Specification For Approval

■ Preliminary specification
□ Final specification

Title	10.1 FB MONO TFT-LCD (FOB)

Buyer	特品
Model	

Supplier	Cheng Du BOE Optoelectronics Technology CO., LTD
Model	RV101FBB-N02-V1

TITLE/SIGNATURE	DATE	ITEM	SIGNATURE/DATE
		Approved	
		Reviewed	
		Reviewed	
		Prepared	

Please return one copy confirmation with signature and your comments

BOE CHENG DU Optoelectronics Technology CO., LTD

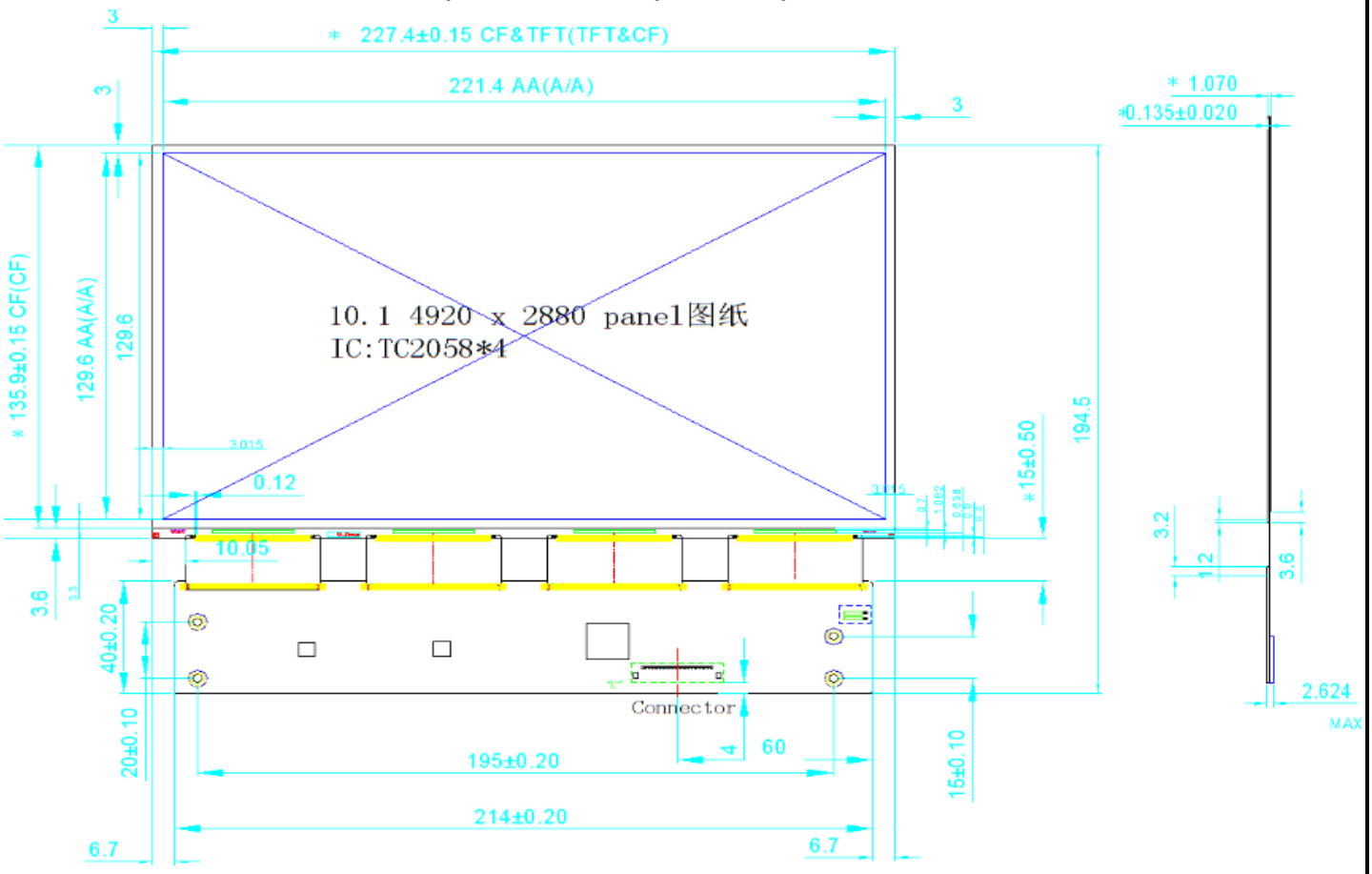
CONTENT LIST

Records Of Revisions				
Revision	Date	Page	Description	Released by
Pre.0	2021.03.19		Initial released	

1.0 GENERAL DESCRIPTION

1.1 Introduction

RV101FBB-N02-V1 is a MONO active matrix LCD Panel using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. It is a transmissive type display operating in the normal black. This TFT-LCD has a 10.1 inch diagonally measured active area with 4920 Horizontal by 2880 Vertical pixel array.



1.2 Features

- 1.070 t Total
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS Compliant

1.3 Application

- 3D Printer

1.4 General Specifications (H: horizontal length, V: Vertical length**)**

Parameter	Specification	Unit	Remark
Active Area	221.43 (H) x 129.6(V)	mm	
Number of Pixels	4920(H) × 2880(V)	pixels	
Pixel Pitch	45(H) × 45(V)	um	
Display Colors	256	gray	
Display Mode	Normally black, Transmissive mode		
Dimensional Outline	227.43(H) × 139.5(V) × 1.070(D)	mm	
Viewing Direction (Human Eye)	U/D/L/R Min. 80/80/80/80	°	Note 1,2

Note:

1. At the U/D/L/R direction, the viewing angle is same;
2. The TFT and CF Align Direction;

2.0 ELECTRICAL SPECIFICATION

2.1 Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. Make sure all the design characteristics are adequate before the panel is initialed. All the measurements should be operated with driver IC and experimental FPC mounted.

Parameter	Symbol	Min	Max	Unit	Remark
LC Operating Voltage *1)	V_{op}	5.2	5.8	V	Ta = 25℃
Operating Temperature	T_{OP}	0	+70	℃	
Storage Temperature	T_{ST}	-10	+80	℃	
Operating Ambient Humidity *2)	Hop	10	*3)	%RH	*3)
Storage Humidity	Hst	10	*3)	%RH	*3)

Note : **[VSS = GND = 0V]**

*1) Liquid Crystal driving voltage

Due to the characteristics of LC Material, this voltage varies with environmental temperature.

*2) Temp≤60℃ 90% RH MAX

*3) Non-condensation

2.2 Electrical Characteristics

Parameter	Symbol	Value	Unit	Remark
		Reference		
TFT Gate ON Voltage	V_{GH}	18	V	Note1
TFT Gate OFF Voltage	V_{GL}	-8	V	Note2
TFT Common Electrode Voltage	V_{COM}	4.56	V	Note3
TFT Kick-Back Voltage Max	ΔVp Max	0.2~0.8	V	
TFT Kick-Back Voltage Min	ΔVp Min	0.3~0.9	V	

Note :

1. V_{GH} is TFT Gate operating voltage.
2. V_{GL} is TFT Gate operating voltage. The low voltage level of VGL signal must be fluctuate with same phase as Vcom, the storage capacitance structure of the product is storage on common.
3. V_{com} must be adjusted to optimize display quality, as Crosstalk and Contrast Ratio etc., We just kindly recommend the setting-voltages the reference value.

In order to get the optimized display quality, the setting-voltage should be changed according to customer's developing condition. (The display quality could be changed by customer's setting –voltage.)

3.0 OPTICAL SPECIFICATIONS

3.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Topcon SR-UL1R and Westar TRD-100A) 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°.The center of the measuring spot on the Display surface shall stay fixed.

The backlight should be operating for 30 minutes prior to measurement.

3.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Threshold Voltage		Vsat		4.1	4.3	4.5	V	Fig.1
		Vth		1.6	1.8	2.0	V	
Viewing Angle	Horizontal	Θ3	CR>10	80				Note 1
		Θ9		80				
	Vertical	Θ12		80				
		Θ6		80				
Contrast Ratio		CR	Θ= 0°	300	400			Note 2
Transmittance		T(%)	Θ= 0°	4.2				Note 3
Response Time		Tr+Tf	Θ= 0°		35	40	ms	Note 5

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing 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 (seeFIG.2).
2. Contrast measurements shall be made at viewing angle of Θ= 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 FIG. 2) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. Transmittance is the value without APF Polarizer.
4. Measurements shall be made at the center of the C/F.
   Measurement condition is UV light by 405nm.
5. The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF.
   The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Tf.

Figure 1. The definition of Vth & Vsat

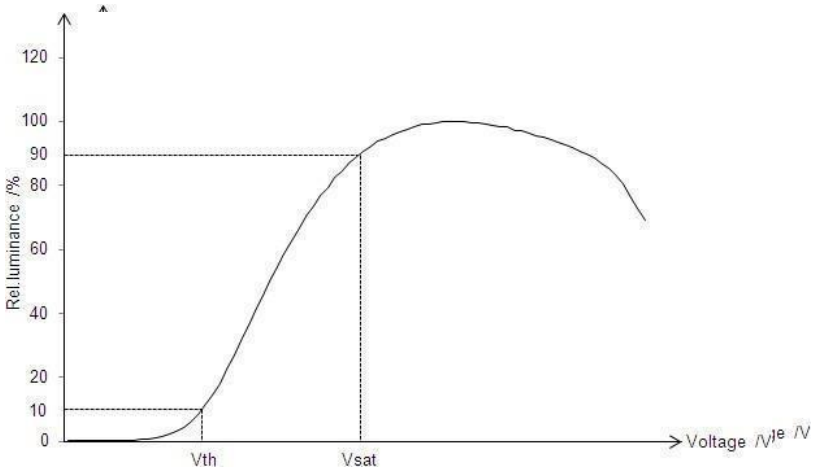


Figure 2. Measurement Set Up

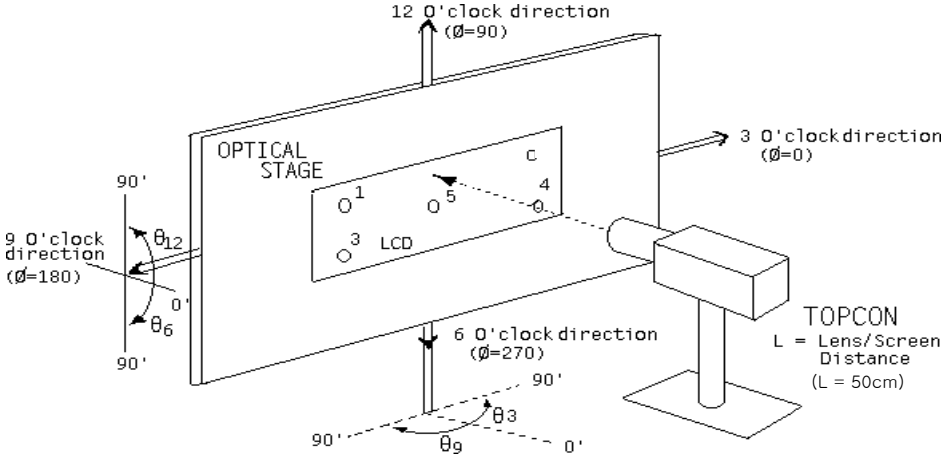
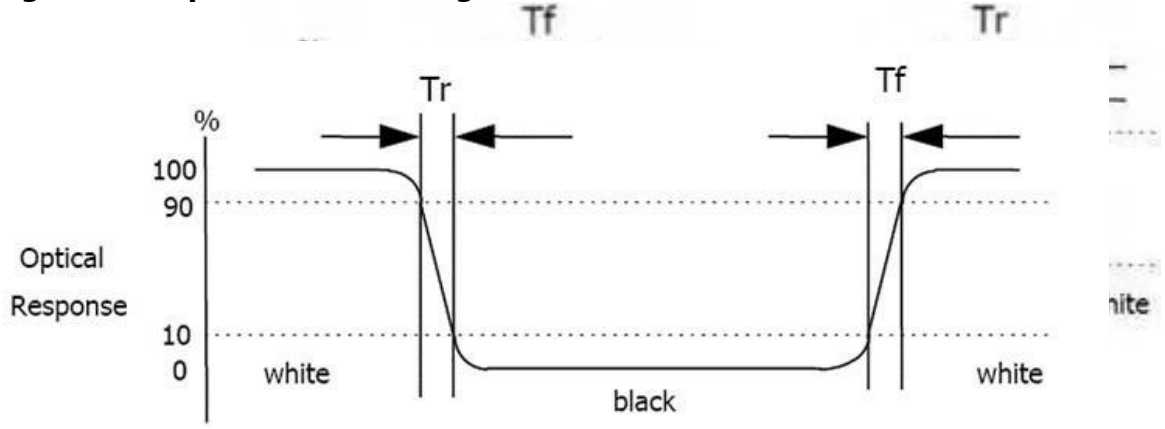


Figure 3. Response Time Testing



4.0 Mechanical Characteristics

4.1 Dimensional Requirements (H: horizontal length, V: Vertical length)

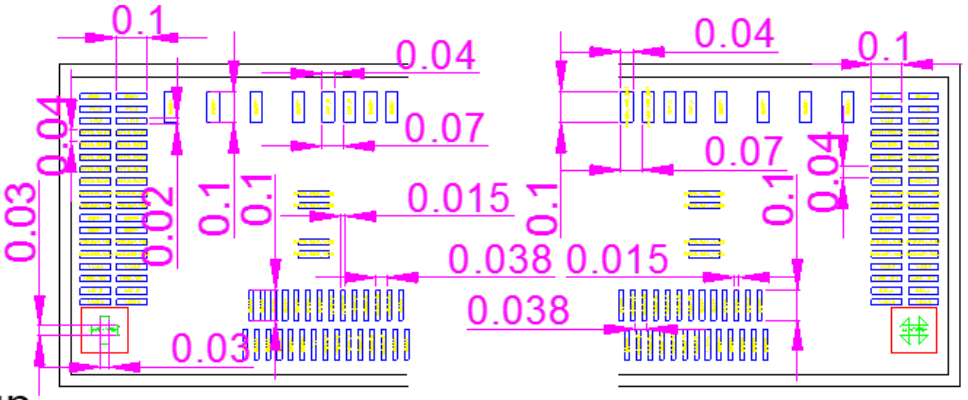
Parameter	Specification	Unit	Remark
Panel size	227.43(H) × 139.5(V)	mm	
CF size	227.43 (H) x 135.9(V)	mm	
Active area	221.4(H) × 129.6(V)	mm	
Number of pixels	4920(H) × 2880(V)	pixels	
Pixel pitch	45(H) × 45(V)	um	
Pixel arrangement	WB Vertical stripe		
COG pad area	3.6	mm	
D-IC to FPC distance	0.638	mm	Note
D-IC width	1.062	mm	
D-IC to CF edge	0.7	mm	
FPC width	0.9	mm	
FPC to Glass edge	0.3	mm	
Seal Area(L/R/U/D)	3.015/3.015/3.0/3.3	mm	
Dimensional outline	227.43(H) × 139.5(V) ×1 . 0 7 0 (D)	mm	
Display mode	Normally Black		

Note:

The size specified is calculated by IC–driver TC2058B

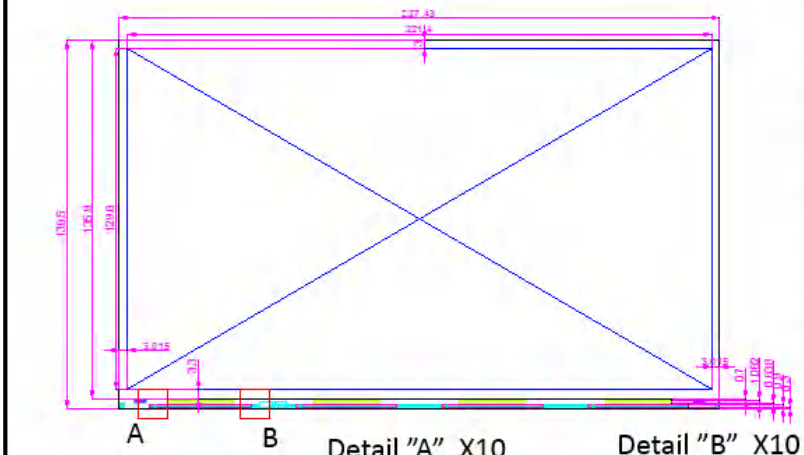
5.0 Data IC PAD & FPC Pin Assignment

5.1 Data IC One D-IC（unit: mm if unspecified）

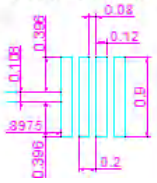


Bump up

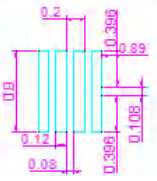
Item	Data	
Input Bump W/S (um)	15/15 15/23	
Output Bump W/S (um)	40/30	
Align Mark	On IC	On Panel



Detail "A" X10



Detail "B" X10



- Pad pin : 176 pin;
- Pad pitch : 200 um;
  width : space = 120 : 80
- 4 EA FPC

5.2 FPC Pin Assignment（unit: mm if unspecified）

1	Mark	37	SW_VGL	73	VSS1A	109	VSS2	145	SW_VGL
2	Null	38	SW_VGL	74	VSS1A	110	VSS2	146	SW_VGL
3	Test	39	Y_1	75	VDD1A	111	VBOT/VDDAH	147	DUMMY
4	Tset	40	Y_1	76	VDD1A	112	VBOT/VDDAH	148	DUMMY
5	Ag_GND	41	VDD1D	77	VDD1D	113	VTOP/VDDAH	149	COM
6	Ag_GND	42	VDD1D	78	VDD1D	114	VTOP/VDDAH	150	COM
7	Ag_GND	43	VDD1D	79	LANE_SEL	115	VDD2	151	CK4
8	VCOM_Feed2	44	VDD1D	80	LANE_SEL	116	VDD2	152	CK2
9	VCOM_Feed2	45	VSS1D	81	ASC_M_R	117	VDD2	153	CK8
10	VCOM	46	VSS1D	82	ASC_M_R	118	Dummy	154	CK6
11	VCOM	47	VSS1D	83	VSS1D	119	VDD2	155	VGL
12	GCL	48	VSS1D	84	Dummy	120	VDD2	156	VGL
13	GCL	49	VSS2	85	Dummy	121	VDD2	157	STV2
14	STV0	50	VSS2	86	SIPI_1N	122	VTOP/VDDAH	158	VSD
15	GCH	51	VSS2	87	SIPI_1N	123	VTOP/VDDAH	159	VDS
16	GCH	52	VBOT/VDDAH	88	SIPI_1P	124	VBOT/VDDAH	160	STV4
17	STV3	53	VBOT/VDDAH	89	SIPI_1P	125	VBOT/VDDAH	161	GCH
18	VDS	54	VTOP/VDDAH	90	Dummy	126	VSS2	162	GCH
19	VSD	55	VTOP/VDDAH	91	SIPI_ON	127	VSS2	163	STV0
20	STV1	56	VDD2	92	SIPI_ON	128	VSS2	164	GCL
21	VGL	57	VDD2	93	SIPI_OP	129	VSS1D	165	GCL
22	VGL	58	VDD2	94	SIPI_OP	130	VSS1D	166	VCOM
23	CLK5	59	Dummy	95	Dummy	131	VSS1D	167	VCOM
24	CLK7	60	Dummy	96	Dummy	132	VSS1D	168	VCOM_Feed2
25	CLK1	61	VDD2	97	Dummy	133	VDD1D	169	VCOM_Feed2
26	CLK3	62	VDD2	98	Dummy	134	VDD1D	170	Ag_GND
27	VCOM	63	VDD2	99	VSS1D	135	VDD1D	171	Ag_GND
28	VCOM	64	VTOP/VDDAH	100	VDD1D	136	VDD1D	172	Ag_GND
29	Dummy	65	VTOP/VDDAH	101	VDD1D	137	Dummy	173	Test
30	Dummy	66	VBOT/VDDAH	102	VDD1A	138	Dummy	174	Tset
31	VGMA1	67	VBOT/VDDAH	103	VDD1A	139	Dummy	175	Null
32	VGMA1	68	VSS2	104	VSS1A	140	Dummy	176	Mark
33	VGMA12	69	VSS2	105	VSS1A	141	V_1446		
34	VGMA12	70	VSS2	106	VSS1D	142	V_1446		
35	Dummy	71	VSS1D	107	VSS1D	143	DUMMY		
36	Dummy	72	VSS1D	108	VSS2	144	DUMMY		

Notes:

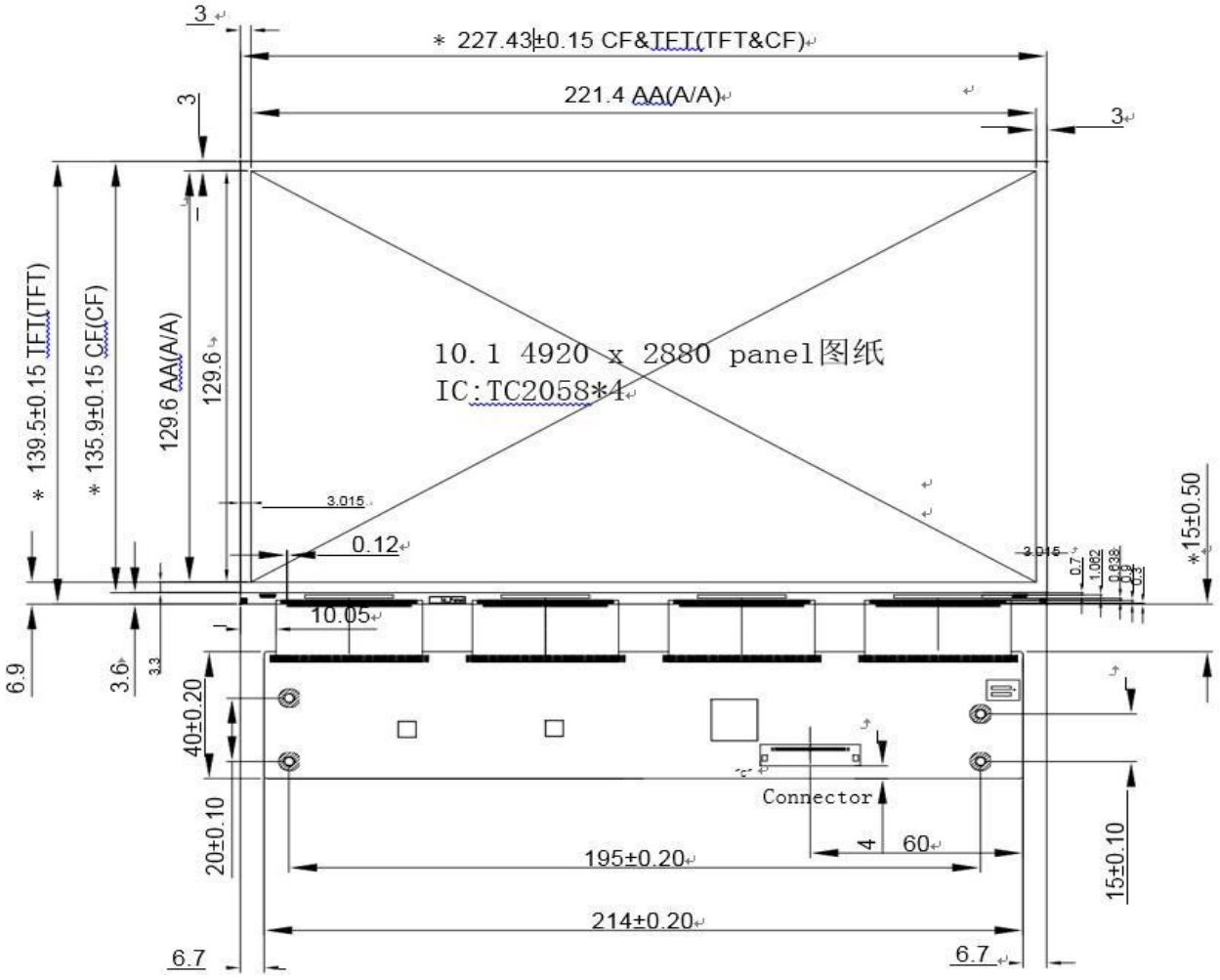
***1) SW must be connected to VGL**

6.0 RELIABILITY TEST

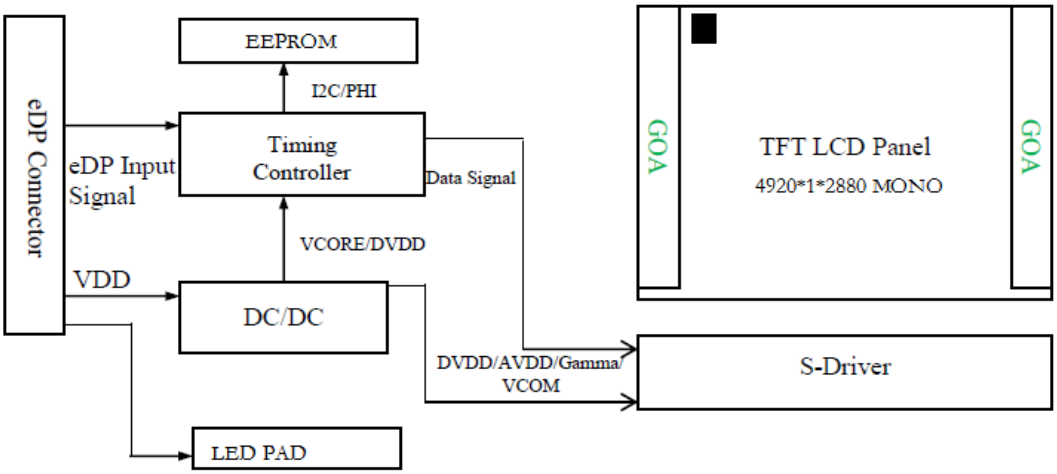
NO	Test Item	Test Condition	Duration
1	High temperature, high humidity operation test(THO)	60℃, 90%	240hr
2	Low temperature operation test(LTO)	0 ℃	240hr
3	High temperature operation test(HTO)	70 ℃	240hr
4	High temperature storage test(HTS)	80℃	240hr
5	Low temperature storage test(LTS)	-10℃	240hr
6	Thermal shock test	-30 ℃ →80 ℃	100hr
	(TST)	(Per 30min)	
7	Vibration	5-200Hz,0.015 psd 200-500,-6db/octave, X/Y/Z each axis 2hrs, total 6hrs	-

7.0 APPENDIX

Figure 4. FOB Outline Dimension (unit: mm)



7.1 ELECTRICAL PART



- 4 lane eDP interface with 5.4Gbps@HBR2 link rates
- Compliant to VESA DisplayPort Standard v1.2a
- Compliant to VESA Embedded DisplayPort Standard v1.3
- Green product (RoHS& Halogen free product)

7.2 Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. Make sure all the design characteristics are adequate before the panel is initialed. All the measurements should be operated with driver IC and experimental FPC mounted.

[VSS = GND = 0V]

Parameter	Symbol	Min	Max	Unit	Remark
Operating Voltage	V_{op}	3.0	3.6	V	Ta = 25℃
Operating Temperature	T_{OP}	0	+70	℃	
Storage Temperature	T_{ST}	-10	+80	℃	
Operating Ambient Humidity	Hop	-	-	%RH	*1)
Storage Humidity	Hst	-	-	%RH	*1)

Note :

*1) Temp≤60℃ 90% RH MAX.

7.3 ELECTRICAL SPECIFICATION

Parameter	Symbol	Value			Unit	Remark
		min	typ	max		
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	
Power Supply Current	I_{DD}	0.46	0.5	0.7	A	*1)
Power Consumption	P_D	-	1.5	2.6	W	
In-Rush Current	I_{RUSH}	-	2	3	A	
Permissible Input Ripple Voltage	V_{RF}	-	-	300	mV	
High Level Differential Input Threshold Voltage	V_{IH}	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-100	-	-	mV	
Differential input voltage	$\|V_{ID}\|$	100	-	600	mV	
Differential input common mode voltage	Vcm	0	-	2	V	

Note :

*1) 1 dot pattern MAX

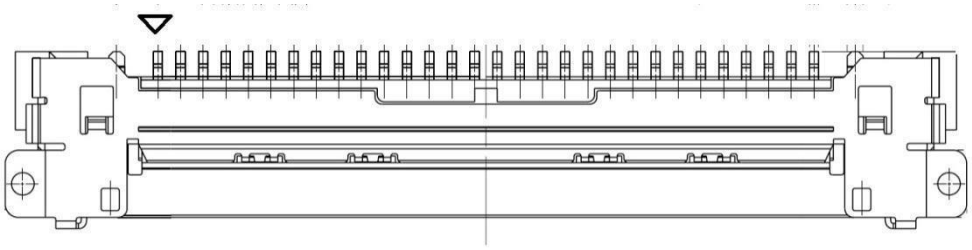
7.4 INTERFACE CONNECTION

7.4.1 Electrical Interface Connection

The electronics interface connector is 20455-040E-66 (IPEX) or Compatible.

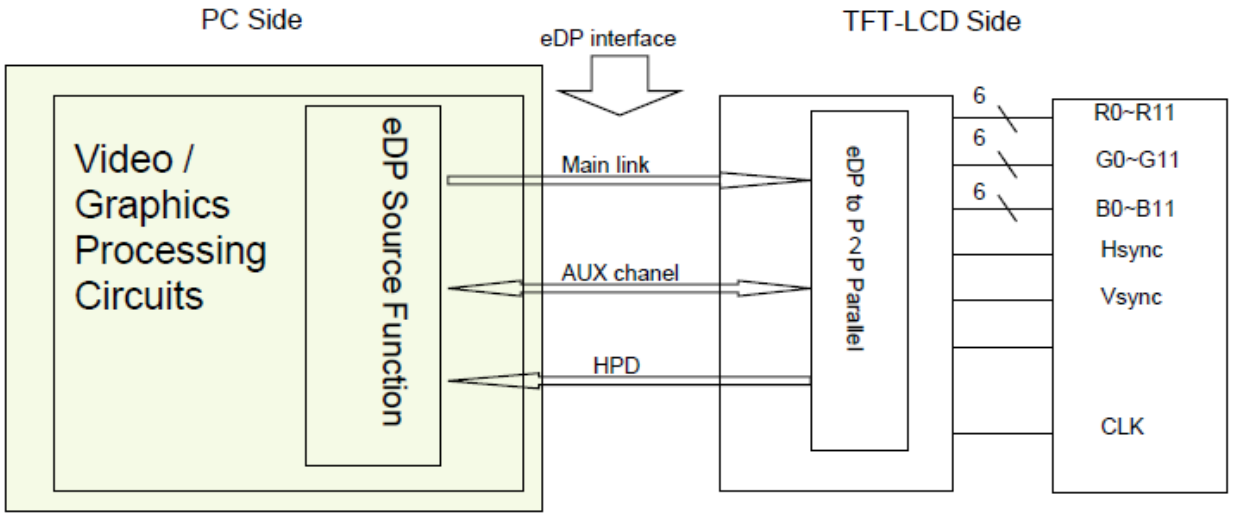
The connector interface pin assignments are listed as follow.

Figure 4. eDP Interface (unit: mm if unspecified)



Pin No	Symbol	Functions	Pin No	Symbol	Functions	Pin No	Symbol	Functions	Pin No	Symbol	Functions
1	LED-	LED Negative Pole	11	LED+	LED Positive Pole	21	LCD_VCC	Power Supply (3.3V)	31	LANE1_P	Lane3P True Signal for Main Link 1
2	LED-	LED Negative Pole	12	NC	No connection	22	LCD_VCC	Power Supply (3.3V)	32	LANE1_N	Lane3N Component Signal for Main Link 1
3	LED-	LED Negative Pole	13	NC	No connection	23	LCD_VCC	Power Supply (3.3V)	33	GND	Ground
4	LED-	LED Negative Pole	14	HPD	HPD signal pin	24	GND	Ground	34	LANE2_P	Lane3P True Signal for Main Link 2
5	NC	No connection	15	GND	Ground	25	AUX_CH_N	AUX_CHN Component Signal for Auxiliary Channel	35	LANE2_N	Lane3N Component Signal for Main Link 2
6	NC	No connection	16	GND	Ground	26	AUX_CH_P	AUX_CHP True Signal for Auxiliary Channel	36	GND	Ground
7	NC	No connection	17	GND	Ground	27	GND	Ground	37	LANE3_P	Lane3P True Signal for Main Link 3
8	LED+	LED Positive Pole	18	GND	Ground	28	LANE0_P	Lane3P True Signal for Main Link 0	38	LANE3_N	Lane3N Component Signal for Main Link 3
9	LED+	LED Positive Pole	19	LCD_TEST	BISTEN	29	LANE0_N	Lane3N Component Signal for Main Link 0	39	GND	Ground
10	LED+	LED Positive Pole	20	LCD_VCC	Power Supply (3.3V)	30	GND	Ground	40	NC	No connection

7.4.2 eDP Interface



Note: TCON(DP667)，Source IC(TC2058*4)

7.5 SIGNAL TIMING SPECIFICATION

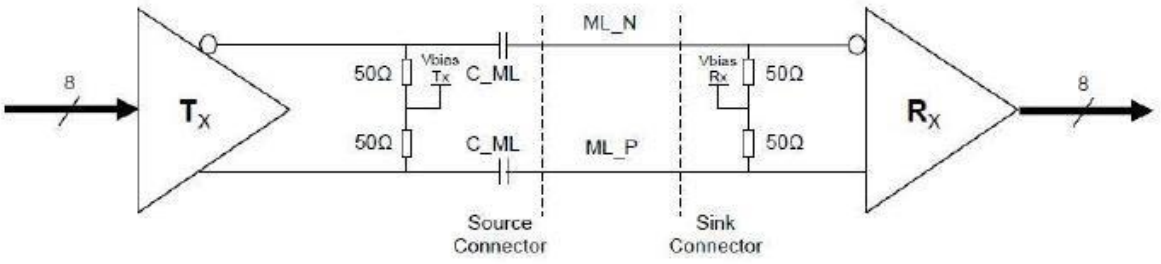
7.5.1 The RV101FBB-N02-V1 Operated By The DE Only

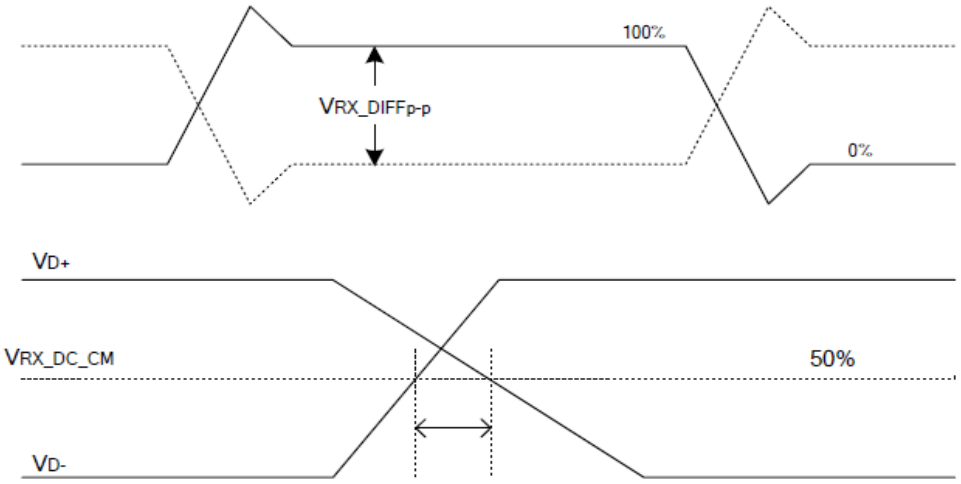
Parameter	Symble	Typ	Unit
DCLK frequency	1/Tc	317.7	MHz
Frame frequency	Fv	60	Hz
Vertical total timing	Tv	2942	lines
Vertical active timing	Tvd	2880	lines
Horizontal total timing	Th	1800	clocks
Horizontal active timing	Thd	1640	clocks
Horizontal start timing	TS	112	clocks
Vertical start timing	VS	16	lines

7.5.2 eDP Rx Interface Timing Parameter

DISPLAYPORT™ MAIN LINK RECEIVER CHARACTERISTICS

Symbol and Parameter	Test Conditions	Min	Typ[2]	Max	Unit
Spread spectrum clock, down-spreading by SOURCE			0.5		%
$V_{RX-DIFFp-p}$: Differential peak-to-peak input voltage at package pins		100		1320	mV
Maximum adaptive/programmable equalization level at 2.7GHz			10		dB
$V_{RX\_DC\_CM}$: Rx input DC common mode voltage			GND		V
$R_{RX-DIFF}$: Differential termination resistance		80	100	120	Ω
R_{RX-SE}: Single-ended termination resistance		40		60	Ω
I_{RX_SHORT}: Rx short circuit current limit				20	mA
$L_{RX\_SKEW\_INTRA\_PAIR}$: Intra-pair skew at Rx package pins (HBR2)					
RX intra-pair skew tolerance at HBR2				60	ps
$L_{RX\_SKEW\_INTRA\_PAIR}$: Intra-pair skew at Rx package pins (HBR)					
RX intra-pair skew tolerance at HBR				150	ps
$L_{RX\_SKEW\_INTRA\_PAIR}$: Intra-pair skew at Rx package pins (RBR)					
RX intra-pair skew tolerance at RBR				300	ps
Receiver Jitter Tolerance for High Bit Rate 2 (HBR2)					
Total jitter tolerance at 2MHz		1026			mUI
Total jitter tolerance at 10MHz		636			mUI
Total jitter tolerance at 20MHz		624			mUI
Total jitter tolerance at 100MHz		620			mUI
Receiver Jitter Tolerance for High Bit Rate (HBR)					
Total jitter tolerance at 2MHz		1227			mUI
Total jitter tolerance at 10MHz		548			mUI
Total jitter tolerance at 20MHz		505			mUI
Total jitter tolerance at 100MHz		491			mUI
Receiver Jitter Tolerance for Reduced Bit Rate (RBR)					
Total jitter tolerance at 2MHz		1648			mUI
Total jitter tolerance at 10MHz		778			mUI
Total jitter tolerance at 20MHz		747			mUI

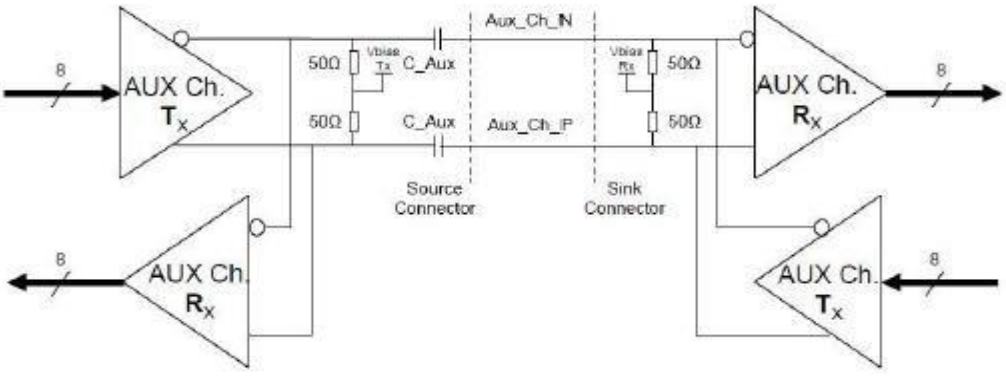




LRX_SKEW_INTRA_PAIR

Displayport™ AUX channel characteristics

Symbol and Parameter	Test Conditions	Min	Typ[2]	Max	Unit
UI: Unit Interval for AUX channel		0.4	0.5	0.6	µs
VAUX-DIFF-p-p: AUX differential peak-to-peak voltage at TP1 when driving the bus		500		800	mV
VAUX-DC-CM-RX: AUX common mode voltage when receiving			GND		V
VAUX-DC-CM-TX: AUX common mode voltage when transmitting			0.15		V
IAUX-SHORT: AUX channel short circuit current				20	mA
RAUX-DIFF: Differential termination resistance		80	100	120	Ω
RAUX-SE: Single-ended termination resistance		40	50	60	Ω
CAUX: AUX AC coupling capacitor		75		200	nF



7.6 Input Signals Display Colors & Gray Scale of Colors

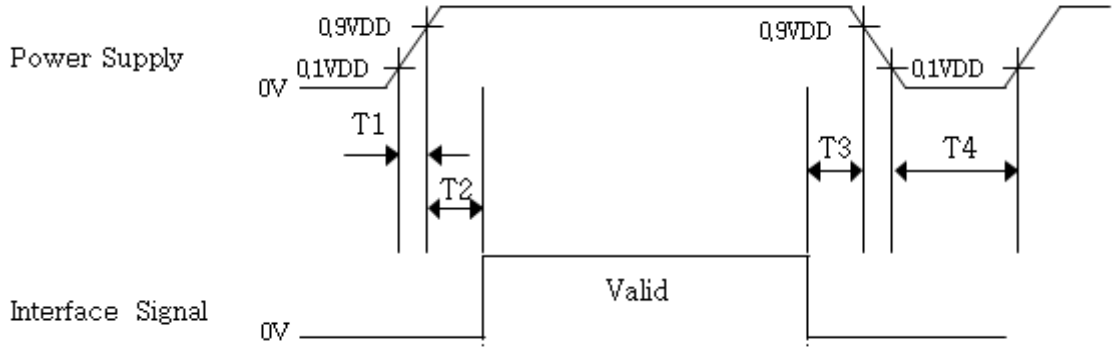
The brightness is based on the 8-bit gray scale data input for the color.The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input

Color & Gray Scale		RED DATA								GREEN DATA								BLUE DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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	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	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	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	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
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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	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
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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	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
Gray Scale of WHITE	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	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	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

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

7.7 Power Sequence

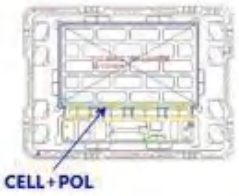
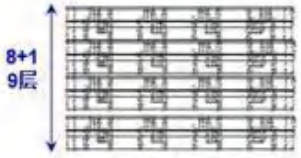
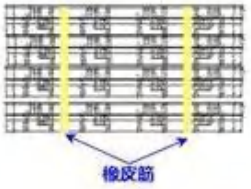
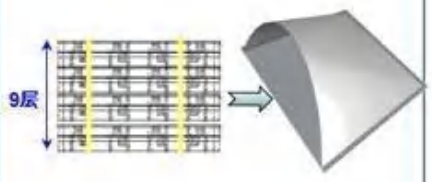
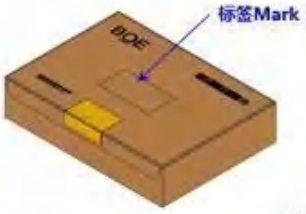
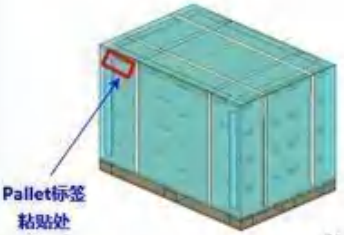
To prevent a latch-up or DC operation of the Open Cell, the power on/off sequence shall be as shown in below.



0.5 ms ≤ T1 ≤ 10 ms
0 ms ≤ T2 ≤ 50 ms
0ms ≤ T3 ≤ 50 ms
1 sec ≤ T4

8.0 PACKING

8.1 Packing Process

将1 CELL放入到Tray中； 1 CELL/Tray；	将Tray叠码8层，然后加放1个空Tray作盖（旋转叠码）； 8 CELL/9 Tray；	用橡皮筋沿平行于Tray的宽边方向捆绑两道；
 Step 1	 Step 2	 Step 3
将9层 Tray放入一个Shielding Bag中，并抽真空； 8 CELL/1 Shielding Bag；	使用抽真空封口机进行封口； 真空压力值：-8KPa~-6KPa	将封好口的一包产品放入一个Inner Box； 8 CELL/1 Inner Box；
 Step 4	 Step 5	 Step 6
用封箱胶带对Inner Box进行封箱，并在Box的Mark处粘贴相应标签；	将封好的Inner Box装入Outer Box； 6 Inner Box/Outer Box；	采用“H”形封箱方式，对Box进行封箱，并在Box的Mark处粘贴相应标签； 48 CELL/Outer Box；
 Step 7	 Step 8	 Step 9
在Pallet上放一个纸底盖，按“田”字型对Outer Box码拍，按照2x2x4堆码； 16 Outer Box/Pallet；	放置护角、缠绕拉伸膜，缠绕层数不少于3层，除底面外的5个面需要全部覆盖； 768 CELL/Pallet；	用打包带打包，横向、纵向每侧各打2道打包带，并粘贴Pallet标签； 768 CELL/Pallet；
 Step 10	 Step 11	 Step 12

9.0 Handling & Cautions

9.1 Mounting Method

- The panel of the LCD consists of two thin glasses with polarizer which easily get damaged. So extreme care should be taken when handling the LCD.
- Excessive stress or pressure on the glass of the LCD should be avoided. Care must be taken to insure that no torsional or compressive forces are applied to the LCD unit when it is mounted.
- If the customer's set presses the main parts of the LCD, the LCD may show the abnormal display. But this phenomenon does not mean the malfunction of the LCD and should be pressed by the way of mutual agreement.
- To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Mount a LCD module with the specified mounting parts.

9.2 Caution of LCD Handling and Cleaning

- Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass maybe broken.
- The polarizer on the surface of panel are made from organic substances. Be very careful for chemicals not to touch the polarizer or it leads the polarizer to bedeteriorated.
- If the use of a chemical is unavoidable, use soft cloth with solvent recommended below to clean the LCD's surface with wipe lightly.

-IPA (Isopropyl Alcohol), Ethyl Alcohol, Tri-chloro, tri-florothane.

- Do not wipe the LCD's surface with dry or hard materials that will damage the polarizer and others. Do not use the following solvent—Water, acetone, Aromatics.
- It is recommended that the LCD be handled with soft gloves during assembly, etc.

The polarizer on the LCD's surface are vulnerable to scratch and thus to be damaged by shape particles.

- Do not drop water or any chemicals onto the LCD's surface.
- A protective film is supplied on the LCD and should be left in place until the LCD is required for operation.
- The ITO pad area needs special careful caution because it could be easily corroded. Donot contact the ITO pad area with HCFC, Soldering flux, Chlorine, Sulfur, saliva or fingerprint. To prevent from the ITO corrosion, customers are recommended that the ITO area would be covered by UV or silicon.
- Handle FPC with care.

9.3 Caution Against Static Charge

- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of staticcharge.
- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- In handling the LCD, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

9.4 Caution For Operation

- It is indispensable to drive the LCD within the specified voltage limit since the higher voltage than the limit causes the shorter LCD's life. An electro-chemical reaction due to DC causes undesirable deterioration of the LCD so that the use of DC drive shouldavoid.
- Do not connect or disconnect the LCD to or from the system when power is on.
- Never use the LCD under abnormal conditions of high temperature and high humidity.
- When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCD may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCD's surface which may affect the operation of the polarizer on the LCD.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand LCD may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCD. The LCD will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.
- Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. If the screen is displayed with fixed pattern, use a screen saver.
- Do not disassemble and/or re-assemble LCD module

9.5 Packaging

- Modules use LCD element, and must be treated as such.
  -Avoid intense shock and falls from a height.
  -To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity for long periods.

9.6 Storage

- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Relative humidity of the environment should therefore be kept below 60%RH.
- Original protective film should be used on LCD's surface (polarizer). Adhesive type protective film should be avoided, because it may change color and/or properties of the polarizer.
- Do not store the LCD near organic solvents or corrosive gasses.
- Keep the LCD safe from vibration, shock and pressure.
- Black or white air-bubbles may be produced if the LCD is stored for long time in thelower temperature or mechanical shocks are applied onto the LCD.
- In the case of storing for a long period of time for the purpose or replacement use, the following ways are recommended.

-Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.
-Store in a dark place where neither exposure to direct sunlight nor light is.
-Keep temperature in the specified storage temperature range.
-Store with no touch on polarizer surface by the anything else. If possible, store the LCD in the packaging situation when it was delivered.

9.7 Safety

- For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.
- In the case of LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water and soap as soon aspossible.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal get in your eyes, flush your eyes with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.

10.0 Applicable Scope

- This product specification only applies to the products manufactured and sold by our company.
- Any specification, quality etc. about other parts mentioned in this product spec are no concern of our company.