Version: 1.0

TECHNICAL SPECIFICATION

MODEL NO. : PA064DS5

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Please contact E Ink or its agent for further information

☐Customer's Confirmation

Customer _____

Date _____

By _____

☐E Ink's Confirmation

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Revision History

Rev.	Issued Date	Revised Contents
1.0	December 30,2011	New

TECHNICAL SPECIFICATION

CONTENTS

1. Application

This technical specification applies to 6.4” color TFT-LCD module , PA064DS5. The applications of the panel are car TV , portable DVD , GPS , multimedia applications and others AV system.

2. Features

. Compatible with NTSC & PAL system

. Pixel in stripe configuration

. Slim and compact

. High Brightness

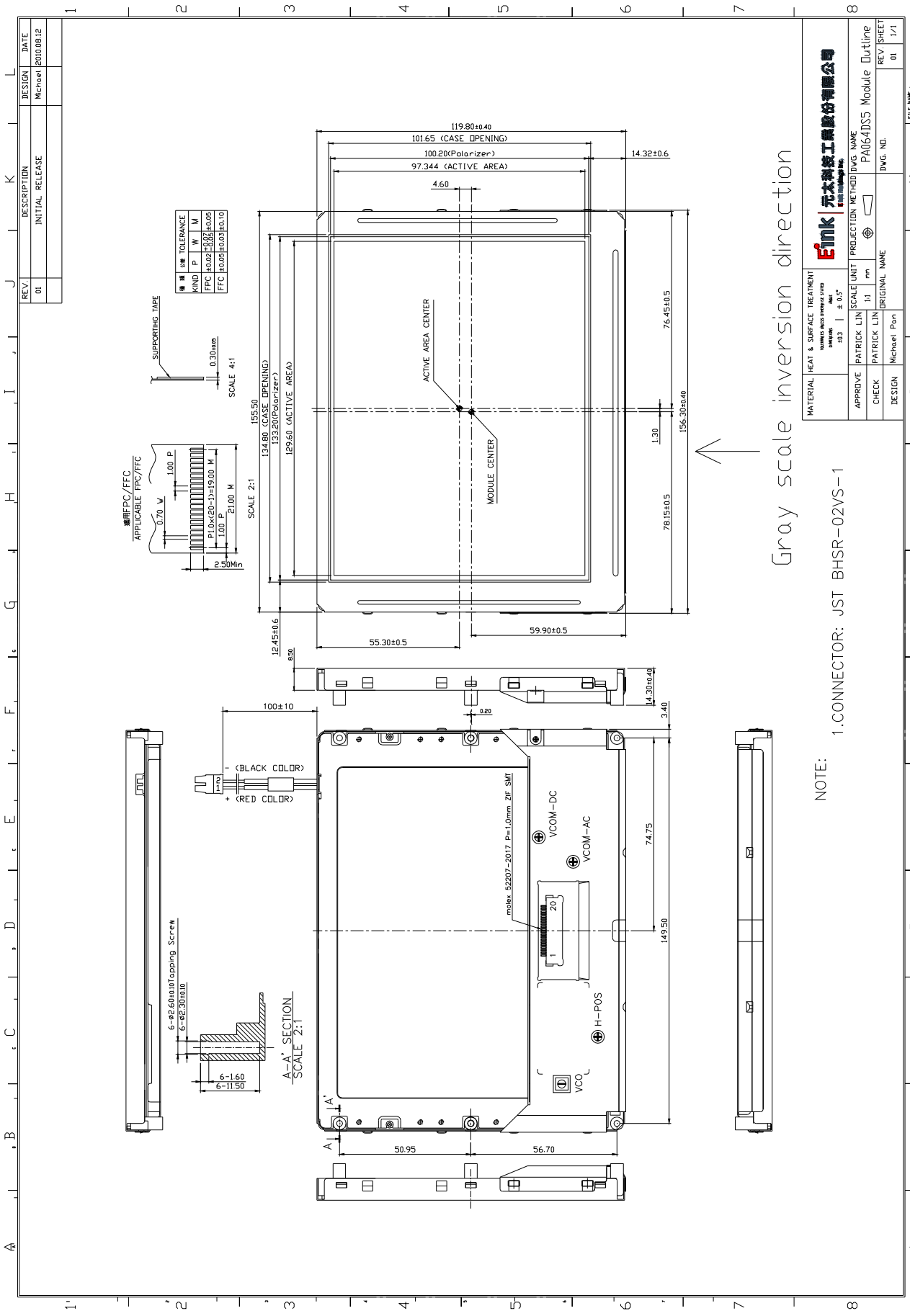
. Image Reversal : Up/Down and Left/Right

.LEAD Free

3. Mechanical Specifications

Parameter	Specifications	Unit
Screen Size	6.4 (diagonal)	inch
Surface Treatment	Anti-Glare+WV film	
Display Format	320 ×(R.G.B)×234	dot
Active Area	129.60 (H)×97.34 (V)	mm
Dot Pitch	0.135 (H)×0.416 (V)	mm
Pixel Configuration	Stripe	
Outline Dimension	156.3 (W)×119.8 (H)×14.3 (D)(Typ.)	mm
Back-light	18 LED	
Weight	226	g
Gray scale inversion direction	6 o’clock [ref to Note 9-3]	

4. Mechanical Drawing of panel



5. Input / Output Terminals

5-1) TFT-LCD Panel Driving

Pin No	Symbol	I/O	Description	Remark
1	$\overline{HSY}$	I/O	Horizontal Sync. Input / Output	Note 5-1
2	POLC	O	Video Polarity Alternating Signal	
3	CSY	I	Composite Sync. Signal	Note 5-1
4	V_{GH}	I	Gate on voltage	Note 5-2
5	V_{GL}	I	Gate off voltage	Note 5-3
6	V_B	I	Video Input B	
7	V_R	I	Video Input R	
8	V_G	I	Video Input G	
9	GND	I	GND	
10	V_{DD}	I	Digital power input	Note 5-4
11	V_{CC}	I	Analogue power input for source driver	Note 5-5
12	GND	I	GND	
13	CKC	I	Select Pin for Internal / External Clock Mode	Note 5-1
14	$\overline{VSY}$	I/O	Vertical Sync. Input / Output	
15	PSI	O	Synchronize Pulse for Decoder	Note 5-6
16	COMPS	I	Select Pin for Composite Sync. Mode & Sync. Separate Mode	Note 5-1
17	$\overline{VIY}$	I	Vertical Sync. Input Pin for Sync. Separate Mode	
18	U/D	I	Up/Down Control for gate driver	Note 5-8
19	R/L	I	Left/Right Control for source driver	Note 5-7
20	NP	I	NTSC / PAL Input	Note 5-9

Note 5-1 : The relation between Pin13 (CKC) and Pin 16 (COMPS) :

Pin13 (CKC)	Pin16 (COMPS)	Pin 1 ($\overline{HSY}$)	Pin3 (CSY)	Pin14 ($\overline{VSY}$)	Pin17 ($\overline{VIY}$)
High	**High**	**$\overline{HSY}$ output**	**CSY input**	**$\overline{VSY}$ output**	**NC**
High	**Low**	**$\overline{HSY}$ output**	**CSY ($H_{sync.}$) input**	**$\overline{VSY}$ output**	**$\overline{VIY}$ ($V_{sync.}$) input**
Low	**-**	**$H_{sync.}$ input**	**External clock**	**$V_{sync.}$ input**	**NC**

Note 5-1-1 : CKC = High , COMPS = High (Composite sync. mode & Internal clock mode)

a. If CKC = 1, COMPS = 1 the phase lock loop (PLL) is adopted in the LCD module (internal clock mode).
b. Input sync. is CSY.
c. Output sync. are Horizontal Sync ($\overline{HSY}$, Pin 1) and Vertical Sync ($\overline{VSY}$, Pin 14).

Note 5-1-2 : CKC = High , COMPS = Low (Sync. Separate mode & Internal clock mode)

a. If CKC = 1, COMPS = 0 the phase lock loop (PLL) is adopted in the LCD module (internal clock mode).
b. Input sync. are Horizontal sync. (CSY , Pin3) and Vertical sync. ($\overline{\text{VIY}}$, Pin17).
c. Output sync. are Horizontal Sync ($\overline{\text{HSY}}$, Pin 1) and Vertical Sync ($\overline{\text{VSY}}$, Pin 14).

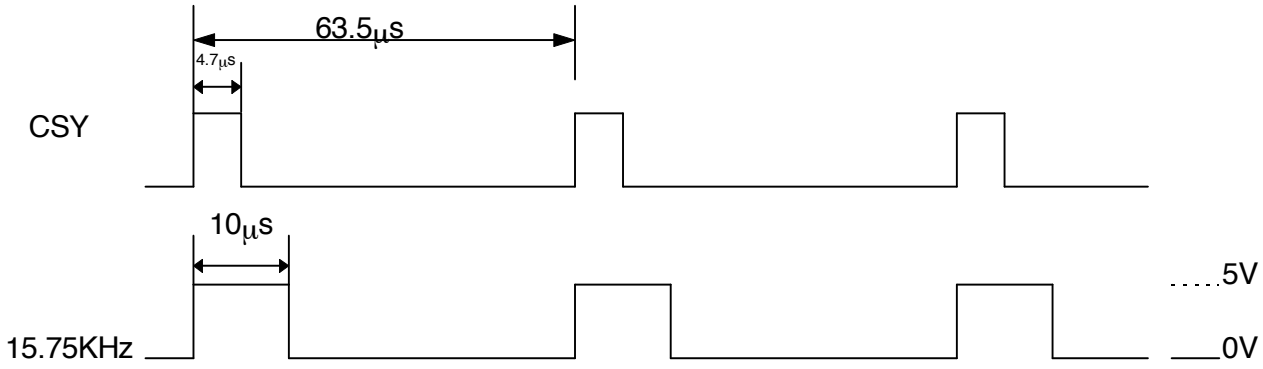
Note 5-1-3 : CKC = Low , COMPS = Don't care (External clock mode)

a. If CKC = 0 , the phase lock loop (PLL) is not adopted in the LCD module.
b. If CKC = 0 , the external clock input frequency of Pin 3 is 6.4 MHz.
c. Input external Vertical Sync ($\overline{\text{VSY}}$, Pin 14) and Horizontal Sync ($\overline{\text{HSY}}$, Pin 1) to synchronize the LCD module.
d. The pulse width of external Horizontal Sync input is 4.7 s±2 s. The pulse width of external Vertical Sync input is 2H~4H.
e. The pulse length of external input Vertical Sync of system is 262H±4H.

Note 5-1-4 : If there is any question about CKC = 0 , please contact E Ink.

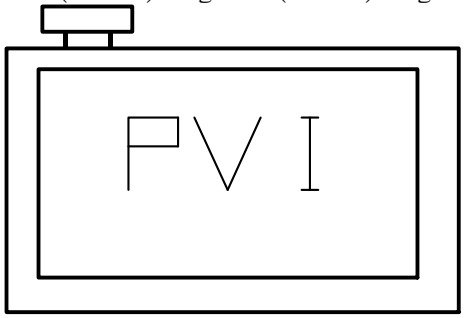
Note 5-2 : V_{GH} TYP.=+17V
Note 5-3 : V_{GL} TYP.=-15V
Note 5-4 : V_{DD} TYP.=+5V
Note 5-5 : V_{CC} TYP.=+5V

Note 5-6 : The frequency of PSI is 15.75KHz.

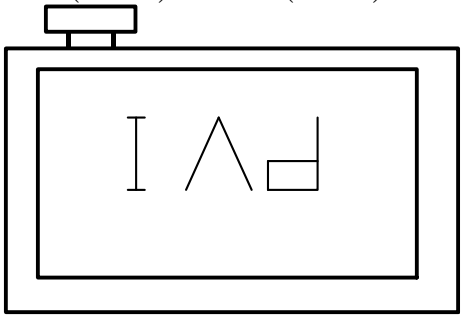


Note 5-7,5-8 : The definitions of U/D & R/L

U/D(PIN 18)=High R/L(PIN 19)=High



U/D(PIN 18)=Low R/L(PIN 19)=Low



Note 5-9 : NTSC = Hi (+5V) , PAL = LOW (0V).

6. Absolute Maximum Ratings

The followings are maximum values , which if exceeded, may cause faulty operation or damage to the unit.

GND = 0 V， Ta = 25 ℃

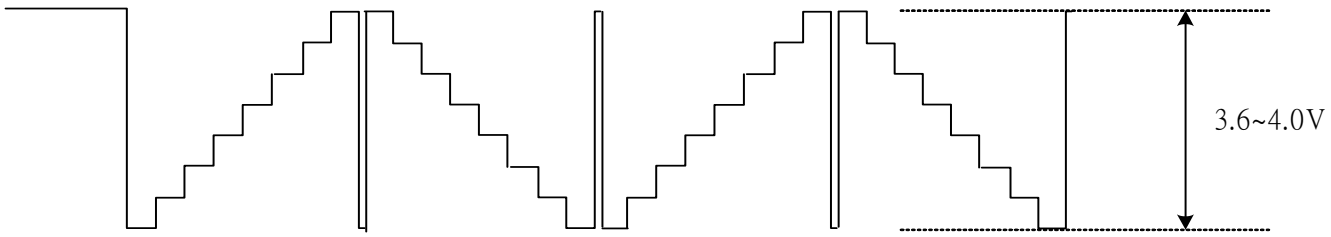
Parameter		Symbol	MIN.	MAX.	Unit	Remark
Supply Voltage For Source Driver	Analog	V_{CC}	-0.3	+7.0	V	
	Digital	V_{DD}	-0.3	+7.0		
Supply Voltage For Gate Driver	Positive	V_{GH}	-0.3	+40	V	
	Negative	V_{GL}	-20	+0.3	V	
		V_{GH} -V_{GL}	-0.3	+40	V	
Storage Temperature		Tst	-30	80	℃	
Operation Temperature		Top	-20	70	℃	

7. Electrical Characteristics

7-1) Operating Condition

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply		V_{CC}	+4.5	+5.0	+5.5	V	
		V_{DD}	+4.5	+5.0	+5.5	V	
		V_{GH}	+15.0	+17.0	+19.0	V	
		V_{GL}	-16.0	-15.0	-14.0	V	DC Component of V_{GL}
Video Signal (V_R, V_G, V_B)		$V_{i\,AC}$	-	+4.0	+4.2	V_{P-P}	AC Component Note 7-1
		$V_{i\,DC}$	-	+2.5	-	V	DC Component
Digital input voltage	H Level	V_{IH}	+0.7 V_{DD}	-	V_{DD}	V	
	L Level	V_{IL}	0	-	+0.3 V_{DD}	V	
Digital output voltage	H Level	V_{OH}	V_{DD}-0.4	-	V_{DD}	V	
	L Level	V_{OL}	0	-	+0.4	V	

Note 7-1 : Both NTSC and PAL system Video Signal input waveform is based on 8 steps gray scale.



7-2) Current Consumption (GND=0V)

Ta= 25 ℃

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Current for Driver	I_{GH}	V_{GH}=+17V	-	5.6	16.8	mA	
	I_{GL}	V_{GL}=-15V	-	8.7	26.1	mA	
	I_{CC}	V_{CC}=+5V	-	9.7	19.4	mA	
	I_{DD}	V_{DD}=+5V	-	13	26	mA	

7-3) Backlight driving & Power Consumption

Pin No	Symbol	Description	Remark
1	+	Input terminal (Anode)	Red
2	-	Input terminal (Cathode)	Black

Parameter	Symbol	Min	TYP	MAX	Unit	Remark
Supply voltage of LED backlight	V_{LED}	-	-	10.65	V	Note 7-1
Supply current of LED backlight	I_{LED}	-	20	30	mA	Note 7-2
Backlight Power Consumption	P_{LED}	-	-	1.278	W	Note 7-1 / Note 7-3

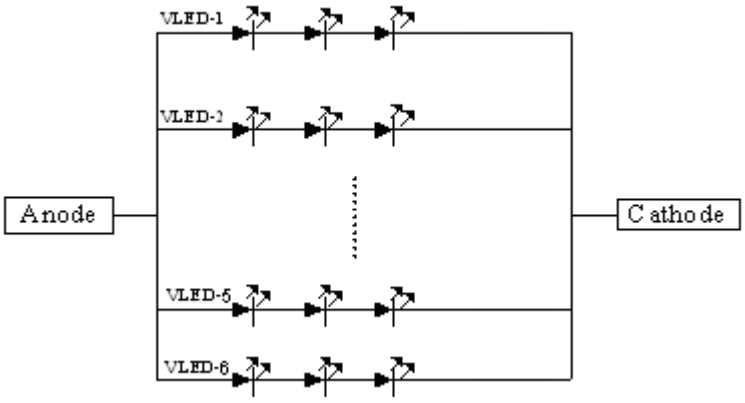
Note 7-1 : I_{LED}= 20mA,constant current. Customer system design for driving should be constant current.

Note 7-2 : The LED driving condition is defined for each LED module. (3 LED Serial)

Input current = 20mA * 6 = 120mA

Note 7-3 : $P_{LED} = V_{LED-1} * I_{LED-1} + V_{LED-2} * I_{LED-2} \ldots\ldots + V_{LED-5} * I_{LED-5} + V_{LED-6} * I_{LED-6}$

$(P_{LED})_{MAX} = (V_{LED})_{MAX} * (I_{LED})_{TYP}$ * Number of LED parallel



Power Consumption

Ta= 25 ℃

Parameter	Symbol	Conditions	TYP.	Unit	Remark
LCD Panel Power Consumption			495.2	mW	Note 7-4
Backlight Power Consumption			1.278	W	Note 7-5
Total Power Consumption			1773.2	mW	

Note 7-4：The power consumption for backlight is not included.

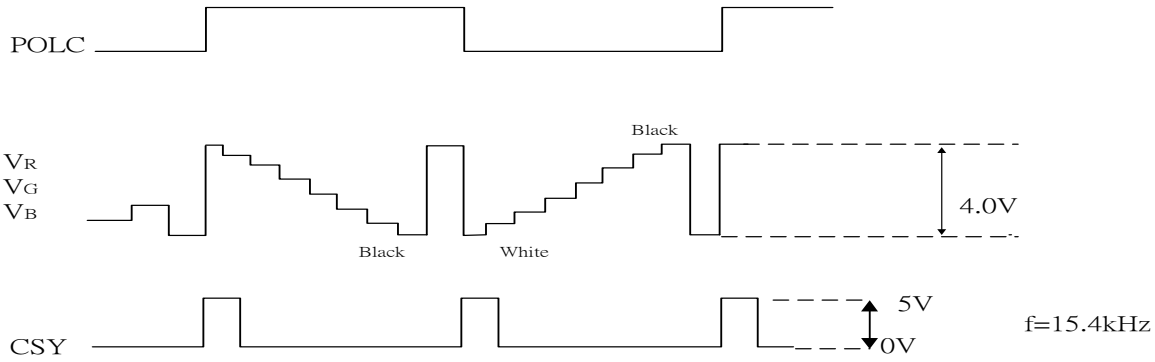
Note 7-5：Backlight power consumption is calculated by $I_L \times V_L$.

7-4) Input / Output Connector

A) LCD Module Connector
52207-2017 (Molex)
FFC Up Connector,
20 Pins
Pitch : 1.0 mm

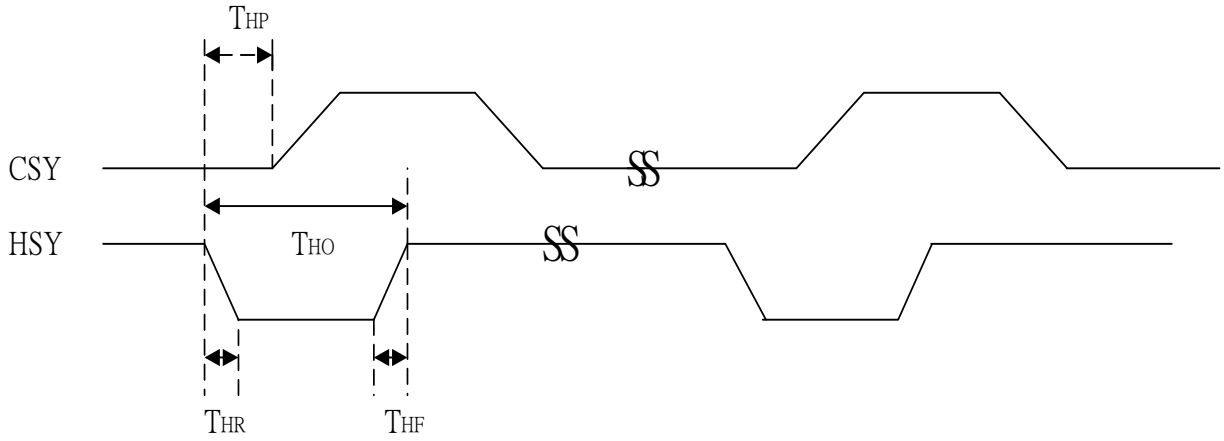
B) Backlight Connector
JST BHSR-02VS-1
Pin No. : 2
Pitch : 4 mm

7-5) Input / Output signal timing chart



a) Composite sync. & sync. separate mode's timing

Parameter			Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Horizontal Sync. Output Pulse	Frequency	NTSC	$F_{HO(N)}$	-	15.75	-	KHz	
		PAL	$F_{HO(P)}$	-	15.63	-	KHz	
	Pulse Width		T_{HO}	4.4	4.7	5.0	µs	
	Phase Difference		T_{HP}	0	2	-	µs	
	Rising Time		T_{HR}	-	-	0.05	µs	
	Falling Time		T_{HF}	-	-	0.05	µs	
Vertical Sync. Output Pulse	Frequency	NTSC			fh/262.5			
		PAL			fh/312.5			
	Pulse Width		T_{VO}	-	4H	-	µs	
	Phase Difference	NTSC	$T_{VPO(N)}$	-	1H	-	µs	odd field
		PAL	$T_{VPO(P)}$	-	1H	-		
	Phase Difference	NTSC	$T_{VPE(N)}$	-	1.5H	-	µs	even field
		PAL	$T_{VPE(P)}$	-	0.5H	-		



b) External clock mode's timing

Parameter		Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Input Clock signal	Frequency	f_{CLI}	5.8	6.4	7.0	MHz	
	Hi pulse width	τ_{WH}	20.0	-	-	ns	
	Lo pulse width	τ_{WL}	20.0	-	-	ns	
	Rising edge time	τ_{rCLI}	-	-	10.0	ns	
	Falling edge time	τ_{fCLI}	-	-	10.0	ns	
Input Horizontal synchronize signal	Frequency	f_{HI}	f_{CLI} / 430	f_{CLI} / 406	f_{CLI} / 396	Hz	
	Pulse width	τ_{HI}	1.0	5.0	9.0	µs	
	Rising edge time	τ_{rHI}	-	-	0.05	µs	
	Falling edge time	τ_{fHI}	-	-	0.05	µs	
Input Vertical Synchronize signal	Frequency	f_{VI}	50	f_{HI} / 262	f_{HI} / 258	Hz	
	Pulse width	$\tau_{VI\ (P)}$	1H	3H	5H		
	Rising edge time	τ_{rVI2}	-	-	0.5	µs	
	Falling edge time	τ_{fVI2}	-	-	0.5	µs	
Data set up time		t_{SU1}	25	-	-	ns	
Data hold time		t_{HO1}	25	-	-	ns	
Data set up time		t_{SU2}	1.0	-	-	µs	
Data hold time		t_{HO2}	1.0	-	-	µs	

7-6) Display Time Range

Composite sync. & sync. separate mode
The Both two timing can adjust with H-position

A) When sync. signal of NTSC system is applied.
   a) Horizontally
      11.35 ~ 61.36µs.
   b) Vertical
      22 ~ 255 H

B) When sync. signal of PAL system is applied.
   a) Horizontally
      11.54 ~ 61.9µs .
   b) Vertical
      30 ~ 302 H

c) Odd field : Scan lines 14n+7 14n+13 (n=2,3,4…) are not displayed.
Even field : Scan lines 14n+4 14n+10 (n=2,3,4…) are not displayed.

External clock mode (CKC = " LOW ")

d) Horizontally direction

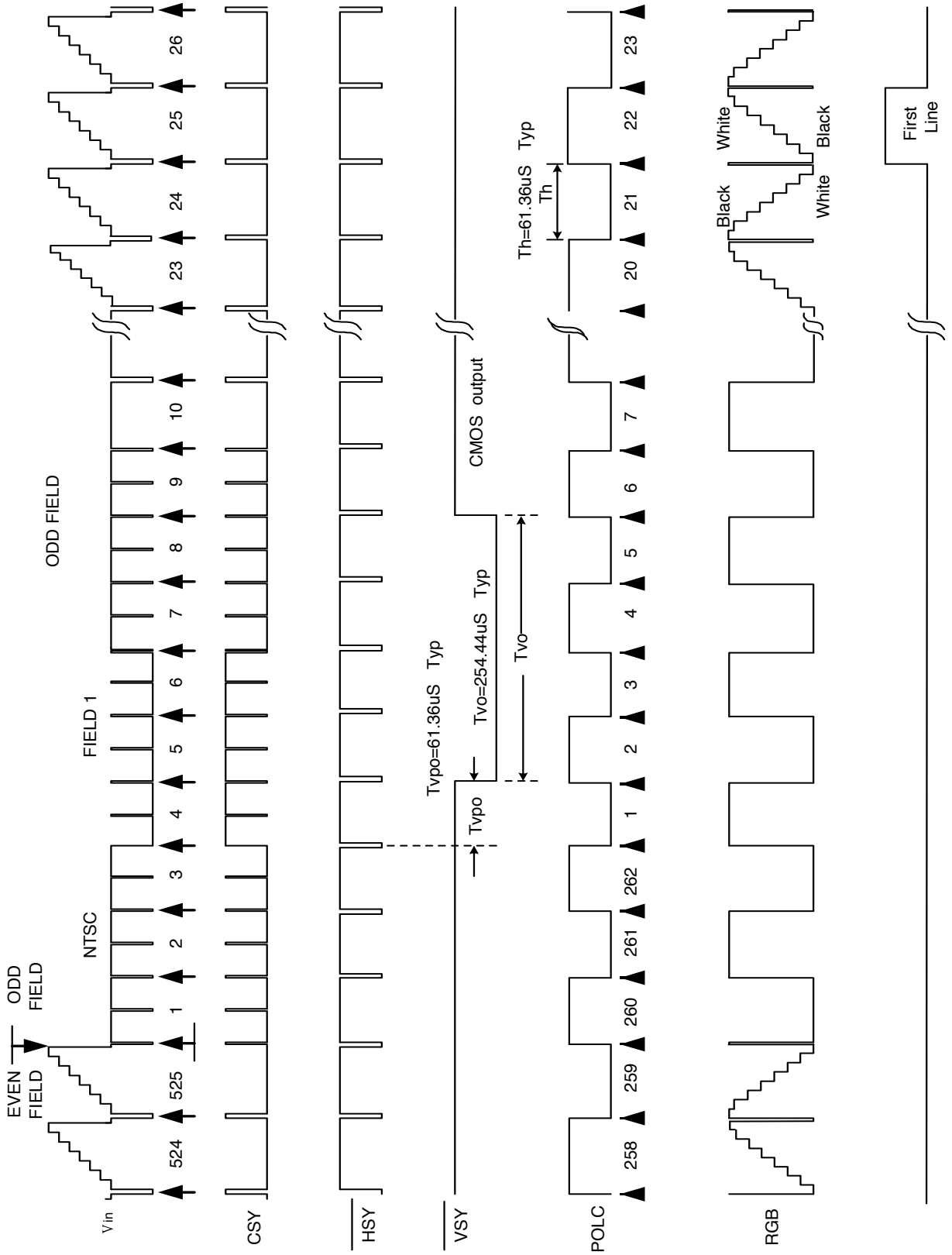
69 ~ 388 CLK from the falling edge of $\overline{\text{HSY}}$

CLK means input external clock. (6.4MHz TYP.)

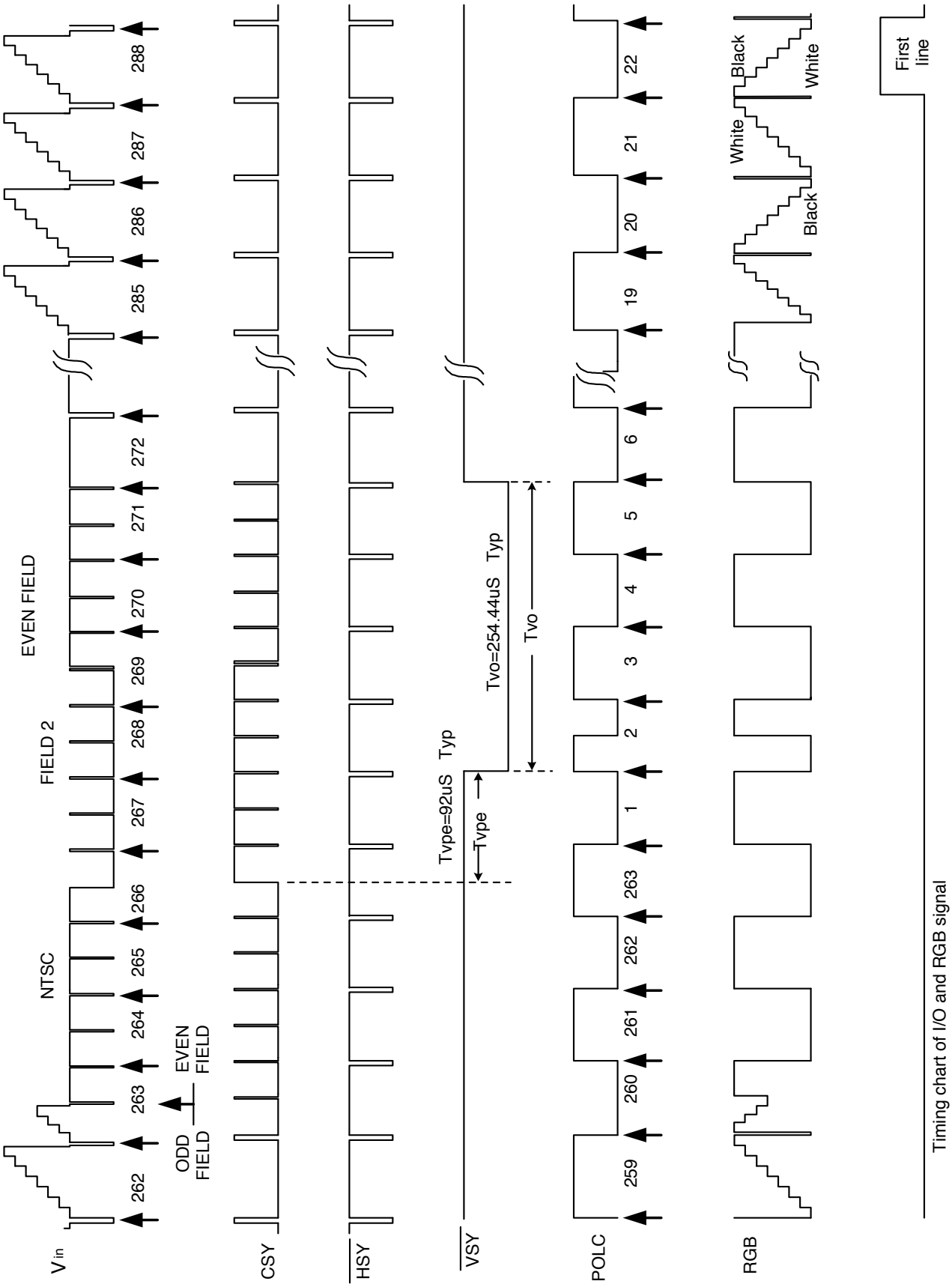
e) Vertical direction

22 ~ 255 H from the falling edge of $\overline{\text{VSY}}$

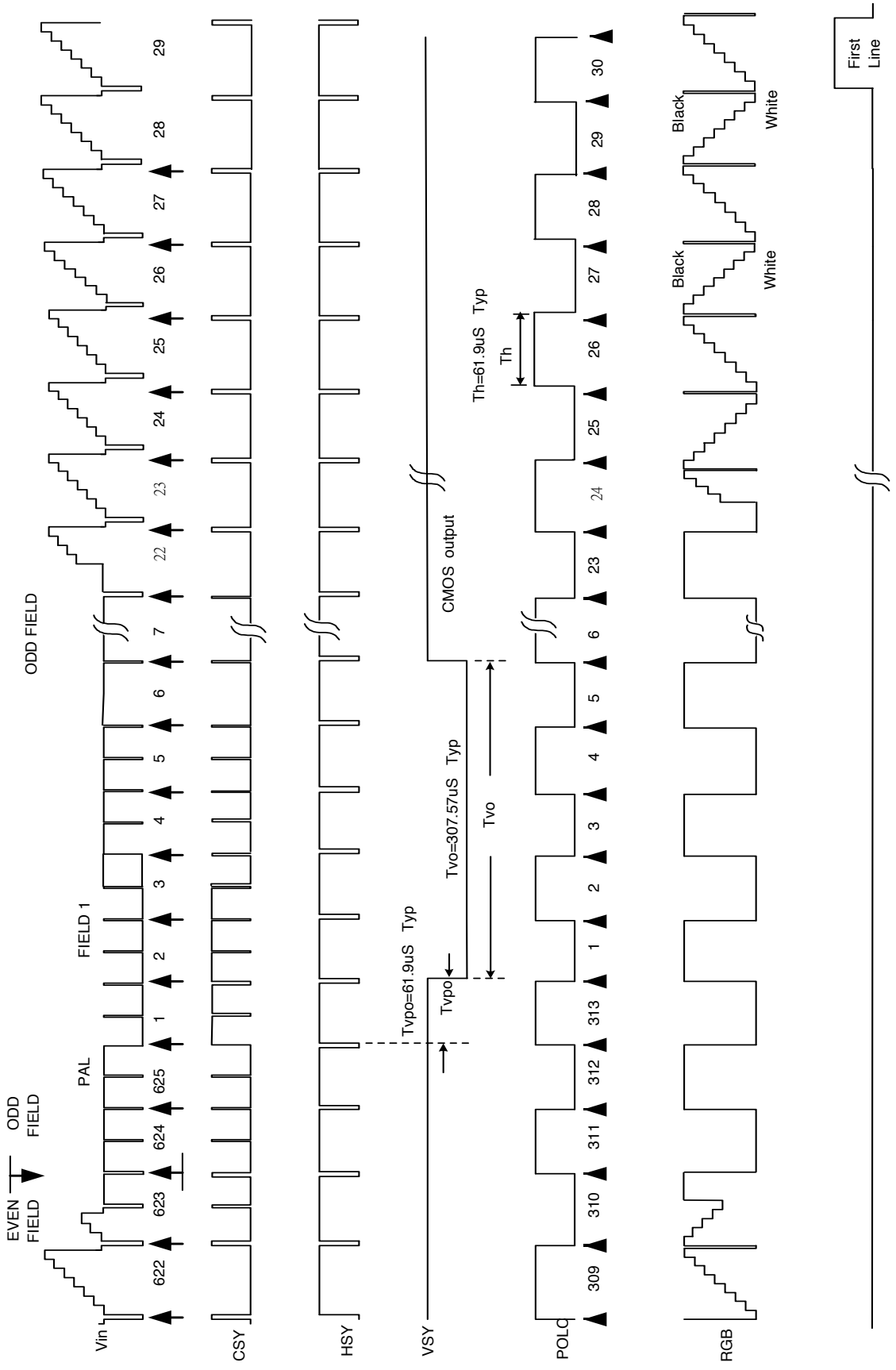
C) NTSC System (Composite sync. mode)

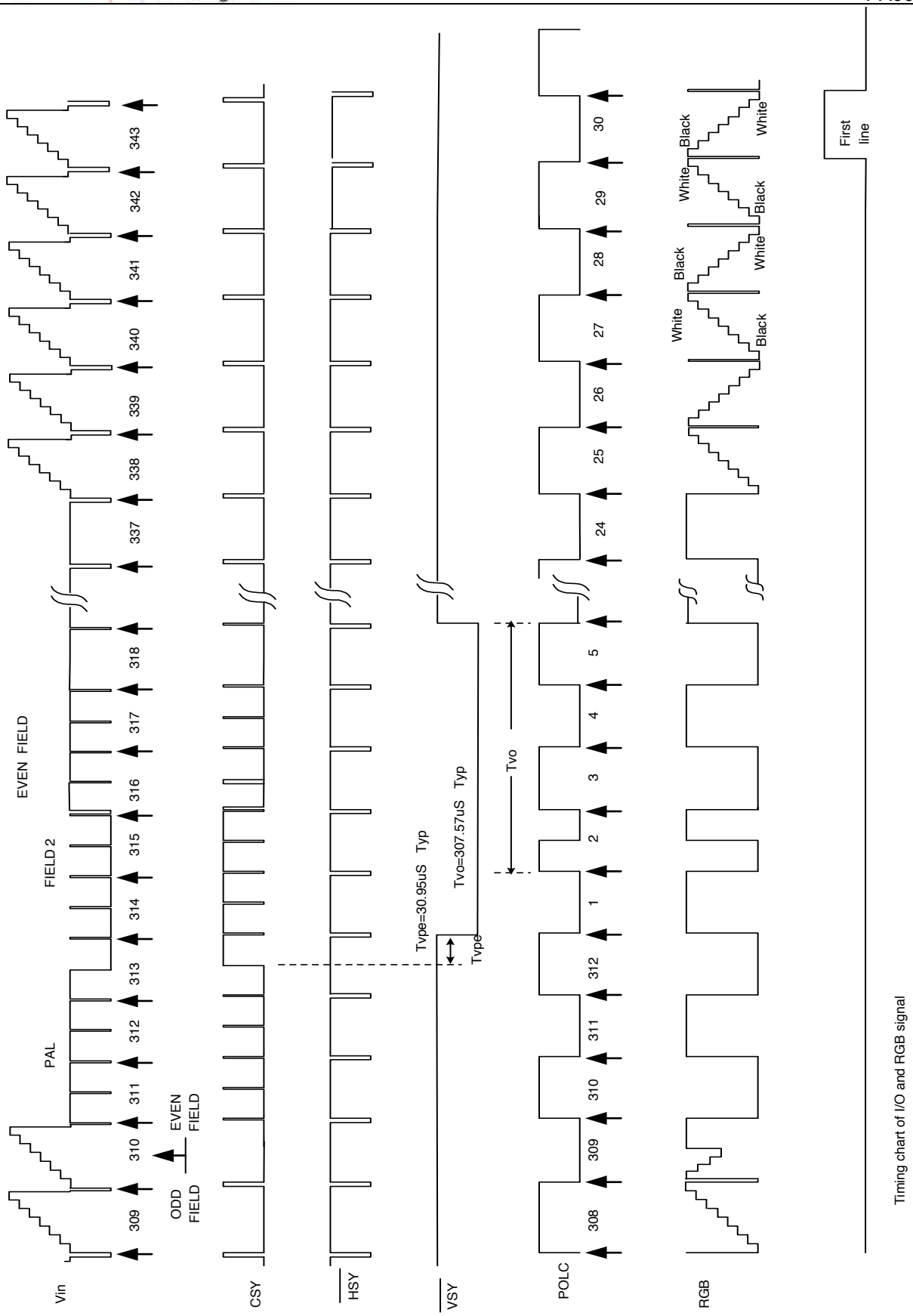


Timing chart of I/O and RGB signal



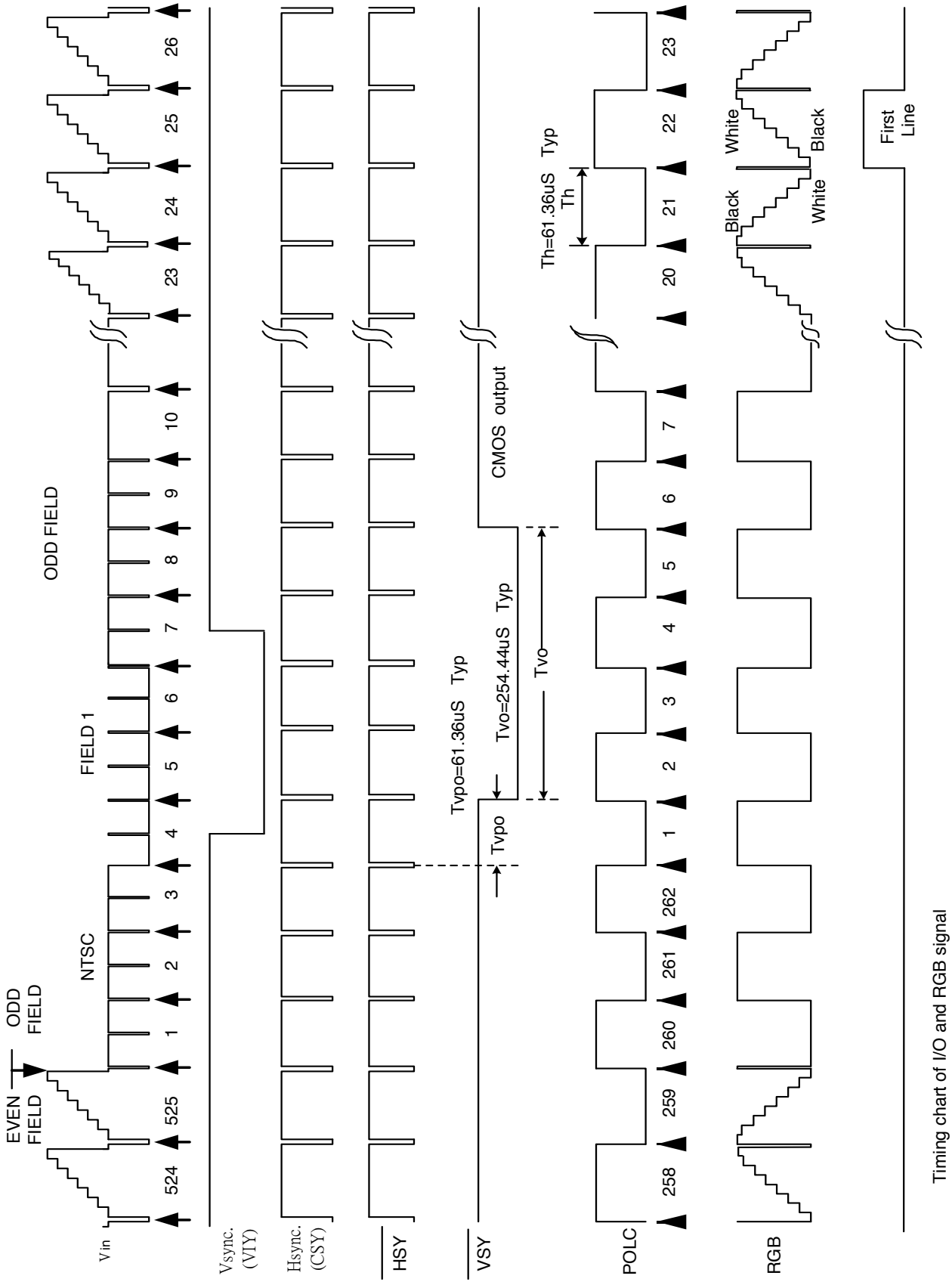
D) PAL System (Composite sync. mode)

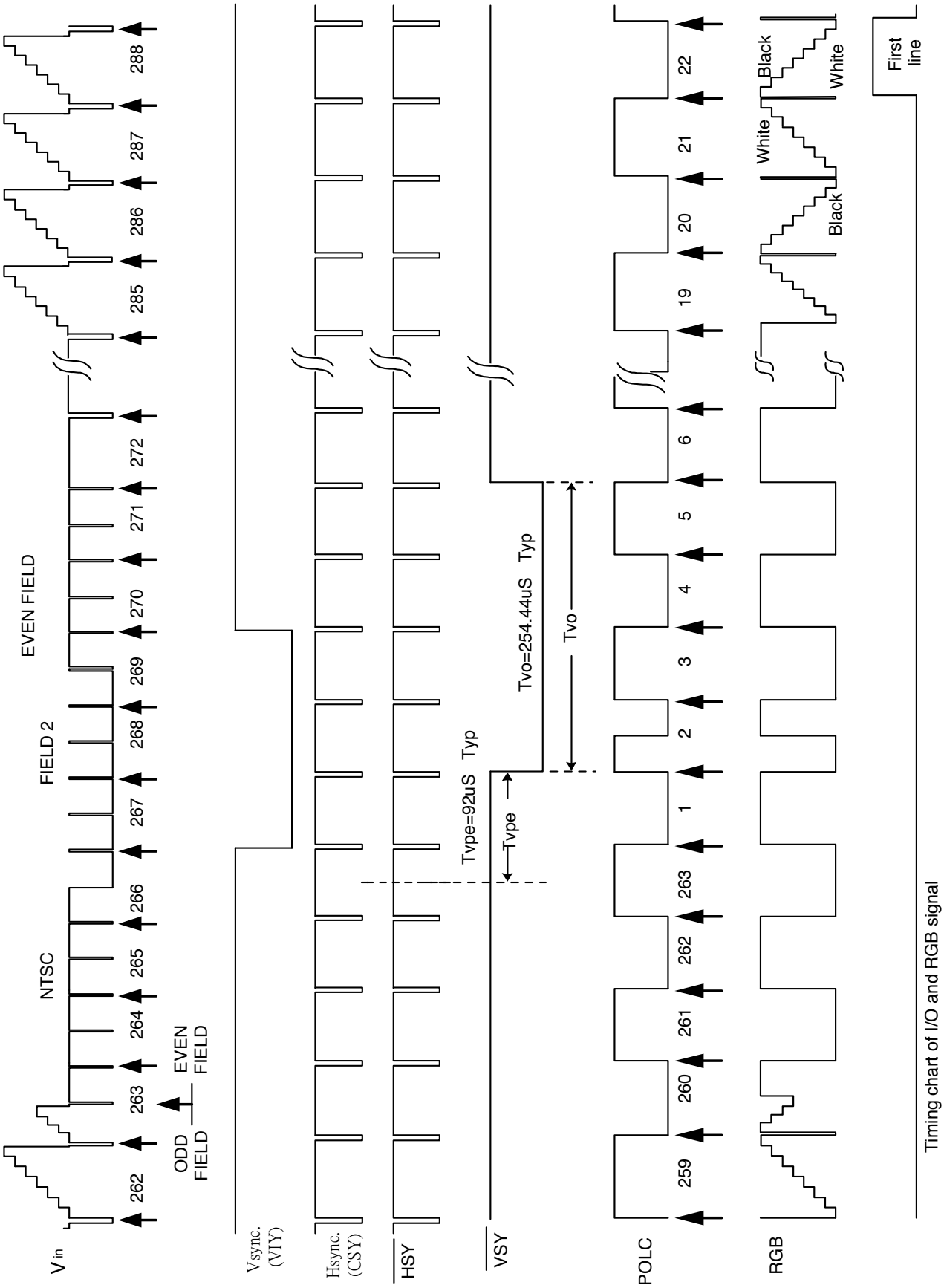




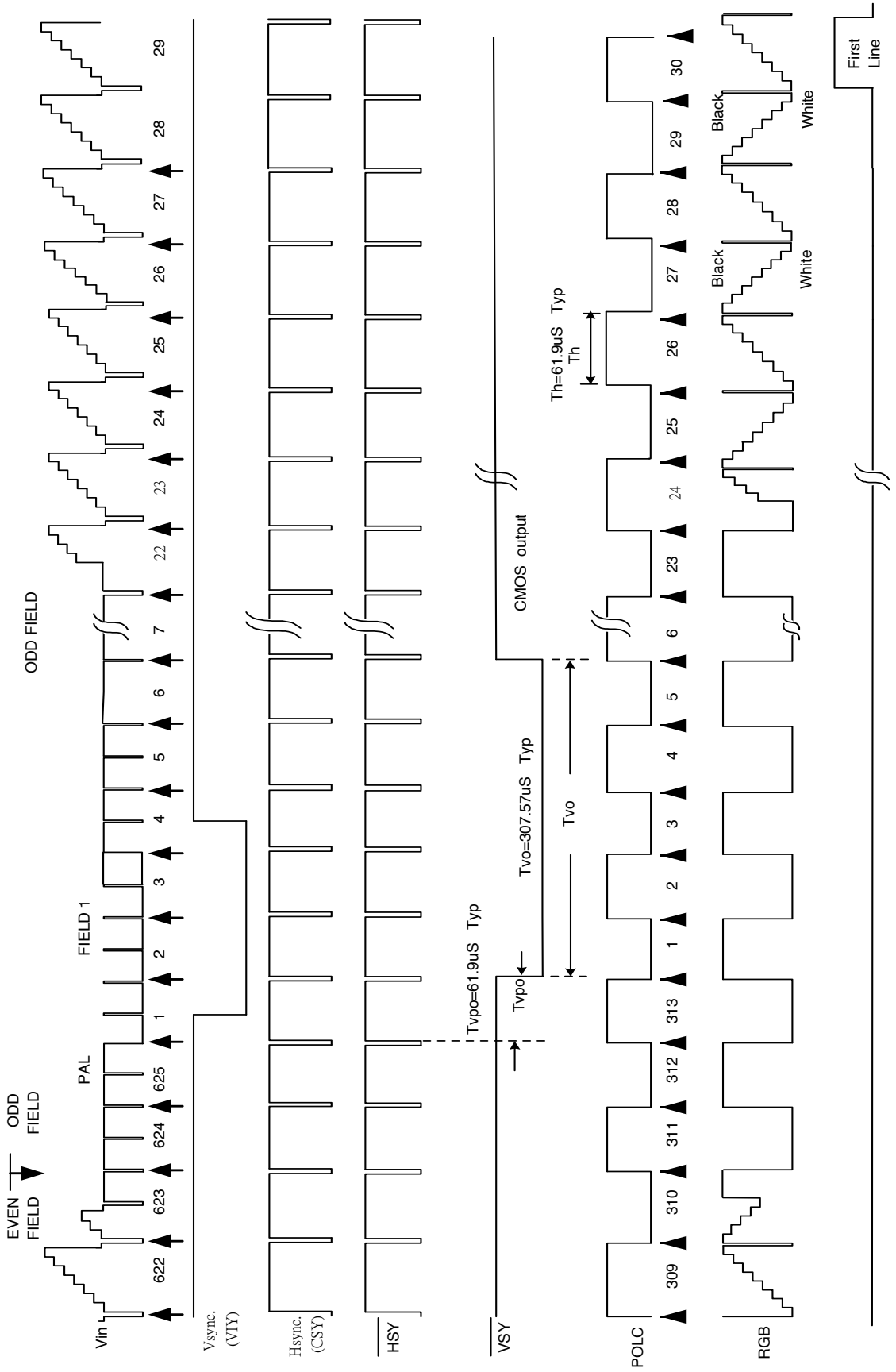
Timing chart of I/O and RGB signal

E) NTSC System (Sync. separate mode)

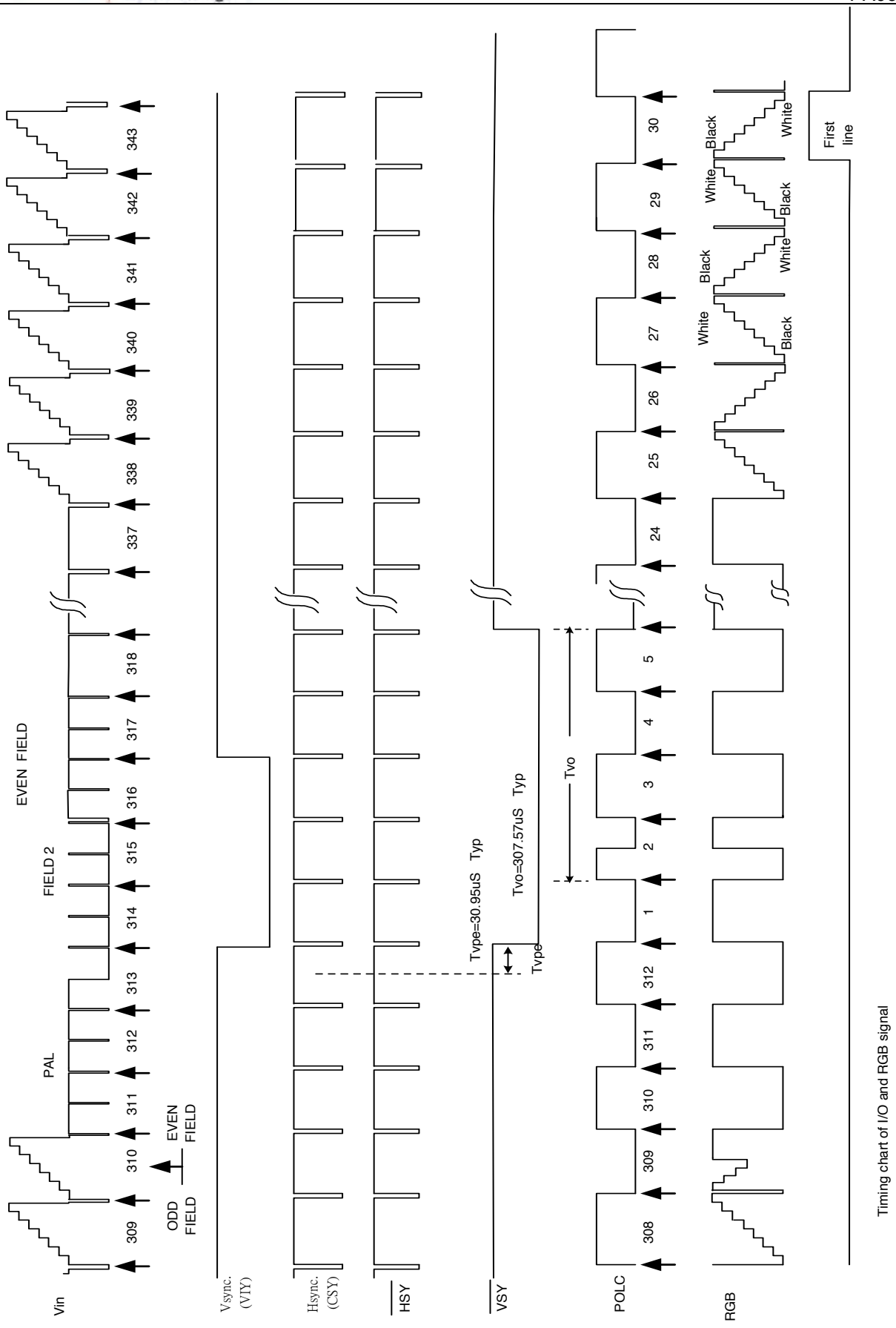




F) PAL System (Sync. separate mode)

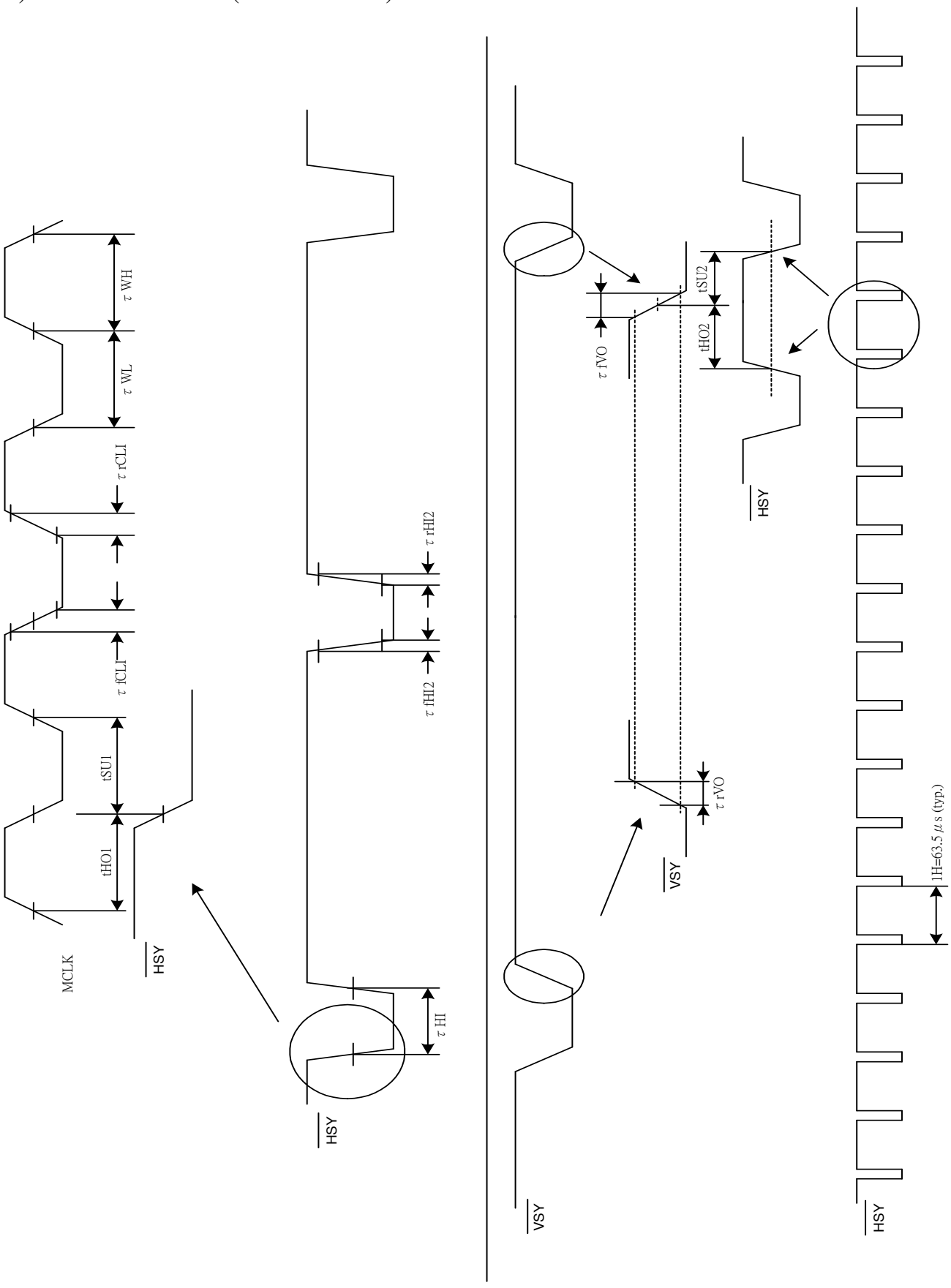


Timing chart of I/O and RGB signal



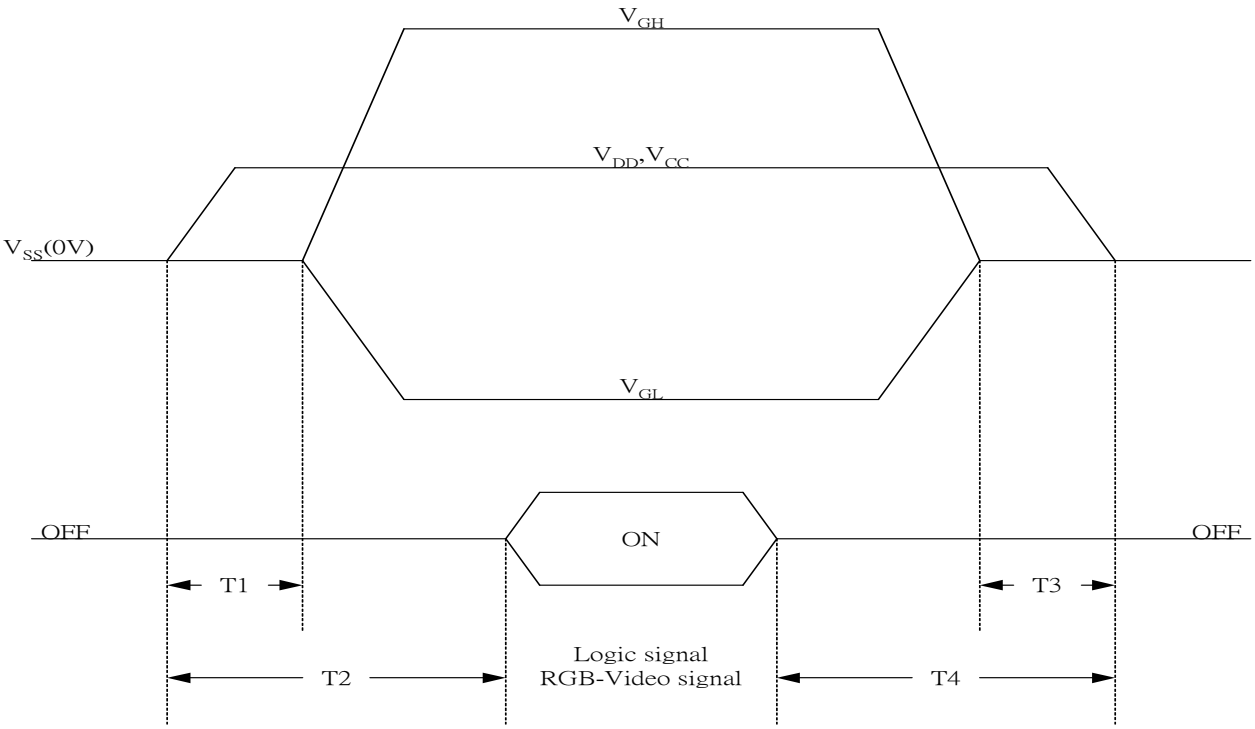
Timing chart of I/O and RGB signal

G) External clock mode (CKC = “LOW”)



8. Power on/off Sequence(Voltage source)

The Power on/off Sequence only effect by V_{CC},V_{SS},V_{DD},V_{GL} and $V_{GH,}$ the others do not care.



1) 10ms≦T1<T2
2) 0ms<T3≦T4≦10ms

9. Optical Characteristics

9-1) Specification

Ta = 25℃

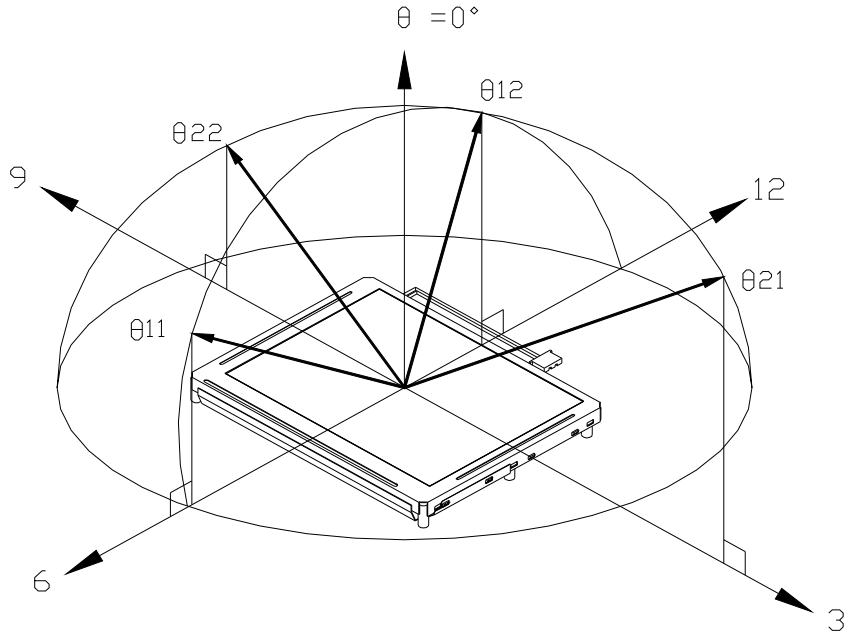
Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle	Horizontal	θ21 , θ22	CR≧10	±60	±70	-	deg	Note 9-3
	Vertical	θ12 (to 12 o'clock)		40	50	-	deg	
		θ11 (to 6 o'clock)		45	55	-	deg	
Contrast Ratio		CR	At optimized Viewing angle	400	600	-		Note 9-1
Response time	Rise	Tr	θ=0°	-	15	30	ms	Note 9-4
	Fall	Tf		-	25	50	ms	
Uniformity		U		75	80	-	%	Note 9-5
Brightness				300	400		cd/㎡	Note 9-2
White Chromaticity		X	θ=0°	0.26	0.3	0.34		Note 9-2
		Y		0.27	0.31	0.35		
LED Life Time	+25℃			20000	30000	-	hr	Note 9-6

Note 9-1 : CR = $\frac{\text{Luminance when LCD is White}}{\text{Luminance when LCD is Black}}$

Contrast Ratio is measured in optimum common electrode voltage.
The test configurations of contrast ratio see section 9-2.

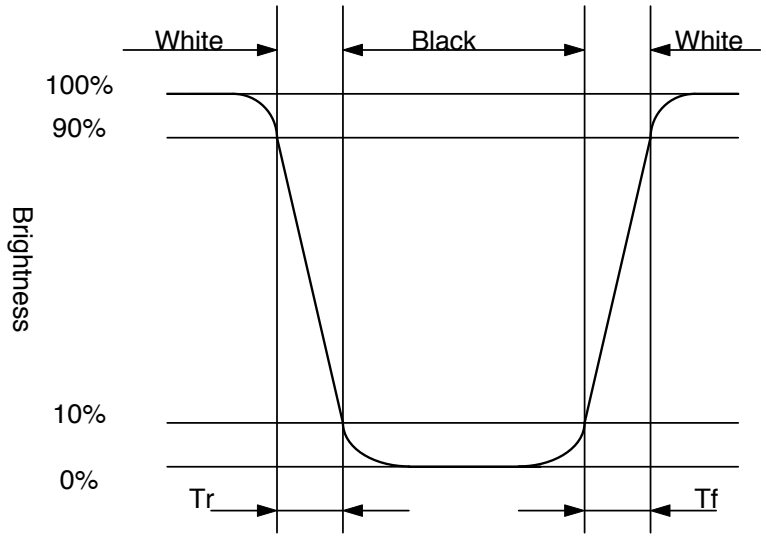
Note 9-2 : 1.Topcon BM-7(fast) luminance meter 1.0° field of view is used in the testing (after 20~30 minutes operation).
2.LED current : 120 mA

Note 9-3 : The definition of viewing angle diagram



* θ 11(to 6 o'clock) Gray scale inversion direction

Note 9-4 : The definitions of response time

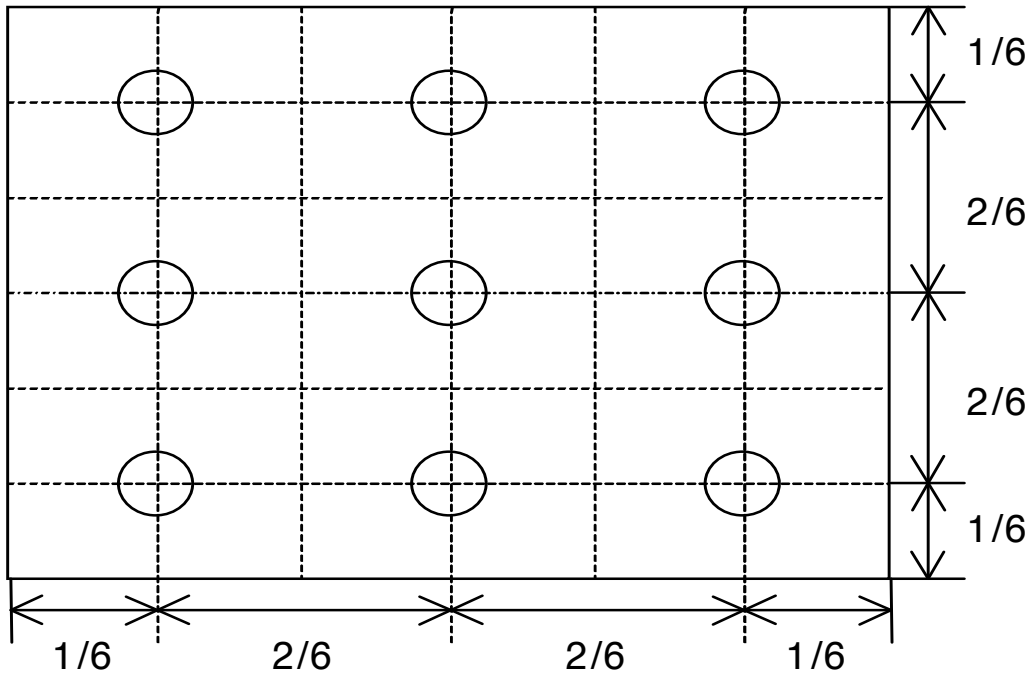


Note 9-5 : The uniformity of LCD is defined as

$$U = \frac{\text{The Minimum Brightness of the 9 testing Points}}{\text{The Maximum Brightness of the 9 testing Points}}$$

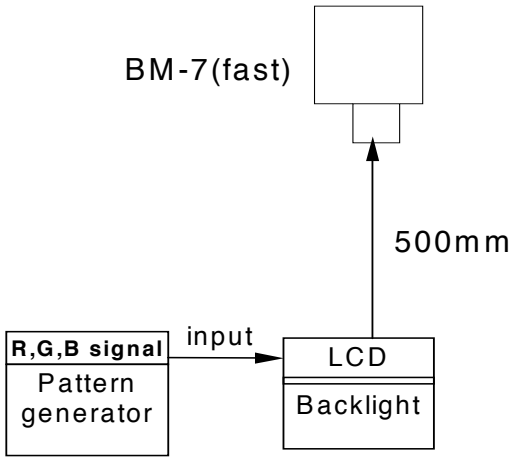
Luminance meter : BM-5A or BM-7 fast (TOPCON)
Measurement distance : 500 mm +/- 50 mm
Ambient illumination : < 1 Lux
Measuring direction : Perpendicular to the surface of module

The test pattern is white



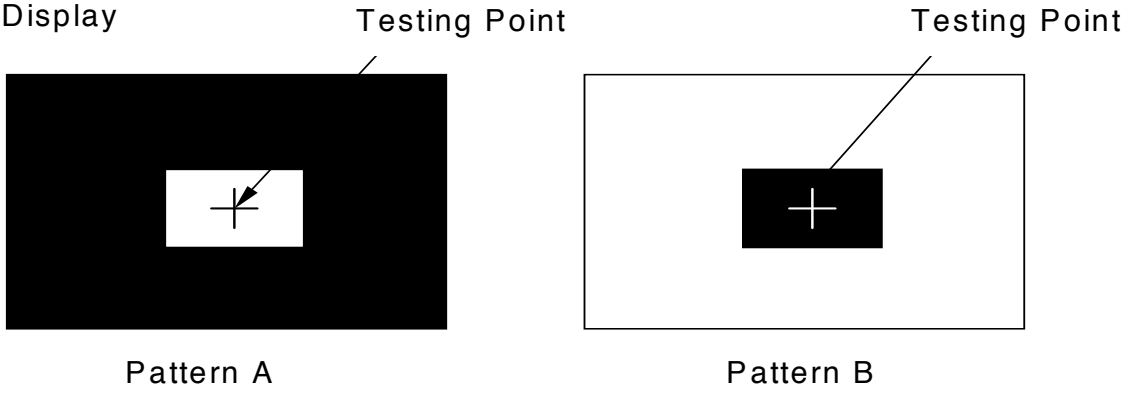
Note 9-6：The “LED Life time” is defined as the module brightness decrease to 50% original Brightness that the ambient temperature is 25°C and I_{LED} =120mA.As the performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature. Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

9-2) Test Configuration



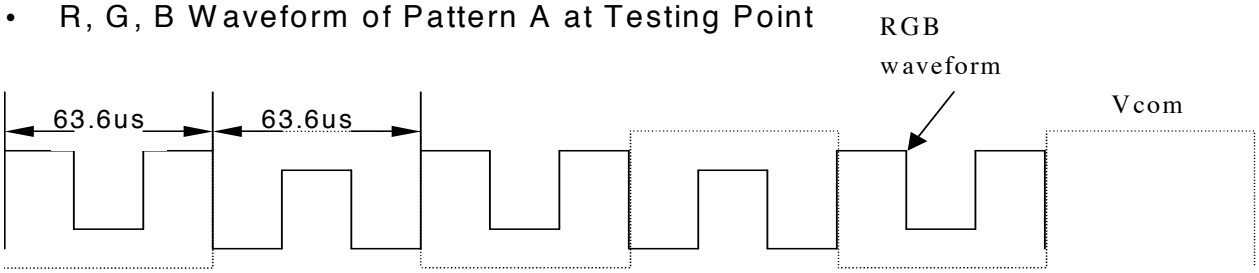
Caution: 1. Environmental illumination ≦ 1 lux
2. Before test CR, Vcom voltage must be adjusted carefully to get the best CR.

- LCD Display

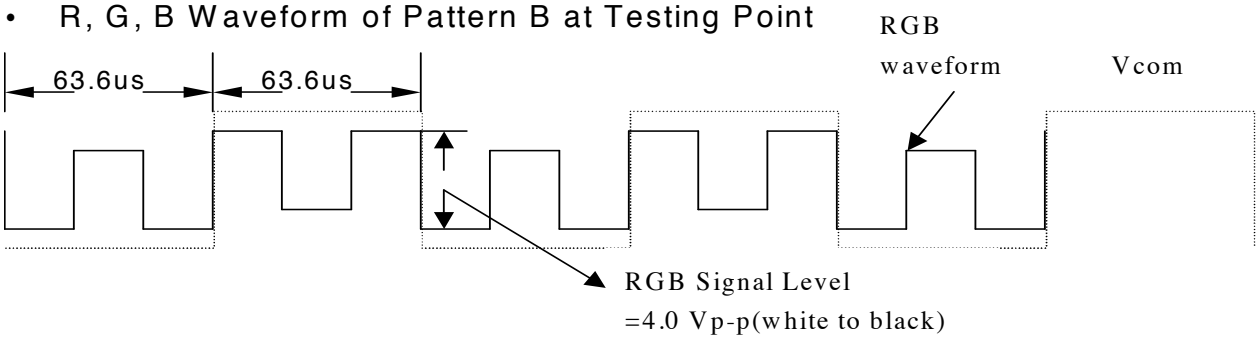


Pattern A Pattern B

- R, G, B Waveform of Pattern A at Testing Point



- R, G, B Waveform of Pattern B at Testing Point



10. Handling Cautions

10-1) Mounting of module

a) Please power off the module when you connect the input/output connector.

b) Polarizer which is made of soft material and susceptible to flaw must be handled carefully.

c) Protective film (Laminator) is applied on surface to protect it against scratches and dirt.

d)Please following the tear off direction as figure10-1 to remove the protective film as slowly as possible, so that electrostatic charge can be minimized.

10-2) Precautions in mounting

a) When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth.

b) Wipe off water drops or finger grease immediately. Long contact with water may cause discoloration or spots.

c) TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Please handle with care.

d) Since CMOS LSI is used in the module. So take care of static electricity and earth yourself when handling.

10-3) Adjusting module

a) Adjusting volumes on the rear face of the module have been set optimally before shipment.

b) Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described may not be satisfied.

10-4) Others

a) Do not expose the module to direct sunlight or intensive ultraviolet rays for many Hours.

b) Store the module at a room temperature place.

c) The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.

d) If LCD panel breaks, it is possibly that the liquid crystal escapes from the panel. Avoid putting it into eyes or mouth. When liquid crystal sticks on hands, clothes or feet. Wash it out immediately with soap.

e) Observe all other precautionary requirements in handling general electronic components.

f) Please adjust the voltage of common electrode as material of attachment by 1 module.

10-5) Polarizer mark

The polarizer mark is to describe the direction of wide view angle film how to mach up with the rubbing direction.

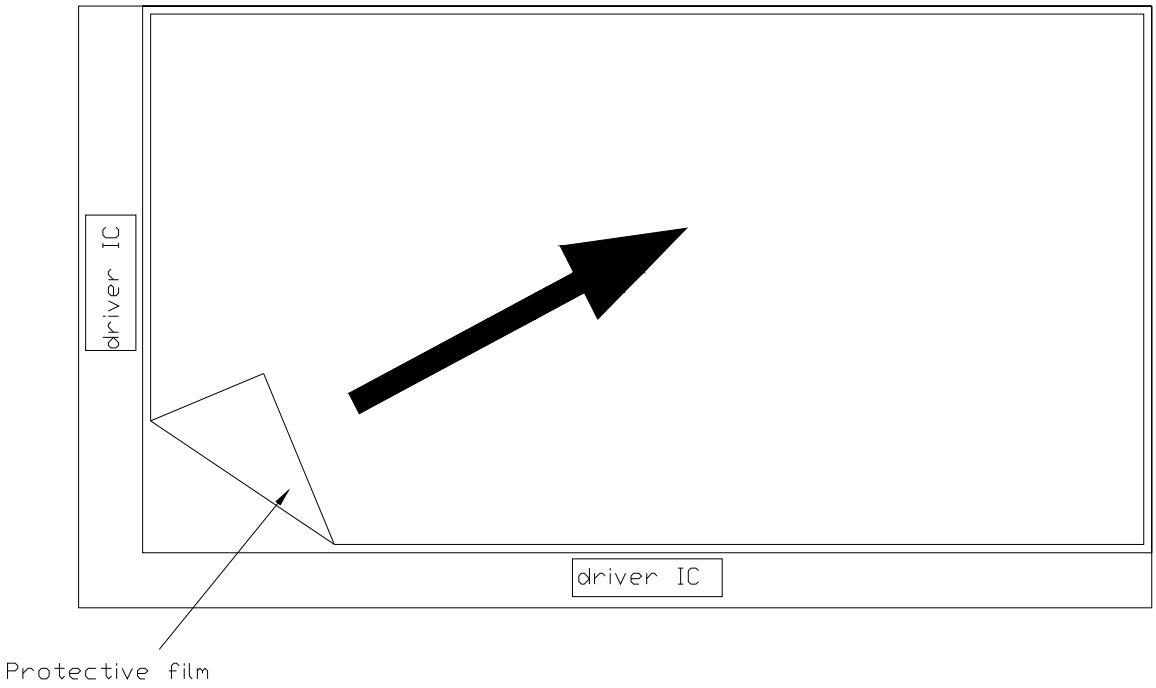


Figure 10-1 the way to peel off protective film

11. Reliability

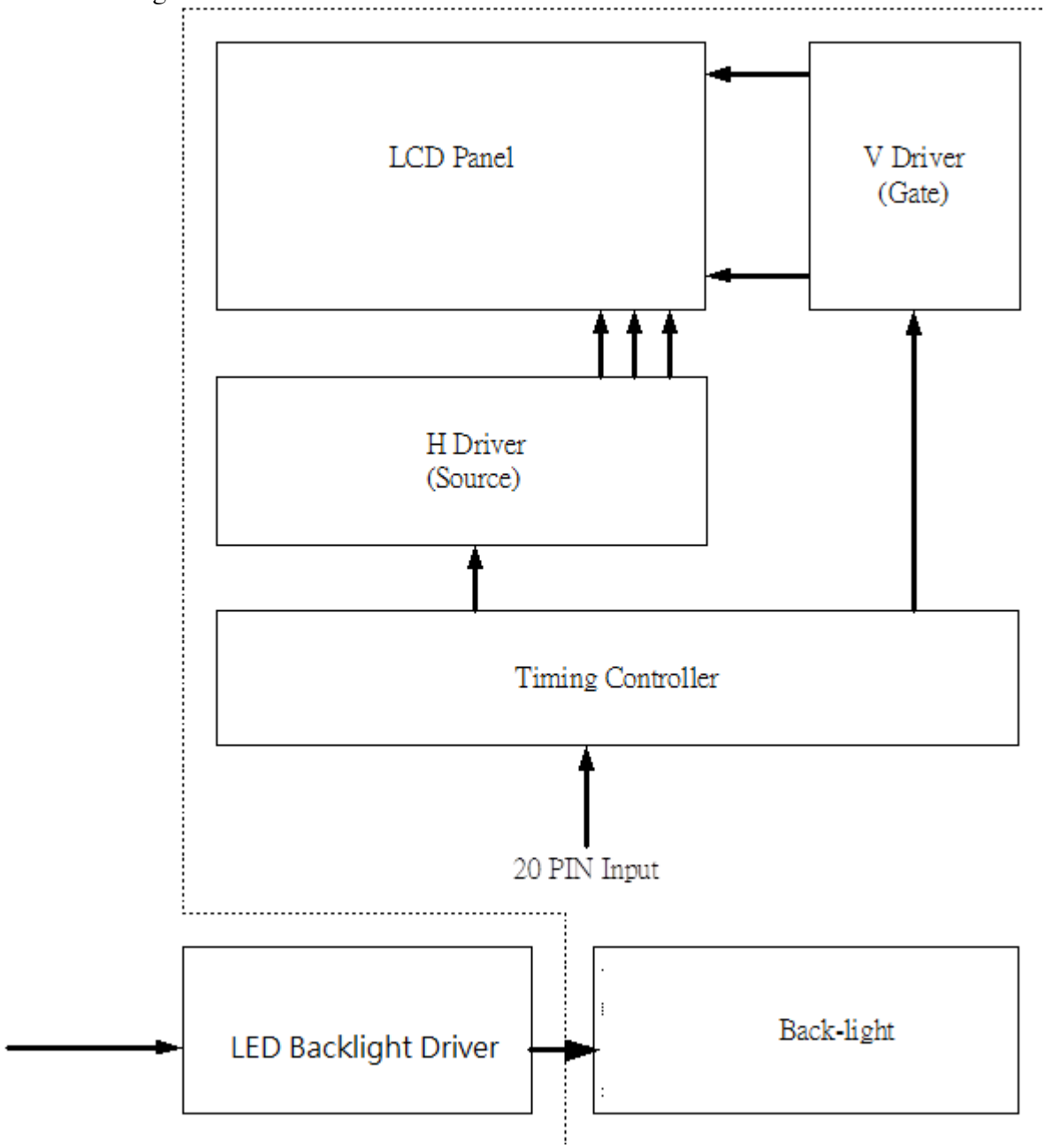
No.	Test Item	Test Condition
1	High Temperature Storage Test	Ta = +80℃, 240 hrs
2	Low Temperature Storage Test	Ta = -30℃, 240 hrs
3	High Temperature Operation Test	Ta = +70℃, 240 hrs
4	Low Temperature Operation Test	Ta = -20℃, 240 hrs
5	High Temperature & High Humidity Operation Test	Ta = +60℃ , 80%RH , 240 hrs
6	Thermal Cycling Test (non-operating)	-25℃ → +25℃→ +70℃, 200 Cycles 30 min 5min 30 min
7	Vibration Test (non-operating)	Frequency : 10 ~ 55 H_Z Amplitude : 1.5 mm Sweep time : 11 mins Test Period : 6 Cycles for each direction of X, Y, Z
8	Shock Test (non-operating)	100G, 6ms Direction: ±X, ±Y, ±Z Cycle: 3 times
9	Electrostatic Discharge Test (non-operating)	150pF, 330Ω Air : ±15KV ; Contact : ±8KV 10 times/point , 9 points/panel face

Ta: ambient temperature

Note : The protective film must be removed before temperature test.

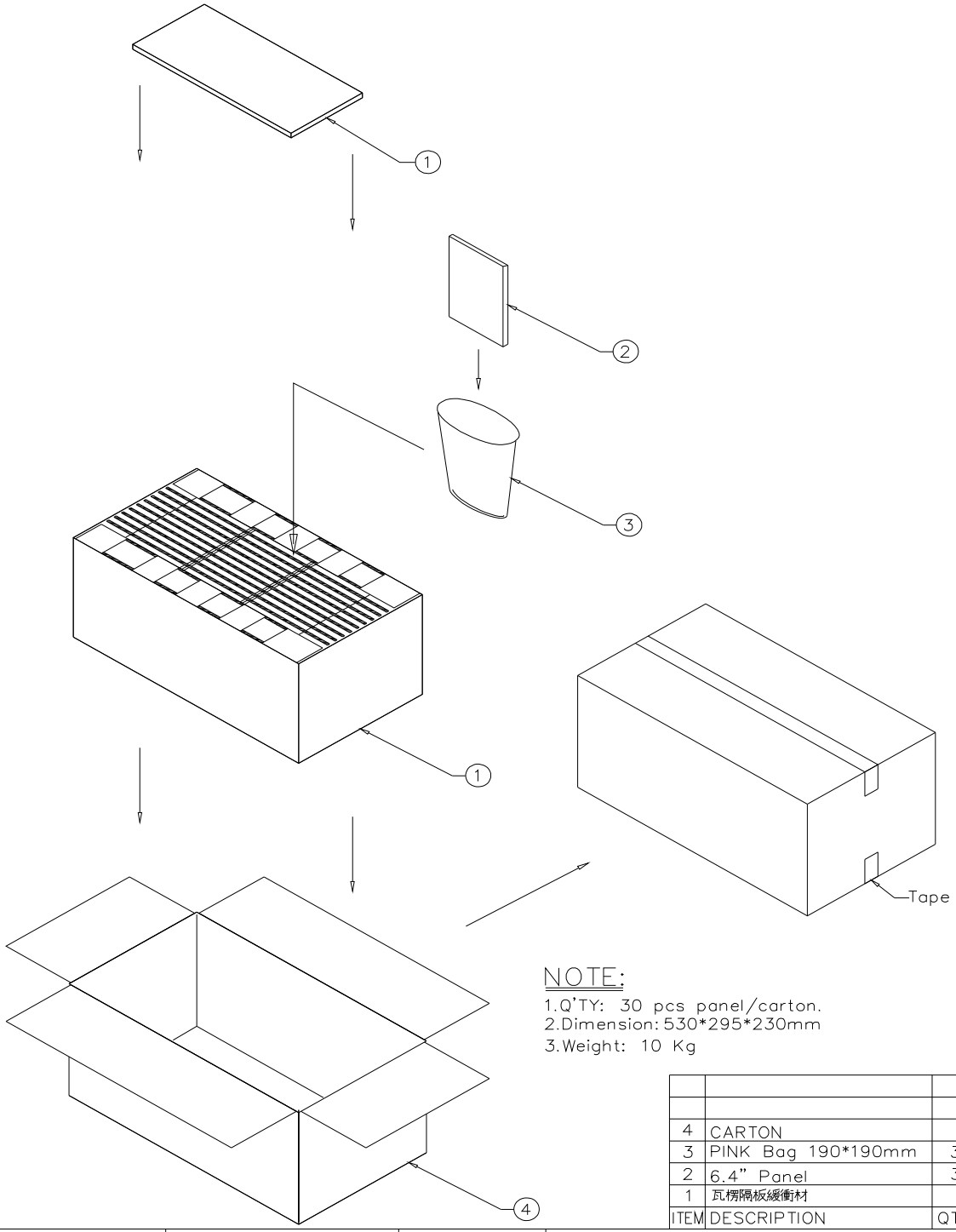
[Criteria]
In the standard conditions, there is not display function NG issue occurred. (including : line defect ,no image). All the cosmetic specification is judged before the reliability stress.

12. Block Diagram



13. Packing

ZONE	REV.	DOCUUMENT NO.	DESCRIPTION	DATE	REV.BY



NOTE:
1.Q'TY: 30 pcs panel/carton.
2.Dimension: 530*295*230mm
3.Weight: 10 Kg

ITEM	DESCRIPTION	QTY	REMARK
4	CARTON	1	
3	PINK Bag 190*190mm	30	抗靜電
2	6.4" Panel	30	
1	瓦楞隔板緩衝材	1	上蓋+ 底座

MTL.SPEC.	UNSPECIFIED TOL'S ANGLE ROUGHNESS	REMARK	E Ink 元太科技工業股份有限公司 E Ink Holdings Inc.

APPROVE	PATRICK LIN	'11.11.23	SCALE	UNIT	SHEET 1 OF 1	DWG.TITLE: PA064DS5 Packing Draw
CHECK	PATRICK LIN	'11.11.23				
DRAWN	Michael	'11.11.23	MTL.NO.	DWG FILE:	REV. 01	A4 SIZE