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TITLE : HV430QUB-F70**Product Specification****Rev.P2****Wuhan BOE Optoelectronics Technology Co., Ltd**

SPEC. NUMBER
S8-65-AB-022

PRODUCT GROUP
TFT-LCD

Rev. P2

ISSUE DATE
2020.09.02

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A4(210 X 297)

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()Final specification

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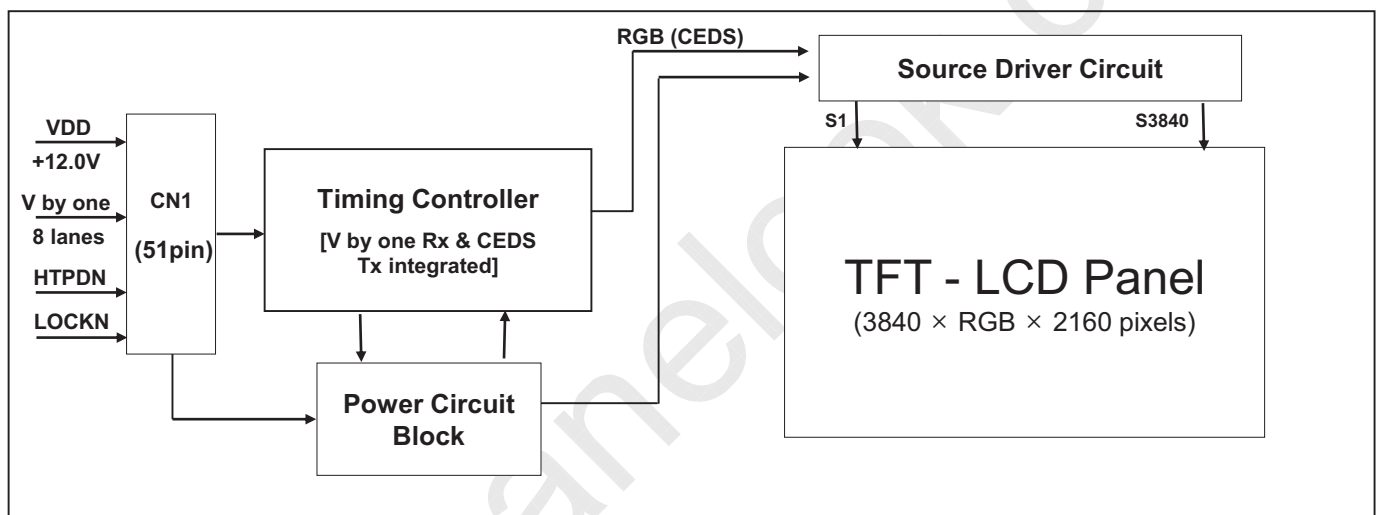
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1.0 GENERAL DESCRIPTION

1.1 Introduction

HV430QUB-F70 is a color active matrix TFT LCD open cell using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 43 inch diagonally measured active area with UHD resolutions (3840 horizontal by 2160 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 1.07G colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2 Features

- V by one interface with 8 lanes
- High-speed response
- Low color shift image quality
- 8-bit + FRC color depth, display 1.07G colors
- High luminance and contrast ratio, low reflection and wide viewing angle
- Gate driver use GOA mode
- DE (Data Enable) only mode
- ADS technology is applied for high display quality
- RoHS compliant

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1.3 Application

- Home Alone Multimedia TFT-LCD TV only
- Ultra High Definition TV(UHD TV)
- Display Terminals for Control System, Public Monitor and etc... are not allowed

1.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remark
Active area	941.184(H) × 529.416(V)	mm	
Number of pixels	3840*(RGB)*2160	pixels	
Pixel pitch	81.7(H) *3(RGB)*245.1 (V)	μm	
Pixel arrangement	Pixels RGB Island	-	
Display colors	1.07G (8bits + FRC)	colors	8bit driver IC
Display mode	Transmission mode, Normally Black		
Open Cell Transmittance	4.3	%	At center point with BOE BLU
Weight	1540	gram	
Power Consumption	8.16(Typ.)	Watt	With TCON board
Surface Treatment	Haze 1%, 3H, Anti-glare treatment (Front Polarizer) Clear (Bottom Polarizer)	-	

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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 values are listed in the below table.

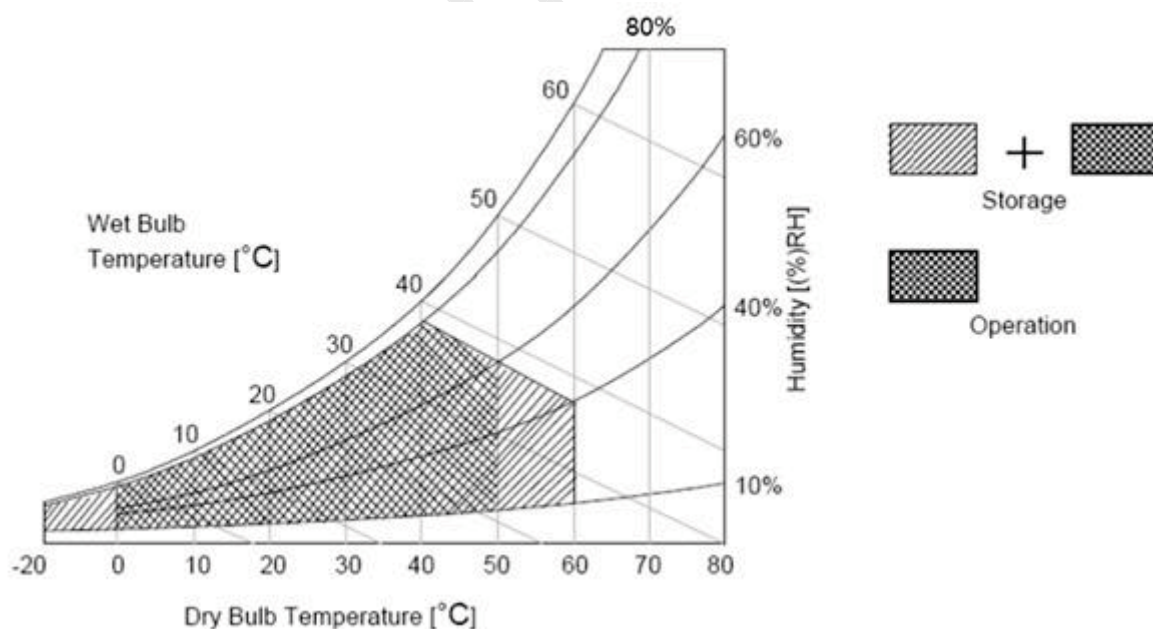
< Table 2. Open Cell Absolute Maximum Ratings >

[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	VSS-0.3	13.2	V	Ta=25°C
Operating Temperature	T _{OP}	0	+50	°C	Note 1
	T _{SUR}	0	+60	°C	
Storage Temperature	T _{ST}	-20	+60	°C	
Operating Ambient Humidity	Hop	10	80	%RH	
Storage Humidity	Hst	10	80	%RH	

Note 1 : Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 °C max. and no condensation of water.



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3.0 ELECTRICAL SPECIFICATIONS

3.1 TFT LCD Open Cell

< Table 3. Open Cell Electrical Specifications >

[Ta =25±2 °C]

Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	V	
Power Supply Ripple Voltage		VRP	-	-	600	mV	
Power Supply Current		IDD	-	0.68	2.1	A	Note 1
Power Consumption		PDD	-	8.16	25.2	Watt	
Rush current		IRUSH	-	-	10	A	Note 2
V by One Interface	Differential Input High Threshold Voltage	VLVTH	-	-	+50	mV	-
	Differential Input Low Threshold Voltage	VLVTL	-50	-	-	mV	-
	Common Input Voltage	VLVC	-	-	-	V	-
	Terminating Resistor	Rt	90	100	110	ohm	-
CMOS Interface	Input High Threshold Voltage	VIH	2.7	-	3.3	V	
	Input Low Threshold Voltage	VIL	0	-	0.6	V	

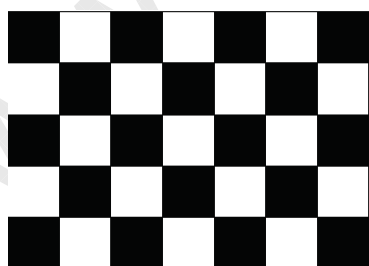
Note 1 : The supply voltage is measured and specified at the interface connector of LCM.

The current draw and power consumption specified is for VDD=12.0V.

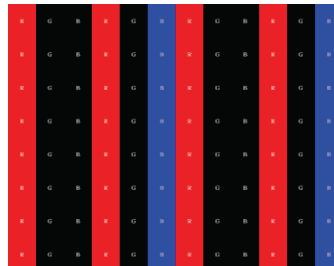
Frame rate $f_v=60\text{Hz}$ and Clock frequency = 74.25MHz.

Test Pattern of power supply current.

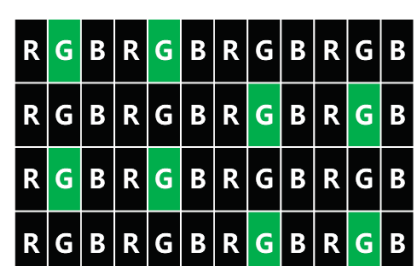
a) Typ : Mosaic 7X5 (L0/L255)



b) Max Pattern (L0/L255)



c) Flicker Test Pattern



2 : The duration of rush current is about 2ms and rising time of power input is 1ms(min)

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3.2 TCON Characteristics

< Table 4. TCON Characteristics >

Parameter	Symbol	Values			Unit	Remark
		Min	Typ	Max		
TCON Surface Temperature	T _{TS}	-	-	100	°C	Note

Note 1: Any point on the TCON surface must be less than 100 °C under any conditions.

2: This test condition is based on BOE module.

3.3 Driver Characteristics

< Table 5. Driver Characteristics >

Parameter	Symbol	Values			Unit	Remark
		Min	Typ	Max		
Driver Surface Temperature	T _{DS}	-	-	125	°C	Note

Note 1: Any point on the driver surface must be less than 125 °C under any conditions.

2: This test condition is based on BOE module.

3.4 PMIC Characteristics

< Table 6. PMIC Characteristics >

Parameter	Symbol	Values			Unit	Remark
		Min	Typ	Max		
PMIC Surface Temperature	T _{PS}	-	-	100	°C	Note

Note 1: Any point on the PMIC surface must be less than 100 °C under any conditions.

2: This test condition is based on BOE module.

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3.5 VCOM I2C Bus Format and interval setting requirement**Setp1 Read VCOM**

Slave Address (0x40h)

Control Address (0xFFh)

(0xFFh write data 00h)

Start	0	1	0	0	0	0	0	0	0	Slave ACK	1	1	1	1	1	1	1	1	Slave ACK	0	0	0	0	0	0	0	0	Slave ACK	Stop
-------	---	---	---	---	---	---	---	---	---	--------------	---	---	---	---	---	---	---	---	--------------	---	---	---	---	---	---	---	---	--------------	------

Slave Address (0x40h)

VCOM Address (0x25h)

Start	0	1	0	0	0	0	0	0	0	Slave ACK	0	0	1	0	0	1	0	1	Slave ACK
-------	---	---	---	---	---	---	---	---	---	--------------	---	---	---	---	---	---	---	---	--------------

Slave Address (0x41h)

(Data Read from 0x25h)

(Data Read from 0x26h)

Re- start	0	1	0	0	0	0	0	1	Slave ACK	D7	D6	D5	D4	D3	D2	D1	D0	Master ACK	D7	D6	D5	D4	D3	D2	D1	D0	Master NACK	Stop
--------------	---	---	---	---	---	---	---	---	--------------	----	----	----	----	----	----	----	----	---------------	----	----	----	----	----	----	----	----	----------------	------

Setp2 Adjust VCOM (Write DAC)

Slave Address (0x40h)

VCOM Address (0x25h)

(0x25h write data xxh)

Start	0	1	0	0	0	0	0	0	Slave ACK	0	0	1	0	0	1	0	1	Slave ACK	x	x	x	x	x	x	x	D1	D0	Slave ACK
-------	---	---	---	---	---	---	---	---	--------------	---	---	---	---	---	---	---	---	--------------	---	---	---	---	---	---	---	----	----	--------------

(0x26h write xxh)

D7	D6	D5	D4	D3	D2	D1	D0	Slave ACK
----	----	----	----	----	----	----	----	--------------

Step3 Write VCOM (Write MTP)

Slave Address (0x40h)

Control Address (0xFFh)

(0xFFh write data 41h)

Start	0	1	0	0	0	0	0	0	Slave ACK	1	1	1	1	1	1	1	1	Slave ACK	0	1	0	0	0	0	0	0	1	Slave ACK	Stop
-------	---	---	---	---	---	---	---	---	--------------	---	---	---	---	---	---	---	---	--------------	---	---	---	---	---	---	---	---	---	--------------	------

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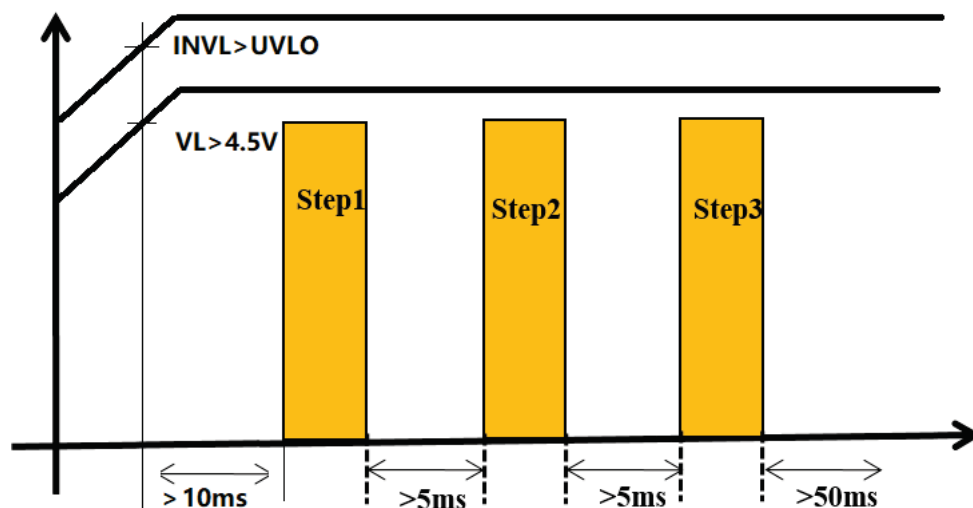
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3.5 VCOM I2C Bus Format and interval setting requirement

Interval of step to step



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4.0 INTERFACE CONNECTION**4.1 V-by-One input connector pin configuration**

< Table 7. 51-Pin V-by-One Input Connector CN1 Pin Configuration >

Pin No	Symbol	Description	Pin No	Symbol	Description
1	VDD	Power Supply +12.0V	27	GND	Ground
2	VDD	Power Supply +12.0V	28	Rx0n	V-by-One HS Data Lane 0
3	VDD	Power Supply +12.0V	29	Rx0p	V-by-One HS Data Lane 0
4	VDD	Power Supply +12.0V	30	GND	Ground
5	VDD	Power Supply +12.0V	31	Rx1n	V-by-One HS Data Lane 1
6	VDD	Power Supply +12.0V	32	Rx1p	V-by-One HS Data Lane 1
7	VDD	Power Supply +12.0V	33	GND	Ground
8	VDD	Power Supply +12.0V	34	Rx2n	V-by-One HS Data Lane 2
9	NC	No Connection	35	Rx2p	V-by-One HS Data Lane 2
10	GND	Ground	36	GND	Ground
11	GND	Ground	37	Rx3n	V-by-One HS Data Lane 3
12	GND	Ground	38	Rx3p	V-by-One HS Data Lane 3
13	GND	Ground	39	GND	Ground
14	GND	Ground	40	Rx4n	V-by-One HS Data Lane 4
15	NC	No Connection	41	Rx4p	V-by-One HS Data Lane 4
16	SSCG0	LL&NC: OFF HL: $\pm 1\%$ LH : $\pm 1.5\%$ HH : $\pm 2\%$	42	GND	Ground
17	SSCG1		43	Rx5n	V-by-One HS Data Lane 5
18	SDA	SDA	44	Rx5p	V-by-One HS Data Lane 5
19	SCL	SCL	45	GND	Ground
20	NC	No Connection	46	Rx6n	V-by-One HS Data Lane 6
21	NC	No Connection	47	Rx6p	V-by-One HS Data Lane 6
22	SEL_SECTION	Low&NC:1 section (default) High:2 section	48	GND	Ground
23	28S Pol Inversion	Low&NC: OFF (default) High: ON	49	Rx7n	V-by-One HS Data Lane 7
24	GND	Ground	50	Rx7p	V-by-One HS Data Lane 7
25	HTPDN	Hot plug detect	51	GND	Ground
26	LOCKN	Lock detect			

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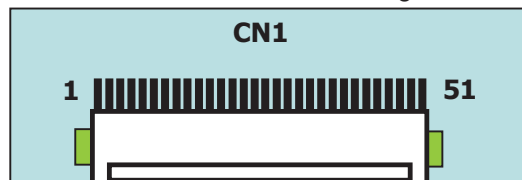
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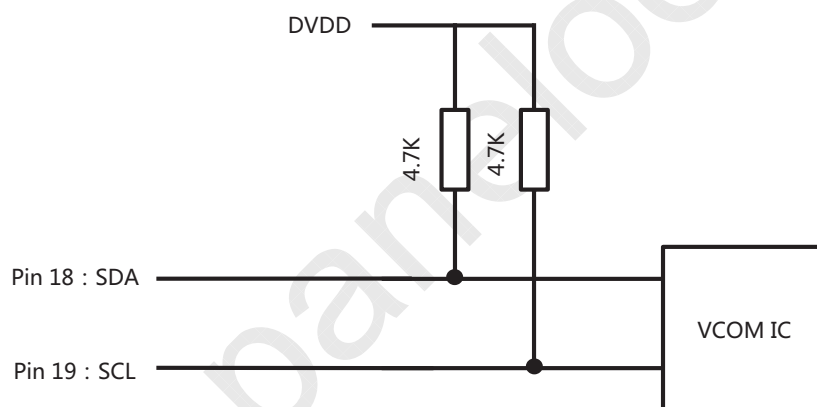
1. NC (Not Connected) : These pins show status of T/con board and are only used for BOE internal operations.
2. Input pins assignments on T/con board refer to the below diagram.



3. If T/con board can't receive correct V-by-One signals, T/con will run BIST pattern as bellow.

PT1:Black (2 sec)	PT2:White (2 sec)	PT3:Red (2 sec)	PT4:Green (2 sec)	PT5:Blue (2 sec)
				

4. Circuit Block Diagram pin of SDA/SCL on T/con board. They are used for flicker adjustment only.



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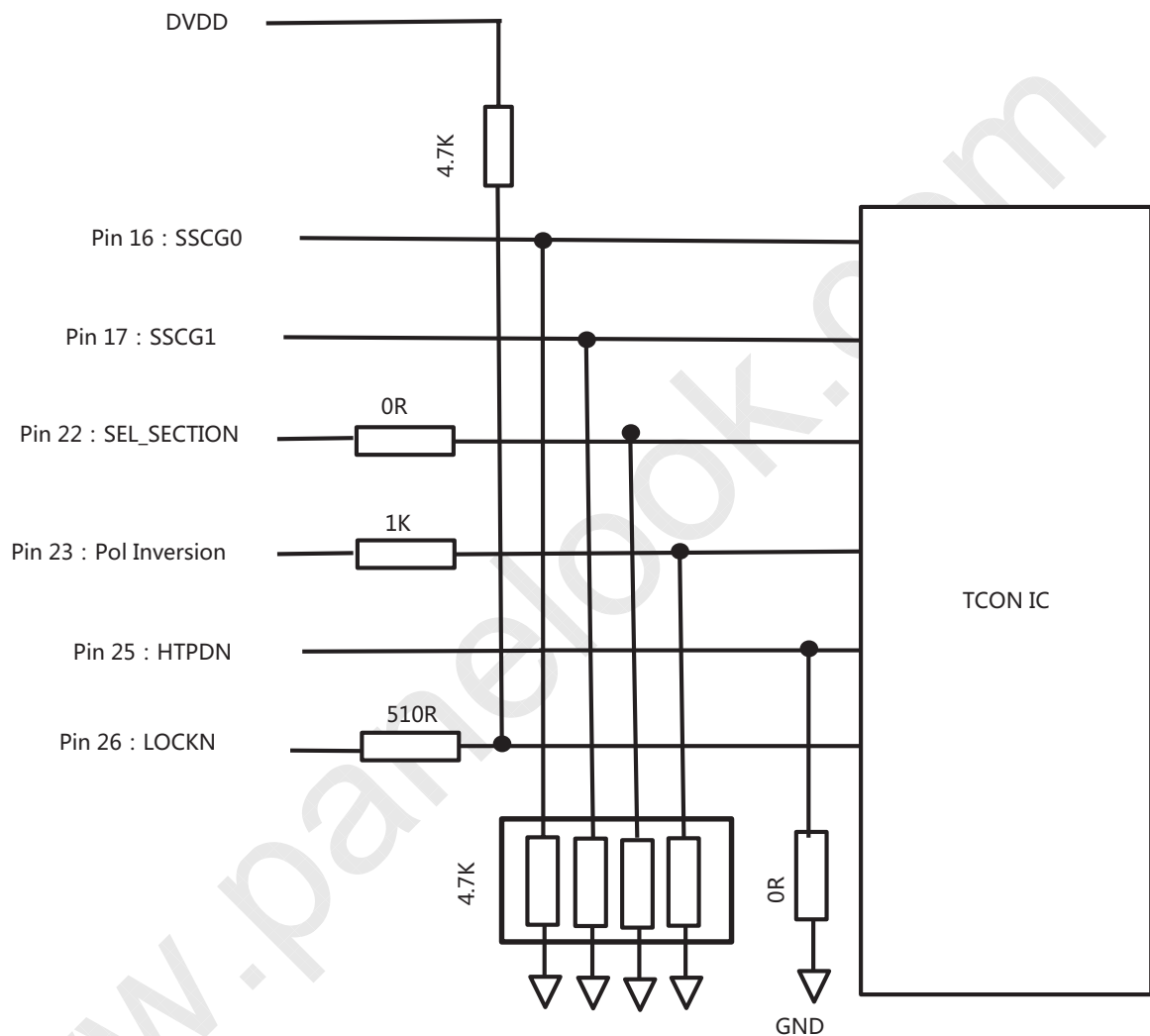
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Notes :

5. Circuit Block Diagram of HTPDN/LOCKN/SEL_SECTION on T/con board.



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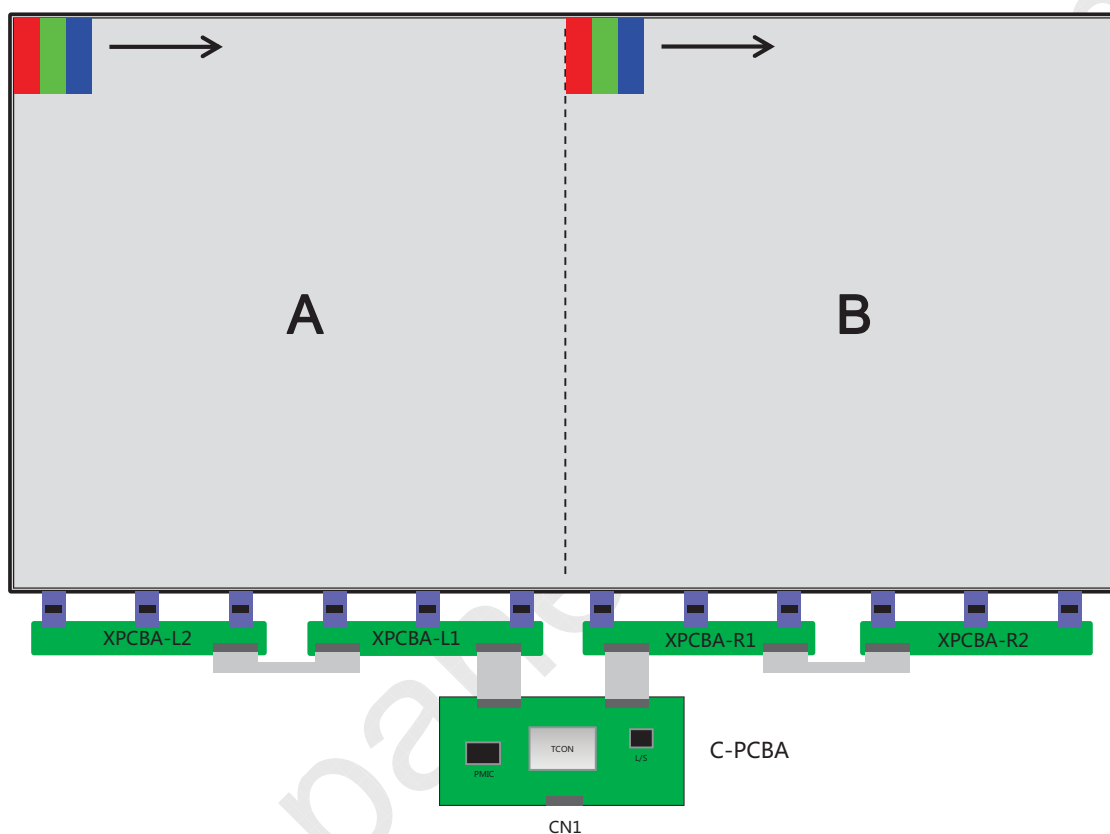
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4.2 V by One Data Mapping Setting

< Table 9. V By One Mapping Diagram >



Connector	V-by-One
CN1	Lane 0 – Lane 7

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4.2 V by One Data Mapping Setting

< Table 10. V By One Data Mapping Setting Table >

1 Section					
Area	Lane	Input Data Stream			
		1st	2nd	.....	480th
A+B	Lane 0	Pixel 1	Pixel 9	.....	Pixel 3833
	Lane 1	Pixel 2	Pixel 10	.....	Pixel 3834
	Lane 2	Pixel 3	Pixel 11	.....	Pixel 3835
	Lane 3	Pixel 4	Pixel 12	.....	Pixel 3836
	Lane 4	Pixel 5	Pixel 13	.....	Pixel 3837
	Lane 5	Pixel 6	Pixel 14	.....	Pixel 3838
	Lane 6	Pixel 7	Pixel 15	.....	Pixel 3839
	Lane 7	Pixel 8	Pixel 16	.....	Pixel 3840

2 Section					
Area	Lane	Input Data Stream			
		1st	2nd	.....	480th
A	Lane 0	Pixel 1	Pixel 5	.....	Pixel 1917
	Lane 1	Pixel 2	Pixel 6	.....	Pixel 1918
	Lane 2	Pixel 3	Pixel 7	.....	Pixel 1919
	Lane 3	Pixel 4	Pixel 7	.....	Pixel 1920
B	Lane 4	Pixel 1921	Pixel 1925	.....	Pixel 3837
	Lane 5	Pixel 1922	Pixel 1926	.....	Pixel 3838
	Lane 6	Pixel 1923	Pixel 1927	.....	Pixel 3839
	Lane 7	Pixel 1924	Pixel 1928	.....	Pixel 3840

Note: T/con board supports two kinds of sections. System board output can choose either of them.

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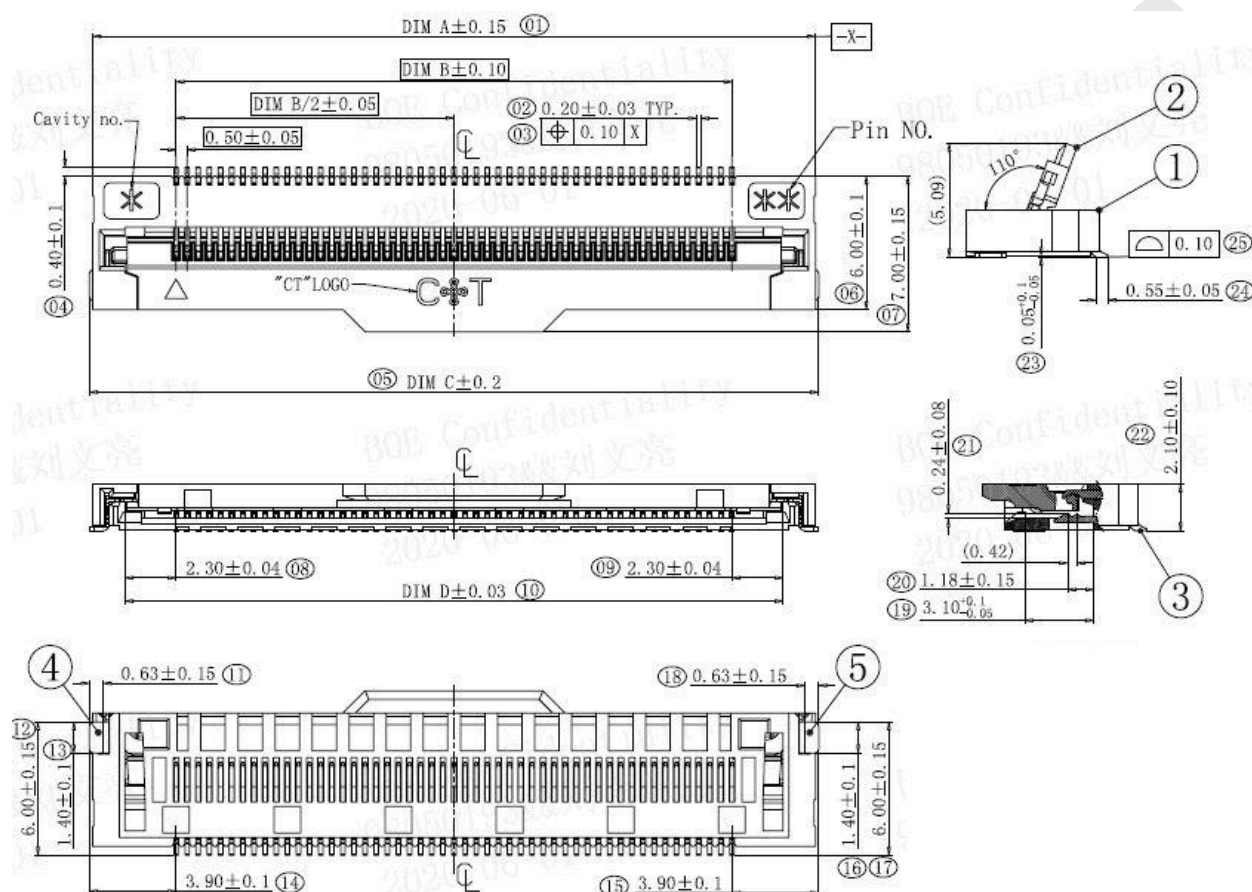
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4.0 INTERFACE CONNECTION**4.3 TCON Board Input Connector & FFC Drawing****-51Pin pin Connector Drawing-F05035-51P-H**

PIN NO.	DIM A	DIM B	DIM C	DIM D
30	22.00	14.50	22.30	19.10
41	27.50	20.00	27.80	24.60
51	32.50	25.00	32.80	29.60

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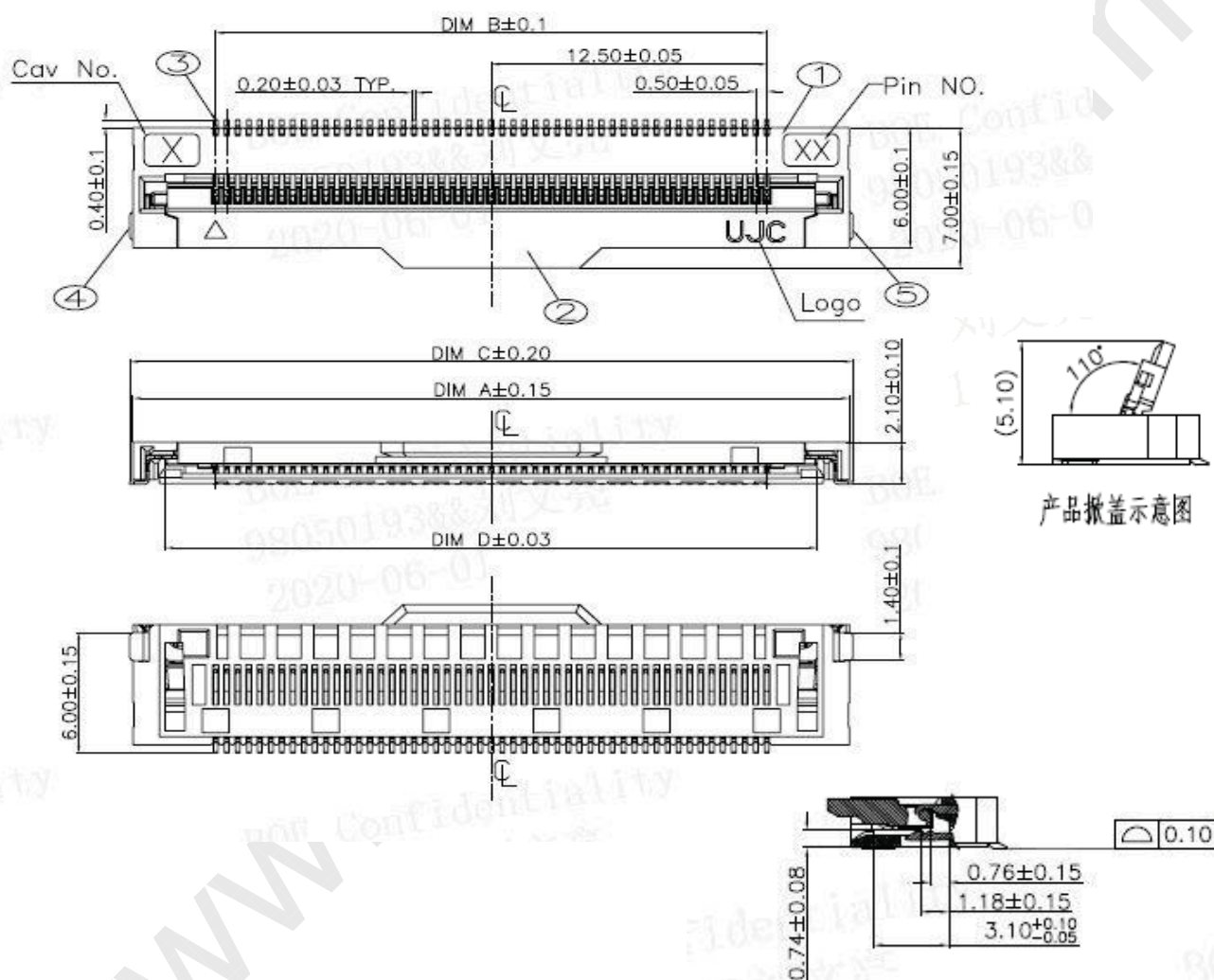
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4.0 INTERFACE CONNECTION**4.3 TCON Board Input Connector & FFC Drawing****-51Pin pin Connector Drawing-PM.FPC.LVS0505101**

PIN NO.	DIM.A	DIM.B	DIM.C	DIM.D	PART NO.
30	22.00	14.50	22.30	19.10	PM.FPC.LVS0503001
41	27.50	20.00	27.80	24.60	PM.FPC.LVS0504101
51	32.50	25.00	32.80	29.60	PM.FPC.LVS0505101

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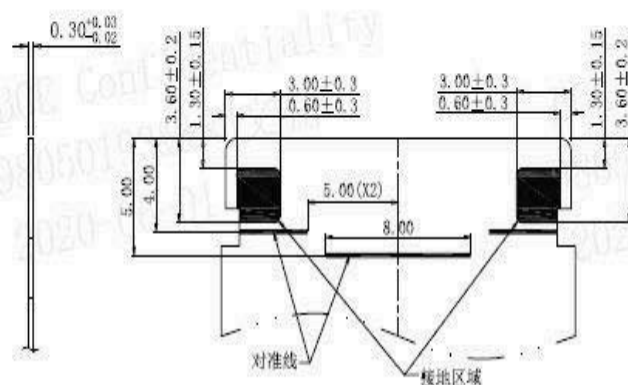
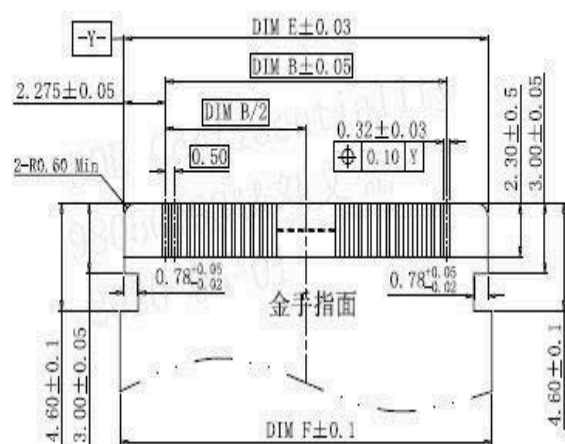
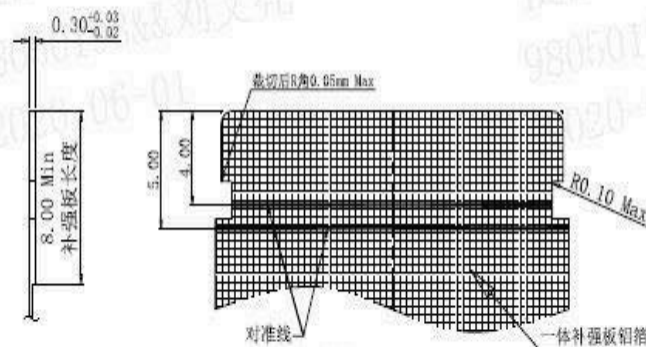
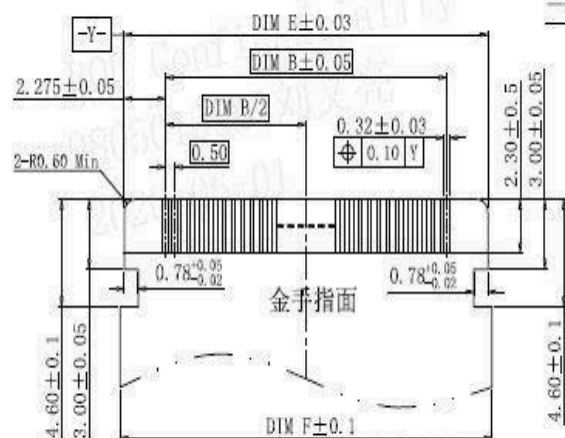
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4.3 TCON Board Input Connector & FFC Drawing**-51pin FFC Drawing****APPLICABLE FPC RECOMMENDED DIMENSION****一体覆膜FFC线****APPLICABLE FPC RECOMMENDED DIMENSION****一体补强板铝箔FFC线(接地)**

PIN NO.	DIM B	DIM E	DIM F
30	14.50	19.05	19.50
41	20.00	24.55	25.00
51	25.00	29.55	30.00

Notes: This FFC drawing is supplied by the connector vendor. It is for reference only.

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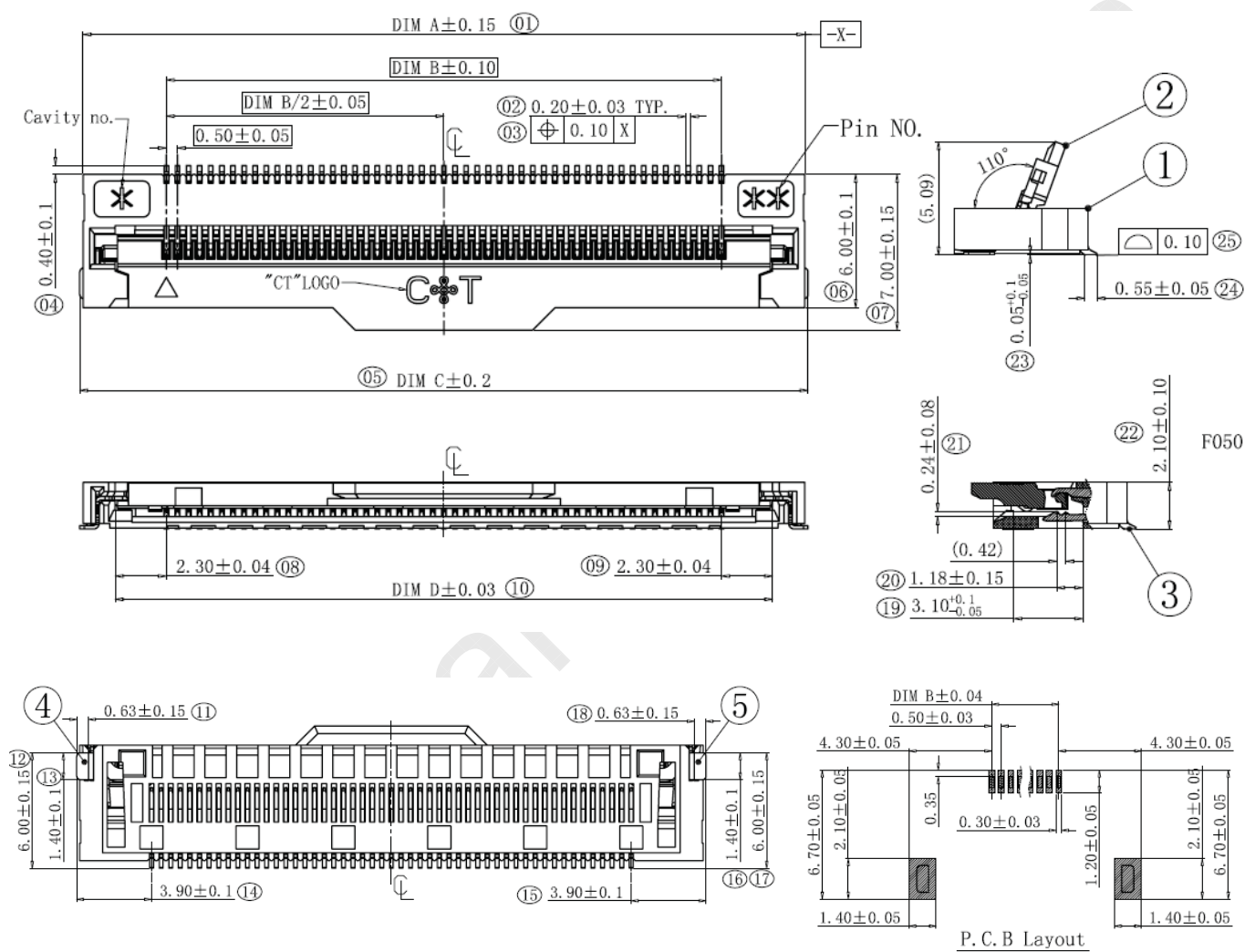
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-51pin Connector Drawing-F05035-51P-H



PIN NO.	DIM A	DIM B	DIM C	DIM D
30	22.00	14.50	22.30	19.10
41	27.50	20.00	27.80	24.60
51	32.50	25.00	32.80	29.60

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-FFC Drawing



Note: It is BOE FFC drawing. Please refer to only one side for T-con Board.

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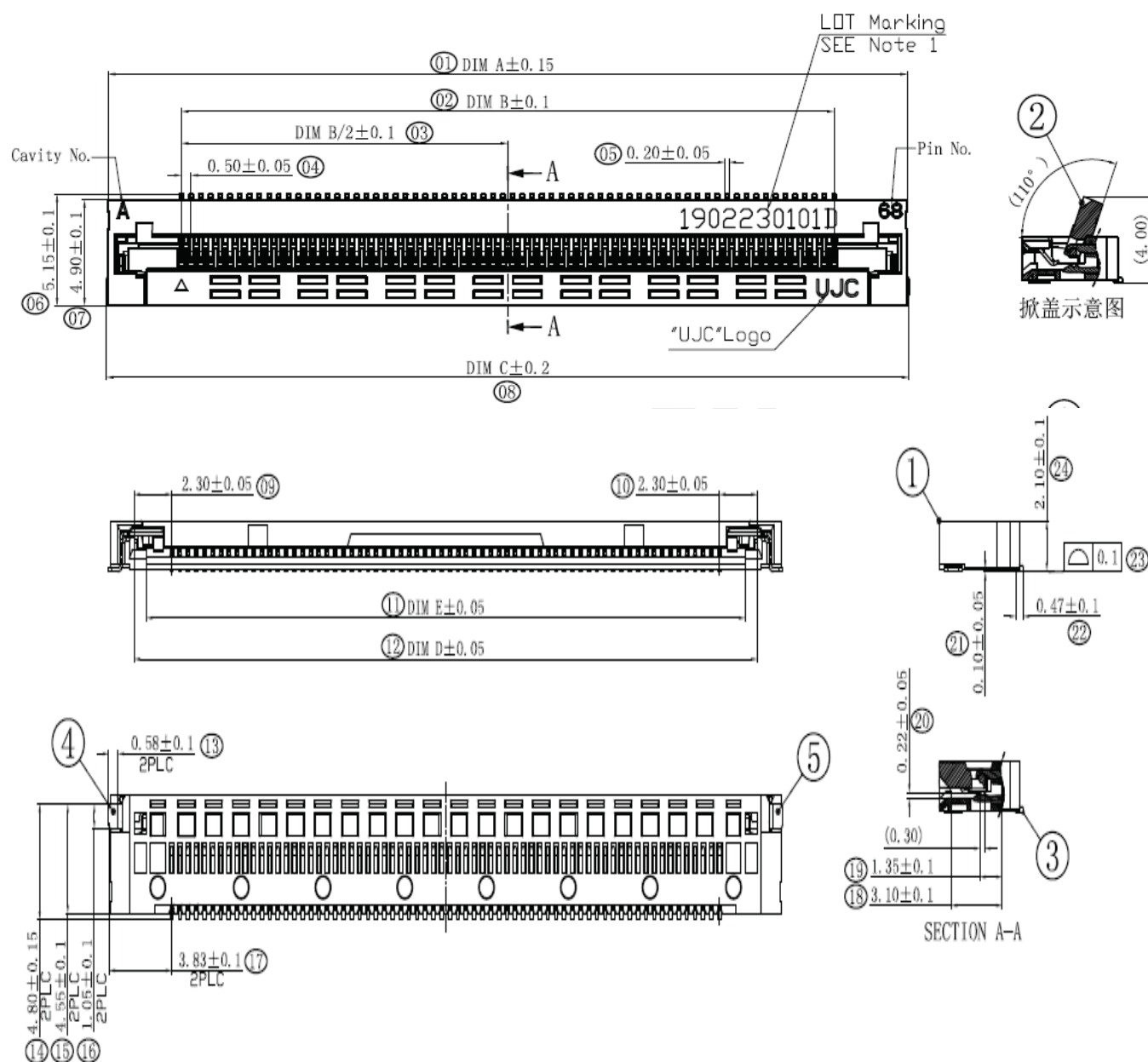
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4.0 INTERFACE CONNECTION**4.5 TCON Board Output CNT &FFC Drawing****-60pin Connector Drawing-PM.FPC.LVS4906001**

PIN NO.	DIM A	DIM B	DIM C	DIM D	DIM E
60	37.00	29.50	37.20	34.10	32.60

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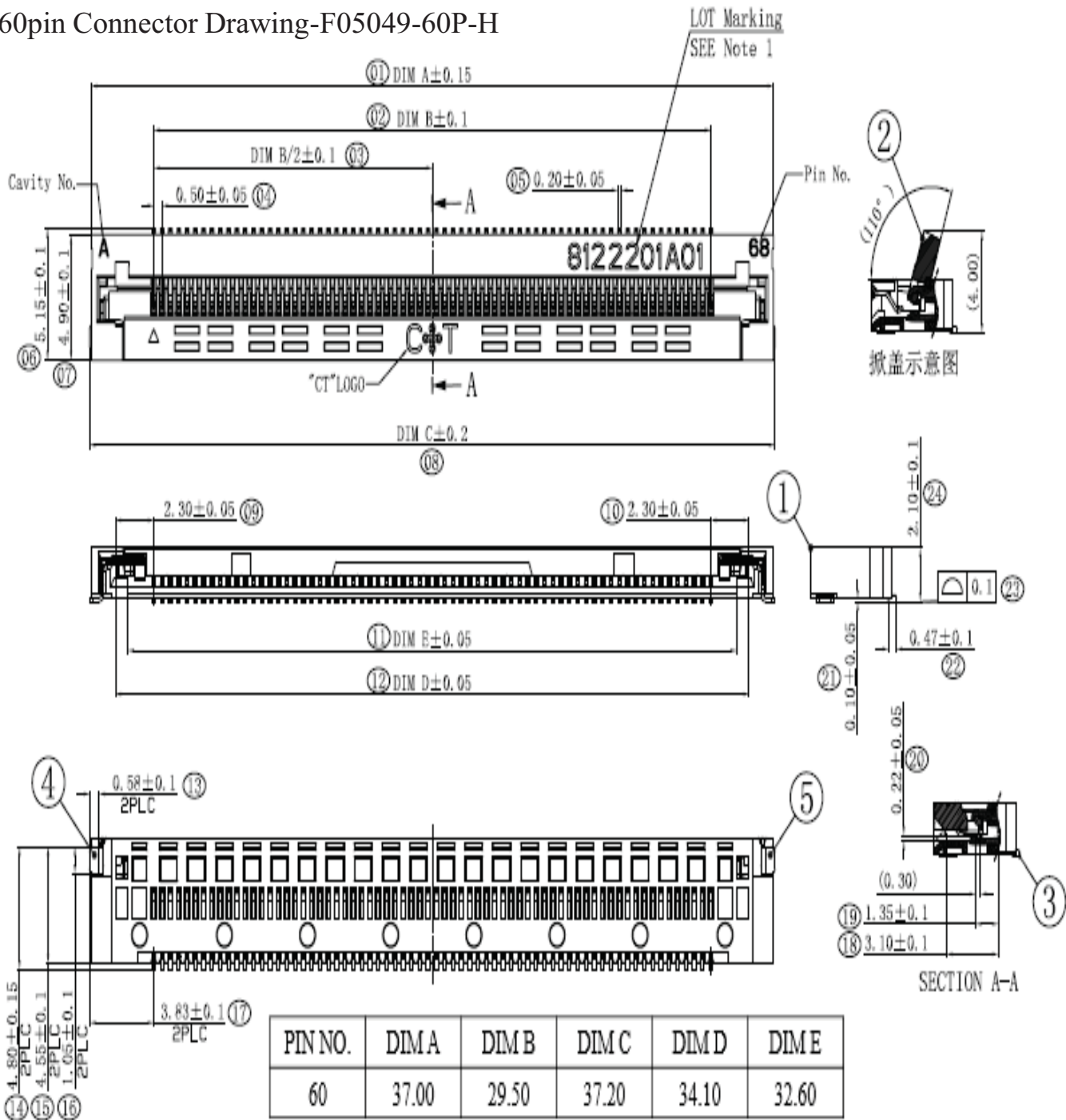
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4.5 TCON Board Output CNT &FFC Drawing

-60pin Connector Drawing-F05049-60P-H



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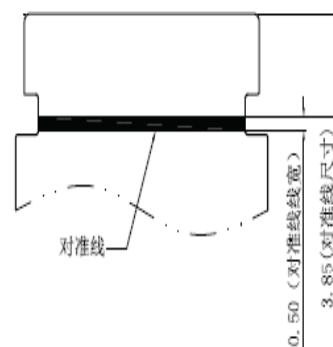
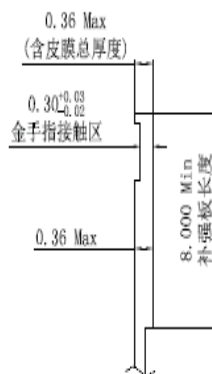
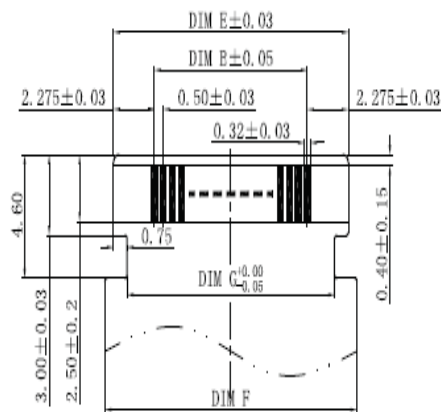
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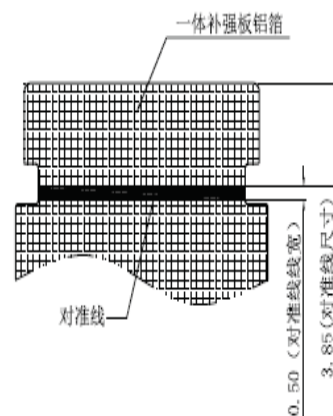
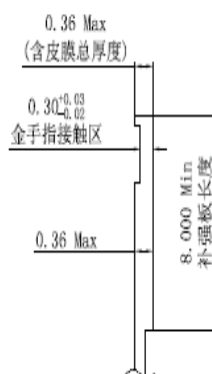
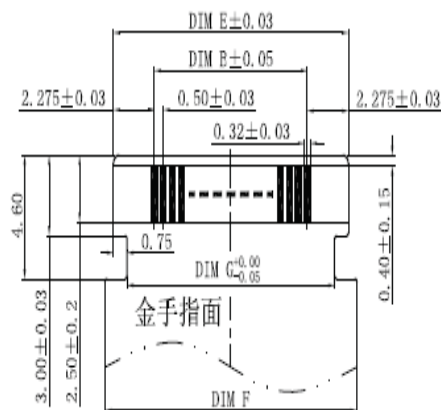
4.5 TCON Board Output CNT &FFC Drawing

-60 Pin FFC Drawing



APPLICABLE FPC RECOMMENDED DIMENSION

蓝白裸线(不接地)



APPLICABLE FPC RECOMMENDED DIMENSION

一体补强板铝箔FFC线

PIN NO.	DIM B	DIM E	DIM F	DIM G
60	29.50	34.05	35.00	32.55

Notes: This FFC drawing is supplied by the connector vendor. It is for reference only.

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5.0 INTERFACE SIGNAL TIMING SPECIFICATION

5.1 V by One signal specification

- Vx1 Byte length and Color mapping

Byte	Packer input	Color data mapping
		30 bpp RGB
0	Bit-0	R2
	Bit-1	R3
	Bit-2	R4
	Bit-3	R5
	Bit-4	R6
	Bit-5	R7
	Bit-6	R8
	Bit-7	R9
1	Bit-8	G2
	Bit-9	G3
	Bit-10	G4
	Bit-11	G5
	Bit-12	G6
	Bit-13	G7
	Bit-14	G8
	Bit-15	G9
2	Bit-16	B2
	Bit-17	B3
	Bit-18	B4
	Bit-19	B5
	Bit-20	B6
	Bit-21	B7
	Bit-22	B8
	Bit-23	B9
3	Bit-24	-
	Bit-25	-
	Bit-26	B0
	Bit-27	B1
	Bit-28	G0
	Bit-29	G1
	Bit-30	R0
	Bit-31	R1

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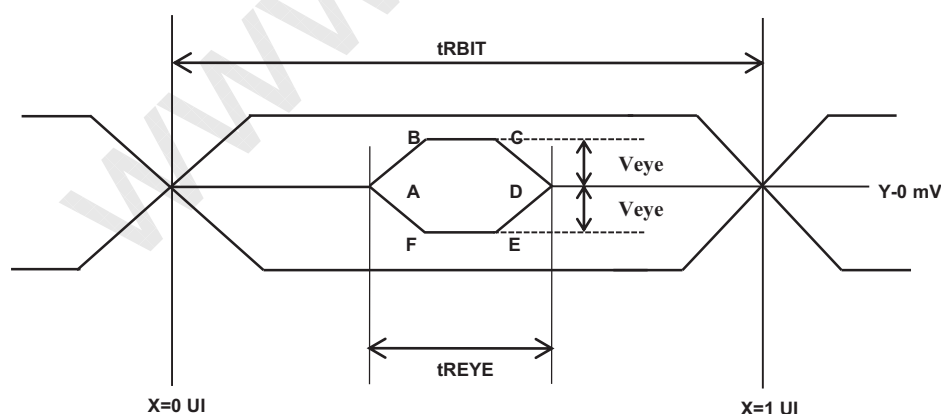
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5.2 Signal Timing Waveform

< Table 12. Signal Timing Waveforms Table >

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Unit Interval(VBO Operation Bit Rate)	tRBIT	3-byte	417	tTCIP/30	625	PS
		4-byte	313	tTCIP/40	469	PS
		5-byte	250	tTCIP/50	375	PS
Eye Width at Package Pin	tREYE	-	-	0.5	-	UI
Eye Width Position A at Package Pin	tA	-	-	0.25	-	UI
Eye Width Position B at Package Pin	tB	-	-	0.3	-	UI
Eye Width Position Cat Package Pin	tC	-	-	0.7	-	UI
Eye Width Position D at Package Pin	tD	-	-	0.75	-	UI
Eye Width Position E at Package Pin	tE	-	-	0.7	-	UI
Eye Width Position F at Package Pin	tF	-	-	0.3	-	UI
Effective Veye level	Veye	-	-	50	-	mv
Intra – pair Skew	TTOSK_intra	-	-0.5	-	0.5	UI
Inter – pair Skew	TTOSK_inter	-	-5	-	5	UI
SSCG	-	30KHz modulation	-0.5		0.5	%



	Y[mV]
A	0
B	50
C	50
D	0
E	-50
F	-50

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5.0 INTERFACE SIGNAL TIMING SPECIFICATION

5.3 V by One Eye Diagram Measurement Settings

< VBO Eye Diagram Measurement Settings >

Oscilloscope PLL setting	
PLL type	2 nd order PLL (=Type II PLL)
Damping Factor	1.3
Bandwidth	3MHz

Note: Please use the measurement results for your reference only.

5.4 CEDS Eye Diagram Measurement Settings

< CEDS Eye Diagram Measurement Settings >

Oscilloscope PLL setting	
PLL type	2 nd order PLL (=Type II PLL)
Damping Factor	700m
Bandwidth	5MHz

Note: Please use the measurement results for your reference only.

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5.0 INTERFACE SIGNAL TIMING SPECIFICATION**5.5 Signal Timing Parameters**

< Table 13. Timing Table >

Item		Symbols	Min	Typ	Max	Unit
Frequency		1/Tc	69	74.25	77	MHz
Vertical	Frame Rate	F	57	60	62	Hz
	Total	T _V	2190	2250	2450	T _H
	Display	T _{VD}	2160			T _H
	Blank	T _{VB}	30	90	290	T _H
Horizontal	Total	T _H	530	550	570	T _{CLK}
	Display	T _{HD}	-	480	-	T _{CLK}
	Blank	T _{HB}	50	70	90	T _{CLK}

Item		Symbols	Min	Typ	Max	Unit
Frequency		1/Tc	69	74.25	77	MHz
Vertical	Frame Rate	F	47	50	51	Hz
	Total	T _V	2190	2700	2715	T _H
	Display	T _{VD}	2160			T _H
	Blank	T _{VB}	30	540	555	T _H
Horizontal	Total	T _H	530	550	570	T _{CLK}
	Display	T _{HD}	-	480	-	T _{CLK}
	Blank	T _{HB}	50	70	90	T _{CLK}

Notes:

- 1.This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.
2. This product should keep data frequency and Horizontal value fixed when adjusting frame rate.
3. 3. This product supports frequency between 50Hz and 60Hz and Vertical & Horizontal values must follow the table.

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5.6 Input Signals, Basic Display Colors and Gray Scale of Colors

< Table 14. Input Signal and Display Color Table >

Color		Input Color Data																															
		MSB RED LSB										MSB GREEN LSB										MSB BLUE LSB											
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0		
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	0	0	0	0	0	0		
	Red(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Green(1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0		
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1		
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	1	1	1	1	1	1		
R	RED(000)	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		
	RED(001)	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	0	0	0		

	RED(1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	RED(1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
G	Green (000)	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		
	Green (000)	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		

	Green (1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0		
	Green (1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0		
B	Blue(000)	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		
	Blue(000)	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		

	Blue(1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0		
	Blue(1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1		

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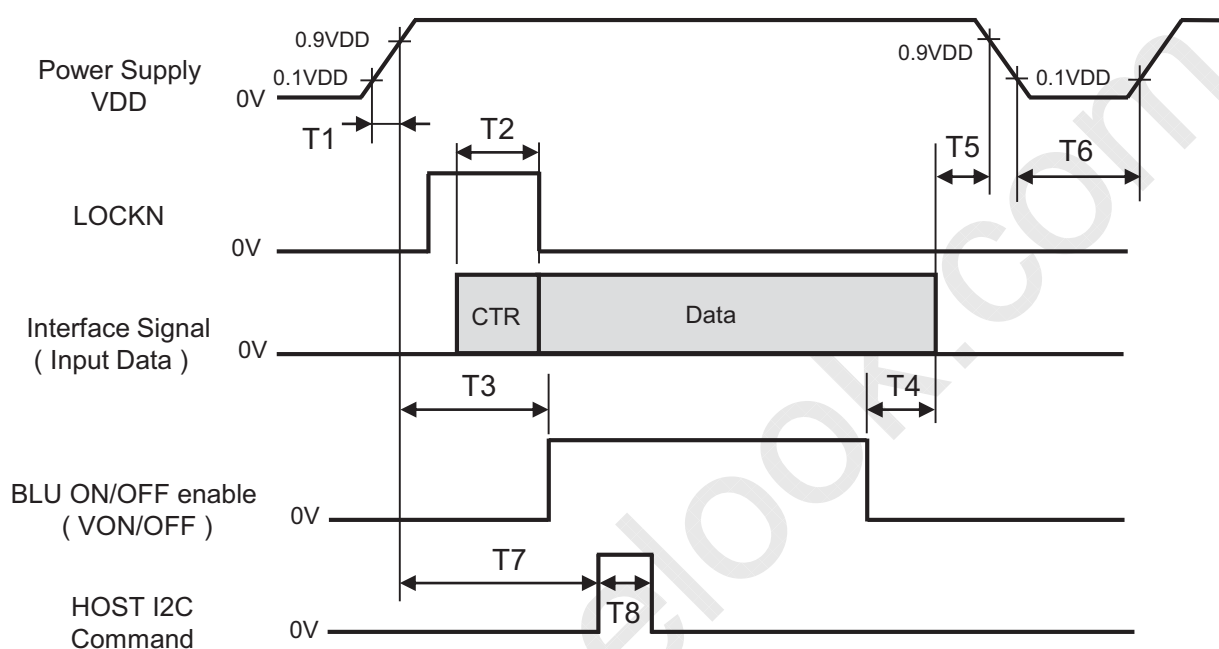
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5.7 Power Sequence

In order to get a normal display of the Open Cell, the power on/off sequence shall be as shown in below.



< Table 15. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	-	-	500	ms
T3	T2	-	-	-
T4	100	-	-	ms
T5	0	-	-	ms
T6	1	-	-	s
T7	T3	-	-	-
T8	Depends on I2C command			ms

Notes: 1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.

2. Back Light must be turned on after power for logic and interface signal are valid.

3. BLU enable must after input data.

4. HOST I2C should operate after BLU enable. It's used for flicker tuning. If customer does not need adjust panel flicker, ignoring T7 & T8.

5. VDD should rise and fall smoothly. If there is rebounding voltage when falling stage, it must smaller than 5 volts.

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6.0 OPTICAL SPECIFICATION

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 (Goniometer system and PR730) and test unit shall be located at an approximate distance 180cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta_{\Phi=0}$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta_{\Phi=90}$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta_{\Phi=180}$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta_{\Phi=270}$ ($=\theta_6$) 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 measurement shall be executed after 30 minutes warm-up period. VDD shall be 12.0V $\pm 10\%$ at 25°C . Optimum viewing angle direction is 6 'clock.

< Table 16. Optical Table >

[VDD = 12.0V, Frame rate = 60Hz, Ta $=25\pm 2^{\circ}\text{C}$]

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark	
Viewing Angle	Horizontal	Θ_3	CR > 10	-	89	-	Deg.	Note1	
		Θ_9		-	89	-	Deg.		
	Vertical	Θ_{12}		-	89	-	Deg.		
		Θ_6		-	89	-	Deg.		
Contrast ratio		CR	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	1000:1	1200:1	-		Note2	
Reproduction of color	White	W_x		TYP. - 0.03	0.290	TYP. + 0.03		Note3	
		W_y			0.297				
	Red	R_x			0.650				
		R_y			0.338				
	Green	G_x			0.318				
		G_y			0.626				
	Blue	B_x			0.154				
		B_y			0.056				
Response Time	G to G	T_g		-	8	10	ms	Note4	
Cell Transmittance					3.87	4.3	-	%	Note5
Gamma Scale					2.0	2.2	2.4		

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Notes :

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.
2. Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ 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 1 shown in Appendix) 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 color chromaticity coordinates specified in this table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel. The chromaticity coordinates are based on BOE backlight.
4. Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV = 60Hz with BOE Tcon Board to optimize. Each time in below table shall be measured by switching the input signal for "any level of gray(bright)" and "any level of gray(dark)"

Measured Response Time		Target																
		0	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
Start	0																	
	15																	
	31																	
	47																	
	63																	
	79																	
	95																	
	111																	
	127																	
	143																	
	159																	
	175																	
	191																	
	207																	
	223																	
	239																	
255																		

5. Definition of Transmittance (T%) :

Module is with white(L255) signal input

$$\text{Transmittance} = \frac{\text{Luminance of LCD Module}}{\text{Luminance of BLU}} \times 100 \%$$

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7.0 MECHANICAL CHARACTERISTICS			
7.1 Surface Treatment and Polarizer Hardness			
The surface of the LCD has an Low haze coating and a coating to Reduce scratching. The front polarizer hardness is at least 3H.			
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8.0 RELIABILITY TEST

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

< Table 17. Reliability Test Parameters >

No	Test Items	Conditions
1	High temperature storage test	Ta = 60 °C, 240 hrs
2	Low temperature storage test	Ta = -20 °C, 240 hrs
3	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs
4	High temperature operation test	Ta = 50 °C, 240hrs
5	Low temperature operation test	Ta = -5 °C, 240hrs
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle

Note : Test condition is based on BOE module.

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9.0 PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD Open Cell.

9.1 Precautions when taking out the Panel

- Pick the pouch only, when taking out panel from a shipping package.
- Recommend to use suitable sucker to pick up and put down panel.

9.2 Precautions for handling the panel

- As the electrostatic discharges may break the LCD panel, handle the LCD panel with care. Peel a protection sheet off from the LCD panel surface as slowly as possible. Refer to the appendix 4.
- As the LCD panel and backlight element are made from fragile glass material, impulse and pressure to the LCD panel should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Put the panel display side down on a flat horizontal plane.
- Handle connectors and cables with care.

9.3 Precautions for the operation

- The LCD product shall be operated under normal conditions as below:
 - VDD: $12\pm 0.12\text{V}$
 - Temperature: $20\pm 15^{\circ}\text{C}$
 - Humidity: $55\pm 20\%$
 - Display pattern: continually changing pattern(Not stationary)
- Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions such as high temperature, high humidity, high altitude, special display patterns, long time operation, outdoor operation, etc., it is strongly recommended to contact BOE for the advice about the application of engineering. Otherwise its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock markets, and controlling systems.
- Do not exceed the absolute maximum rating value.
- Periodical power-off or screen save is needed after long-term display. Product reliability and functions may not be guaranteed when it under 24 hours operation continuously per day.

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9.0 PRECAUTIONS

- Do not insert or pull out the interface connector while the LCD panel is operating.
- LCD Response time depends on the temperature.(In lower temperature, it becomes longer)
- Ensure all input signals and power supplies are complete and valid when the panel is operating. Otherwise the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the panel would be damaged. Specially, pay attention to the turn on and off sequence.

9.4 Precautions for the atmosphere

- Storage atmosphere requirement.

ITEM	UNIT	MIN	MAX
Storage Temperature	(°C)	5	40
Storage Humidity	(%RH)	35	75
Storage Life	6 months		
Storage Condition	• The storage room should be equipped with a dark and good ventilation facility. • Prevent products from being exposed to the direct sunlight, moisture and water. • The product need to keep away from organic solvent and corrosive gas. • Be careful for condensation at sudden temperature change. • Storage condition is guaranteed under packing conditions.		

- Dew drop atmosphere should be avoided. When expose to drastic fluctuation of temperature (hot to cold or cold to hot) , the LCD module may be affected. Specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCD module's surface which may affect the operation of the polarizer and LCD module.
- Do not store and/or operate the LCD panel in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

9.5 Precautions for the panel characteristics

- Do not apply fixed pattern data signal to the LCD panel at product aging.
- Applying fixed pattern for a long time may cause image sticking.

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9.0 PRECAUTIONS

9.6 Other precautions

- In particular in winter, Before putting Panel boxes on the line, aging process is required to make the temperature of products similar to the temperature of workplace.
- Do not disassemble and/or re-assemble LCD panel.
- Do not re-adjust variable resistor or switch etc.
- When returning the panel for repair or etc., Please pack the panel not to be broken. We recommend to use the original shipping packages.
- Product assembled into module should be stored in the bag(cover case).
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Be careful not to give any extra mechanical stress to the panel when designing the set, and backlight.
- Do not pull, fold or bend the source COF and the gate COF in any processes.
- If the liquid crystal material leaks from the panel, this should be kept away from the eyes or mouth. If this contacts to hands, legs, or clothes, you must washed it away with soap thoroughly and see a doctor for the medical examination.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

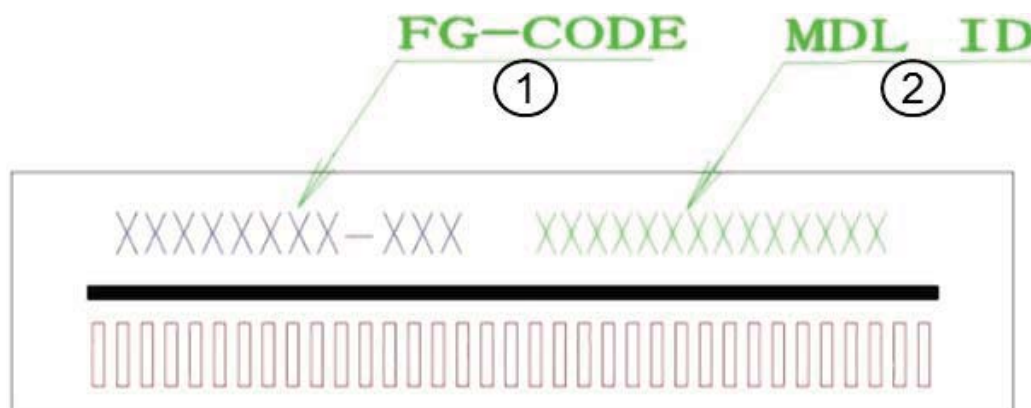
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10.0 PRODUCT SERIAL NUMBER



MDL ID Naming Rule:

Digit Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	S	L	S	N	1	6	3	5	9	4	2	0	A	A	0	0	0
Description	Model Code /GBN		Grade	Line	Year		Month	Model Extension Code (Last 4 Digits Of FGCD)				Serial No 00001-ZZZZZZ					

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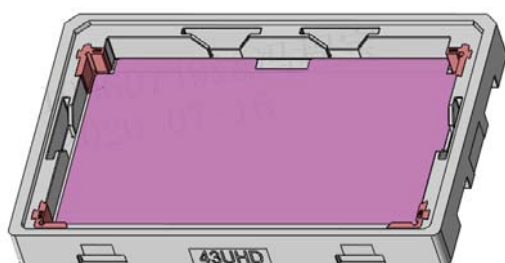
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11.0 PACKING INFORMATION

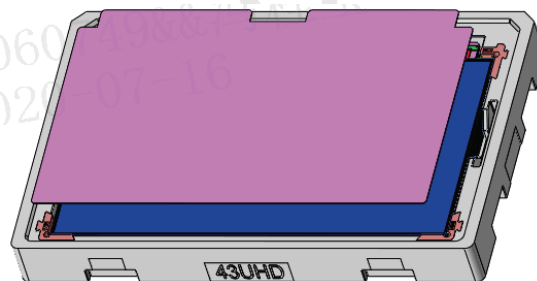
BOE provides the standard shipping container for customers, unless customer specifies their packing information. The standard packing method and Barcode information are shown in the below.

11.1 Packing Order

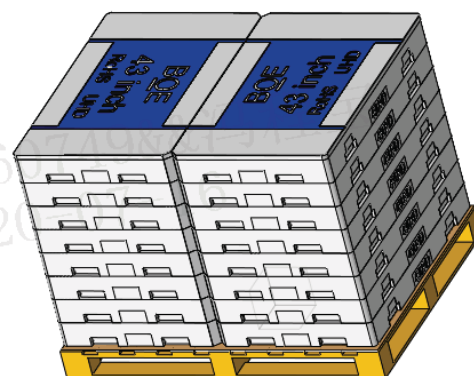
Put 1pcs EPE in the Box



Then put 1pcs panels into the box, total 17pcs panels and 1 8pcs EPE per box



Last put one Paper cover and pack with belt , and use wrapping film to bind up them



Put 16ea boxes on the one pallet, the n put 2ea cover on the top of boxes

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11.2 Packing Note

- Box Dimension : 1110(±3)mmL×722(±2)mmW×127(±1.5)mmH
- Package Quantity in one Box : 17pcs

11.3 Box Label

- Label Size : 110 mm (L) × 55 mm (W)
- Contents

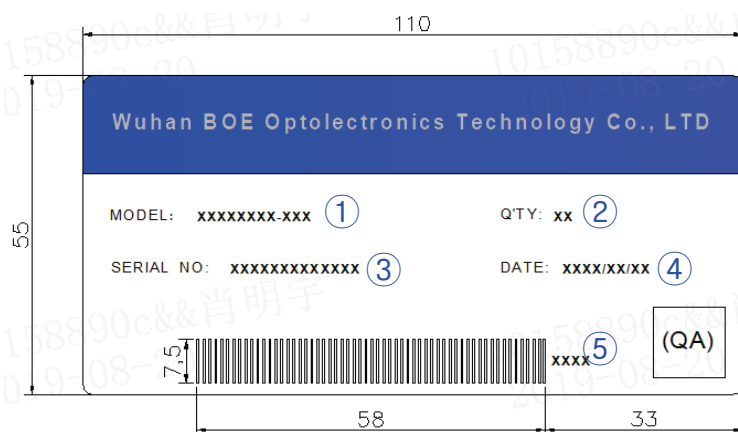
Model : HV430QUB-F70

Q`ty : 17 Open Cell in one box.

Serial No. : Box Serial No. See next page for detail description.

Date : Packing Date

FG Code : FG Code of Product



1. FG-CODE(前12位)
2. 包装数量
3. Box ID
4. 包装日期
5. FG-Code后四位

Box ID Naming Rule:

Digit	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	S	L	S	N	1	6	3	5	9	4	2	0	0
Description	Products GBN		Grade	Line	Year		Month	Revision Code	Serial No 00001-ZZZZZZ				

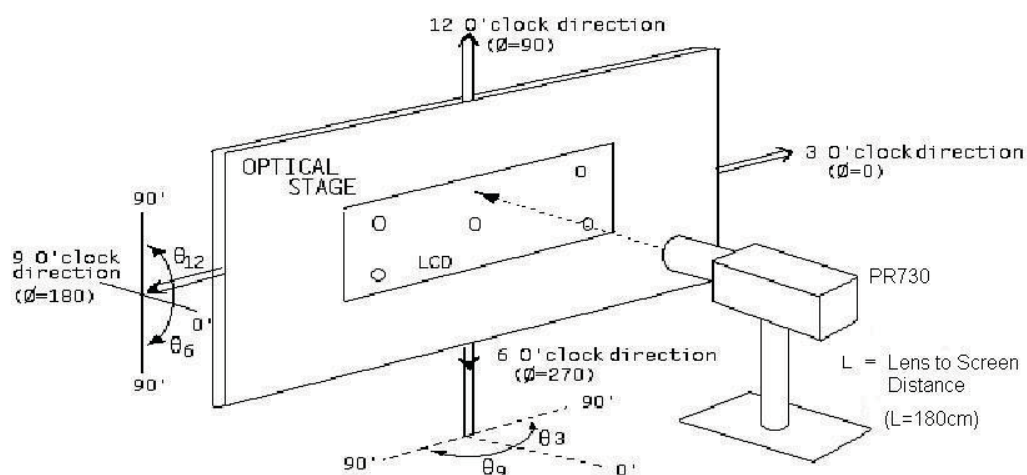
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12.0 APPENDIX 1

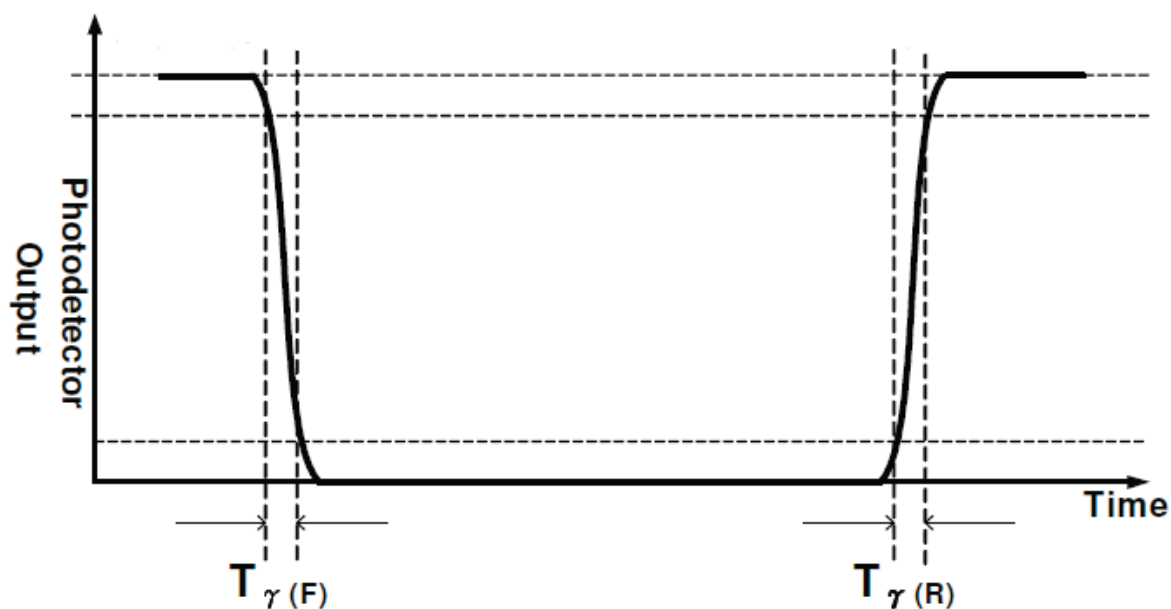


< Figure 1. Measurement Set Up >

Any level of gray (Bright)

Any level of gray (Dark)

Any level of gray (Bright)



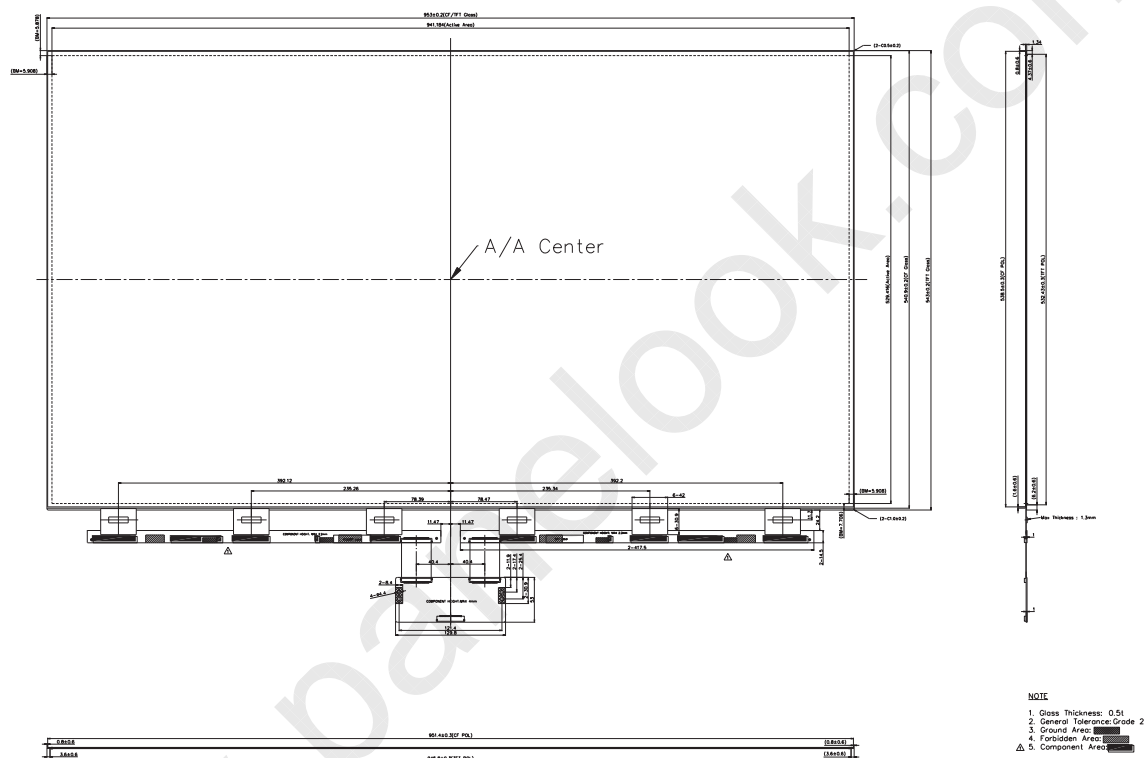
< Figure 2. Response Time Testing >

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12.0 APPENDIX 2

< Figure 3. TFT-LCD Open Cell Outline Dimensions >



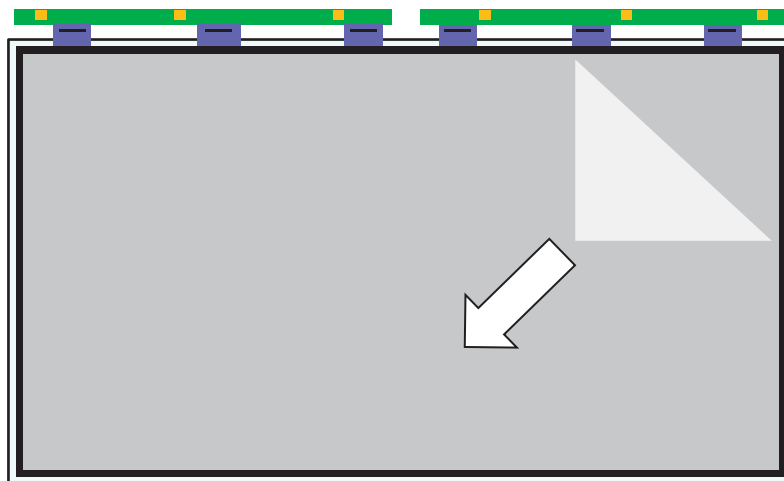
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12.0 APPENDIX 3



< Figure 4. TFT POL Protect Film Peeling Method >

Peeling Step:

1. Be sure to peel off slowly(recommended more than 7sec) and constant speed.
2. Peeling direction shows in Figure 4.
3. Be sure to ground person with adequate methods such as the anti-static wrist band.
4. Be sure to ground each source PCB while peeling off the protection film.
5. Ionized air should be blown over during peeling action.
6. The protection film must not touch drivers and source PCBs.
7. If adhesive may remain on the polarizer after the protection film peeling off, please remove with isopropyl-alcohol.

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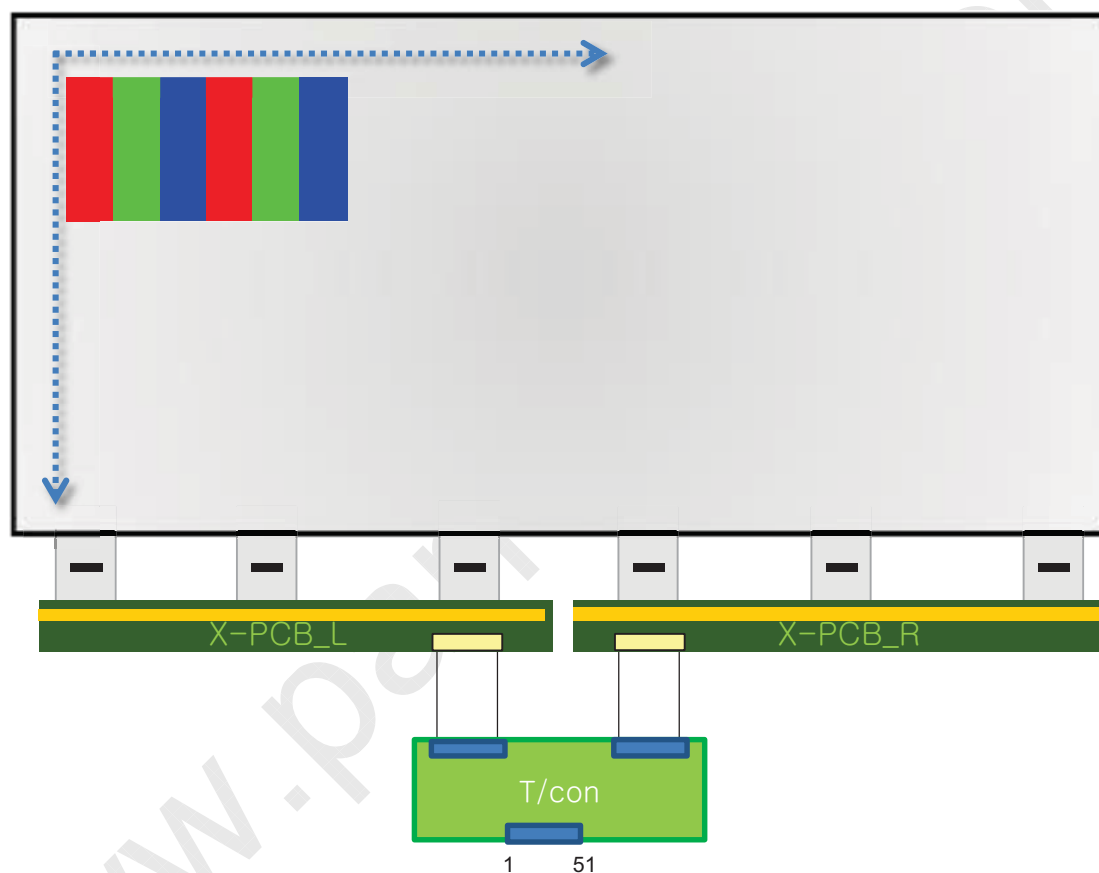
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12.0 APPENDIX 4

This product is reverse type display. RGB data mapping scan direction : from left-up to right-down.



< Figure 5. Display Mode>

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