Version : 0.3

TECHNICAL SPECIFICATION

MODEL NO : PD035QU2

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Please contact PVI or its agent for further information.

☐Customer's Confirmation

Customer

Date

By

☐PVI's Confirmation

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Revision History

Rev.	Issued Date	Revised Contents
0.1	Sep.15.2008	Preliminary
0.2	Sep.19.2008	Modify Page5: 4.Mechanical Drawing of TFT-LCD Module
0.3	Sep.30.2008	Modify Page 9 7-2) Recommended Driving Condition for Back Light

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TECHNICAL SPECIFICATION

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1. Application

This data sheet applies to a color TFT LCD module,PD035QU2.This module applies to OA product, which requires high quality flat panel display. If you must use in severe reliability environments, please don't extend over PVI's reliability test conditions.

2. Features

. Amorphous silicon TFT LCD panel with LED back-light unit

. Pixel in stripe configuration

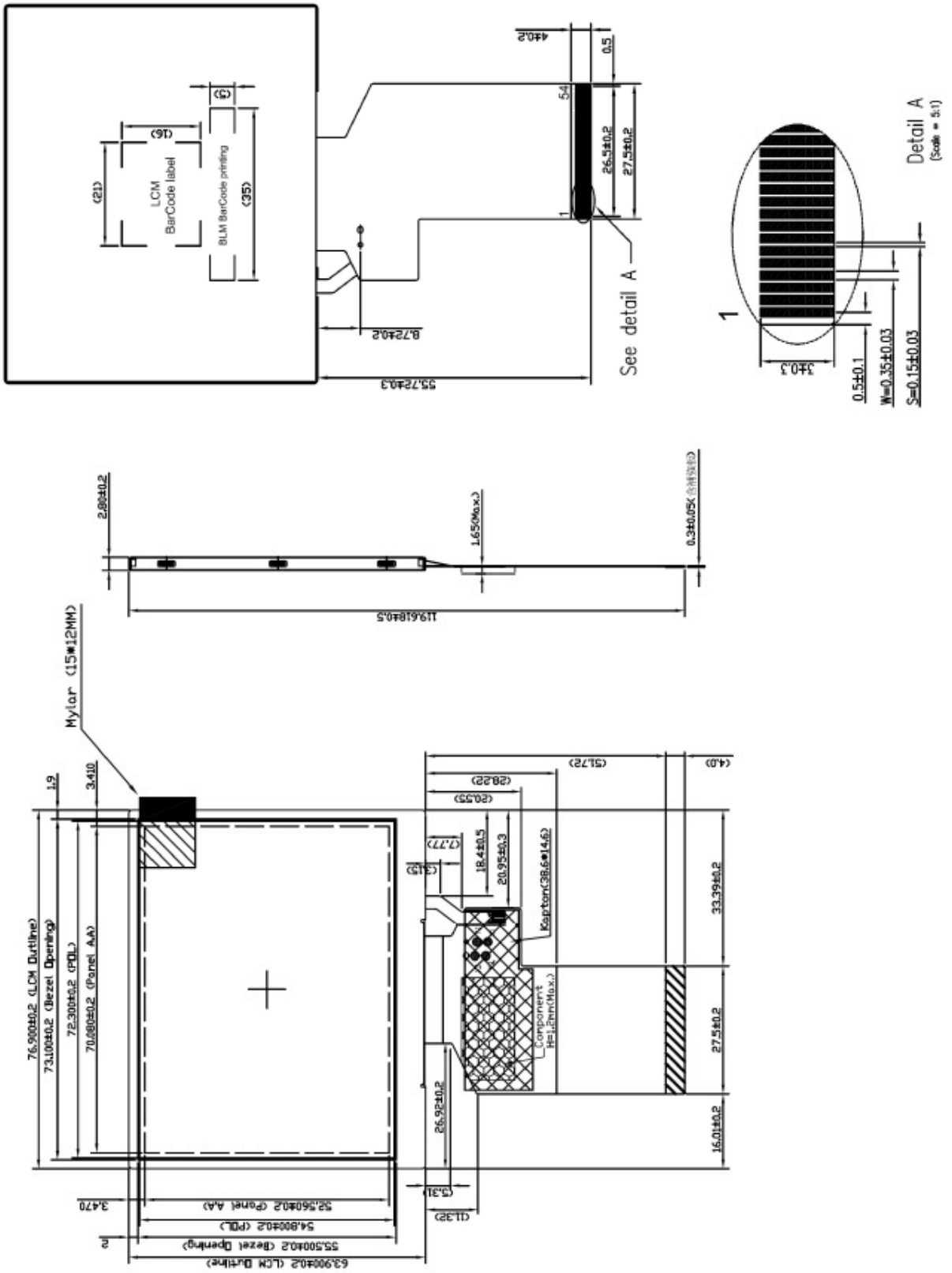
. Slim and compact, designed for O/A application

3. Mechanical Specifications

Parameter	Specifications	Unit
Screen Size	3.45 (diagonal)	inch
Display Format	320×(RGB)×240	dot
Active Area	70.08(H)×52.56(V)	mm
Pixel Pitch	0.073(H)×0.219(V)	mm
Pixel Configuration	Stripe	
Display Colors	16.7M	
Surface Treatment	Haze 20%	
Back-light	6-LEDs	
Outline Dimension	76.9(W)×63.9 (H)×2.8 (D)(typ.)	mm
Weight	(31)	g
Display mode	Normally white	
Gray scale inversion direction	6 (ref to Note 14-1)	o'clock

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4. Mechanical Drawing of TFT-LCD Module



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5. Input / Output Terminals

5-1) TFT-LCD Panel Driving

Pin No.	Symbol	Function	Remark
1	VBL-	Backlight LED Ground	
2	VBL-	Backlight LED Ground	
3	VBL+	Backlight LED Power	
4	VBL+	Backlight LED Power	
5	Y1	Top electrode	
6	X1	Right electrode	
7	NC	Note Use	
8	/RESET	Hardware Reset	
9	SPENA	SPI Interface Data Enable Signal	Note 5-3
10	SPCLK	SPI Interface Data Clock	Note 5-3
11	SPDAT	SPI interface Data	Note 5-3
12	B0	Blue Data Bit 0	
13	B1	Blue Data Bit 1	
14	B2	Blue Data Bit 2	
15	B3	Blue Data Bit 3	
16	B4	Blue Data Bit 4	
17	B5	Blue Data Bit 5	
18	B6	Blue Data Bit 6	
19	B7	Blue Data Bit 7	
20	G0	Green Data Bit0	
21	G1	Green Data Bit 1	
22	G2	Green Data Bit 2	
23	G3	Green Data Bit 3	
24	G4	Green Data Bit 4	
25	G5	Green Data Bit 5	
26	G6	Green Data Bit 6	
27	G7	Green Data Bit 7	
28	R0	Red Data Bit 0 / DX 0	Note 5-4
29	R1	Red Data Bit 1/ DX 1	Note 5-4
30	R2	Red Data Bit 2/ DX 2	Note 5-4
31	R3	Red Data Bit 3/ DX 3	Note 5-4
32	R4	Red Data Bit 4/ DX 4	Note 5-4
33	R5	Red Data Bit 5/ DX 5	Note 5-4
34	R6	Red Data Bit 6/ DX 6	Note 5-4
35	R7	Red Data Bit 7/ DX 7	Note 5-4
36	HSYNC	Horizontal Sync Input	
37	VSYNC	Vertical Sync Input	
38	DCLK	Dot Data Clock	
39	NC	Not Use	
40	NC	Not Use	
41	Vcc	Digital Power	
42	Vcc	Digital Power	
43	Y2	Bottom electrode	
44	X2	Left electrode	
45	NC	Internal test use	
46	NC	Not Use	
47	NC	Internal Test Use	
48	SEL2	Control The Input Data Format / Floating	Note 5-1
49	SEL1	Control The Input Data Format	Note 5-1,5
50	SEL0	Control The Input Data Format	Note 5-1,5

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51	NC	Not Use	
52	DE	Data Enable Input	Note 5-2
53	GND	Ground	
54	GND	Ground	

Note 5-1:The mode control(SEL2) not use, it can't control CCIR601 interface, If not use CCIR601,it can floating.

Note 5-2:For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used. Suggest used SYNC mode.

Note 5-3:Usually pull high.

Note 5-4: IF select serial RGB or CCIR601/656 input mode is selected, only DX0-DX7 used, and the other short to GND, Only selected serial RGB、CCIR601/656 interface, DX BUS will enable, Digital input mode DX0 is LSB is MSB.

Note 5-5:Control the input data format

SEL 2-0: Define the input interface mode.

SEL2	SEL1	SEL0	Format	Operating Frequency
0	0	0	Parallel-RGB data format (only support stripe type color filter)	6.5MHz
0	0	1	Serial-RGB data format	19.5MHz
0	1	0	CCIR 656 data format (640RGB)	24.54MHz
0	1	1	CCIR 656 data format (720RGB)	27MHz
1	0	0	YUV mode A data format (Cr-Y-Cb-Y)	24.54MHz
1	0	1	YUV mode A data format (Cr-Y-Cb-Y)	27MHz
1	1	0	YUV mode B data format (Cb-Y-Cr-Y)	27MHz
1	1	1	YUV mode B data format (Cb-Y-Cr-Y)	24.54MHz

Input format	DOTCLK Freq (MHz)	Display Data	Active Area (DOTCLK)
YUV mode	24.54	640	1280
	27	720	1440

Mode	D[23:16]	D[15:8]	D[7:0]	IHS	IVS	DEN
ITU-R BT 656	D[23:16]	GND	GND	NC	NC	NC
ITU-R BT 601	D[23:16]	GND	GND	IHS	IVS	NC
8 bit RGB	D[23:16]	GND	GND	IHS	IVS	NC for HV Mode DEN for DEN Mode
24 bit RGB	R[7:0]	G[7:0]	B[7:0]	IHS	IVS	NC for HV Mode DEN for DEN Mode

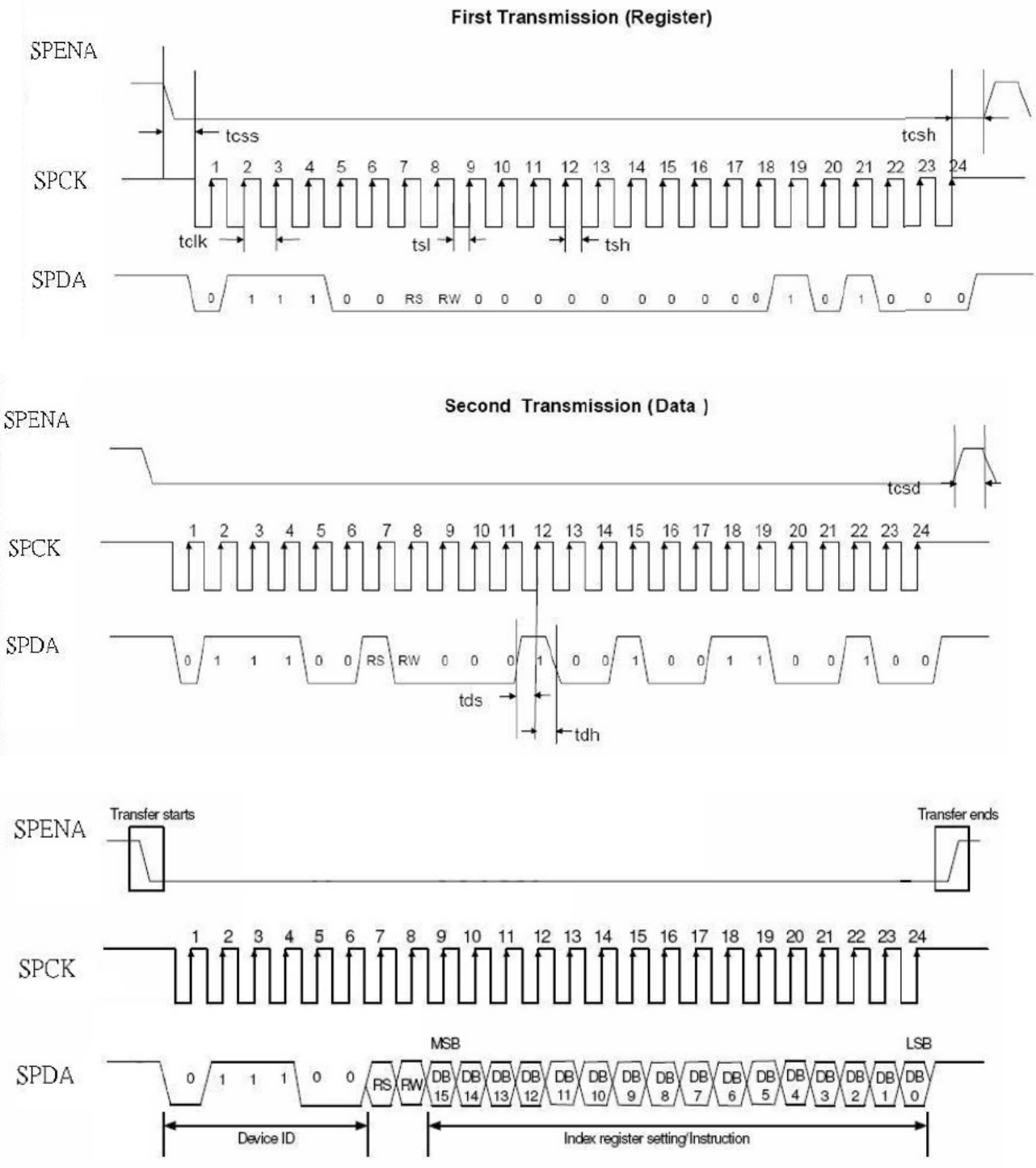
SPI timing Characteristics

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
SPCK period	T_{CK}	60	-	-	ns
SPCK high width	T_{CKH}	30	-	-	ns
SPCK low width	T_{CKL}	30	-	-	ns
Data setup time	T_{SUI}	12	-	-	ns
Data hold time	T_{HDI}	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_{CO}	50	-	-	ns
SPDA output latency	T_{CS}	-	1/2	-	T_{CK}

Reference initial code:

```
Vgh,Vgl:(0x70,0x0003);//VGH=16.3V,VGL=-10.2V
VcomAC: (0x72,0x6164);
VcomDC: (0x70,0x0005);
PWM: (0x72,0xB4D4);//PWM=19.7(B/L)
```

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6. Absolute Maximum Ratings:

GND=0V, Ta=25℃

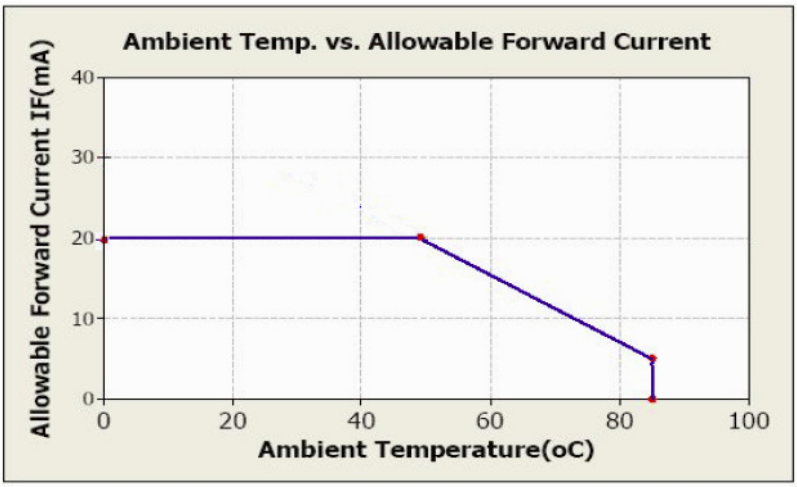
Parameters	Symbol	Condition	Min.	MAX.	Unit	Remark
Power Voltage	DVDD,AVDD	GND=0	-0.3	5.0	V	
Input Signal Voltage	Vin	GND=0	-0.3	VDD+0.3	V	Note 6-1
Logic Output Voltage	Vout	GND=0	-0.3	VDD+0.3	V	Note 6-1

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Note 6-1:Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1.T≦60°C,90% RH Max

T＞60°C, absolute humidity shall be less than 90% RH at 60°C



7. Electrical Characteristics

7-1) Recommended Operating Conditions:

VSSA=GND=0V, Ta=25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Voltage	VCC	3.0	3.3	3.6	V	
Digital Operation Current	Icc	-	8.6	-	V	
Gate On Power	VGH	14	15	18	V	
Gate Off Power	VGL	-11	-10	-8	V	
Vcom High Voltage	VcomH	-	3.7	-	V	Note 7-1
Vcom Low Voltage	VcomL	-	-1.6	-	V	Note 7-1
Vcom Level max	VcomA	-	-	6	V	

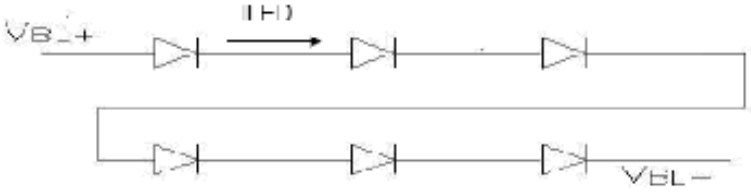
Note 7-1: VcomH & VcomL : Adjust the color with gamma data. Vp-p should be higher then 4V .(Option 5V)

7-2) Recommended Driving Condition for Back Light

Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		-	20	-	mA	
Power Consumption		-	400	420	mW	
LED Voltage	VBL+	18.6	19.8	21	V	Note 7-2

Note 7-2 :There are 1 Groups LED



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8.DC Characteristics

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

9.AC Characteristics

Digital Parallel RGB interface

Signal	Item	Symbol	Min	Typ	Max	Unit
Dclk	Frequency	Tosc	-	156	-	ns
	High Time	Tch	-	78	-	Ns
	Low Time	Tcl	-	78	-	Ns
Data	Setup Time	Tsu	12	-	-	Ns
	Hold Time	Thd	12	-	-	Ns
Hsync	Period	TH	-	408	-	Tosc
	Pulse Width	THS	5	30	-	Tosc
	Back-Porch	Thb	-	38	-	Tosc
	Display Period	TEP	-	320	-	Tosc
	Hsync-den time	THE	36	68	88	Tosc
	Front-Porch	Thf	-	20	-	Tosc
Vsync	Period	Tv	-	262	-	TH
	Pulse Width	Tvs	1	3	5	TH
	Back-Porch	Tvb	-	15	-	TH
	Display Period	Tvd	-	240	-	TH
	Front-porch	Tvf	2	4	-	TH

Note: 1Thp + Thb=68,the user is make up by yourself

2.Tv=Tvs+Tvb+Tvd+Tvf, the user is make up by yourself

3.When SYNC mode is used,1st data start from 68th Dclk after Hsync falling

Digital Serial RGB interface

Signal	Item	Symbol	Min	Typ	Max	Unit
Dclk	Frequency	Tosc	-	52	-	ns
	High Time	Tch	-	78	-	Ns
	Low Time	Tcl	-	78	-	Ns
Data	Setup Time	Tsu	12	-	-	Ns
	Hold Time	Thd	12	-	-	Ns
Hsync	Period	TH	-	1224	-	Tosc
	Pulse Width	THS	5	90	-	Tosc
	Back-Porch	Thb	-	114	-	Tosc
	Display Period	TEP	-	960	-	Tosc
	Hsync-den time	THE	108	204	264	Tosc
	Front-Porch	Thf	-	60	-	Tosc
Vsync	Period	Tv	-	262	-	TH
	Pulse Width	Tvs	1	3	5	TH
	Back-Porch	Tvb	-	15	-	TH
	Display Period	Tvd	-	240	-	TH
	Front-porch	Tvf	2	4	-	TH

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Note: 1Thp + Thb=204,the user is make up by yourself

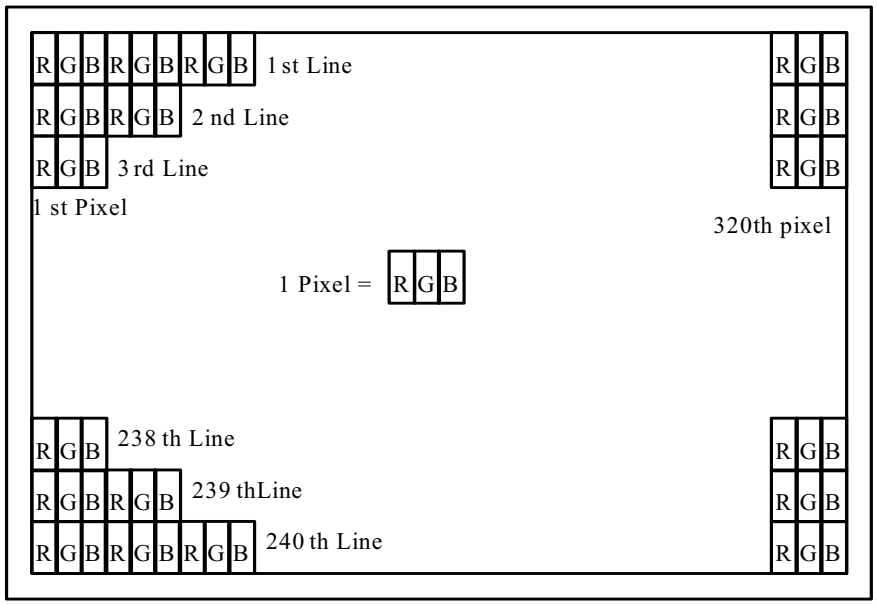
2.Tv=Tvs+Tvb+Tvd+Tvf, the user is make up by yourself

3.When SYNC mode is used,1st data start from 204th Dclk after Hsync falling

CCIR601/656 interface

Signal	Item	Symbol	Min	Typ	Max	Unit
Dclk	Frequency	Tosc	-	37	-	ns
	High Time	Tch	-	78	-	ns
	Low Time	Tcl	-	78	-	ns
Data	Setup Time	Tsu	12	-	-	ns
	Hold Time	Thd	12	-	-	ns

10. Pixel Arrangement



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11. Display Color and Gray Scale Reference

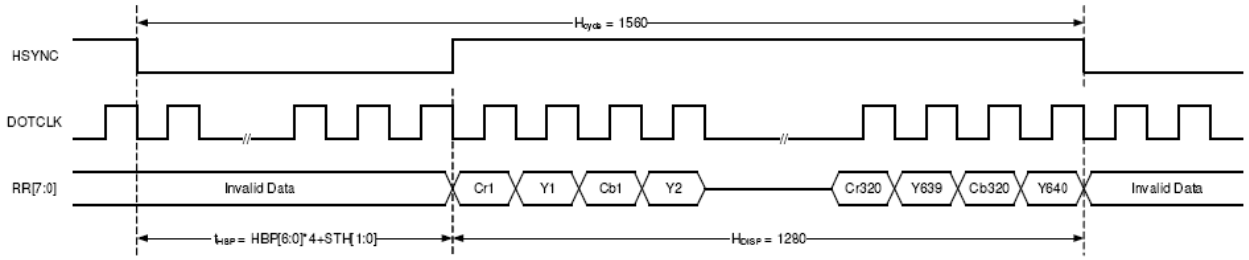
Color		Input Color Data																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	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
	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
	Magent	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
Red	Red	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	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker																								
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	Brighte																								
	Red	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	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
Green	Green	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Darker																								
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	Brighte																								
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green	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
Blue	Blue	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	0	0	0	0	0	0	0	1
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Darker																								
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	Brighte																								
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue	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

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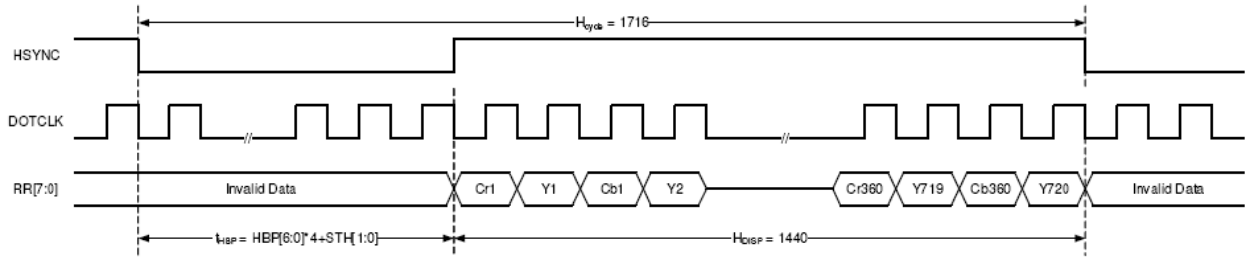
12. Waveform

12-1)CCIR601 Horizontal Timing

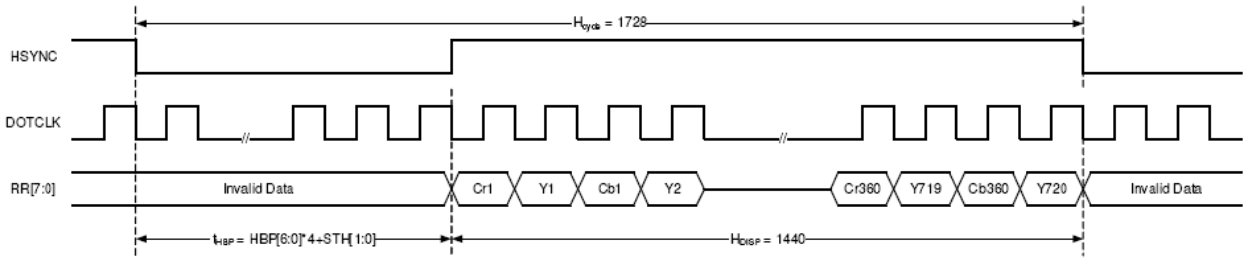
SEL[2:0] = 100, NTSC/PAL



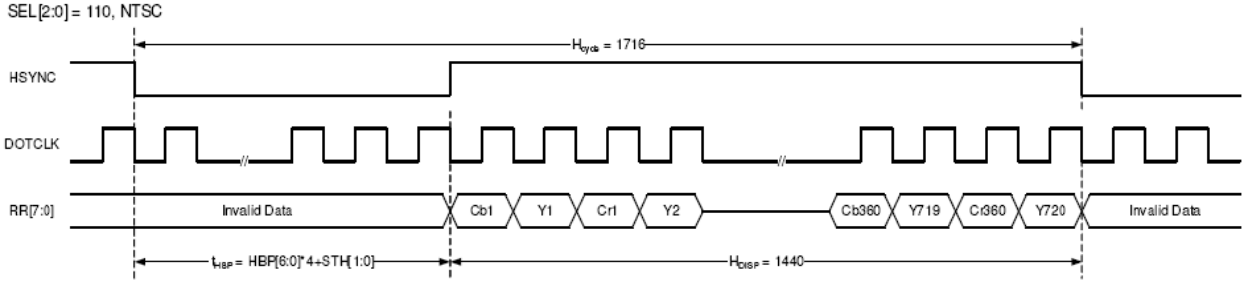
SEL[2:0] = 101, NTSC



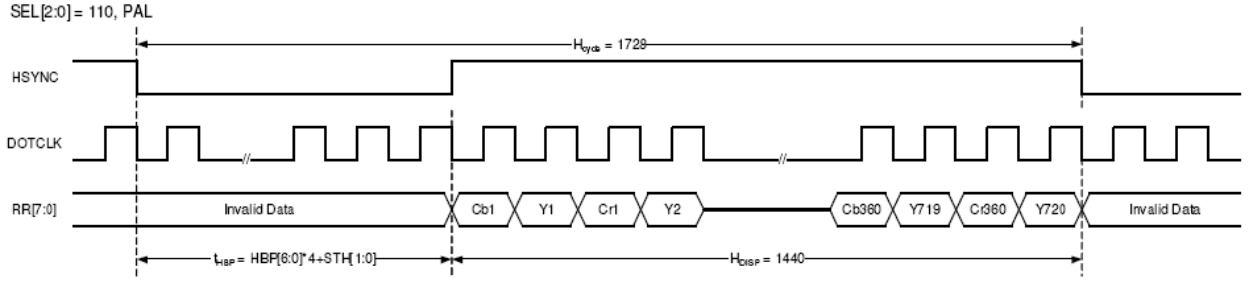
SEL[2:0] = 101, PAL



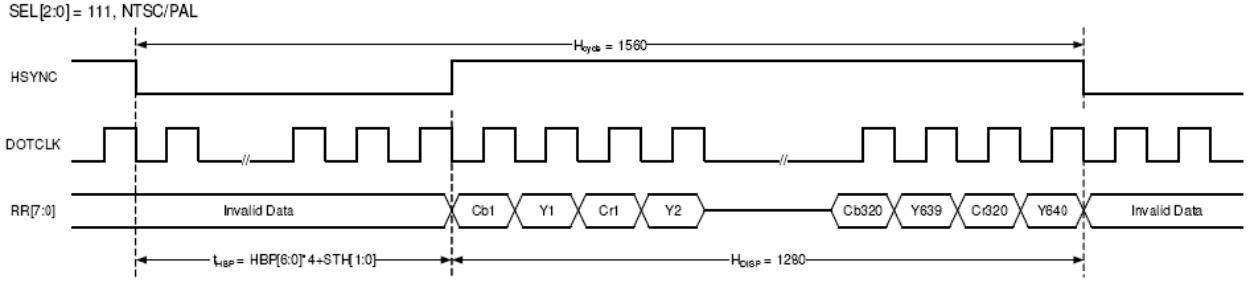
SEL[2:0] = 110, NTSC



SEL[2:0] = 110, PAL



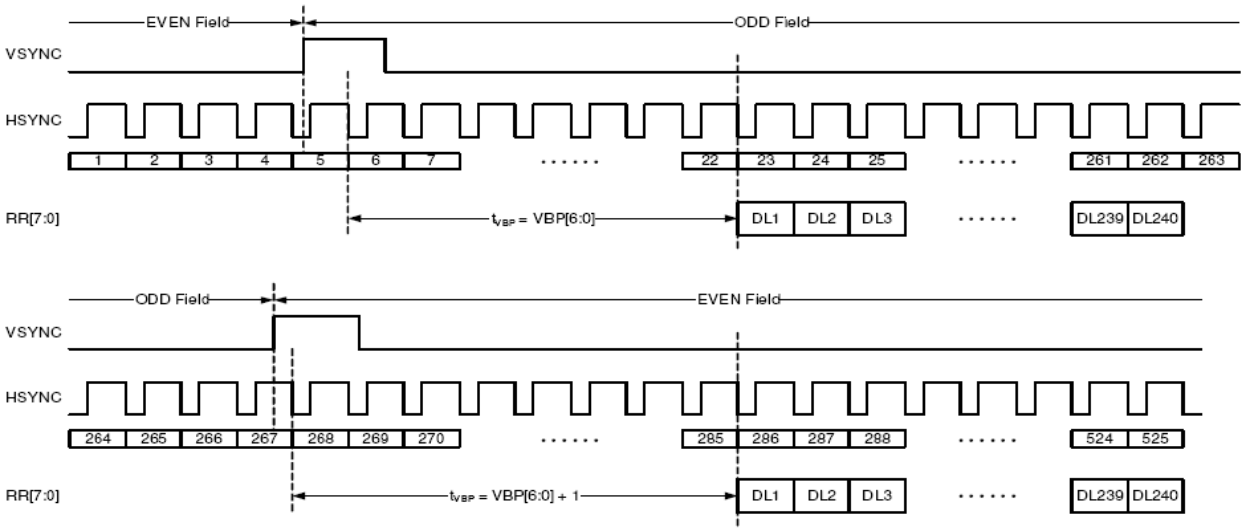
SEL[2:0] = 111, NTSC/PAL



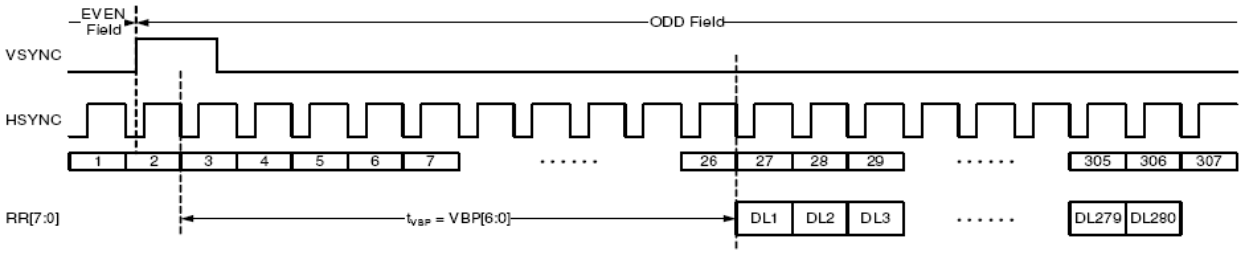
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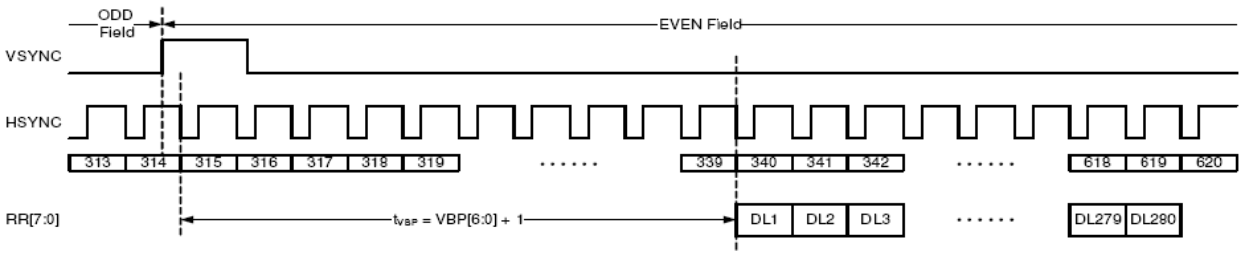
12-2)CCIR601 Vertical Timing

SEL[2:0] = 100 ~ 111, NTSC

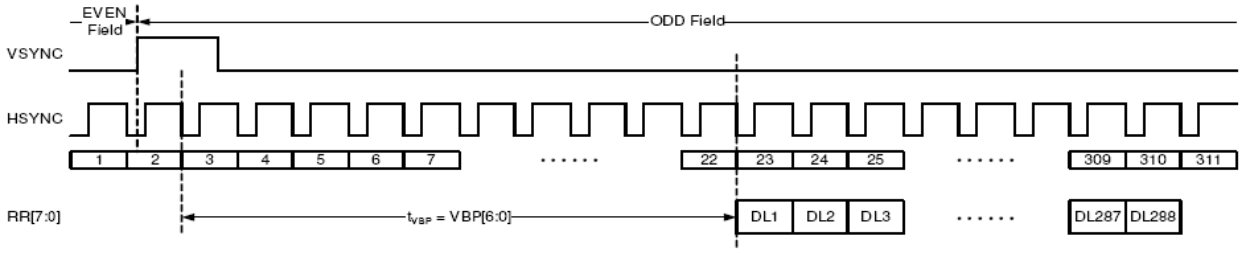


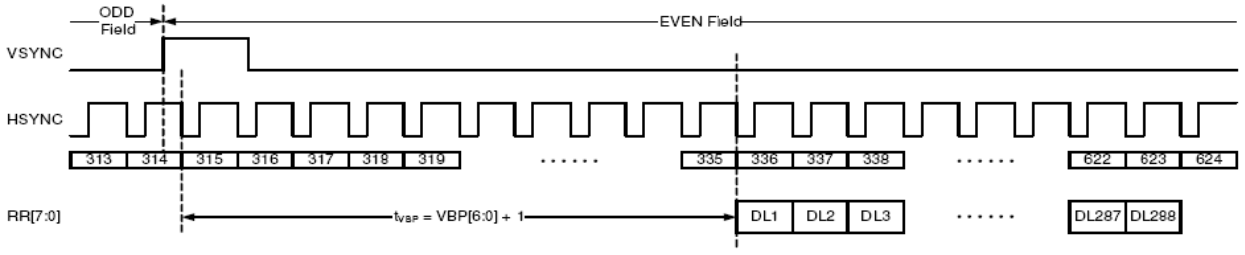
SEL[2:0] = 100 ~ 111, PAL, PALM=0





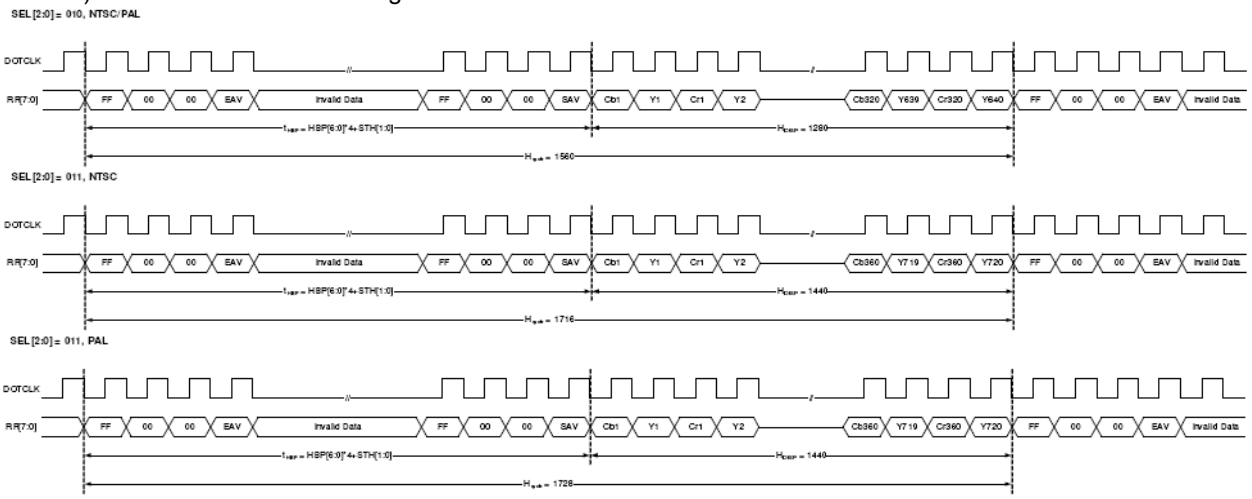
SEL[2:0] = 100 ~ 111, PAL, PALM=1





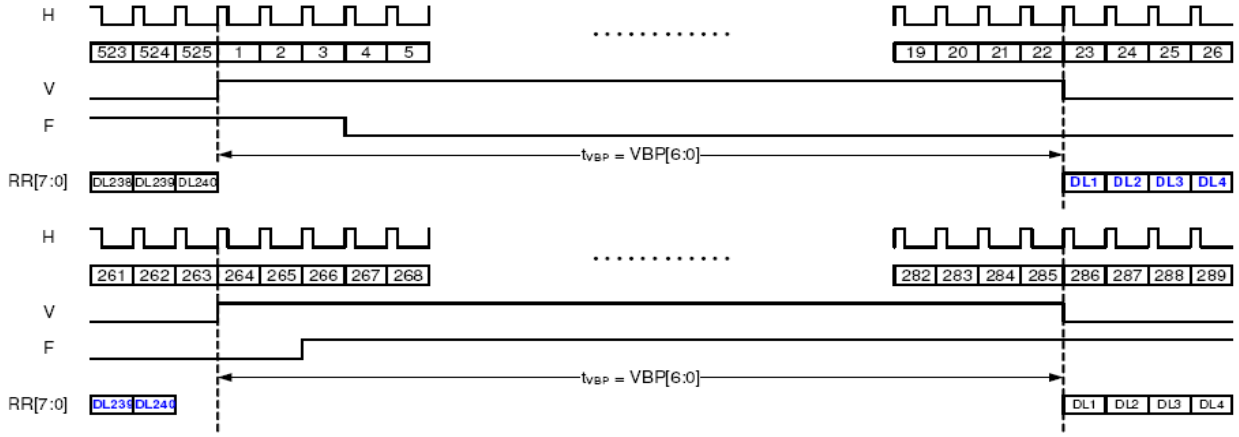
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12-3) CCIR656 Horizontal Timing

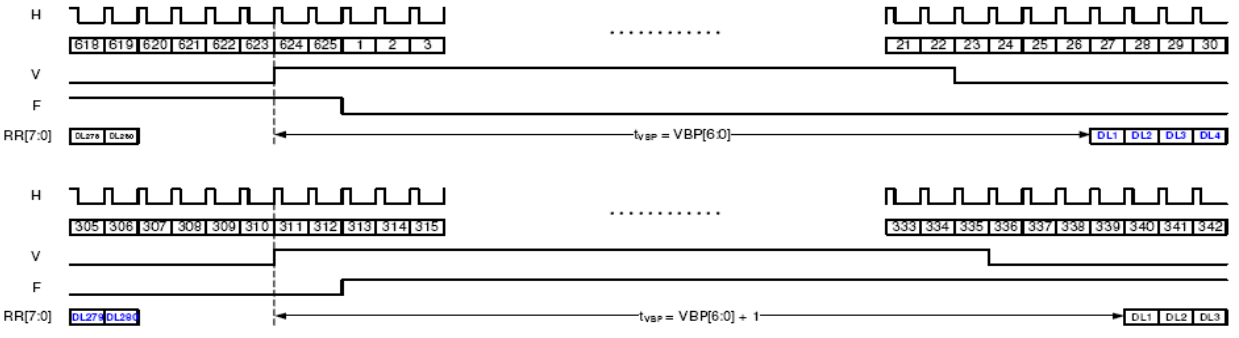


12-4)CCIR656 Vertical Timing

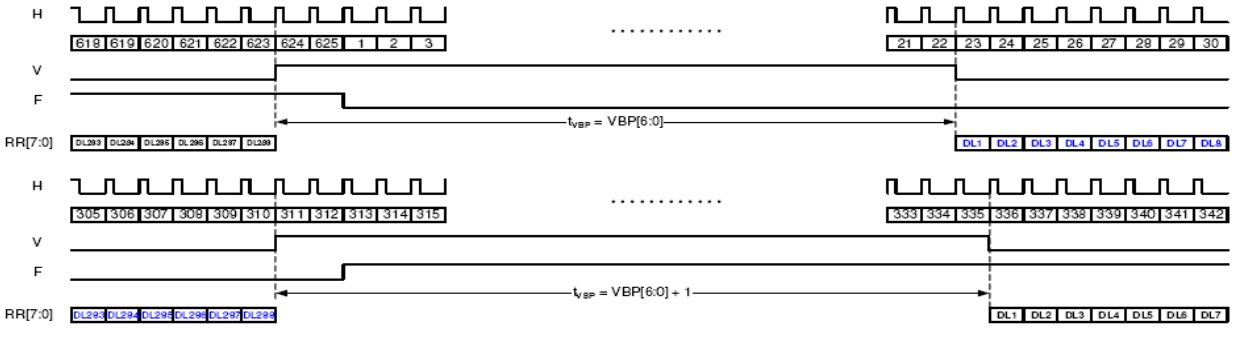
SEL[2:0] = 010, 011, NTSC (F=0 → ODD field, F=1 → EVEN field)



SEL[2:0] = 010, 011, PAL, PALM=0 (F=0 → ODD field, F=1 → EVEN field)

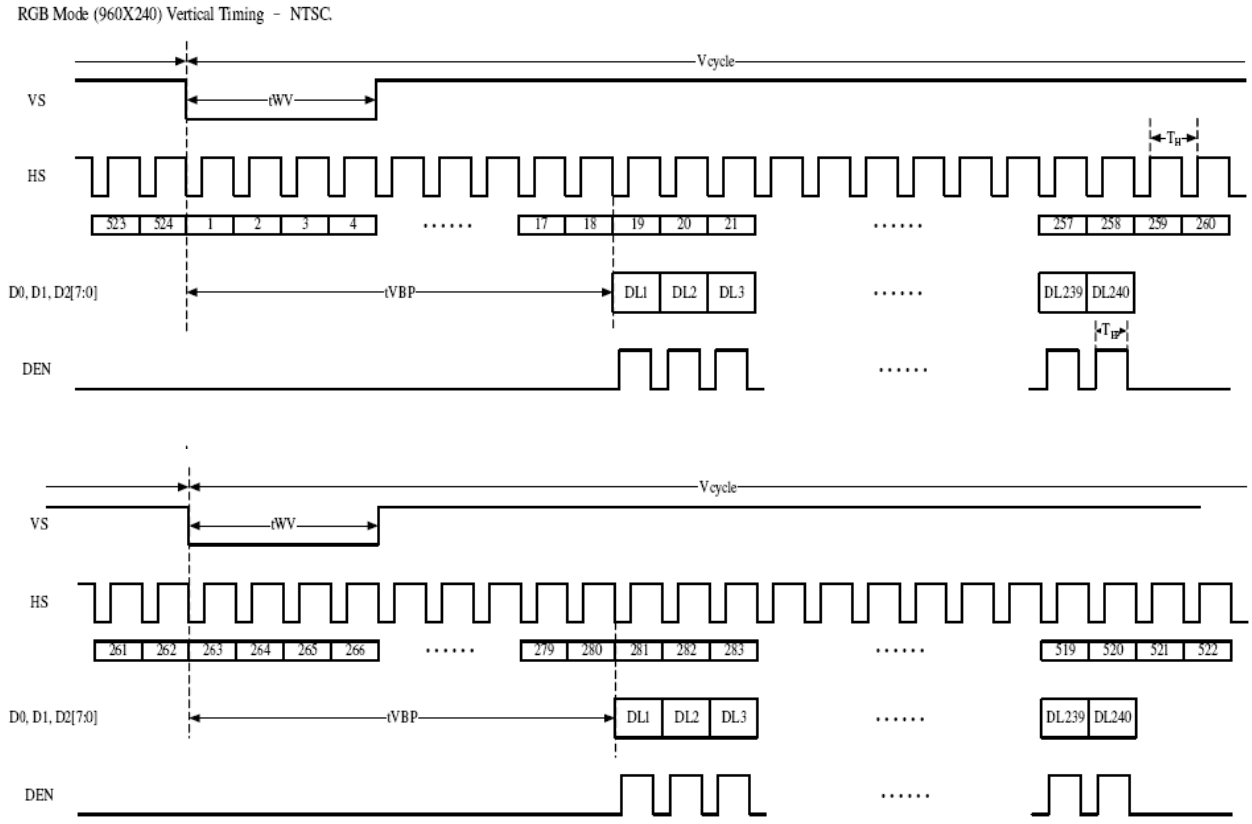


SEL[2:0] = 010, 011, PAL, PALM=1 (F=0 → ODD field, F=1 → EVEN field)

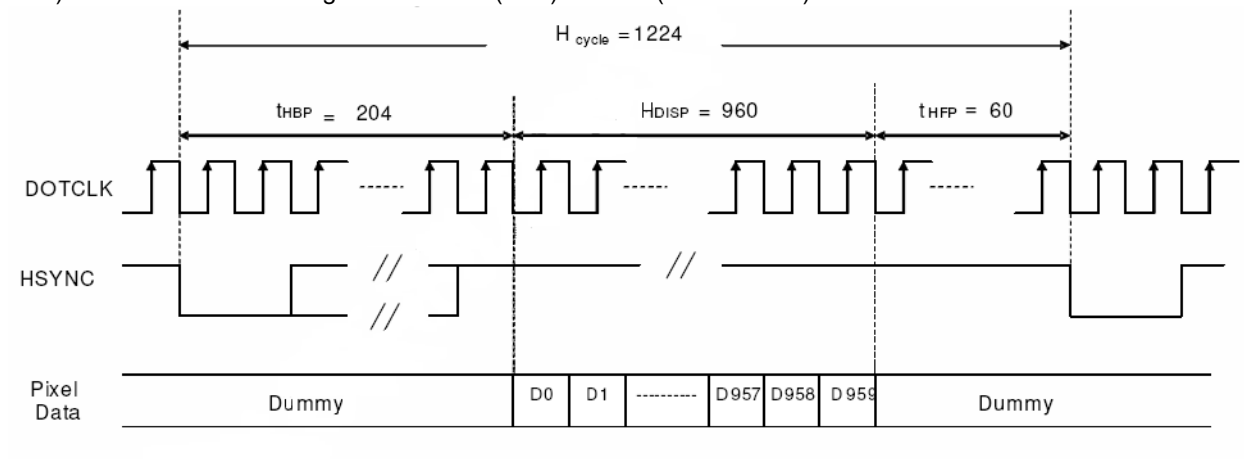


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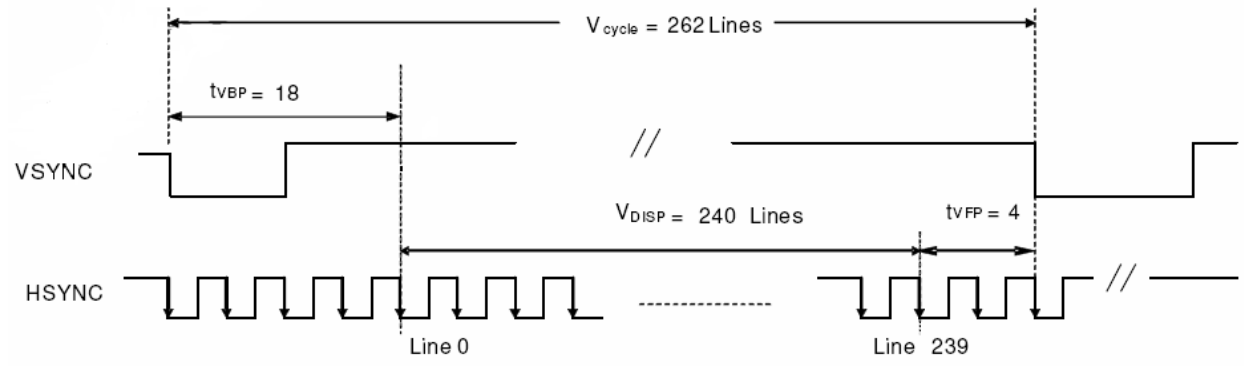
12-5)Digital RGB NTSC mode Vertical Data Format for 262T_H



12-6)Data Transaction Timing in Serial RGB(8 bit)Interface(SYNC Mode)



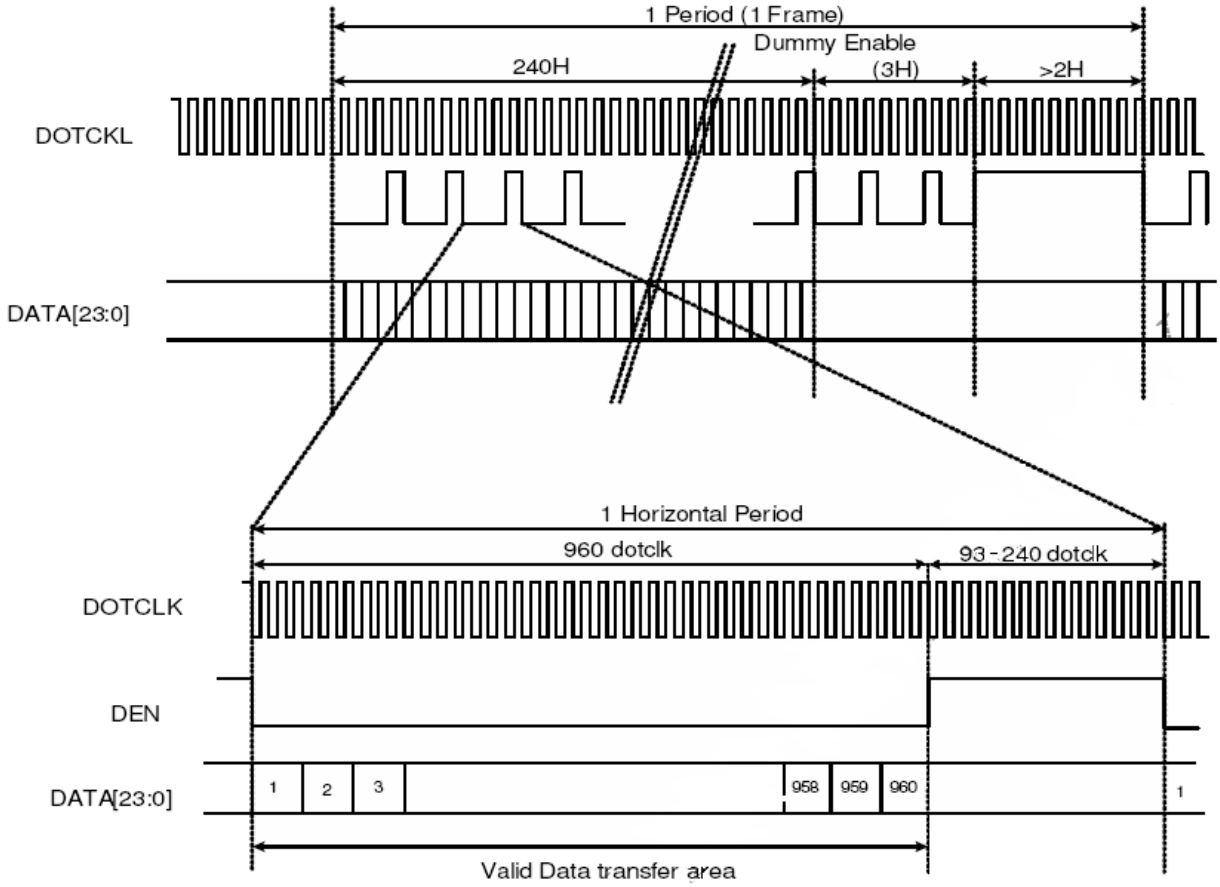
a) Horizontal Data Transaction Timing



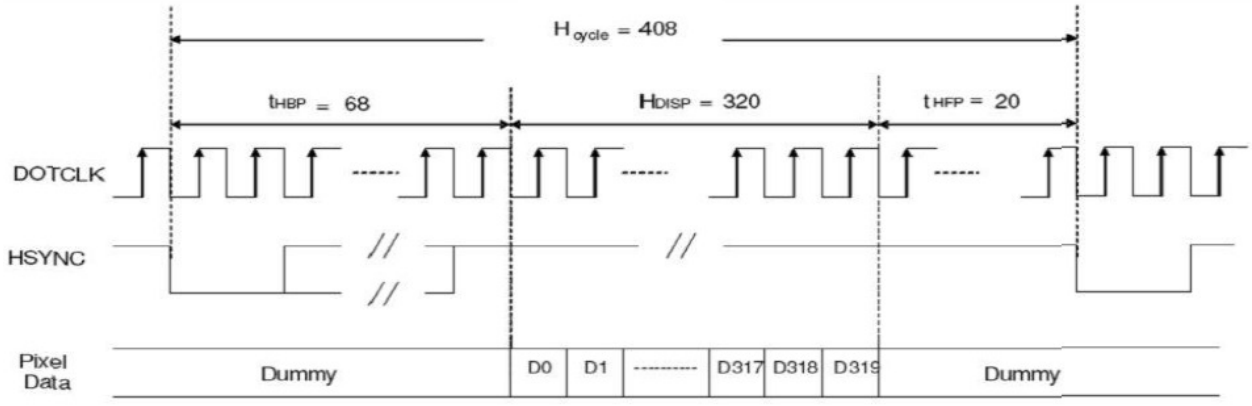
b)Vertical Data Transaction Timing

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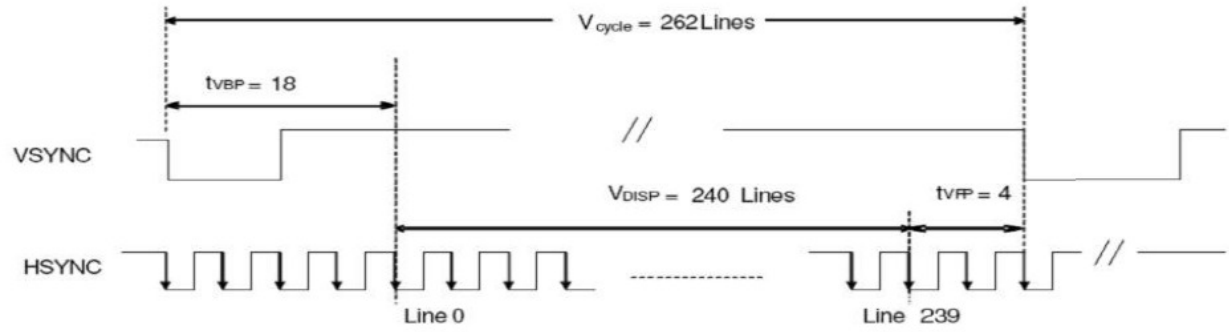
12-7)Data Transaction Timing in Serial RGB(8bit)Interface(DE Mode)



12-8)Data Transaction Timing in Parallel RGB(24 bit)Interface(SYNC Mode)



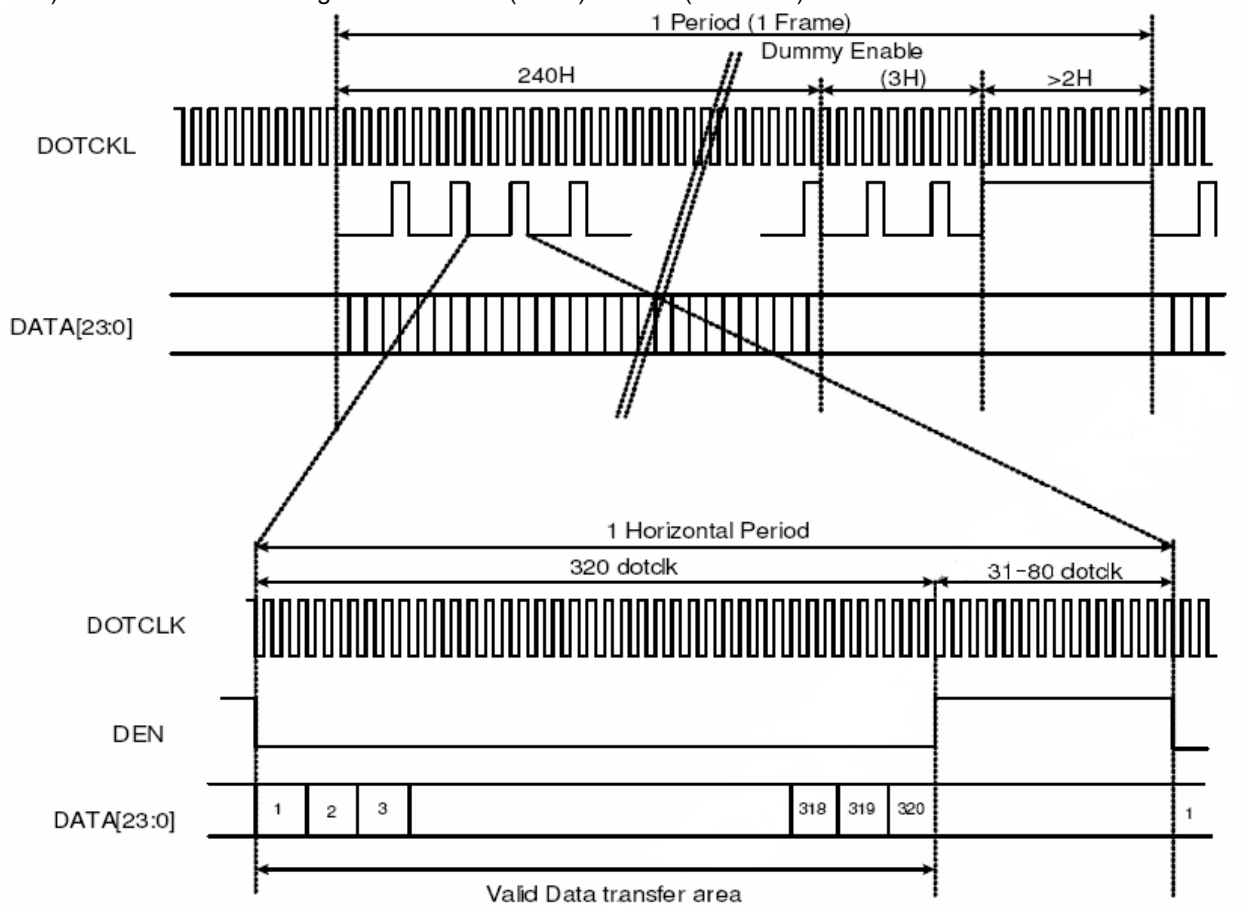
a)Horizontal Data Transaction Timing



b)Vertical Data Transaction Timing

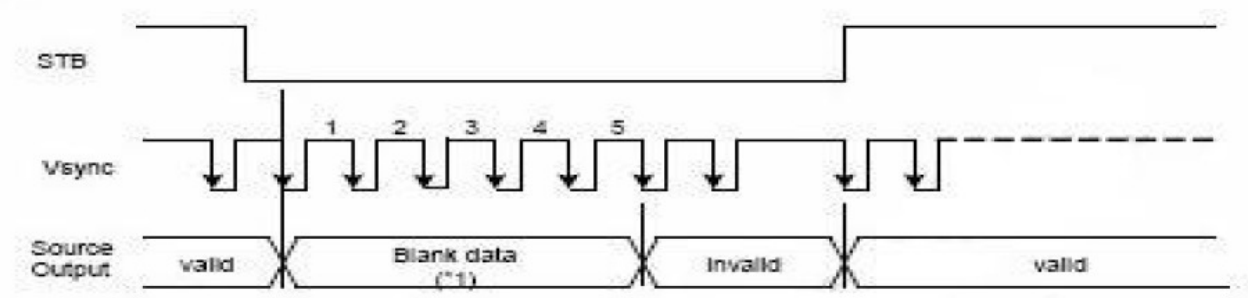
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12-9)Data Transaction Timing in Parallel RGB(24 bit)Interface(DE Mode)

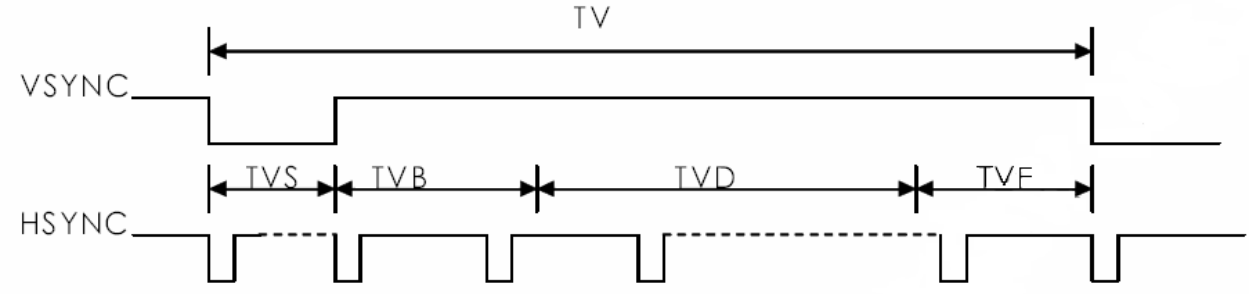


12-10)Standby ON/OFF Control

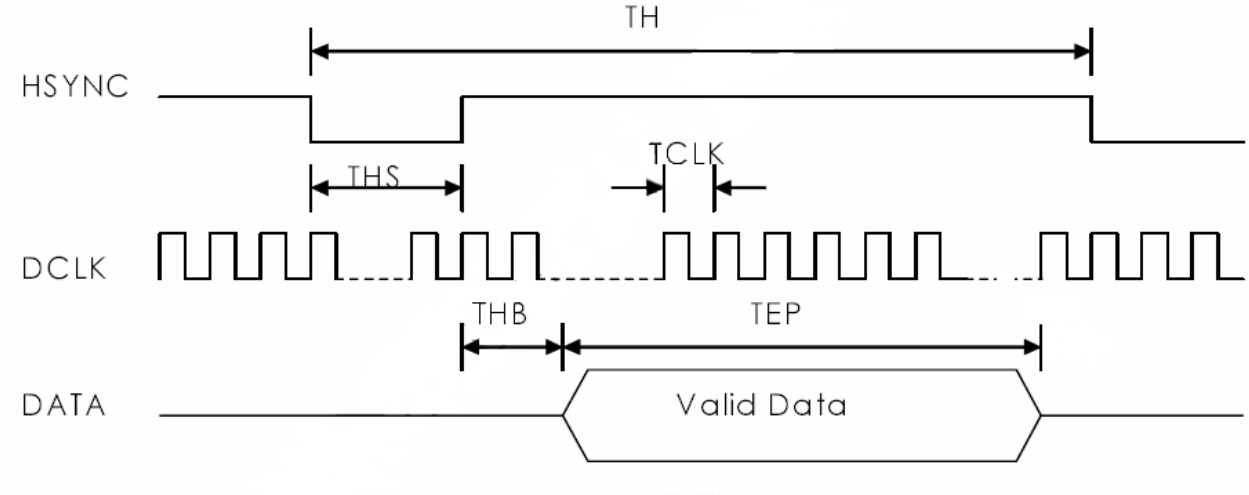
When STB pin is pulled L, blank data is outputted for 5-frames first, form the falling edge of the following VSYNC signal. The blank data would be gray level 255 for normally white LC.

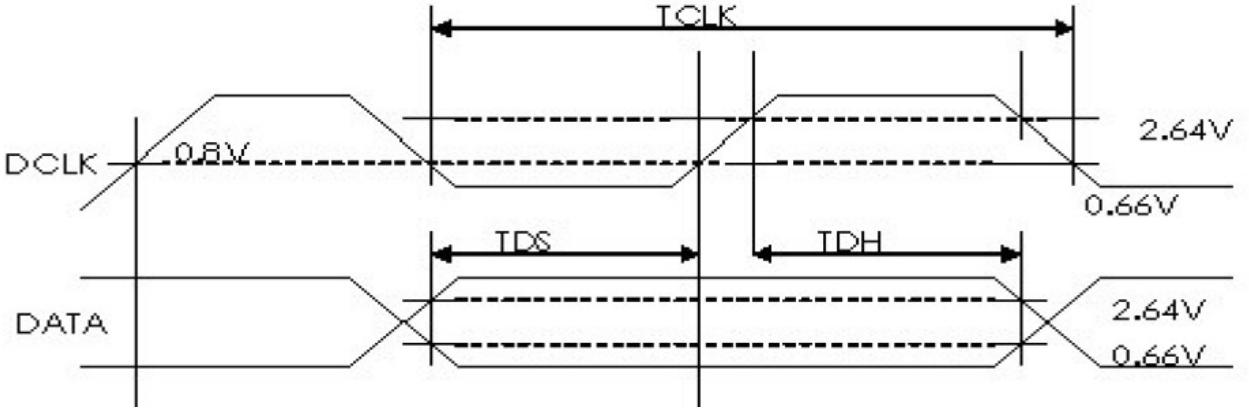


12-11)Clock and Sync waveforms

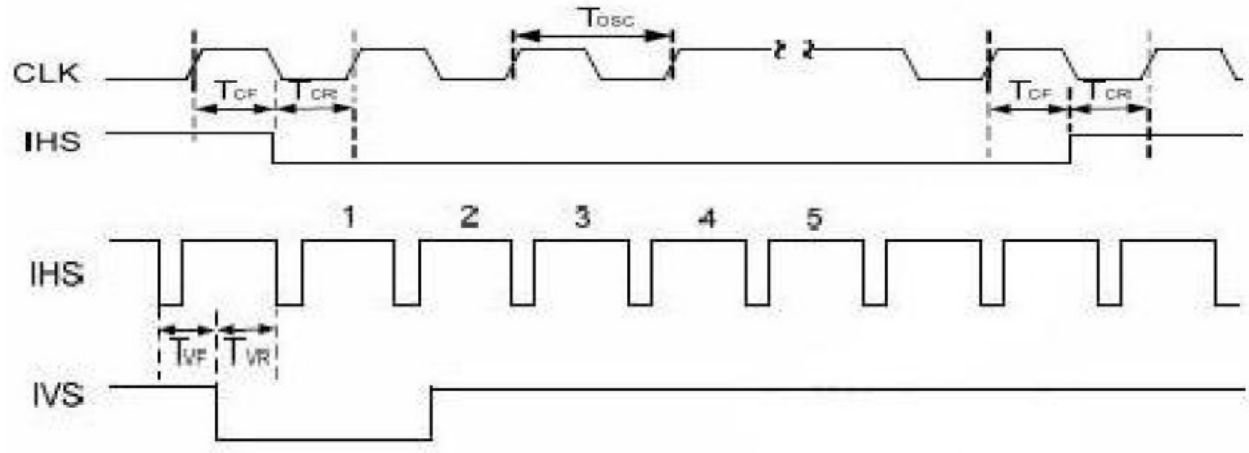


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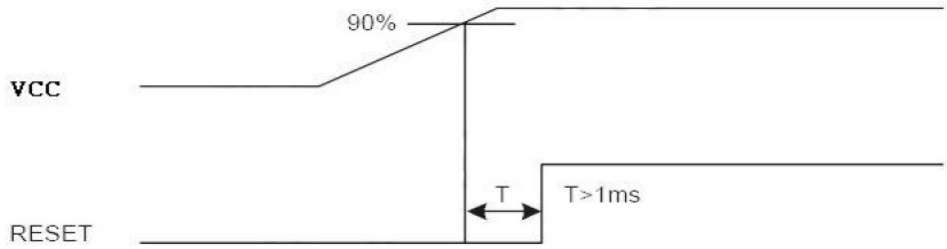


12-12)HIS and IVS timing waveforms



12-13)Reset Timing Chart

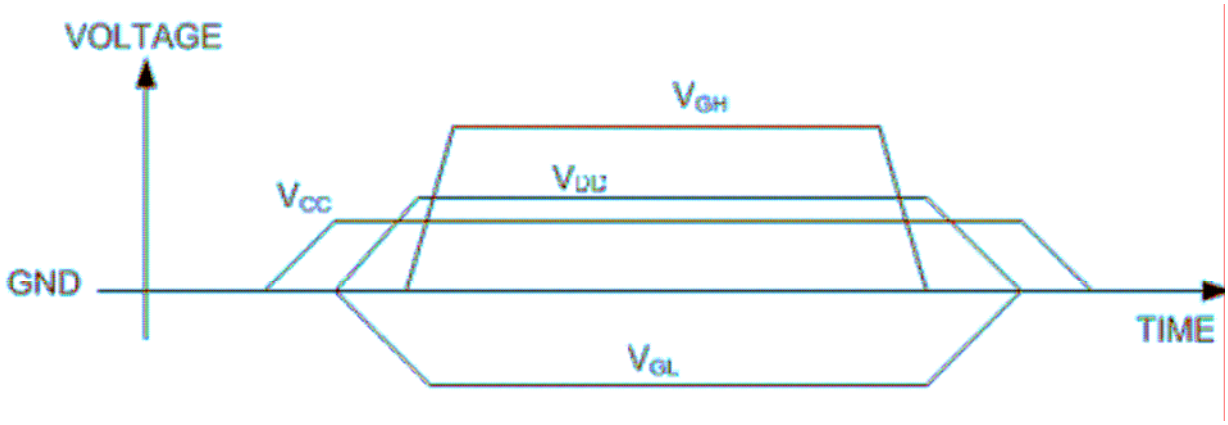
The RESET input must be held at least 1ms after power is stable



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13.Power On Sequence

VCC->VDD

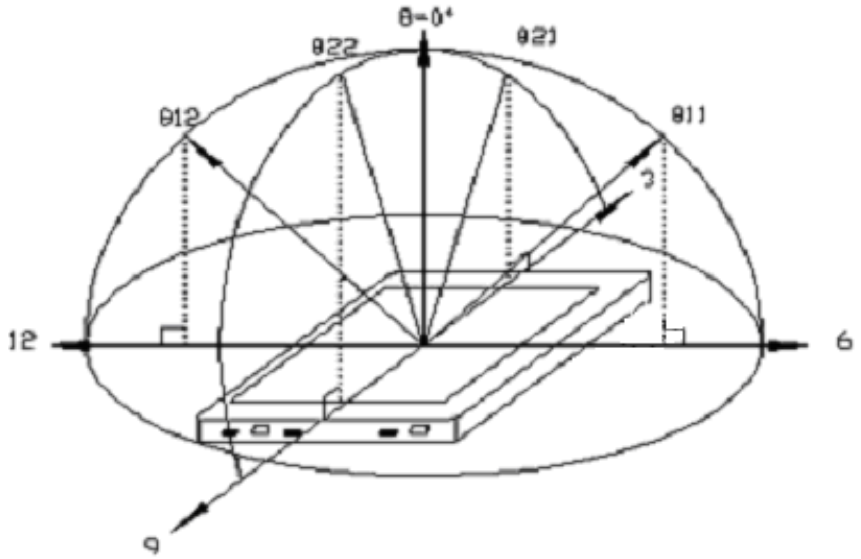


14. Optical Characteristics

14-1) Specification: Ta = 25℃

Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle	Horizontal	θ21, θ22	CR≧10	50	60	-	deg	Note 14-1
	Vertical	θ12		40	50	-	deg	
		θ11		45	55		deg	
Contrast Ratio		CR	At optimized Viewing angle	300	400			Note 14-2
Luminance		L	θ=0°	180	250	---	cd/㎡	
White Chromaticity		x	θ=0°	0.26	0.31	0.36		
		y	θ=0°	0.28	0.33	0.38		
Response time	Rise	Tr	θ=0°	-	10	-	ms	Note 14-3
	Fall	Tf		-	15	-	ms	
LED Life Time			+25℃	-	50000	-	hrs	Note 14-4

Note 14-1 : The definitions of viewing angles

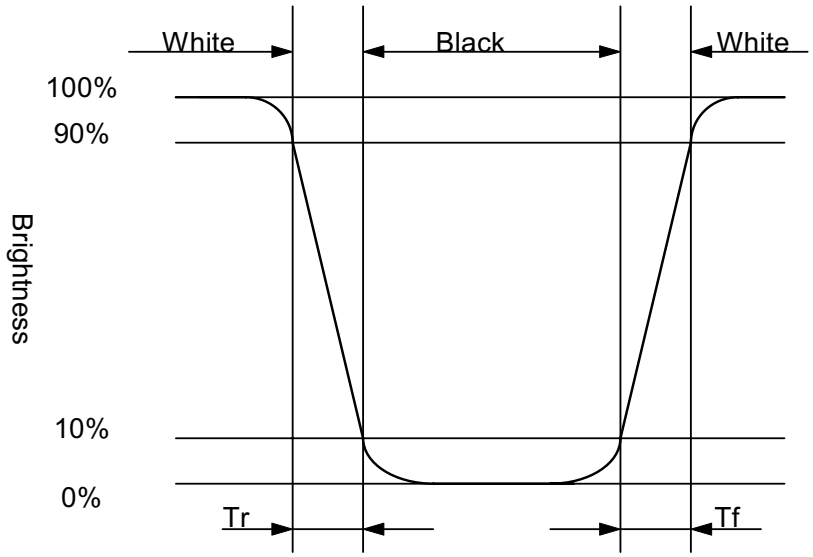


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Note 14-2 : CR = $\frac{\text{Luminance when Testing point is White}}{\text{Luminance when Testing point is Black}}$

Contrast Ratio is measured in optimum common electrode voltage.

Note 14-3 : The definition of response time :



Note 14-4 : The “LED Life time “ is defined as the module brightness decrease to 50% original Brightness that the ambient temperature is 25℃ and I_{LED} =20mA

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15. Handling Cautions

15-1) 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.

15-2) 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.

15-3) 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.

15-4) 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.

15-5) Polarizer mark

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

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16. Reliability Test

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℃, 90%RH, 240 hrs
6	Thermal Shock Test (non-operating)	-20℃→+70℃, 100 Cycles, 30 min 30 min
7	Vibration Test (non-operating)	Frequency:10~550Hz Amplitude: 1.3mm Sweep:1.5G,33.3~400Hz Vibration: Sinusoidal Wave,1Hrs for X,Y,Z direction
8	Shock Test (non-operating)	100G, 6ms Direction : ±X, ±Y, ±Z Cycle : 3 times Half sinusoidal wave
9	Electrostatic Discharge Test (non-operating)	150pF, 330Ω Air : ±8KV ; Contact : ±6KV

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

[Criteria]

1. The test samples have recovery time for 2 hours at room temperature before the function check. In the standard conditions, there is no display function NG issue occurred.
2. All the cosmetic specifications are judged before the reliability stress.

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17. Block Diagram
TBD

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18. Packing

TBD

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