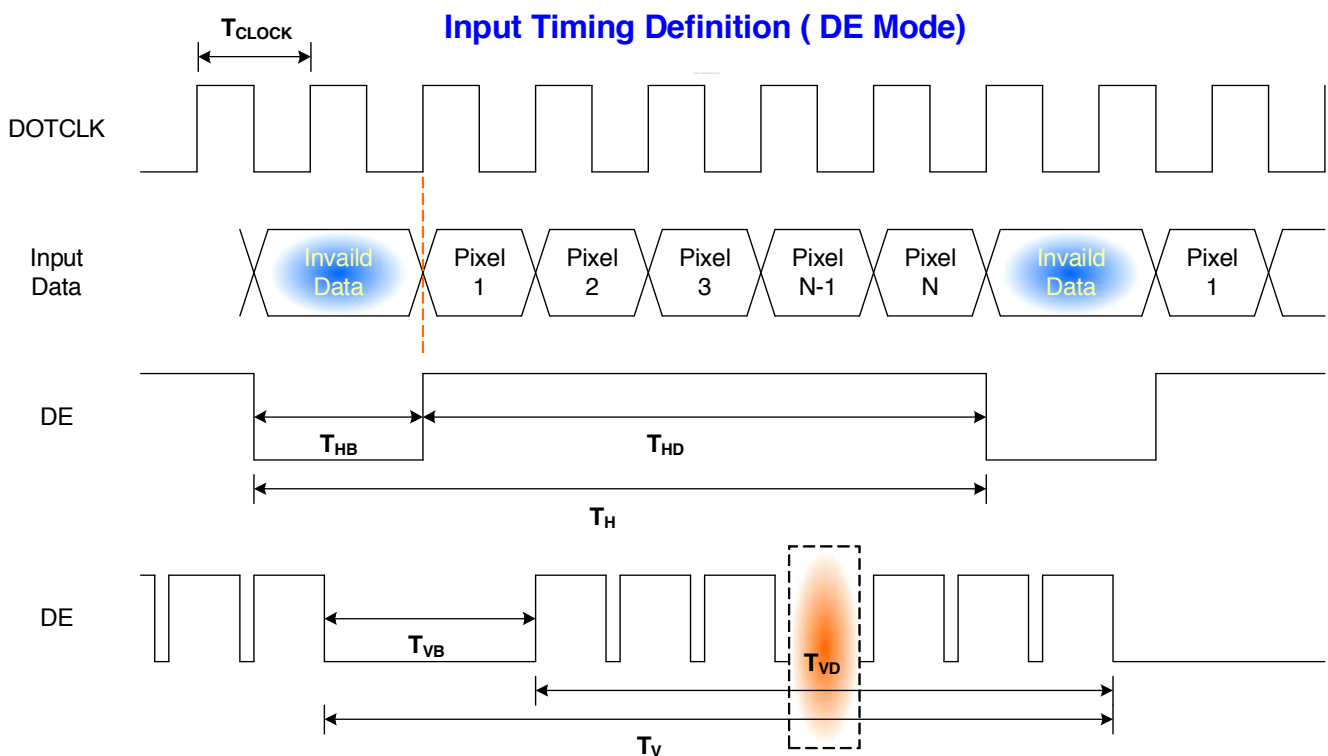
### 6.4.1 Timing Characteristics

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	$1/T_{\text{Clock}}$	-	59.4	72	MHz	
Vertical Section	Period	$T_V$	908	916	2047	$T_{\text{Line}}$
	Active	$T_{VD}$	900			
	Blanking	$T_{VB}$	8	16	-	
Horizontal Section	Period	$T_H$	830	1080	2047	$T_{\text{Clock}}$
	Active	$T_{HD}$	800			
	Blanking	$T_{HB}$	30	280	-	

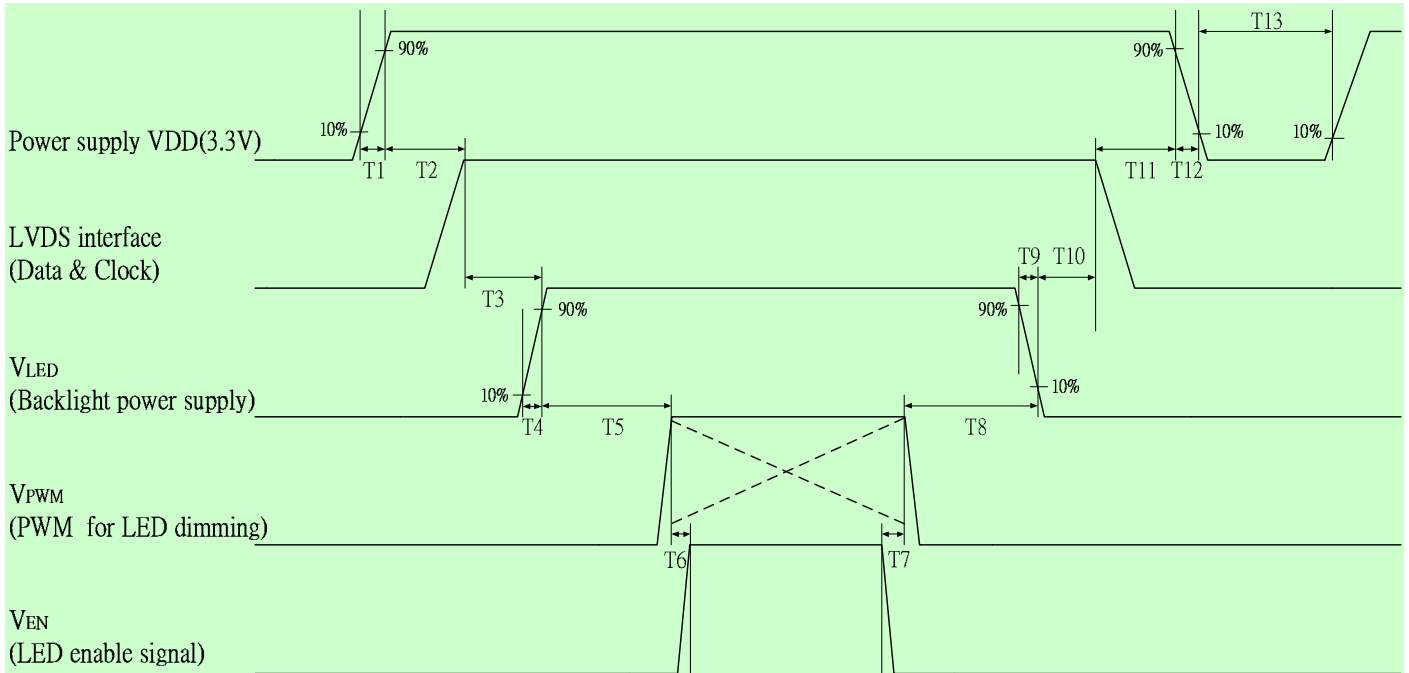
Note : DE mode only

### 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.	Typ.	Max.	
T1	0.5	-	10	ms
T2	0	-	50	
T3	200	-	-	
T4	0.5	-	10	
T5	10	-	-	
T6	10	-	-	
T7	0	-	-	
T8	10	-	-	
T9	0	-	10	
T10	200	-	-	
T11	0.5	-	50	
T12	0	-	10	
T13	400	-	-	



## 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 integrative 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

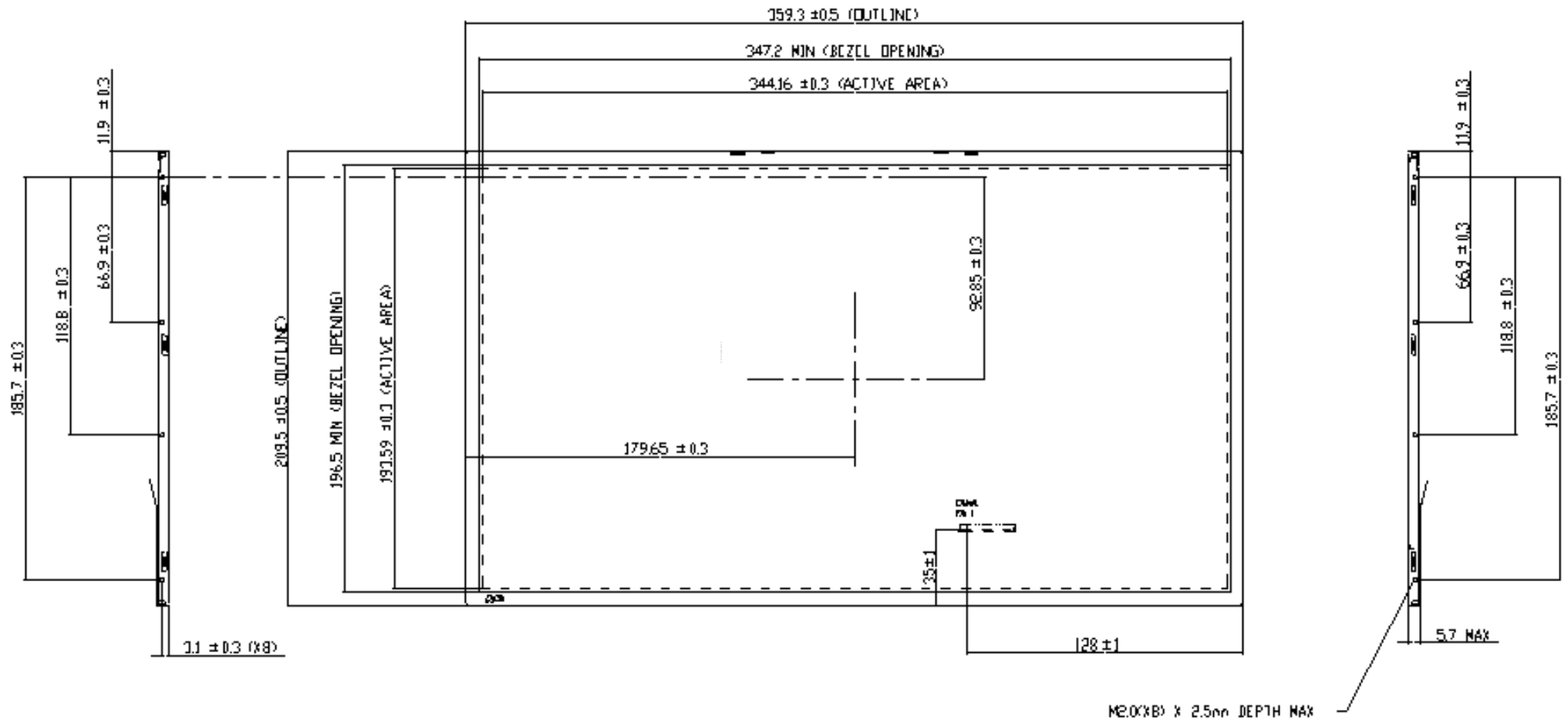
Items	Required Condition	Note
Temperature Humidity Bias	Ta= 40°C, 90%RH, 300h	
High Temperature Operation	Ta= 50°C, Dry, 300h	
Low Temperature Operation	Ta= 0°C, 300h	
High Temperature Storage	Ta= 60°C, 35%RH, 300h	
Low Temperature Storage	Ta= -20°C, 50%RH, 250h	
Thermal Shock Test	Ta=-20°Cto 60°C, Duration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

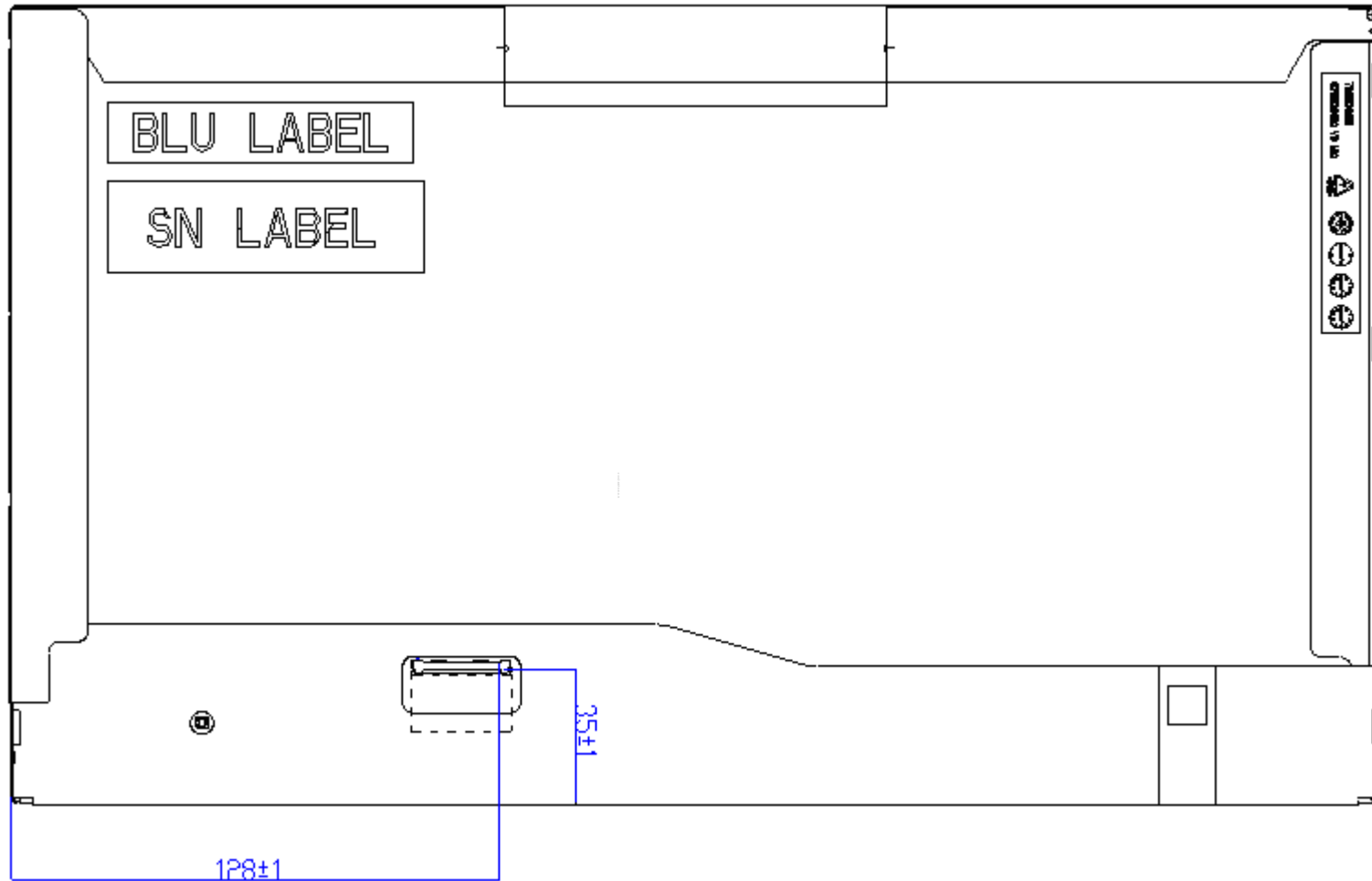
**Note1:** According to EN 61000-4-2 , ESD class B: Some performance degradation allowed. No data lost  
. Self-recoverable. No hardware failures.

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

## 11. Mechanical Characteristics

### 11.1 LCM Outline Dimension





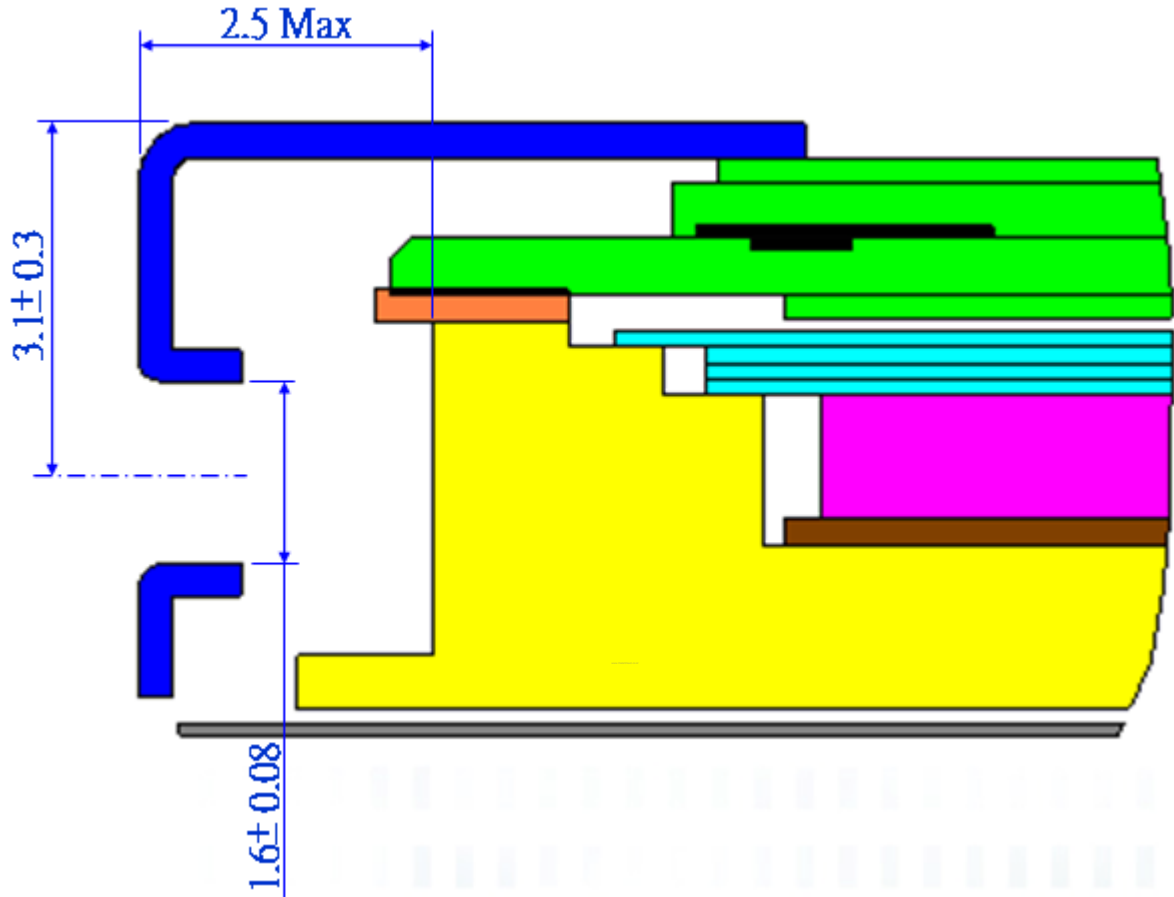
Note: Prevention IC damage, IC positions not allowed any overlap over these areas.

## 11.2 Screw Hole Depth and Center Position

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

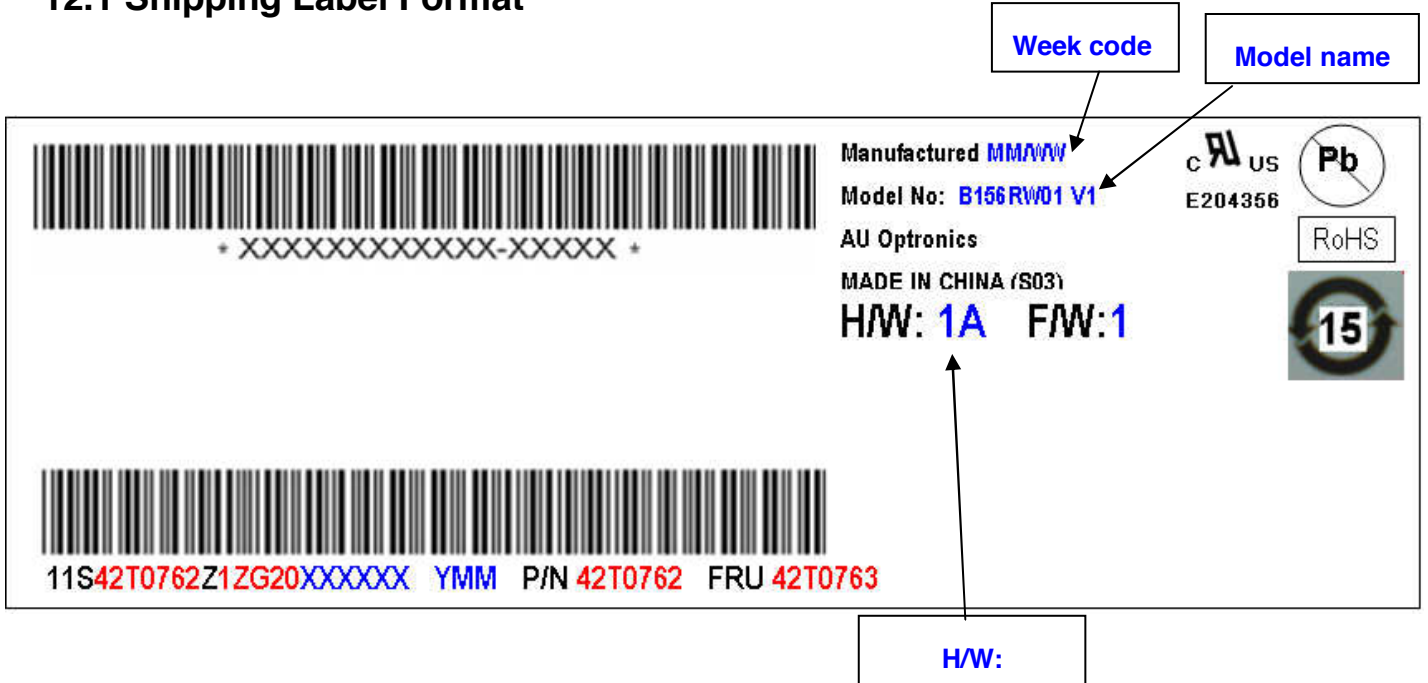
Screw hole center location, from front surface =  $3.1 \pm 0.3$ mm (See drawing)

Screw Torque: Maximum 2.5 kgf-cm



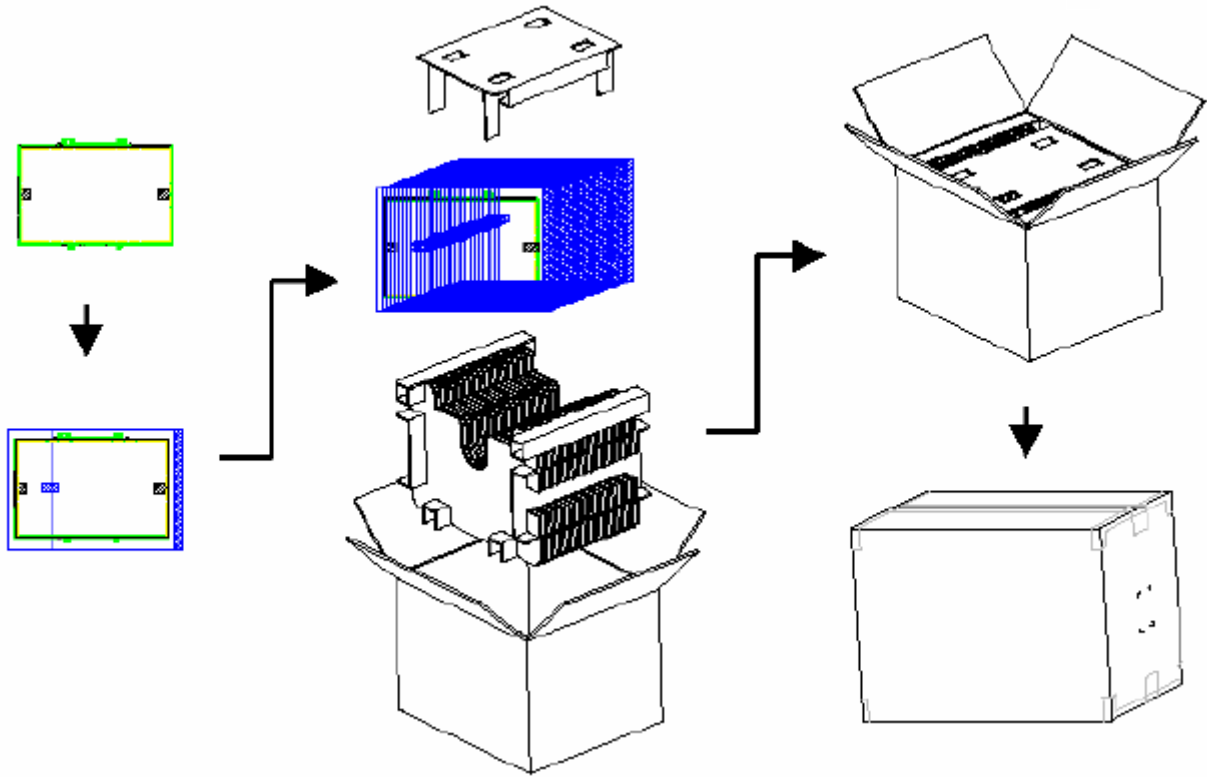
## 12. Shipping and Package

### 12.1 Shipping Label Format

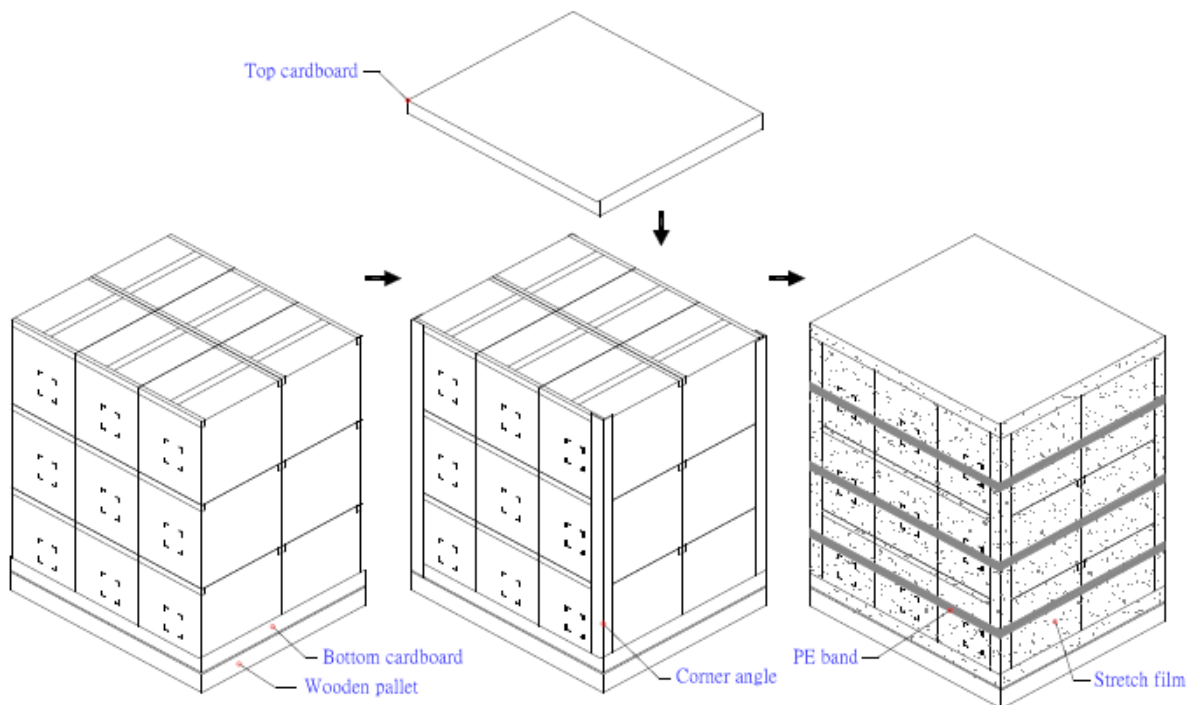


## 12.2 Carton package

The outside dimension of carton is 455(L)mm × 380(W)mm × 355(H)mm



## 12.3 Shipping package of palletizing sequence



Note : Limit of box palletizing = Max 3 layers(ship and stock conditions)





# Product Specification

AU OPTRONICS CORPORATION

## 13. Appendix: EDID description (TBD)

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)	Remarks	Value (Hex)	Value (Decimal)	Value (Binary)	Remarks
0	00	Header	00	EDID VESA Spec Fixed	00	0	00000000	
1	01	Header	FF	EDID VESA Spec Fixed	FF	255	11111111	
2	02	Header	FF	EDID VESA Spec Fixed	FF	255	11111111	
3	03	Header	FF	EDID VESA Spec Fixed	FF	255	11111111	
4	04	Header	FF	EDID VESA Spec Fixed	FF	255	11111111	
5	05	Header	FF	EDID VESA Spec Fixed	FF	255	11111111	
6	06	Header	FF	EDID VESA Spec Fixed	FF	255	11111111	
7	07	Header	00	EDID VESA Spec Fixed	00	0	00000000	
8	08	ID Manufacturer Name	#N/A		30	48	00110000	LEN
9	09	ID Manufacturer Name	#N/A		AE	174	10101110	
10	0A	ID Product Code	#N/A		B1	177	10110001	15.6"W 16:9 HD+ 1600x900 LED B/L
11	0B	ID Product Code	#N/A		40	64	01000000	
12	0C	ID Product Code	00	not used	00	0	00000000	
13	0D	ID Serial Number (32-bit serial number)	00	not used	00	0	00000000	# 0
14	0E	ID Serial Number (32-bit serial number)	00	not used	00	0	00000000	
15	0F	ID Serial Number (32-bit serial number)	00	not used	00	0	00000000	
16	10	Week of Manufacture			01	1	00000001	1 weeks
17	11	Year of Manufacture			12	18	00010010	2008 years
18	12	EDID Structure version	01		01	1	00000001	
19	13	EDID Revision	03	Ver. 1.3	03	3	00000011	Ver. 1.3
20	14	Video Input Definition	80	Digital	80	128	10000000	Digital
21	15	Max H Image Size(cm)			22	34	00100010	34cm
22	16	Max V Image Size(cm)			13	19	00010011	19cm
23	17	Display gamma (gamma x 100)-100	78	2.2	78	120	01111000	2.20
24	18	Feature support(DPMS)	EA	Lenovo Spec fixed	EA	234	11101010	Standby , Suspend , Active Off/Very Low Power , RGB color display , Preferred Timing Mode
25	19	Red/Green Low Bits			C9	201	11001001	
26	1A	Blue/White Low Bits			95	149	10010101	
27	1B	Red x			9E	158	10011110	0.620
28	1C	Red y			57	87	01010111	0.340
29	1D	Green x			54	84	01010100	0.330
30	1E	Green y			92	146	10010010	0.571
31	1F	Blue x			26	38	00100110	0.150
32	20	Blue y			0F	15	00001111	0.060
33	21	White x			50	80	01010000	0.313
34	22	White y			54	84	01010100	0.329
35	23	Established Timing 1	00	Lenovo Spec fixed	00	0	00000000	
36	24	Established Timing 2	00	Lenovo Spec fixed	00	0	00000000	
37	25	Manufacturer's Timings	00		00	0	00000000	
38	26	Standard Timing Identification #1	01	Lenovo Spec fixed	01	1	00000001	
39	27	Standard Timing Identification #1	01	Lenovo Spec fixed	01	1	00000001	
40	28	Standard Timing Identification #2	01	Lenovo Spec fixed	01	1	00000001	
41	29	Standard Timing Identification #2	01	Lenovo Spec fixed	01	1	00000001	
42	2A	Standard Timing Identification #3			01	1	00000001	
43	2B	Standard Timing Identification #3			01	1	00000001	
44	2C	Standard Timing Identification #4			01	1	00000001	
45	2D	Standard Timing Identification #4			01	1	00000001	
46	2E	Standard Timing Identification #5			01	1	00000001	
47	2F	Standard Timing Identification #5			01	1	00000001	
48	30	Standard Timing Identification #6			01	1	00000001	
49	31	Standard Timing Identification #6			01	1	00000001	
50	32	Standard Timing Identification #7			01	1	00000001	
51	33	Standard Timing Identification #7			01	1	00000001	
52	34	Standard Timing Identification #8			01	1	00000001	
53	35	Standard Timing Identification #8			01	1	00000001	
54	36	Pixel Clock*10,000 (LSB)			68	104	01101000	106MHz (Refresh rate 60.22 Hz)
55	37	Pixel Clock*10,000 (MSB) /			29	41	00101001	
56	38	Horizontal Active			40	64	01000000	1600 pixels
57	39	Horizontal Blanking			4A	74	01001010	330 pixels
58	3A	Horizontal Active : Horizontal Blanking			61	97	01100001	
59	3B	Vertical Active			84	132	10000100	900 lines
60	3C	Vertical Blanking			0C	12	00001100	12 lines
61	3D	Vertical Active : Vertical Blanking			30	48	00110000	
62	3E	Horizontal Sync. Offset			40	64	01000000	64 pixels
63	3F	Horizontal Sync Pulse Width			2A	42	00101010	42 pixels
64	40	Vertical Sync Offset : Sync Width			33	51	00110011	3 lines / 3 lines
65	41	Horizontal Vertical Sync Offset*Width upper 2bits			00	0	00000000	
66	42	Horizontal Image Size			58	88	01011000	344 mm
67	43	Vertical Image Size			C1	193	11000001	193 mm
68	44	Horizontal & Vertical Image Size			10	16	00010000	
69	45	Horizontal Border			00	0	00000000	0 pixels
70	46	Vertical Border			00	0	00000000	0 lines
71	47	Flags			18	24	00011000	Non-interlaced , Normal display, no stereo , Digital separate , Vertical Polarity Negative , Horizontal Polarity Negative



# Product Specification

AU OPTRONICS CORPORATION

Byte# (decimal)	Byte# (HEX)	Field Name and Comments	Value (HEX)	Remarks	Value (Hex)	Value (Decimal)	Value (Binary)	Remarks
72	48	Pixel Clock/10,000 (LSB) (Slow Refresh rate)			68	104	01101000	106MHz (Refresh rate 50.01 Hz)
73	49	Pixel Clock/10,000 (MSB) / (Slow Refresh rate)			29	41	00101001	
74	4A	Horizontal Active			40	64	01000000	1600 pixels
75	4B	Horizontal Blanking			D4	212	11010100	724 pixels
76	4C	Horizontal Active : Horizontal Blanking			62	98	01100010	
77	4D	Vertical Active			84	132	10000100	900 lines
78	4E	Vertical Blanking			0C	12	00001100	12 lines
79	4F	Vertical Active : Vertical Blanking			30	48	00110000	
80	50	Horizontal Sync. Offset			40	64	01000000	64 pixels
81	51	Horizontal Sync Pulse Width			2A	42	00101010	42 pixels
82	52	Vertical Sync Offset : Sync Width			33	51	00110011	3 lines / 3 lines
83	53	Horizontal Vertical Sync OffsetWidth upper 2bits = 0			00	0	00000000	
84	54	Horizontal Image Size			58	88	01011000	344 mm
85	55	Vertical Image Size			C1	193	11000001	193 mm
86	56	Horizontal & Vertical Image Size			10	16	00010000	
87	57	Horizontal Border			00	0	00000000	0 pixels
88	58	Vertical Border			00	0	00000000	0 lines
89	59	Flags			18	24	00011000	Non-interlaced , Normal display, no stereo , Digital separate , Vertical Polarity Negative , Horizontal Polarity Negative
90	5A	Flag	00	VESA Spec Fixed	00	0	00000000	
91	5B	Flag	00	VESA Spec Fixed	00	0	00000000	
92	5C	Flag	00	VESA Spec Fixed	00	0	00000000	
93	5D	Data Type Tag	0F	Lenovo Spec fixed	0F	15	00001111	Description defined by manufacture
94	5E	Flag	00	VESA Spec Fixed	00	0	00000000	
95	5F	(Horizontal active pixel /8)-31	#N/A	#N/A	A9	169	10101001	1600 pixel
96	60	Image Aspect Ratio	#N/A	#N/A	09	9	00001001	16 : 9
97	61	Middle Refresh Rate	00		32	50	00110010	50 Hz
98	62	(Horizontal active pixel /8)-31	#N/A	#N/A	A9	169	10101001	1600 pixel
99	63	Image Aspect Ratio	#N/A	#N/A	09	9	00001001	16 : 9
100	64	Low Refresh Rate	00		28	40	00101000	40 Hz
101	65	Brightness(1/10nit)	00		16	22	00010110	220 nit
102	66	Feature flag			09	9	00001001	TN LED Backlight
103	67	Reserved	00	Lenovo Spec fixed	00	0	00000000	
104	68	LCD Supplier manufacture Code (3 character ID)			06	6	00000110	AUO
105	69				AF	175	10101111	
106	6A	LCD Supplier Product code			56	86	01010110	V
107	6B	LCD Supplier Product code			31	49	00110001	1
108	6C	Flag	00	VESA Spec Fixed	00	0	00000000	
109	6D	Flag	00	VESA Spec Fixed	00	0	00000000	
110	6E	Flag	00	VESA Spec Fixed	00	0	00000000	
111	6F	Data Type Tag	FE	Lenovo Spec fixed	FE	254	11111110	ASCII String
112	70	Flag	00	VESA Spec Fixed	00	0	00000000	
113	71	Model Name			42	66	01000010	[B]
114	72	Model Name			31	49	00110001	[I]
115	73	Model Name			35	53	00110101	[S]
116	74	Model Name			36	54	00110110	[6]
117	75	Model Name			52	82	01010010	[R]
118	76	Model Name			57	87	01010111	[W]
119	77	Model Name			30	48	00110000	[0]
120	78	Model Name			31	49	00110001	[1]
121	79	Model Name			20	32	00100000	[I]
122	7A	Model Name			56	86	01010110	[M]
123	7B	Model Name			31	49	00110001	[1]
124	7C	Model Name			20	32	00100000	[I]
125	7D	Model Name			0A	10	00001010	[*]
126	7E	Extension flag	00	VESA Spec Fixed	00	0	00000000	
127	7F	Checksum			49	73	01001001	