



**RAYSTAR**

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## RFC570D-AIW-DNN

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### SPECIFICATION

CUSTOMER:

APPROVED BY	
PCB VERSION	
DATE	

FOR CUSTOMER USE ONLY

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

Release DATE:

## Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	2015/12/04		First issue
A	2016/01/21		Modify Static electricity test
B	2016/08/11		Modify Vibration test
C	2016/11/17		Modify Summary

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## 2.Summary

TFT 5.7" is a TN transmissive type color active matrix TFT liquid crystal display that use amorphous silicon TFT as switching devices. This module is a composed of a TFT\_LCD module, It is usually designed for industrial application and this module follows RoHs,

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### 3. General Specifications

- Size: 5.7 inch
- Dot Matrix: 320 x RGBx240(TFT) dots
- Module dimension: 126.00(W) x 101.55(H) x 6.0(D)(MAX) mm
- Active area: 115.2 x 86.40 mm
- Dot pitch: 0.12 x 0.36 mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12 o'clock
- Gray Scale Inversion Direction: 6 o'clock
- Backlight Type: LED, Normally White
- With /Without TP: Without TP
- Surface: Glare

\*Color tone slight changed by temperature and driving voltage.

## 4.Interface

### 4.1. LCM PIN Definition

Pin No.	Symbol	I/O	Description	Remark
1	IF1	I	Input data format control (Note1)	Note1
2	IF2	I	Input data format control (Note1)	Note1
3	POL	O	Polarity Signal connect to VCOM driving circuit.	Note3
4	RESET	I	Hardware reset.	
5	SPENA	I	Chip select	Note2
6	SPCL	I	Serial Clock	Note2
7	SPDA	I/O	Serial Data	
8	B0	I	Blue Data bit (LSB)	
9	B1	I	Blue Data bit	
10	B2	I	Blue Data bit	
11	B3	I	Blue Data bit	
12	B4	I	Blue Data bit	
13	B5	I	Blue Data bit	
14	B6	I	Blue Data bit	
15	B7	I	Blue Data bit(MSB)	
16	G0	I	Green Data bit(LSB)	
17	G1	I	Green Data bit	
18	G2	I	Green Data bit	
19	G3	I	Green Data bit	
20	G4	I	Green Data bit	
21	G5	I	Green Data bit	
22	G6	I	Green Data bit	
23	G7	I	Green Data bit(MSB)	
24	R0	I	Red Data bit(LSB)	
25	R1	I	Red Data bit	
26	R2	I	Red Data bit	
27	R3	I	Red Data bit	
28	R4	I	Red Data bit	
29	R5	I	Red Data bit	
30	R6	I	Red Data bit	
31	R7	I	Red Data bit(MSB)	
32	Hsync	I	Horizontal synchronous signal	
33	Vsync	I	Vertical synchronous signal	
34	Data CLK	I	Dot data clock	
35	AVDD	I	4.5V~5.5V	
36	AVDD	I	4.5V~5.5V	
37	Vcc	I	3V~3.6V	
38	Vcc	I	3V~3.6V	
39	NPC	O	NTSC/PAL mode Auto detection result H:NTSC/L:PAL	
40	VGL	I	Gate off power	
41	VGL	I	Gate off power	
42	UD	I	Up/Down scan setting. H: Reverse scan / L:	

			Normal scan	
43	VGH	I	Gate on power	
44	LRC	I	Shift direction of device internal shift register control.	
45	GND	I	GROUND	
46	VCOM	I	VCOM driving input	Note3
47	VCOM	I	VCOM driving input	
48	ENB	I	Data enable input. Normally pull low.	Note4
49	GND	I	GROUND	
50	GND	I	GROUND	

Note: 1.Control the input data format.

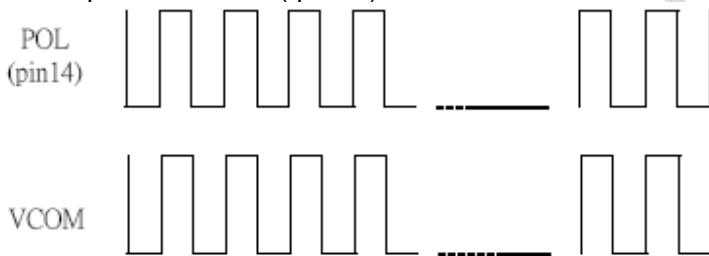
IF2,IF1	Input data format
L,L(default)	Serial RGB
L,H	Parallel RGB
H,L	CCIR601
H,H	CCIR656

2. Pin 5 · Pin 6 usually pull high.

3. The polarity of VCOM (Pin 46,47) should be generated from POL (Pin 3).

4. For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If ENB signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used.

5. The phase of POL ( pin 3 ):



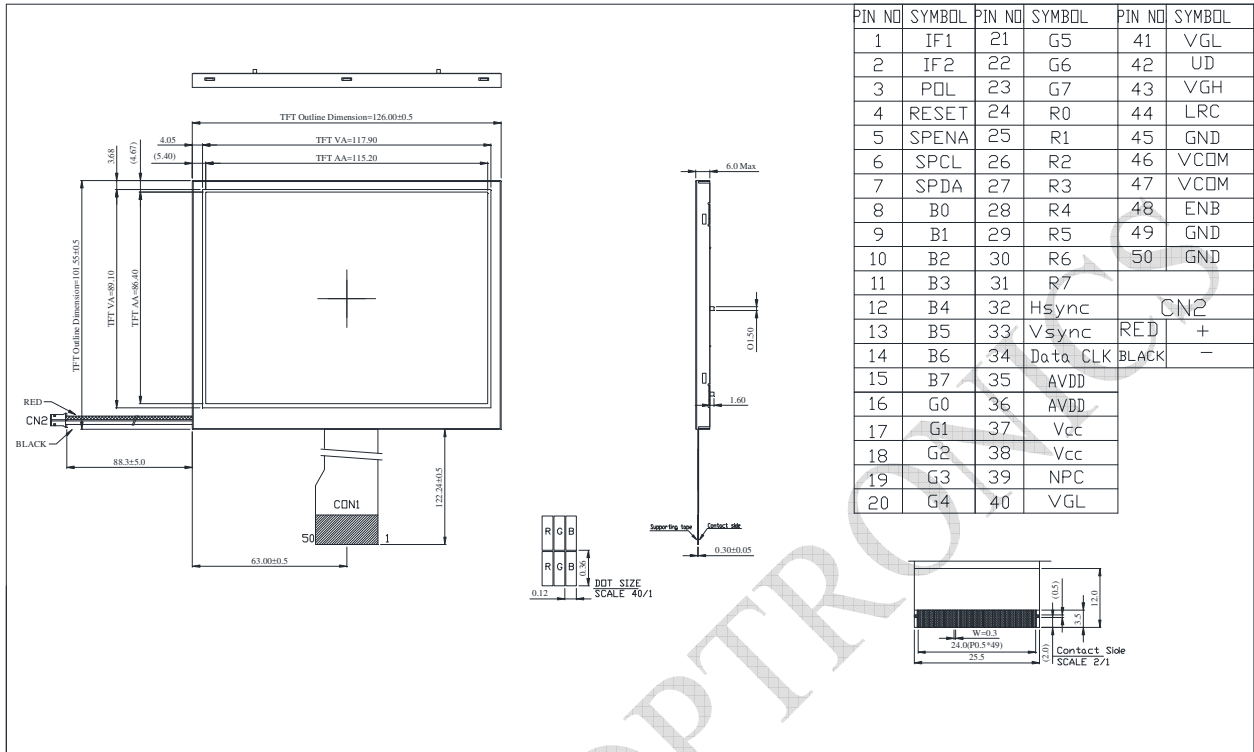
#### 4.2. Backlight PIN Definition

Pin No.	Symbol	I/O	Description
1	VLED+	I	Red, LED_ Anode
2	VLED-	I	Black, LED_ Cathode

Note: The backlight interface connector is a model **PHR-2** manufactured by JST or equivalent.  
The matching connector part number is **S 2B-PH-K-S** manufactured by JST or equivalent.

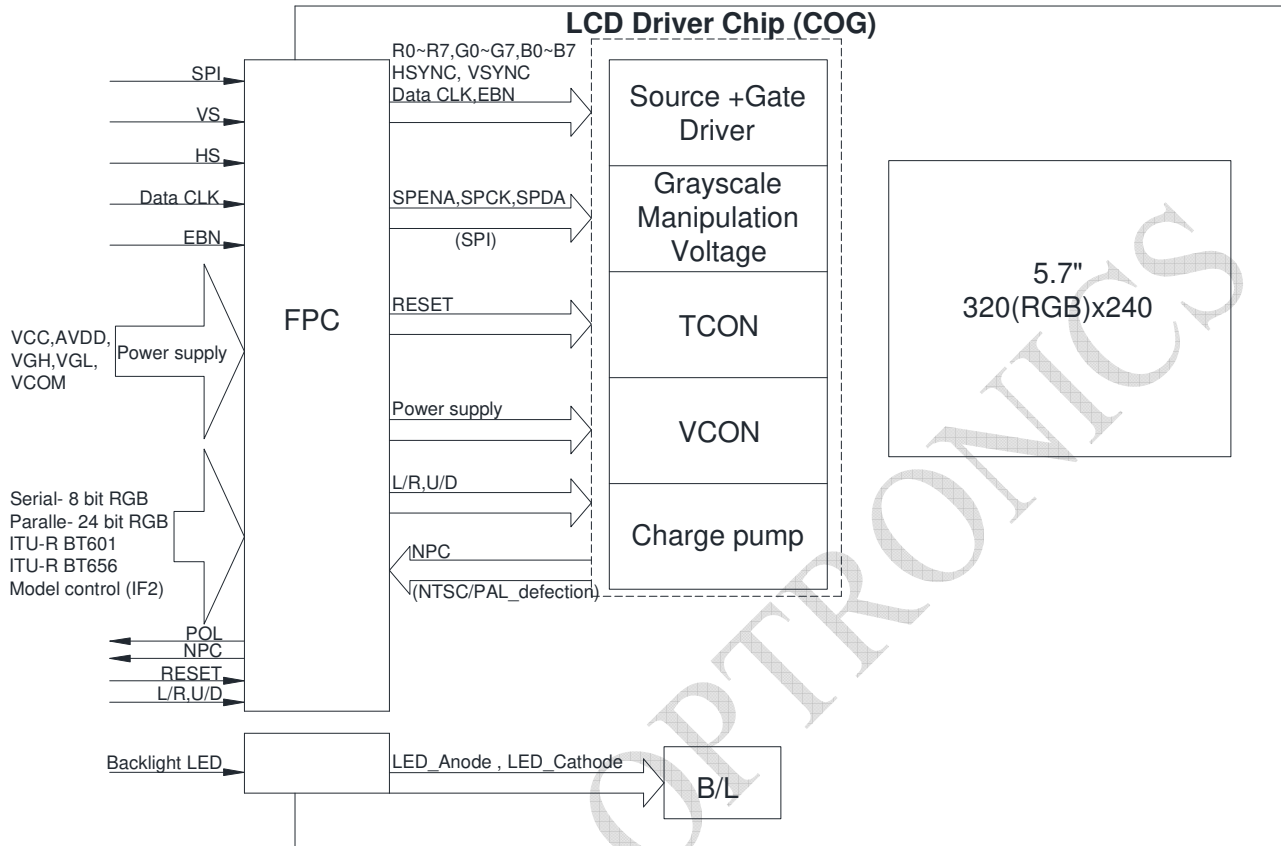


# 5. Contour Drawing



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## 6. Block Diagram

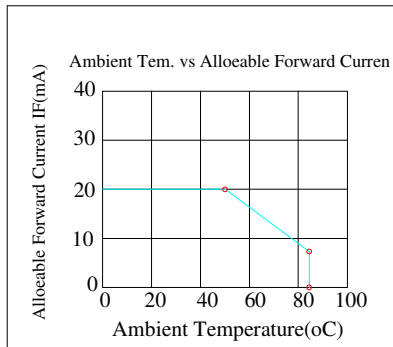


## 7. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	$T_{OP}$	-20	—	+70	°C
Storage Temperature	$T_{ST}$	-30	—	+80	°C
Power Supply Voltage	$V_{GH}$	-0.3	—	32.0	V
	$V_{GL}$	-22	—	0.3	V
	$V_{GH} - V_{GL}$	-0.3	—	+45	V

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

- Temp.  $\leq 60^{\circ}\text{C}$ , 90% RH MAX. Temp.  $> 60^{\circ}\text{C}$ , Absolute humidity shall be less than 90% RH at  $60^{\circ}\text{C}$



## 8. Electrical Characteristics

### 8.1. Operating conditions:

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For LCM	VCC	—	3.0	3.3	3.6	V
Input High Volt.	V <sub>IH</sub>	—	0.7 VCC	—	VCC	V
Input Low Volt.	V <sub>IL</sub>	—	0	—	0.3 VCC	V
LCD Driving Supply Voltage	V <sub>GH</sub> *1	Ta=25°C		15		V *3
	V <sub>GL</sub> *2			-10		
	VcomH		2.5		5.5	
	VcomL		-2.0		0	
Supply Current For LCM	I <sub>VCC</sub>	VCC=3.3V	—	5	8	mA

Notes:

\*1) V<sub>GH</sub> is TFT Gate on operating voltage.

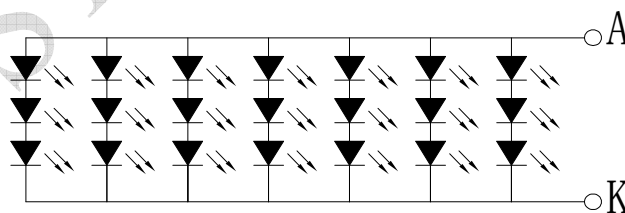
\*2) V<sub>GL</sub> is TFT Gate off operating voltage, V<sub>GL</sub> signal must be fluctuates with same phase as Vcom when Storage on Gate structure.

\*3) Vcom must be adjusted to optimize display quality\_Crosstalk Contrast Ratio and etc.

### 8.2. LED driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		-	140	-	mA	
Power Consumption			1365	1470	mW	
LED voltage	VBL+	9.0	-	10.5	V	Note 1
LED Life Time		-	50,000	-	Hr	Note 2,3,4

Note 1 : There are 1 Groups LED



Note 2 : Ta = 25 °C

Note 3 : Brightness to be decreased to 50% of the initial value

Note 4 : The single LED lamp case

## 9.DC CHARATERISTICS

Parameter	Symbol	Rating			Unit	Condition
		Min	Typ	Max		
Low level input voltage	$V_{IL}$	0	-	0.3VCC	V	
High level input voltage	$V_{IH}$	0.7VCC	-	VCC	V	

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## 10.AC CHARATERISTICS

### 10.1. CCIR601/656 Interface

#### Input signal characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK period	Tosc	-	37	-	ns
Data setup time	Tsu	12	-	-	ns
Data hold time	THo	12	-	-	ns

#### Hardware reset timing

Parameter	Symbol	Min.	Typ	Max	Unit
Reset low pulse width	TRSB	10	-	-	µs

#### Output signal characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Rising time	Tr	-	-	10	ns
Falling time	Tf	-	-	10	ns
Internal STH setup time	Tsus	12	-	-	ns
Internal STH hold time	THDS	12	-	-	ns
Internal data setup time	TSUD	60	-	-	ns
Internal data hold time	THDD	40	-	-	ns
OEH pulse width	TOEH	-	1248	-	ns
OEV pulse width	TOEV	-	4992	-	ns
CKV pulse width	TCKV	-	3744	-	ns
Hsync-DEH time	T <sub>1</sub>	-	4368	-	ns
Hsync-CKV time	T <sub>2</sub>	-	2496	-	ns
Hsync-OEV time	T <sub>3</sub>	-	624	-	ns
Vsync-setup time	TSUV		1872	-	ns
Vsync-pulse time	TSTV		1	-	TH
Vsync-STV time	NTSC		19	-	TH
	PAL		27	-	TH
OEH-STV time	THE	-	2	-	TH
Output settling time	TOES	-	12	20	µs

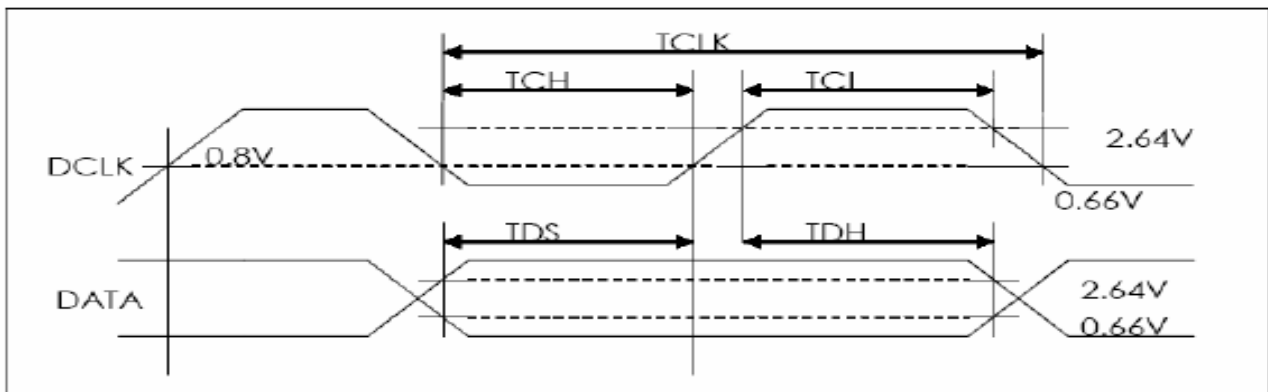
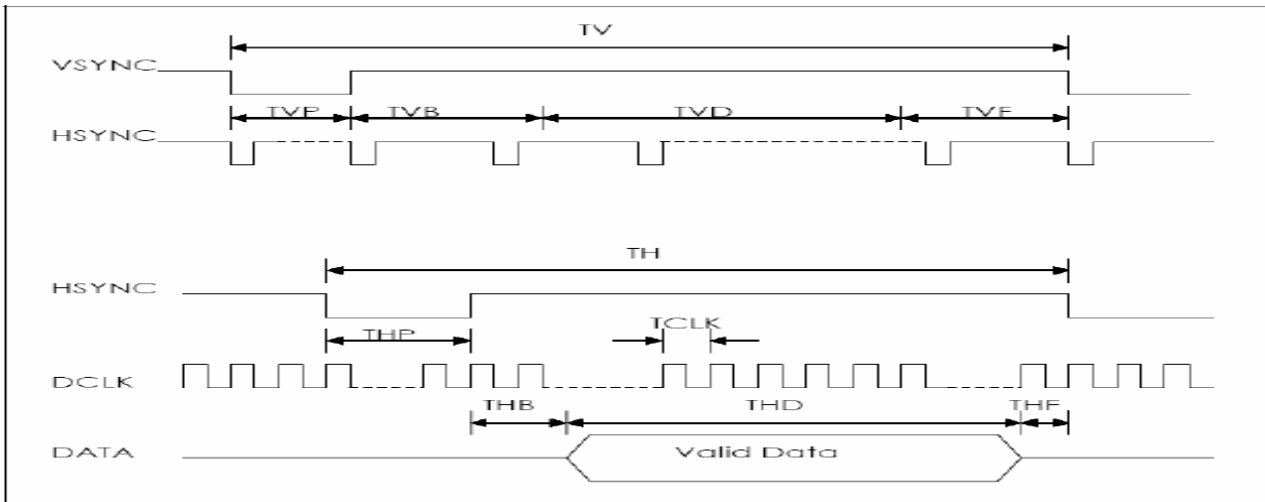
### 10.2. 24-bits parallel RGB Interface

#### AC Timing Characteristics

Signal	Item	Symbol	Min.	Typ.	Max.	Unit
Dclk	Frequency	Dclk	-	6.4	-	MHZ
	High time	Tch	-	78	-	ns
	Low time	Tcl	-	78	-	ns
Data	Setup time	Tds	12	-	-	ns
	Hold time	Tdh	12	-	-	ns

Hsync	Period		TH	-	408	-	DCLK
	Pulse Width		Thp	-	30	-	DCLK
	Back-Porch		Thb	-	38	-	DCLK
	Display Period		Thd	-	320	-	DCLK
	Front-Porch		Thf	-	20	-	DCLK
Vsync	Period	NTSC	TV	-	262.5	-	DCLK
		PAL			312.5		
	Pulse Width		Tvp	1	3	5	TH
	Back-Porch	NTSC	Tvb	-	15	-	TH
		PAL			23		
	Display Period		Tvd	-	240	-	TH
	Front-Porch	NTSC	Tvf	-	4.5	-	TH
PAL		46.5					

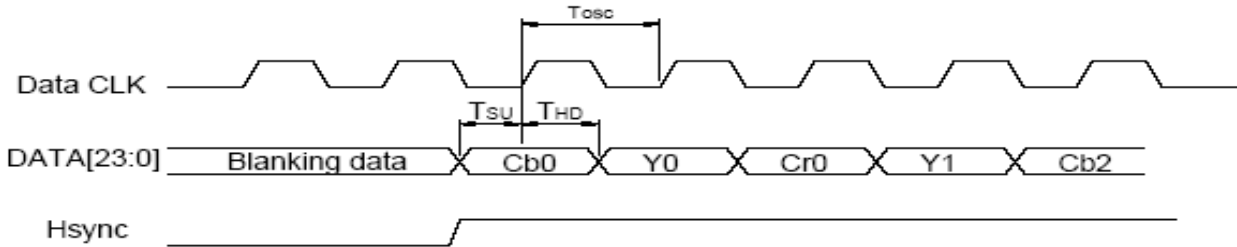
### AC Timing Diagrams



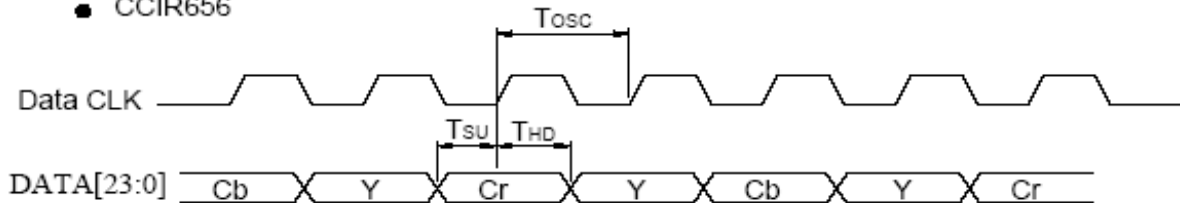
# 11. Waveform

## 11.1. Timing Controller Timing Chart Clock and Data waveform

- CCIR601( HS\_POL="L" in Register R2)

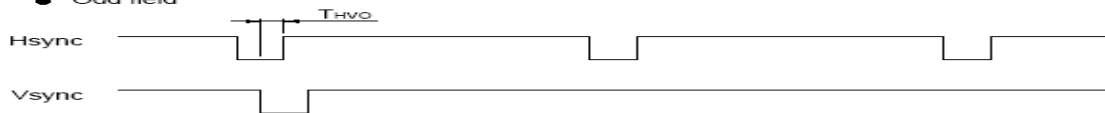


- CCIR656

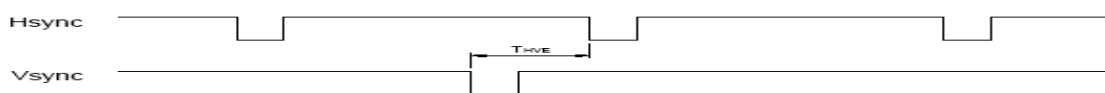


## 11.2. Digital / Analog RGB timing waveform Hsync and Vsync timing

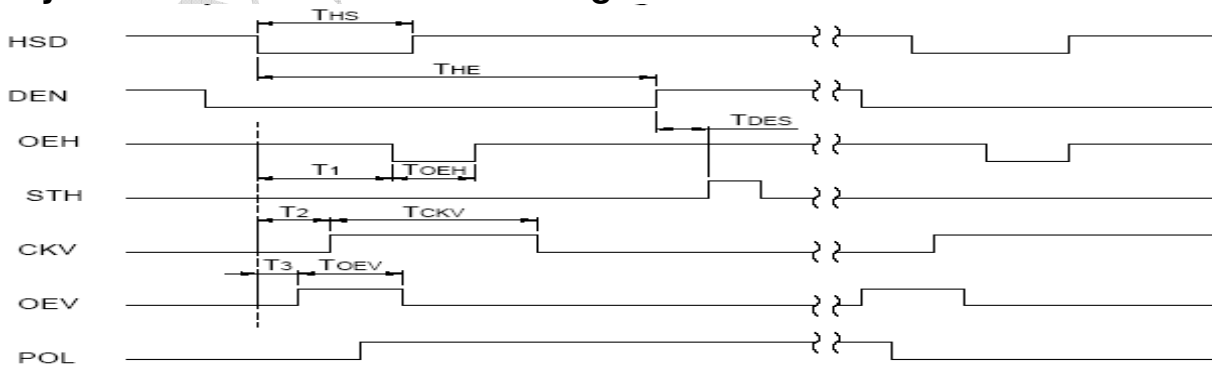
- Odd field



- Even field

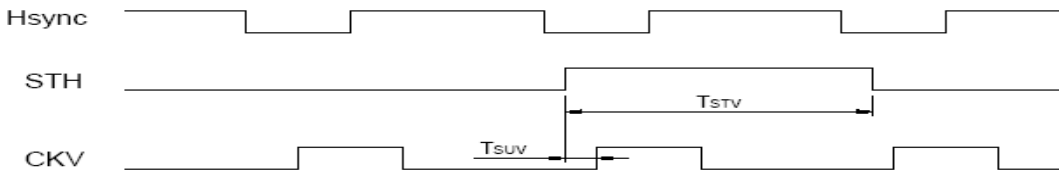


## Hsync and horizontal control timing waveform

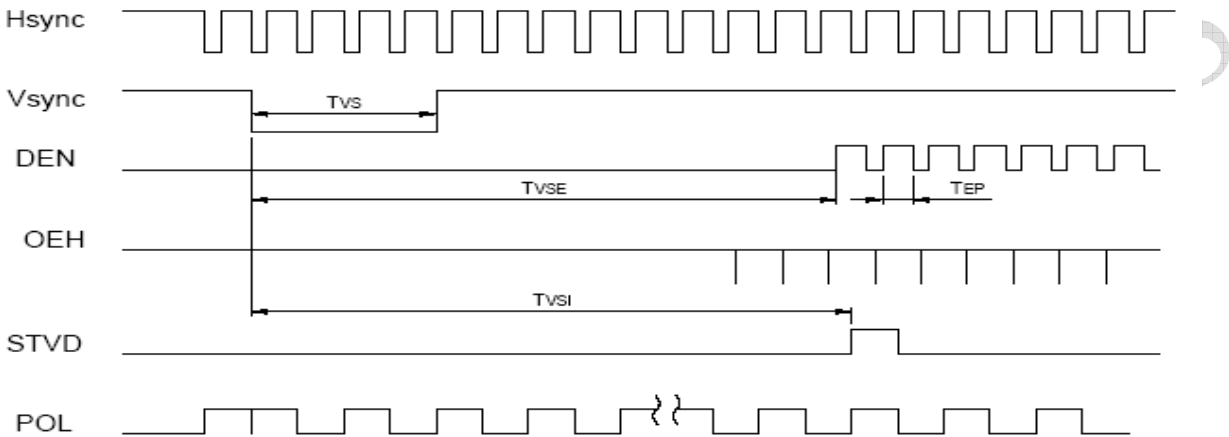




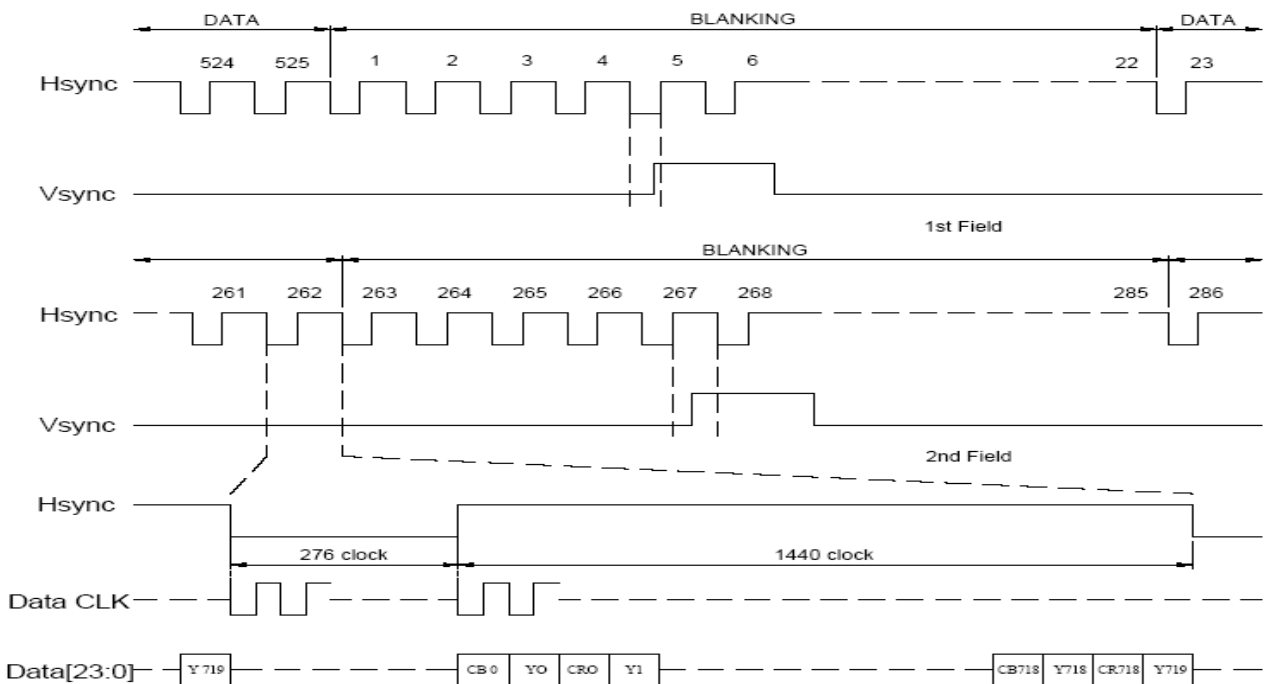
### Hsync and vertical shift clock timing waveform



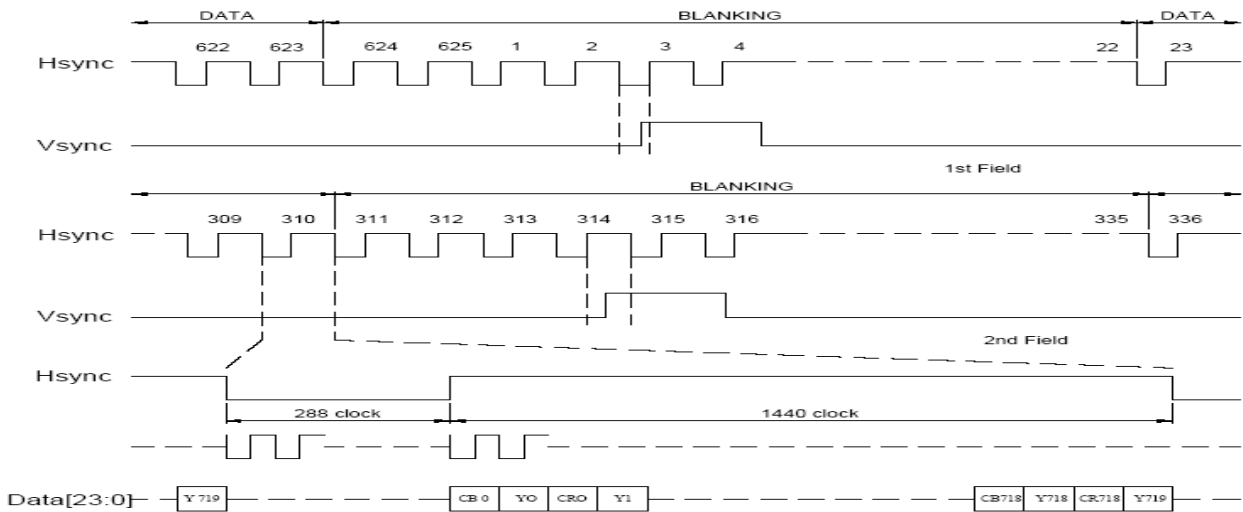
### Hsync and vertical shift clock timing waveform



### 11.3. CCIR601 timing waveform (VS\_POL="H", HS\_POL="L" in Register R2)

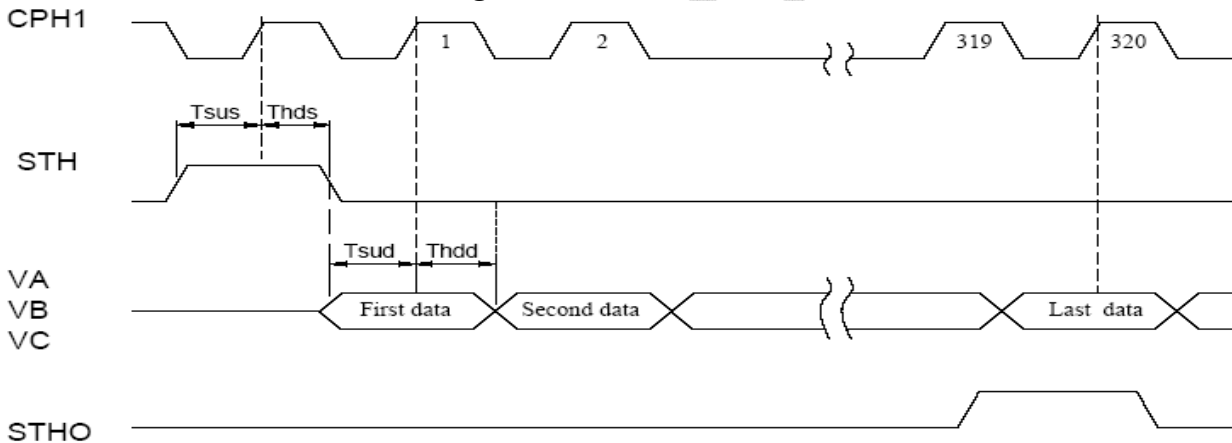


ITU-BT.601 NTSC Input Timing

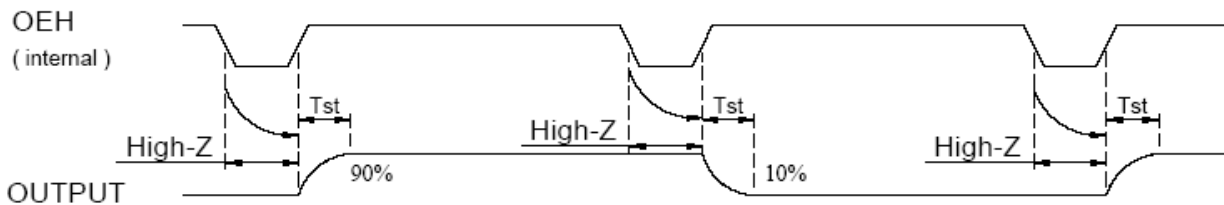


ITU-BT.601 PAL Input Timing

### 11.4. Source Driver Timing Chart Clock and Start Pulse timing waveform



### 11.5. OEH and Data Output timing waveform



### 11.6. Analog video signal characteristics

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
Video signal amplitude (VA, VB, VC)	$V_{IAC}$	-	3.81	-	V
	$V_{IDC}$	-	2.385	-	V

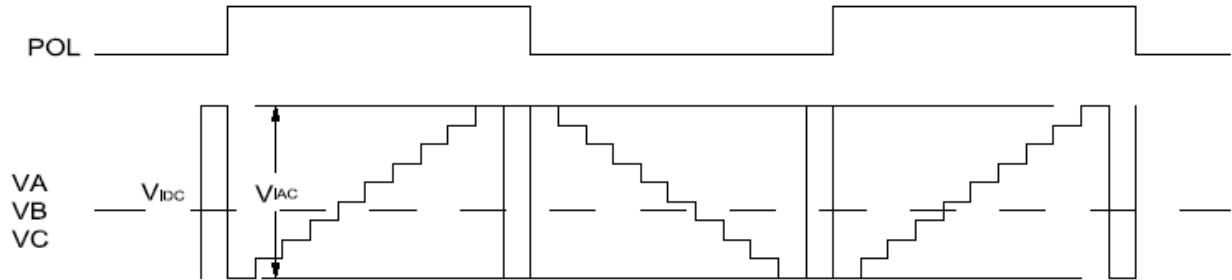
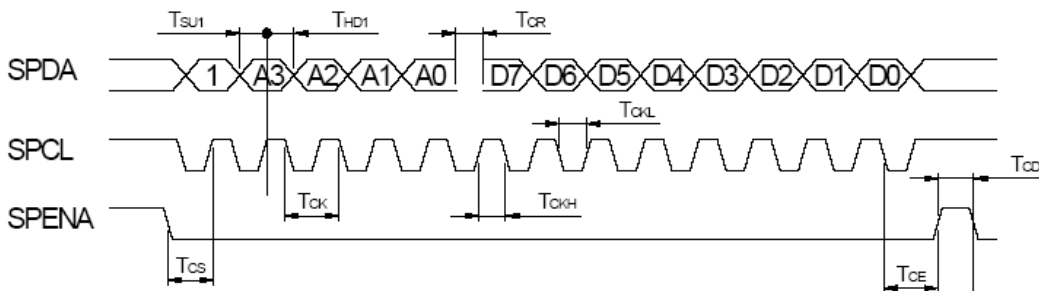


Fig. 4-(a) Horizontal timing

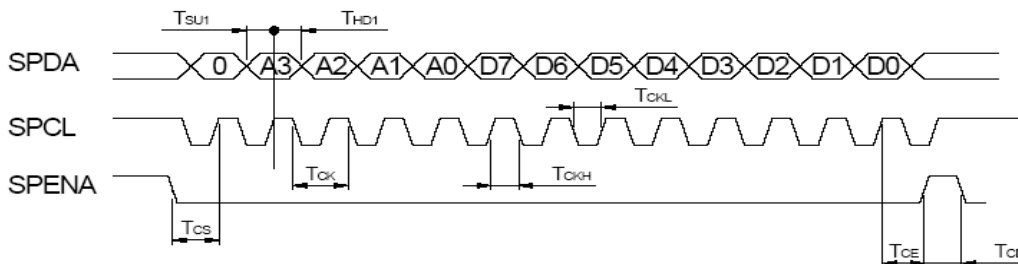
### 11.7. SPI timing characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
SPCL period	$T_{CK}$	60	-	-	ns
SPCL high width	$T_{CKH}$	30	-	-	ns
SPCL low width	$T_{CKL}$	30	-	-	ns
Data setup time	$T_{SU1}$	12	-	-	ns
Data hold time	$T_{HD1}$	12	-	-	ns
SPENA to SPCK setup time	$T_{CS}$	20	-	-	ns
SPENA to SPDA hold time	$T_{CE}$	20	-	-	ns
SPENA high pulse width	$T_{CD}$	50	-	-	ns
SPDA output latency	$T_{CR}$		1/2	-	$T_{CK}$

● SPI "read" timing

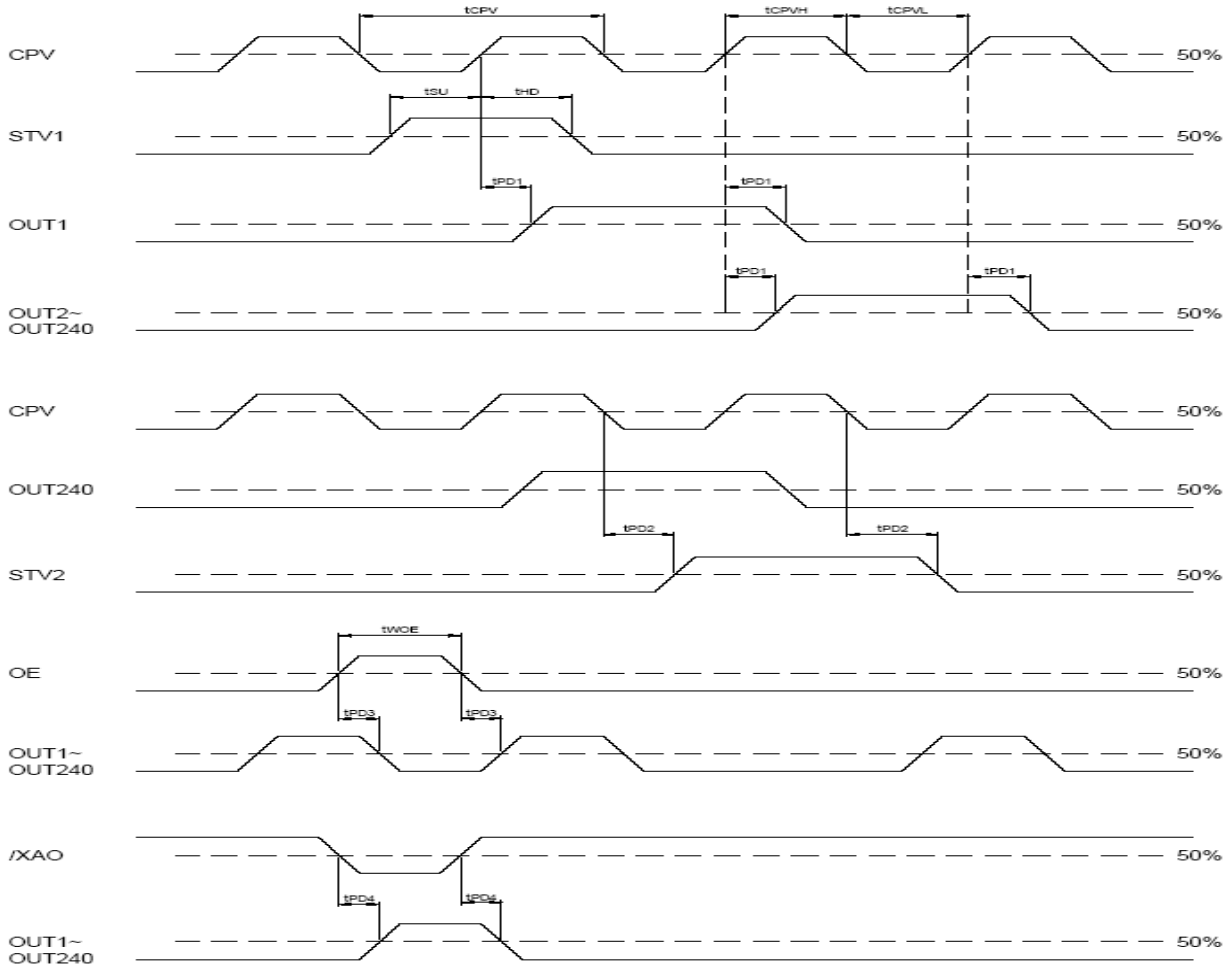


● SPI "write" timing



11.8. Gate Driver Timing Chart

Parameter	Symbol	Condition	Spec		Unit
			Min.	Max.	
Operation frequency	tCPV		5	-	μs
CPV pulse width	tCPVH,tCPVL	50%duty cycle	2.5	-	
OE pulse width	twOE		1	-	
Data setup time	tsu		0.4	-	us
Data hold time	thd		0.7	-	
Output delay time	tpd1	CL=300pF	-	1	
Output delay time	tpd2	CL=300pF	-	0.8	
Output delay time	tpd3	CL=300pF	-	0.8	
Output delay time	tpd4	CL=300pF	-	10	



## 12. Optical Characteristics

Item	Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time	Tr	$\theta=0^\circ$ 、 $\Phi=0^\circ$	-	15	30	ms	Note 3,5
	Tf		-	35	50	ms	
Contrast ratio	CR	At optimized viewing angle	150	250	-	-	Note 4,5
Color Chromaticity	White	Wx	$\theta=0^\circ$ 、 $\Phi=0$	0.282	0.312	0.342	Note 2,6,7
				Wy	0.319	0.349	
Viewing angle (Gray Scale Inversion Direction)	Hor.	$\Theta_R$	$CR \geq 10$	60	70	Deg.	Note 1
		$\Theta_L$		60	70		
	Ver.	$\Phi_T$		40	50		
		$\Phi_B$		60	70		
Brightness	-	-	400	500		cd/ m <sup>2</sup>	Center of display

Ta=25±2°C, IL=140mA

Note 1: Definition of viewing angle range

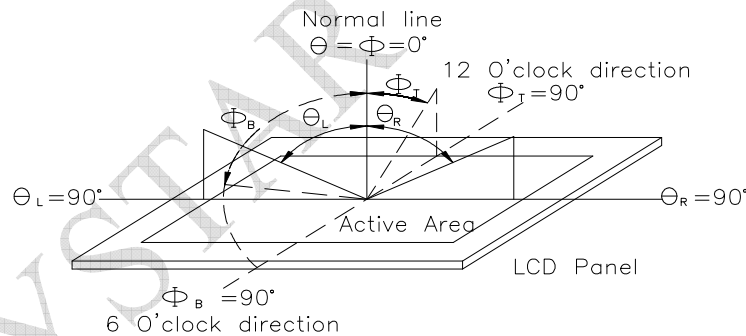


Fig.12.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

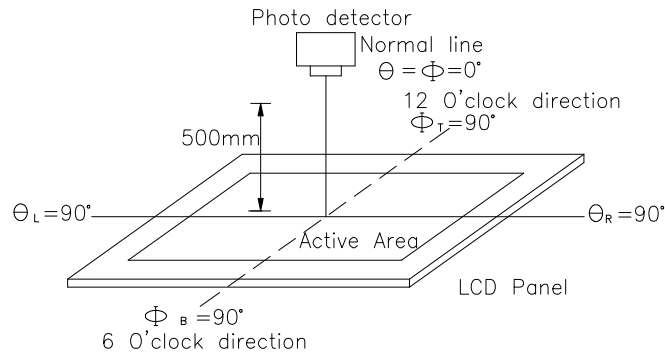
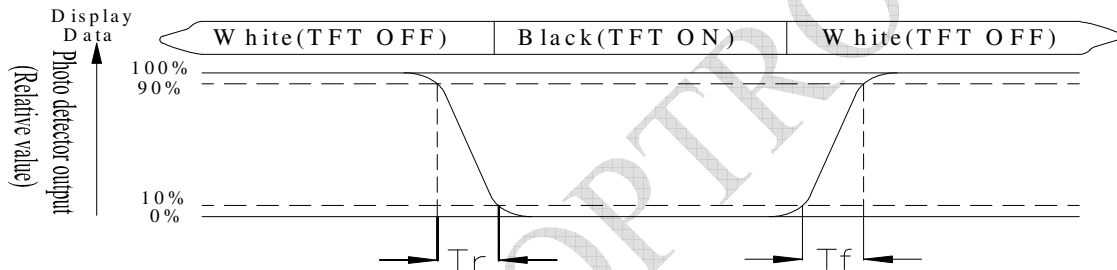


Fig. 12.2. Optical measurement system setup

Note 3: Definition of Response time:

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time,  $T_r$ , is the time between photo detector output intensity changed from 90% to 10%. And fall time,  $T_f$ , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: White  $V_i = V_{i50} \pm 1.5V$

Black  $V_i = V_{i50} \pm 2.0V$

“±” means that the analog input signal swings in phase with VCOM signal.

“±” means that the analog input signal swings out of phase with VCOM signal.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

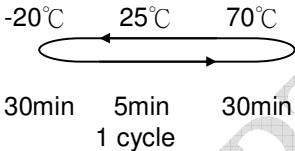
Note 6: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

## 13. Reliability

Content of Reliability Test (Wide temperature, -20°C~70°C)

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60°C,90%RH max	60°C,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation  <div style="text-align: center;">  <p>-20°C      25°C      70°C</p> <p>30min    5min    30min</p> <p>1 cycle</p> </div>	-20°C/70°C 10 cycles	—
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 3 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact) ,±800v(air), RS=330Ω CS=150pF 10 times	—

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

# 14.PACKAGE SPECIFICATION

<b>LCM Model</b>	RFC570D-AIW-DNN	<h2 style="margin: 0;">LCM 包裝規格書</h2> <h3 style="margin: 0;">LCM Packaging Specifications</h3>	<b>Approve</b>	<b>Check</b>	<b>Contact</b>
<b>Drawing NO.</b>			<b>DATE</b>	初版	版次 Ver
			14'02/07	13'11/08	A

**1.包裝材料規格表 (Packaging Material) :(per carton)**

NO.	Item	Model	Dimensions	Quantity
1	成品 (LCM)	RFC570D-AIW-DNN		90
2	TRAY 盤 (2)	PKCA1XXXXXXXXXXXX0184	315mm*265mm	30
3	BP01 內盒(3)Product Box	PK3Y1XXXXXXXXXXXX0001	332*280*100mm	6
4	泡棉(4)Foam	-----		6
5	外紙箱(5)Carton	PK4X1XXXXXXXXXXXX0000	565*340*320mm	1
6				
7				
8				
9				

**2.單箱數量規格表(Packaging Specifications and Quantity) :**

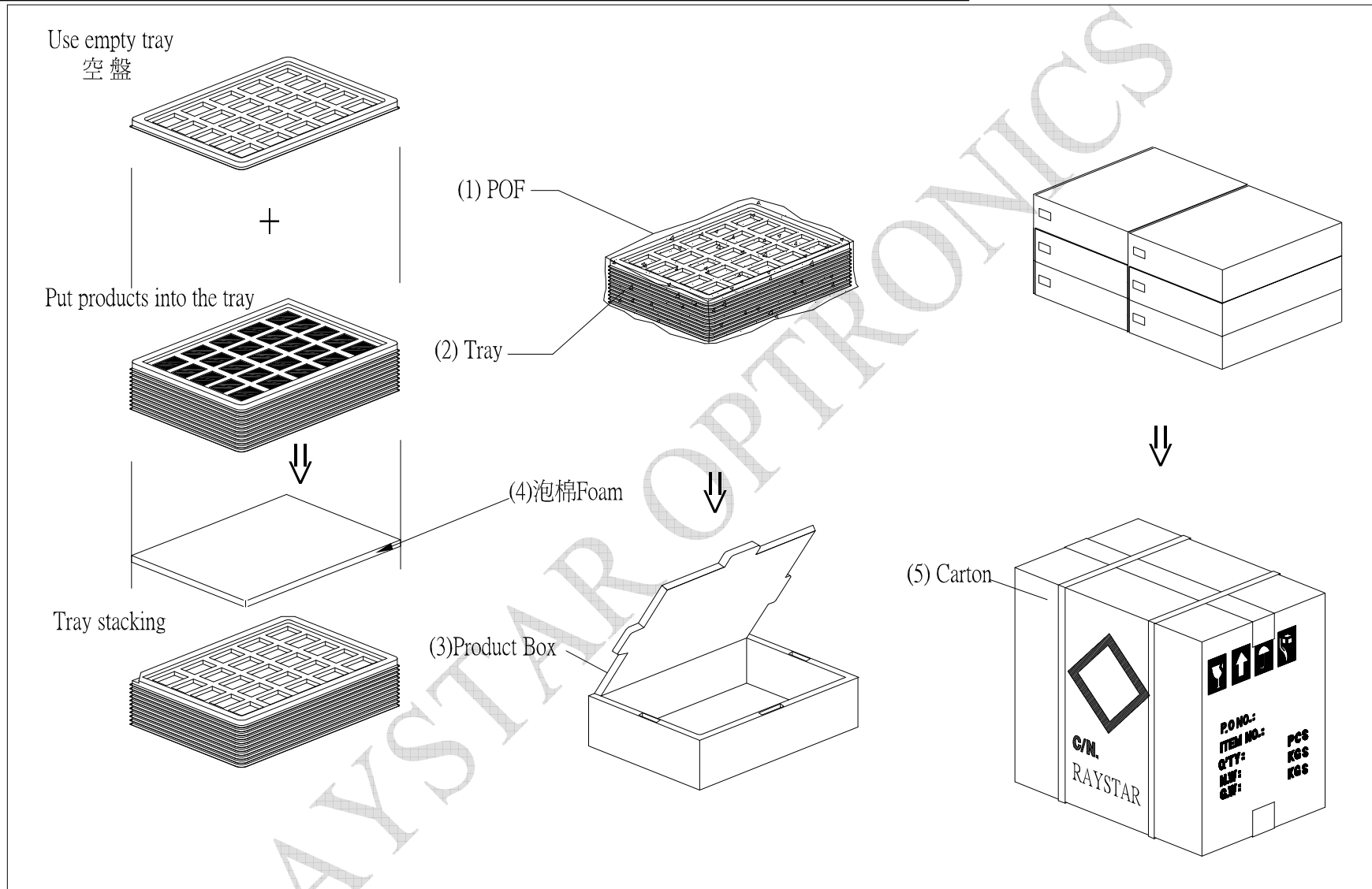
(1)LCM quantity per box : no per tray                      3    x no of tray                      5 = 15

(2)Total LCM quantity in carton : quantity per box    15   x no of boxes                      6 = 90

**特 記 事 項 (REMARK)**

<p>1. Label Specifications :</p> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> MOOEL:  LOT NO :  QUANTITY:  CHECK: </div>	
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**LCM Sample Estimate Feedback Sheet**

**Module Number :** \_\_\_\_\_

**1 、 Panel Specification :**

1. Panel Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. View Direction :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Numbers of Dots :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. View Area :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Active Area :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. Operating Temperature :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Storage Temperature :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8. Others :	_____	

**2 、 Mechanical Specification :**

1. PCB Size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. Frame Size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Material of Frame :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. Connector Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Fix Hole Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. Backlight Position :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Thickness of PCB :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8. Height of Frame to PCB :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
9. Height of Module :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
10. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

**3 、 Relative Hole Size :**

1. Pitch of Connector :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. Hole size of Connector :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. Mounting Hole size :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. Mounting Hole Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

**4 、 Backlight Specification :**

1. B/L Type :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2. B/L Color :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3. B/L Driving Voltage (Reference for LED Type) :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4. B/L Driving Current :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5. Brightness of B/L :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6. B/L Solder Method :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7. Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____

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<b>Module Number :</b> _____		
<b>5 · <u>Electronic Characteristics of Module</u> :</b>		
1.Input Voltage :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
2.Supply Current :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
3.Driving Voltage for LCD :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
4.Contrast for LCD :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
5.B/L Driving Method :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
6.Negative Voltage Output :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
7.Interface Function :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
8.LCD Uniformity :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
9.ESD test :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
10.Others :	<input type="checkbox"/> Pass	<input type="checkbox"/> NG , _____
<b>6 · <u>Summary</u> :</b>		
<p style="text-align: right;">Sales signature : _____</p> <p style="text-align: right;">Customer Signature : _____      <u>Date</u> :   /   / _____</p>		