TECHNICAL LITERATURE

For

TFT-LCD module

MODEL　No. LR10FHD02-4LANE

RECORDS OF REVISION

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Table of contents

1. Application

   This specification applies to a color TFT-LCD module

2. Overview

   This module is a color active matrix LCD module incorporating TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, a control circuit and power supply circuit, and a backlight unit. Graphics and texts can be displayed on a 1920×3×1080 dots panel with 16,777,216 colors by using eDP (Embedded Display Port) Ver1.3 interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving.

   In this TFT-LCD panel, color filters for excellent color performance and backlights for high brightness are incorporated to realize brighter and clearer pictures, making this model optimum for use in multi-media applications.

   Optimum viewings are in all directions.

   Backlight-driving LED controller is not built in this module.

   eDP Transfer rate Specification : 1.62Gbps / 4 lane

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	27.42 (10.8") Diagonal	cm
Active area	239.04(H)×134.46 (V)	mm
Pixel format	1920 (H)×1080 (V)	pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	0.1245 (H) × 0.1245 (V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally black	
Surface treatment	Anti-glare coating (Haze value 24%)	
	Hard coating (3H)	

Outline dimensions

Parameter		Min.	Typ.	Max.	Unit	Remark
Unit outline dimensions [Note 3-1]	Width	249.7	250.2	250.7	mm	
	Height	148.75	149.25	149.75	mm	
	Depth	2.1	2.3	2.5	mm	w/o PCB w/ Shielding tape
Mass				197	g	

4. Input Terminals

4 - 1. Symbol

CN1 (eDP signals, +3.3V DC power supply, and B/L power supply)

Pin No.	Symbol	I/O	Function	Remark
1	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
2	H_GND	P	High Speed Ground	
3	Lane3_N	I	Complement Signal Link Lane 3	
4	Lane3_P	I	True Signal Link Lane 3	
5	H_GND	P	High Speed Ground	
6	Lane2_N	I	Complement Signal Link Lane 2	
7	Lane2_P	I	True Signal Link Lane 2	
8	H_GND	P	High Speed Ground	
9	Lane1_N	I	Complement Signal Link Lane 1	
10	Lane1_P	I	True Signal Link Lane 1	
11	H_GND	P	High Speed Ground	
12	Lane0_N	I	Complement Signal Link Lane 0	
13	Lane0_P	I	True Signal Link Lane 0	
14	H_GND	P	High Speed Ground	
15	AUX_CH_P	I	True Signal Auxiliary Channel	
16	AUX_CH_N	I	Complement Signal Auxiliary Channel	
17	H_GND	P	High Speed Ground	
18	BIST	I	BIST patters selection L: Disable[default], H: enable	[Note 4-1-3]
19	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
20	VDD	P	LCD logic and driver power(3.3V)	
21	VDD	P	LCD logic and driver power(3.3V)	
22	VDD	P	LCD logic and driver power(3.3V)	
23	VDD	P	LCD logic and driver power(3.3V)	
24	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
25	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
26	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
27	LCD_GND	P	LCD logic and driver ground	
28	LCD_GND	P	LCD logic and driver ground	
29	LCD_GND	P	LCD logic and driver ground	
30	LCD_GND	P	LCD logic and driver ground	
31	HPD	O	HPD signal pin	[Note 4-1-4]
32	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
33	PWM_OUT	O	PWM_OUT	[Note 4-1-6]
34	PWM_IN	I	PWM_IN	[Note 4-1-5]
35	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
36	VBL1	P	LED Anode	
37	VBL1	P	LED Anode	
38	VBL2	P	LED Anode	
39	VBL2	P	LED Anode	

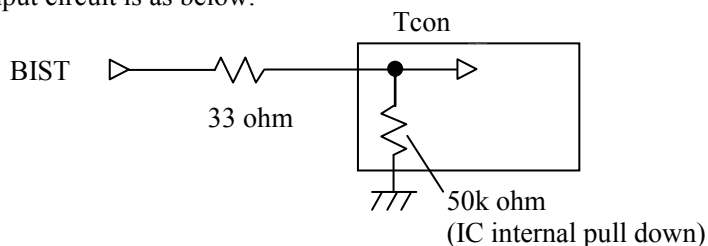| Pin No.	Symbol	I/O	Function	Remark
40	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
41	LED_C1	P	LED Cathode 1	
42	LED_C2	P	LED Cathode 2	
43	LED_C3	P	LED Cathode 3	
44	LED_C4	P	LED Cathode 4	
45	LED_C5	P	LED Cathode 5	
46	LED_C6	P	LED Cathode 6	
47	LED_C7	P	LED Cathode 7	
48	LED_C8	P	LED Cathode 8	
49	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]
50	NC	-	Reserved for LCD manufacturer's use	[Note4-1-1]

※1　I : Input , O : Output , P : Power:

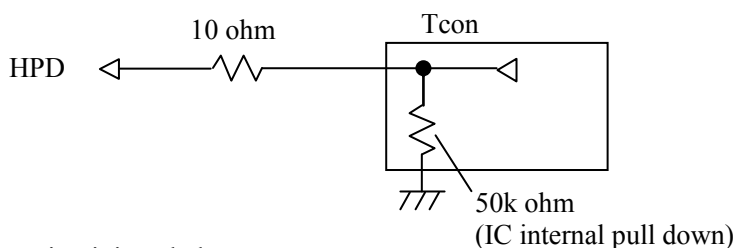[Note 4-1-1] Don't input any signals or any powers into a NC pin. Keep the NC pin open.

[Note 4-1-2]

・ Connector used : MINIFREX3-BFN(51pin)　I-PEX

[Note 4-1-3] Input circuit is as below.

Tcon

BIST ▷ ⟶ 〜〜 ⟶ ● ⟶ ▷

33 ohm

⏚ 50k ohm
(IC internal pull down)

[Note 4-1-4] Output circuit is as below.

10 ohm　Tcon

HPD ◁ ⟵ 〜〜 ⟵ ● ◁

⏚ 50k ohm
(IC internal pull down)

[Note 4-1-5] Input circuit is as below.

VDD

1M ohm

PWM_IN ▷ ⟶ 〜〜 ⟶ ● ⟶ ▷

33 ohm
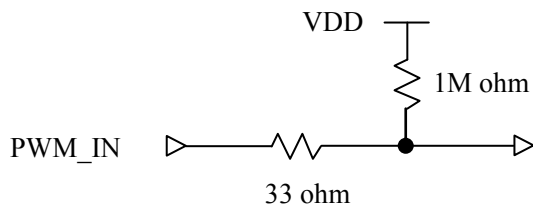
[Note 4-1-6] Output circuit is as below.

PWM_OUT ◁ ⟵ 〜〜 ◁

33 ohm
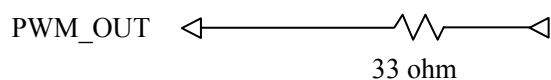
4 - 2.　eDP interface

Fig.4-2-1　DP architecture.
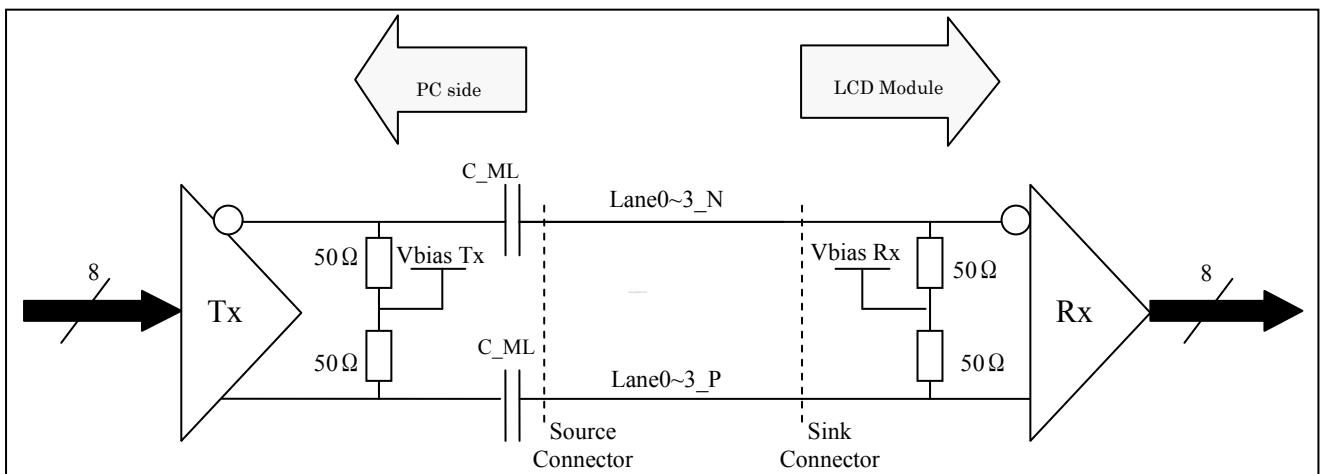
Fig.4-2-2　Main Link differential pair.
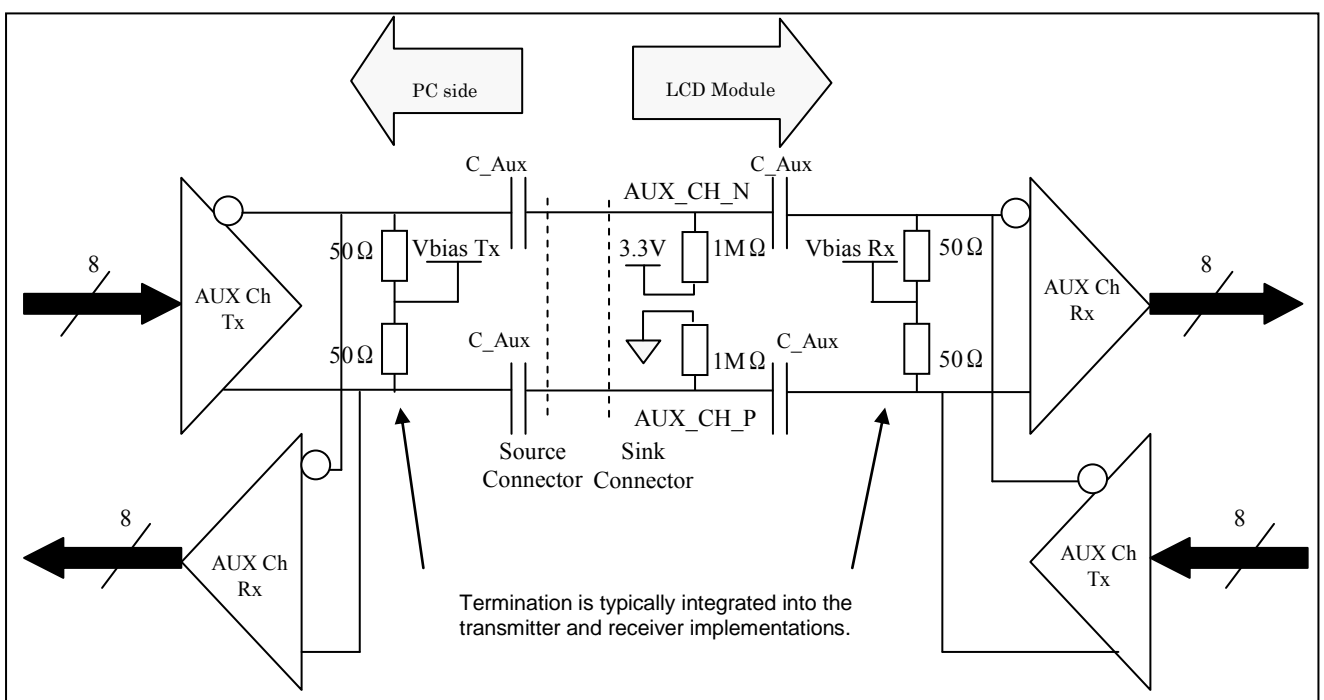
Fig.4-2-3　AUX Link differential pair.

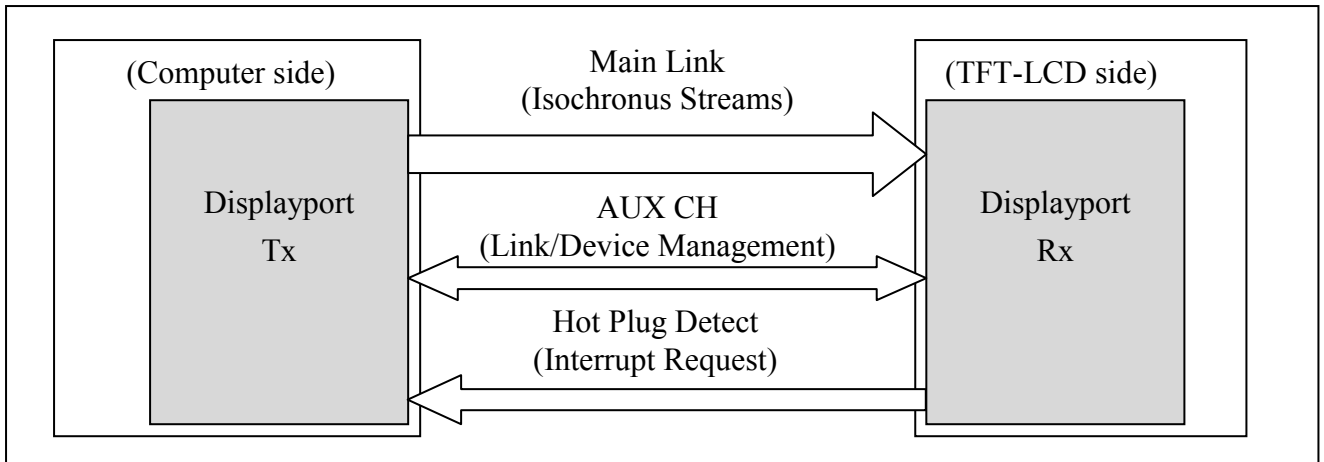| Lane0	Lane1	Lane2	Lane3
R0-7:0	R1-7:0	R2-7:0	R3-7:0
G0-7:0	G1-7:0	G2-7:0	G3-7:0
B0-7:0	B1-7:0	B2-7:0	B3-7:0
R4-7:0	R5-7:0	R6-7:0	R7-7:0
G4-7:0	G5-7:0	G6-7:0	G7-7:0
B4-7:0	B5-7:0	B6-7:0	B7-7:0
R8-7:0	R9-7:0	R10-7:0	R11-7:0
G8-7:0	G9-7:0	G10-7:0	G11-7:0
B8-7:0	B9-7:0	B10-7:0	B11-7:0

Fig.4-2-4　eDP 4 lane 8 bit input data mapping.

[Note] 　・Regarding eDP link-training, this module supports both Fast-Link and Full-Link.
　　　・Please adjust and optimize Voltage Swing Level and Pre-Emphasis Level
　　　　according to the condition of using eDP signal.

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings		Unit	Remark
			Min.	Max.		
+3.3V supply voltage	VDD	Ta=25℃	-0.3	+4.0	V	
Input voltage(eDP)	VI	Ta=25℃	-0.3	+1.1	V	[Note 5-1]
Input voltage(BL)	VPWM	Ta=25℃	-0.3	VDD+0.3	V	[Note 5-2]
Storage temperature (ambient)	Tstg	－	-20	+60	℃	[Note 5-3]
Operating temperature(ambient)	Topa	－	0	+50	℃	

[Note 5-1] eDP signals

[Note 5-2] Back light control signals (PWM_IN)

[Note 5-3] Humidity : 90%RH Max. at Ta≦+40℃.

Maximum wet-bulb temperature at +39℃ or less at Ta>+40℃.

No condensation.

6. Electrical Characteristics

6 - 1. TFT-LCD panel driving

Ta＝+25℃

DC Electrical Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	VDD	+3.0	+3.3	+3.6	V	[Note 6-1-1]
Current dissipation	IDD	—	315	500	mA	[Note 6-1-2]
Power dissipation	PDD	—	1.04	1.65	W	[Note 6-1-3]
Permissive input ripple voltage	V_{RP}	—	—	100	mV_{P-P}	VDD = +3.3V

eDP AUX Channel Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Unit Interval for AUX channel	UI_{AUX}	0.4	0.5	0.6	μs	
peak-to-peak voltage at TP1	$V_{AUX-DIFF-p}$	0.32	-	1.32	V	
AUX DC Common Mode Voltage	$V_{AUX-DC-CM}$	0	-	2.0	V	
AUX Short Circuit Current Limit	I_{AUX_SHORT}	-	-	90	mA	
AUX CH termination DC resistance	R_{AUX-_TERM}	-	100	-	Ω	
AUX AC Coupling Capacitor	C_{AUX}	75	-	200	nF	
Number of pre-charge pulses	Pre-charge pulses	10	-	16	-	

eDP Main Link Receiver Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Link clock down spreading	Down_Spread_ Amplitude	0	-	0.5	%	
Differential Peak-to-peak Input Voltage at RX package pins	$V_{RX-DIFFp-p}$	90	-	1380	mV	
Differential Return Loss at 1.35 GHz at RX package pins	$RL_{RX-DIFF}$	9	-	-	dB	
RX DC Common Mode Voltage	$V_{RX-DC-CM}$	0	-	2.0	V	
Differential termination resistance	$V_{RX-TERM}$	-	100	-	Ω	
RX Short Circuit Current Limit	$I_{RX-SHORT}$	-	-	50	mA	
Lane Intra-pair Skew at RX package pins	$L_{RX-SKEW-INTRA-PAIR-Reduced-Bit-Rate}$	-	-	260	ps	

[Note 6-1-1] ON-OFF conditions for supply voltage
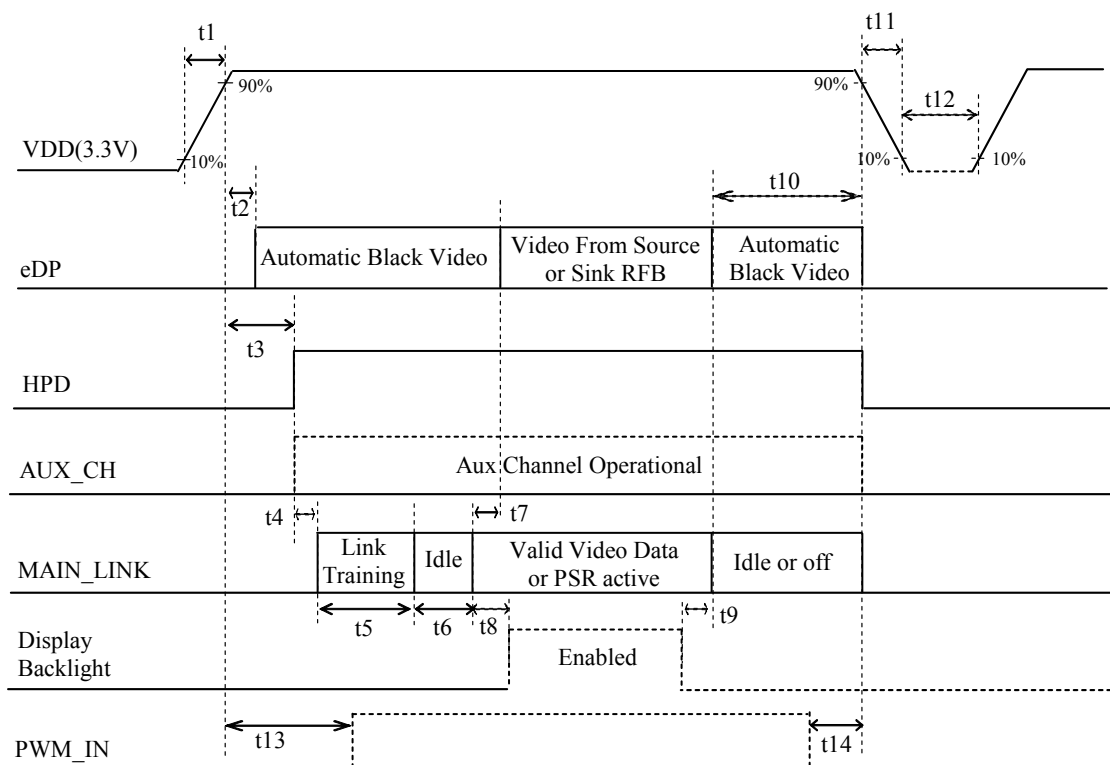
[Note] Do not keep the interface signal high-impedance or unusual signal when power is on.

Symbol	Min	Max	Unit	Note
t1	0.5	10	ms	
t2	0	200	ms	
t3	60	150	ms	
t4	0	-	ms	
t5	-	-	ms	
t6	-	-	ms	
t7	0	50	ms	
t8	17	-	ms	
t9	17	-	ms	
t10	0	500	ms	
t11	5	50	ms	[Note 1]
t12	500	-	ms	
t13	100		ms	
t14	0	-	ms	

[Note 1] As for the power off sequence for VDD (t11), Be sure to keep above mentioned timing.
  If the VDD power off sequence timing is other than shown above, LCD may cause permanent damage.
  As for the power sequence for backlight, it is recommended to apply above mentioned input timing.
  If the backlight is light on and off at a timing other than shown above, displaying image may get disturbed.

VDD-dip conditions

1) 2.5 V ≦ VDD < 3.0 V

    td ≦ 10 ms

Under above condition, the display image should return to an appropriate figure after VDD voltage recovers.

2) VDD < 2.5 V

VDD-dip conditions should also follow the ON-OFF conditions for supply voltage
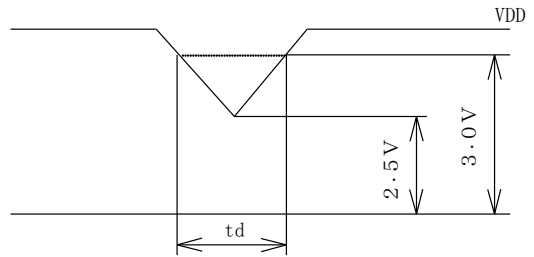
[Note 6-1-2] Typical current condition: 16-gray-bar pattern.

VDD=+3.3V

| RGB | RGB | RGB | .... | RGB | RGB |
| GS0 | GS16 | GS32 | | GS224 | GS240 |
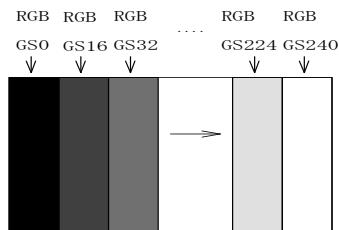
Maximum current condition: Vertical stripe pattern

VDD=+3.3V

[Note 6-1-3] Typical power condition: 16-gray-bar pattern.

    VDD=+3.3V

Maximum power condition: Vertical stripe pattern

    VDD=+3.3V

s

6 - 2.　Backlight driving

The backlight system is edge-lighting type with White-LED (White Light Emitting Diode).

The characteristics of White-LED are shown in the following table.　　　　　　(Ta=25 °C)

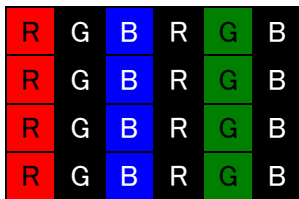| Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED voltage	V_L	—	28.5	29.5	V	
LED current range	V_L	—	14	—	mA	Value for one string
Number of circuit strings		—	8	—		[Note 1]
Lamp power consumption	W_L	—	3.2	3.3	W	[Note 2]
LED life time	L_L	15000	—	—	Hour	[Note 3]

[Note 1] The LED backlight is composed by 8 strings from which 5 LEDs is connected with the series.
　　　　The figure below shows the circuit chart of each string.

Pin No.	Symbol
36	(VBL1)
37	(VBL1)
38	VBL2
39	VBL2
40	NC
41	LED_C1
42	LED_C2
43	LED_C3
44	LED_C4
45	LED_C5
46	LED_C6
47	LED_C7
48	LED_C8
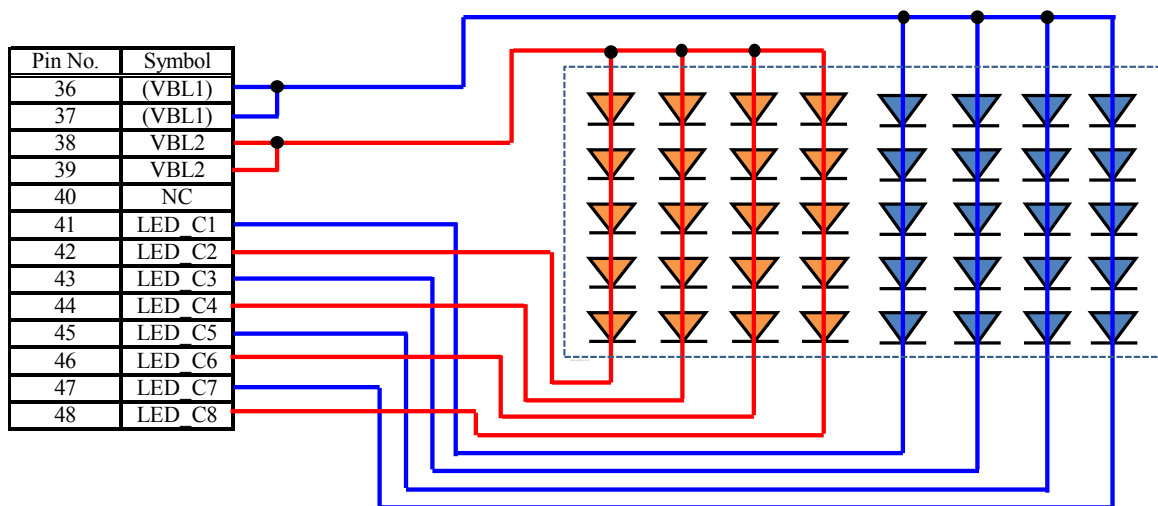
[Note 2] Calculated value for reference ($I_L \times V_L$)　@400cd/㎡

[Note 3] LED life time is defined as the time when Brightness becomes 50 % of the original value.
　　　　under the condition of Ta = 25℃　and I_f = 14 mA, and continuous lighting.

7. Timing Characteristics of Input Signals

7 - 1. Timing characteristics

・60Hz   VDD=+3.0V～+3.6V, Ta＝0℃～+50℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	－	148.5	－	MHz	[Note 7-1-1]
Data enable Signal	Horizontal period	TH	－	2200	－	clock	
				14.8		μs	
	Horizontal period (High)	THd	－	1920	－	clock	
	Vertical period	TV	－	1125	－	Line	
			－	16.67	－	ms	
	Vertical period (High)	TVd	－	1080	－	line	

・48H z   VDD=+3.0V～+3.6V, Ta＝0℃～+50℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	－	118.8	－	MHz	[Note 7-1-1]
Data enable Signal	Horizontal period	TH	－	2200	－	clock	
				18.5		μs	
	Horizontal period (High)	THd	－	1920	－	clock	
	Vertical period	TV	－	1125	－	Line	
			－	20.83	－	ms	
	Vertical period (High)	TVd	－	1080	－	line	

[Note 7-1-1] In case of using the long vertical period, the deterioration of display quality, flicker, etc, may occur.
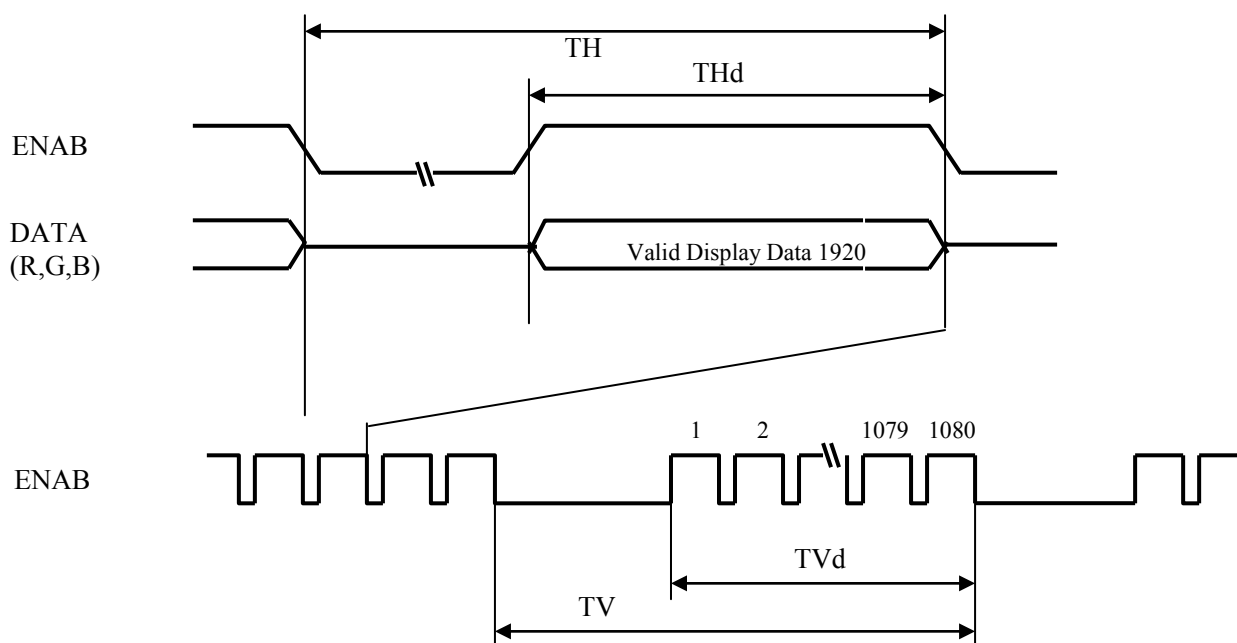
7 - 2.　Input data signals and display position on the screen

R1	G1	B1	R2	G2	B2
(1,1)			(1,2)		

1・1	1・2	1・3		1・1920
2・1	2・2			
3・1				

R G B

1080・1920

1080・1
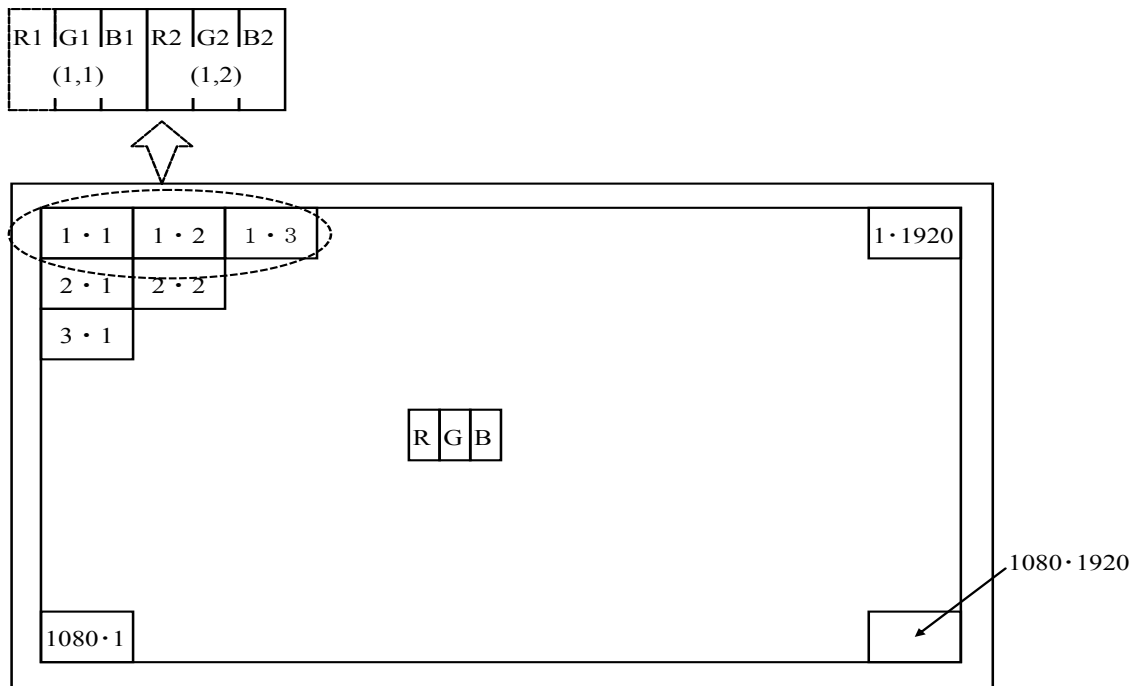
Display position of input data(V ・ H)

8. Input Signals, Basic Display Colors and Gray Scale of Each Color

Colors & Gray Scale	Gray Scale	Date signal																							
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
		LSB							MSB	LSB							MSB	LSB							MSB
Basic Color Black	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Green	–	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Cyan	–	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	–	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magenta	–	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Yellow	–	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
Gray Scale of Red Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	↓				↓								↓								↓				
⇩	↓				↓								↓								↓				
Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇩	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	↓				↓								↓								↓				
⇩	↓				↓								↓								↓				
Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
⇩	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
⇧	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
⇧	↓				↓								↓								↓				
⇩	↓				↓								↓								↓				
Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
⇩	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0 : Low level voltage, 1 : High level voltage

Each basic color can be displayed in 256 gray scales from 8 bit data signals.

According to the combination of 24 bit data signals, the 16.7M color display can be achieved on the screen.

9. EDID Specifications

9 - 1. EDID data structure

This is the EDID(Extended Display Identification Data) data formats to support displays as defined in the VESA Plug & Display

Byte (decimal)	Byte (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	00			
1	01			
2	02			
3	03			
4	04			
5	05			
6	06			
7	07			
8	08			
9	09			
10	0A			
11	0B			
12	0C			
13	0D			
14	0E			
15	0F			
16	10			
17	11			
18	12			
19	13			
20	14			
21	15			
22	16			
23	17			
24	18			
25	19			
26	1A			
27	1B			
28	1C			
29	1D			
30	1E			

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31	1F
32	20
33	21
34	22
35	23
36	24
37	25
38	26
39	27
40	28
41	29
42	2A
43	2B
44	2C
45	2D
46	2E
47	2F
48	30
49	31
50	32
51	33
52	34
53	35
54	36
55	37
56	38
57	39
58	3A
59	3B
60	3C
61	3D
62	3E
63	3F
64	40
65	41
66	42
67	43

T.B.D

68	44
69	45
70	46
71	47
72	48
73	49
74	4A
75	4B
76	4C
77	4D
78	4E
79	4F
80	50
81	51
82	52
83	53
84	54
85	55
86	56
87	57
88	58
89	59
90	5A
91	5B
92	5C
93	5D
94	5E
95	5F
96	60
97	61
98	62
99	63
100	64
101	65

T.B.D

102	66
103	67
104	68
105	69
106	6A
107	6B
108	6C
109	6D
110	6E
111	6F
112	70
113	71
114	72
115	73
116	74
117	75
118	76
119	77
120	78
121	79
122	7A
123	7B
124	7C
125	7D
126	7E
127	7F

T.B.D

10. Optical Characteristics

Ta=+25℃, VDD=+3.3V

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	$\theta 21, \theta 22$	CR>10	80	—	—	deg.	[Note 9-1, 9-3, 9-4, 9-6]
	Vertical	$\theta 11$		80	—	—	deg.	
		$\theta 12$		80	—	—	deg	
Contrast ratio		CR	$\theta =0°$	600	800	—		[Note 9-2, 9-4, 9-6]
Response time		τ r+ τ d		—	25	—	ms	[Note 9-2, 9-5, 9-6]
Chromaticity of white		x		0.283	0.313	0.343		
		y		0.299	0.329	0.359		
Chromaticity of red		x		—	0.640	—		
		y		—	0.330	—		
Chromaticity of green		x	$\theta =0°$	—	0.300	—		[Note 9-2, 9-6] Normal operation (PWM Duty=100%)
		y		—	0.600	—		
Chromaticity of blue		x		—	0.150	—		
		y		—	0.060	—		
NTSC ratio				68	72		%	
Luminance of white		Y_{LI}		340	400	—	cd/m^2	
White Uniformity		δ w	$\theta =0°$	—	1.25	1.40		[Note 9-2, 9-7]
Gamma			$\theta =0°$	—	2.2	—		[Note 9-2, 9-6]

※ The measurement shall be taken (30) minutes after lighting the module at the following rating:

Condition: PWM Duty = 100%

The optical characteristics shall be measured in a dark room or equivalent.

[Note 9-1] Measurement of viewing angle range and Response time.

Detector (EZ contrast/Photo Diode)
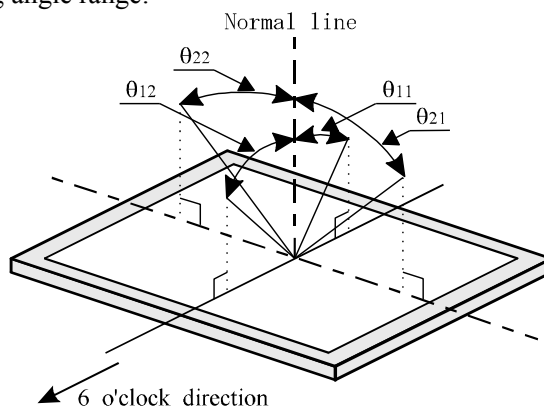
Center of the screen ($\theta =0°$)
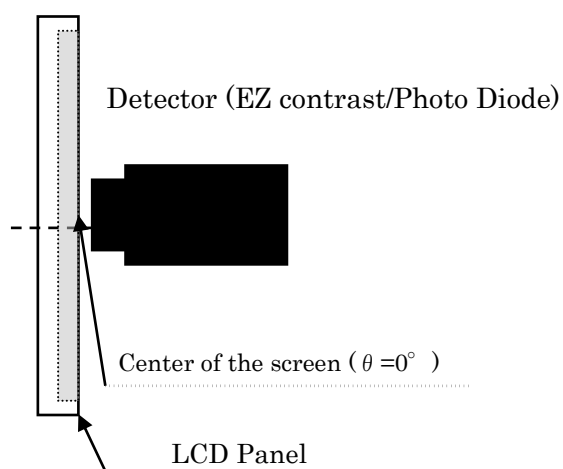
LCD Panel

Viewing angle range:EZ-CONTRAST

/Response time: Photo diode)

[Note 9-2] Measurement of luminance and Chromaticity and Contrast.

Detector(SR-3)

400mm

Field=2°

Center of the screen ($\theta =0°$)
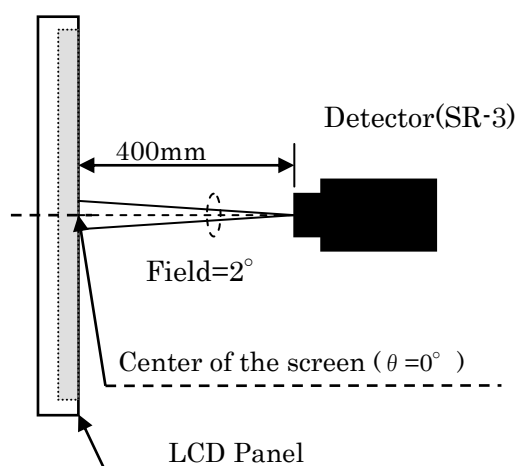
LCD Panel

[Note 9-3] Definitions of viewing angle range:

[Note 9-4] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

[Note 9-5] Definition of response time:

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .
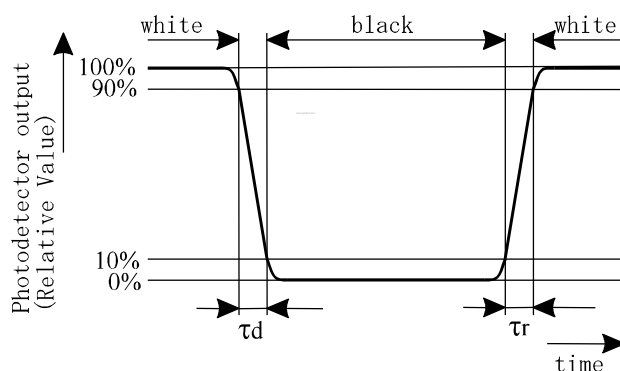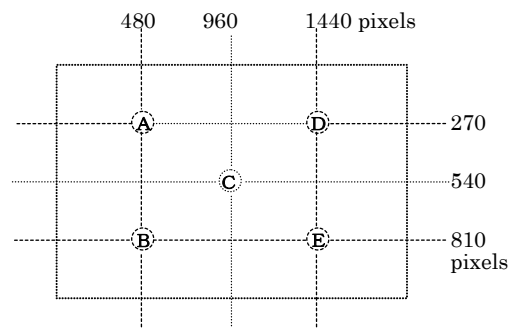

[Note 9-6] This shall be measured at center of the screen.

[Note 9-7] Definition of white uniformity:

White uniformity is defined as the following with five measurements (A～E).

$$\delta w = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$

11. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

12. Handling Precautions
  a) Be sure to turn off the power supply when inserting or disconnecting the cable.
    Please insert for too much stress not to join a connector in the case of insertion of a connector.
  b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
  c) Since the front polarizer is easily damaged, pay attention not to scratch it.
  d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
  e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
  f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
  g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.
  h) This module has its circuitry PCBs on the side and should be handled carefully in order not to be stressed.
  i) Protect sheet(Laminate film) is attached to the module surface to prevent it from being scratched. Peel the sheet off slowly just before the use with strict attention to electrostatic charges. Ionized air shall be blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc. Working under the following environments is desirable.
      · All workers wear conductive shoes, conductive clothes, conductive fingerstalls and grounding belts without fail.
      · Use Ionized blower for electrostatic removal, and peel of the protect sheet with a constant speed. (Peeling of it at over 2 seconds)
  j) The polarizer surface on the panel is treated with Anti Glare . In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.
  k) Do not expose the LCD module to a direct sunlight, for a long period of time to protect the module from the ultra violet ray.
  l) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.
  m) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.
  n) Disassembling the module can cause permanent damage and should be strictly avoided.
    Please don't remove the fixed tape, insulating tape etc that was pasted on the original module.
    (Except for protection film of the panel.)
  o) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
    (Please use a screen saver etc., in order to avoid an afterimage.)
  p) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.
  q) Epoxy resin (amine series curing agent), silicone adhesive material (dealcoholization series and oxime series),
    tray forming agent (azo compound) etc, in the cabinet or the packing materials may induce abnormal display with polarizer film deterioration regardless of contact or noncontact to polarizer film.
    Be sure to confirm the component of them.

r) Do not use polychloroprene. If you use it, there is some possibility of generating Cl_2 gas that influences the reliability of the connection between LCD panel and driver IC.

t) Do not put a laminate film on LCD module, after peeling of the original one. If you put on it, it may cause discoloration or spots because of the occurrence of air gaps between the polarizer and the film.

u) Ground module bezel to stabilize against EMI and external noise.

13. Packaging Condition

Piling number of cartons	7
Package quantity in one carton	40 pcs
Carton size	630 x 515 x 235 mm
Total mass of one carton filled with full modules	15kg
Packing form	Fig.1

14. Label

1) Module Bar code label:

 T.B.D

2) Packing bar code label

 T.B.D

15. RoHS Directive

This LCD module is compliant with RoHS Directive.

16. Reliability Test Items

No.	Test item	Conditions
1	High temperature storage test	Ta = 60℃ 240h
2	Low temperature storage test	Ta = -20℃ 240h
3	High temperature & high humidity operation test	Ta = 40℃ ；90%RH 240h (No condensation)
4	High temperature operation test	Ta = 50℃ 240h
5	Low temperature operation test	Ta = 0℃ 240h
6	Vibration test (non- operating)	Frequency:10~57Hz/Vibration width (one side):0.076mm :57~500Hz/acceleration:9.8m/s^2 Sweep time: 11minutes Test period: 1 hour for each direction of X,Y,Z
7	Shock test (non- operating)	Max. gravity：490 m/s^2 Pulse width：11 ms, half sine wave Direction： ±X,±Y,±Z once for each direction.
8	ESD	±200V, 200pF(0Ω) 1time/each terminal

[Result Evaluation Criteria] Under the display quality test conditions with normal operation state.
   Do not change these conditions as such changes may affect practical display function.
[Normal operation state] Temperature：+15～+35℃, Humidity：45～75%, Atmospheric pressure：86
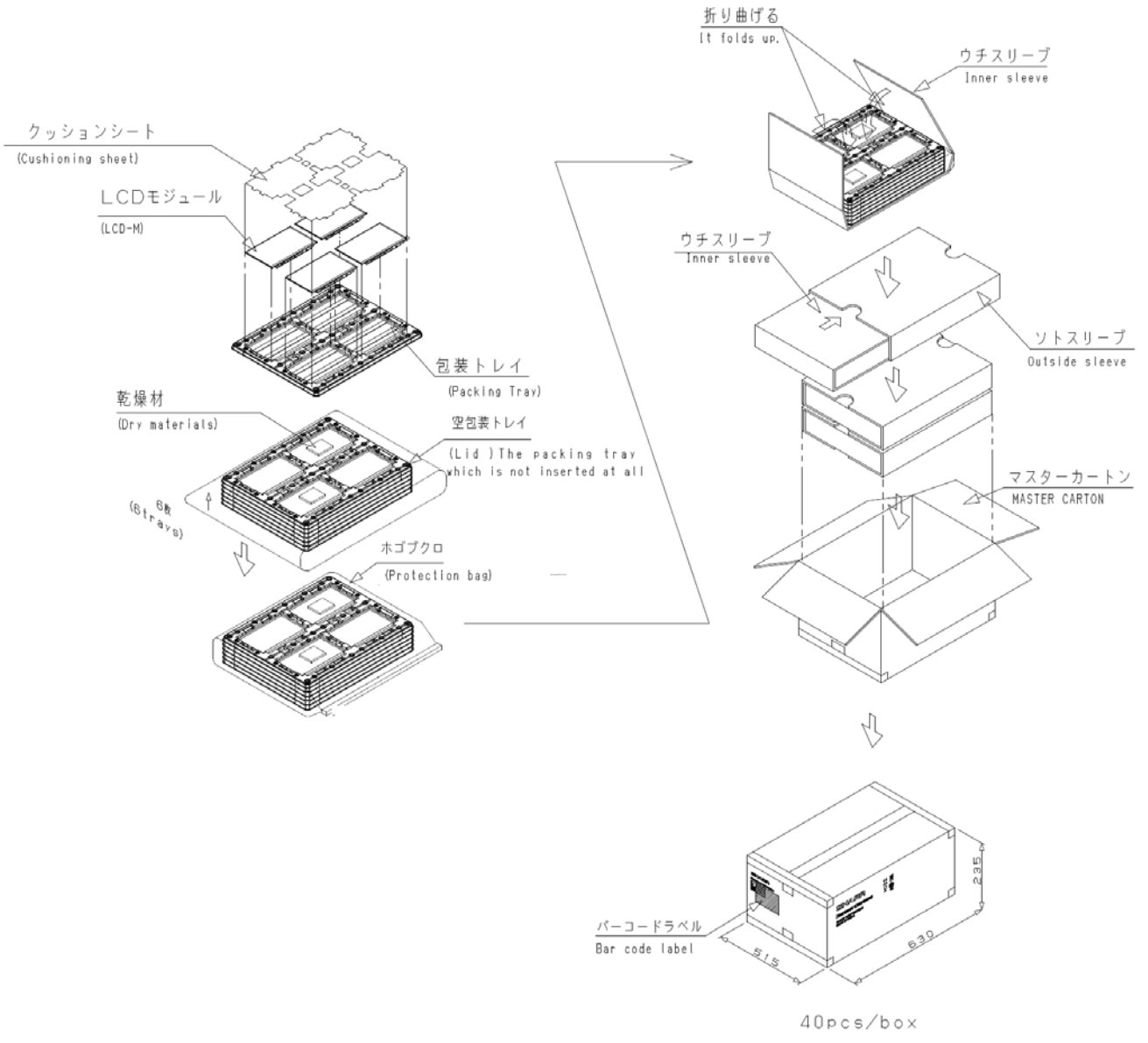 ～106kPa

Tentative

折り曲げる
It folds up.

ウチスリーブ
Inner sleeve

クッションシート
(Cushioning sheet)

ＬＣＤモジュール
(LCD-M)

包装トレイ
(Packing Tray)

乾燥材
(Dry materials)

ウチスリーブ
Inner sleeve

ソトスリーブ
Outside sleeve

空包装トレイ
(Lid)The packing tray
which is not inserted at all

6枚
(6trays)

ホゴブクロ
(Protection bag)

マスターカートン
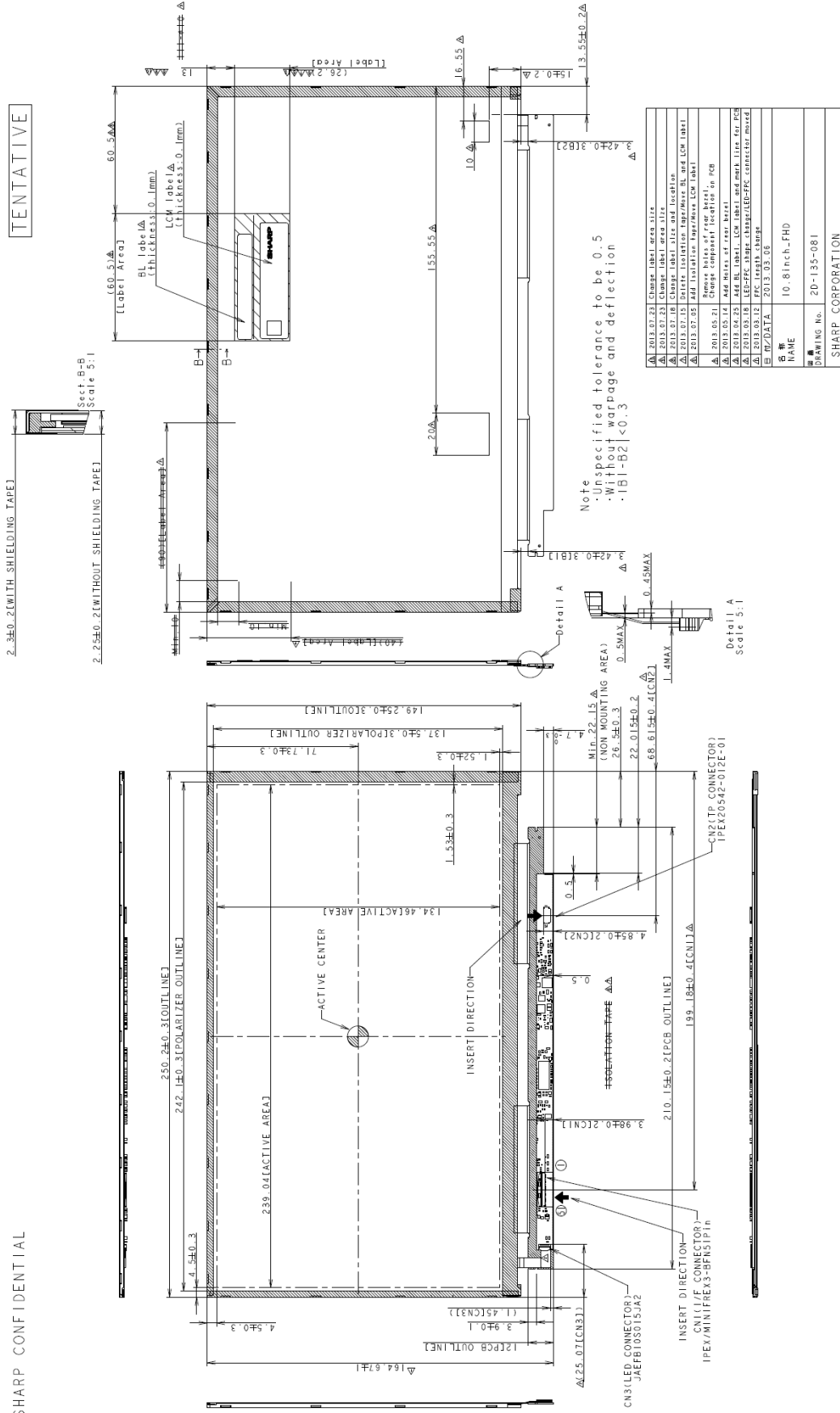MASTER CARTON

バーコードラベル
Bar code label

235

630

515

40pcs/box

Fig. 1　Packing form

Fig. 2 Outline Dimensions

LD-D2113803-27

SHARP CONFIDENTIAL

TENTATIVE