(V) Preliminary Specifications
( ) Final Specifications

Module	**10.1”(10.1”) HD 16:9 Color TFT-LCD (RGB 6-bits+FRC) with LED Backlight design**
Model Name	B101XAN01.2 (H/W:0A)
Note ( )	***LED Backlight without driving circuit design***

Customer	**Date**
Checked & Approved by	**Date**
Note: This Specification is subject to change without notice.	

Approved by	**Date**
Trista Jiang	02/25/2013
Prepared by	**Date**
Terry Chien	02/25/2013
NBBU Marketing Division AU Optronics corporation	

Contents

Record of Revision

Version and Date	Page	Old description	New Description	Remark
0.0 2013/01/10	All	Preliminary Edition for Customer		
0.1 2013/02/25	P29~ P31		Update EDID	

1. Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.
2) Be sure to turn off power supply when inserting or disconnecting from input connector.
3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
7) Do not open nor modify the Module Assembly.
8) Do not press the reflector sheet at the back of the module to any directions.
9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
11) After installation of the TFT Module into an enclosure (Notebook PC Bezel, for example), do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.
12) Small amount of materials having no flammability grade is used in the LCD module. The LCD module should be supplied by power complied with requirements of Limited Power Source (IEC60950 or UL1950), or be applied exemption.
13) Disconnecting power supply before handling LCD modules, it can prevent electric shock, DO NOT TOUCH the electrode parts, cables, connectors and LED circuit part of TFT module that a LED light bar build in as a light source of back light unit. It can prevent electrostatic breakdown.

2. General Description

B101XAN01.2 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 WXGA, 1,366(H) x768(V) screen and 16.7M colors without LED backlight driving circuit. All input signals are LVDS interface compatible.

B101XAN01.2 is designed for a display unit of notebook style personal computer and industrial machine.

2.1 General Specification

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

Items	Unit	Specifications			
Screen Diagonal	[mm]	255.28			
Active Area	[mm]	222.5214X 125.1072 typ			
Pixels H x V		1,366x3(RGB) x 768			
Pixel Pitch	[mm]	0.1629x 0.1629			
Pixel Format		R.G.B. Vertical Stripe			
Display Mode		AHVA, Normally Black			
White Luminance (ILED=22mA) (Note: ILED is LED current)	[cd/m^2]	350 nits (typ) 300 nits (min)			
Luminance Uniformity		1.25 max. (5 points)			
Contrast Ratio		800 typ			
Response Time	[ms]	25 typ / 35 Max			
Nominal Input Voltage VDD	[Volt]	+3.3 typ.			
Power Consumption (Column Inversion)	[Watt]	2.65W max. (w/o LED driver) BLU power 1.95 W (w/o efficency,30ea,21mA)			
Weight	[Grams]	135g max (Panel Only)			
Physical Size	[mm]		Min.	Typ.	Max.
		Length	233.3	233.8	234.3
		Width	138.5	139	139.5
		Thickness	-	-	2.4 (Panel Side) 4.4 (PCBA Side)
Electrical Interface		40 pin LVDS, w/o LED driver			

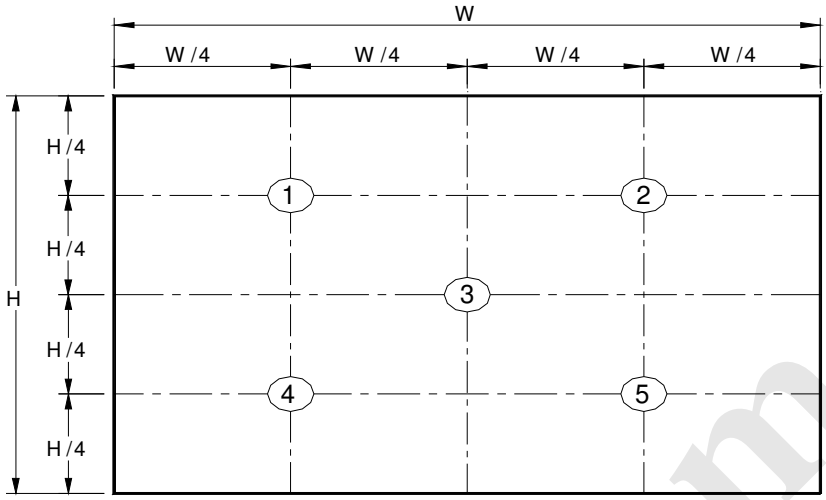
Glass Thickness	[mm]	0.25
Surface Treatment		Anti-Glare
Support Color		16.7M colors (RGB 6-bits+FRC)
Temperature Range Operating Storage (Non-Operating)	 [°C] [°C]	 -20 to +60 -30 to +70
RoHS Compliance		RoHS Compliance

2.2 Optical Characteristics

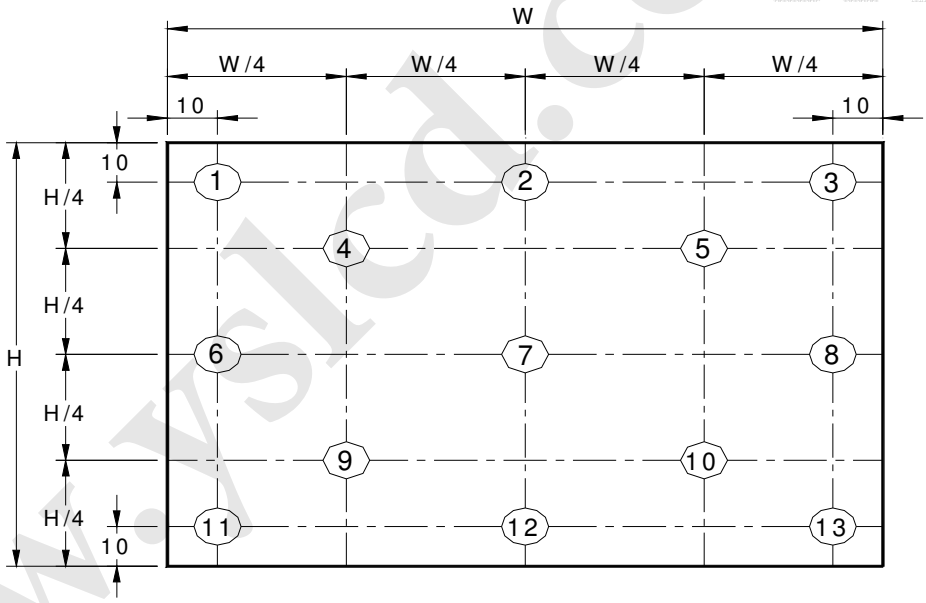
The optical characteristics are measured under stable conditions at 25℃ (Room Temperature) :

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
White Luminance I_{LED}=21mA (Base Panel Only)			5 points average	300	350	-	cd/m^2	1, 4, 5.
Viewing Angle		θ_R	Horizontal (Right) CR = 10	80	85	-	degree	4, 9
		θ_L	(Left)	80	85	-		
		ψ_H	Vertical (Upper) CR = 10	80	85	-		
		ψ_L	(Lower)	80	85	-		
Luminance Uniformity		δ_{5P}	5 Points	-	-	1.25		1, 3, 4
Luminance Uniformity		δ_{13P}	13 Points	-	-	1.5		2, 3, 4
Contrast Ratio		CR		-	800	-		4, 6
Cross talk		%				4		4, 7
Response Time		T_r	Rising	-	15	20	msec	4, 8
		T_f	Falling	-	10	15		
		T_{RT}	Rising + Falling	-	25	35		
Color / Chromaticity Coodinates	Red	Rx		TBD	TBD	TBD		4
		Ry		TBD	TBD	TBD		
	Green	Gx		TBD	TBD	TBD		
		Gy		TBD	TBD	TBD		
	Blue	Bx		TBD	TBD	TBD		
		By		TBD	TBD	TBD		
	White	Wx		0.283	0.313	0.343		
		Wy		0.299	0.329	0.359		
NTSC		%		-	50	-		

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



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



Note 3: The luminance uniformity of 5 or13 points is defined by dividing the maximum luminance values by the minimum test point luminance

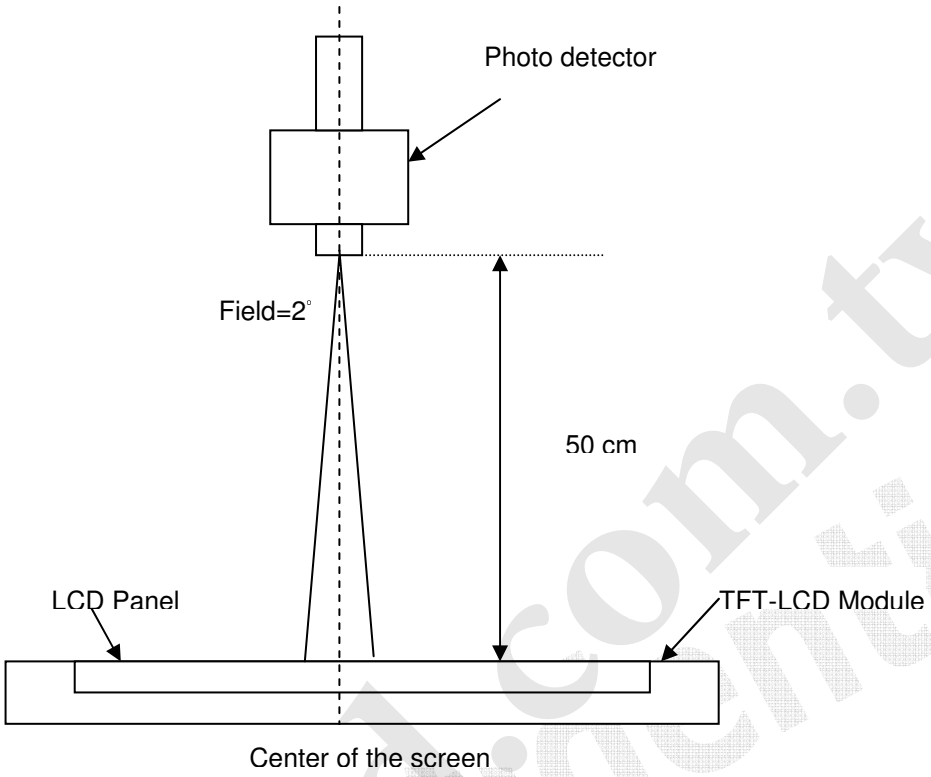
$$\delta_{W5} = \frac{\text{Maximum Brightness of five points}}{\text{Minimum Brightness of five points}}$$

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

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.



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

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

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

Note 6： Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

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

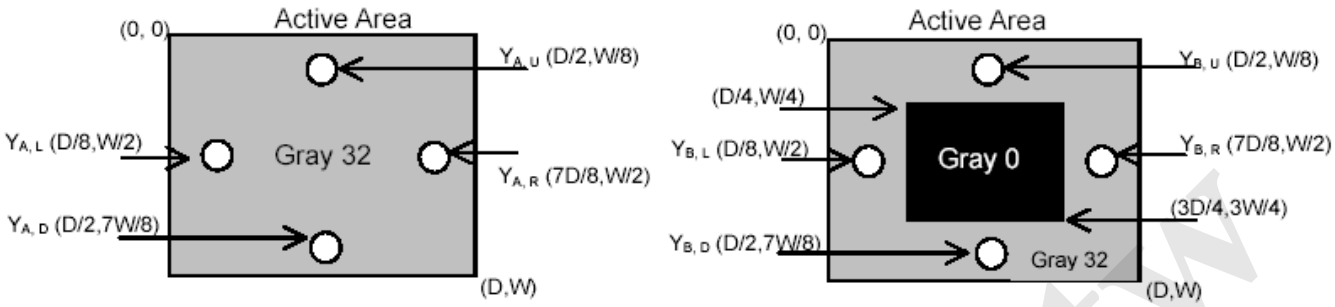
Note 7： Definition of Cross Talk (CT)

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

Where

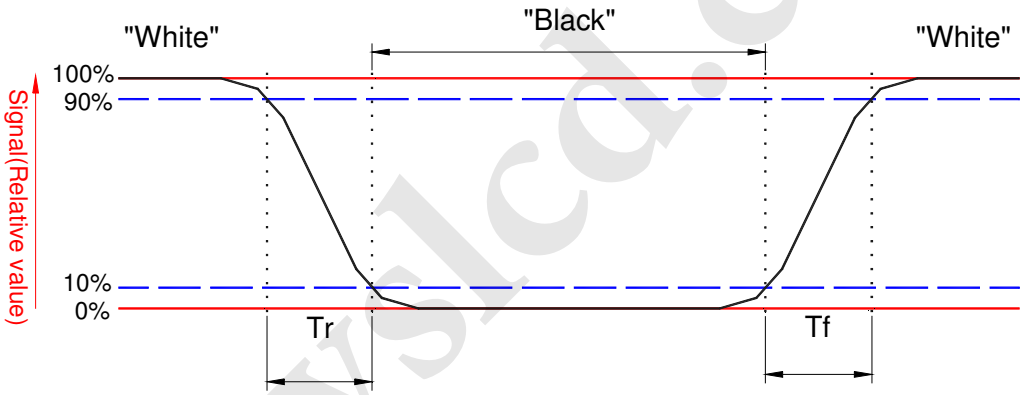
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

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



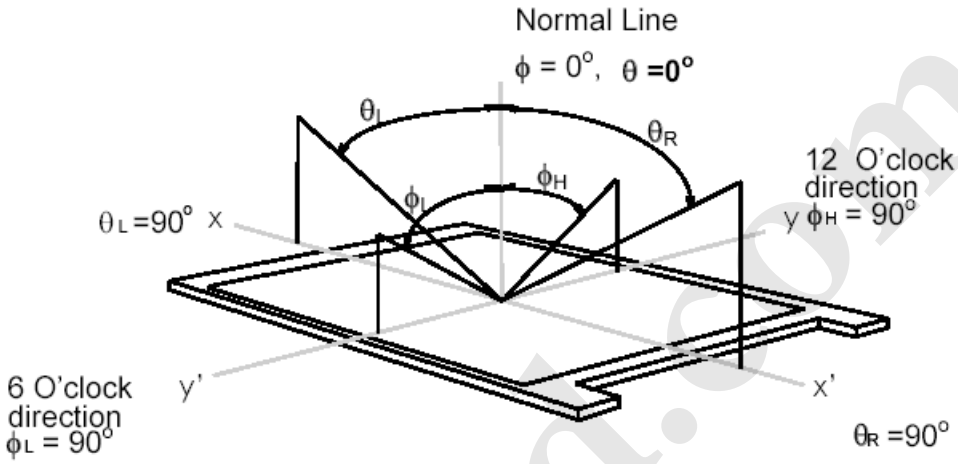
Note 8: Definition of response time:

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



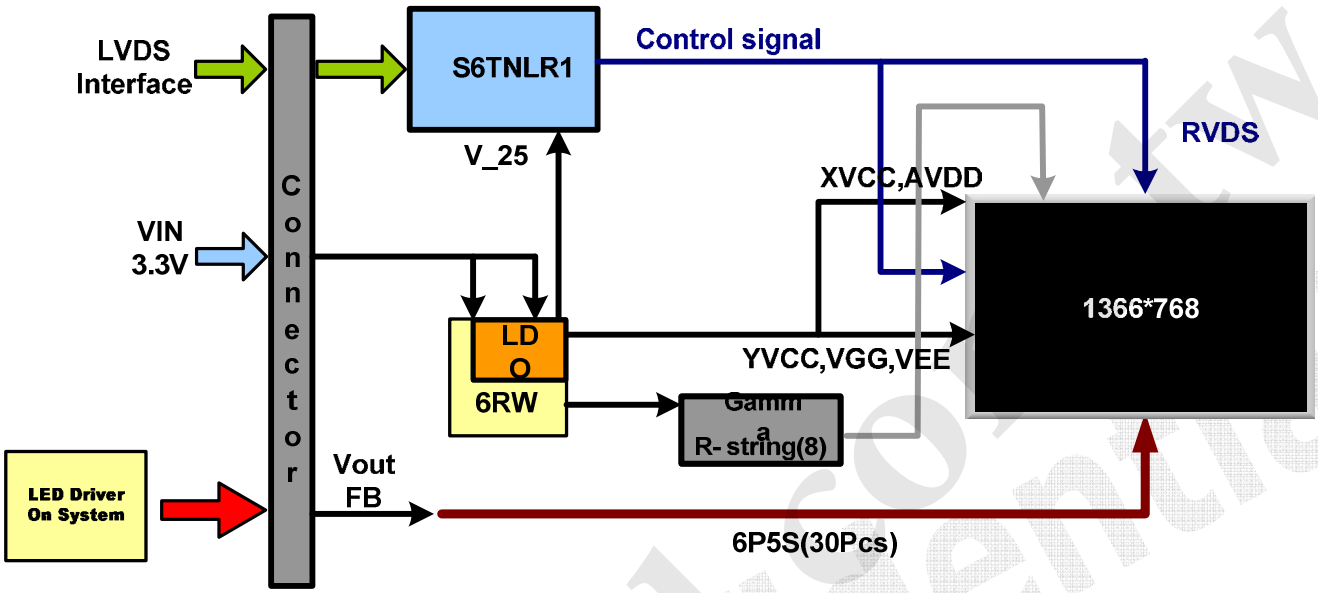
Note 9. Definition of viewing angle

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



3. Functional Block Diagram

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



4. Absolute Maximum Ratings

An absolute maximum rating of the module is as following:

4.1 Absolute Ratings of TFT LCD Module

Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	Vin	-0.3	+4	[Volt]	Note 1,2

4.2 Absolute Ratings of Environment

Item	Symbol	Min	Max	Unit	Conditions
Operating Temperature	TOP	-20	+60	[°C]	Note 4
Operation Humidity	HOP	5	95	[%RH]	Note 4
Storage Temperature	TST	-30	+70	[°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).

5. Electrical Characteristics

5.1 TFT LCD Module

5.1.1 Power Specification

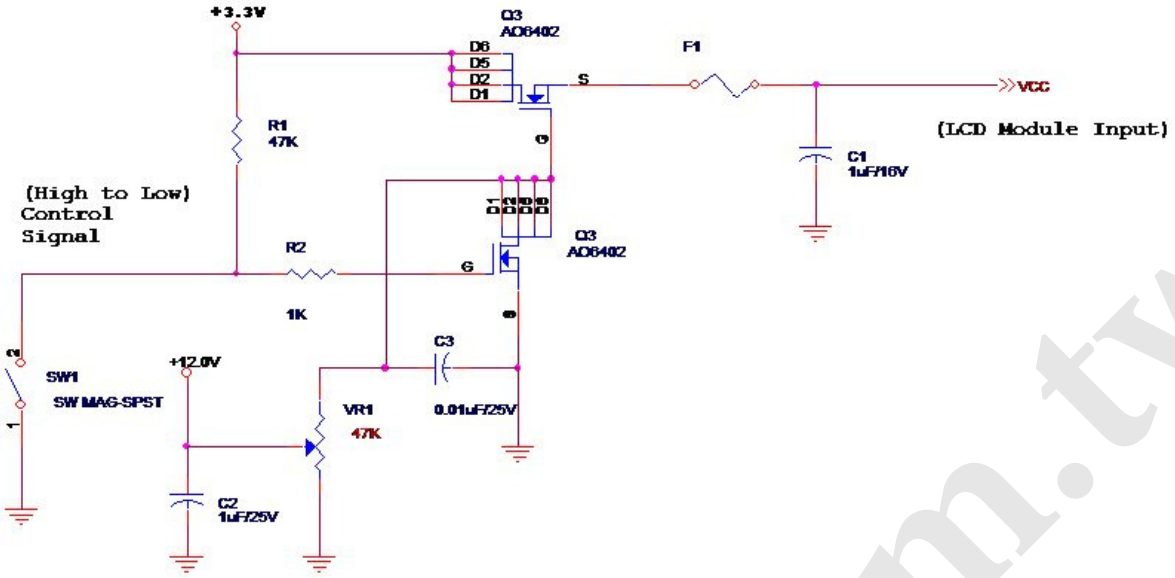
Input power specifications are as follows;

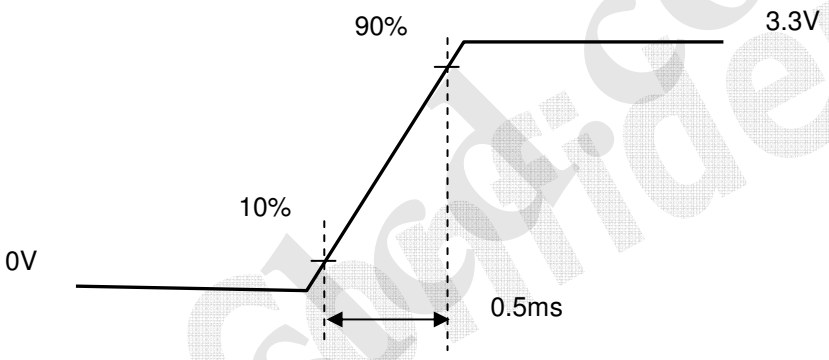
The power specification are measured under 25℃ and frame frenquency under 60Hz

Symble	Parameter	Min	Typ	Max	Units	Note
VDD	Logic/LCD Drive Voltage	3.0	3.3	3.6	[Volt]	
PDD	VDD Power	-	-	0.7	[Watt]	Note 1
IDD	IDD Current	-	213	195	[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 : White Pattern at 3.3V driving voltage. ($P_{max}=V_{3.3} \times I_{white}$)

Note 2 : Measure Condition





Vin rising time

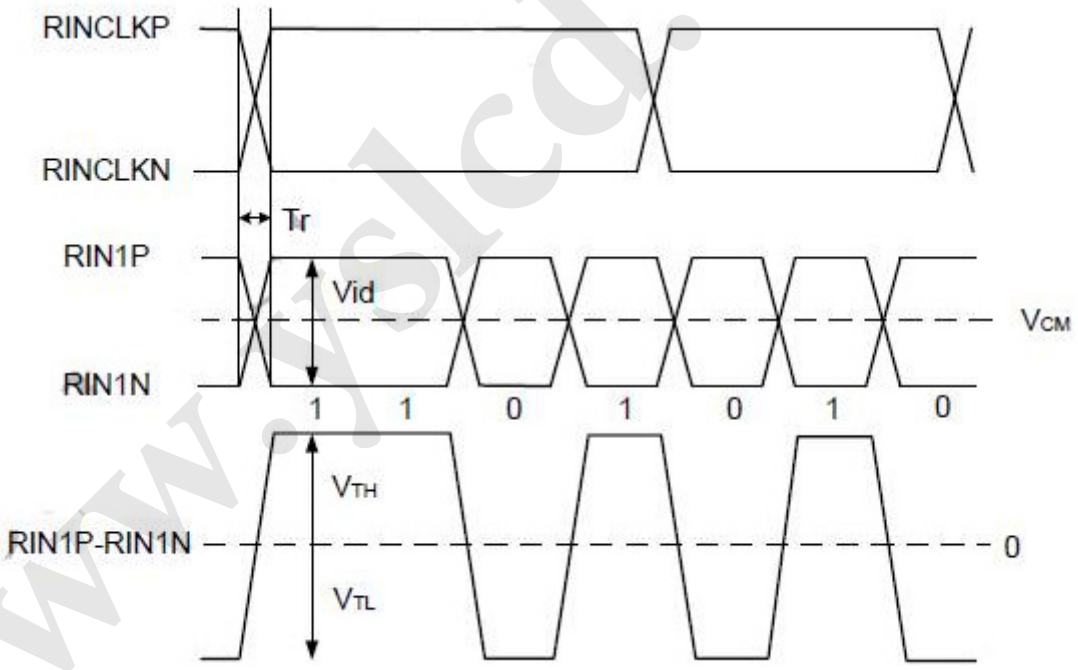
5.1.2 Signal Electrical Characteristics

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

Signal electrical characteristics are as follows;

Parameter	Condition	Min	Max	Unit
V_{th}	Differential Input High Threshold (Vcm=+1.2V)	-	100	[mV]
V_{tl}	Differential Input Low Threshold (Vcm=+1.2V)	-100		[mV]
V_{ID}	Differential Input Voltage	100	600	[mV]
V_{cm}	Differential Input Common Mode Voltage	0.2	2.2	[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	-	-	1.95W (w/o efficiency)	[Watt]	(Ta=25℃), Note 1
LED Life-Time	N/A	15K		-	Hour	(Ta=25℃), Note 2 I_F=21 mA
LED Forward Voltage	VF	2.8	3.0	3.3	[Volt]	
LED Forward Voltage of every LED string	VF-string	-	15	16.5	[Volt]	
LED Forward Current	IF		21		[mA]	

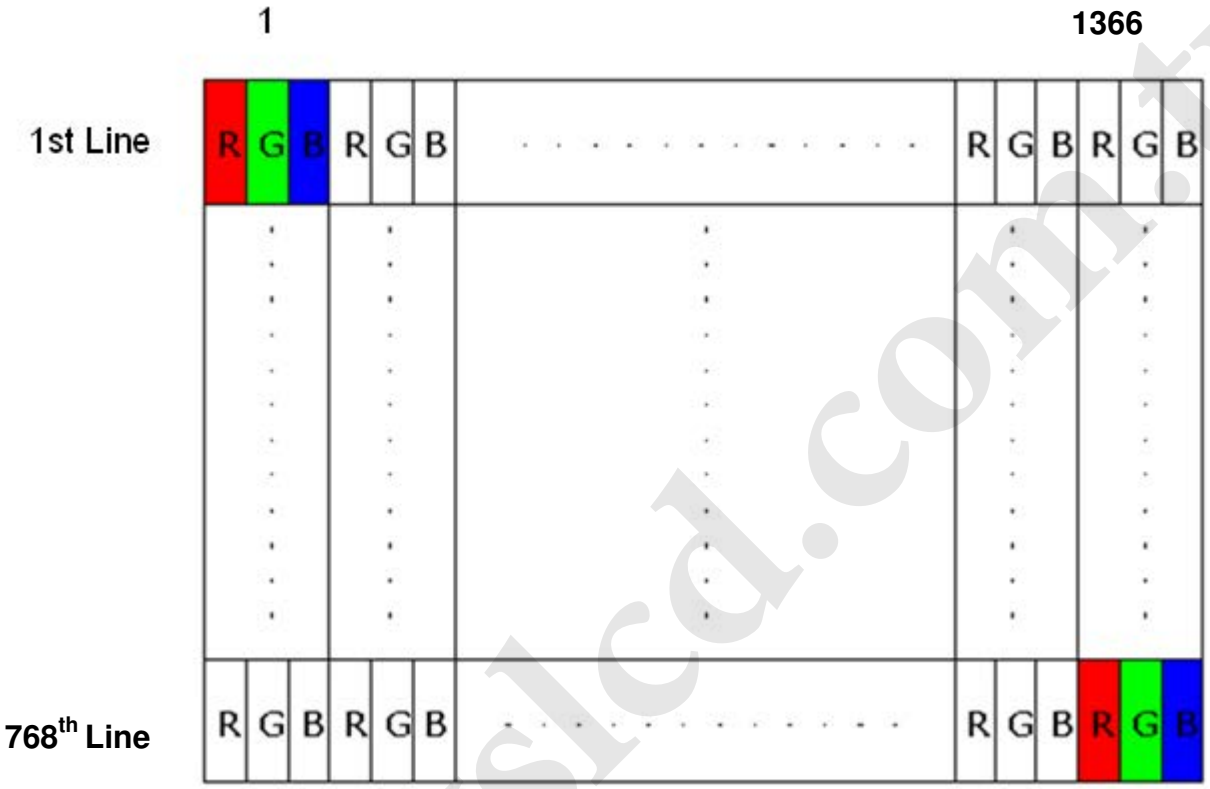
Note 1: Calculator value for reference P_{LED} = V_F (Normal Distribution) * I_F (Normal Distribution)

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

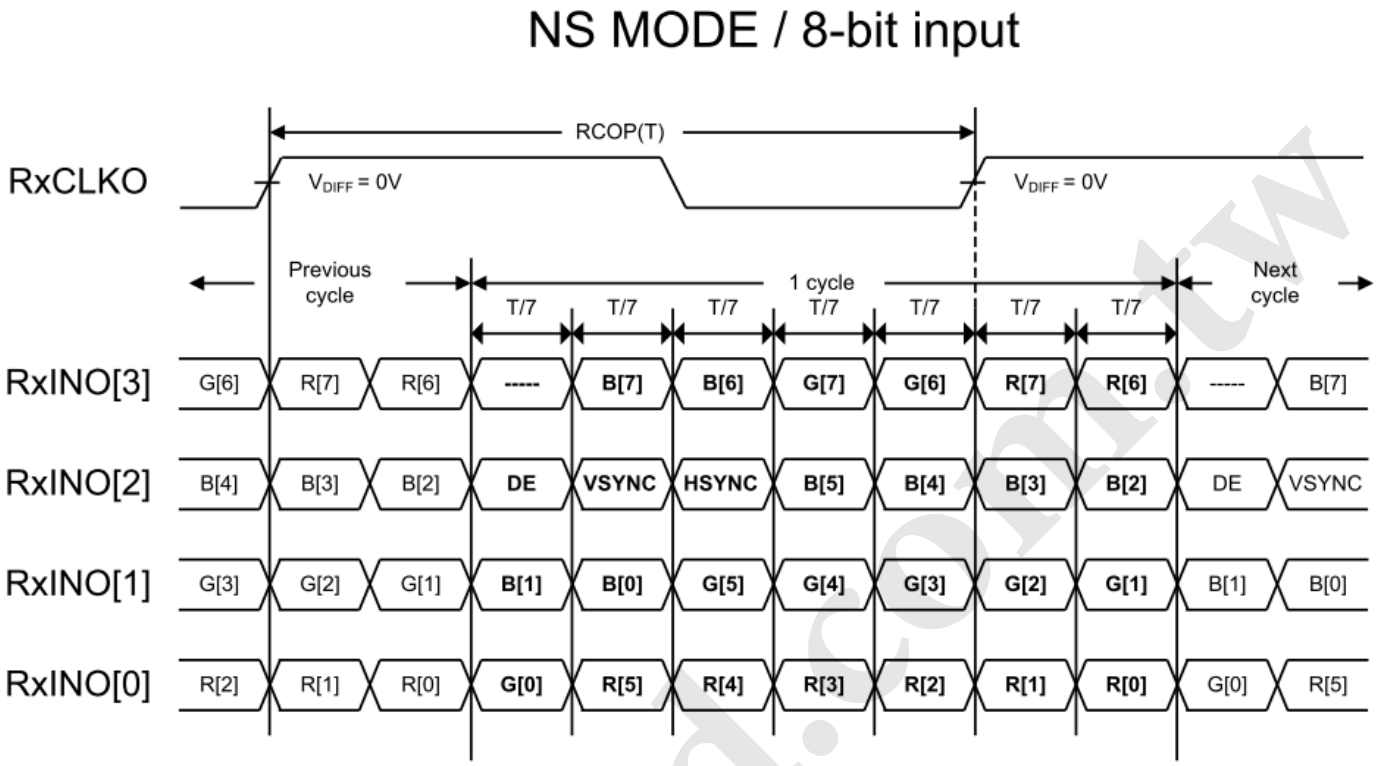
6. Signal Interface Characteristic

6.1 Pixel Format Image

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



6.2 The Input Data Format



Signal Name	Description	
R7 R6 R5 R4 R3 R2 R1 R0	Red Data 7 (MSB) Red Data 6 Red Data 5 Red Data 4 Red Data 3 Red Data 2 Red Data 1 Red Data 0 (LSB) Red-pixel Data	Red-pixel Data Each red pixel's brightness data consists of these 8 bits pixel data.
G7 G6 G5 G4 G3 G2 G1 G0	Green Data 7(MSB) Green Data 6 Green Data 5 Green Data 4 Green Data 3 Green Data 2 Green Data 1 Green Data 0 (LSB) Green-pixel Data	Green-pixel Data Each green pixel's brightness data consists of these 8 bits pixel data.
B7 B6 B5 B4 B3 B2	Blue Data 8(MSB) Blue Data 7 Blue Data 5 Blue Data 4 Blue Data 3 Blue Data 2	Blue-pixel Data Each blue pixel's brightness data consists of these 8 bits pixel data.

B1 B0	Blue Data 1 Blue Data 0 (LSB) 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 .

Note1: DE Mode Only.
Note 2: 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

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
2	VDD	Power Supply +3.3V
3	VDD	Power Supply +3.3V
4	VDDEDID	EDID +3.3V Power
5	AGING	Aging Mode Power Supply (AUO only)
6	CLK_EDID	EDID Clock Input
7	DATA_EDID	EDID Data Input
8	RXOIN0N	Negative LVDS Differential Data INPUT for odd pixel
9	RXOIN0P	Positive LVDS Differential Data INPUT for odd pixel
10	GND	Ground
11	RXOIN1N	Negative LVDS Differential Data INPUT for odd pixel
12	RXOIN1P	Positive LVDS Differential Data INPUT for odd pixel
13	GND	Ground
14	RXOIN2N	Negative LVDS Differential Data INPUT for odd pixel
15	RXOIN2P	Positive LVDS Differential Data INPUT for odd pixel
16	GND	Ground
17	RXOCLKINN	Negative LVDS Differential Clock INPUT for odd pixel
18	RXOCLKINP	Positive LVDS Differential Clock INPUT for odd pixel
19	GND	Ground
20	RXOIN3N	Negative LVDS Differential Data INPUT for odd pixel
21	RXOIN3P	Positive LVDS Differential Data INPUT for odd pixel

22	GND	Ground
23	FB6	LED Cathode Feedback 6
24	FB5	LED Cathode Feedback 5
25	GND	Ground
26	FB4	LED Cathode Feedback 4
27	FB3	LED Cathode Feedback 3
28	GND	Ground
29	FB2	LED Cathode Feedback 2
30	FB1	LED Cathode Feedback 1
31	GND	Ground
32	GND	Ground
33	GND	Ground
34	NC	No Connect
35	NC	No Connect
36	NC	No Connect
37	NC	No Connect
38	VLED Output	LED Backlight power
39	VLED Output	LED Backlight power
40	VLED Output	LED Backlight power

6.4 Interface Timing

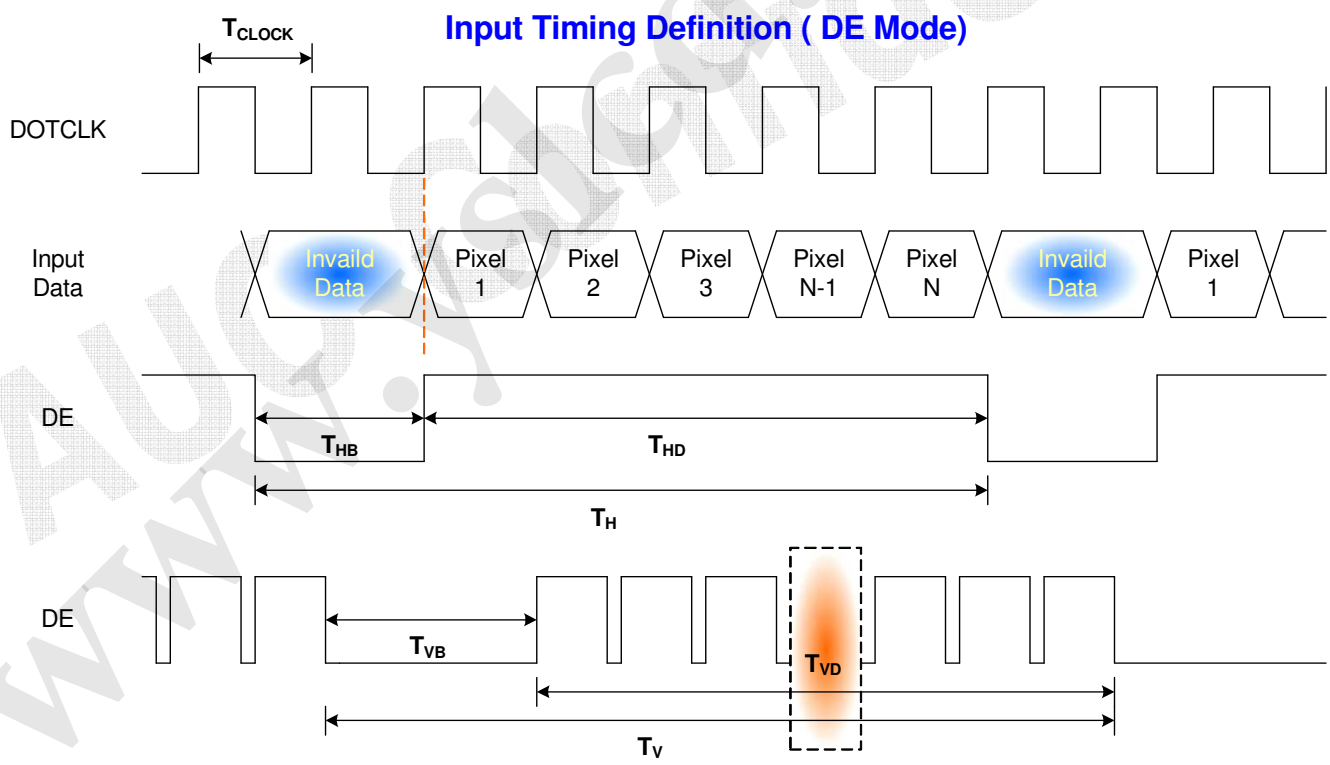
6.4.1 Timing Characteristics

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

Parameter		Symbol	Min.	Typ.	Max.	Unit
Frame Rate		---	--	60	---	Hz
Clock frequency		1/ T_{Clock}	69.38	72.4	89.6	MHz
Vertical Section	Period	T_V	774	790	862	T_{Line}
	Active	T_{VD}	768			
	Blanking	T_{VB}	6	22	94	
Horizontal Section	Period	T_H	1494	1526	1732	T_{Clock} (Note 2)
	Active	T_{HD}	1366			
	Blanking	T_{HB}	128	160	366	

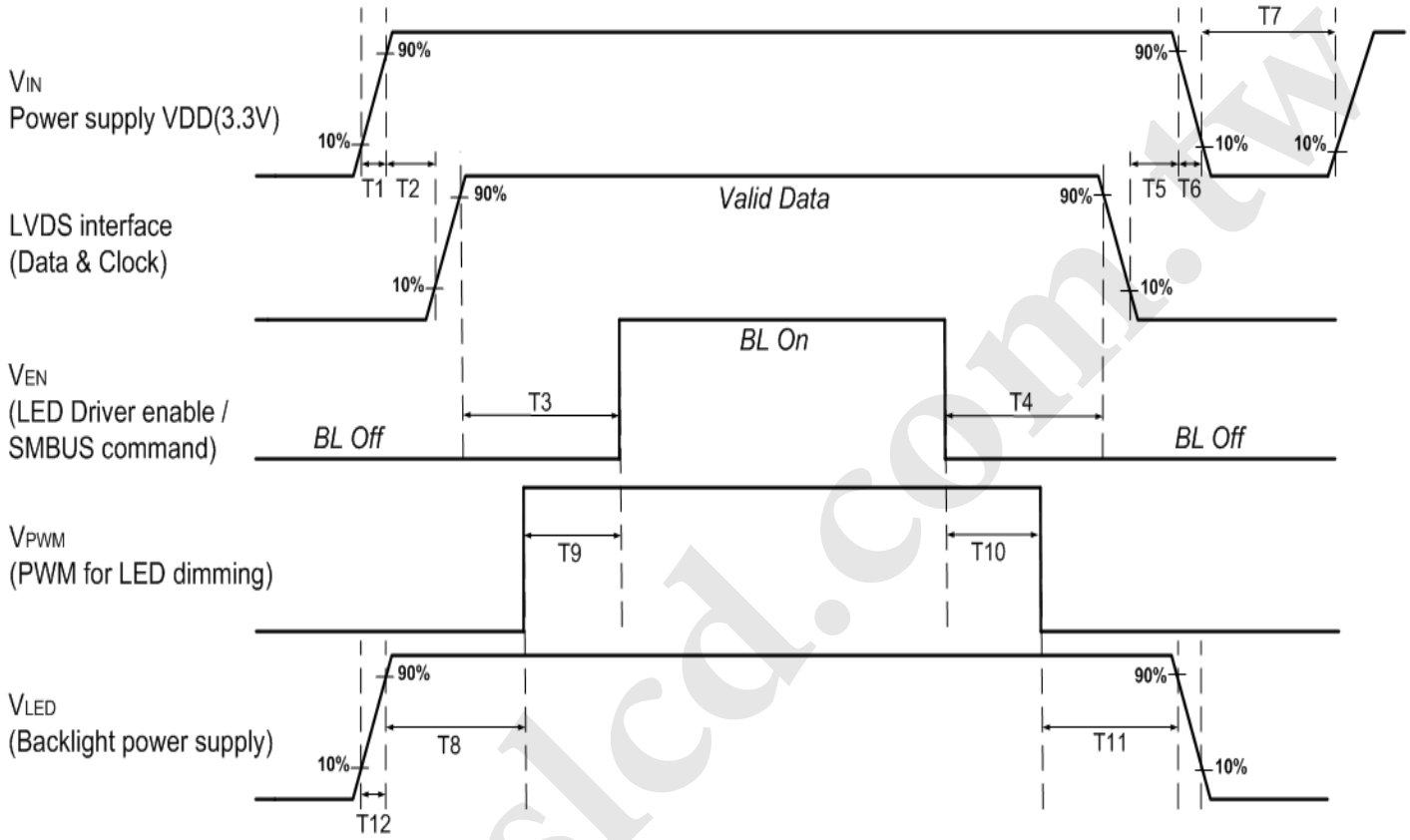
Note1 : DE mode only

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 Min.	Value Max.	Units
T1	0.5	10	ms
T2	0	50	ms
T3	200	-	ms
T4	200	-	ms
T5	0	50	ms
T6	0	10	ms
T7	500	-	ms
T8	10	-	ms
T9	10	-	ms
T10	10	-	ms
T11	10	-	ms
T12	0.5	10	ms

7. Panel Reliability Test

7.1 Vibration Test

Test Spec:

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

7.2 Shock Test

Test Spec:

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

7.3 Reliability Test

Items	Required Condition	Note
Temperature Humidity Bias	Ta= 40℃, 90%RH, 240h	
High Temperature Operation	Ta= 60℃, Dry, 240h	
Low Temperature Operation	Ta=-20℃, 240h	
High Temperature Storage	Ta= 70℃, 240h	
Low Temperature Storage	Ta= -20℃, 240h	
Thermal Shock Test	Ta=-30℃(30min) ~70℃(30min), 20cycles condition.	
ESD	Contact : ±8 KV Air : ±15 KV	Note 1

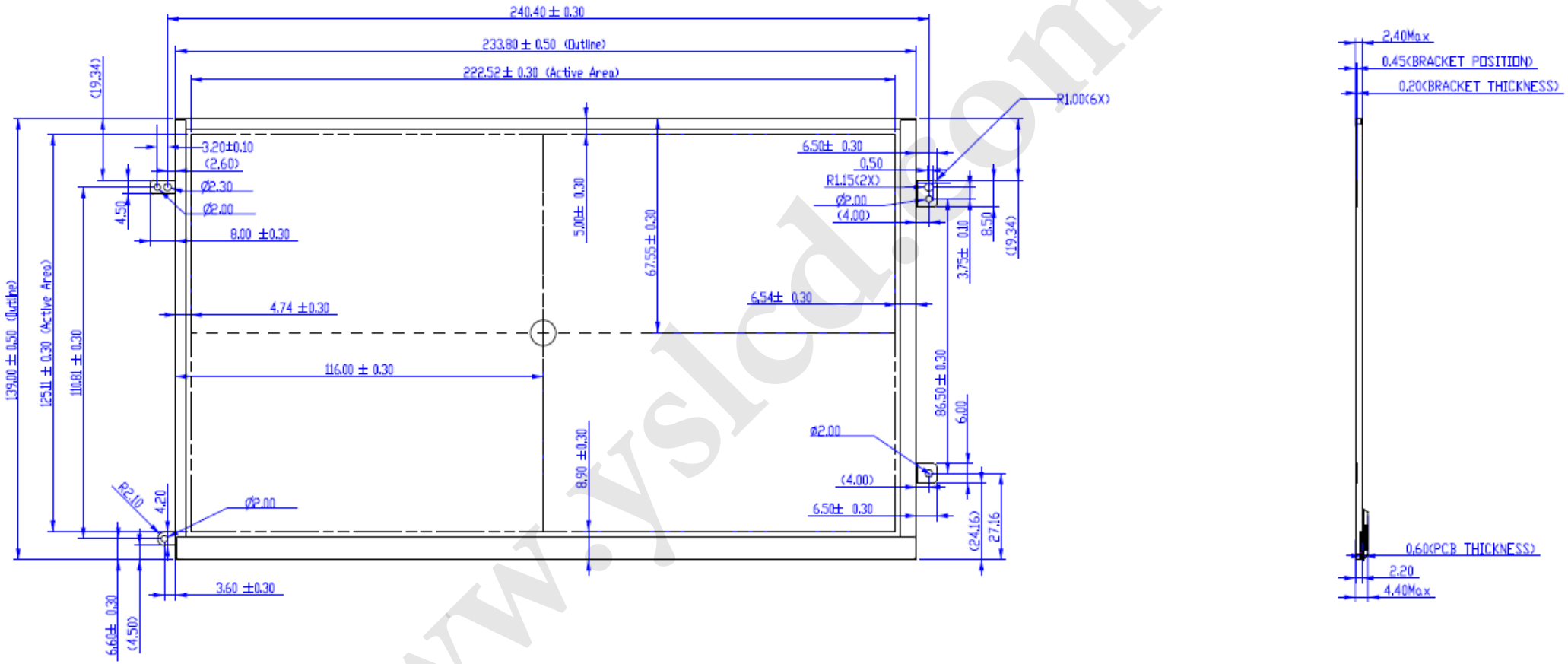
Note1: According to EN 61000-4-2 , ESD class B: Some performance degradation allowed. No data lost . Self-recoverable. No hardware failures.

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

8. Mechanical Characteristics

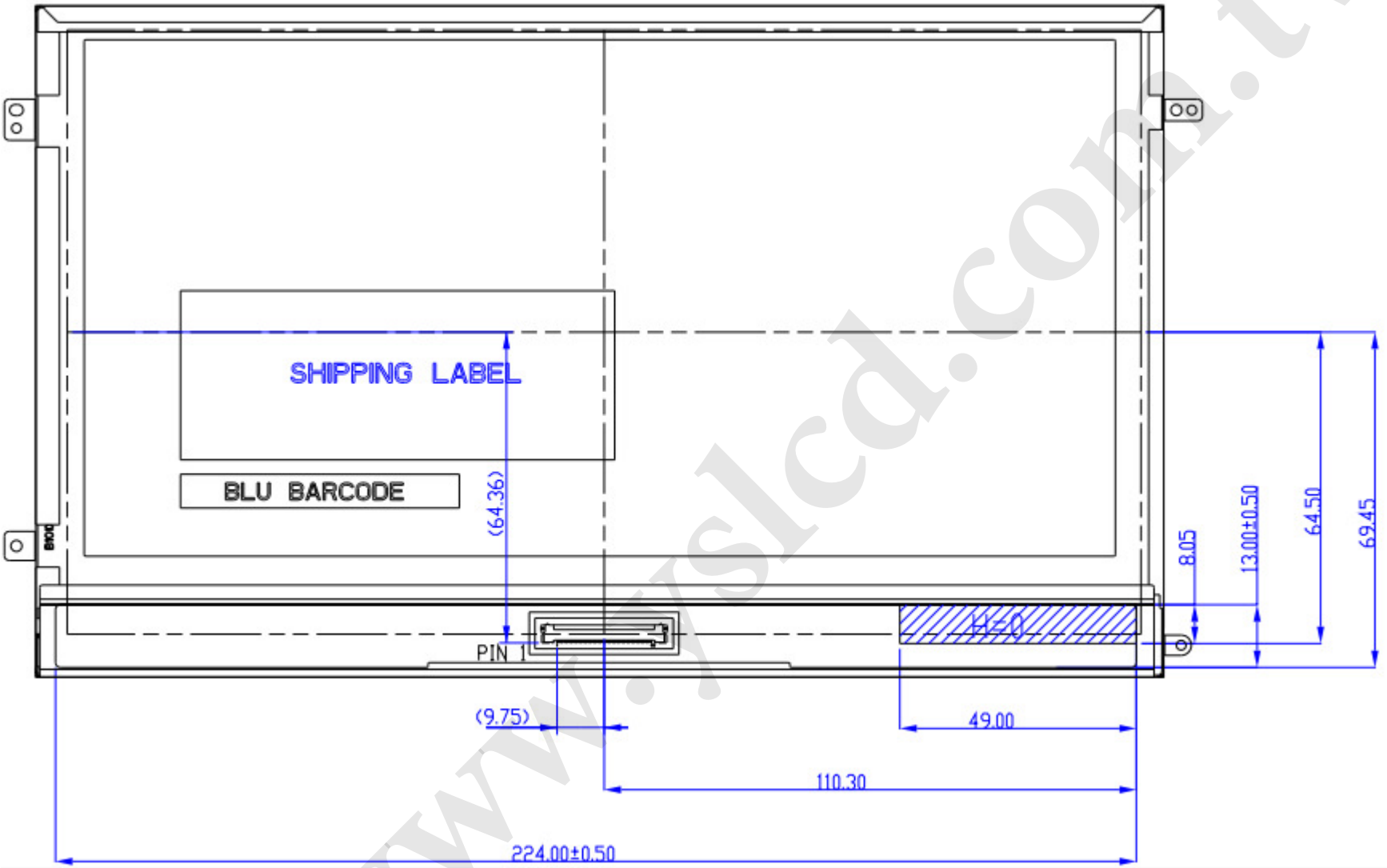
8.1 LCM Outline Dimension

8.1.1 Front View



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

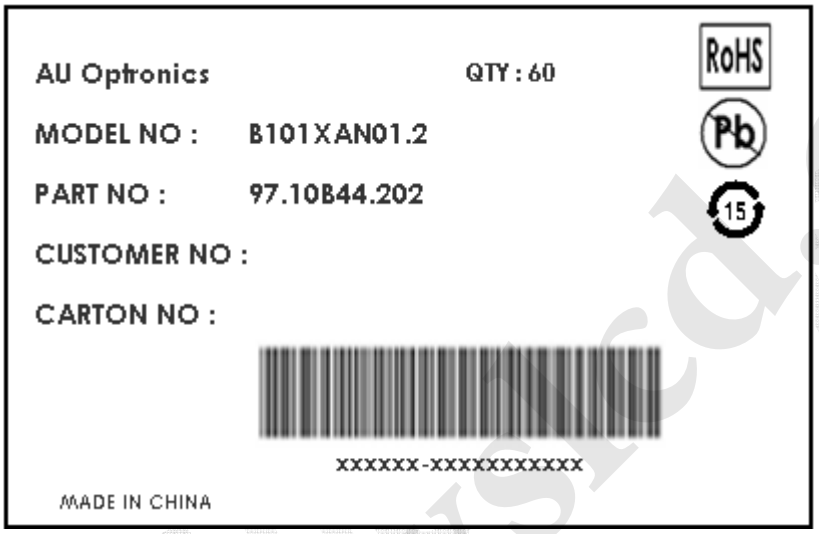
8.1.2 Rear View



9. Shipping and Package

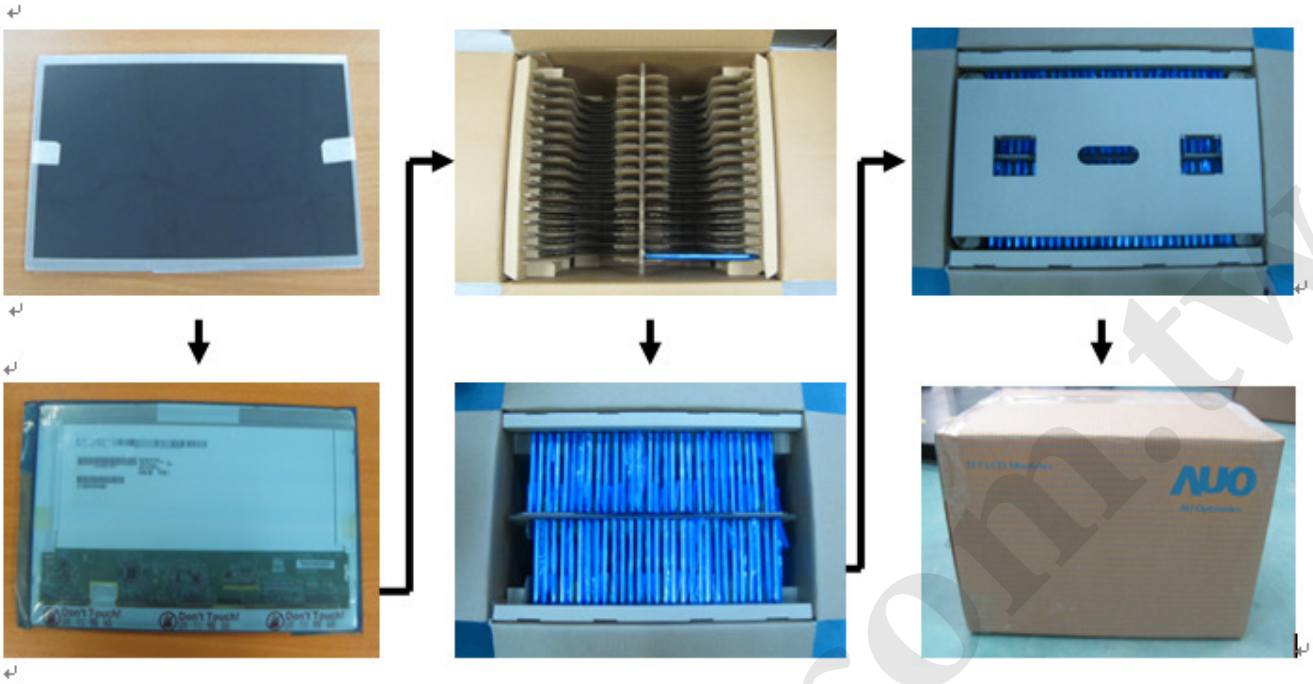
9.1 Shipping Label Format

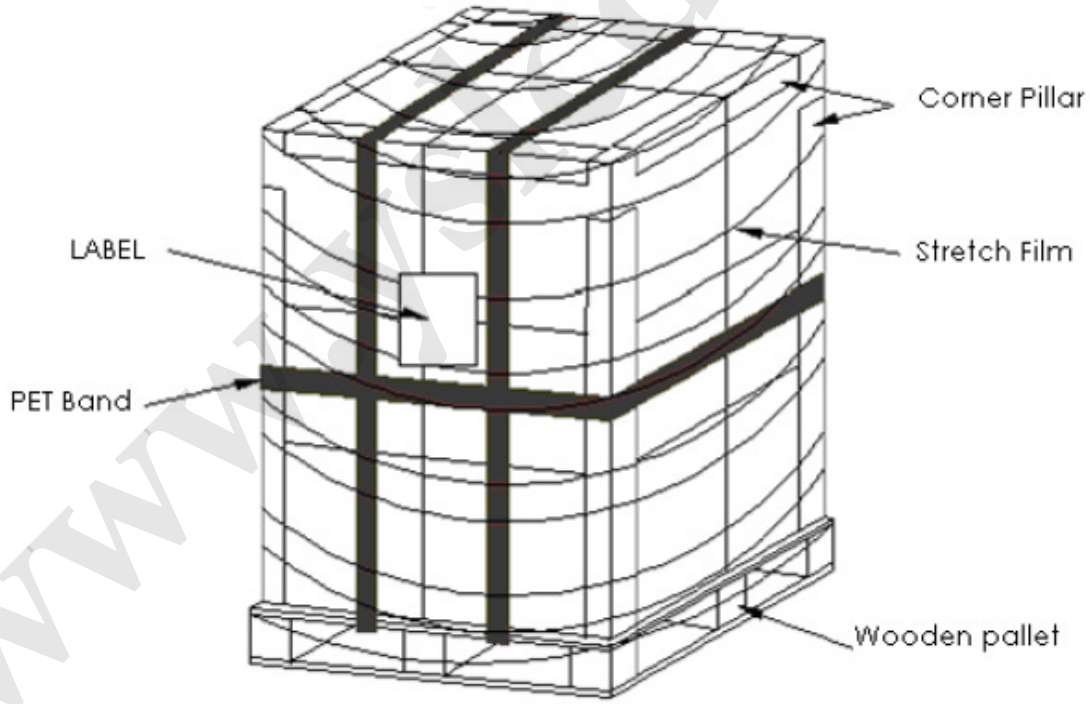
9.2 Carton Label Format



9.3 Shipping Package of Palletizing Sequence

Packing Flow





10. Appendix: EDID Description

B101XAN01 0 EDID Code

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	DC	11011100	220	
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	17	00010111	23	
12	EDID Structure Ver.	01	00000001	1	
13	EDID revision #	04	00000100	4	
14	**Video input def.** *(digital I/P, non-TMDS, CRGB)*	A0	10100000	160	
15	**Max H image size** *(rounded to cm)*	16	00010110	22	
16	**Max V image size** *(rounded to cm)*	0D	00001101	13	
17	**Display Gamma** *(=(gamma*100)-100)*	78	01111000	120	
18	**Feature support** *(no DPMS, Active OFF, RGB, tmg Blk#1)*	02	00000010	2	
19	Red/green low bits **(Lower 2:2:2:2 bits)**	99	10011001	153	
1A	Blue/white low bits **(Lower 2:2:2:2 bits)**	85	10000101	133	
1B	Red x **(Upper 8 bits)**	95	10010101	149	
1C	Red y/ highER 8 bits	55	01010101	85	
1D	Green x	56	01010110	86	
1E	Green y	92	10010010	146	
1F	Blue x	28	00101000	40	
20	Blue y	22	00100010	34	
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	
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	54	01010100	84	
37	Pixel Clock/10000 USB	1F	00011111	31	
38	Horz active **Lower 8bits**	56	01010110	86	
39	Horz blanking **Lower 8bits**	44	01000100	68	
3A	HorzAct:HorzBlnk **Upper 4:4 bits**	51	01010001	81	
3B	Vertical Active **Lower 8bits**	00	00000000	0	
3C	Vertical Blanking **Lower 8bits**	16	00010110	22	
3D	Vert Act : Vertical Blanking **(upper 4:4 bit)**	30	00110000	48	
3E	HorzSync. Offset	C0	11000000	192	
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**	DE	11011110	222	
43	Vertical Image Size **Lower 8bits**	7D	01111101	125	
44	Horizontal & Vertical Image Size **(upper 4:4 bits)**	00	00000000	0	
45	Horizontal Border *(zero for internal LCD)*	00	00000000	0	
46	Vertical Border *(zero for internal LCD)*	00	00000000	0	
47	Signal *(non-intr, norm, no stero, sep sync, neg pol)*	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	
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	30	00110000	48	0
74	Manufacture P/N	31	00110001	49	1
75	Manufacture P/N	58	01011000	88	X
76	Manufacture P/N	41	01000001	65	A
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	13	00010011	19	
			SUM	6144	
			SUM to HEX	1800	