TFT LCD Approval Specification

MODEL NO.: N121IB - L05

Customer: Lenovo International

Approved by: _____

Note:

核准時間	部門	審核	角色	投票
2009-08-28 18:33:08	NB 產品管理處	楊 2009.08.28 竣 傑	Director	Accept

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
3.0	May. 15, 2009	All	All	Approval specification was first issued.
3.1	Jun. 30. 2009	12	5.1	Note (1) Connector Part No.: FI-XB30SL-HF10
				Note (2) User's connector Part No: FI-XB30S-HF10
		18~19	6.2	Update Converter specification
		20	7.1	Update 50Hz timing
		21~22	7.2	Update timing specification
		23	8.2	Update optical specification
3.2	Aug. 24. 2009	21	7.2	Update Power on/off sequence

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N121IB - L05 is a 12.1" TFT Liquid Crystal Display module with LED Backlight unit and 30 pins LVDS interface. This module supports 1280 x 800 WXGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The converter module for Backlight is built in.

1.2 FEATURES

- WXGA (1280 x 800 pixels) resolution
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock
- Meet RoHS requirement
- LED Backlight

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATI0NS

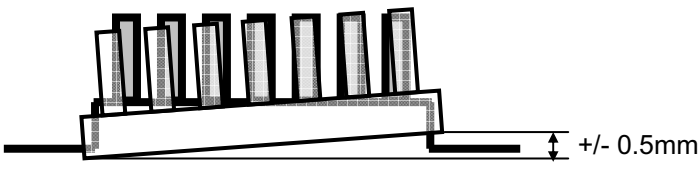
Item	Specification	Unit	Note
Active Area	261.12 (H) x 163.2 (V) (12.1" diagonal)	mm	(1)
Bezel Opening Area	263.67 (H) x 165.75 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.204 (H) x 0.204 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Anti-glare type	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	275.3	275.8	276.3	mm	(1)
	Vertical(V)	177.4	178	178.6	mm	
	Depth(D)	---	5.0	5.3	mm	
Weight		---	285	295	g	-
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	220/2	G/ms	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

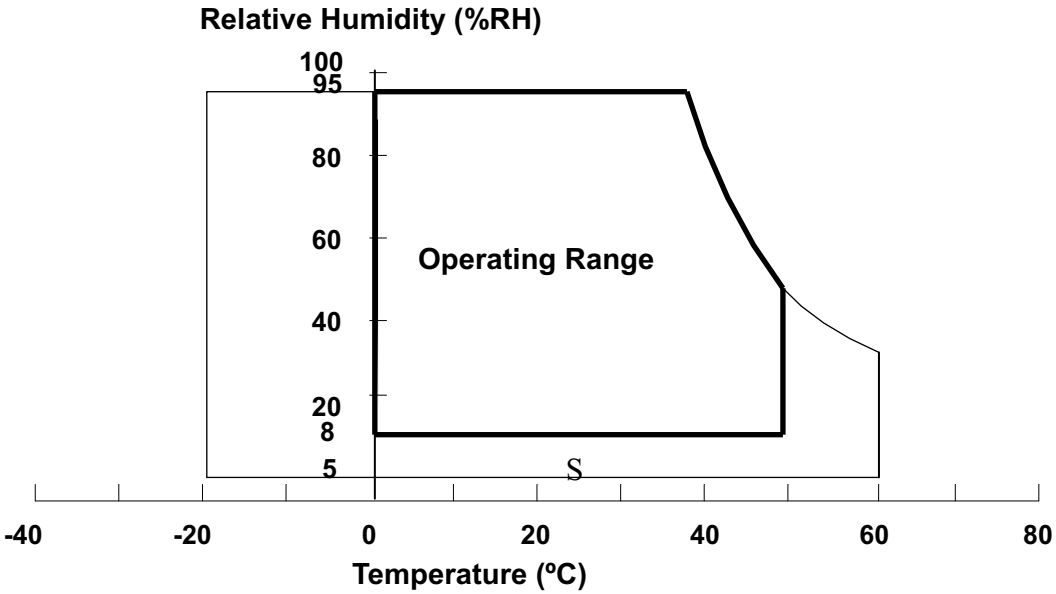
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 ºC Min. and 60 ºC Max.

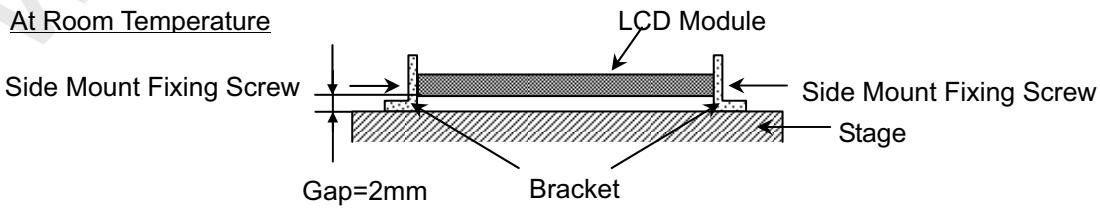


Note (3) 1 time for ± X, ± Y, ± Z. for Condition (220G / 2ms) is half Sine Wave,

Note (4) 10 ~ 500 Hz, 0.5 Hr / Cycle, 1 cycles for each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	V_{CC}+0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
LED Light Bar Power Supply Voltage	V_L	-35	23.8	V	(1), (2)
LED Light Bar Power Supply Current	I_L	0	150	mA	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

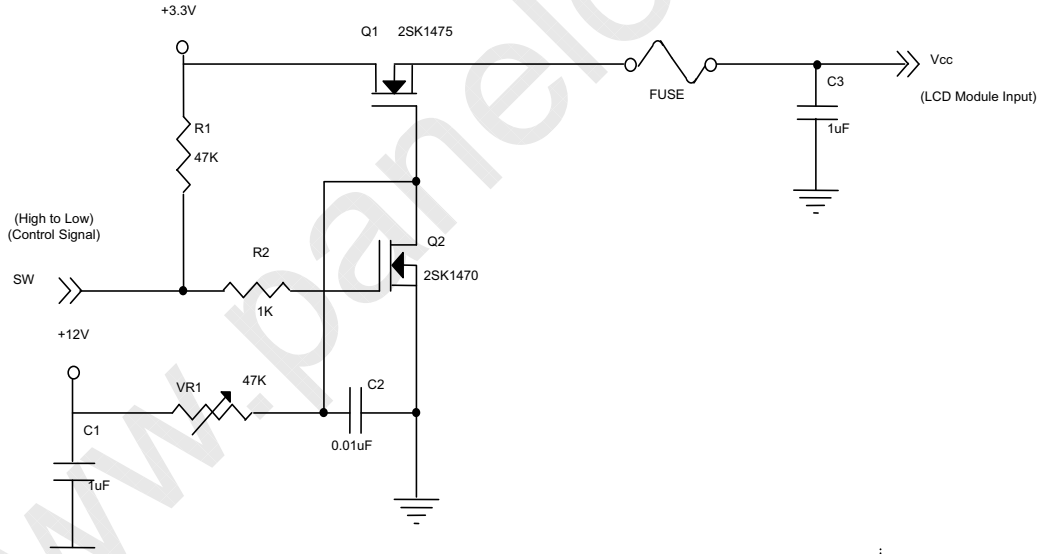
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Permissive Ripple Voltage		V_{RP}			100	mV	-
Rush Current		I_{RUSH}			1.5	A	(2)
Initial Stage Current		I_{IS}			1.0	A	(2)
Power Supply Current	White	Icc		270	300	mA	(3)a
	Black			330	360	mA	(3)b
LVDS Differential Input High Threshold		$V_{TH(LVDS)}$	+100			mV	(5), V_{CM}=1.2V
LVDS Differential Input Low Threshold		$V_{TL(LVDS)}$			-100	mV	(5) V_{CM}=1.2V
LVDS Common Mode Voltage		V_{CM}	1.125		1.375	V	(5)
LVDS Differential Input Voltage		$\|V_{ID}\|$	100		600	mV	(5)
Terminating Resistor		R_T		100		Ohm	
Power per EBL WG		P_{EBL}		1.69		W	(4)

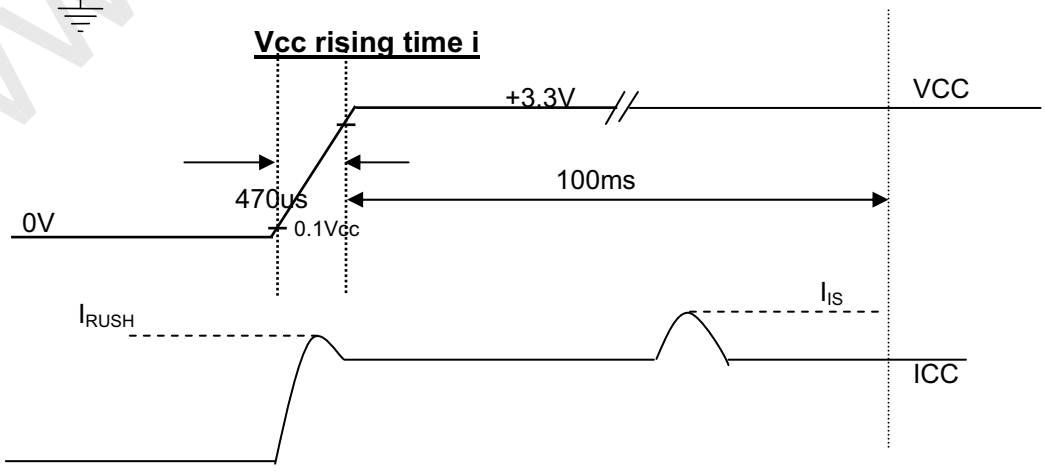
Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) I_{RUSH}: the maximum current when VCC is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.





Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

Active Area

b. Black Pattern

Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the converter input power. Test conditions are as follows.

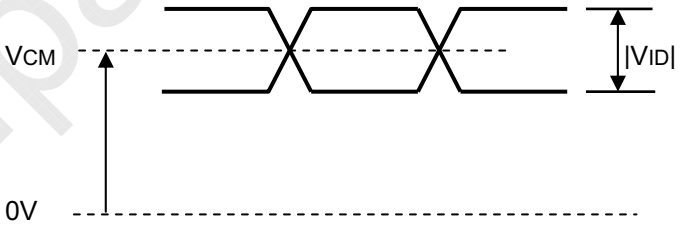
(a) Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz,

(b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.

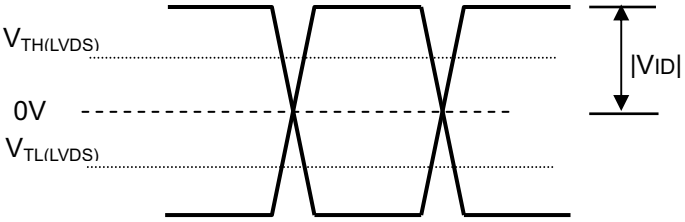
(c) Luminance: 60 nits.

Note (5) The parameters of LVDS signals are defined as the following figures.

Single Ended



Differential

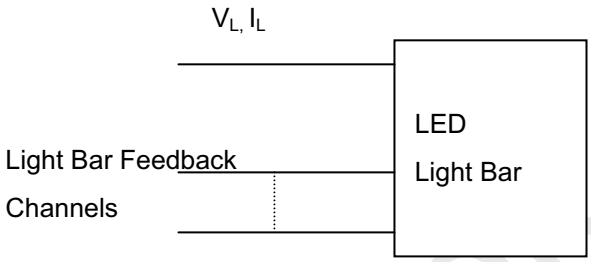


3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED light bar Power Supply Voltage	V_L	20.3	22.4	23.8	V_{dc}	(1), (2)
LED light bar Power Supply Current	I_L	99.7	105	110.3	mA	
LED Life Time	L_{BL}	15,000	-	-	Hrs	(4)
Power Consumption	P_L	2.02	2.35	2.62	W	(3), I_L = 105mA

Note (1) LED light bar configuration is shown as below:



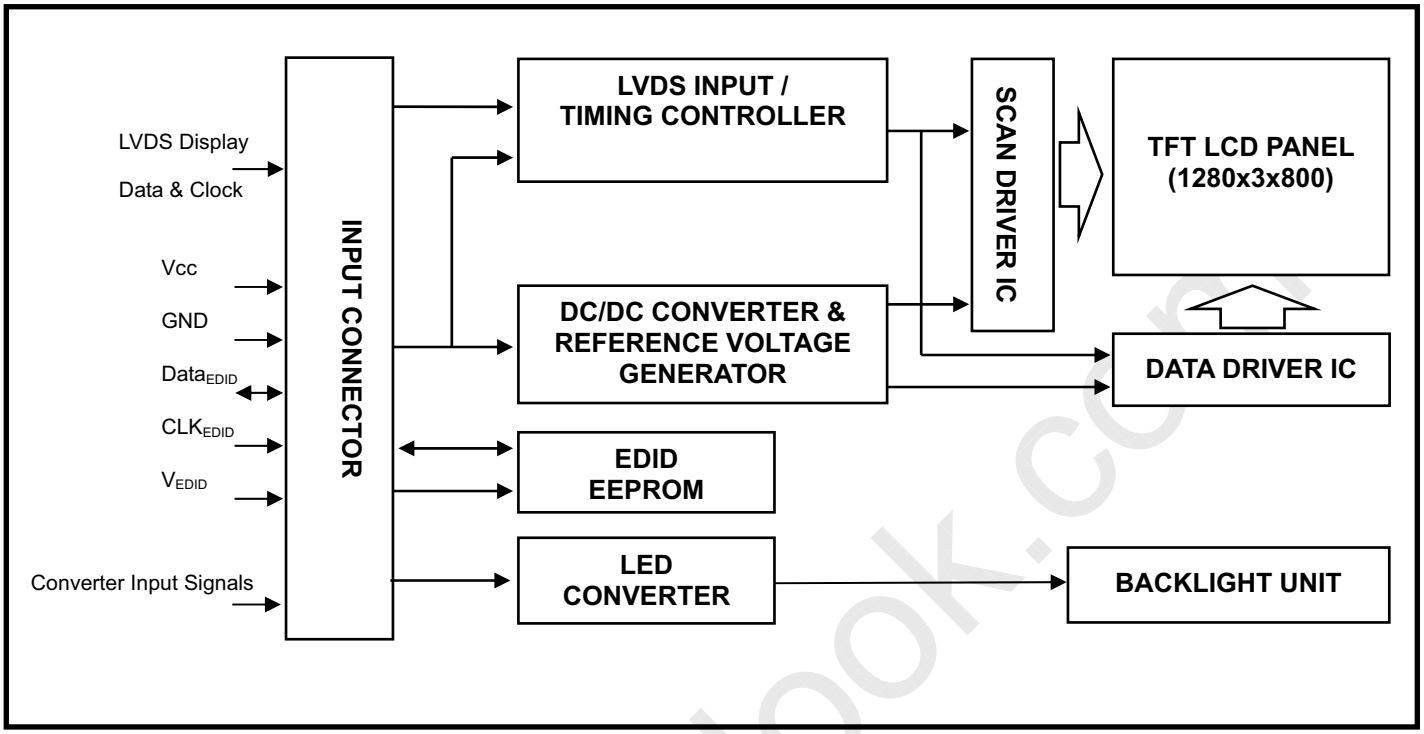
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 °C and I_L = 17.5 mA(Per EA) until the brightness becomes ≦ 50% of its original value.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



5. INPUT TERMINAL PIN ASSIGNMENT

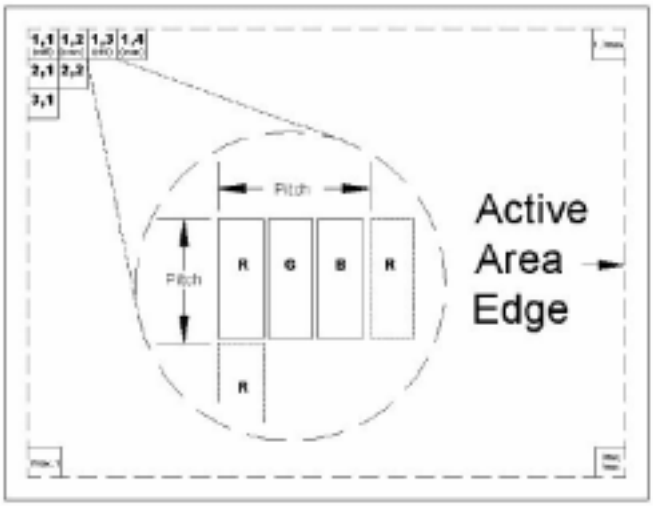
5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	NC	No Connection (Reserved for supplier)		-
2	VCCS	Power Supply, 3.3V (typical)		-
3	VCCS	Power Supply, 3.3V (typical)		-
4	EE_VDD	DDC 3.3V power		
5	BIST	Panel Self Test		
6	EE_SC	DDC Clock		
7	EE_SD	DDC Data		
8	IRin0-	- LVDS differential data input (R0-R5, G0)	Negative	R0~R5,G0-
9	IRn0+	+ LVDS differential data input (R0-R5, G0)	Positive	
10	GND	Ground		
11	IRin1-	- LVDS differential data input (G1-G5, B0-B1)	Negative	
12	IRn1+	+ LVDS differential data input (G1-G5, B0-B1)	Positive	G1~G5,B0,B1
13	GND	Ground		
14	IRin2-	- LVDS differential data input (B2-B5,HS,VS, DE)	Negative	-
15	IRn2+	+ LVDS differential data input (B2-B5,HS,VS, DE)	Positive	B2~B5,Hsync,Vsync,DE
16	GND	Ground		
17	ICLK-	- LVDS differential clock input	Negative	LVDS Level
18	ICLK+	+ LVDS differential clock input	Positive	
19	GND	Ground	-	-
20	GND	Ground	-	-
21	GND	Ground		
22	GND	Ground		
23	GND	Ground		
24	NC	No Connection		
25	LED_VCCS	LED Power		
26	LED_VCCS	LED Power		
27	LED_VCCS	LED Power		
28	LED_PWM	PWM Control Signal of LED Converter		
29	LED_EN	Enable Control Signal of LED Converter		
30	NC	No Connection		

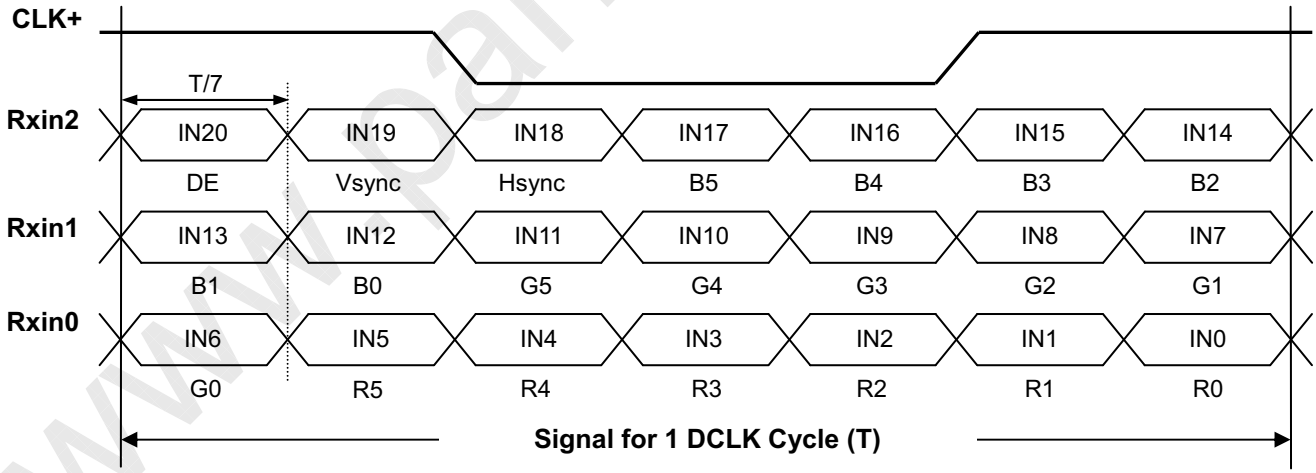
Note (1) Connector Part No.: FI-XB30SL-HF10

Note (2) User's connector Part No: FI-XB30S-HF10

Note (3) The first pixel is odd as shown in the following figure.



5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL



5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

5.4 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPDI standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	ID system manufacturer name (LSB)	30	00110000
9	9	ID system manufacturer name (MSB)	AE	10101110
10	0A	ID system Product Code (LSB)	11	00010001
11	0B	ID system Product Code (MSB)	40	01000000
12	0C	ID Serial Number (32-bit serial number)	00	00000000
13	0D	ID Serial Number (32-bit serial number)	00	00000000
14	0E	ID Serial Number (32-bit serial number)	00	00000000
15	0F	ID Serial Number (32-bit serial number)	00	00000000
16	10	Week of Manufacture	05	00000101
17	11	Year of Manufacture	13	00010011
18	12	EDID Structure version	01	00000001
19	13	EDID Revision	03	00000011
20	14	Video Input Definition	80	10000000
21	15	Max H image size (“26.112cm”)	1A	00011010
22	16	Max V image size (“16.575cm”)	11	00010001
23	17	Display gamma (gamma x 100)-100, (Gamma 2.2)	78	01111000
24	18	Feature support	EA	11101010
25	19	Rx1 Rx0 Ry1 Ry0 Gx1 Gx0 Gy1 Gy0	98	10011000
26	1A	Bx1 Bx0 By1 By0 Wx1 Wx0 Wy1 Wy0	D5	11010101
27	1B	Rx=0.572	92	10010010
28	1C	Ry=0.360	5C	01011100
29	1D	Gx=0.346	58	01011000
30	1E	Gy=0.578	94	10010100
31	1F	Bx=0.155	27	00100111
32	20	By=0.11	1C	00011100
33	21	Wx=0.313	50	01010000
34	22	Wy=0.329	54	01010100
35	23	Established Timing 1	00	00000000
36	24	Established Timing 2	00	00000000
37	25	Manufacturer's Timings	00	00000000
38	26	Standard Timing Identification #1	01	00000001
39	27	Standard Timing Identification #1	01	00000001
40	28	Standard Timing Identification #2	01	00000001

41	29	Standard Timing Identification #2	01	00000001
42	2A	Standard Timing Identification #3	01	00000001
43	2B	Standard Timing Identification #3	01	00000001
44	2C	Standard Timing Identification #4	01	00000001
45	2D	Standard Timing Identification #4	01	00000001
46	2E	Standard Timing Identification #5	01	00000001
47	2F	Standard Timing Identification #5	01	00000001
48	30	Standard Timing Identification #6	01	00000001
49	31	Standard Timing Identification #6	01	00000001
50	32	Standard Timing Identification #7	01	00000001
51	33	Standard Timing Identification #7	01	00000001
52	34	Standard Timing Identification #8	01	00000001
53	35	Standard Timing Identification #8	01	00000001
54	36	Detailed timing description # 1 60Hz Timing Pixel clock (“69.3MHz”, According to VESA CVT Rev1.1)	12	00010010
55	37	# 1 Pixel Clock (MSB) / (example: Pixel Clock / 10000)	1B	00011011
56	38	# 1 Horizontal Active (“1280”)	00	00000000
57	39	# 1 Horizontal Blanking (“132”)	84	10000100
58	3A	# 1Horizontal Active : Horizontal Blanking (“1280 : 132”)	50	01010000
59	3B	# 1Vertical Active (”800”)	20	00100000
60	3C	# 1Vertical Blanking (”18”)	12	00010010
61	3D	# 1Vertical Active : Vertical Blanking (”800 :18”)	30	00110000
62	3E	# 1 Horizontal Sync. Offset (”40”)	28	00101000
63	3F	# 1 Horizontal Sync Pulse Width ("26”)	1A	00011010
64	40	# 1 Vertical Sync Offset : Sync Width (”3 :4”)	34	00110100
65	41	# 1 Horizontal Vertical Sync Offset/Width upper 2bits = 0	00	00000000
66	42	# 1 Horizontal Image Size (260 mm)	04	00000100
67	43	# 1 Vertical Image Size (170 mm)	AA	10101010
68	44	# 1 Horizontal & Vertical Image Size (260:170)	10	00010000
69	45	# 1 Horizontal Border = 0	00	00000000
70	46	# 1 Vertical Border = 0	00	00000000
71	47	# 1 Flags, Non-interlaced,Normal display,no stereo,Digital separate sync,H/V pol negatives	18	00011000
72	48	Detailed timing description # 2 Slow Refresh Rate Timing Pixel clock (“57.75MHz”, According to VESA CVT Rev1.1) Refresh Rate:50Hz	8F	10001111
73	49	# 2 Slow Refresh Rate Pixel Clock (MSB) / (example: Pixel Clock / 10000)	16	00010110
74	4A	# 2 Horizontal Active (“1280”)	00	00000000
75	4B	# 2 Horizontal Blanking (“132”)	84	10000100
76	4C	# 2Horizontal Active : Horizontal Blanking (“1280 : 132”)	50	01010000
77	4D	# 2Vertical Active (”800”)	20	00100000
78	4E	# 2Vertical Blanking (”18”)	12	00010010
79	4F	# 2Vertical Active : Vertical Blanking (”800 :18”)	30	00110000
80	50	# 2 Horizontal Sync. Offset (”40”)	28	00101000
81	51	# 2 Horizontal Sync Pulse Width ("26”)	1A	00011010
82	52	# 2 Vertical Sync Offset : Sync Width (”3 :4”)	34	00110100
83	53	# 2 Horizontal Vertical Sync Offset/Width upper 2bits = 0	00	00000000
84	54	# 2 Horizontal Image Size (260 mm)	04	00000100
85	55	# 2 Vertical Image Size (170 mm)	AA	10101010

86	56	# 2 Horizontal & Vertical Image Size (260:170)	10	00010000
87	57	# 2 Horizontal Border = 0	00	00000000
88	58	# 2 Vertical Border = 0	00	00000000
89	59	# 2 Flags, Non-interlaced,Normal display,no stereo,Digital separate sync,H/V pol negatives	18	00011000
90	5A	Flag	00	00000000
91	5B	Flag	00	00000000
92	5C	Flag	00	00000000
93	5D	Data Type Tag	0F	00001111
94	5E	Flag	00	00000000
95	5F	Middle Refresh Rate #1 (Horizontal active pixels / 8) - 31	81	10000001
96	60	Middle Refresh Rate #1 Image Aspect ratio (16 : 10)	0A	00001010
97	61	Middle Refresh Rate #1 Refresh Rate = 60Hz	3C	00111100
98	62	Low Refresh Rate #2 (Horizontal active pixels / 8) - 31	81	10000001
99	63	Low Refresh Rate #2 Image Aspect ratio(16 : 10)	0A	00001010
100	64	Low Refresh Rate #2 Refresh Rate=50Hz	32	00110010
101	65	Brightness(220 /10 nit)	16	00010110
102	66	Feature flag	09	00001001
103	67	Reserved	00	00000000
104	68	LCD Supplier manufacturer code	0D	00001101
105	69	LCD Supplier manufacturer code, (Hex, LSB first)	AF	10101111
106	6A	LCD Supplier Product code	33	00110011
107	6B	LCD Supplier Product code (Hex, LSB first)	12	00010010
108	6C	Flag	00	00000000
109	6D	Flag	00	00000000
110	6E	Flag	00	00000000
111	6F	Data Type Tag	FE	11111110
112	70	Flag	00	00000000
113	71	Model Name (N121IB6-L06, 1st character, "N")	4E	01001110
114	72	Model Name (N121IB6-L06, 2st character, "1")	31	00110001
115	73	Model Name (N121IB6-L06, 3st character, "2")	32	00110010
116	74	Model Name (N121IB6-L06, 4st character, "1")	31	00110001
117	75	Model Name (N121IB6-L06, 5st character, "I")	49	01001001
118	76	Model Name (N121IB6-L06, 6st character, "B")	42	01000010
119	77	Model Name (N121IB6-L06, 7st character, "-")	2D	00101101
120	78	Model Name (N121IB6-L06, 8st character, "L")	4C	01001100
121	79	Model Name (N121IB6-L06, 9st character, "0")	30	00110000
122	7A	Model Name (N121IB6-L06, 10st character, "5")	35	00110101
123	7B	Model Name(If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	0A	00001010
124	7C	Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
125	7D	Model Name (If <13 char, then terminate with ASCII code 0Ah, set remaining char = 20h)	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	54	01010100

6. CONVERTER SPECIFICATION

6.1 ABSOLUTE MAXIMUM RATINGS

Symbol	Ratings
Vin	28V
PWM, EN	-0.3V~5.5V

6.2 RECOMMENDED OPERATING RATINGS

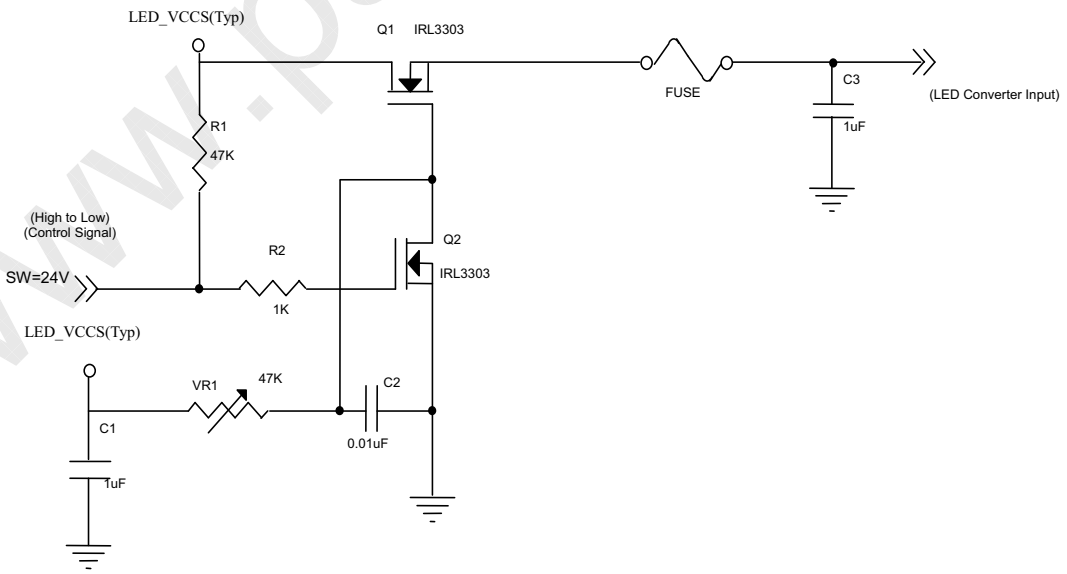
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input power supply voltage		V_{in}	6.0	12.0	21.0	V	
Converter Rush Current		$ILED_{RUSH}$	-	-	1.5	A	(2)
Converter Initial Stage Current		$ILED_{IS}$	-	-	1.5	A	(2)
EN Control Level	Backlight On		1.6	---	5.5	V	
	Backlight Off		0	---	0.8	V	
PWM Control Level	PWM High Level		2.0	---	5.5	V	
	PWM Low Level		0	---	0.8	V	
PWM Control Duty Ratio			1.5	---	100	%	
PWM Control Ripple Voltage		V_{PWM_pp}	---	---	100	mV	
PWM Control Frequency		f_{PWM}	165	---	1000	Hz	
LED Power Current	Vin=6V	I_{BL}	418	510	602	mA	(1)
	Vin=12V		209	255	301	mA	(1)
	Vin=21V		124	153	180	mA	(1)

Note (1) The specified LED power supply current is under the conditions at “LED_VCCS = Min, Typ, Max”, Ta = 25 ± 2 ºC, f_{PWM} = 200 Hz, Duty=100%.

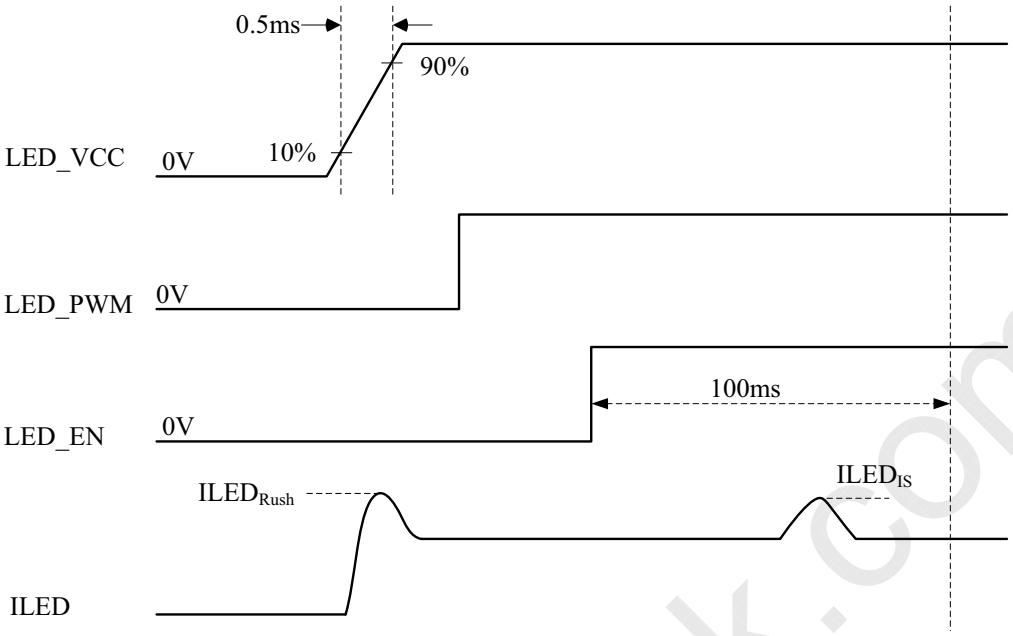
Note (2) $ILED_{RUSH}$: the maximum current when LED_VCCS is rising,

$ILED_{IS}$: the maximum current of the first 100ms after power-on,

Measurement Conditions: Shown as the following figure. LED_VCCS = 12, Ta = 25 ± 2 ºC, f_{PWM} = 200 Hz, Duty=100%.



VLED rising time is 500us



7. INTERFACE TIMING

7.1 INPUT SIGNAL TIMING SPECIFICATIONS

The specifications of input signal timing are as the following table and timing diagram.

Timing 1: 60Hz

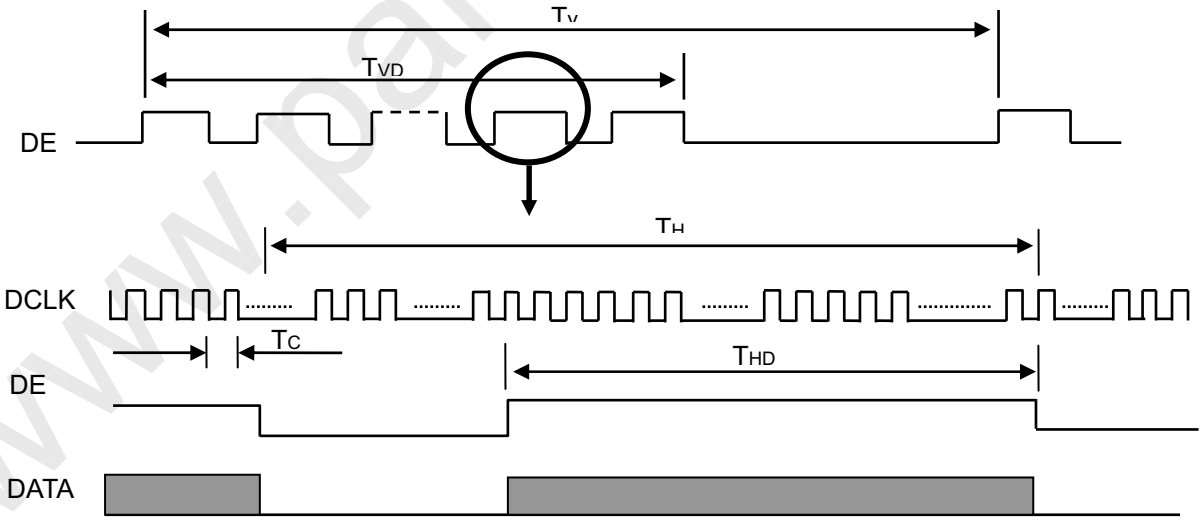
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	65.835	69.3	72.765	MHz	-
DE	Vertical Total Time	TV	802	818	1023	TH	-
	Vertical Active Display Period	TVD	800	800	800	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	18	TV-TVD	TH	
	Horizontal Total Time	TH	1380	1412	1600	Tc	-
	Horizontal Active Display Period	THD	1280	1280	1280	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	132	TH-THD	Tc	

Timing 2: 50Hz

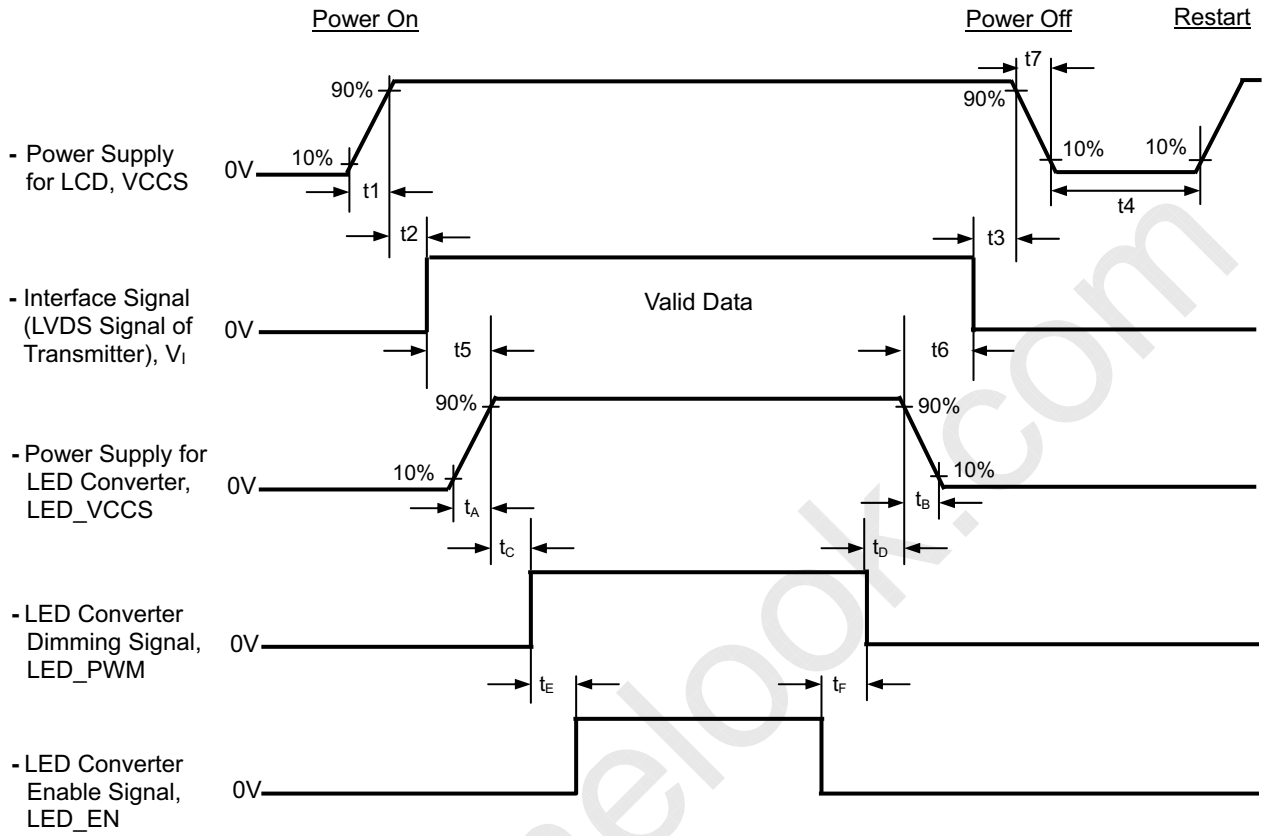
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	54.863	57.75	60.638	MHz	-
DE	Vertical Total Time	TV	802	818	920	TH	-
	Vertical Active Display Period	TVD	800	800	800	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	18	TV-TVD	TH	
	Horizontal Total Time	TH	1380	1412	1480	Tc	-
	Horizontal Active Display Period	THD	1280	1280	1280	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	132	TH-THD	Tc	

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

INPUT SIGNAL TIMING DIAGRAM



7.2 POWER ON/OFF SEQUENCE



Timing Specifications:

0.5 ≦ t1 ≦ 10 ms

0 ≦ t2 ≦ 50 ms

0 ≦ t3

t4 ≧ 150 ms

0 ≦ t7 ≦ 10 ms

t_A ≧ 0.5 ms

t_C ≧ 0 ms

t_D ≧ 0 ms

t_E ≧ 0 ms

t_F ≧ 0 ms

$t5 + t_C + t_E$ ≧ 200 ms

$t6 + t_D + t_F$ ≧ 0 ms

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Please follow the LED converter power sequence as above. If the customer could not follow, it might cause backlight flash issue during display ON/OFF or damage the LED backlight controller

8. OPTICAL CHARACTERISTICS

8.1 TEST CONDITIONS

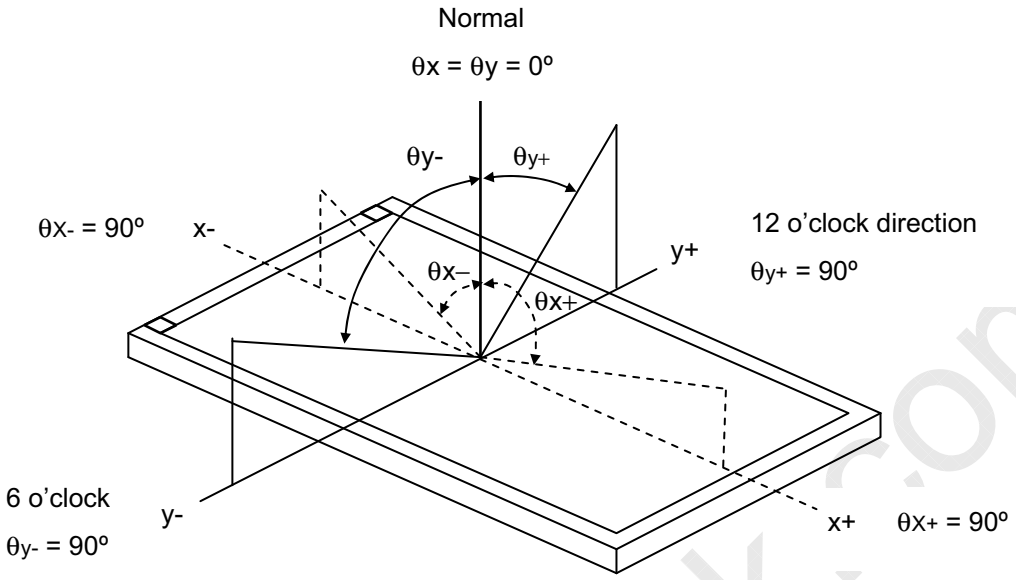
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I_L	105	mA

The measurement methods of optical characteristics are shown in Section 8.2. The following items should be measured under the test conditions described in Section 8.1 and stable environment shown in Note (5).

8.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Normal Angle	300	600	-	-	(2), (5)
Response Time		T_R		-	3	8	ms	(3)
		T_F		-	7	12	ms	
Luminance of White (5P)		L_{AVE}		185	220	-	cd/m^2	(4), (5)
White Variation (5P)		δW		--	--	1.25	%	(5), (6)
White Variation (13P)		δW		--	--	1.53	%	(5), (6)
Color gamut		C.G		42	45		%	(5), (7)
Color Chromaticity	Red	Rx		Typ.-0.03	0.572	Typ.+0.03	-	(1), (5)
		Ry			0.360		-	
	Green	Gx			0.346		-	
		Gy			0.578		-	
	Blue	Bx			0.155		-	
		By			0.110		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θ_x+	CR≥10	40	45	-	Deg.	(1), (5)
		θ_x-		40	45	-		
	Vertical	θ_Y+		15	20	-		
		θ_Y-		40	45	-		

Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

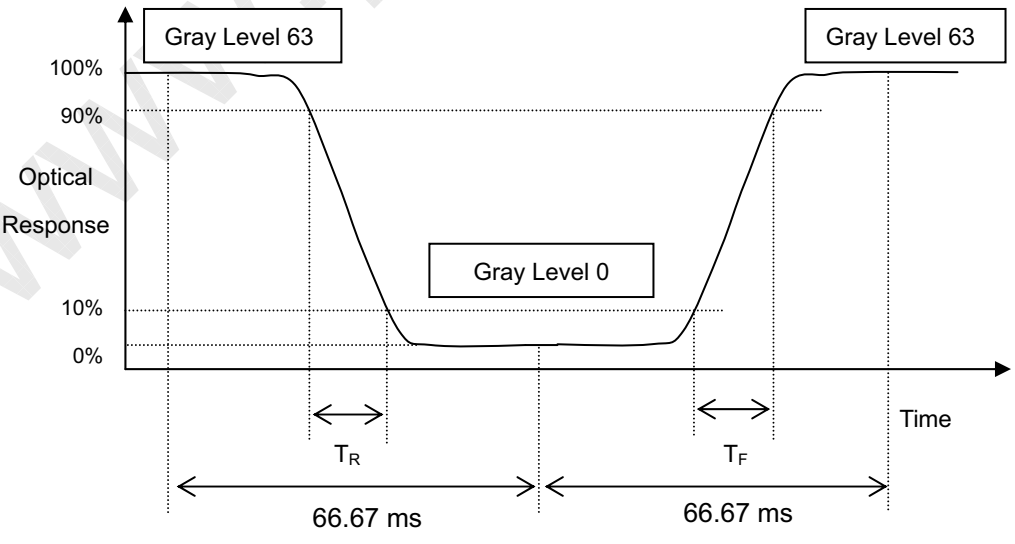
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (5)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F) and measurement method:



Note (4) Definition of Average Luminance of White (L_{AVE}):

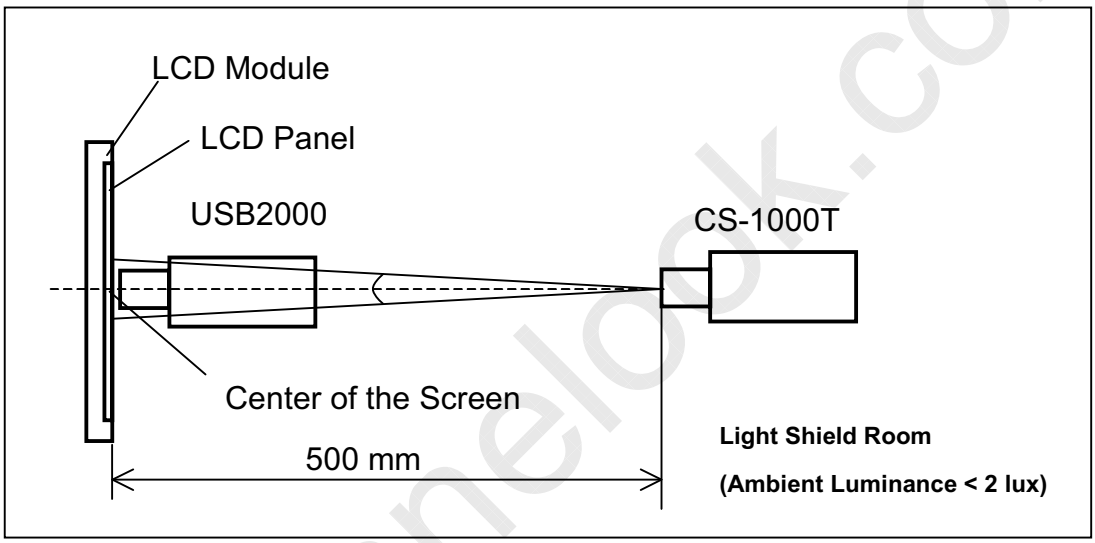
Measure the luminance of gray level 63 at 5 points

L_{AVE} = [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 (6).

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

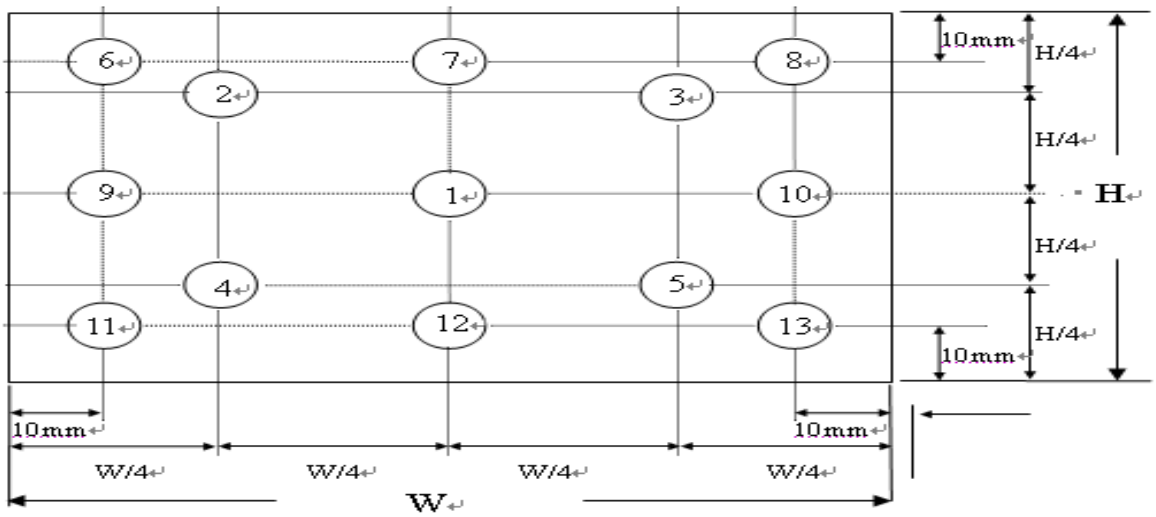


Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]

δW = Maximum [L (1) ~ L(13)] / Minimum[L (1) ~ L(13)]



Note (7) Definition of color gamut (C.G%):

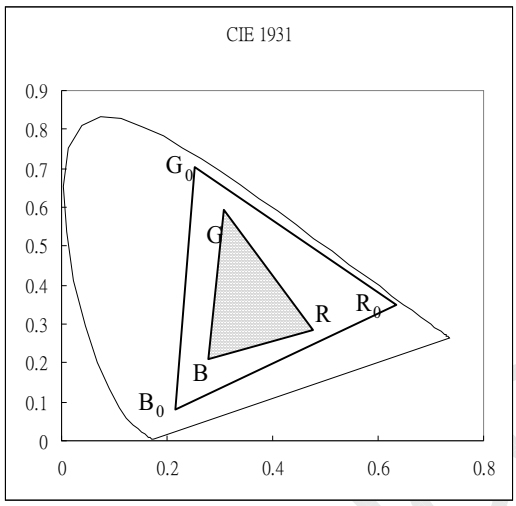
C.G%= R G B / R_0 G_0 B_0,*100%

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

R_0 G_0 B_0 : area of triangle defined by R_0, G_0, B_0

. R G B: area of triangle defined by R, G, B



9. PRECAUTIONS

9.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the lamp wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

9.2 SAFETY PRECAUTIONS

(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.

9.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

9.4 OTHER PRECAUTIONS

(1) When fixed patterns are displayed for a long time, remnant image is likely to occur.

10. PACKAGING

10.1 CARTON

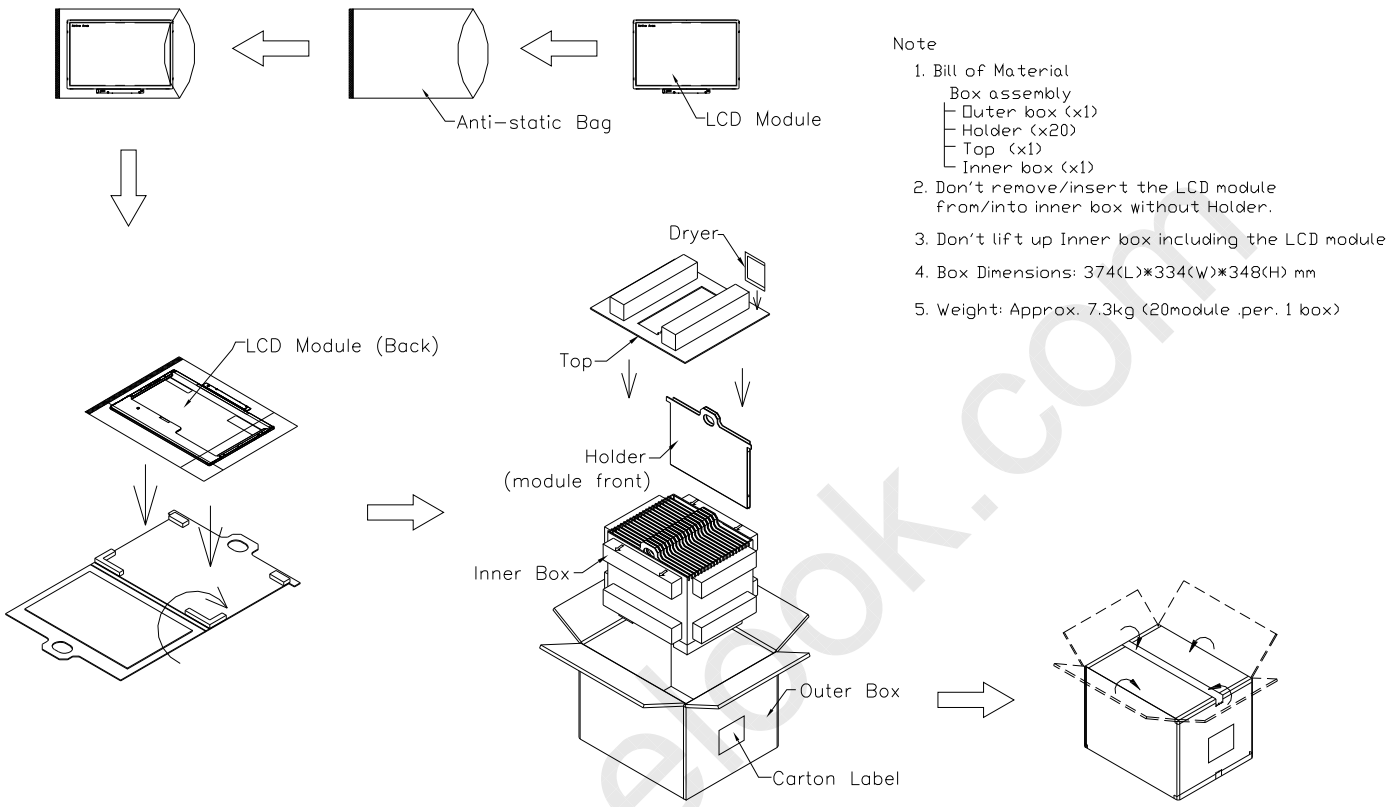


Figure. 10-1 Packing method

10.2 PALLET

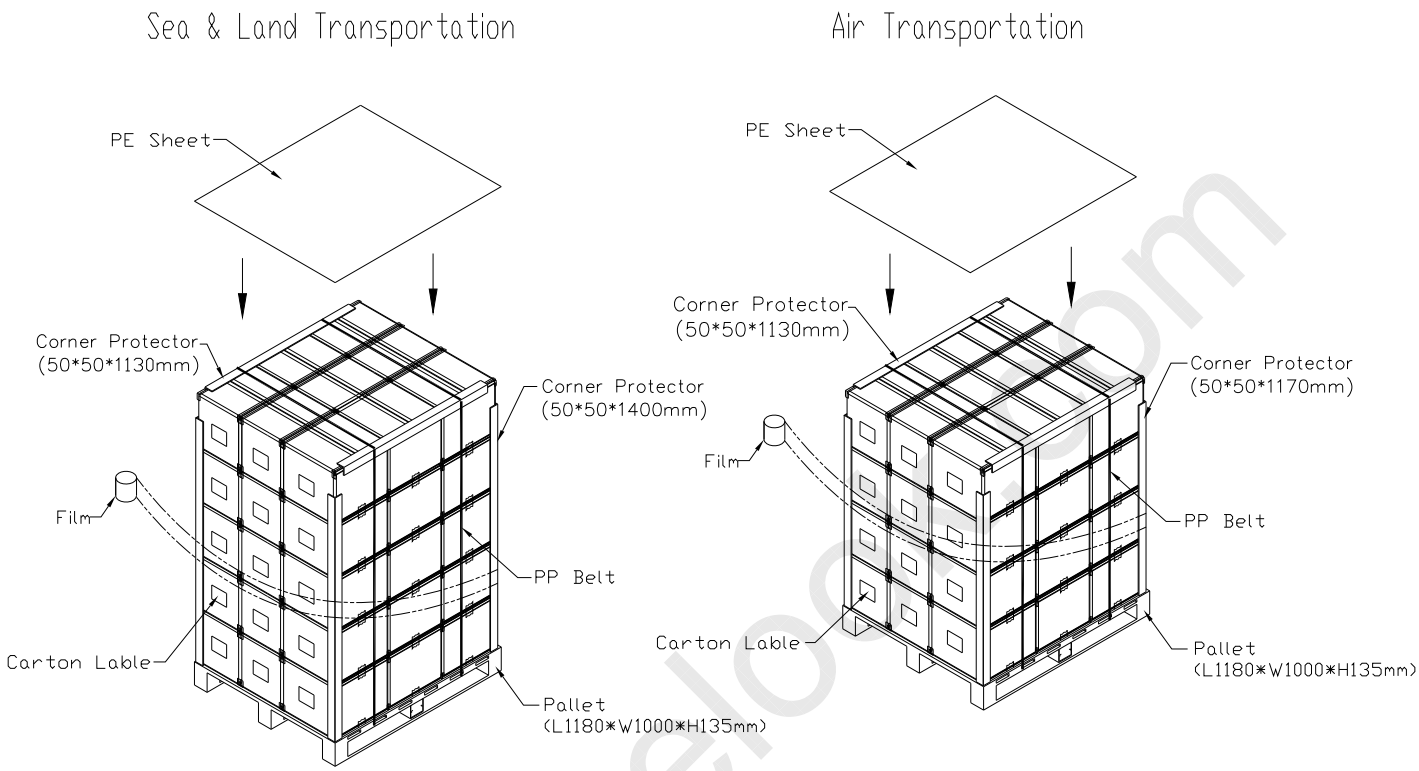


Figure. 10-2 Packing method

11. DEFINITION OF LABELS

11.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: N121IB - L05

(b) Revision: Rev. XX, for example: A1, …, C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D X N N N N

- Serial No.
- CMO Internal Use
- Year, Month, Date
- CMO Internal Use
- Revision
- CMO Internal Use

(d) Production Location: MADE IN China.

(e) LEOO: UL compliance remarks for CMO NingBo site production. It won't be available when production location isn't CMO NingBo.

Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

For barcode content

11S PPPPPPP Z1Z HHH SSSSSS YMM

(a) 11S: Fixed characters.

(b) PPPPPPP (P/N): Customer part number 42T0714, fixed characters

(c) Z1Z: Fixed characters.

(d) HHH (Header Code): FWV

(e) SSSSSS: Series number.

(f) YMM: Y: The last character of year. MM: Month

11.2 CMO CARTON LABEL

12 LCD Module Inspection Specifications

12.1 Description

These inspection standards shall be applied to LCD Module supplied by CHI MEI Optoelectronics Corporation.

12.2 The environmental condition of inspection

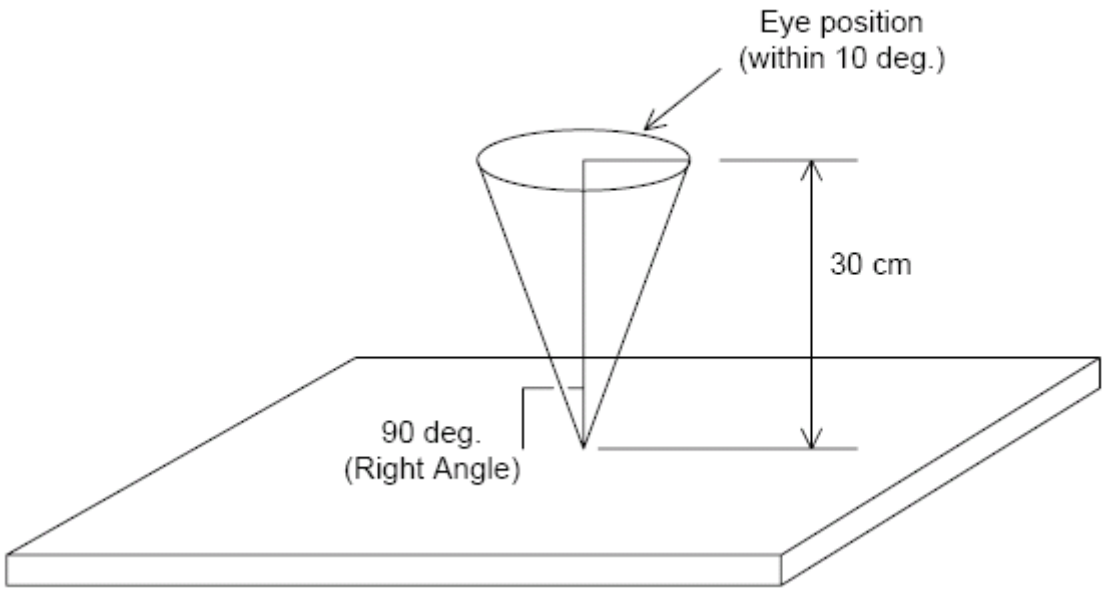
The environmental condition and visual inspection shall be conducted as below.

(1) Ambient temperature : 15~25℃

(2) Humidity: 25~75 %RH

(3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.

(4) Panel visual inspection on the operation condition for cosmetic shall be conducted at the distance 30cm between the LCD module and eyes of inspector.



(5) Using method for ND Filter

When using ND Filter for judging Mura, placing ND Filter near Mura defect and get close to the surface of LCD Panel (its distance shall be 1~2cm between the surface of Panel and ND Filter). Don't touch the surface of polarizer to avoid scratching polarizer, and then move to the defect position to judge mura by view angel 90 degree (The viewing angle shall be 90 degree to the right top of Mura defect with panel)

12.3 Classification of defects

Defects are classified two types, major defect and minor defect according to the defect. And, the definition of defects is classified as below.

(1) Major defect

Any defect may result in functional failure, or reduce the usability of product for its purpose. For example, electrical failure, deformation and etc..

(2) Minor defect

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

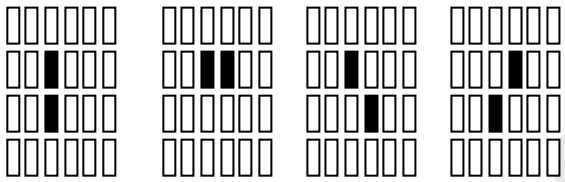
The criteria on major and/or minor judgement will be according with the classification of defects.

12.4 Inspection Criteria

(1) Definition of dot defect

Define spec for 2 dot adjacent and minimum distance

2-adjacent(Linked Pixels)



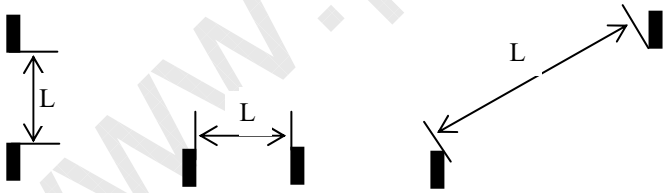
▯：sub-Pixel(R,G,B)

Minimum Distance;

Lit to Lit：L＞=15mm

Unlit to Unlit：L＞=5mm

Lit to Unlit：Not Applicable



L:Sub-Pixel to Sub-Pixel,Sub-Pixel to 2-adjacent or 2-adjacent to 2-adjacent

(2) Display Inspection

a) Ambient Illumination: 250 Lux or more for light on inspection

b) Viewing Angle: Within LCD Viewing Angle Specification

c) Inspection Pattern (Bright dot): In black pattern

Inspection Pattern (Dark dot): In red, green , blue pattern

Items		XGA WXGA	SXGA+ WXGA+ WSXGA+	UXGA WUXGA	HD HD+ FHD
Bright dot	Random	N≦2	N≦2(G=1)	N≦2(G=0)	N≦2(G=0)
	2 dots adjacent	N≦1(G=0)	N≦0	N≦0	N≦0
	3 dots adjacent or more	N≦0	N≦0	N≦0	N≦0
Dark dot	Random	N≦3	N≦5	N≦10	N≦3
	2 dots adjacent	N≦1	N≦1	N≦2	N≦1
	3 dots adjacent or more	N≦0	N≦0	N≦0	N≦0
Distance	Lit to Lit	L≧15mm	L≧15mm	L≧15mm	L≧15mm
	Unlit to Unlit	L≧5mm	L≧5mm	L≧5mm	L≧5mm
	Lit to Unlit	Not allowable	Not allowable	Not allowable	Not allowable
Total bright and dark dot		N≦5	N≦7 (SXGA+ WXGA+) N≦9 (WSXGA+)	N≦10 (UXGA) N≦12 (WUXGA)	N≦5
Defective Dot (Lit/Unlit) : Noticeable defective dots in the office environment (250 lux) will be counted regardless of defective dot size					
Display failure (V-line/H-line/Cross line etc.)				Not allowable	
Mura	Mura defect can not show in 50% gray pattern with 8% ND-filter or judge by limit sample if necessary				

(3) Appearance inspection

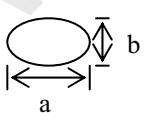
a) Ambient Illumination: 500 ~ 700 Lux

b) Viewing Angle: Backlight-Off Condition: At Right Angle To Polarizer Surface

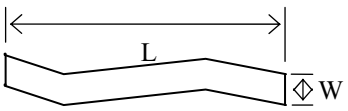
Backlight-On Condition: Within LCD Viewing Angle Specification

c) Inspection Pattern: In White and 32-Gray(Half-Gray)Screens(Backlight-On)

Items	Size(mm)	Acceptable count
1. Scratch(Line Shape) : B/L –off condition	W<0.05	Ignore
	0.05=<W<0.1; 0.3=<L=<3.0	N=<4
	0.10=<W or 3.0<L	N=0
	Shall be no visible at B/L on.	
2. Dent : B/L –off condition	D<0.2	Ignore
	0.2=<D<0.5	N=<5
	0.5=<D	N=0
	Spacing between defects shall be more than 30 mm. (0.2=<D<0.5)	
	Shall be no visible at B/L on.	
3. Bubble : B/L –off condition	D<0.2	Ignore
	0.2=<D<0.5	N=<5
	0.5=<D	N=0
	Shall be no visible at B/L on.	
4. Foreign material (Line-shape: stain inclusion) :B/L-on condition	W<0.05	Ignore
	0.05=<W<0.10; 0.3<L=<2.0	N=<4
	0.10<W or 2.0<L	N=0
	Shall be no visible at B/L on.	
5. Foreign material (Dot-shape: stain inclusion) :B/L-on condition	D<0.2	Ignore
	0.2=<D<0.5	N=<5
	0.5=<D	N=0
6. Peeling on Polizer edge :B/L-off condition	D<0.2	Ignore
	0.2=<D<0.5	N=<5
	0.5=<D	N=0
	Bubble or glue shall not be visible within PC bezel opening area with specified inspection viewing angle.	
	Continuous peeling off on polarizer edge shall be discussed.	
	Shall be no visible at B/L on.	



D=(a+b)/2



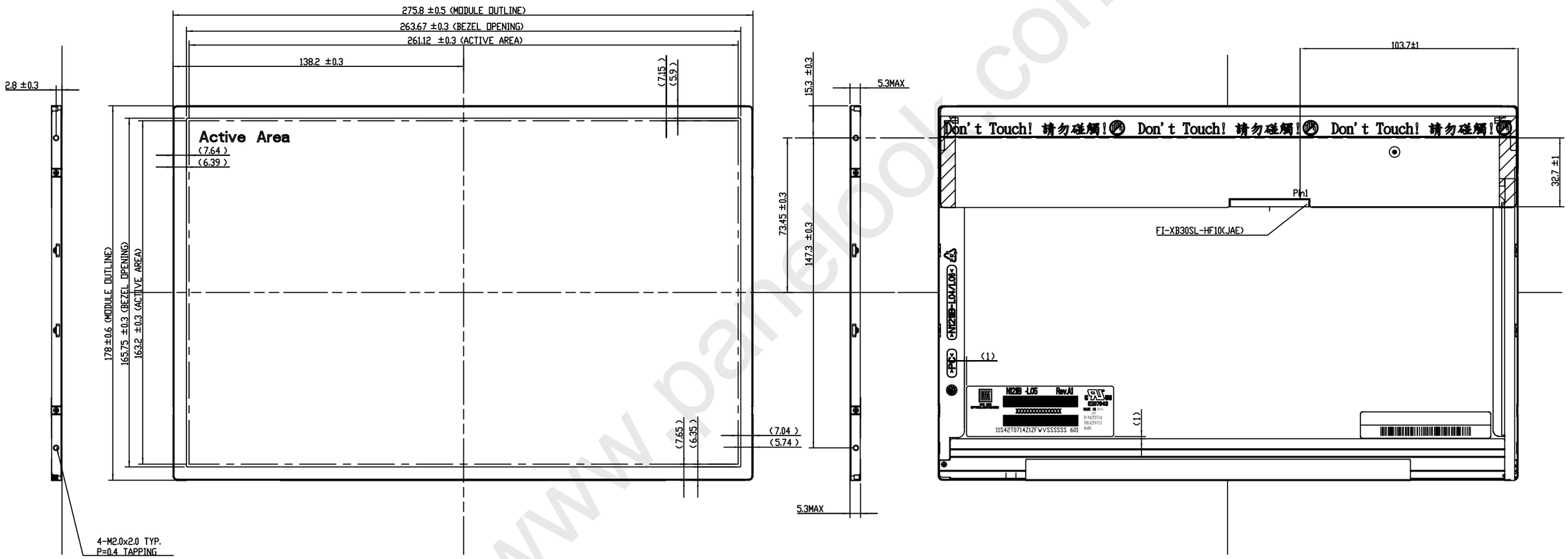
W: width, L : length

12.5 External Appearance Inspection Criteria

Item	Contents	
Screw	Parts mounting, incomplete assembly, deformation, oxidized, crooked or rusty is not permitted.	
CCFT cable	Cable not continuous、Break-off 、Connector Burn-off /Break-off	
Metal frame (Bezel)	Scratch	*Noticeable scratch and exfoliation coating are not permitted. *The oxidized metal is not permitted.
	Incomplete assembly is not permitted.	
Backlight	Scratch	The scratch which may causes a problem in practical use is not permitted.
	Break-off	Breaking off is not permitted.
	Crack	The crack is not permitted.
Stain on Polarizer	The stain which can't be wiped off is not permitted.	
Tape/Label	Incorrect position, missed label is not permitted.	
Connector	Oxidized/rusty connector is not permitted.	
Outline size	Spec. out is not permitted.	

12.6 Classification of defects

Inspection Item	Criteria and Description	Defect type
Vertical line	Signal input, vertical line off or irregular V-line appears	major
Horizontal line	Signal input, horizontal line off or irregular H-line appears	major
Cross line	Pattern signal input, a correct display is not obtained	major
No display	Signal input, display is dead	major
Irregular display	Pattern signal input, a correct display is not obtained	major
Dots defect	Exceed specified standards	minor
Scratch and Dent on polarizer	Exceed specified standards	minor
Foreign material	Exceed specified standards	minor
Mura	Mura defect can not show in 50% gray pattern with 8% ND-filter or judge by limit sample if necessary	minor
External Appearance	Rust, deformation, irregular plating, coating missing etc. A appearance defect that do not affect function or performance	minor
Bezel claw	Bezel claw missing or not bent	major
Polarizer bubble	Exceed specified standards	minor
Flicker	No noticeable flicker by naked eyes at any gray scale level	major
LCD Pooling	In 50% gray pattern, hold LCD panel TOP edge (PCB side) by both hands and swing slightly back and forth 2 times per second for 3 cycles by 15 degrees (Range 30 degrees)	minor



1.UNIT:MM.
2.GENERAL TOLERENCE:±0.5MM.
3.SCREW TORQUE ACCEPTABLE:MAX 2.3 kgf-cm.
Ⓟ4.FLATNESS:0.5mm MAX.

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	ASSY_MODULE_DRAWING_N121IB-L05					2D REV.	A
						3D REV.	1.2+
Approved	SHUNNAN	Drawing No.	N121J4101A				
Checked	JACKSON_CHEN	Part No.	NA				
Drawer	ERWIN	Material	NA		Sheet	1 / 2	A1
Designer	ERWIN	Date	14-Jan-2009	Scale	1:1	Unit:mm	

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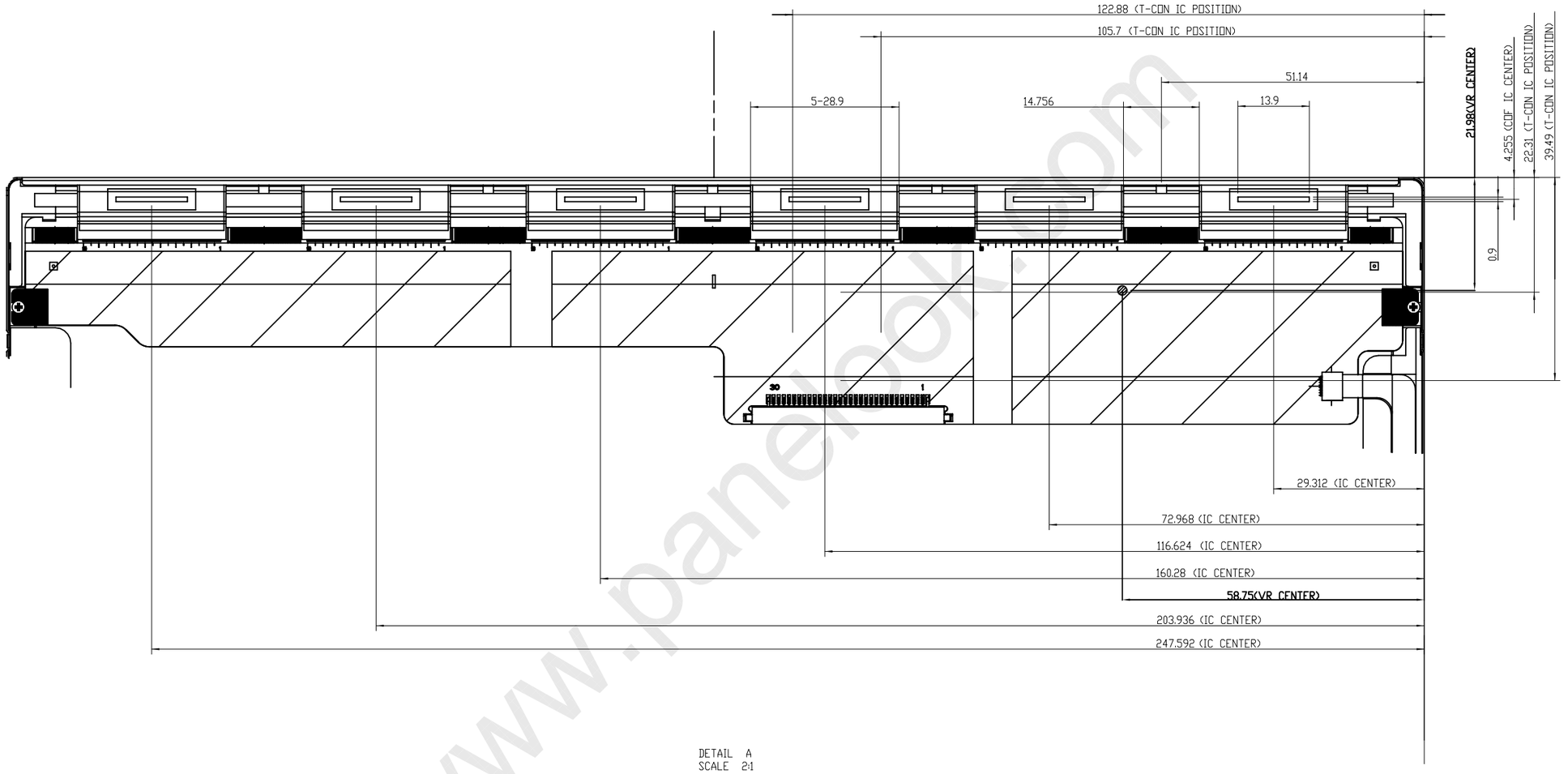

DETAIL A
SCALE 2:1

NOTES:

1.In order to avoid abnormal display, pooling and white spot, no overlapping is suggested at cables, antennas, camera, WLAN, WAN or other foreign objects over COF driver IC, TCON and VR locations..

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	ASSY_MODULE_DRAWING_N121IB-L05					2D REV.	A
						3D REV.	1.2+
Approved	SHUNNAN	Drawing No.	N121J4101A				
Checked	JACKSON_CHEN	Part No.	NA				
Drawer	ERWIN	Material	NA	Sheet	2 / 2	A1	
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