



PRODUCT SPECIFICATION

Part Number

PT322435A-TLMWD-EM31

CUSTOMER	
CUSTOMER PART NUMBER	
DESCRIPTION	
APPROVED BY	
DATE	

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3. Module Numbering System

P T _____ - _____ - _____
 1. 2. 3. 4. 5. 6. 7. 8. 9 10. 11. 12. 13. 14.

1. P-TEC TFT

8. VIEWING DIRECTION

D: 6 o'clock

U: 12 o'clock

F: Full Viewing Angle

2. LENGTH x WIDTH PIXELS

If third character is a zero, it is removed to shorten part number. Example: 240 x 320 = PT3224

9. A ~ Z CODE

Assigned by P-tec

3. DIAGONAL DIMENSIONS

Example: 3.5" display = 35 in part number

11. TEMPERATURE RANGE

Normal: Left Blank

Wide: X

4. PRODUCT VERSION

Series assigned by P-tec

12. LUMINANCE

Blank: Normal (<300 nit)

M: Middle (>= 300 nit)

H: High (> 600 nit)

5. LCD MODE

T: TN

I: IPS

V: VA

13. TOUCH PANEL OPTION

No TP: Left Blank

C: Capacitive TP

R: Resistive TP

6. POLARIZER

LM: Transmissive

LF: Transflective

14. SPECIAL CHARACTERS

Customer special requirements

7. BACKLIGHT COLOR

No Backlight: Left Blank

W: White

B: Blue/Green

S: Yellow/Green

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4. Application

This specification is applied to the 3.45 inch QVGA supported TFT-LCD module, and can display 262k colors. The module is designed for PMP, GPS application and other electronic products which require flat panel display of digital signal interface.

5. Features

- QVGA (320×240 pixels) resolution.
- Display in 262k colors
- Line inversion mode with stripe type.
- On-chip voltage generator
- SYNC mode is supported for digital RGB input data format.
- Digital 24-bit RGB/SERIAL RGB/CCIR656/CCIR601

6. General Specifications

Item	Specifications	Unit
Screen Size	3.45 (Diagonal)	inch
Display Format	320RGB(H)×240(V)	dot
Active Area	70.08(H)×52.56(V)	mm
Dot Size	73(H)×219(V)	um
Pixel Configuration	RGB Vertical Stripe	-
Display Mode	TN Type Transmissive Mode Normally White	-
Surface Treatment	Anti-Glare and Hard Coating(3H)	-
Viewing Direction	6 O'clock (The Gray Inversion will appear at this direction)	-
Outline Dimension	76.9(W)×63.9(H)×3.26(D)	mm
Weight	(31)	g
RoHS Compliance	P-TEC certifies this product to be in compliance with European Union Directive 2002/95/EC on the restriction of certain hazardous substances in electrical and electronic equipment.	-

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7. Absolute Maximum Ratings

7.1 Absolute Ratings of Environment

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-30	+80	°C	(1)(2)
Operating Ambient Temperature	T _{OP}	-20	+70	°C	(1)(2)

Note1: Background color changes slightly depending on ambient temperature.

This phenomenon is reversible.

Note2: Please refer to item of RELIABILITY.

7.2 Electrical Absolute Ratings

7.2.1 TFT-LCD Module

(Ta=25±2°C, GND=V_{SS}=0V)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{CC}	-0.3	5.0	V	-
Input Signal Voltage	V _{in}	-0.3	V _{DD} +0.3	V	-
Logic Output Voltage	V _{OUT}	-0.3	V _{DD} +0.3	V	-



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8. Electrical Characteristics

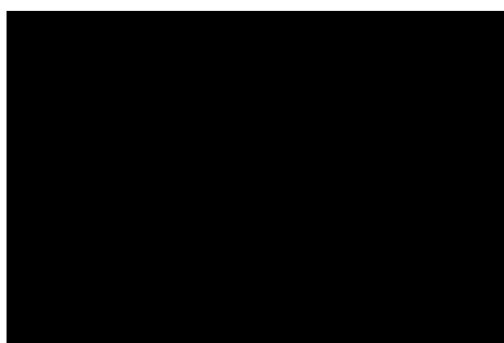
8.1 TFT-LCD Module

(Ta=25±2°C)

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V _{CC}	3.0	3.3	3.6	V	-
Gate High Voltage	V _{GH}	-	13.9	-	V	-
Gate Low Voltage	V _{GL}	-	-13.6	-	V	-
V _{COM} High Voltage	V _{COM H}	-	3.9	-	V	(2)
V _{COM} Low Voltage	V _{COM L}	-	-1.2	-	V	(2)
V _{COM} level max	V _{COM A}	-	-	6	V	-
Digital Power Supply Current	I _{CC}	-	8.6	-	mA	(1)
Input High Threshold Voltage	V _{IH}	0.7 V _{CC}	-	V _{CC}	V	-
Input Low Threshold Voltage	V _{IL}	0	-	0.3 V _{CC}	V	-
VSYNC Frequency	F _V	-	60	-	Hz	-
DCLK Frequency	DCLK	-	6.5	-	MHz	(3)

Note (1) The specified power consumption is under the conditions at V_{CC} =3.3V, V_{GH} =13.9V, V_{GL} =-13.6V, V_{COM H} =3.9V , V_{COM L}=-1.2V, F_V=60Hz, whereas a power dissipation check pattern below is displayed.

Black Pattern / 0 Gray



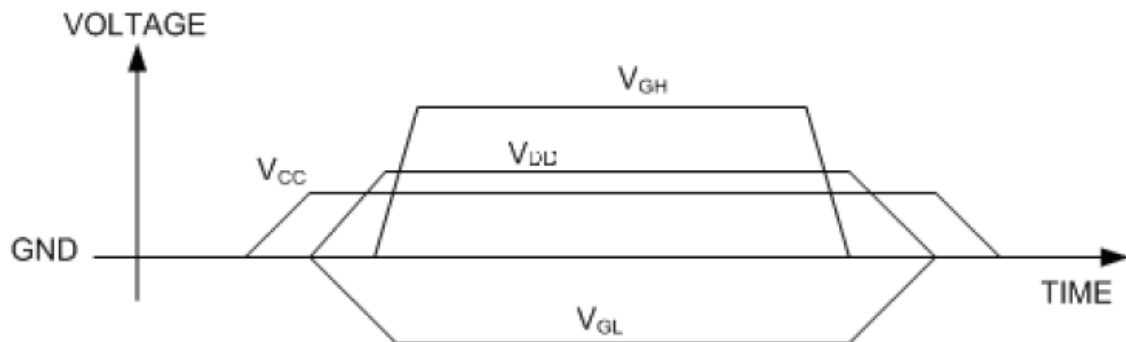
Active Area

Note2. VcomH& VcomL: Adjust the color with gamma data. Vp-p should be higher then 4V.(Option 5V)



Note3. For Parallel-RGB data Use

Note: Please power on following the sequence $V_{CC} \rightarrow V_{DD}$

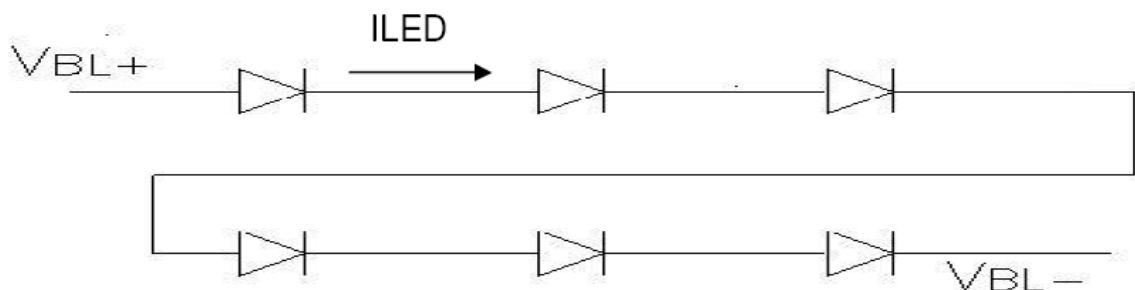


8.2 Backlight Unit

($T_a = 25 \pm 2^\circ\text{C}$)

Item	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Current of Backlight Unit	I_B	-	20	-	mA	-
Voltage of Backlight Unit	V_{BL+}	18.6	19.8	21.0	V	(1)
Power Consumption	P_{BL}	-	(0.4)	0.42	W	-
LED Life Time(25°C)	-	10000	-	-	hr	(2),(3)

Note 1 : There are 1 Groups LED



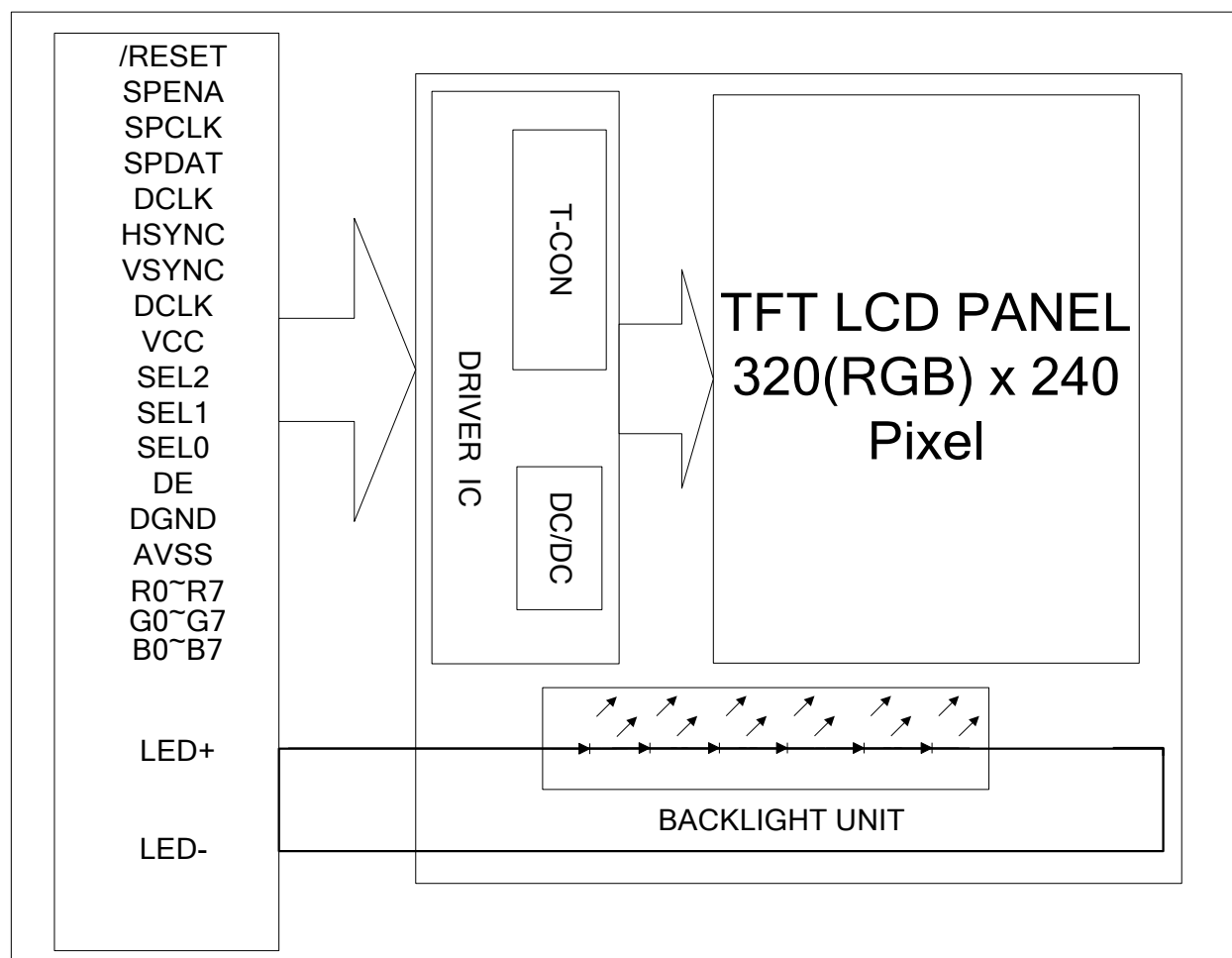
Note 2 : $T_a = 25^\circ\text{C}$

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



9. Block Diagram

9.1 TFT-LCD Module with Backlight Unit





10. Input / Output Terminals Pin Assignment

10.1 TFT-LCD Module

Pin No.	Symbol	I/O	Description	Remark
1	LED-	I	Backlight LED Ground	
2	LED-	I	Backlight LED Ground	
3	LED+	I	Backlight LED Power	
4	LED+	I	Backlight LED Power	
5	NC	-	No connection	
6	NC	-	No connection	
7	NC	-	No connection	
8	/RESET	I	Hardware Reset	
9	SPENA	I	SPI Interface Data Enable Signal	Note3
10	SPCLK	I	SPI Interface Data Clock	Note3
11	SPDAT	I	SPI Interface Data	Note3
12	B0	I	Blue Data Bit 0	
13	B1	I	Blue Data Bit 1	
14	B2	I	Blue Data Bit 2	
15	B3	I	Blue Data Bit 3	
16	B4	I	Blue Data Bit 4	
17	B5	I	Blue Data Bit 5	
18	B6	I	Blue Data Bit 6	
19	B7	I	Blue Data Bit 7	
20	G0	I	Green Data Bit 0	
21	G1	I	Green Data Bit 1	
22	G2	I	Green Data Bit 2	
23	G3	I	Green Data Bit 3	
24	G4	I	Green Data Bit 4	
25	G5	I	Green Data Bit 5	
26	G6	I	Green Data Bit 6	
27	G7	I	Green Data Bit 7	
28	R0	I	Red Data Bit0 /DX0	Note4
29	R1	I	Red Data Bit1 /DX1	Note4
30	R2	I	Red Data Bit2 /DX2	Note4



Pin No.	Symbol	I/O	Description	Remark
31	R3	I	Red Data Bit3 /DX3	Note4
32	R4	I	Red Data Bit4 /DX4	Note4
33	R5	I	Red Data Bit5 /DX5	Note4
34	R6	I	Red Data Bit6 /DX6	Note4
35	R7	I	Red Data Bit7 /DX7	Note4
36	HSYNC	I	Horizontal Sync Input	
37	VSYNC	I	Vertical Sync Input	
38	DCLK	I	Dot Data Colck	
39	NC	-	No connection	
40	NC	-	No connection	
41	Vcc	I	Digital Power	
42	Vcc	I	Digital Power	
43	NC	-	No connection	
44	NC	-	No connection	
45	NC	-	Internal Test Use	
46	NC	-	No connection	
47	NC	-	Internal Test Use	
48	SEL2	I	Control the input data format/floating	Note1
49	SEL1	I	Control the input data format	Note1,5
50	SEL0	I	Control the input data format	Note1,5
51	NC	-	No connection	
52	DE	I	Data Enable Input	Note2
53	DGND	I	Ground	
54	AVSS	I		

Note:

1. The mode control (SEL2) not use, it can't control CCIR601 interface. If not use CCIR601, it can floating.
2. For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed now, SYNC mode is used. Otherwise, DE+SYNC mode is used. Suggest used SYNC mode. Suggest the DE signal usually pull low.
3. Usually pull high.
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 and DX7 is MSB.
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

10.2 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_{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_{CO}	50	-	-	ns
SPDA output latency	T_{CS}	-	1/2	-	T_{CK}

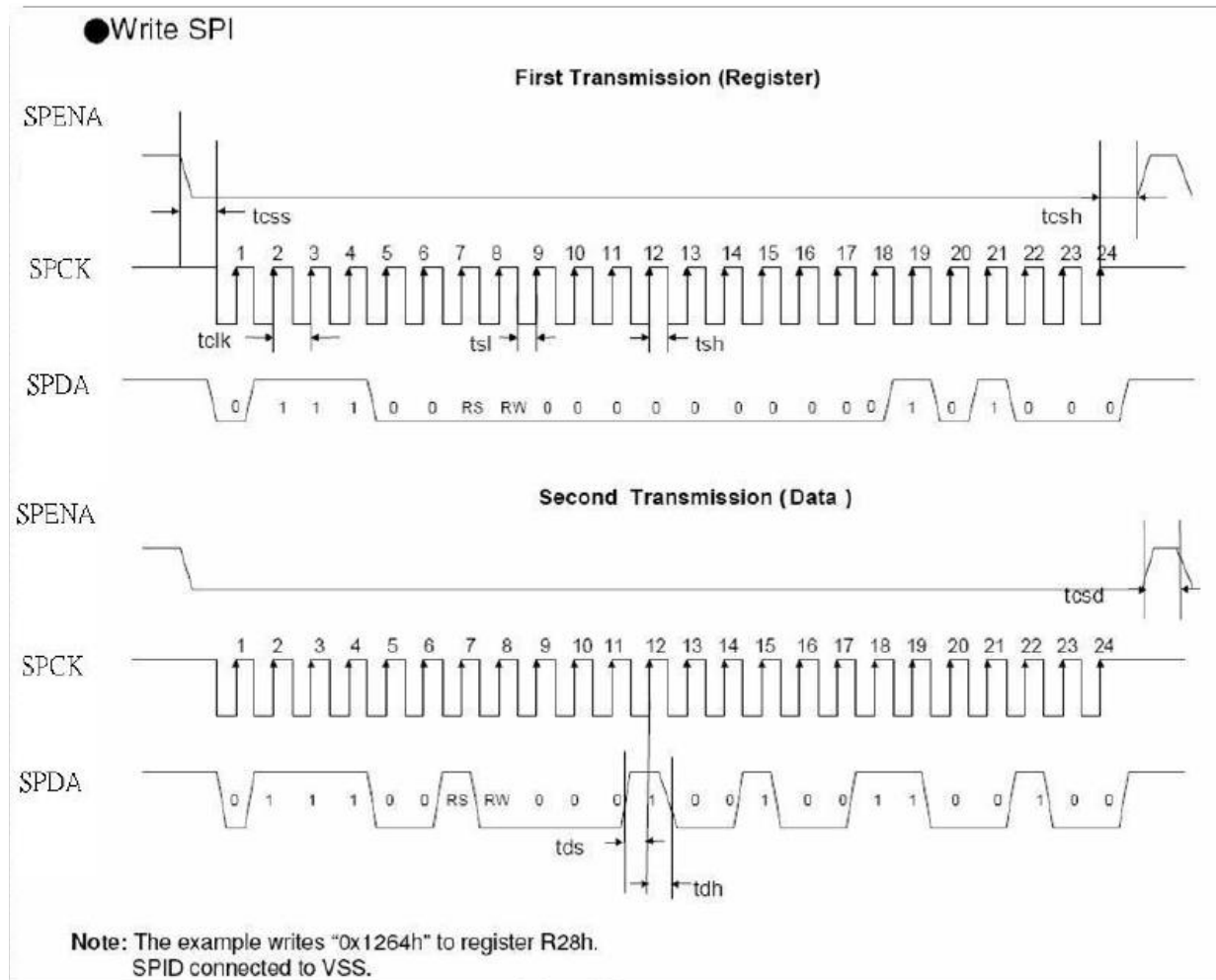


Figure 10.2-1 SPI read_write timing

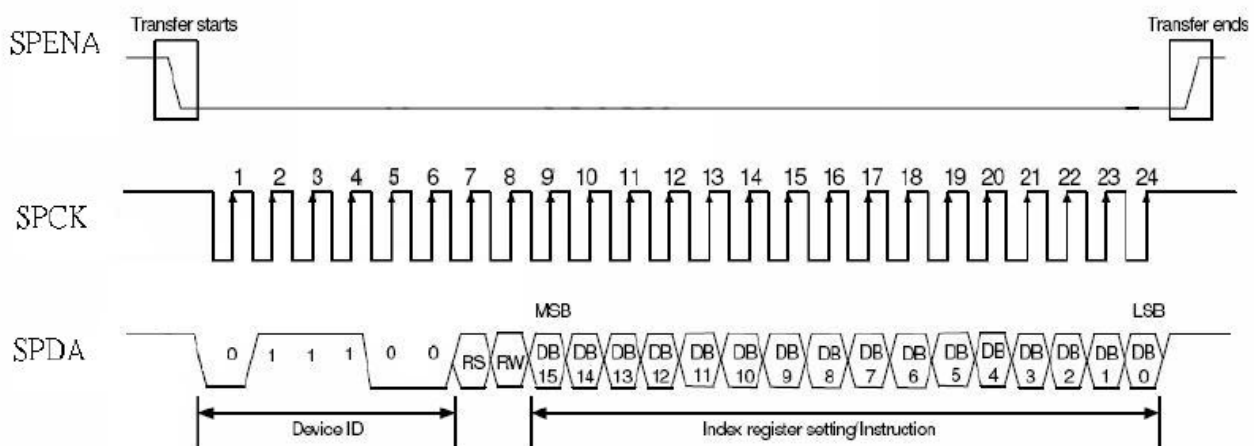


Figure 10.2-2 SPI timing



10.3 Color Data Input Assignment

The brightness of each primary color(red, green and blue) is based on the 8 bit gray scale data input for the color. The higher the binary input, the brighter the color. The table provides the assignment of color versus data input.

Color		Data Signal																							
		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
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of RED	Red(0) / Dark	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)	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(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	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(254)	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(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	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(1)	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(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	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(254)	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(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	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(1)	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(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue(253)	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(254)	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(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

**11. Interface Timing****11.1 Input Signal Characteristics****Digital Parallal 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	Tsoc
	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: 1. $T_{hp} + T_{hb} = 68$, the user is make up by yourself.

2. $T_v = T_{vs} + T_{vb} + T_{vd} + T_{vf}$, 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	
	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

Note: 1. $T_{hp} + T_{hb} = 204$, the user is make up by yourself.

2. $T_v = T_{vs} + T_{vb} + T_{vd} + T_{vf}$, the user is make up by yourself.

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

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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

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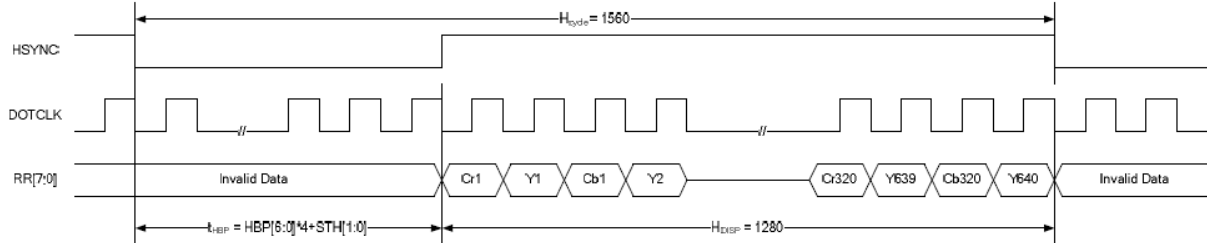
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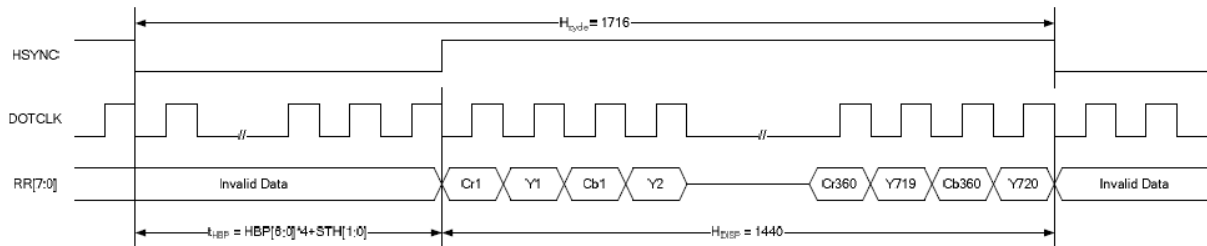
18

11.2 Waveform

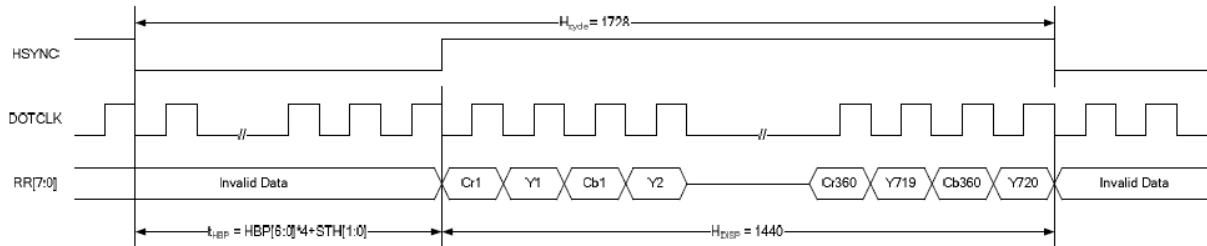
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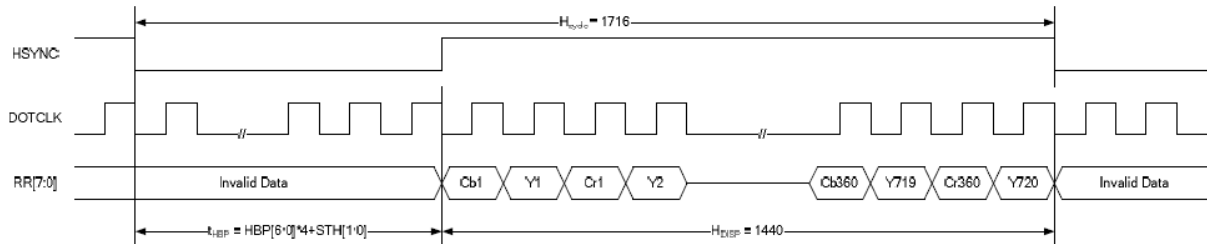
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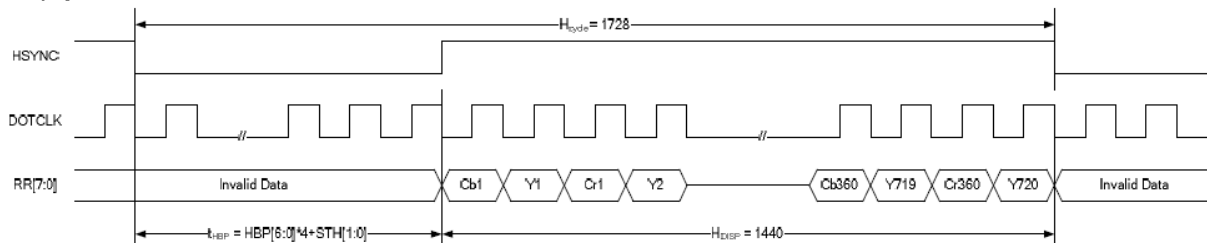
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SEL[2:0] = 110, NTSC



SEL[2:0] = 110, PAL



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

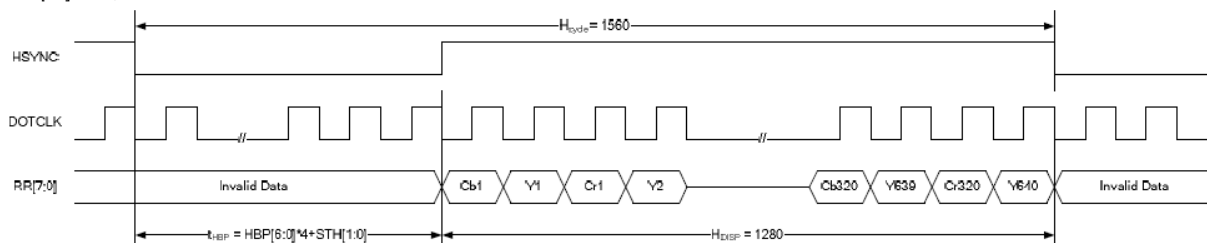
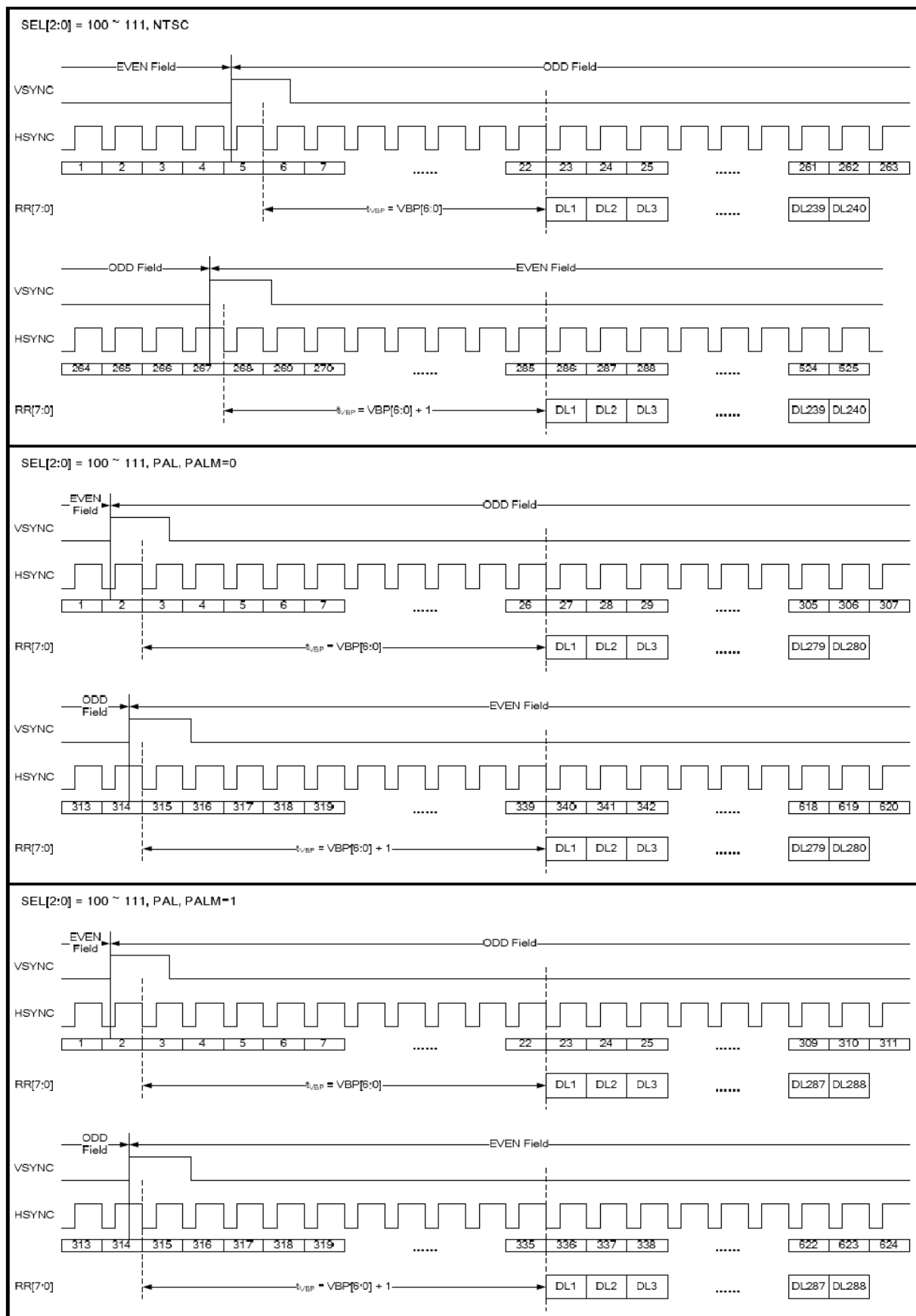




Figure11.2-1 CCIR601 Horizontal Timing



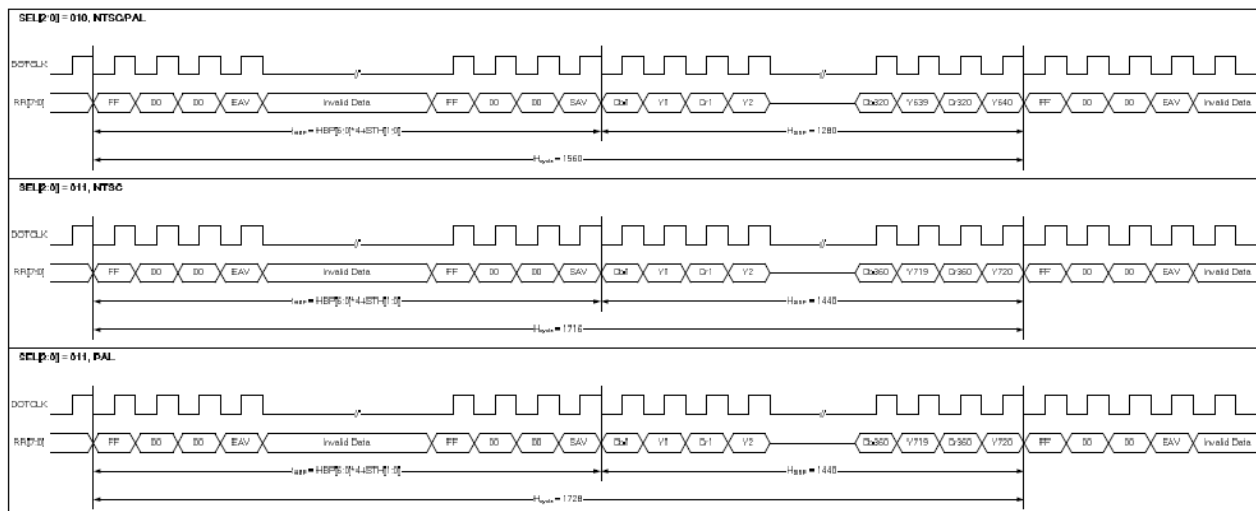
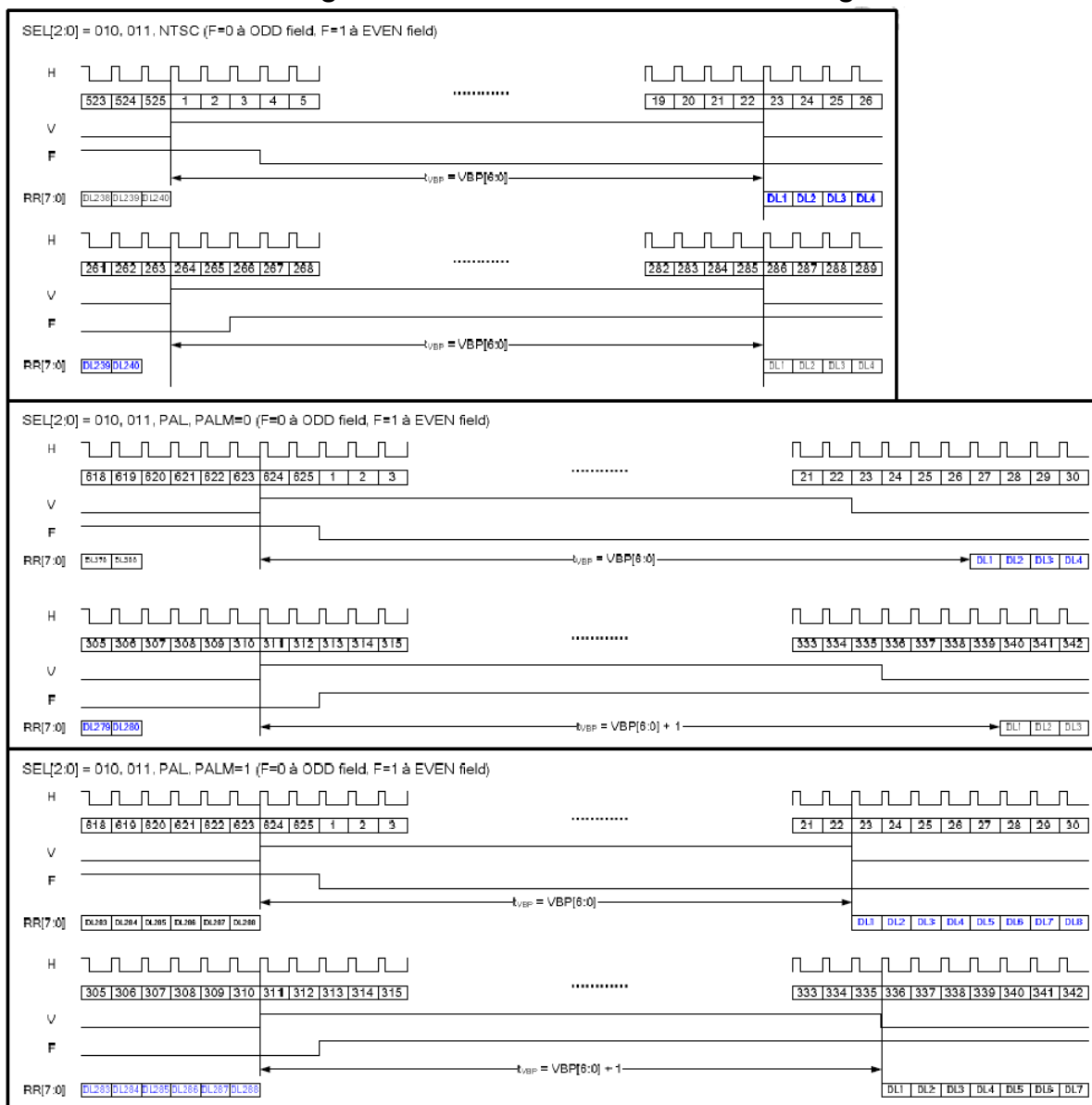
**P-TEC****MODEL NO.**

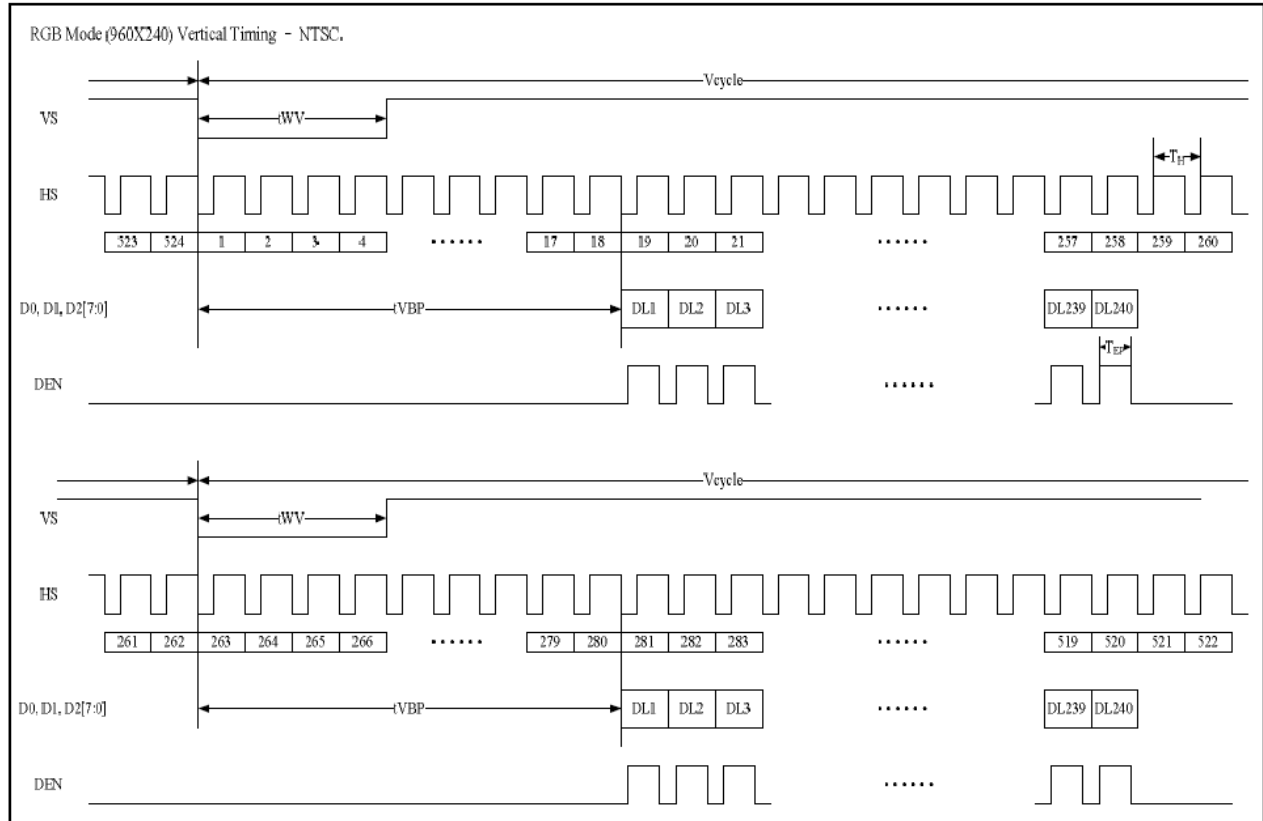
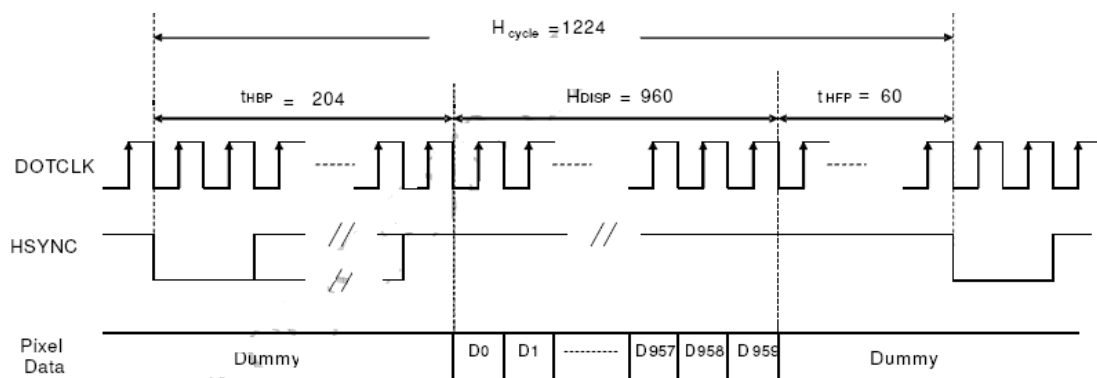
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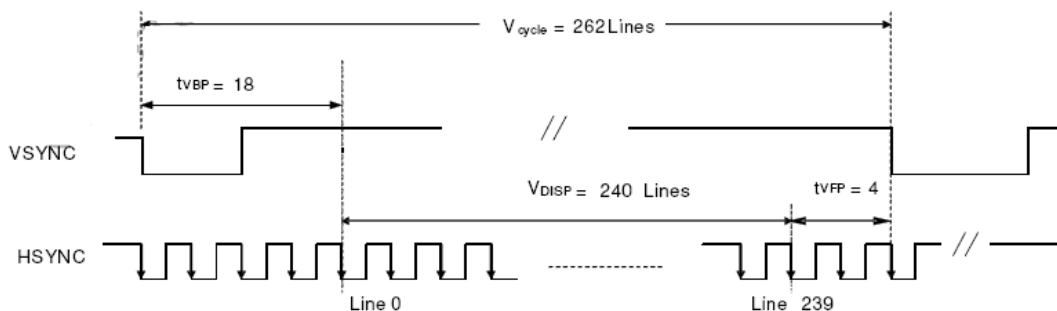
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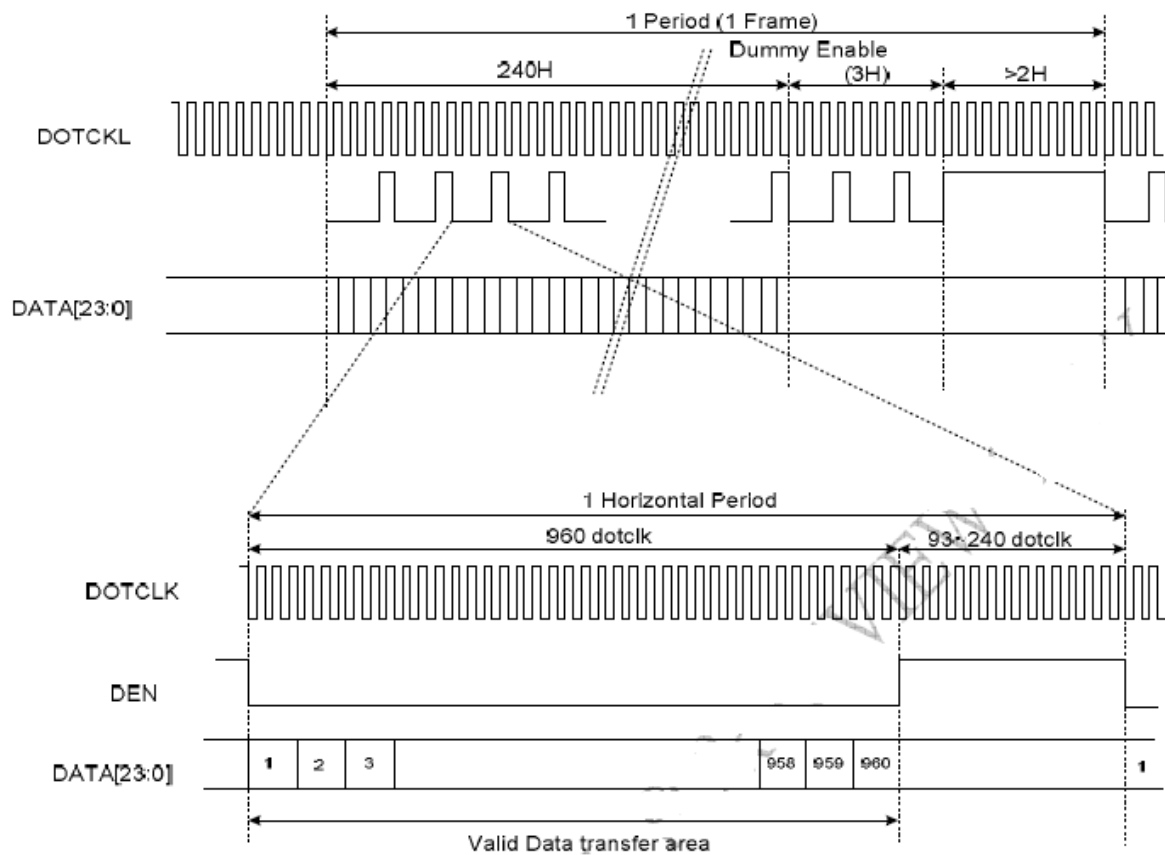
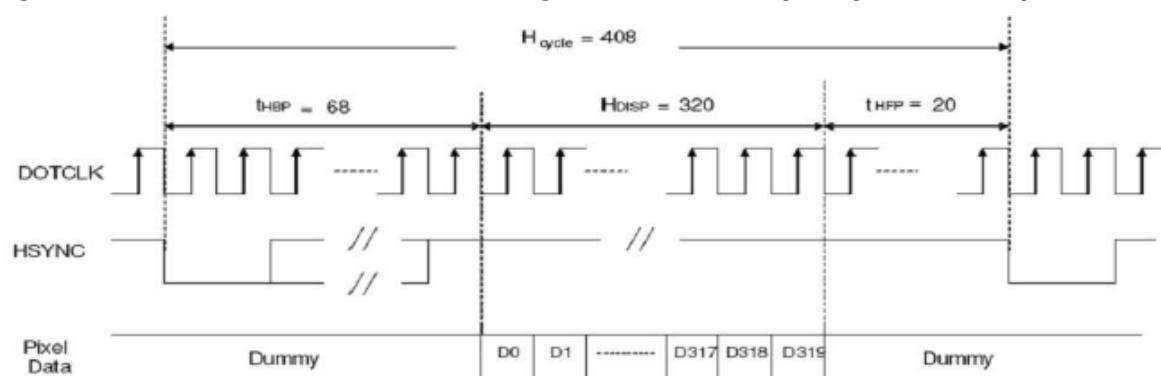
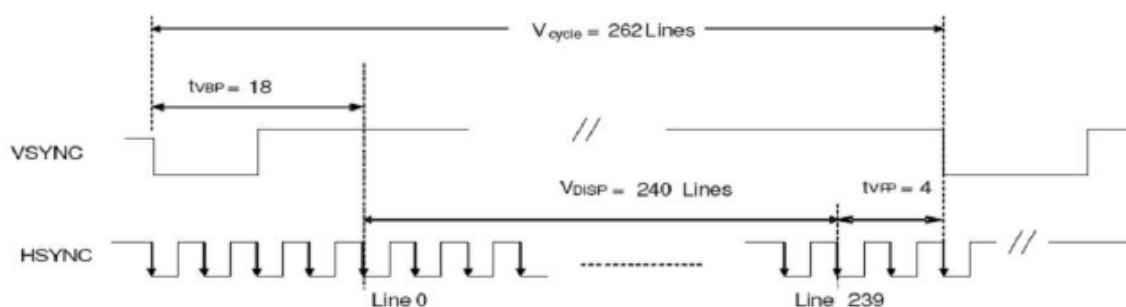
Figure11.2-1 CCIR601 Vertical Timing**Figure11.2-2 CCIR656 Horizontal Timing**

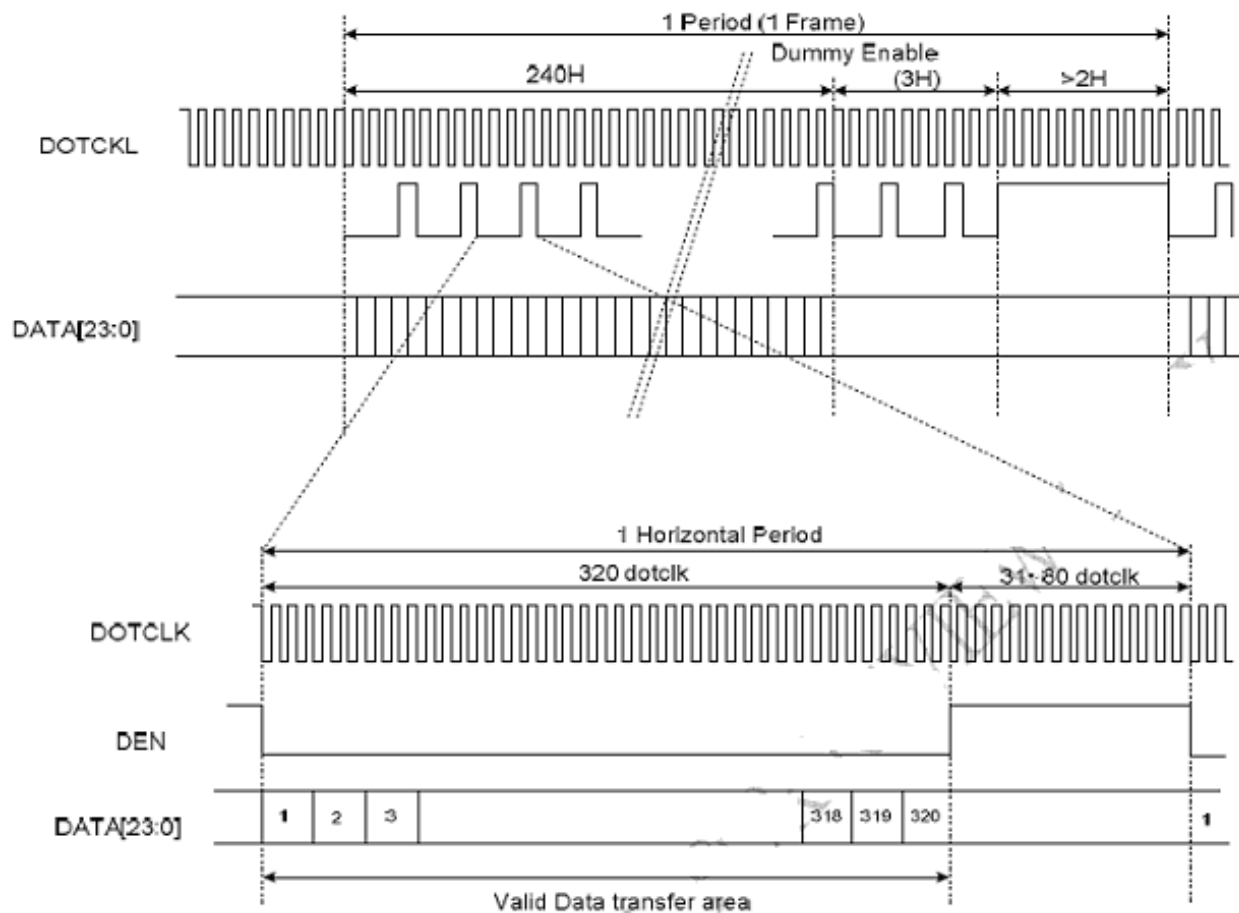
**Figure11.2-2 CCIR656 Vertical Timing****Figure11.2-3 Digital RGB NTSC mode Vertical Data Format for 262T_H**

a) Horizontal Data Transaction Timing



b) Vertical Data Transaction Timing

**Figure11.2-3 Data Transaction Timing in Serial RGB (8 bit) Interface (SYNC Mode)****Figure11.2-3 Data Transaction Timing in Serial RGB (8 bit) Interface (DE Mode)****a) Horizontal Data Transaction Timing****b) Vertical Data Transaction Timing**

**Figure11.2-3 Data Transaction Timing in Parallel RGB (24 bit) Interface (SYNC Mode)****Figure11.2-4 Data Transaction Timing in Parallel RGB (24 bit) Interface (DE Mode)**

11.2.1 Clock and Sync Waveform

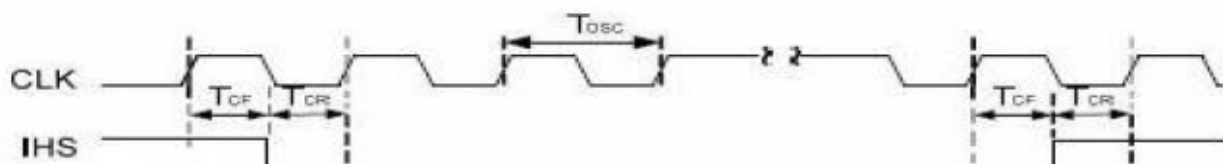




Figure11.2-5 CLK and IHS timing waveform

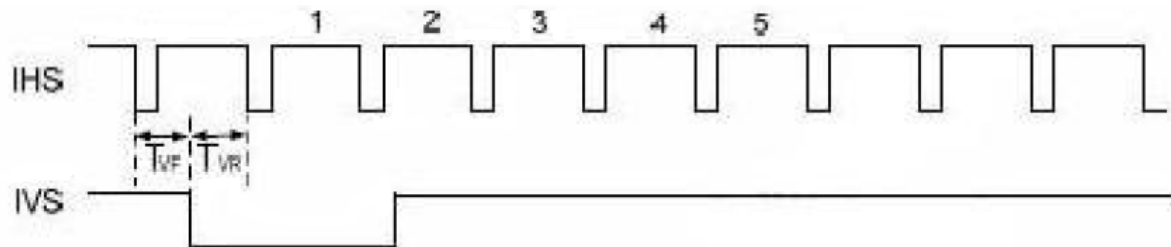
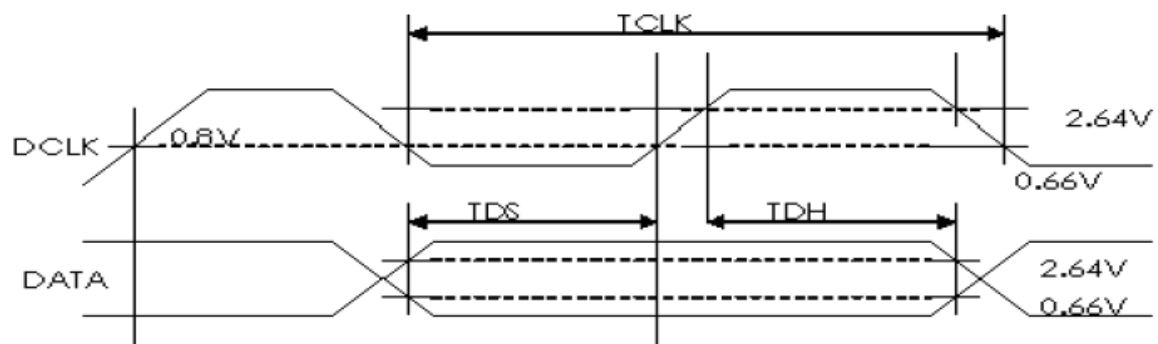
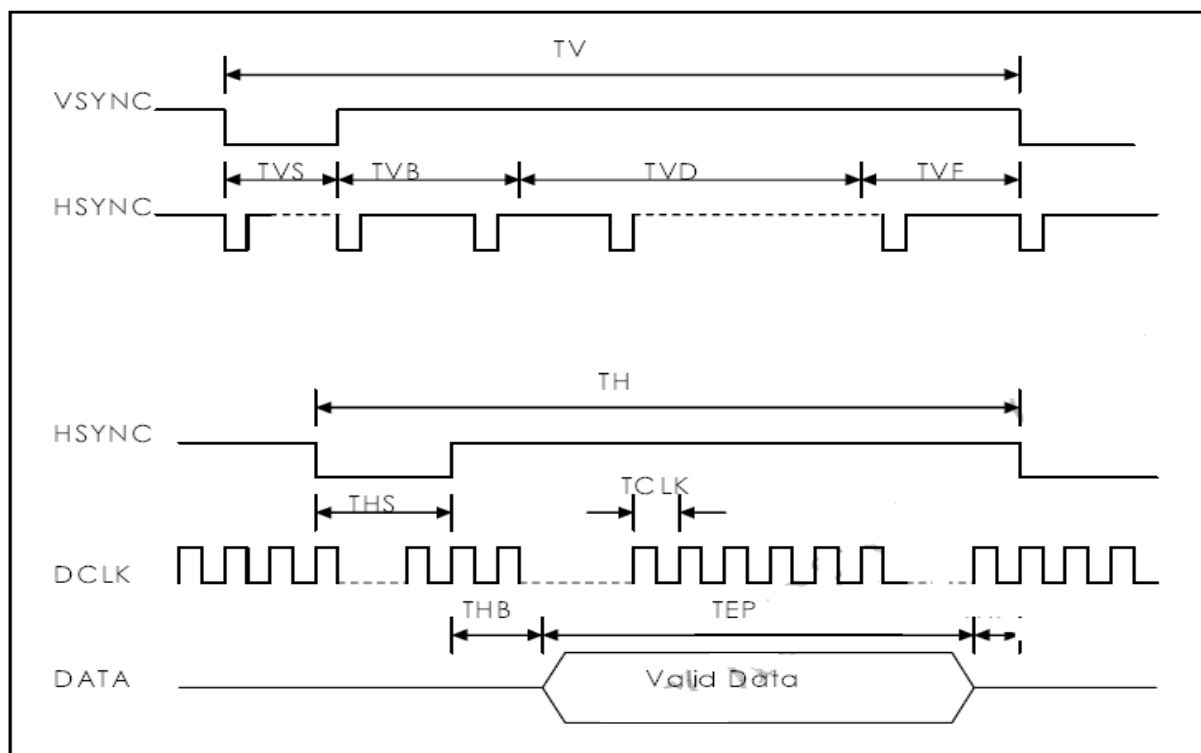


Figure11.2-6 IHS and IVS timing waveforms





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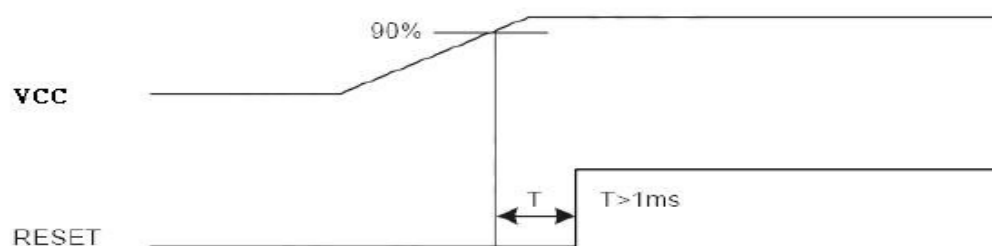
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11.2.2 Reset Timing Chart

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



Reset timing



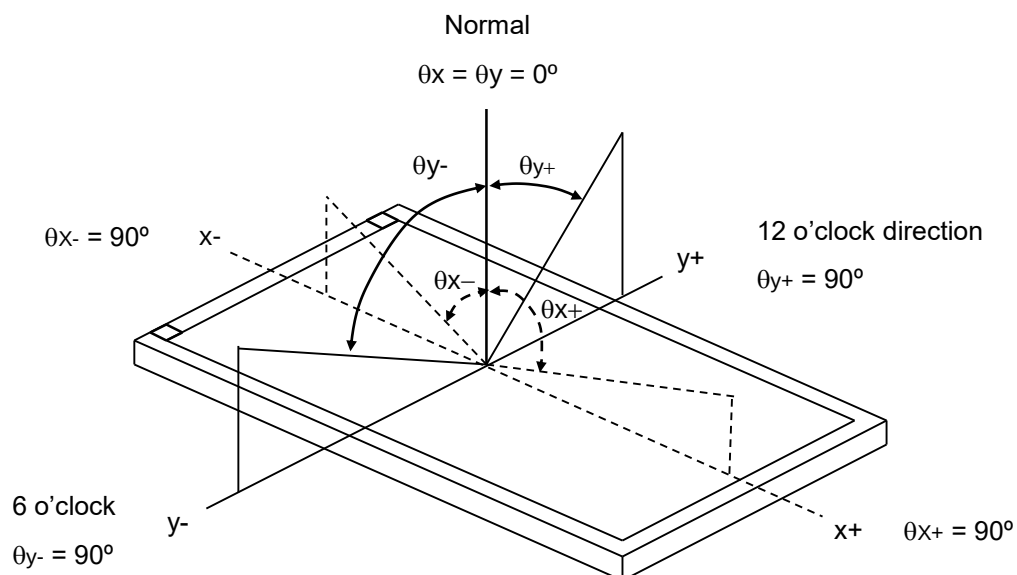
12. Optical Characteristics

The optical characteristics should be measured in a dark environment (≤ 1 lux)
or equivalent state with the methods shown in Note (4).

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing Normal Angle	300	(400)	-	-	(2)
Response Time		T_R		-	10	-	ms	(3)
		T_F		-	15	-	ms	
Luminance(Center)		Y		200	(300)	-	cd/m ²	(4)
Brightness uniformity		BUNI		70	(75)	-	%	(5)
Color Chromaticity	White	Wx		0.26	0.31	0.36	-	
		Wy		0.28	0.33	0.38	-	
Viewing Angle	Horizontal	θ_{x+}	CR ≥ 10	50	(60)	-	deg.	(1),(4)
		θ_{x-}		50	(60)	-		
	Vertical	θ_{y+}		40	(50)	-		
		θ_{y-}		45	(55)	-		



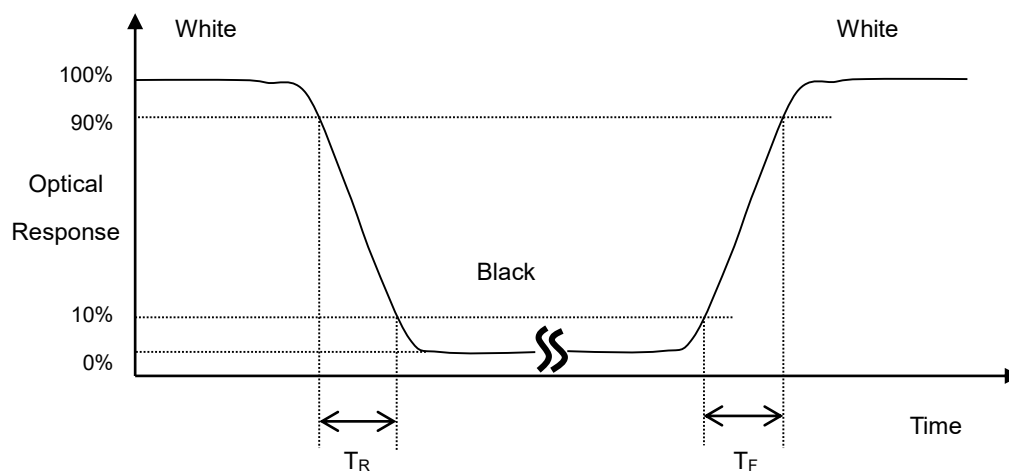
Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

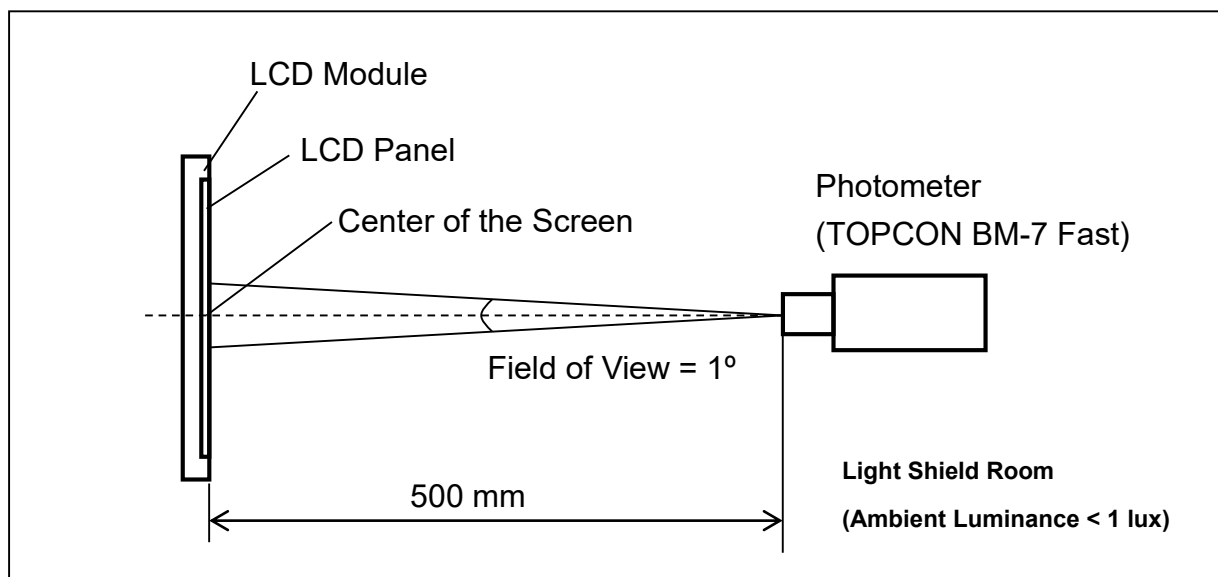
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note (3) Definition of Response Time (T_R , T_F):

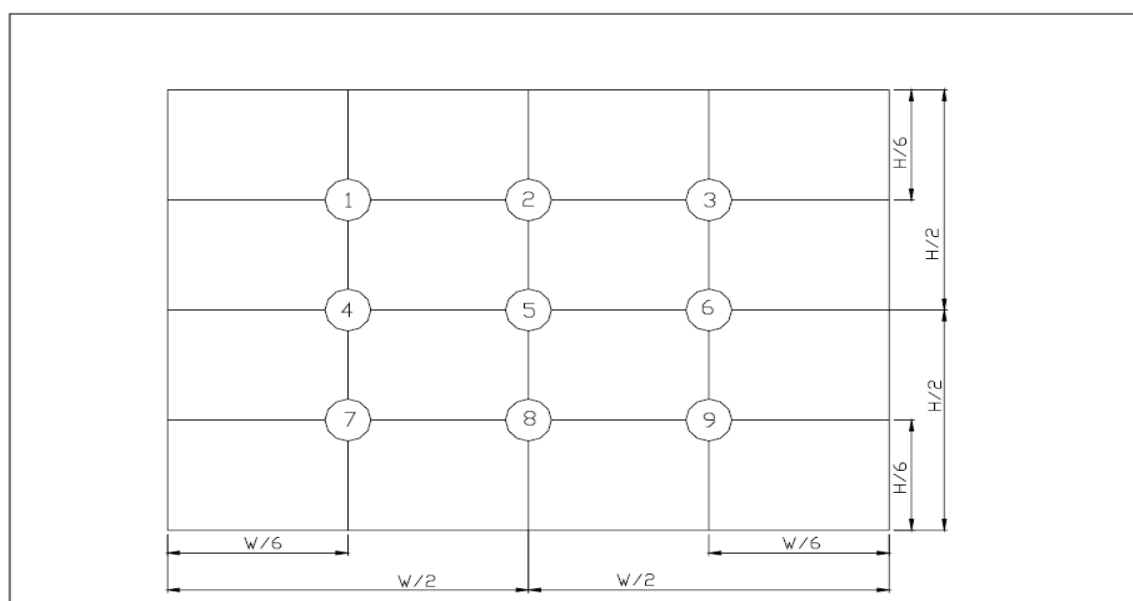


**Note (4) Measurement Set-Up:**

The LCD module should be stabilized at a given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.

**Note (5) Definition of brightness uniformity**

Brightness uniformity = $(\text{Min Luminance of 9 points}) / (\text{Max Luminance of 9 points}) \times 100\%$



(單位 : mm)



13. Reliability Test

No.	Test Items	Test Condition	REMARK
1	High Temperature Storage Test	Ta=80°C Dry 240h	
2	Low Temperature Storage Test	Ta=-30°C Dry 240h	
3	High Temperature Operation Test	Ta=70°C Dry 240h	
4	Low Temperature Operation Test	Ta=-20°C Dry 240h	
5	High Temperature and High Humidity Operation Test	Ta=60°C 90%RH 240h	
6	Electro Static Discharge Test	Panel surface / top case. Contact / Air : $\pm 6\text{KV}$ / $\pm 8\text{KV}$, 150pF , 330 Ω	Non-operating
7	Shock Test (non-operating)	Shock Level : 100G Waveform : Half Sinusoidal Wave Shock Time : 6ms Number of Shocks : 3 times for each $\pm X$, $\pm Y$, $\pm Z$ direction	
8	Vibration Test (non-operating)	Frequency range: 10Hz ~ 550Hz Stoke : 1.3mm. Sweep : 1.5G, 33.3~400Hz Vibration : Sinusoidal Wave, 1Hrs for X,YZ direction.	
9	Thermal Shock Test	-20°C(0.5h) ~ 70°C(0.5h) / 100 cycles	

***** Ta= Ambient Temperature

Note:

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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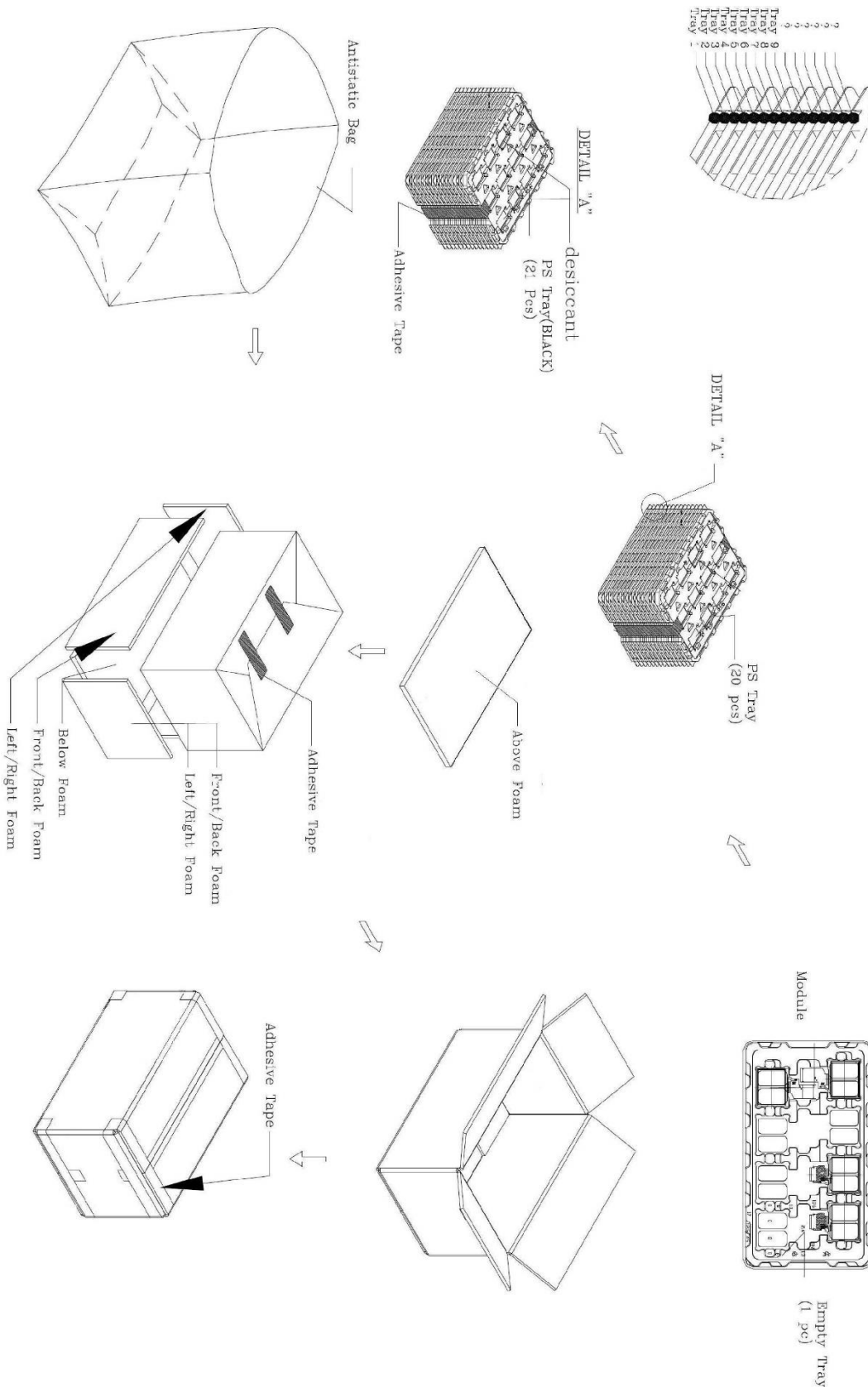
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14. Packaging



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15. Precautions

15.1 Assembly and Handling Precautions

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It's recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) Don't apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD module in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow.

15.2 Safety Precautions

- (1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

15.3 Terms of Warrant

- (1) Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- (2) Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.



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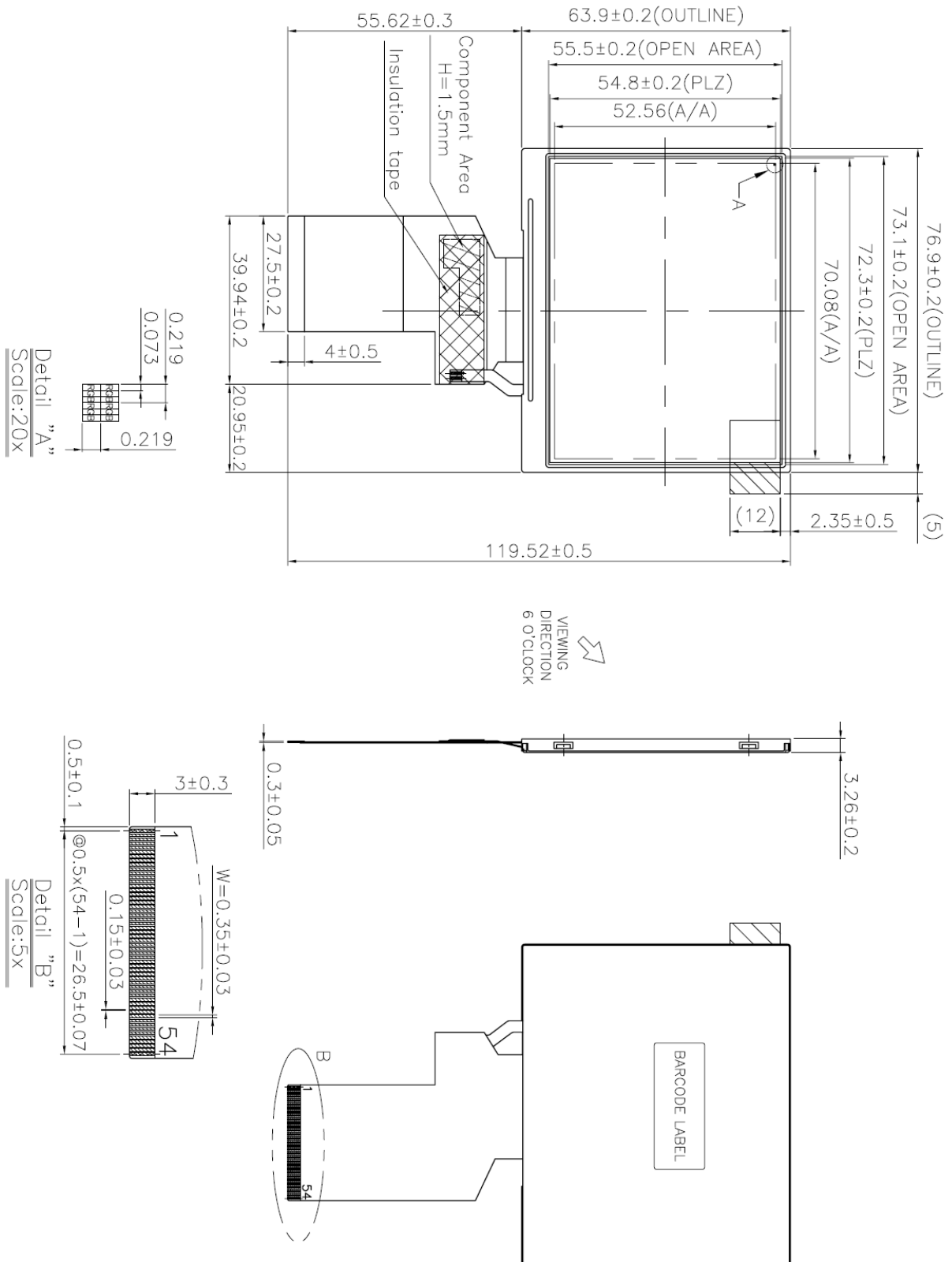
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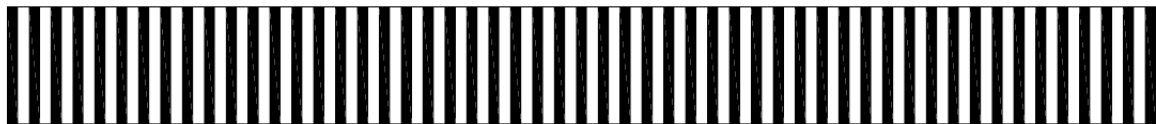
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16.Outline Drawing

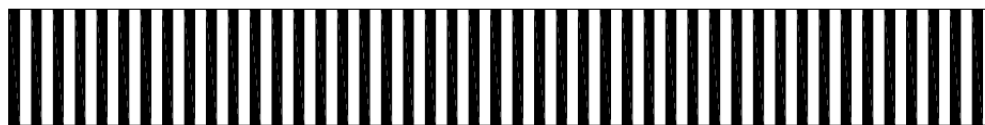


**17. Definition of Labels**

The bar code nameplate is pasted on each module as illustration, and its definitions are as following explanation.



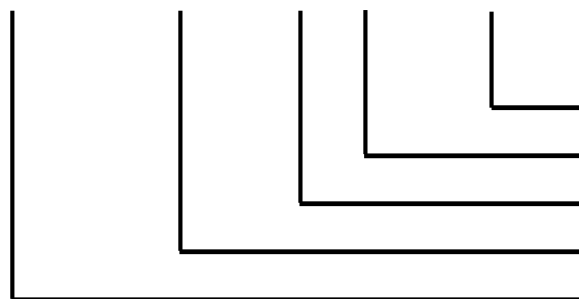
PT322435-TLMWD-E31A



A B C D E F G H I J K L M

(a) Module Name: PT322435-TLMWD-E31A

(b) Serial ID:

A B C D E F G H I J K L M

Serial No.
Revision Code
Factory Code
Manufactured Date
Screen Size

Serial ID includes the information as below:

(a) Screen size (Diagonal): Inch Code (ABCD)

3.5" → 0350

10.4" → 1040

(b) Manufactured Date: Year, Month, Day (EFG)

Year (E)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mark	0	1	2	3	4	5	6	7	8	9
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Mark	A	B	C	D	E	F	G	H	I	J

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Month (F)

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mark	1	2	3	4	5	6	7	8	9	A	B	C

Day (G)

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mark	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	G
Day	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Mark	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	

(c) Factory Code (H):

For P-TEC internal use.

(d) Revision Code (I):

Cover all the change, for example: 1: Rev.1, 2: Rev.2, 3: Rev.3...etc.

(e) Serial No. (JKLM):

Manufacturing sequence of product, for example: 0001~9999.

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18. Incoming Inspection Standards

18.1 Inspection Parameters

1. Incoming Inspection

Both parties agree that the inspection specifications of TFT-LCD Modules (hereinafter known as "Modules") stipulated hereunder is the only and final standard applicable in the process of inspection. P-TEC shall be under no liability or obligation (including incidental loss, products liability or other consequential loss) whatsoever for any defect in quality or performance or shortage in quantity of the Modules that have passed such inspection.

2. Liability

2.1 Inspection Deadline

The Customer should inspect the Modules either at the Delivery Point or within twenty (20) calendar days after arrival at the Delivery Destination.

2.2 Notification of Rejection

The Customer may reject one or more defective or non-conforming Modules if the Modules fail to meet the AQL (Acceptable Quality Level) and pass the inspection. In that case, the customer should notify P-TEC of the rejection by either documents or mail within in three (3) business days from the date of reception of the Modules. Otherwise, the Modules shall be deemed to have met the AQL and passed the inspection.

3. Inspection Specifications

Both parties agree that the inspection shall contain and follow the inspection specifications stipulated in the attachment, including:

3.1 Scope

3.2 Sampling Plan

3.3 Panel Inspection Condition

3.4 Display Quality

3.5 Mechanics Specifications

3.6 Notification for Storage Handling

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4. Limited Warranty

P-TEC represents and warrants that all Modules shall (i) conform to the specifications set hereunder, and (ii) be free from any defects in material and workmanship for twelve (12) months after the Customer's acceptance or deemed acceptance. P-TEC will replace, rework or refund the Customer for the defective or non-conforming Modules at P-TEC's option, provided that the Customer (i) promptly informs P-TEC of the defects or non-conformities within the warranty period, (ii) complies with the specifications and conditions hereunder, and (iii) complies with P-TEC's procedure for Modules replacement, reworking and/or return. The warranty period for the Modules replaced or reworked shall be the remaining term for such Modules.

5. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, TERMS OR CONDITIONS, EXPRESS OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY

AND FITNESS FOR A PARTICULAR PURPOSE, ALL OF WHICH ARE EXPRESSLY DISCLAIMED. P-TEC'S WARRANTIES HEREIN APPLY ONLY TO THE CUSTOMER AND ARE NOT TO BE EXTENDED TO ANY THIRD PARTY.

6. Governing Law

This Agreement shall be governed and construed in accordance with the laws of the Republic of China. Both parties agree to submit any dispute, which cannot be amicably resolved, to Hsinchu District Court for the first instance.



Inspection Specifications

1. Scope

Specifications contain

- 1.1 Display Quality Evaluation
- 1.2 Mechanics Specification

2. Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E.

- 2.1 Lot size: Quantity per shipment as one lot (different model as different lot).
- 2.2 Sampling type: Normal inspection, single sampling.
- 2.3 Sampling level: Level II.
- 2.4 AQL: Acceptable Quality Level
 - Major defect: AQL=0.65
 - Minor defect: AQL=1.0

3. Panel Inspection Condition

3.1 Environment:

Room Temperature: $25\pm 5^{\circ}\text{C}$.

Humidity: $65\pm 5\%$ RH.

Illumination: 300 ~ 700 Lux.

3.2 Inspection Distance:

35 ± 5 cm

3.3 Inspection Angle:

The vision of inspector should be perpendicular to the surface of the Module.

3.4 Inspection time:

Perceptibility Test Time: 20 seconds max.

4. Display Quality

4.1 Function Related:

The function defects of line defect, abnormal display, and no display are considered Major defects.



4.2 Bright/Dark Dots:

Defect Type	Specification	Major	Minor
Bright Dots	$N \leq 1$		•
Dark Dots	$N \leq 2$		•
Total Bright and Dark Dots	$N \leq 2$		•

Note: 1: The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

The bright dot defect must be visible through 2% ND filter

Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

4.3 Pixel Definition:

R	G	B	R	G	B	R	G	B			Dot Defect
R	G	B	R	G	B	R	G	B			Adjacent Dot Defect
			R	G	B	R	G	B			Cluster

Note

1: If pixel or partial sub-pixel defects exceed 50% of the affected pixel or sub-pixel area, it shall be considered as 1 defect.

Note 2: There should be no distinct non-uniformity visible through 2% ND Filter within 2 sec inspection times.

4.4 Visual Inspection specifications:



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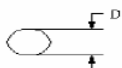
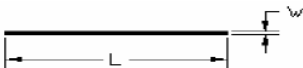
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<u>Defect Type</u>		<u>Specification Size</u>	<u>Count(N)</u>	Major	Minor
Dot Shape (Particle、Scratch and Bubbles in display area) 		$D \leq 0.1 \text{ mm}$	Ignored		
		$0.10\text{mm} < D \leq 0.4\text{mm}$	$N \leq 2$		
		$D > 0.4\text{mm}$	$N=0$		•
Line Shape (Particles、Scratch、Lint and Bubbles in display area) 		$W \leq 0.01 \text{ mm}$	Ignored		
		$0.01\text{mm} < W \leq 0.05\text{mm}$ and $L \leq 3\text{mm}$	$N \leq 3$		
		$W > 0.05\text{mm}$ or $L > 3 \text{ mm}$	$N=0$		•
Bubble in cell (active area)		It should be found by eyes			•
Bezel	Scratch	No harm			•
	Dirt				•
	Wrap				•
	Sunken				•
Label	No label	No			•
	Inverted label				•
	Broken				•
	Dirt	Word can be read.			•
	Not clear	No			•
	Word out of shape				•
	Mistake				•
	Position	Be attached on right position			•
Screw	Not enough	No			•
	Limp	No			•



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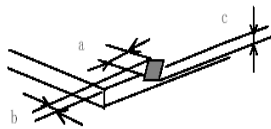
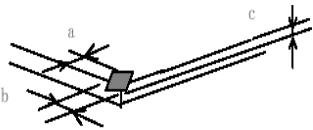
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Item		Specification/Description			Note
Touch Panel	Scratch	L(mm)	W(mm)	Acceptable number	Note:1
		$L \leq 10$	$W < 0.05$	Disregard	
			$0.05 \leq W < 0.1$	$N \leq 4$	
			$W \geq 0.1$	0	
	Foreign Materials (Linear shape)	$L \leq 10$	$W < 0.05$	Disregard	Note:1
			$0.05 \leq W < 0.1$	$N \leq 3$	
			$W \geq 0.1$	0	
	Foreign Materials (Circular shape)	Dimension(mm)		Acceptable number	Note:2
		$D \leq 0.25$		Disregard	
		$0.25 < D \leq 0.5$		$N \leq 6$	
		$D > 0.5$		0	
	Glass chipping			$a \leq 5.0\text{mm}$ $b \leq 3.0\text{mm}$ $c \leq t$ (t : Glass think)	Note:3
				$a \leq 3.0\text{mm}$ $b \leq 3.0\text{mm}$ $c \leq t$ (t : Glass think)	Note:3



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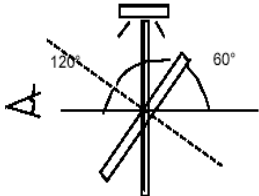
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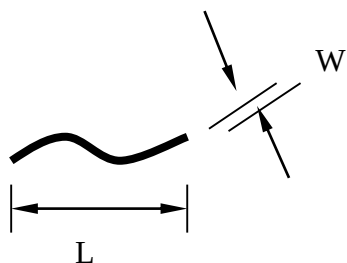
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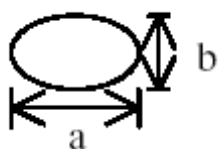
	Newton-ring	(In case of doubtful situations) Observe on 60° from the product surface under a while Fluorescent lamp (3-wavelength lamp).	Average diameter $\leq 1/3$ Touch Panel area Disregard.	Note:3
	Membrane Drum			$H \leq 0.3\text{mm}$

Note1.

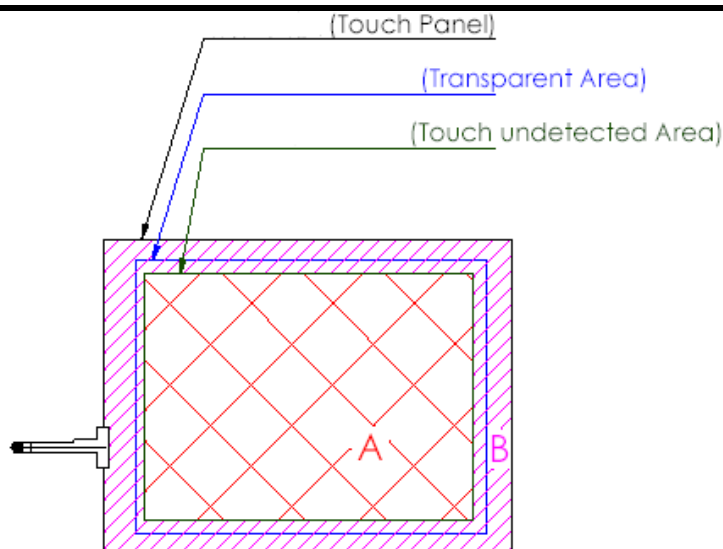


Note2.

D : Diameter $D=(a+b)/2$



Note3.



A area : Without any defect point effect on normal operation.

B area : None-specify

Connector	Connection status	No bend on pins and damage		•
FPC/FFC	Broken	No		•

Note: Extraneous substance and scratch not affecting the display of image, for instance, extraneous substance under polarizer film but outside the display area, or scratch on metal bezel and backlight module or polarizer film outside the display area, shall not be considered as defective or non-conforming.

5. Mechanics specifications

As for the outside dimensions and weight of the Modules, please refer to product specifications for more details.

6. Notification for Storage Handling

6.1 Storage:

6.1.1 Environment condition must be within the product specifications, otherwise the module might be damaged.

6.1.2 Pile of stacking shall follow the instruction of P-TEC.

6.2 Handling:

6.2.1 Twisting or Bending of the Module is prohibited.

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6.2.2 All chemicals are unfit for use unless otherwise instructed by P-TEC.

6.2.3 Plugging in & unplugging:

The power must be turned off before plugging in or unplugging the Module.

6.2.4 ESD protection:

The Module must not be touched without proper grounding.

6.2.5 High Voltage:

The rear side of Module must not be touched without protection.

6.2.6 Power sequence:

Shall follow the instruction of P-TEC.

18.2 Handling of LCM

(1)Don't give external shock.

(2)Don't apply excessive force on the surface.

(3)Liquid in LCD is hazardous substance. Must not lick and swallow. when the liquid is attach to your hand, skin, cloth etc. Wash it out thoroughly and immediately.

(4)Don't operate it above the absolute maximum rating.

(5)Don't disassemble the LCM.