

2. General Description

B133XTN01.0 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 HD, 1366(H) x768(V) screen and 262k colors (RGB 6-bits data driver) with LED backlight driving circuit. All input signals are LVDS interface compatible.

B133XTN01.0 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:

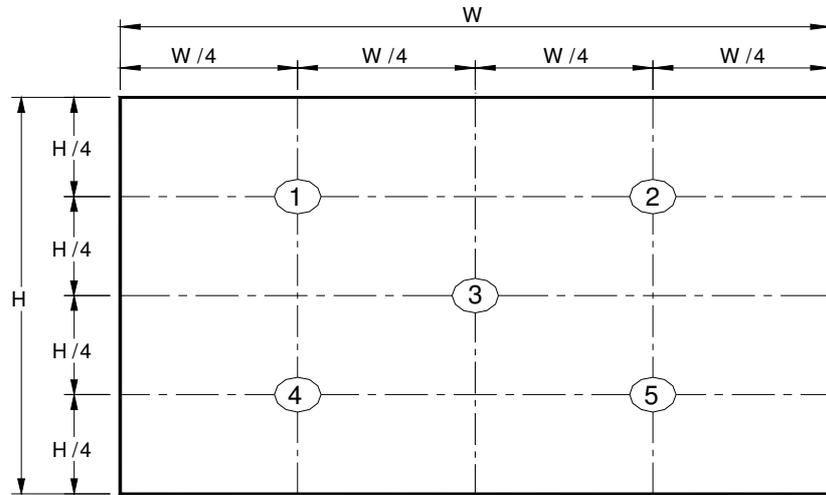
Items	Unit	Specifications			
Screen Diagonal	[mm]	336.6			
Active Area	[mm]	293.42 X 164.97			
Pixels H x V		1366x3(RGB) x 768			
Pixel Pitch	[mm]	0.2148X0.2148			
Pixel Format		R.G.B. Vertical Stripe			
Display Mode		Normally White			
White Luminance (I _{LED} =20mA) (Note: I _{LED} is LED current)	[cd/m ²]	200 typ. (5 points average) 170 min. (5 points average)			
Luminance Uniformity		1.25 max. (5 points)			
Contrast Ratio		500 typ.			
Response Time	[ms]	8 typ / 16 Max			
Nominal Input Voltage VDD	[Volt]	+3.3 typ.			
Power Consumption	[Watt]	3.0 max. (Include Logic and BLU power)			
Weight	[Grams]	260 max.			
Physical Size Include bracket	[mm]		Min.	Typ.	Max.
		Length	313.6	314.1	314.6
		Width	188.2	188.7	189.2
		Thickness	-	-	3.0 (3.2 at PCB)
Electrical Interface		1 channel LVDS			
Glass Thickness	[mm]	0.4			
Surface Treatment		Glare, Hardness 3H Reflection 4.3%			
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

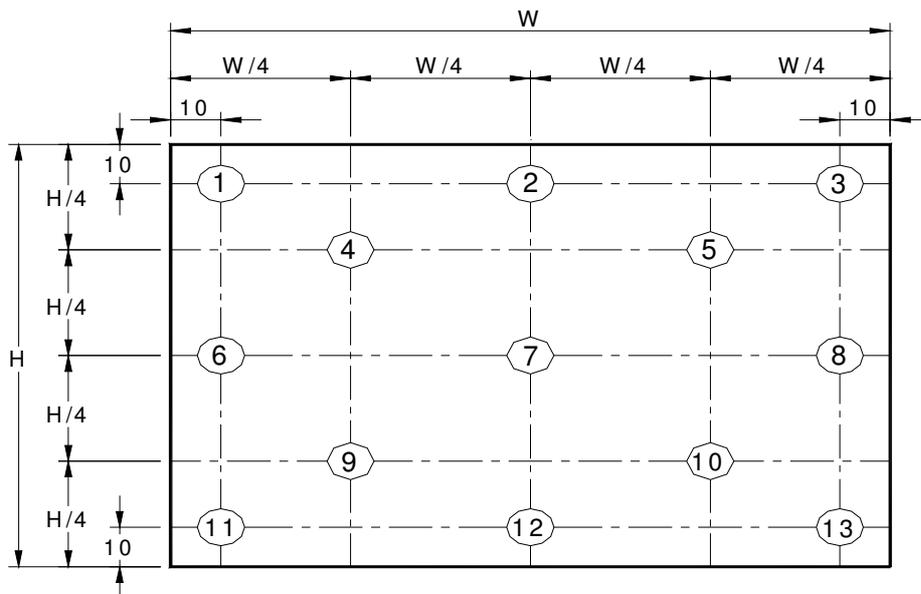
The optical characteristics are measured under stable conditions at 25°C (Room Temperature) :

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance I _{LED} =20mA		5 points average	170	200	-	cd/m ²	1, 4, 5.
Viewing Angle	θ_R	Horizontal (Right) CR = 10 (Left)	40	45	-	degree	4, 9
	θ_L		40	45	-		
	ϕ_H	Vertical (Upper) CR = 10 (Lower)	10	15	-		
	ϕ_L		30	35	-		
Luminance Uniformity	δ_{5P}	5 Points	-	-	1.25		1, 3, 4
Luminance Uniformity	δ_{13P}	13 Points	-	-	1.60		2, 3, 4
Contrast Ratio	CR		400	500	-		4, 6
Cross talk	%				4		4, 7
Response Time	T _r	Rising	-	3	-	msec	4, 8
	T _f	Falling	-	5	-		
	T _{RT}	Rising + Falling	-	8	16		
Color / Chromaticity Coordinates	Red	R _x	CIE 1931	0.550	0.580	0.610	4
		R _y		0.305	0.335	0.365	
	Green	G _x		0.300	0.330	0.360	
		G _y		0.535	0.565	0.595	
	Blue	B _x		0.125	0.155	0.185	
		B _y		0.110	0.140	0.170	
	White	W _x		0.283	0.313	0.343	
		W _y		0.299	0.329	0.359	
NTSC	%		-	45	-		

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



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



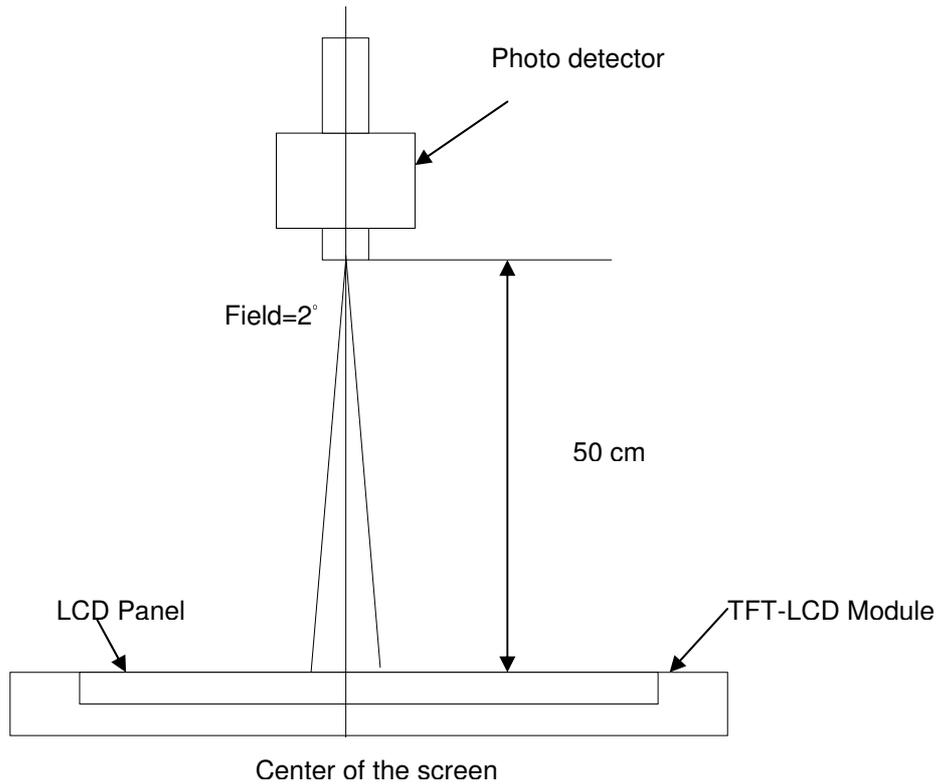
Note 3: The luminance uniformity of 5 or 13 points is defined by dividing the maximum luminance values by the minimum test point luminance

$$\delta_{w5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

$$\delta_{w13} = \frac{\text{Maximum Brightness of thirteen points}}{\text{Minimum Brightness of thirteen points}}$$

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. Measurement should be executed in the center of screen unless otherwise noted.



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.

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

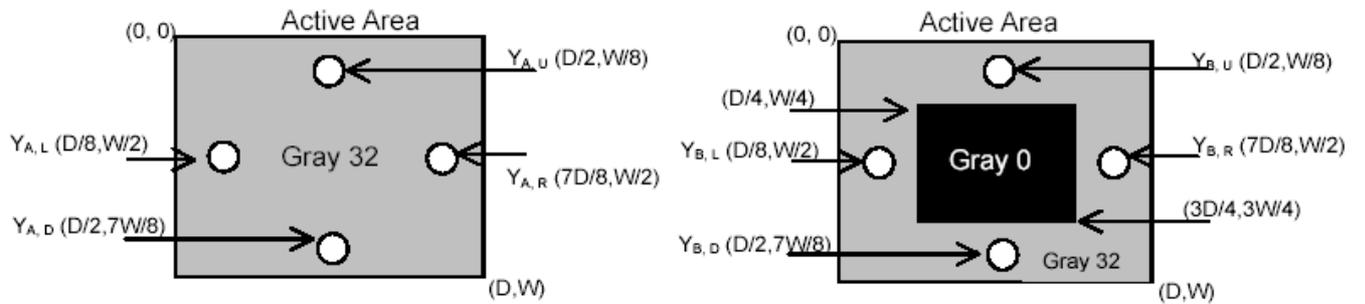
Note 7 : Definition of Cross Talk (CT)

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

Where

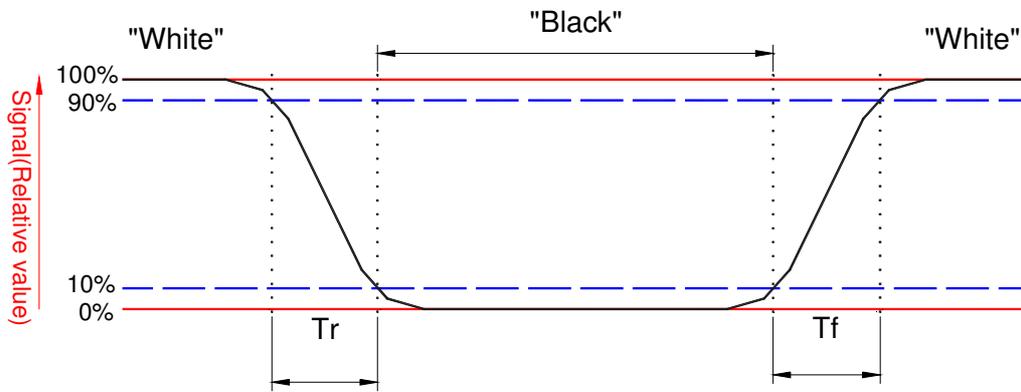
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

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



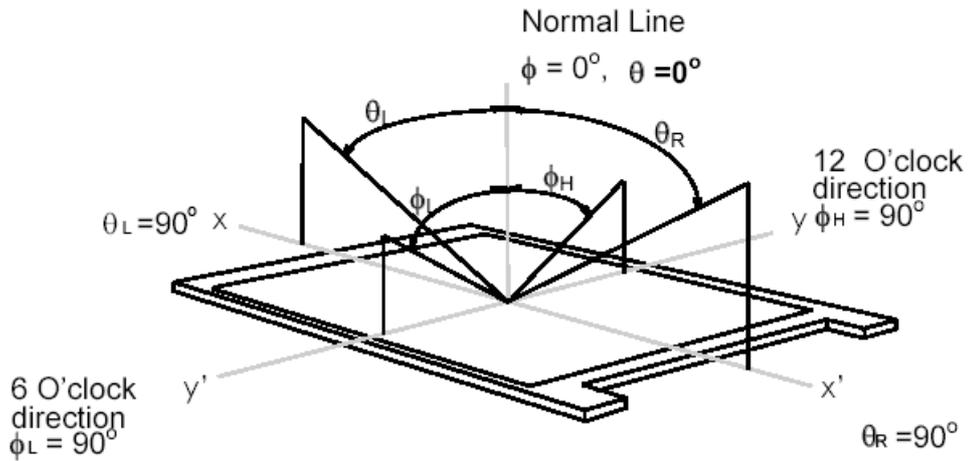
Note 8: Definition of response time:

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 is interval between the 10% and 90% of amplitudes. Refer to figure as below.



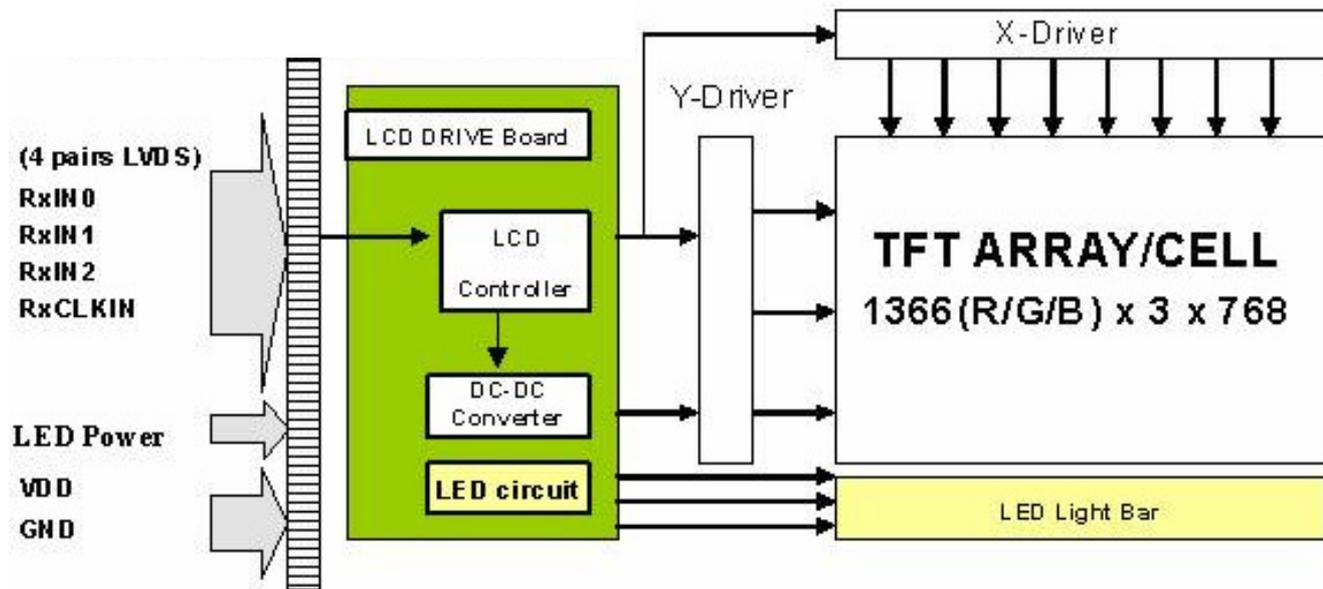
Note 9. Definition of viewing angle

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 13.3 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 Voltage	Vin	-0.3	+4.0	[Volt]	Note 1,2

4.2 Absolute Ratings of Environment

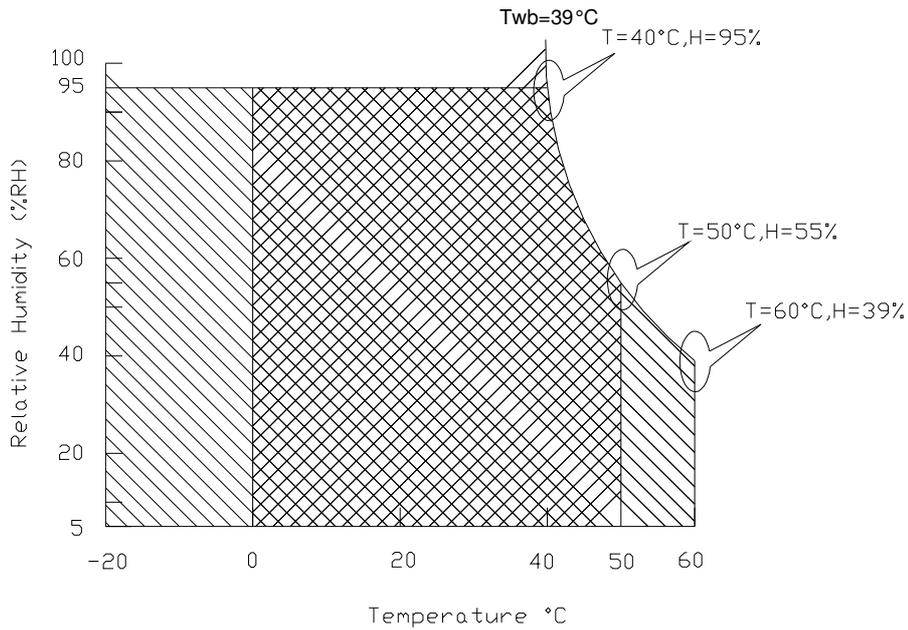
Item	Symbol	Min	Max	Unit	Conditions
Operating Temperature	TOP	0	+50	[°C]	Note 4
Operation Humidity	HOP	5	95	[%RH]	Note 4
Storage Temperature	TST	-20	+60	[°C]	Note 4
Storage Humidity	HST	5	95	[%RH]	Note 4

Note 1: At Ta (25°C)

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

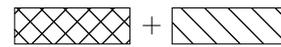
Note 3: LED specification refer to section 5.2

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

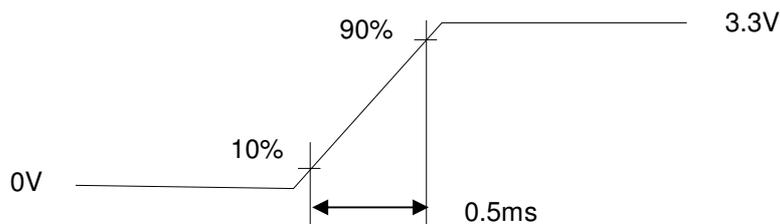
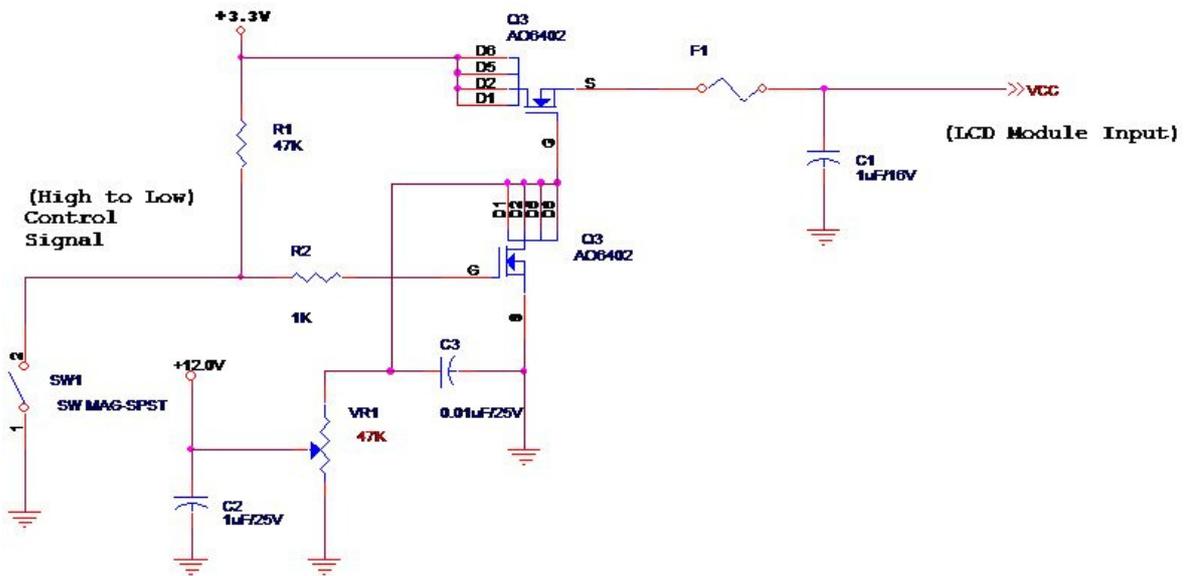
Input power specifications are as follows;

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	-	-	0.8	[Watt]	Note 1
IDD	IDD Current	-	-	242	[mA]	Note 1
IRush	Inrush Current	-	-	2000	[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. ($P_{max}=V_{3.3} \times I_{black}$)

Note 2 : Measure Condition



Vin rising time

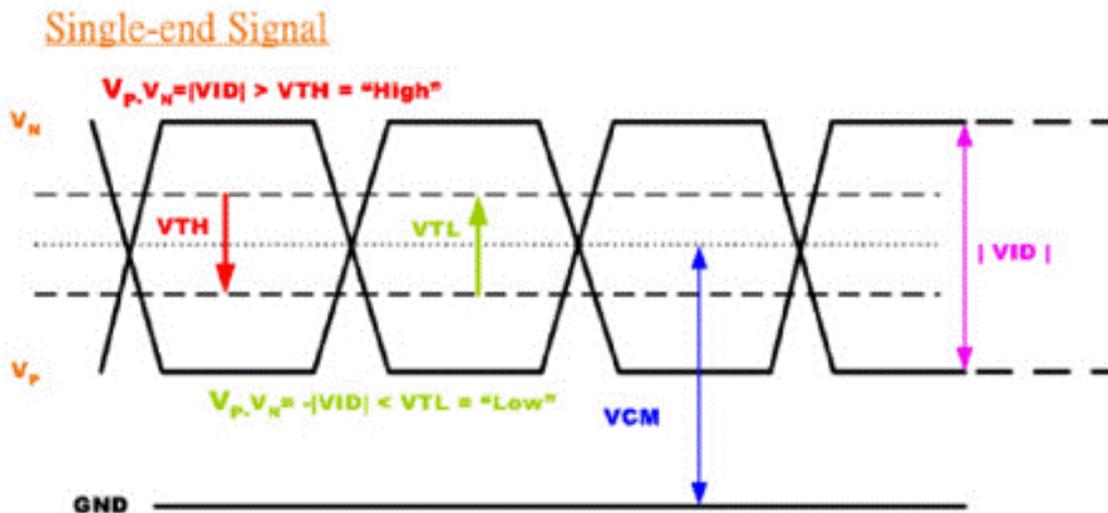
5.1.2 Signal Electrical Characteristics

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	-	-	2.2	[Watt]	(Ta=25°C), Note 1 Vin =12V
LED Life-Time	N/A	12,000	-	-	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. PLED include driving circuit loss.

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

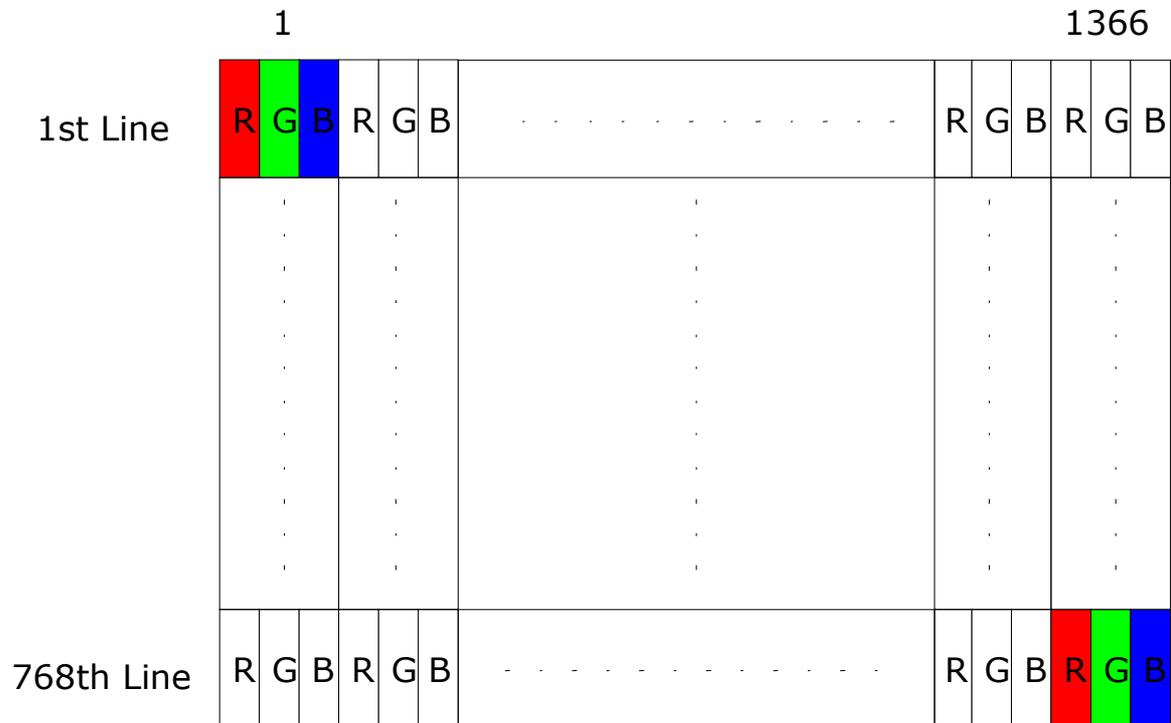
5.2.2 Backlight input signal characteristics

Parameter	Symbol	Min	Typ	Max	Units	Remark
LED Power Supply	VLED	6.0	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	200	-	20K	Hz	
PWM Duty Ratio	Duty	5	--	100	%	

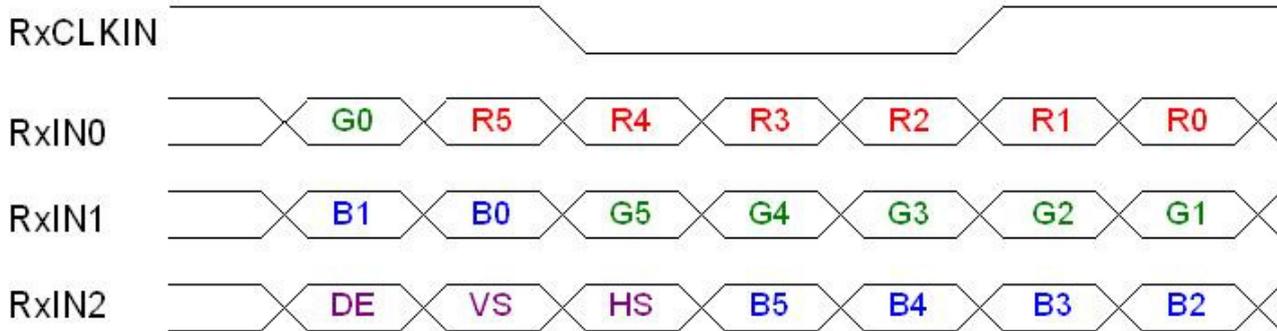
6. Signal Interface Characteristic

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	
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 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.

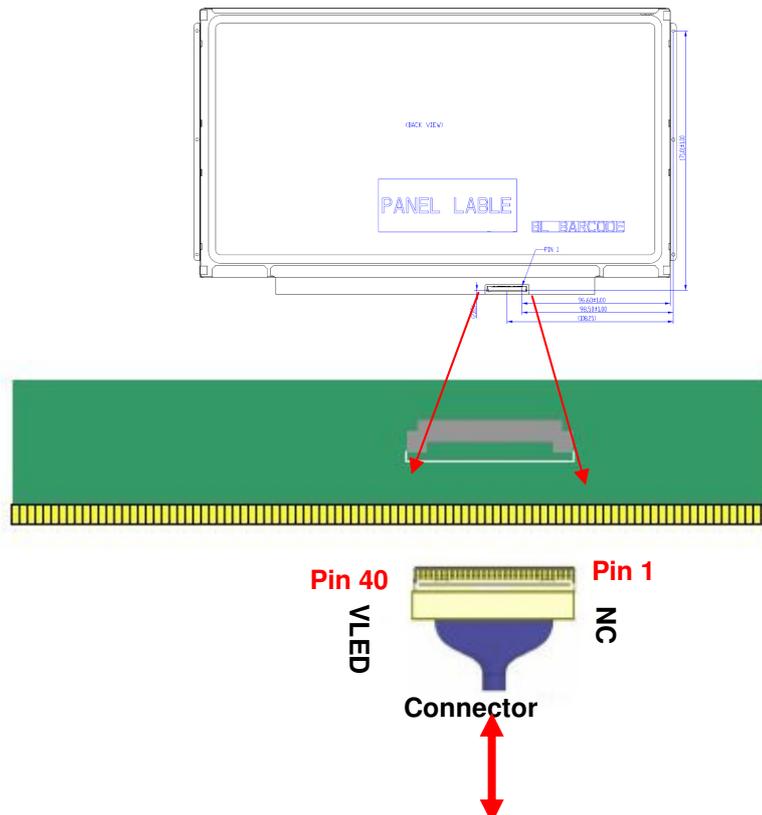
Connector Name / Designation	For Signal Connector
Manufacturer	IPEX or Compatible
Type / Part Number	IPEX 20455-040E-12R or Compatible
Mating Housing/Part Number	IPEX 20453-040T-11 or Compatible

6.3.2 Pin Assignment

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

PIN#	Signal Name	Description
1	NC	No Connection (Reserve)
2	VDD	Power Supply +3.3V
3	VDD	Power Supply +3.3V
4	VEDID	EDID +3.3V Power
5	NC	No Connect (Reserve)
6	CLK_EDID	EDID Clock Input
7	DAT_EDID	EDID Data Input
8	RxOIN0-	-LVDS Differential Data INPUT(Odd R0-R5,G0)
9	RxOIN0+	+LVDS Differential Data INPUT(Odd R0-R5,G0)
10	VSS	Ground
11	RxOIN1-	-LVDS Differential Data INPUT(Odd G1-G5,B0-B1)
12	RxOIN1+	+LVDS Differential Data INPUT(Odd G1-G5,B0-B1)
13	VSS	Ground
14	RxOIN2-	-LVDS Differential Data INPUT(Odd B2-B5,HS,VS,DE)
15	RxOIN2+	+LVDS Differential Data INPUT(Odd B2-B5,HS,VS,DE)
16	VSS	Ground
17	RxOCKIN-	-LVDS Odd Differential Clock INPUT
18	RxOCKIN+	+LVDS Odd Differential Clock INPUT
19	NC	No connection
20	NC	No connection

21	NC	No connection
22	NC	No connection
23	NC	No connection
24	NC	No connection
25	NC	No connection
26	NC	No connection
27	NC	No connection
28	NC	No connection
29	NC	No connection
30	NC	No connection
31	VLED_GND	LED Ground
32	VLED_GND	LED Ground
33	VLED_GND	LED Ground
34	NC	No Connection (Reserve)
35	VPWM_EN	PWM logic input level
36	VLED_EN	LED enable input level
37	NC	NC
38	VLED	LED Power Supply 6V-21V
39	VLED	LED Power Supply 6V-21V
40	VLED	LED Power Supply 6V-21V



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

6.4 Interface Timing

6.4.1 Timing Characteristics

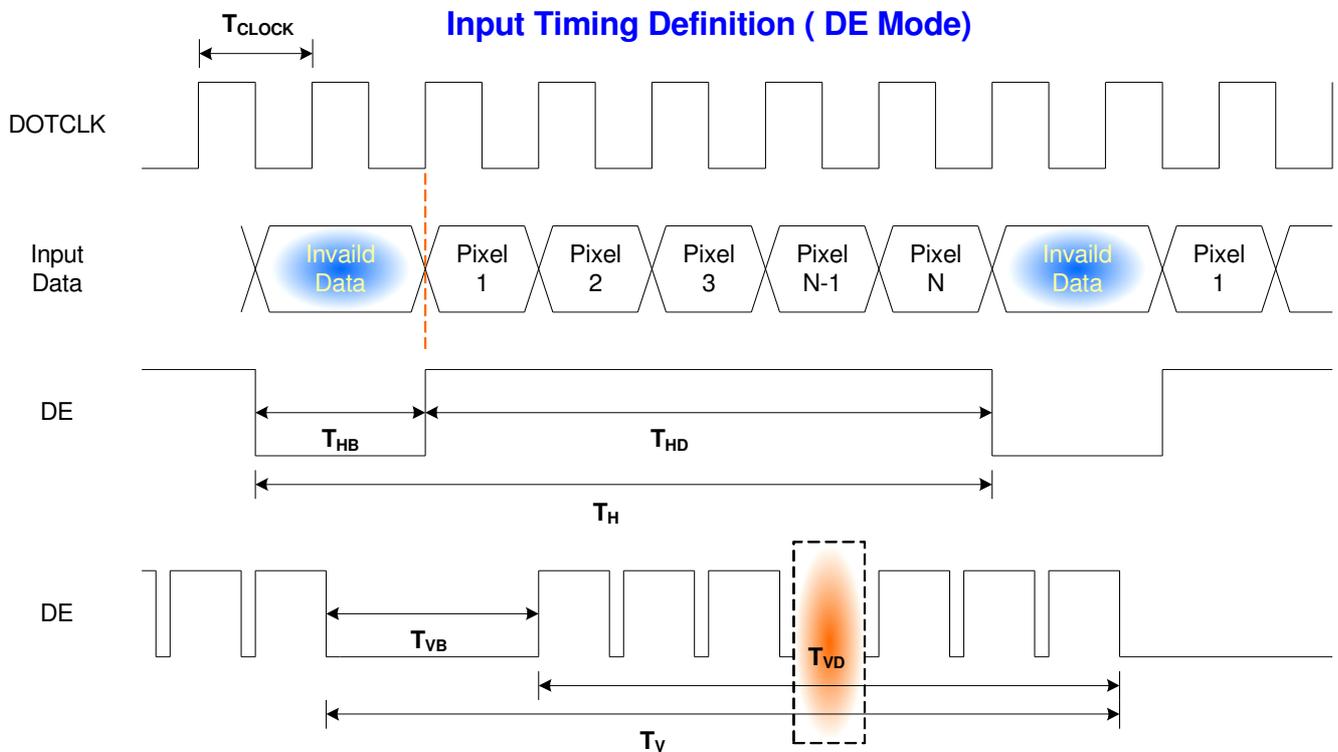
Basically, interface timings should match the 1366x768 /60Hz manufacturing guide line timing.

Parameter	Symbol	Min.	Typ.	Max.	Unit	
Frame Rate	-	50(Note2)	60	-	Hz	
Clock frequency	1/ T _{clock}	65	69.3	80	MHz	
Vertical Section	Period	T _V	776	793	1000	T _{Line}
	Active	T _{VD}	768			
	Blanking	T _{VB}	8	25	232	
Horizontal Section	Period	T _H	1426	1456	2000	T _{Clock}
	Active	T _{HD}	1366			
	Blanking	T _{HB}	60	90	634	

Note1: DE mode only.

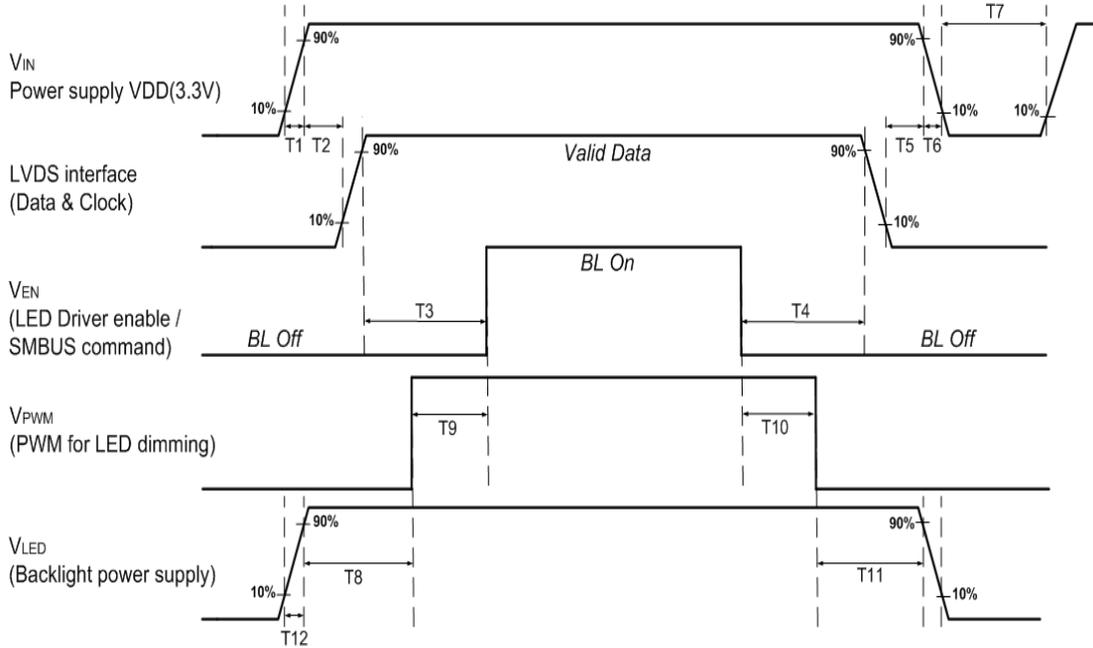
Note2: Frame rate 50 Hz is written by system BIOS.

6.4.2 Timing diagram

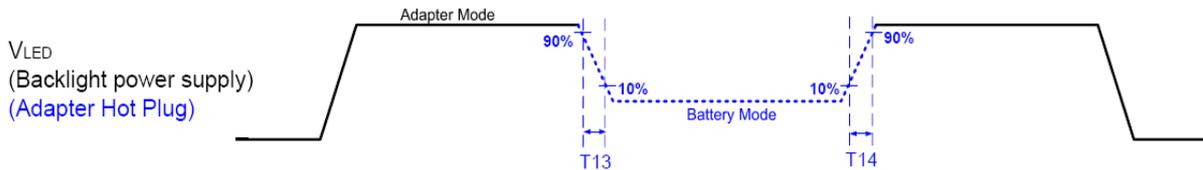


6.5 Power ON/OFF Sequence

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



When the adapter is hot plugged, the backlight power supply sequence is shown as below.



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	-	
T10	10	-	
T11	10	-	
T12	0.5	10	
T13	1*	-	
T14	1*	-	

*Note : If Seamless change, T13 & T14 = 5 x T_{PWM} (T_{PWM}= 1/PWM Frequency)

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°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°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. Self-recoverable.
No data lost, No hardware failures.

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



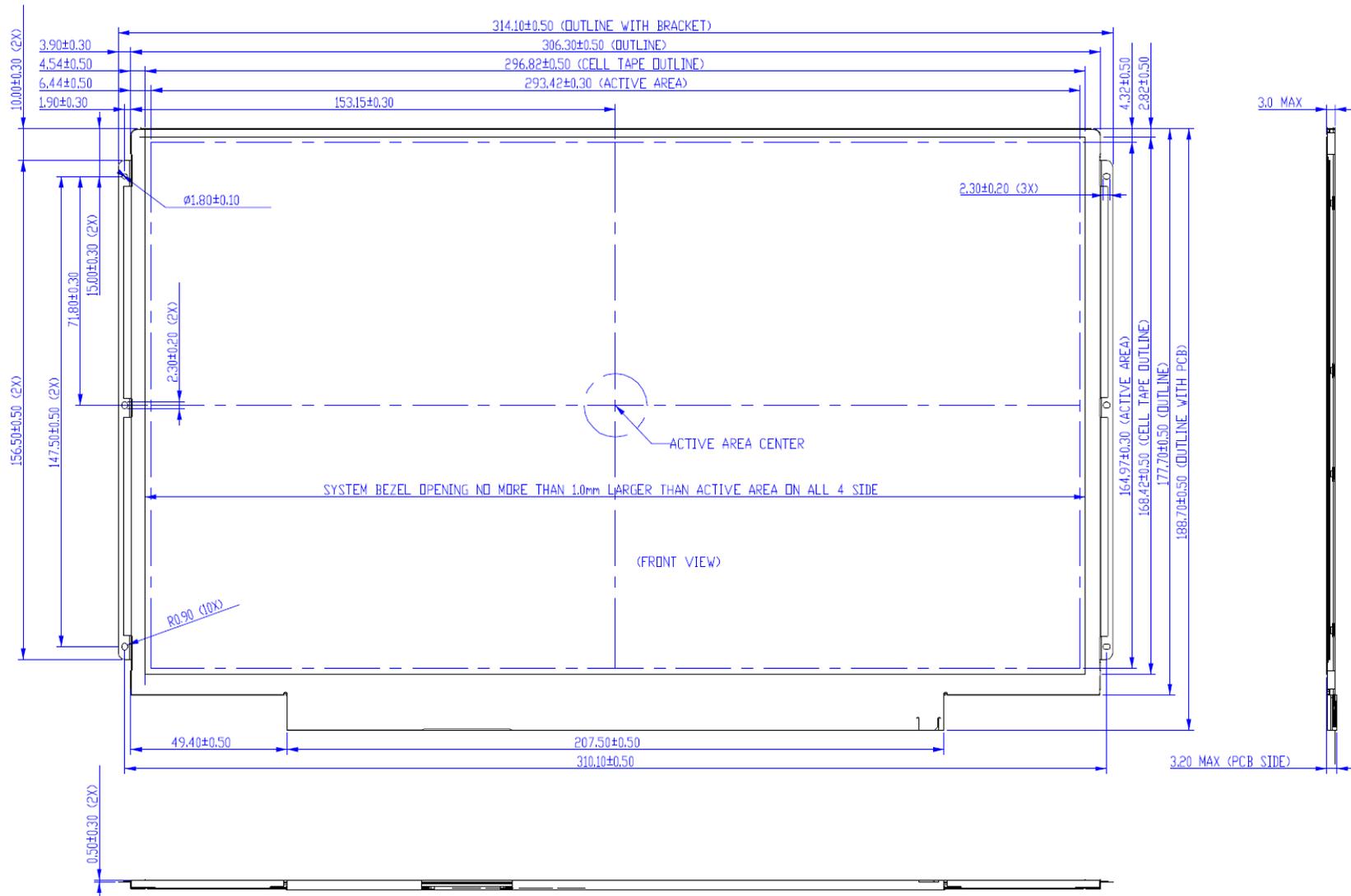
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8. Mechanical Characteristics

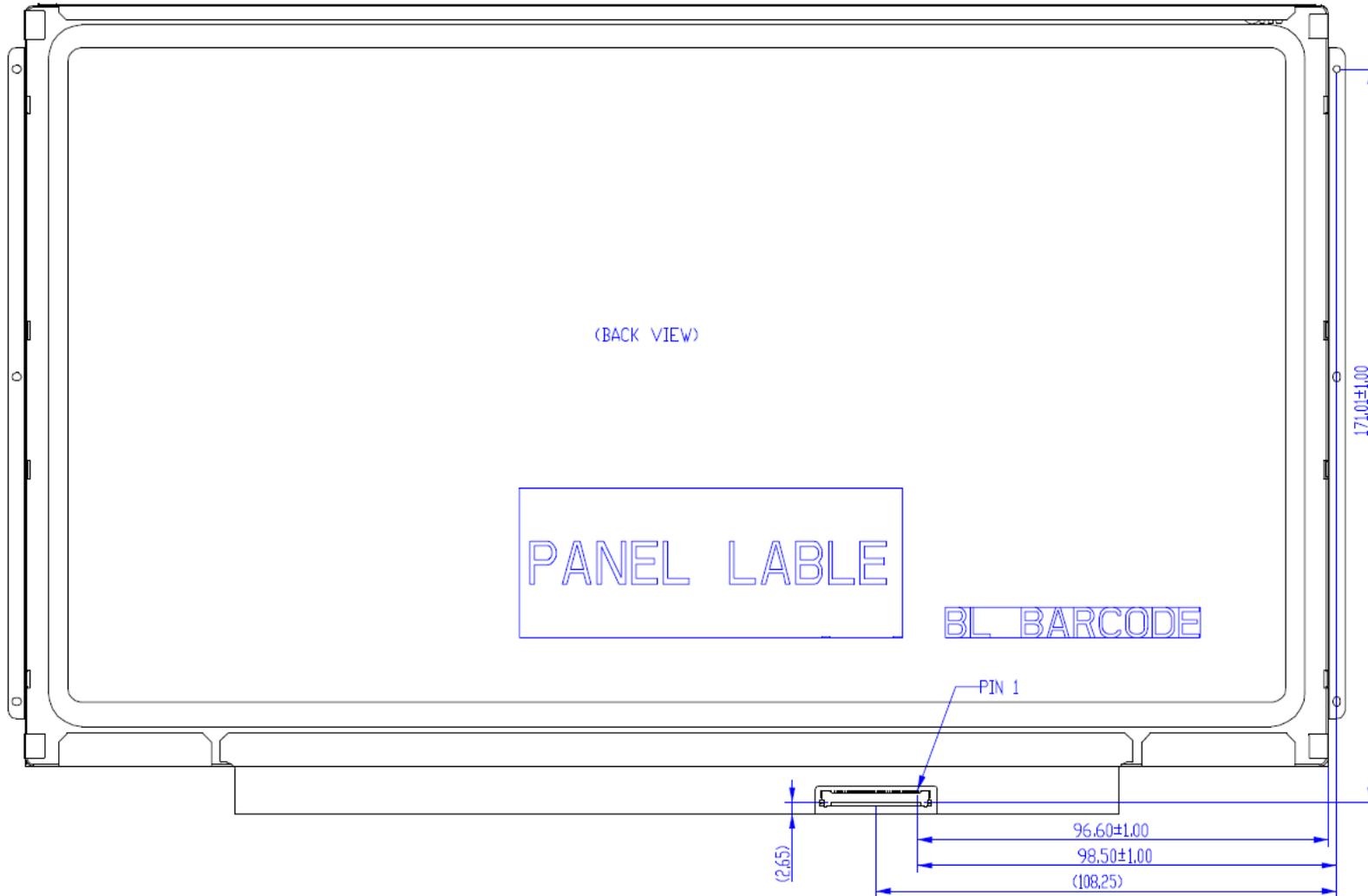
8.1 LCM Outline Dimension

8.1.1 Standard Front View



8.1.2 Standard Rear View & Key components remark and remind

Prevention damage the IC, connector, Capacitor...., we recommend your design (Ex: cable, rib, hardness parts) far away those section those have remarked at this drawing.



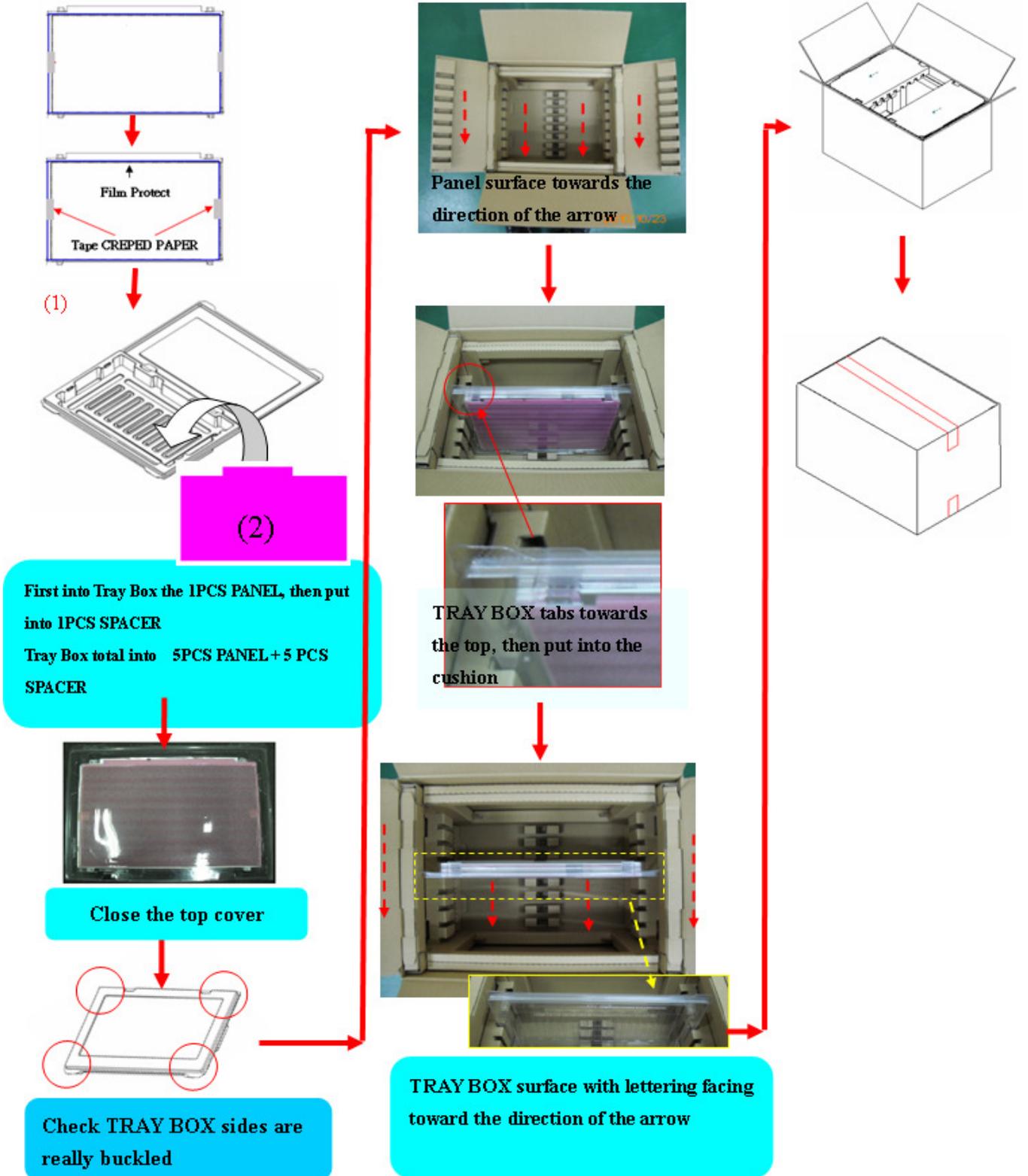
Note: Prevention IC damage, IC positions not allowed any overlap over these areas.

9. Shipping and Package

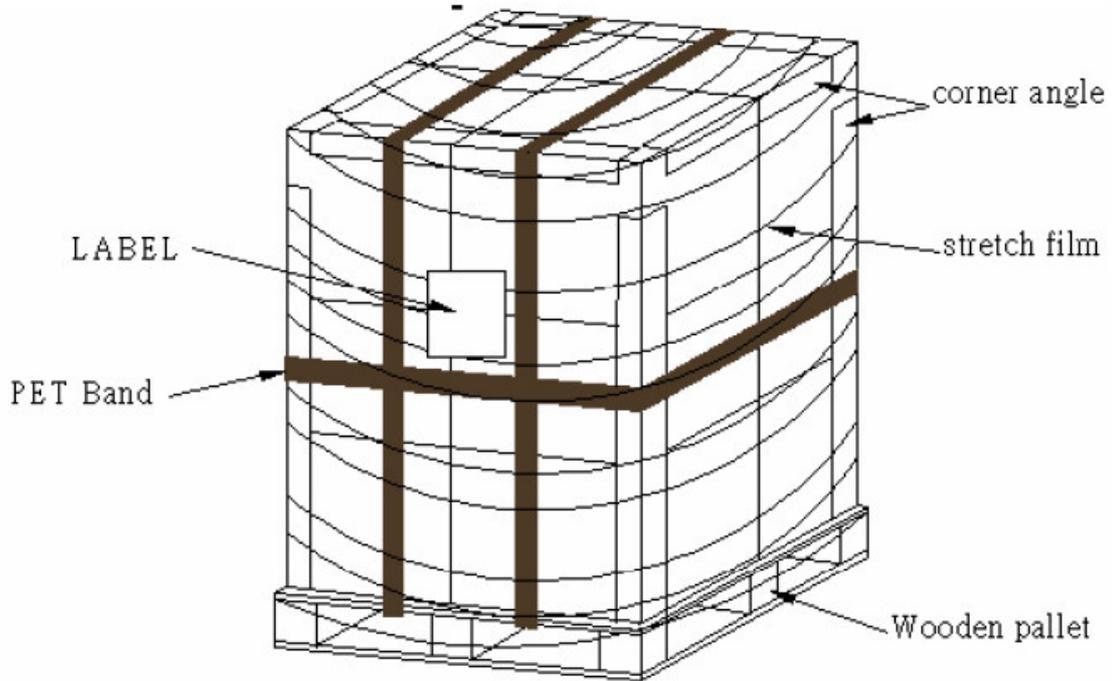
9.1 Shipping Label Format



9.2 Carton Package



9.3 Shipping Package of Palletizing Sequence





10. Appendix

10.1 EDID Description

Address	FUNCTION	Value	Value	Value	Note
HEX		HEX	BIN	DEC	
00	Header	00	00000000	0	
01		FF	11111111	255	
02		FF	11111111	255	
03		FF	11111111	255	
04		FF	11111111	255	
05		FF	11111111	255	
06		FF	11111111	255	
07		00	00000000	0	
08	EISA Manuf. Code LSB	06	00000110	6	
09	Compressed ASCII	AF	10101111	175	
0A	Product Code	2C	00101100	44	
0B	hex, LSB first	10	00010000	16	
0C	32-bit ser #	00	00000000	0	
0D		00	00000000	0	
0E		00	00000000	0	
0F		00	00000000	0	
10	Week of manufacture	00	00000000	0	
11	Year of manufacture	15	00010101	21	
12	EDID Structure Ver.	01	00000001	1	
13	EDID revision #	03	00000011	3	
14	Video input def. (<i>digital I/P, non-TMDS, CRGB</i>)	80	10000000	128	
15	Max H image size (<i>rounded to cm</i>)	1D	00011101	29	
16	Max V image size (<i>rounded to cm</i>)	10	00010000	16	
17	Display Gamma (<i>=(gamma*100)-100</i>)	78	01111000	120	
18	Feature support (<i>no DPMS, Active OFF, RGB, tmg Blk#1</i>)	0A	00001010	10	
19	Red/green low bits (Lower 2:2:2:2 bits)	BB	10111011	187	
1A	Blue/white low bits (Lower 2:2:2:2 bits)	F5	11110101	245	
1B	Red x (Upper 8 bits)	94	10010100	148	
1C	Red y/ highER 8 bits	55	01010101	85	
1D	Green x	54	01010100	84	
1E	Green y	90	10010000	144	
1F	Blue x	27	00100111	39	
20	Blue y	23	00100011	35	
21	White x	50	01010000	80	
22	White y	54	01010100	84	
23	Established timing 1	00	00000000	0	
24	Established timing 2	00	00000000	0	
25	Established timing 3	00	00000000	0	
26	Standard timing #1	01	00000001	1	



Product Specification

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27		01	00000001	1	
28	Standard timing #2	01	00000001	1	
29		01	00000001	1	
2A	Standard timing #3	01	00000001	1	
2B		01	00000001	1	
2C	Standard timing #4	01	00000001	1	
2D		01	00000001	1	
2E	Standard timing #5	01	00000001	1	
2F		01	00000001	1	
30	Standard timing #6	01	00000001	1	
31		01	00000001	1	
32	Standard timing #7	01	00000001	1	
33		01	00000001	1	
34	Standard timing #8	01	00000001	1	
35		01	00000001	1	
36	Pixel Clock/10000 LSB	12	00010010	18	
37	Pixel Clock/10000 USB	1B	00011011	27	
38	Horz active Lower 8bits	56	01010110	86	
39	Horz blanking Lower 8bits	5A	01011010	90	
3A	HorzAct:HorzBlnk Upper 4:4 bits	50	01010000	80	
3B	Vertical Active Lower 8bits	00	00000000	0	
3C	Vertical Blanking Lower 8bits	19	00011001	25	
3D	Vert Act : Vertical Blanking (upper 4:4 bit)	30	00110000	48	
3E	HorzSync. Offset	30	00110000	48	
3F	HorzSync.Width	20	00100000	32	
40	VertSync.Offset : VertSync.Width	36	00110110	54	
41	Horz&Vert Sync Offset/Width Upper 2bits	00	00000000	0	
42	Horizontal Image Size Lower 8bits	25	00100101	37	
43	Vertical Image Size Lower 8bits	A4	10100100	164	
44	Horizontal & Vertical Image Size (upper 4:4 bits)	10	00010000	16	
45	Horizontal Border <i>(zero for internal LCD)</i>	00	00000000	0	
46	Vertical Border <i>(zero for internal LCD)</i>	00	00000000	0	
47	Signal <i>(non-intr, norm, no stero, sep sync, neg pol)</i>	18	00011000	24	
48	Detailed timing/monitor	00	00000000	0	
49	descriptor #2	00	00000000	0	
4A		00	00000000	0	
4B		0F	00001111	15	
4C		00	00000000	0	
4D		00	00000000	0	
4E		00	00000000	0	
4F		00	00000000	0	
50		00	00000000	0	
51		00	00000000	0	
52		00	00000000	0	
53		00	00000000	0	
54		00	00000000	0	
55		00	00000000	0	



Product Specification

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56		00	00000000	0	
57		00	00000000	0	
58		00	00000000	0	
59		20	00100000	32	
5A	Detailed timing/monitor	00	00000000	0	
5B	descriptor #3	00	00000000	0	
5C		00	00000000	0	
5D		FE	11111110	254	
5E		00	00000000	0	
5F	Manufacture	41	01000001	65	A
60	Manufacture	55	01010101	85	U
61	Manufacture	4F	01001111	79	O
62		0A	00001010	10	
63		20	00100000	32	
64		20	00100000	32	
65		20	00100000	32	
66		20	00100000	32	
67		20	00100000	32	
68		20	00100000	32	
69		20	00100000	32	
6A		20	00100000	32	
6B		20	00100000	32	
6C	Detailed timing/monitor	00	00000000	0	
6D	descriptor #4	00	00000000	0	
6E		00	00000000	0	
6F		FE	11111110	254	
70		00	00000000	0	
71	Manufacture P/N	42	01000010	66	B
72	Manufacture P/N	31	00110001	49	1
73	Manufacture P/N	33	00110011	51	3
74	Manufacture P/N	33	00110011	51	3
75	Manufacture P/N	58	01011000	88	X
76	Manufacture P/N	54	01010100	84	T
77	Manufacture P/N	4E	01001110	78	N
78	Manufacture P/N	30	00110000	48	0
79	Manufacture P/N	31	00110001	49	1
7A	Manufacture P/N	2E	00101110	46	.
7B	Manufacture P/N	30	00110000	48	0
7C		20	00100000	32	
7D		0A	00001010	10	
7E	Extension Flag	00	00000000	0	
7F	Checksum	6F	01101111	111	