



倍顯(香港)有限公司
Facelcd(HongKong) Limited

PRODUCT SPECIFICATION



- ☐ Tentative Specification
☐ Preliminary Specification
☒ Approval Specification

Model NO. : FB133END205-A

Customer:

APPROVED BY

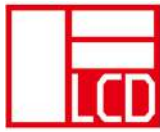
SIGNATURE

Name / Title

Note

Please return 1 copy for your confirmation with your signature
and comments.

Approved By	Checked By	Prepared By



倍顯(香港)有限公司
Facelcd(HongKong) Limited

REVISION HISTORY

Revision No.	Page	Description of Changes	Date	Prepared
0	-			



Contents

No.	Items	Page
1.0	General Description	4
2.0	Absolute Maximum Ratings	6
3.0	Electrical Specifications	7
4.0	Optical Specifications	8
5.0	Interface Connection	10
6.0	Signal Timing Specification	13
7.0	Input Signals, Display Colors & Gray Scale of Colors	15
8.0	Power Sequence	16
9.0	Connector Description	17
10.0	Mechanical Characteristics	18
11.0	Reliability Test	19
12.0	Mechanical Outline Dimension	20
13.0	EDID Table	22



1.0 GENERAL DESCRIPTION

1.1 Introduction

This is a color active matrix TFT LCD FOB using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This FOB has a 13.3inch diagonally measured active area with Full-HD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this FOB can display 262k(6bit) colors and color gamut 72%. The TFT-LCD panel used for this FOB is a low reflection and higher color type. All input signals are eDP1.3 interface compatible.

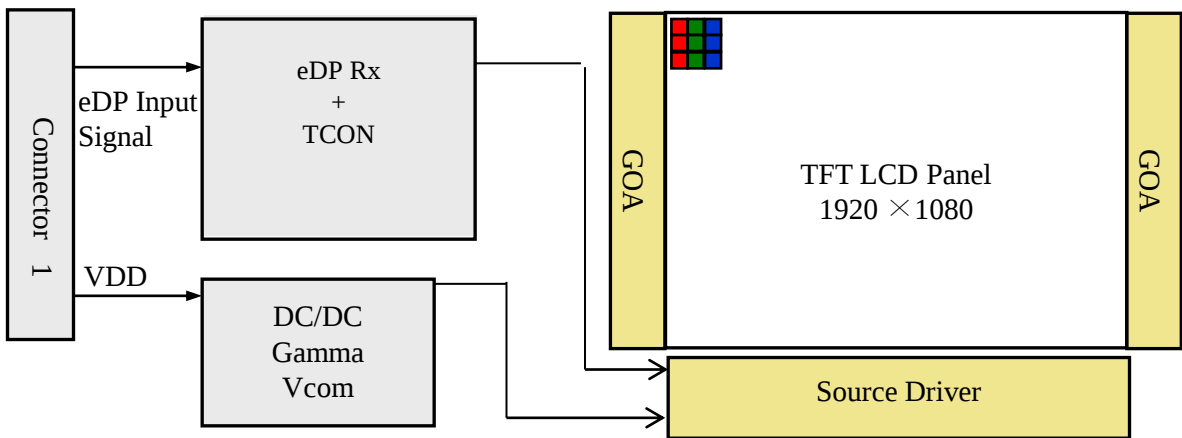


Figure 1. Drive Architecture

1.2 Features

- 2 lane eDP interface with 2.7Gbps link rates
- Thin and light weight
- 262k(6bit) color depth, color gamut 72%
- Data enable signal mode
- Side mounting frame
- Green product (RoHS & Halogen free product)
- Low driving voltage and low power consumption
- On board EDID chip



1.3 Application

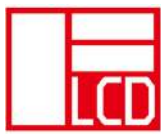
- Notebook PC (Wide type)

1.4 General Specification

The followings are general specifications at the model FOB. (listed in Table 1)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	293.76 (H) x 165.24 (V)	mm	
Number of pixels	1920 (H) × 1080 (V)	pixels	
Pixel pitch	153(H) × 153(V)	um	
Pixel arrangement	RGB Vertical stripe		
Display colors	262k(6bit)		
Color gamut	72%		
Display mode	Normally Black		
Panel outline	300.26*177.39*2.4	mm	
Surface treatment	Glare		
Surface hardness	3H		



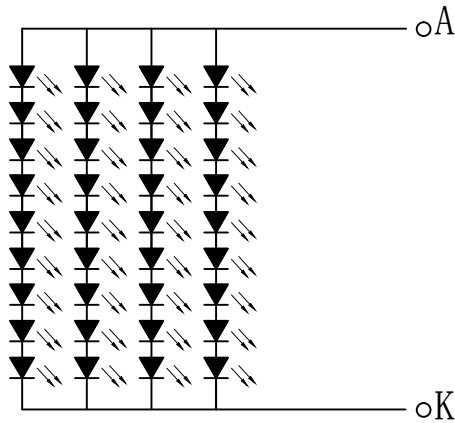
1.5 Backlight Unit

The following shows the block diagram of the 13.3 inch Backlight Unit. And it includes 36 pcs LED in the LED light bar. (9 strings and 4pcs LED of one string).

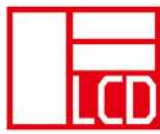
LED LIGHTBAR UNIT CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lightbar input Voltage	V	26	28	30	V _{RMS}	
Lightbar input current	I _L		80		mA	
Luminance of white	YLI		200		cd/m ²	
Lightbar Life Time	L _{BL}	20000		-	Hrs	

1.6 LED structure



Backlight LED Circuit



2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings>

Ta=25+/-2°C

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	-0.5	4.0	V	Note 1
Logic Supply Voltage	V _{IN}	V _{SS} -0.3	V _{DD} +0.3	V	
Operating Temperature	T _{OP}	0	+50	°C	Note 2
Storage Temperature	T _{ST}	-20	+60	°C	

Notes :

1. Permanent damage to the device may occur if maximum values are exceeded functional operation should be restricted to the condition described under normal operating conditions.

2. Temperature and relative humidity range are shown in the figure below.

90% RH Max. (40 °C ≥ Ta) Maximum wet - bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

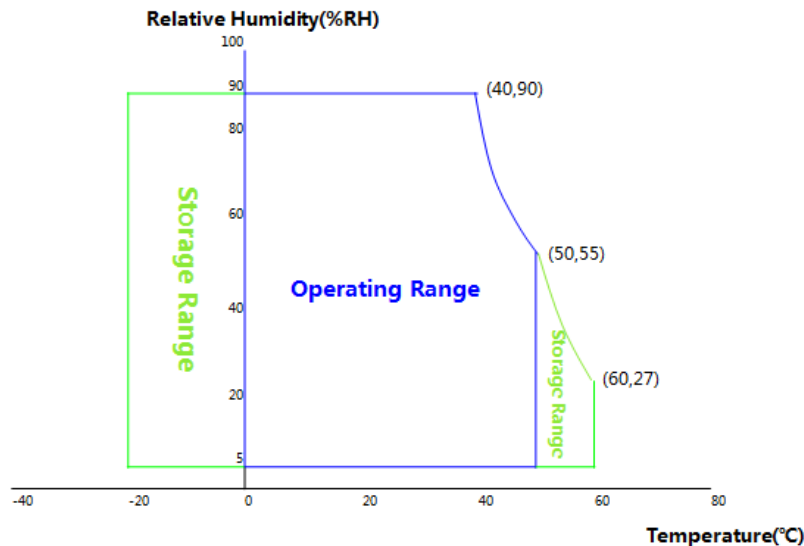


Figure 2. Temperature and Relative Humidity Range



3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical Specifications >

Ta=25+/-2°C

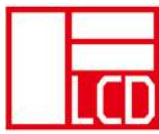
Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	3.0	3.3	3.6	V	Note 1
Permissible Input Ripple Voltage	V _{RF}	-	-	100	mV	At V _{DD} = 3.3V
Power Supply Current	I _{DD}	-	242	-	mA	Note 1
Differential Input Voltage	V _{ID}	120	-	1320	mV	
Power Consumption	P _D	-	0.8	1.6	W	Note 1

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.3V at 25°C.

a) Typ : Mosaic Pattern

b) Max :RGB

2. Calculated value for reference (V_{LED} × I_{LED})



4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of luminance meter system (PR730&PR810) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta\phi=0$ ($=03$) as the 3 o'clock direction (the "right"), $\theta\phi=90$ ($=012$) as the 12 o'clock direction ("upward"), $\theta\phi=180$ ($=09$) as the 9 o'clock direction ("left") and $\theta\phi=270$ ($=06$) as the 6 o'clock direction ("bottom"). While scanning θ and/or ϕ , the center of the measuring spot on the display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be $3.3 \pm 0.3\text{V}$ at 25°C . Optimum viewing angle direction is 6 o'clock.

4.2 Optical Specifications

<Table 4. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ_3	CR > 10	-	85	-	Deg.	Note 1
		Θ_9		-	85	-	Deg.	
	Vertical	Θ_{12}		-	85	-	Deg.	
		Θ_6		-	85	-	Deg.	
Luminance Contrast Ratio		CR	$\Theta = 0^\circ$	600	800	-		Note 2
Color Gamut		-	-	-	72	-	%	-
Response Time (Rising + Falling)		T _{RT}	Ta= 25°C $\Theta = 0^\circ$	-	30	35	ms	Note 3



Notes :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 7).
2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see Figure 7) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. The electro-optical response time measurements shall be made as Figure 10 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_f , and 90% to 10% is T_r .



5.0 INTERFACE CONNECTION

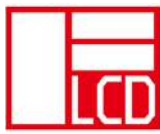
5.1 Electrical Interface Connection

The electronics interface connector is UJU IS050-L30B-C10.

The connector interface pin assignments are listed in Table 5.

<Table 5. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	NC	No connection
2	H-GND	Ground
3	LAN1_N	Complement Signal Link_Lane1
4	LAN1_P	True Signal Link_Lane1
5	H-GND	Ground
6	LAN0_N	Complement Signal Link_Lane0
7	LAN0_P	True Signal Link_Lane0
8	H-GND	High Speed Ground
9	AUXP	True Signal Link_Auxiliry Channel
10	AUXN	Complement Signal Link_Auxiliry Channel
11	H-GND	Ground
12	LCD_VCC	Power Supply, 3.3V (typ.)
13	LCD_VCC	Power Supply, 3.3V (typ.)
14	BIST	Panel self test enable
15	H-GND	Ground
16	H-GND	Ground
17	HPD	HPD(Hot Plug Detect) Signal Pin
18	BL_GND	High Speed Ground
19	BL_GND	High Speed Ground
20	BL_GND	High Speed Ground
21	BL_GND	High Speed Ground
22	BL_EN	Backlight on/off Control pin
23	BL_PWM	Back light PWM Dimming
24	NC	No connection
25	NC	No connection
26	BL_PWR	Backlight power
27	BL_PWR	Backlight power
28	BL_PWR	Backlight power
29	BL_PWR	Backlight power
30	NC	No connection



5.2 eDP Interface

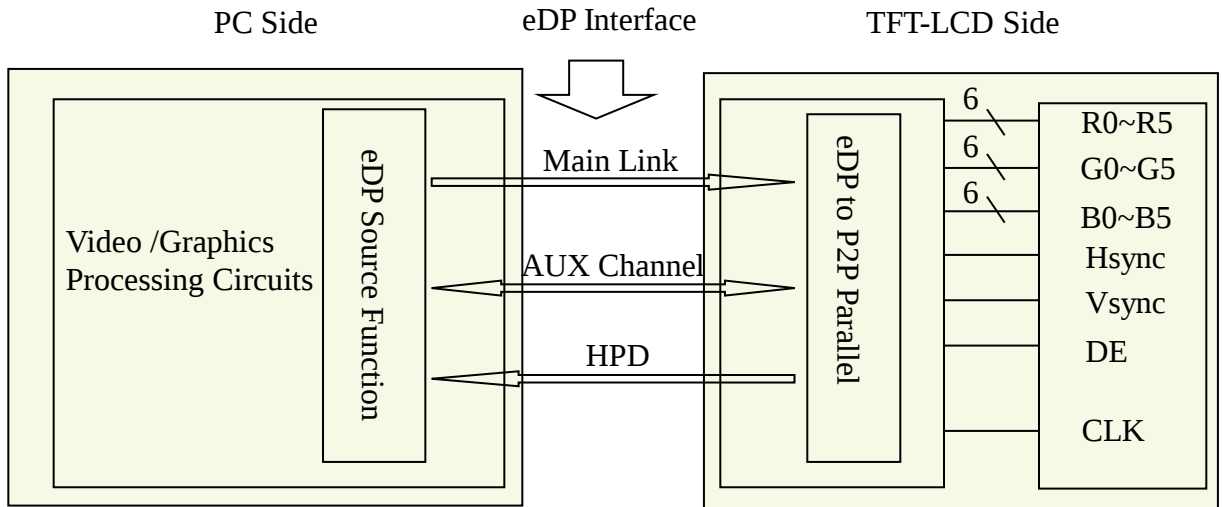
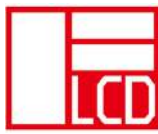


Figure 5. eDP Interface Architecture

Note:

Transmitter : NT71851 or equivalent.

Transmitter is not contained in FOB.



5.3 Data Input Format

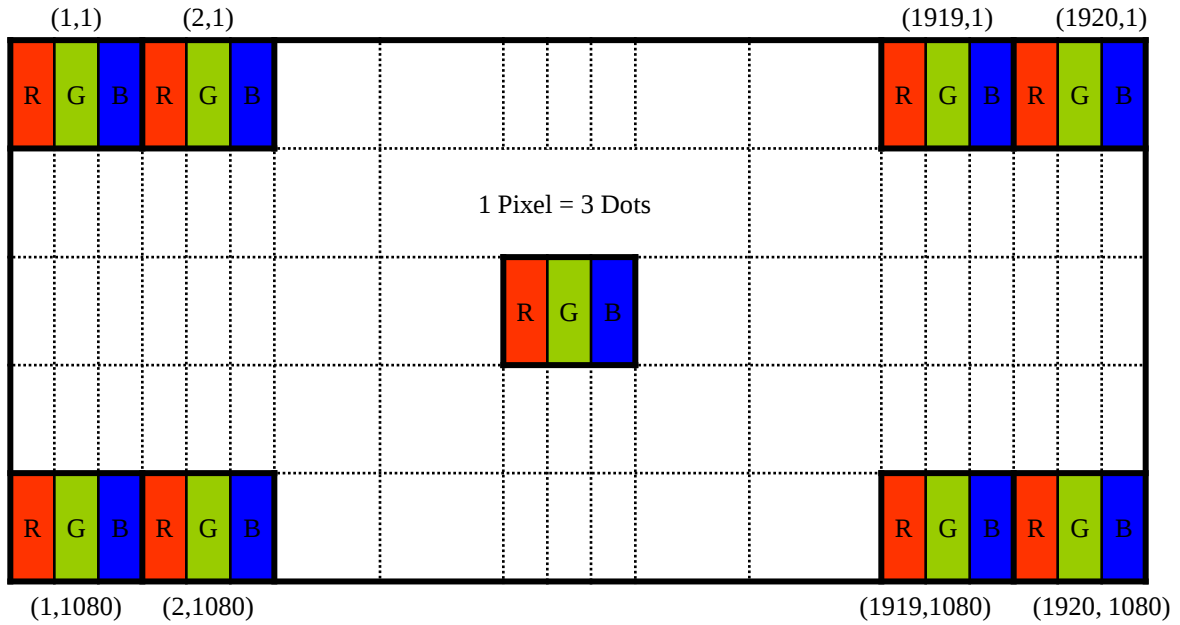
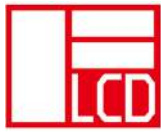


Figure 6. Display Position of Input Data (V-H)



6.0 SIGNAL TIMING SPECIFICATION

6.1 The FOB is Operated By The DE Only

< Table 6. Signal Timing Specification >

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	101	147.8	158	MHz
Frame Period		Tv	1090	1120	1200	lines
			-	60	-	Hz
			-	16.67	-	ms
Vertical Display Period		Tvd	-	1080	-	lines
One line Scanning Period		Th	2080	2200	2400	clocks
Horizontal Display Period		Thd	-	1920	-	clocks



6.2 eDP Rx Interface Timing Parameter

The specification of the eDP Rx interface timing parameter is shown in Table 7.

<Table 7. eDP Main-Link RX TP4 Package Pin Parameters>

Item	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock	SSC		0.5		%	
Differential peak-to-peak input voltage at package pins	VRX-DIFFp-p	120	0	1200	mV	
Rx input DC common mode voltage	VRX_DC_CM	-	GND	-	V	
Differential termination resistance	RRX-DIFF	80	100	120	Ω	
Single-ended termination resistance	RRX-SE	40	-	60	Ω	
Rx short circuit current limit	IRX_SHORT	-	-	20	mA	
Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR	LRX_SKEW_INTRA_PAIR	-	-	150	ps	

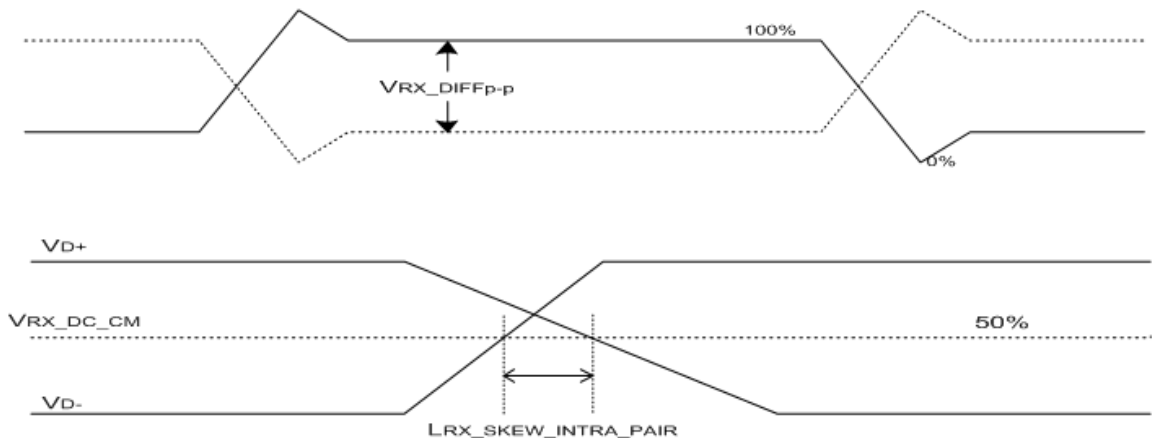
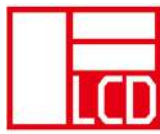


Figure 7. VRX-DIFFp-p & LRX_SKEW_INTRA_PAIR



	Colors & Gray scale	Data signal													
		R0 R1 R2 R3 R4 R5	G0 G1 G2 G3 G4 G5	B0 B1 B2 B3 B4 B5											
Basic colors	Black	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	1 1 1 1 1 1											
	Green	0 0 0 0 0 0	1 1 1 1 1 1	0 0 0 0 0 0											
	Light Blue	0 0 0 0 0 0	1 1 1 1 1 1	1 1 1 1 1 1											
	Red	1 1 1 1 1 1	0 0 0 0 0 0	0 0 0 0 0 0											
	Purple	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	Black	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0											
	△	1 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0											
	Darker	0 1 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0											
	△	↑		↑		↑									
	▽	↓		↓		↓									
	Brighter	1 0 1 1 1 1	0 0 0 0 0 0	0 0 0 0 0 0											
	▽	0 1 1 1 1 1	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											
Gray scale of Green	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	1 0 0 0 0 0	0 0 0 0 0 0											
	Darker	0 0 0 0 0 0	0 1 0 0 0 0	0 0 0 0 0 0											
	△	↑		↑		↑									
	▽	↓		↓		↓									
	Brighter	0 0 0 0 0 0	1 0 1 1 1 1	0 0 0 0 0 0											
	▽	0 0 0 0 0 0	0 1 1 1 1 1	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											
Gray scale of Blue	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	0 0 0 0 0 0	1 0 0 0 0 0											
	Darker	0 0 0 0 0 0	0 0 0 0 0 0	0 1 0 0 0 0											
	△	↑		↓		↑									
	▽	↓		↓		↓									
	Brighter	0 0 0 0 0 0	0 0 0 0 0 0	1 0 1 1 1 1											
	▽	0 0 0 0 0 0	0 0 0 0 0 0	0 1 1 1 1 1											
	Blue	0 0 0 0 0 0	0 0 0 0 0 0	1 1 1 1 1 1											
Gray scale of White & Black	Black	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0 0											
	△	1 0 0 0 0 0	1 0 0 0 0 0	1 0 0 0 0 0											
	Darker	0 1 0 0 0 0	0 1 0 0 0 0	0 1 0 0 0 0											
	△	↑		↑		↑									
	▽	↓		↓		↓									
	Brighter	1 0 1 1 1 1	1 0 1 1 1 1	1 0 1 1 1 1											
	▽	0 1 1 1 1 1	0 1 1 1 1 1	0 1 1 1 1 1											
	White	1 1 1 1 1 1	1 1 1 1 1 1	1 1 1 1 1 1											



8.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD FOB, the power on/off sequence shall be as shown in below.

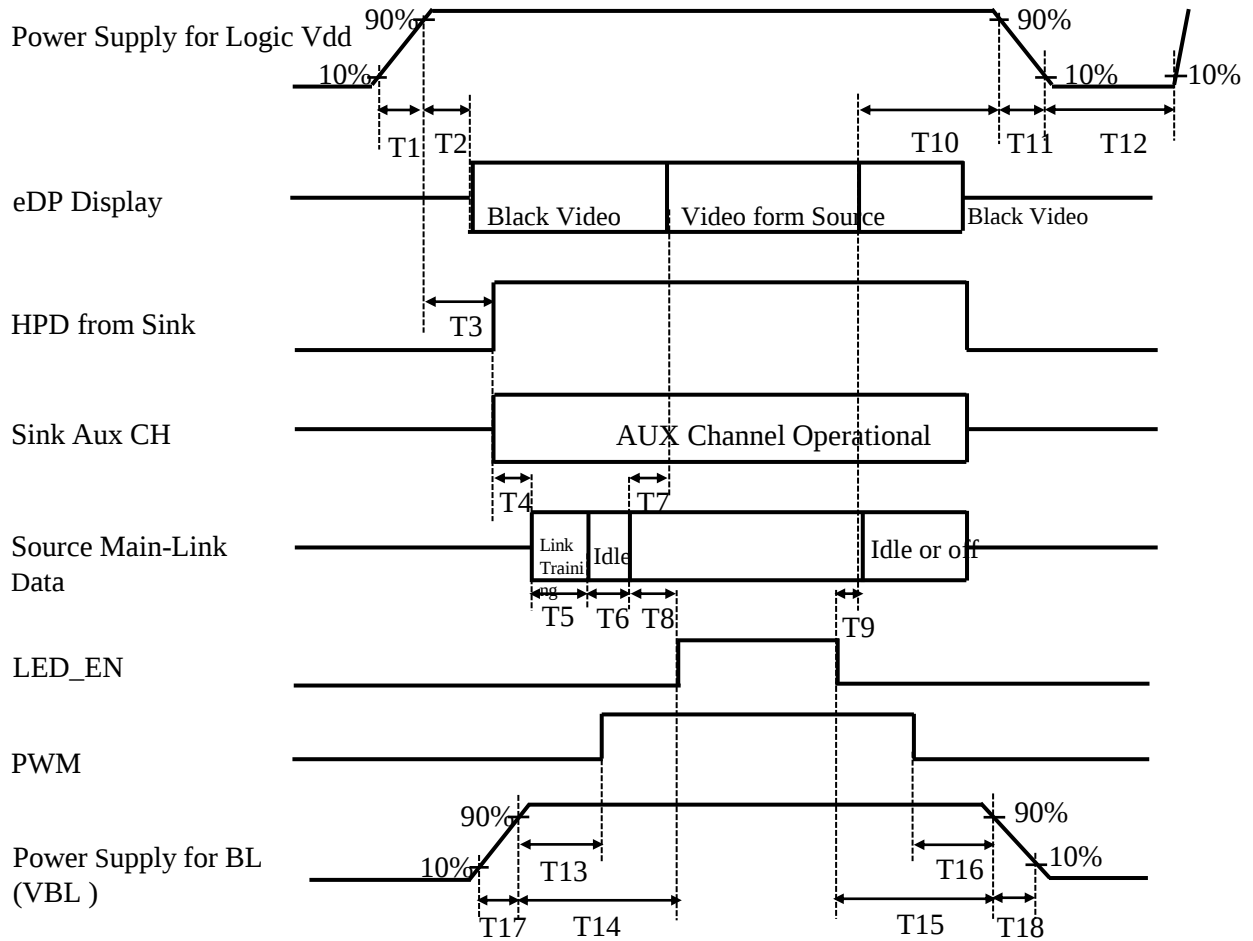


Figure 8. Power Sequence

- | | | |
|--|---|---------------------------|
| ● $0.5\text{ms} \leq T1 \leq 10\text{ ms}$ | ● $0\text{ms} < T10 < 500\text{ ms}$ | ● $0\text{ms} < T16$ |
| ● $0\text{ms} < T2 \leq 200\text{ ms}$ | ● $0.5\text{ms} \leq T11 \leq 10\text{ ms}$ | ● $0.5\text{ms} \leq T17$ |
| ● $0\text{ms} < T3 \leq 200\text{ ms}$ | ● $500\text{ms} \leq T12$ | ● $0.5\text{ms} \leq T18$ |
| ● $T3+T4+T5+T6+T8 > 200\text{ms}$ | ● $0\text{ms} < T13$ | |
| ● $0\text{ms} < T7 \leq 50\text{ms}$ | ● $0\text{ms} < T14$ | |
| ● $T7 < T8$ | ● $0\text{ms} < T15$ | |
| ● $0\text{ms} < T9$ | | |

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Backlight sequence is reference.



9.0 Connector Description

Physical interface is described as for the connector on LCM.

These connectors are capable of accommodating the following signals and will be following components.

9.1 TFT LCD FOB

< Table 9. Signal Connector >

Connector Name /Description	For Signal Connector
Manufacturer	UJU
Type/ Part Number	UJU IS050-L30B-C10
Mating Housing/ Part Number	I-PEX 20454-030T



10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

Figure 23 shows mechanical outlines for the FOB
Other parameters are shown in Table 10.

<Table 10. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	293.76 (H) x 165.24 (V)	mm
Number of pixels	1920 (H) X 1080 (V) (1 pixel = R + G + B dots)	pixels
Pixel pitch	153(H) × 153(V)	um
Pixel arrangement	RGB Vertical stripe	
Display colors	262K(6bit)	
Display mode	Normally Black	
Panel outline	300.26*177.39*2.4	mm

10.2 Mounting

See Figure 20.

10.3 Glare and Polarizer Hardness.

The surface of the LCD has a Glare coating and a 3H hardness coating to reduce scratching.



11.0 RELIABILITY TEST

The reliability test items and its conditions are shown in below.

<Table 11. Reliability Test>

No	Test Items	Conditions
1	High temperature storage test	Ta = 60°C , 60%RH, 240 hrs
2	Low temperature storage test	Ta = -20°C , 240 hrs
3	High temperature & high humidity operation test	Ta = 50°C , 80%RH, 240 hrs
4	High temperature operation test	Ta = 50°C , 60%RH, 240 hrs
5	Low temperature operation test	Ta = 0°C , 240 hrs
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 60%±3%RH, 100 cycle
7	Vibration test (non-operating)	Ta = 25°C , 60%RH, 1.5G, 10~500Hz, Sine X,Y,Z / Sweep rate : 1 hour
8	Shock test (non-operating)	Ta = 25°C , 60%RH, 220G, Half Sine Wave 2msec ± X, ± Y, ± Z Once for each direction
9	Electro-static discharge test (operating)	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV Ta = 25°C , 60%RH,

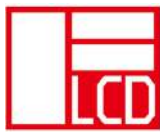


12.0 EDID Table

Address (HEX)	Function	Hex	Dec	Input values.	Notes
00	Header	00	0	0	EDID Header
01		FF	255	255	
02		FF	255	255	
03		FF	255	255	
04		FF	255	255	
05		FF	255	255	
06		FF	255	255	
07		00	0	0	
08	ID Manufacturer Name	09	9	BOE	ID = BOE
09		E5	229		
0A	ID Product Code	19	25	1817	ID = 1817
0B		07	7		
0C	32-bit serial No.	00	0		
0D		00	0		
0E		00	0		
0F		00	0		
10	Week of manufacture	01	1	1	
11	Year of Manufacture	1C	28	2018	Manufactured in 2018
12	EDID Structure Ver.	01	1	1	EDID Ver 1.0
13	EDID revision #	04	4	4	EDID Rev. 0.4
14	Video input definition	A5	165	-	digital signal/DP input
15	Max H image size	1D	29	29	29 cm (Approx)
16	Max V image size	11	17	17	17 cm (Approx)
17	Display Gamma	78	120	2.2	Gamma curve = 2.2
18	Feature support	0A	10		RGB display, Preferred Timming mode
19	Red/Green low bits	11	17	-	Red / Green Low Bits
1A	Blue/White low bits	60	96	-	Blue / White Low Bits
1B	Red x high bits	AB	171	0.668	Red (x) = 10101011 (0.668)
1C	Red y high bits	53	83	0.326	Red (y) = 01010011 (0.326)
1D	Green x high bits	47	71	0.278	Green (x) = 01000111 (0.278)
1E	Green y high bits	96	150	0.587	Green (y) = 10010110 (0.587)
1F	Blue x high bits	23	35	0.138	Blue (x) = 00100011 (0.138)
20	BLue y high bits	18	24	0.096	Blue (y) = 00011000 (0.096)
21	White x high bits	50	80	0.313	White (x) = 01010000 (0.313)
22	White y high bits	54	84	0.329	White (y) = 01010100 (0.329)
23	Established timing 1	00	0	-	
24	Established timing 2	00	0	-	



25	Established timing 3	00	0	-	
26	Standard timing #1	01	1		Not Used
27		01	1		
28	Standard timing #2	01	1		Not Used
29		01	1		
2A	Standard timing #3	01	1		Not Used
2B		01	1		
2C	Standard timing #4	01	1		Not Used
2D		01	1		
2E	Standard timing #5	01	1		Not Used
2F		01	1		
30	Standard timing #6	01	1		Not Used
31		01	1		
32	Standard timing #7	01	1		Not Used
33		01	1		
34	Standard timing #8	01	1		Not Used
35		01	1		
36	Detailed timing/monitor descriptor #1	BC	188	147.8	147.8MHz Main clock
37		39	57		
38		80	128	1920	Hor Active = 1920
39		18	24	280	Hor Blanking = 280
3A		71	113	-	4 bits of Hor. Active + 4 bits of Hor. Blanking
3B		38	56	1080	Ver Active = 1080
3C		28	40	40	Ver Blanking = 40
3D		40	64	-	4 bits of Ver. Active + 4 bits of Ver. Blanking
3E		30	48	48	Hor Sync Offset = 48
3F		20	32	32	H Sync Pulse Width = 32
40		36	54	3	V sync Offset = 3 line
41		00	0	6	V Sync Pulse width : 6 line
42		26	38	294	Horizontal Image Size = 294 mm (Low 8 bits)
43		A5	165	165	Vertical Image Size = 165 mm (Low 8 bits)
44		10	16	-	4 bits of Hor Image Size + 4 bits of Ver Image Size
45		00	0	0	Hor Border (pixels)
46		00	0	0	Vertical Border (Lines)
47		1A	26		Refer to right table



48	Detailed timing/monitor descriptor #2	36	54	118.3	118.3MHz Main clock
49		2E	46		
4A		80	128	1920	Hor Active = 1920
4B		18	24	280	Hor Blanking = 280
4C		71	113	-	4 bits of Hor. Active + 4 bits of Hor. Blanking
4D		38	56	1080	Ver Active = 1080
4E		28	40	40	Ver Blanking = 40
4F		40	64	-	4 bits of Ver. Active + 4 bits of Ver. Blanking
50		30	48	48	Hor Sync Offset = 48
51		20	32	32	H Sync Pulse Width = 32
52		36	54	3	V sync Offset = 3 line
53		00	0	6	V Sync Pulse width : 6 line
54		26	38	294	Horizontal Image Size = 294 mm (Low 8 bits)
55		A5	165	165	Vertical Image Size = 165 mm (Low 8 bits)
56		10	16	-	4 bits of Hor Image Size + 4 bits of Ver Image Size
57		00	0	0	Hor Border (pixels)
58		00	0	0	Vertical Border (Lines)
59		1A	26		
5A	Detailed timing/monitor descriptor #3	00	0		ASCII Data Sting Tag
5B		00	0		
5C		00	0		
5D		FE	254		
5E		00	0		
5F		00	0	0	
60		00	0	0	
61		00	0	0	
62		00	0	0	
63		00	0	0	
64		00	0	0	
65		00	0	0	
66		00	0	0	
67		00	0	0	
68		00	0	0	
69		00	0	0	
6A		00	0	0	
6B		00	0	0	



倍顯(香港)有限公司

Facelcd(HongKong) Limited

6C	Detailed timing/monitor descriptor #4	00	0		Product Name Tag (ASCII)
6D		00	0		
6E		00	0		
6F		FC	252		
70		00	0		
71		00	0	0	
72		00	0	0	
73		00	0	0	
74		00	0	0	
75		00	0	0	
76		00	0	0	
77		00	0	0	
78		00	0	0	
79		00	0	0	
7A		00	0	0	
7B		00	0	0	
7C		00	0	0	
7D		00	0	0	
7E	Extension flag	00	0		
7F	Checksum	54	84	-	

[illegible]