




# Product Specification

AU OPTRONICS CORPORATION

(✓) Preliminary Specifications

( ) Final Specifications

Module	15.6" (15.55) FHD 16:9 Color TFT-LCD with LED Backlight design
Model Name	B156HW01 V4 (H/W:0A)
Note (  )	R,G phosphor LED Backlight with driving circuit design

Customer

Date

Checked &  
Approved by

Date

Approved by

Date

Prepared by

Ining Lai

10/28/2009

Note: This Specification is subject to change without notice.

**NBBU Marketing Division /  
AU Optronics corporation**



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# Product Specification

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## Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.1 2009/05/13	All	Preliminary Edition for Customer		
0.2 2009/10/28	All	Updated Shipping leabel		

## 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

B156HW01 V4 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 16:9 FHD (1920(H) x 1080(V)) screen and 262k colors (RGB 6-bits data driver) with LED backlight driving circuit. All input signals are LVDS interface compatible.

B156HW01 V4 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			
Active Area	[mm]	344.16 x 193.59			
Pixels H x V		1920x3(RGB) x 1080			
Pixel Pitch	[mm]	<b>0.17925 x 0.17925</b>			
Pixel Format		R.G.B. Vertical Stripe			
Display Mode		Normally White			
White Luminance ( <b>I<sub>LED</sub>=20mA</b> ) ( <b>Note: I<sub>LED</sub> is LED current</b> )	[cd/m <sup>2</sup> ]	270 typ. (5 points average) 230 min. (5 points average)			
Luminance Uniformity		1.25 max. (5 points)			
Contrast Ratio		400 :1			
Response Time	[ms]	8 typ / 16 Max			
Nominal Input Voltage VDD	[Volt]	+3.3 typ.			
Power Consumption	[Watt]	11.5 max. (Include Logic and Blu power)			
Weight	[Grams]	475 max.			
Physical Size <b>Without inverter, bracket.</b>	[mm]		Min.	Typ.	Max.
		Length	358.8	359.3	359.8
		Width	209.0	209.5	210
		Thickness	-	-	5.8
Electrical Interface		2 channel LVDS			
Glass Thickness	[mm]	0.5			
Surface Treatment		Anti-glare, Hardness 2H,Haze=42%±7 Reflection type=normal, Reflection ≤ 3%			
Support Color		262K colors ( RGB 6-bit )			
Temperature Range Operating Storage (Non-Operating)	[°C]	0 to +50			
	[°C]	-20 to +60			
RoHS Compliance		RoHS Compliance			



# Product Specification

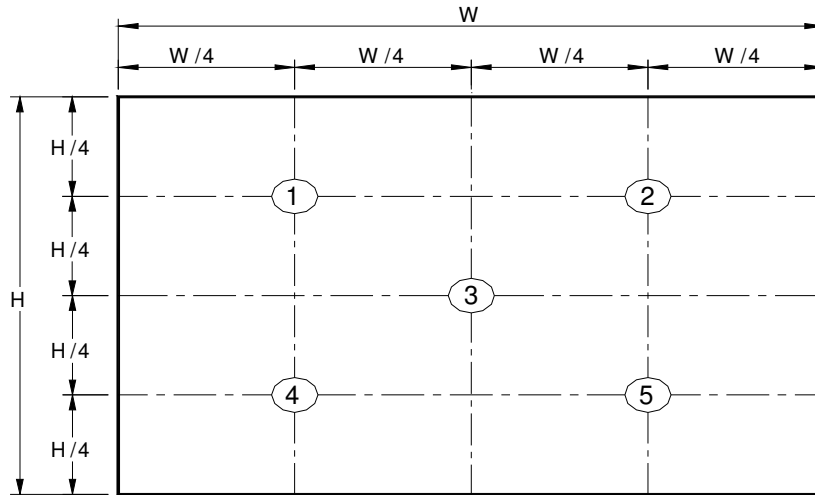
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## 2.2 Optical Characteristics

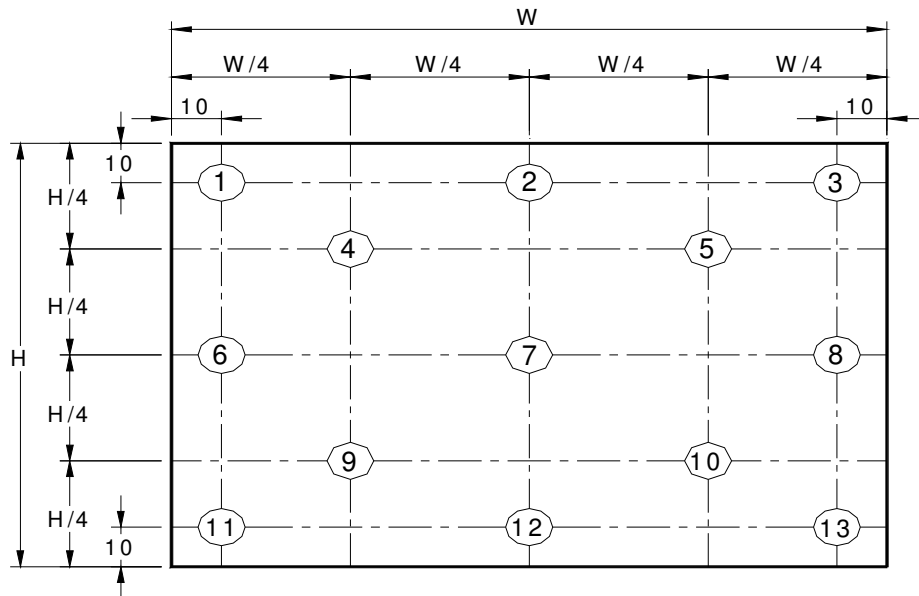
The optical characteristics are measured under stable conditions at 25°C (Room Temperature) :

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance ILED=20mA			5 points average	230	270	-	cd/m²	1, 4, 5.
Viewing Angle		θ <sub>R</sub> θ <sub>L</sub>	Horizontal (Right) CR = 10 (Left)	60 60	70 70	- -	degre e	4, 9
		ψ <sub>H</sub> ψ <sub>L</sub>	Vertical (Upper) CR = 10 (Lower)	45 50	60 60	- -		
Luminance Uniformity		δ <sub>5P</sub>	5 Points	-	-	1.25		1, 3, 4
Luminance Uniformity		δ <sub>13P</sub>	13 Points	-	-	1.50		2, 3, 4
Contrast Ratio		CR		300	400	-		4, 6
Cross talk		%				4		4, 7
Response Time		T <sub>r</sub>	Rising	-	6	9	msec	4, 8
		T <sub>f</sub>	Falling	-	2	5		
		T <sub>RT</sub>	Rising + Falling	-	8	14		
Color / Chromaticity Coodinates	Red	R <sub>x</sub>	CIE 1931	0.646	0.676	0.706	-	4
		R <sub>y</sub>		0.283	0.313	0.343		
	Green	G <sub>x</sub>		0.187	0.217	0.247		
		G <sub>y</sub>		0.631	0.661	0.691		
	Blue	B <sub>x</sub>		0.112	0.142	0.172		
		B <sub>y</sub>		0.037	0.067	0.097		
	White	W <sub>x</sub>		0.263	0.313	0.363		
		W <sub>y</sub>		0.279	0.329	0.379		
NTSC		%		--	95			

**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

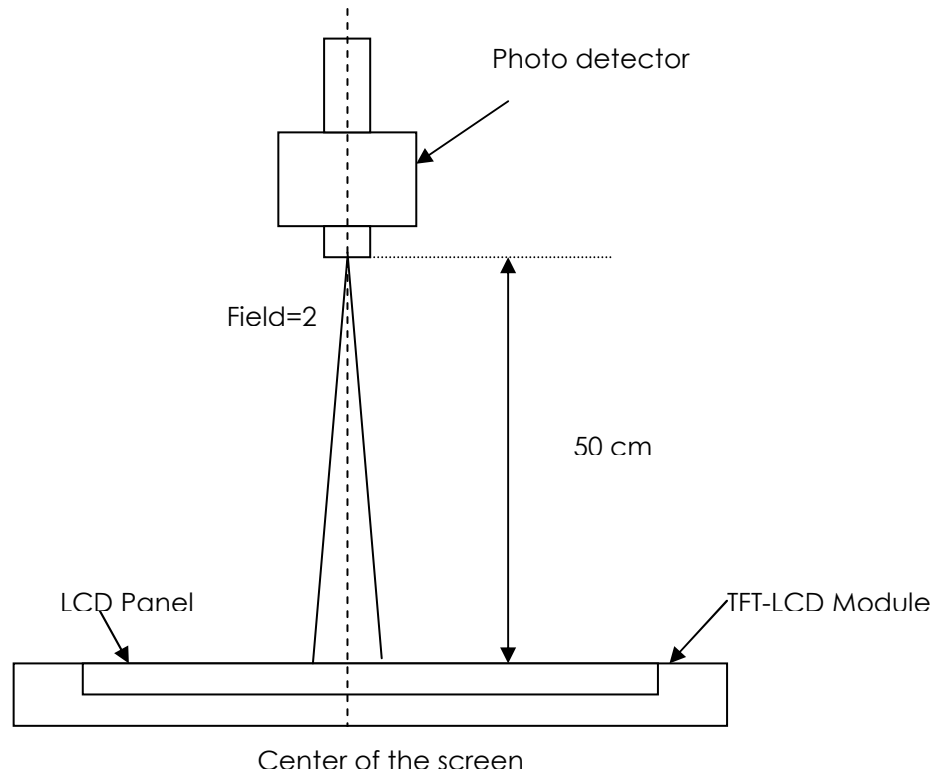
$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

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

**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)

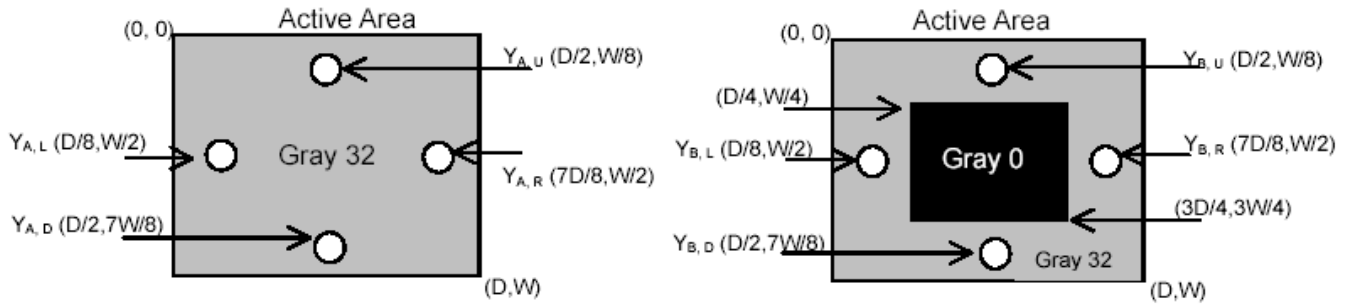
$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where

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

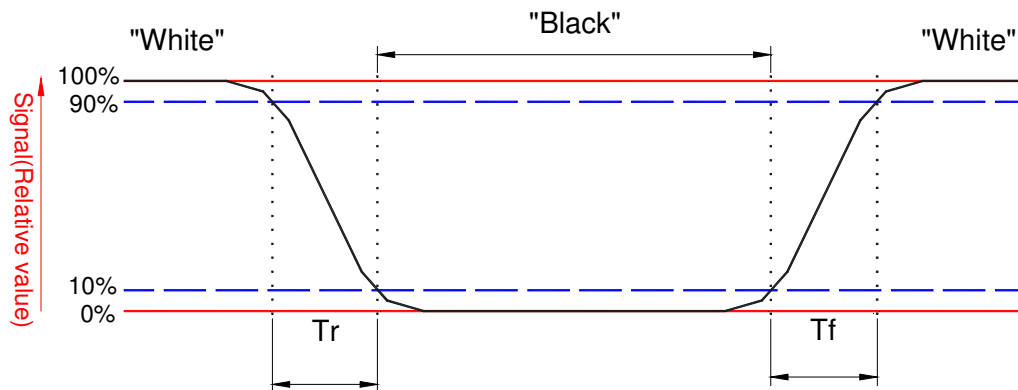
$Y_B$  = Luminance of measured location with gray level 0 pattern (cd/m<sup>2</sup>)





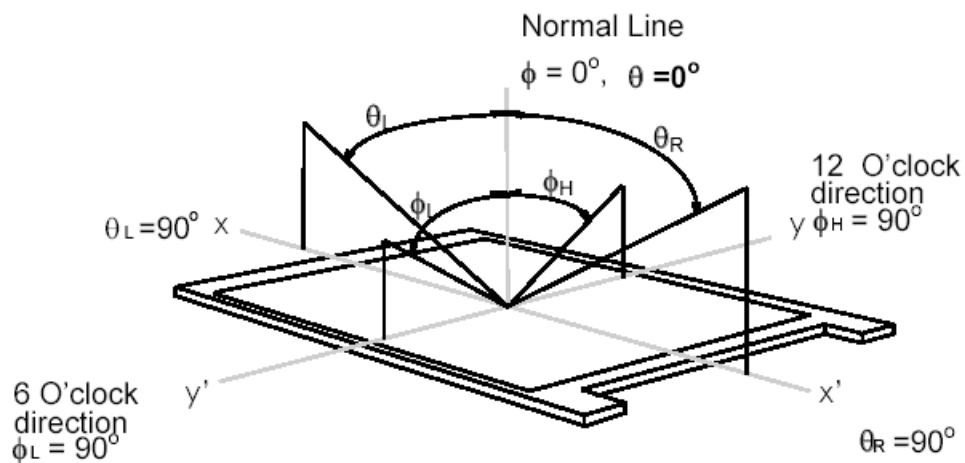
**Note 8:** Definition of response time:

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.



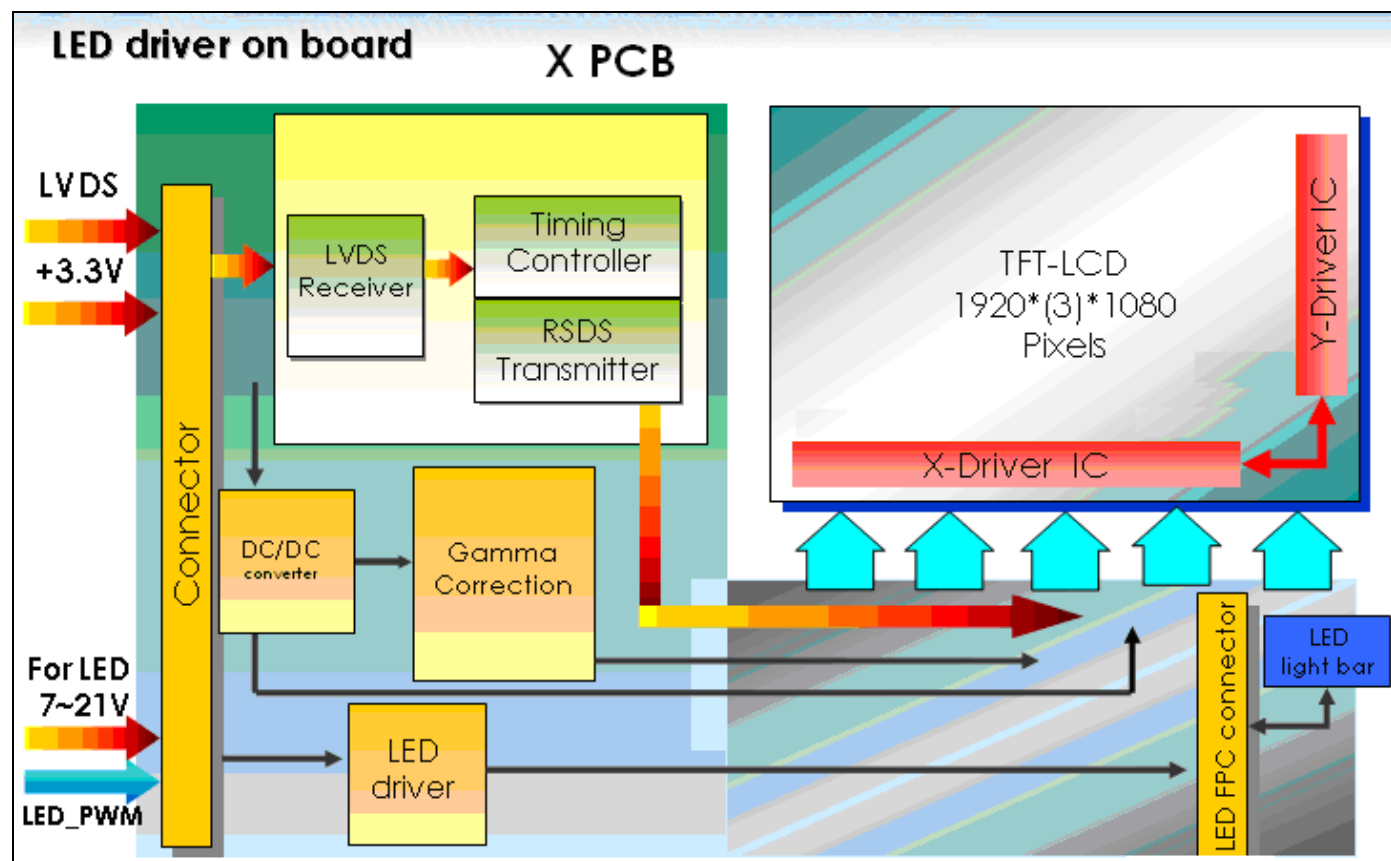
## Note 9. Definition of viewing angle

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.



## 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

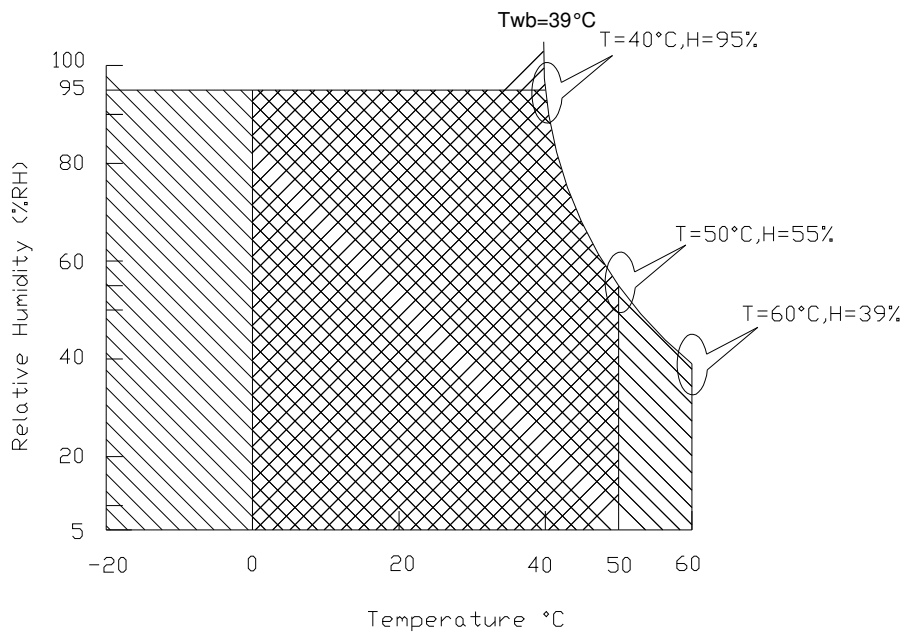
Item	Symbol	Min	Max	Unit	Conditions
Operating	TOP	0	+50	[°C]	Note 4
Operation Humidity	HOP	5	95	[%RH]	Note 4
Storage Temperature	TST	-20	+60	[°C]	Note 4
Storage Humidity	HST	5	95	[%RH]	Note 4

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

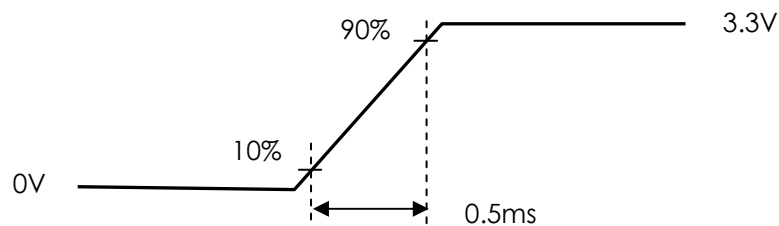
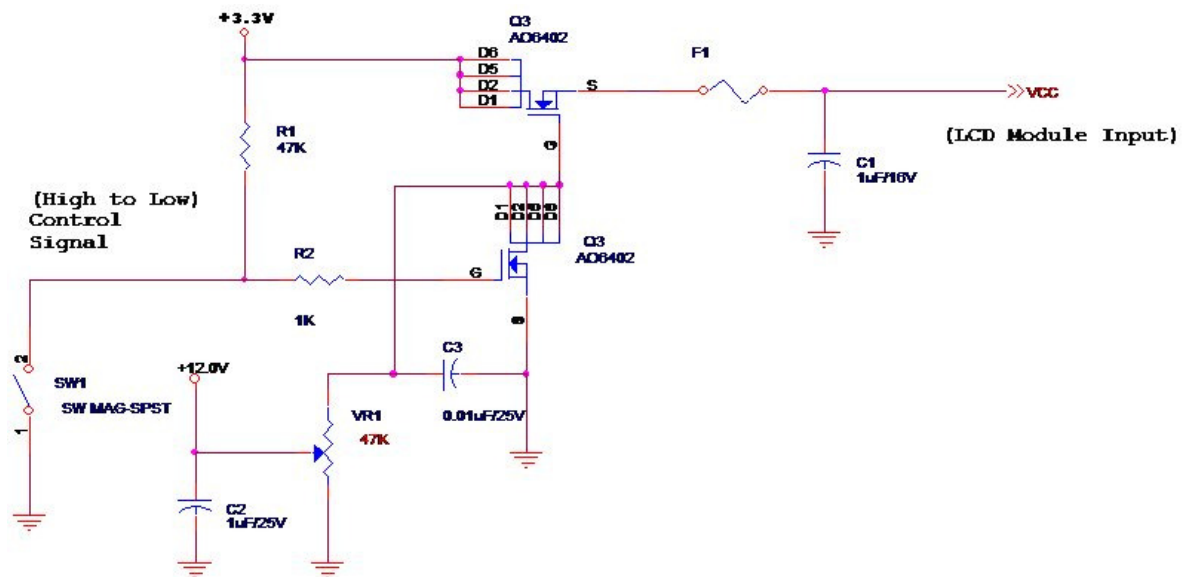
Input power specifications are as follows;

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	-	-	2.0	[Watt]	Note 1/2
IDD	IDD Current	-	-	606	[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 at 3.3V driving voltage. ( $P_{max}=V_{3.3} \times I_{black}$ )

Note 2 : Measure Condition



Vin rising time

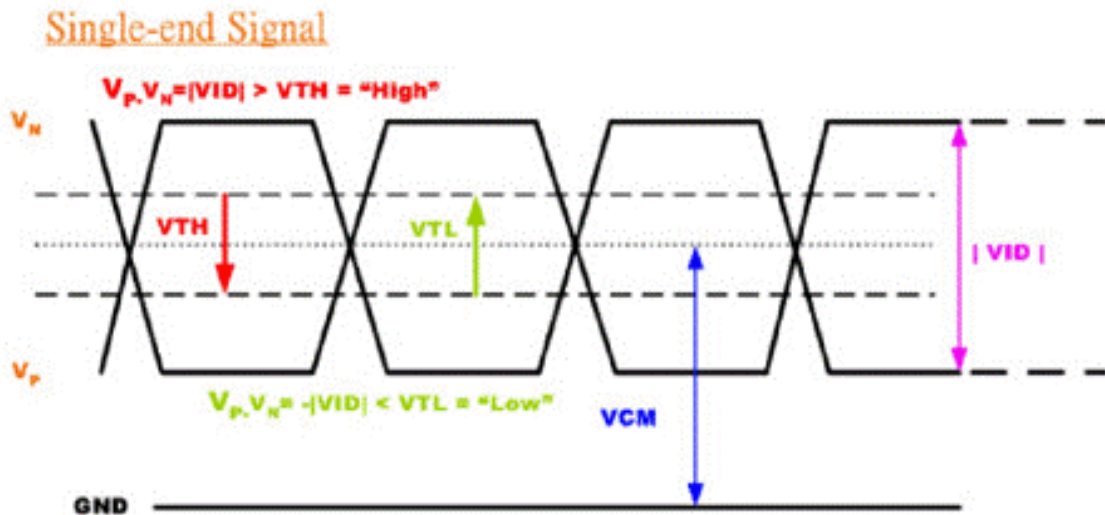
## 5.1.2 Signal Electrical Characteristics

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 ( $V_{cm}=+1.2V$ )	-	100	[mV]
$V_{TL}$	Differential Input Low Threshold ( $V_{cm}=+1.2V$ )	-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	-	9.0	9.6	[Watt]	(Ta=25°C), Note 1 Vin =12V
LED Life-Time	N/A	10,000	-	-	Hour	(Ta=25°C), Note 2 If=20 mA

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

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

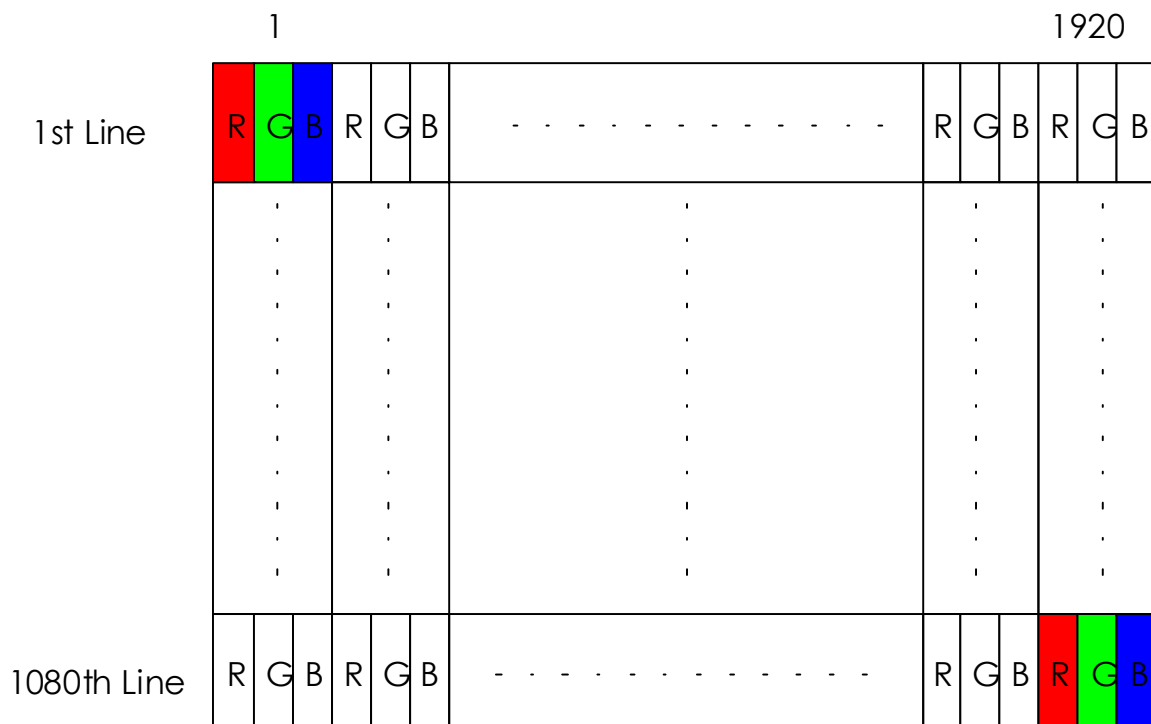
### 5.2.2 Backlight input signal characteristics

Parameter	Symbol	Min	Typ	Max	Units	Remark
LED Power Supply	VLED	7.0	12.0	21.0	[Volt]	Define as Connector Interface (Ta=25°C)
LED Enable Input High Level	VLED_EN	2.5	-	5.5	[Volt]	
LED Enable Input Low Level		-	-	0.8	[Volt]	
PWM Logic Input High Level	VPWM_EN	2.5	-	5.5	[Volt]	
PWM Logic Input Low Level		-	-	0.8	[Volt]	
PWM Input Frequency	FPWM	100	200	20k	Hz	
PWM Duty Ratio	Duty	5	--	100	%	

## 6. Signal Characteristic

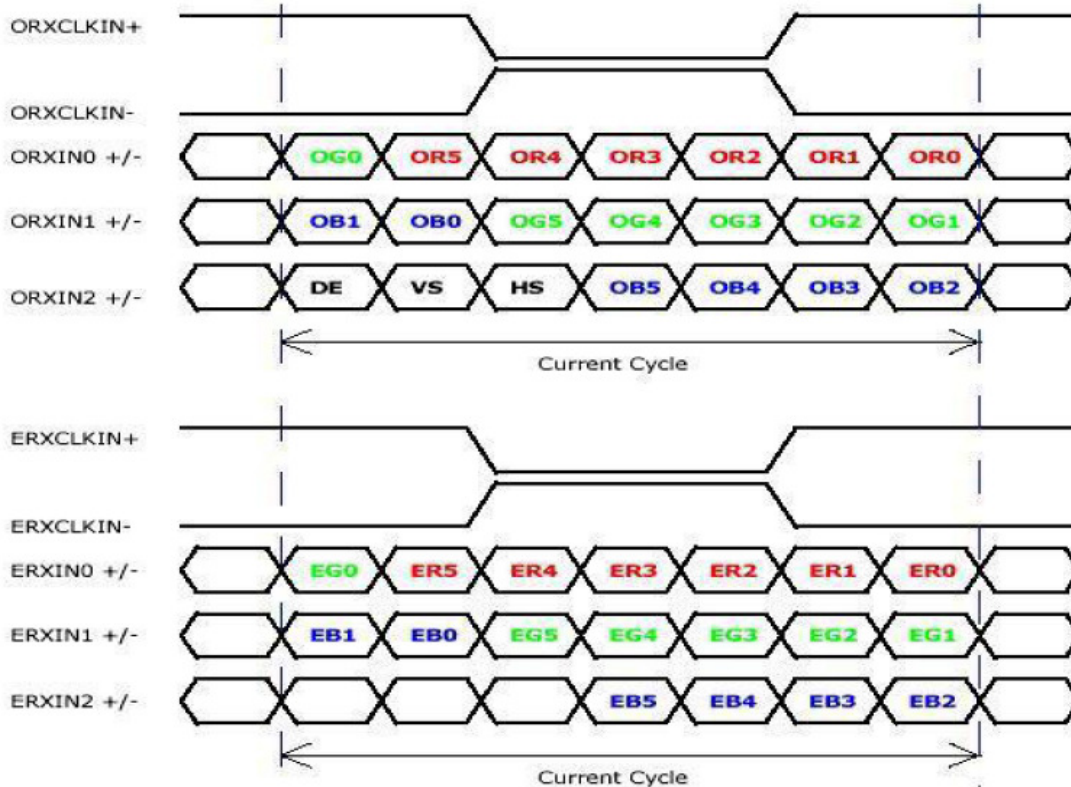
### 6.1 Pixel Format Image

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.
	Red-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.
	Green-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.
	Blue-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

### 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	IPEX or compatible
Type / Part Number	IPEX 20455-040E-12 or compatible
Mating Housing/Part Number	IPEX 20353-040T-11 or compatible

### 6.3.2 Pin Assignment

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

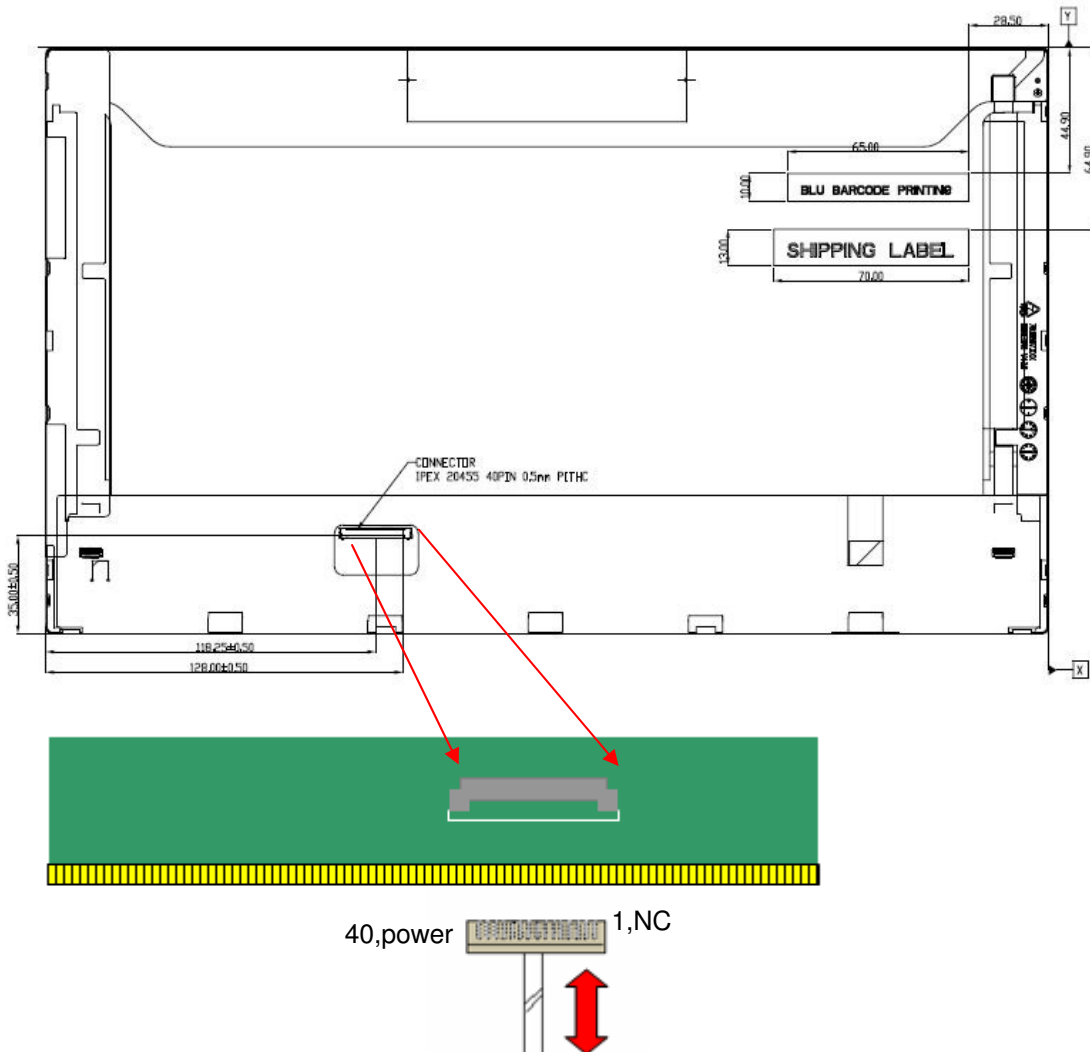
Pin	Signal	Description
1	NC	No connection (Reserve)
2	AVDD	PowerSupply,3.3V (typical)
3	AVDD	PowerSupply,3.3V (typical)
4	DVDD	DDC 3.3Vpower
5	NC	No Connection (Reserve)
6	SCL	DDCClock
7	SDA	DDCData
8	Odd_Rin0-	-LVDSdifferential data input(R0-R5,G0)
9	Odd_Rin0+	+LVDSdifferential data input(R0-R5,G0)
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_ClkIN+	+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)



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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_ClkIN+	+LVDSdifferential clock input
31	GND	Ground-Shield
32	VLED_GND	LED Ground
33	VLED_GND	LED Ground
34	NC	No connection (Reserve)
35	PWM	System PWM Logic Input level
36	LED_EN	LED enable input level
37	NC	No Connection (Reserve)
38	VLED	LED Power Supply
39	VLED	LED Power Supply
40	VLED	LED Power Supply



Note1: Input signals shall be low or High-impedance state when VDD is off.

## 6.4 Interface Timing

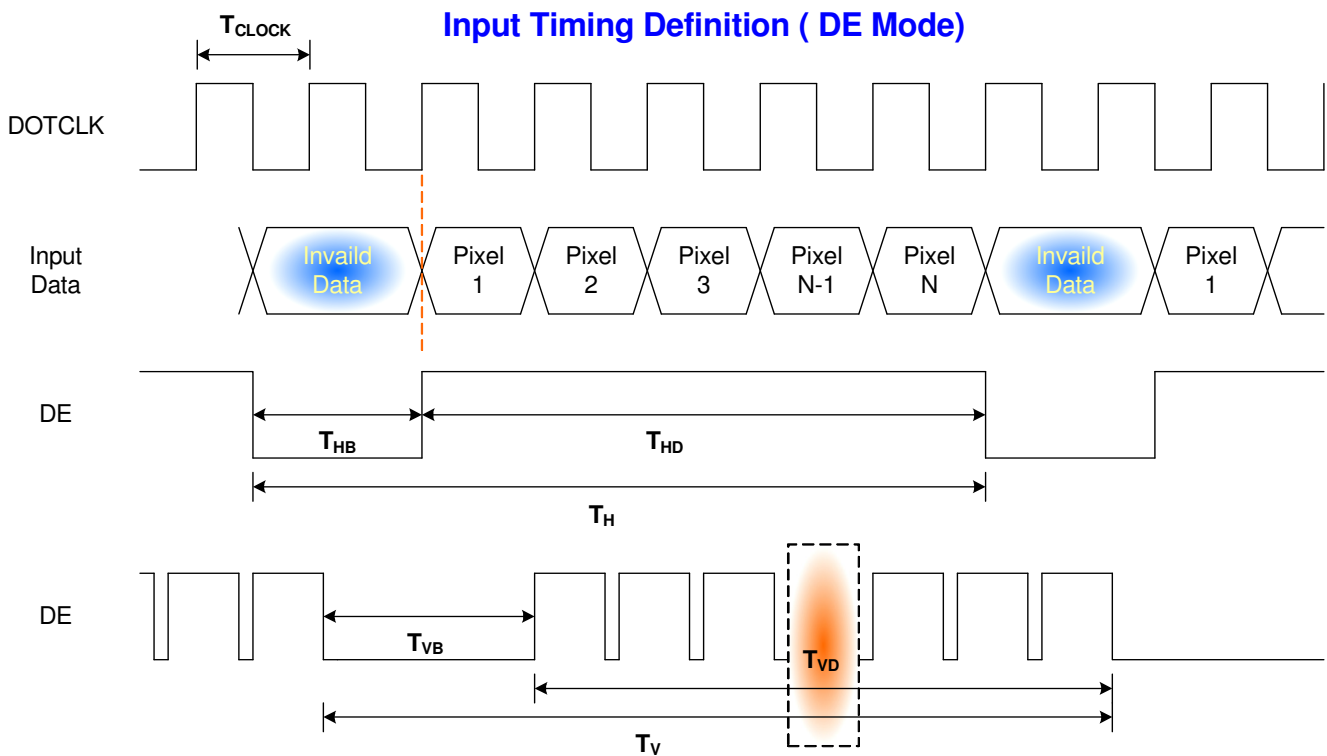
### 6.4.1 Timing Characteristics

Basically, interface timings should match the 1920x1080 /60Hz manufacturing guide line timing.

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		-	50	60	-	Hz
Clock frequency		1/ T <sub>Clock</sub>	-	71.19	85	MHz
Vertical Section	Period	T <sub>V</sub>	1088	1130	-	T <sub>Line</sub>
	Active	T <sub>VD</sub>	1080			
	Blanking	T <sub>VB</sub>	8	50	-	
Horizontal Section	Period	T <sub>H</sub>	990	1050	-	T <sub>Clock</sub>
	Active	T <sub>HD</sub>	960			
	Blanking	T <sub>HB</sub>	30	90	-	

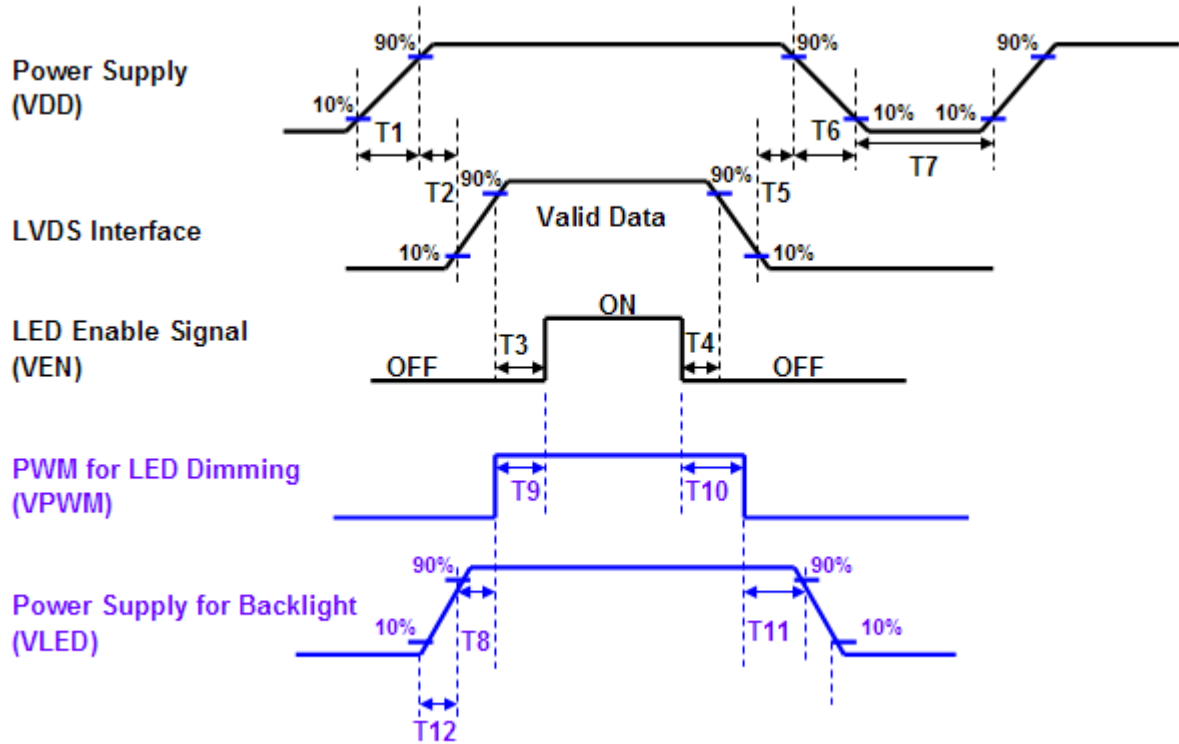
Note : DE mode only

### 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	-	
T8	10	-	
T9	10	180	
T10	10	180	
T11	10	-	
T12	0.5	10	



Note: If T3, T5, T6 couldn't match above specifications, must request  $T3+T5+T6 > 200\text{ms}$  at least

## 7. Vibration and Shock 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 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

### 7.3. Reliability

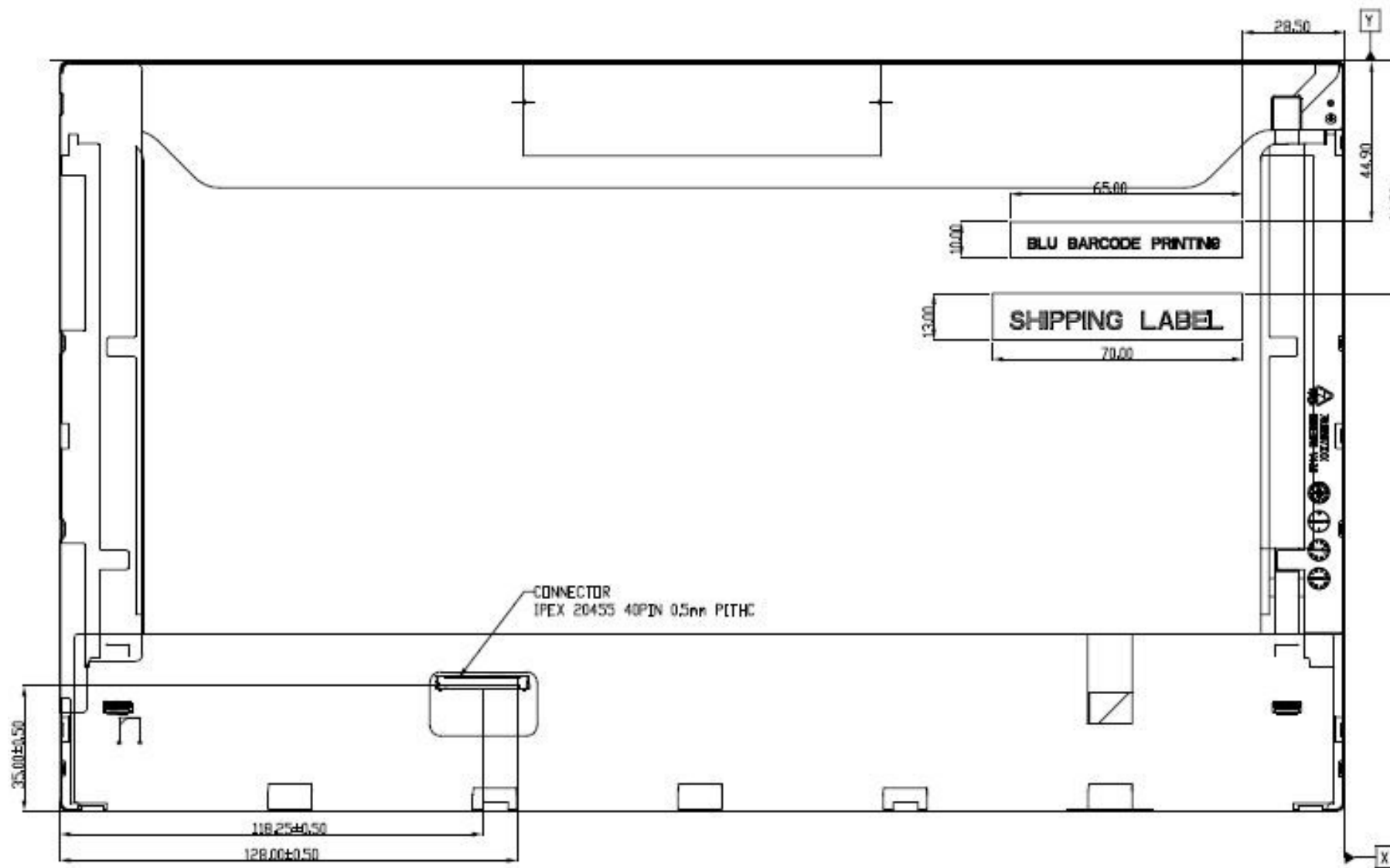
Items	Required Condition	Note
Temperature Humidity Bias	Ta= 40°C , 90%RH, 300h	
High Temperature Operation	Ta= 50°C , Dry, 300h	
Low Temperature Operation	Ta= 0°C , 300h	
High Temperature Storage	Ta= 60°C , 35%RH, 300h	
Low Temperature Storage	Ta= -20°C , 50%RH, 300h	
Thermal Shock Test	Ta=-20°C to 60°C , 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%







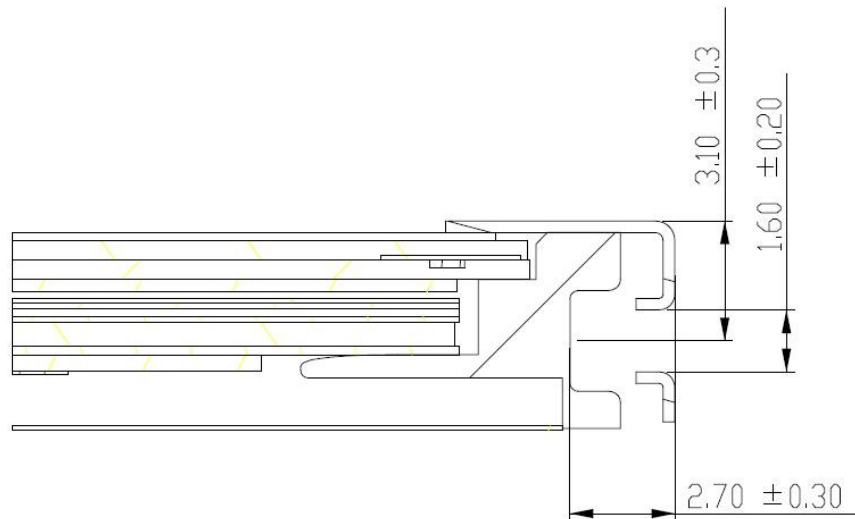
Note: Prevention IC damage, IC positions not allowed any overlap over these areas.

## 8.2 Screw Hole Depth and Center Position

Maximum Screw penetration from side surface is  $2.7 \pm 0.3\text{mm}$  (See drawing)

Screw hole center location, from front surface =  $3.10 \pm 0.3\text{mm}$  (See drawing)

Screw Torque: Maximum 2.5 kgf-cm






# Product Specification




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## 9. Shipping and Package

### 9.1 Shipping Label Format

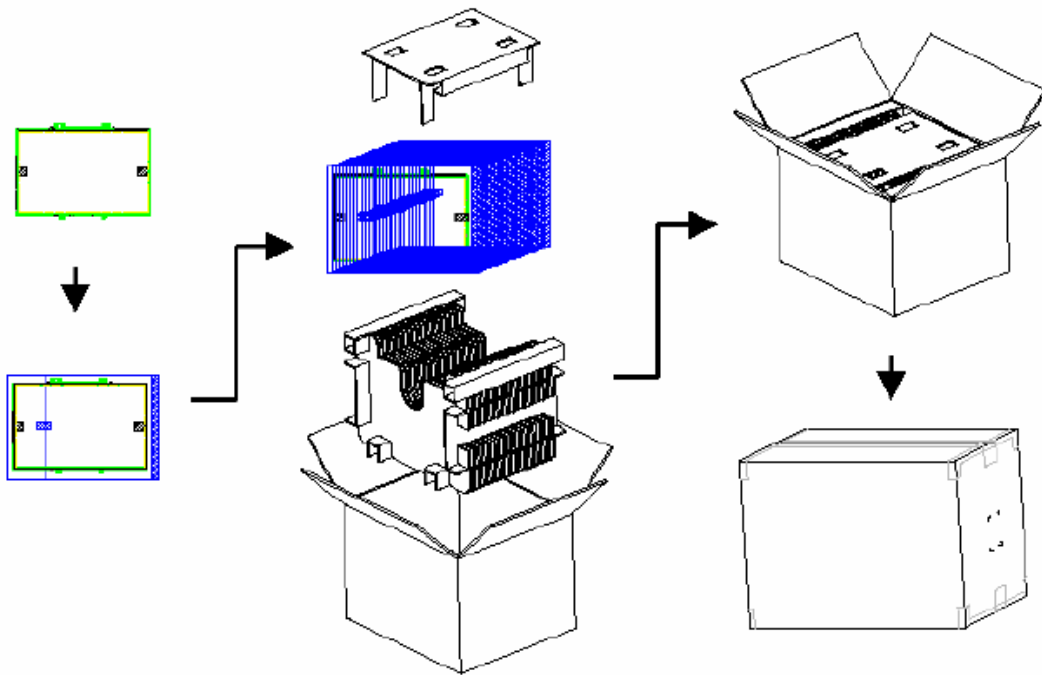
  
\*XXXXXXXXXXXX-XXXX\*

Manufactured 11/02  
Model No: B156HW01 V4  
AU Optronics  
MADE IN CHINA (S03)  
H/W: 0A F/W:1

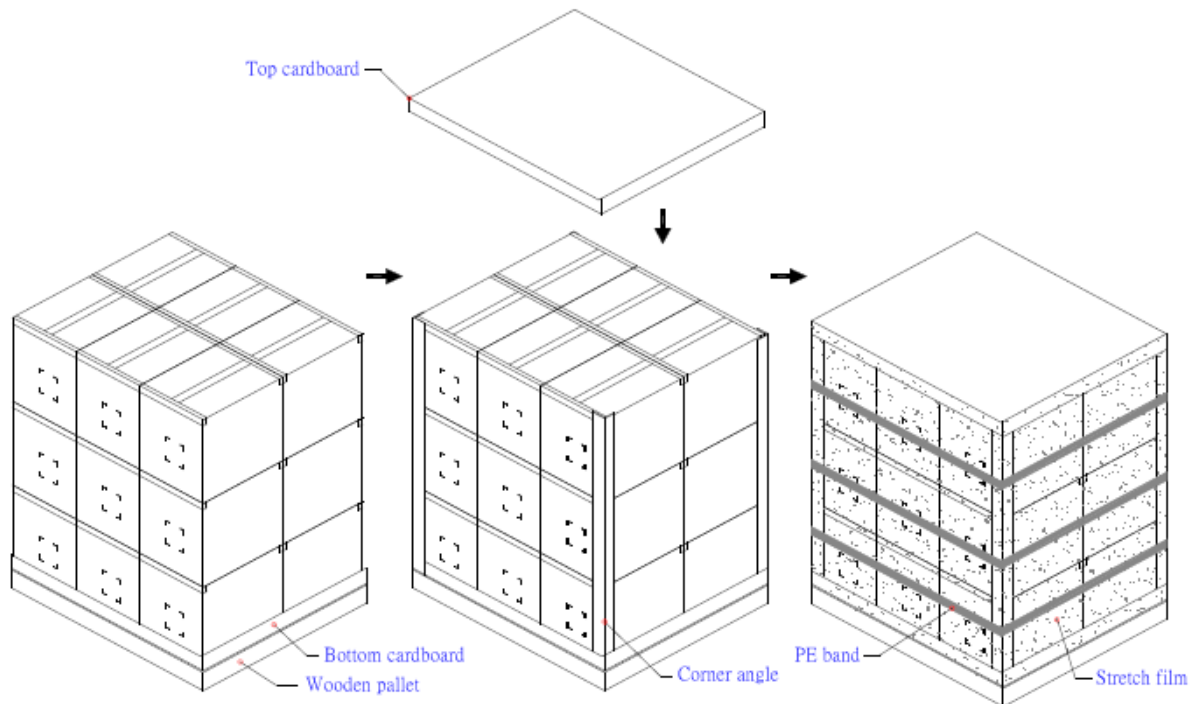
c  US   
E204356  
RoHS  


  
11S42T0764Z1ZH1BXXXXXX YMM P/N 42T0764 FRU 42T0765

## 9.2. Carton package



## 9.3 Shipping package of palletizing sequence





# Product Specification

AU OPTRONICS CORPORATION

## 10. Appendix: EDID description

This cell color is fill in data for LCD Supplier.

Please input two words for Hex value.

This cell color is auto Calculation.

This cell color is Fixed data.

This cell color is Blank data.

This cell color is Fixed data.					AUO				
This cell color is Blank data.					B154HW01 V4				
			Lenovo Requirements		DV				
Byte#	Byte#	Field Name and Comments	Value	Remarks	Value	Value	Value	Remarks	
(decimal)	(HEX)		(HEX)		(Hex)	(Decimal )	(Binary)		
0	00	Header	00	EDID VESA Spec Fixed	00	0	00000000	Header	
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	30	LEN	30	48	00110000	LEN	Vender/ Product ID
9	09		AE		AE	174	10101110		
10	0A	ID Product Code	B2	15.6"W 16:9 FHD 1920x1080 LED B/L	B2	178	10110010	15.6"W 16:9 FHD 1920x1080 LED B/L	
11	0B		40		40	64	01000000		
12	0C	ID Serial Number (32-bit serial number)	00	not used	00	0	00000000	# 0	
13	0D		00	not used	00	0	00000000		
14	0E		00	not used	00	0	00000000		
15	0F		00	not used	00	0	00000000		
16	10	Week of Manufacture			01	1	00000001	1 weeks	EDID Version/ Revision
17	11	Year of Manufacture			13	19	00010011	2009 years	
18	12	EDID Structure version	01	Ver. 1.3	01	1	00000001	Ver. 1.3	
19	13	EDID Revision	03		03	3	00000011		
20	14	Video Input Definition	80	Digital	80	128	10000000	Digital	Display Parameter
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	78	2.2	78	120	01111000	2.20	



# Product Specification

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		(gamma x 100)-100							
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			21	33	00100001		Color Characteristic
26	1A	Blue/White Low Bits			35	53	00110101		
27	1B	Red x			AD	173	10101101	0.676	
28	1C	Red y			50	80	01010000	0.314	
29	1D	Green x			37	55	00110111	0.215	
30	1E	Green y			AA	170	10101010	0.665	
31	1F	Blue x			24	36	00100100	0.141	
32	20	Blue y			11	17	00010001	0.069	
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		Established Timings
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		Standard Timing ID
39	27		01	Lenovo Spec fixed	01	1	00000001		
40	28	Standard Timing Identification #2	01	Lenovo Spec fixed	01	1	00000001		
41	29		01	Lenovo Spec fixed	01	1	00000001		
42	2A	Standard Timing Identification #3			01	1	00000001		
43	2B				01	1	00000001		
44	2C	Standard Timing Identification #4			01	1	00000001		
45	2D				01	1	00000001		
46	2E	Standard Timing Identification #5			01	1	00000001		
47	2F				01	1	00000001		
48	30	Standard Timing Identification #6			01	1	00000001		
49	31				01	1	00000001		
50	32	Standard Timing Identification #7			01	1	00000001		
51	33				01	1	00000001		
52	34	Standard Timing Identification #8			01	1	00000001		
53	35				01	1	00000001		
54	36	Pixel Clock/10,000 (LSB)		Refresh rate 60Hz	4C	76	01001100	139MHz (Refresh rate 60 Hz)	



# Product Specification

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55	37	Pixel Clock/10,000 (MSB) /			36	54	00110110	
56	38	Horizontal Active			80	128	10000000	1920 pixels
57	39	Horizontal Blanking			82	130	10000010	130 pixels
58	3A	Horizontal Active : Horizontal Blanking			70	112	01110000	
59	3B	Vertical Active			38	56	00111000	1080 lines
60	3C	Vertical Blanking			32	50	00110010	50 lines
61	3D	Vertical Active : Vertical Blanking			40	64	01000000	
62	3E	Horizontal Sync. Offset			3C	60	00111100	60 pixels
63	3F	Horizontal Sync Pulse Width			30	48	00110000	48 pixels
64	40	Vertical Sync Offset : Sync Width			AA	170	10101010	10 lines / 10 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
72	48	Pixel Clock/10,000 (LSB) (Slow Refresh rate)		Refresh rate 50Hz	3F	63	00111111	115.83MHz (Refresh rate 50 Hz)
73	49	Pixel Clock/10,000 (MSB) / (Slow Refresh rate)			2D	45	00101101	
74	4A	Horizontal Active			80	128	10000000	1920 pixels
75	4B	Horizontal Blanking			82	130	10000010	130 pixels
76	4C	Horizontal Active : Horizontal Blanking			70	112	01110000	
77	4D	Vertical Active			38	56	00111000	1080 lines
78	4E	Vertical Blanking			32	50	00110010	50 lines
79	4F	Vertical Active : Vertical Blanking			40	64	01000000	
80	50	Horizontal Sync. Offset			3C	60	00111100	60 pixels
81	51	Horizontal Sync Pulse			30	48	00110000	48 pixels

Timing  
Descriptor  
#1

Timing  
Description  
#2



# Product Specification

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		Width						
82	52	Vertical Sync Offset : Sync Width			AA	170	10101010	10 lines / 10 lines
83	53	Horizontal Vertical Sync Offset/Width 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	D1	209	D1	209	11010001	1920 pixel
96	60	Image Aspect Ratio	09	16 : 9	09	9	00001001	16 : 9
97	61	Middle Refresh Rate	32	50	32	50	00110010	50 Hz
98	62	(Horizontal active pixel /8)-31	D1	209	D1	209	11010001	1920 pixel
99	63	Image Aspect Ratio	09	16 : 9	09	9	00001001	16 : 9
100	64	Low Refresh Rate	28	40	28	40	00101000	40 Hz
101	65	Brightness(1/10nit)	1B	270	1B	27	00011011	270 nit
102	66	Feature flag	09	TN, White LED B/L,	19	25	00011001	TN, White LED backlight, BGR substripe Design,
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			56	86	01010110	

Timing  
Description  
#3

Lenovo unique customization





## Product Specification

AU OPTRONICS CORPORATION

		code						
107	6B	LCD Supplier Product code			34	52	00110100	4
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	[1]
115	73	Model Name			35	53	00110101	[5]
116	74	Model Name			36	54	00110110	[6]
117	75	Model Name			48	72	01001000	[H]
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	[ ]
122	7A	Model Name			56	86	01010110	[V]
123	7B	Model Name			34	52	00110100	[4]
124	7C	Model Name			20	32	00100000	[ ]
125	7D	Model Name			0A	10	00001010	[^]
126	7E	Extension flag	00	VESA Spec Fixed	00	0	00000000	
127	7F	Checksum			D6	214	11010110	

Timing  
Description  
#4

Extension Flag

127	7F	Checksum (Auto calc from 00h - 7Eh)			D6	214	11010110	Checksum Pass	Checksum
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# Product Specification

AU OPTRONICS CORPORATION